

ภาคผนวก ง
เอกสารสอบเทียบเครื่องมือ

บริษัท ทีพีไอ โพลีน จำกัด (มหาชน)

- ☒ บริษัท ทีพีโอ โพลีน จำกัด (มหาชน) : TPI POLENE PUBLIC COMPANY LIMITED
☐ บริษัท ทีพีโอ โพลีน เพาเวอร์ จำกัด (มหาชน) : TPI POLENE POWER PUBLIC COMPANY LIMITED
☐ บริษัท ทีพีโอ โพลีน ชีวอินทรีย์ จำกัด : TPI POLENE BIO ORGANIC COMPANY LIMITED

NO. 042950

ใบอนุญาตให้นำสิ่งของออกนอกโรงงาน

☐ ไม่นำของกลับ
☒ ต้องนำของกลับ

ประมาณการวันที่จะนำของกลับ

วันที่ 24 กรกฎาคม 2567

วันที่ 27 เดือน มิ.ย. พ.ศ. 2567

ข้าพเจ้าชื่อ นาย ภิรมย์ หนุ่ยพานิช, พ.ร.ท. หนุ่ยพานิช, พ.ร.ท. หนุ่ยพานิช, พ.ร.ท. หนุ่ยพานิช

ทะเบียนรถ..... วันเวลาที่นำออก 28 มิ.ย. 67

ขออนุญาตนำสิ่งของออกตามรายการดังข้างล่างนี้

ลำดับที่	รายละเอียดการนำของออก	จำนวน	หน่วย	หมายเหตุ
1	Primary Flow Standard (Dry Cell)	1	1 เครื่อง	
2	N - N (Wet Cell)	1	1 เครื่อง	

วัตถุประสงค์ นำไปซ่อมแซม

สถานที่ส่งของ..... โทรศัพท์.....

(กรณีนำของออกไปซ่อม ให้ระบุหมายเลข P/R ดังต่อไปนี้)

ผู้ขอ	ผู้ควบคุม	ผู้ตรวจสอบ
1	2	

ได้ตรวจสอบความถูกต้องและลายมือชื่อผู้อนุมัติแล้ว
เห็นว่าถูกต้องเรียบร้อย

ข้าพเจ้าได้ตรวจสอบรายการและจำนวน ตามที่แจ้งแล้ว
เห็นว่าครบถ้วน จึงลงลายมือชื่อไว้เป็นหลักฐาน

ร.ป.ก.

เจ้าหน้าที่หน่วยรักษาความปลอดภัย/นายเวร

- หมายเหตุ (1) ผู้ขออนุญาตนำของออก คือผู้มีอำนาจของผู้รับเหมาหรือเจ้าหน้าที่ ทีพีโอ
(2) พนักงานทีพีโอ ผู้ตรวจสอบความถูกต้อง (ระดับ MP1 ขึ้นไป) โปรดเขียนตัวบรรจง
(3) ผู้อนุมัติคือ ผู้ช่วยผู้จัดการฝ่ายขึ้นไปที่นั่น กรณีผู้จัดการฝ่ายไม่อยู่ให้ผู้จัดการแผนกที่จะนำของออกลงนามแทนและใส่
เครื่องหมาย ✓ ลงในช่อง ☐ ลงนามแทนเพราะผู้ช่วยผู้จัดการฝ่ายขึ้นไปที่นั่นไม่อยู่
(4) กรณีที่นำอุปกรณ์ และทรัพย์สินของบริษัทฯ ออกไปซ่อมหรือนำไปใช้ในการปฏิบัติงานนอกเขตโรงงาน เมื่อซ่อมเสร็จ
หรือเสร็จสิ้น จากการปฏิบัติงานแล้วจะนำกลับเข้าโรงงาน โปรดแจ้งหน่วยงานรักษาความปลอดภัยเพื่อลงทะเบียนการ
นำของเข้า หากไม่แจ้งจะถือว่าอุปกรณ์และทรัพย์สินนั้น ๆ ยังไม่ได้นำกลับเข้าโรงงาน ยกเว้นอุปกรณ์ที่นำไปประกอบ
เข้ากับเครื่องจักรกล/เครื่องยนต์ และอุปกรณ์ที่ซ่อมโดย Supplier และส่งคืนผ่าน Store ให้ระบุไม่นำของกลับ

ลิขสิทธิ์ - แผนการรักษาความปลอดภัย

สีเขียว-ผู้ขาย, ผู้นำของออก

สีเหลือง=USER ผู้ร้องขอนำออก

บริษัท ยูไนเต็ด แอนนาลิสต์ แอนด์ เอ็นจิเนียริง
คอนซัลแตนท์ จำกัด

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Stack									
1	Pre-Test Console	Total Suspended Particulate Particular Matter (PM ₁₀)	Apex Instruments, USA.	XC-572-V 1904011	Envi Equipment Service Co., Ltd.	E23-08066	5 Aug 23	4 Aug 24	-
2	Flue gas Analyzer	Sulphur Dioxide Oxide of Nitrogen as Nitrogen Dioxide	Testo	Testo 350 60899617	Entech Industrial Sulation Co., Ltd.	G 660614	5 Oct 23	4 Oct 24	-

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

CERTIFICATE OF CALIBRATION

Customer : United Analyst and Engineering Consultant Co., Ltd.
Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Description of Equipment : Console meter
Manufacturer : Apex Instrument
Model Number : XC-572-V
Serial Number : 1904011
ID/Control No. : -
Environment Conditions : Temperature (25 ± 2) °C
Humidity (50 ± 15) % RH
Cal. Date : 05/08/2023
Issue Date : 05/08/2023

Meter Console Information		Calibration Conditions		Factors/Conversions	
Console Model Number	XC-572-V	Date	05/08/2023	Std Temp	293 K
Console Serial Number	1904011	Time	09:50 AM	Std Press	760 mm Hg
DGM Model Number	SK25EX	Calibration Reference No.	SER23-08027	K _i	0.386
DGM Serial Number	00004114	Barometric Pressure	758.99 mmHg	Console Leak Check	PASS
		Calibration Meter Gamma	0.999		

Calibration Data									
Metering Console					Calibration Meter				
Run Time	DGM Orifice DH	Volume Initial	Volume Final	Outlet Temp Initial	Outlet Temp Final	Volume Initial	Volume Final	Outlet Temp Initial	Outlet Temp Final
Elapsed (Q)	(P _{at})	(V _{in})	(V _{out})	(t _{in})	(t _{out})	(V _{wi})	(V _{wf})	(t _{in})	(t _{out})
min	mm H ₂ O	m ³	m ³	°C	°C	m ³	m ³	°C	°C
12.35	13.0	1342.996	1343.136	29	29	155.32046	155.46168	27	27
12.42	13.0	1343.136	1343.276	29	29	155.46168	155.60264	27	27
8.80	26.0	1343.282	1343.422	29	29	155.60872	155.75014	27	27
8.80	26.0	1343.422	1343.562	30	30	155.75014	155.89098	26	26
13.95	40.0	1343.569	1343.849	30	30	155.89796	156.17902	26	26
13.95	40.0	1343.849	1344.129	31	31	156.17902	156.45838	26	26
10.50	70.0	1344.138	1344.418	31	31	156.46734	156.74556	26	26
10.47	70.0	1344.418	1344.698	32	32	156.74556	157.02264	26	26
9.12	90.0	1344.711	1344.991	32	32	157.03528	157.31088	26	26
9.12	90.0	1344.991	1345.271	32	32	157.31088	157.58638	25	25

Calibration Method or Calibration Procedure Used

US EPA Method (United State Environmental Protection Agency)

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

Result of Calibration

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

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

Calibrated by : Mr. Sanya Sangnil

Approved by :

(Mr. Mana Fuekhu)
Technical Manager

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

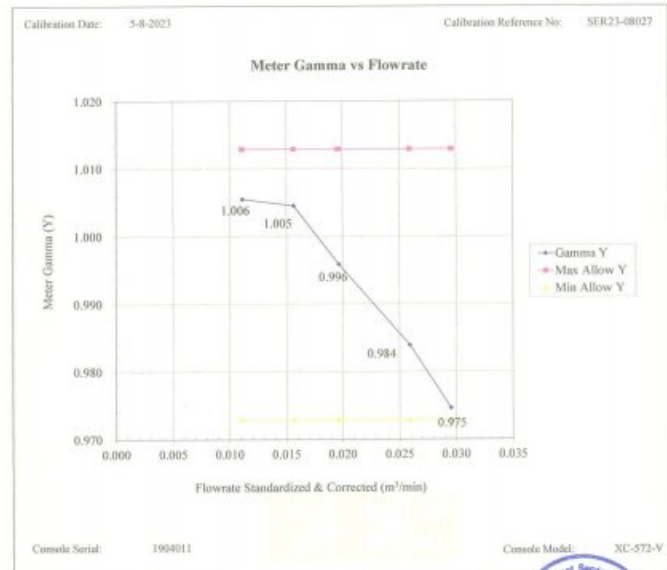
METHOD 5 CONSOLE CALIBRATION
USING REFERENCE WET GAS METER W-NK-2.5-B-Z No.547425
5-POINT METRIC UNIT

Meter Console Information		Calibration Conditions		Factors/Conversions	
Console Model Number	XC-572-V	Date	05/08/2023	Std Temp	293 K
Console Serial Number	1904011	Time	09:50 AM	Std Press	760 mm Hg
DGM Model Number	SK25EX	Calibration Reference No.	SER23-08027	K _i	0.386
DGM Serial Number	00004114	Barometric Pressure	758.99 mmHg	Console Leak Check	PASS
		Calibration Meter Gamma	0.999		

Calibration Data						
Results						
Standardized Data				Dry Gas Meter		
Dry Gas Meter		Calibration Meter		Calibration Factor	Flowrate	
(V _{ref})	(Q _{ref})	(V _w)	(Q _w)	Value	Variation	Std & Corr
m ³	m ³ /min	m ³	m ³ /min	(Y)	(ΔY)	(Q _{ref})
0.137	0.011	0.138	0.011	1.006	0.014	0.011
0.137	0.011	0.137	0.011	1.005	0.012	0.011
0.137	0.016	0.138	0.016	1.007	0.014	0.016
0.137	0.016	0.138	0.016	1.002	0.010	0.016
0.275	0.020	0.275	0.020	0.999	0.006	0.020
0.275	0.020	0.273	0.020	0.993	0.000	0.020
0.276	0.026	0.272	0.026	0.986	-0.007	0.026
0.276	0.026	0.271	0.026	0.982	-0.011	0.026
0.276	0.030	0.269	0.030	0.975	-0.018	0.030
0.277	0.030	0.270	0.030	0.974	-0.018	0.030
				0.993	Y Average	ΔH@ Average

Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is ±0.02.
For ΔH_g, orifice pressure differential that equates to 0.75 cfm (0.0212 m³/min) at standard temperature and pressure, acceptable tolerance of individual values from the average is ±0.2 inches (5.1mm) H₂O

Meter Console Information		Calibration Conditions		Factors/Conversions	
Console Model Number	XC-572-V	Date	05/08/2023	Std Temp	293 K
Console Serial Number	1904011	Time	09:50 AM	Std Press	760 mm Hg
DGM Model Number	SK25EX	Calibration Reference No.	SER23-08027	K _i	0.386
DGM Serial Number	00004114	Barometric Pressure	758.99 mmHg	Console Leak Check	PASS
		Calibration Meter Gamma	0.999		



เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Meter Console Information		Calibration Conditions				Factors/Conversions	
Console Model Number	XC-572-V	Date	Time	05/08/2023	09:50 AM	Std Temp	293 K
Console Serial Number	1904011	Calibration Reference No.	SER23-08027			Std Press	760 mm Hg
DGM Model Number	SK25EX	Barometric Pressure	758.99 mmHg			K ₁	0.386
DGM Serial Number	00004114	Calibration Meter Gamma	0.999			Console Leak Check	PASS



เอกสารไม่ควบคุม

THERMOCOUPLES SYSTEM CALIBRATION

Sampling System Equipment Information		Calibration Conditions			
Console Model Number	XC-572-V	Date	Time	05/08/2023	12:10 PM
Console Serial Number	1904011	Calibration Reference No.	SER23-08027		
DGM Model Number	SK25EX	Reference Thermometer	DIGICON		
DGM Serial Number	00004114	Serial Number	183169105		
Meter Box Model Number	JENCO 765 KF				
Meter Box Serial Number	JC 17215				

