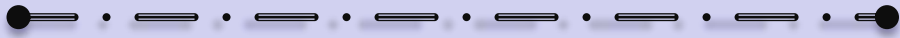


ภาคผนวก จ



เอกสารเทียบเครื่องมือที่ใช้ในการตรวจวิเคราะห์

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
1	Orifice Transfer Standard Calibrator	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Andersen Instruments, Inc.	G25A 1901	Jiranatee Associates Co., Ltd.	COF-002-66	14 Jul 23	13 Jul 25	-
2	U-Tube Manometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Dwyer	1221-36-W/M -	Technology Promotion Association (Thailand-Japan)	23P1401	9 May 23	8 May 24	-
3	Aneroid Barometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀) Hydrogen Sulphide	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	23P1859	2 Jun 23	1 Jun 24	-
4	Dial Thermo-Hygrometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀) Hydrogen Sulphide	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	23H1200	6 Jun 23	5 Jun 24	-
5	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i CM19050149	UAE Consultant Co.,Ltd.	01112023	1 Nov 23	31 Oct 24	-
6	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i CM19050150	UAE Consultant Co.,Ltd.	01112023	1 Nov 23	31 Oct 24	-
7	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i CM22177051	UAE Consultant Co.,Ltd.	21112023	21 Nov 23	20 Nov 24	-
8	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i CM22387035	UAE Consultant Co.,Ltd.	07112023	7 Nov 23	6 Nov 24	-
9	Standard Gases (Mixture)	Nitrogen Dioxide	Airgas	EB0143262 2015PSIG	Airgas an Air Liquide company	E04N99E15A01D3	21 Jun 21	21 Jun 24	-
10	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1201778115	UAE Consultant Co.,Ltd.	09112023	9 Nov 23	8 Nov 24	-
11	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1182920012	UAE Consultant Co.,Ltd.	03112023	3 Nov 23	2 Nov 24	-
12	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1182920015	UAE Consultant Co.,Ltd.	09112023	9 Nov 23	8 Nov 24	-
13	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	42i 1182920016	UAE Consultant Co.,Ltd.	03112023	3 Nov 23	2 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	Standard Gases (Mixture)	Sulphur Dioxide	Airgas	E80143262 2015PSIG	Airgas an Air Liquide company	E04N99E15A01D3	21 Jun 21	21 Jun 24	-
15	Wind Speed/Wind Direction	WSWD	Scarlet Tech Ltd.	WL-21 2205DT0113	Thai Meteorological Department	390/23	1 Nov 23	31 Oct 24	-
16	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	01dB	CAL31 84065	Innovative Instrument Co.,Ltd.	23-ACT-115	4 Aug 23	3 Aug 24	-
17	Sound Level Meter	$L_{Aeq} 24\text{ hrs}$, L_{A90} , L_{Amax} , ระดับเสียงรบกวน	Larson Davis	LxT1 0007304	Larson Davis-A PCB Piezotronics Div.	2023003661	22 Mar 23	21 Mar 24	-
18	Sound Level Meter	$L_{Aeq} 24\text{ hrs}$, L_{A90} , L_{Amax} , ระดับเสียงรบกวน	Larson Davis	LxT1 0007305	Larson Davis-A PCB Piezotronics Div.	2023003663	22 Mar 23	21 Mar 24	-
19	Sound Level Meter	$L_{Aeq} 24\text{ hrs}$, L_{A90} , L_{Amax} , ระดับเสียงรบกวน	Larson Davis	LxT1 0007306	Larson Davis-A PCB Piezotronics Div.	2023003664	22 Mar 23	21 Mar 24	-
20	Sound Level Meter	$L_{Aeq} 24\text{ hrs}$, L_{A90} , L_{Amax} , ระดับเสียงรบกวน	Larson Davis	LxT1 0007308	Larson Davis-A PCB Piezotronics Div.	2023003666	22 Mar 23	21 Mar 24	-
21	Sound Level Meter	$L_{Aeq} 24\text{ hrs}$, L_{A90} , L_{Amax} , ระดับเสียงรบกวน	Larson Davis	LxT1 0007309	Larson Davis-A PCB Piezotronics Div.	2023003671	22 Mar 23	21 Mar 24	-
22	Sound Level Meter	$L_{Aeq} 24\text{ hrs}$, L_{A90} , L_{Amax} , ระดับเสียงรบกวน	Larson Davis	LxT1 0007310	Larson Davis-A PCB Piezotronics Div.	2023003673	22 Mar 23	21 Mar 24	-

List of Instruments Certification for Water Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Water									
1	pH Meter	pH	Horiba	LAQUA-PH210 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	Horiba	LAQUA-EC210 HC0J0014	Technology Promotion Association (Thailand-Japan)	23CH1232	27 Sep 23	26 Sep 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	Larson Davis	CAL150 6458	Innovative Instrument Co.,Ltd.	23-ACT-065	12 May 23	11 May 24	-
2	Sound Level Meter	$L_{Aeq} 8 \text{ hrs}$, L_{Amax}	Rion, Japan	NL-42 00321435	Sithiporn Associates Co., Ltd.	ACL23144	9 May 23	8 May 24	-
3	Sound Level Meter	$L_{Aeq} 8 \text{ hrs}$, L_{Amax}	Rion, Japan	NL-42 00321440	Sithiporn Associates Co., Ltd.	ACL23145	9 May 23	8 May 24	-
4	Sound Level Meter	$L_{Aeq} 8 \text{ hrs}$, L_{Amax}	Rion, Japan	NL-42 00558037	Sithiporn Associates Co., Ltd.	ACL23179	8 Jun 23	7 Jun 24	-
5	Primary Flow Calibrator	Calibrate personal pump	TSI, Inc	5300 53002052003	Innovative Instrument Co., Ltd.	23-AFM-121	26 May 23	25 May 24	-
6	Aneroid Barometer	Total Dust Respirable Dust	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	23P1858	2 Jun 23	1 Jun 24	-
7	Digital Thermo - Hygrometer	Total Dust Respirable Dust	Digicon	TH-02 395034175	Technology Promotion Association (Thailand-Japan)	23H1101	24 May 23	23 May 24	-
8	Thermal Environment Monitor	Heat Meter	3M	QuesTemp 32 TPS030006	Innovative Instrument Co.,Ltd.	23-TPM-483	17 Oct 23	16 Oct 24	-
9	Thermal Environment Monitor	Heat Meter	TSI QUEST	QuesTemp 32 TPT030008	Innovative Instrument Co.,Ltd.	23-TPM-502	2 Nov 23	1 Nov 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) ฝุ่นละอองเล็กกว่า 10 ไมครอน (PM-10)	Mettler-Toledo	MS204TS/00 C252436235	National Food Institute, Ministry of Industry, Thailand	2402420-003-01	19 Apr 24	18 Apr 25	-
2	Analytical Balance (Readability 0.001 mg)	ฝุ่นทุกขนาด (Total Dust) ฝุ่นขนาดที่เข้าถึงและสะสมในถุงลมของปอดได้	Mettler-Toledo	XP6 / B322373893	National Food Institute, Ministry of Industry, Thailand	2402420-002-01	19 Apr 24	18 Apr 25	-
Equipment for Water Quality Analysis									
3	pH Meter	ความเป็นกรด-ด่าง (pH) อุณหภูมิ (Temperature)	Mettler-Toledo	Seven Easy S20 / 1230525212	DKSH (Thailand) Ltd.	C07240167	9 Apr 24	8 Apr 25	-
4	pH Meter		Mettler-Toledo	SevenCompact S220/ C113432421	National Food Institute, Ministry of Industry, Thailand	2303560-001-01	26 Jun 23	25 Jun 24	-
5	Conductivity Meter	การนำไฟฟ้า (Conductivity)	SI Analytics	Lab955 / 16300356	DKSH (Thailand) Ltd.	C24240057	11 Mar 24	10 Mar 25	-
6	Analytical Balance (Readability 0.01 mg)	ของแข็งละลายทั้งหมด (TDS) สารแขวนลอย (SS)	Mettler-Toledo	XSR205DU / C210685394	National Food Institute, Ministry of Industry, Thailand	2402283-002-01	2 Apr 24	1 Apr 25	-
7	Hot Air Oven		Memmert	UF55 / B216.1666	National Food Institute, Ministry of Industry, Thailand	2400141-001-01	11 Oct 23	10 Oct 24	-
8	Analytical Balance (Readability 0.1 mg)	น้ำมันและไขมัน (Oil&Grease)	Mettler-Toledo	AB-2045/FACT / 1129361010	Technology Promotion Association (Thailand-Japan)	24MM292	11 May 24	10 May 25	-
9	BOD Incubator	บีโอดี (BOD)	Arco	UC4-1320 / (UAE.WAO.015/2561)	Technology Promotion Association (Thailand-Japan)	24TM303	10 Feb 24	9 Feb 25	-
10	DO Meter		YSI	5100 / 11B101863	Technology Promotion Association (Thailand-Japan)	24TW39	21 Feb 24	20 Feb 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									
11	COD Reactor (Heating Block)	ซีโอดี (COD)	Hanna	HI839800 / 1147807	Hanna Instruments (Thailand) Ltd.	HIT-2417-0568	25 Apr 24	24 Apr 25	-
12	UV-VIS Spectrophotometer	ไนเตรด-ไนโตรเจน, ฟอสเฟต (Phosphate) แอมโมเนีย-ไนโตรเจน (Ammonia- Nitrogen)	Hitachi	U-1900 / 2021-064	DQE Services Co.,Ltd.	SP24-008	16 Jan 24	15 Jan 25	-
13	UV-VIS Spectrophotometer	ไซยาไนด์ (Cyanide), ฟอर्मัลดีไฮด์ (Formaldehyde) สารประกอบฟีนอล (Phenol), สี (Color) ไนเตรด (Nitrate)	Hitachi	U-2900 / 21E22-009	DQE Services Co.,Ltd.	SP24-001	4 Jan 24	3 Jan 25	-
14	Digestor Unit	ทีเคเอ็น (TKN)	FOSS TECATOR	DT2520 / 91794469	FOSS South East Asia	9809	8 Feb 24	7 Feb 25	-
15	Distillation Unit (Kjeldahl Method)		FOSS TECATOR	KT200 / 91790524	FOSS South East Asia	9810	9 Feb 24	7 Feb 25	-
16	Atomic Absorption Spectrophotometer (AAS)	โลหะหนัก ได้แก่ปรอท (Hg) แคดเมียม (Se) แคดเมียม (Cd) ตะกั่ว (Pb) อาร์เซนิก (As) โครเมียม (Cr, Cr6+, Cr3+) บาร์เรียม (Ba) นิกเกิล (Ni) ทองแดง (Cu) สังกะสี (Zn) และ แมงกานีส (Mn)	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	-
17	Inductively Coupled Plasma (ICP)		Agilent Technologies	System ID:G8015A G8015AA / MY18030001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	13 Nov 23	12 Nov 24	-
18	Cold Vapor Atomic (CVAAS)	ปรอท (Hg) -น้ำ	Nippon Instrument Corporation	RA-4500 / 17780278	Coax Group Corporation Ltd.	Preventive Maintenance Report	9 Jul 24	8 Jul 25	-
19	Gas Chromatography (GC)	pesticide (Pesticide)	Agilent Technologies	System ID:CN11021007 7890 / CN11021007	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	21 Feb 24	19 Feb 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	Incubator	โคลิฟอร์มแบคทีเรีย (Coliform Bacteria)	Memmert	IPP 260 / V615.0187	Technology Promotion Association (Thailand-Japan)	24TM648	1 Apr 24	31 Mar 25	-
21	Incubator		Memmert	IPP 260 / V618.0033	Technology Promotion Association (Thailand-Japan)	24TM651	2 Apr 24	1 Apr 25	-
22	Water Bath		Memmert	WNE 14 / L416.0606	Technology Promotion Association (Thailand-Japan)	24TM29	10 Feb 24	8 Feb 25	-
23	Water Bath		Memmert	WNE 14 / L416.0612	Technology Promotion Association (Thailand-Japan)	24TM30	10 Feb 24	8 Feb 25	-
24	Auto Clave		ALP	CL-40L / 807298	National Food Institute, Ministry of Industry, Thailand	2304203-001-01	10 Aug 23	9 Aug 24	-
25	Auto Clave		ALP	CL-40L / 808763	National Food Institute, Ministry of Industry, Thailand	2402281-001-01	2 Apr 24	1 Apr 25	-
26	Analytical Balance		OHAUS	PX623 / C236754745	DKSH (Thailand) Ltd.	C01234158	7 Dec 23	6 Dec 24	-

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

CERTIFICATE OF CALIBRATION

Certificate No. : COF-002-66

Page 2 of 2 Pages

MEASUREMENT ITEM
MANUFACTURER
MODEL/TYPE
SERIAL NUMBER
ID NUMBER
CONDITION AS-RECEIVED
CUSTOMER

: Top Load Orifice
: Anderson Instruments
: G25A
: 1901
: UAE/INV/051/2547
: Used Item
: United Analyst and Engineering Consultant Co., Ltd.
: 81 Sai Udomsuk 41, Sukhumvit Road, Bangkok, Phrahanong,
: Bangkok 10260

RECEIVED DATE
MEASUREMENT DATE
ISSUE DATE

: 07 Jul 2023
: 14 Jul 2023
: 18 Jul 2023

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follows:

Temperature : 23.0 ± 3.0 °C
Relative Humidity : 35.0 ± 15.0 %RH
Atmospheric Pressure : 1010 ± 10 hPa

CALIBRATION CONDITION:

Preconditioning : 24 hours at ambient conditions
Measurement Condition : The average values during measurement are 23.9 °C and 54.5%RH.

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

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibration procedure:
The Orifice gas flow device was calibrated against
Standard Rotary Displacement Meter (Rods,
Meter) Model G65/MC/WZdp, The We-CE 004
was used as a calibration guideline.

Traceability:
This certificate provides a traceability of the
measurement to recognition of the national
standards and to realization of the international
system of units (SI) through the VSL (National
Metrology Institute of Netherlands) via Certificate
number: 02218901.

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".

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 [T ₀] °C	Temperature [T _m] °C	Ap_meter mmHg	Ap_Orifice mmHg	γ	Standard Flow [Q _s] m^3/min
1	0.701	754.115	23.87	23.10	55.600	1.626	1.273	0.548
2	0.997	754.083	23.80	23.23	61.350	3.236	1.795	0.914
3	1.121	754.005	23.81	23.20	61.323	4.838	2.079	1.057
4	1.172	754.004	23.72	23.16	30.933	4.891	2.088	1.122
5	1.410	753.994	23.76	23.18	29.415	7.159	2.671	1.352

Slope (a): 1.98463

Intercept (b): -0.01636

Correlation coefficient (r): 0.99972

Uncertainty (k=2): 0.015 m^3/min

Table 2: The results of Q actual calibration data

Plate	Flow rate m^3/min	Pressure [Pa] mmHg	Temperature [T ₀] °C	Temperature [T _m] °C	Ap_meter mmHg	Ap_Orifice mmHg	γ	Standard Flow [Q _s] m^3/min
1	0.701	754.115	23.87	23.10	55.600	1.626	0.880	0.651
2	0.997	754.083	23.80	23.23	61.350	3.236	1.129	0.917
3	1.121	754.005	23.81	23.20	61.323	4.838	1.367	1.061
4	1.172	754.004	23.72	23.16	30.933	4.891	1.388	1.136
5	1.410	753.994	23.76	23.18	29.415	7.159	1.679	1.357

Slope (a): 1.24306

Intercept (b): -0.01029

Correlation coefficient (r): 0.99972

Uncertainty (k=2): 0.015 m^3/min

End of Certificate of Calibration

Calibrated by:
□ Mr. Sorasak Thachalad
□ Mrs. Jiraporn Lertsamphol



Approved signature:
Mr. Parinya Booncharatan
Calibration Department Manager



เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

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



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534H PITTANAKARN ROAD SOI 11, SUANLIANG, SUANLIANG, BANGKOK 10250
TEL. 0-2717-3800-24 FAX: 0-2719-9484

Certificate of Calibration

Certificate No. : 23P1401
Page : 1 of 2

Equipment : U-Tube Manometer

Manufacturer: Dwyer

Model : 1221-35-WIM

Serial No. :

ID No. : UAE-EFM/022/2560

Condition As-Received: Used Item

Received Date: 28 April 2023

Calibration Date: 09 May 2023

Reference: 2304-0703WSC

Ambient Temperature: (23 ± 2) °C

Relative Humidity: (50 ± 15) %

Atmospheric Pressure: 1010 mbar

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

81 Sai Udomsuk 41, Sukhumvit Road, Bangkok,

Phrahanong, Bangkok 10260

Procedure used: The calibration was conducted by direct comparison method against Pressure Measuring Instruments
Standard according to in-house calibration procedure CP-PM4, using "OKD-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	1188	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 inHg

4. This instrument was used clean air and oil 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 Aussarnee
Issue Date: 11 May 2023

Approved Signatory: Attapol P.
| | Phatima Prapaipal
| | Sura Suwanasri
| | Attapol Panurach

เอกสารไม่ควบคุม
0 0314241



Cert.No.: 23P1401
Page: 2 of 2

Result of calibration:- Without adjustment

Function:- Pressure Measurement

Increasing Pressure

Range : 0 inHg to 36 inHg

Scale Interval : 0.1 inHg (The Fifth Estimate)

Applied Pressure (inHg)	UUC Indication		AP (inHg)	Error (inHg)
	High-port side (inHg)	Low-port side (inHg)		
0.00	0.00	0.00	0.00	0.00
2.00	1.00	-0.98	1.98	-0.02
4.00	2.00	-1.98	3.98	-0.02
6.00	3.00	-2.98	5.98	-0.02
8.00	4.00	-3.98	7.98	-0.02
10.00	5.00	-4.98	9.98	-0.02
12.00	6.00	-6.00	12.00	0.00
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	-11.00	22.00	0.00
24.00	12.02	-12.00	24.02	0.02
26.00	13.02	-13.00	26.02	0.02
28.00	14.02	-14.00	28.02	0.02
30.00	15.04	-15.00	30.04	0.04
32.00	16.04	-16.00	32.04	0.04
34.00	17.02	-17.00	34.02	0.02
36.00	18.00	-17.98	35.98	0.02

The uncertainty of measurement was ± 0.11 inHg

* 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-

Attapol P.
เอกสารไม่ควบคุม
0 1160340



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.: 23P1859

Page: 1 of 2

Equipment: Aneroid Barometer

Manufacturer: Barigo

Model: -

Serial No.: -

ID No.: UAE.ANV.123/2550

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

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 9-1 : 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)

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 10200

Calibrated by: Suksan Khankaew
Issue Date: 08 June 2023

Approved Signatory: Attapol P.
[] Phasinee Prabpai
[] Sura Suwanasri
[x] Attapol Panuratchi

เอกสารไม่ควบคุม

a 0316959



Cert.No.: 23P1859

Page: 2 of 2

Result of calibration:- Without adjustment

Function:- Absolute Pressure Measurement

Range: 960 hPa to 1030 hPa

Scale Interval: 1 hPa (The Fifth Estimate)

Increasing Pressure

Applied Pressure (hPa)	968.80	969.94	981.10	991.02	1003.33	1013.39	1024.48	1035.27
UUC* Indication (hPa)	960.0	970.0	980.0	990.0	1000.0	1010.0	1020.0	1030.0
Error (hPa)	1.20	0.06	-1.10	-1.92	-3.33	-3.39	-4.48	-5.27

Decreasing Pressure

Applied Pressure (hPa)	1035.27	1023.97	1013.46	1003.54	992.07	981.34	970.00	959.03
UUC* Indication (hPa)	1020.0	1020.0	1010.0	1000.0	990.0	980.0	970.0	960.0
Error (hPa)	-5.27	-3.97	-3.46	-3.54	-2.07	-1.34	0.00	0.97

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 %



-o0o-

เอกสารไม่ควบคุม

a 1165505



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.: 23H1200

Page: 1 of 2

Equipment: Dial Thermo-Hygrometer

Manufacturer: Barigo

Model: -

Serial No.: -

ID No.: UAE.ANV.130/2550

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 ± 3) %

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	2360185	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-ONSC Accredited No. Calibration 0008

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 10200

Calibrated by: Somchai Dumvor
Issue Date: 07 June 2023

Approved Signatory: Chakrit Waeewanjai
[x] Chakrit Waeewanjai
[] Pongthippa Tanmyakul
[] Viporn Tantiyawuti

เอกสารไม่ควบคุม

a 0316274



Cert. No.: 23H1200

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	48	7.9	1.6
25.0	60.0	63	3.0	1.7
25.0	80.0	76	-4.0	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	44	3.9	1.6
25.0	60.0	60	0.0	1.7
25.0	80.0	75	-5.0	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	39.5	-0.444	0.72

UUC* : Unit Under Calibration

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

-o0o-

เอกสารไม่ควบคุม

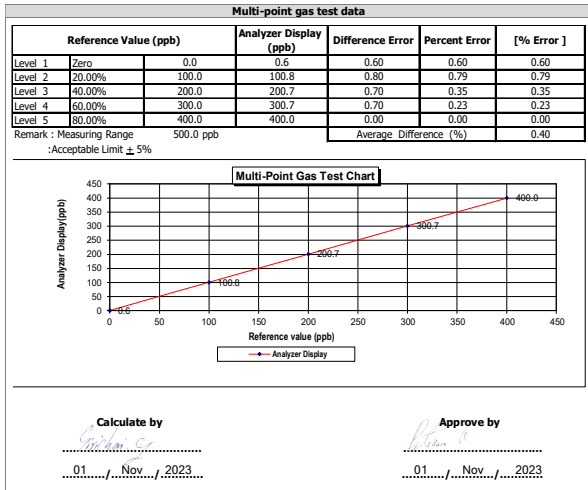
a 1165295

MULTI-POINT GAS TEST REPORT

Test Date : Nov 1, 2023

Equipment : Gas Analyzer (NO₂) **Model** : 42i
Manufacturer : Thermo Scientific **Serial Number** : CM19050149

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

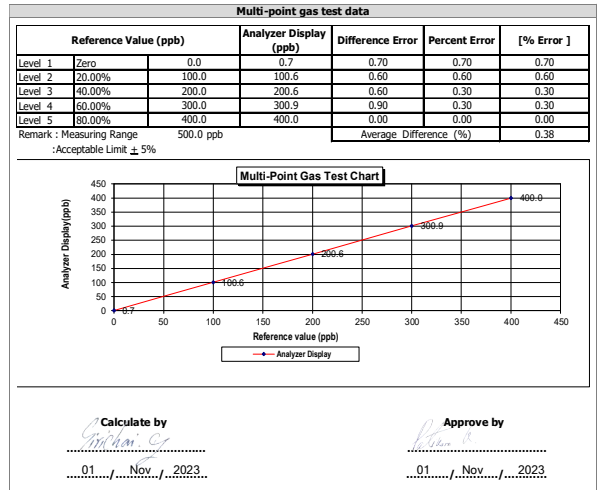


MULTI-POINT GAS TEST REPORT

Test Date : Nov 1, 2023

Equipment : Gas Analyzer (NO₂) **Model** : 42i
Manufacturer : Thermo Scientific **Serial Number** : CM19050150

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

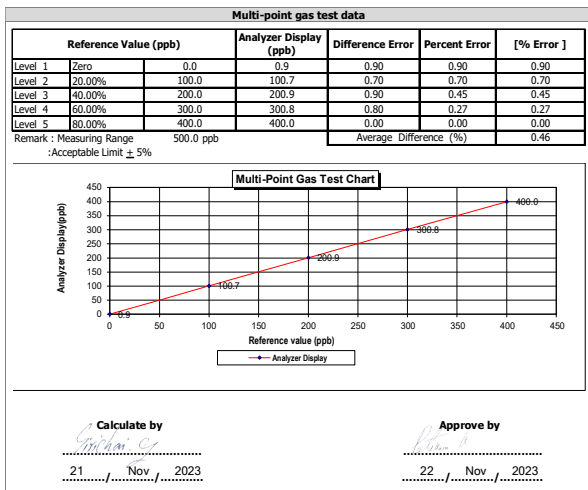


MULTI-POINT GAS TEST REPORT

Test Date : Nov 21, 2023

Equipment : Gas Analyzer (NO₂) **Model** : 42i
Manufacturer : Thermo Scientific **Serial Number** : CM22177051

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

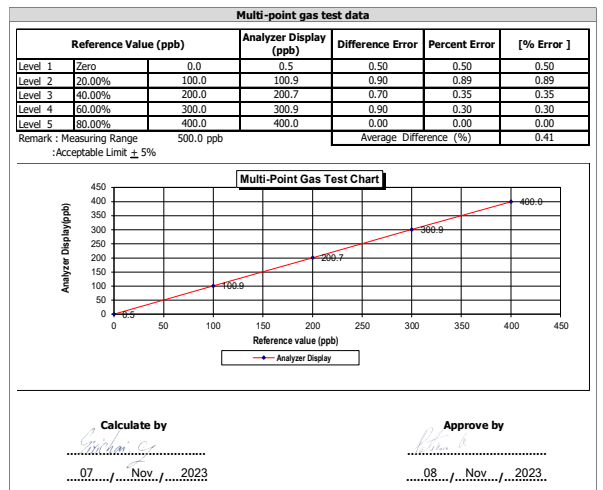


MULTI-POINT GAS TEST REPORT

Test Date : Nov 7, 2023

Equipment : Gas Analyzer (NO₂) **Model** : 42i
Manufacturer : Thermo Scientific **Serial Number** : CM22387035

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



CERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

Part Number: BC4NE0E16A01L13 Reference Number: 122-002135167-1
Cylinder Number: EBC143262 Cylinder Volume: 144.4 CF
Laboratory: 126 - Durham (SAP) - NC Cylinder Pressure: 2015 PSIG
PGVP Number: B2202* Valve Outlet: 650
Gas Code: CO,NO,NOX,SO2,RA_N Certification Date: Jun 21, 2021

Expiration Date: Jun 21, 2024

Certification confirmed in accordance with EPA Traceability Program for Analytical and Calibration of Gases (January 2012) document EPA-880/1-12-011. Using the assay procedures listed, Analytical Laboratories does not make a correction for any gas impurities. This cylinder was field analyzed. Problems are noted below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration value. All concentrations are on a standard basis unless otherwise noted.

On this date this cylinder was analyzed at 0.7 megapascals

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	45.00 PPM	45.94 PPM	G1	+/- 1.4% NIST Traceable	03/14/2021, 06/02/2021
NITRIC OXIDE	45.00 PPM	45.94 PPM	G1	+/- 1.4% NIST Traceable	03/14/2021, 06/02/2021
SULFUR DIOXIDE	45.00 PPM	45.94 PPM	G1	+/- 1.4% NIST Traceable	03/14/2021, 06/02/2021
CARBON MONOXIDE	984.8 PPM	984.8 PPM	G1	+/- 0.7% NIST Traceable	03/14/2021
NITROGEN	Balance	Balance			

Type	Lot ID	Cylinder No.	Concentration	Uncertainty	Expiration Date
NITROGEN	20081120	GC795858	49.52 PPM NITRIC OXIDE/NITROGEN	+/- 1.0%	Feb 02, 2025
PM10	2138	D985025	5.91 PPM NITROGEN DIOXIDE/AIR	+/- 2.0%	Feb 02, 2025
PM2.5	40142858102	CC1505591	4.348 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.1%	Feb 18, 2025
NITROGEN	16011043	CC143227	48.09 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.5%	Jan 17, 2022
NITROGEN	14050119	CC484217	98.0 PPM CARBON MONOXIDE/NITROGEN	+/- 0.8%	Nov 15, 2025

The NIST, PM10, and PM2.5 are not subject to the same uncertainty as the other gases. See the assay report for details.

