

ภาคผนวก จ

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
Stack									
1	Pre-Test Console	Total Suspended Particulate	Apex Instruments, USA.	XC-572-V 0807048	Envi Equipment Service Co., Ltd.	E23-08069	9 Aug 23	8 Aug 24	-
2	Flue gas Analyzer	Sulphur Dioxide Oxide of Nitrogen as Nitrogen Dioxide	Testo	Testo 350 New 02376344	Entech Industrial Sulation Co., Ltd.	G 660610	4 Oct 23	3 Oct 24	-
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)	23P1398	9 May 23	8 May 24	-
3	Air Flow Meter	Particular Matter (PM _{2.5})	Mesa Labs	DeltaCal DC1 159822	Innovative Instrument Co.,Ltd.	23-AFM-203	27 Sep 23	26 Sep 24	-
4	Aneroid Barometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀) Particular Matter (PM _{2.5})	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	23P1858	2 Jun 23	1 Jun 24	-
5	Dial Thermo-Hygrometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀) Particular Matter (PM _{2.5})	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	23H1201	5 Jun 23	5 Jun 24	-
6	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1201778105	UAE Consultant Co.,Ltd.	21112023	21 Nov 23	20 Nov 24	-
7	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1201778107	UAE Consultant Co.,Ltd.	21112023	21 Nov 23	20 Nov 24	-
8	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1201778109	UAE Consultant Co.,Ltd.	21112023	21 Nov 23	20 Nov 24	-
9	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Environmental Instrument	42C 42C-67174-356	UAE Consultant Co.,Ltd.	01112023	1 Nov 23	31 Oct 24	-
10	Standard Gases (Mixture)	Nitrogen Dioxide	Airgas	EB0143262 2015PSIG	Airgas an Air Liquide company	E04NI99E15A01D3	21 Jun 21	21 Jun 24	-
11	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1180540065	UAE Consultant Co.,Ltd.	03112023	3 Nov 23	2 Nov 24	-
12	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1180540066	UAE Consultant Co.,Ltd.	09112023	9 Nov 23	8 Nov 24	-
13	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1180540067	UAE Consultant Co.,Ltd.	09112023	9 Nov 23	8 Nov 24	-

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
14	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	42i 1182920016	UAE Consultant Co.,Ltd.	03112023	3 Nov 23	2 Nov 24	-
15	Standard Gases (Mixture)	Sulphur Dioxide	Airgas	EB0143262 2015PSIG	Airgas an Air Liquide company	E04NI99E15A01D3	21 Jun 21	21 Jun 24	-
16	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2205DT0113	Thai Meteorological Department	390/23	1 Nov 23	31 Oct 24	-
17	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM14465	Calibration Laboratory Co.Ltd	Q23117019	20 Oct 23	19 Oct 24	-
18	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	Svantek	SV36 107224	Innovative Instrument Co.,Ltd.	23-ACT-117	4 Aug 23	3 Aug 24	-
19	Sound Level Meter	L _{Aeq} 24 hours, L _{Aeq} 1 hours, L _{Amax} , L _{A90} , L _{Adn} ระดับเสียงรบกวน	Larson Davis	LxT1 0007308	Larson Davis-A PCB Piezotronics Div.	2023003666	22 Mar 23	21 Mar 24	-
20	Sound Level Meter	L _{Aeq} 24 hours, L _{Aeq} 1 hours, L _{Amax} , L _{A90} , L _{Adn} ระดับเสียงรบกวน	Larson Davis	LxT1 0007309	Larson Davis-A PCB Piezotronics Div.	2023003671	22 Mar 23	21 Mar 24	-
21	Sound Level Meter	L _{Aeq} 24 hours, L _{Aeq} 1 hours, L _{Amax} , L _{A90} , L _{Adn} ระดับเสียงรบกวน	Larson Davis	LxT1 0007310	Larson Davis-A PCB Piezotronics Div.	2023003673	22 Mar 23	21 Mar 24	-
22	Sound Level Meter	L _{Aeq} 24 hours, L _{Aeq} 1 hours, L _{Amax} , L _{A90} , L _{Adn} ระดับเสียงรบกวน	Larson Davis	LxT1 0007311	Larson Davis-A PCB Piezotronics Div.	2023003675	22 Mar 23	21 Mar 24	-
23	Sound Level Meter	L _{Aeq} 24 hours, L _{Aeq} 1 hours, L _{Amax} , L _{A90} , L _{Adn} ระดับเสียงรบกวน	Larson Davis	LxT1 0007312	Larson Davis-A PCB Piezotronics Div.	2023003676	22 Mar 23	21 Mar 24	-
24	Sound Level Meter	L _{Aeq} 24 hours, L _{Aeq} 1 hours, L _{Amax} , L _{A90} , L _{Adn} ระดับเสียงรบกวน	Larson Davis	LxT1 0007313	Larson Davis-A PCB Piezotronics Div.	2023002738	22 Mar 23	21 Mar 24	-

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
Water									
1	pH Meter	pH	Horiba	LAQUA-PH210 HA1G0019	Technology Promotion Association (Thailand-Japan)	23CH1226	27 Sep 23	26 Sep 24	-
2	DO Meter	DO	Horiba	LAQUA-DO210 HE1D0008	Technology Promotion Association (Thailand-Japan)	23TW219	27 Sep 23	26 Sep 24	-
3	Conductivity Meter	Conductivity	YSI	Pro30 18K100976	Technology Promotion Association (Thailand-Japan)	23CH1488	22 Dec 23	21 Dec 24	-

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	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	Svantek	SV35A 73246	Innovative Instrument Co.,Ltd.	23-ACT-110	27 Jun 23	26 Jun 24	-
2	Sound Level Meter	L _{Aeq} 8 hrs, L _{Amax}	Rion, Japan	NL-42 00409175	Sithiporn Associates Co., Ltd.	ACL24055	18 Jan 24	17 Jan 25	-
3	Sound Level Meter	L _{Aeq} 8 hrs, L _{Amax}	Rion, Japan	NL-42 00558036	Sithiporn Associates Co., Ltd.	ACL24057	18 Jan 24	17 Jan 25	-
4	Sound Level Meter	L _{Aeq} 8 hrs, L _{Amax}	Rion, Japan	NL-42 00409177	Sithiporn Associates Co., Ltd.	ACL23130	26 Apr 23	25 Apr 24	-
5	Noise Dosimeter	Noise Dosimeter	Svantek	SV 104 91928	Innovative Instrument Co.,Ltd.	24-NDM-014	24 Jan 24	23 Jan 25	-
6	Noise Dosimeter	Noise Dosimeter	Svantek	SV 104 91923	Innovative Instrument Co.,Ltd.	24-NDM-017	25 Jan 24	24 Jan 25	-
7	Noise Dosimeter	Noise Dosimeter	Svantek	SV 104IS 106063	Innovative Instrument Co.,Ltd.	23-NDM-062	23 Mar 23	22 Mar 24	-
8	Noise Dosimeter	Noise Dosimeter	Svantek	SV 104IS 106069	Innovative Instrument Co.,Ltd.	24-NDM-018	25 Jan 24	24 Jan 25	-
9	Noise Dosimeter	Noise Dosimeter	Svantek	SV 104 91924	Innovative Instrument Co.,Ltd.	24-NDM-015	25 Jan 24	24 Jan 25	-

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Workplace									
10	Primary Flow Calibrator	Calibrate personal pump	TSI.Inc	4146 41461922007	Innovative Instrument Co., Ltd.	23-AFM-221 Rev.1	25 Oct 23	24 Oct 24	-
11	Aneroid Barometer	Total Dust Respirable Dust	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	23P1857	2 Jun 23	1 Jun 24	-
12	Digital Thermo - Hygrometer	Total Dust Respirable Dust	Digicon	TH-02 395034175	Technology Promotion Association (Thailand-Japan)	23H1101	24 May 23	23 May 24	-
13	Thermal Environment Monitor	Heat Meter	3M	QuesTemp 34 TEH020027	Innovative Instrument Co.,Ltd.	23-TPM-192	3 Apr 23	2 Apr 24	-
14	Thermal Environment Monitor	Heat Meter	TSI QUEST	QuesTemp 32 TPT030008	Innovative Instrument Co.,Ltd.	23-TPM-502	2 Nov 23	1 Nov 24	-
15	Digital Lux Meter	Lux	Extech Instrument, Taiwan	407026 A 056652	Innovative Instrument Co., Ltd.	23-LXM-139	20 Apr 23	19 Apr 24	-

List of Instruments Certification for Environmental Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
Equipment for Air Quality Analysis									
1	Analytical Balance (Readability 0.1 mg)	ฝุ่นละอองรวม (TSP) ฝุ่นละอองขนาดไม่เกิน 10 ไมครอน ฝุ่นละอองขนาดไม่เกิน 2.5 ไมครอน	Mettler-Toledo	AB204-S/FACT / B108115858	National Food Institute, Ministry of Industry, Thailand	2402420-001-01	19 Apr 24	18 Apr 25	-
2	Analytical Balance (Readability 0.1 mg)		Mettler-Toledo	MS204TS/00 C252436235	National Food Institute, Ministry of Industry, Thailand	2402420-003-01	19 Apr 24	18 Apr 25	-
3	Analytical Balance (Readability 0.001 mg)		Mettler-Toledo	XP6 / B322373893	National Food Institute, Ministry of Industry, Thailand	2402420-002-01	19 Apr 24	18 Apr 25	-
4	UV-VIS Spectrophotometer	ก๊าซออกไซด์ของไนโตรเจน ในรูปไนโตรเจนไดออกไซด์	Agilent Technologies	Cary60 G6860A / MY15410009	DQE Services Co.,Ltd.	SP23-021	20 May 23	18 May 24	-
5	UV-VIS Spectrophotometer		Hitachi	U-1900 / 2021-064	DQE Services Co.,Ltd.	SP24-008	17 Jan 24	16 Jan 25	-
6	Analytical Balance (Readability 0.001 mg)	ฝุ่นทุกขนาด, ฝุ่นขนาดที่เข้าถึงและ สะสมในถุงลมของปอดได้	Mettler-Toledo	XP6 / B322373893	Mettler-Toledo (Thailand) Ltd.	23MM333	7 Apr 23	5 Apr 24	-
7	Incubator	ยีสต์และรา	Memmert	IPP 260 / V615.0187	Technology Promotion Association (Thailand-Japan)	23TM378	12 Apr 23	10 Apr 24	-
8	Incubator		Memmert	IPP 260 / V618.0033	Technology Promotion Association (Thailand-Japan)	23TM729	27 Apr 23	25 Apr 24	-
9	Auto Clave		ALP	CL-40L / 808763	Technology Promotion Association (Thailand-Japan)	23TM763	27 Apr 23	25 Apr 24	-

List of Instruments Certification for Environmental Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
Equipment for Water Quality Analysis									
10	pH Meter	อุณหภูมิ (Temperature) ความเป็นกรด-ด่าง (pH)	Mettler-Toledo	Seven Easy S20 / 1231155210	National Food Institute, Ministry of Industry, Thailand	2401718-001-01	11 Mar 24	10 Mar 25	-
11	pH Meter		Mettler-Toledo	Seven Easy S20 / 1230525212	DKSH (Thailand) Ltd.	C07240167	9 Apr 24	8 Apr 25	-
12	Conductivity Meter	ค่าความนำไฟฟ้า (Electrical Conductivity)	SI Analytics	Lab955 / 16300356	DKSH (Thailand) Ltd.	C24240057	11 Mar 24	10 Mar 25	-
13	BOD Incubator	บีโอดี (BOD)	Arco	UC4-1320 / (UAE.WAO.015/2561)	Technology Promotion Association (Thailand-Japan)	24TM303	10 Feb 24	9 Feb 25	-
14	UV-VIS Spectrophotometer	ไนเตรต-ไนโตรเจน (NO3-N) แอมโมเนีย-ไนโตรเจน (NH3-N)	Agilent Technologies	Cary60 G6860A / MY15410009	DQE Services Co.,Ltd.	SP24-018	7 May 24	6 May 25	-
15	UV-VIS Spectrophotometer		Hitachi	U-2900 / 21E22-009	DQE Services Co.,Ltd.	SP24-001	4 Jan 24	3 Jan 25	-
16	Analytical Balance (Readability 0.01 mg)	ปริมาณของแข็งละลายน้ำทั้งหมด(TDS) ของแข็งแขวนลอย (SS)	Mettler-Toledo	XSR205DU / C210685394	National Food Institute, Ministry of Industry, Thailand	2402283-002-01	2 Apr 24	1 Apr 25	-
17	Hot Air Oven		Memmert	UF55 / B216.1666	National Food Institute, Ministry of Industry, Thailand	2400141-001-01	11 Oct 23	10 Oct 24	-
18	Analytical Balance (Readability 0.1 mg)	น้ำมันและไขมัน (Oil & Grease)	Mettler-Toledo	AB-204S/FACT / 1129361010	Technology Promotion Association (Thailand-Japan)	24MM292	11 May 24	10 May 25	-
19	COD Reactor (Heating Block)	ซีโอดี (COD)	Hanna	HI839800-02 / 6480019101	Hanna Instruments (Thailand) Ltd.	HIT-2413-0434	25 Mar 24	24 Mar 25	-

List of Instruments Certification for Environmental Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
Equipment for Water Quality Analysis									
20	Digestor Unit	ทีเคเอ็น (TKN)	FOSS TECATOR	DT2520 / 91794469	FOSS South East Asia	9809	8 Feb 24	7 Feb 25	-
21	Distillation Unit (Kjeldahl Method)		FOSS TECATOR	KT200 / 91790524	FOSS South East Asia	9810	9 Feb 24	7 Feb 25	-
22	Atomic Absorption Spectrophotometer (AAS)	แมงกานีส (Mn), สารหนู (As), ตะกั่ว (Pb) แคดเมียม (Cd), ค่าอัตราส่วนการดูดซับโซเดียม (SAR) เหล็ก (Fe), อลูมิเนียม (Al), นิกเกิล (Ni), ทองแดง (Cu)	Agilent Technologies	System ID:G8432A AA240FS / MY13160001	Thailand Institute of Scientific and Technological Research(TISTR)	MTC.ACL.No 358/67	11 Mar 24	10 Mar 25	-
23	Inductively Coupled Plasma (ICP)	โครเมียม (Cr), ซีลีเนียม (Se), สังกะสี (Zn) Phosphorus, Calcium, Magnesium	Agilent Technologies	System ID:G8015A G8015AA / MY18030001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	13 Nov 23	12 Nov 24	-
24	Cold Vapor Atomic (CVAAS)	ปรอท (Hg)	Nippon Instrument Corporation	RA-4500 / 17780278	Coax Group Corporation Ltd.	Preventive Maintenance Report	9 Jul 24	8 Jul 25	-

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

CERTIFICATE OF CALIBRATION

Customer : United Analyst and Engineering Consultant Co., Ltd.
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Description of Equipment : Console meter
Manufacturer : Apex Instrument
Model Number : XC-572-V
Serial Number : 0807048
ID./Control No. : -
Environment Conditions : Temperature (25 ± 2) °C
Humidity (50 ± 15) % RH
Cal. Date : 09/08/2023
Issue Date : 09/08/2023

Calibration Method or Calibration Procedure Used

US EPA Method (United State Environmental Protection Agency)

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

Result of Calibration

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

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

Calibrated by : Mr. Sanya Sangnil

Approved by :

(Mr. Mana Fuchon)
Technical Manager

เอกสารไม่ควบคุม

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

Meter Console Information		Calibration Conditions				Factors/Conversions		
Console Model Number	XC-572-V	Date	Time	09/08/2023	09:45 AM	Std Temp	293	K
Console Serial Number	0807048	Calibration Reference No.	SER23-08028			Std Press	760	mm Hg
DGM Model Number	SK25EX	Barometric Pressure	758.24			K ₁	0.386	
DGM Serial Number	00003811	Calibration Meter Gamma	0.999			Console Leak Check	PASS	

Calibration Data									
Run Time	Metering Console					Calibration Meter			
	DGM Orifice DH	Volume Initial	Volume Final	Outlet Temp Initial	Outlet Temp Final	Volume Initial	Volume Final	Outlet Temp Initial	Outlet Temp Final
Elapsed (Q)	(P _{in})	(V _{in})	(V _{out})	(t _{in})	(t _{out})	(V _{wi})	(V _{wf})	(t _{in})	(t _{out})
min	mm H ₂ O	m ³	m ³	°C	°C	m ³	m ³	°C	°C
12.83	13.0	1149.315	1149.455	29	29	160.47814	160.62142	27	27
12.87	13.0	1149.455	1149.595	29	29	160.62142	160.76496	27	27
9.27	26.0	1149.606	1149.746	29	29	160.78130	160.92678	27	27
9.23	26.0	1149.746	1149.886	29	29	160.92678	161.07252	26	26
14.58	40.0	1149.894	1150.174	29	29	161.08058	161.37034	26	26
14.60	40.0	1150.174	1150.454	29	29	161.37034	161.65974	26	26
11.07	70.0	1150.467	1150.747	29	29	161.67304	161.95980	26	26
11.07	70.0	1150.747	1151.027	29	29	161.95980	162.24604	25	25
9.52	90.0	1151.038	1151.318	29	29	162.25684	162.54152	25	25
9.50	90.0	1151.318	1151.598	30	30	162.54152	162.82528	25	25



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	09/08/2023	09:45 AM	Std Temp	293	K
Console Serial Number	0807048	Calibration Reference No.	SER23-08028			Std Press	760	mm Hg
DGM Model Number	SK25EX	Barometric Pressure	758.24			K ₁	0.386	
DGM Serial Number	00003811	Calibration Meter Gamma	0.999			Console Leak Check	PASS	

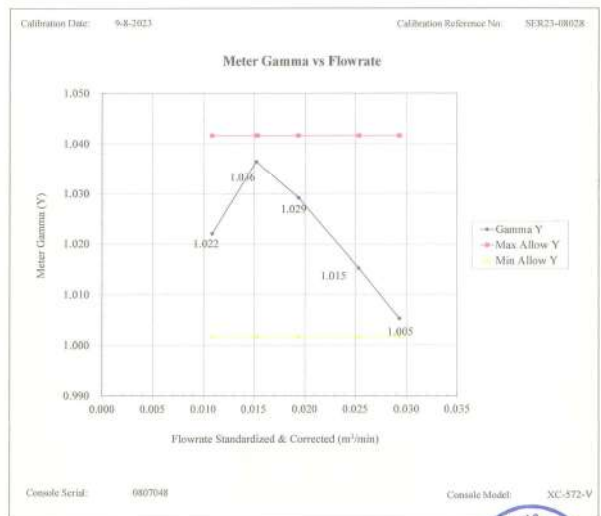
Calibration Data									
Results									
Standardized Data				Dry Gas Meter					
Dry Gas Meter		Calibration Meter		Calibration Factor		Flowrate			
(V _{in}) _{std}	(Q _{in}) _{std}	(V _w) _{std}	(Q _w) _{std}	(Y)	Variation	Std & Corr	.0212 m ³ /min	(ΔH _g)	Variation
m ³	m ³ /min	m ³	m ³ /min				m ³ /min	mm H ₂ O	
0.137	0.011	0.139	0.011	1.021	-0.001	0.011	48.480	0.343	
0.137	0.011	0.140	0.011	1.023	0.001	0.011	48.556	0.419	
0.137	0.015	0.142	0.015	1.035	0.014	0.015	49.161	1.024	
0.137	0.015	0.142	0.015	1.037	0.016	0.015	48.472	0.335	
0.275	0.019	0.283	0.019	1.030	0.008	0.019	47.188	-0.949	
0.275	0.019	0.283	0.019	1.029	0.007	0.019	47.414	-0.724	
0.276	0.025	0.280	0.025	1.016	-0.005	0.025	48.836	0.699	
0.277	0.025	0.281	0.025	1.014	-0.007	0.025	48.850	0.713	
0.277	0.029	0.279	0.029	1.007	-0.015	0.029	47.137	-1.000	
0.277	0.029	0.278	0.029	1.004	-0.018	0.029	47.277	-0.860	
1.022				Y Average		48.137			
						ΔH@ Average			

Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is ±0.02.
For ΔH_g, orifice pressure differential that equates to 0.75 cfm (0.0212 m³/min) at standard temperature and pressure, acceptable tolerance of individual values from the average is ±0.2 inches (5.1 mm).



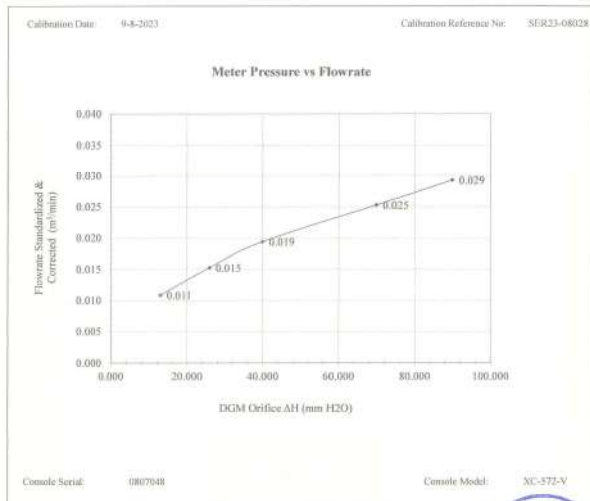
เอกสารไม่ควบคุม

Meter Console Information		Calibration Conditions				Factors/Conversions		
Console Model Number	XC-572-V	Date	Time	09/08/2023	09:45 AM	Std Temp	293	K
Console Serial Number	0807048	Calibration Reference No.	SER23-08028			Std Press	760	mm Hg
DGM Model Number	SK25EX	Barometric Pressure	758.24			K ₁	0.386	
DGM Serial Number	00003811	Calibration Meter Gamma	0.999			Console Leak Check	PASS	



เอกสารไม่ควบคุม

Meter Console Information		Calibration Conditions		Factors/Conversions	
Console Model Number	XC-572-V	Date	09/08/2023	Std Temp	293 K
Console Serial Number	0807048	Time	09:45 AM	Std Press	760 mm Hg
DGM Model Number	SK25EX	Calibration Reference No.	SER23-08028	K ₁	0.386
DGM Serial Number	00003811	Barometric Pressure	758.24 mmHg	Console Leak Check	PASS
		Calibration Meter Gamma	0.999		



เอกสารไม่ควบคุม

THERMOCOUPLES SYSTEM CALIBRATION

Sampling System Equipment Information		Calibration Conditions		
Console Model Number	XC-572-V	Date	09/08/2023	11:45 AM
Console Serial Number	0807048	Calibration Reference No.	SER23-08028	
DGM Model Number	SK25EX	Reference Thermometer	DIGICON	
DGM Serial Number	00003811	Serial Number	183169105	
Meter Box Model Number	JENCO 765 KF			
Meter Box Serial Number	JC 08944			

Results										
Console Thermocouple Simulator										
Channel and test point	Meter Box Channel Temperature Reading (°C)									
	-18.0	25.0	38.0	93.0	149.0	260.0	371.0	482.0	593.0	1038.0
Stack	-19.0	24.0	37.0	92.0	148.0	257.0	370.0	481.0	593.0	1038.0
Aux	-19.0	23.0	37.0	92.0	147.0					
Probe	-19.0	23.0	37.0	92.0	148.0					
Filter	-19.0	23.0	37.0	92.0	147.0					
Exit	-18.0	23.0	37.0							

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



เอกสารไม่ควบคุม

Instrument description	Flue Gas Analyzer
Instrument model	Testo 350 New
Control unit serial no.	02398589/208
Instrument serial no.	02376244/208
ID no. or control no.	UAE.BH42.113/2555
Manufacturer	Testo SE & Co. KGaA
Probe description	-
Probe model	-
Probe serial no.	-
Customer name	UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Customer address	BI SOI UDOMSU41, SUKHUMVIT ROAD, BANGCHAK PRAKAMONG BANGKOK 10260

Total pages of certificate	2 Pages
Receiving no.	L-233244
Receiving date	28-Sep-23
Parameter of calibration	Gas Calibration(Oxygen 2.496,10.04,21.02 %vol, Carbon Monoxide 80.14,302,1003 ppm, Nitrogen Dioxide 30.34,80.96,201.9 ppm, Nitric Oxide 30.01,151.5,322.5 ppm, Sulphur Dioxide 50.36,100.8,600.8 ppm)
Condition of UUC.	Used
Ambient condition	All of the Measurement were carried out the stabilized laboratory Temperature : 23 ± 0.5 °C Humidity : 55 ± 15 %RH
Calibration place	17/121 Soi Ngamwongwan 47 Yaek 48, Toongsuanghong, Lakki, Bangkok 10210
Calibration procedure no.	This instrument was calibrated by comparison with Standard gas mixture according to calibration Work Instruction no. WI-CL-28-C

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

This Calibration Certificate may not be reproduced other than in full except with the permission of the issuing laboratory.

Calibration certificates without signature and seal are not valid and The results relate only to the items tested/calibrated.

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

Date of calibration : 04-Oct-23

Kwanthai
Mr. Kwanthai Khambong
Calibration Technician

Wongset
Mrs. Nongluck Wongsetee
Technical Manager

เอกสารไม่ควบคุม

Standard References (Table 1)

Standard	Certificate No.	Vendor	Due date
Oxygen (O ₂) 2.496 % Vol	4219/21	Linde	30-Sep-25
Oxygen (O ₂) 10.04 % Vol	CG-0153-21	Nimt	18-Nov-26
Oxygen (O ₂) 21.02 % Vol	CG-0941-22	Nimt	10-Feb-27
Carbon monoxide (CO) 80.14 ppm	CG-0940-22	Nimt	14-Feb-27
Carbon monoxide (CO) 302 ppm	1915/23	Linde	16-Jun-25
Carbon monoxide (CO) 1003 ppm	2584/23	Linde	10-Sep-25
Nitrogen Dioxide (NO ₂) 30.34 ppm	2703/22	Linde	22-Aug-24
Nitrogen Dioxide (NO ₂) 80.96 ppm	3740/21	Linde	26-Jun-24
Nitrogen Dioxide (NO ₂) 201.9 ppm	1975/23	Linde	17-Jul-25
Nitric Oxide (NO) 30.01 ppm	CG-0014-23	Nimt	19-Feb-25
Nitric Oxide (NO) 151.5 ppm	0161/23	Linde	22-Jan-25
Nitric Oxide (NO) 322.5 ppm	1974/23	Linde	17-Jul-25
Sulphur Dioxide (SO ₂) 50.36 ppm	2004/23	Linde	17-Jul-25
Sulphur Dioxide (SO ₂) 100.8 ppm	3507/22	Linde	09-Nov-24
Sulphur Dioxide (SO ₂) 600.8 ppm	2003/23	Linde	17-Jul-25

Measured room conditions

Temperature	22.5 °C	Humidity	66.7 %RH	Pressure	1007.5 mbar
-------------	---------	----------	----------	----------	-------------

Calibration conditions

Gas Temperature	23 °C	Flow rate	1,100 ml/min	Gas pressure	1019.4 mbar
-----------------	-------	-----------	--------------	--------------	-------------

Calibration Results (Without adjustment) (Table 2)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (±)
O ₂ (%Vol)	2.496	2.53	0.032	0.15
O ₂ (%Vol)	10.04	10.09	0.05	0.20
O ₂ (%Vol)	21.02	21.11	0.09	0.30
CO (ppm)	80.14	81	0.86	3.0
CO (ppm)	302	302	0	6.0
CO (ppm)	1003	1000	-3	12
NO ₂ (ppm)	30.34	28.2	-2.14	8.0
NO ₂ (ppm)	80.96	79.4	-1.56	6.0
NO ₂ (ppm)	201.9	200.8	-1.1	12
NO (ppm)	30.01	28	-2.01	8.0
NO (ppm)	151.5	153	1.5	8.0
NO (ppm)	322.5	325	2.5	12
SO ₂ (ppm)	50.36	51	0.64	6.0
SO ₂ (ppm)	100.8	101	0.2	6.0
SO ₂ (ppm)	600.8	600	-0.8	13

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

End of Report

เอกสารไม่ควบคุม

CERTIFICATE OF CALIBRATION

Certificate No.: CL-004-65

Page 1 of 2 Pages

MEASUREMENT ITEM

MANUFACTURER

MODEL/TYPE

SERIAL NUMBER

ID NUMBER

CONDITION AS-RECEIVED

CUSTOMER

: Top Load Office

: Tech Environmental, Inc.

: TE-9025A

: 3399

: UAE.FRM.064/2580

: Used item

: United Analyst 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 GGS/IMC/W2-20. The MGC-004 was used as a calibration guideline.

Traceability:

This certificate provides a traceability of the measurement to recognized national standards and to realization of the international system of units (SI) through the VSL (National Metrology Institute of Netherlands) via Certificate number: 0221501

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

MEASUREMENT DATE

ISSUE DATE

: 15 Jul 2022

: 25 Jul 2022

: 26 Jul 2022

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follows:

Temperature: 23.0 ± 3.0 °C

Relative Humidity: 55.0 ± 15.0 %RH

Atmospheric Pressure: 1030 ± 10 hPa

CALIBRATION CONDITION:

Preconditioning:

Measurement Condition:

: 24 hours at ambient condition.

: The average values during measurement are 24.7 °C and 52.1 %RH.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:
☐ Mr. Surak Theerakul
☒ Mrs. Jiraporn Sertthamthul



Approved signatory:

[Signature]
Mr. Parisa Booncharoen
Calibration Department Manager

Continuation of Certificate of Calibration Number CL-004-65

Page 2 of 2 Pages

MEASUREMENT RESULTS:

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

Table 1: The results of Q Standard calibration data

Plate	Flow rate m ³ /min	Pressure [Pa] mmHg	Temperature [Ta] °C	Temperature [Tm] °C	Ap_meter mmHg	Ap_Office inH ₂ O	Y	Standard Flow [Qs] m ³ /min
1	0.699	756.468	24.680	23.730	55.667	1.705	1.503	0.647
2	1.001	756.479	24.910	24.180	61.363	3.454	1.855	0.919
3	1.114	756.494	24.550	23.970	41.751	4.535	1.126	1.053
4	1.156	756.510	24.470	23.900	30.652	5.138	2.264	1.118
5	1.416	756.534	24.400	24.150	30.300	7.619	3.757	1.357

Slope (a):

2.04689

Intercept (b):

-0.03001

Correlation coefficient (r):

0.99987

Uncertainty (k=2):

0.010 m³/min

Table 2: The results of Q actual calibration data

Plate	Flow rate m ³ /min	Pressure [Pa] mmHg	Temperature [Ta] °C	Temperature [Tm] °C	Ap_meter mmHg	Ap_Office inH ₂ O	Y	Standard Flow [Qs] m ³ /min
1	0.699	756.468	24.680	23.730	55.667	1.705	0.819	0.649
2	1.001	756.479	24.910	24.180	61.363	3.454	1.167	0.922
3	1.114	756.494	24.550	23.970	41.751	4.535	1.336	1.054
4	1.156	756.510	24.470	23.900	30.652	5.138	1.422	1.121
5	1.416	756.534	24.400	24.150	30.300	7.619	1.733	1.360

Slope (a):

1.28208

Intercept (b):

-0.03449

Correlation coefficient (r):

0.99987

Uncertainty (k=2):

0.011 m³/min

End of Certificate of Calibration



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

เอกสารไม่ควบคุม



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

Certificate of Calibration

Certificate No.: 23P1398
Page: 1 of 2

Equipment:

: U Tube Manometer

Manufacturer:

: Dwyer

Model:

: 1221-30-WM

Serial No.:

: -

ID No.:

: UAE.EMA2.095/2505

Condition As-Received:

: Used item

Received Date:

: 26 April 2023

Calibration Date:

: 09 May 2023

Reference:

: 2304-0703WSC

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

Ambient Temperature: (23 ± 2) °C

Relative Humidity: (50 ± 15) %

Atmospheric Pressure: 1010 mbar

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 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-0137-22	24 Aug 2023

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

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

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

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

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

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

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

- National Institute of Metrology Thailand (NIMT)

Calibrated by: Suwit Aussarree
Issue Date: 11 May 2023

Approved Signatory:

[Signature]
Phalinee Pratsipal
Sura Suwananart
Atapol Panurach

เอกสารไม่ควบคุม
B 0314239



Cert.No.: 23P1398
Page: 2 of 2

Result of calibration:- Without adjustment

Function:- Pressure Measurement

Increasing Pressure

Range: 0 inH₂O to 36 inH₂O

Scale Interval: 0.1 inH₂O (The Fifth Estimate)

Applied Pressure (inH ₂ O)	UUC Indication		AP (inH ₂ O)	Error (inH ₂ O)
	High-port side (inH ₂ O)	Low-port side (inH ₂ O)		
0.00	0.00	0.00	0.00	0.00
2.00	1.00	-1.00	2.00	0.00
4.00	2.00	-2.00	4.00	0.00
6.00	3.00	-3.02	6.02	0.02
10.00	5.00	-5.02	10.02	0.02
12.00	6.00	-6.02	12.02	0.02
14.00	7.00	-7.00	14.00	0.00
16.00	8.00	-8.00	16.00	0.00
18.00	9.00	-9.00	18.00	0.00
20.00	10.00	-10.00	20.00	0.00
22.00	11.00	-11.02	22.02	0.02
24.00	12.00	-12.02	24.02	0.02
26.00	13.00	-13.02	26.02	0.02
28.00	14.00	-14.00	28.00	0.00
30.00	15.02	-15.02	30.04	0.04
32.00	16.02	-16.02	32.04	0.04
34.00	17.00	-17.00	34.00	0.00
36.00	17.96	-18.00	35.96	0.16

The uncertainty of measurement was ± 0.11 inH₂O

* UUC = Unit Under Calibration

* AP = 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 %.

-o0o-

[Signature]
เอกสารไม่ควบคุม
a 1160344

Certificate of Calibration

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

Certificate No : 23-AFM-203

Request No : Req-2023-1919

Unit Under Calibration Details

Measurement Item : Air Flow Meter
Manufacturer : BGI
Model : Delta Cal DC1
Serial Number : 159K22
ID : UAE.EFM.0392561
Sensor Model : -
Sensor Serial Number : -
Location of Calibration : LAB 4 AIR VELOCITY METER

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 20 %RH
Barometric Pressure : 1013 kPa ± 10 kPa
Received Date : 7 September 2023
Calibration Date : 27 September 2023
Calibration Procedure : In-house method CP-AFM-01 by Comparison technique with Standard Primary Flow Calibrator


Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Gilibrator 3 Standard flow	10021011003	Sensidyne	12 July 2024
Air Flow Meter	Gilibrator 3 High flow	18501012032	Sensidyne	12 July 2024
Temperature meter	GT 31	08000057	Qcicorn	27 February 2024
Pressure meter	CPG2400	41006KDUJ651882	TPA	7 November 2023


Traceability :

This Certificate is traceable to SI Unit through Sensidyne A2LA Accreditation No. 3943.01

Note :

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

Calibration By : 
Mr. Noppadol Luangatt
Service Calibration Engineer

Approved By : 
Mr. Pacit Mathavom
Calibration Engineer Supervisor
Issue Date : 27 September 2023

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the laboratory.
FM-708-AFM-01 Rev.00 Issue date 01/07/19

เอกสารไม่ควบคุม

Certificate No : 23-AFM-203

Request No : Req-2023-1919

Result of Calibration :

Temperature (°C)	Pressure (kPa)	STD (l/min)	EUC (l/min)	Error (l/min)	Uncertainty (l/min)
24.90	100.64	14.58	14.50	-0.08	0.20
24.90	100.64	15.06	15.00	-0.06	0.21
25.08	100.63	15.90	15.80	-0.10	0.22
24.90	100.63	16.78	16.67	-0.11	0.23
24.90	100.63	18.46	18.30	-0.16	0.26

Note

STD : Standard UUC : Unit Under Calibration

- UUC Reference Condition : At 23.0 °C, 101.3 kPa, Air

- Flow Rate was corrected for non-standard operating condition by using equation :

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

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

* Indicates non accredited

End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the laboratory.
FM-708-AFM-01 Rev.00 Issue date 01/07/19

เอกสารไม่ควบคุม

Certificate of Calibration

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

Certificate No : 23-TPM-461

Request No : Req-2023-1919

Page : 1/2

Unit Under Calibration Details

Calibration Parameter : Temperature
Instrument Name : Air Flow meter
Manufacturer : BGI
Model : Delta Cal DC1
Serial Number : 159K22
Resolution : 0.1 °C
ID Number : UAE.EFM.0392561
Range Calibration : 20 °C to 50 °C
Type of Sensor : RTD
Sensor Diameter (mm) : 3
Calibration Position (mm) : 45
Instrument Status : Used

Calibration Environment and Details


Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 15 %RH
Received Date : 7 September 2023
Calibrated Date : 27 September 2023
Calibration Procedure : In-house method CP-TPM-01 by Comparison with Standard Thermometer.

Reference Standard
Digital Thermometer with Sensor, Manufacturer: GINGO/GINGO, Model: GT11/RTD100, SN: 08000057, ID: 02-TPM Which was calibrated on 27 February 2023, Calibration Certificate No. : QR23-0494

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

Note

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

Approved By : 
Mr. Noppadol Luangatt
Technical Manager
Issue Date : 27 September 2023

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

เอกสารไม่ควบคุม

Calibration Note

UUC Adjustment : No Adjust

Certificate No : 23-TPM-461

Request No : Req-2023-1919

Page : 2/2

Result of Calibration :

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (°C)
T _a	20.033	20.0	0.0	0.13
	25.033	25.0	0.0	0.13
	30.033	30.1	-0.1	0.13
	35.034	35.1	-0.1	0.13
	40.040	40.0	0.0	0.13
	45.039	45.0	0.0	0.13
	50.043	50.0	0.0	0.13
T _f	20.033	20.0	0.0	0.13
	25.033	25.0	0.0	0.13
	30.033	30.1	-0.1	0.13
	35.034	35.2	-0.2	0.13
	40.040	40.2	-0.2	0.13
	45.039	45.2	-0.2	0.13
	50.043	50.2	-0.2	0.13

End of Certificate

Calibrated By : 
Mr. Strichok Jimpakdeesul

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

เอกสารไม่ควบคุม

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, BANGKOK 10250
TEL. 0-2715-3000-34 FAX. 0-2719-9484

HAC-MRA
NSC-NSC TESTER
CALIBRATION UNIT

Certificate of Calibration

Certificate No.: 23P1858
Page: 1 of 2

Equipment: Aneroid Barometer

Manufacturer: Barigo

Model: -

Serial No.: -

ID No.: UAE_ANV.124/2550

Condition As-Received: Used Item

Received Date: 26 May 2023

Calibration Date: 02 June 2023

Reference: 2305-0919WSC

Ambient Temperature: (23 ± 2) °C

Relative Humidity: (50 ± 15) %

Atmospheric Pressure: 1007 mbar

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

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

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

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

Condition of this result of calibration

1. Reference standards instruments:

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Standard Barometer	DP142	1422505046	MP-0094-23	03 May 2024

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

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

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

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

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

7. This Certification is traceable to the International System of Unit maintained through:-
-National Institute of Metrology Thailand (NIMT)

Calibrated by: Suksan Khankaew

Issue Date: 06 June 2023

Approved Signatory: *Attapol P.*

✓ | Phasinee Prabpai

✓ | Sura Suwanasri

✓ | Attapol Panurach

เอกสารไม่ควบคุม
๑ 0316958

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, BANGKOK 10250
TEL. 0-2715-3000-34 FAX. 0-2719-9484

HAC-MRA
NSC-NSC TESTER
CALIBRATION UNIT

Certificate of Calibration

Certificate No.: 23P1858
Page: 2 of 2

Result of calibration:- Without adjustment

Function:- Absolute Pressure Measurement

Range: 980 hPa to 1030 hPa
Scale Interval: 1 hPa (The Fifth Estimate)

Increasing Pressure									
Applied Pressure (hPa)	959.93	970.47	981.93	991.32	1002.28	1011.64	1021.14	1032.35	
UUC* Indication (hPa)	960.0	970.0	980.0	990.0	1000.0	1010.0	1020.0	1030.0	
Error (hPa)	0.07	-0.47	-1.93	-1.32	-2.28	-1.64	-1.14	-2.30	

Decreasing Pressure									
Applied Pressure (hPa)	1032.30	1021.44	1011.67	1002.36	992.35	981.94	970.49	959.94	
UUC* Indication (hPa)	1030.0	1020.0	1010.0	1000.0	990.0	980.0	970.0	960.0	
Error (hPa)	-2.30	-1.44	-1.67	-2.36	-2.35	-1.94	-0.49	0.06	

The uncertainty of measurement was ± 0.30 hPa

* UUC = Unit Under Calibration

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

-00-

เอกสารไม่ควบคุม
๑ 1165506

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, BANGKOK 10250
TEL. 0-2715-3000-34 FAX. 0-2719-9484

HAC-MRA
NSC-NSC TESTER
CALIBRATION UNIT

Certificate of Calibration

Certificate No.: 23H1201
Page: 1 of 2

Equipment: Dial Thermo-Hygrometer

Manufacturer: Barigo

Model: -

Serial No.: -

ID No.: UAE_EMA2.014/2550

Condition As-Received: Used Item

Received Date: 26 May 2023

Calibration Date: 30 May 2023
to 06 June 2023

Reference: 2305-0919WSC

Ambient Temperature: (25 ± 3) °C

Relative Humidity: (50 ± 20) %

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

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

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

Procedure used: Calibration 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) Hygro-M2 Dew Point Monitor	5112	2360195	20703	02 Aug 2023
2) Handheld Thermometer With Sensor	1523	3240076	23305	15 Mar 2024

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

3. This Certification is traceable to the International System of Unit maintained through:-
-National Institute of Standards and Technology (NIST), The United States of America.
-Technology Promotion Association (Thailand-Japan), NSC-NSC Accredited No. Calibration 0006

Calibrated by: Somchai Dumvor

Issue Date: 07 June 2023

Approved Signatory: *Amf*

✓ | Chakrit Waewwanjua

✓ | Pornthippa Tameyakul

✓ | Viporn Tantiyawuti

เอกสารไม่ควบคุม
๑ 0316275

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, BANGKOK 10250
TEL. 0-2715-3000-34 FAX. 0-2719-9484

HAC-MRA
NSC-NSC TESTER
CALIBRATION UNIT

Certificate of Calibration

Certificate No.: 23H1201
Page: 2 of 2

Result of Calibration:-

Function: Humidity Measurement

Before Adjustment

Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (±%R.H.)
25.0	40.1	55	14.9	1.6
25.0	60.0	66	6.0	1.7
25.0	80.0	78	-2.0	1.9

Result of Calibration:-

Function: Humidity Measurement

After Adjustment

Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (±%R.H.)
25.0	40.1	48	5.9	1.6
25.0	60.0	60	0.0	1.7
25.0	80.0	72	-8.0	1.9

Result of Calibration:-

Function: Temperature Measurement

Without Adjustment

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
19.987	20.0	0.013	0.72
30.016	30.0	-0.016	0.72
39.944	39.0	-0.944	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-

เอกสารไม่ควบคุม
๑ 1165294

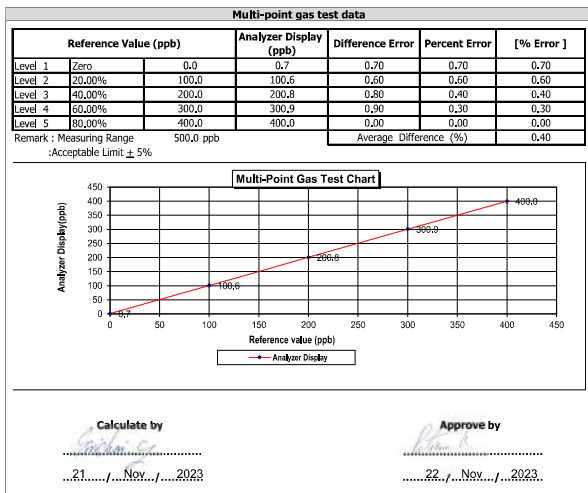
MULTI-POINT GAS TEST REPORT

Test Date : Nov 21, 2023

Equipment : Gas Analyzer (NO₂) Model : 42i
Manufacturer : Thermo Scientific Serial Number : 1201778105