Results										
Console Thermocouple Simulator										
Channel and test point	Meter Box Channel Temperature Reading (°C)									
	-18.0	25.0	38.0	93.0	149.0	260.0	371.0	482.0	593.0	816.0
Stack	-17.0	25.0	37.0	93.0	149.0	258.0	370.0	481.0	592.0	814.0
Aux	-16.0	25.0	37.0	93.0	149.0					
Probe	-17.0	24.0	37.0	93.0	149.0					
Filter	-16.0	24.0	37.0	93.0	149.0					
Oven	-16.0	24.0	37.0	93.0	149.0					
Exit	-16.0	24.0	37.0							

Tolerance Range			
Stack	± 1.50% Absolute	Meter	± 3.0 °C
Probe	± 3.0 °C	Exit	± 2.0 °C
Filter	± 3.0 °C		



เอกสารไม่ควบคุม

Certificate No: G 660614
Date of issue : 05-Oct-23

Instrument description : Flue Gas Analyzer
Instrument model : Testo 350 New
Control unit serial no. : 03099402/701
Instrument serial no. : 60899617/701
ID no. or control no. : UAE.FRM. 007/2560
Manufacturer : Testo SE & Co. KGaA
Probe description : -
Probe model : -
Probe serial no. : -
Customer name : United Analyst and Engineering Consultant Co., Ltd.
Customer address : 81 Soi Udomsuk 41, Sukhumvit Rd., Bangchak, Phrakhanong, Bangkok 10260

Total pages of certificate : 2 Pages
Receiving no. : L-233264
Receiving date : 28-Sep-23
Parameter of calibration : Gas Calibration (Oxygen 2.498, 10.04, 21.02 %vol, Carbon Monoxide 80.14, 302, 1003 ppm, Nitrogen Dioxide 30.34, 80.96, 201.9 ppm, Nitric Oxide 30.01, 151.5, 322.5 ppm, Sulphur Dioxide 50.36, 100.8, 600.8 ppm)

Condition of UUC : Used
Ambient condition : All of the Measurement were carried out the stabilized laboratory
Temperature : 23 ± 5 °C
Humidity : 55 ± 15 %RH

Calibration place : 17/121 Soi Ngamwongwan 47 Yaek 48, Toonsonghong, Lakki, Bangkok 10210

Calibration procedure no. : This instrument was calibrated by comparison with Standard gas mixture according to calibration Work Instruction no. WI-CL-28-C

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

Date of calibration : 05-Oct-23

Kwanchoi K.
Mr. Kwanchoi Khamsung
Calibration Technician

W. Nongluck Wongtettee
Mrs. Nongluck Wongtettee
Technical Manager

เอกสารไม่ควบคุม



Certificate No.: G 660614

Standard References (Table 1)

Standard	Certificate No.	Vendor	Due date
Oxygen (O ₂) 2.498 % Vol	4219/21	Linde	30-Sep-25
Oxygen (O ₂) 10.04 % Vol	CG-0153-21	Nimt	18-Nov-26
Oxygen (O ₂) 21.02 % Vol	CG-0041-22	Nimt	10-Feb-27
Carbon monoxide (CO) 80.14 ppm	CG-0040-22	Nimt	14-Feb-27
Carbon monoxide (CO) 302 ppm	1915/23	Linde	16-Jun-25
Carbon monoxide (CO) 1003 ppm	2584/23	Linde	10-Sep-25
Nitrogen Dioxide (NO ₂) 30.34 ppm	2703/22	Linde	22-Aug-24
Nitrogen Dioxide (NO ₂) 80.96 ppm	3240/21	Linde	26-Jun-24
Nitrogen Dioxide (NO ₂) 201.9 ppm	1975/23	Linde	17-Jul-25
Nitric Oxide (NO) 30.01 ppm	CG-0014-23	Nimt	19-Feb-25
Nitric Oxide (NO) 151.5 ppm	0161/23	Linde	22-Jan-25
Nitric Oxide (NO) 322.5 ppm	1974/23	Linde	17-Jul-25
Sulphur Dioxide (SO ₂) 50.36 ppm	2004/23	Linde	17-Jul-25
Sulphur Dioxide (SO ₂) 100.8 ppm	3507/22	Linde	09-Nov-24
Sulphur Dioxide (SO ₂) 600.8 ppm	2003/23	Linde	17-Jul-25

Measured room conditions

Temperature : 22.1 °C Humidity : 66.7 %RH Pressure : 1009.4 mbar

Calibration conditions

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

Calibration Results (Without adjustment) (Table 2)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty
O ₂ (%Vol)	2.498	2.48	-0.018	0.15
O ₂ (%Vol)	10.04	10.07	0.03	0.20
O ₂ (%Vol)	21.02	21.10	0.08	0.30
CO (ppm)	80.14	81	0.86	3.0
CO (ppm)	302	304	2	6.0
CO (ppm)	1003	1008	5	12
NO ₂ (ppm)	30.34	28.2	-2.14	8.0
NO ₂ (ppm)	80.96	80.5	-0.46	8.0
NO ₂ (ppm)	201.9	204.7	2.8	12
NO (ppm)	30.01	29	-1.01	8.0
NO (ppm)	151.5	152	0.5	8.0
NO (ppm)	322.5	322	-0.5	12
SO ₂ (ppm)	50.36	50	-0.36	6.0
SO ₂ (ppm)	100.8	103	2.2	6.0
SO ₂ (ppm)	600.8	606	5.2	13

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

End of Report

เอกสารไม่ควบคุม

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	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	01dB	CAL31 82795	Innovative Instrument Co.,Ltd.	23-ACT-109	27 Jun 23	26 Jun 24	-
2	Sound Level Meter	L _{Aeq} 24 hours, L _{Amax} , L _{A90}	Larson Davis	LxT2 0005305	Innovative Instrument Co.,Ltd.	23-SLM-225	28 Jun 23	27 Jun 24	-
3	Sound Level Meter	L _{Aeq} 24 hours, L _{Amax} , L _{A90}	Larson Davis	LxT2 0005339	Innovative Instrument Co.,Ltd.	23-SLM-223	28 Jun 23	27 Jun 24	-
4	Sound Level Meter	L _{Aeq} 24 hours, L _{Amax} , L _{A90}	Larson Davis	LxT2 0005341	Innovative Instrument Co.,Ltd.	23-SLM-228	28 Jun 23	27 Jun 24	-
5	Sound Level Meter	L _{Aeq} 24 hours, L _{Amax} , L _{A90}	Larson Davis	LxT2 0005342	Innovative Instrument Co.,Ltd.	23-SLM-186	2 Jun 23	1 Jun 24	-

Certificate of Calibration

Customer

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

Certificate No : 23-ACT-109
Request No : Req-2023-1406

Unit Under Calibration Details

Measurement item : Acoustic Calibrator
Manufacturer : 01dB
Model : CAL31
Serial Number : 82795
ID : UAE.EPM.113/2560
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 : 26 June 2023
Calibration Date : 27 June 2023
Location of Calibration : LAB 1 Acoustic
Calibration Procedure : In-house method CP-ACT-02 based on IEC 60942:2017 Electroacoustics - Sound calibrators


Reference Standard	Model	Serial Number	Traceable	Due Calibration
Sound Calibrator	SV 35A	58079	EEI	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. Pucit Mathavorn
Calibration Engineer Supervisor
Issue Date : 27 June 2023

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
PM-106 เอกสารไม่ควบคุม

Certificate No : 23-ACT-109
Request No : Req-2023-1406

Sound pressure level

Calibration Results : Without Adjustment

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty (± dB)	Acceptance limit Class 1 (± dB)
	Measured	Error	Measured	Error		
94 dB / 1000 Hz	94.11	0.11	-	-	0.13	0.25

Frequency of Sound pressure level

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

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

Calibration Range (Hz)	Without Adjustment	Adjustment	Uncertainty (± %)	Acceptance limit Class 1 (± %)
	Measured (%)	Measured (%)		
94 dB / 1000 Hz	0.08	-	0.40	2.5

Note :

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

End of Calibration

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
PM-106 เอกสารไม่ควบคุม

Certificate of Calibration

Customer

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

Certificate No : 23-SLM-225
Request No : Req-2023-1413

Unit Under Calibration Details

Measurement item : Sound Level Meter
Manufacturer : LARSON DAVIS
Model : LxT2
Serial Number : 000305
ID : UAE.EPM.116/2562
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : 37S802
Microphone S/N : 011769
Preamplifier Model : PRMLxT2H
Preamplifier S/N : 056100
Instrument Status : Used

Calibration Environment and Details


Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 26 June 2023
Calibrated Date : 28 June 2023
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests
Location of Calibration : Lab Acoustic


Reference Standard

Instrument	Brand	Model	S/N.	Due calibration	Traceability
Standard Microphone	GRAS	40AN	188273	6 October 2023	GRAS
Multifrequency Calibrator	Quest	Quest-cal	EFA000234	29 June 2023	TSI
Audio Generator	Svante	Svante401	131	12 October 2023	WK Electric

Note

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

Calibrated By : 
Mr. Noppadon Luangart
Calibration Officer

Approved By : 
Mr. Pucit Mathavorn
Calibration Engineer Supervisor
Issue Date : 28 June 2023

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

Certificate No : 23-SLM-225
Request No : Req-2023-1413

1. Indication at the calibration check frequency

UUC Setting FAST / A / 37-139	Nominal Level (dB)	Before Adjust		After Adjust		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		UUC (dB)	ERR (dB)	UUC (dB)	ERR (dB)		
Calibrator Setting 1000 Hz 114 dB	113.77	114.0	+0.23	113.8	+0.03	0.2	0.3

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN. 73240

2. Self-generated noise, Microphone installed

UUC Setting FAST / 37-139	Measured (dB)	UNCERTAINTY (± dB)
UUC Weighting A	30.9	0.1

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

UUC Setting FAST / 37-139	Measured (dB)	UNCERTAINTY (± dB)
UUC Weighting A	30.6	0.1
C	30.1	0.1
Z	34.5	0.1

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

UUC Setting FAST / 37-139	Deviation from various Frequency Weighting Response curve			UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	A (dB)	C (dB)	Z (dB)		
STD Setting 125 Hz	0.0	0.1	0.0	0.6	2.0
1000 Hz	0.0	0.0	0.0	0.6	1.0
4000 Hz	1.0	1.1	1.0	0.6	3.0
8000 Hz	2.1	2.1	2.1	0.7	5.0

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เอกสารไม่ควบคุม

Certificate No : 23-SLM-225
Request No : Req-2023-1413

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

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

6. Frequency and time weightings at 1kHz

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

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

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เอกสารไม่ควบคุม

Certificate No : 23-SLM-225
Request No : Req-2023-1413

7. Long Term Stability

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

8. Level linearity on the reference level range

UUC Setting FAST / A / 37-139	Anticipated REF (dB)	Deviation		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
		UUC (dB)	ERR (dB)		
STD dB	(dB)	(dB)	(dB)		
143.00	143	143.0	0.0	0.3	0.8
139.00	139	139.0	0.0		1.1
134.00	134	134.0	0.0		1.1
129.00	129	129.0	0.0		1.1
124.00	124	124.0	0.0		1.1
119.00	119	119.0	0.0		1.1
114.00	114	114.0	0.0		1.1
109.00	109	109.0	0.0		1.1
104.00	104	104.0	0.0		1.1
99.00	99	98.9	-0.1		1.1
94.00	94	94.0	0.0		1.1
89.00	89	89.0	0.0		1.1
84.00	84	84.0	0.0		1.1
79.00	79	79.0	0.0		1.1
74.00	74	74.0	0.0		1.1
69.00	69	69.0	0.0		1.1
64.00	64	64.0	0.0		1.1
59.00	59	59.0	0.0		1.1
54.00	54	54.0	0.0		1.1
49.00	49	49.1	0.1		1.1
44.00	44	44.2	0.2		1.1
43.00	43	43.2	0.2		1.1
42.00	42	42.3	0.3		1.1
41.00	41	41.4	0.4		1.1
40.00	40	40.5	0.5		1.1

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เอกสารไม่ควบคุม

Certificate No : 23-SLM-225
Request No : Req-2023-1413

9. Level linearity including the level range control

UUC Setting FAST / A	STD REF	Measured		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
		UUC (dB)	ERR (dB)		
UUC Range	(dB)	(dB)	(dB)		
37-139	45.9	46.0	0.1	0.3	1.1
	114	114.0	0.0		1.1