Instrument/Make/Model	Analytical Principle	Last Multi-point Calibration
Model 6703 AHR2001333 CO	FTIR	Jan 30, 2021
Model 6703 AHR2001333 NO	FTIR	Jan 30, 2021
Model 6703 AHR2001333 NO2	FTIR	Jan 30, 2021
Model 6703 AHR2001333 SO2	FTIR	Jan 30, 2021

Test Date Available Upon Request

NOTES: PO #5221002807

GROSS WT: 38.40kg

NET WT: 4.73kg



เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Nov 3, 2023

Equipment : Gas Analyzer (SO₂) Model : 43i
Manufacturer : Thermo SCIENTIFIC Serial Number : 1182920012

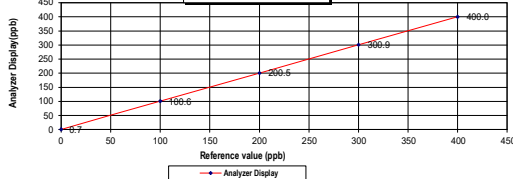
Standard Gas Concentration	Dilutor Detail
Sulphur Dioxide (SO ₂)	44.68 PPM Manufacturer : Thermo SCIENTIFIC
Nitric Oxide (NO)	45.94 PPM Model : 146i
Methane (CH ₄)	- PPM Serial Number : 1180540071
Carbon Monoxide (CO)	984.8 PPM
Cylinder No. :	EB0143262
Expiration Date :	Jun 24, 2024

Multi-point gas test data

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1 Zero	0.0	0.7	0.70	0.70
Level 2 20.00%	100.0	100.6	0.60	0.60
Level 3 40.00%	200.0	200.5	0.50	0.25
Level 4 60.00%	300.0	300.9	0.90	0.30
Level 5 80.00%	400.0	400.0	0.00	0.00

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

Multi-Point Gas Test Chart



Calculate by

03/11/2023

Approve by

03/11/2023

MULTI-POINT GAS TEST REPORT

Test Date : Nov 9, 2023

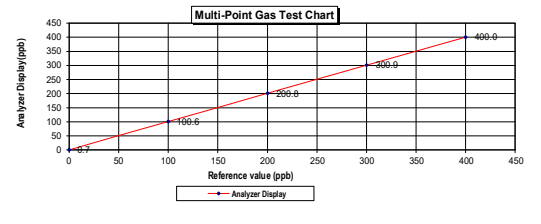
Equipment : Gas Analyzer (SO₂) Model : 43i
Manufacturer : Thermo SCIENTIFIC Serial Number : 1201778115

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. :	EB0143262
Expiration Date :	Jun 24, 2024

Multi-point gas test data

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1 Zero	0.0	0.7	0.70	0.70
Level 2 20.00%	100.0	100.6	0.60	0.60
Level 3 40.00%	200.0	200.8	0.80	0.40
Level 4 60.00%	300.0	300.9	0.90	0.30
Level 5 80.00%	400.0	400.0	0.00	0.00

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



Calculate by

09/11/2023

Approve by

09/11/2023

MULTI-POINT GAS TEST REPORT

Test Date : Nov 3, 2023

Equipment : Gas Analyzer (SO₂) Model : 43i
Manufacturer : Thermo SCIENTIFIC Serial Number : 1182920012

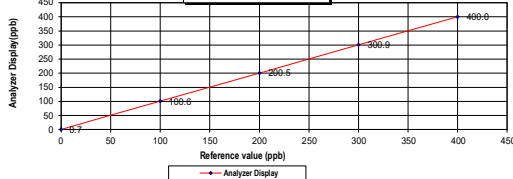
Standard Gas Concentration	Dilutor Detail
Sulphur Dioxide (SO ₂)	44.68 PPM Manufacturer : Thermo SCIENTIFIC
Nitric Oxide (NO)	45.94 PPM Model : 146i
Methane (CH ₄)	- PPM Serial Number : 1180540071
Carbon Monoxide (CO)	984.8 PPM
Cylinder No. :	EB0143262
Expiration Date :	Jun 24, 2024

Multi-point gas test data

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1 Zero	0.0	0.7	0.70	0.70
Level 2 20.00%	100.0	100.6	0.60	0.60
Level 3 40.00%	200.0	200.5	0.50	0.25
Level 4 60.00%	300.0	300.9	0.90	0.30
Level 5 80.00%	400.0	400.0	0.00	0.00

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

Multi-Point Gas Test Chart



Calculate by

03/11/2023

Approve by

03/11/2023

MULTI-POINT GAS TEST REPORT

Test Date : Nov 9, 2023

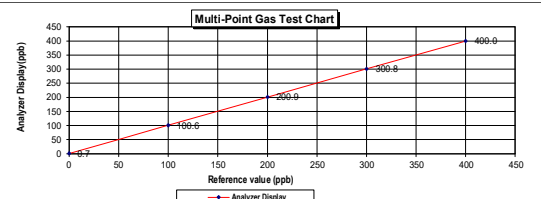
Equipment : Gas Analyzer (SO₂) Model : 43i
Manufacturer : Thermo SCIENTIFIC Serial Number : 1182920015

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. :	EB0143262
Expiration Date :	Jun 24, 2024

Multi-point gas test data

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1 Zero	0.0	0.7	0.70	0.70
Level 2 20.00%	100.0	100.6	0.60	0.60
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 $\pm 5\%$



Calculate by

09/11/2023

Approve by

09/11/2023

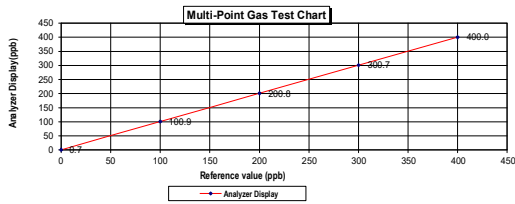
MULTI-POINT GAS TEST REPORT

Test Date : Nov 3, 2023

Equipment : Gas Analyzer (SO₂) Model : 431
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 : 1461
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
Level 2 20.00%	100.0	100.9	0.90	0.89
Level 3 40.00%	200.0	200.8	0.80	0.40
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		Average Difference (%)		
:Acceptable Limit ± 5%		0.44		



Calculate by : *[Signature]* Approve by : *[Signature]*
03 Nov 2023 03 Nov 2023

CERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

Part Number: E04NE60E15A01L3 Reference Number: 122-02 136/167-1
Cylinder Number: EBC143262 Cylinder Volume: 146.4 CF
Laboratory: 124 • Durham (SAP) • NC Cylinder Pressure: 2015 PSIG
PGVP Number: B2202 • Valve Outlet: 660
Gas Code: CO,NO,NOX,SO₂,RA,N Certification Date: Jun 21, 2021
Expiration Date: Jun 21, 2024

Confirmation performed in accordance with EPA Traceability Policy for Assay and Certification of Gases Calibration Standard (2012) document EPA 809A-12511, using the assay procedure listed. Analytical Methodology does not involve correction for any real interference. This laboratory is a United Analytical Grade gas as indicated by the confidence level of 99.99%. There are no significant interferences which affect the use of this calibration. All gas calculations are on a molecular basis unless otherwise noted.
Do Not Use This Grade: Below 100 ppm, or 0.7 mole percent.

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	45.00 PPM	45.96 PPM	G1	+/- 4% NIST Traceable	09/14/2021, 06/21/2021
NITRIC OXIDE	45.00 PPM	45.94 PPM	G1	+/- 4% NIST Traceable	09/14/2021, 06/21/2021
SULFUR DIOXIDE	45.00 PPM	44.80 PPM	G1	+/- 1.0% NIST Traceable	09/14/2021, 06/21/2021
CARBON MONOXIDE	984.8 PPM	984.8 PPM	G1	+/- 0.7% NIST Traceable	09/14/2021
NITROGEN	Balance	Balance			

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NITRUM	20081-20	CCT090658	45.92 PPM NITRIC OXIDE/NITROGEN	+/- 1.0%	Feb 02, 2026
PRM	12338	D985026	4.91 PPM NITROGEN MONOXIDE/AIR	+/- 2.0%	Feb 02, 2026
SM-S	4C1423658102	CC505591	4.348 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.1	Feb 18, 2025
ULTRAM	16011043	CC413227	46.09 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.6%	Jun 17, 2022
NITRUM	140621-9	CC434277	984.9 PPM CARBON MONOXIDE/NITROGEN	+/- 0.8%	Nov 15, 2025

Instrument/Make/Model	Analytical Principle	Last Multi-point Calibration
In calid E703 A/R2001333 CO	FTIR	Jun 30, 2021
In calid E703 A/R2001333 NO	FTIR	Jun 30, 2021
In calid E703 A/R2001333 NO2	FTIR	Jun 30, 2021
In calid E703 A/R2001333 SO2	FTIR	Jun 30, 2021

Test Data Available Upon Request

NOTES: PO #521002807
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.

[Signature]
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 3

Object : Wind Speed & Wind Direction Data Logger
Manufacturer : SCARLETT/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 842 S/N 91583

: HOOK GAGE NO 1425 : Wind Aloft Plotting Board

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

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

Serial Number 110730029 (sensor 120629586)

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

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

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

STANDARD BAROMETER : Digital Barometer Vaisala Type PTB220 No. V1220015

: Digital Barometer Vaisala Type PTB220 No. V1220015

Calibrated by : *[Signature]* Signed : *[Signature]* (Authorized Signatory)

Mr. Watchapol Subwat Mr. Pichod Promsat

Mechanical Engineer

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	hPa/mbar H2O 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.	
US DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRECTION	TESTED WIND DIRECTION
0	0
90	90
180	180
270	

Calibrated by : *[Signature]*
Mr. Watchapol Subwat
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau

เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

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

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
1006.06	1006	0.06
1005.84	1006	-0.16
1005.48	1005	0.48
1005.81	1010	-0.39
1009.76	1010	-0.24
1009.69	1009	0.69
1009.45	1009	0.45
1009.24	1009	0.24
1008.89	1009	-0.11
1007.66	1008	-0.34
1006.99	1007	-0.01
1006.29	1006	0.29
1004.66	1005	-0.44

Average

0.42

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	756	0.41
755.24	756	0.24
755.10	756	0.10
755.00	756	0.00
754.77	756	-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

INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7/19 MOO 11, SOI SUKTHAKORN 11 TAMBON BANG KAEU,
AMPHOE BANG PHU BANUT PRAKAN PROVINCE 10540 THAILAND
TEL: 090-02110-9800-1 FAX: 090-02110-7540



INNOVATIVE
Innovative Instrument Calibration Lab



ANAB
Accredited Calibration Laboratory
AC 306

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-ACT-115
Request No : Req-2023-1544

Unit Under Calibration Details

Measurement Item : Acoustic Calibrator
Manufacturer : 01dB
Model : CAL31
Serial Number : 84065
ID : UAE.EFM.167/2561
Class : 1
Range : 94 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 : 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. Noppadon Luangart
Service Calibration Engineer

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

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

Certificate No : 23-ACT-115
Request No : Req-2023-1544

Sound pressure level

Calibration Results : Without Adjustment

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty (\pm dB)	Acceptance limit Class 1 (\pm dB)
	Measured	Error	Measured	Error		
94 dB / 1000 Hz	93.90	-0.10	-	-	0.14	0.25

Frequency of Sound pressure level

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (\pm %)	Acceptance limit Class 1 (\pm %)
	Measured (Hz)	Error (%)	Measured (Hz)	Error (%)		
94 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 (\pm %)	Acceptance limit Class 1 (\pm %)
	Measured (%)	Error (%)	Measured (%)	Error (%)		
94 dB / 1000 Hz	0.12	-	-	-	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 apply 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 2023003661

Customer:

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

Model Number LxT1

Serial Number 0007304

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 23 Mar 2023

Calibration Due

Temperature 23.64 °C \pm 0.25 °C

Humidity 50.1 %RH \pm 2.0 %RH

Static Pressure 95.98 kPa \pm 0.13 kPa

Evaluation Method

Tested with:

PCB 377B02, S/N 345233
Larson Davis CAL200, S/N 9079
Larson Davis PRMLxT1, S/N 077639
Larson Davis CAL291, S/N 0108

Data reported in dB re 20 μ Pa.

Compliance Standards

Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8370:

IEC 60601:2001 Type 1
IEC 60804:2000 Type 1
IEC 61262:2002
IEC 61260:2001 Class 1
IEU 616/2:2013 Class 1

ANSI S1.4-2014 Class 1
ANSI S1.4 (R2006) Type 1
ANSI S1.11 (R2008) Class 1
ANSI S1.25 (R2007)
ANSI S1.43 (R2001) 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 \pm 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 uncertainty was 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 4.0.0, 2010-05-10

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

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

2023-03/17/18 (1)



Page 1 of 3

LARSON DAVIS
A PCB DIVISION

D0001.8366 Rev G

เอกสารไม่ควบคุม

Certificate Number 2023003661

1/2" adaptor is used with the preamplifier.

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

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 S1.4-2014Part1 successfully completed by Physikalisch-Technische Bundesanstalt (PTB) on 2007-09-09 reference number PTB-1.72-0304218.

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 S1.4-2014Part2, 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	2023-06-09	2023-09-09	0007250
Han Scientific 2636-11 Temperature Probe	2023-06-25	2023-06-25	006798
Larson Davis CAL200 Acoustic Calibrator	2022-07-21	2023-07-21	007077
Larson Davis Model 831	2023-02-22	2024-02-22	007162
PCB 377A13 1/2" Inch Prepolarized Pressure Microphone	2023-03-06	2024-03-06	007183
SRS DS160 Ultra Low Distortion Generator	2022-03-29	2023-03-29	007633
Larson Davis 1/2" Preamplifier for Model 831 Type I	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	-49.52	-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	-0.21	-0.20	-1.20	0.80	0.23	Pass
1000	0.18	0.00	-0.70	0.70	0.23	Pass
8000	-3.39	-3.00	-5.50	-1.50	0.32	Pass

— End of measurement results—

Certificate Number 2023003661

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	47.44

— 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

2023-03/17/18 (1)



Page 3 of 3

LARSON DAVIS
A PCB DIVISION

D0001.8366 Rev G

เอกสารไม่ควบคุม

Calibration Certificate

Certificate Number 2023003633

Customer:
United Analyt and Engineering Consultant Co Ltd
No. 81 Soi Edoonok 41, Sukhumvit Road,
Bangkok, Phra Khanong,
Bangkok, 10249, Thailand

Model Number LX1
Serial Number 0007304
Test Results Pass
Initial Condition As Manufactured
Description SoundTrack LX1 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 23.57 °C ± 0.25 °C
Humidity 50.3 %RH ± 2.0 %RH
Static Pressure 86.12 kPa ± 0.13 kPa

Evaluation Method Tested electrically using Larson Davis PRLX11 SN 077639 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 D0001.8364:

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 **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.

Correction data from Larson Davis LX1 Manual for SoundTrack LX1 & SoundExpert LX1. I770.01 Rev D Supporting Firmware Version 4.0.5, 2019-09-10.

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 2626-IT Temperature Probe	2021-08-25	2023-05-25	006796
SRS DS360 Ultra Low Distortion Generator	2023-03-30	2023-03-30	007174

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



LARSON DAVIS
A PCB DIVISION

2023-3-23T13:47:13

Page 1 of 8

D0001.8407 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

2023-3-23T13:47:13

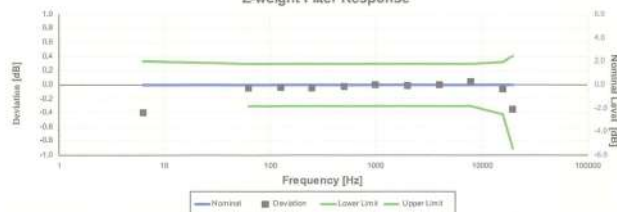
Page 2 of 8

D0001.8407 Rev G

เอกสารไม่ควบคุม

Certificate Number 2023003633

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 61072-1:2013 5.5; IEC 60651:2001 6.1 and 6.2.2; IEC 60804:2000 5; ANSI S1.4(1983) (R2006) 5.1 and 6.2.1; 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	-0.40	-0.40	-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
1,599.26	-0.01	-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
15,848.93	-0.06	-0.06	-0.42	0.32	0.15	Pass
19,952.62	-0.35	-0.35	-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

2023-3-23T13:47:13

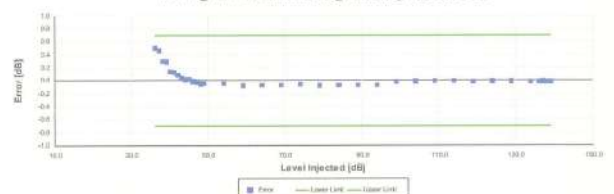
Page 3 of 8

D0001.8407 Rev G

เอกสารไม่ควบคุม

Certificate Number 2023003633

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) 6.3; 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
30.00	0.50	-0.70	0.70	0.16	Pass
37.00	0.46	-0.70	0.70	0.16	Pass
38.00	0.30	-0.70	0.70	0.16	Pass
39.00	0.29	-0.70	0.70	0.16	Pass
40.00	0.15	-0.70	0.70	0.16	Pass
41.00	0.13	-0.70	0.70	0.16	Pass
42.00	0.09	-0.70	0.70	0.16	Pass
43.00	0.04	-0.70	0.70	0.17	Pass
44.00	0.02	-0.70	0.70	0.17	Pass
45.00	0.02	-0.70	0.70	0.16	Pass
46.00	-0.01	-0.70	0.70	0.16	Pass
47.00	-0.02	-0.70	0.70	0.16	Pass
48.00	-0.05	-0.70	0.70	0.16	Pass
49.00	-0.04	-0.70	0.70	0.16	Pass
54.00	-0.04	-0.70	0.70	0.16	Pass
59.00	-0.07	-0.70	0.70	0.16	Pass
64.00	-0.07	-0.70	0.70	0.16	Pass
69.00	-0.07	-0.70	0.70	0.16	Pass
74.00	-0.06	-0.70	0.70	0.16	Pass
79.00	-0.07	-0.70	0.70	0.16	Pass
84.00	-0.07	-0.70	0.70	0.16	Pass
89.00	-0.07	-0.70	0.70	0.16	Pass
94.00	-0.07	-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	0.00	-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	-0.01	-0.70	0.70	0.15	Pass
134.00	-0.01	-0.70	0.70	0.15	Pass
139.00	-0.01	-0.70	0.70	0.15	Pass
144.00	-0.01	-0.70	0.70	0.15	Pass
149.00	-0.01	-0.70	0.70	0.15	Pass
154.00	-0.01	-0.70	0.70	0.15	Pass
159.00	-0.01	-0.70	0.70	0.15	Pass
164.00	-0.01	-0.70	0.70	0.15	Pass
169.00	-0.01	-0.70	0.70	0.15	Pass
174.00	-0.01	-0.70	0.70	0.15	Pass
179.00	-0.01	-0.70	0.70	0.15	Pass
184.00	-0.01	-0.70	0.70	0.15	Pass
189.00	-0.01	-0.70	0.70	0.15	Pass
194.00	-0.01	-0.70	0.70	0.15	Pass
199.00	-0.01	-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

2023-3-23T13:47:13

Page 4 of 8

D0001.8407 Rev G

เอกสารไม่ควบคุม

Certificate Number 2023003533

Peak Rise Time

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

Amplitude [dB]	Duration [µs]		Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
137.85	40	Negative Pulse	135.19	133.74	135.74	0.15	Pass
		Positive Pulse	135.20	133.73	135.73	0.15	Pass
30		Negative Pulse	134.26	133.74	135.74	0.15	Pass
		Positive Pulse	134.25	133.73	135.73	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		OVL	± 0.50	0.15 ±	Pass
	5		OVL	± 1.00	0.15 ±	Pass
	10		OVL	± 1.50	0.15 ±	Pass
126.85	3		-0.12	± 0.50	0.15 ±	Pass
	5		-0.11	± 1.00	0.15 ±	Pass
	10		OVL	± 1.50	0.15 ±	Pass
116.85	3		-0.13	± 0.50	0.15 ±	Pass
	5		-0.13	± 1.00	0.15 ±	Pass
	10		-0.26	± 1.50	0.15 ±	Pass
106.85	3		-0.13	± 0.50	0.15 ±	Pass
	5		-0.13	± 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 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	-0.12	± 1.00	0.15 ±	Pass
	10	OVL	± 1.50	0.15 ±	Pass
116.85	3	-0.13	± 0.50	0.15 ±	Pass
	5	-0.13	± 1.00	0.15 ±	Pass
	10	-0.25	± 1.50	0.15 ±	Pass
106.85	3	-0.12	± 0.50	0.15 ±	Pass
	5	-0.11	± 1.00	0.15 ±	Pass
	10	-0.16	± 1.50	0.15 ±	Pass
— End of measurement results—					

Certificate Number 2023003533

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	93.90	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	29.43	36.00	Pass
C-weight Noise Floor	28.93	35.00	Pass
Z-weight Noise Floor	33.44	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	135.76	135.05	136.65	0.15	Pass
THD	-86.85	-88.00	-85.00	0.01 ±	Pass
THD+N	-82.82	-85.00	-80.00	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

2023-3-23T13:47:13

Page 5 of 8

DMM01.BA07 Rev G

เอกสารไม่ควบคุม

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

2023-3-23T13:47:13

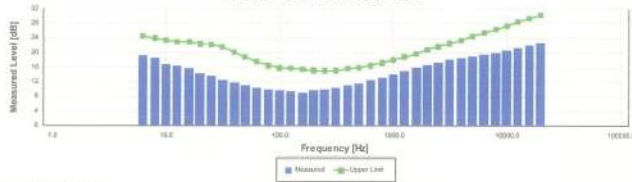
Page 6 of 8

DMM01.BA07 Rev G

เอกสารไม่ควบคุม

Certificate Number 2023003533

1/3-Octave Self-Generated Noise



The SUM is set to low range.

Frequency [Hz]	Test Result [dB]	Upper limit [dB]	Result
6.30	19.29	24.60	Pass
8.00	18.45	24.00	Pass
10.00	18.85	23.50	Pass
12.50	16.37	23.00	Pass
16.00	15.82	22.90	Pass
20.00	14.32	22.40	Pass
25.00	13.64	22.30	Pass
31.50	12.57	21.50	Pass
40.00	11.80	20.20	Pass
50.00	11.13	18.80	Pass
63.00	10.46	17.60	Pass
80.00	10.08	16.60	Pass
100.00	9.85	15.90	Pass
125.00	9.47	15.70	Pass
160.00	9.11	15.90	Pass
200.00	8.07	15.20	Pass
250.00	10.03	15.20	Pass
315.00	10.45	15.20	Pass
400.00	11.08	15.70	Pass
500.00	11.08	16.00	Pass
630.00	12.49	16.60	Pass
800.00	13.31	17.30	Pass
1,000.00	14.19	18.10	Pass
1,250.00	15.03	18.90	Pass
1,600.00	15.92	19.80	Pass
2,000.00	16.69	20.80	Pass
2,500.00	17.42	21.70	Pass
3,150.00	18.00	22.60	Pass
4,000.00	18.51	23.50	Pass
5,000.00	18.96	24.60	Pass
6,300.00	19.51	25.50	Pass
8,000.00	20.05	26.50	Pass
10,000.00	20.57	27.40	Pass
12,500.00	21.26	28.50	Pass
16,000.00	21.97	29.50	Pass
20,000.00	22.79	30.40	Pass
-- End of measurement results--			

Certificate Number 2023003533

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

2023-3-23T13:47:13

Page 7 of 8

DMM01.BA07 Rev G

เอกสารไม่ควบคุม

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

2023-3-23T13:47:13

Page 8 of 8

DMM01.BA07 Rev G

เอกสารไม่ควบคุม

Calibration Certificate

Certificate Number 2023003663

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 0007305

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 23 Mar 2023

Calibration Due

Temperature 23.49 °C ± 0.25 °C

Humidity 50.7 %RH ± 2.0 %RH

Static Pressure 85.87 kPa ± 0.13 kPa

Evaluation Method

Tested with:

Larson Davis CAL200, S/N 9070

Larson Davis CAL291, S/N 0108

Larson Davis PRMLxT1, S/N 077640

PCB 377B02, S/N 345234

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 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 (R2006) Type 1

ANSI S1.11 (R2008) 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, 2010-09-10

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

2023-5-23T17:58:48

Page 1 of 3

D0001.8384 Rev O

เอกสารไม่ควบคุม

Certificate Number 2023003663

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-1.72-4034218.

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, is 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.