Standard Gas Concentration

Sulphur Dioxide (SO ₂)	44.68	PPM	Manufacturer :	Thermo Scientific
Nitric Oxide (NO)	45.94	PPM	Model :	146i
Methane (CH ₄)	-	PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	984.8			
Cylinder No. :	EB0143262			
Expiration Date :	Jun 21, 2024			



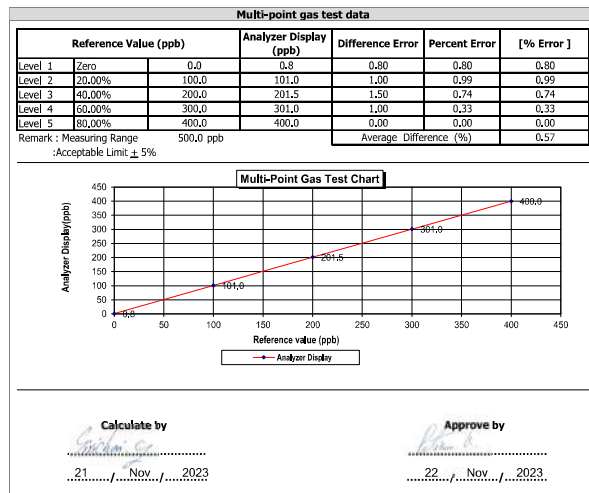
MULTI-POINT GAS TEST REPORT

Test Date : Nov 21, 2023

Equipment : Gas Analyzer (NO₂) Model : 42i
Manufacturer : Thermo Scientific Serial Number : 1201778107

Standard Gas Concentration

Sulphur Dioxide (SO ₂)	44.68	PPM	Manufacturer :	Thermo Scientific
Nitric Oxide (NO)	45.94	PPM	Model :	146i
Methane (CH ₄)	-	PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	984.8			
Cylinder No. :	EB0143262			
Expiration Date :	Jun 21, 2024			



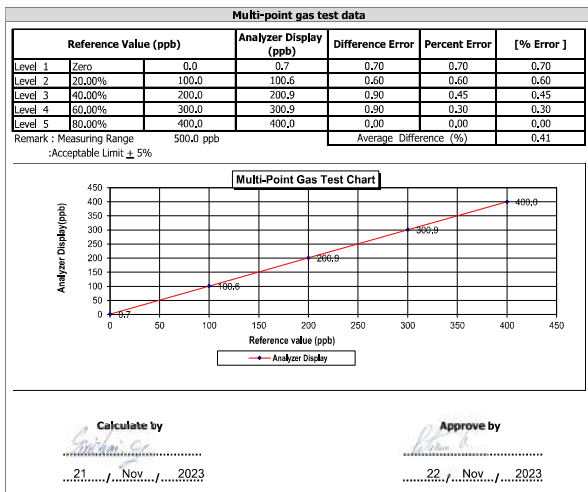
MULTI-POINT GAS TEST REPORT

Test Date : Nov 21, 2023

Equipment : Gas Analyzer (NO₂) Model : 42i
Manufacturer : Thermo Scientific Serial Number : 1201778109

Standard Gas Concentration

Sulphur Dioxide (SO ₂)	44.68	PPM	Manufacturer :	Thermo Scientific
Nitric Oxide (NO)	45.94	PPM	Model :	146i
Methane (CH ₄)	-	PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	984.8			
Cylinder No. :	EB0143262			
Expiration Date :	Jun 21, 2024			



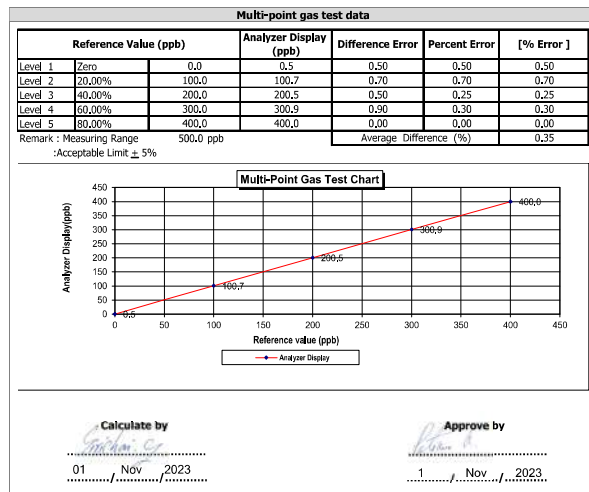
MULTI-POINT GAS TEST REPORT

Test Date : Nov 1, 2023

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

Standard Gas Concentration

Sulphur Dioxide (SO ₂)	44.68	PPM	Manufacturer :	Thermo Scientific
Nitric Oxide (NO)	45.94	PPM	Model :	146i
Methane (CH ₄)	-	PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	984.8			
Cylinder No. :	EB0143262			
Expiration Date :	Jun 21, 2024			



CERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

Part Number: E04N199E15A01D3 Reference Number: 122-402135167-1
Cylinder Number: EB0143262 Cylinder Volume: 144.4 CF
Laboratory: 124 - Durham (SAP) - NC Cylinder Pressure: 2015 PSIG
PGVP Number: B22021 Valve Outlet: 650
Gas Code: CO,NO,NOX,SO2,BALN Certification Date: Jun 21, 2021
Expiration Date: Jun 21, 2024

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gasometer Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig (i.e. 6.7 megapascals)

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
N ₂ O	45.00 PPM	45.58 PPM	G1	±1.4% NIST Traceable	06/14/2021, 06/21/2021
NITRIC OXIDE	45.00 PPM	45.94 PPM	G1	±1.4% NIST Traceable	06/14/2021, 06/21/2021
SULFUR DIOXIDE	45.00 PPM	44.68 PPM	G1	±1.0% NIST Traceable	06/14/2021, 06/21/2021
CARBON MONOXIDE	1000 PPM	984.8 PPM	G1	±0.7% NIST Traceable	06/14/2021
NITROGEN	Balance				

CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	20051120	CC705088	49.82 PPM NITRIC OXIDE/NITROGEN	±1.0%	Feb 02, 2025
PRM	12388	D865025	9.91 PPM NITROGEN DIOXIDE/AIR	±2.0%	Feb 20, 2020
GMS	401421358102	CC505581	4.348 PPM NITROGEN DIOXIDE/NITROGEN	±2.1	Feb 18, 2023
NTRM	16011043	CC413277	48.02 PPM SULFUR DIOXIDE/NITROGEN	±0.8%	Jun 17, 2022
NTRM	14600119	CC434277	980.9 PPM CARBON MONOXIDE/NITROGEN	±0.6%	Nov 15, 2025

ANALYTICAL EQUIPMENT			
Instrument/Make/Model	Analytical Principle	Last Multi-point Calibration	
Nicolet 6700 AHR0801333 CO	FTIR	Jun 03, 2021	
Nicolet 6700 AHR0801333 NO	FTIR	Jun 03, 2021	
Nicolet 6700 AHR0801333 NO2	FTIR	Jun 03, 2021	
Nicolet 6700 AHR0801333 SO2	FTIR	Jun 03, 2021	

Triad Data Available Upon Request

NOTES: PO #5221002807
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 : Nov 3, 2023

Equipment : Gas Analyzer (SO₂) Model : 43i
Manufacturer : Thermo SCIENTIFIC Serial Number : 1180540065

Standard Gas Concentration

Sulphur Dioxide (SO₂) 44.68 PPM
Nitric Oxide (NO) 45.94 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 984.8 PPM
Cylinder No. : EB0143262
Expiration Date : Jun 24, 2024

Dilutor Detail

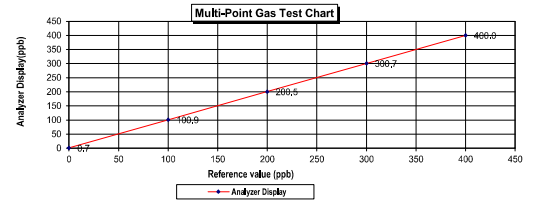
Manufacturer : Thermo SCIENTIFIC
Model : 146i
Serial Number : 1180540071

Multi-point gas test data

	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.7	0.70	0.70
Level 2	20.00%	100.0	100.9	0.90	0.89
Level 3	40.00%	200.0	200.5	0.50	0.25
Level 4	60.00%	300.0	300.7	0.70	0.23
Level 5	80.00%	400.0	400.0	0.00	0.00

Remark : Measuring Range 500.0 ppb

:Acceptable Limit ± 5%



Calculate by

03 / Nov / 2023

Approve by

03 / Nov / 2023

Page 1 of 1

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Nov 9, 2023

Equipment : Gas Analyzer (SO₂) Model : 43i
Manufacturer : Thermo SCIENTIFIC Serial Number : 1180540066

Standard Gas Concentration

Sulphur Dioxide (SO₂) 44.68 PPM
Nitric Oxide (NO) 45.94 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 984.8 PPM
Cylinder No. : EB0143262
Expiration Date : Jun 24, 2024

Dilutor Detail

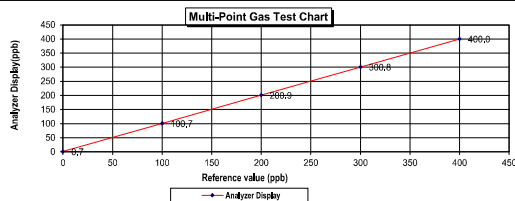
Manufacturer : Thermo SCIENTIFIC
Model : 146i
Serial Number : 1180540071

Multi-point gas test data

	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.7	0.70	0.70
Level 2	20.00%	100.0	100.7	0.70	0.70
Level 3	40.00%	200.0	200.9	0.90	0.45
Level 4	60.00%	300.0	300.8	0.80	0.27
Level 5	80.00%	400.0	400.0	0.00	0.00

Remark : Measuring Range 500.0 ppb

:Acceptable Limit ± 5%



Calculate by

9 / 11 / 66

Approve by

9 / Nov / 2023

Page 1 of 1

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Nov 9, 2023

Equipment : Gas Analyzer (SO₂) Model : 43i
Manufacturer : Thermo SCIENTIFIC Serial Number : 1180540067

Standard Gas Concentration

Sulphur Dioxide (SO₂) 44.68 PPM
Nitric Oxide (NO) 45.94 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 984.8 PPM
Cylinder No. : EB0143262
Expiration Date : Jun 24, 2024

Dilutor Detail

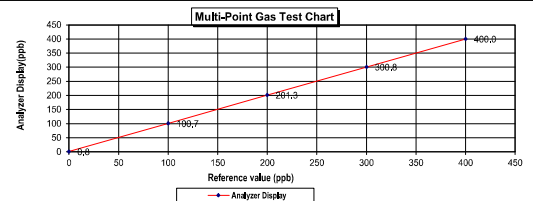
Manufacturer : Thermo SCIENTIFIC
Model : 146i
Serial Number : 1180540071

Multi-point gas test data

	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.8	0.80	0.80
Level 2	20.00%	100.0	100.7	0.70	0.70
Level 3	40.00%	200.0	201.3	1.30	0.65
Level 4	60.00%	300.0	300.8	0.80	0.27
Level 5	80.00%	400.0	400.0	0.00	0.00

Remark : Measuring Range 500.0 ppb

:Acceptable Limit ± 5%



Calculate by

9 / 11 / 66

Approve by

9 / Nov / 2023

Page 1 of 1

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

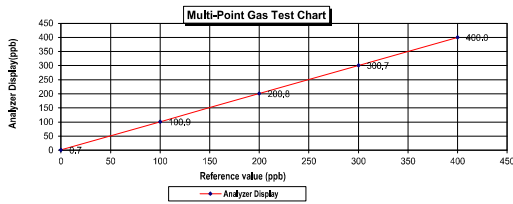
Test Date : Nov 3, 2023

Equipment : Gas Analyzer (SO₂) Model : 43i
Manufacturer : Thermo SCIENTIFIC Serial Number : 1182920016

Standard Gas Concentration	Dilutor Detail
Sulphur Dioxide (SO ₂) 44.68 PPM	Manufacturer : Thermo SCIENTIFIC
Nitric Oxide (NO) 45.94 PPM	Model : 146i
Methane (CH ₄) - PPM	Serial Number : 1180540071
Carbon Monoxide (CO) 984.8 PPM	
Cylinder No. : E80143262	
Expiration Date : Jun 24, 2024	

Multi-point gas test data

Reference Value (ppb)			Analyzer Display (ppb)	Difference Error	Percent Error	(% Error)	
Level 1	Zero	0.0	0.7	0.70	0.70	0.70	
Level 2	20.00%	100.0	100.9	0.90	0.89	0.89	
Level 3	40.00%	200.0	200.8	0.80	0.40	0.40	
Level 4	60.00%	300.0	300.7	0.70	0.23	0.23	
Level 5	80.00%	400.0	400.0	0.00	0.00	0.00	
Remark : Measuring Range			500.0 ppb				
				Average Difference (%)			0.44



Calculate by

03 Nov 2023

Approve by

03 Nov 2023

เอกสารไม่ควบคุม

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E04NI99E15A01D3 Reference Number: 122-402135167-1
Cylinder Number: E80143262 Cylinder Volume: 144.4 CF
Laboratory: 124 - Durham (SAP) - NC Cylinder Pressure: 2015 PSI/G
PGVP Number: B22021 Valve Outlet: 680
Gas Code: CO,NO,NOX,SO₂,BALN Certification Date: Jun 21, 2021
Expiration Date: Jun 21, 2024

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gas Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.
Do Not Use This Cylinder below 100 psig, i.e. 6.7 megapascals.

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	45.00 PPM	45.96 PPM	G1	$\pm 1.4\%$ NIST Traceable	06/14/2021, 06/21/2021
NITRIC OXIDE	45.00 PPM	45.94 PPM	G1	$\pm 1.4\%$ NIST Traceable	06/14/2021, 06/21/2021
SULFUR DIOXIDE	45.00 PPM	44.88 PPM	G1	$\pm 1.0\%$ NIST Traceable	06/14/2021, 06/21/2021
CARBON MONOXIDE	1000 PPM	984.8 PPM	G1	$\pm 0.7\%$ NIST Traceable	06/14/2021
NITROGEN	Balance				

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	20081120	CCT08068	48.82 PPM NITRIC OXIDE/NITROGEN	$\pm 1.0\%$	Feb 02, 2025
PRM	12368	D886025	6.91 PPM NITROGEN DIOXIDE/AIR	$\pm 2.0\%$	Feb 02, 2025
GMS	401423638102	CC505581	4.348 PPM NITROGEN DIOXIDE/NITROGEN	± 2.1	Feb 18, 2023
NTRM	16011043	CC413277	48.02 PPM SULFUR DIOXIDE/NITROGEN	$\pm 0.8\%$	Jun 17, 2022
NTRM	14060119	CC434277	980.9 PPM CARBON MONOXIDE/NITROGEN	$\pm 0.6\%$	Nov 15, 2025

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet 6700 AHR0801333 CO	FTIR	Jun 03, 2021
Nicolet 6700 AHR0801333 NO	FTIR	Jun 03, 2021
Nicolet 6700 AHR0801333 NO ₂	FTIR	Jun 03, 2021
Nicolet 6700 AHR0801333 SO ₂	FTIR	Jun 03, 2021

Triad Data Available Upon Request

NOTES: PO #5221002807
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

THAI METEOROLOGICAL DEPARTMENT

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

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue : 1 November, 2023

Certification No. 390/23

Page : 1 of 5

Object : Wind Speed & Wind Direction Data Logger

Manufacturer : SCARLET/TECH

Type : WL-21

Mfg Code : Wireless Receiver 2205DR0113

Wind Sensor 2205DT0113

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

81 Soi Udomsuk 41, Sukhumvit Road,

Bangchak, Prachinong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1013.5 hPa

NATIONAL STANDARD WIND TUNNEL : Thermal Anemometer 642 S/N 91563

: HOOK GAGE NO 1425 : Wind Aloft Plotting Board

N.J.S.T. Test Reference Number 731/241460

: Standard Velocity at 20 - 30 m/sec

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

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION

: Standard Velocity at 0 - 20 m/sec

STANDARD THERMOMETER

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

: Iseto, Iseto 845 Serial No. 02848057 : ThermoSchneider No.918802

STANDARD BAROMETER

: Digital Barometer Vaisala Type PTB220 No. V1220015

Calibrated by : Mr. Watchapol Subwat

Signed : Mr. Pirod Pomsut

Authorized Signatory

for the Calibration

Sub-Standard Instrument

เอกสารไม่ควบคุม

THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

1 November, 2023

Certification No. 390/23

Page : 2 of 5

Standard	HOOK GAGE NO. 1425	TESTED ANEMOMETER
Ultrasonic Anemometer	Pressure Vacuum Velocity	Velocity Correction
m/sec	inches H2O inches H2O m/sec	m/sec m/sec
1.00	- - -	1.0 0.0
3.02	- - -	3.0 0.02
5.00	- - -	5.0 0.0
7.04	- - -	7.0 0.04
9.02	- - -	8.9 0.12
11.02	- - -	9.0 2.02
13.01	- - -	13.0 0.01
15.01	- - -	14.9 0.11
17.02	- - -	17.0 0.02
20.02	- - -	19.9 0.12

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

Calibrated by :

Mr. Watchapol Subwat

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau

THAI METEOROLOGICAL DEPARTMENT

เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 390/23

1 November, 2023

Page : 3 of 5

Standard Barometer Pressure	Tested Barometer Pressure	Correction
1009.68	1009	0.68
1007.51	1007	0.51
1007.13	1007	0.13
1006.90	1007	-0.10
1006.72	1007	-0.28
1006.59	1006	0.59
1006.28	1006	0.28
1006.05	1006	0.05
1005.84	1006	-0.16
1005.40	1005	0.40
1009.81	1010	-0.39
1009.76	1010	-0.24
1009.69	1009	0.69
1009.45	1009	0.45
1009.34	1009	0.34
1008.89	1009	-0.11
1007.66	1008	-0.34
1006.99	1007	-0.01
1006.29	1006	0.29
1004.56	1005	-0.44

Average

0.22

Calibrated by :

Mr. Watcharapol Subwat
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau

เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 390/23

1 November, 2023

Page : 4 of 5

Standard Barometer Pressure	Tested Barometer Pressure	Correction
757.32	757	0.32
755.69	756	-0.31
755.41	755	0.41
755.24	755	0.24
755.10	755	0.10
755.00	755	0.00
754.77	755	-0.23
754.60	754	0.60
754.44	754	0.44
754.17	754	0.17
757.27	757	0.27
757.38	757	0.38
757.33	757	0.33
757.15	757	0.15
756.99	757	-0.01
756.73	757	-0.27
755.81	756	-0.19
755.90	755	0.90
754.78	755	-0.22
753.48	753	0.48

Average

0.15

Calibrated by :

Mr. Watcharapol Subwat
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau

เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 390/23

1 November, 2023

Page : 5 of 5

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.12	45	0.12
30.21	30	0.21
15.42	15	0.42

Calibrated by :

Mr. Watcharapol Subwat
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau

เอกสารไม่ควบคุม



CALIBRATION LABORATORY Co., LTD.

2/10-11/14, 95 Soi Phrasert Manukul 29-Yaen 4, Phrasert Manukul Rd., Ladprao, Bangkok 10320
Tel. 02-579-0353-4 Fax: 02-579-2572 www.cal-lab.com E-mail: info@cal-lab.com



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2601/721A3301
SERIAL NO. : UM14465/UM14465
CLID. NO. : 252000712
JOB CONTROL NO. : 231019117019

CUSTOMER : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
81 SOI UDOMSUK 41, SUKHUMVIT ROAD,
BANGCHAK, PHRAKHANONG, BANGKOK 10260

DATE OF RECEIVED : 19 October 2023

DATE OF ISSUED : 25 October 2023

Report of calibration screening must not be taken in part. Except complete. Without the approval of the Calibration Laboratory Co., Ltd.

Calibrated By : Suwit Phanbusabong
Calibration Engineer

[Signature]

Approved By : Mongkol Yotsontorn
Authorized Signatory
25 October 2023



This Calibration Certificate documents the traceability to national standards, which realize the units of measurement according to the International System of Units (SI)

Certificate No. Q23117019
F3-011-04/01-12

page 1 of 4

เอกสารไม่ควบคุม





CALIBRATION LABORATORY Co.,LTD.

210-11, M.50 Soi Prasert Manukit 29 Yaei 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel. 02-578-0353-4 Fax: 02-578-2672 www.ccl-lab.com E-mail: sale@ccl-lab.com



REPORT OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2601/721A3301
SERIAL NO. : UM14465/UM14465
DATE OF CALIBRATION : 20 October 2023

ENVIRONMENT CONDITIONS :

Temperature : $(23 \pm 2) ^\circ\text{C}$

Relative Humidity : $(55 \pm 15) \%RH$

PROCEDURE USED :

This instrument was calibrated under procedure No. CLC-CPEE-08 based on ISO 16063-21 as calibration guideline.
The calibration was performed by using Digital Multimeter, Programmable Timer/Counter and Vibration Calibrator Amplifier which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

1. Vibration Calibrator, The Modal Shop Model 9110D S/N. 11424.
2. Digital Multimeter, Hewlett Packard Model 34401A S/N. J1-46A75935.
3. Programmable Timer/Counter, Philips Model PM6680B S/N. SM607101.

TRACEABILITY :

1. The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. AV-0030-23, Due Date 26 June 2024.
2. The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. EE-0136-22, Due Date 11 November 2023.
3. The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 07-0943/23, Due Date 12 April 2024.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2$, which for a normal distribution corresponds to a coverage probability of approximately 95 %. It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2022)".

Certificate No. Q23117019

F3-011-04/01-12

page 2 of 4

เอกสารไม่ควบคุม



CALIBRATION LABORATORY Co.,LTD.

210-11, M.50 Soi Prasert Manukit 29 Yaei 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel. 02-578-0353-4 Fax: 02-578-2672 www.ccl-lab.com E-mail: sale@ccl-lab.com



CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

CALIBRATION DATA

1. ACCELERATION RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(g)	(frequency)		(g)	(g)	(g)	\pm (% of rdg.)
0.3	50 Hz	peak	0.300	0.307	-0.007	1.9
0.4	50 Hz		0.400	0.407	-0.007	1.9
0.5	50 Hz		0.500	0.508	-0.008	1.9
0.6	50 Hz		0.600	0.609	-0.009	1.9
0.7	50 Hz		0.700	0.710	-0.010	1.9
0.3	100 Hz	peak	0.300	0.307	-0.007	1.9
0.4	100 Hz		0.400	0.408	-0.008	1.9
0.5	100 Hz		0.500	0.509	-0.009	1.9
0.6	100 Hz		0.600	0.609	-0.009	1.9
0.7	100 Hz		0.700	0.710	-0.010	1.9

2. VELOCITY RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm/s)	(frequency)		(mm/s)	(mm/s)	(mm/s)	\pm (% of rdg.)
3	50 Hz	peak	3.000	3.059	-0.059	1.9
4	50 Hz		4.000	4.068	-0.068	1.9
5	50 Hz		5.000	5.079	-0.079	1.9
6	50 Hz		6.000	6.089	-0.089	1.9
7	50 Hz		7.000	7.097	-0.097	1.9
3	100 Hz	peak	3.000	3.064	-0.064	1.9
4	100 Hz		4.000	4.072	-0.072	1.9
5	100 Hz		5.000	5.085	-0.085	1.9
6	100 Hz		6.000	6.091	-0.091	1.9
7	100 Hz		7.000	7.099	-0.099	1.9

Certificate No. Q23117019

F3-011-04/01-12

page 3 of 4

เอกสารไม่ควบคุม



CALIBRATION LABORATORY Co.,LTD.

210-11, M.50 Soi Prasert Manukit 29 Yaei 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel. 02-578-0353-4 Fax: 02-578-2672 www.ccl-lab.com E-mail: sale@ccl-lab.com



CALIBRATION DATA

3. DISPLACEMENT RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm)	(frequency)		(mm)	(mm)	(mm)	\pm (% of rdg.)
0.03	50 Hz	peak	0.030	0.030	0.000	2.7
0.04	50 Hz		0.040	0.040	0.000	2.4
0.05	50 Hz		0.050	0.050	0.000	2.2
0.06	50 Hz		0.060	0.061	-0.001	2.1
0.07	50 Hz		0.070	0.071	-0.001	2.1
0.03	100 Hz	peak	0.030	0.030	0.000	2.7
0.04	100 Hz		0.040	0.040	0.000	2.4
0.05	100 Hz		0.050	0.050	0.000	2.2
0.06	100 Hz		0.060	0.061	-0.001	2.1
0.07	100 Hz		0.070	0.071	-0.001	2.1

Note: The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 009 Page 1,2 of 59

This report is valid for the above stated instrument's only.

End of Certificate

Certificate No. Q23117019

F3-011-04/01-12

page 4 of 4

เอกสารไม่ควบคุม



INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7/139 Moo 11, Soi Sutintakorn 11 Tambon Bang Kadi,
Amphoe Bang Phli Samut Prakan Province 10540 THAILAND
TEL. 0890-2130-7800 FAX: 0890-2130-7140



Certificate of Calibration

Customer

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

Certificate No : 23-ACT-117
Request No : Req-2023-1546

Unit Under Calibration Details

Measurement Item : Acoustic Calibrator
Manufacturer : SVANTEK
Model : SV 36
Serial Number : 107224
ID : UAE.EFM.171/2564
Class : 1
Range : 94 , 114 dB / 1000 Hz
Instrument Status : Used

Calibration Environment and Details

Temperature : $(23 \pm 2) ^\circ\text{C}$
Humidity : $(50 \pm 20) \%RH$
Barometric Pressure : $(1013 \pm 10.0) \text{ hPa}$
Received Date : 21 July 2023
Calibration Date : 4 August 2023
Location of Calibration : LAB 1 Acoustic
Calibration Procedure : In-house method CP-ACT-02 based on IEC 60942:2017 Electroacoustics - Sound calibrators

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

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. Noppadol Luangart
Service Calibration Engineer

Approved By :
Mr. Pacit Mathavorn
Calibration Engineer Supervisor
Issue Date : 4 August 2023

The results stated only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the issuing organization.
F3-011-04/01-12

เอกสารไม่ควบคุม

Certificate No : 23-ACT-117

Request No : Req-2023-1546

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	94.03	-0.03	-	-	0.13	0.25
114 dB / 1000 Hz	114.11	0.11	-	-	0.13	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	-	-	0.01	0.70
114 dB / 1000 Hz	1000.00	0.00	-	-	0.01	0.70

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

Calibration Range (Hz)	Without Adjustment	Adjustment	Uncertainty (± %)	Acceptance limit Class 1 (± %)
	Measured (%)	Measured (%)		
94 dB / 1000 Hz	0.26	-	0.40	2.5
114 dB / 1000 Hz	0.38	-	0.40	2.5

Note :

- Acceptance limit was IEC60602:2017 Class 1
- The calibration results exclude the calibration pressure correction
- The calibration results exclude the microphone volume correction

End of Calibration

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

Calibration Certificate

Certificate Number 2023003666

Customer:

United Analyst and Engineering Consultant Co Ltd
No. 81 Soi Udonwut 41, Sukhumvit Road,
Bangkok, Phra Khanong,
Bangkok, 10260, Thailand

Model Number LxT1

Serial Number 0507308

Test Results Pass

Initial Condition As Manufactured

Description SoundTrack LxT Class 1
Class 1 Sound Level Meter
Firmware Revision: 2.404

Procedure Number D0001.8354

Technician Jacob Cannon

Calibration Date 23 Mar 2023

Calibration Due

Temperature 23.54 °C ± 0.26 °C

Humidity 50.5 %RH ± 2.0 %RH

Static Pressure 85.96 kPa ± 0.13 kPa

Evaluation Method

Tested with:

Larson Davis CAL200, S/N 9079

Larson Davis CAL291, S/N 0108

PCB 377602, S/N 345238

Larson Davis PRLMLT1, S/N 077643

Data reported in dB re 20 µPa.

Compliance Standards

Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8378:

IEC 60661:2001 Type 1

IEC 60804:2000 Type 1

IEC 61262:2002

IEC 61360:2001 Class 1

IEC 61818:2013 Class 1

ANSI S1.4-2014 Class 1

ANSI S1.4 (R2006) Type 1

ANSI S1.11 (R2009) Class 1

ANSI S1.26 (R2007)

ANSI S1.43 (R2007) Type 1

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017.

Test points marked with a ± in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

This report may not be reproduced, except in full, unless permission for the publication of an approved abstract is obtained in writing from the organization issuing this report.

Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert LxT, I770.01 Rev D Supporting Firmware Version: 4.0.5, 2019-05-10

For 1/8" microphones, the Larson Davis ADP024 1/4" to 1/2" adaptor is used with the calibrators and the Larson Davis ACP043 1/4" to

LARSON DAVIS - A PCB DIVISION
1681 West 820 North
Provo, UT 84601, United States
716-684-0001

2023-3-23T16:38:01



Page 1 of 3



D0001.8354 Rev G

เอกสารไม่ควบคุม

Certificate Number 2023003666

1/2" adaptor is used with the preamplifier.

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa

Periodic tests were performed in accordance with procedures from IEC 61672-3:2013 / ANSIASA S1.4-2014Part3.

Pattern approval for IEC 61672-1:2013 / ANSIASA S1.4-2014Part 1 successfully completed by Physikalisch-Technische Bundesanstalt (PTB) on 2007-10-09 reference number PTB-1.72-0334218.

The sound level meter submitted for testing successfully completed the periodic tests of IEC 61672-3:2013 / ANSIASA S1.4-2014Part 3, for the environmental conditions under which the tests were performed. As evidence was publicly available, from an independent testing organization responsible for approving the results of pattern-evaluation tests performed in accordance with IEC 61672-2:2013 / ANSIASA S1.4-2014Part 2, to demonstrate that the model of sound level meter fully conformed to the class 1 specifications in IEC 61672-1:2013 / ANSIASA S1.4-2014Part 1, the sound level meter submitted for testing conforms to the class 1 specifications in IEC 61672-1:2013 / ANSIASA S1.4-2014Part 1.

Standards Used			
Description	Cal Date	Cal Due	Cal Standard
Larson Davis CAL291 Residual Intensity Calibrator	2022-09-09	2023-09-09	001250
Hart Scientific 2426-H Temperature Probe	2021-08-25	2023-05-25	006798
Larson Davis CAL300 Acoustic Calibrator	2022-07-21	2023-07-21	007837
Larson Davis Model 831	2022-02-22	2024-02-22	007162
PCB 377A13 1/2 inch Prepolarized Pressure Microphone	2023-03-06	2024-03-06	007185
SRS DS360 Ultra Low Distortion Generator	2022-03-29	2023-03-29	007635
Larson Davis 1/2" Preamplifier for Model 831 Type 1	2022-09-28	2023-09-28	PCB0004783

Acoustic Calibration

Measured according to IEC 61672-3:2013 10 and ANSI S1.4-2014 Part 3: 10

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
1000 Hz	114.01	113.80	114.20	0.14	Pass

Loaded Circuit Sensitivity

Measurement	Test Result [dB re 1 V / Pa]	Lower Limit [dB re 1 V / Pa]	Upper Limit [dB re 1 V / Pa]	Expanded Uncertainty [dB]	Result
1000 Hz	-49.76	-52.44	-48.33	0.14	Pass

— End of measurement results—

Acoustic Signal Tests, C-weighting

Measured according to IEC 61672-3:2013 12 and ANSI S1.4-2014 Part 3: 12 using a comparison coupler with Unit Under Test (UUT) and reference SLM using slow time-weighted sound level for compliance to IEC 61672-1:2013 5.5; ANSI S1.4-2014 Part 1: 5.5

Frequency [Hz]	Test Result [dB]	Expected [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
125	-0.17	-0.20	-1.20	0.80	0.23	Pass
1000	0.16	0.00	-0.70	0.70	0.23	Pass
8000	-3.88	-3.00	-6.50	-1.50	0.32	Pass

— End of measurement results—

LARSON DAVIS - A PCB DIVISION
1681 West 820 North
Provo, UT 84601, United States
716-684-0001

2023-3-23T16:38:01



Page 2 of 3



D0001.8354 Rev G

เอกสารไม่ควบคุม

Certificate Number 2023003666

Self-generated Noise

Measured according to IEC 61672-3:2013 11.1 and ANSI S1.4-2014 Part 3: 11.1

Measurement	Test Result [dB]
A-weighted	40.34

— End of measurement results—

— End of Report—

Signature: Jacob Cannon

LARSON DAVIS - A PCB DIVISION
1681 West 820 North
Provo, UT 84601, United States
716-684-0001

2023-3-23T16:38:01



Page 1 of 3



D0001.8354 Rev G

เอกสารไม่ควบคุม

Calibration Certificate

Certificate Number 2023003654

Customer:

United Analyst and Engineering Consultant Co Ltd
No. 81 Soi Udomsak 41, Sukhumvit Road,
Bangkok, Phra Khanong,
Bangkok, 10260, Thailand

Model Number: LxT1

Serial Number: 0007308

Test Results: Pass

Initial Condition: As Manufactured

Description: SoundTrack LxT Class 1
Class 1 Sound Level Meter
Firmware Revision: 2.404

Procedure Number: D0001.8378

Technician: Jacob Cannon

Calibration Date: 23 Mar 2023

Calibration Due: 23 Mar 2024

Temperature: 23.64 °C ± 0.25 °C

Humidity: 49.2 %RH ± 2.0 %RH

Static Pressure: 86.07 kPa ± 0.13 kPa

Evaluation Method Tested electrically using Larson Davis PRLxT1 S/N 077643 and a 12.0 pF capacitor to simulate microphone capacitance. Data reported in dB re 20 µPa assuming a microphone sensitivity of 50.0 mV/Pa.

Compliance Standards Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8384:

IEC 60851:2001 Type 1	ANSI S1.4-2014 Class 1
IEC 60804:2000 Type 1	ANSI S1.4 (R2006) Type 1
IEC 61252:2002	ANSI S1.25 (R2007)
IEC 61672:2013 Class 1	ANSI S1.43 (R2007) Type 1
IEC 61268:2001 Class 1	ANSI S1.11 (R2009) Class 1

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017. Test points marked with a * in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plane to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

This report may not be reproduced, except in full, unless permission for the publication of an approved abstract is obtained in writing from the organization issuing this report.

Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert Ltd, I770.01 Rev O Supporting Firmware Version 4.0.5, 2010 05 10

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa

Description	Standards Used	Cal Date	Cal Due	Cal Standard
Hart Scientific 3626-H Temperature Probe		2023-08-25	2023-05-25	006798
SRS DS360 Ultra Low Distortion Generator		2022-12-29	2023-12-29	007118

LARSON DAVIS – A PCB DIVISION
1681 West 820 North
Provo, UT 84601, United States
716-684-0001

2023-3-23T16:53:02



Page 1 of 8

LARSON DAVIS
A PCB DIVISION

D0001.8407 Rev O

เอกสารไม่ควบคุม

LARSON DAVIS – A PCB DIVISION
1681 West 820 North
Provo, UT 84601, United States
716-684-0001

2023-3-23T16:53:02



Page 2 of 8

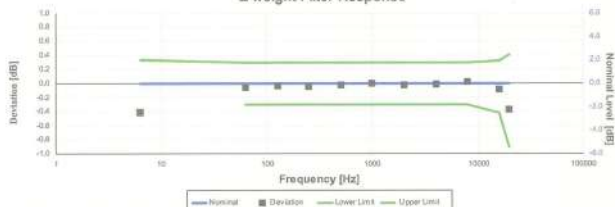
LARSON DAVIS
A PCB DIVISION

D0001.8407 Rev O

เอกสารไม่ควบคุม

Certificate Number 2023003654

Z-weight Filter Response



Electrical signal test of frequency weighting performed according to IEC 61672-3:2013 13 and ANSI S1.4-2014 Part 3: 13 for compliance to IEC 61672-1:2013 5.5, IEC 60851:2001 6.1 and 9.2.2, IEC 60804:2000 5, ANSI S1.4:1983 (R2006) 5.1 and 8.2.1, ANSI S1.4-2014 Part 1: 5.5

Frequency [Hz]	Test Result [dB]	Deviation [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
8.31	-0.41	-0.41	-1.11	0.33	0.15	Pass
63.10	-0.06	-0.06	-0.30	0.30	0.15	Pass
125.89	-0.04	-0.04	-0.30	0.30	0.15	Pass
251.19	-0.05	-0.05	-0.30	0.30	0.15	Pass
501.19	-0.03	-0.03	-0.30	0.30	0.15	Pass
1,000.00	0.00	0.00	-0.30	0.30	0.15	Pass
1,995.26	-0.03	-0.03	-0.30	0.30	0.15	Pass
3,981.07	-0.02	-0.02	-0.30	0.30	0.15	Pass
7,943.28	0.02	0.02	-0.30	0.30	0.15	Pass
15,948.93	-0.08	-0.08	-0.42	0.32	0.15	Pass
19,952.02	-0.37	-0.37	-0.91	0.41	0.15	Pass

— End of measurement results—

LARSON DAVIS – A PCB DIVISION
1681 West 820 North
Provo, UT 84601, United States
716-684-0001

2023-3-23T16:53:02



Page 3 of 8

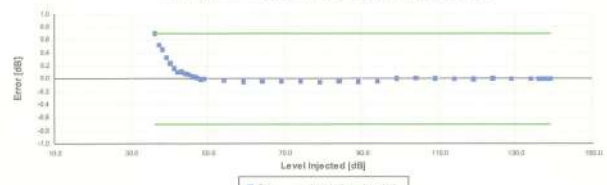
LARSON DAVIS
A PCB DIVISION

D0001.8407 Rev O

เอกสารไม่ควบคุม

Certificate Number 2023003654

A-weighted Broadband Log Linearity: 8,000.00 Hz



Broadband level linearity performed according to IEC 61672-3:2013 16 and ANSI S1.4-2014 Part 3: 16 for compliance to IEC 61672-1:2013 5.6, IEC 60804:2000 6.2, IEC 61252:2002 8, ANSI S1.4 (R2006) 5.8, ANSI S1.4-2014 Part 1: 5.6, ANSI S1.43 (R2007) 6.2

Level [dB]	Error [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
35.00	0.69	-0.70	0.70	0.16	Pass
37.00	0.62	-0.70	0.70	0.16	Pass
39.00	0.45	-0.70	0.70	0.16	Pass
39.00	0.32	-0.70	0.70	0.16	Pass
40.00	0.24	-0.70	0.70	0.16	Pass
41.00	0.16	-0.70	0.70	0.16	Pass
42.00	0.10	-0.70	0.70	0.16	Pass
43.00	0.11	-0.70	0.70	0.17	Pass
44.00	0.07	-0.70	0.70	0.17	Pass
45.00	0.05	-0.70	0.70	0.16	Pass
46.00	0.03	-0.70	0.70	0.16	Pass
47.00	0.02	-0.70	0.70	0.16	Pass
48.00	-0.01	-0.70	0.70	0.16	Pass
49.00	0.00	-0.70	0.70	0.16	Pass
50.00	-0.03	-0.70	0.70	0.16	Pass
59.00	-0.05	-0.70	0.70	0.16	Pass
64.00	-0.04	-0.70	0.70	0.16	Pass
69.00	-0.04	-0.70	0.70	0.16	Pass
74.00	-0.04	-0.70	0.70	0.16	Pass
79.00	-0.05	-0.70	0.70	0.16	Pass
84.00	-0.04	-0.70	0.70	0.16	Pass
89.00	-0.05	-0.70	0.70	0.16	Pass
94.00	-0.04	-0.70	0.70	0.16	Pass
99.00	0.01	-0.70	0.70	0.15	Pass
104.00	0.01	-0.70	0.70	0.15	Pass
109.00	0.01	-0.70	0.70	0.15	Pass
114.00	0.00	-0.70	0.70	0.15	Pass
119.00	-0.01	-0.70	0.70	0.15	Pass
124.00	0.01	-0.70	0.70	0.15	Pass
129.00	0.00	-0.70	0.70	0.15	Pass
134.00	0.00	-0.70	0.70	0.15	Pass
136.00	0.00	-0.70	0.70	0.15	Pass
137.00	0.00	-0.70	0.70	0.15	Pass
138.00	0.00	-0.70	0.70	0.15	Pass
139.00	0.00	-0.70	0.70	0.15	Pass

— End of measurement results—

LARSON DAVIS – A PCB DIVISION
1681 West 820 North
Provo, UT 84601, United States
716-684-0001

2023-3-23T16:53:02



Page 4 of 8

LARSON DAVIS
A PCB DIVISION

D0001.8407 Rev O

เอกสารไม่ควบคุม

Certificate Number 2023003654

Peak Rise Time

Peak rise time performed according to IEC 60651-2001 8.4.4 and ANSI S1.4-1983 (R2006) 8.4.4

Peak line time (primary) accounting for noise cases 1, 2, 3, 4, 5 and 6 (see 4.1.2						
--	--	--	--	--	--	--

Positive Pulse Crest Factor

200 µs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Crest Factor measured according to IEC 60651-2001 9.4.2 and ANSI S1.4-1983 (R2006) 8.4.2

Amplitude [dB]	Crest Fac	Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
136.85	3	OVL	± 0.50	0.15 ±	Pass
	5	OVL	± 1.00	0.15 ±	Pass
	10	OVL	± 1.50	0.15 ±	Pass
128.85	3	-0.13	± 0.50	0.15 ±	Pass
	5	-0.14	± 1.00	0.15 ±	Pass
	10	OVL	± 1.50	0.15 ±	Pass
116.85	3	-0.14	± 0.50	0.15 ±	Pass
	5	-0.12	± 1.00	0.15 ±	Pass
	10	-0.26	± 1.50	0.15 ±	Pass
106.85	3	-0.15	± 0.50	0.15 ±	Pass
	5	-0.13	± 1.00	0.15 ±	Pass
	10	0.00	± 1.50	0.15 ±	Pass
— End of measurement results —					

Negative Pulse Crest Factor

200 µs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Crest Factor measured according to IEC 60651-2001 9.4.2 and ANSI S1.4-1983 (R2006) 8.4.2

Test Factor measured according to EN 60529:2001 9.6.2 and Annex 4 (Table 1)					
Amplitude [dB]	Crest Factor	Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
136.85	3	OVLd	± 0.50	0.15 ±	Pass
	5	OVLd	± 1.00	0.15 ±	Pass
	10	OVLd	± 1.50	0.15 ±	Pass
	3	-0.13	± 0.50	0.15 ±	Pass
128.85	5	-0.13	± 1.00	0.15 ±	Pass
	10	OVLd	± 1.50	0.15 ±	Pass
	3	-0.14	± 0.50	0.15 ±	Pass
	5	-0.13	± 1.00	0.15 ±	Pass
116.85	10	-0.26	± 1.50	0.15 ±	Pass
	3	-0.15	± 0.50	0.15 ±	Pass
	5	-0.14	± 1.00	0.15 ±	Pass
	10	-0.26	± 1.50	0.15 ±	Pass
-- End of measurement results --					

LARSON DAVIS - A PCB DIVISION
1681 West 820 North
Provo, UT 84601, United States
716-684-0001



LARSON DAVIS
A PCB DIVISION

2023-3-27116-5102

Page 5 of 8

20001.8407 Rev G

เอกสารไม่ควบคุม

Certificate Number 2023003654

Gain

Gain measured according to IEC 61672-3:2013 17.3 and 17.4 and ANSI S1.4-2014 Part 3: 17.3 and 17.4

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
0 dB Gain	93.95	93.90	94.10	0.15	Pass
0 dB Gain, Linearity	41.12	40.30	41.70	0.16	Pass
CBA Low Range	94.00	93.90	94.10	0.15	Pass
CBA Normal Range	94.00	93.20	94.80	0.15	Pass
-- End of measurement results --					

Broadband Noise Floor

Self-generated noise measured according to IEC 61672-3:2013 11.2 and ANSI S1.4-2014 Part 3: 11.2

Measurement	Test Result [dB]	Upper Limit [dB]	Result
A-weight Noise Floor	26.89	36.00	Pass
C-weight Noise Floor	26.75	35.00	Pass
Z-weight Noise Floor	32.72	39.00	Pass
-- End of measurement results --			

Total Harmonic Distortion

Measured using 1/3-Octave filters

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
10 Hz Signal	135.72	135.06	136.65	0.15	Pass
THD	-66.58	-58.00	-58.00	0.01 ±	Pass
THD+N	-62.79	-58.00	-58.00	0.01 ±	Pass
-- End of measurement results --					

LARSON DAVIS - A PCB DIVISION
1681 West 820 North
Provo, UT 84601, United States
716-684-0001



LARSON DAVIS
A PCB DIVISION

2023-3-27116-5102

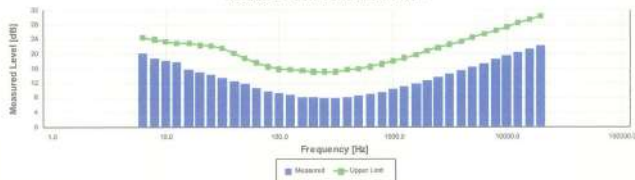
Page 6 of 8

20001.8407 Rev G

เอกสารไม่ควบคุม

Certificate Number 2023003654

1/3-Octave Self-Generated Noise



The SLM is set to low range.