10. Tone burst response

UUC Setting A / 37-139	STD Toneburst (ms)	Anticipated Ref (dB)	Measured		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
			UUC (dB)	ERR (dB)		
UUC Time Response						
Fast	200	135.0	134.9	-0.1	0.2	1
	2	138.0	137.8	-0.2		+1.0, -2.5
	0.25	109.0	108.8	-0.2		+1.5, -5.0
Slow	200	128.6	128.4	-0.2		1
	2	109.0	108.8	-0.2		+1.0, -5.0
	200	129.0	129.0	0.0		1
SEL	2	109.0	109.0	0.0		+1.0, -2.5
	0.25	109.0	109.0	0.0		+1.5, -5.0

11. Peak C Sound level

UUC Setting FAST / C / 95-142	STD REF	Measured		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
		UUC (dB)	ERR (dB)		
STD Setting	(dB)	(dB)	(dB)		
Complete cycle	137.4	136.8	-0.60	0.2	3.0
Positive half cycle	136.4	136.2	-0.20		2.0
Negative half cycle	136.4	136.2	-0.20		2.0

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เอกสารไม่ควบคุม

Certificate No : 23-SLM-225
Request No : Req-2023-1413

12. Overload indication

UUC Setting FAST / A / 37-139	Measured UUC (dB)	UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
STD Setting			
Positive one-half cycle	144.9		
Negative one-half cycle	144.8		
Deviated	0.1	0.2	1.5

13. High Level Stability

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

End of Certificate

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

เอกสารไม่ควบคุม

Certificate of Calibration

Customer
Name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD. Certificate No : 23-SLM-223
Address: 81 Soi Udomsak 41, Sukhumvit Road, Bangthak, Prakanong, Bangkok Request No : Req-2023-1411
10260

Unit Under Calibration Details

Measurement item : Sound Level Meter Microphone Class : 2
Manufacturer : LARSON DAVIS Microphone Model : 37B002
Model : LxT2 Microphone SN : 11791
Serial Number : 0005339 Preamplifier Model : PRMLxT2B
ID : UAEFEM036/2563 Preamplifier SN : 056131
Resolution : 0.1 dB Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 20 June 2023
Calibration Date : 28 June 2023
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests
Location of Calibration : Lab Acoustic

Reference Standard


Instrument	Brand	Model	SN	Due calibration	Traceability
Standard Microphone	GRAS	40AN	188273	6 October 2023	GRAS
Multifrequency Calibrator	Quest	Quest-cal	EFA000234	29 June 2023	TSI
Audio Generator	Scantek	Scan401	131	12 October 2023	WK Electric

Note

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

Calibrated By : 

Mr. Noppadol Luangrat
Calibration Officer

Approved By : 

Mr. Poch Mathavom
Calibration Engineer Supervisor

Issue Date : 28 June 2023

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

เอกสารไม่ควบคุม

Certificate No : 23-SLM-223

Request No : Req-2023-1411

1. Indication at the calibration check frequency

UUC Setting FAST / A / 37-139	Nominal Level	Before Adjust		After Adjust		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	(dB)	UUC (dB)	ERR (dB)	UUC (dB)	ERR (dB)		
Calibrator Setting 1000 Hz 114 dB	113.77	114.3	+0.53	113.8	+0.03	0.2	0.3

Note : Absolute sensitivity was established by the use of Sound Calibrator brand SVANTEK, Model SV 35A, SN. 73140

2. Self-generated noise, Microphone installed

UUC Setting FAST / 37-139	Measured (dB)	UNCERTAINTY (± dB)
UUC Weighting A	28.0	0.1

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

UUC Setting FAST / 37-139	Measured (dB)	UNCERTAINTY (± dB)
UUC Weighting A	27.3	0.1
C	27.2	0.1
Z	31.5	0.1

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

UUC Setting FAST / 37-139 STD Setting (dB)	Deviation from various Frequency Weighting Response curve (dB)			UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	A	C	Z		
125 Hz	1.2	1.3	1.3	0.6	2.0
1000 Hz	0.0	0.0	0.0	0.6	1.0
4000 Hz	0.2	0.2	0.2	0.6	3.0
8000 Hz	0.3	0.3	0.4	0.7	5.0

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เอกสารไม่ควบคุม

Certificate No : 23-SLM-223

Request No : Req-2023-1411

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

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

6. Frequency and time weightings at 1kHz

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

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

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เอกสารไม่ควบคุม

Certificate No : 23-SLM-223

Request No : Req-2023-1411

7. Long Term Stability

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

8. Level linearity on the reference level range

UUC Setting FAST / A / 37-139	Anticipated REF (dB)	Deviation		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		UUC (dB)	ERR (dB)		
STD dB	(dB)	(dB)	(dB)		
140.00	140	139.9	-0.1	0.3	0.8
139.00	139	139.0	0.0		1.1
134.00	134	134.0	0.0		1.1
129.00	129	129.0	0.0		1.1
124.00	124	124.0	0.0		1.1
119.00	119	119.0	0.0		1.1
114.00	114	114.0	0.0		1.1
109.00	109	109.0	0.0		1.1
104.00	104	104.0	0.0		1.1
99.00	99	99.0	0.0		1.1
94.00	94	94.0	0.0		1.1
89.00	89	89.0	0.0		1.1
84.00	84	84.0	0.0		1.1
79.00	79	79.0	0.0		1.1
74.00	74	74.0	0.0		1.1
69.00	69	69.0	0.0		1.1
64.00	64	64.0	0.0		1.1
59.00	59	59.0	0.0		1.1
54.00	54	54.0	0.0		1.1
49.00	49	49.0	0.0		1.1
44.00	44	44.1	0.1		1.1
39.00	39	39.3	0.3		1.1
34.00	34	34.4	0.4		1.1
29.00	29	29.5	0.5		1.1

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เอกสารไม่ควบคุม

Certificate No : 23-SLM-223
Request No : Req-2023-1411

9. Level linearity including the level range control

UUC Setting	STD	Measured			UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
		REF	UUC	ERR		
FAST / A	(dB)	(dB)	(dB)	(dB)	(\pm dB)	(\pm dB)
37-139	42.5	42.6	0.1		0.3	1.1
	114	114.0	0.0			1.1

10. Tone burst response

UUC Setting	STD	Anticipated	Measured		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
			Ref	ERR		
A / 37-139	(ms)	(dB)	(dB)	(dB)	(\pm dB)	(\pm dB)
Fast	200	135.0	134.9	-0.1		1
	2	118.0	117.6	-0.4		+1.0, -2.5
	0.25	109.0	108.6	-0.4		+1.5, -5.0
Slow	200	128.6	128.5	-0.1		1
	2	109.0	108.8	-0.2		+1.0, -5.0
	200	129.0	129.0	0.0		1
SEL	2	109.0	109.0	0.0		+1.0, -2.5
	0.25	100.0	99.8	-0.2		+1.5, -5.0

11. Peak C Sound level

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

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

เอกสารไม่ควบคุม

Certificate No : 23-SLM-223
Request No : Req-2023-1411

12. Overload indication

UUC Setting	Measured	UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
FAST / A / 37-139	UUC		
STD Setting	(dB)	(\pm dB)	(\pm dB)
Positive one-half cycle	141.4		
Negative one-half cycle	141.5		
Deviated	-0.1	0.2	1.5

13. High Level Stability

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

End of Certificate

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

เอกสารไม่ควบคุม

Certificate of Calibration

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangkok, Prakanong, Bangkok 10260
Certificate No : 23-SLM-228
Request No : Req-2023-1409

Unit Under Calibration Details

Measurement item : Sound Level Meter
Manufacturer : LARSON DAVIS
Model : LS72
Serial Number : 0005341
ID : UAE.EFM.038/2563
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : 375B02
Microphone S/N : 11793
Preamplifier Model : PRMLX7B
Preamplifier S/N : 056133
Instrument Status : Used


Calibration Environment and Details

Temperature : $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$
Humidity : $50\% \text{RH} \pm 20\% \text{RH}$
Barometric Pressure : $1013 \text{ hPa} \pm 10 \text{ hPa}$
Received Date : 20 June 2023
Calibrated Date : 28 June 2023
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-1 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests
Location of Calibration : Lab Acoustic

Reference Standard

Instrument	Brand	Model	SN	Date calibration	Traceability
Standard Microphone	GRAS	40AN	188273	6 October 2023	GRAS
Multifrequency Calibrator	Quest	Quest-cal	EFA000234	29 June 2023	TSI
Audio Generator	Svante	Svan401	171	12 October 2023	WK Electric

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

Calibrated By : 
Mr. Noppadol Luangrat
Calibration Officer

Approved By : 
Mr. Pait Mathavorn
Calibration Engineer Supervisor
Issue Date : 28 June 2023

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

เอกสารไม่ควบคุม

Certificate No : 23-SLM-228
Request No : Req-2023-1409

1. Indication at the calibration check frequency

UUC Setting	Nominal Level	Before Adjust		After Adjust		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
		UUC	ERR	UUC	ERR		
FAST / A / 37-139	(dB)	(dB)	(dB)	(dB)	(dB)	(\pm dB)	(\pm dB)
Calibrator Setting	1000 Hz 114 dB	113.77	114.7	+0.93	113.8	+0.03	0.2

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN. 73246

2. Self-generated noise, Microphone installed

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139	(dB)	(\pm dB)
UUC Weighting	(dB)	(\pm dB)
A	29.3	0.1

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

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139	(dB)	(\pm dB)
UUC Weighting	(dB)	(\pm dB)
A	28.9	0.1
C	28.5	0.1
Z	32.6	0.1

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

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
	A	C	Z		
FAST / 37-139	(dB)	(dB)	(dB)	(\pm dB)	(\pm dB)
STD Setting	(dB)	(dB)	(dB)	(\pm dB)	(\pm dB)
125 Hz	0.0	0.1	0.1	0.6	2.0
1000 Hz	0.0	0.0	0.0	0.6	1.0
4000 Hz	0.7	0.6	0.7	0.6	3.0
8000 Hz	1.2	1.1	1.2	0.7	5.0

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

เอกสารไม่ควบคุม

Certificate 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-SLM-186
Request No: Req-2023-1165

Unit Under Calibration Details

Measurement Item: Sound Level Meter
Manufacturer: LARSON DAVIS
Model: LxT2
Serial Number: 6005342
ID: UAE.EFM.039/2563
Resolution: 0.1 dB
Microphone Class: 2
Microphone Model: 375B02
Microphone SN: 11794
Preamplifier Model: PRMLX12B
Preamplifier SN: 056134
Instrument Status: Used

Calibration Environment and Details

Temperature: 23 °C ± 2 °C
Humidity: 50%RH ± 20%RH
Barometric Pressure: 1013 hPa ± 10 hPa
Received Date: 26 May 2023
Calibrated Date: 2 June 2023
Calibration Procedure: In-house method CP-SLM-01 based on IEC 61672-3: 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests
Location of Calibration: Lab Acoustic

Instrument	Brand	Model	SN.	Due calibration	Traceability
Standard Microphone	GRAS	40AN	188273	6 October 2023	GRAS
Multifrequency Calibrator	Quest	Quest-eal	EFA000234	29 June 2023	TSI
Audio Generator	Svante	Svan401	131	12 October 2023	WK Electric

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

Calibrated By: 
Mr. Noppon Luangrat
Calibration Officer
Approved By: 
Mr. Pait Mathavom
Calibration Engineer Supervisor
Issue Date: 2 June 2023

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

Certificate No: 23-SLM-186
Request No: Req-2023-1165

1. Indication at the calibration check frequency

UUC Setting FAST / A / 37-139 Calibrator Setting 1000 Hz 114 dB	Nominal Level (dB)	Before Adjust UUC (dB)		After Adjust UUC (dB)		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	114.54	114.4	-0.14	114.5	-0.04	0.2	0.3

Note: Absolute sensitivity was established by the use of Sound Calibrator Brand JM, Model AC-390, SN. AC-300001087

2. Self-generated noise, Microphone installed

UUC Setting FAST / 37-139 UUC Weighting A	Measured (dB)	UNCERTAINTY (± dB)
	28.2	0.1

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

UUC Setting FAST / 37-139 UUC Weighting A C Z	Measured (dB)	UNCERTAINTY (± dB)
	27.7	0.1
	27.0	0.1
	31.5	0.1

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

UUC Setting FAST / 37-139 STD Setting 125 Hz 1000 Hz 4000 Hz 8000 Hz	Deviation from various Frequency Weighting Response curve A (dB) C (dB) Z (dB)			UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	(dB)	(dB)	(dB)		
	0.1	0.1	0.1	0.6	2.0
	0.0	0.0	0.0	0.6	1.0
	0.4	0.4	0.4	0.6	3.0
	0.4	0.3	0.4	0.7	5.0