Description	Standards Used		
	Cal Date	Cal Due	Cal Standard
Larson Davis CAL291 Residual Intensity Calibrator	2022-09-09	2023-09-09	001250
Hart Scientific 2626-II Temperature Probe	2021-08-25	2021-08-25	006798
Larson Davis CAL200 Acoustic Calibrator	2022-07-21	2023-07-21	007027
Larson Davis Model 831	2023-02-22	2024-02-22	007182
PCB 377A11 1/2 inch Pre-polarized Pressure Microphone	2023-01-06	2024-01-06	007183
SRS DS360 Ultra Low Distortion Generator	2022-01-29	2023-01-29	007635
Larson Davis 1/2" Preamplifier for Model 831 Type I	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	-49.60	-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	-0.21	-0.20	-1.20	0.80	0.23	Pass
1000	0.16	0.00	-0.70	0.70	0.23	Pass
8000	-3.28	-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



LARSON DAVIS
A PCB DIVISION

2023-5-23T17:58:48

Page 2 of 3

D0001.8384 Rev O

เอกสารไม่ควบคุม

Calibration Certificate

Certificate Number 2023003660

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 0007305

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 23.57 °C ± 0.25 °C

Humidity 50.5 %RH ± 2.0 %RH

Static Pressure 86.08 kPa ± 0.13 kPa

Evaluation Method

Tested electrically using Larson Davis PRMLxT1 S/N 077640 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 D0001.8394:

IEC 60651:2001 Type 1

IEC 60804:2000 Type 1

IEC 61252:2002

IEC 61672:2013 Class 1

IEC 61260:2001 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 (R2008) 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, 2010-09-10

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

2023-5-23T17:58:58

Page 3 of 8

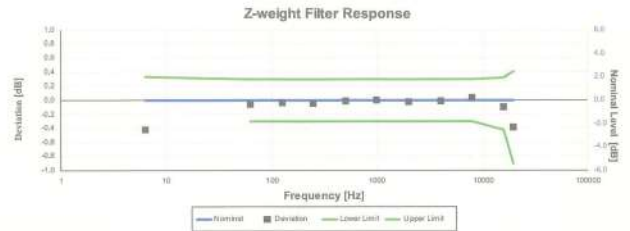
D0001.8407 Rev O

เอกสารไม่ควบคุม

Certificate Number 2023003550

Certificate Number 2023003550

Description	Standards Used	Cal Date	Cal Due	Cal Standard
Hart Scientific 2626-II Temperature Probe		2023-08-25	2023-05-25	000798
SRS DS340 Ultra Low Distortion Generator		2023-09-02	2023-09-02	007167



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) 9.1 and 9.2.1, 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	-0.43	-0.43	-1.11	0.33	0.15	Pass
63.10	-0.06	-0.06	-0.30	0.30	0.15	Pass
125.89	-0.03	-0.03	-0.30	0.30	0.15	Pass
251.19	-0.05	-0.05	-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
1,995.26	-0.02	-0.02	-0.30	0.30	0.15	Pass
3,961.07	-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

2023-5-27116-45104

Page 2 of 8

D9001.8407 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

2023-5-27116-45104

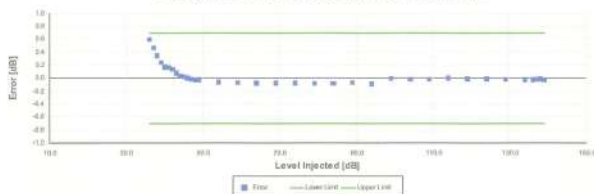
Page 3 of 8

D9001.8407 Rev G

เอกสารไม่ควบคุม

Certificate Number 2023003550

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: 5.8, ANSI S1.4-3 (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	0.47	-0.70	0.70	0.16	Pass
38.00	0.34	-0.70	0.70	0.16	Pass
39.00	0.25	-0.70	0.70	0.16	Pass
40.00	0.17	-0.70	0.70	0.16	Pass
41.00	0.17	-0.70	0.70	0.16	Pass
42.00	0.14	-0.70	0.70	0.16	Pass
43.00	0.08	-0.70	0.70	0.17	Pass
44.00	0.04	-0.70	0.70	0.17	Pass
45.00	0.03	-0.70	0.70	0.16	Pass
46.00	-0.06	-0.70	0.70	0.16	Pass
47.00	-0.01	-0.70	0.70	0.16	Pass
48.00	-0.02	-0.70	0.70	0.16	Pass
49.00	-0.02	-0.70	0.70	0.16	Pass
50.00	-0.06	-0.70	0.70	0.16	Pass
51.00	-0.06	-0.70	0.70	0.16	Pass
52.00	-0.07	-0.70	0.70	0.16	Pass
53.00	-0.07	-0.70	0.70	0.16	Pass
54.00	-0.08	-0.70	0.70	0.16	Pass
55.00	-0.08	-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	-0.01	-0.70	0.70	0.15	Pass
61.00	-0.01	-0.70	0.70	0.15	Pass
62.00	-0.02	-0.70	0.70	0.15	Pass
63.00	-0.01	-0.70	0.70	0.15	Pass
64.00	-0.01	-0.70	0.70	0.15	Pass
65.00	-0.01	-0.70	0.70	0.15	Pass
66.00	-0.01	-0.70	0.70	0.15	Pass
67.00	-0.01	-0.70	0.70	0.15	Pass
68.00	-0.01	-0.70	0.70	0.15	Pass
69.00	-0.01	-0.70	0.70	0.15	Pass
70.00	-0.01	-0.70	0.70	0.15	Pass
71.00	-0.01	-0.70	0.70	0.15	Pass
72.00	-0.01	-0.70	0.70	0.15	Pass
73.00	-0.01	-0.70	0.70	0.15	Pass
74.00	-0.01	-0.70	0.70	0.15	Pass
75.00	-0.01	-0.70	0.70	0.15	Pass
76.00	-0.01	-0.70	0.70	0.15	Pass
77.00	-0.01	-0.70	0.70	0.15	Pass
78.00	-0.01	-0.70	0.70	0.15	Pass
79.00	-0.01	-0.70	0.70	0.15	Pass
80.00	-0.01	-0.70	0.70	0.15	Pass
81.00	-0.01	-0.70	0.70	0.15	Pass
82.00	-0.01	-0.70	0.70	0.15	Pass
83.00	-0.01	-0.70	0.70	0.15	Pass
84.00	-0.01	-0.70	0.70	0.15	Pass
85.00	-0.01	-0.70	0.70	0.15	Pass
86.00	-0.01	-0.70	0.70	0.15	Pass
87.00	-0.01	-0.70	0.70	0.15	Pass
88.00	-0.01	-0.70	0.70	0.15	Pass
89.00	-0.01	-0.70	0.70	0.15	Pass
90.00	-0.01	-0.70	0.70	0.15	Pass
91.00	-0.01	-0.70	0.70	0.15	Pass
92.00	-0.01	-0.70	0.70	0.15	Pass
93.00	-0.01	-0.70	0.70	0.15	Pass
94.00	-0.01	-0.70	0.70	0.15	Pass
95.00	-0.01	-0.70	0.70	0.15	Pass
96.00	-0.01	-0.70	0.70	0.15	Pass
97.00	-0.01	-0.70	0.70	0.15	Pass
98.00	-0.01	-0.70	0.70	0.15	Pass
99.00	-0.01	-0.70	0.70	0.15	Pass
100.00	-0.01	-0.70	0.70	0.15	Pass
101.00	-0.01	-0.70	0.70	0.15	Pass
102.00	-0.01	-0.70	0.70	0.15	Pass
103.00	-0.01	-0.70	0.70	0.15	Pass
104.00	-0.01	-0.70	0.70	0.15	Pass
105.00	-0.01	-0.70	0.70	0.15	Pass
106.00	-0.01	-0.70	0.70	0.15	Pass
107.00	-0.01	-0.70	0.70	0.15	Pass
108.00	-0.01	-0.70	0.70	0.15	Pass
109.00	-0.01	-0.70	0.70	0.15	Pass
110.00	-0.01	-0.70	0.70	0.15	Pass
111.00	-0.01	-0.70	0.70	0.15	Pass
112.00	-0.01	-0.70	0.70	0.15	Pass
113.00	-0.01	-0.70	0.70	0.15	Pass
114.00	-0.01	-0.70	0.70	0.15	Pass
115.00	-0.01	-0.70	0.70	0.15	Pass
116.00	-0.01	-0.70	0.70	0.15	Pass
117.00	-0.01	-0.70	0.70	0.15	Pass
118.00	-0.01	-0.70	0.70	0.15	Pass
119.00	-0.01	-0.70	0.70	0.15	Pass
120.00	-0.01	-0.70	0.70	0.15	Pass
121.00	-0.01	-0.70	0.70	0.15	Pass
122.00	-0.01	-0.70	0.70	0.15	Pass
123.00	-0.01	-0.70	0.70	0.15	Pass
124.00	-0.01	-0.70	0.70	0.15	Pass
125.00	-0.01	-0.70	0.70	0.15	Pass
126.00	-0.01	-0.70	0.70	0.15	Pass
127.00	-0.01	-0.70	0.70	0.15	Pass
128.00	-0.01	-0.70	0.70	0.15	Pass
129.00	-0.01	-0.70	0.70	0.15	Pass
130.00	-0.01	-0.70	0.70	0.15	Pass
131.00	-0.01	-0.70	0.70	0.15	Pass
132.00	-0.01	-0.70	0.70	0.15	Pass
133.00	-0.01	-0.70	0.70	0.15	Pass
134.00	-0.01	-0.70	0.70	0.15	Pass
135.00	-0.01	-0.70	0.70	0.15	Pass
136.00	-0.01	-0.70	0.70	0.15	Pass
137.00	-0.01	-0.70	0.70	0.15	Pass
138.00	-0.01	-0.70	0.70	0.15	Pass
139.00	-0.03	-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

2023-5-27116-45104

Page 4 of 8

D9001.8407 Rev G

เอกสารไม่ควบคุม

Certificate Number 2023003550

Peak Rise Time

Peak rise time performed according to IEC 60651:2001 9.4.4 and ANSI S1.4:1983 (R2006) 8.4.4

Peak rate time performance according to test cases 1.201 to 1.2.4 and Annex 3.1							
---	--	--	--	--	--	--	--

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 Factor	Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
135.85	3	OVLD	± 0.50	0.15 ±	Pass
	5	OVLD	± 1.00	0.15 ±	Pass
	10	OVLD	± 1.50	0.15 ±	Pass
126.85	3	-0.13	± 0.50	0.15 ±	Pass
	5	-0.13	± 1.00	0.15 ±	Pass
	10	OVLD	± 1.50	0.15 ±	Pass
116.85	3	-0.12	± 0.50	0.15 ±	Pass
	5	-0.12	± 1.00	0.15 ±	Pass
	10	0.00	± 1.50	0.15 ±	Pass
106.85	3	-0.13	± 0.50	0.15 ±	Pass
	5	-0.13	± 1.00	0.15 ±	Pass
	10	-0.09	± 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

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	-0.10	± 0.50	0.15 ±	Pass
	5	-0.09	± 1.00	0.15 ±	Pass
	10	OVLD	± 1.50	0.15 ±	Pass
116.85	3	-0.11	± 0.50	0.15 ±	Pass
	5	-0.09	± 1.00	0.15 ±	Pass
	10	0.02	± 1.50	0.15 ±	Pass
106.85	3	-0.11	± 0.50	0.15 ±	Pass
	5	-0.10	± 1.00	0.15 ±	Pass
	10	-0.07	± 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

2023-5-27116-45104

Page 5 of 8

D9001.8407 Rev G

เอกสารไม่ควบคุม

Certificate Number 2023003650

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	41.15	40.30	41.70	0.18	Pass
OBA Low Range	94.00	93.90	94.10	0.15	Pass
OBA Normal Range	94.00	93.20	94.50	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	27.02	36.00	Pass
C-weight Noise Floor	26.72	35.00	Pass
Z-weight Noise Floor	32.86	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	135.82	135.05	136.65	0.15	Pass
THD	-86.26	-85.00	-87.00	0.01 %	Pass
THD+N	-82.32	-81.00	-83.00	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

2023-3-27T18:45:04

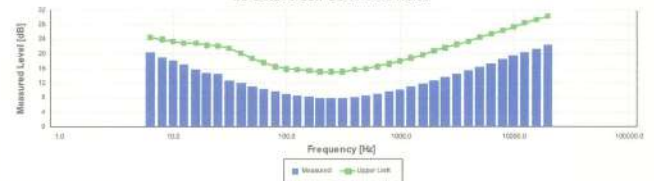
Page 6 of 8

DO001.8487 Rev G

เอกสารไม่ควบคุม

Certificate Number 2023003650

1/3-Octave Self-Generated Noise



The SLM is set to low range.

Frequency [Hz]	Test Result [dB]	Upper limit [dB]	Result
6.30	20.31	24.60	Pass
8.00	16.95	24.00	Pass
10.00	16.14	23.50	Pass
12.50	17.24	23.00	Pass
16.00	15.68	22.90	Pass
20.00	14.93	22.40	Pass
25.00	14.51	22.30	Pass
31.50	12.80	21.50	Pass
40.00	12.15	20.20	Pass
50.00	11.04	18.80	Pass
63.00	10.43	17.60	Pass
80.00	9.74	16.60	Pass
100.00	9.24	15.90	Pass
125.00	8.84	15.70	Pass
160.00	8.29	15.50	Pass
200.00	7.96	15.20	Pass
250.00	7.84	15.20	Pass
315.00	7.92	15.20	Pass
400.00	8.08	15.70	Pass
500.00	8.50	16.00	Pass
630.00	9.10	16.60	Pass
800.00	9.67	17.30	Pass
1000.00	10.25	18.10	Pass
1250.00	11.12	18.90	Pass
1600.00	11.81	19.80	Pass
2000.00	12.80	20.80	Pass
2500.00	13.69	21.70	Pass
3150.00	14.65	22.60	Pass
4000.00	15.54	23.50	Pass
5000.00	16.48	24.50	Pass
6300.00	17.51	25.50	Pass
8000.00	18.47	26.50	Pass
10000.00	19.45	27.40	Pass
12500.00	20.44	28.50	Pass
16000.00	21.44	29.50	Pass
20000.00	22.40	30.40	Pass

-- End of measurement results --

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

2023-3-27T18:45:04

Page 7 of 8

DO001.8487 Rev G

เอกสารไม่ควบคุม

Certificate Number 2023003650

Calibration Certificate

Certificate Number 2023003664

Customer:

United Analyst and Engineering Consultant Co Ltd
No. 81 Soi Udonrak 41, Sukhumvit Road,
Bangkok, Pira Khasong,
Bangkok, 10260, ThailandModel Number: LxT1
Serial Number: 8007306
Test Results: Pass

Initial Condition: As Manufactured

Description: SoundTrack LxT Class 1
Class 1 Sound Level Meter
Firmware Revision: 2.404Procedure Number: DO001.8384
Technician: Jacob Cannon
Calibration Date: 23 Mar 2023Calibration Due:
Temperature: 23.44 °C ± 0.25 °C
Humidity: 50.2 %RH ± 2.0 %RH
Static Pressure: 85.97 kPa ± 0.13 kPaEvaluation Method: Tested with:
Larson Davis CAL201, S/N 0108
PCB 377B02, S/N 345235
Larson Davis PRLxT1, S/N 077641
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 DO001.8378:

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 (R2009) 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 % 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 latest 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 ADP924 1/4" to 1/2" adaptor is used with the calibrators and the Larson Davis ADP943 1/4" to 1/2" adaptor is used with the calibrators.

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

2023-3-27T18:45:02

Page 1 of 3

DO001.8486 Rev G

เอกสารไม่ควบคุม

Signature: Jacob Cannon

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

2023-3-27T18:45:04

Page 8 of 8

DO001.8487 Rev G

เอกสารไม่ควบคุม

Certificate Number 2023003664

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-1.72-0294216.

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	2022-09-09	2023-09-09	901250
Hart Scientific 2626-11 Temperature Probe	2021-09-25	2023-09-25	006798
Larson Davis CAL200 Acoustic Calibrator	2023-07-31	2023-07-31	007927
Larson Davis Model 931	2023-02-22	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 177 Preamplifier for Model 931 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	-49.94	-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	-0.22	-0.20	-1.20	0.80	0.23	Pass
1000	0.14	0.00	-0.70	0.70	0.23	Pass
8000	-3.28	-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

LARSON DAVIS
A PCB DIVISION

D0001.8400 Rev G

เอกสารไม่ควบคุม

Certificate Number 2023003664

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	40.44

— 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

LARSON DAVIS
A PCB DIVISION

D0001.8400 Rev G

เอกสารไม่ควบคุม

Calibration Certificate

Certificate Number 2023003641

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 0007306

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 ± 0.28 °C
Humidity 49.1 %RH ± 2.0 %RH
Static Pressure 86.13 kPa ± 0.13 kPa

Evaluation Method Tested electrically using Larson Davis PRLxT1 S/N 077641 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.

Connection data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert LxT 1770.01 Rev O Supporting Firmware Version 4.0.3, 2018-09-10

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

Certificate Number 2023003641

Standards Used			
Description	Cal Date	Cal Due	Cal Standard
Hart Scientific 2626-11 Temperature Probe	2021-09-25	2023-09-25	006798
SRS DS360 Ultra Low Distortion Generator	2022-03-29	2023-03-29	007635

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



Page 1 of 8

LARSON DAVIS
A PCB DIVISION

D0001.8400 Rev G

เอกสารไม่ควบคุม

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

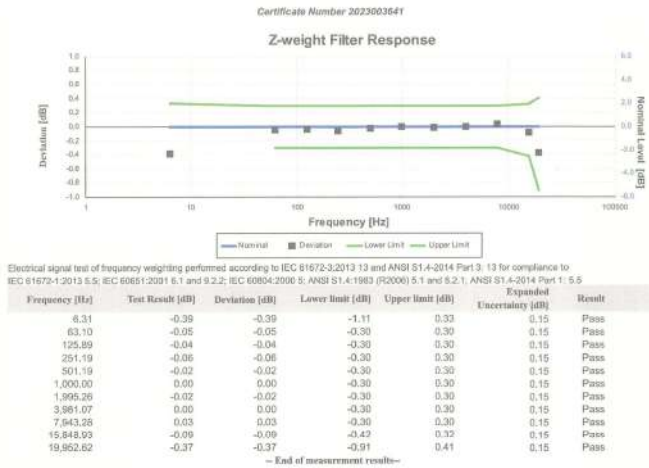


Page 2 of 8

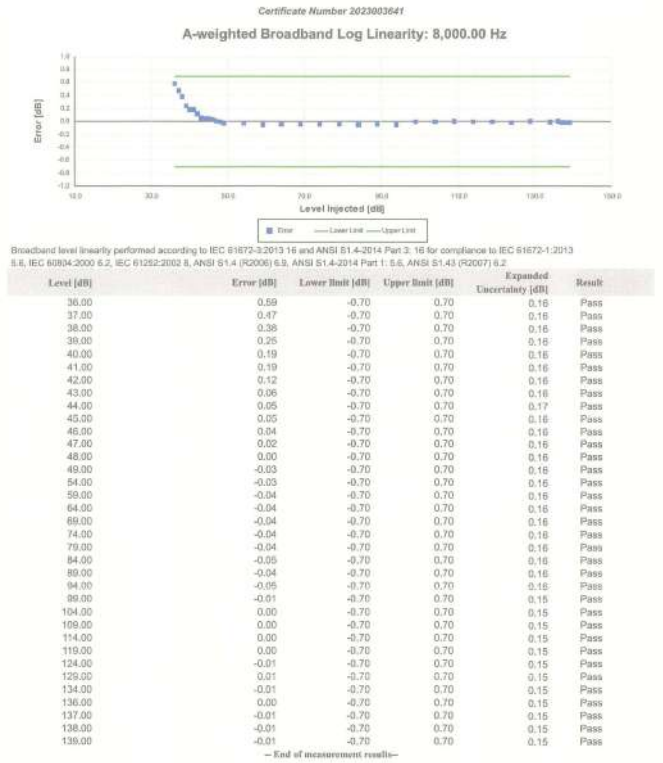
LARSON DAVIS
A PCB DIVISION

D0001.8400 Rev G

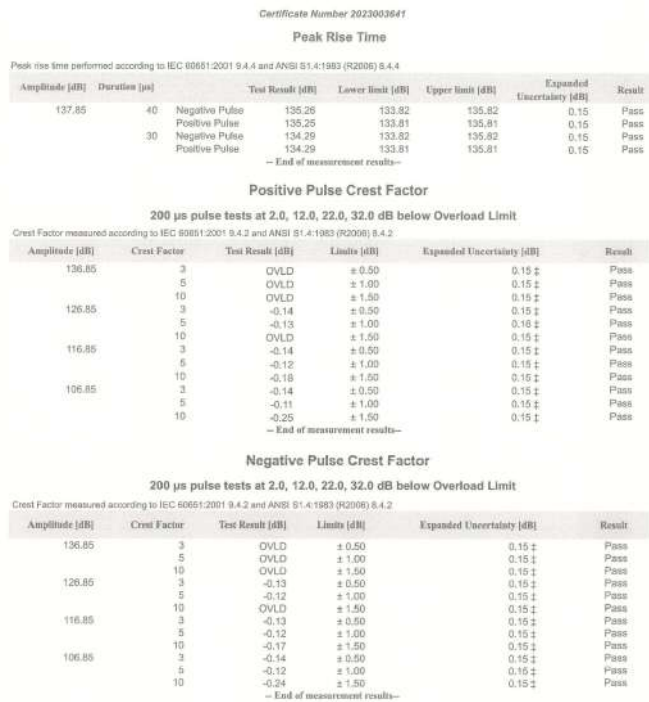
เอกสารไม่ควบคุม



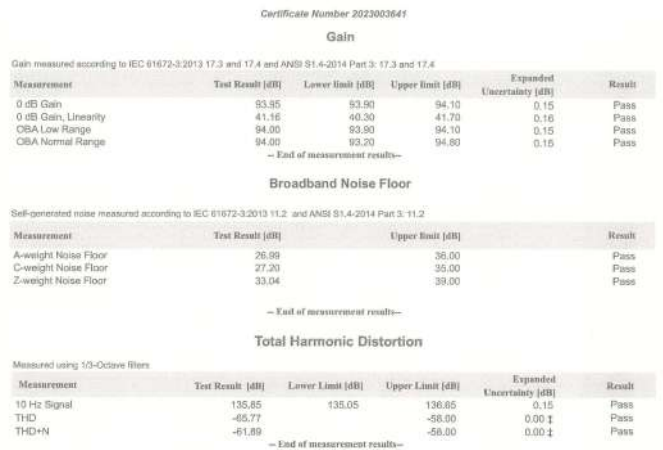
เอกสารไม่ควบคุม



เอกสารไม่ควบคุม



เอกสารไม่ควบคุม



เอกสารไม่ควบคุม



The SLM is set to low range.

Frequency [Hz]	Test Result [dB]	Upper Limit [dB]	Result
6.30	19.96	24.60	Pass
8.00	18.41	24.00	Pass
10.00	18.46	23.50	Pass
12.50	17.19	23.00	Pass
16.00	16.76	22.90	Pass
20.00	16.12	22.40	Pass
25.00	15.58	22.30	Pass
31.50	15.02	21.50	Pass
40.00	13.96	20.20	Pass
50.00	13.10	18.80	Pass
63.00	12.83	17.60	Pass
80.00	11.97	16.60	Pass
100.00	11.14	15.90	Pass
125.00	10.24	15.70	Pass
160.00	9.68	15.50	Pass
200.00	9.33	15.20	Pass
250.00	8.90	15.20	Pass
315.00	8.90	15.20	Pass
400.00	8.83	15.70	Pass
500.00	8.84	16.00	Pass
630.00	9.18	16.60	Pass
800.00	9.69	17.30	Pass
1,000.00	10.36	18.10	Pass
1,250.00	11.06	18.90	Pass
1,600.00	11.97	19.80	Pass
2,000.00	12.72	20.80	Pass
2,500.00	13.62	21.70	Pass
3,150.00	14.83	22.60	Pass
4,000.00	15.49	23.50	Pass
5,000.00	16.43	24.50	Pass
6,300.00	17.48	25.50	Pass
8,000.00	18.45	26.50	Pass
10,000.00	19.43	27.40	Pass
12,500.00	20.40	28.50	Pass
16,000.00	21.43	29.50	Pass
20,000.00	22.39	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

2023-3-27113-10-34

Page 7 of 8

D0001.0407 Rev 0

เอกสารไม่ควบคุม

Certificate Number 2023003641



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

2023-3-27113-10-34

Page 8 of 8

D0001.0407 Rev 0

เอกสารไม่ควบคุม

Calibration Certificate

Certificate Number 2023003666

Customer:
United Analyst and Engineering Consultant Co Ltd
No. 11 Set Udonok 41, Sukhumvit Road,
Bangkok, Phra Khaoeng,
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: D0001.8384
Technician: Jacob Cannon

Calibration Date: 23 Mar 2023

Calibration Due:
Temperature: 23.54 °C ± 0.25 °C
Humidity: 60.5 %RH ± 2.0 %RH
Static Pressure: 85.98 kPa ± 0.13 kPa

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

Larson Davis CAL200, S/N 8079
Larson Davis CAL201, S/N 0108
PCB 377B02, S/N 345238
Larson Davis PFMxLxT1, S/N 077643

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 61262:2002
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 S1.26 (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 selected 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, 2013-03-10

For 1/8" 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

2023-3-27113-10-34

Page 1 of 3

D0001.0407 Rev 0

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 / 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-1.72-034218.

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.

Description	Cal Date	Cal Due	Cal Standard
Larson Davis CAL291 Residual Intensity Calibrator	2023-09-09	2025-09-09	001250
Hart Scientific 2626-11 Temperature Probe	2021-06-25	2023-05-25	006789
Larson Davis CAL200 Acoustic Calibrator	2023-07-21	2025-07-21	007827
Larson Davis Model 831	2023-05-22	2024-05-22	007182
PCB 377A13 1/2 inch Bipolarized Pressure Microphone	2023-03-06	2024-03-06	007185
SRS DS360 Ultra Low Distortion Generator	2023-03-29	2025-03-29	007635
Larson Davis 1/2" Preamplifier for Model 831 Type 1	2023-09-28	2025-09-28	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 Limit Under Test (LUT) 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	-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



LARSON DAVIS
A PCB DIVISION

2023-3-27113-10-34

Page 2 of 3

D0001.0407 Rev 0

เอกสารไม่ควบคุม

Certificate Number 2023003654

Self-generated Noise

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

Measurement Test Result [dBr]
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



2023-3-23T18:28:01

Page 3 of 3

20001.8407 Rev G

เอกสารไม่ควบคุม

Calibration Certificate

Certificate Number 2023003654

Customer:

United Analyst and Engineering Consultant Co Ltd
No. 81 1st Udonnuek 41, Sakumvit 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 D0001.8375

Technician Jacob Cannon

Calibration Date 23 Mar 2023

Calibration Due

Temperature 23.84 °C ± 0.25 °C

Humidity 49.2 %RH ± 2.0 %RH

Static Pressure 86.57 kPa ± 0.13 kPa

Evaluation Method Tested electrically using Larson Davis PRMLxT1 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/µPa.

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 61269:2001 Class 1

ANSI S1.4-2014 Class 1

ANSI S1.4 (R2006) Type 1

ANSI S1.25 (R2007)

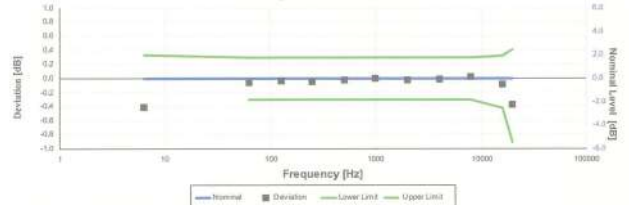
ANSI S1.43 (R2007) Type 1

ANSI S1.11 (R2009) Class 1

Certificate Number 2023003654

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 60651:2001 6.1 and 8.2.2, IEC 60804:2000 5, ANSI S1.4:1989 (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	-0.41	-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
15,848.93	-0.08	-0.08	-0.42	0.32	0.15	Pass
19,952.82	-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



2023-3-23T18:33:02

Page 2 of 8

20001.8407 Rev G

เอกสารไม่ควบคุม

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

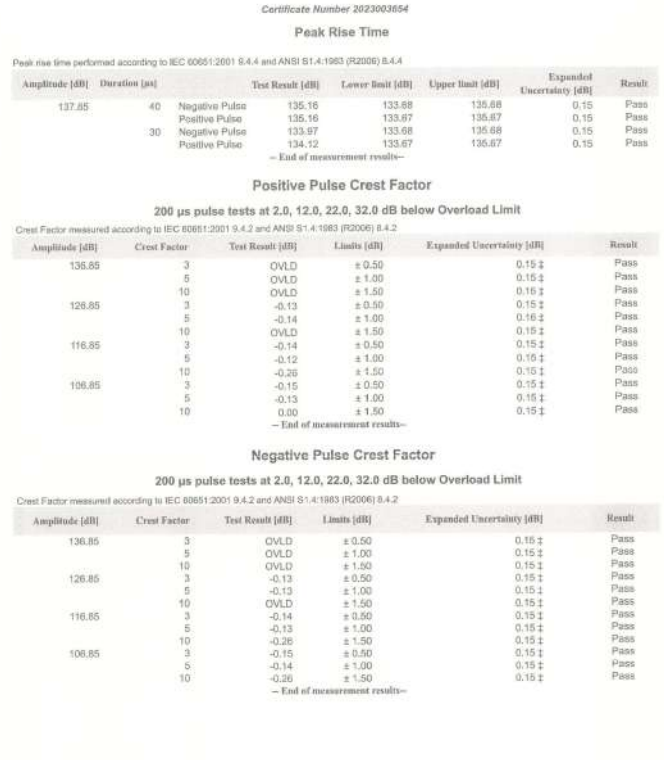
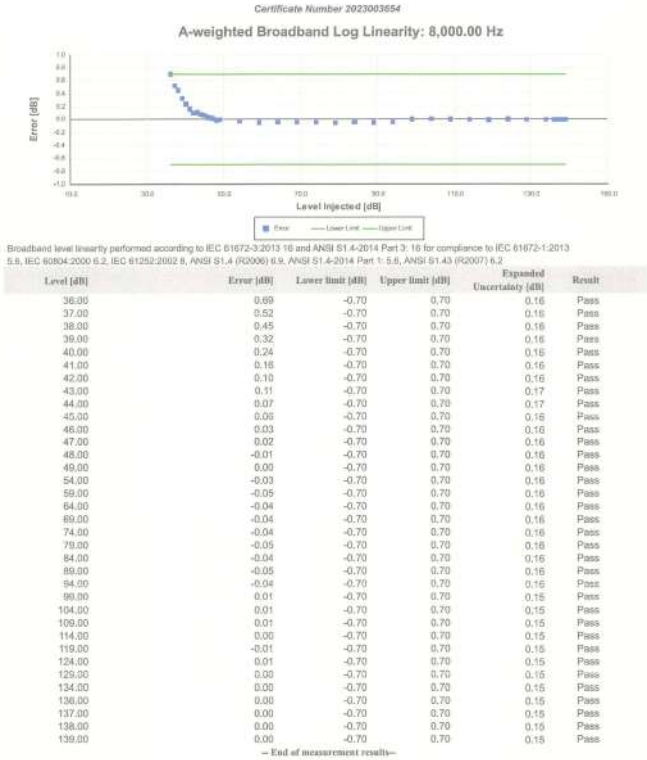


2023-3-23T18:33:02

Page 3 of 8

20001.8407 Rev G

เอกสารไม่ควบคุม



เอกสารไม่ควบคุม

เอกสารไม่ควบคุม



Certificate Number 2023003654

Calibration Certificate

Certificate Number 2023003671

Customer:

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

Model Number

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

D0001.8384

Technician

Jacob Cannon

Calibration Date

24 Mar 2023

Calibration Due

23.54 °C ±0.25 °C

Temperature

50.5 %RH ±2.0 %RH

Humidity

85.58 kPa ±0.13 kPa

Static Pressure

Evaluation Method

Tested with:

Larson Davis PPM LxT1, S/N 077644

Larson Davis CAL291, 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 (R2009) 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 * 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 Ltd, 1770.01 Rev D 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 1/2" adaptor is used with the calibrators.