Frequency [Hz]	Test Result [dB]	Upper Limit [dB]	Result
6.30	20.17	24.60	Pass
8.00	19.77	24.00	Pass
10.00	18.00	23.50	Pass
12.50	17.78	23.00	Pass
16.00	15.73	22.90	Pass
20.00	15.18	22.40	Pass
25.00	14.40	22.30	Pass
31.50	13.51	21.50	Pass
40.00	12.61	20.20	Pass
50.00	11.82	18.80	Pass
63.00	10.73	17.60	Pass
80.00	9.86	16.60	Pass
100.00	9.25	15.90	Pass
125.00	8.88	15.70	Pass
160.00	8.17	15.50	Pass
200.00	8.12	15.20	Pass
250.00	7.81	15.20	Pass
315.00	7.99	15.20	Pass
400.00	8.02	15.70	Pass
500.00	8.52	16.00	Pass
630.00	8.96	16.60	Pass
800.00	9.59	17.30	Pass
1,000.00	10.30	18.10	Pass
1,250.00	11.10	18.90	Pass
1,600.00	11.95	19.80	Pass
2,000.00	12.80	20.80	Pass
2,500.00	13.67	21.70	Pass
3,150.00	14.58	22.60	Pass
4,000.00	15.52	23.50	Pass
5,000.00	16.48	24.50	Pass
6,300.00	17.43	25.50	Pass
8,000.00	18.47	26.50	Pass
10,000.00	19.41	27.45	Pass
12,500.00	20.40	28.50	Pass
16,000.00	21.37	29.50	Pass
20,000.00	22.38	30.40	Pass
-- End of measurement results --			

LARSON DAVIS - A PCB DIVISION
1681 West 820 North
Provo, UT 84601, United States
716-684-0001



LARSON DAVIS
A PCB DIVISION

2023-3-27116-5102

Page 7 of 8

20001.8407 Rev G

เอกสารไม่ควบคุม

Certificate Number 2023003654

Signature: Jacob Cannon

LARSON DAVIS - A PCB DIVISION
1681 West 820 North
Provo, UT 84601, United States
716-684-0001



LARSON DAVIS
A PCB DIVISION

2023-3-27116-5102

Page 8 of 8

20001.8407 Rev G

เอกสารไม่ควบคุม

Calibration Certificate

Certificate Number 2023003671

Customer:

United Analyst and Engineering Consultant Co Ltd
No. 81 Soi Udomsak 41, Sukhumvit Road,
Bangkok, Phra Khanong,
Bangkok, 10260, Thailand

Model Number

LxT1
0007309

Test Results

Pass

Initial Condition

As Manufactured

Description

SoundTrack LxT Class 1
Class 1 Sound Level Meter
Firmware Revision: 2.404

Procedure Number

D0001.8384

Technician

Jacob Cannon

Calibration Date

24 Mar 2023

Temperature

23.54 °C ± 0.25 °C

Humidity

50.6 %RH ± 2.0 %RH

Static Pressure

85.98 kPa ± 0.13 kPa

Evaluation Method

Tested with:

Larson Davis PRLxT1, S/N 077544

Larson Davis CAL201, S/N 0108

PCB 377B02, S/N 345230

Larson Davis CAL200, S/N 9079

Data reported in dB re 20 µPa.

Compliance Standards

Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8378:

IEC 60651:2001 Type 1

ANSI S1.4-2014 Class 1

IEC 60804:2000 Type 1

ANSI S1.4 (R2006) Type 1

IEC 61252:2002

ANSI S1.11 (R2006) Class 1

IEC 61260:2001 Class 1

ANSI S1.25 (R2007)

IEC 61672:2013 Class 1

ANSI S1.43 (R2007) Type 1

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017. Test points marked with a 2 in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

This report may not be reproduced, except in full, unless permission for the publication of an approved abstract is obtained in writing from the organization issuing this report.

Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert LxT, I770.01 Rev O Supporting Firmware Version 4.0.5, 2019-05-10

For 1/4" microphones, the Larson Davis ADP024 1/4" to 1/2" adaptor is used with the calibrators and the Larson Davis ADP943 1/4" to

LARSON DAVIS – A PCB DIVISION
1681 West 820 North
Provo, UT 84601, United States
716-684-0001



Page 1 of 3



D0001.8384 Rev G

เอกสารไม่ควบคุม

Certificate Number 2023003671

1/2" adaptor is used with the preamplifier.

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa

Periodic tests were performed in accordance with procedures from IEC 61672-3:2013 / ANSIASA S1.4-2014Part3.

Pattern approval for IEC 61672-1:2013 / ANSIASA S1.4-2014Part 1 successfully completed by Physikalisch-Technische Bundesanstalt (PTB) on 2017-10-09 reference number PTB-1.72-4034218.

The sound level meter submitted for testing successfully completed the periodic tests of IEC 61672-3:2013 / ANSIASA S1.4-2014Part 3, for the environmental conditions under which the tests were performed. As evidence was publicly available, from an independent testing organization responsible for approving the results of pattern-evaluation tests performed in accordance with IEC 61672-2:2013 / ANSIASA S1.4-2014Part 2, to demonstrate that the model of sound level meter fully conformed to the class 1 specifications in IEC 61672-1:2013 / ANSIASA S1.4-2014Part 1, the sound level meter submitted for testing conforms to the class 1 specifications in IEC 61672-1:2013 / ANSIASA S1.4-2014Part 1.

Standards Used	
Description	Cal Date
Larson Davis CAL201 Residual Intensity Calibrator	2022-09-09
Hart Scientific 2636-11 Temperature Probe	2023-05-25
Larson Davis CAL200 Acoustic Calibrator	2022-07-21
Larson Davis Model 831	2023-02-22
PCB 377A13 1/2 inch Prepolarized Pressure Microphone	2023-01-06
SRS DS360 Ultra Low Distortion Generator	2023-01-29
Larson Davis 1/2" Preamplifier for Model 831 Type 1	2023-09-28

Acoustic Calibration

Measured according to IEC 61672-3:2013 10 and ANSI S1.4-2014 Part 3: 10

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
1000 Hz	114.00	113.80	114.20	0.14	Pass

Loaded Circuit Sensitivity

Measurement	Test Result [dB re 1 V / Pa]	Lower Limit [dB re 1 V / Pa]	Upper Limit [dB re 1 V / Pa]	Expanded Uncertainty [dB]	Result
1000 Hz	-49.99	-52.44	-48.33	0.14	Pass

— End of measurement results—

Acoustic Signal Tests, C-weighting

Measured according to IEC 61672-3:2013 12 and ANSI S1.4-2014 Part 3: 12 using a comparison coupler with Unit Under Test (UUT) and reference SLM using slow time-weighted sound level for compliance to IEC 61672-1:2013 5.5, ANSI S1.4-2014 Part 1: 5.5

Frequency [Hz]	Test Result [dB]	Expected [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
125	-0.06	-0.20	-1.20	0.80	0.23	Pass
1000	0.12	0.00	-0.70	0.70	0.23	Pass
8000	-5.12	-3.00	-5.50	-1.50	0.32	Pass

— End of measurement results—

LARSON DAVIS – A PCB DIVISION
1681 West 820 North
Provo, UT 84601, United States
716-684-0001



Page 2 of 3



D0001.8384 Rev G

เอกสารไม่ควบคุม

Certificate Number 2023003671

Self-generated Noise

Measured according to IEC 61672-3:2013 11.1 and ANSI S1.4-2014 Part 3: 11.1

Measurement	Test Result [dB]
A-weighted	40.25

— End of measurement results—

LARSON DAVIS – A PCB DIVISION
1681 West 820 North
Provo, UT 84601, United States
716-684-0001



Page 3 of 3



D0001.8384 Rev G

เอกสารไม่ควบคุม

Calibration Certificate

Certificate Number 2023003643

Customer:

United Analyst and Engineering Consultant Co Ltd
No. 81 Soi Udomsak 41, Sukhumvit Road,
Bangkok, Phra Khanong,
Bangkok, 10260, Thailand

Model Number

LxT1

Serial Number

0007309

Test Results

Pass

Initial Condition

As Manufactured

Description

SoundTrack LxT Class 1

Class 1 Sound Level Meter

Firmware Revision: 2.404

Procedure Number

D0001.8378

Technician

Jacob Cannon

Calibration Date

23 Mar 2023

Temperature

23.99 °C ± 0.25 °C

Humidity

50.2 %RH ± 2.0 %RH

Static Pressure

86.13 kPa ± 0.13 kPa

Evaluation Method

Tested electrically using Larson Davis PRLxT1 S/N 077544 and a 12.0 pF capacitor to simulate microphone capacitance. Data reported in dB re 20 µPa assuming a microphone sensitivity of 50.0 mV/Pa.

Compliance Standards

Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8384:

IEC 60651:2001 Type 1

ANSI S1.4-2014 Class 1

IEC 60804:2000 Type 1

ANSI S1.4 (R2006) Type 1

IEC 61252:2002

ANSI S1.25 (R2007) Type 1

IEC 61672:2013 Class 1

ANSI S1.43 (R2007) Type 1

IEC 61260:2001 Class 1

ANSI S1.11 (R2006) Class 1

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017. Test points marked with a 2 in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

This report may not be reproduced, except in full, unless permission for the publication of an approved abstract is obtained in writing from the organization issuing this report.

Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert LxT, I770.01 Rev O Supporting Firmware Version 4.0.5, 2019-05-10

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa

LARSON DAVIS – A PCB DIVISION
1681 West 820 North
Provo, UT 84601, United States
716-684-0001



Page 1 of 8



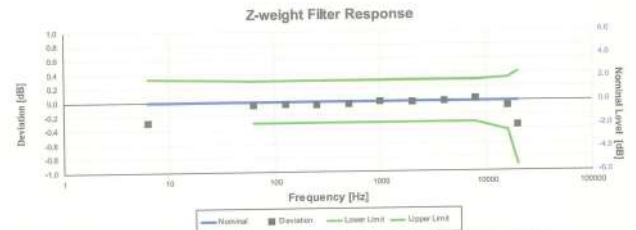
D0001.8407 Rev G

เอกสารไม่ควบคุม

Certificate Number 2023003643

Certificate Number 2023003643

Description	Cal Date	Cal Due	Cal Standard
Hart Scientific 2626-II Temperature Probe	2021-08-25	2023-05-25	000798
SRR D8360 Ultra Low Distortion Generator	2022-03-30	2023-03-30	007174



Electrical signal test of frequency weighting performed according to IEC 61672-3:2013 13 and ANSI S1.4-2014 Part 3: 13 for compliance to IEC 61672-1:2013 5.5, IEC 60651:2001 6.1 and 9.2.2, IEC 60804:2000 5, ANSI S1.4:1983 (R2006) 5.1 and 8.2.1, ANSI S1.4-2014 Part 1: 5.5

Frequency [Hz]	Test Result [dB]	Deviation [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
6.31	-0.29	-0.29	-1.11	0.33	0.15	Pass
63.10	-0.05	-0.05	-0.30	0.30	0.15	Pass
125.89	-0.04	-0.04	-0.30	0.30	0.15	Pass
251.19	-0.05	-0.05	-0.30	0.30	0.15	Pass
501.19	-0.03	-0.03	-0.30	0.30	0.15	Pass
1,000.00	0.00	0.00	-0.30	0.30	0.15	Pass
1,995.28	-0.02	-0.02	-0.30	0.30	0.15	Pass
3,981.07	0.00	0.00	-0.30	0.30	0.15	Pass
7,943.26	0.04	0.04	-0.30	0.30	0.15	Pass
15,848.92	-0.07	-0.07	-0.42	0.32	0.15	Pass
19,952.62	-0.36	-0.36	-0.91	0.41	0.15	Pass

— End of measurement results—

LARSON DAVIS – A PCB DIVISION
1681 West 820 North
Provo, UT 84601, United States
716-684-0001



LARSON DAVIS
A PCB DIVISION

2023-5-27T14:30:38

Page 2 of 8

(2000) 3487 Rev G

เอกสารไม่ควบคุม

LARSON DAVIS – A PCB DIVISION
1681 West 820 North
Provo, UT 84601, United States
716-684-0001



LARSON DAVIS
A PCB DIVISION

2023-5-27T14:30:38

Page 3 of 8

(2000) 3487 Rev G

เอกสารไม่ควบคุม

Certificate Number 2023003643

A-weighted Broadband Log Linearity: 8,000.00 Hz



Broadband level linearity performed according to IEC 61672-3:2013 16 and ANSI S1.4-2014 Part 3: 16 for compliance to IEC 61672-1:2013 5.6, IEC 60804:2000 6.2, IEC 61252:2002 8, ANSI S1.4 (R2006) 8.9, ANSI S1.4-2014 Part 1: 5.6, ANSI S1.4.3 (R2007) 6.2

Level [dB]	Error [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
36.00	0.51	-0.70	0.70	0.16	Pass
37.00	0.51	-0.70	0.70	0.16	Pass
38.00	0.39	-0.70	0.70	0.16	Pass
39.00	0.36	-0.70	0.70	0.16	Pass
40.00	0.26	-0.70	0.70	0.16	Pass
41.00	0.18	-0.70	0.70	0.16	Pass
42.00	0.14	-0.70	0.70	0.16	Pass
43.00	0.10	-0.70	0.70	0.17	Pass
44.00	0.08	-0.70	0.70	0.17	Pass
45.00	0.05	-0.70	0.70	0.16	Pass
46.00	0.01	-0.70	0.70	0.16	Pass
47.00	0.01	-0.70	0.70	0.16	Pass
48.00	0.01	-0.70	0.70	0.16	Pass
49.00	0.00	-0.70	0.70	0.16	Pass
50.00	-0.04	-0.70	0.70	0.16	Pass
51.00	-0.07	-0.70	0.70	0.16	Pass
52.00	-0.06	-0.70	0.70	0.16	Pass
53.00	-0.06	-0.70	0.70	0.16	Pass
54.00	-0.07	-0.70	0.70	0.16	Pass
55.00	-0.07	-0.70	0.70	0.16	Pass
56.00	-0.07	-0.70	0.70	0.16	Pass
57.00	-0.07	-0.70	0.70	0.16	Pass
58.00	-0.07	-0.70	0.70	0.16	Pass
59.00	-0.07	-0.70	0.70	0.16	Pass
60.00	-0.07	-0.70	0.70	0.16	Pass
61.00	-0.07	-0.70	0.70	0.16	Pass
62.00	-0.07	-0.70	0.70	0.16	Pass
63.00	-0.07	-0.70	0.70	0.16	Pass
64.00	-0.07	-0.70	0.70	0.16	Pass
65.00	-0.07	-0.70	0.70	0.16	Pass
66.00	-0.07	-0.70	0.70	0.16	Pass
67.00	-0.07	-0.70	0.70	0.16	Pass
68.00	-0.07	-0.70	0.70	0.16	Pass
69.00	-0.07	-0.70	0.70	0.16	Pass
70.00	-0.07	-0.70	0.70	0.16	Pass
71.00	-0.07	-0.70	0.70	0.16	Pass
72.00	-0.07	-0.70	0.70	0.16	Pass
73.00	-0.07	-0.70	0.70	0.16	Pass
74.00	-0.07	-0.70	0.70	0.16	Pass
75.00	-0.07	-0.70	0.70	0.16	Pass
76.00	-0.07	-0.70	0.70	0.16	Pass
77.00	-0.07	-0.70	0.70	0.16	Pass
78.00	-0.07	-0.70	0.70	0.16	Pass
79.00	-0.07	-0.70	0.70	0.16	Pass
80.00	-0.07	-0.70	0.70	0.16	Pass
81.00	-0.07	-0.70	0.70	0.16	Pass
82.00	-0.07	-0.70	0.70	0.16	Pass
83.00	-0.07	-0.70	0.70	0.16	Pass
84.00	-0.07	-0.70	0.70	0.16	Pass
85.00	-0.07	-0.70	0.70	0.16	Pass
86.00	-0.07	-0.70	0.70	0.16	Pass
87.00	-0.07	-0.70	0.70	0.16	Pass
88.00	-0.07	-0.70	0.70	0.16	Pass
89.00	-0.07	-0.70	0.70	0.16	Pass
90.00	-0.07	-0.70	0.70	0.16	Pass
91.00	-0.07	-0.70	0.70	0.16	Pass
92.00	-0.07	-0.70	0.70	0.16	Pass
93.00	-0.07	-0.70	0.70	0.16	Pass
94.00	-0.07	-0.70	0.70	0.16	Pass
95.00	-0.07	-0.70	0.70	0.16	Pass
96.00	-0.07	-0.70	0.70	0.16	Pass
97.00	-0.07	-0.70	0.70	0.16	Pass
98.00	-0.07	-0.70	0.70	0.16	Pass
99.00	-0.07	-0.70	0.70	0.16	Pass
100.00	-0.07	-0.70	0.70	0.16	Pass
101.00	-0.07	-0.70	0.70	0.16	Pass
102.00	-0.07	-0.70	0.70	0.16	Pass
103.00	-0.07	-0.70	0.70	0.16	Pass
104.00	-0.07	-0.70	0.70	0.16	Pass
105.00	-0.07	-0.70	0.70	0.16	Pass
106.00	-0.07	-0.70	0.70	0.16	Pass
107.00	-0.07	-0.70	0.70	0.16	Pass
108.00	-0.07	-0.70	0.70	0.16	Pass
109.00	-0.07	-0.70	0.70	0.16	Pass
110.00	-0.07	-0.70	0.70	0.16	Pass
111.00	-0.07	-0.70	0.70	0.16	Pass
112.00	-0.07	-0.70	0.70	0.16	Pass
113.00	-0.07	-0.70	0.70	0.16	Pass
114.00	-0.07	-0.70	0.70	0.16	Pass
115.00	-0.07	-0.70	0.70	0.16	Pass
116.00	-0.07	-0.70	0.70	0.16	Pass
117.00	-0.07	-0.70	0.70	0.16	Pass
118.00	-0.07	-0.70	0.70	0.16	Pass
119.00	-0.07	-0.70	0.70	0.16	Pass
120.00	-0.07	-0.70	0.70	0.16	Pass
121.00	-0.07	-0.70	0.70	0.16	Pass
122.00	-0.07	-0.70	0.70	0.16	Pass
123.00	-0.07	-0.70	0.70	0.16	Pass
124.00	-0.07	-0.70	0.70	0.16	Pass
125.00	-0.07	-0.70	0.70	0.16	Pass
126.00	-0.07	-0.70	0.70	0.16	Pass
127.00	-0.07	-0.70	0.70	0.16	Pass
128.00	-0.07	-0.70	0.70	0.16	Pass
129.00	-0.07	-0.70	0.70	0.16	Pass
130.00	-0.07	-0.70	0.70	0.16	Pass
131.00	-0.07	-0.70	0.70	0.16	Pass
132.00	-0.07	-0.70	0.70	0.16	Pass
133.00	-0.07	-0.70	0.70	0.16	Pass
134.00	-0.07	-0.70	0.70	0.16	Pass
135.00	-0.07	-0.70	0.70	0.16	Pass
136.00	-0.07	-0.70	0.70	0.16	Pass
137.00	-0.07	-0.70	0.70	0.16	Pass
138.00	-0.07	-0.70	0.70	0.16	Pass
139.00	-0.07	-0.70	0.70	0.16	Pass
140.00	-0.07	-0.70	0.70	0.16	Pass

LARSON DAVIS – A PCB DIVISION
1681 West 820 North
Provo, UT 84601, United States
716-684-0001



LARSON DAVIS
A PCB DIVISION

2023-5-27T14:30:38

Page 4 of 8

(2000) 3487 Rev G

เอกสารไม่ควบคุม

Certificate Number 2023003643

— End of measurement results—

Peak Rise Time

Peak rise time performed according to IEC 60851:2001 9.4.4 and ANSI S1.4:1983 (R2006) 9.4.4

Amplitude [dB]	Duration [µs]		Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
137.85	40	Negative Pulse	134.90	133.44	135.44	0.15	Pass
		Positive Pulse	134.89	133.43	135.43	0.15	Pass
	30	Negative Pulse	133.95	133.44	135.44	0.15	Pass
		Positive Pulse	133.90	133.43	135.43	0.15	Pass
— End of measurement results—							

Positive Pulse Crest Factor

200 µs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Crest Factor measured according to IEC 60851:2001 9.4.2 and ANSI S1.4:1983 (R2006) 9.4.2

Amplitude [dB]	Crest Factor	Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
136.85	3	OVLD	± 0.50	0.15 ±	Pass
	5	OVLD	± 1.00	0.15 ±	Pass
	10	OVLD	± 1.50	0.15 ±	Pass
126.85	3	-0.12	± 0.50	0.15 ±	Pass
	5	-0.11	± 1.00	0.15 ±	Pass
	10	OVLD	± 1.50	0.15 ±	Pass
116.85	3	-0.13	± 0.50	0.15 ±	Pass
	5	-0.14	± 1.00	0.15 ±	Pass
	10	-0.09	± 1.50	0.15 ±	Pass
106.85	3	-0.13	± 0.50	0.15 ±	Pass
	5	-0.12	± 1.00	0.15 ±	Pass
	10	-0.16	± 1.50	0.15 ±	Pass

— End of measurement results—

Negative Pulse Crest Factor

200 µs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Crest Factor measured according to IEC 60851:2001 9.4.2 and ANSI S1.4:1983 (R2006) 9.4.2

Amplitude [dB]	Crest Factor	Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
136.85	3	OVLD	± 0.50	0.15 ±	Pass
	5	OVLD	± 1.00	0.15 ±	Pass
	10	OVLD	± 1.50	0.15 ±	Pass
126.85	3	-0.12	± 0.50	0.15 ±	Pass
	5	-0.11	± 1.00	0.15 ±	Pass
	10	OVLD	± 1.50	0.15 ±	Pass
116.85	3	-0.13	± 0.50	0.15 ±	Pass
	5	-0.12	± 1.00	0.15 ±	Pass
	10	-0.08	± 1.50	0.15 ±	Pass
106.85	3	-0.12	± 0.50	0.15 ±	Pass
	5	-0.10	± 1.00	0.15 ±	Pass
	10	-0.08	± 1.50	0.15 ±	Pass

— End of measurement results—

LARSON DAVIS – A PCB DIVISION
1681 West 820 North
Provo, UT 84601, United States
716-684-0001



LARSON DAVIS
A PCB DIVISION

2023-5-27T14:30:38

Page 5 of 8

(2000) 3487 Rev G

เอกสารไม่ควบคุม

Certificate Number 2023003643

Gain

Gain measured according to IEC 61672-3:2013 17.3 and 17.4 and ANSI S1.4-2014 Part 3: 17.3 and 17.4

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
0 dB Gain	93.95	93.90	94.10	0.15	Pass
0 dB Gain, Linearity	41.14	40.30	41.70	0.16	Pass
OBA Low Range	94.00	93.90	94.10	0.15	Pass
OBA Normal Range	94.00	93.20	94.80	0.15	Pass

— End of measurement results—

Broadband Noise Floor

Self-generated noise measured according to IEC 61672-3:2013 11.2 and ANSI S1.4-2014 Part 3: 11.2

Measurement	Test Result [dB]	Upper Limit [dB]	Result
A-weight Noise Floor	27.17	36.00	Pass
C-weight Noise Floor	27.11	35.00	Pass
Z-weight Noise Floor	33.45	39.00	Pass

— End of measurement results—

Total Harmonic Distortion

Measured using 1/3-Octave filters

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
10 Hz Signal	135.48	135.05	136.65	0.15	Pass
THD	-66.97	-58.00	-58.00	0.01 ‡	Pass
THD+N	-62.77	-58.00	-58.00	0.01 ‡	Pass

— End of measurement results—

LARSON DAVIS – A PCB DIVISION
1681 West 820 North
Provo, UT 84601, United States
716-684-0001LARSON DAVIS
A PCB DIVISION

2023-3-23T14:30:16

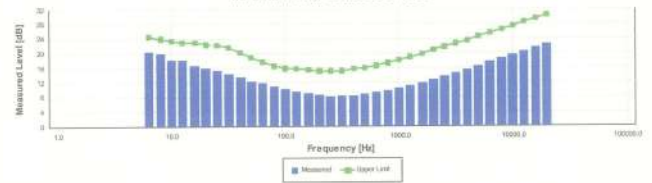
Page 6 of 8

D0001.8407 Rev G

เอกสารไม่ควบคุม

Certificate Number 2023003643

1/3-Octave Self-Generated Noise



The SLM is set to low range.

Frequency [Hz]	Test Result [dB]	Upper Limit [dB]	Result
6.30	20.34	24.60	Pass
8.00	19.89	24.00	Pass
10.00	18.12	23.50	Pass
12.50	16.13	23.00	Pass
16.00	16.66	22.90	Pass
20.00	15.96	22.40	Pass
25.00	15.30	22.30	Pass
31.50	14.43	21.50	Pass
40.00	13.41	20.20	Pass
50.00	12.32	18.80	Pass
63.00	11.73	17.60	Pass
80.00	10.83	16.60	Pass
100.00	10.13	15.90	Pass
125.00	9.49	15.70	Pass
160.00	9.11	15.50	Pass
200.00	8.56	15.20	Pass
250.00	8.22	15.20	Pass
315.00	8.28	15.20	Pass
400.00	8.42	15.70	Pass
500.00	8.75	16.00	Pass
630.00	9.18	16.60	Pass
800.00	9.71	17.30	Pass
1,000.00	10.35	18.10	Pass
1,250.00	11.09	18.90	Pass
1,600.00	11.85	19.80	Pass
2,000.00	12.88	20.80	Pass
2,500.00	13.79	21.70	Pass
3,150.00	14.69	22.60	Pass
4,000.00	15.54	23.50	Pass
5,000.00	16.54	24.50	Pass
6,300.00	17.66	25.50	Pass
8,000.00	18.54	26.50	Pass
10,000.00	19.55	27.40	Pass
12,500.00	20.51	28.50	Pass
16,000.00	21.52	29.50	Pass
20,000.00	22.51	30.40	Pass

— End of measurement results—

LARSON DAVIS – A PCB DIVISION
1681 West 820 North
Provo, UT 84601, United States
716-684-0001LARSON DAVIS
A PCB DIVISION

2023-3-23T14:30:16

Page 7 of 8

D0001.8407 Rev G

เอกสารไม่ควบคุม

Certificate Number 2023003673

Calibration Certificate

Certificate Number 2023003673

Customer:
United Analyst and Engineering Consultant Co Ltd
No. 11 Set Udomsak 41, Sukhumvit Road,
Bangkok, Ploa Khaoeng,
Bangkok, 10260, ThailandModel Number LxT1
Serial Number 0007310
Test Results PassInitial Condition As Manufactured
Description SoundTrack LxT Class 1
Class 1 Sound Level Meter
Firmware Revision: 2.404Procedure Number D0001.8384
Technician Jacob Cannon
Calibration Date 24 Mar 2023
Calibration Due
Temperature 23.47 °C ± 0.25 °C
Humidity 50.8 %RH ± 2.0 %RH
Static Pressure 85.89 kPa ± 0.13 kPaEvaluation Method Tested with:
Larson Davis PPMxLxT1, S/N 077845
PCB 377B02, S/N 345240
Larson Davis CAL200, S/N 9079
Larson Davis CAL291, S/N 0108

Data reported in dB re 20 µPa.

Compliance Standards Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8378:

IEC 60651:2001 Type 1
IEC 60904:2000 Type 1
IEC 61262:2002
IEC 61260:2001 Class 1
IEC 61672:2013 Class 1
ANSI S1.4 (R2008) Type 1
ANSI S1.11 (R2009) Class 1
ANSI S1.25 (R2007)
ANSI S1.43 (R2007) Type 1Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017.
Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

This report may not be reproduced, except in full, without permission for the publication of an approved abstract is obtained in writing from the organization issuing this report.

Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert Ltd, 0770.01 Rev O Supporting Firmware Version 4.0.5, 2019-00-10

For 1/4" microphones, the Larson Davis ADP624 1/4" to 1/2" adaptor is used with the calibrators and the Larson Davis ADPO43 1/4" to 1/2" adaptor.

LARSON DAVIS – A PCB DIVISION
1681 West 820 North
Provo, UT 84601, United States
716-684-0001LARSON DAVIS
A PCB DIVISION

2023-3-23T14:30:16

Page 8 of 8

D0001.8407 Rev G

เอกสารไม่ควบคุม

LARSON DAVIS – A PCB DIVISION
1681 West 820 North
Provo, UT 84601, United States
716-684-0001LARSON DAVIS
A PCB DIVISION

2023-3-23T14:30:16

Page 1 of 3

D0001.8407 Rev G

เอกสารไม่ควบคุม

Certificate Number 2023003673

1/2" adaptor is used with the preamplifier.

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa

Periodic tests were performed in accordance with procedures from IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part 3.

Pattern approval for IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1 successfully completed by Physikalisch-Technische Bundesanstalt (PTB) on 2007-10-09 reference number PTB-1.72-4034218.

The sound level meter submitted for testing successfully completed the periodic tests of IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part 3, for the environmental conditions under which the tests were performed. As evidence was publicly available, from an independent testing organization responsible for approving the results of pattern-evaluation tests performed in accordance with IEC 61672-2:2013 / ANSI/ASA S1.4-2014/Part 2, to demonstrate that the model of sound level meter fully conform to the class 1 specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1, the sound level meter submitted for testing conforms to the class 1 specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1.

Standards Used			
Description	Cal Date	Cal Due	Cal Standard
Larson Davis CAL291 Residual Intensity Calibrator	2022-09-09	2023-09-09	001230
Hart Scientific 2626-II Temperature Probe	2021-08-25	2023-05-25	006798
Larson Davis CAL200 Acoustic Calibrator	2022-07-21	2023-07-21	007182
Larson Davis Model R11	2023-02-22	2024-02-22	007182
PCB 377A13 1/2 inch Prepolarized Pressure Microphone	2023-03-06	2024-03-06	007185
SRS DS360 Ultra Low Distortion Generator	2022-03-29	2023-03-29	007635
Larson Davis 1/2" Preamplifier for Model 831 Type 1	2022-09-28	2023-09-28	PCB00004763

Acoustic Calibration

Measured according to IEC 61672-3:2013 10 and ANSI S1.4-2014 Part 3: 10

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
1000 Hz	114.01	113.60	114.20	0.14	Pass

Loaded Circuit Sensitivity

Measurement	Test Result [dB re 1 V / Pa]	Lower Limit [dB re 1 V / Pa]	Upper Limit [dB re 1 V / Pa]	Expanded Uncertainty [dB]	Result
1000 Hz	-50.12	-52.44	-48.33	0.14	Pass

— End of measurement results—

Acoustic Signal Tests, C-weighting

Measured according to IEC 61672-3:2013 12 and ANSI S1.4-2014 Part 3: 12 using a comparison coupler with Unit Under Test (UUT) and reference SLM using slow time-weighted sound level for compliance to IEC 61672-1:2013 5.6; ANSI S1.4-2014 Part 1: 5.5

Frequency [Hz]	Test Result [dB]	Expected [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
125	-0.19	-0.20	-1.20	0.80	0.23	Pass
1000	0.14	0.00	-0.70	0.70	0.23	Pass
8000	-3.64	-3.00	-5.50	-1.50	0.32	Pass

— End of measurement results—

LARSON DAVIS – A PCB DIVISION
1681 West 820 North
Provo, UT 84601, United States
716-684-0001



Page 2 of 3



20001-0406 Rev G

2023-3-23T09:59:13

เอกสารไม่ควบคุม

Certificate Number 2023003673

Self-generated Noise

Measured according to IEC 61672-3:2013 11.1 and ANSI S1.4-2014 Part 3: 11.1

Measurement	Test Result [dB]
A-weighted	40.34

— End of measurement results—

Signature: Jacob Cannon

LARSON DAVIS – A PCB DIVISION
1681 West 820 North
Provo, UT 84601, United States
716-684-0001



Page 3 of 3



20001-0406 Rev G

2023-3-23T09:59:13

เอกสารไม่ควบคุม

Calibration Certificate

Certificate Number 2023003658

Customer:
United Analyst and Engineering Consultant Co Ltd
No. 81 Soi Udomsak 41, Sukhumvit Road,
Bangchak, Phra Khanong,
Bangkok, 10260, Thailand

Model Number	LxT1	Procedure Number	D0001.8378
Serial Number	0007310	Technician	Jacob Cannon
Test Results	Pass	Calibration Date	23 Mar 2023
Initial Condition	As Manufactured	Calibration Due	23.63 °C ± 0.25 °C
Description	SoundTrack LxT Class 1 Class 1 Sound Level Meter Firmware Revision: 2.404	Humidity	49.6 %RH ± 2.0 %RH
		Static Pressure	86.01 kPa ± 0.13 kPa

Evaluation Method Tested electrically using Larson Davis PRMLxT1 S/N 877645 and a 12.0 pF capacitor to simulate microphone capacitance. Data reported in dB re 20 µPa assuming a microphone sensitivity of 50.0 mV/Pa.

Compliance Standards Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8384:

IEC 60651:2001 Type 1	ANSI S1.4-2014 Class 1
IEC 60604:2000 Type 1	ANSI S1.4 (R2006) Type 1
IEC 61252:2002	ANSI S1.25 (R2007)
IEC 61672:2013 Class 1	ANSI S1.43 (R2007) Type 1
IEC 61260:2001 Class 1	ANSI S1.11 (R2009) Class 1

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017. Test points marked with a ± in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty of approximately 95% confidence level.

This report may not be reproduced, except in full, unless permission for the publication of an approved abstract is obtained in writing from the organization issuing this report.

Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert LxT, 1770.01 Rev G Supporting Firmware Version 4.2.5, 2019-05-10

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa

LARSON DAVIS – A PCB DIVISION
1681 West 820 North
Provo, UT 84601, United States
716-684-0001



Page 1 of 8



D0001-0407 Rev G

2023-3-23T11:43:22

เอกสารไม่ควบคุม

Certificate Number 2023003658

Standards Used			
Description	Cal Date	Cal Due	Cal Standard
Hart Scientific 2626-II Temperature Probe	2021-08-25	2023-05-25	006798
SRS DS360 Ultra Low Distortion Generator	2022-09-02	2023-09-02	007167

LARSON DAVIS – A PCB DIVISION
1681 West 820 North
Provo, UT 84601, United States
716-684-0001



Page 2 of 8



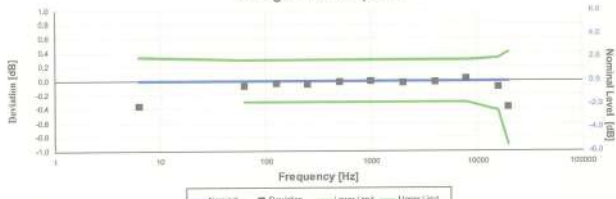
D0001-0407 Rev G

2023-3-23T11:43:22

เอกสารไม่ควบคุม

Certificate Number 2023003658

Z-weight Filter Response



Electrical signal test of frequency weighting performed according to IEC 61672-3:2013 13 and ANSI S1.4-2014 Part 3: 13 for compliance to IEC 61672-1:2013 5.5, IEC 60651:2001 6.1 and 9.2.2; IEC 60894:2000 6; ANSI S1.4-1983 (R2006) 5.1 and 8.2.1; ANSI S1.4-2014 Part 1: 5.5

Frequency (Hz)	Test Result (dB)	Deviation (dB)	Lower Limit (dB)	Upper Limit (dB)	Expanded Uncertainty (dB)	Result
6.31	-0.36	-0.36	-1.11	0.33	0.15	Pass
63.10	-0.07	-0.07	-0.30	0.30	0.15	Pass
125.89	-0.04	-0.04	-0.30	0.30	0.15	Pass
251.19	-0.05	-0.05	-0.30	0.30	0.15	Pass
501.19	-0.02	-0.01	-0.30	0.30	0.15	Pass
1,000.00	0.00	0.00	-0.30	0.30	0.15	Pass
1,995.26	-0.03	-0.03	-0.30	0.30	0.15	Pass
3,981.07	-0.01	-0.01	-0.30	0.30	0.15	Pass
7,943.28	0.03	0.03	-0.30	0.30	0.15	Pass
15,848.93	-0.09	-0.09	-0.42	0.32	0.15	Pass
19,952.62	-0.38	-0.38	-0.91	0.41	0.15	Pass

— End of measurement results—

LARSON DAVIS – A PCB DIVISION
1681 West 820 North
Provo, UT 84601, United States
716-684-0001



LARSON DAVIS
A PCB DIVISION

2023-5-23117-43-22

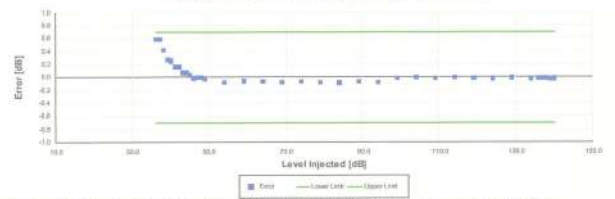
Page 3 of 8

(FORM) 0407 Rev G

เอกสารไม่ควบคุม

Certificate Number 2023003658

A-weighted Broadband Log Linearity: 8,000.00 Hz



Broadband level linearity performed according to IEC 61672-3:2013 16 and ANSI S1.4-2014 Part 3: 16 for compliance to IEC 61672-1:2013 5.8, IEC 60894:2000 6.2, IEC 61252-2002 8, ANSI S1.4 (R2006) 6.8, ANSI S1.4-2014 Part 1: 5.8, ANSI S1.43 (R2007) 6.2

Level (dB)	Error (dB)	Lower Limit (dB)	Upper Limit (dB)	Expanded Uncertainty (dB)	Result
36.00	0.59	-0.70	0.70	0.16	Pass
37.00	0.58	-0.70	0.70	0.16	Pass
38.00	0.41	-0.70	0.70	0.16	Pass
39.00	0.27	-0.70	0.70	0.16	Pass
40.00	0.25	-0.70	0.70	0.16	Pass
41.00	0.18	-0.70	0.70	0.16	Pass
42.00	0.16	-0.70	0.70	0.16	Pass
43.00	0.07	-0.70	0.70	0.17	Pass
44.00	0.07	-0.70	0.70	0.17	Pass
45.00	0.04	-0.70	0.70	0.18	Pass
46.00	-0.01	-0.70	0.70	0.16	Pass
47.00	0.00	-0.70	0.70	0.16	Pass
48.00	0.00	-0.70	0.70	0.16	Pass
49.00	-0.03	-0.70	0.70	0.18	Pass
50.00	-0.08	-0.70	0.70	0.16	Pass
51.00	-0.06	-0.70	0.70	0.16	Pass
54.00	-0.07	-0.70	0.70	0.16	Pass
59.00	-0.08	-0.70	0.70	0.16	Pass
64.00	-0.07	-0.70	0.70	0.16	Pass
69.00	-0.08	-0.70	0.70	0.16	Pass
74.00	-0.07	-0.70	0.70	0.18	Pass
79.00	-0.06	-0.70	0.70	0.16	Pass
84.00	-0.09	-0.70	0.70	0.16	Pass
89.00	-0.07	-0.70	0.70	0.16	Pass
94.00	-0.06	-0.70	0.70	0.16	Pass
99.00	-0.01	-0.70	0.70	0.15	Pass
104.00	-0.01	-0.70	0.70	0.15	Pass
109.00	-0.02	-0.70	0.70	0.15	Pass
114.00	-0.00	-0.70	0.70	0.15	Pass
119.00	-0.01	-0.70	0.70	0.15	Pass
124.00	-0.02	-0.70	0.70	0.15	Pass
129.00	-0.01	-0.70	0.70	0.15	Pass
134.00	-0.02	-0.70	0.70	0.15	Pass
139.00	-0.02	-0.70	0.70	0.15	Pass
144.00	-0.01	-0.70	0.70	0.15	Pass
149.00	-0.03	-0.70	0.70	0.15	Pass
150.00	-0.02	-0.70	0.70	0.15	Pass

LARSON DAVIS – A PCB DIVISION
1681 West 820 North
Provo, UT 84601, United States
716-684-0001



LARSON DAVIS
A PCB DIVISION

2023-5-23117-43-22

Page 4 of 8

(FORM) 0407 Rev G

เอกสารไม่ควบคุม

Certificate Number 2023003658

— End of measurement results—

Peak Rise Time

Peak rise time performed according to IEC 60651:2001 9.4.4 and ANSI S1.4-1983 (R2006) 9.4.4

Amplitude (dB)	Duration (µs)	Test Result (dB)	Lower limit (dB)	Upper limit (dB)	Expanded Uncertainty (dB)	Result
137.85	40	Negative Pulse	135.01	133.55	135.55	0.15
		Positive Pulse	135.00	133.52	135.52	0.15
	30	Negative Pulse	134.07	133.55	135.55	0.15
		Positive Pulse	134.07	133.52	135.52	0.15

— End of measurement results—

Positive Pulse Crest Factor

200 µs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Crest Factor measured according to IEC 60651:2001 8.4.2 and ANSI S1.4-1983 (R2006) 8.4.2

Amplitude (dB)	Crest Factor	Test Result (dB)	Limits (dB)	Expanded Uncertainty (dB)	Result
136.85	3	OVL	± 0.50	0.15 ±	Pass
	5	OVL	± 1.00	0.15 ±	Pass
	10	OVL	± 1.50	0.15 ±	Pass
126.85	3	-0.13	± 0.50	0.15 ±	Pass
	5	-0.14	± 1.00	0.16 ±	Pass
	10	OVL	± 1.50	0.15 ±	Pass
116.85	3	-0.12	± 0.50	0.15 ±	Pass
	5	-0.14	± 1.00	0.15 ±	Pass
	10	-0.26	± 1.50	0.15 ±	Pass
106.85	3	-0.13	± 0.50	0.15 ±	Pass
	5	-0.11	± 1.00	0.15 ±	Pass
	10	-0.25	± 1.50	0.15 ±	Pass

— End of measurement results—

Negative Pulse Crest Factor

200 µs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Crest Factor measured according to IEC 60651:2001 8.4.2 and ANSI S1.4-1983 (R2006) 8.4.2

Amplitude (dB)	Crest Factor	Test Result (dB)	Limits (dB)	Expanded Uncertainty (dB)	Result
136.85	3	OVL	± 0.50	0.15 ±	Pass
	5	OVL	± 1.00	0.15 ±	Pass
	10	OVL	± 1.50	0.15 ±	Pass
126.85	3	-0.11	± 0.50	0.15 ±	Pass
	5	-0.11	± 1.00	0.15 ±	Pass
	10	OVL	± 1.50	0.15 ±	Pass
116.85	3	-0.11	± 0.50	0.15 ±	Pass
	5	-0.10	± 1.00	0.15 ±	Pass
	10	-0.22	± 1.50	0.15 ±	Pass
106.85	3	-0.11	± 0.50	0.15 ±	Pass
	5	-0.12	± 1.00	0.15 ±	Pass
	10	-0.24	± 1.50	0.15 ±	Pass

— End of measurement results—

LARSON DAVIS – A PCB DIVISION
1681 West 820 North
Provo, UT 84601, United States
716-684-0001



LARSON DAVIS
A PCB DIVISION

2023-5-23117-43-22

Page 5 of 8

(FORM) 0407 Rev G

เอกสารไม่ควบคุม

Certificate Number 2023003658

Gain

Gain measured according to IEC 61672-3:2013 17.3 and 17.4 and ANSI S1.4-2014 Part 3: 17.3 and 17.4

Measurement	Test Result (dB)	Lower limit (dB)	Upper limit (dB)	Expanded Uncertainty (dB)	Result
0 dB Gain	93.95	93.90	94.10	0.15	Pass
0 dB Gain, Linearity	41.14	40.30	41.70	0.16	Pass
OBA Low Range	94.00	93.90	94.10	0.15	Pass
OBA Normal Range	94.00	93.20	94.80	0.15	Pass

— End of measurement results—

Broadband Noise Floor

Self-generated noise measured according to IEC 61672-3:2013 11.2 and ANSI S1.4-2014 Part 3: 11.2

Measurement	Test Result (dB)	Upper limit (dB)	Result
A-weight Noise Floor	26.90	36.00	Pass
C-weight Noise Floor	26.68	35.00	Pass
Z-weight Noise Floor	32.81	39.00	Pass

— End of measurement results—

Total Harmonic Distortion

Measured using 1/3-Octave filters

Measurement	Test Result (dB)	Lower Limit (dB)	Upper Limit (dB)	Expanded Uncertainty (dB)	Result
10 Hz Signal	135.55	135.05	136.65	0.10	Pass
THD	-68.91	-68.00	-68.00	0.01 ±	Pass
THD+N	-62.76	-68.00	-68.00	0.01 ±	Pass

— End of measurement results—

LARSON DAVIS – A PCB DIVISION
1681 West 820 North
Provo, UT 84601, United States
716-684-0001



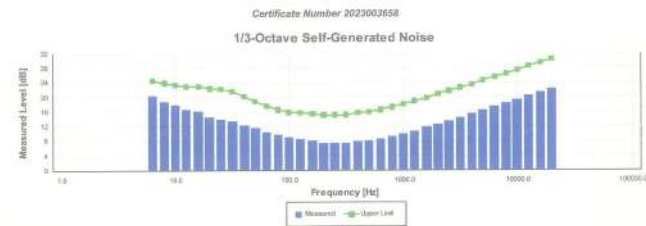
LARSON DAVIS
A PCB DIVISION

2023-5-23117-43-22

Page 6 of 8

(FORM) 0407 Rev G

เอกสารไม่ควบคุม



The SLM is set to low range.