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
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Certificate No: 23-SLM-186
Request No: Req-2023-1165

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

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

6. Frequency and time weightings at 1kHz

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

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

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
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Certificate No: 23-SLM-186
Request No: Req-2023-1165

7. Long Term Stability

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

8. Level linearity on the reference level range

UUC Setting FAST / A / 37-139 STD dB 130.00 134.00 129.00 124.00 119.00 114.00 109.00 104.00 99.00 94.00 89.00 84.00 79.00 74.00 69.00 64.00 59.00 54.00 49.00 44.00 39.00 34.00 29.00	Anticipated REF (dB)	Deviation UUC (dB)	ERR (dB)	UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	130	134	134.0	0.0	1.1
	129	129	129.0	0.0	1.1
	124	124	124.0	0.0	1.1
	119	119	119.0	0.0	1.1
	114	114	114.0	0.0	1.1
	109	109	109.0	0.0	1.1
	104	104	104.0	0.0	1.1
	99	99	99.0	0.0	1.1
	94	94	94.0	0.0	1.1
	89	89	89.0	0.0	1.1
	84	84	84.0	0.0	1.1
	79	79	79.0	0.0	1.1
	74	74	74.0	0.0	1.1
	69	69	69.0	0.0	1.1
	64	64	64.0	0.0	1.1
	59	59	59.0	0.0	1.1
	54	54	54.0	0.0	1.1
	49	49	49.0	0.0	1.1
	44	44	44.1	0.1	1.1
	39	39	39.3	0.3	1.1
	34	34	34.4	0.4	1.1
	29	29	27.6	0.6	0.8

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
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Certificate No : 23-SLM-186
Request No : Req-2023-1165

9. Level linearity including the level range control

UUC Setting	STD	Measured		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
	REF	UUC	ERR		
UUC Range	(dB)	(dB)	(dB)		
37-139	43.0	43.1	0.1	0.3	1.1
	114	114.0	0.0		1.1

10. Tone burst response

UUC Setting	STD	Anticipated	Measured		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
	Toneburst	Ref	UUC	ERR		
UUC Time Response	(ms)	(dB)	(dB)	(dB)		
Fast	200	135.0	134.9	-0.1	0.2	1
	2	118.0	117.8	-0.2		+1.0, -2.5
	0.25	109.0	108.5	-0.5		+1.5, -5.0
Slow	200	128.6	128.4	-0.2		1
	2	109.0	108.8	-0.2		+1.0, -5.0
	200	129.0	129.0	0.0		1
SEL	2	109.0	109.0	0.0	0.2	+1.0, -2.5
	0.25	109.0	99.7	-0.3		+1.5, -5.0

11. Peak C Sound level

UUC Setting	Anticipated	Measured		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
	REF	UUC	ERR		
STD Setting	(dB)	(dB)	(dB)		
Complete cycle	137.4	136.7	-0.70	0.2	3.0
Positive half cycle	136.4	136.2	-0.20		2.0
Negative half cycle	136.4	136.2	-0.20		2.0

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

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Certificate No : 23-SLM-186
Request No : Req-2023-1165

12. Overload indication

UUC Setting	Measured	UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
FAST / A / 37-139	UUC		
STD Setting	(dB)		
Positive one-half cycle	141.8		
Negative one-half cycle	142.0		
Deviated	-0.2	0.2	1.5

13. High Level Stability

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

End of Certificate

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

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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 HC0J0020	Technology Promotion Association (Thailand-Japan)	23CH1571	14 Dec 23	13 Dec 24	-



Cert.No.: 23CH1226
Page.: 1 of 3

Certificate of Calibration

Equipment : pH Meter
Manufacturer : Horiba
Model : LAQUA-PH210
Serial No. : HA1G0019
ID No. : UAE.EFM.202/2564(EFM.pH.10/64)
Condition As-Received: Used Item
Received Date : 26 September 2023
Calibration Date : 27 September 2023
Reference : 2309-0881WSC-4
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
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 Lemgagtrakul

Approved by :
Approved Signatory

(✓) Saithip Meangmai
() Warakorn Lemgagtrakul
() 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.

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A 0059073



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

Condition of this calibration result

1. Reference Standard Instrument : -
- | Instrument | Serial No. | ID No. | Cert. No. | Due Date |
|--------------------------------|------------|----------|-----------|-------------|
| 1) Document Process Calibrator | 54030049 | 130RC116 | 23E2802 | 27 Aug 2024 |
| 2) Ref. Standard Thermometer | 4982054 | 110RC044 | 23I908 | 26 Jul 2024 |
- This certification is traceable to the International System of Unit maintained through:-
- Technology Promotion Association (Thailand-Japan)

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

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

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

Calibration Results

Function : mV Measurement

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

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (±mV)	Coverage factor k
			mV	pH		
pH Meter S/N.: HA1G0019	4.00	177.48	177.6	4.01	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

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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 (±)	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 (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement (± °C)	Coverage factor k
25.0	25.002	25.0	-0.002	0.13	2.00
30.0	30.004	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 %.

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a 1182399



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

Certificate of Testing

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

Approved by :
Approved Signatory

(✓) Saithip Meangmai
() Warakorn Lemgagtrakul
() Ponpan Paipim

Issue Date : 29 September 2023

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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)	DO Meter Reading	Standard Deviation
(mg/L)	(mg/L)	(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.

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a 118262



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
5344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL: 0-2717-3000-29 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 :
Approved Signatory

() Ponnipha Tameyakul
() Ponpan Paipim
(✓) Suwit Imjai

Issue Date : 5 October 2023

The Uncertainties are for a confidence probability of approximately 95%

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

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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	22/1285	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 %.

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a 1183569



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
5344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL: 0-2717-3000-29 FAX: 0-2719-9484



Cert.No.: 23CH1571
Page.: 1 of 3

Certificate of Calibration

Equipment : Conductivity Meter
Manufacturer : Horiba
Model : LAQUA-EC210
Serial No. : HCOJ0020
ID No. : UAE.EFM.078/2564(EFM.SCT.04/64)
Condition As-Received: Used Item
Received Date : 13 December 2023
Calibration Date : 14 December 2023
Reference : 2312-0277WSC-2
Submitted by : United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong, Bangkok 10260
Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 15) %
Calibration Procedure: In-house method :
- CP-CH6 by direct measurement
with certified reference material (CRM)
- CP-CH8 by comparison with standard thermometer

Calibrated by : Walalak Sirinthean

Approved by :
Approved Signatory

(✓) Saitip Meangmai
() Warakorn Lernagatrakul
() Ponpan Paipim

Issue Date : 18 December 2023

The Uncertainties are for a confidence probability of approximately 95%

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

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Cert.No.: 23CH1571

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	9549224	130RC003	231435	10 Apr 2024
2) Ref. Std. Thermometer	4982054	110RC044	231908	26 July 2024

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

2. Certified Reference Materials :-

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

Conductivity Solution	Manufacturer	Lot No.	Exp. date
1413.0 μ S/cm	CPA Chem	931955	30 Sep 2024
12.880 mS/cm	CPA Chem	913597	14 July 2024

- Control Conductivity calibration solution temperature by Water bath (25 \pm 0.1) $^{\circ}$ 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 μ S/cm

Conductivity Electrode Serial No.: 9B0K0167

Standard Conductivity Solution	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement (\pm)	Coverage factor k
1413.0 μ S/cm	1402 μ S/cm	1413 μ S/cm	9.2 μ S/cm	2.00
12.880 mS/cm	12.30 mS/cm	12.64 mS/cm	0.086 mS/cm	2.00

Remark - UUC* = Unit Under Calibration

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Cert.No.: 23CH1571

Page.: 3 of 3

Calibration Results**Function : Temperature Measurement**

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model :	9383
- Serial No. :	9B0K0167

Dimension of probe;

- Length :	104 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	25.001	25.0	-0.001	0.13	2.00
30.0	30.001	30.0	-0.001	0.13	2.00
35.0	35.000	35.1	0.100	0.13	2.00

Remark : - UUC* = Unit Under Calibration

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

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List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Workplace									
1	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	Svantek	SV36 107224	Innovative Instrument Co.,Ltd.	23-ACT-117	4 Aug 23	3 Aug 24	-
2	Sound Level Meter	$L_{Aeq\ 8\ hrs}$, L_{Amax}	Rion, Japan	NL-42 00558037	Sithiporn Associates Co., Ltd.	ACL23179	8 Jun 23	7 Jun 24	-
3	Sound Level Meter	$L_{Aeq\ 8\ hrs}$, L_{Amax}	Rion, Japan	NL-42 00409178	Sithiporn Associates Co., Ltd.	ACL23131	26 Apr 23	25 Apr 24	-
4	Sound Level Meter	$L_{Aeq\ 8\ hrs}$, L_{Amax}	Rion, Japan	NL-42 01010781	Sithiporn Associates Co., Ltd.	ACL23147	9 May 23	8 May 24	-
5	Noise Dosimeter	Noise Dosimeter	Svantek	SV 104IS 67627	Innovative Instrument Co.,Ltd.	23-NDM-222	29 Aug 23	28 Aug 24	-
6	Noise Dosimeter	Noise Dosimeter	Svantek	SV 104IS 128363	Innovative Instrument Co.,Ltd.	23-NDM-089	8 May 23	7 May 24	-
7	Noise Dosimeter	Noise Dosimeter	Svantek	SV 104IS 128477	Innovative Instrument Co.,Ltd.	23-NDM-097	9 May 23	8 May 24	-
8	Noise Dosimeter	Noise Dosimeter	Svantek	SV 104IS 67629	Innovative Instrument Co.,Ltd.	23-NDM-190	11 Aug 23	10 Aug 24	-
9	Noise Dosimeter	Noise Dosimeter	Svantek	SV 104IS 128475	Innovative Instrument Co.,Ltd.	23-NDM-096	9 May 23	8 May 24	-
10	Noise Dosimeter	Noise Dosimeter	Svantek	SV 104 110833	Innovative Instrument Co.,Ltd.	23-NDM-268	27 Oct 23	26 Oct 24	-
11	Noise Dosimeter	Noise Dosimeter	Svantek	SV 104 117696	Innovative Instrument Co.,Ltd.	23-NDM-105	12 May 23	11 May 24	-
12	Noise Dosimeter	Noise Dosimeter	Svantek	SV 104IS 128372	Innovative Instrument Co.,Ltd.	23-NDM-091	9 May 23	8 May 24	-
13	Noise Dosimeter	Noise Dosimeter	Svantek	SV 104IS 128360	Innovative Instrument Co.,Ltd.	23-NDM-088	8 May 23	7 May 24	-
14	Noise Dosimeter	Noise Dosimeter	Svantek	SV 104 117730	Innovative Instrument Co.,Ltd.	23-NDM-106	12 May 23	11 May 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									
15	Noise Dosimeter	Noise Dosimeter	Svantek	SV 104IS 128477	Innovative Instrument Co.,Ltd.	23-NDM-097	9 May 23	8 May 24	-
16	Noise Dosimeter	Noise Dosimeter	Svantek	SV 104 117688	Innovative Instrument Co.,Ltd.	23-NDM-108	12 May 23	11 May 24	-
17	Noise Dosimeter	Noise Dosimeter	Svantek	SV 104IS 128367	Innovative Instrument Co.,Ltd.	23-NDM-090	8 May 23	7 May 24	-
18	Noise Dosimeter	Noise Dosimeter	Svantek	SV 104 143225	Innovative Instrument Co.,Ltd.	23-NDM-179	7 Aug 23	6 Aug 24	-
19	Noise Dosimeter	Noise Dosimeter	Svantek	SV 104 143231	Innovative Instrument Co.,Ltd.	23-NDM-185	7 Aug 23	6 Aug 24	-
20	Primary Flow Calibrator	Calibrate personal pump	TSI.Inc	4146 41462327002	Innovative Instrument Co., Ltd.	23-AFM-144	24 Jul 23	23 Jul 24	-
21	Aneroid Barometer	Total Dust Respirable Dust	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	23P1859	2 Jun 23	1 Jun 24	-
22	Digital Thermo - Hygrometer	Total Dust Respirable Dust	Digicon	TH-02 395034174	Technology Promotion Association (Thailand-Japan)	23H1102	24 May 23	23 May 24	-
23	Thermal Environment Monitor	Heat Meter	3M	QuesTemp 34 TEH020027	Innovative Instrument Co.,Ltd.	23-TPM-192	3 Apr 23	2 Apr 24	-
24	Thermal Environment Monitor	Heat Meter	TSI QUEST	QuesTemp 32 TPT030008	Innovative Instrument Co.,Ltd.	23-TPM-502	2 Nov 23	1 Nov 24	-
25	Digital Lux Meter	Lux	Extech Instrument, Taiwan	407026 A 056652	Innovative Instrument Co., Ltd.	23-LXM-139	20 Apr 23	19 Apr 24	-

Certificate of Calibration

Customer

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

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

Unit Under Calibration Details

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

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	EEI	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 Luangert
Service Calibration Engineer

Approved By : Mr. Pacit 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 Innovative Instrument Co., Ltd.
FM-10

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

Sound pressure level

Calibration Results : Without Adjustment

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty (± dB)	Acceptance limit Class 1 (± dB)
	Measured	Error	Measured	Error		
94 dB / 1000 Hz	94.03	0.03	-	-	0.13	0.25
114 dB / 1000 Hz	114.11	0.11	-	-	0.13	0.25

Frequency of Sound pressure level

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

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

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

Note :

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

End of Calibration

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
FM-10

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: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,
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 : 29 MAY 2023
Calibration Date : 07-08 JUNE 2023
Date of Issue : 09 JUNE 2023

Calibrated by : Nuthakorn 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.