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

2023-3-24T09:44:49



Page 1 of 3



D0001.8384 Rev G

— End of Report —

Signature: Jacob Cannon

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

2023-3-23T18:33:02



Page 8 of 8



D0001.8407 Rev G

เอกสารไม่ควบคุม

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 / ANSI S1.4-2014 Part 3.

Pattern approval for IEC 61672-3:2013 / ANSI S1.4-2014 Part 1 successfully completed by Physikalisch-Technische Bundesanstalt (PTB) on 2007-10-09 reference number PTB-1.73-0394216.

The sound level meter submitted for testing successfully completed the periodic tests of IEC 61672-3:2013 / ANSI 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 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 S1.4-2014 Part 1, the sound level meter submitted for testing conforms to the class 1 specifications in IEC 61672-1:2013 / ANSI S1.4-2014 Part 1.

Standards Used			
Description	Cal Date	Cal Due	Cal Standard
Larson Davis CAL291 Residual Intensity Calibrator	2023-09-09	2023-09-09	001250
Hart Scientific 2026-11 Temperature Probe	2021-08-25	2023-05-25	066798
Larson Davis CAL290 Acoustic Calibrator	2023-07-21	2023-07-21	007027
Larson Davis Model 831	2023-02-22	2024-02-22	007182
PCB 377A13 1/2 inch Pre-polarized Pressure Microphone	2023-03-06	2024-03-06	007183
SRS DS660 Ultra Low Distortion Generator	2023-03-29	2023-03-29	007633
Larson Davis 1/2" Preamplifier for Model 831 Type 1	2023-09-28	2023-09-28	PC300004783

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	-49.90	-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

2023-3-24T09:44:49



Page 2 of 3



D0001.8408 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 —

Signature: Jacob Cannon

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

2023-3-24T09:44:49



Page 3 of 3



D0001.8384 Rev G

เอกสารไม่ควบคุม

Calibration Certificate

Certificate Number 2023003643

Customer:

United Analyst and Engineering Consultant Co Ltd
No. 11 Soi Udonmek 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

Calibration Due

Temperature 23.89 °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 077844 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 60816:2001 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 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.S, 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

2023-3-27/14.30.38



Page 1 of 8

LARSON DAVIS
A PCB DIVISION

D0001.8407 Rev G

เอกสารไม่ควบคุม

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

2023-3-27/14.30.38



Page 2 of 8

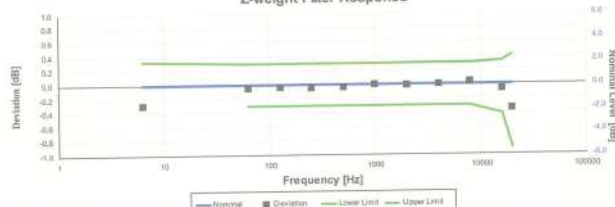
LARSON DAVIS
A PCB DIVISION

D0001.8407 Rev G

เอกสารไม่ควบคุม

Certificate Number 2023003643

Z-weight Filter Response



Electrical signal level 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 60816:2001 6.1 and 9.2.2, IEC 60804:2000 5, ANSI S1.4-1982 (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
8.31	-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
1,995.26	-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
7,943.26	0.04	0.04	-0.30	0.30	0.15	Pass
15,846.53	-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

2023-3-27/14.30.38



Page 3 of 8

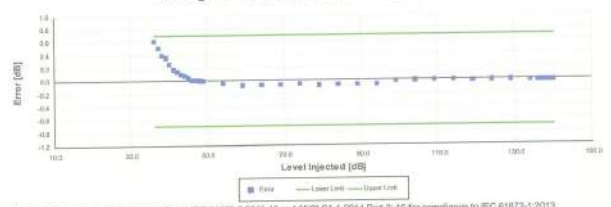
LARSON DAVIS
A PCB DIVISION

D0001.8407 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 6, ANSI S1.4 (R2006) 6.9, ANSI S1.4-2014 Part 1: 5.5, ANSI S1.43 (R2007) 6.2

Level [dB]	Error [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
36.00	0.61	-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	-0.06	-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	-0.06	-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	-0.01	-0.70	0.70	0.15	Pass
62.00	-0.01	-0.70	0.70	0.15	Pass
63.00	0.00	-0.70	0.70	0.15	Pass
64.00	0.00	-0.70	0.70	0.15	Pass
65.00	-0.02	-0.70	0.70	0.15	Pass
66.00	-0.01	-0.70	0.70	0.15	Pass
67.00	-0.01	-0.70	0.70	0.15	Pass
68.00	-0.01	-0.70	0.70	0.15	Pass
69.00	-0.01	-0.70	0.70	0.15	Pass
70.00	-0.01	-0.70	0.70	0.15	Pass
71.00	-0.01	-0.70	0.70	0.15	Pass
72.00	-0.01	-0.70	0.70	0.15	Pass
73.00	-0.01	-0.70	0.70	0.15	Pass
74.00	-0.01	-0.70	0.70	0.15	Pass
75.00	-0.02	-0.70	0.70	0.15	Pass
76.00	-0.02	-0.70	0.70	0.15	Pass
77.00	-0.02	-0.70	0.70	0.15	Pass
78.00	-0.02	-0.70	0.70	0.15	Pass
79.00	-0.02	-0.70	0.70	0.15	Pass
80.00	-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

2023-3-27/14.30.38



Page 4 of 8

LARSON DAVIS
A PCB DIVISION

D0001.8407 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
		Negative Pulse	133.95	133.44	135.44	0.15 Pass
126.85	30	Positive Pulse	133.90	133.43	135.43	0.15 Pass
		Negative Pulse	133.90	133.43	135.43	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	OVL	± 0.50	0.15 ±	Pass
	5	OVL	± 1.00	0.15 ±	Pass
	10	OVL	± 1.50	0.15 ±	Pass
126.85	3	-0.12	± 0.50	0.15 ±	Pass
	5	-0.11	± 1.00	0.15 ±	Pass
	10	OVL	± 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	OVL	± 0.50	0.15 ±	Pass
	5	OVL	± 1.00	0.15 ±	Pass
	10	OVL	± 1.50	0.15 ±	Pass
126.85	3	-0.12	± 0.50	0.15 ±	Pass
	5	-0.11	± 1.00	0.15 ±	Pass
	10	OVL	± 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	-0.06	± 1.50	0.15 ±	Pass

-- End of measurement results--

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

2023-3-23T14:30:38

Page 5 of 8

10001.0407 Rev G

เอกสารไม่ควบคุม

Certificate Number 2023003643

Gain

Gain measured according to IEC 61672-3:2013 17.3 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	93.90	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	38.00	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

2023-3-23T14:30:38

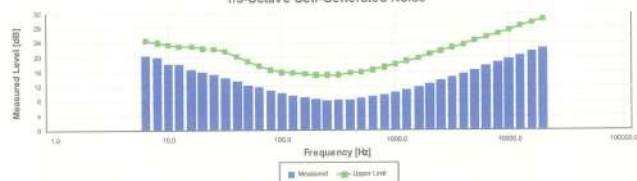
Page 6 of 8

10001.0407 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
8.30	20.34	24.60	Pass
8.80	19.89	24.00	Pass
10.00	18.12	23.50	Pass
12.50	18.13	23.00	Pass
16.00	16.66	22.90	Pass
20.00	15.98	22.40	Pass
25.00	15.30	22.30	Pass
31.50	14.43	21.50	Pass
40.00	13.41	20.30	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	11.86	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	17.56	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

2023-3-23T14:30:38

Page 7 of 8

10001.0407 Rev G

เอกสารไม่ควบคุม

Certificate Number 2023003643

Signature: Janet Cannon

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

2023-3-23T14:30:38

Page 8 of 8

10001.0407 Rev G

เอกสารไม่ควบคุม

Calibration Certificate

Certificate Number 2023003673

Customer:

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

Model Number LxT1

Serial Number 0007310

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

Temperature 23.47 °C ± 0.25 °C

Humidity 50.8 %RH ± 2.0 %RH

Static Pressure 85.69 kPa ± 0.13 kPa

Evaluation Method

Tested with:

Larson Davis PRLxT1, SN 977645

PCB 377B02, SN 340240

Larson Davis CAL200, SN 9079

Larson Davis CAL291, SN 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 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 (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, 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 ADP043 1/4" to

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



Page 1 of 3



D0001.8406 Rev O

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 61672-2:2013 / 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-1.73-4034216.

The sound level meter submitted for testing successfully completed the periodic tests of IEC 61672-2:2013 / 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.

Description	Standards Used		
	Cal Date	Cal Due	Cal Standard
Larson Davis CAL291 Residual Intensity Calibrator	2022-09-09	2023-09-09	081250
Hart Scientific 2626-H Temperature Probe	2021-06-25	2023-05-25	066798
Larson Davis CAL200 Acoustic Calibrator	2022-07-21	2023-07-21	087827
Larson Davis Model 931	2023-02-21	2024-02-21	007182
PCB 177A13 1/2 inch Prepolarized Pressure Microphone	2023-03-06	2024-03-06	007185
SRS DS560 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	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	-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



D0001.8406 Rev O

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 –

– End of Report –

Signature: Jacob Cannon

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



Page 3 of 3



D0001.8406 Rev O

เอกสารไม่ควบคุม

Calibration Certificate

Certificate Number 2023003658

Customer:

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

Model Number LxT1

Serial Number 0007310

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 23.83 °C ± 0.25 °C

Humidity 49.6 %RH ± 2.0 %RH

Static Pressure 86.01 kPa ± 0.13 kPa

Evaluation Method Tested electrically using Larson Davis PRLxT1 SN 977645 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 61260:2001 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, 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



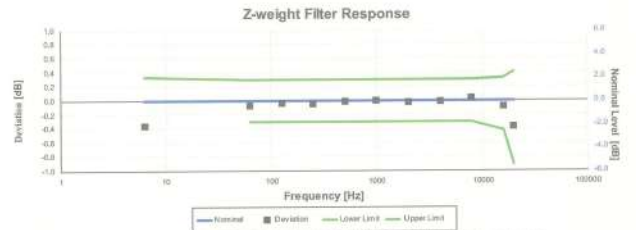
D0001.8407 Rev O

เอกสารไม่ควบคุม

Certificate Number 2023003658

Certificate Number 2023003658

Description	Standards Used		
	Cal Date	Cal Due	Cal Standard
Hart Scientific 2626-II Temperature Probe	2021-08-25	2023-05-25	066798
SRS DS360 Ultra Low Distortion Generator	2022-09-02	2023-09-02	007167



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 60681:2001 6.1 and R.2.2, IEC 60894:2000 5, ANSI S1.4-1983 (R2009) 5.1 and R.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
19,952.82	-0.38	-0.38	-0.81	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

2023-5-23T17:43:22

Page 2 of 8

F00001.0407 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

2023-5-23T17:43:22

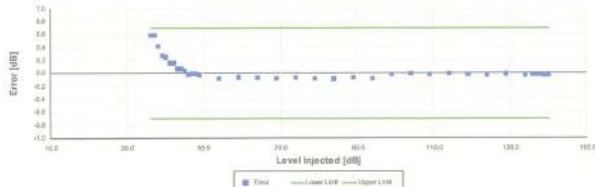
Page 3 of 8

F00001.0407 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 5.6, IEC 60894:2000 6.2, IEC 61252:2002 8, ANSI S1.4 (R2006) 5.9, ANSI S1.4-2014 Part 1: 5.8, ANSI S1.4.3 (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	0.16	-0.70	0.70	0.16	Pass
42.00	0.18	-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	0.16	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	0.16	Pass
50.00	-0.08	-0.70	0.70	0.16	Pass
51.00	-0.06	-0.70	0.70	0.16	Pass
52.00	-0.07	-0.70	0.70	0.16	Pass
53.00	-0.08	-0.70	0.70	0.16	Pass
54.00	-0.07	-0.70	0.70	0.16	Pass
55.00	-0.08	-0.70	0.70	0.16	Pass
56.00	-0.07	-0.70	0.70	0.16	Pass
57.00	-0.08	-0.70	0.70	0.16	Pass
58.00	-0.07	-0.70	0.70	0.16	Pass
59.00	-0.08	-0.70	0.70	0.16	Pass
60.00	-0.07	-0.70	0.70	0.16	Pass
61.00	-0.08	-0.70	0.70	0.16	Pass
62.00	-0.07	-0.70	0.70	0.16	Pass
63.00	-0.08	-0.70	0.70	0.16	Pass
64.00	-0.07	-0.70	0.70	0.16	Pass
65.00	-0.08	-0.70	0.70	0.16	Pass
66.00	-0.07	-0.70	0.70	0.16	Pass
67.00	-0.08	-0.70	0.70	0.16	Pass
68.00	-0.07	-0.70	0.70	0.16	Pass
69.00	-0.08	-0.70	0.70	0.16	Pass
70.00	-0.07	-0.70	0.70	0.16	Pass
71.00	-0.08	-0.70	0.70	0.16	Pass
72.00	-0.07	-0.70	0.70	0.16	Pass
73.00	-0.08	-0.70	0.70	0.16	Pass
74.00	-0.07	-0.70	0.70	0.16	Pass
75.00	-0.08	-0.70	0.70	0.16	Pass
76.00	-0.07	-0.70	0.70	0.16	Pass
77.00	-0.08	-0.70	0.70	0.16	Pass
78.00	-0.07	-0.70	0.70	0.16	Pass
79.00	-0.08	-0.70	0.70	0.16	Pass
80.00	-0.07	-0.70	0.70	0.16	Pass
81.00	-0.08	-0.70	0.70	0.16	Pass
82.00	-0.07	-0.70	0.70	0.16	Pass
83.00	-0.08	-0.70	0.70	0.16	Pass
84.00	-0.07	-0.70	0.70	0.16	Pass
85.00	-0.08	-0.70	0.70	0.16	Pass
86.00	-0.07	-0.70	0.70	0.16	Pass
87.00	-0.08	-0.70	0.70	0.16	Pass
88.00	-0.07	-0.70	0.70	0.16	Pass
89.00	-0.08	-0.70	0.70	0.16	Pass
90.00	-0.07	-0.70	0.70	0.16	Pass
91.00	-0.08	-0.70	0.70	0.16	Pass
92.00	-0.07	-0.70	0.70	0.16	Pass
93.00	-0.08	-0.70	0.70	0.16	Pass
94.00	-0.07	-0.70	0.70	0.16	Pass
95.00	-0.08	-0.70	0.70	0.16	Pass
96.00	-0.07	-0.70	0.70	0.16	Pass
97.00	-0.08	-0.70	0.70	0.16	Pass
98.00	-0.07	-0.70	0.70	0.16	Pass
99.00	-0.08	-0.70	0.70	0.16	Pass
100.00	-0.07	-0.70	0.70	0.16	Pass
101.00	-0.08	-0.70	0.70	0.16	Pass
102.00	-0.07	-0.70	0.70	0.16	Pass
103.00	-0.08	-0.70	0.70	0.16	Pass
104.00	-0.07	-0.70	0.70	0.16	Pass
105.00	-0.08	-0.70	0.70	0.16	Pass
106.00	-0.07	-0.70	0.70	0.16	Pass
107.00	-0.08	-0.70	0.70	0.16	Pass
108.00	-0.07	-0.70	0.70	0.16	Pass
109.00	-0.08	-0.70	0.70	0.16	Pass
110.00	-0.07	-0.70	0.70	0.16	Pass
111.00	-0.08	-0.70	0.70	0.16	Pass
112.00	-0.07	-0.70	0.70	0.16	Pass
113.00	-0.08	-0.70	0.70	0.16	Pass
114.00	-0.07	-0.70	0.70	0.16	Pass
115.00	-0.08	-0.70	0.70	0.16	Pass
116.00	-0.07	-0.70	0.70	0.16	Pass
117.00	-0.08	-0.70	0.70	0.16	Pass
118.00	-0.07	-0.70	0.70	0.16	Pass
119.00	-0.08	-0.70	0.70	0.16	Pass
120.00	-0.07	-0.70	0.70	0.16	Pass
121.00	-0.08	-0.70	0.70	0.16	Pass
122.00	-0.07	-0.70	0.70	0.16	Pass
123.00	-0.08	-0.70	0.70	0.16	Pass
124.00	-0.07	-0.70	0.70	0.16	Pass
125.00	-0.08	-0.70	0.70	0.16	Pass
126.00	-0.07	-0.70	0.70	0.16	Pass
127.00	-0.08	-0.70	0.70	0.16	Pass
128.00	-0.07	-0.70	0.70	0.16	Pass
129.00	-0.08	-0.70	0.70	0.16	Pass
130.00	-0.07	-0.70	0.70	0.16	Pass
131.00	-0.08	-0.70	0.70	0.16	Pass
132.00	-0.07	-0.70	0.70	0.16	Pass
133.00	-0.08	-0.70	0.70	0.16	Pass
134.00	-0.07	-0.70	0.70	0.16	Pass
135.00	-0.08	-0.70	0.70	0.16	Pass
136.00	-0.07	-0.70	0.70	0.16	Pass
137.00	-0.08	-0.70	0.70	0.16	Pass
138.00	-0.07	-0.70	0.70	0.16	Pass
139.00	-0.08	-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

2023-5-23T17:43:22

Page 4 of 8

F00001.0407 Rev G

เอกสารไม่ควบคุม

Certificate Number 2023003658

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	Pass
		Positive Pulse	135.00	133.52	135.52	0.15	Pass
30	30	Negative Pulse	134.07	133.55	135.55	0.15	Pass
		Positive Pulse	134.07	133.52	135.52	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 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
138.85	3	O.V.L.D	± 0.50	0.15 ±	Pass
	5	O.V.L.D	± 1.00	0.15 ±	Pass
	10	O.V.L.D	± 1.50	0.15 ±	Pass
128.85	3	-0.13	± 0.50	0.15 ±	Pass
	5	-0.14	± 1.00	0.15 ±	Pass
	10	O.V.L.D	± 1.50	0.15 ±	Pass
118.85	3	-0.12	± 0.50	0.15 ±	Pass
	5	-0.14	± 1.00	0.15 ±	Pass
	10	-0.26	± 1.50	0.15 ±	Pass
108.85	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 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
138.85	3	O.V.L.D	± 0.50	0.15 ±	Pass
	5	O.V.L.D	± 1.00	0.15 ±	Pass
	10	O.V.L.D	± 1.50	0.15 ±	Pass
128.85	3	-0.11	± 0.50	0.15 ±	Pass
	5	-0.11	± 1.00	0.15 ±	Pass
	10	O.V.L.D	± 1.50	0.15 ±	Pass
118.85	3	-0.11	± 0.50	0.15 ±	Pass
	5	-0.10	± 1.00	0.15 ±	Pass
	10	-0.23	± 1.50	0.15 ±	Pass
108.85	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

2023-5-23T17:43:22

Page 5 of 8

F00001.0407 Rev G

เอกสารไม่ควบคุม

Certificate Number 2023003658

Gain

Gain measured according to IEC 61072-3:2013 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	0.15	Pass
THD	-66.81	-58.00	-58.00	0.01 %	Pass
THD+N	-62.78	-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

2023-5-23T17:43:22

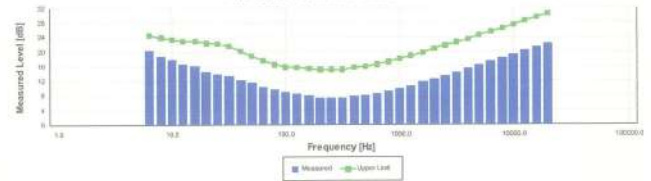
Page 6 of 8

000010407 Rev G

เอกสารไม่ควบคุม

Certificate Number 2023003658

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	18.79	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	21.59	Pass
40.00	12.35	20.29	Pass
50.00	11.55	18.80	Pass
63.00	10.50	17.60	Pass
80.00	9.71	16.80	Pass
100.00	9.02	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	12.59	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
716-684-0001



LARSON DAVIS
A PCB DIVISION

2023-5-23T17:43:22

Page 7 of 8

000010407 Rev G

เอกสารไม่ควบคุม

Certificate Number 2023003658



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.: 23CH1226
Page: 1 of 3

Certificate of Calibration

Equipment : pH Meter
Manufacturer : Horiba
Model : LAQUA-PH210
Serial No. : HA1C0019
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,
Bangchak, Phrakhanong, Bangkok 10260

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

Calibrated by : Warakorn Lernagatrakul

Approved by :
Approved Signatory

(✓) Sathip Meangmai
() Warakorn Lernagatrakul
() 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



LARSON DAVIS
A PCB DIVISION

2023-5-23T17:43:22

Page 8 of 8

000010407 Rev G

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	4962054	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		

เอกสารไมคอบคุม
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
	6.986	7.00	-34.2	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 ($^{\circ}$ C)	Standard Temperature ($^{\circ}$ C)	UUC* Reading ($^{\circ}$ C)	Error ($^{\circ}$ C)	Uncertainty of measurement (\pm $^{\circ}$ 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-

เอกสารไมคอบคุม
a 1182399



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3 : EQUIPMENT CALIBRATION AND TESTING SERVICES
33/44 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 : 2309-08B4WSC-3
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong, Bangkok 10260
Laboratory Condition : Temperature (25 ± 5) $^{\circ}$ C
Humidity (50 ± 20) %
Test Procedure : In - house method : CP-CH9
by Comparison Technique with Azide Modification Method
Tested by : Walailak Sinthean
Approved by :
Approved Signatory
(☒) Saitthip Meangmai
(☐) Warakorn Lernagatrakul
(☐) Ponpan Paipim
Issue Date : 29 September 2023

เอกสารไมคอบคุม
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-

เอกสารไมคอบคุม
a 1182622



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
53/44 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-29 FAX. 0-2719-9484



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 :
() Pornthippa 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	2211285	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
53/44 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-29 FAX. 0-2719-9484



Cert.No.: 23CH1232
Page.: 1 of 3

Certificate of Calibration

Equipment : Conductivity Meter
Manufacturer : Horiba
Model : LAQUA-EC210
Serial No. : HCQJ0014
ID No. : UAE-EFM.205/2564(EFM SCT. 10/64)
Condition As-Received : Used Item
Received Date : 26 September 2023
Calibration Date : 27 September 2023
Reference : 2309-0882WSC-5
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 Lemgagrakul
Approved by :
(✓) Saithip Meangmai
() Warakorn Lemgagrakul
() 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

เอกสารไม่ควบคุม
A 0059074



Cert.No.: 23CH1232
Page.: 2 of 3

Condition of this result of calibration

1. Reference Standard Instrument :-

Instrument	Serial No.	ID No.	Certificate No.	Due date
1) Thermometer	1963878	130RC095	2311051	05 Sep 2024
2) Ref. Std Thermometer	4982054	110RC044	231908	26 Jul 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 ± 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.: 9B0H0061

Standard Conductivity Solution	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement (±)	Coverage factor k
1413.0 µS/cm	1424 µS/cm	1413 µS/cm	9.2 µS/cm	2.00
12.880 mS/cm	12.55 mS/cm	12.47 mS/cm	0.086 mS/cm	2.00

Remark - UUC* = Unit Under Calibration

เอกสารไม่ควบคุม
a 1182398



Cert.No.: 23CH1232
Page.: 3 of 3

Calibration Results

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe,

- Model : 9383
- Serial No. : 980H0061

Dimension of probe;

- Length : 113 mm
- Diameter : 10 mm
- Immersion Depth : 90 mm

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (± °C)	Coverage factor k
25.0	25.000	25.0	0.000	0.13	2.00
30.0	30.002	30.0	-0.002	0.13	2.00
35.0	35.001	35.0	-0.001	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 %.

-o0o-

Sathip
เอกสารไม่ควบคุม
a 1182397

INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7-139 MOO 11, SOI SUTINAKORN 11 TAMBON BANG KAEU,
AMPHOE BANG PHU SAMUT PRAKARN PROVINCE 10140 THAILAND
TEL : 0809-2110-7800-1 FAX: 0809-2110-7140



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-ACT-065
Request No : Req-2023-0976

Unit Under Calibration Details

Measurement Item : Acoustic Calibrator
Manufacturer : LARSON DAVIS
Model : CAL150
Serial Number : 6458
ID : UAE.EFM.056/2564
Class : 2
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 : 9 May 2023
Calibration Date : 12 May 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	EEI	31 May 2023
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 Mathavorn
Calibration Engineer Supervisor
Issue Date : 12 May 2023

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

เอกสารไม่ควบคุม

INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7-139 MOO 11, SOI SUTINAKORN 11 TAMBON BANG KAEU,
AMPHOE BANG PHU SAMUT PRAKARN PROVINCE 10140 THAILAND
TEL : 0809-2110-7800-1 FAX: 0809-2110-7140



Certificate No : 23-ACT-065
Request No : Req-2023-0976

Sound pressure level

Calibration Results : Without Adjustment

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty (± dB)	Acceptance limit Class 2 (± dB)
	Measured	Error	Measured	Error		
94 dB / 1000 Hz	93.91	-0.09	-	-	0.13	0.40
114 dB / 1000 Hz	113.96	-0.04	-	-	0.13	0.40

Frequency of Sound pressure level

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

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

Calibration Range (Hz)	Without Adjustment	Adjustment	Uncertainty (± %)	Acceptance limit Class 2 (± %)
	Measured (%)	Measured (%)		
94 dB / 1000 Hz	0.02	-	0.40	3.0
114 dB / 1000 Hz	0.23	-	0.40	3.0

Note :

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

End of Calibration

เอกสารไม่ควบคุม

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

451-451/1 Sirinthorn Rd.,Bangbunru, Bangplud Bangkok 10700 THAILAND.
Tel.0-2435-8800 Fax.0-2433-1679 e-mail:center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL23144
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No. : 00321435 / 176347 / 11455
ID No. : UAE.EMA2.084/2555

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 : 05 MAY 2023
Calibration Date : 08-09 MAY 2023
Date of Issue : 10 MAY 2023

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23144
Job No. : VC66AC0053
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	EP-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EP-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	EP-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. Pich.

Continuation of Calibration Certificate

Cert. No. : ACL23144
Job No. : VC66AC0053
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. Pich.

Continuation of Calibration Certificate

Cert. No. : ACL23144
Job No. : VC66AC0053
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.8

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

Frequency Weighting	Measured value (dB)
A-weight	11.6
C-weight	17.5
Flat	23.3

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.3	0.3	0.3	±1.5
1000	0.1	0.1	0.1	±1.0
8000	0.2	0.3	0.2	±5.0

QP-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Pich.

Continuation of Calibration Certificate

Cert. No. : ACL23144
Job No. : VC66AC0053
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long-term stability

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

QP-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Pich.

Continuation of Calibration Certificate

Cert. No. : ACL23144
Job No. : VC66AC0053
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	38.9	-0.1	±1.1
34.0	33.9	-0.1	±1.1
30.0	29.9	-0.1	±1.1
29.0	28.9	-0.1	±1.1
28.0	27.9	-0.1	±1.1
27.0	26.9	-0.1	±1.1
26.0	25.9	-0.1	±1.1
25.0	24.9	-0.1	±1.1

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL23144
Job No. : VC66AC0053
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	136.2	-0.2	±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. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL23144
Job No. : VC66AC0053
Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Petchur

451-451/1 Sirinthorn Rd., Bangbunru, Bangplud Bangkok 10700 THAILAND.
Tel.0-2435-8800 Fax.0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL23145
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No. : 00321440 / 156391 / 11460
ID No. : UAE/EMA2.089/2555

Condition As Found : GOOD

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

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

Received Date : 05 MAY 2023
Calibration Date : 08-09 MAY 2023
Date of Issue : 10 MAY 2023

Calibrated by : Nathakorn Pisutpaisan

Approved by : T. Petchur
(Thanakul Petchurai)

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

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

Continuation of Calibration Certificate

Cert. No. : ACL23145
Job No. : VC66AC0053
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).

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. R. R.

Continuation of Calibration Certificate

Cert. No. : ACL23145
Job No. : VC66AC0053
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.

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. R. R.