Frequency [Hz]	Test Result [dB]	Upper Limit [dB]	Result
6.30	20.34	24.60	Pass
8.00	18.70	24.00	Pass
10.00	17.87	23.50	Pass
12.50	16.67	23.00	Pass
16.00	16.25	22.90	Pass
20.00	14.64	22.40	Pass
25.00	13.98	22.30	Pass
31.50	13.39	21.90	Pass
40.00	12.35	20.20	Pass
50.00	11.55	18.80	Pass
63.00	10.50	17.60	Pass
80.00	9.71	16.60	Pass
100.00	8.02	15.90	Pass
125.00	8.51	15.70	Pass
160.00	8.14	15.50	Pass
200.00	7.51	15.20	Pass
250.00	7.42	15.20	Pass
315.00	7.44	15.20	Pass
400.00	7.80	15.70	Pass
500.00	8.14	16.00	Pass
630.00	8.66	16.60	Pass
800.00	9.34	17.30	Pass
1,000.00	10.07	18.10	Pass
1,250.00	10.79	18.90	Pass
1,600.00	11.74	19.80	Pass
2,000.00	12.50	20.80	Pass
2,500.00	13.50	21.70	Pass
3,150.00	14.48	22.60	Pass
4,000.00	15.43	23.50	Pass
5,000.00	16.41	24.50	Pass
6,300.00	17.40	25.50	Pass
8,000.00	18.39	26.50	Pass
10,000.00	19.37	27.40	Pass
12,500.00	20.41	28.50	Pass
16,000.00	21.38	29.50	Pass
20,000.00	22.35	30.40	Pass

— End of measurement results —

LARSON DAVIS – A PCB DIVISION
1681 West 820 North
Provo, UT 84601, United States
716-684-0801



LARSON DAVIS
A PCB DIVISION

2023-5-23T17:40:23

Page 7 of 8

DM001-BA00 Rev G

เอกสารไม่ควบคุม

Certificate Number 2023003658

Signature: Jacob Cannon

LARSON DAVIS – A PCB DIVISION
1681 West 820 North
Provo, UT 84601, United States
716-684-0801



LARSON DAVIS
A PCB DIVISION

2023-5-23T17:40:22

Page 8 of 8

DM001-BA00 Rev G

เอกสารไม่ควบคุม

Calibration Certificate

Certificate Number 2023003675

Customer:
United Analyst and Engineering Consultant Co Ltd
No. 91 Set Vidarak 41, Sukhumvit Road,
Bangkok, Phra Khanong,
Bangkok, 10260, Thailand

Model Number LxT1
Serial Number 0507311
Test Results Pass
Initial Condition As Manufactured
Description SoundTrack LxT Class 1
Class 1 Sound Level Meter
Firmware Revision: 2.404

Procedure Number D0001.8364
Technician Jacob Cannon
Calibration Date 24 Mar 2023
Calibration Due
Temperature 23.56 °C ± 0.26 °C
Humidity 49.9 %RH ± 2.0 %RH
Static Pressure 85.89 kPa ± 0.13 kPa

Data reported in dB re 20 µPa.

Evaluation Method Tested with:
Larson Davis CAL291, SN 0108
Larson Davis CAL200, SN 9079
PCB 377B02, SN 345617
Larson Davis PRMLxT1, SN 077646

Compliance Standards Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8378:

IEC 60651:2001 Type 1
IEC 60804:2000 Type 1
IEC 61252:2002
IEC 61260:2001 Class 1
IEC 61672:2013 Class 1

ANSI S1.4-2014 Class 1
ANSI S1.4 (R2008) Type 1
ANSI S1.11 (R2009) Class 1
ANSI S1.25 (R2007)
ANSI S1.43 (R2007) Type 1

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017.

Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

This report may not be reproduced, except in full, unless permission for the publication of an approved abstract is obtained in writing from the organization issuing this report.

Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert LxT, 070.01 Rev O Supporting Firmware Version 4.0.5, 2010-09-10

For 1/4" microphones, the Larson Davis ADP024 1/4" to 1/2" adaptor is used with the calibration and the Larson Davis ADP043 1/4" to

LARSON DAVIS – A PCB DIVISION
1681 West 820 North
Provo, UT 84601, United States
716-684-0801



LARSON DAVIS
A PCB DIVISION

2023-5-24T18:12:13

Page 1 of 3

DM001-BA00 Rev G

เอกสารไม่ควบคุม

Certificate Number 2023003675

1/2" adaptor is used with the preamplifier.

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa

Periodic tests were performed in accordance with procedures from IEC 61672-3:2013 / ANSIASA S1.4-2014 Part 3.

Pattern approval for IEC 61672-1:2013 / ANSIASA S1.4-2014 Part 1 successfully completed by Physikalisch-Technische Bundesanstalt (PTB) on 2007-10-08 reference number PTB-1.72-4034218.

The sound level meter submitted for testing successfully completed the periodic tests of IEC 61672-3:2013 / ANSIASA S1.4-2014 Part 3, for the environmental conditions under which the tests were performed. As evidence was publicly available, from an independent testing organization responsible for approving the results of pattern-evaluation tests performed in accordance with IEC 61672-2:2013 / ANSIASA S1.4-2014 Part 2, to demonstrate that the model of sound level meter fully conformed to the class 1 specifications in IEC 61672-1:2013 / ANSIASA S1.4-2014 Part 1, the sound level meter submitted for testing conforms to the class 1 specifications in IEC 61672-1:2013 / ANSIASA S1.4-2014 Part 1.

Standards Used			
Description	Cal Date	Cal Due	Cal Standard
Larson Davis CAL291 Residual Intensity Calibrator	2022-09-09	2023-09-09	001250
Hart Scientific 2626-11 Temperature Probe	2021-06-25	2023-06-25	006794
Larson Davis CAL290 Acoustic Calibrator	2022-07-21	2023-07-21	007827
Larson Davis Model 931	2023-02-22	2024-02-22	007182
PCB 377A13 1/2 inch PrePolarized Pressure Microphone	2023-03-06	2024-03-06	007185
SRS DS360 Ultra Low Distortion Generator	2022-03-29	2023-03-29	007635
Larson Davis 1/2" Preamplifier for Model 931 Type 1	2022-09-28	2023-09-28	PCB0004793

Acoustic Calibration

Measured according to IEC 61672-3:2013 10 and ANSI S1.4-2014 Part 3: 10

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
1000 Hz	114.01	113.80	114.20	0.14	Pass

Loaded Circuit Sensitivity

Measurement	Test Result [dB re 1 V / Pa]	Lower Limit [dB re 1 V / Pa]	Upper Limit [dB re 1 V / Pa]	Expanded Uncertainty [dB]	Result
1000 Hz	-49.73	-52.44	-48.33	0.14	Pass

— End of measurement results —

Acoustic Signal Tests, C-weighting

Measured according to IEC 61672-3:2013 12 and ANSI S1.4-2014 Part 3: 12 using a comparison coupler with Unit Under Test (UUT) and reference SLM using slow time-weighted sound level for compliance to IEC 61672-1:2013 5.5, ANSI S1.4-2014 Part 1: 5.5

Frequency [Hz]	Test Result [dB]	Expected [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
125	-0.19	-0.20	-1.20	0.80	0.23	Pass
1000	0.15	0.00	-0.70	0.70	0.23	Pass
8000	-3.69	-3.00	-5.50	-1.50	0.32	Pass

— End of measurement results —

LARSON DAVIS – A PCB DIVISION
1681 West 820 North
Provo, UT 84601, United States
716-684-0801



LARSON DAVIS
A PCB DIVISION

2023-5-24T18:12:13

Page 2 of 3

DM001-BA00 Rev G

เอกสารไม่ควบคุม

Certificate Number 2023003675

Self-generated Noise

Measured according to IEC 61672-3:2013 11.1 and ANSI S1.4-2014 Part 3: 11.1

Measurement	Test Result [dB]
A-weighted	40.32

— End of measurement results —

— End of Report —

Signature: Jacob Cannon

LARSON DAVIS – A PCB DIVISION
1681 West 820 North
Provo, UT 84601, United States
716-684-0001



LARSON DAVIS
A PCB DIVISION

2023-5-24T19:13:13

Page 3 of 3

00001.8404 Rev G

เอกสารไม่ควบคุม

Calibration Certificate

Certificate Number 2023003651

Customer:

United Analyst and Engineering Consultant Co Ltd
No. 11 Soi Udomsak 41, Sukhumvit Road,
Bangkok, Phra Khanong,
Bangkok, 10260, Thailand

Model Number LxT1

Serial Number 0007311

Test Results Pass

Initial Condition As Manufactured

Description SoundTrack LxT Class 1

Class 1 Sound Level Meter

Firmware Revision: 2.404

Procedure Number 00001.8378

Technician Jacob Cannon

Calibration Date 23 Mar 2023

Calibration Due

Temperature 23.6 °C ± 0.25 °C

Humidity 50.3 %RH ± 2.0 %RH

Static Pressure 86.08 kPa ± 0.13 kPa

Evaluation Method Tested electrically using Larson Davis PMLxT 1 SN 077646 and a 12.0 pF capacitor to simulate microphone capacitance. Data reported in dB re 20 µPa assuming a microphone sensitivity of 50.0 mV/Pa.

Compliance Standards Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure 00001.8384:

IEC 60601:2001 Type 1	ANSI S1.4-2014 Class 1
IEC 60604:2000 Type 1	ANSI S1.4 (R2006) Type 1
IEC 61252:2002	ANSI S1.25 (R2007)
IEC 61672:2013 Class 1	ANSI S1.43 (R2007) Type 1
IEC 61260:2001 Class 1	ANSI S1.11 (R2006) Class 1

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017. Test points marked with a 1 in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

This report may not be reproduced, except in full, unless permission for the publication of an approved abstract is obtained in writing from the organization issuing this report.

Conversion data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert Ltd. 0770.01 Rev O Supporting Firmware Version 4.0.5, 2019-09-10

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa

LARSON DAVIS – A PCB DIVISION
1681 West 820 North
Provo, UT 84601, United States
716-684-0001



LARSON DAVIS
A PCB DIVISION

2023-5-23T18:40:17

Page 1 of 8

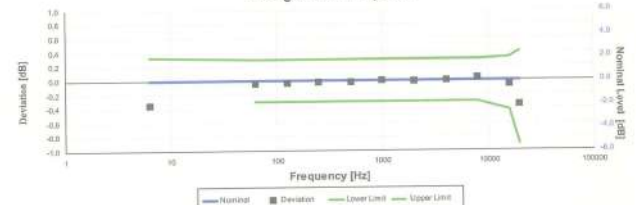
00001.8407 Rev G

เอกสารไม่ควบคุม

Certificate Number 2023003651

Certificate Number 2023003651

Z-weight Filter Response



Electrical signal test of frequency weighting performed according to IEC 61672-3:2013 13 and ANSI S1.4-2014 Part 3: 13 for compliance to IEC 61672-1:2013 5.5, IEC 60601:2001 6.1 and 9.2.2, IEC 60604:2000 5, ANSI S1.4:1983 (R2006) 5.1 and 8.2.1, ANSI S1.4-2014 Part 1: 5.5

Frequency [Hz]	Test Result [dB]	Deviation [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
6.31	-0.36	-0.35	-1.11	0.33	0.15	Pass
63.10	-0.05	-0.05	-0.30	0.30	0.15	Pass
125.89	-0.03	-0.03	-0.30	0.30	0.15	Pass
251.19	-0.03	-0.03	-0.30	0.30	0.15	Pass
501.19	-0.03	-0.03	-0.30	0.30	0.15	Pass
1,000.00	0.00	0.00	-0.30	0.30	0.15	Pass
1,995.26	-0.02	-0.01	-0.30	0.30	0.15	Pass
3,981.07	0.00	0.00	-0.30	0.30	0.15	Pass
7,943.28	0.04	0.04	-0.30	0.30	0.15	Pass
15,048.93	-0.06	-0.06	-0.42	0.32	0.15	Pass
19,952.62	-0.35	-0.35	-0.61	0.41	0.15	Pass

— End of measurement results —

LARSON DAVIS – A PCB DIVISION
1681 West 820 North
Provo, UT 84601, United States
716-684-0001



LARSON DAVIS
A PCB DIVISION

2023-5-23T16:40:17

Page 2 of 8

00001.8407 Rev G

เอกสารไม่ควบคุม

LARSON DAVIS – A PCB DIVISION
1681 West 820 North
Provo, UT 84601, United States
716-684-0001



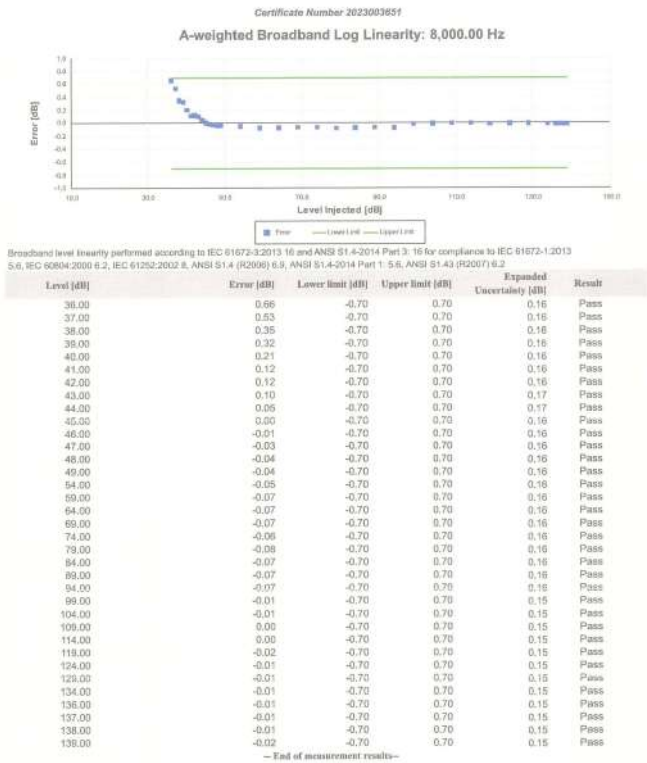
LARSON DAVIS
A PCB DIVISION

2023-5-23T16:40:17

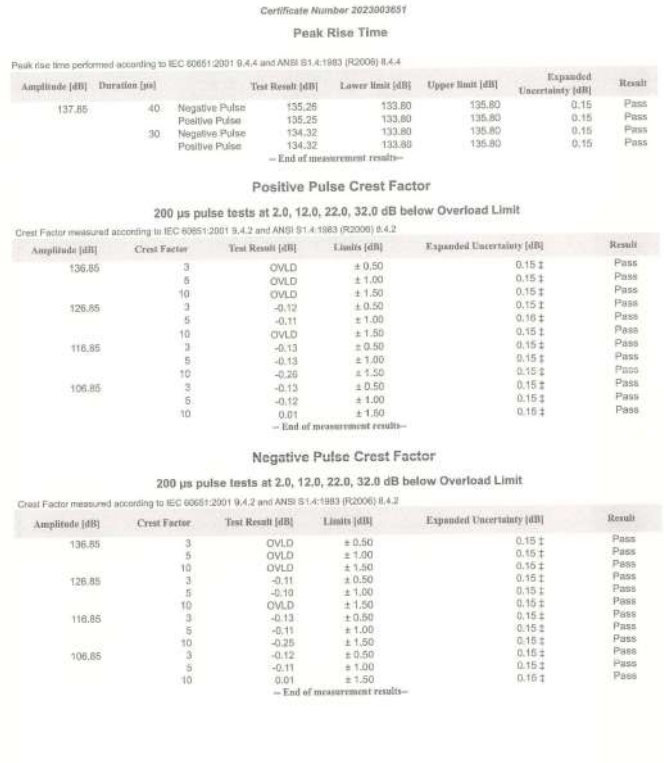
Page 3 of 8

00001.8407 Rev G

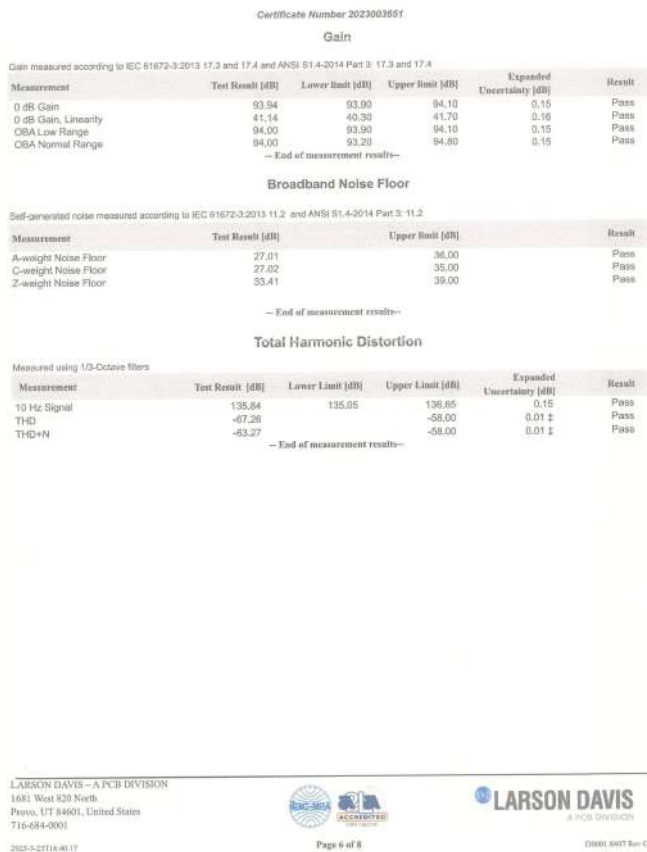
เอกสารไม่ควบคุม



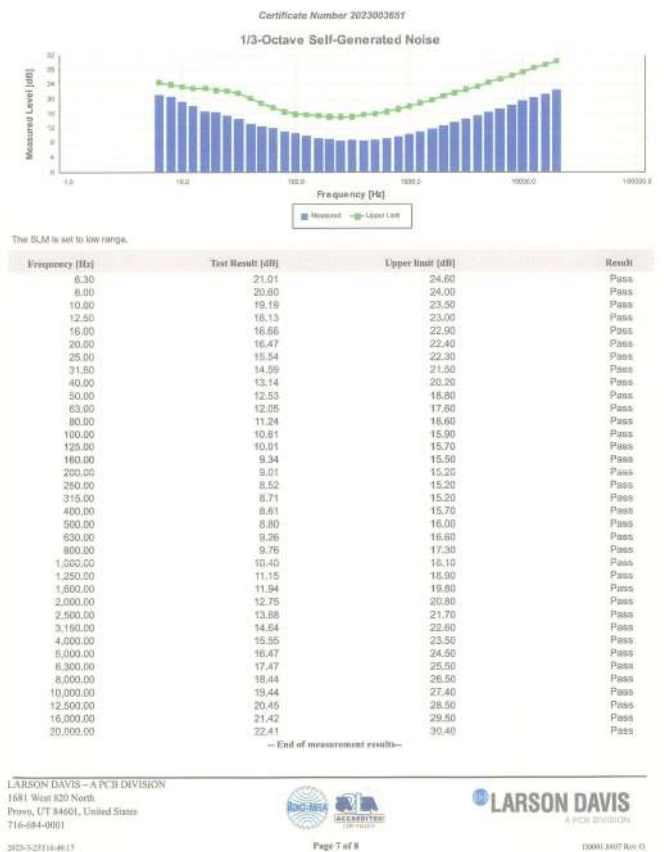
เอกสารไม่ควบคุม



เอกสารไม่ควบคุม



เอกสารไม่ควบคุม



เอกสารไม่ควบคุม

Certificate Number 2023003678

Calibration Certificate

Certificate Number 2023003678

Customer:
United Analyst and Engineering Consultant Co Ltd
No. 81 Soi Udomsak 41, Sukhumvit Road,
Bangkok, Phra Khanong
Bangkok, 10260, Thailand

Model Number LxT1
Serial Number 0007312
Test Results Pass

Initial Condition As Manufactured

Description SoundTrack LxT Class 1
Class 1 Sound Level Meter
Firmware Revision: 2.04

Procedure Number D0001.8384
Technician Jacob Cannon
Calibration Date 24 Mar 2023

Calibration Due
Temperature 23.58 °C ± 0.25 °C
Humidity 49.3 %RH ± 2.0 %RH
Static Pressure 85.71 kPa ± 0.13 kPa

Evaluation Method Tested with: Data reported in dB re 20 µPa.

Larson Davis CAL200, S/N 9079
PCB 377802, S/N 345818
Larson Davis PRIMeLxT1, S/N 077647
Larson Davis CAL291, S/N 0108

Compliance Standards Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8378:

IEC 60651:2001 Type 1
IEC 60804:2000 Type 1
IEC 61260:2002
IEC 61260:2001 Class 1
IEC 61672:2013 Class 1
ANSI S1.4-2014 Class 1
ANSI S1.4 (R2006) Type 1
ANSI S1.11 (R2009) Class 1
ANSI S1.25 (R2007)
ANSI S1.43 (R2007) Type 1

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017.

Test points marked with a 2 in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

This report may not be reproduced, except in full, unless permission for the publication of an approved abstract is obtained in writing from the organization issuing this report.

Connection data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert LxT, 1770.01 Rev O Supporting Firmware Version 4.0.5, 2019-09-10

For 1/4" microphones, the Larson Davis ADP024 1/4" to 1/2" adaptor is used with the calibrators and the Larson Davis ADP043 1/4" to

LARSON DAVIS - A PCB DIVISION
1681 West 820 North
Provo, UT 84601, United States
716-684-0001



LARSON DAVIS
A PCB DIVISION

2023-3-24T18:38:14

Page 1 of 3

D0001.8406 Rev G

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Certificate Number 2023003678

1/2" adaptor is used with the preamplifier.

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa

Periodic tests were performed in accordance with procedures from IEC 61672-3:2013 / ANSI/ASA S1.4-2014 Part 3.

Pattern approval for IEC 61672-1:2013 / ANSI/ASA S1.4-2014 Part 1 successfully completed by Physikalisch-Technische Bundesanstalt (PTB) on 2007-10-08 reference number PTB-1.72-0334218.

The sound level meter submitted for testing successfully completed the periodic tests of IEC 61672-3:2013 / ANSI/ASA S1.4-2014 Part 3, for the environmental conditions under which the tests were performed. As evidence was publicly available, from an independent testing organization responsible for approving the results of pattern-evaluation tests performed in accordance with IEC 61672-2:2013 / ANSI/ASA S1.4-2014 Part 2, to demonstrate that the model of sound level meter fully conformed to the class 1 specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014 Part 1; the sound level meter submitted for testing conforms to the class 1 specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014 Part 1.

Standards Used			
Description	Cal Date	Cal Due	Cal Standard
Larson Davis CAL291 Residual Intensity Calibrator	2023-06-09	2023-06-09	061250
Hart Scientific 2026-41 Temperature Probe	2023-06-25	2023-06-25	006798
Larson Davis CAL290 Acoustic Calibrator	2022-07-21	2023-07-21	007027
Larson Davis Model K31	2023-02-22	2024-02-22	007182
PCB 377A13 1/2 inch Bipolarized Pressure Microphone	2023-03-06	2024-03-06	007185
SRS DS360 Ultra Low Distortion Generator	2022-03-29	2023-03-29	007635
Larson Davis 1/2" Preamplifier for Model K31 Type 1	2023-06-28	2023-06-28	PCB0004783

Acoustic Calibration

Measured according to IEC 61672-3:2013 10 and ANSI S1.4-2014 Part 3: 10

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
1000 Hz	114.01	113.80	114.20	0.14	Pass

Loaded Circuit Sensitivity

Measurement	Test Result [dB re 1 V / Pa]	Lower Limit [dB re 1 V / Pa]	Upper Limit [dB re 1 V / Pa]	Expanded Uncertainty [dB]	Result
1000 Hz	-49.85	-52.44	-48.33	0.14	Pass

— End of measurement results—

Acoustic Signal Tests, C-weighting

Measured according to IEC 61672-3:2013 12 and ANSI S1.4-2014 Part 3: 12 using a comparison coupler with Unit Under Test (UUT) and reference SLM using slow time-weighted sound level for compliance to IEC 61672-1:2013 5.5, ANSI S1.4-2014 Part 3: 5.5

Frequency [Hz]	Test Result [dB]	Expected [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
125	-0.20	-0.20	-1.20	0.80	0.23	Pass
1000	0.14	0.00	-0.70	0.70	0.23	Pass
8000	-3.72	-3.00	-5.50	-1.50	0.32	Pass

— End of measurement results—

Certificate Number 2023003678

Self-generated Noise

Measured according to IEC 61672-3:2013 11.1 and ANSI S1.4-2014 Part 3: 11.1

Measurement	Test Result [dB]
A-weighted	40.51

— End of measurement results—

Signature: Jacob Cannon

LARSON DAVIS - A PCB DIVISION
1681 West 820 North
Provo, UT 84601, United States
716-684-0001



LARSON DAVIS
A PCB DIVISION

2023-3-24T18:38:14

Page 3 of 3

D0001.8406 Rev G

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Calibration Certificate

Certificate Number 2023003652

Customer:
United Analyst and Engineering Consultant Co Ltd
No. 81 Soi Udonvok 41, Sukhumvit Road,
Bangkok, Phra Khanong,
Bangkok, 10260, Thailand

Model Number LxT1
Serial Number 0007312
Test Results Pass
Initial Condition As Manufactured
Description SoundTrack LxT Class 1
Class 1 Sound Level Meter
Firmware Revision: 2.404

Procedure Number D0001.8378
Technician Jacob Cannon
Calibration Date 23 Mar 2023
Calibration Due
Temperature 23.62 °C ± 0.25 °C
Humidity 49.5 %RH ± 2.0 %RH
Static Pressure 86.08 kPa ± 0.13 kPa

Evaluation Method Tested electrically using Larson Davis PRAILX1T SN 077647 and a 12.0 pF capacitor to simulate microphone capacitance. Data reported in dB re 20 µPa assuming a microphone sensitivity of 50.0 mV/Pa.

Compliance Standards Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8384:

IEC 60651:2001 Type 1	ANSI S1.4-2014 Class 1
IEC 60804:2000 Type 1	ANSI S1.4 (R2006) Type 1
IEC 61252:2002	ANSI S1.25 (R2007)
IEC 61672:2013 Class 1	ANSI S1.43 (R2007) Type 1
IEC 61260:2001 Class 1	ANSI S1.11 (R2009) Class 1

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017. Test points marked with a † in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

This report may not be reproduced, except in full, unless permission for the publication of an approved abstract is obtained in writing from the organization issuing this report.

Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert LxT 070.01 Rev O Supporting Firmware Version: 4.0.5, 2019-09-10

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa

LARSON DAVIS – A PCB DIVISION
1681 West 820 North
Provo, UT 84601, United States
716-684-0001



LARSON DAVIS
A PCB DIVISION

2023-3-23T16:42:12

Page 1 of 8

D0001.8407 Rev O

เอกสารไม่ควบคุม

LARSON DAVIS – A PCB DIVISION
1681 West 820 North
Provo, UT 84601, United States
716-684-0001



LARSON DAVIS
A PCB DIVISION

2023-3-23T16:42:12

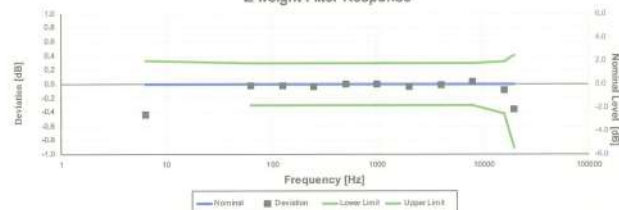
Page 2 of 8

D0001.8407 Rev O

เอกสารไม่ควบคุม

Certificate Number 2023003652

Z-weight Filter Response



Electrical signal test of frequency weighting performed according to IEC 61672-3:2013 13 and ANSI S1.4-2014 Part 3: 13 for compliance to IEC 61672-1:2013 5.5, IEC 60651:2001 6.1 and 9.2.2; IEC 60804:2000 5; ANSI S1.4:1983 (R2006) 5.1 and 5.2.1; ANSI S1.4-2014 Part 1: 5.5

Frequency [Hz]	Test Result [dB]	Deviation [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
6.31	-0.44	-0.44	-1.11	0.33	0.15	Pass
63.10	-0.03	-0.03	-0.30	0.30	0.15	Pass
125.89	-0.03	-0.03	-0.30	0.30	0.15	Pass
251.19	-0.04	-0.04	-0.30	0.30	0.15	Pass
501.19	-0.01	-0.01	-0.30	0.30	0.15	Pass
1,000.00	0.00	0.00	-0.30	0.30	0.15	Pass
1,999.26	-0.03	-0.03	-0.30	0.30	0.15	Pass
3,981.07	-0.01	-0.01	-0.30	0.30	0.15	Pass
7,943.28	0.04	0.04	-0.30	0.30	0.15	Pass
15,848.03	-0.08	-0.08	-0.42	0.32	0.16	Pass
19,952.62	-0.37	-0.37	-0.61	0.41	0.15	Pass

— End of measurement results—

LARSON DAVIS – A PCB DIVISION
1681 West 820 North
Provo, UT 84601, United States
716-684-0001



LARSON DAVIS
A PCB DIVISION

2023-3-23T16:42:12

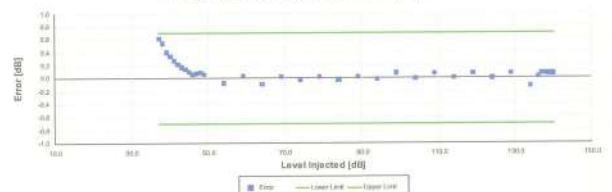
Page 3 of 8

D0001.8407 Rev O

เอกสารไม่ควบคุม

Certificate Number 2023003652

A-weighted Broadband Log Linearity: 8,000.00 Hz



Broadband level linearity performed according to IEC 61672-3:2013 16 and ANSI S1.4-2014 Part 3: 16 for compliance to IEC 61672-1:2013 5.8, IEC 60804:2000 6.2, IEC 61252:2002 8, ANSI S1.4 (R2006) 6.8, ANSI S1.4-2014 Part 1: 5.6, ANSI S1.43 (R2007) 6.2

Level [dB]	Error [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
37.00	0.81	-0.70	0.70	0.16	Pass
38.00	0.54	-0.70	0.70	0.16	Pass
39.00	0.40	-0.70	0.70	0.16	Pass
40.00	0.33	-0.70	0.70	0.16	Pass
41.00	0.27	-0.70	0.70	0.16	Pass
42.00	0.22	-0.70	0.70	0.16	Pass
43.00	0.18	-0.70	0.70	0.17	Pass
44.00	0.15	-0.70	0.70	0.17	Pass
45.00	0.16	-0.70	0.70	0.16	Pass
46.00	0.07	-0.70	0.70	0.16	Pass
47.00	0.07	-0.70	0.70	0.16	Pass
48.00	0.09	-0.70	0.70	0.16	Pass
49.00	0.06	-0.70	0.70	0.16	Pass
50.00	-0.07	-0.70	0.70	0.16	Pass
59.00	0.03	-0.70	0.70	0.16	Pass
64.00	-0.09	-0.70	0.70	0.16	Pass
69.00	0.03	-0.70	0.70	0.16	Pass
74.00	-0.03	-0.70	0.70	0.16	Pass
79.00	0.02	-0.70	0.70	0.16	Pass
84.00	-0.02	-0.70	0.70	0.16	Pass
89.00	0.03	-0.70	0.70	0.16	Pass
94.00	-0.02	-0.70	0.70	0.15	Pass
99.00	0.08	-0.70	0.70	0.15	Pass
104.00	0.00	-0.70	0.70	0.15	Pass
109.00	0.08	-0.70	0.70	0.15	Pass
114.00	0.01	-0.70	0.70	0.15	Pass
119.00	0.07	-0.70	0.70	0.15	Pass
124.00	0.01	-0.70	0.70	0.15	Pass
129.00	0.08	-0.70	0.70	0.15	Pass
134.00	-0.12	-0.70	0.70	0.15	Pass
139.00	0.02	-0.70	0.70	0.15	Pass
137.00	0.07	-0.70	0.70	0.15	Pass
136.00	0.07	-0.70	0.70	0.15	Pass
135.00	0.07	-0.70	0.70	0.15	Pass
134.00	0.07	-0.70	0.70	0.15	Pass
140.00	0.07	-0.70	0.70	0.15	Pass

— End of measurement results—

LARSON DAVIS – A PCB DIVISION
1681 West 820 North
Provo, UT 84601, United States
716-684-0001



LARSON DAVIS
A PCB DIVISION

2023-3-23T16:42:12

Page 4 of 8

D0001.8407 Rev O

เอกสารไม่ควบคุม

Certificate Number 2023003552

Peak Rise Time

Peak rise time performed according to IEC 60651-2001 8.4.4 and ANSI S1.4-1983 (R2006) 8.4.4

Test results are performed according to the test plan and test method (shown below)							
Amplitude [dB]	Duration [μs]		Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
137.85	40	Negative Pulse	134.73	133.30	135.30	0.15	Pass
		Positive Pulse	134.72	133.28	135.28	0.15	Pass
	30	Negative Pulse	133.79	133.30	135.30	0.15	Pass
		Positive Pulse	133.78	133.28	135.28	0.15	Pass
— End of measurement results—							

Positive Pulse Crest Factor

200 μs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Crest Factor measured according to IEC 60651-2001 8.4.2 and ANSI S1.4-1983 (R2006) 8.4.2

Amplitude [dB]	Crest Factor	Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
136.85	3	OVLD	± 0.50	0.15 ±	Pass
	5	OVLD	± 1.00	0.15 ±	Pass
	10	OVLD	± 1.50	0.15 ±	Pass
128.85	3	-0.12	± 0.50	0.15 ±	Pass
	5	-0.07	± 1.00	0.15 ±	Pass
	10	OVLD	± 1.50	0.15 ±	Pass
116.85	3	-0.16	± 0.50	0.15 ±	Pass
	5	-0.05	± 1.00	0.15 ±	Pass
	10	-0.24	± 1.50	0.15 ±	Pass
106.85	3	-0.19	± 0.50	0.15 ±	Pass
	5	-0.09	± 1.00	0.15 ±	Pass
	10	-0.30	± 1.50	0.15 ±	Pass
— End of measurement results—					

Negative Pulse Crest Factor

200 μs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Crest Factor measured according to IEC 60651-2001 8.4.2 and ANSI S1.4-1983 (R2006) 8.4.2

Amplitude [dB]	Crest Factor	Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
136.85	3	OVLD	± 0.50	0.15 ±	Pass
	5	OVLD	± 1.00	0.15 ±	Pass
	10	OVLD	± 1.50	0.15 ±	Pass
126.85	3	-0.11	± 0.50	0.15 ±	Pass
	5	-0.08	± 1.00	0.15 ±	Pass
	10	OVLD	± 1.50	0.15 ±	Pass
116.85	3	-0.10	± 0.50	0.15 ±	Pass
	5	-0.06	± 1.00	0.15 ±	Pass
	10	-0.23	± 1.50	0.15 ±	Pass
106.85	3	-0.18	± 0.50	0.15 ±	Pass
	5	-0.11	± 1.00	0.15 ±	Pass
	10	-0.28	± 1.50	0.15 ±	Pass
— End of measurement results—					

LARSON DAVIS – A PCB DIVISION
1681 West 820 North
Provo, UT 84601, United States
716-684-0001



LARSON DAVIS
A PCB DIVISION

2023-3-27116-42-12

Page 5 of 8

(D886) 8497 Rev D

เอกสารไม่ควบคุม

Certificate Number 2023003552

Gain

Gain measured according to IEC 61672-3:2013 17.3 and 17.4 and ANSI S1.4-2014 Part 3: 17.3 and 17.4

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
0 dB Gain	93.92	93.86	94.08	0.15	Pass
0 dB Gain, Linearity	41.16	40.26	41.66	0.16	Pass
OBA Low Range	93.97	93.86	94.06	0.15	Pass
OBA Normal Range	93.96	93.20	94.90	0.15	Pass
-- End of measurement results--					

Broadband Noise Floor

Self-generated noise measured according to IEC 61672-3:2013 11.2 and ANSI S1.4-2014 Part 3: 11.2

Measurement	Test Result [dB]	Upper Limit [dB]	Result
A-weight Noise Floor	26.86	36.00	Pass
C-weight Noise Floor	26.56	35.00	Pass
Z-weight Noise Floor	32.26	39.00	Pass

-- End of measurement results--

Total Harmonic Distortion

Measured using 1/3-Octave filters

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
10 Hz Signal	135.35	135.05	136.65	0.15	Pass
THD	-64.53	-68.00	-60.00	0.01 ±	Pass
THD+N	-61.30	-65.00	-58.00	0.01 ±	Pass
-- End of measurement results--					

LARSON DAVIS – A PCB DIVISION
1681 West 820 North
Provo, UT 84601, United States
716-684-0001



LARSON DAVIS
A PCB DIVISION

2023-3-27116-42-12

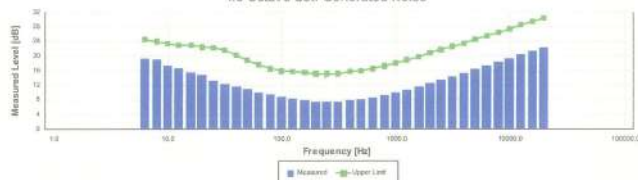
Page 6 of 8

(D886) 8497 Rev D

เอกสารไม่ควบคุม

Certificate Number 2023003552

1/3-Octave Self-Generated Noise



The SLM is set to low range.

Frequency [Hz]	Test Result [dB]	Upper limit [dB]	Result
6.30	19.36	24.90	Pass
8.00	18.96	24.00	Pass
10.00	17.32	23.50	Pass
12.50	16.60	23.00	Pass
16.00	15.47	22.90	Pass
20.00	14.67	22.40	Pass
25.00	13.12	22.30	Pass
31.50	12.38	21.50	Pass
40.00	11.67	20.20	Pass
50.00	10.95	18.80	Pass
63.00	10.08	17.60	Pass
80.00	9.46	16.60	Pass
100.00	8.73	15.90	Pass
125.00	8.30	15.70	Pass
160.00	7.83	15.50	Pass
200.00	7.53	15.20	Pass
250.00	7.40	15.20	Pass
315.00	7.44	15.20	Pass
400.00	7.80	15.70	Pass
500.00	8.11	16.00	Pass
630.00	8.69	16.60	Pass
800.00	9.34	17.30	Pass
1,000.00	10.05	18.10	Pass
1,250.00	10.74	18.90	Pass
1,600.00	11.61	19.80	Pass
2,000.00	12.58	20.80	Pass
2,500.00	13.49	21.70	Pass
3,150.00	14.42	22.80	Pass
4,000.00	15.39	23.50	Pass
5,000.00	16.38	24.50	Pass
6,300.00	17.34	25.50	Pass
8,000.00	18.33	26.50	Pass
10,000.00	19.35	27.40	Pass
12,500.00	20.35	28.50	Pass
16,000.00	21.34	29.50	Pass
20,000.00	22.35	30.40	Pass
-- End of measurement results--			

LARSON DAVIS – A PCB DIVISION
1681 West 820 North
Provo, UT 84601, United States
716-684-0001



LARSON DAVIS
A PCB DIVISION

2023-3-27116-42-12

Page 7 of 8

(D886) 8497 Rev D

เอกสารไม่ควบคุม

Certificate Number 2023003552

Signature: Jacob Cannon

LARSON DAVIS – A PCB DIVISION
1681 West 820 North
Provo, UT 84601, United States
716-684-0001



LARSON DAVIS
A PCB DIVISION

2023-3-27116-42-12

Page 8 of 8

(D886) 8497 Rev D

เอกสารไม่ควบคุม

Calibration Certificate

Certificate Number 2023002738

Customer:

United Analyst and Engineering Consultant Co Ltd
No. 81 Soi Udonwong 41, Sukhumvit Road,
Bangkok, Phra Khanong,
Bangkok, 10260, Thailand

Model Number

LxT1

Serial Number

0007313

Test Results

Pass

Initial Condition

As Manufactured

Description

SoundTrack LxT Class 1
Class 1 Sound Level Meter
Firmware Revision: 2.404

Procedure Number

D0001.8384

Technician

Jacob Cannon

Calibration Date

24 Mar 2023

Calibration Due

23.62 °C

Temperature

49.3 %RH

Humidity

85.7 kPa

Static Pressure

± 0.25 °C

± 2.0 %RH

± 0.13 kPa

Evaluation Method

Tested with:

PCB 377B02, S/N 345819

Larson Davis CAL201, S/N 0108

Larson Davis PRMLxT1, S/N 077648

Larson Davis CAL200, S/N 9079

Date reported in dB re 20 µPa.

Compliance Standards

Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8378:

IEC 60651-2001 Type 1

IEC 60604-2000 Type 1

IEC 61252-2002

IEC 61280-2001 Class 1

IEC 61672-2013 Class 1

ANSI S1.4-2014 Class 1

ANSI S1.4 (R2006) Type 1

ANSI S1.11 (R2009) Class 1

ANSI S1.25 (R2007)

ANSI S1.43 (R2007) Type 1

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017.

Test points marked with a ± in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

This report may not be reproduced, except in full, unless permission for the publication of an approved abstract is obtained in writing from the organization issuing this report.

Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert LxT, 1770.01 Rev O Supporting Firmware Version 4.0.5, 2019-09-10

For 1/4" microphones, the Larson Davis ADP024 1/4" to 1/2" adaptor is used with the calibrators and the Larson Davis ADP043 1/4" to

LARSON DAVIS – A PCB DIVISION
1681 West 820 North
Provo, UT 84601, United States
716-684-0001

2023-5-24T18:41:07



Page 1 of 3



D0001.8406 Rev G

เอกสารไม่ควบคุม

Certificate Number 2023003677

1/2" adaptor is used with the preamplifier,

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa

Periodic tests were performed in accordance with procedures from IEC 61672-3:2013 / ANSIASA S1.4-2014/Part 3.

Pattern approval for IEC 61672-1:2013 / ANSIASA S1.4-2014/Part 1 successfully completed by Physikalisch-Technische Bundesanstalt (PTB) on 2007-10-09 reference number PTB-1.72-4034218.

The sound level meter submitted for testing successfully completed the periodic tests of IEC 61672-3:2013 / ANSIASA S1.4-2014/Part 3, for the environmental conditions under which the tests were performed. As evidence was publicly available, from an independent testing organization responsible for approving the results of pattern-evaluation tests performed in accordance with IEC 61672-2:2013 / ANSIASA S1.4-2014/Part 2, to demonstrate that the model of sound level meter fully conformed to the class 1 specifications in IEC 61672-1:2013 / ANSIASA S1.4-2014/Part 1; the sound level meter submitted for testing conforms to the class 1 specifications in IEC 61672-1:2013 / ANSIASA S1.4-2014/Part 1.

Standards Used			
Description	Cal Date	Cal Due	Cal Standard
Larson Davis CAL201 Residual Intensity Calibrator	2023-09-09	2023-09-09	001250
Hart Scientific 2526-H Temperature Probe	2021-08-25	2021-05-25	006798
Larson Davis CAL200 Acoustic Calibrator	2023-07-21	2023-07-21	007007
Larson Davis Model 831	2023-02-22	2024-02-22	007182
PCB 377A13 1/2 inch PrePolarized Pressure Microphone	2023-01-06	2024-03-06	007185
SRS DS360 Ultra Low Distortion Generator	2022-03-29	2023-03-29	007635
Larson Davis 1/2" Preamplifier for Model 831 Type 1	2022-09-28	2023-09-28	PCB0004783

Acoustic Calibration

Measured according to IEC 61672-3:2013 10 and ANSI S1.4-2014 Part 3: 10

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
1000 Hz	114.01	113.80	114.20	0.14	Pass

Loaded Circuit Sensitivity

Measurement	Test Result [dB re 1 V / Pa]	Lower Limit [dB re 1 V / Pa]	Upper Limit [dB re 1 V / Pa]	Expanded Uncertainty [dB]	Result
1000 Hz	-49.76	-52.44	-48.33	0.14	Pass

— End of measurement results—

Acoustic Signal Tests, C-weighting

Measured according to IEC 61672-3:2013 12 and ANSI S1.4-2014 Part 3: 12 using a comparison coupler with Unit Under Test (UUT) and reference SLM using slow time-weighted sound level for compliance to IEC 61672-1:2013 5.5, ANSI S1.4-2014 Part 1: 5.5

Frequency [Hz]	Test Result [dB]	Expected [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
125	-0.20	-0.20	-1.20	0.80	0.23	Pass
1000	0.13	0.00	-0.70	0.70	0.23	Pass
8000	-3.30	-3.00	-5.50	-1.50	0.32	Pass

— End of measurement results—

LARSON DAVIS – A PCB DIVISION
1681 West 820 North
Provo, UT 84601, United States
716-684-0001

2023-5-24T18:41:07



Page 2 of 3



D0001.8406 Rev G

เอกสารไม่ควบคุม

Certificate Number 2023003677

Self-generated Noise

Measured according to IEC 61672-3:2013 11.1 and ANSI S1.4-2014 Part 3: 11.1

Measurement	Test Result [dB]
A-weighted	44.29

— End of measurement results—

— End of Report—

Signature: Jacob Cannon

LARSON DAVIS – A PCB DIVISION
1681 West 820 North
Provo, UT 84601, United States
716-684-0001

2023-5-24T18:41:07



Page 3 of 3



D0001.8406 Rev G

เอกสารไม่ควบคุม

Calibration Certificate

Certificate Number 2023002738

Customer:

United Analyst and Engineering Consultant Co Ltd
No. 81 Soi Udonwong 41, Sukhumvit Road,
Bangkok, Phra Khanong,
Bangkok, 10260, Thailand

Model Number

LxT1

Serial Number

0007313

Test Results

Pass

Initial Condition

As Manufactured

Description

SoundTrack LxT Class 1
Class 1 Sound Level Meter
Firmware Revision: 2.404

Procedure Number

D0001.8378

Technician

Jacob Cannon

Calibration Date

23 Mar 2023

Calibration Due

23.66 °C

Temperature

49.3 %RH

Humidity

85.98 kPa

Static Pressure

± 0.25 °C

± 2.0 %RH

± 0.13 kPa

Evaluation Method

Tested electrically using Larson Davis PRMLxT1 S/N 077648 and a 12.0 pF capacitor to simulate microphone capacitance. Data reported in dB re 20 µPa assuming a microphone sensitivity of 50.0 mV/Pa.

Compliance Standards

Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8384:

IEC 60651-2001 Type 1

IEC 60804-2000 Type 1

IEC 61252-2002

IEC 61672-2013 Class 1

IEC 61280-2001 Class 1

ANSI S1.4-2014 Class 1

ANSI S1.4 (R2006) Type 1

ANSI S1.25 (R2007)

ANSI S1.43 (R2007) Type 1

ANSI S1.11 (R2009) Class 1

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017. Test points marked with a ± in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

This report may not be reproduced, except in full, unless permission for the publication of an approved abstract is obtained in writing from the organization issuing this report.

Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert LxT, 1770.01 Rev O Supporting Firmware Version 4.0.5, 2019-09-10

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa

LARSON DAVIS – A PCB DIVISION
1681 West 820 North
Provo, UT 84601, United States
716-684-0001

2023-5-23T18:24:28



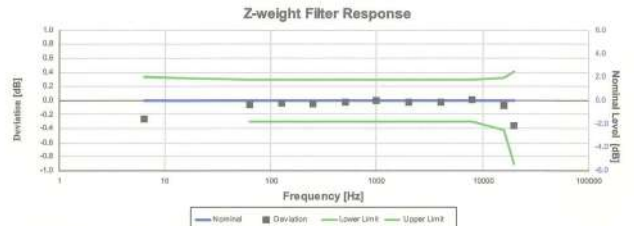
Page 1 of 8



D0001.8407 Rev G

เอกสารไม่ควบคุม

Standards Used			
Description	Cal Date	Cal Due	Cal Standard
Hart Scientific 2626-11 Temperature Probe	2021-08-25	2023-05-25	006798
SRS DS360 Ultra Low Distortion Generator	2022-12-29	2023-12-29	007118



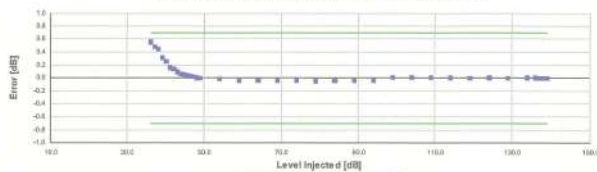
Electrical signal test of frequency weighting performed according to IEC 61672-3:2013 13 and ANSI S1.4-2014 Part 3: 13 for compliance to IEC 61672-1:2013 5.5, IEC 60651:2001 6.1 and 9.2.2, IEC 60804:2000 5, ANSI S1.4:1983 (R2006) 5.1 and 8.2.1, ANSI S1.4-2014 Part 1: 5.5

Frequency [Hz]	Test Result [dB]	Deviation [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
6.31	-0.27	-0.27	-1.11	0.33	0.15	Pass
53.10	-0.06	-0.06	-0.30	0.30	0.15	Pass
125.89	-0.04	-0.04	-0.30	0.30	0.15	Pass
251.19	-0.05	-0.05	-0.30	0.30	0.15	Pass
501.19	-0.03	-0.03	-0.30	0.30	0.15	Pass
1,000.00	0.00	0.00	-0.30	0.30	0.15	Pass
1,995.26	-0.03	-0.03	-0.30	0.30	0.15	Pass
3,981.07	-0.02	-0.02	-0.30	0.30	0.15	Pass
7,943.28	0.01	0.01	-0.30	0.30	0.15	Pass
15,848.93	-0.08	-0.08	-0.42	0.32	0.15	Pass
19,952.62	-0.37	-0.37	-0.91	0.41	0.15	Pass
- End of measurement results-						

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

A-weighted Broadband Log Linearity: 8,000.00 Hz



Broadband level linearity performed according to IEC 61672-3:2013 16 and ANSI S1.4-2014 Part 3: 16 for compliance to IEC 61672-1:2013 5.6, IEC 60804:2000 6.2, IEC 61252:2002 8, ANSI S1.4 (R2006) 6.8, ANSI S1.4-2014 Part 1: 5.6, ANSI S1.4.3 (R2007) 6.2

Level [dB]	Error [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
36.00	0.25	-0.70	0.70	0.16	Pass
37.00	0.48	-0.70	0.70	0.16	Pass
38.00	0.44	-0.70	0.70	0.16	Pass
39.00	0.31	-0.70	0.70	0.16	Pass
40.00	0.26	-0.70	0.70	0.16	Pass
41.00	0.16	-0.70	0.70	0.16	Pass
42.00	0.15	-0.70	0.70	0.16	Pass
43.00	0.10	-0.70	0.70	0.17	Pass
44.00	0.06	-0.70	0.70	0.17	Pass
45.00	0.04	-0.70	0.70	0.16	Pass
46.00	0.03	-0.70	0.70	0.16	Pass
47.00	0.03	-0.70	0.70	0.16	Pass
48.00	0.00	-0.70	0.70	0.16	Pass
49.00	0.00	-0.70	0.70	0.16	Pass
50.00	-0.02	-0.70	0.70	0.16	Pass
51.00	-0.04	-0.70	0.70	0.16	Pass
54.00	-0.04	-0.70	0.70	0.16	Pass
59.00	-0.04	-0.70	0.70	0.16	Pass
64.00	-0.04	-0.70	0.70	0.16	Pass
69.00	-0.04	-0.70	0.70	0.16	Pass
74.00	-0.04	-0.70	0.70	0.16	Pass
79.00	-0.05	-0.70	0.70	0.16	Pass
84.00	-0.04	-0.70	0.70	0.16	Pass
89.00	-0.04	-0.70	0.70	0.16	Pass
94.00	-0.04	-0.70	0.70	0.16	Pass
99.00	0.01	-0.70	0.70	0.15	Pass
104.00	0.02	-0.70	0.70	0.15	Pass
109.00	0.01	-0.70	0.70	0.15	Pass
114.00	0.00	-0.70	0.70	0.15	Pass
119.00	0.00	-0.70	0.70	0.15	Pass
124.00	0.01	-0.70	0.70	0.15	Pass
129.00	0.00	-0.70	0.70	0.15	Pass
134.00	0.00	-0.70	0.70	0.15	Pass
136.00	0.01	-0.70	0.70	0.15	Pass
137.00	0.00	-0.70	0.70	0.15	Pass
138.00	0.00	-0.70	0.70	0.15	Pass
139.00	0.00	-0.70	0.70	0.15	Pass
- End of measurement results-					

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Certificate Number 2023003882

Gain

Gain measured according to IEC 61672-3:2013 17.3 and 17.4 and ANSI S1.4-2014 Part 3: 17.3 and 17.4

Measurement	Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
0 dB Gain	93.95	93.90	94.10	0.15	Pass
0 dB Gain, Linearity	41.09	40.30	41.70	0.16	Pass
CBA Low Range	94.00	93.90	94.10	0.15	Pass
CBA Normal Range	94.00	93.20	94.80	0.15	Pass

— End of measurement results—

Broadband Noise Floor

Self-generated noise measured according to IEC 61672-3:2013 11.2 and ANSI S1.4-2014 Part 3: 11.2

Measurement	Test Result [dB]	Upper limit [dB]	Result
A-weight Noise Floor	26.97	26.00	Pass
C-weight Noise Floor	26.58	35.00	Pass
Z-weight Noise Floor	32.49	39.00	Pass

— End of measurement results—

Total Harmonic Distortion

Measured using 1/3-Octave filters

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
10 Hz Signal	135.70	135.05	136.65	0.15	Pass
THD	-66.61	-66.00	-68.00	0.01 ±	Pass
THD+N	-62.64	-66.00	-58.00	0.01 ±	Pass

— End of measurement results—

LARSON DAVIS – A PCB DIVISION
1681 West 820 North
Provo, UT 84601, United States
716-684-0001

Page 6 of 8

LARSON DAVIS
A PCB DIVISION

D9001.0407 Rev G

2023-3-23T18:34:36

เอกสารไม่ควบคุม

Certificate Number 2023003882

1/3-Octave Self-Generated Noise



The GUM is set to low range.

Frequency [Hz]	Test Result [dB]	Upper limit [dB]	Result
6.30	19.80	24.00	Pass
8.00	19.80	24.00	Pass
10.00	17.19	23.50	Pass
12.50	15.99	23.00	Pass
16.00	15.86	22.90	Pass
20.00	14.51	22.40	Pass
25.00	13.66	22.30	Pass
31.50	12.51	21.50	Pass
40.00	11.77	20.20	Pass
50.00	10.95	18.80	Pass
63.00	10.01	17.60	Pass
80.00	9.05	16.60	Pass
100.00	8.51	15.90	Pass
125.00	7.92	15.70	Pass
160.00	7.54	15.50	Pass
200.00	7.46	15.20	Pass
250.00	7.39	15.20	Pass
315.00	7.47	15.20	Pass
400.00	7.66	15.70	Pass
500.00	8.16	16.00	Pass
630.00	8.75	16.60	Pass
800.00	9.37	17.30	Pass
1,000.00	10.15	18.10	Pass
1,250.00	10.99	18.90	Pass
1,600.00	11.82	19.80	Pass
2,000.00	12.70	20.80	Pass
2,500.00	13.72	21.70	Pass
3,150.00	14.57	22.80	Pass
4,000.00	15.53	23.50	Pass
5,000.00	16.46	24.50	Pass
6,300.00	17.44	25.50	Pass
8,000.00	18.45	26.50	Pass
10,000.00	19.43	27.40	Pass
12,500.00	20.42	28.50	Pass
16,000.00	21.39	29.50	Pass
20,000.00	22.40	30.40	Pass

— End of measurement results—

LARSON DAVIS – A PCB DIVISION
1681 West 820 North
Provo, UT 84601, United States
716-684-0001

Page 7 of 8

LARSON DAVIS
A PCB DIVISION

D9001.0407 Rev G

2023-3-23T18:34:36

เอกสารไม่ควบคุม

Certificate Number 2023003882

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL: 0-2717-3000-29 FAX: 0-2719-9484Cert.No.: 23CH1226
Page: 1 of 3

Certificate of Calibration

Equipment : pH Meter
 Manufacturer : Horiba
 Model : LAQUA-PH210
 Serial No. : HA1G0019
 ID No. : UAE.EFM.202/2564(EFM.pH.10/64)
 Condition As-Received: Used Item
 Received Date : 26 September 2023
 Calibration Date : 27 September 2023
 Reference : 2309-0881WSC-4
 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 ± 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 Lerngagtrakul

Approved by :
Approved Signatory(✓) Sathip Meangmai
() Warakorn Lerngagtrakul
() Ponpan Paipim

Issue Date : 2 October 2023

The Uncertainties are for a confidence probability of approximately 95%

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

LARSON DAVIS – A PCB DIVISION
1681 West 820 North
Provo, UT 84601, United States
716-684-0001

Page 8 of 8

LARSON DAVIS
A PCB DIVISION

D9001.0407 Rev G

2023-3-23T18:34:36

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม
A 0059073



Cert.No.: 23CH1226
Page: 2 of 3

Condition of this calibration result

1. Reference Standard Instrument :-

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC116	23E2802	27 Aug 2024
2) Ref. Standard Thermometer	4982054	110RC044	23I908	26 Jul 2024

This certification is traceable to the International System of Unit maintained through:-
- Technology Promotion Association (Thailand-Japan)

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

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	913598	14 July 2025
pH 6.986	CPA chem	863833	28 Dec 2023
pH 9.997	CPA chem	913600	14 July 2024

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

Calibration Results

Function : mV Measurement

Performing standard curve by Fluke at pH (4,7)(7,10)

Unit Under Calibration	Nominal Value		Standard Voltage Input		Actual Reading		Uncertainty of Measurement (\pm mV)	Coverage factor k
	pH	mV	mV	pH	mV	pH		
pH Meter S/N.: HA1G0019	4.00	177.48	177.6	4.01	0.058	2.00	0.058	2.00
	7.00	0.00	0.2	7.00	0.058	2.00		
	7.00	0.00	0.2	7.00	0.058	2.00		
	10.00	-177.48	-177.2	10.01	0.058	2.00		

เอกสารไมควบคุม
a 1182400



Cert.No.: 23CH1226
Page: 3 of 3

Calibration Results

Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH measurement (\pm)	Coverage factor k
pH Electrode S/N.: -	4.008	4.01	141.5	0.0079	2.00
	6.986	6.98	-34.9	0.011	2.00
	9.997	10.01	-205.7	0.0085	2.00

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : 9652

- Serial No. : -

- Dimension of probe;

- Length : 103 mm

- Diameter : 16 mm

- Immersion Depth : 90 mm

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement (\pm °C)	Coverage factor k
25.0	25.002	25.0	-0.002	0.13	2.00
30.0	30.004	30.0	-0.004	0.13	2.00
35.0	35.003	35.0	-0.003	0.13	2.00

Remark : - UUC* = Unit Under Calibration

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

-000-

เอกสารไมควบคุม
a 1182399



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

Cert.No.: 23TW219
Page: 1 of 2

Certificate of Testing

Equipment : DO Meter
Manufacturer : Horiba
Model : LAQUA-DO210
Serial No. : HE1D0008
ID No. : UAE.EFM.207/2564(EFM.DO.09/64)
Received Date : 26 September 2023
Test Date : 27 September 2023
Reference : 2309-0884WSC-3
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong, Bangkok 10260
Laboratory Condition : Temperature (25 \pm 5) °C
Humidity (50 \pm 20) %
Test Procedure : In - house method : CP-CH9
by Comparison Technique with Azide Modification Method
Tested by : Walailak Sinthean
Approved by :
Approved Signatory
(☒) Saithip Meangmai
(☐) Warakorn Lernagatrakul
(☐) Ponpan Paipim
Issue Date : 29 September 2023

เอกสารไมควบคุม
B 0325261



Cert.No.: 23TW219
Page: 2 of 2

Condition of this result of calibration

1. Reference Standard Instruments :

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

Instruments	Serial No.	ID No.	Certificate No.	Due Date
1) Burette	-	130BU10	23CG1172	22 Mar 2025
2) Balance	1124013382	140RC006	23MM18	20 Feb 2024

2. Standard Material :-

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

Result : Dissolved Oxygen Meter Adjustment With Air 100 %
Dissolved Oxygen Probe No.: 9K1B0020

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.16	8.16	0.0071

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.

-000-

เอกสารไมควบคุม
a 1182622



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



Cert. No.: 23LM168
Page: 1 of 2

Certificate of Calibration

Equipment : DO Meter with Sensor
Manufacturer : Horiba
Model : LAQUA-DO210
Serial No. : HE1D0008
ID No. : UAE.EFM.207/2564(EFM.DO.09/64)
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : TPA Chemistry Calibration Laboratory
Received Order : 25 September 2023
Calibrated Date : 29 September 2023
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
AC Line Voltage : (220 ± 22) V
Calibrated by : Krisda Malee
Approved by :
() Ponthippa Tameyakul
() Ponpan Paipim
(✓) Suwit Imjai
Issue Date : 5 October 2023

The Uncertainties are for a confidence probability of approximately 95%

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

เอกสารไม่ควบคุม
A 0059010



Equipment : DO Meter with Sensor
Condition As-Received : Used Item
Reference : 2309-0884WSC-4

Cert. No.: 23LM168
Page: 2 of 2

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	Serial No.	Cert. No.	Traceable	Due Date
1) Digital Thermometer	2188080	221285	TPA	21 Oct 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.

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

Result of Calibration :- (*) Without Adjustment

Function : Temperature measurement.

This instrument was connected with temperature sensor, S/N: 18F100252

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty (± °C)	Coverage Factor k
25.0	100	25.004	24.8	-0.204	0.16	2.00
30.0	100	30.000	29.8	-0.200	0.16	2.00
35.0	100	34.998	34.8	-0.198	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 %.

-o0o-

เอกสารไม่ควบคุม
a 1183569



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



Cert.No.: 23CH1488
Page: 1 of 3

Certificate of Calibration

Equipment : Conductivity Meter
Manufacturer : YSI
Model : Pro 30
Serial No. : 18K100976
ID No. : UAE.EFM.071/2562(ENV.SCT.01/62)
Condition As-Received: Used Item
Received Date : 21 November 2023
Calibration Date : 22 November 2023
Reference : 2311-0721WSC-1
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong, Bangkok 10260
Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 15) %
Calibration Procedure: In -house method :-
- CP-CH6 by direct measurement with certified reference material (CRM)
- CP-CH8 by comparison with standard thermometer
Calibrated by : Warakorn Lernagatrakul
Approved by :
(✓) Sathip Meangmai
() Warakorn Lernagatrakul
() Ponpan Paipim
Issue Date : 27 November 2023

The Uncertainties are for a confidence probability of approximately 95%

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

เอกสารไม่ควบคุม
A 0061267



Condition of this result of calibration

1. Reference Standard Instrument :-

Instrument	Serial No.	ID No.	Certificate No.	Due date
1) Thermometer	1963878	130RC095	2311051	05 Sep 2024
2) Ref. Std. Thermometer	4982054	110RC044	231908	26 July 2024

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

2. Certified Reference Materials :-

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

Conductivity Solution	Manufacturer	Lot No.	Exp. date
1413.0 µS/cm	CPA Chem	913596	14 July 2024
12.880 mS/cm	CPA Chem	913597	14 July 2024

- 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.: 18L100008

Standard Conductivity Solution	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement (±)	Coverage factor k
1413.0 µS/cm	1393 µS/cm	1413 µS/cm	9.2 µS/cm	2.00
12.880 mS/cm	12.36 mS/cm	12.42 mS/cm	0.086 mS/cm	2.00

Remark - UUC* = Unit Under Calibration

Cert.No.: 23CH1488
Page: 2 of 3

เอกสารไม่ควบคุม
a 1191350



Cert.No.: 23CH1488
Page.: 3 of 3

Calibration Results

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : PRO 30 COND-T
- Serial No. : 18L100008

Dimension of probe;

- Length : 7 mm
- Diameter : 2.4 mm
- Immersion Depth : 95 mm

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (± °C)	Coverage factor k
25.0	25.002	25.0	-0.002	0.13	2.00
30.0	30.002	30.0	-0.002	0.13	2.00
35.0	35.002	35.0	-0.002	0.13	2.00

Remark : - UUC* = Unit Under Calibration

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

-00-

เอกสารไม่ควบคุม
a 1191349

Certificate of Calibration

Customer

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

Certificate No : 23-ACT-110
Request No : Req-2023-1407

Unit Under Calibration Details

Measurement item : Acoustic Calibrator
Manufacturer : SVANTEK
Model : SV 35A
Serial Number : 73246
ID : UAE.EFM.104/2561
Class : 1
Range : 94 , 114 dB / 1000 Hz
Instrument Status : Used

Calibration Environment and Details

Temperature : (23 ±2 °C)
Humidity : (50 ± 20 %RH)
Barometric Pressure : (1013 ±10.0 hPa)
Received Date : 26 June 2023
Calibration Date : 27 June 2023
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	EET	31 May 2024
THD Multimeter	2015	1047765	NIMT	31 January 2024

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

Note

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

Calibrated By : Mr. Noppadon Luangart
Service Calibration Engineer

Approved By : Mr. Pacit Mathayorn
Calibration Engineer Supervisor
Issue Date : 27 June 2023

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

Certificate No : 23-ACT-110

Request No : Req-2023-1407

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	-	-	0.13	0.25
114 dB / 1000 Hz	113.77	-0.23	-	-	0.13	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	-	-	0.01	0.70
114 dB / 1000 Hz	1000.00	0.00	-	-	0.01	0.70

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

Calibration Range (Hz)	Without Adjustment	Adjustment	Uncertainty (± %)	Acceptance limit Class 1 (± %)
	Measured (%)	Measured (%)		
94 dB / 1000 Hz	0.09	-	0.40	2.5
114 dB / 1000 Hz	0.28	-	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

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

SITHIPORN ASSOCIATES CO., LTD. CALIBRATION LABORATORY

451-459/1 Sithiporn Road, Bangburua, Bangkok, Bangkok 10700 Thailand
Tel : +66 2433 8331 Email : calibration@sithiporn.com

Cert. No. : ACL24055
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00409175 / 185834 / 90621
ID No.: UAE.EFM.014/2564

Condition As Found : GOOD

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

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

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

Calibrated by : Nathakorn Pisutpaisan

Approved by : (Thanakul Petchurai)

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

เอกสารไม่ควบคุม

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

459-459/1 Srinthorn Road, Bangbunru, Bangkok, 10700 Thailand
Tel. +66 2433 6331 Email: calibration@sithiporn.com



Cert. No. : ACL24055
Job No. : VC67AC0034
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

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

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

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

3.1 National Institute of Metrology (Thailand).

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

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

459-459/1 Srinthorn Road, Bangbunru, Bangkok, 10700 Thailand
Tel. +66 2433 6331 Email: calibration@sithiporn.com



Cert. No. : ACL24055
Job No. : VC67AC0034
Pages : 3 of 8

Summary of Measurement Result :

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

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

459-459/1 Srinthorn Road, Bangbunru, Bangkok, 10700 Thailand
Tel. +66 2433 6331 Email: calibration@sithiporn.com



Cert. No. : ACL24055
Job No. : VC67AC0034
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
16.4

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

Frequency Weighting	Measured value (dB)
A - weight	11.6
C - weight	17.8
Flat	23.8

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	0.0	0.0	0.0	± 1.0
8000	0.9	1.0	1.0	±5.0

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

459-459/1 Srinthorn Road, Bangbunru, Bangkok, 10700 Thailand
Tel. +66 2433 6331 Email: calibration@sithiporn.com



Cert. No. : ACL24055
Job No. : VC67AC0034
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.1	0.1	

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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



Cert. No. : ACL24055
Job No. : VC67AC0034
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.1	0.1	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.0	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	104.1	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	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	34.0	0.0	±1.1
30.0	30.0	0.0	±1.1
29.0	29.0	0.0	±1.1
28.0	28.0	0.0	±1.1
27.0	27.1	0.1	±1.1
26.0	26.0	0.0	±1.1
25.0	25.1	0.1	±1.1

เอกสารไม่ควบคุม

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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



Cert. No. : ACL24055
Job No. : VC67AC0034
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	116.9	-0.1	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	107.9	-0.1	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
	0.25	1	99.0	98.8	-0.2	1.5 ; -5.0
SEL	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

10. Peak C sound level

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

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±2.0
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±2.0

เอกสารไม่ควบคุม

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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



Cert. No. : ACL24055
Job No. : VC67AC0034
Pages : 8 of 8

11. Overload indication

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

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

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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



Cert. No. : ACL24057
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No. : 00558036 / 176346 / 47891
ID No. : UAE.EFM.035/2558

Condition As Found : GOOD

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

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

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

Calibrated by : Nathakorn Pisutpaisan

Approved by : T. Petchurai
(Thanakul Petchurai)

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

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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



Cert. No. : ACL24057
Job No. : VC67AC0034
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

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

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

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

3.1 National Institute of Metrology (Thailand).

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

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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



Cert. No. : ACL24057
Job No. : VC67AC0034
Pages : 3 of 8

Summary of Measurement Result :

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

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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



Cert. No. : ACL24057
Job No. : VC67AC0034
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
15.1

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

Frequency Weighting	Measured value (dB)
A - weight	13.4
C - weight	20.0
Flat	25.7

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.0	0.1	0.1	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	0.6	0.7	0.7	±5.0

เอกสารไม่ควบคุม

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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



Cert. No. : ACL24057
Job No. : VC67AC0034
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	-0.1	-0.2	0.0	±2.0
125	-0.1	0.0	-0.1	±1.5
250	0.0	0.0	-0.1	±1.5
500	0.0	0.0	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.0	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

เอกสารไม่ควบคุม

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

453-453/1 Srinthorn Road, Bangbunru, Bangkok, 10700 Thailand
Tel: +66 2433 8331 Email: calibration@sithiporn.com



Cert. No. : ACL24057
Job No. : VC67AC0034
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.0	0.0	±1.1
133.0	132.9	-0.1	±1.1
132.0	131.9	-0.1	±1.1
131.0	130.9	-0.1	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.0	0.0	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.0	0.0	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	34.0	0.0	±1.1
30.0	30.0	0.0	±1.1
29.0	28.9	-0.1	±1.1
28.0	27.9	-0.1	±1.1
27.0	27.0	0.0	±1.1
26.0	25.9	-0.1	±1.1
25.0	24.9	-0.1	±1.1

เอกสารไม่ควบคุม

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

453-453/1 Srinthorn Road, Bangbunru, Bangkok, 10700 Thailand
Tel: +66 2433 8331 Email: calibration@sithiporn.com



Cert. No. : ACL24057
Job No. : VC67AC0034
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lepeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	135.6	-0.8	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±2.0
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±2.0

เอกสารไม่ควบคุม

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

453-453/1 Srinthorn Road, Bangbunru, Bangkok, 10700 Thailand
Tel: +66 2433 8331 Email: calibration@sithiporn.com



Cert. No. : ACL24057
Job No. : VC67AC0034
Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

เอกสารไม่ควบคุม

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

451-451/1 Srinthorn Rd., Bangbunru, Bangkok 10700 THAILAND.
Tel: 0-2433-8800 Fax: 0-2433-1679 e-mail: cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL23130
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 00409177 / 185836 / 90623
ID No.: UAE.EFM.016/2564

Condition As Found : GOOD

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

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

Received Date : 18 APRIL 2023
Calibration Date : 24-26 APRIL 2023
Date of Issue : 27 APRIL 2023

Calibrated by : Nathakorn Pisutpaisan

Approved by :
(Thanakul Petchumai)

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

เอกสารไม่ควบคุม

Continuation of Calibration Certificate

Cert. No. : ACL23130
Job No. : VC66AC0048
Pages : 2 of 8

Calibration Procedure : CP-AC-01

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-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL_BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL_BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL_BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAI	34560495	AA-3002-23	14-FEB-24

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

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

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

QP-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Pichai

Continuation of Calibration Certificate

Cert. No. : ACL23130
Job No. : VC66AC0048
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	-	-	-	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

Note : Pass/Fail evaluation for each parameter, will be considered together from the acceptance limit and the Maximum-permitted uncertainty of measurement.

QP-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Pichai

Continuation of Calibration Certificate

Cert. No. : ACL23130
Job No. : VC66AC0048
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
15.7

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

Frequency Weighting	Measured value (dB)
A - weight	13.1
C - weight	19.6
Flat	25.3

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
125	0.4	0.4	0.4	± 1.5
1000	-0.1	-0.1	-0.1	± 1.0
8000	1.3	1.4	1.5	±5.0

QP-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Pichai

Continuation of Calibration Certificate

Cert. No. : ACL23130
Job No. : VC66AC0048
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	-0.1	0.0	±2.0
125	0.0	0.1	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.1	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

QP-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Pichai

Continuation of Calibration Certificate

Cert. No. : ACL23130
Job No. : VC66AC0048
Pages : 6 of 8

7. Level linearity on the reference level range

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

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Pich

Continuation of Calibration Certificate

Cert. No. : ACL23130
Job No. : VC66AC0048
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

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

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

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Pich

Continuation of Calibration Certificate

Cert. No. : ACL23130
Job No. : VC66AC0048
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.7	89.7	0.0	±1.5

12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Pich

INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
710500013, SOI SUTHAPOORN 11 TAMBON BANG KAEU
AMPHOE BANG PHU SANG MUANG PRAKARN PROVINCE 10140 THAILAND
TEL. : 0609-2110-7000 FAX. : 0609-2110-7140

Page: 1/4

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address : 81 Soi Udomak 41, Sakdumvit Road, Bangkok, Prakanung, Bangkok 10260
Certificate No : 24-NDM-014
Request No : Req-2023-2879

Unit Under Calibration Details

Measurement Item : Noise Dosimeter
Microphone Chn : 2
Manufactures : SVANTEK
Microphone Model : SV27
Model : SV 104
Microphone S/N : 96601
Serial Number : 91928
Preamplifier Model : -
ID : -
Preamplifier S/N : -
Resolution : 0.3 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 December 2023
Calibrated Date : 24 January 2024
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration : Lab Acoustic

Reference Standard

Instrument	Brand	Model	S/N	Due calibration	Traceability
Multifrequency Calibrator	Quest	Quest-cal	EP000234	25 July 2024	TSI
Standard Microphone	GRAS	40AN	183273	21 August 2024	GRAS
Sine Generator	SvanteK	Svsn401	131	9 October 2024	WK Electric
Timer	EXTECH	-	00-ACT	21 March 2024	TPA

Note

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

Calibrated By :
Mr. Nopphon Luangjai
Service Calibration EngineerApproved By :
Mr. Pich Mathayom
Calibration Engineer Supervisor
Issue Date : 24 January 2024

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

เอกสารไม่ควบคุม

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

1. Absolute acoustical sensitivity

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

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

2. Frequency weightings

UUC Setting	Deviation from various Frequency Weighting		UNCERTAINTY	Tolerances
	A	C		
FAST / 55-140	(dB)	(dB)	(± dB)	(± dB)
STD Setting				
563 Hz	-0.1	-0.2	0.40	2.8
125 Hz	0.4	0.3	0.40	1.5
250 Hz	0.1	0.1	0.40	1.5
500 Hz	0.1	0.1	0.40	1.5
1000 Hz	0.0	0.0	0.40	-
2000 Hz	0.1	0.0	0.40	2.0
4000 Hz	2.5	2.5	0.40	3.8
8000 Hz	-3.0	-3.0	0.40	5.8

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

เอกสารไม่ควบคุม

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

3. Linearity of response to steady signals

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

UUC Setting	FAST / A / High									
	Ref	(dB)	55.0	80.0	90.0	100.0	110.0	114.0	120.0	140.0
1000 Hz	Level A	(dB)	55.4	80.3	90.1	100.0	110.0	114.0	120.0	140.0
	Error	(dB)	0.4	0.3	0.1	0.0	0.0	0.0	0.0	0.0
		(dB)								
8000 Hz	Ref	(dB)			88.9	98.9	108.9	112.9	118.9	138.9
	Level A	(dB)			89.0	99.0	108.9	112.9	118.9	138.8
	Error	(dB)			0.1	0.1	0.0	0.0	0.0	-0.1
63 Hz	Ref	(dB)						87.8	93.8	103.8
	Level A	(dB)						87.8	93.7	103.7
	Error	(dB)						0.0	-0.1	-0.1
Tolerances Limit		(±dB)	1.0							
UNCERTAINTY		(±dB)	0.3							

b. Sound exposure meter linearity of error

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances
FAST / A / 55-140	Ref	UUC	Ref	UUC	Error		Limit
Calibrator Setting	(s)	(s)	(Pa ² h)	(Pa ² h)	(%)	(%)	(%)
1000 Hz 110 dB	27	27	0.30	0.30	0.00	5.6	-21, +26
1000 Hz 110 dB	45	45	0.50	0.50	0.00		
1000 Hz 110 dB	90	90	1.00	0.99	-1.00		
1000 Hz 110 dB	180	180	2.00	1.98	-1.00		
1000 Hz 120 dB	36	36	4.00	3.94	-1.50		
1000 Hz 120 dB	72	72	8.00	7.87	-1.63	5.6	
1000 Hz 120 dB	90	90	10.00	9.90	-1.00		
1000 Hz 120 dB	180	180	20.00	19.76	-1.20		
1000 Hz 120 dB	360	360	40.00	39.42	-1.45		
1000 Hz 120 dB	720	720	80.00	78.66	-1.68		

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

เอกสารไม่ควบคุม

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

4. Response to short duration

a. Response for sinusoidal signals - reference level

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

b. Sound exposure meter response for series of toneburst impulses

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

5. Response to unipolar pulse

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

* Indicates non accredited

End of Certificate

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

เอกสารไม่ควบคุม

Certificate of Calibration

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Name : 81 Soi Udonrak 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260
Certificate No : 24-NDM-017
Request No : Req-2023-2682

Unit Under Calibration Details

Measurement item : Noise Dosimeter
Manufacturer : SVANTEK
Model : SV 104
Serial Number : 91923
ID : -
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : SV27
Microphone S/N : 86604
Preamplifier Model : -
Preamplifier S/N : -
Instrument Status : Used

Calibration Environment and Details


Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 21 December 2023
Calibrated Date : 25 January 2024
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration : Lab Acoustic


Reference Standard

Instrument	Brand	Model	SN	Due calibration	Traceability
Multifrequency Calibrator	Quest	Quest cal	EFA000234	25 July 2024	TSI
Standard Microphone	GRAS	40AN	188273	21 August 2024	GRAS
Sine Generator	SVANTEK	SVan01	131	9 October 2024	WK Electric
Timer	EXTECH	-	05-ACT	21 March 2024	TFA

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 Laungert
Service Calibration Engineer

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

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

เอกสารไม่ควบคุม

Certificate No : 24-NDM-017
Request No : Req-2023-2682

1. Absolute acoustical sensitivity

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

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

2. Frequency weightings

UUC Setting	Deviation from various Frequency Weighting		UNCERTAINTY	Tolerances Limit
	A	C		
FAST / 55-140	(dB)	(dB)	(± dB)	(± dB)
STD Setting				
463 Hz	0.0	0.0	0.40	2.0
125 Hz	-0.1	0.0	0.40	1.5
250 Hz	-0.3	-0.2	0.40	1.5
500 Hz	-0.2	0.0	0.40	1.5
1000 Hz	0.0	0.0	0.40	-
2000 Hz	0.6	0.7	0.40	2.0
4000 Hz	2.5	2.5	0.40	3.0
8000 Hz	-2.9	-2.9	0.40	5.0

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

เอกสารไม่ควบคุม

Certificate No : 24-NDM-017
Request No : Req-2023-2682

3. Linearity of response to steady signals

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

UUC Setting	Ref	FAST / A / High									
		(dB)	55.0	80.0	90.0	100.0	110.0	114.0	120.0	130.0	140.0
1000 Hz	Level A	(dB)	55.1	80.3	90.1	100.0	110.0	114.0	119.9	129.9	139.9
	Error	(dB)	0.1	0.3	0.1	0.0	0.0	0.0	-0.1	-0.1	-0.1
8000 Hz	Ref	(dB)			88.9	98.9	108.9	112.9	118.9	128.9	138.9
	Level A	(dB)			88.9	98.9	108.9	112.9	118.9	128.9	138.9
	Error	(dB)			0.0	0.0	0.0	0.0	0.0	0.0	0.0
63 Hz	Ref	(dB)						87.8	93.8	103.8	113.8
	Level A	(dB)						87.8	93.8	103.8	113.8
	Error	(dB)						0.0	0.0	0.0	0.0
Tolerances Limit		(±dB)	1.0								
UNCERTAINTY		(±dB)	0.3								

b. Sound exposure meter linearity of error

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
	Ref	UUC	Ref	UUC	Error		
FAST / A / 55-140	(s)	(s)	(Pa ² h)	(Pa ² h)	(%)	(%)	(%)
Calibrator Setting							
1000 Hz 110 dB	27	27	8.30	8.30	0.00	5.6	-21, -26
1000 Hz 110 dB	45	45	0.50	0.50	0.00		
1000 Hz 110 dB	90	90	1.00	0.99	-1.00		
1000 Hz 110 dB	180	180	2.00	1.98	-1.00		
1000 Hz 120 dB	36	36	4.00	3.94	-1.50		
1000 Hz 120 dB	72	72	8.00	7.87	-1.63	5.6	-21, -26
1000 Hz 120 dB	90	90	10.00	9.90	-1.00		
1000 Hz 120 dB	180	180	20.00	19.76	-1.20		
1000 Hz 120 dB	360	360	40.00	39.42	-1.45		
1000 Hz 120 dB	720	720	80.00	78.66	-1.68		

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

เอกสารไม่ควบคุม

Certificate No : 24-NDM-017
Request No : Req-2023-2682

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		
FAST / A / 55-140	(s)	(s)	(Pa ² h)	(Pa ² h)	(Pa ² h)	(Pa ² h)	(Pa ² h)
Calibrator Setting							
4000 Hz 95 dB	2846	2846	1.00	0.98	-0.02	0.052	-0.29 ~ -0.41

b. Sound exposure meter response for series of toneburst impulses

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

5. Response to unipolar pulse

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
	Ref	UUC	Ref	UUC	Error		
FAST / A / 55-140	(s)	(s)	(Pa ² h)	(Pa ² h)	(%)	(%)	(%)
Calibrator Setting							
Continuous Rectangle +			10.13			3.7	-21 ~ -26
Continuous Rectangle -	29		10.37		±2.37		

* Indicates non accredited

End of Certificate

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

เอกสารไม่ควบคุม

Certificate of Calibration

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Name : 81 Soi (donosuk 41, Sukhumvit) Road, Bangkok, Pratuang, Bangkok 10200
Address : 81 Soi (donosuk 41, Sukhumvit) Road, Bangkok, Pratuang, Bangkok 10200
Certificate No : 23-NDM-062
Request No : Req-2023-0663

Unit Under Calibration Details

Measurement item : Noise dosimeter
Manufacturer : SVANTEK
Model : SV 1040S
Serial Number : 106063
ID : UAE.FM.108.2564
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : SV 2715
Microphone SN : 106782
Preamplifier Model : -
Preamplifier SN : -
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 : 22 March 2023
Calibrated Date : 23 March 2023
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration : Lab Acoustic


Reference Standard

Instrument	Brand	Model	SN	Due calibration	Traceability
Multi-frequency Calibrator	Quest	Quest-cal	188272	29 June 2023	TSI
Standard Microphone	GRAS	40AN	188273	8 October 2023	GRAS
Sine Generator	Svante	Svan401	131	12 October 2021	WK Electric
Timer	EXTRECH	-	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. Noppadol Luangtan
Calibration Officer

Approved By : 
Mr. Paet Mahavorn
Calibration Engineer Supervisor
Issue Date : 23 March 2023

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

เอกสารไม่ควบคุม

Certificate No : 23-NDM-062
Request No : Req-2023-0603

1. Absolute acoustical sensitivity

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
FAST / A / 60-140	Ref	UUC	Ref	UUC	Error	(%)	(%)
Calibrator Setting	(s)	(s)	(Pa h)	(Pa h)	(%)		
1000 Hz 114 dB	120.00	120	3.19	3.13	-1.88	3.0	-21, +26

Note: Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN. 39079

2. Frequency weightings

UUC Setting	Deviation from various Frequency Weighting		UNCERTAINTY	Tolerances Limit
FAST / 60-140	A	C	(± dB)	(± dB)
STD Setting	(dB)	(dB)		
*63 Hz	0.2	0.2	0.40	2.0
125 Hz	0.2	0.1	0.40	1.3
250 Hz	0.2	0.2	0.40	1.5
500 Hz	0.1	0.1	0.40	1.2
1000 Hz	0.0	0.0	0.40	-
2000 Hz	-0.9	-0.9	0.40	2.8
4000 Hz	-0.7	-0.7	0.40	3.0
8000 Hz	-1.6	-1.7	0.40	5.0