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SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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	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-42KA1	34560495	AA-3002-23	14-FEB-24

- This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.
- This certificate is traceable to the international system of unit maintained at :
 - 3.1 National Institute of Metrology (Thailand).
 - 3.2 Thailand Institute of Scientific and Technological Research (TISTR).

เอกสารไม่ควบคุม

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

T. Petch.

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)			Acceptance Limits
	Flat	C-weight	A-weight	
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

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เอกสารไม่ควบคุม

T. Petch.

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)			Acceptance Limits
	Flat	C-weight	A-weight	
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

T. Petch.

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

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T. Petch.

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8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
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
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

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

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T. Petchu

SITHIPORN ASSOCIATES CO., LTD. CALIBRATION LABORATORY

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

SITHIPORN associates



Cert. No. : ACL24162
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00409178 / 185837 / 90624
ID No.: UAE.EFM.017/2564

Condition As Found : GOOD

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

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

Received Date : 10 MAY 2024
Calibration Date : 04 - 05 JUNE 2024
Date of Issue : 06 JUNE 2024

Calibrated by : Nathakorn Pisutpaisan

Approved by : T. Petchu
(Thanakul Petchurai)

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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. Petchu

SITHIPORN ASSOCIATES CO., LTD. CALIBRATION LABORATORY

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

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Cert. No. : ACL24162
Job No. : VC67AC0071
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by follow on IEC-61672-3 (2013) Standard for sound level meter (SLM).
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.
For tests results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

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

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

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

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

Summary of Measurement Result :

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

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F. Lehn

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	-0.1	±1.5
250	0.0	-0.1	-0.1	±1.5
500	0.0	0.0	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.0	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.2

เอกสารไม่ควบคุม
F. Lehn

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
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	18.3
Flat	24.0

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	-0.1	-0.1	-0.1	± 1.5
1000	-0.1	-0.1	-0.1	± 1.0
8000	1.2	1.2	1.2	±5.0

เอกสารไม่ควบคุม
F. Lehn

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	132.9	-0.1	± 1.1
132.0	131.9	-0.1	± 1.1
131.0	130.9	-0.1	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	26.0	0.0	± 1.1
25.0	24.9	-0.1	± 1.1

เอกสารไม่ควบคุม
F. Lehn

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
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

10. Peak C sound level

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

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

เอกสารไม่ควบคุม
T. Petchur

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No. : 01010781 / 194536 / 14659
ID No. : UAE.EFM.084/2565

Condition As Found : GOOD

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

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

Received Date : 10 MAY 2024
Calibration Date : 30 - 31 MAY 2024
Date of Issue : 04 JUNE 2024

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.

เอกสารไม่ควบคุม
T. Petchur

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

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T. Petchur

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by follow on IEC-61672-3 (2013) Standard for sound level meter (SLM).
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.
For tests results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

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

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

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

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

Summary of Measurement Result :

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

เอกสารไม่ควบคุม
T. Kehn

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

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T. Kehn

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.2

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

Frequency Weighting	Measured value (dB)
A - weight	10.8
C - weight	17.2
Flat	22.9

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.1	0.2	0.2	± 1.5
1000	-0.1	-0.1	-0.1	± 1.0
8000	0.3	0.4	0.4	±5.0

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T. Kehn

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	135.1	0.1	± 1.1
134.0	134.1	0.1	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.1	0.1	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.1	0.1	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.1	0.1	± 1.1
30.0	30.1	0.1	± 1.1
29.0	29.1	0.1	± 1.1
28.0	28.2	0.2	± 1.1
27.0	27.2	0.2	± 1.1
26.0	26.4	0.4	± 1.1
25.0	25.5	0.5	± 1.1

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T. Kehn

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

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

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

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T. Kehn

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

เอกสารไม่ควบคุม
T. Kehn

Certificate of Calibration

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

Certificate No : 23-NDM-222
Request No : Req-2023-1748

Unit Under Calibration Details

Measurement item : Noise Dosimeter
Manufacturer : SVANTEK
Model : SV 104S
Serial Number : 67627
ID : -
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : SV 278S
Microphone S/N : 68647
Preamplifier Model : -
Preamplifier S/N : -
Instrument Status : Used


Calibration Environment and Details


Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 21 August 2023
Calibrated Date : 29 August 2023
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration : Lab Acoustic

Reference Standard

Instrument	Brand	Model	S/N	Due calibration	Traceability
Multi-frequency Calibrator	Quest	Quest-cal	188272	25 July 2024	TSI
Standard Microphone	GRAS	40AN	188273	6 October 2023	GRAS
Sine Generator	Svantek	Svan401	131	12 October 2023	WK Electric
Timer	EXTech	-	05-ACT	20 March 2024	TPA

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

Calibrated By : 
Mr. Noppadol Luangart
Calibration Officer

Approved By : 
Mr. Pichit Mathavon
Calibration Engineer Supervisor
Issue Date : 29 August 2023

เอกสารไม่ควบคุม

Certificate No : 23-NDM-222
Request No : Req-2023-1748

1. Absolute acoustical sensitivity

UUC Setting	Time		Exposure Measurement			UNCERTAINTY (%)	Tolerances Limit (%)
	Ref (s)	UUC (s)	Ref (Pa ² h)	UUC (Pa ² h)	Error (%)		
FAST / A / 60-140 Calibrator Setting	120	120	3.18	3.13	-1.57	3.1	-21, +26

Note : Absolute sensitivity was established by the use of Sound Calibrator brand SVANTEK, Model SV 35A, S/N: 58079

2. Frequency weightings

UUC Setting	Deviation from various Frequency Weighting		UNCERTAINTY (± dB)	Tolerances Limit (± dB)
	A (dB)	C (dB)		
FAST / 60-140 STD Setting	(dB)	(dB)	(± dB)	(± dB)
63 Hz	0.5	0.6	0.40	2.0
125 Hz	-0.8	-0.5	0.40	1.5
250 Hz	-0.4	0.1	0.40	1.5
500 Hz	-0.1	0.3	0.40	1.5
1000 Hz	0.0	0.0	0.40	-
2000 Hz	0.4	0.8	0.40	2.0
4000 Hz	1.5	1.3	0.40	3.0
8000 Hz	-2.0	-1.9	0.40	5.0

เอกสารไม่ควบคุม

Certificate No : 23-NDM-222
Request No : Req-2023-1748

3. Linearity of response to steady signals

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

UUC Setting		FAST / A / High									
Ref	(dB)	60.0	80.0	90.0	100.0	110.0	114.0	120.0	130.0	140.0	
1000 Hz	Level A	(dB)	60.4	80.4	90.2	100.1	110.0	114.0	120.0	130.0	140.0
	Error	(dB)	0.4	0.4	0.2	0.1	0.0	0.0	0.0	0.0	0.0
8000 Hz	Ref	(dB)			88.9	98.9	108.9	112.9	118.9	128.9	138.9
	Level A	(dB)			88.9	98.9	108.9	112.9	118.9	128.9	138.9
	Error	(dB)			0.0	0.0	0.0	0.0	0.0	-0.1	-0.1
63 Hz	Ref	(dB)						87.8	93.8	103.8	113.8
	Level A	(dB)						87.8	93.8	103.8	113.8
	Error	(dB)						0.0	0.0	0.0	0.0
Tolerances Limit		(±dB)	1.0								
UNCERTAINTY		(±dB)	0.3								

b. Sound exposure meter linearity of error

UUC Setting		Time		Exposure Measurement			UNCERTAINTY	Tolerances
FAST / A / 60-140	Ref	UUC	Ref	UUC	Error	Limit		
Calibrator Setting	(s)	(s)	(Pa ² h)	(Pa ² h)	(%)	(%)	(%)	
1000 Hz 110 dB	27	27	0.30	0.30	0.00	5.6	-21,+26	
1000 Hz 110 dB	45	45	0.50	0.50	0.00			
1000 Hz 110 dB	90	90	1.00	0.99	-1.00			
1000 Hz 110 dB	180	180	2.00	1.98	-1.00			
1000 Hz 120 dB	36	36	4.00	3.94	-1.50			
1000 Hz 120 dB	72	72	8.00	7.87	-1.63	5.6		
1000 Hz 120 dB	90	90	10.00	9.90	-1.00			
1000 Hz 120 dB	180	180	20.00	19.78	-1.10			
1000 Hz 120 dB	360	360	40.00	39.42	-1.45			
1000 Hz 120 dB	720	720	80.00	79.18	-1.02			

Certificate No : 23-NDM-222
Request No : Req-2023-1748

4. Response to short duration

a. Response for sinusoidal signals - reference level

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

b. Sound exposure meter response for series of toneburst impulses

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances
FAST / A / 60-140	Ref	UUC	Ref	UUC	Error		Limit
Calibrator Setting	(s)	(s)	(Pa ² h)	(Pa ² h)	(%)	(%)	(%)
Burst 1 ms, 95 dB	2846	2846	1.00	0.98	-2.00	5.6	-21 + 26
Burst 1 ms, 100 dB	900	900	1.00	0.98	-2.00		-29 + 41
Burst 1 ms, 108 dB	143	143	1.00	0.99	-1.00		-29 + 41

5. Response to unipolar pulse

UUC Setting	Time	Exposure Measurement		UNCERTAINTY	Tolerances
FAST / A / 60-140	UUC	UUC	Different		Limit
Calibrator Setting	(s)	(Pa ² h)	(%)	(%)	(%)
Continuous Rectangle +	29	10.13	0.00	3.7	-21 ~ +26
Continuous Rectangle -		10.13			

* Indicates non accredited

End of Certificate

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

เอกสารไม่ควบคุม

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

เอกสารไม่ควบคุม

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD. Certificate No : 24-NDM-078
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260 Request No : Req-2024-0531

Unit Under Calibration Details

Measurement item : Noise Dosimeter Microphone Class : 2
Manufacturer : SVANTEK Microphone Model : SV 27BS
Model : SV 104IS Microphone S/N : 131706
Serial Number : 128363 Preamplifier Model : -
ID : - Preamplifier S/N : -
Resolution : 0.1 dB Instrument Status : Used

Calibration Environment and Details


Temperature : 23.0 °C ± 2.0 °C
Humidity : 80 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 5 March 2024
Calibrated Date : 21 March 2024
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration : Lab Acoustic


Reference Standard

Instrument	Brand	Model	S/N	Due calibration	Traceability
Multifrequency Calibrator	Quest	Quest-cal	EFA000234	25 July 2024	TSI
Standard Microphone	GRAS	40AN	188273	21 August 2024	GRAS
Size Generator	SvanteK	Svan401	131	9 October 2024	WK Electric
Timer	EXTech	-	05-AC1	21 March 2024	TPA

Note

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

Calibrated By : 
Mr. Noppadon Luangtan
Service Calibration Engineer

Approved By : 
Mr. Pavit Mahavorn
Calibration Engineer Supervisor
Issue Date : 21 March 2024

Certificate No : 24-NDM-078
Request No : Req-2024-0531

1. Absolute acoustical sensitivity

UUC Setting		Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
FAST / A / 60-140	Ref	UUC	Ref	UUC	Error	(%)		
Calibrator Setting	(s)	(s)	(Pa ² h)	(Pa ² h)	(%)	(%)		
1000 Hz 114 dB	120	120	3.18	3.13	-1.6	3.1	-21	+26