Continuation of Calibration Certificate

Cert. No. : ACL23145
Job No. : VC66AC0053
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)
17.8

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

Frequency Weighting	Measured value (dB)
A - weight	12.6
C - weight	17.9
Flat	23.6

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.5	0.5	0.5	± 1.5
1000	0.2	0.2	0.2	± 1.0
8000	-1.3	-1.2	-1.2	± 5.0

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. R. R.

Continuation of Calibration Certificate

Cert. No. : ACL23145
Job No. : VC66AC0053
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. R. R.

Continuation of Calibration Certificate

Cert. No. : ACL23145
Job No. : VC66AC0053
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.0	0.0	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.0	0.0	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.0	0.0	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	53.9	-0.1	±1.1
49.0	49.0	0.0	±1.1
44.0	43.9	-0.1	±1.1
39.0	38.9	-0.1	±1.1
34.0	33.9	-0.1	±1.1
30.0	29.9	-0.1	±1.1
29.0	28.9	-0.1	±1.1
28.0	27.9	-0.1	±1.1
27.0	26.9	-0.1	±1.1
26.0	25.9	-0.1	±1.1
25.0	25.0	0.0	±1.1

QF-TS12-04-04-020664

เอกสารไม่ควบคุม
T. Petchum

Continuation of Calibration Certificate

Cert. No. : ACL23145
Job No. : VC66AC0053
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	128.1	0.1	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	136.2	-0.2	±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. Petchum

Continuation of Calibration Certificate

Cert. No. : ACL23145
Job No. : VC66AC0053
Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

เอกสารไม่ควบคุม
T. Petchum

451-451/1 Sirinthorn Rd., Bangbunru, Bangplud Bangkok 10700 THAILAND.
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL23179
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 00558037 / 200032 / 47892
ID No.: UAE.EFM.036/2558

Condition As Found : GOOD

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT (UAE)
81 SOI UDOMSUK 41, SUKHUMVIT ROAD,
BANGKHAO 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 : 29 MAY 2023
Calibration Date : 07-08 JUNE 2023
Date of Issue : 09 JUNE 2023

Calibrated by : Nathakorn Pisutpaisan

Approved by : T. Petchum
(Thanakul Petchum)

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.

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

Continuation of Calibration Certificate

Cert. No. : ACL23179
Job No. : VC66AC0062
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	MY53202742	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).

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

7. Btch.

Continuation of Calibration Certificate

Cert. No. : ACL23179
Job No. : VC66AC0062
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)
15.4

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

Frequency Weighting	Measured value (dB)
A - weight	12.0
C - weight	18.2
Flat	24.1

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	-0.1	-0.1	-0.1	± 1.0
8000	1.6	1.7	1.7	±5.0

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

7. Btch.

Continuation of Calibration Certificate

Cert. No. : ACL23179
Job No. : VC66AC0062
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.

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

7. Btch.

Continuation of Calibration Certificate

Cert. No. : ACL23179
Job No. : VC66AC0062
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

7. Btch.

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

7. Btch.

Continuation of Calibration Certificate

Cert. No. : ACL23179
Job No. : VC66AC0062
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.0	0.0	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.0	0.0	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.0	0.0	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.1	0.1	±1.1
84.0	84.1	0.1	±1.1
79.0	79.0	0.0	±1.1
74.0	74.1	0.1	±1.1
69.0	69.1	0.1	±1.1
64.0	64.0	0.0	±1.1
59.0	59.1	0.1	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	34.0	0.0	±1.1
30.0	29.9	-0.1	±1.1
29.0	29.0	0.0	±1.1
28.0	28.0	0.0	±1.1
27.0	27.0	0.0	±1.1
26.0	25.9	-0.1	±1.1
25.0	25.0	0.0	±1.1

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Petch.

Continuation of Calibration Certificate

Cert. No. : ACL23179
Job No. : VC66AC0062
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	135.4	-1.0	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.1	0.1	±2.0
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.3	-0.1	±2.0

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Petch.

Continuation of Calibration Certificate

Cert. No. : ACL23179
Job No. : VC66AC0062
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.8	89.6	-0.2	±1.5

12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Petch.

INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7-109 MOO 13, SOI SUTENAKORN 11 TAMBON BANG KAEI,
AMPHUR BANG PHU SAMUT PRAKAN PROVINCE 10540 THAILAND
TEL : 0860-2110-5800-1 FAX: 0860-2110-7140

Page 3/2

Certificate of Calibration

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

Certificate No : 23-AFM-121
Request No : Req-2023-0950

Unit Under Calibration Details

Measurement Item : Primary Flow Calibrator
Manufacturer : TSI
Model : 5300
Serial Number : 53002052003
ID : UAE.FFM.162/2564

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 hPa ± 10 hPa
Received Date : 4 May 2023
Calibration Date : 26 May 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	Sensidyne	15 June 2023
Air Flow Meter	Gilibrator 3 High flow	18501012012	Sensidyne	15 June 2023
Air Flow Meter	4045 F	4043 0533 001	MIT	5 January 2024
Temperature meter	GT 11	12060077	Quborn	27 February 2024
Pressure meter	CPK2400	41000KDU/851982	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 Laungprai
Service Calibration Engineer

Approved By :
Mr. Pachi Mahavorn
Calibration Engineer Supervisor
Issue Date : 26 May 2023

The results related only to the item calibrated. This certificate shall not be reproduced except in full, without written approval of the Issuing Authority.
FM-708-AFM-01 Rev.05 Issue date 01/01/23

เอกสารไม่ควบคุม

Certificate No : 23-AFM-121
Request No : Req-2023-0950

Result of Calibration :

Temperature (°C)	Pressure (kPa)	STD (L/min)	UUC (L/min)	Error (L/min)	Uncertainty (L/min)
24.60	101.43	1.604	1.51	-0.094	0.026
25.20	101.43	10.01	9.48	-0.53	0.142
25.00	101.47	20.00	19.14	-0.86	0.28
25.20	101.65	50.12	48.98	-1.14	1.30
26.70	102.24	99.9	96.98	-2.92	2.68
35.70	103.26	152.7	146.65	-6.05	3.97
41.30	104.27	202.9	192.51	-10.39	5.28

Note
STD : Standard UUC : Unit Under Calibration
- UUC Reference Condition : At atmospheric pressure and room temperature condition
- 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 body. เอกสารไม่ควบคุม
FM-708-AFM-01 Rev.05 Issue Date: 01/07/23



Certificate of Calibration

Certificate No. : 23P1858
Page : 1 of 2

Equipment : Aneroid Barometer
Manufacturer : Barigo
Model : -
Serial No. : -
ID No. : UAE/ANV/124/2550

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: 28 May 2023

Calibration Date: 02 June 2023

Reference: 2305-0919WSC

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

Ambient Temperature: (23 ± 2) °C

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

Relative Humidity: (50 ± 15) %

Atmospheric Pressure: 1007 mbar

Procedure used: The calibration was conducted by direct comparison method against Pressure Measuring Instruments Standard according to in-house calibration procedure CP-P10, using * DKD-R 8-1 ; 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 : 08 June 2023

Approved Signatory : 
| Phatinee Pratsarpai
| Sure Suwanasri
| Attapol Panurach

เอกสารไม่ควบคุม
8 0316958



Cert.No.: 23P1858
Page: 2 of 2

Result of calibration:- Without adjustment

Function:- Absolute Pressure Measurement

Range: 960 hPa to 1030 hPa

Scale Interval: 1 hPa (The Fifth Estimate)

Increasing Pressure

Applied Pressure (hPa)	999.93	970.47	981.93	991.32	1002.26	1011.84	1021.14	1032.30
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	-2.26	-1.64	-1.14	-2.30

Decreasing Pressure

Applied Pressure (hPa)	1032.30	1021.44	1011.67	1002.38	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 %.

-000-

Attapol P.
เอกสารไม่ควบคุม
8 1165506



Certificate of Calibration

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

Certificate No. : 23-TPM-483
Request No : Req-2023-2174
Page : 1/2

Unit Under Calibration Details

Calibration Parameter : Temperature

Instrument Name : Thermal Environment Monitor

Manufacturer : JM

Model : QT-32

Serial Number : TFS010006

Resolution : 0.1 °C

ID Number : UAE/EFM/081/2561

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 ± 0.5 °C

Humidity : 55 %RH ± 15 %RH

Received Date : 11 October 2023

Calibrated Date : 17 October 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-ONSAC Accreditation No.: Calibration 0292

Note

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

Approved By : 

Mr. Noppadol Luangrit

Technical Manager

Issue Date : 17 October 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
8 0316958



Calibration Note
UUC Adjustment : Not Adjust
Certificate No : 23-TPM-483
Request No : Req-2023-2174
Page : 2/2

Result of Calibration :

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (°C)
WET	20.031	19.9	+ 0.1	0.13
	25.035	24.9	+ 0.1	0.13
	30.035	29.8	+ 0.2	0.13
	35.037	34.8	+ 0.2	0.13
	40.039	39.8	+ 0.1	0.13
	45.040	44.9	+ 0.1	0.13
	50.044	49.9	+ 0.1	0.13
	60.046	59.8	+ 0.2	0.13
DRY	20.033	19.9	+ 0.1	0.13
	25.035	24.9	+ 0.1	0.13
	30.034	29.9	+ 0.1	0.13
	35.036	34.9	+ 0.1	0.13
	40.038	40.0	0.0	0.13
	45.041	45.0	0.0	0.13
	50.044	50.0	0.0	0.13
	60.046	59.9	+ 0.1	0.13
GLOBE	20.031	19.8	+ 0.1	0.13
	25.033	24.8	+ 0.1	0.13
	30.034	29.8	+ 0.2	0.13
	35.038	34.8	+ 0.2	0.13
	40.040	39.9	+ 0.1	0.13
	45.043	44.8	+ 0.1	0.13
	50.042	49.9	+ 0.1	0.13
	60.047	59.8	+ 0.2	0.13

End of Certificate

Calibrated By :
Mr. Sirichok Jongsakdeesakul

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, Bangchak, Prakanong,
Bangkok 10260
Page : 1/2

Unit Under Calibration Details

Calibration Parameter : Temperature
Instrument Name : Thermal Environment Monitor
Manufacturer : TSI QUEST
Model : QT-32
Serial Number : TPT030009
Resolution : 0.1 °C
ID Number : UAE-EFM219-2562
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: 0000057, ID: 62-TPM Which was calibrated on 27 February 2023, Calibration Certificate No.: QR23-0494
Traceability : This Certificate is traceable to SI Unit through Quality 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 Luangtan
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	Standard 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	25.1	+ 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
	35.033	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. Sirichok Jongsakdeesakul

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



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250
TEL: 0-2713-5000-24 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. : 395034175
ID No. : UAE-EFM 5842565

Condition As-Received: Used Item

Received Date: 18 May 2023

Calibration Date: 22 May 2023

to 24 May 2023

Reference: 2305-0641WSC

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 Udomsak 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260

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

Condition of this result of calibration

1.Reference standards instruments

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Chilled Mirror Hygrometer	Dew Mastor	44730	20563A	14 Jun 2023
2) Handheld Thermometer With Sensor	1521	ASA039	2201251	12 Oct 2023

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
-National Institute of Metrology Thailand (NIMT)

Calibrated by : Kraipon Onrat
Issue Date : 25 May 2023

Approved Signatory :
[] Chakrit Waoewanjua
[] Pornthippa Tameyakul
[] 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	0.678	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

Calibration Report

Certificate No.: 2402420-002-01
Equipment: Electronic Balance
Model: XPE
Serial No.: 8322373893
Capacity: 6.1 g
Manufacturer: METTLER TOLEDO
Resolution: 0.00001 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 Standard:

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	15862	TCS	M03111825	28 November 2024

Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo Hygro Meter	808-H1	NFI.BTH 019/23	Quality Room	Q624-0492	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	1.999983	1.999983	1.999981	0.000003

FC-012 Revision: 01 Date: 20-04-05

2008 ๒๕๕๑-๒๕๖๓ ๒๕๖๓ มูลนิธิส่งเสริมและพัฒนาอุตสาหกรรม ศูนย์บริการห้องปฏิบัติการอุตสาหกรรมอาหาร 10700 กรุงเทพมหานคร 2008 Soi 36, Anur Awarth Road, Bang Yi Khan Subdistrict, Bang Phut District, Bangkok 10700, Thailand
Tel: +66(0)2-452 8500 Fax: +66(0)2-452 8515

Calibration Report

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

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

Nominal Value	Standard Value	Average Reading	Correction	Uncertainty	Coverage Factor
(g)	(g)	(g)	(g)	(g)	#
Unloaded	0.0000000	0.0000000	0.0000000	0.0000032	2.00
0.01	0.0099979	0.0099999	-0.0000022	0.0000047	2.00
0.05	0.0500010	0.0500003	-0.0000007	0.0000048	2.00
0.10	0.1000010	0.1000000	-0.0000010	0.0000069	2.00
0.15	0.1500020	0.1500002	-0.0000018	0.0000083	2.00
0.17	0.1700050	0.1700006	-0.0000044	0.0000112	2.00
0.20	0.1999990	0.2000002	0.0000012	0.0000083	2.00
1.50	1.4999750	1.4999771	0.0000021	0.0000207	2.00
3.00	2.9999680	2.9999699	0.0000019	0.0000208	2.00
4.50	4.4999810	4.4999867	0.0000057	0.0000232	2.00
6.00	5.9999490	5.9999511	0.0000021	0.0000232	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 %.

FC-012 Revision: 01 Date: 20-04-05

2008 ๒๕๕๑-๒๕๖๓ ๒๕๖๓ มูลนิธิส่งเสริมและพัฒนาอุตสาหกรรม ศูนย์บริการห้องปฏิบัติการอุตสาหกรรมอาหาร 10700 กรุงเทพมหานคร 2008 Soi 36, Anur Awarth Road, Bang Yi Khan Subdistrict, Bang Phut District, Bangkok 10700, Thailand
Tel: +66(0)2-452 8500 Fax: +66(0)2-452 8515

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.: WC-00024208
Page: 1 of 3
Model: InLab Solids
Brand: METTLER TOLEDO

Customer: United Analyst and Engineering Consultant Company Limited
3 Soi Udumuk 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 Khlaiphloi
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 Hammed 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

(Signature)
(Miss Orawan Khlaiphloi)
Person in charge

(Signature)
(Mr. Nitinun Sihanwan)
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.

DKSH Technology Limited
2533 Sukhumvit Road, Bangkok, Phrakhanong, Bangkok 10260
Phone: +66 2539 7000 Email: info@calibration@dksh.com Website: www.dksh.com/certificate-mpland
Delivering Growth - in Asia and Beyond.

เอกสารไม่ควบคุม
CAL-FM-C07-14: 9 April 2024

Certificate No.: C07240167 Page 2 of 3

Calibration Results:

pH Scale

Input	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

DKSH Technology Limited
2533 Sukhumvit Road, Bangkok, Phrakhanong, Bangkok 10260
Phone: +66 2539 7000 Email: info@calibration@dksh.com Website: www.dksh.com/certificate-mpland
Delivering Growth - in Asia and Beyond.

เอกสารไม่ควบคุม
CAL-FM-C07-14: 9 April 2024

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

บริษัท ดีเคเอส อีเซีย จำกัด
DKSH Technology Limited
2533 สุขุมวิท ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangkok, Prakhong, Bangkok 10260
Phone: +66 2032 7550 Email: info.calibration@dksh.com Website: www.dksh.com/certification-thailand

Delivering Growth - in Asia and Beyond.

เอกสารไม่ควบคุม

CAL-FM-C07-14: 9 Apr 2024



Certificate of Calibration

Equipment: Digital Thermometer with Probe
Model: SevenEasy pH
Serial No.: 1230525212
Manufacturer: METTLER TOLEDO
ID No.: UAE.WAS.003/2553

Certificate No.: C15240373
Issued Date: 09 April 2024
Job No.: WO-00024208
Page: 1 of 2
Condition: In Condition

Customer: United Analyst and Engineering Consultant Company Limited
3 Soi Udomsuk 41 Sukhumvit Road,
Bangkok, Prakhong, 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. Nateekam 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. Nateekam 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 อีเซีย จำกัด
DKSH Technology Limited
2533 สุขุมวิท ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangkok, Prakhong, Bangkok 10260
Phone: +66 2032 7550 Email: info.calibration@dksh.com Website: www.dksh.com/certification-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 อีเซีย จำกัด
DKSH Technology Limited
2533 สุขุมวิท ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangkok, Prakhong, Bangkok 10260
Phone: +66 2032 7550 Email: info.calibration@dksh.com Website: www.dksh.com/certification-thailand

Delivering Growth - in Asia and Beyond.

เอกสารไม่ควบคุม

CAL-FM-C15-14: 06 Dec 2022



Calibration Certificate

Certificate No.: 2303560-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.,
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhong, Bangkok 10260

Page 1 of 2

Equipment: pH Meter
Manufacturer: Mettler Toledo
Model: Seven Compact S220
Serial No.: C113432421
ID No.: UAE.WAT.009/2564
Order No.: 2303560
Operation No.: 2303560-001
Date of Receipt: 23 June 2023
Date of Calibration: 26 June 2023

Calibrated by Mr. Worapob Soontong
Scientist
Approved by (Mr. Praphat Tuangit) (for)
Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team

Date of Issue: 27 June 2023

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

2303560-001-01: หน่วยวัดค่า pH (แบบพกพา) รุ่น Seven Compact S220 ของบริษัท Mettler Toledo
2303560-001-01: pH meter (portable) model Seven Compact S220 by Mettler Toledo
24-06-2023: วันที่ออกใบ: 24-06-2023

เอกสารไม่ควบคุม

CAL-FM-C15-14: 06 Dec 2022



Certificate of Calibration

Certificate No.: C24240057 Page: 2 of 2

Equipment: CONDUCTIVITY METER Certificate No.: C24240057
Model: Lab 955 Issued Date: 11 March 2024
Serial No. (or ID.): 16300356 Job No.: WO-00020309
Manufacturer: SI Analytic Page: 1 of 2
Electrode Serial No. 16070067 Model: LF413T Brand: SI Analytic
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 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

(Mr. Nitinun Srihawan)

Authorized signatory

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

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

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

บริษัท เทคโนโลยี จำกัด
DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangkok, Phrakhanong, Bangkok 10260
Phone: +66 2638 7000 Email: info.calibration@dksh.com Website: www.dksh.com/calibration-thailand

Delivering Growth - in Asia and Beyond.

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 µS/cm	26.7 µS/cm	-1.700 µS/cm	2.00	0.21 µS/cm
1413.0 µS/cm	1428 µS/cm	-15.0 µS/cm	2.00	9.0 µS/cm
111.3 mS/cm	108.4 mS/cm	2.9 mS/cm	2.00	0.67 mS/cm

After Adjustment : at 1413 µS/cm

Standard	Unit Under Calibration	Correction	Coverage Factor	Uncertainty (±)
Conductivity Solution	Reading		(k)	
25.000 µS/cm	25.9 µS/cm	-0.900 µS/cm	2.00	0.21 µS/cm
1413.0 µS/cm	1413 µS/cm	0.0 µS/cm	2.00	9.0 µS/cm
111.3 mS/cm	107.5 mS/cm	3.8 mS/cm	2.00	0.67 mS/cm

The End of Certificate

บริษัท เทคโนโลยี จำกัด
DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangkok, Phrakhanong, Bangkok 10260
Phone: +66 2638 7000 Email: info.calibration@dksh.com Website: www.dksh.com/calibration-thailand

Delivering Growth - in Asia and Beyond.

เอกสารไม่ควบคุม

CAL-FM-C24-09: 12 Sep 2022



Calibration Certificate

Certificate No.: 2402283-002-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 SOI UDOMSUK 41, SUKHUMVIT ROAD,
Bangchack, Prakanong, Bangkok 10260

Page 1 of 4

Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: 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

เอกสารไม่ควบคุม



Calibration Report

Certificate No.: 2402283-002-01
Equipment: Electronic Balance Manufacturer: METTLER TOLEDO
Model: XSR205DU Resolution: 0.00001 g / 0.0001 g
Serial No.: C210685394 ID No.: UAE.WAO.010/2565
Capacity: 220 g

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

Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1mg to 200g	8505567572	TCS	M23040535	8 April 2024
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	608-H1	NFI.BTH.016/23	Quality Reborn	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.

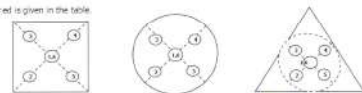
Calibration Results:

1. Repeatability of Reading:

Nominal 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





ศูนย์บริการและพัฒนาอุตสาหกรรมอาหาร
Foundation for Industrial Development National Food Institute
Food Industrial Laboratory Service Center



Calibration Report

Certificate No.: 2402283-002-01

Equipment:

Electronic Balance

Model: XSR250U

Serial No.: C210685394

Capacity: 220 g

Manufacturer: METTLER TOLEDO

Resolution: 0.00001 g / 0.0001 g

ID No.: UAE.WAO.010/2565

Date of Calibration: 2 April 2024

Page 3 of 4

Calibration Results: (Continued)

Calibration Range: 0 - 80 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value: (Range: 0 - 80 g ; Resolution: 0.00001 g)

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (g)	Coverage Factor k
Unloaded	0.00000	0.00000	0.00000	0.0000006	2.00
0.001	0.001003	0.00101	-0.00001	0.0000089	2.00
0.005	0.005003	0.00500	0.00000	0.0000092	2.00
0.01	0.010003	0.01000	0.00000	0.0000089	2.00
0.05	0.049996	0.05000	0.00000	0.0000096	2.00
0.1	0.100011	0.10000	0.00001	0.000011	2.00
0.5	0.500016	0.50001	0.00001	0.000014	2.00
1	1.000003	1.00002	-0.00002	0.000016	2.00
2	2.000023	2.00001	0.00001	0.000017	2.00
5	5.000017	5.00002	0.00000	0.000020	2.00
10	10.000009	10.00000	0.00001	0.000026	2.00
20	20.000031	20.00000	0.00003	0.000037	2.00
30	30.000040	30.00001	0.00003	0.000050	2.00
50	50.000028	50.00002	0.00001	0.000048	2.00
80	80.000068	80.00002	0.00005	0.000011	2.00

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

2008 ถนนสุขุมวิท 36 แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10110
2008 Soi 36, Aun Anan Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10110, Thailand
Tel: +66(0) 2422 8588, Fax: +66(0) 2422 8545

เอกสารไม่ควบคุม

Hz



ศูนย์บริการและพัฒนาอุตสาหกรรมอาหาร
Foundation for Industrial Development National Food Institute
Food Industrial Laboratory Service Center



Calibration Certificate

Certificate No.: 2400141-001-01

Client name:

UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.

Address:

3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhnong, Bangkok 10260

Page 1 of 3

Equipment:

CHAMBER (Hot Air Oven)

Manufacturer:

MEMMERT

Model:

UF 55

Serial No.:

B216.1666

ID No.:

UAE.WAO.027/2559

Order No.:

2400141

Operation No.:

2400141-001

Date of Receipt:

11 October 2023

Date of Calibration:

11 October 2023

Calibrated by

Mr. Worapob Soonthong
Scientist

Approved by

(Mr. Pheraphat Tunsitj)
Manager, Division of Calibration Laboratory

Date of Issue:

16 October 2023

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

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

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

2008 ถนนสุขุมวิท 36 แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10110
2008 Soi 36, Aun Anan Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10110, Thailand
Tel: +66(0) 2422 8588, Fax: +66(0) 2422 8545

เอกสารไม่ควบคุม

Hz



ศูนย์บริการและพัฒนาอุตสาหกรรมอาหาร
Foundation for Industrial Development National Food Institute
Food Industrial Laboratory Service Center



Calibration Report

Certificate No.: 2402283-002-01

Equipment:

Electronic Balance

Model: XSR250U

Serial No.: C210685394

Capacity: 220 g

Manufacturer: METTLER TOLEDO

Resolution: 0.00001 g / 0.0001 g

ID No.: UAE.WAO.010/2565

Date of Calibration: 2 April 2024

Page 4 of 4

Calibration Results: (Continued)

Calibration Range: 81 - 200 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value: (Range: 81 - 200 g ; Resolution: 0.0001 g)

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (g)	Coverage Factor k
90	90.00018	90.0001	0.0000	0.00015	2.00
100	100.00005	100.0001	0.0000	0.00015	2.00
110	110.00007	110.0001	0.0000	0.00016	2.00
120	120.00009	120.0000	0.0001	0.00017	2.00
130	130.00010	130.0000	0.0001	0.00019	2.00
140	140.00011	140.0000	0.0001	0.00020	2.00
150	150.00009	150.0001	0.0000	0.00020	2.00
160	160.00010	160.0001	0.0000	0.00022	2.00
170	170.00012	170.0001	0.0000	0.00023	2.00
200	200.00016	200.0002	0.0000	0.00028	2.00

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

***** End *****

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

2008 ถนนสุขุมวิท 36 แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10110
2008 Soi 36, Aun Anan Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10110, Thailand
Tel: +66(0) 2422 8588, Fax: +66(0) 2422 8545

เอกสารไม่ควบคุม

Hz



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

Page 2 of 3

Location:

Laboratory, Floor 2, UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.

Environment Condition:

Ambient Temperature (28 ± 1) °C

Relative Humidity (63 ± 2) %

Line Voltage (228 ± 1) Volt

Condition of this results of Calibration:

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

Instrument	Model	Serial No./ID No.	Certificate No.	Due Date	Through
Digital Thermometer with sensor	34972A	MY49016894	TE 660380-01	22 April 2024	NATIONAL FOOD INSTITUTE
RTD	CH201-209/ RTD#201-209				

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

UVC Description :

Time of Record 1 Hour 9 Minute At 104.0, 140.0 and 180.0 °C

Fresh air Damper

Open

Position

Close

Not Available

7. Result of Calibration :

X

Without adjustment

After adjustment

Hz

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

2008 ถนนสุขุมวิท 36 แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10110
2008 Soi 36, Aun Anan Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10110, Thailand
Tel: +66(0) 2422 8588, Fax: +66(0) 2422 8545

เอกสารไม่ควบคุม

Hz

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

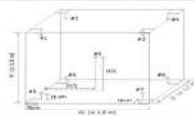


Table 1 : Reporting of Temperature

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	Average			
104.0	104.0	104.0	104.0	0.090	0.18	0.38
140.0	140.0	140.1	140.0	0.075	0.28	0.47
180.0	180.0	180.1	180.0	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 -----

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

ศูนย์บริการและสนับสนุนด้านวิทยาศาสตร์และเทคโนโลยี
3008 Soi 36, Anan Road, Bang Yi Khan Subdistrict, Bang Khak District, Bangkok 10700, Thailand
Tel: +66(0) 2405 0600 Fax: +66(0) 2405 0605



เอกสารไม่ควบคุม

Certificate of Calibration

Cert.No.: 24MM292
Page.: 1 of 3

Equipment : Electronic Balance
Manufacturer : Mettler Toledo
Model : AB204-S/FACT
Serial No. : 1129361010
ID No. : UAE.WAS.002/2552
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Balance Room (108)
Received order : 11 May 2024
Calibration Date : 11 May 2024
Ambient Temperature : 15 °C to 40 °C
Relative Humidity : 30 % to 90 %
Calibrated by : Khl Ruttanaprapachai
Kunchit
Approved by : Approved Signatory
() Ponpan Paipim
() Suwit Imjai
(✓) Kunchit Promprat

Issue Date : 15 May 2024

The Uncertainties are for a confidence probability of approximately 95%

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

เอกสารไม่ควบคุม



Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2405-0166OC-1
Procedure used : Calibration was conducted using in-house calibration procedure CP-0801 based on UKAS LAB 14 according to direct measurement method against standard weight.

Cert.No.: 24MM292
Page: 2 of 3

Condition of this result of calibration

1. Reference standard instruments:

Instruments	Model	Serial No.	ID No.	Test report No.	Due date
1) Standard Weight Set (E2)	15884	24053	70RC007	MM-0013-24	25 Jan 2026

- This certificate is valid only to the item calibrated on date and place of calibration.
- This result of calibration was made on requested at the point specified by customer.
- This certificate is not certified for any commercial transaction.
- This certification is traceable to the International System of Unit.