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

เอกสารไม่ควบคุม

Certificate No : 23-NDM-062
Request No : Req-2023-0603

3. Linearity of response to steady signals

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

UUC Setting	FAST / A / High													
1000 Hz	Ref	(dB)	60.0	80.0	90.0	100.0	110.0	120.0	130.0	140.0				
Level A	(dB)	60.1	80.3	90.2	100.1	110.1	120.1	130.1	140.1					
Error	(dB)	0.1	0.2	0.2	0.1	0.1	0.0	0.1	0.0	0.0				
8000 Hz	Ref	(dB)			88.8	98.9	108.9	118.9	128.9	138.9				
Level A	(dB)				88.9	98.9	108.9	118.9	128.9	138.8				
Error	(dB)				0.0	0.0	0.0	0.0	0.0	-0.1				
63 Hz	Ref	(dB)							87.8	93.8	103.8	113.8		
Level A	(dB)								87.8	93.8	103.8	113.7		
Error	(dB)								0.0	0.0	0.0	-0.1		
Tolerances Limit	(±dB)												1.0	
UNCERTAINTY	(±dB)												0.27	

b. Sound exposure meter linearity of error

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
FAST / A / 60-140	Ref	UUC	Ref	UUC	Error	(%)	(%)
Calibrator Setting	(s)	(s)	(Pa h)	(Pa h)	(%)		
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	0.99	-1.00	4.3	-21, +26
1000 Hz 110 dB	180	180	2.00	1.96	-1.00		
1000 Hz 120 dB	36	36	4.00	3.94	-1.50		
1000 Hz 120 dB	72	72	8.00	8.05	+0.63		
1000 Hz 120 dB	90	90	10.00	9.90	-1.00	3.8	-21, +26
1000 Hz 120 dB	180	180	20.00	19.76	-1.20		
1000 Hz 120 dB	360	360	40.00	39.42	-1.45		
1000 Hz 120 dB	720	720	80.00	80.48	+0.61		

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

เอกสารไม่ควบคุม

Certificate No : 23-NDM-062
Request No : Req-2023-0603

4. Response to short duration

a. Response for sinusoidal signals - reference level

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
FAST / A / 60-140	Ref	UUC	Ref	UUC	Error	(%)	(%)
Calibrator Setting	(s)	(s)	(Pa h)	(Pa h)	(Pa h)		
4000 Hz 95 dB	2846	2846	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
FAST / A / 60-140	Ref	UUC	Ref	UUC	Error	(%)	(%)
Calibrator Setting	(s)	(s)	(Pa h)	(Pa h)	(%)		
Burst 1 ms, 95 dB	2846	2846	1.00	1.00	0.00		-21 - +26
Burst 1 ms, 100 dB	900	900	1.00	1.00	0.00	2.0	-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
FAST / A / 60-140	Ref	UUC	Ref	UUC	Different	(%)	(%)
Calibrator Setting	(s)	(s)	(Pa h)	(Pa h)	(%)		
Continuous Rectangle +			10.13				
Continuous Rectangle -	28		10.37		+2.37	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

Certificate of Calibration

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address : 81 Soi Udomak 41, Sakhumvit Road, Bangchak, Prakanong, Bangkok 10260
Certificate No : 24-NDM-018
Request No : Req-2023-2689

Unit Under Calibration Details

Measurement Item : Noise Dosimeter
Manufacturer : SVANTEK
Model : SV 1048S
Serial Number : 106069
ID : -
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : SV 278S
Microphone S/N : 106312
Preamplifier Model : -
Preamplifier S/N : -
Instrument Status : Used

Calibration Environment and Details


Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 21 December 2023
Calibrated Date : 25 January 2024
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration : Lab Acoustic

Reference Standard

Instrument	Brand	Model	SN	Due calibration	Traceability
Multi-frequency Calibrator	Quest	Quest-cal	EFA00234	25 July 2024	TSI
Standard Microphone	GRAS	40AN	180273	21 August 2024	GRAS
Sine Generator	SvanteK	Svsm01	U3	9 October 2024	WK Electric
Timer	EXTECH	-	05-ACT	21 March 2024	TPA

Note

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

Calibrated By : 
Mr. Noppadol Luangrui
Service Calibration Engineer

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

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

เอกสารไม่ควบคุม

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

1. Absolute acoustical sensitivity

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

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

2. Frequency weightings

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

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

เอกสารไม่ควบคุม

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

3. Linearity of response to steady signals

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

UUC Setting		FAST / A / High									
1000 Hz	Ref	(dB)	60.0	80.0	90.0	100.0	110.0	114.0	120.0	130.0	140.0
	Level A	(dB)	60.0	80.1	90.1	100.0	110.0	114.0	120.0	129.9	139.9
	Error	(dB)	0.0	0.1	0.1	0.0	0.0	0.0	0.0	-0.1	-0.1
8000 Hz	Ref	(dB)			88.9	98.9	108.9	112.9	118.9	128.9	138.9
	Level A	(dB)			89.0	99.0	109.0	112.9	118.9	128.9	138.9
	Error	(dB)			0.1	0.0	0.0	0.0	0.0	0.0	-0.1
63 Hz	Ref	(dB)						87.8	93.8	103.8	113.8
	Level A	(dB)						87.8	93.8	103.8	113.8
	Error	(dB)						0.0	0.0	0.0	0.0
Tolerances Limit		(±dB)	1.0								
UNCERTAINTY		(±dB)	0.3								

b. Sound exposure meter linearity of error

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit (%)
FAST / A / 60-140	Ref	UUC	Ref	UUC	Error		
Calibrator Setting	(s)	(s)	(Pa ² h)	(Pa ² h)	(%)	(%)	
1000 Hz 110 dB	27	27	0.30	0.30	0.00	5.6	-21, +26
1000 Hz 110 dB	45	45	0.50	0.50	0.00		
1000 Hz 110 dB	90	90	1.00	0.99	-1.00		
1000 Hz 110 dB	180	180	2.00	1.98	-1.00		
1000 Hz 120 dB	36	36	4.00	4.03	+0.75		
1000 Hz 120 dB	72	72	8.00	8.05	+0.63	5.6	
1000 Hz 120 dB	90	90	10.00	10.13	+1.30		
1000 Hz 120 dB	180	180	20.00	20.22	+1.10		
1000 Hz 120 dB	360	360	40.00	40.34	+0.85		
1000 Hz 120 dB	720	720	80.00	80.49	+0.61		

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

เอกสารไม่ควบคุม

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

4. Response to short duration

a. Response for sinusoidal signals - reference level

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

b. Sound exposure meter response for series of toneburst impulses

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
	Ref	UUC	Ref	UUC	Error		
FAST / A / 60-140	(s)	(s)	(Pa ² /h)	(Pa ² /h)	(%)	(%)	(%)
Calibrator Setting	60	60					
Burst 1 ms, 95 dB	2846	2846	1.00	0.98	-2.00	5.6	-21 ~ +26
Burst 1 ms, 100 dB	990	990	1.00	0.98	-2.00		-29 ~ +41
Burst 1 ms, 108 dB	143	143	1.00	0.99	-1.00		-29 ~ +41

5. Response to unipolar pulse

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
	Ref	UUC	Ref	UUC	Error		
FAST / A / 60-140	(s)	(s)	(Pa ² /h)	(Pa ² /h)	(%)	(%)	(%)
Calibrator Setting	10	10					
Continuous Rectangle +			10.13			3.7	-21 ~ +26
Continuous Rectangle -	28		10.13		0.00		

* Indicates non accredited

End of Certificate

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

เอกสารไม่ควบคุม

Certificate of Calibration

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Name : 81 Soi Udomak 41, Sukhumvit Road, Bangkok, Prakanong, Bangkok 10260
Certificate No : 24-NDM-015
Request No : Req-2023-2680

Unit Under Calibration Details

Measurement item : Noise Dosimeter
Manufacturer : SVANTEK
Model : SV 104
Serial Number : 91924
ID :
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : SV27
Microphone S/N : 96600
Pre-amplifier Model : -
Pre-amplifier S/N : -
Instrument Status : Used

Calibration Environment and Details


Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 21 December 2023
Calibrated Date : 25 January 2024
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration : Lab Acoustic


Reference Standard

Instrument	Brand	Model	SN	Date calibration	Traceability
Multi-frequency Calibrator	Quest	Quest-cal	EFA00234	25 July 2024	TSI
Standard Microphone	GRAS	40AN	180273	21 August 2024	GRAS
Sine Generator	Scantek	Scantek01	131	9 October 2024	WK Electric
Timer	EXTech	-	05-ACT	21 March 2024	TFA

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 Luangsom
Service Calibration Engineer

Approved By : 
Mr. Patch Mathasorn
Calibration Engineer Supervisor
Issue Date : 25 January 2024

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

เอกสารไม่ควบคุม

Certificate No : 24-NDM-015

Request No : Req-2023-2680

1. Absolute acoustical sensitivity

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

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

2. Frequency weightings

UUC Setting	Deviation from various Frequency Weighting		UNCERTAINTY	Tolerances Limit
	A	C		
FAST / 55-140	(dB)	(dB)	(± dB)	(± dB)
STD Setting				
*63 Hz	-0.1	0.0	0.40	2.0
125 Hz	0.0	0.0	0.40	1.5
250 Hz	-0.3	-0.3	0.40	1.5
500 Hz	-0.2	-0.2	0.40	1.5
1000 Hz	0.0	0.0	0.40	-
2000 Hz	0.7	0.7	0.40	2.0
4000 Hz	2.5	2.4	0.40	3.0
8000 Hz	-3.8	-2.9	0.40	5.0

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

เอกสารไม่ควบคุม

Certificate No : 24-NDM-015

Request No : Req-2023-2680

3. Linearity of response to steady signals:

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

UUC Setting	FAST / A / High											
	Ref	(dB)	55.0	80.0	90.0	100.0	110.0	114.0	120.0	130.0	140.0	
1000 Hz	Level A	(dB)	55.4	80.2	90.1	100.0	110.0	114.0	120.0	130.0	140.0	
	Error	(dB)	0.4	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	
		(dB)										
8000 Hz	Ref	(dB)			88.9	98.9	108.9	112.9	118.9	128.9	138.9	
	Level A	(dB)			88.9	98.9	108.9	112.9	118.9	128.9	138.9	
	Error	(dB)			0.0	0.0	0.0	0.0	0.0	0.0	0.0	
63 Hz	Ref	(dB)						87.8	93.8	103.8	113.8	
	Level A	(dB)						87.8	93.8	103.8	113.8	
	Error	(dB)						0.0	0.0	0.0	0.0	
Tolerances Limit		(±dB)	1.0									
UNCERTAINTY		(±dB)	0.3									

b. Sound exposure meter linearity of error

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances
FAST / A / 55-140	Ref	UUC	Ref	UUC	Error		Limit
Calibrator Setting	(s)	(s)	(Pa ² h)	(Pa ² h)	(%)	(%)	(%)
1000 Hz 110 dB	27	27	0.30	0.30	0.00	5.6	-21, +26
1000 Hz 110 dB	45	45	0.55	0.51	-2.00		
1000 Hz 110 dB	90	90	1.00	1.01	+1.00		
1000 Hz 110 dB	180	180	2.00	2.02	+1.00		
1000 Hz 120 dB	36	36	4.00	4.03	+0.75		
1000 Hz 120 dB	72	72	8.00	8.05	+0.63	5.6	
1000 Hz 120 dB	90	90	10.00	10.13	+1.30		
1000 Hz 120 dB	180	180	20.00	20.22	+1.10		
1000 Hz 120 dB	360	360	40.00	40.34	+0.85		
1000 Hz 120 dB	720	720	80.00	80.49	+0.61		

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

เอกสารไม่ควบคุม

Certificate No : 24-NDM-015

Request No : Req-2023-2680

4. Response to short duration

a. Response for sinusoidal signals - reference level

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
	Ref	UUC	Ref	UUC	Error		
FAST / A / 55-140	(s)	(s)	(Pa ² h)	(Pa ² h)	(%)	(%)	(%)
Calibrator Setting	2846	2846	1.00	0.98	-0.02	0.052	-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		
FAST / A / 55-140	(s)	(s)	(Pa ² h)	(Pa ² h)	(%)	(%)	(%)
Calibrator Setting	60	60	1.00	0.98	-2.00	5.6	-21, +26
Burst 1 ms, 95 dB	2846	2846	1.00	0.98	-2.00		
Burst 1 ms, 100 dB	900	900	1.00	0.98	-2.00		
Burst 1 ms, 105 dB	143	143	1.00	0.99	-1.00		

5. Response to unipolar pulse

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

* Indicates non accredited

End of Certificate

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

เอกสารไม่ควบคุม

Certificate of Calibration

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD. Certificate No : 23-AFM-221 Rev.1

Name : 81 Soi Udomsak 41, Sukhumvit Road, Bangkok, Prakanong. Request No : Req-2023-2172

Address : Bangkok 10260

Unit Under Calibration Details

Measurement Item : Air Flow Meter

Manufacturer : TSI

Model : 4146

Serial Number : 41461922007

ID : UAEFFM2232562

Location of Calibration : LAB 4 AIR VELOCITY METER

Calibration Environment and Details

Temperature : 23 °C ± 3 °C

Humidity : 55 %RH ± 20 %RH

Barometric Pressure : 1013 hPa ± 10 hPa

Received Date : 11 October 2023

Calibration Date : 25 October 2023

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

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Gilibrator 3 Standard flow	19031011003	Sonodyne	12 July 2024
Air Flow Meter	Gilibrator 3 High flow	18501012012	Sonodyne	12 July 2024
Temperature meter	GT 11	06000057	Quborn	27 February 2024
Pressure meter	CPG2400	41000KDU/651882	TPA	7 November 2023

Traceability :


This Certificate is traceable to SI Unit through Sonodyne AZLA Accreditation No. 3943.01

Note :

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

This Certificate was issued to replace to Calibration Certificate No. 23-AFM-221

Calibration By : 
Mr. Nopadol Luangrat
Service Calibration Engineer

Approved By : 
Mr. Pachi Matharom
Calibration Engineer Supervisor

Issue Date : 7 November 2023

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

เอกสารไม่ควบคุม

Certificate No.: 23-AFM-221 Rev.1
Request No.: Req-2023-2172

Result of Calibration:

Temperature (°C)	Pressure (kPa)	STD (U/min)	UUC (U/min)	Error (U/min)	Uncertainty (U/min)
25.40	101.36	0.020	0.019	-0.001	0.0013
25.30	101.17	0.049	0.049	0.000	0.0033
25.30	101.19	0.098	0.101	0.003	0.0028
25.20	101.38	0.196	0.200	0.004	0.0056
25.30	101.18	0.498	0.500	0.002	0.0073
25.20	101.36	1.001	1.001	0.000	0.003
25.20	101.38	1.705	1.701	-0.004	0.005
25.40	101.15	2.003	2.007	0.004	0.006
25.30	101.10	2.986	3.000	0.014	0.042
25.30	101.10	3.979	4.001	0.022	0.056
25.30	101.10	5.013	5.002	-0.011	0.070

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

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

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

* Indicates non accredited

End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Laboratory.
FM-706-AFM-01 Rev.00 Issue date 02/07/19

เอกสารไม่ควบคุม



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
5344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250
TEL: 0-2717-3000-24 FAX: 0-2719-9484



Certificate of Calibration

Certificate No.: 23H1101
Page: 1 of 2

Equipment: Digital Thermo-Hygrometer
Manufacturer: Digicon
Model: TH-02
Serial No.: 385034175
ID No.: UAE.EFM.184/2565

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

Condition As-Received: Used Item

Received Date: 18 May 2023

Calibration Date: 22 May 2023

to 24 May 2023

Reference: 2305-0641WSC

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

Ambient Temperature: (25 ± 3) °C

81 Soi Udomsak 41, Sukhumvit Road, Bangchak,
Phraekhong, Bangkok 10260

Relative Humidity: (50 ± 20) %

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

Condition of this result of calibration

1. Reference standards instruments:


Instrument	Model	Serial No.	Certificate No.	Due Date
1) Chilled Mirror Hygrometer	Dew Master	44730	20563A	14 Jun 2023
2) Handheld Thermometer With Sensor	1521	ASA339	2201251	12 Oct 2023

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

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

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

Calibrated by: Krapong Onrat
Issue Date: 25 May 2023

Approved Signatory: 
[] Chakrit Wawwanjua
[] Pornthippa Tameyaykul
[] Viporn Tantiyawutti

เอกสารไม่ควบคุม
B 0314979



Cert. No.: 23H1101
Page: 2 of 2

Result of Calibration:-

Function:

Without Adjustment
Humidity Measurement

Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (±%R.H.)
25.0	40.1	41	0.9	1.3
25.0	50.1	51	0.9	1.6
25.0	60.0	60	0.0	1.6
25.0	70.2	67	-3.2	1.6

Result of Calibration:-

Function:

Without Adjustment
Temperature Measurement

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
20.014	20.4	0.386	0.42
25.022	25.6	0.578	0.42
30.033	30.3	0.267	0.42
40.000	40.1	0.100	0.42

UUC* : Unit Under Calibration

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

-oOo-



เอกสารไม่ควบคุม
a 1162980

Certificate of Calibration

Customer: UNITED ANALYST AND ENGINEERING
Name: CONSULTANT CO., LTD.
Address: 81 Soi Udomsak 41, Sukhumvit Road, Bangchak,
Phraekhong, Bangkok 10260
Certificate No.: 23-TPM-192
Request No.: Req-2023-0710
Page: 1/2

Unit Under Calibration Details

Calibration Parameter: Temperature
Instrument Name: Thermal Environment Monitor
Manufacturer: Quest Technologies
Model: QT-34
Serial Number: TEH020027
Resolution: 0.1 °C
ID Number: UAEANV.125/2551
Range Calibration: 20 °C to 60 °C
Type of Sensor: RTD
Sensor Diameter (mm): 4.5
Calibration Position (mm): 67.3
Instrument Status: Used


Calibration Environment and Details

Temperature: 23 °C ± 3 °C
Humidity: 55 %RH ± 15 %RH
Received Date: 28 March 2023
Calibrated Date: 3 April 2023
Calibration Procedure: In-house method CP-TPM-01 by Comparison with Standard Thermometer.

Reference Standard: Digital Thermometer with Sensor, Manufacturer: GINGGO-GINGGO, Model: GT11/RTD100, SN:
06000057, ID: 02-TPM Which was calibrated on 27 February 2023, Calibration Certificate No.: QR23-
0494
Traceability: This Certificate is traceable to SI Unit through Quality Reborn Co., Ltd., NSC-ONSC Accreditation No.:
Calibration 0292

Note

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

Approved By: 
Mr. Noppadon Luangart
Technical Manager
Issue Date: 3 April 2023


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

Calibration Note
UUC Adjustment : Not Adjust
Certificate No : 23-TPM-502
Request No : Req-2023-0710
Page : 2/2

Result of Calibration :

UUC Sensor	Itemset Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (°C)
WET	20.032	20.2	+0.2	0.13
	25.033	25.2	+0.2	0.13
	30.033	30.2	+0.2	0.13
	35.039	35.2	+0.2	0.13
	40.041	40.2	+0.2	0.13
	45.040	45.2	+0.2	0.13
	50.043	50.2	+0.2	0.13
	60.050	60.2	+0.2	0.13
DRY	20.033	19.8	+0.2	0.13
	25.033	24.8	+0.2	0.13
	30.034	29.8	+0.2	0.13
	35.037	34.8	+0.2	0.13
	40.039	39.8	+0.2	0.13
	45.042	44.8	+0.2	0.13
	50.044	49.9	+0.1	0.13
	60.047	59.9	+0.1	0.13
GLOBE	20.031	19.8	+0.2	0.13
	25.033	24.8	+0.2	0.13
	30.036	29.8	+0.2	0.13
	35.037	34.8	+0.2	0.13
	40.041	39.8	+0.2	0.13
	45.043	44.8	+0.2	0.13
	50.045	49.9	+0.1	0.13
	60.049	59.9	+0.1	0.13

End of Certificate

Calibrated By : 
Mr. Sittichok Jongsakulvanon

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

Certificate of Calibration

Customer
Name : UNITED ANALYST AND ENGINEERING
CONSULTANT CO.,LTD.
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangkok, Prakanong,
Bangkok 10260
Certificate No : 23-TPM-502
Request No : Req-2023-2230
Page : 1/2

Unit Under Calibration Details

Calibration Parameter : Temperature
Instrument Name : Thermal Environment Monitor
Manufacturer : TSI QUEST
Model : QT-32
Serial Number : TPT030008
Resolution : 0.1 °C
ID Number : UAE.EFM.219/2562
Range Calibration : 20 °C to 60 °C
Type of Sensor : RTD
Sensor Diameter (mm) : 4.5
Calibration Position (mm) : 67.5
Instrument Status : Used

Calibration Environment and Details


Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 15 %RH
Received Date : 18 October 2023
Calibrated Date : 2 November 2023
Calibration Procedure : In-house method CP-TPM-01 by Comparison with Standard Thermometer.

Reference Standard : Digital Thermometer with Sensor, Manufacturer: GINGO/GINGO, Model: GT11/RTD100, SN: 0800057, ID: 02-TPM Which was calibrated on 27 February 2023, Calibration Certificate No. : QR23-0494

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

Note

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

Approved By : 
Mr. Noppadol Luangut
Technical Manager
Issue Date : 2 November 2023

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

Calibration Note
UUC Adjustment : Not Adjust
Certificate No : 23-TPM-502
Request No : Req-2023-2230
Page : 2/2

Result of Calibration :

UUC Sensor	Itemset Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (°C)
WET	20.031	20.0	0.0	0.13
	25.033	25.0	0.0	0.13
	30.033	30.0	0.0	0.13
	35.036	35.0	0.0	0.13
	40.040	40.0	0.0	0.13
	45.040	45.0	0.0	0.13
	50.043	50.0	0.0	0.13
	60.047	60.0	0.0	0.13
DRY	20.033	20.1	+0.1	0.13
	25.034	25.3	+0.1	0.13
	30.037	30.1	+0.1	0.13
	35.039	35.1	+0.1	0.13
	40.039	40.1	+0.1	0.13
	45.041	45.1	+0.1	0.13
	50.043	50.1	+0.1	0.13
	60.045	60.1	+0.1	0.13
GLOBE	20.032	20.0	0.0	0.13
	25.033	25.0	0.0	0.13
	30.034	30.0	0.0	0.13
	35.037	35.0	0.0	0.13
	40.038	40.0	0.0	0.13
	45.040	45.0	0.0	0.13
	50.043	50.0	0.0	0.13
	60.046	60.0	0.0	0.13

End of Certificate

Calibrated By : 
Mr. Sittichok Jongsakulvanon

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

Certificate of Calibration

Customer
Name : UNITED ANALYST AND ENGINEERING CONSULTANT
CO.,LTD.
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangkok, Prakanong,
Bangkok 10260
Certificate No : 23-LXM-139
Request No : Req-2023-0706
Page : 1/2

Unit Under Calibration Details

Instrument Name : Digital Lux Meter
Manufacturer : EXTECH
Model : 407026
Serial Number : A056652
Resolution : 1 lx
ID Number : UAE.EFM.126/2365
Range Calibration : 2000, 20000 lx
Instrument Status : Used

Calibration Environment and Details

Temperature : 25 °C ± 2 °C
Humidity : 60 %RH ± 20 %RH
Received Date : 28 March 2023
Calibrated Date : 20 April 2023

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 11 November 2022, Certificate No.: TP-1027-22

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. Paitit Mathavorn
Calibration Engineer Supervisor
Issue Date : 20 April 2023

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

Calibration Note

UUC Adjustment ☐ Zero adjustment before use

Certificate No.: 25-UXM-130

Request No.: Req-2023-0708

Page: 2/2

Result of Calibration:

UUC Range (kg)	Standard (kg)	UUC Reading (kg)	Correction (kg)	Uncertainty (± kg)
2000	50	0	0	0.0058
	50	50	0	2.2 % of Reading
	100	100	0	2.2 % of Reading
	200	201	-1	2.2 % of Reading
	300	302	-2	2.2 % of Reading
	400	402	-2	2.2 % of Reading
	600	603	-3	2.2 % of Reading
	800	806	-6	2.2 % of Reading
	1000	1008	-8	2.2 % of Reading
	1200	1207	-7	2.2 % of Reading
	1400	1408	-8	2.2 % of Reading
	1600	1610	-10	2.2 % of Reading
	1800	1804	-4	2.2 % of Reading
	2000	1991	9	2.2 % of Reading
	2000	2000	0	2.2 % of Reading
20000	4000	3970	30	2.2 % of Reading
	5000	4950	50	2.2 % of Reading

* Indicates not accredited

End of Certificate

Calibrated By: *MC*

Mr. Nopadon Luangrat

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

เอกสารไม่ควบคุม

Calibration Certificate

Certificate No.: 2402420-001-01
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.: B108115858

ID No.: UAE.AIR.016/2555

Order No.: 2402420

Operation No.: 2402420-001

Date of Receipt: 19 April 2024

Date of Calibration: 19 April 2024

Calibrated by Mr. Pheraphat Tuanjit
Scientist

Approved by *P. Pheraphat*
(Miss Preeyaporn Jaengkarnkit)
Vice President, Department of Laboratory Services
Responsible for the Technical Management Team

Date of Issue: 23 April 2024

The uncertainties are for a confidence probability of approximately 95%

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

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

Calibration Report

Certificate No.: 2402420-001-01
Equipment: Electronic Balance
Model: AB204-S/FACT
Serial No.: B108115858
Capacity: 220 g
Manufacturer: METTLER TOLEDO
Resolution: 0.0001 g
ID No.: UAE.AIR.016/2555

Date of Calibration: 19 April 2024 Page 2 of 3

Environment Condition: Ambient Temperature: 22.1 ± 0.6 °C Relative Humidity: 49 ± 1.9 %

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

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

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

2. Reference Standard:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1-500g	15860	TCS	M2311015	28 November 2024
Standard Weight Class E2	1-500g	15862	TCS	M2311015	28 November 2024
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	008-HI	NFI.BTH 019/23	Quality Reason	QR24-0492	4 March 2025

3. This certificate is traceable to SI UNIT

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

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

Calibration Results:


1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
100	0.000057
200	0.000079


2. Off-Center Error:

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


Reading obtained is given in the table:



□



✓



□

1	2	3	4	5	(Maximum Difference)
(0)	(0)	(0)	(0)	(0)	(0)
(no. 0000)	(no. 0001)	(no. 0005)	(no. 0006)	(no. 0010)	(0.001)
(no. 0001)	(no. 0002)	(no. 0006)	(no. 0007)	(no. 0011)	
(no. 0002)	(no. 0003)	(no. 0007)	(no. 0008)	(no. 0012)	
(no. 0003)	(no. 0004)	(no. 0008)	(no. 0009)	(no. 0013)	
(no. 0004)	(no. 0005)	(no. 0009)	(no. 0010)	(no. 0014)	
(no. 0005)	(no. 0006)	(no. 0010)	(no. 0011)	(no. 0015)	
(no. 0006)	(no. 0007)	(no. 0011)	(no. 0012)	(no. 0016)	
(no. 0007)	(no. 0008)	(no. 0012)	(no. 0013)	(no. 0017)	
(no. 0008)	(no. 0009)	(no. 0013)	(no. 0014)	(no. 0018)	
(no. 0009)	(no. 0010)	(no. 0014)	(no. 0015)	(no. 0019)	
(no. 0010)	(no. 0011)	(no. 0015)	(no. 0016)	(no. 0020)	
(no. 0011)	(no. 0012)	(no. 0016)	(no. 0017)	(no. 0021)	
(no. 0012)	(no. 0013)	(no. 0017)	(no. 0018)	(no. 0022)	
(no. 0013)	(no. 0014)	(no. 0018)	(no. 0019)	(no. 0023)	
(no. 0014)	(no. 0015)	(no. 0019)	(no. 0020)	(no. 0024)	
(no. 0015)	(no. 0016)	(no. 0020)	(no. 0021)	(no. 0025)	
(no. 0016)	(no. 0017)	(no. 0021)	(no. 0022)	(no. 0026)	
(no. 0017)	(no. 0018)	(no. 0022)	(no. 0023)	(no. 0027)	
(no. 0018)	(no. 0019)	(no. 0023)	(no. 0024)	(no. 0028)	
(no. 0019)	(no. 0020)	(no. 0024)	(no. 0025)	(no. 0029)	
(no. 0020)	(no. 0021)	(no. 0025)	(no. 0026)	(no. 0030)	
(no. 0021)	(no. 0022)	(no. 0026)	(no. 0027)	(no. 0031)	
(no. 0022)	(no. 0023)	(no. 0027)	(no. 0028)	(no. 0032)	
(no. 0023)	(no. 0024)	(no. 0028)	(no. 0029)	(no. 0033)	
(no. 0024)	(no. 0025)	(no. 0029)	(no. 0030)	(no. 0034)	
(no. 0025)	(no. 0026)	(no. 0030)	(no. 0031)	(no. 0035)	
(no. 0026)	(no. 0027)	(no. 0031)	(no. 0032)	(no. 0036)	
(no. 0027)	(no. 0028)	(no. 0032)	(no. 0033)	(no. 0037)	
(no. 0028)	(no. 0029)	(no. 0033)	(no. 0034)	(no. 0038)	
(no. 0029)	(no. 0030)	(no. 0034)	(no. 0035)	(no. 0039)	
(no. 0030)	(no. 0031)	(no. 0035)	(no. 0036)	(no. 0040)	
(no. 0031)	(no. 0032)	(no. 0036)	(no. 0037)	(no. 0041)	
(no. 0032)	(no. 0033)	(no. 0037)	(no. 0038)	(no. 0042)	
(no. 0033)	(no. 0034)	(no. 0038)	(no. 0039)	(no. 0043)	
(no. 0034)	(no. 0035)	(no. 0039)	(no. 0040)	(no. 0044)	
(no. 0035)	(no. 0036)	(no. 0040)	(no. 0041)	(no. 0045)	
(no. 0036)	(no. 0037)	(no. 0041)	(no. 0042)	(no. 0046)	
(no. 0037)	(no. 0038)	(no. 0042)	(no. 0043)	(no. 0047)	
(no. 0038)	(no. 0039)	(no. 0043)	(no. 0044)	(no. 0048)	
(no. 0039)	(no. 0040)	(no. 0044)	(no. 0045)	(no. 0049)	
(no. 0040)	(no. 0041)	(no. 0045)	(no. 0046)	(no. 0050)	
(no. 0041)	(no. 0042)	(no. 0046)	(no. 0047)	(no. 0051)	
(no. 0042)	(no. 0043)	(no. 0047)	(no. 0048)	(no. 0052)	
(no. 0043)	(no. 0044)	(no. 0048)	(no. 0049)	(no. 0053)	
(no. 0044)	(no. 0045)	(no. 0049)	(no. 0050)	(no. 0054)	
(no. 0045)	(no. 0046)	(no. 0050)	(no. 0051)	(no. 0055)	
(no. 0046)	(no. 0047)	(no. 0051)	(no. 0052)	(no. 0056)	
(no. 0047)	(no. 0048)	(no. 0052)	(no. 0053)	(no. 0057)	
(no. 0048)	(no. 0049)	(no. 0053)	(no. 0054)	(no. 0058)	
(no. 0049)	(no. 0050)	(no. 0054)	(no. 0055)	(no. 0059)	
(no. 0050)	(no. 0051)	(no. 0055)	(no. 0056)	(no. 0060)	
(no. 0051)	(no. 0052)	(no. 0056)	(no. 0057)	(no. 0061)	
(no. 0052)	(no. 0053)	(no. 0057)	(no. 0058)	(no. 0062)	
(no. 0053)	(no. 0054)	(no. 0058)	(no. 0059)	(no. 0063)	
(no. 0054)	(no. 0055)	(no. 0059)	(no. 0060)	(no. 0064)	
(no. 0055)	(no. 0056)	(no. 0060)	(no. 0061)	(no. 0065)	
(no. 0056)	(no. 0057)	(no. 0061)	(no. 0062)	(no. 0066)	
(no. 0057)	(no. 0058)	(no. 0062)	(no. 0063)	(no. 0067)	
(no. 0058)	(no. 0059)	(no. 0063)	(no. 0064)	(no. 0068)	
(no. 0059)	(no. 0060)	(no. 0064)	(no. 0065)	(no. 0069)	
(no. 0060)	(no. 0061)	(no. 0065)	(no. 0066)	(no. 0070)	
(no. 0061)	(no. 0062)	(no. 0066)	(no. 0067)	(no. 0071)	
(no. 0062)	(no. 0063)	(no. 0067)	(no. 0068)	(no. 0072)	
(no. 0063)	(no. 0064)	(no. 0068)	(no. 0069)	(no. 0073)	
(no. 0064)	(no. 0065)	(no. 0069)	(no. 0070)	(no. 0074)	
(no. 0065)	(no. 0066)	(no. 0070)	(no. 0071)	(no. 0075)	
(no. 0066)	(no. 0067)	(no. 0071)	(no. 0072)	(no. 0076)	
(no. 0067)	(no. 0068)	(no. 0072)	(no. 0073)	(no. 0077)	
(no. 0068)	(no. 0069)	(no. 0073)	(no. 0074)	(no. 0078)	
(no. 0069)	(no. 0070)	(no. 0074)	(no. 0075)	(no. 0079)	
(no. 0070)	(no. 0071)	(no. 0075)	(no. 0076)	(no. 0080)	
(no. 0071)	(no. 0072)	(no. 0076)	(no. 0077)	(no. 0081)	
(no. 0072)	(no. 0073)	(no. 0077)	(no. 0078)	(no. 0082)	
(no. 0073)	(no. 0074)	(no. 0078)	(no. 0079)	(no. 0083)	
(no. 0074)	(no. 0075)	(no. 0079)	(no. 0080)	(no. 0084)	
(no. 0075)	(no. 0076)	(no. 0080)	(no. 0081)	(no. 0085)	
(no. 0076)	(no. 0077)	(no. 0081)	(no. 0082)	(no. 0086)	
(no. 0077)	(no. 0078)	(no. 0082)	(no. 0083)	(no. 0087)	
(no. 0078)	(no. 0079)	(no. 0083)	(no. 0084)	(no. 0088)	
(no. 0079)	(no. 0080)	(no. 0084)	(no. 0085)	(no. 0089)	
(no. 0080)	(no. 0081)	(no. 0085)	(no. 0086)	(no. 0090)	
(no. 0081)	(no. 0082)	(no. 0086)	(no. 0087)	(no. 0091)	
(no. 0082)	(no. 0083)	(no. 0087)	(no. 0088)	(no. 0092)	
(no. 0083)	(no. 0084)	(no. 0088)	(no. 0089)	(no. 0093)	
(no. 0084)	(no. 0085)	(no. 0089)	(no. 0090)	(no. 0094)	
(no. 0085)	(no. 0086)	(no. 0090)	(no. 0091)	(no. 0095)	
(no. 0086)	(no. 0087)	(no. 0091)	(no. 0092)	(no. 0096)	
(no. 0087)	(no. 0088)	(no. 0092)	(no. 0093)	(no. 0097)	
(no. 0088)	(no. 0089)	(no. 0093)	(no. 0094)	(no. 0098)	
(no. 0089)	(no. 0090)	(no. 0094)	(no. 0095)	(no. 0099)	
(no. 0090)	(no. 0091)	(no. 0095)	(no. 0096)	(no. 0100)	
(no. 0091)	(no. 0092)	(no. 0096)	(no. 0097)	(no. 0101)	
(no. 0092)	(no. 0093)	(no. 0097)	(no. 0098)	(no. 0102)	
(no. 0093)	(no. 0094)	(no. 0098)	(no. 0099)	(no. 0103)	
(no. 0094)	(no. 0095)	(no. 0099)	(no. 0100)	(no. 0104)	
(no. 0095)	(no. 0096)	(no. 0100)	(no. 0101)	(no. 0105)	
(no. 0096)	(no. 0097)	(no. 0101)	(no. 0102)	(no. 0106)	
(no. 0097)	(no. 0098)	(no. 0102)	(no. 0103)	(no. 0107)	
(no. 0098)	(no. 0099)	(no. 0103)	(no. 0104)	(no. 0108)	
(no. 0099)	(no. 0100)	(no. 0104)	(no. 0105)	(no. 0109)	
(no. 0100)	(no. 0101)	(no. 0105)	(no. 0106)	(no. 0110)	
(no. 0101)	(no. 0102)	(no. 0106)	(no. 0107)	(no. 0111)	
(no. 0102)	(no. 0103)	(no. 0107)	(no. 0108)	(no. 0112)	
(no. 0103)	(no. 0104)	(no. 0108)	(no. 0109)	(no. 0113)	
(no. 0104)	(no. 0105)	(no. 0109)	(no. 0110)	(no. 0114)	
(no. 0105)	(no. 0106)	(no. 0110)	(no. 0111)	(no. 0115)	
(no. 0106)	(no. 0107)	(no. 0111)	(no. 0112)	(no. 0116)	
(no. 0107)	(no. 0108)	(no. 0112)	(no. 0113)	(no. 0117)	
(no. 0108)	(no. 0109)	(no. 0113)	(no. 0114)	(no. 0118)	
(no. 0109)	(no. 0110)	(no. 0114)	(no. 0115)	(no. 0119)	
(no. 0110)	(no. 0111)	(no. 0115)	(no. 0116)	(no. 0120)	
(no. 0111)	(no. 0112)	(no. 0116)	(no. 0117)	(no. 0121)	
(no. 0112)	(no. 0113)	(no. 0117)	(no. 0118)	(no. 0122)	
(no. 0113)	(no. 0114)	(no. 0118)	(no. 0119)	(no. 0123)	
(no. 0114)	(no. 0115)	(no. 0119)	(no. 0120)	(no. 0124)	
(no. 0115)	(no. 0116)	(no. 0120)	(no. 0121)	(no. 0125)	
(no. 0116)	(no. 0117)	(no. 0121)	(no. 0122)	(no. 0126)	
(no. 0117)	(no. 0118)	(no. 0122)	(no. 0123)	(no. 0127)	
(no. 0118)	(no. 0119)	(no. 0123)	(no. 0124)	(no. 0128)	
(no. 0119)	(no. 0120)	(no. 0124)	(no. 0125)	(no. 0129)	
(no. 0120)	(no. 0121)	(no. 0125)	(no. 0126)	(no. 0130)	
(no. 0121)	(no. 0122)	(no. 0126)	(no. 0127)	(no. 0131)	
(no. 0122)	(no. 0123)	(no. 0127)	(no. 0128)	(no. 0132)	
(no. 0123)	(no. 0124)	(no. 0128)	(no. 0129)	(no. 0133)	
(no. 0124)	(no. 0125)	(no. 0129)	(no. 0130)	(no. 0134)	
(no. 0125)	(no. 0126)	(no. 0130)	(no. 0131)	(no. 0135)	
(no. 0126)	(no. 0127)	(no. 0131)	(no. 0132)	(no. 0136)	
(no. 0127)	(no. 0128)	(no. 0132)	(no. 0133)	(no. 0137)	
(no. 0128)	(no. 0129)	(no. 0133)	(no. 0134)	(no. 0138)	
(no. 0129)	(no. 0130)	(no. 0134)	(no. 0135)	(no. 0139)	
(no. 0130)	(no. 0131)	(no. 0135)	(no. 0136)	(no. 0140)	
(no. 0131)	(no. 0132)	(no. 0136)	(no. 0137)	(no. 0141)	
(no. 0132)	(no. 0133)	(no. 0137)	(no. 0138)	(no. 0142)	
(no. 0133)	(no. 0134)	(no. 0138)	(no. 0139)	(no. 0143)	
(no. 0134)	(no. 0135)	(no. 0139)	(no. 0140)	(no. 0144)	
(no. 0135)	(no. 0136)	(no. 0140)	(no. 0141)	(no. 0145)	
(no. 0136)	(no. 0137)	(no. 0141)	(no. 0142)	(no. 0146)	
(no. 0137)	(no. 0138)	(no. 0142)	(no. 0143)	(no. 0147)	
(no. 0138)	(no. 0139)	(no. 0143)	(no. 0144)	(no. 0148)	
(no. 0139)	(no. 0140)	(no. 0144)	(no. 0145)	(no. 0149)	
(no. 0140)	(no. 0141)	(no. 0145)	(no. 0146)	(no. 0150)	
(no. 0141)	(no. 0142)	(no. 0146)	(no. 0147)	(no. 0151)	
(no. 0142)	(no. 0143)	(no. 0147)	(no. 0148)	(no. 0152)	
(no. 0143)	(no. 0144)	(no. 0148)	(no. 0149)	(no. 0153)	
(no. 0144)	(no. 0145)	(no. 0149)	(no. 0150)	(no. 0154)	
(no. 0145)	(no. 0146)	(no. 0150)	(no. 0151)	(no. 0155)	
(no. 0146)	(no. 0147)	(no. 0151)	(no. 0152)	(no. 0156)	
(no. 0147)	(no. 0148)	(no. 0152)	(no. 0153)	(no. 0157)	
(no. 0148)	(no. 0149)	(no. 0153)	(no. 0154)	(no. 0158)	
(no. 0149)	(no. 0150)	(no. 0154)	(no. 0155)	(no. 0159)	
(no. 0150)	(no. 0151)	(no. 0155)	(no. 0156)	(no. 0160)	
(no. 0151)	(no. 0152)	(no. 0156)	(no. 0157)	(no. 0161)	
(no. 0152)	(no. 0153)	(no. 0157)	(no. 0158)	(no. 0162)	
(no. 0153)	(no. 0154)	(no. 0158)	(no. 0159)	(no. 0163)	
(no. 0154)	(no. 0155)	(no. 0159)	(no. 0160)	(no. 0164)	
(no. 0155)	(no. 0156)	(no. 0160)	(no. 0161)	(no. 0165)	

Calibration Certificate

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

Page 1 of 3

Equipment: Electronic Balance

Manufacturer: METTLER TOLEDO

Model: MS204TS/00

Serial No.: C252436235

ID No.: UAE.AIR.023/2566


Order No.: 2402420

Operation No.: 2402420-003

Date of Receipt: 19 April 2024

Date of Calibration: 19 April 2024

Calibrated by Mr.Pheraphat Tuanjit
Scientist

Approved by 
(Miss Preeyaporn Jaengkarnkit)
Vice President, Department of Laboratory Services
Responsible for the Technical Management Team

Date of Issue: 23 April 2024

The uncertainties are for a confidence probability of approximately 95%

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

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

Calibration Report

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

Date of Calibration: 19 April 2024

Page 2 of 3

Environment Condition: Ambient Temperature: 21.7 ± 1.5 °C Relative Humidity: 65 ± 6.7 %

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

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

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

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1-500mg	15880	TCS	N2311815	28 November 2024
Standard Weight Class E2	1-500g	15882	TCS	N2311825	28 November 2024
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	608-H1	NFI.BTH 019/23	Quality Room	QK24-0492	4 March 2025

3. This certification is traceable to SI UNIT

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

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

Calibration Results:




1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
100	0.000074
200	0.000074

2. Off-Center Error:

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

The balance reading obtained is given in the table:

		
1	2	3
(g)	(g)	(g)
100.0005	100.0006	100.0003
100.0006	100.0006	100.0003
100.0005	100.0006	100.0005
(Maximum Difference)		
0.0002		

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

Calibration Report

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

Date of Calibration: 19 April 2024

Page 3 of 3

Calibration Results: (Continued)

Calibration Range: 0-200 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value:

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (+/- g)	Coverage Factor k
Unloaded	0.00000	0.00000	0.00000	0.000094	2.00
0.1	0.10000	0.10000	0.00000	0.000094	2.00
1	0.99998	1.00000	0.00002	0.000097	2.00
5	4.99987	5.00000	0.00013	0.000096	2.00
10	10.00002	10.00000	0.00002	0.00012	2.00
20	20.00003	20.00001	-0.00002	0.00014	2.00
50	49.99998	50.00003	0.00005	0.00012	2.00
70	70.00000	70.00005	0.00005	0.00017	2.00
100	99.99997	100.00006	0.00009	0.00017	2.00
150	149.99994	150.00012	0.00018	0.00022	2.00
200	200.00001	200.00015	0.00014	0.00028	2.00

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

----- End -----

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

Calibration Certificate

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

Page 1 of 3

Equipment: Electronic Balance

Manufacturer: METTLER TOLEDO

Model: XP6

Serial No.: B322373893

ID No.: UAE.AIR.019/2556

Order No.: 2402420

Operation No.: 2402420-002

Date of Receipt: 19 April 2024

Date of Calibration: 19 April 2024

Calibrated by Mr.Pheraphat Tuanjit
Scientist

Approved by 
(Miss Preeyaporn Jaengkarnkit)
Vice President, Department of Laboratory Services
Responsible for the Technical Management Team

Date of Issue: 23 April 2024

The uncertainties are for a confidence probability of approximately 95%

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

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

Calibration Report

Certificate No.: 2402420-002-01
Equipment: Electronic Balance
Model: XPE
Serial No.: 8322373893
Capacity: 6.1 g
Manufacturer: METTLER TOLEDO
Resolution: 0.000001 g
ID No.: UAE.AIR.019/2556

Date of Calibration: 19 April 2024
Environment Condition: Ambient Temperature: 22.6 ± 1.8 °C Relative Humidity: 48 ± 6.0 %
Place of Calibration: Room 206 Balance Room 2, UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Condition of Equipment: Good Condition
Condition of This Results of Calibration:

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

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1-500mg	15880	TCS	M03111815	28 November 2024
Standard Weight Class E2	1-500g	15882	TCS	M03111825	28 November 2024

Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	608-H1	NFI.BTH.019/23	Quality Room	QK24-0492	4 March 2025

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

Calibration Results:

1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
3	0.0000057
6	0.0000119

2. Off-Center Error:

A mass of 3 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)
1.999981	1.999983	1.999980	1.999984	1.999983	1.999981	0.000003

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

Calibration Certificate

Certificate No.: 2401718-001-01
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: METTLER TOLEDO
Model: SevenEasy pH
Serial No.: 1231166210
ID No.: UAE.WAT.010/2553

Order No.: 2401718
Operation No.: 2401718-001
Date of Receipt: 27 February 2024
Date of Calibration: 11 March 2024

Calibrated by: Mr. Manas Somsak
Specialist
Approved by: (Mr. Phraphat Tuanjit)
Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team
Date of issue: 12 March 2024

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

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

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

Calibration Report

Certificate No.: 2401718-001-01
Equipment: pH Meter
Manufacturer: METTLER TOLEDO
Model: SevenEasy pH
Serial No.: 1231155210
ID No.: UAE.WAT.0102553
Date of Calibration: 11 March 2024

Calibration Results: (Manual Temperature Compensation at 25 °C)
1. Calibration of pH Meter (offset value before adjust: -0.4 mV)

Nominal pH	DC Voltage Standard (mV)	Average Indicator Reading (mV)	pH	Uncertainty (±mV)	Coverage Factor (K)
0	414.121	414	0.00	0.08	2.00
2	295.814	296	2.00	0.08	2.00
4	177.464	178	4.00	0.08	2.00
6	59.160	59	6.00	0.08	2.00
7	0.001	0	7.00	0.08	2.00
8	-59.159	-59	8.00	0.08	2.00
10	-177.461	-177	10.00	0.08	2.00
12	-295.811	-296	12.00	0.08	2.00
14	-414.118	-414	14.00	0.08	2.00

2. Calibration of pH Meter with Electrode (Manual Temperature Compensation at 25 °C)
Equipment: pH Electrode
Manufacturer: METTLER TOLEDO
Model: InLab Solids
Serial No.: 3085701
ID No.: N/A
Performance of Electrode system: (Three-Point Calibration at pH 4, 7 and 10)

Certified Value (25 °C pH)	Average Indicator Reading		Relative Slope (%)	Uncertainty (± pH)	Coverage Factor (K)
	pH	mV			
4.008	4.01	188	-	0.0071	2.00
7.004	7.00	13	-96.9	0.0086	2.00
10.010	10.01	-160	-97.2	0.0085	2.00
8.865	8.87	21	-	0.0074	2.00

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

Calibration Report

Certificate No.: 2401718-001-01
Equipment: Digital Thermometer with RTD (pH Meter)
Resolution: 0.1 °C
Model: SevenEasy pH
Serial No.: 1231155210
ID No.: UAE.WAT.0102553
Manufacturer: METTLER TOLEDO
Date of Calibration: 11 March 2024

Calibration point: 15.0, 25.0 and 35.0 °C
Calibration result:
- The probe was immersed in liquid bath or dry bath to a minimum depth of 100 mm.
- Description of probe, model: N/A, S/N: N/A
Dimension of probe: Diameter 4 mm, Length 120 mm.
Sheath material: Stainless Steel

UUC ¹ Reading (°C)	Standard Temperature (°C)	Correction Value (°C)	Uncertainty ± (°C)
15.1	14.998	0.1	0.099
25.1	24.998	0.1	0.099
35.1	34.997	0.1	0.099

Note
- UUC¹: Unit Under Calibration

¹ The report uncertainty of measurement was based on standard uncertainty multiplied by coverage factor k=2, providing a level of confidence of approximately 95 %.