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

2. Frequency weightings

UUC Setting		Deviation from various Frequency Weighting		UNCERTAINTY	Tolerances Limit
FAST / 60-140	A	C	(± dB)		
STD Setting	(dB)	(dB)	(± dB)		
63 Hz	0.3	0.6	0.40	2.0	
125 Hz	0.6	0.7	0.40	1.5	
250 Hz	0.2	0.3	0.40	1.5	
500 Hz	0.2	0.3	0.40	1.5	
1000 Hz	0.0	0.0	0.40	-	
2000 Hz	-0.3	-0.3	0.40	2.0	
4000 Hz	1.1	1.1	0.40	3.0	
8000 Hz	-2.1	-2.1	0.40	5.0	

Certificate No : 24-NDM-078
Request No : Req-2024-0531

3. Linearity of response to steady signals

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

UUC Setting		FAST / A / High										
Ref	(dB)	60.0	80.0	90.0	100.0	110.0	114.0	120.0	130.0	140.0		
1000 Hz	Level A (dB)	59.5	80.2	90.1	100.0	110.0	114.0	120.0	130.0	140.0		
	Error (dB)	-0.5	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0		
8000 Hz	Ref (dB)			88.9	98.9	108.9	112.9	118.9	128.9	138.9		
	Level A (dB)			88.9	98.9	108.9	112.9	118.9	128.9	138.9		
	Error (dB)			0.0	0.0	0.0	0.0	0.0	0.0	-0.1		
63 Hz	Ref (dB)						87.8	93.8	103.8	113.8		
	Level A (dB)						87.8	93.8	103.8	113.8		
	Error (dB)						0.0	0.0	0.0	0.0		
Tolerances Limit (±dB)		1.0										
UNCERTAINTY (±dB)		0.3										

b. Sound exposure meter linearity of error

UUC Setting		Time		Exposure Measurement			UNCERTAINTY	Tolerances
FAST / A / 60-140	Ref	UUC	Ref	UUC	Error	Limit		
Calibrator Setting	(s)	(s)	(Pa ² /h)	(Pa ² /h)	(%)	(%)	(%)	
1000 Hz 110 dB	27	27	0.30	0.31	+3.33	5.6	-21, +26	
1000 Hz 110 dB	45	45	0.50	0.51	+2.00			
1000 Hz 110 dB	90	90	1.00	1.01	+1.00			
1000 Hz 110 dB	180	180	2.00	2.02	+1.00			
1000 Hz 120 dB	36	36	4.00	4.03	+0.75			
1000 Hz 120 dB	72	72	8.00	8.05	+0.63	5.6		
1000 Hz 120 dB	90	90	10.00	10.13	+1.30			
1000 Hz 120 dB	180	180	20.00	20.22	+1.10			
1000 Hz 120 dB	360	360	40.00	40.34	+0.85			
1000 Hz 120 dB	720	720	80.00	80.49	+0.61			

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the owner.
PM-708-NDM-01 Rev.02 Issue date: 7/11/23

เอกสารไม่ควบคุม

Certificate No : 24-NDM-078
Request No : Req-2024-0531

4. Response to short duration

a. Response for sinusoidal signals - reference level

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

b. Sound exposure meter response for series of toneburst impulses

UUC Setting		Time		Exposure Measurement			UNCERTAINTY	Tolerances
FAST / A / 60-140	Ref	UUC	Ref	UUC	Error			
Calibrator Setting	(s)	(s)	(Pa ² /h)	(Pa ² /h)	(%)		Limit	
Burst 1 ms, 95 dB	2846	2846	1.00	0.98	-2.00	5.6	-21	+26
Burst 1 ms, 100 dB	900	900	1.00	0.98	-2.00		-29	+41
Burst 1 ms, 108 dB	143	143	1.00	0.99	-1.00		-29	+41

5. Response to unipolar pulse

UUC Setting		Time		Exposure Measurement		UNCERTAINTY (%)	Tolerances Limit (%)
FAST / A / 60-140	UUC		UUC	Different			
Calibrator Setting	(s)		(Pa ² /h)	(%)			
Continuous Rectangle +	29		10.37	0.00	3.7	-21	+26
Continuous Rectangle -			10.37				

* Indicates non accredited

End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the owner.
PM-708-NDM-01 Rev.02 Issue date: 7/11/23

เอกสารไม่ควบคุม

Certificate of Calibration

Customer

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

Certificate No : 24-NDM-111
Request No : Req-2024-0836

Unit Under Calibration Details

Measurement item : Noise Downmeter
Manufacturer : SVANTEK
Model : SV 1048S
Serial Number : 128477
ID : UAE.IFM.088.2566
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : SV 27IS
Microphone S/N : 85456
Preamplifier Model : -
Preamplifier S/N : -
Instrument Status : Used

Calibration Environment and Details


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


Reference Standard

Instrument	Brand	Model	S/N	Due calibration	Traceability
Multifrequency Calibrator	Quest	Questcal	EFA000234	25 July 2024	TSI
Standard Microphone	GRAS	40AN	188273	21 August 2024	GRAS
Sine Generator	SvanteK	Svan901	131	9 October 2024	WK Electric
Timer	EXTech	-	05-ACT	14 March 2025	TPA

Note

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

Calibrated By : 
Mr. Noppaden Luangrat
Service Calibration Engineer

Approved By : 
Mr. Pavin Mathavorn
Calibration Engineer Supervisor
Issue Date : 26 April 2024

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the owner.
PM-708-NDM-01 Rev.02 Issue date: 7/11/23

เอกสารไม่ควบคุม

Certificate No : 24-NDM-111
Request No : Req-2024-0836

1. Absolute acoustical sensitivity

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances
FAST / A / 60-140	Ref	UUC	Ref	UUC	Error		Limit
Calibrator Setting	(s)	(s)	(Pa ² ·h)	(Pa ² ·h)	(%)	(%)	(%)
1000 Hz 114 dB	120	120	3.18	3.13	-1.6	3.1	-21, +26

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

2. Frequency weightings

UUC Setting		Deviation from various Frequency Weighting		UNCERTAINTY (± dB)	Tolerances Limit (± dB)
FAST / A / 60-140		A	C		
STD Setting (dB)	(dB)				
63 Hz	-0.2	-0.1	0.40	2.0	
125 Hz	-0.2	0.0	0.40	1.5	
250 Hz	-0.3	-0.1	0.40	1.5	
500 Hz	-0.2	-0.1	0.40	1.5	
1000 Hz	0.0	0.0	0.40	-	
2000 Hz	0.6	0.6	0.40	2.0	
4000 Hz	1.5	1.5	0.40	3.0	
8000 Hz	0.6	0.7	0.40	5.0	

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the owner.
PM-708-NDM-01 Rev.02 Issue date: 7/11/23

เอกสารไม่ควบคุม

Certificate No : 24-NDM-111
Request No : Req-2024-0836

3. Linearity of response to steady signals

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

UUC Setting		FAST / A / High									
1000 Hz	Ref	(dB)	60.0	80.0	90.0	100.0	110.0	114.0	120.0	130.0	140.0
	Level A	(dB)	59.8	80.1	90.1	100.0	110.0	114.0	120.0	130.0	140.0
	Error	(dB)	-0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
8000 Hz	Ref	(dB)			88.9	98.9	108.9	112.9	118.9	128.9	138.9
	Level A	(dB)			89.0	98.9	108.9	112.9	118.9	128.9	138.8
	Error	(dB)			0.1	0.0	0.0	0.0	0.0	0.0	-0.1
63 Hz	Ref	(dB)					87.8	93.8	103.8	113.8	
	Level A	(dB)					87.8	93.8	103.8	113.8	
	Error	(dB)						0.0	0.0	0.0	0.0
Tolerances Limit		(±dB)	1.0								
UNCERTAINTY		(±dB)	0.3								

b. Sound exposure meter linearity of error

UUC Setting		Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
FAST / A / 60-140		Ref	UUC	Ref	UUC	Error		
Calibrator Setting		(s)	(s)	(Pa ² h)	(Pa ² h)	(%)	(%)	(%)
1000 Hz 110 dB		27	27	0.30	0.31	+3.33	5.6	-21, +26
1000 Hz 110 dB		45	45	0.50	0.51	+2.00		
1000 Hz 110 dB		90	90	1.00	1.01	+1.00		
1000 Hz 110 dB		180	180	2.00	2.02	+1.00		
1000 Hz 120 dB		36	36	4.00	4.03	+0.75		
1000 Hz 120 dB		72	72	8.00	8.05	+0.63	5.6	
1000 Hz 120 dB		90	90	10.00	10.13	+1.30		
1000 Hz 120 dB		180	180	20.00	20.22	+1.10		
1000 Hz 120 dB		360	360	40.00	40.34	+0.85		
1000 Hz 120 dB		720	720	80.00	80.49	+0.61		

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

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P34-708-NDM-01 Rev.02 Issue date: 7/11/25

Certificate No : 24-NDM-111
Request No : Req-2024-0836

4. Response to short duration

a. Response for sinusoidal signals - reference level

UUC Setting		Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
FAST / A / 60-140		Ref	UUC	Ref	UUC	Error		
Calibrator Setting		(s)	(s)	(Pa ² h)	(Pa ² h)	(Pa ² h)	(Pa ² h)	(Pa ² h)
8000 Hz 95 dB		2846	2846	1.00	0.98	-0.02	0.052	-0.29 - +0.41

b. Sound exposure meter response for series of toneburst impulses

UUC Setting		Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
FAST / A / 60-140		Ref	UUC	Ref	UUC	Error		
Calibrator Setting		(s)	(s)	(Pa ² h)	(Pa ² h)	(%)	(%)	(%)
Burst 1 ms, 95 dB		2846	2846	1.00	0.98	-2.00	5.6	-21 - +26
Burst 1 ms, 100 dB		900	900	1.00	0.98	-2.00		-29 - +41
Burst 1 ms, 105 dB		143	143	1.00	0.99	-1.00		-29 - +41

5. Response to unipolar pulse

UUC Setting	Time	Exposure Measurement			UNCERTAINTY	Tolerances
FAST / A / 60-140	UUC	UUC	Difference	Limit		
Calibrator Setting	(s)	(Pa ² h)	(%)	(%)	(%)	
Continuous Rectangle +	29	10.37	0.00	3.7	-21 - +26	
Continuous Rectangle -		10.37				

* Indicates non accredited

End of Certificate

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

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P34-708-NDM-01 Rev.02 Issue date: 7/11/25

Certificate of Calibration

Customer
Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260
Certificate No : 23-NDM-190
Request No : Req-2023-1548

Unit Under Calibration Details

Measurement item : Noise Dosimeter
Manufacturer : SVANTEK
Model : SV 104S
Serial Number : 67629
ID : +
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : SV 27IS
Microphone S/N : 68643
Preamplifier Model : -
Preamplifier S/N : +
Instrument Status : Used

Calibration Environment and Details


Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 21 July 2023
Calibrated Date : 11 August 2023
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration : Lab Acoustic


Reference Standard

Instrument	Brand	Model	S/N	Due calibration	Traceability
Multifrequency Calibrator	Quest	Quest-cal	188272	25 July 2024	TSI
Standard Microphone	GRAS	40AN	188273	6 October 2023	GRAS
Sine Generator	Svanick	Svan401	131	12 October 2023	WK Electric
Timer	EXTech	-	05-ACT	20 March 2024	TPA

Note

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

Calibrated By : 
Mr. Noppadon Luangart
Calibration Officer

Approved By : 
Mr. Pait Mahavon
Calibration Engineer Supervisor
Issue Date : 11 August 2023

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

เอกสารไม่ควบคุม

Certificate No : 23-NDM-190
Request No : Req-2023-1548

1. Absolute acoustical sensitivity

UUC Setting		Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
FAST / A / 60-140		Ref	UUC	Ref	UUC	Error		
Calibrator Setting		(s)	(s)	(Pa ² h)	(Pa ² h)	(%)	(%)	(%)
1000 Hz 114 dB		120	120	3.18	3.13	-1.57	3.1	-21, +26