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

Range capacity : 0 g to 220 g Resolution 0.0001 g

Before Adjustment :

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (± mg)	Coverage Factor (k)
100	100.0000	0.0000	0.19	2.03
200	200.0006	-0.0006	0.30	2

After Adjustment :

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

Applied Weight (g)	Standard Deviation of Reading (g)
100	0.00007
200	0.00005



Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2405-0166OC-1
Result of calibration

Cert.No.: 24MM292
Page: 3 of 3

2. Effect of off center loading

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

Position 1 (g)	Position 2 (g)	Position 3 (g)	Position 4 (g)	Position 5 (g)	Maximum difference between off-center and central loading (g)
-0.0004	-0.0004	-0.0003	-0.0003	-0.0004	0.0001

3. Departure from nominal value

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (± mg)	Coverage Factor (k)
Unload	0.0000	0.0000	0.15	2.13
0.01	0.0100	0.0000	0.15	2.13
0.05	0.0500	0.0000	0.15	2.13
0.1	0.1000	0.0000	0.15	2.13
0.5	0.5000	0.0000	0.15	2.13
1	1.0000	0.0000	0.15	2.13
10	10.0000	0.0000	0.15	2.11
50	49.9999	+0.0001	0.17	2.06
100	99.9999	+0.0001	0.19	2.03
150	149.9998	+0.0002	0.26	2
200	199.9990	+0.0010	0.30	2

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

-oOo-

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม



Cert. No.: 24TM303
Page : 1 of 3

Certificate of Calibration

Equipment : BOD Incubator
Manufacturer : Arco
Model : UC4-1320
Serial No. : 13URC4S013201
ID No. : UAE.WAO.015/2561
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phra Khanong,
Bangkok 10260
Location : Lab Floor 2
Received Order : 10 February 2024
Calibration Date : 10 February 2024
Ambient Temperature : $(26 \pm 10) ^\circ\text{C}$
Relative Humidity : $(50 \pm 30) \%$
Calibrated by : Tawatchai Pama
Approved by :
() Pornthippa Tameyakul
(✓) Unnopphol Harachai
() Suwit Imjai
Issue Date : 19 February 2024

The Uncertainties are for a confidence probability of approximately 95%

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

เอกสารไม่ควบคุม



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2402-0234OC-1
Result of Calibration : (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Not Available
Cert. No.: 24TM303
Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
20.0	20.1	19.9	0.37	0.72	1.4	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	1	2	3	4	5	6	7	8	9 (ref.)	
20.0	19.873	19.803	20.322	19.690	19.615	19.565	19.612	19.558	19.645	0.58

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

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

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

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

UUC* : Unit Under Calibration

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

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

-000-

เอกสารไม่ควบคุม



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2402-0234OC-1
Cert. No.: 24TM303
Page : 2 of 3

Procedure Used :-

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY59003411	23LM208	TPA	27 Dec 2024

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

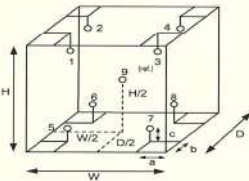
3. This certification is traceable to the International System of Unit.

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

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available



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

เอกสารไม่ควบคุม




Cert.No.: 24TW39
Page.: 1 of 2

Certificate of Testing

Equipment : DO Meter
Manufacturer : YSI
Model : 5100
Serial No. : 11B 101863
ID No. : UAE.WAO.004/2554
Received Date : 20 February 2024
Test Date : 21 February 2024
Reference : 2402-0629DSC-1
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak,
Phra Khanong, Bangkok 10260
Laboratory Condition : Temperature (25 ± 5) °C
Humidity (50 ± 20) %
Test Procedure : In - house method : CP-CH9
by Comparison Technique with Azide Modification Method
Tested by : Walailak Sirinthan
Approved by :
() Pornthippa Tameyakul
() Unnopphol Harachai
(✓) Salthip Meangmai
Issue Date : 22 February 2024

เอกสารไม่ควบคุม



Cert.No.: 24TW39
Page: 2 of 2

Condition of this result of calibration

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

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

2. Standard Material :-

Material	Manufacturer	Lot.No.	Assay
Sodium Thiosulfate pentahydrate	Merck	AM1763318	100.2%

Result : Dissolved Oxygen Meter Adjustment With Air 100 %
 Dissolved Oxygen Probe No.: 22B100125

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.20	8.19	0.0055

This report was certified only for the instrument we tested. It is allowable to use for study intend to use for advertising and referral purpose is prohibited. This report may not be reproduced other in full without written approval of the laboratory

-000-

เอกสารไม่ควบคุม



Hanna Instruments (Thailand) Ltd.
 410/97-48 Soi Ratchadapisek 24, Ratchadapisek Rd., Samsen-nok,
 Huaykwang, Bangkok 10310 Tel: 0-2541-4199 Fax: 0-2541-4198




Certificate No.: HIT-2417-0568
Page: 1 of 2

CERTIFICATE OF CALIBRATION


Equipment :	COD Test Tube Heater		
Meter Model :	HIS39800-02	Serial No. :	1147807
Tube Heater :	25 Vial Capacity	Resolution :	0.1°C
Temperature Range :	(-10 to 160)°C	Temperature of Reaction :	150°C
Manufacturer :	Hanna Instruments	Made in :	Romania
Condition As-Received :	Used Product	Reference :	RE240681
Ambient Temperature :	(25 ± 2)°C	Relative Humidity :	(50 ± 15)%RH
Customer name :	United Analyst and Engineering Consultant Co., Ltd. 3 Soi Udomsuk 41, Sukhumvit Rd., Bangchak, Phrakhanong, Bangkok 10260		
Received date :	22 April 2024		
Calibrate date :	23 April 2024		
Issue date :	25 April 2024		
Calibrated Location :	Hanna Instruments (Thailand) Ltd.		
Calibration Procedure :	This calibrator was conducted by using in-house: calibration procedure CP-04 by using certified reference standard instruments.		

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

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-2417-0568
Page: 2 of 2

Condition of this calibration result:

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

Instruments	Model	Serial No.	Certificate No.	Traceable
Data Acquisition Switch Unit	34970A	MY44065265	WK2307-164-1	WK Electric Co., Ltd.
Digital Thermo-Hygrometer	HT-771SD	AL07155	24H41	Technology Promotion Association (Thailand-Japan).

Calibration Result:

Measurement Temperature Source Accuracy for COD Reactor.

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

Unit : °C


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

Figure: Shows the location of the temperature source.


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

** End of certificate **

เอกสารไม่ควบคุม



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.: SP24-008
 Page: 1 of 5

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

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

Location of calibration : Laboratory 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)
 Technical Manager

Approved by : 
 (Ms. Chomthicha Sangerng)
 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 capacity of the laboratory and its uncertainty to recognized national standards used 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



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



REPORT OF CALIBRATION

Certificate No. : SP24-008 Page 2 of 5

Environment Condition : Ambient Temperature 25 ± 5 °C

Relative humidity 55 ± 20 %RH

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

Certified Reference Materials :

Material	Serial No.	Certificate No.	Due date
Absorbance Standard set	25760	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, Ladprao, Bangkok 10230
Phone : +66 (0)2 538 2054, Email : dqservicesinfo@gmail.com



REPORT OF CALIBRATION

Certificate No. : SP24-008 Page 3 of 5


Calibration Results : Without adjustment

Photometric Accuracy :


Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
420	0.0000	0.000	0.0000	0.0028	2.00
	0.5780	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, Ladprao, Bangkok 10230
Phone : +66 (0)2 538 2054, Email : dqservicesinfo@gmail.com



REPORT OF CALIBRATION


Certificate No. : SP24-008 Page 4 of 5

Photometric Accuracy :


Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000	0.000	0.0000	0.0050	2.00
	0.7469	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, Ladprao, Bangkok 10230
Phone : +66 (0)2 538 2054, Email : dqservicesinfo@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

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 Udornsuk 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 :
(Mr.Tanawat Rittidach)

Approved by :
(Ms.Chonthicha Sangsriem)

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, 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 Sarna Scientific Limited

Spectral Band Width of UUC : 1.5 nm.

Scan Speed of UUC : 200 nm/min

Scan Interval of UUC : 0.1 nm.



Resolution of UUC : Photometric 0.001 Abs.

Wavelength 0.1 nm.

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021

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. : 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

FM-708-02 R01 1/11/2021

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. : SP24-001Page 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	0.743	0.0039	0.0057	2.00
257	0.0000	0.000	0.0000	0.0050	2.00
	0.8674	0.862	0.0054	0.0059	2.00
313	0.0000	0.000	0.0000	0.0050	2.00
	0.2919	0.289	0.0029	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

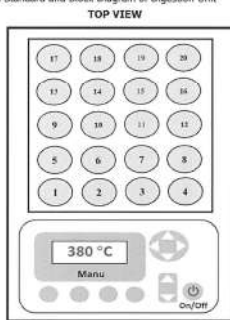
เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021

Verification Report

Certificate No.: 2302413-001-01
Equipment: HEATING BLOCK DIGESTION
Model: 2520 **Serial No.:** 91794469
Resolution: 1 °C **ID No.:** UAE.WAS.011/2560
Manufacturer: FOSS
Date of Calibration: 30-31 March 2023 **Page 4 of 4**
Calibration point: 380 °C
Calibration result: Continued

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



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

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

----- End -----

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

FOSS

Customer Service Report

Date: 30/11/21
Customer: UAE
Instrument: KJ200
Hours Start: 9:00
Hours Finish: 14:00
Travel To Customer: 1
Labour: 9:00
Travel From Customer: 15:00

FOSS South East Asia
3388 Srinrat Building, 25th - 26th Floor, Unit No. 3388/90,
Rama IV Road, Klongtoey, Klongtoey, Bangkok, Thailand 10110

Report No: 5874

Address: 91/790524
Serial: 91790524

Application	Special	Standard
Normal	Courtesy Visit	Installation
Distributor	PMA Onboarding	Quote
Internal	Warranty	Repair
Digital Service	Sales Support	Remote
		Other

PO/Quote Number: 2302413-001-01
PMA Type: Foss Care PM
Contract No.: 2302413-001-01

Details of Work / Test	Condition / Status
- Check instrument	Pass
- Check PM kit for KJ200	Pass
- Check Safety Valve	Pass
- Check Rubber Gasket	Pass
- Check Seal	Pass
- Check Heating element	Pass
- Check New Gasket PCB	Pass
- Check Safety door	Pass
- Check Safety door complete	Pass
- Check Leveling	Pass
- Check Volume 250 ml set 30 ml for 25 ml	Pass

Part No.	Batch	Description	Qty
10009963	11.03.2023	Foss PM kit KJ200	1
1575 0014	23.03.21	Safety Valve	1
1575 0016	23.03.21	Rubber Gasket for Heating	2
10009963	11.03.21	Heating Element	1
10009963	11.03.21	Seal	1
10009963	11.03.21	KJ200 new panel PCB	1
10009963	23.03.21	Safety door complete	1

I confirm this report is accurate and complete
Signed FOSS: [Signature]
Signed Customer: [Signature]
Name: [Name]
Name: [Name]

Would you be willing to participate in a brief survey in order to tell us how we performed?

เอกสารไม่ควบคุม

FOSS Preventive Maintenance Protocol

Instrument	Kjeltec™ 2100 = KJ200
Recommended PM interval (whichever occurs first between interval and no. of samples analysed)	12 months
Preventive maintenance kit (P/N)	10009963 S/N 91790524

Introduction

A maintenance protocol provides systematic and functional means of maintaining a specific instrument type. The recommended PM interval depends on the operational conditions and is based on our extensive experience and knowledge of manufacturing and maintaining analytical instruments.

Apart from sample throughput, the environmental conditions also need to be considered. A demanding environment, such as high ambient temperature, humidity, dirtiness etc can measurably shorten component lifetime and also the maintenance and component replacement intervals.

NOTE!

The content of this protocol is subject to change over time. In order to safeguard that you obtain the correct parts, please make sure to indicate serial no and date of installation when contacting your FOSS representative.

Maintenance Procedure

Exchange of Parts and Cleaning

Step	Action	Part	P/N	OK
1	Replace	Adapter for dig. tube 250 ml	1000 0056	<input type="checkbox"/>
2	Replace	Non return valve	1000 3538	<input type="checkbox"/>
3	Replace valves in alkali pump	Valve kit reagent/water pump	1575 0093	<input type="checkbox"/>
4	Replace steam tubing	Silicone tubing 8/12 mm	1582 0006	<input type="checkbox"/>
5	Replace alkali tubing	Tubing reinforced for alkali	1582 0011	<input type="checkbox"/>
6	Replace water tubing	Tubing PVC 8/11 mm	1582 0004	<input type="checkbox"/>
7	Cleaning	Steam generator		<input type="checkbox"/>
8	Cleaning	Splash head		<input type="checkbox"/>

Check and Adjustments

Step	Action	Module	Measured	Limits	OK
1	Check alkali volume, 10 ml/stroke	Alkali pump	98	At 50 ml - 0/+3 ml	<input checked="" type="checkbox"/>
2	Check distillation volume		120ml	100 - 150 ml/4 min	<input checked="" type="checkbox"/>
3	Check front panel switches				<input checked="" type="checkbox"/>
4	Check cables and electrical connections				<input checked="" type="checkbox"/>
5	Check level pins in steam generator				<input checked="" type="checkbox"/>
6	Check safety door switch				<input checked="" type="checkbox"/>

เอกสารไม่ควบคุม

Dedicated Analytical Solutions

FOSS Analytical AS
65 Slangenvej
DK-3450 Hillerød
Denmark
Tel +45 7010 9120
Fax +45 7010 1371
E-mail support@foss.dk
Web www.foss.dk

FOSS Analytical AB
Box 70
SE-263 21 Billgärde
Sweden
Tel +46 42 261500
Fax +46 42 340345
E-mail support@foss.se
Web www.foss.se

Customer Support, 1001 4572 / Rev. 3

Customer Support, 1001 4572 / Rev. 3

2/2

เอกสารไม่ควบคุม



Request No. 25-67 / 0275

MTC. ACL.No. 358 / 67

CALIBRATION CERTIFICATE

NOMENCLATURE : 1. Atomic Absorption Spectrophotometer "Agilent Technologies"
Model AA240FS, Serial No. MY13160001

2. Working standard solution "Inorganic Ventures"

Multi Analyte Custom Grade Solution, Lot No. S2-ME8675610

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

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

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

2. Estimation Uncertainty of Measurement in Analytical Chemistry (QP-513)

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

CALIBRATION DATE : 2 February 2024

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

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

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

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

Calibrated by Atipat
(Mr. Atipat Ratana)

Approved by SUMLEE
(Miss Sumlee Deening)
Director of Analytical Chemistry Laboratory
Ref. 2015267020100454001
Issued Date : 11 March 2024

The results relate only to the items tested/calibrated or value assigned.
Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

FM.BLMTC.002 Rev.4

Head Office
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail : numpai@tistr.or.th Website:www.tistr.or.th

Office/Laboratory
Soi 1C, Bangsoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
Fax. (66) 0 2323 9165
E-mail : mtg@tistr.or.th

Office
196 Phahonyothin Road, Chatuchak, Bangkok 10900,
Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail : sumalee@tistr.or.th

เอกสารไม่ควบคุม
S225, S217

Request No. 25-67 / 0275

1 / 5

MTC. ACL. No. 358 / 67

CALIBRATION DATA

1. Noise Level

Element	Cd	Cr	Cu	Fe	Pb	Mn	Ni	Zn
Absorbance	0.0096	0.0004	-0.0003	0.0001	-0.0011	-0.0005	0.0008	0.0004
	0.001	0.0017	-0.0009	0.0008	0.0001	0.0002	-0.0003	0.0007
	0.0096	0.0017	-0.0020	0.0005	0.0005	0.0004	0.0013	0.0014
	0.0091	0.0018	-0.0007	0.0005	0.0004	-0.0003	-0.0001	0.0010
	-0.0001	0.0019	-0.0014	0.0003	0.0010	0.0003	0.0002	-0.0001
	0.0011	0.0014	-0.0017	0.0009	-0.0008	0.0004	0.0006	0.0010
	-0.0002	0.0015	-0.0015	0.0003	0.0002	-0.0008	0.0009	0.0013
	0.0096	0.0012	-0.0001	0.0006	0.0008	0.0001	-0.0002	0.0013
	0.0008	0.0009	-0.0003	0.0003	0.0005	0.0002	0.0001	0.0007
	0.0012	0.0011	-0.0012	0.0008	0.0003	0.0004	0.0004	0.0013
	0.0003	0.0015	-0.0019	0.0001	-0.0002	0.0000	-0.0003	0.0003
	0.0005	0.0017	-0.0019	-0.0007	0.0000	-0.0007	0.0005	0.0005
	-0.0006	0.0016	0.0000	0.0006	-0.0001	0.0013	0.0006	0.0010
	0.0003	0.0011	-0.0002	0.0001	-0.0007	0.0009	0.0009	0.0002
	0.0003	0.0012	-0.0011	0.0007	-0.0003	-0.0003	0.0010	0.0009
	0.0004	0.0018	-0.0016	-0.0004	-0.0006	0.0008	0.0007	0.0007
	-0.0001	0.0018	-0.0018	0.0013	-0.0006	-0.0001	0.0014	0.0006
	0.0005	0.0017	-0.0001	0.0001	-0.0012	-0.0004	0.0001	0.0002
	0.0010	0.0018	-0.0007	0.0003	-0.0005	-0.0002	0.001	0.0003
	0.0004	0.0019	-0.0008	-0.0001	-0.0004	0.0003	0.0002	0.0008
Average Absorbance	0.000	0.001	-0.001	0.000	0.000	0.000	0.000	0.001

Continue 2 / 5

INDUSTRIAL METROLOGY AND TESTING SERVICE CENTRE

The results relate only to the items tested/calibrated or value assigned.
Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

FM.BLMTC.002 Rev.4

Head Office
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail : numpai@tistr.or.th Website:www.tistr.or.th

Office/Laboratory
Soi 1C, Bangsoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
Fax. (66) 0 2323 9165
E-mail : mtg@tistr.or.th

Office
196 Phahonyothin Road, Chatuchak, Bangkok 10900,
Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail : sumalee@tistr.or.th

เอกสารไม่ควบคุม
S225, S217



Request No. 25-67 / 0275

2 / 5

MTC. ACL. No. 358 / 67

2. Precision

Element	Conc. (mg/l)	Absorbance										Ave. Abs.	SD	%RSD
Cd	0.02	0.0078	0.0076	0.0069	0.0075	0.0071	0.0070	0.0076	0.0074	0.0077	0.0067	0.007	0.0004	5.15
	0.30	0.1008	0.1007	0.0999	0.0997	0.1000	0.0996	0.1008	0.1002	0.1005	0.0999	0.100	0.0005	0.46
	0.70	0.2301	0.2306	0.2277	0.2305	0.2310	0.2295	0.2290	0.2293	0.2305	0.2296	0.230	0.0010	0.42
Cr	0.10	0.0094	0.0093	0.0093	0.0098	0.0094	0.0095	0.0090	0.0090	0.0094	0.0090	0.009	0.0003	2.75
	0.30	0.0241	0.0236	0.0221	0.0238	0.0231	0.0226	0.0231	0.0223	0.0230	0.0231	0.023	0.0006	2.75
	0.70	0.0500	0.0500	0.0500	0.0524	0.0499	0.0511	0.0509	0.0512	0.0515	0.0504	0.051	0.0008	1.63
Cu	0.05	0.0061	0.0062	0.0064	0.0061	0.0069	0.0069	0.0061	0.0062	0.0064	0.0061	0.006	0.0003	5.00
	0.30	0.0419	0.0411	0.0402	0.0407	0.0405	0.0404	0.0399	0.0400	0.0399	0.0400	0.040	0.0006	1.58
	0.70	0.0960	0.0960	0.0960	0.0959	0.0947	0.0955	0.0952	0.0952	0.0951	0.0955	0.096	0.0005	0.48
Fe	0.10	0.0096	0.0101	0.0103	0.0100	0.0099	0.0096	0.0106	0.0099	0.0105	0.0102	0.010	0.0003	3.38
	0.50	0.0426	0.0415	0.0428	0.0427	0.0421	0.0426	0.0413	0.0430	0.0421	0.0419	0.042	0.0006	1.33
	1.00	0.0830	0.0839	0.0847	0.0834	0.0832	0.0820	0.0839	0.0838	0.0837	0.0845	0.084	0.0008	0.92
Pb	0.20	0.0078	0.0074	0.0078	0.0076	0.0076	0.0078	0.0077	0.0078	0.0078	0.0077	0.008	0.0001	1.71
	0.70	0.0278	0.0273	0.0271	0.0267	0.0270	0.0264	0.0274	0.0273	0.0269	0.0269	0.027	0.0004	1.45
	1.50	0.0551	0.0548	0.0552	0.0555	0.0547	0.0546	0.0544	0.0544	0.0549	0.0547	0.055	0.0004	0.64
Mn	0.05	0.0116	0.0107	0.0110	0.0103	0.0108	0.0108	0.0112	0.0107	0.0109	0.0108	0.011	0.0003	3.15
	0.30	0.0650	0.0649	0.0649	0.0651	0.0646	0.0646	0.0649	0.0646	0.0640	0.0648	0.065	0.0003	0.48
	0.70	0.1463	0.1465	0.1459	0.1471	0.1475	0.1474	0.1487	0.1473	0.1462	0.1468	0.147	0.0008	0.56
Ni	0.10	0.0095	0.0100	0.0096	0.0103	0.0102	0.0096	0.0100	0.0095	0.0097	0.0096	0.010	0.0003	3.04
	0.50	0.0443	0.0433	0.0438	0.0444	0.0430	0.0437	0.0444	0.0437	0.0438	0.0434	0.044	0.0005	1.09
	1.00	0.0812	0.0820	0.0834	0.0829	0.0818	0.0829	0.0833	0.0835	0.0816	0.0819	0.082	0.0008	0.99
Zn	0.05	0.0374	0.0377	0.0373	0.0377	0.0374	0.0377	0.0373	0.0371	0.0371	0.0374	0.037	0.0002	0.61
	0.30	0.1985	0.1993	0.1975	0.1992	0.1979	0.1988	0.1995	0.1985	0.1974	0.2004	0.199	0.0009	0.47
	0.70	0.4027	0.4031	0.4019	0.4021	0.4023	0.3981	0.4042	0.4025	0.3993	0.3997	0.402	0.0019	0.48

Continue 3 / 5

INDUSTRIAL METROLOGY AND TESTING SERVICE CENTRE

The results relate only to the items tested/calibrated or value assigned.
Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

FM.BLMTC.002 Rev.4

Head Office
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail : numpai@tistr.or.th Website:www.tistr.or.th

Office/Laboratory
Soi 1C, Bangsoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
Fax. (66) 0 2323 9165
E-mail : mtg@tistr.or.th

Office
196 Phahonyothin Road, Chatuchak, Bangkok 10900,
Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail : sumalee@tistr.or.th

เอกสารไม่ควบคุม
S225, S217

Request No. 25-67 / 0275

3 / 5

MTC. ACL. No. 358 / 67

3. Trueness

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

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

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

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

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

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Cu	0.051	0.067	-0.004	7.58	± 0.003
	0.303	0.296	-0.007	2.19	± 0.009
	0.704	0.698	-0.005	0.74	± 0.020

Continue 4 / 5

INDUSTRIAL METROLOGY AND TESTING SERVICE CENTRE

The results relate only to the items tested/calibrated or value assigned.
Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

FM.BLMTC.002 Rev.4

Head Office
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail : numpai@tistr.or.th Website:www.tistr.or.th

Office/Laboratory
Soi 1C, Bangsoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
Fax. (66) 0 2323 9165
E-mail : mtg@tistr.or.th

Office
196 Phahonyothin Road, Chatuchak, Bangkok 10900,
Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail : sumalee@tistr.or.th

เอกสารไม่ควบคุม
S225, S217



Request No. 25-67 / 0275 4 / 5 MTC. ACL. No. 358 / 67

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

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Fe	0.100	0.104	0.005	4.60	± 0.014
	0.500	0.482	-0.018	-3.55	± 0.015
	1.006	0.968	-0.038	-3.75	± 0.029

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

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Pb	0.201	0.202	0.001	0.34	± 0.014
	0.706	0.719	0.012	1.73	± 0.030
	1.513	1.559	-0.054	-3.57	± 0.061

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

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Mn	0.0505	0.050	0.000	0.83	± 0.005
	0.3051	0.306	0.003	1.12	± 0.007
	0.7023	0.698	-0.004	0.62	± 0.014

Continue 5 / 5

INDUSTRIAL METROLOGY AND TESTING SERVICE CENTRE

The results relate only to the items tested/calibrated or value assigned.
Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

FMBL.MTC.002 Rev.4

Head Office
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang, Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail : rumpat@tistr.or.th Website:www.tistr.or.th

Office/Laboratory
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road, Amphoe Muang Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
Fax. (66) 0 2323 9145
E-mail : mtc@tistr.or.th

Office
196 Phahonyothin Road, Chatuchak, Bangkok 10900, Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail : rumpat@tistr.or.th

เอกสารไม่ควบคุม



Request No. 25-67 / 0275 5 / 5 MTC. ACL. No. 358 / 67

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

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

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

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

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

Calibrated by Atipat Approved by Suladda
(Mr. Atipat Ratana) (Miss Suladda Deawtong)
Director of Analytical Chemistry Laboratory
Issued Date : 11 March 2024

INDUSTRIAL METROLOGY AND TESTING SERVICE CENTRE
End of Certificate

The results relate only to the items tested/calibrated or value assigned.
Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

FMBL.MTC.002 Rev.4

Head Office
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang, Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail : rumpat@tistr.or.th Website:www.tistr.or.th

Office/Laboratory
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road, Amphoe Muang Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
Fax. (66) 0 2323 9145
E-mail : mtc@tistr.or.th

Office
196 Phahonyothin Road, Chatuchak, Bangkok 10900, Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail : rumpat@tistr.or.th

เอกสารไม่ควบคุม



Agilent 5110 and 5100 ICP-OES Preventive Maintenance Checklist

Agilent Preventive Maintenance provides factory recommended service for your analytical systems to assure reliable operation and the accuracy of your results. Delivered by highly-trained and certified service engineers using genuine Agilent parts and supplies, Agilent Preventive Maintenance provides everything you need to reduce unplanned downtime and keep your systems operating at their peak.

For more information about Agilent Technologies services please visit our web site using the following URL: <http://www.agilent.com/en-us/services/analytical-instrument-services>

Customer Information

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

Service Engineer's Responsibilities

- Only complete/printout pages that relate to the system being serviced.
- Complete empty fields with the relevant information.
- Complete the relevant checkboxes in the checklist using a "X" or tick mark "✓" in the checkbox.
- Complete Not Applicable check boxes to indicate services not delivered, as needed.
- Complete the PM service in the order of the tasks listed.
- Complete the Service Review section together with the customer.



Agilent 5110 and 5100 ICP-OES Preventive Maintenance Checklist

System Information

Instrument system name and ID	ICP 5110 VDV
Instrument system site and location	UAE / 3rd Floor Laboratory
List system component product numbers	List the serial numbers of each component
1. G 8015 A	1. M718030001
2. G 9481 A	2. 1801-01988
3.	3.
4.	4.
5.	5.
6.	6.
7.	7.
8.	8.
9.	9.
10.	10.

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

Agilent 5110 and 5100 ICP-OES Preventive Maintenance Checklist

General Preparation

- ☒ Discuss any specific questions or issues with the customer prior to starting.
- ☒ Review the instrument logbook.
- ☒ Perform general external inspection of system for cleanliness.
- ☒ Check for proper installation of safety-related parts, assemblies, sensors etc.
- ☒ Check for required firmware/software updates and verify with customers if they would like it installed.
- ☒ For HF application systems, if standard sample introduction system was not installed, ask the customer to install it. ^{14/6}
- ☒ Run Instrument Performance Test and record results in Instrument Performance Test Results Table - Pre PM.