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

Calibration Report

Certificate No.: 2401718-001-01
Equipment: Digital Thermometer with RTD (pH Meter)
Resolution: 0.1 °C
Model: SevenEasy pH
Serial No.: 1231155210
ID No.: UAE.WAT.0102553
Manufacturer: METTLER TOLEDO
Date of Calibration: 11 March 2024

Location: Chemical Calibration Laboratory, National Food Institute
Environment Condition: Ambient Temperature 23 °C ± 1 °C
Relative Humidity 51 % ± 2 %

Condition of this results of Calibration:
1. Calibration Method:
- In house method, W-TS-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 0877/66	06-Jun-24	TSTR
Platinum Resistance Thermometer (PRT)	5627A	877332			

Support Equipment: - Low Temperature Bath (SOCAL-6), Model: Europa-6 Plus Basic, S/N: 34159012



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

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

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

CERTIFICATE OF CALIBRATION

Certificate No.: SP23-021
Customer: United Analyst and Engineering Consultant Co., Ltd. (Head Office)
Address: 3 Soi Udomsak 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: 20 May 2023
Calibration Date: 20 May 2023
Issue Date: 23 May 2023
Condition Instrument: Good

Calibrated by: 
(Mr. Tanawat Ritimach)
Technical Manager
Approved by: 
(Ms. Chonhicha Sangnorn)
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.

FM-708-02 R01 1/1/2021



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. : SP23-021 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 : 60 nm/min


Scan Interval of UUC : 0.15 nm.

Resolution of UUC : Photometric 0.0001 Abs.


Wavelength 0.1 nm.

FM-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. : SP23-021 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	0.5742	0.0045	0.0031	2.00
	1.0490	1.0423	0.0067	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	0.5577	0.0030	0.0034	2.00
	1.0247	1.0234	0.0013	0.0035	2.00
	2.1229	2.1171	0.0058	0.0088	2.00
465	0.0000	0.0000	0.0000	0.0028	2.00
	0.5236	0.5184	0.0052	0.0029	2.00
	0.9634	0.9607	0.0027	0.0029	2.00
	1.9763	1.9715	0.0048	0.0081	2.00
546.1	0.0000	-0.0001	0.0001	0.0028	2.00
	0.5191	0.5159	0.0032	0.0031	2.00
	1.0003	0.9980	0.0023	0.0033	2.00
	1.9987	1.9917	0.0070	0.0087	2.00
590	0.0000	0.0000	0.0000	0.0028	2.00
	0.5523	0.5501	0.0022	0.0030	2.00
	1.0809	1.0808	0.0001	0.0030	2.00
	2.0391	2.0336	0.0055	0.0081	2.00
635	0.0000	0.0000	0.0000	0.0028	2.00
	0.5601	0.5585	0.0016	0.0031	2.00
	1.0512	1.0485	0.0027	0.0030	2.00
	1.9294	1.9317	-0.0023	0.0083	2.00

FM-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. : SP23-021 Page 4 of 5

Photometric Accuracy :


Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000	0.0000	0.0000	0.0050	2.00
	0.7478	0.7436	0.0042	0.0058	2.00
257	0.0000	0.0000	0.0000	0.0050	2.00
	0.8686	0.8648	0.0038	0.0064	2.00
313	0.0000	0.0000	0.0000	0.0050	2.00
	0.2912	0.2908	0.0004	0.0052	2.00
350	0.0000	0.0000	0.0000	0.0050	2.00
	0.6448	0.6398	0.0050	0.0058	2.00

FM-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. : SP23-021 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	360.3	0.63	0.18	2.00
418.59	418.0	0.59	0.18	2.00
445.94	445.3	0.64	0.18	2.00
453.66	453.0	0.66	0.18	2.00
460.02	459.6	0.42	0.18	2.00
536.59	536.4	0.19	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	529.0	-0.12	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	684.5	-0.10	0.18	2.00
740.72	741.0	-0.28	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 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 TIS 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



CERTIFICATE OF CALIBRATION

Certificate No. : SP24-008Page 1 of 5

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

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

Location of calibration : Laboratory 315

Equipment : UV-Vis Spectrophotometer

Manufacturer : Hitachi

Model : U-1900

Serial No. : 2021-064


ID No. : UAE.WAS.006/2552


Received Date : 16 January 2024

Calibration Date : 16 January 2024

Issue Date : 19 January 2024

Condition Instrument : Good

Calibrated by :

(Mr.Tanawut Rittidach)

Approved by :

(Ms. Chonthicha Sangern)

Technical ManagerQuality Manager



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

The measurement capability of the laboratory and its traceability to 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 DQE Services Co., Ltd.

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021

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



REPORT OF CALIBRATION

Certificate No. : SP24-008Page 2 of 5

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

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

Certified Reference Materials :

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

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

Spectral Band Width of UUC : 4.0 nm.

Scan Speed of UUC : 200 nm/min



Scan Interval of UUC : 0.1 nm.

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

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021

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



REPORT OF CALIBRATION

Certificate No. : SP24-008Page 3 of 5

Calibration Results : Without adjustment



Photometric Accuracy :

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

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021

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



REPORT OF CALIBRATION

Certificate No. : SP24-008Page 4 of 5

Photometric Accuracy :

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

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021

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

REPORT OF CALIBRATION

Certificate No. : SP24-008 Page 5 of 5

Wavelength Accuracy :

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

Remark : - UUC = Unit Under Calibration

- N/A = Not Available

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

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

- * Indicates non TISI accredited

- End of Certificate -

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021

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

Certificate of Calibration

Cert.No.: 23MM333
Page.: 1 of 3

Equipment : Electronic Balance
Manufacturer : Mettler Toledo
Model : XP6
Serial No. : B322373893
ID No. : UAE.AIR.019/2556
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Balance Room 2
Received order : 07 April 2023
Calibration Date : 07 April 2023
Ambient Temperature : 15 °C to 40 °C
Relative Humidity : 30 % to 90 %
Calibrated by : Suwit Imjai
Approved by : 
Pormthippa Tameyakul
Malee Butkruea
Issue Date : 10 April 2023

The Uncertainties are for a confidence probability of approximately 95%

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

เอกสารไม่ควบคุม

Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2304-0015OC-3
Procedure used :-

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

Condition of this result of calibration

1. Reference standard instruments:-

Instruments	Model	Serial No.	ID No.	Test report No.	Due date
1) Standard Weight Set (E2)	15884	24053	70RC007	MM-0010-22	20 Jan 2024

2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This result of calibration was made on requested at the point specified by customer.
4. This certificate is not certified for any commercial transaction.
5. This certification is traceable to the International System of Unit.

Result of calibration () Without Adjustment (*) After Adjustment by Internal Calibration
Range capacity : 0 g to 6.1 g **Resolution** 0.000001 g

Before Adjustment :

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (± mg)	Coverage Factor (k)
3	2.999987	+0.000013	0.026	2.00
6	6.000003	-0.000003	0.036	2.00

After Adjustment :

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

Applied Weight (g)	Standard Deviation of Reading (g)
3	0.0000027
6	0.0000030

เอกสารไม่ควบคุม

Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2304-0015OC-3
Result of calibration

2. **Effect of off center loading**
A mass of 2 g was placed to various position on the pan.
The weighing machine reading error obtained is given in the table

Position 1 (g)	Position 2 (g)	Position 3 (g)	Position 4 (g)	Position 5 (g)	Maximum difference between off-center and central loading (g)
-0.000006	-0.000007	-0.000007	-0.000010	-0.000002	0.000004

3. **Departure from nominal value**

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (± mg)	Coverage Factor (k)
Unload	0.000000	0.000000	0.0060	2.37
0.01	0.009998	+0.000002	0.0060	2.13
0.05	0.050003	-0.000003	0.0070	2.05
0.1	0.100007	-0.000007	0.0090	2.03
0.15	0.150000	0.000000	0.011	2.00
0.17	0.169998	+0.000002	0.014	2.00
0.2	0.200002	-0.000002	0.014	2.00
1.5	1.500001	-0.000001	0.020	2.00
3	2.999990	+0.000010	0.026	2.00
4.5	4.499994	+0.000006	0.036	2.00
6	5.999982	+0.000018	0.036	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 %.

เอกสารไม่ควบคุม



Cert. No.: 23TM378
Page : 1 of 3

Certificate of Calibration

Equipment : Incubator
Manufacturer : Memmert
Model : IPP 260
Serial No. : V615.0187
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 : 11 April 2023
Calibration Date : 12 April 2023
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Preecha Hiahib
Approved by :
() Pornthippa Tameyakul
(/) Malee Butkruea
() Suwit Imjai
Issue Date : 24 April 2023

The Uncertainties are for a confidence probability of approximately 95%

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

เอกสารไม่ควบคุม



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2304-0155OC-1
Procedure Used :-

Cert. No.: 23TM378
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	34972A	MY49001451	23LM27	25 Feb 2024

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

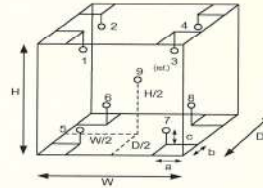
3. This certification is traceable to the International System of Unit.

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available

Environment during calibration		
	Beginning	Finished
Temp. (°C)	25	26
REL.Humid. (%)	57	61
AC Supply (Volt)	220	220



Probe Installation Details :

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

Dimension of Chamber :

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

Position :	Ref. Std. ID No.:
1	19RTD-2/1
2	19RTD-2/2
3	19RTD-2/3
4	19RTD-2/4
5	19RTD-2/5
6	19RTD-2/6
7	19RTD-2/7
8	19RTD-2/8
9 (ref.)	19RTD-2/9

เอกสารไม่ควบคุม



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2304-0155OC-1
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Not Available

Cert. No.: 23TM378
Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
35.0	35.0	35.0	0.052	0.53	0.60	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	1	2	3	4	5	6	7	8	9 (ref.)	
35.0	35.092	35.148	34.817	35.149	34.894	35.323	34.773	35.056	34.802	0.30

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

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

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

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

UUC* : Unit Under Calibration

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

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

-000-

เอกสารไม่ควบคุม



Cert. No.: 23TM729
Page : 1 of 3

Certificate of Calibration

Equipment : Incubator
Manufacturer : Memmert
Model : IPP 260
Serial No. : V618.0033
ID No. : UAE.MIC.021/2561
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Microbiology Laboratory (302)
Received Order : 27 April 2023
Calibration Date : 27 April 2023
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Tawatchai Pama
Approved by :
() Pornthippa Tameyakul
(/) Malee Butkruea
() Suwit Imjai
Issue Date : 11 May 2023

The Uncertainties are for a confidence probability of approximately 95%

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

เอกสารไม่ควบคุม



Equipment : Autoclave
Condition As-Received : Used Item
Reference : 2304-0461OC-2
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source

Cert. No.: 23TM763
Page : 3 of 3

Operating parameter Set : Temperature = 115.0 °C
Sterilization period = 15 minute

UUC* Setting (°C)	UUC* Reading (°C)	Position	Average* Standard Reading (°C)	Stability (± °C)	Pressure Reading (MPa)	Uncertainty (± °C)	Coverage Factor k
115.0	115.0	1	115.213	0.22	0.08	0.75	2
		2	115.166				
		3	115.260				

Operating parameter Set : Temperature = 121.0 °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
121.0	121.0	1	121.260	0.29	1.1	0.75	2
		2	121.224				
		3	121.284				

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 %.

-000-

Male.

เอกสารไม่ควบคุม

a 1159367



Certificate of Calibration

Equipment: pH METER
Model: SevenEasy
Serial No. (or ID.): 1230525212 (UAE.WAS.003/2553)
Manufacturer: METTLER TOLEDO
Electrode Serial No.: 1156883
Condition: In Condition

Certificate No.: C07240167
Issued Date: 9 April 2024
Job No.: WO-00024208
Page: 1 of 3
Model: InLab Solids Brand: METTLER TOLEDO

Customer: United Analyst and Engineering Consultant Company Limited
3 Soi Udomsuk 41 Sukhumvit Road,
Bangkok, Prakanong, Bangkok 10260 Thailand

Environment Condition: Temperature 23 °C ± 2 °C
Humidity 50 %RH ± 15 %RH

Calibration Place: Environment Laboratory, DKSH Technology Limited,
2533 Sukhumvit Road, Bangkok,
Phrakhanong, Bangkok 10260 Thailand

Calibration By: Miss.Orawan Khlaiphio
Calibration Date: 9 April 2024
The Method used: In house method, CAL-WI-58, base on ASTM E 70-07

Traceability: This certificate is traceable to SI Units, Sample Test is assured through primary measurement method Harned cell, through CPAchem Ltd. (ISO/IEC 17034) Certificate No. 938377, 931985, 931984 And pH Scale traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through Industrial Foundation Electrical and Electronics Institute Certificate No. CA20230350EA

(Miss.Orawan Khlaiphio)
Person in charge

(Mr. Nitinun Srihawan)
Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.
The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).
These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

Unit Under Calibration: pH meter
DKSH Technology Limited
2533 Sukhumvit Road, Bangkok, Prakanong, Bangkok 10260
Phone: +66 2619 7550 Email: info@dksh.com Website: www.dksh.com/certificat-thailand

Delivering Growth - in Asia and Beyond.

เอกสารไม่ควบคุม

CAL-FM-C07-14: 9 Apr 2024



Certificate No.: C07240167 Page 2 of 3

Calibration Results:

pH Scale

Input (mV)	pH Meter Reading			Uncertainty of Measurement (mV)	Coverage Factor (k)
	(mV)	Error (mV)	(pH)		
414.12	414	-0.12	0.00	0.58	2.00
354.96	355	0.04	1.00	0.58	2.00
295.8	296	0.20	2.00	0.58	2.00
236.64	237	0.36	3.00	0.58	2.00
177.48	178	0.52	4.00	0.58	2.00
118.32	118	-0.32	5.00	0.58	2.00
59.16	59	-0.16	6.00	0.58	2.00
0	0	0.00	7.00	0.58	2.00
-59.16	-59	0.16	8.00	0.58	2.00
-118.32	-118	0.32	9.00	0.58	2.00
-177.48	-177	0.48	10.00	0.58	2.00
-236.64	-236	0.64	11.00	0.58	2.00
-295.8	-296	-0.20	12.00	0.58	2.00
-354.96	-355	-0.04	13.00	0.58	2.00
-414.12	-414	0.12	14.00	0.58	2.00

Unit Under Calibration: pH meter
DKSH Technology Limited
2533 Sukhumvit Road, Bangkok, Prakanong, Bangkok 10260
Phone: +66 2619 7550 Email: info@dksh.com Website: www.dksh.com/certificat-thailand

Delivering Growth - in Asia and Beyond.

เอกสารไม่ควบคุม

CAL-FM-C07-14: 9 Apr 2024



Certificate No.: C07240167 Page 3 of 3

Practical slope and zero point*

The three-point calibration using three standard buffer solutions; pH 4.008 , pH 6.985 and pH 9.997

-During calibration, display of pH meter reading: pH 4.00 , pH 7.00 and pH 10.01

The practical slope of the pH electrode: 57.01 (mV/pH), 96.37%

The zero point of the pH electrode; 6.88 (pH)

Sample Test Results

Standard Buffer Solution (pH)	Unit Under Calibration (pH)	Difference (pH)	Uncertainty of Measurement (pH)	Coverage Factor (k)
4.008	3.99	-0.018	0.0070	2.00
6.985	7.00	0.015	0.0091	2.00
9.997	10.02	0.023	0.0074	2.00

* Calibration Marked "Not TISI Accredited" in this Certificate have been included for completeness.

The End of Certificate

Unit Under Calibration: pH meter
DKSH Technology Limited
2533 Sukhumvit Road, Bangkok, Prakanong, Bangkok 10260
Phone: +66 2619 7550 Email: info@dksh.com Website: www.dksh.com/certificat-thailand

Delivering Growth - in Asia and Beyond.

เอกสารไม่ควบคุม

CAL-FM-C07-14: 9 Apr 2024



Certificate of Calibration

Certificate No.: C15240373
Page: 2 of 2

Equipment: Digital Thermometer with Probe
Model: SevenEasy pH
Serial No.: 1230525212
Manufacturer: METTLER TOLEDO
ID No.: UAE.WAS.003/2553

Certificate No.: C15240373
Issued Date: 09 April 2024
Job No.: WO-00024208
Page: 1 of 2
Condition: In Condition

Customer: United Analyst and Engineering Consultant Company Limited
3 Soi Udomsuk 41 Sukhumvit Road,
Bangkok, Prakanong, Bangkok 10260 Thailand

Environment Condition: Temperature: 22 °C ± 3 °C
Humidity: 50 %RH ± 20 %RH
Voltage: 220 VAC ± 10 %

Calibration Place: Thermo-Hygro Laboratory, DKSH Technology Limited.
2533 Sukhumvit Road, Bangkok,
Phrakhanong, Bangkok 10260 Thailand

Calibration By: Mr. Nateekarn Mitjit
Calibration Date: 09 April 2024
The Method used: In house method, CAL-WI-19, by comparison with standard thermometer
Traceability: This certificate is traceable to the International System of Unit maintained by Quality Reborn Co.,Ltd. (QR) Certificate No. QR23-1073

(Mr. Nateekarn Mitjit)
Person in charge

(Mr. Pramote Ramrong)
Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.
The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).
These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

บริษัท ดีเคเอส อีซี จำกัด
DKSH Technology Limited
2533 ซอยสุขุมวิท 41 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
Phone: +66 2039 7000 Email: info.calibration@dksh.com Website: www.dksh.com/certidfi-thailand

Delivering Growth – in Asia and Beyond.

เอกสารไม่ควบคุม
CAL-FM-C15-14: 06 Dec 2022

Reference standard equipment:

Equipment	Certificate no	Cal. date	Next Cal. date
Digital Thermometer with Probe	QR23-1073	2 May 23	2 May 24

Calibration Results:

Without Adjustment

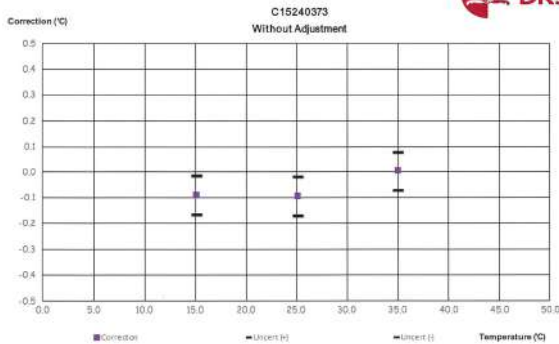
Sensor Type: RTD		Channel: -		
Diameter (mm) 4	Length (mm): 135		Immersion (mm): 110	
Calibrate Point.(°C)	STD. Reading (°C)	UUC. Reading (°C)	Correction of UUC (°C)	Uncertainty (± °C)
15.0	15.010	15.1	-0.090	0.076
25.0	25.006	25.1	-0.094	0.076
35.0	35.004	35.0	0.004	0.076

The End of Certificate

บริษัท ดีเคเอส อีซี จำกัด
DKSH Technology Limited
2533 ซอยสุขุมวิท 41 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
Phone: +66 2039 7000 Email: info.calibration@dksh.com Website: www.dksh.com/certidfi-thailand

Delivering Growth – in Asia and Beyond.

เอกสารไม่ควบคุม
CAL-FM-C15-14: 06 Dec 2022



Certificate of Calibration

Equipment: CONDUCTIVITY METER
Model: Lab 955
Serial No. (or ID.): 16300356
Manufacturer: SI Analytic
Electrode Serial No.: 16070067
Condition: In Condition

Certificate No.: C24240057
Issued Date: 11 March 2024
Job No.: WO-00020309
Page: 1 of 2
Model: LF413T
Brand: SI Analytic

Customer: United Analyst and Engineering Consultant Company Limited
3 Soi Udomsuk 41 Sukhumvit Road,
Bangkok, Prakanong, Bangkok 10260 Thailand

Environment Condition: Temperature: 23 °C ± 2 °C
Humidity: 50 %RH ± 15 %RH

Calibration Place: Environment Laboratory, DKSH Technology Limited.
2533 Sukhumvit Road, Bangkok,
Phrakhanong, Bangkok 10260 Thailand

Calibration By: Mr. Pongpisut Suebchantha
Calibration Date: 11 March 2024
The Method used: In house method, CAL-WI-49, base on ASTM D 1125-14 and D 5391-14
Traceability: This certificate is traceable to the SI Units maintained by CRM of NIST(SRM) through CPA chem Co., Ltd. (ISO/IEC 17034) Certificate No. 960753, 890591, 890593

(Mr. Pongpisut Suebchantha)

Person in charge

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.
The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).
These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

(Mr. Nitinun Srihawan)

Authorized signatory

บริษัท ดีเคเอส อีซี จำกัด
DKSH Technology Limited
2533 ซอยสุขุมวิท 41 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
Phone: +66 2039 7000 Email: info.calibration@dksh.com Website: www.dksh.com/certidfi-thailand

Delivering Growth – in Asia and Beyond.

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

CAL-FM-C24-09: 12 Sep 2022

Calibration Results:

Before Adjustment

Standard	Unit Under Calibration	Correction	Coverage Factor	Uncertainty (±)
Conductivity Solution	Reading		(k)	
25.000 $\mu\text{S/cm}$	26.7 $\mu\text{S/cm}$	-1.700 $\mu\text{S/cm}$	2.00	0.21 $\mu\text{S/cm}$
1413.0 $\mu\text{S/cm}$	1428 $\mu\text{S/cm}$	-15.0 $\mu\text{S/cm}$	2.00	9.0 $\mu\text{S/cm}$
111.3 mS/cm	108.4 mS/cm	2.9 mS/cm	2.00	0.67 mS/cm

After Adjustment : at 1413 $\mu\text{S/cm}$

Standard	Unit Under Calibration	Correction	Coverage Factor	Uncertainty (±)
Conductivity Solution	Reading		(k)	
25.000 $\mu\text{S/cm}$	25.9 $\mu\text{S/cm}$	-0.900 $\mu\text{S/cm}$	2.00	0.21 $\mu\text{S/cm}$
1413.0 $\mu\text{S/cm}$	1413 $\mu\text{S/cm}$	0.0 $\mu\text{S/cm}$	2.00	9.0 $\mu\text{S/cm}$
111.3 mS/cm	107.5 mS/cm	3.8 mS/cm	2.00	0.67 mS/cm

The End of Certificate



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 Sol Udomsuk 41, Sukhumvit Road,
Bangchak, Phraekhanong,
Bangkok 10260
Location : Lab Floor 2
Received Order : 10 February 2024
Calibration Date : 10 February 2024
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Tawatchai Pama
Approved by :
() Ponthipha Tameyakul
(✓) Unnopphol Harachai
() Suwit Injai
Issue Date : 19 February 2024

The Uncertainties are for a confidence probability of approximately 95 %

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



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2402-0234OC-1
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Not Available

Cert. No.: 24TM303
Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
20.0	20.1	19.9	0.37	0.72	1.4	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	Position									
20.0	1	2	3	4	5	6	7	8	9 (ref.)	
	19.873	19.803	20.322	19.690	19.615	19.585	19.612	19.558	19.645	0.58

Average* : The average of 30 values in each position.
Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.
Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.
Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.
UUC* : Unit Under Calibration

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

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

-000-



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2402-0234OC-1
Procedure Used :-

Cert. No.: 24TM303
Page : 2 of 3

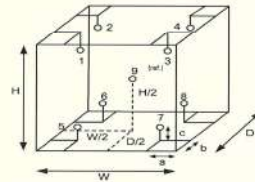
Calibration were conducted using calibration procedure CP-OT02 based on TLAS G-20 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).
The temperature scale used was based on ITS-90.

Condition of this result of calibration

- Reference standard instrument:-
Instrument Serial No. Cert. No. Traceable Due Date
1) Data Acquisition MY59003411 23LM208 TPA 27 Dec 2024
- This certificate is valid only to the item calibrated on date and place of calibration.
- This certification is traceable to the International System of Unit.

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

Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Not Available



Probe Installation Details :
a = 10 cm
b = 10 cm
c = 10 cm
Dimension of Chamber :
D = 0.62 m
W = 1.2 m
H = 1.2 m
Capacity = 0.89 m³

Environment during calibration		
	Beginning	Finished
Temp. (°C)	28	31
REL Humid. (%)	70	65
AC Supply (Volt)	233	234

Position :	Ref. Std. ID No.:
1	20RTD-2/1
2	20RTD-2/2
3	20RTD-2/3
4	20RTD-2/4
5	20RTD-2/5
6	20RTD-2/6
7	20RTD-2/7
8	20RTD-2/8
9 (ref.)	20RTD-2/9

DQE Services

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



ISO 9001:2015
CALIBRATION DATA

CERTIFICATE OF CALIBRATION

Certificate No. : SP24-018

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. : UAE.WAT.020/2558

Received Date : 7 May 2024

Calibration Date : 7 May 2024

Issue Date : 9 May 2024

Condition Instrument : Good

Calibrated by : 
(Mr.Tanawut Ritidach)
Technical Manager


Approved by : 
(Ms. Chonthicha Sangngem)
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.

DQE Services

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



ISO 9001:2015
CALIBRATION DATA

REPORT OF CALIBRATION

Certificate No. : SP24-018

Page 2 of 5

Environment Condition : Ambient Temperature 25 ± 5 °C

Relative humidity 55 ± 20 %RH

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

Certified Reference Materials :

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

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

Spectral Band Width of UUC : 1.5 nm.

Scan Speed of UUC : 60 nm/min

Scan Interval of UUC : 0.15 nm.

Resolution of UUC : Photometric 0.0001 Abs.


Wavelength 0.1 nm.

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

DQE Services

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



ISO 9001:2015
CALIBRATION DATA

REPORT OF CALIBRATION

Certificate No. : SP24-018

Page 3 of 5

Calibration Results : Without adjustment


Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
420	0.0000	0.0000	0.0000	0.0028	2.00
	0.5780	0.5747	0.0033	0.0031	2.00
	1.0484	1.0438	0.0046	0.0029	2.00
	2.1876	2.1832	0.0044	0.0080	2.00
440	0.0000	0.0000	0.0000	0.0028	2.00
	0.5595	0.5581	0.0014	0.0034	2.00
	1.0239	1.0231	0.0008	0.0035	2.00
	2.1230	2.1219	0.0011	0.0080	2.00
465	0.0000	0.0000	0.0000	0.0028	2.00
	0.5230	0.5184	0.0046	0.0030	2.00
	0.9633	0.9614	0.0019	0.0029	2.00
	1.9753	1.9731	0.0022	0.0070	2.00
546.1	0.0000	0.0000	0.0000	0.0028	2.00
	0.5181	0.5150	0.0031	0.0031	2.00
	1.0002	0.9964	0.0038	0.0033	2.00
	1.9973	1.9914	0.0059	0.0088	2.00
590	0.0000	0.0000	0.0000	0.0028	2.00
	0.5517	0.5485	0.0032	0.0030	2.00
	1.0803	1.0772	0.0031	0.0030	2.00
	2.0373	2.0293	0.0080	0.0080	2.00
635	0.0000	0.0000	0.0000	0.0028	2.00
	0.5591	0.5565	0.0026	0.0031	2.00
	1.0518	1.0482	0.0036	0.0030	2.00
	1.9274	1.9202	0.0072	0.0079	2.00

เอกสารไม่ควบคุม

DQE Services

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



ISO 9001:2015
CALIBRATION DATA

REPORT OF CALIBRATION

Certificate No. : SP24-018



Page 4 of 5

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000	0.0000	0.0000	0.0050	2.00
	0.7469	0.7435	0.0034	0.0057	2.00
257	0.0000	0.0000	0.0000	0.0050	2.00
	0.8674	0.8639	0.0035	0.0060	2.00
313	0.0000	0.0000	0.0000	0.0050	2.00
	0.2919	0.2907	0.0012	0.0051	2.00
350	0.0000	0.0000	0.0000	0.0050	2.00
	0.6430	0.6402	0.0028	0.0055	2.00

เอกสารไม่ควบคุม

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. : SP24-018Page 5 of 5


Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor k
241.72	242.0	-0.28	0.18	2.00
279.45	279.5	-0.05	0.18	2.00
287.81	287.9	-0.09	0.18	2.00
334.06	333.9	0.16	0.18	2.00
360.93	360.5	0.43	0.18	2.00
418.59	418.1	0.49	0.18	2.00
445.94	445.6	0.34	0.18	2.00
453.66	453.3	0.36	0.18	2.00
460.02	459.8	0.22	0.18	2.00
536.59	536.0	0.59	0.18	2.00
637.98	638.7	-0.72	0.18	2.00
431.38	430.8	0.58	0.18	2.00
472.50	472.4	0.10	0.18	2.00
513.47	513.7	-0.23	0.18	2.00
528.88	529.1	-0.22	0.18	2.00
573.17	573.5	-0.33	0.18	2.00
585.35	585.2	0.15	0.20	2.00
684.40	685.1	-0.70	0.18	2.00
740.72	741.4	-0.68	0.20	2.00
748.55	749.1	-0.55	0.18	2.00
807.03	807.3	-0.27	0.18	2.00
879.28	879.3	-0.02	0.18	2.00

Remark : - UUC = Unit Under Calibration
- N/A = Not Available
- The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor k, which for a normal distribution corresponds to a coverage probability of approximately 95%
- * Indicates non TISI accredited

- End of Certificate -

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. : SP24-001Page 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 : 4 January 2024

Calibration Date : 4 January 2024



Issue Date : 5 January 2024

Condition Instrument : Good

Calibrated by : Approved by : 
(Mr.Tanawat Rittidach) (Ms. Chonthicha Sangsorn)
Technical ManagerQuality Manager

The calibration result is applied only to the above calibrated item and was found accurate as shown on date and place of calibration only.
The measurement capability of the laboratory and its traceability to 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 DQE Services Co., Ltd.

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. : SP24-001Page 2 of 5

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

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

Certified Reference Materials :

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

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


Spectral Band Width of UUC : 1.5 nm.

Scan Speed of UUC : 200 nm/min

Scan Interval of UUC : 0.1 nm.

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

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. : SP24-001Page 3 of 5

Calibration Results : Without adjustment

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
420	0.0000	0.000	0.0000	0.0028	2.00
	0.5780	0.575	0.0030	0.0031	2.00
	1.0484	1.045	0.0034	0.0029	2.00
	2.1876	2.192	-0.0044	0.0080	2.00
440	0.0000	0.000	0.0000	0.0028	2.00
	0.5595	0.558	0.0015	0.0034	2.00
	1.0239	1.023	0.0009	0.0035	2.00
	2.1230	2.125	-0.0020	0.0079	2.00
465	0.0000	0.000	0.0000	0.0028	2.00
	0.5230	0.520	0.0030	0.0030	2.00
	0.9633	0.961	0.0023	0.0029	2.00
	1.9753	1.975	0.0003	0.0070	2.00
546.1	0.0000	0.000	0.0000	0.0028	2.00
	0.5181	0.516	0.0021	0.0031	2.00
	1.0002	0.997	0.0032	0.0033	2.00
	1.9973	1.993	0.0043	0.0084	2.00
590	0.0000	0.000	0.0000	0.0028	2.00
	0.5517	0.550	0.0017	0.0030	2.00
	1.0803	1.079	0.0013	0.0030	2.00
	2.0373	2.032	0.0053	0.0080	2.00
635	0.0000	0.000	0.0000	0.0028	2.00
	0.5591	0.558	0.0011	0.0031	2.00
	1.0518	1.050	0.0018	0.0030	2.00
	1.9274	1.923	0.0044	0.0079	2.00

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021

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 : dgeservicesinfo@gmail.com

REPORT OF CALIBRATION

Certificate No. : SP24-001 Page 4 of 5

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000 0.7469	0.000 0.743	0.0000 0.0039	0.0050 0.0057	2.00 2.00
257	0.0000 0.8674	0.000 0.862	0.0000 0.0054	0.0050 0.0059	2.00 2.00
313	0.0000 0.2919	0.000 0.289	0.0000 0.0029	0.0050 0.0051	2.00 2.00
350	0.0000 0.6430	0.000 0.641	0.0000 0.0020	0.0050 0.0055	2.00 2.00

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

REPORT OF CALIBRATION

Certificate No. : SP24-001 Page 5 of 5

Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor k
241.72	241.2	0.52	0.18	2.00
279.45	279.0	0.45	0.18	2.00
287.81	287.4	0.41	0.18	2.00
334.06	333.8	0.26	0.18	2.00
360.93	360.6	0.33	0.18	2.00
418.59	418.4	0.19	0.18	2.00
445.94	445.8	0.14	0.18	2.00
453.66	453.4	0.26	0.18	2.00
460.02	459.8	0.22	0.18	2.00
536.59	536.4	0.19	0.18	2.00
637.98	638.0	-0.02	0.18	2.00
431.38	431.2	0.18	0.18	2.00
472.50	472.5	0.00	0.18	2.00
513.47	513.4	0.07	0.18	2.00
528.88	528.9	-0.02	0.18	2.00
573.17	573.4	-0.23	0.18	2.00
585.35	585.2	0.15	0.20	2.00
684.40	684.4	0.00	0.18	2.00
740.72	741.0	-0.28	0.20	2.00
748.55	748.8	-0.25	0.18	2.00
807.03	807.1	-0.07	0.18	2.00
879.28	879.5	-0.22	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 TSI accreditation

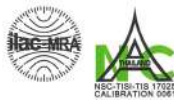
- End of Certificate -

เอกสารไม่ควบคุม

FM-708-02 801 1/13/2021

เอกสารไม่ควบคุม

FM-708-02 801 1/13/2021



Calibration Certificate

Certificate No.: 2402283-002-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 SOI UDOMSUK 41, SUKHUMVIT ROAD,
Bangchack, Prakhonong, Bangkok 10260

Page 1 of 4

Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: XSR205DU
Serial No.: C210685394
ID No.: UAE.WAO.010/2565
Order No.: 2402283
Operation No.: 2402283-002
Date of Receipt: 2 April 2024
Date of Calibration: 2 April 2024

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

The uncertainties are for a confidence probability of approximately 95%

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

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



Calibration Report

Certificate No.: 2402283-002-01
Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: XSR205DU
Serial No.: C210685394
Capacity: 220 g
Resolution: 0.00001 g / 0.0001 g
ID No.: UAE.WAO.010/2565

Page 2 of 4

Date of Calibration: 2 April 2024

Environment Condition: Ambient Temperature: 24.5 ± 0.5 °C Relative Humidity: 47.5 ± 2.5 %

Place of Calibration: Laboratory, UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

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

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	3mg to 200g	8505567572	TCS	M23040335	8 April 2024
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	608-H1	NFI.BTH 018/23	Quality Return	QR24-0343	9 February 2025

3. This certificate is traceable to SI UNIT

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

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

Calibration Results:

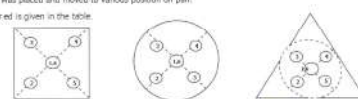
1. Repeatability of Reading:

Normal Value (g)	Standard Deviation of Reading (g)
40	0.000042
80	0.000052
100	0.000048
200	0.000048

2. Off-Center Error:

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

The balance reading obtained is given in the table



1	2	3	4	5	6	(Maximum Difference)
(g)	(g)	(g)	(g)	(g)	(g)	(g)
100.0000	100.0001	99.9999	99.9999	100.0001	100.0000	0.0001

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

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม



ศูนย์บริการและพัฒนาอุตสาหกรรมอาหาร
Foundation for Industrial Development National Food Institute
Food Industrial Laboratory Service Center



Calibration Report

Certificate No.: 2400141-001-01
Equipment: CHAMBER (Hot Air Oven)
Model: UF 55 Serial No.: B216.1666
Resolution: 0.1 °C ID No.: UAE.WAO.027/2559
Manufacturer: MEMMERT

Date of Calibration: 11 October 2023
Calibration point: 104.0, 140.0 and 180.0 °C

Page 3 of 3

Calibration Condition	Temperature (°C)	Relative Humidity (%)	Line Voltage (Volt)
MIN	28.2	61.4	227.4
MAX	28.3	65.1	229.3

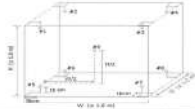


Table 1 : Reporting of Temperature

Calibration point (°C)	Measured Temperature (°C) @ Sensor No. (Sensor No.9 is REF)									Uncertainty ± (°C)
	#1	#2	#3	#4	#5	#6	#7	#8	#9	
104.0	104.05	103.98	104.02	104.08	104.00	104.05	103.99	104.17	104.00	0.53
140.0	140.09	139.99	139.91	140.05	139.99	139.91	139.97	140.26	139.97	0.73
180.0	180.46	180.33	180.25	180.28	180.33	179.96	180.31	180.64	180.16	0.90

Table 2 : Reporting of Characterization Result

UUC* Setting (°C)	UUC* reading (°C)		Stability ± (°C)	Uniformity ± (°C)	Overall Variation ± (°C)
	MIN	MAX			
104.0	104.0	104.0	0.090	0.18	0.38
140.0	140.0	140.1	0.075	0.28	0.47
180.0	180.0	180.1	0.13	0.48	0.88

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

UUC* = Unit Under Calibration

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

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

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

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

----- End -----

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

3388 Siriraj Building, 25th - 26th Floor, Unit No. 3388/90, Rama IV Road, Klongtoey, Bangkok, Thailand 10110
Tel: +66(0) 2460 0000 Fax: +66(0) 2460 0001
www.hanna-instruments.com

เอกสารไม่ควบคุม



Hanna Instruments (Thailand) Ltd.
410/67-68 Soi Ratchadapisek 24, Ratchadapisek Rd., Samen-ek,
Huaykwang, Bangkok 10310 Tel: 0-2541-4199 Fax: 0-2541-4198



Certificate No.: HIT-2413-0434

Page: 1 of 2

CERTIFICATE OF CALIBRATION

Equipment: COD Test Tube Heater
Meter Model: H1839800-02 Serial No.: 06480019101
Tube Heater: 25 Vial Capacity Resolution: 0.1 °C
Temperature Range: (-10 to 160) °C Temperature of Reaction: 150 °C
Manufacturer: Hanna Instruments Made in: Romania
Condition As-Received: Used Product Reference: RE240528
Ambient Temperature: (25 ± 2) °C Relative Humidity: (50 ± 15) %RH
Customer name: United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Rd., Bangchak,
Phrakhanong, Bangkok 10260
Received date: 25 March 2024
Calibrate date: 25 March 2024
Issue date: 27 March 2024
Calibrated Location: Hanna Instruments (Thailand) Ltd.
Calibration Procedure: This calibrator was conducted by using in-house: calibration procedure CP-04 by using certified reference standard instruments.

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

Approved by:
Mr. Anan Suwanchaisakul
Authorized Signatory



This certificate was certified only for the instrument we calibrated.

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

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

approval of the head of Hanna Instrument (Thailand).

เอกสารไม่ควบคุม



Certificate No.: HIT-2413-0434

Page: 2 of 2

Condition of this calibration result:

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

Instruments	Model	Serial No.	Certificate No.	Traceable
Data Acquisition Switch Unit	34970A	MY44065265	WK2307-164-1	WK Electric Co., Ltd.
Digital Thermohygrometer	HT-771SD	AL07135	24H41	Technology Promotion Association (Thailand-Japan).

Calibration Result:

Measurement Temperature Source Accuracy for COD Reactor.