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 55A, SN. 58079

2. Frequency weightings

UUC Setting	Deviation from various Frequency Weighting		UNCERTAINTY	Tolerances Limit
	A	C		
FAST / 60-140	(dB)	(dB)	(± dB)	(± dB)
STD Setting				
*63 Hz	0.2	0.2	0.40	2.0
125 Hz	-0.3	0.0	0.40	1.5
250 Hz	-0.2	0.3	0.40	1.5
500 Hz	0.1	0.5	0.40	1.5
1000 Hz	0.0	0.0	0.40	-
2000 Hz	0.3	0.7	0.40	2.0
4000 Hz	1.2	1.0	0.40	3.0
8000 Hz	-1.7	-1.6	0.40	5.0

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Certificate No : 24-NDM-104
Request No : Req-2024-0718

3. Linearity of response to steady signals

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

UUC Setting		FAST / A / High									
Ref	(dB)	55.0	80.0	80.0	100.0	110.0	114.0	120.0	130.0	140.0	
1000 Hz	Level A (dB)	54.5	80.1	80.1	100.0	110.0	114.0	119.9	129.9	139.9	
	Error (dB)	-0.5	0.1	0.1	0.0	0.0	0.0	-0.1	-0.1	-0.1	
8000 Hz	Ref (dB)				88.9	98.9	108.9	112.9	118.9	128.9	138.9
	Level A (dB)				89.0	99.0	109.0	112.9	118.9	128.9	138.8
	Error (dB)				0.1	0.0	0.0	0.0	0.0	0.0	-0.1
63 Hz	Ref (dB)					87.8	93.8	103.8	113.8		
	Level A (dB)					87.8	93.7	103.7	113.7		
	Error (dB)					0.0	-0.1	-0.1	-0.1		
Tolerances Limit (±dB)		±1.0									
UNCERTAINTY (±dB)		0.3									

b. Sound exposure meter linearity of error

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

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PM-709-NDM-01 Rev.02 Issue 007/11/23

Certificate No : 24-NDM-104
Request No : Req-2024-0718

4. Response to short duration

a. Response for sinusoidal signals - reference level

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

b. Sound exposure meter response for series of toneburst impulses

UUC Setting		Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
FAST / A / 55-140		Ref	UUC	Ref	UUC	Error		
Calibrator Setting		(s)	(s)	(Pa·h)	(Pa·h)	(%)		(%)
Burst 1 ms, 95 dB		2846	2846	1.00	0.98	-2.00	5.6	-21 ~ +26
Burst 1 ms, 100 dB		900	900	1.00	0.98	-2.00		-29 ~ +41
Burst 1 ms, 105 dB		143	143	1.00	0.99	-1.00		-29 ~ +41

5. Response to unipolar pulse

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

* Indicates non accredited

End of Certificate

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

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PM-709-NDM-01 Rev.02 Issue 007/11/23

Certificate of Calibration

Customer

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

Certificate No : 24-NDM-073
Request No : Req-2024-0526

Unit Under Calibration Details

Measurement item : Noise Dosimeter
Manufacturer : SVANTEK
Model : SV 1040S
Serial Number : 128372
ID : -
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : SV 270S
Microphone S/N : 132718
Preamplifier Model : -
Preamplifier S/N : -
Instrument Status : Used

Calibration Environment and Details


Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 5 March 2024
Calibrated Date : 21 March 2024
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration : Lab Acoustic

Reference Standard

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

Note

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

Calibrated By : 
Mr. Noppon Luangan
Service Calibration Engineer

Approved By : 
Mr. Patch Mathewom
Calibration Engineer Supervisor
Issue Date : 21 March 2024

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

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PM-709-NDM-01 Rev.02 Issue 007/11/23

Certificate No : 24-NDM-073
Request No : Req-2024-0526

1. Absolute acoustical sensitivity

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances
FAST / A / 60-140	Ref	UUC	Ref	UUC	Error		Limit
Calibrator Setting	(s)	(s)	(Pa ² ·h)	(Pa ² ·h)	(%)	(%)	(%)
1000 Hz 114 dB	120	120	3.18	3.13	-1.6	3.1	-21, +26

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

2. Frequency weightings

UUC Setting		Deviation from various Frequency Weighting		UNCERTAINTY (± dB)	Tolerances Limit (± dB)
FAST : 60-140		A	C		
STD Setting	(dB)	(dB)	(dB)		
63 Hz	0.2	0.3	0.40	2.0	
125 Hz	0.5	0.7	0.40	1.5	
250 Hz	0.3	0.4	0.40	1.5	
500 Hz	0.2	0.3	0.40	1.5	
1000 Hz	0.0	0.0	0.40	-	
2000 Hz	-0.8	-0.1	0.40	2.0	
4000 Hz	1.1	1.0	0.40	3.0	
8000 Hz	-1.7	-1.7	0.40	5.0	

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

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PM-709-NDM-01 Rev.02 Issue 007/11/23

Certificate No : 24-NDM-073
Request No : Req-2024-0526

3. Linearity of response to steady signals

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

UUC Setting	FAST / A / High										
	Ref	(dB)	60.0	80.0	90.0	100.0	110.0	118.0	120.0	130.0	140.0
1000 Hz	Level A	(dB)	59.8	80.1	90.3	100.1	110.0	114.0	120.0	130.0	140.0
	Error	(dB)	-0.2	0.1	0.3	0.1	0.0	0.0	0.0	0.0	0.0
	Ref	(dB)			88.9	98.9	106.9	112.9	118.9	128.9	138.9
8000 Hz	Level A	(dB)			89.0	98.9	106.9	112.9	118.9	128.9	138.8
	Error	(dB)			0.1	0.0	0.0	0.0	0.0	0.0	-0.1
	Ref	(dB)						87.8	93.8	103.8	113.8
63 Hz	Level A	(dB)						87.8	93.8	103.8	113.8
	Error	(dB)						0.0	0.0	0.0	0.0
Tolerances Limit		(±dB)	1.0								
UNCERTAINTY		(±dB)	0.3								

b. Sound exposure meter linearity of error

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances
FAST / A / 60-140	Ref	UUC	Ref	UUC	Error		Limit
Calibrator Setting	(s)	(s)	(Pa ² h)	(Pa ² h)	(%)	(%)	(%)
1000 Hz 110 dB	27	27	0.30	0.30	0.00	5.6	-21, +26
1000 Hz 110 dB	45	45	0.50	0.50	0.00		
1000 Hz 110 dB	90	90	1.00	1.01	+1.00		
1000 Hz 110 dB	180	180	2.00	2.02	+1.00		
1000 Hz 120 dB	36	36	4.00	4.03	+0.75		
1000 Hz 120 dB	72	72	8.00	8.05	+0.63	5.6	
1000 Hz 120 dB	90	90	10.00	9.90	-1.00		
1000 Hz 120 dB	180	180	20.00	19.76	-1.20		
1000 Hz 120 dB	360	360	40.00	39.42	-1.43		
1000 Hz 120 dB	720	720	80.00	80.49	+0.61		

Certificate No : 24-NDM-073
Request No : Req-2024-0526

4. Response to short duration

a. Response for sinusoidal signals - reference level

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
	Ref	UUC	Ref	UUC	Error		
FAST / A / 60-140	(s)	(s)	(Pa ² h)	(Pa ² h)	(%)	(%)	(%)
Calibrator Setting	(s)	(s)	(Pa ² h)	(Pa ² h)	(%)	(%)	(%)
4000 Hz 95 dB	2846	2846	1.00	1.00	0.00	0.052	-0.29, +0.41

b. Sound exposure meter response for series of toneburst impulses

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
	Ref	UUC	Ref	UUC	Error		
FAST / A / 60-140	(s)	(s)	(Pa ² h)	(Pa ² h)	(%)	(%)	(%)
Calibrator Setting	(s)	(s)	(Pa ² h)	(Pa ² h)	(%)	(%)	(%)
Burst 1 ms, 95 dB	2846	2846	1.00	1.00	0.00	5.6	-21, +26
Burst 1 ms, 100 dB	900	900	1.00	1.00	0.00		-29, +41
Burst 1 ms, 108 dB	143	143	1.00	1.00	+1.00		-29, +41

5. Response to unipolar pulse

UUC Setting	Time		Exposure Measurement		UNCERTAINTY	Tolerances Limit
	Ref	UUC	UUC	Different		
FAST / A / 60-140	(s)	(s)	(Pa ² h)	(%)	(%)	(%)
Calibrator Setting	(s)	(s)	(Pa ² h)	(%)	(%)	(%)
Continuous Rectangle +	29		10.37	0.00	3.7	-21, +26
Continuous Rectangle -			10.37			

* Indicates non accredited

End of Certificate

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FM-708-NDM-01 Rev.02 Issue 07/11/23

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FM-708-NDM-01 Rev.02 Issue 07/11/23

Certificate of Calibration

Customer

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

Certificate No : 24-NDM-080
Request No : Req-2024-0533

Unit Under Calibration Details

Measurement Item : Noise Dosimeter
Manufacturer : SVANTEK
Model : SV 104IS
Serial Number : 128360
ID : -
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : SV 27IS
Microphone S/N : 133702
Preamplifier Model : -
Preamplifier S/N : -
Instrument Status : Used

Calibration Environment and Details

Temperature : 23.0 °C ± 2.0 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 5 March 2024
Calibrated Date : 21 March 2024
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration : Lab Acoustic


Reference Standard

Instrument	Brand	Model	SN	Due calibration	Traceability
Multifrequency Calibrator	Quest	Quest-cal	EFA000234	25 July 2024	TSI
Standard Microphone	GRAS	40AN	188273	21 August 2024	GRAS
Sine Generator	SvanteK	SvanteK01	131	9 October 2024	WK Electric
Timer	EXTTECH	-	05-ACT	21 March 2024	TPA

Note

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

Calibrated By : 
Mr. Neppadon Luangn
Service Calibration Engineer

Approved By : 
Mr. Pachi Matthavorn
Calibration Engineer Supervisor
Issue Date : 21 March 2024

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FM-708-NDM-01 Rev.02 Issue 07/11/23

Certificate No : 24-NDM-080
Request No : Req-2024-0533

1. Absolute acoustical sensitivity

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
	Ref	UUC	Ref	UUC	Error		
FAST / A / 60-140	(s)	(s)	(Pa ² h)	(Pa ² h)	(%)	(%)	(%)
Calibrator Setting	(s)	(s)	(Pa ² h)	(Pa ² h)	(%)	(%)	(%)
1000 Hz 114 dB	120	120	3.18	3.13	-1.6	3.1	-21, +26

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

2. Frequency weightings

UUC Setting	Deviation from various Frequency Weighting		UNCERTAINTY	Tolerances Limit
	A	C		
FAST / 60-140	(dB)	(dB)	(± dB)	(± dB)
STD Setting	(dB)	(dB)	(± dB)	(± dB)
*63 Hz	0.1	0.4	0.40	2.0
125 Hz	0.0	0.2	0.40	1.5
250 Hz	-0.2	-0.1	0.40	1.3
500 Hz	-0.2	-0.1	0.40	1.5
1000 Hz	0.0	0.0	0.40	-
2000 Hz	0.5	0.5	0.40	2.0
4000 Hz	2.0	2.0	0.40	3.0
8000 Hz	-3.0	-3.0	0.40	5.0

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FM-708-NDM-01 Rev.02 Issue 07/11/23

Certificate No : 24-NDM-080
Request No : Req-2024-0533

3. Linearity of response to steady signals

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

UUC Setting		FAST / A / High										
1000 Hz	Ref	(dB)	60.0	80.0	90.0	100.0	110.0	120.0	130.0	140.0		
	Level A	(dB)	60.0	80.2	90.2	100.1	110.0	120.0	130.0	140.0		
	Error	(dB)	0.0	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0
8000 Hz	Ref	(dB)			88.9	98.9	108.9	112.9	118.9	128.9	138.9	
	Level A	(dB)			88.9	98.9	108.9	112.9	118.9	128.9	138.9	
	Error	(dB)			0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.1
63 Hz	Ref	(dB)						87.8	95.8	103.8	113.8	
	Level A	(dB)						87.8	95.8	103.8	113.8	
	Error	(dB)						0.0	0.0	0.0	0.0	0.0
Tolerances Limit		(±dB)	1.0									
UNCERTAINTY		(±dB)	0.3									

b. Sound exposure meter linearity of error

UUC Setting		Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
FAST / A / 60-140		Ref	UUC	Ref (Pa ² h)	UUC (Pa ² h)	Error (%)		
Calibrator Setting		(s)	(s)				(%)	(%)
1000 Hz 110 dB	27	27		0.30	0.30	0.00	5.6	-21, +26
1000 Hz 110 dB	45	45		0.50	0.50	0.00		
1000 Hz 110 dB	90	90		1.00	0.99	-1.00		
1000 Hz 110 dB	180	180		2.00	1.98	-1.00		
1000 Hz 120 dB	36	36		4.00	3.94	-1.50		
1000 Hz 120 dB	72	72		8.00	7.87	-1.63		
1000 Hz 120 dB	90	90		10.00	9.90	-1.00		
1000 Hz 120 dB	180	180		20.00	19.76	-1.20	5.6	
1000 Hz 120 dB	360	360		40.00	39.42	-1.45		
1000 Hz 120 dB	720	720		80.00	78.66	-1.68		