Inspect and clean the system

- ☒ Look for any obvious external damage or problems.
- ☒ Inspect water cooling hoses, gas lines and power cord for excessive wear or damage.
- ☒ Perform a general internal inspection of the system for excessive dust accumulation, clean if necessary.
- ☒ Inspect sample introduction components and record any required maintenance in the Service Engineer Comments and notify the customer as the required actions required.
- ☒ Record the instrument operating conditions in the ICP-OES Status Results Table.
- ☒ Replace the polychromator purge filter.
- ☒ Replace the radial pre-optics window.
- ☒ Replace the axial pre-optics window for SVDV and VDV instruments.
- ☒ Check exhaust flow for the correct positive extraction at the exhaust duct to insure they meet minimum specifications.
- ☒ Replace air inlet dust filter.
- ☒ Replace high capacity air inlet dust filter element if installed. ^{14/5}
- ☒ Remove and clean instrument water inlet filter.

G8481A Cooling water system

- ☐ Section NOT Applicable
- ☒ Drain cooling fluid and remove any particles from the chiller reservoir
- ☒ Remove, clean and reinstall water inlet metal mesh filter.
- ☒ Re fill with Polyclear cooling fluid.
- ☒ Clean the cooling system Air filter and the condenser by compressed air or vacuum cleaner.

Issued: 3 February 2017, Revision: 1.1 Copyright © 2017
Page 3 of 8

Agilent Technologies

เอกสารไม่ควบคุม

Agilent 5110 and 5100 ICP-OES Preventive Maintenance Checklist

SPS 3 Auto Sampler

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

SPS 4 Auto Sampler

- ☒ Section NOT Applicable
- ☐ Clean the spill tray, rack location mat, end frames and chassis with a damp soft cloth and diluted mild detergent.
- ☐ Clean the auto sampler cover panels, if cover kit is installed, with domestic window cleaner
- ☐ Check the X-axis and Z-axis drive belts for cracks, splits, damaged teeth, excessive fraying, color changes or degradation from fumes.
- ☐ Check the X-axis, Theta-axis and Z-axis PFC cables for cracks, incorrect positioning, damaged edges or damaged connectors.
- ☐ Pump Tubing Replacement. Replace peristaltic pump tubing. Replace all tubing that goes from the rinse station to the pump and from the pump to the waste/rinse bottles

AVS 4.6, 7

- ☒ Section NOT Applicable
- ☐ Replace valve rotor seal
- ☐ Check fittings for signs of leaks
- ☐ Check tubing including autosampler tubing for kinks or excessive wear
- ☐ Check high flow pump for signs of leaks

Instrument Adjustment

- ☒ Check position of Zn peak, adjust if required.
- ☒ Check Argon Ratio, adjust to specified value if required.
- ☒ Perform Detector Calibration.
- ☒ Perform Instrument Calibration.
- ☒ Run Instrument Performance Test and record results in Instrument Performance Test Results Table - Post PM.
- ☒ For systems using ICP Expert version 7.3 and above run the following Instrument tests and record the result in the Instrument Test Results Table
 - ☒ Subsystem Communications Test
 - ☒ Air Flow

Issued: 3 February 2017, Revision: 1.1 Copyright © 2017
Page 4 of 8

Agilent Technologies

เอกสารไม่ควบคุม

Agilent 5110 and 5100 ICP-OES Preventive Maintenance Checklist

- ☒ Water Flow
- ☒ Gas Flows
- ☒ RF Generator
- ☒ Camera Test
- ☒ Optics Test
- ☒ Nebulizer Test

Instrument Performance Test Results Table

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

	Pre PM Sensitivity Check		Post PM Sensitivity Check	
	Radial	Axial *	Radial	Axial*
Zn 213.857 nm SRBR	4100.6	8364.0	4375.0	8400.8
Mn 257.610 nm SRBR	11064.7	31849.1	12801.7	30846.2
Al 306.152 nm SBR	7.5	14.9	9.9	16.8
K 766.491 nm SBR	5.1	36.8	6.4	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

Issued: 3 February 2017, Revision: 1.1 Copyright © 2017
Page 5 of 8

Agilent Technologies

เอกสารไม่ควบคุม

Agilent 5110 and 5100 ICP-OES Preventive Maintenance Checklist

ICP-OES Status Results Table

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

Measurement	Standby Mode		Plasma On	
Mains Voltage	224.540	VAC	224.713	VAC
Mains Current	0.204	A	0.104	A
Instrument Temperature	22.6	°C	22.7	°C
RF Air Flow (sensor speed)	15.0	Hz	15.0	Hz
Plasma Exhaust Temperature	No measurement		26.7	°C
Water Flow Oscillator	No measurement		1.64	L/min
Water Flow Detector	1.06	L/min	1.06	L/min
Water Inlet Temperature	18.0	°C	18.0	°C
Polychromator Temperature	35.0	°C	35.0	°C
OCD Temperature	-33.8	°C	-33.8	°C
Thermal Stabilizer	35.0	°C	35.0	°C
Argon Supply Pressure	671.94	kPa	671.33	kPa
Purge Gas Supply Pressure*1	674.30	kPa	643.40	kPa
Option Gas Supply Pressure*1	N/A	kPa	N/A	kPa
Nebulizer Flow	No measurement		0.70	L/min
Nebulizer Back Pressure	No measurement		164.63	kPa
Plasma Gas Flow	No measurement		11.98	L/min
Auxiliary Gas Flow	No measurement		1.00	L/min
RF Power	No measurement		1800	W
RF Supply Current	No measurement		8.663	A
RF Supply Voltage	No measurement		184.660	V

*1 If option installed

Issued: 3 February 2017, Revision: 1.1 Copyright © 2017
Page 6 of 8

Agilent Technologies

เอกสารไม่ควบคุม

Agilent 5110 and 5100 ICP-OES
Preventive Maintenance Checklist

ICP-OES Parts List Table

Part description	Part Number	Product / Model # where used	Quantity Consumed
Axial Pre-Optic Window	G8010-68014	G8010A, G8011A, G8014A/G8015A	1
Radial Pre-Optic Window	G8010-68015	All	1
Polyclear Cooling Fluid	G3292-80010	G8481A	
Purge Gas Filter	G8010-60136	All	1
Air inlet filter	G8000-68002	All	1
High Capacity Air Filter	G8010-60189	Optional	
Rotor seal for 6-7 port valve for AVS6/7	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 engineers stock:			
X axis drive belt	5410047500	SPS 3	
Z axis drive belt	5410047400	SPS 3	
Peristaltic pump tubing, PVC Solvaflex, 3 bridged,	3710049000	SPS 4	

Restore system

For HF applications, ask the customer to reinstall their sample introduction system.

Leave system in an idle state: on and purging.

Guidance: If the PM service is performed prior to a qualification service, then use the qualification procedure as a guide for final instrument set up and checkout.

Service Review

- ☒ Affix the PM sticker to the system or instrument logbook based on the customer's request.
- ☒ Complete the Service Engineer Comments section below if there are additional comments.

Issued: 3 February 2017, Revision: 1.1 Copyright © 2017
Page 7 of 8

Agilent Technologies

เอกสารไม่ควบคุม

Agilent 5110 and 5100 ICP-OES
Preventive Maintenance Checklist

- ☒ Review the service and any test results with the customer.
- ☒ If the instrument firmware was updated, record the details of the change in the Service Engineer's Comments box below or if necessary, in the customer's IQ records.

Service Engineer Comments (optional)

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

Other Important Customer Web Links

How to get information on your product:

- ☒ Literature Library - <http://www.agilent.com/en-us/products/icp-oes/icp-oes-systems/5110-icp-oes#literature>
- ☒ Need to know more? - <http://www.agilent.com/crosslab/university/>
- ☒ Need technical support, FAQs? - <http://www.agilent.com/en-us/support/landing/icp-oes>
- ☒ Need supplies? - www.agilent.com/chem/supplies

Service Completion

Service request number 600565787 Date service completed 30 Nov 2022

Agilent signature HONGWAT T. Customer signature S. Kim

Document part number: G8014-90075

Issued: 3 February 2017, Revision: 1.1 Copyright © 2017
Page 8 of 8

Agilent Technologies

เอกสารไม่ควบคุม

Report Summary

Instrument Model Agilent 5100/5110 VDV ICP-OES
Instrument ID G8011A/G8015A
Instrument Serial Number MY18030001
Software Version 7.3.1.9507
Firmware Version 3442
Tested By Test Before PM
Test Completed On 11/30/2022 9:35:32 AM

Result Summary

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

เอกสารไม่ควบคุม

Resolution Test

Element Wavelength	Specification	Width
N (174.213 nm)	≤ 9.40	6.62
As (188.980 nm)	≤ 8.20	6.20
C (193.027 nm)	≤ 11.50	8.35
Mo (202.032 nm)	≤ 8.20	6.41
Cr (206.158 nm)	≤ 13.40	9.04
Zn (213.857 nm)	≤ 8.70	6.62
Pb (220.353 nm)	≤ 9.50	7.13
Co (228.615 nm)	≤ 17.20	11.71
Ba (230.424 nm)	≤ 9.40	7.21
Mn (257.610 nm)	≤ 13.30	9.50
Mn (260.568 nm)	≤ 20.30	14.33
Cr (267.716 nm)	≤ 11.00	8.14
Cu (324.754 nm)	≤ 25.00	18.98
Cu (327.395 nm)	≤ 14.20	11.24
Sr (338.071 nm)	≤ 33.50	24.47
Ba (455.403 nm)	≤ 44.00	33.88
Sr (460.733 nm)	≤ 36.00	17.22
Ba (493.408 nm)	≤ 36.00	25.48
Ba (614.171 nm)	≤ 42.00	25.47
Ar (675.283 nm)	≤ 74.00	59.62
K (766.491 nm)	≤ 80.00	64.94

Pass

เอกสารไม่ควบคุม

Sensitivity Test					
Pass					
Radial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 46.0	SRBR	147.7	1158.5	55.5
Se (196.026 nm)	≥ 41.0	SRBR	111.1	1195.3	97.7
Zn (213.857 nm)	≥ 1421.0	SRBR	4100.6	51959.5	159.6
Pb (220.353 nm)	≥ 46.0	SRBR	192.5	2808.6	185.7
Mn (257.610 nm)	≥ 3518.0	SRBR	11064.7	264169.0	507.6
Al (396.152 nm)	≥ 3.4	SBR	7.5	49047.9	5770.5
Ba (493.408 nm)	≥ 34.0	SBR	107.4	1887710.3	17407.5
K (766.491 nm)	≥ 1.8	SBR	5.1	100805.9	16626.4
Axial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 208.0	SRBR	234.9	3056.4	152.9
Se (196.026 nm)	≥ 159.0	SRBR	218.1	3865.1	271.6
Zn (206.200 nm)	≥ 234.0	SRBR	1306.5	15850.4	144.5
Zn (213.857 nm)	≥ 1743.0	SRBR	8364.0	183037.8	476.4
Cd (214.439 nm)	≥ 4227.0	SRBR	7718.5	143240.2	342.8
Pb (220.353 nm)	≥ 320.0	SRBR	576.3	14485.2	580.4
Mn (257.610 nm)	≥ 10626.0	SRBR	31842.1	1411257.3	1958.9
Cr (267.716 nm)	≥ 1048.0	SRBR	4492.1	183110.6	1632.2
Cu (324.754 nm)	≥ 19.0	SBR	46.2	371487.5	7862.9
Al (396.152 nm)	≥ 6.0	SBR	14.9	278447.4	17552.6
Ba (493.408 nm)	≥ 60.0	SBR	190.6	10061527.3	52519.8
K (766.491 nm)	≥ 24.0	SBR	36.8	1922163.4	50858.1

Page 3 of 4

เอกสารไม่ควบคุม

Precision Test		
Pass		
Radial		
Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 2.60	0.82
Se (196.026 nm)	≤ 2.60	0.71
Zn (213.857 nm)	≤ 1.50	0.43
Pb (220.353 nm)	≤ 2.60	0.76
Mn (257.610 nm)	≤ 1.50	0.60
Al (396.152 nm)	≤ 1.50	0.48
Ba (493.408 nm)	≤ 1.50	0.89
K (766.491 nm)	≤ 1.50	0.42
Axial		
Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 1.50	0.57
Se (196.026 nm)	≤ 1.50	0.76
Zn (206.200 nm)	≤ 1.50	0.61
Zn (213.857 nm)	≤ 1.50	0.51
Cd (214.439 nm)	≤ 1.50	0.55
Pb (220.353 nm)	≤ 1.50	0.52
Mn (257.610 nm)	≤ 1.50	0.54
Cr (267.716 nm)	≤ 1.50	0.54
Cu (324.754 nm)	≤ 1.50	0.69
Al (396.152 nm)	≤ 1.50	0.91
Ba (493.408 nm)	≤ 1.50	0.85
K (766.491 nm)	≤ 1.50	1.22

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	PM Functional test	
Test Completed On	11/30/2022 11:43:36 AM	
Result Summary		
Subsystem Communications Test	Pass	
Air Flow Test	Pass	
Water Flow Test	Pass	
Gas Flows Test	Pass	
RF Generator Test	Pass	
Camera Test	Pass	
Optics Test	Skipped	
Advanced Valve System Test	Skipped	
Resolution Test	Skipped	
Sensitivity Test	Skipped	
Precision Test	Skipped	
Subsystem Communications Test	Pass	
Air Flow Test	Pass	
30% Air Flow (relative speed)	75% Air Flow (relative speed)	
14.00	19.00	
Water Flow Test	Pass	
RF Water Flow(L/min)	Camera Water Flow (L/min)	Water Inlet Temperature (°C)
1.44	1.05	16.51

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	163.37	2.00	1.99	108.49
Makeup Target Flow	Actual Flow	Back Pressure	Plasma Target Flow	Actual Flow	Back Pressure
2.00	2.00	112.85	18.00	17.91	23.46
RF Generator Test			Pass		
RF Power Supply Test	Passed				
RF Power Supply (V)	147.437				
RF Oscillator Test	Passed				
RF Oscillator Frequency (MHz)	0.000				
Work Coil Current (A)	45.069				
RF Power Supply Current (A)	1.997				
Camera Test			Pass		
	Integration Time (ms)	Standard Deviation	Status		
Electronic Offset Test	1000	5.305	Passed		
Dark Current Test	6000	0.578	Passed		
Array Test	5	0.024	Passed		
Linearity Test		0.118	Passed		

Page 2 of 2

เอกสารไม่ควบคุม

Report Summary		
Instrument Model	Agilent 5100/5110 VDV ICP-OES	
Instrument ID	G8011A/G8015A	
Instrument Serial Number	MY18030001	
Software Version	7.3.1.9507	
Firmware Version	3442	
Tested By	PM Performance test	
Test Completed On	11/30/2022 12:10:42 PM	
Result Summary		
Subsystem Communications Test	Skipped	
Air Flow Test	Skipped	
Water Flow Test	Skipped	
Gas Flows Test	Skipped	
RF Generator Test	Skipped	
Camera Test	Skipped	
Optics Test	Pass	
Advanced Valve System Test	Skipped	
Resolution Test	Pass	
Sensitivity Test	Pass	
Precision Test	Pass	
Optics Test		
	Radial	Axial
Intensity	5674608	5823476
Wavelength	737.212	737.212

Page 1 of 4

เอกสารไม่ควบคุม

Resolution Test			Pass
Element Wavelength	Specification	Width	
N (174.213 nm)	≤ 9.40	6.79	
As (188.980 nm)	≤ 8.20	6.09	
C (193.027 nm)	≤ 11.50	8.29	
Mo (202.032 nm)	≤ 8.20	8.30	
Cr (206.158 nm)	≤ 13.40	9.05	
Zn (213.857 nm)	≤ 8.70	6.77	
Pb (220.353 nm)	≤ 9.50	7.02	
Co (228.615 nm)	≤ 17.20	11.67	
Ba (230.424 nm)	≤ 9.40	7.39	
Mn (257.610 nm)	≤ 13.30	9.48	
Mn (260.568 nm)	≤ 20.30	14.25	
Cr (267.716 nm)	≤ 11.00	7.94	
Cu (324.754 nm)	≤ 25.00	18.99	
Cu (327.395 nm)	≤ 14.20	11.33	
Sr (338.071 nm)	≤ 33.50	24.44	
Ba (455.403 nm)	≤ 44.00	33.86	
Sr (460.733 nm)	≤ 36.00	17.51	
Ba (493.408 nm)	≤ 36.00	25.56	
Ba (514.171 nm)	≤ 42.00	24.96	
Ar (675.283 nm)	≤ 74.00	59.38	
K (766.491 nm)	≤ 80.00	65.63	

Page 2 of 4

เอกสารไม่ควบคุม

Sensitivity Test						Pass
Radial						
Element Wavelength	Specification	Method	Ratio	Standard	Blank	
As (188.980 nm)	≥ 46.0	SRBR	147.8	1149.3	54.8	
Se (196.026 nm)	≥ 41.0	SRBR	111.6	1222.8	101.0	
Zn (213.857 nm)	≥ 1421.0	SRBR	4375.0	52592.3	143.7	
Pb (220.353 nm)	≥ 46.0	SRBR	199.8	2744.4	166.5	
Mn (257.610 nm)	≥ 3518.0	SRBR	12801.7	285591.3	496.0	
Al (396.152 nm)	≥ 3.4	SBR	9.9	52888.6	4873.6	
Ba (493.408 nm)	≥ 34.0	SBR	154.6	2287291.6	14696.1	
K (766.491 nm)	≥ 1.8	SBR	6.4	106701.6	14350.9	
Axial						
Element Wavelength	Specification	Method	Ratio	Standard	Blank	
As (188.980 nm)	≥ 208.0	SRBR	242.4	3170.1	154.8	
Se (196.026 nm)	≥ 159.0	SRBR	226.1	4134.5	289.3	
Zn (206.200 nm)	≥ 234.0	SRBR	1126.6	13782.0	146.5	
Zn (213.857 nm)	≥ 1743.0	SRBR	8400.8	177166.3	442.5	
Cd (214.439 nm)	≥ 4227.0	SRBR	7001.9	125884.2	321.6	
Pb (220.353 nm)	≥ 320.0	SRBR	536.3	12909.3	532.6	
Mn (257.610 nm)	≥ 10625.0	SRBR	30846.2	1267989.0	1738.8	
Cr (267.716 nm)	≥ 1048.0	SRBR	4396.0	167335.6	1424.4	
Cu (324.754 nm)	≥ 19.0	SBR	52.1	373690.7	7033.1	
Al (396.152 nm)	≥ 6.0	SBR	16.8	268357.7	15112.4	
Ba (493.408 nm)	≥ 60.0	SBR	225.2	10173441.5	44971.7	
K (766.491 nm)	≥ 24.0	SBR	39.7	1874136.2	46055.7	

Page 3 of 4

เอกสารไม่ควบคุม

Precision Test			Pass
Radial			
Element Wavelength	Specification	Measured Value % RSD	
As (188.980 nm)	≤ 2.60	0.60	
Se (196.026 nm)	≤ 2.60	0.84	
Zn (213.857 nm)	≤ 1.50	0.29	
Pb (220.353 nm)	≤ 2.60	0.59	
Mn (257.610 nm)	≤ 1.50	0.28	
Al (396.152 nm)	≤ 1.50	0.28	
Ba (493.408 nm)	≤ 1.50	0.59	
K (766.491 nm)	≤ 1.50	0.23	
Axial			
Element Wavelength	Specification	Measured Value % RSD	
As (188.980 nm)	≤ 1.50	0.71	
Se (196.026 nm)	≤ 1.50	0.43	
Zn (206.200 nm)	≤ 1.50	0.46	
Zn (213.857 nm)	≤ 1.50	0.37	
Cd (214.439 nm)	≤ 1.50	0.48	
Pb (220.353 nm)	≤ 1.50	0.48	
Mn (257.610 nm)	≤ 1.50	0.74	
Cr (267.716 nm)	≤ 1.50	0.26	
Cu (324.754 nm)	≤ 1.50	0.51	
Al (396.152 nm)	≤ 1.50	0.45	
Ba (493.408 nm)	≤ 1.50	0.81	
K (766.491 nm)	≤ 1.50	0.84	

Page 4 of 4

เอกสารไม่ควบคุม

UNITED ANALYST AND ENGINEERING CONSULTANT COMPANY Ltd.

Automatic Mercury Analyzer

Model RA-4500

Preventive Maintenance Report

Serial No. : 17780278

Ver 2.0.7

Soft version : Ver 2.0.7

ROM version : Ver 2.0.1

Date : 11 July 2023

PM by : *Pradit mayong*
(Pradit M.)

Approved by : *Pathom S.*
(Pathom S.)



Coax Group Corporation Ltd.

1131/62,64,325-331 Nakornchaisri road,
Kwang ThanonNakornchaisri, Dusit, Bangkok 10300 Thailand
Tel. 02-2435263, 02-6682436 Fax. 02-2437386

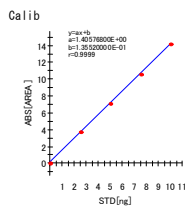
เอกสารไม่ควบคุม

Inspection result

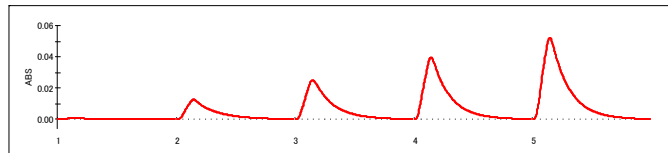
ITEM	STANDARD	RESULT	JUDGE
1. Self Check			
1.1 Heating		PASS	OK
1.2 Cooling		PASS	OK
1.3 Leak		PASS	OK
1.4 Optical system		PASS	OK
1.5 Drift		PASS	OK
2. Analytical curve inspection(AREA)			
2.1 No Pretreatment (Low Conc.)	Correlation coefficient (r) ≥ 0.9990	1.0000	OK
3. Repeatability(AREA)			
3.1 No Pretreatment 100ppb, n=5		1. 99.12 ppb 2. 101.48 ppb 3. 101.24 ppb 4. 102.34 ppb 5. 101.92 ppb C.V. ≤ 5%	1.23% OK
4. Blank	Below 1.0 (AREA)	0.2062	OK

เอกสารไม่ควบคุม

Title : Preventive Maintenance RA-4500 sn:17780278
Date : 7/11/2023
Name : Coax Group
Memo : Calibration Curve 0-10ng



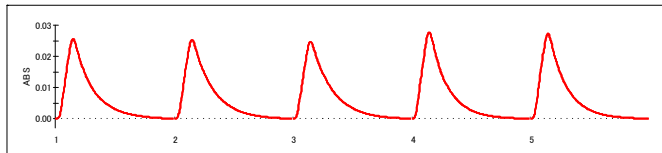
No.	STD [ppb]	SVOL [mL]	CVOL [mL]	DVOL [mL]	STD [ng]	AREA [ON]	MEAS [ng]	Dev [%]	Note
1	100.000	0.000	5.000	5.000	0.000	0.0859	-0.0353	-	
2	100.000	0.025	5.000	5.000	2.500	3.7687	2.5845	3.4	
3	100.000	0.050	5.000	5.000	5.000	7.1028	4.9562	0.9	
4	100.000	0.075	5.000	5.000	7.500	10.6441	7.4753	0.3	
5	100.000	0.100	5.000	5.000	10.000	14.2203	10.0193	0.2	



No.	NAME	SVOL [mL]	CVOL [mL]	DVOL [mL]	AREA [ON]	MEAS [ng]	CONC [ug/L]	Note
1	hg 100 ppb	0.050	5.000	5.000	7.1027	4.9561	99.122	
2	hg 100 ppb	0.050	5.000	5.000	7.2687	5.0742	101.484	
3	hg 100 ppb	0.050	5.000	5.000	7.2514	5.0619	101.238	
4	hg 100 ppb	0.050	5.000	5.000	7.3285	5.1168	102.336	
5	hg 100 ppb	0.050	5.000	5.000	7.2996	5.0962	101.924	

No.	NAME	TRY	AV [ug/L]	SD [ug/L]	Cv [%]
1	hg 100 ppb	5	101.2208	1.246264	1.23

เอกสารไม่ควบคุม



Self Check
Heat check: PASS!! (24.9degC[05:00] -> 28.9degC[02:31]
Sensor check: PASS!! (78- 18- 60)
Leak check: PASS!! (0.17L/min)
Sig/Ref check: PASS!! (Sig: 3.73V, Ref: 3.94V)
Drift check: PASS!! (-0.0027882 - -0.0032876 = 0.0004993)

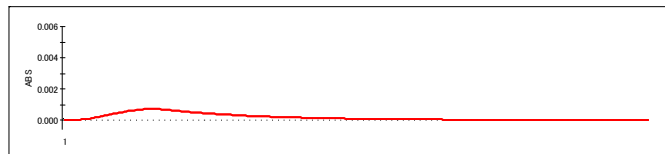
เอกสารไม่ควบคุม



Title : Preventive Maintenance RA-4500 sn:17780278
Date : 7/11/2023
Name : Coax Group
Memo : Blank

SMP

No.	NAME	SVOL [mL]	CVOL [mL]	DVOL [mL]	AREA [ON]	MEAS [ng]	CONC [ug/L]	Note
1	Blank				0.2062	0.0503		



Agilent CrossLab Start Up Services Agilent 7890 Gas Chromatograph Preventive Maintenance Checklist

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

Delivered by highly trained and certified service engineers using genuine Agilent parts and supplies, Agilent Preventive Maintenance provides everything you need to reduce unplanned downtime and keep your systems operating at their peak. This checklist will be completed at the end of the service and provided to you as a record of the preventive maintenance activities.

เอกสารไม่ควบคุม

NIC NIPPON INSTRUMENTS CORPORATION

เอกสารไม่ควบคุม

Agilent 7890 GC Preventive Maintenance Checklist

Introduction

Customer Information

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

Important Customer Web Links

- For more information about **Agilent Technologies services**, please visit our website using the following URL: <http://www.agilent.com/en-us/products/crosslab-instrument-services/service-repair>
- The **Agilent Community** is an excellent place to get answers, collaborate with others about applications and Agilent products, and find in-depth documents and videos relevant to Agilent technologies. Visit <https://community.agilent.com/welcome>.
- To access **Agilent University**, visit <http://www.agilent.com/crosslab/university/> to learn about training options, which include online, classroom and onsite delivery. A training specialist can work directly with you to help determine your best options.
- A useful **Agilent Resource Center** web page is available, which includes short videos on maintenance, quick lists of consumables for new instruments, and other valuable information. Check out the Resource Page here: <https://www.agilent.com/en-us/agilentresources>.
- Need technical support, FAQs, supplies? – visit our **Support Home page** <http://www.agilent.com/search/support>.
- Videos** about specific preparation requirements for your instrument can be found by searching the **Agilent YouTube** channel at <https://www.youtube.com/user/agilent>.
- 7890B Manuals** are also available on Agilent.com:
 - Safety**
https://www.agilent.com/cs/library/usermanuals/public/7890B_Safety.pdf
 - Installation and First Startup**
https://www.agilent.com/cs/library/usermanuals/public/7890B_Installation.pdf
 - Operation Manual**
https://www.agilent.com/cs/library/usermanuals/public/7890B_Operation.pdf
 - Maintaining Your GC**
https://www.agilent.com/cs/library/usermanuals/public/G3430-90052%207890B_Maintaining%20Guide.pdf

เอกสารไม่ควบคุม

Agilent 7890 GC Preventive Maintenance Checklist

Service Engineer's Responsibilities

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

Additional Instruction Notes

- Check for any active service notes for this unit. If there are any applicable "Safety" or "Modification Recommended" Service notes, plan to implement the changes on this unit before doing any qualification service.
- Do not implement firmware updates, unless you get approval from the customer and are sure that they are compatible with the instrument control software.

เอกสารไม่ควบคุม

System Information

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

Instrument System Name and ID	CN11021007
Instrument System Site and Location	Instrument Room

List System Component Product Numbers	List the Serial Numbers of each Component
1. G3440A	CN11021007
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	

Preparation

- ☒ Discuss any specific issues with the customer before starting.
- ☒ Review the instrument logbook for recorded problems and comments.
- ☒ Save instrument control settings before starting the procedure.
- ☒ Perform a general inspection of the system for cleanliness.
- ☒ Check for proper installation of parts, assemblies, sensors etc.
- ☒ Check system for required installation of components, settings as defined by current Service Notes.
- ☒ Check for required firmware updates and verify with customers if they would like them installed.
- ☒ Before starting the following procedures, record the Detector Signal Output(s) in the results table. If the GC is turned OFF or in a service mode, comparing the detector outputs before and after the service is not possible.