Capacity (Vial)	Nominal Value (°C)	Average Value (°C)	Uncertainty of Measurement (± °C)
25 Vial	150.0	150.0	0.50

Unit: °C

(1A)	(2A)	(3A)	(4A)	(5A)
149.477	149.183	150.029	150.627	149.731
(1B)	(2B)	(3B)	(4B)	(5B)
149.845	150.325	150.275	149.688	150.599
(1C)	(2C)	(3C)	(4C)	(5C)
149.869	150.077	150.571	150.217	150.409
(1D)	(2D)	(3D)	(4D)	(5D)
149.295	150.434	150.347	150.243	150.390
(1E)	(2E)	(3E)	(4E)	(5E)
149.911	149.301	150.232	150.162	149.418

Figure: Shows the location of the temperature source.

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

** End of certificate **

เอกสารไม่ควบคุม

FOSS

Customer Service Report

FOSS South East Asia
3388 Siriraj Building, 25th - 26th Floor, Unit No. 3388/90,
Rama IV Road, Klongtoey, Bangkok, Thailand 10110

Report No: 9809

Date: 8 Feb 2024
Customer: UAE
Instrument: DT2520

Address: BANGLA
Serial: 91374467

Hours	Travel To Customer	Labour	Travel From Customer
Start	08:00	14:00	15:00
Finish	09:10	15:00	15:00

Application		Special	Standard
Normal	Installation	Courtesy Visit	Training
Distributor	Quote	PMA Onboarding	In House
Internal	Repair	Warranty	PM
Digital Service	Remote	Sales Support	Other

PQ/Quote Number: If applicable

PMA Type: FOSS (PMA) If applicable Contract No. If applicable

Details of Work / Test	Condition / Status
1. DT2520	
- ตรวจสอบสายไฟ	
- ตรวจสอบ connection	
- วัดอุณหภูมิ cable kit, temp set point	
- ตรวจสอบ cable kit	
- 30.0 - 100.0 °C	
- 30.0 - 40.0 °C = 4.7 min	
- 100.0 - 150.0 °C = 4.7 min	

Instrument Ready for Use ☒ OK ☐ Not OK If not OK - Comment

Part No.	Batch	Description	Qty
50039452	1.5.0.0.2023	Cable kit detector	1
10016674	01.01.2023	Temperature control	

I confirm this report is accurate and complete
Signed FOSS:
Signed Customer:
Name:
Would you be willing to participate in a brief survey in order to tell us how we performed? ☐ Email:

เอกสารไม่ควบคุม

FOSS

Customer Service Report

Date: 9 Feb 2024		Report No: 9810																																																					
Customer: UAE		Address: Bangkok																																																					
Instrument: KT200		Serial: 91290524																																																					
Hours	Travel To Customer	Labour	Travel From Customer																																																				
Start	08:00	09:30	15:00																																																				
Finish	09:30	12:00	16:30																																																				
<table><thead><tr><th colspan="2">Application</th><th>Special</th><th colspan="2">Standard</th></tr></thead><tbody><tr><td>Normal</td><td><input type="checkbox"/></td><td>Courtesy Visit</td><td><input type="checkbox"/></td><td>Installation</td><td><input type="checkbox"/></td><td>Training</td><td><input type="checkbox"/></td></tr><tr><td>Distributor</td><td><input type="checkbox"/></td><td>PMA Onboarding</td><td><input type="checkbox"/></td><td>Quota</td><td><input type="checkbox"/></td><td>In House</td><td><input type="checkbox"/></td></tr><tr><td>Internal</td><td><input type="checkbox"/></td><td>Warranty</td><td><input type="checkbox"/></td><td>Repair</td><td><input type="checkbox"/></td><td>PW</td><td><input checked="" type="checkbox"/></td></tr><tr><td>Digital Service</td><td><input type="checkbox"/></td><td>Sales Support</td><td><input type="checkbox"/></td><td>Remote</td><td><input type="checkbox"/></td><td>Other</td><td><input type="checkbox"/></td></tr></tbody></table>				Application		Special	Standard		Normal	<input type="checkbox"/>	Courtesy Visit	<input type="checkbox"/>	Installation	<input type="checkbox"/>	Training	<input type="checkbox"/>	Distributor	<input type="checkbox"/>	PMA Onboarding	<input type="checkbox"/>	Quota	<input type="checkbox"/>	In House	<input type="checkbox"/>	Internal	<input type="checkbox"/>	Warranty	<input type="checkbox"/>	Repair	<input type="checkbox"/>	PW	<input checked="" type="checkbox"/>	Digital Service	<input type="checkbox"/>	Sales Support	<input type="checkbox"/>	Remote	<input type="checkbox"/>	Other	<input type="checkbox"/>															
Application		Special	Standard																																																				
Normal	<input type="checkbox"/>	Courtesy Visit	<input type="checkbox"/>	Installation	<input type="checkbox"/>	Training	<input type="checkbox"/>																																																
Distributor	<input type="checkbox"/>	PMA Onboarding	<input type="checkbox"/>	Quota	<input type="checkbox"/>	In House	<input type="checkbox"/>																																																
Internal	<input type="checkbox"/>	Warranty	<input type="checkbox"/>	Repair	<input type="checkbox"/>	PW	<input checked="" type="checkbox"/>																																																
Digital Service	<input type="checkbox"/>	Sales Support	<input type="checkbox"/>	Remote	<input type="checkbox"/>	Other	<input type="checkbox"/>																																																
PO/Quote Number:		If applicable																																																					
PMA Type		FOSS/ITEC	If applicable																																																				
Contract No.		If applicable																																																					
<table><thead><tr><th>Details of Work / Test</th><th>Condition / Status</th></tr></thead><tbody><tr><td># PM KT200</td><td></td></tr><tr><td>- ตรวจสอบสถานะการทำงานของเครื่อง</td><td></td></tr><tr><td>- ตรวจสอบระดับสารเคมี</td><td></td></tr><tr><td>- ตรวจสอบระดับน้ำยา</td><td></td></tr><tr><td>- ตรวจสอบระดับน้ำยา</td><td></td></tr><tr><td>- ตรวจสอบระดับน้ำยา</td><td></td></tr><tr><td># ตรวจสอบความพร้อมของเครื่อง</td><td></td></tr><tr><td>1000225 สารเคมี</td><td>Complete</td></tr><tr><td>1000225 สารเคมี</td><td>Complete</td></tr><tr><td>Instrument Ready for Use</td><td><input checked="" type="checkbox"/> OK <input type="checkbox"/> Not OK</td></tr><tr><td colspan="2">If not OK - Comment</td></tr><tr><td>Part No:</td><td>Batch</td><td>Description</td><td>Qty</td></tr><tr><td>1000985</td><td>14.12.2020</td><td>Foss PM kit KT200 Leica Analyst 800</td><td>1</td></tr><tr><td colspan="4">I confirm this report is accurate and complete</td></tr><tr><td>Signed FOSS</td><td></td><td>Signed Customer</td><td></td></tr><tr><td>Name</td><td></td><td>Name</td><td></td></tr><tr><td colspan="4">Would you be willing to participate in a brief survey in order to tell us how we performed?</td></tr><tr><td colspan="4">Email</td></tr></tbody></table>				Details of Work / Test	Condition / Status	# PM KT200		- ตรวจสอบสถานะการทำงานของเครื่อง		- ตรวจสอบระดับสารเคมี		- ตรวจสอบระดับน้ำยา		- ตรวจสอบระดับน้ำยา		- ตรวจสอบระดับน้ำยา		# ตรวจสอบความพร้อมของเครื่อง		1000225 สารเคมี	Complete	1000225 สารเคมี	Complete	Instrument Ready for Use	<input checked="" type="checkbox"/> OK <input type="checkbox"/> Not OK	If not OK - Comment		Part No:	Batch	Description	Qty	1000985	14.12.2020	Foss PM kit KT200 Leica Analyst 800	1	I confirm this report is accurate and complete				Signed FOSS		Signed Customer		Name		Name		Would you be willing to participate in a brief survey in order to tell us how we performed?				Email			
Details of Work / Test	Condition / Status																																																						
# PM KT200																																																							
- ตรวจสอบสถานะการทำงานของเครื่อง																																																							
- ตรวจสอบระดับสารเคมี																																																							
- ตรวจสอบระดับน้ำยา																																																							
- ตรวจสอบระดับน้ำยา																																																							
- ตรวจสอบระดับน้ำยา																																																							
# ตรวจสอบความพร้อมของเครื่อง																																																							
1000225 สารเคมี	Complete																																																						
1000225 สารเคมี	Complete																																																						
Instrument Ready for Use	<input checked="" type="checkbox"/> OK <input type="checkbox"/> Not OK																																																						
If not OK - Comment																																																							
Part No:	Batch	Description	Qty																																																				
1000985	14.12.2020	Foss PM kit KT200 Leica Analyst 800	1																																																				
I confirm this report is accurate and complete																																																							
Signed FOSS		Signed Customer																																																					
Name		Name																																																					
Would you be willing to participate in a brief survey in order to tell us how we performed?																																																							
Email																																																							

เอกสารไม่ควบคุม

Agilent
CrossLab
From Insight to Outcome

Agilent 55 240 280 Series Atomic Absorption Spectroscopy Systems

Preventive Maintenance Checklist

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

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

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

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

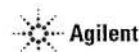
Introduction

Customer Information

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

Revision: 10.00, Issued: November 2021

© Agilent Technologies, Inc. 2021



เอกสารไม่ควบคุม

Agilent
CrossLab
From Insight to Outcome

Instrument Preventive Maintenance Checklist

Important Customer Web Links

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

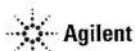
Service Engineer's Responsibilities

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

This information is subject to change without notice.

Revision: 10.00, Issued: November 2021

© Agilent Technologies, Inc. 2021



เอกสารไม่ควบคุม

Agilent
CrossLab
From Insight to Outcome

Instrument Preventive Maintenance Checklist

Instrument Maintenance

System Information

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

Instrument System Name and ID	
Instrument System Site and Location	UNITED ANALYST AND ENGINEERING CONSULTANT / 2nd Lab

List System Component Product Numbers	List the Serial Numbers of each Component
1. G 6472 A	17 016 0001
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	

Preparation, Safe operation and Initial performance checks

Revision: 10.00, Issued: November 2021

© Agilent Technologies, Inc. 2021



เอกสารไม่ควบคุม

Preventive Maintenance Procedures

FLAME SYSTEM section

☐ Section not applicableElectronic components

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

Mechanical components

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

Optics components

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

Revision: 10.00, Issued: November 2021
© Agilent Technologies, Inc. 2021

เอกสารไม่ควบคุม

Sample introduction and Atomization

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

Gas handling components and safety interlocks

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

Analytical performance for Flame systems

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

Revision: 10.00, Issued: November 2021
© Agilent Technologies, Inc. 2021

เอกสารไม่ควบคุม

FURNACE SYSTEM section

☒ Section not applicableElectronic components

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

Mechanical components

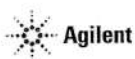
- ☐ Run SVD tests to exercise all motor drives over the full range of their travel:
 - ☐ Monochromator drive
 - ☐ Slit drive
 - ☐ Lamp selector

Optics components

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

Gas handling, water system and workhead component checks

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

Revision: 10.00, Issued: November 2021
© Agilent Technologies, Inc. 2021

เอกสารไม่ควบคุม

- ☐ Tube
- ☐ Electrodes
- ☐ Shroud

- ☐ Check and clean the end windows on the workhead.
- ☐ Check safety interlock operation.

Analytical performance for Furnace systems

- ☐ Optimize the instrument ready to perform Cu sensitivity test.
- ☐ Run the sensitivity test for a 25 ppb copper sample and record the results in the results table.

PSD autosampler accessory for Furnace systems

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

Sample introduction pump system (SIPS) accessory

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

Revision: 10.00, Issued: November 2021
© Agilent Technologies, Inc. 2021

เอกสารไม่ควบคุม

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

Sample preparation system (SPS 4) accessory☒ Section NOT Applicable

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

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

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

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

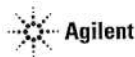
For further details refer to the SPS 4 service manual G8410-90050.

Sample preparation system (SPS 3) accessory☒ Section NOT Applicable

- ☐ Check the x-axis and z-axis timing belts – Replace if there is any cracks, splits or color deterioration and belt tension.
- ☐ Check belt tensions - adjust if required
- ☐ Check the lubrication pad for single x-axis shaft. If pad is dry or customer has observed any vibration or erratic movements of the x-axis carriage, add 1 mL of Dow Corning 200 0 Fluid, 200 CS into the well.
- ☐ Check the auto-sampler ability to find tube positions - Calibrate if required.
- ☐ Clean the exterior surfaces of the accessory with soft lint free cloth. This cloth can be dampened with warm water or a mild detergent. Do not use organic solvents or abrasive cleaning agents.

Revision: 10.00, Issued November 2021

© Agilent Technologies, Inc. 2021



เอกสารไม่ควบคุม

Signature Page

Service Review

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

Test Results

Test Description		
Flame optics PMT Gain test		
For copper at 324.8 nm, 4 mA, 0.5 nm slit width	< 55 %	44 %
Flame performance test with 5 ppm copper sample		
Air/acetylene, mixing paddle removed	Abs value > 0.5	0.7401 Abs
Air/acetylene, mixing paddle installed, 10 replicates	%RSD < 1.0	0.5 % RSD
Deuterium furnace optics PMT Gain test		
For copper at 324.8 nm, 4 mA, 0.5 nm slit width	< 55 %	55 %
Deuterium furnace performance test with 25 ppb copper sample (327.4 nm)		
Precision %RSD	≤ 4.0%	3.4 %
Abs value	≥ 0.15	0.17 Abs
Zeeman furnace analytical performance: 25 ppb copper sample (327.4 nm)		
Precision %RSD	≤ 4.0%	3.4 %
Abs value	≥ 0.10	0.14 Abs
MSR%	≤ 70 %	62 %

Revision: 10.00, Issued November 2021

© Agilent Technologies, Inc. 2021



เอกสารไม่ควบคุม

Vapor generation accessory VGA (hydride generator)☒ Section NOT Applicable

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

UltrAA lamp accessory (external)☒ Section NOT Applicable

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

Restore System

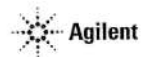
- ☒ If you have altered the customer's instrumentation during the course of PM, restore to the original status to allow the customer to conduct their normal activities (e.g., reload the customer's method.)

Guidance

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

Revision: 10.00, Issued November 2021

© Agilent Technologies, Inc. 2021



เอกสารไม่ควบคุม

AA consumable and parts list table

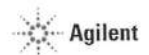
Part Description		Product/Model # where used	PM supplied or Consumable	Instrument-Type
Test Solution - Cu Spmn solution	6610030100	50 55 140 240 280	PM supplied	Common
Test Solution - Blank solution	5190-7001	50 55 140 240 280	PM supplied	Common
Copper, 1000 ug/ml, 100ml	5190-6279	50 55 140 240 280	*	Common
Kit, Mix 7 O-rings, aqueous, complete set	9910093400	50 55 140 240 280	PM supplied	Flame
Organic Kit	9910093500	50 55 140 240 280	PM supplied	Flame
Wire Nebulizer Cleaning	9910024700	50 55 140 240 280	consumable	Flame
Tubing-Capillary Std Nebis	9910024800	50 55 140 240 280	consumable	Flame
Capillary Tube Hvac Neb (3) (organics only)	9910044000	50 55 140 240 280	consumable	Flame
Glass impact beads (5 pk)	9910025700	50 55 140 240 280	consumable	Flame
Teflon impact beads (5 pk) (organics only)	9910053300	50 55 140 240 280	consumable	Flame
Burner cleaning strip (100 pk)	9910053900	50 55 140 240 280	consumable	Flame
Window UV silica - round (right side)	2610082600	50 55 140 240 280	PM supplied	Common
Window UV silica - rectangular (left side)	2010082500	50 55 140 240 280	PM supplied	Common
Pad adhesive window (round)	4910012700	50 55 140 240 280	PM supplied	Common
Pad adhesive window (rectangular)	4910012800	50 55 140 240 280	PM supplied	Common
Electrode kit (1 pr) (D2)	6310003400	GTA120	PM supplied	Furnace
Shroud (D2)	6310003100	GTA120	PM supplied	Furnace
Zeeman electrode kit (1 pr)	6310003500	GTA120	PM supplied	Furnace
Zeeman shroud	6310003600	GTA120	PM supplied	Furnace
O-ring PSD rinse bottle	6910025900	PSD120	PM supplied	Furnace

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

Items classified as PM supplied in the above table are included in the standard PM. Those classified as consumable should be provided by the customer or charged to the customer if supplied by the Agilent service engineer.

Revision: 10.00, Issued November 2021

© Agilent Technologies, Inc. 2021



เอกสารไม่ควบคุม

Service Engineer Comments (optional)

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

Service Completion

Service request number 6006371115

Date service completed 24 January 2024

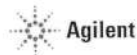
Agilent signature Worawit T.

Customer signature Janda

Total number of pages in this document 13

Revision: 10.00, Issued: November 2021

© Agilent Technologies, Inc. 2021



เอกสารไม่ควบคุม

SVD Results Report



Report ID: Diagnostic Start Time: 1/24/2024 9:41:24 AM Diagnostic End Time: 1/24/2024 10:05:56 AM

Customer: Service Engineer: Worawit T.
Address: Contact Details:

Instrument Configuration

Configuration:

Serial Number: MY13160001 Turret Type: Automatic
Instrument Model: Varian AA140/240/280 Number Of Lamps: 4
Flame Instrument: True Mono Type: Automatic
Furnace Instrument: True Gasbox Type: "Y" Gas Box
Zeeman Present: False Auto Burner Adjuster: False
Internal Zeeman: False Mains Frequency: 50
Internal UltraAA: False Firmware Version: 2.11
Optics Type: Double Beam Photomultiplier Type: Normal(900nm)
D2 BG Correction Fitted: True PWB Version: 45
Boot Block Version: 1.09

EEPROM Data:

Instrument Run Hours: 62609.832 D2 Run Hours: 49136.000
Zero Wavelength Offset: 30.146 D2 Serial Number: not set
Mono Correction: 0.765 D2 Install Date: 1/1/1970
Flame Hours: 29802.416 D2 Original Intensity: 1.000
D2 Last Intensity: 475.000

Frequency:

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

Result: Passed

Report Generated At: 1/24/2024 10:11:18 AM

1

SVD Results Report SVD

เอกสารไม่ควบคุม

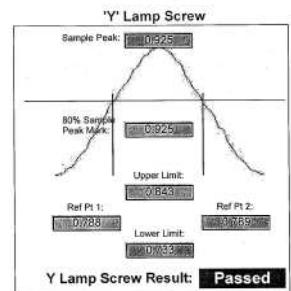
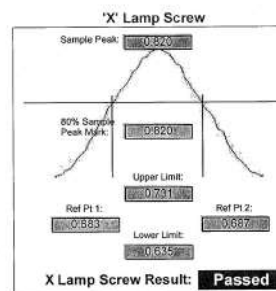
Power Supply:

Averaging Period: 30.0
Datapoint Count: 20

	Lower Limit (V)	Actual (V)	Upper Limit (V)	Result:
12.00 V Rail	10.80	12.19	13.20	Passed
-12.00 V Rail	-13.20	-11.90	-10.80	Passed
5.00 V Rail	4.50	5.05	5.50	Passed
310.00 V Rail	279.00	320.00	341.00	Passed

Optics

Beam Balance:

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

Grating Squareness:

Lamp Element(s): Copper
Lamp Turret Position: 3
Lamp Current(mA): 4.00
Slit Width(nm): 0.5
1st Order Wavelength(nm): 324.80
Lamp Alignment: Performed

	Lower Limit (nm)	Actual (nm)	Upper Limit (nm)	Result:
Zero Order	-0.10	0.00	0.10	Passed
First Order	324.45	324.75	325.15	Passed
Second Order	649.23	649.52	649.97	Passed

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Wavelength Repeatability:

Lamp Used: Copper
Peak Used(nm): 324.750
Connected to Socket: 3

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

Lamp Alignment: **Performed**

Lower Limit(nm) 324.758 324.888 Upper Limit(nm)

(Approach from Zero Order)

(Approach from end)

Sample 1: 324.828 Sample 2: 324.828

Sample 3: 324.828 Sample 4: 324.823

Sample 5: 324.823 Sample 6: 324.823

Sample 7: 324.823 Sample 8: 324.823

Sample 9: 324.823 Sample 10: 324.823

Mean: 324.825

Standard Deviation: 0.002

Result: **Passed**

Mechanical

Wavelength Drive:

Passed

Slit Drive:

Passed

Turret Drive:

Passed

Auto Burner Adjuster Drive:

Untested

Miscellaneous

Signal Processing Linearity:

Calculate Mode: New Calc Mode

	Lower Limit	Actual	Upper Limit	Result:
S0	114	261	297	Passed
S1	156	165	191	Passed
S2	271	296	332	Passed
S3	474	507	579	Passed
S4	825	918	1008	Passed
S5	1435	1528	1754	Passed
S6	2498	2769	3053	Passed
S7	4347	4752	5313	Passed

Interlocks:

Burner Fitted: **Working**
N2O Burner Fitted: **Untested**
Flame Shield Closed: **Working**
Gas Control Fitted: **Untested**
Pressure Release Bung Fitted: **Working**
Liquid Trap Fitted: **Working**
Flame Detect: **Working**
GCU Active: **Working**
Oxidant Pressure: **Working**
Oxidant Changeover: **Untested**
Ignition: **Working**

Report Generated At: 1/24/2024 10:11:18 AM

4

SVD Results Report **SVD**
เอกสารไม่ควบคุม

Report Generated At: 1/24/2024 10:11:18 AM

5

SVD Results Report **SVD**
เอกสารไม่ควบคุม

Auto Lamp Recognition:

Lamp 1: Uncoded Lamp/Not Connected
Lamp 2: 87 - Silver/Cadmium/Lead/Zinc(UltrAA) (Ag/C/Lamp 6: Not Supported
Lamp 3: 14 - Copper (Cu)
Lamp 4: Uncoded Lamp/Not Connected
Lamp 5: Not Supported
Lamp 7: Not Supported
Lamp 8: Not Supported

Result: **Passed**

GTA Temperature Monitoring:

Not Performed

Notes:

PM 24 Jan 2024

Signatures:

David

Salilod

Date

Worawit T.

Date

24/1/24

Date

Sequential by time report

1/24/2024 11:46 AM

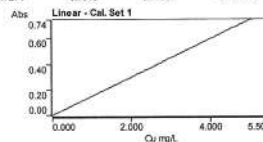
SpectrAA

Page 1 of 1

Analyst
Date Started 1/24/2024 11:39 AM GMT: 1/24/2024 4:39 AM
Worksheet
Comment Cu 5 PPM Sense check
Method Cu
Computer name DESKTOP-R9UJFRS
Serial Number MY13160001

Method: Cu (Flame)

Sample ID	Conc mg/L	%RSD	Mean Abs
CAL ZERO	0.000	55.0	0.0003
Readings	0.0002	0.0002	0.0004
1/24/2024			
STANDARD 1	5.000	1.7	0.7419
Readings	0.7274	0.7515	0.7468
1/24/2024			



Curve Fit = Linear
Characteristic Conc = 0.028 mg/L
r = 1.0000
Calculated Conc = 0.000 5.000
Residuals = 0.000 0.000

Abs = 0.14833 x C + 0.00029

Sample 001	4.988	0.7	0.7401
Readings	0.7454	0.7389	0.7349
1/24/2024			

Report Generated At: 1/24/2024 10:11:18 AM

6

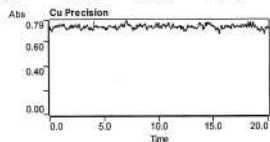
SVD Results Report **SVD**
เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Analyst
Date Started 1/24/2024 11:47 AM GMT: 1/24/2024 4:47 AM
Worksheet Cu 5 PPM Precision
Comment
Methods Cu
Computer name DESKTOP-R8UJRS
Serial Number: MY13160001

Method: Cu (Flame)

Sample ID	Exp Abs	%RSD	Mean Abs
Cu Precision	0.723	0.6	0.7232
Readings			
0.7221	0.7195	0.7225	0.7283
0.7201	0.7213	0.7265	0.7174
			1/24/2024



Agilent CrossLab Start Up Services

Agilent 5100 5110 ICP-OES Preventive Maintenance

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

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

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

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Introduction

Customer Information

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

Important Customer Web Links

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

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Service Engineer's Responsibilities

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

เอกสารไม่ควบคุม

Instrument Maintenance

System Information

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

Instrument System Name and ID	3100 VDV ICP-OES
Instrument System Site and Location	UNE

List System Component Product Numbers	List the Serial Numbers of each Component
1. G 3039A	N4 1903 0001
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	

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

เอกสารไม่ควบคุม

Preparation

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

เอกสารไม่ควบคุม

Preventive Maintenance Procedures

Record Pre-PM instrument performance

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

Clean and inspect ICP-OES system

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

Agilent Water Recirculator

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

เอกสารไม่ควบคุม

SPS 3 Auto Sampler

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

SPS 4 Auto sampler

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

AVS 4, 6, 7 Advanced Valve System

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

เอกสารไม่ควบคุม

ICP-OES adjustment

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

Record Post-PM instrument performance

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

เอกสารไม่ควบคุม

Restore Instrument

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

Service Review

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

เอกสารไม่ควบคุม

Test Results

Instrument Performance Test Results Table

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

	Pre PM Sensitivity Check		Post PM Sensitivity Check	
	Radial	Axial*	Radial	Axial*
Zn 213.857 nm SRBR	4190.3	6649.9	4700.6	7364.2
Mn 257.610 nm SRBR	15681.0	23295.3	14569.1	29992.5
Al 396.152 nm SBR	12.1	14.6	11.3	15.6
K 766.491 nm SBR	8.0	31.2	7.4	39.7

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

Instrument Test Results Table

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

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

เอกสารไม่ควบคุม

ICP-OES Status Results Table

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

Measurement	Standby Mode	Plasma On
Mains Voltage	225.153 VAC	226.613 VAC
Mains Current	0.090 A	0.219 A
Instrument Temperature	24.0 °C	25.1 °C
RF Air Flow (sensor speed)	15.0 Hz	19.0 Hz
Plasma Exhaust Temperature	No measurement	39.2 °C
Water Flow Oscillator	No measurement	1.32 L/min
Water Flow Detector	0.94 L/min	0.91 L/min
Water Inlet Temperature	17.3 °C	17.3 °C
Polychromator Temperature	35.0 °C	35.0 °C
OCD Temperature	-39.8 °C	-39.8 °C
Thermal Stabilizer	35.0 °C	35.0 °C
Argon Supply Pressure	659.52 kPa	608.63 kPa
Purge Gas Supply Pressure*1	656.41 kPa	627.71 kPa
Option Gas Supply Pressure*1	- kPa	- kPa
Nebulizer Flow	No measurement	0.70 L/min
Nebulizer Back Pressure	No measurement	166.30 kPa
Plasma Gas Flow	No measurement	11.98 L/min
Auxiliary Gas Flow	No measurement	1.00 L/min
RF Power	No measurement	1199.5 W
RF Supply Current	No measurement	5.223 A
RF Supply Voltage	No measurement	194.481 V

*1 If option installed

เอกสารไม่ควบคุม

Consumed PM Parts

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

Consumed Parts Reference

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

☐ Section Not Applicable

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

เอกสารไม่ควบคุม

Signature Page

Service Engineer Comments (optional)

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

Service Verification

 Service Request Number:
6006371120
 Service Engineer Name:
Kanyakorn S.
 Service Engineer Signature:
Kanyakorn S.
 Total number of pages in this document:
14

Date Service Completed:

15 Nov 2023

Customer Name:

Aphorn Onkong

Customer Signature:

Aphorn Onkong

เอกสารไม่ควบคุม

Report Summary	
Instrument Model	Agilent 5100/5110 VDV ICP-OES
Instrument ID	G8011A/G8015A
Instrument Serial Number	MY18030001
Software Version	7.3.1.9507
Firmware Version	3442
Tested By	Kanyakorn S.
Test Completed On	11/13/2023 9:18:24 AM
Result Summary	
Subsystem Communications Test	Skipped
Air Flow Test	Skipped
Water Flow Test	Skipped
Gas Flows Test	Skipped
RF Generator Test	Skipped
Camera Test	Skipped
Optics Test	Skipped
Advanced Valve System Test	Skipped
Resolution Test	Pass
Sensitivity Test	Fail
Precision Test	Pass

เอกสารไม่ควบคุม

Resolution Test			Pass
Element Wavelength	Specification	Width	
N (174.213 nm)	≤ 9.40	6.92	
As (188.980 nm)	≤ 8.20	6.12	
C (193.027 nm)	≤ 11.50	8.31	
Mo (202.032 nm)	≤ 8.20	6.35	
Cr (206.158 nm)	≤ 13.40	8.99	
Zn (213.857 nm)	≤ 8.70	6.64	
Pb (220.353 nm)	≤ 9.50	7.00	
Co (228.615 nm)	≤ 17.20	11.68	
Ba (230.424 nm)	≤ 9.40	7.27	
Mn (257.610 nm)	≤ 13.30	9.46	
Mn (260.568 nm)	≤ 20.30	14.18	
Cr (267.716 nm)	≤ 11.00	8.01	
Cu (324.754 nm)	≤ 25.00	18.89	
Cu (327.395 nm)	≤ 14.20	11.29	
Sr (338.071 nm)	≤ 33.50	24.46	
Ba (455.403 nm)	≤ 44.00	33.62	
Sr (460.733 nm)	≤ 36.00	17.37	
Ba (493.408 nm)	≤ 36.00	25.47	
Ba (514.171 nm)	≤ 42.00	25.43	
Ar (675.283 nm)	≤ 74.00	60.50	
K (766.491 nm)	≤ 80.00	65.33	

Page 2 of 4

เอกสารไม่ควบคุม

Sensitivity Test			Fail		
Radial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 46.0	SRBR	142.0	958.5	41.7
Se (196.026 nm)	≥ 41.0	SRBR	105.9	937.4	67.5
Zn (213.857 nm)	≥ 1421.0	SRBR	4190.3	44372.5	111.6
Pb (220.353 nm)	≥ 46.0	SRBR	213.9	2521.3	125.4
Mn (257.610 nm)	≥ 3518.0	SRBR	13681.0	279551.7	416.6
Al (396.152 nm)	≥ 3.4	SBR	12.1	52269.7	3994.3
Ba (493.408 nm)	≥ 34.0	SBR	185.8	2294372.8	12280.0
K (766.491 nm)	≥ 1.8	SBR	8.0	107401.4	11876.7
Axial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 208.0	SRBR	189.4	2285.0	129.5
Se (196.026 nm)	≥ 159.0	SRBR	168.7	2813.7	233.8
Zn (206.200 nm)	≥ 234.0	SRBR	905.0	10156.4	123.0
Zn (213.857 nm)	≥ 1743.0	SRBR	6849.9	135760.6	390.5
Cd (214.439 nm)	≥ 4227.0	SRBR	5597.6	92921.3	273.9
Pb (220.353 nm)	≥ 320.0	SRBR	454.8	10111.2	451.1
Mn (257.610 nm)	≥ 10625.0	SRBR	27295.3	1126118.1	1697.0
Cr (267.716 nm)	≥ 1048.0	SRBR	3948.2	144875.3	1322.0
Cu (324.754 nm)	≥ 19.0	SBR	49.2	341489.7	6798.2
Al (396.152 nm)	≥ 6.0	SBR	14.6	235321.6	15043.9
Ba (493.408 nm)	≥ 60.0	SBR	103.3	8393101.3	45500.3
K (766.491 nm)	≥ 24.0	SBR	31.2	1447045.2	44917.1

Page 3 of 4

เอกสารไม่ควบคุม

Precision Test			Pass
Radial			
Element Wavelength	Specification	Measured Value % RSD	
As (188.980 nm)	≤ 2.60	1.22	
Se (196.026 nm)	≤ 2.60	0.76	
Zn (213.857 nm)	≤ 1.50	0.33	
Pb (220.353 nm)	≤ 2.60	0.86	
Mn (257.610 nm)	≤ 1.50	0.45	
Al (396.152 nm)	≤ 1.50	0.37	
Ba (493.408 nm)	≤ 1.50	0.68	
K (766.491 nm)	≤ 1.50	0.33	
Axial			
Element Wavelength	Specification	Measured Value % RSD	
As (188.980 nm)	≤ 1.50	0.63	
Se (196.026 nm)	≤ 1.50	0.87	
Zn (206.200 nm)	≤ 1.50	0.59	
Zn (213.857 nm)	≤ 1.50	0.46	
Cd (214.439 nm)	≤ 1.50	0.70	
Pb (220.353 nm)	≤ 1.50	0.36	
Mn (257.610 nm)	≤ 1.50	0.95	
Cr (267.716 nm)	≤ 1.50	0.56	
Cu (324.754 nm)	≤ 1.50	0.69	
Al (396.152 nm)	≤ 1.50	0.63	
Ba (493.408 nm)	≤ 1.50	0.86	
K (766.491 nm)	≤ 1.50	1.13	

Page 4 of 4

เอกสารไม่ควบคุม

Report Summary	
Instrument Model	Agilent 5100/5110 VDV ICP-OES
Instrument ID	G6011A/G6015A
Instrument Serial Number	MY18030001
Software Version	7.3.1.9507
Firmware Version	3442
Tested By	Kanyakorn S.
Test Completed On	11/13/2023 11:10:02 AM
Result Summary	
Subsystem Communications Test	Pass
Air Flow Test	Skipped
Water Flow Test	Skipped
Gas Flows Test	Skipped
RF Generator Test	Skipped
Camera Test	Skipped
Optics Test	Pass
Advanced Valve System Test	Skipped
Resolution Test	Pass
Sensitivity Test	Pass
Precision Test	Pass
Subsystem Communications Test	Pass
Optics Test	
	Pass
Intensity	Radial 3522064 Axial 4003312
Wavelength	Radial 737.212 Axial 737.212

Page 1 of 4

เอกสารไม่ควบคุม

Resolution Test			Pass
Element Wavelength	Specification	Width	
N (174.213 nm)	≤ 9.40	6.92	
As (188.980 nm)	≤ 8.20	6.08	
C (193.027 nm)	≤ 11.50	8.33	
Mo (202.032 nm)	≤ 8.20	6.31	
Cr (206.158 nm)	≤ 13.40	8.98	
Zn (213.857 nm)	≤ 8.70	6.73	
Pb (220.353 nm)	≤ 9.50	7.02	
Co (228.615 nm)	≤ 17.20	11.65	
Ba (230.424 nm)	≤ 9.40	7.38	
Mn (257.610 nm)	≤ 13.30	9.46	
Mn (260.568 nm)	≤ 20.30	14.05	
Cr (267.716 nm)	≤ 11.00	7.92	
Cu (324.754 nm)	≤ 25.00	18.84	
Cu (327.395 nm)	≤ 14.20	11.31	
Sr (338.071 nm)	≤ 33.50	24.18	
Ba (455.403 nm)	≤ 44.00	33.28	
Sr (460.733 nm)	≤ 36.00	17.41	
Ba (493.408 nm)	≤ 36.00	25.43	
Ba (514.171 nm)	≤ 42.00	25.27	
Ar (675.263 nm)	≤ 74.00	56.87	
K (766.491 nm)	≤ 80.00	65.88	

Page 2 of 4

เอกสารไม่ควบคุม

Sensitivity Test						Pass
Radial						
Element Wavelength	Specification	Method	Ratio	Standard	Blank	
As (188.980 nm)	≥ 46.0	SRBR	168.6	1264.6	53.3	
Se (196.026 nm)	≥ 41.0	SRBR	122.4	1256.0	90.7	
Zn (213.857 nm)	≥ 1421.0	SRBR	4700.8	53870.1	130.7	
Pb (220.353 nm)	≥ 46.0	SRBR	236.0	3100.6	155.7	
Mn (257.610 nm)	≥ 3518.0	SRBR	14569.1	318398.1	476.2	
Al (396.152 nm)	≥ 3.4	SBR	11.5	59510.5	4761.6	
Ba (493.408 nm)	≥ 34.0	SBR	170.6	2490835.6	14514.2	
K (766.491 nm)	≥ 1.8	SBR	7.4	117698.7	14024.1	
Axial						
Element Wavelength	Specification	Method	Ratio	Standard	Blank	
As (188.980 nm)	≥ 208.0	SRBR	214.5	2706.2	142.8	
Se (196.026 nm)	≥ 159.0	SRBR	188.0	3262.8	255.9	
Zn (206.200 nm)	≥ 234.0	SRBR	1088.2	12794.8	135.3	
Zn (213.857 nm)	≥ 1743.0	SRBR	7564.2	155883.9	427.8	
Cd (214.439 nm)	≥ 4227.0	SRBR	6647.3	116281.7	304.4	
Pb (220.353 nm)	≥ 320.0	SRBR	519.3	12490.2	530.3	
Mn (257.610 nm)	≥ 10625.0	SRBR	29992.5	1305852.5	1890.2	
Cr (267.716 nm)	≥ 1048.0	SRBR	4366.6	173343.4	1547.9	
Cu (324.754 nm)	≥ 19.0	SBR	46.8	361093.0	7560.5	
Al (396.152 nm)	≥ 6.0	SBR	15.6	274029.5	16498.6	
Ba (493.408 nm)	≥ 60.0	SBR	203.6	9028914.5	44122.1	
K (766.491 nm)	≥ 24.0	SBR	39.7	1701521.4	41771.8	

Page 3 of 4

เอกสารไม่ควบคุม

Precision Test			Pass
Radial			
Element Wavelength	Specification	Measured Value % RSD	
As (188.980 nm)	≤ 2.60	0.85	
Se (196.026 nm)	≤ 2.60	1.26	
Zn (213.857 nm)	≤ 1.50	0.42	
Pb (220.353 nm)	≤ 2.60	0.54	
Mn (257.610 nm)	≤ 1.50	0.60	
Al (396.152 nm)	≤ 1.50	0.47	
Ba (493.408 nm)	≤ 1.50	0.68	
K (766.491 nm)	≤ 1.50	0.50	
Axial			
Element Wavelength	Specification	Measured Value % RSD	
As (188.980 nm)	≤ 1.50	0.42	
Se (196.026 nm)	≤ 1.50	0.66	
Zn (206.200 nm)	≤ 1.50	0.42	
Zn (213.857 nm)	≤ 1.50	0.54	
Cd (214.439 nm)	≤ 1.50	0.42	
Pb (220.353 nm)	≤ 1.50	0.22	
Mn (257.610 nm)	≤ 1.50	0.54	
Cr (267.716 nm)	≤ 1.50	0.49	
Cu (324.754 nm)	≤ 1.50	0.85	
Al (396.152 nm)	≤ 1.50	0.61	
Ba (493.408 nm)	≤ 1.50	0.78	
K (766.491 nm)	≤ 1.50	1.00	

Page 4 of 4

เอกสารไม่ควบคุม

Report Summary		
Instrument Model	Agilent 5100/5110 VDV ICP-OES	
Instrument ID	G8011A/G8015A	
Instrument Serial Number	MY18030001	
Software Version	7.3.1.9507	
Firmware Version	3442	
Tested By	Kanyakorn S.	
Test Completed On	11/13/2023 11:15:43 AM	
Result Summary		
Subsystem Communications Test	Pass	
Air Flow Test	Pass	
Water Flow Test	Pass	
Gas Flows Test	Pass	
RF Generator Test	Pass	
Camera Test	Pass	
Optics Test	Skipped	
Advanced Valve System Test	Skipped	
Resolution Test	Skipped	
Sensitivity Test	Skipped	
Precision Test	Skipped	
Subsystem Communications Test	Pass	
Air Flow Test	Pass	
30% Air Flow (relative speed)	75% Air Flow (relative speed)	
14.00	20.00	
Water Flow Test	Pass	
RF Water Flow(L/min)	Camera Water Flow (L/min)	Water Inlet Temperature (°C)
1.27	0.61	20.37

Page 1 of 2

เอกสารไม่ควบคุม

Gas Flows Test			Pass		
Nebulizer Target Flow	Actual Flow	Back Pressure	Auxiliary Target Flow	Actual Flow	Back Pressure
0.70	0.70	271.62	2.00	2.00	111.13
Makeup Target Flow	Actual Flow	Back Pressure	Plasma Target Flow	Actual Flow	Back Pressure
2.00	2.00	116.00	18.00	17.94	23.11
RF Generator Test			Pass		
RF Power Supply Test		Passed			
RF Power Supply (V)		147.380			
RF Oscillator Test		Passed			
RF Oscillator Frequency (MHz)		25.843			
Work Coil Current (A)		44.410			
RF Power Supply Current (A)		1.999			
Camera Test			Pass		
	Integration Time (ms)	Standard Deviation	Status		
Electronic Offset Test	1000	5.361	Passed		
Dark Current Test	6000	0.779	Passed		
Array Test	5	0.025	Passed		
Linearity Test		0.118	Passed		

Page 2 of 2

เอกสารไม่ควบคุม

UNITED ANALYST AND ENGINEERING CONSULTANT COMPANY Ltd.

Automatic Mercury Analyzer

Model RA-4500

Preventive Maintenance Report

Serial No. : 17780278

Soft version : Ver 2.0.7

ROM version : Ver 2.0.1

Date : 09 July 2024

PM by : Pradit Mayong

(Pradit M.)

Approved by : Kitichai S.

(Kitichai S.)



Coax Group Corporation Ltd.

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

Kwang Thanon Nakornchaisri, Dusit, Bangkok 10300 Thailand

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

เอกสารไม่ควบคุม

Inspection result

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

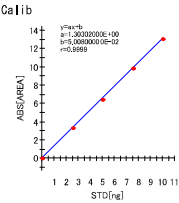
เอกสารไม่ควบคุม

Counter

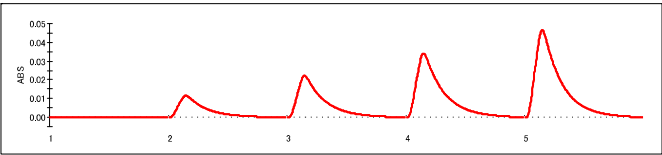
Measurement Count	2057122-09-08	Clear	F1 Subst(H2)2000h	0900h24-07-08	Clear
Mercury Exhaust Filter Amount(mg)1500mg	122-09-08	Clear	F2 Subst(H2)2000h	0901h24-07-08	Clear
Lamp Active Time(3000h)	1h13m24-07-08	Clear	F3 Subst(H2)2000h	0902h24-07-08	Clear
Membrane Filter Usage Time(2000h)	0909h24-07-08	Clear	F4 Subst(H2)2000h	0903h24-07-08	Clear
		Clear	F5 Subst(H2)2000h	0904h24-07-08	Clear
Water Pump Subst(750h)	0909h24-07-08	Clear	F6 Subst(H2)2000h	0905h24-07-08	Clear
Heating Lamp Time	500h24-07-08	Clear	F7 Subst(H2)2000h	0906h24-07-08	Clear

เอกสารไม่ควบคุม

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

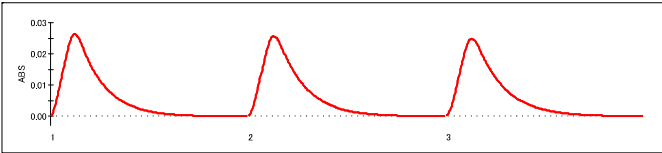


No.	STD [ppb]	SVOL [mL]	CVOL [mL]	DVOL [mL]	STD [ng]	AREA [ON]	MEAS [ng]	Dev [%]	Note
1	100.000	0.000	5.000	5.000	0.000	0.0846	0.0265	-	
2	100.000	0.025	5.000	5.000	2.500	3.3464	2.5298	1.2	
3	100.000	0.050	5.000	5.000	5.000	6.4170	4.8863	2.3	
4	100.000	0.075	5.000	5.000	7.500	9.8647	7.5322	0.4	
5	100.000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



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

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



Self Check
Heat check: PASS!! (26, 3degC[05:00] -> 30, 3degC[02:29])
Sensor check: PASS!! (53- [0- 43])
Leak check: PASS!! (0.19L/min)
Sig/Ref check: PASS!! (Sig: 4.00V, Ref: 4.02V)
Drift check: PASS!! (0.000061 - -0.000017g = 0.0000240)

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

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