Revision: 2.00, Issued: December 30, 2020
 Agile Document Number: D0007063
 DE number: 44166.7597222222
 © Agilent Technologies, Inc. 2020

Page 4 of 9



เอกสารไม่ควบคุม

Preventive Maintenance Procedure

Clean and inspect GC

- ☒ Unplug power cord from the power source.
- ☒ Open GC covers and vacuum/remove any dust/debris. Pay particular attention to cooling fans.
- ☒ Inspect internal connectors for proper contact and placement.
- ☒ Reconnect Power to the GC. Power the GC on and verify the power on self-test passed.
- ☒ Verify oven motor spins freely and turns on with the oven door closed; off when the door is opened.
- ☒ Verify operation of all other fans - the inlet and EPC cooling fans.
- ☒ Verify oven intake/outlet flap assembly is operating smoothly while heating and cooling the oven

Inlet and detector consumable replacement

- ☒ For the inlets installed, perform inlet maintenance as defined in the 7890 manual - "Maintaining Your GC" - for the inlet(s) installed.
- ☒ Replace the split vent trap cartridge filter on units with these inlets: Split/Splitless Capillary (SSL), Multi-Mode Inlet (MMI), Programmed Temperature Vaporizer (PTV), Volatiles Interface (VI).
- ☒ If the inlet system is used in Split Mode with viscous samples, inspect and clean the split vent tube on the inlet and flush or replace the tubing between the inlet and the split vent trap.
- ☒ If the GC includes a Flame Ionization Detector (FID), replace the jet. If the ignitor shows any buildup of sample or corrosion, replace the ignitor. Examine the FID collector and castle assemblies for contamination - clean as necessary.

Zero Sensors and Leak test

- ☒ Zero all pressure sensors per the procedure in the 7890 "Advanced User Guide".
- ☒ Perform inlet pressure decay test(s) as defined in the 7890 "Troubleshooting Manual". If the PM is done in preparation for an Operational Qualification, then the pressure decay test defined within that protocol can be used for the PM.
- ☒ Record if test passed or failed in the results table.

Revision: 2.00, Issued: December 30, 2020
 Agile Document Number: D0007063
 DE number: 44166.7597222222
 © Agilent Technologies, Inc. 2020

Page 5 of 9



เอกสารไม่ควบคุม

ALS Maintenance

- ☐ Section NOT applicable
- ☒ Check all cabling and configuration settings between GC, tray, and injectors.
- ☒ Vacuum or remove any dust, especially around fans.
- ☒ Check operation of all fans.
- ☒ Check syringe for smooth plunger operation.
- ☒ Check for smooth operation of the needle support - clean if necessary

Restore Instrument

- ☒ Restore the normal operating conditions or customer method using the Browser interface or Data System.
- ☒ Purge the system with carrier flow for 15 minutes.
- ☒ Bake out the system, then restore the normal operating conditions.
- ☒ Bake out the system, then restore the normal operating conditions.
- ☒ After equilibration, check and record the post PM detector signal output values. Results should be similar or lower than the detector outputs recorded prior to PM.
- ☒ Perform a chemical checkout. If this is a routine PM, inject the customer's sample using the ALS if applicable. This will act as a final checkout of both the ALS and the GC.

Note: If the PM Service is performed prior to a qualification service, then use the qualification procedure as a guide for final instrument set up and checkout.

Revision: 2.00, Issued: December 30, 2020
 Agile Document Number: D0007063
 DE number: 44166.7597222222
 © Agilent Technologies, Inc. 2020

Page 6 of 9



เอกสารไม่ควบคุม

Signature Page

Service Review

- ☒ Attach available reports/printouts of all tests to this documentation.
- ☒ Record the Preventive Maintenance service activity in the customer's records/logbook.
- ☒ Update/reset instrument maintenance counters as appropriate.
- ☒ Affix the PM sticker to the system or instrument logbook based on the customer's request.
- ☒ Complete the Service Engineer Comments section if there are additional comments.
- ☒ Review with the customer this service, parts replaced, and test results obtained.
- ☒ If the instrument firmware was updated, record the details of the change in the Service Engineer's Comments box or if necessary, in the customer's IQ records.
- ☐ Supply the customer with a copy of the Smart Alerts flyer.
- ☐ Describe Smart Alerts to the customer.
- ☐ Install Smart Alerts if requested.

7890 GC Test Results Table

Detector Signal Outputs	Before PM Service	After PM Service
Front detector output	NA.	NA.
Back detector output	NA.	22.0
AUX detector output	NA.	NA.
Pressure decay test	Expected test result	Actual test result
Front inlet pressure decay test	Pass	Pass
Back inlet pressure decay test	Pass	NA.

Revision: 2.00, Issued: December 30, 2020
 Agile Document Number: D0007063
 DE number: 44166.7597222222
 © Agilent Technologies, Inc. 2020

Page 7 of 9



เอกสารไม่ควบคุม



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2404-0003OC-1
Result of Calibration :- (°) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Close

Cert. No.: 24TM648
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	0.028	0.13	0.24	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	1	2	3	4	5	6	7	8	9 (ref.)	
35.0	34.908	35.004	34.989	35.099	35.089	35.095	34.921	34.936	35.002	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



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL.0-2717-3009-29 FAX.0-2719-9484



Certificate of Calibration

Cert. No.: 24TM651
Page : 1 of 3

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 : 01 April 2024
Calibration Date : 02 April 2024
Ambient Temperature : (25 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Man Pattanasongpaiboon

Approved by :

() Ponpan Paipim
(✓) Suwit Imjai
() Kunchit Prompratt

Issue Date : 7 April 2024

The Uncertainties are for a confidence probability of approximately 95%

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

เอกสารไม่ควบคุม



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2404-0003OC-3
Procedure Used :-

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

Condition of this result of calibration

1. Reference standard instrument:-

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

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

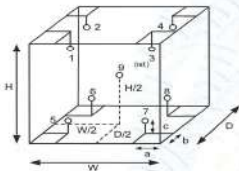
3. This certification is traceable to the International System of Unit.

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

Result of Calibration :- (°) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close



Probe Installation Details :

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

Dimension of Chamber :

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

Environment during calibration		
	Beginning	Finished
Temp. (°C)	25	25
REL.Humid. (%)	54	57
AC Supply (Volt)	221	224

Position :	Ref. Std. ID No.:
1	20-16RTD-01
2	20-16RTD-02
3	20-16RTD-03
4	23-16RTD-04
5	22-16RTD-05
6	20-16RTD-06
7	20-16RTD-07
8	22-16RTD-08
9 (ref.)	22-16RTD-09



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2404-0003OC-3
Result of Calibration :- (°) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Close

Cert. No.: 24TM651
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
22.0	22.0	22.0	0.039	0.22	0.42	2
44.0	44.0	44.0	0.048	0.50	0.90	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	1	2	3	4	5	6	7	8	9 (ref.)	
22.0	22.008	22.034	22.039	22.021	21.746	21.696	21.668	21.668	21.846	0.30
44.0	44.267	44.602	44.293	44.402	44.004	43.961	43.766	44.000	44.205	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

เอกสารไม่ควบคุม



Cert. No.: 24TM29
Page : 1 of 3

Certificate of Calibration

Equipment : Water Bath
Manufacturer : Memmert
Model : WNE 14
Serial No. : L416.0606
ID No. : UAE.MIC.002/2560
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phra Khanong,
Bangkok 10260
Location : Microbiology Laboratory
Received Order : 10 February 2024
Calibration Date : 10 February 2024
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Krisda Malee
Approved by :
() Pormthippa Tameyakul
(✓) Unnopphol Harachai
() Suwit Imjai
Issue Date : 19 February 2024

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

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

เอกสารไม่ควบคุม



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2402-0232OC-2
Procedure Used :-

Cert. No.: 24TM29
Page : 2 of 3

Calibration were conducted using in-house calibration procedure CP-OT04 Based on ASTM E715 according to direct measurement method with Data Acquisition which connected with Industrial Platinum Resistance Thermometer (IPRT).

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY49001451	23LM27	TPA	25 Feb 2024

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

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

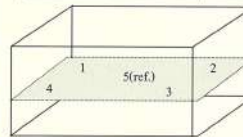
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Heat transfer medium used : Water

	Environmental		AC Voltage Supply
	(°C)	(%R.H.)	
Beginning of Calibration	26	51	220
Finished of Calibration	25	50	221



Front

Position :	Ref. Std. ID No.:
1	N37P301419
2	N37P300732
3	N37P301420
4	N37P301421
5(ref.)	N37P301425

เอกสารไม่ควบคุม



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2402-0232OC-2
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source

Cert. No.: 24TM29
Page : 3 of 3

Calibration point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Average* Standard Reading (°C)					Uncertainty (± °C)
			1	2	3	4	5 (ref.)	
44.5	44.4	44.4	44.508	44.469	44.502	44.521	44.527	0.15

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Coverage Factor k
44.5	0.15	0.074	2

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

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

Stability : One-half of the greatest maximum difference of measured temperature at any one probe.

UUC* : Unit Under Calibration

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

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

-o0o-

เอกสารไม่ควบคุม



Cert. No.: 24TM30
Page : 1 of 3

Certificate of Calibration

Equipment : Water Bath
Manufacturer : Memmert
Model : WNE 14
Serial No. : L416.0612
ID No. : UAE.MIC.003/2560
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phra Khanong,
Bangkok 10260
Location : Microbiology Laboratory
Received Order : 10 February 2024
Calibration Date : 10 February 2024
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Krisda Malee
Approved by :
() Pormthippa Tameyakul
(✓) Unnopphol Harachai
() Suwit Imjai
Issue Date : 19 February 2024

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

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

เอกสารไม่ควบคุม



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2402-0232OC-3
Page : 2 of 3

Procedure Used :- Calibration were conducted using in-house calibration procedure CP-OT04 Based on ASTM E715 according to direct measurement method with Data Acquisition which connected with Industrial Platinum Resistance Thermometer (IPRT).

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY49001451	23LM27	TPA	25 Feb 2024

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

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

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

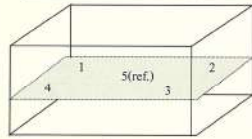
Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Heat transfer medium used : Water

	Environmental		AC Voltage Supply
	(°C)	(%R.H.)	(Volt)
Beginning of Calibration	24	54	221
Finished of Calibration	26	55	220

Position :	Ref. Std. ID No.:
1	N37P301419
2	N37P300732
3	N37P301420
4	N37P301421
5(ref.)	N37P301425



Front

เอกสารไม่ควบคุม



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2402-0232OC-3
Page : 3 of 3
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source

Calibration point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Average* Standard Reading (°C)					Uncertainty (± °C)
			Position					
			1	2	3	4	5 (ref.)	
44.5	44.6	44.6	44.491	44.463	44.496	44.518	44.528	0.15

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Coverage Factor k
44.5	0.12	0.059	2

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

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

Stability : One-half of the greatest maximum difference of measured temperature at any one probe.

UUC* : Unit Under Calibration

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

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

-000-

เอกสารไม่ควบคุม



มูลนิธิส่งเสริมและพัฒนาอาหาร
ศูนย์บริการห้องปฏิบัติการอุตสาหกรรมอาหาร
Foundation for Industrial Development National Food Institute
Food Industrial Laboratory Service Center



Calibration Certificate

Certificate No.: 2304203-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhnong, Bangkok 10260

Page 1 of 3

Equipment: Autoclave
Manufacturer: ALP
Model: CL-40L
Serial No.: 807298
ID No.: UAE.MIC.019/2560
Order No.: 2304203
Operation No.: 2304203-001
Date of Receipt: 10 August 2023
Date of Calibration: 10 August 2023

Calibrated by Mr.Worapob Sooktong
Scientist
Approved by (Mr.Pheraphat Tuanjit)
Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team
Date of Issue: 15 August 2023

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

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

F-C5-009 Revision: 01 Date: 20-04-65

เอกสารไม่ควบคุม



มูลนิธิส่งเสริมและพัฒนาอาหาร
ศูนย์บริการห้องปฏิบัติการอุตสาหกรรมอาหาร
Foundation for Industrial Development National Food Institute
Food Industrial Laboratory Service Center



Calibration Report

Certificate No.: 2304203-001-01
Equipment: Autoclave
Model: CL-40L
Serial No.: 807298
Resolution: 1 °C
ID No.: UAE.MIC.019/2560
Manufacturer: ALP
Date of Calibration: 10 August 2023

Page 2 of 3

Location: 301, UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Environment Condition: Ambient Temperature (28 ± 1) °C
Relative Humidity (65 ± 2) %
Line Voltage (225 ± 1) Volt

Condition of this results of Calibration:

1. This instrument was calibrated by insert 3 standard temperature recorder with RTD into its autoclave and calibration according to W-TE-018 based on BS 2646-1(2021) : Autoclaves for sterilization in laboratories Design, construction, safety and performance Specification.

- The temperature scale used was based on ITS - 90.

- All data show below were final values and the initial data may be obtained upon request.

2. Reference Standard Instrument :

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
Digital Thermometer with RTD (Data Logger)	HTTemp140-2	S25601	NC-22-11-22-176	9-Nov-23	MADETECH INC.
	HTTemp140-2	S25602	NC-22-11-22-175	9-Nov-23	MADETECH INC.
	HTTemp140-2	RS4918	TE 660383-01	8-Apr-24	NATIONAL FOOD INSTITUTE

3. This certificate is traceable to International System of Units (SI Units).

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

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

6. This standard does not apply to sterilizers or disinfectors used for medical, dental, pharmaceutical.

7. Condition of Calibrated item : Good

UUC Description : Setting program function sterilization : STERILIZE/NORMAL

Time of sterilization 15 Minute At 121 °C

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

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

เอกสารไม่ควบคุม



Calibration Report

Certificate No.: 2304203-001-01
Equipment: Autoclave
Model: CL-40L Serial No.: 807298
Resolution: 1 °C ID No.: UAE.MIC.019/2560
Manufacturer: ALP

Date of Calibration: 10 August 2023 Page 3 of 3

Calibration point: 121 °C

Calibration result:

Calibration Condition	Temperature (°C)	Relative Humidity (%)	Line Voltage (Volt)
Min	27.0	63.5	223.3
Max	28.3	67.3	225.9

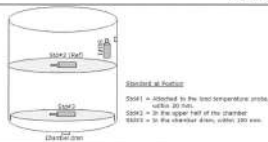


Table 1 : Reporting of Temperature

Calibration Point (°C)	Measured Temperature (°C) @ Sensor No. (Sensor No.2 is REF)			Uncertainty ± (°C)
	Std. # 1	Std. # 2 (Ref)	Std. # 3	
121	121.68	121.70	121.66	0.66

Table 2 : Reporting of Characterization Result

UUC* Setting (°C)	UUC* Reading				Stability ± (°C)	Uniformity (°C)	Overall Variation (°C)
	Min (°C)	Max (°C)	Average (°C)	MPa			
121	121	121	121	0.10	0.11	0.12	0.23

Note

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

----- End -----

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

2008 บางนาซอย 36 แขวงคลองตันเหนือ เขตวัฒนา กรุงเทพมหานคร 10700 **เขตกานโน้ต**
2008 Soi 36, Aun Anan Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand
Tel : +66(0) 2462 8688 Fax : +66(0) 2462 8645



Calibration Certificate

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

Page 1 of 3

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

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

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

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

2008 บางนาซอย 36 แขวงคลองตันเหนือ เขตวัฒนา กรุงเทพมหานคร 10700 **เขตกานโน้ต**
2008 Soi 36, Aun Anan Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand
Tel : +66(0) 2462 8688 Fax : +66(0) 2462 8645



Calibration Report

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

Date of Calibration: 2 April 2024 Page 2 of 3

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

Condition of this results of Calibration:

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

Reference Standard Instrument :

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

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

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

2008 บางนาซอย 36 แขวงคลองตันเหนือ เขตวัฒนา กรุงเทพมหานคร 10700 **เขตกานโน้ต**
2008 Soi 36, Aun Anan Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand
Tel : +66(0) 2462 8688 Fax : +66(0) 2462 8645



Calibration Report

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

Date of Calibration: 2 April 2024 Page 3 of 3

Calibration point: 115.0 and 121.0 °C

Calibration result:

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

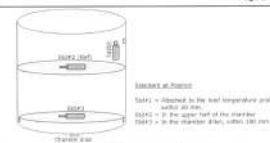


Table 1 : Reporting of Temperature

Calibration Point (°C)	Measured Temperature (°C) @ Sensor No. (Sensor No.2 is REF)			Uncertainty ± (°C)
	Std. # 1	Std. # 2 (Ref)	Std. # 3	
115.0	115.28	115.35	115.38	0.64
121.0	121.28	121.36	121.37	0.64

Table 2 : Reporting of Characterization Result

UUC* Setting (°C)	UUC* Reading				Stability ± (°C)	Uniformity (°C)	Overall Variation (°C)
	Min (°C)	Max (°C)	Average (°C)	MPa			
115.0	115.0	115.1	115.0	0.08	0.19	0.13	0.48
121.0	121.0	121.1	121.0	0.12	0.17	0.10	0.38

Note

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

----- End -----

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

2008 บางนาซอย 36 แขวงคลองตันเหนือ เขตวัฒนา กรุงเทพมหานคร 10700 **เขตกานโน้ต**
2008 Soi 36, Aun Anan Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand
Tel : +66(0) 2462 8688 Fax : +66(0) 2462 8645





Certificate of Calibration

Certificate No.: C01234158

Page: 2 of 3

Equipment: Balance
Model: PX623
Serial No. (or ID.): C236754745 (UAE.MC.055/2565)
Manufacturer: Ohaus
Condition: In condition

Certificate No.: C01234158
Issued Date: 08 December 2023
Job No.: WO-00011251
Page: 1 of 3

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

Environment Condition: Temperature 25 °C ± 0.5 °C
 Humidity 54 %RH ± 1.7 %RH

Calibration Place: United Analyst and Engineering Consultant Co., Ltd. (301 Microbiology Room)
 3 Soi Udomsuk 41, Sukhumvit Road, Bangchak Sub-District,
 Phrakhanong District, Bangkok, THAILAND 10260

Calibration By: Mr. Adisai Maknoi
Calibration Date: 07 December 2023

The Method used: In-house method, CAL-WI-47, based on UKAS Lab 14

Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Co., Ltd. Certificate No. C02222534

(Mr. Adisai Maknoi)
 Person in charge

(Mr. Rungrod Jenkitrakulchai)
 Authorized signatory

This certificate is issued in the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories. The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM). These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

บริษัท ดีเคเอส อีเซีย จำกัด
 DKSH Technology Limited
 2533 สุขุมวิท 41 แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
 2533 Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
 Phone: +66 2630 7100 Email: info.calibration@dksh.com Website: www.dksh.com/certificat-thailand

Delivering Growth - in Asia and Beyond.

เอกสารไม่ควบคุม

CAL-FM-C01-14: 12 Sep 2022

Calibration Results:

Before Adjustment

Eccentric Error: Weight to be 1/3 or 1/2 of Maximum capacity, taken from the center of the pan as a zero reference.

Nominal Test Value		Reference Points (g)				
		A	B	C	D	E
200 (g)		-	0.000	-0.003	0.000	0.001

Repeatability: Determination of the standard deviation of weighing balance., Readability 0.001 (g)

Nominal test value (g)	Standard Deviation
50	0.0008
500	0.0008

Error of Indication from nominal or conventional mass value., Readability 0.001 (g)

Nominal Value (g)	Conventional Mass (g)	Displayed Value (g)	Error of Indication (g)	Uncertainty (g)	k
1	1.0000	1.000	0.000	0.0013	2.10
5	5.0001	5.000	0.000	0.0013	2.10
10	10.0001	10.001	0.001	0.0013	2.10
20	20.0000	20.000	0.000	0.0013	2.09
50	50.0001	50.000	0.000	0.0013	2.09
100	100.0001	100.001	0.001	0.0013	2.09
200	200.0004	200.002	0.002	0.0014	2.07
300	300.0005	300.002	0.002	0.0015	2.05
400	400.0006	400.004	0.003	0.0016	2.03
500	500.0006	500.008	0.007	0.0019	2.02
600	600.0007	600.009	0.008	0.0021	2.01

บริษัท ดีเคเอส อีเซีย จำกัด
 DKSH Technology Limited
 2533 สุขุมวิท 41 แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
 2533 Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
 Phone: +66 2630 7100 Email: info.calibration@dksh.com Website: www.dksh.com/certificat-thailand

Delivering Growth - in Asia and Beyond.

เอกสารไม่ควบคุม

CAL-FM-C01-14: 12 Sep 2022

Certificate No.: C01234158

Page: 3 of 3

After Adjustment

Eccentric Error: Weight to be 1/3 or 1/2 of Maximum capacity, taken from the center of the pan as a zero reference.

Nominal Test Value		Reference Points (g)				
		A	B	C	D	E
200 (g)		-	0.001	-0.002	-0.002	0.001

Repeatability: Determination of the standard deviation of weighing balance., Readability 0.001 (g)

Nominal test value (g)	Standard Deviation
50	0.0006
500	0.0008

Error of Indication from nominal or conventional mass value., Readability 0.001 (g)

Nominal Value (g)	Conventional Mass (g)	Displayed Value (g)	Error of Indication (g)	Uncertainty (g)	k
1	1.0000	1.000	0.000	0.0013	2.10
5	5.0001	5.000	0.000	0.0013	2.10
10	10.0001	10.000	0.000	0.0013	2.10
20	20.0000	20.000	0.000	0.0013	2.10
50	50.0001	50.000	0.000	0.0013	2.10
100	100.0001	100.000	0.000	0.0014	2.09
200	200.0004	200.000	0.000	0.0014	2.07
300	300.0005	300.001	0.001	0.0015	2.05
400	400.0006	400.002	0.001	0.0017	2.04
500	500.0006	500.001	0.000	0.0019	2.02
600	600.0007	600.002	0.001	0.0021	2.01

The End of Certificate

บริษัท ดีเคเอส อีเซีย จำกัด
 DKSH Technology Limited
 2533 สุขุมวิท 41 แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
 2533 Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
 Phone: +66 2630 7100 Email: info.calibration@dksh.com Website: www.dksh.com/certificat-thailand

Delivering Growth - in Asia and Beyond.

เอกสารไม่ควบคุม

CAL-FM-C01-14: 12 Sep 2022

Refer to Certificate No.: C01234158

Page: 1 of 3

Statements of conformity:

This conformity certificate documents the validity of the following statements of conformity based on the measurement results of corresponding calibration certificate:

The error of indication determined during calibration are under given measurement and environmental conditions and considering the expanded measurement uncertainty (coverage probability 95%) within the specification. The given measurement uncertainty already includes other all effects by according to the standard method, UKAS Lab14. Therefore, those parameters have not been assessed separately.

Tolerance and Decision rules:

Assessment of the conformity of the measurement device are done based on direct comparison of the relevant measurement results with the tolerances and decision rule are prescribed by the customer.

- Decision rule:** ☐ Choice A Binary Statement for Simple Acceptance Rule ($w = 0$), Specific Risk < 50% PFA.
☒ Choice B Non-binary statement with guard band ($w = 1$ U), Pass or Fail Specific Risk < 2.5% PFA and Condition Pass or Condition Fail Specific Risk < 50% PFA.
☐ Choice C Customer defined, Customers may define arbitrary multiple of r to have applied as guard band ($w = r$ U).
 ; PFA - Probability of False Accept

(Mr. Rungrod Jenkitrakulchai)
 Authorized signatory

บริษัท ดีเคเอส อีเซีย จำกัด
 DKSH Technology Limited
 2533 สุขุมวิท 41 แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
 2533 Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
 Phone: +66 2630 7100 Email: info.calibration@dksh.com Website: www.dksh.com/certificat-thailand

Delivering Growth - in Asia and Beyond.

เอกสารไม่ควบคุม

CAL-FM-C01-14: 12 Sep 2022

Statements of conformity:

Before Adjustment

Readability: 0.001 g

Nominal Value g	Error of indication g	Guard band (w) g	Tolerance (±) g	Conformity
1	0.000	0.0013	0.002	Pass
5	0.000	0.0013	0.010	Pass
10	0.001	0.0013	0.020	Pass
20	0.000	0.0013	0.040	Pass
50	0.000	0.0013	0.100	Pass
100	0.001	0.0013	0.200	Pass
200	0.002	0.0014	0.400	Pass
300	0.002	0.0015	0.600	Pass
400	0.003	0.0016	0.800	Pass
500	0.007	0.0019	1.000	Pass
600	0.008	0.0021	1.200	Pass

The validity of the statements of conformity cannot be guaranteed for different places of use, environmental conditions or improper use.

Statements of conformity:

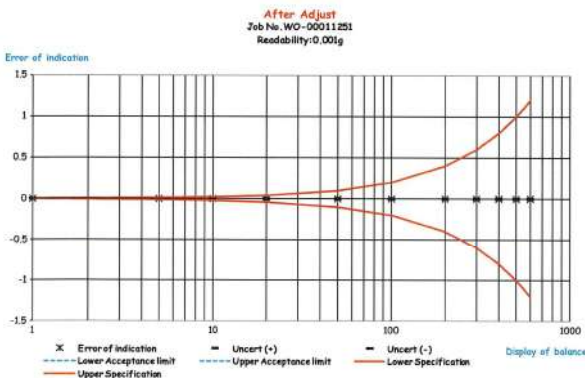
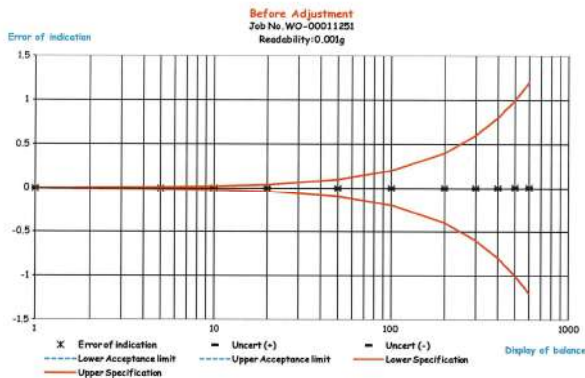
After Adjustment

Readability: 0.001 g

Nominal Value g	Error of indication g	Guard band (w) g	Tolerance (±) g	Conformity
1	0.000	0.0013	0.002	Pass
5	0.000	0.0013	0.010	Pass
10	0.000	0.0013	0.020	Pass
20	0.000	0.0013	0.040	Pass
50	0.000	0.0013	0.100	Pass
100	0.000	0.0014	0.200	Pass
200	0.000	0.0014	0.400	Pass
300	0.001	0.0015	0.600	Pass
400	0.001	0.0017	0.800	Pass
500	0.000	0.0019	1.000	Pass
600	0.001	0.0021	1.200	Pass

The validity of the statements of conformity cannot be guaranteed for different places of use, environmental conditions or improper use.

The End of Statements of conformity



ใบตรวจสอบสภาพเครื่องชั่ง

เลขที่ใบงาน: WO-00011251

ชนิดเครื่องมือ: Balance

รุ่น: PX623

หมายเลขเครื่อง: C236754745

ตรวจสอบ (รับ)	รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
		ปกติ	ไม่ปกติ	
07 Dec 2023				
ปกติ	ไม่ปกติ			
	General			
<input checked="" type="checkbox"/>	<input type="checkbox"/> 1. สายไฟ/Adapter, power supply 220/110V	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/> 2. ความสมบูรณ์ชุดกระชากกันลม (Cover)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/> 3. ความสมบูรณ์ชุดของระดับน้ำ	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/> 4. การปรับระดับของขาตั้งเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/> 5. การทดสอบของไม่กด	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/> 6. ความสมบูรณ์ของ Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/> 7. การแสดงผลของ Display หลังจากรับน้ำหนัก	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/> 8. ชุดรองจานชั่ง (Stopper) / pan support	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/> 9. การทำงานของ Function Internal / External	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/> 10. ความสะอาดของพื้นเครื่องภายในและภายนอก load cell	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/> 11. สภาวะแวดล้อม ณ สถานที่ตั้งเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

หมายเหตุเพิ่มเติมเขียนข้อแก้ไข :

Mr. Adisai Maknoi
Service Engineer