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PM-08-NDM-01 Rev.02 Issue date: 11/23

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Certificate No : 24-NDM-080
Request No : Req-2024-0533

4. Response to short duration

a. Response for sinusoidal signals - reference level

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

b. Sound exposure meter response for series of toneburst impulses

UUC Setting		Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
FAST / A / 60-140		Ref	UUC	Ref (Pa ² h)	UUC (Pa ² h)	Error (%)		
Calibrator Setting		(s)	(s)	(Pa ² h)	(Pa ² h)	(%)	(%)	(%)
Burst 1 ms, 95 dB	2846	2846	1.00	0.98	-2.00		5.6	-21 - +26
Burst 1 ms, 100 dB	900	900	1.00	0.98	-2.00			-29 - +41
Burst 1 ms, 108 dB	143	143	1.00	0.99	-1.00			-29 - +41

5. Response to unipolar pulse

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

* Indicates non accredited

End of Certificate

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PM-08-NDM-01 Rev.02 Issue date: 11/23

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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 : 24-NDM-109
Request No : Req-2024-0834

Unit Under Calibration Details

Measurement item : Noise Dosimeter
Manufacturer : SVANTEK
Model : SV 104
Serial Number : 117730
ID : UAE-IFM-1192565
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : SV27
Microphone S/N : 77362
Preamplifier Model : -
Preamplifier S/N : -
Instrument Status : Used

Calibration Environment and Details


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


Reference Standard

Instrument	Brand	Model	S/N	Due calibration	Traceability
Multifrequency Calibrator	Quest	Quest-cal	EFA000234	25 July 2024	TSE
Standard Microphone	GRAS	40AN	188273	21 August 2024	GRAS
Sine Generator	SvanteK	Svnt401	131	9 October 2024	WK Electric
Timer	EXTech	-	05-ACT	14 March 2025	TPA

Note

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

Calibrated By : 
Mr. Noppadon Luangrat
Service Calibration Engineer

Approved By : 
Mr. Pasi Mahavorn
Calibration Engineer Supervisor
Issue Date : 28 April 2024

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the owner.
PM-08-NDM-01 Rev.02 Issue date: 11/23

เอกสารไม่ควบคุม

Certificate No : 24-NDM-109
Request No : Req-2024-0834

1. Absolute acoustical sensitivity

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances
FAST / A / 55-140	Ref	UUC	Ref	UUC	Error		
Calibrator Setting	(s)	(s)	(Pa ² h)	(Pa ² h)	(%)	(%)	(%)
1000 Hz 114 dB	120	120	3.18	3.13	-1.6	3.1	-21, +20

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

2. Frequency weightings

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

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PM-08-NDM-01 Rev.02 Issue date: 11/23

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Certificate No : 24-NDM-109
Request No : Req-2024-0834

3. Linearity of response to steady signals

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

UUC Setting		FAST / A / High									
1000 Hz	Ref	(dB)	55.0	80.0	90.0	100.0	110.0	114.0	120.0	130.0	140.0
	Level A	(dB)	54.7	80.1	90.1	100.0	110.0	114.0	120.0	130.0	140.0
	Error	(dB)	-0.3	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
8000 Hz	Ref	(dB)			88.9	98.9	108.9	112.9	118.9	128.9	138.9
	Level A	(dB)			88.9	98.9	108.9	112.9	118.9	128.9	138.9
	Error	(dB)			0.0	0.0	0.0	0.0	0.0	0.0	0.0
63 Hz	Ref	(dB)					87.8	93.8	103.8	113.8	
	Level A	(dB)					87.8	93.8	103.8	113.8	
	Error	(dB)						0.0	0.0	0.0	0.0
Tolerances Limit		(±dB)	1.0								
UNCERTAINTY		(±dB)	0.3								

b. Sound exposure meter linearity of error

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances
FAST / A / 55-140	Ref	UUC	Ref	UUC	Error		Limit
Calibrator Setting	(s)	(s)	(Pa ² ·h)	(Pa ² ·h)	(%)	(%)	(%)
1000 Hz 110 dB	27	27	0.30	0.30	0.00	5.6	-21, +26
1000 Hz 110 dB	45	45	0.50	0.50	0.00		
1000 Hz 110 dB	99	99	1.00	1.01	+1.00		
1000 Hz 110 dB	180	180	2.00	2.02	+1.00		
1000 Hz 120 dB	36	36	4.00	4.03	+0.75		
1000 Hz 120 dB	72	72	8.00	8.05	+0.63	5.6	
1000 Hz 120 dB	90	90	10.00	10.13	+1.30		
1000 Hz 120 dB	180	180	20.00	20.22	+1.10		
1000 Hz 120 dB	360	360	40.00	40.34	+0.85		
1000 Hz 120 dB	720	720	80.00	80.49	+0.61		

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PM-109-NDM-01 Rev.02 Issue date: 7/11/23

4. Response to short duration

a. Response for sinusoidal signals - reference level

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

b. Sound exposure meter response for series of toneburst impulses

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances
	Ref	UUC	Ref	UUC	Error		
FAST / A / 55-140	(s)	(s)	(Pa ² ·h)	(Pa ² ·h)	(%)	(%)	Limit
Calibrator Setting	(s)	(s)	(Pa ² ·h)	(Pa ² ·h)	(%)	(%)	(%)
Burst 1 ms, 95 dB	2846	2846	1.00	1.00	0.00	5.6	-21 ~ +26
Burst 1 ms, 100 dB	900	900	1.00	1.00	0.00		-29 ~ +41
Burst 1 ms, 106 dB	143	143	1.00	1.01	+1.00		-29 ~ +41

5. Response to unipolar pulse

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances
	Ref	UUC	Ref	UUC	Different		
FAST / A / 55-140	(s)	(s)	(Pa ² ·h)	(Pa ² ·h)	(%)	(%)	Limit
Calibrator Setting	(s)	(s)	(Pa ² ·h)	(Pa ² ·h)	(%)	(%)	(%)
Continuous Rectangle +	28	28	10.13	10.13	0.00	3.7	-21 ~ +26
Continuous Rectangle -			10.13				

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End of Certificate

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PM-109-NDM-01 Rev.02 Issue date: 7/11/23

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD. Certificate No : 24-NDM-111
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangkok, Prakanong, Bangkok 10260 Request No : Req-2024-0836

Unit Under Calibration Details

Measurement item : Noise Downmeter Microphone Class : 2
Manufacturer : SVANTEK Microphone Model : SV 2715
Model : SV 1048S Microphone S/N : 85456
Serial Number : 128477 Preamplifier Model : -
ID : UAE-ETM-088-2566 Preamplifier S/N : -
Resolution : 0.1 dB Instrument Status : Used

Calibration Environment and Details

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


Reference Standard

Instrument	Brand	Model	S/N	Due calibration	Traceability
Multifrequency Calibrator	Quest	Questcal	EFA000234	25 July 2024	TSI
Standard Microphone	GRAS	40AN	188273	21 August 2024	GRAS
Sine Generator	SvanteK	Svan901	131	9 October 2024	WK Electric
Timer	EXTech	-	05-ACT	14 March 2025	TPA

Note

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

Calibrated By : 
Mr. Noppadon Luangrat
Service Calibration Engineer

Approved By : 
Mr. Pavin Mathavorn
Calibration Engineer Supervisor
Issue Date : 26 April 2024

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PM-109-NDM-01 Rev.02 Issue date: 7/11/23

Certificate No : 24-NDM-110
Request No : Req-2024-0835

3. Linearity of response to steady signals

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

UUC Setting	FAST / A / High										
	Ref	(dB)	55.0	80.0	90.0	100.0	110.0	114.0	120.0	130.0	140.0
1000 Hz	Ref	(dB)	54.6	80.1	90.1	100.0	110.0	114.0	119.9	129.9	139.9
	Level A	(dB)									
	Error	(dB)	-0.4	0.1	0.1	0.0	0.0	0.0	-0.1	-0.1	-0.1
8000 Hz	Ref	(dB)			88.9	98.9	108.9	112.9	118.9	128.9	138.9
	Level A	(dB)			88.9	98.9	108.9	112.9	118.9	128.9	138.9
	Error	(dB)			0.0	0.0	0.0	0.0	0.0	0.0	0.1
63 Hz	Ref	(dB)					87.8	93.8	103.8	113.8	
	Level A	(dB)					87.8	93.8	103.8	113.8	
	Error	(dB)					0.0	0.0	0.0	0.0	
Tolerances Limit		(dB)	1.0								
UNCERTAINTY		(dB)	0.3								

b. Sound exposure meter linearity of error

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
	Ref	UUC	Ref	UUC	Error		
FAST / A / 55-140	(s)	(s)	(Pa ² /h)	(Pa ² /h)	(%)	(%)	(%)
Calibrator Setting	(s)	(s)	(Pa ² /h)	(Pa ² /h)	(%)	(%)	(%)
1000 Hz 110 dB	27	27	0.30	0.30	0.00	5.6	-21, +26
1000 Hz 110 dB	45	45	0.50	0.50	0.00		
1000 Hz 110 dB	90	90	1.00	0.99	-1.00		
1000 Hz 110 dB	180	180	2.00	1.98	-1.00		
1000 Hz 120 dB	36	36	4.00	3.94	-1.50		
1000 Hz 120 dB	72	72	8.00	7.87	-1.61	5.6	-21, +26
1000 Hz 120 dB	90	90	10.00	9.90	-1.00		
1000 Hz 120 dB	180	180	20.00	19.76	-1.20		
1000 Hz 120 dB	360	360	40.00	39.42	-1.45		
1000 Hz 120 dB	720	720	80.00	78.66	-1.68		

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FM-708-NDM-01 Rev.02 Issue 2023/11/23

4. Response to short duration

a. Response for sinusoidal signals - reference level

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

b. Sound exposure meter response for series of toneburst impulses

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
	Ref	UUC	Ref	UUC	Error		
FAST / A / 55-140	(s)	(s)	(Pa ² /h)	(Pa ² /h)	(%)	(%)	(%)
Calibrator Setting	(s)	(s)	(Pa ² /h)	(Pa ² /h)	(%)	(%)	(%)
Burst 1 ms, 95 dB	2846	2846	1.00	1.00	0.00	5.6	-21 - +26
Burst 1 ms, 100 dB	900	900	1.00	1.00	0.00		-29 - +41
Burst 1 ms, 105 dB	143	143	1.00	1.01	+1.00		-29 - +41

5. Response to unipolar pulse

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

* Indicates non accredited

End of Certificate

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Certificate of Calibration

Customer

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

Certificate No : 24-NDM-075
Request No : Req-2024-0528

Unit Under Calibration Details

Measurement item : Noise Dosimeter
Microphone Class : 2
Manufacture : SVANTEK
Microphone Model : SV 27IS
Model : SV 104IS
Microphone S/N : 133712
Serial Number : 128367
Preamplifier Model : -
ID : -
Preamplifier S/N : -
Resolution : 0.1 dB
Instrument Status : Used

Calibration Environment and Details


Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 5 March 2024
Calibrated Date : 21 March 2024
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration : Lab Acoustic


Reference Standard

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

Note

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

Calibrated By : 
Mr. Noppodon Luangtan
Service Calibration Engineer

Approved By : 
Mr. Paen Mathavorn
Calibration Engineer Supervisor
Issue Date : 21 March 2024

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FM-708-NDM-01 Rev.02 Issue 2023/11/23

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FM-708-NDM-01 Rev.02 Issue 2023/11/23

Certificate No : 24-NDM-075

Request No : Req-2024-0528

3. Linearity of response to steady signals

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

UUC Setting		FAST / A / High										
Ref	(dB)	60.0	80.0	90.0	100.0	110.0	114.0	120.0	130.0	140.0		
1000 Hz	Level A	(dB)	59.9	80.2	90.2	100.1	110.0	114.0	120.0	130.0	140.0	
	Error	(dB)	-0.1	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0.0	
8000 Hz	Ref	(dB)			88.9	98.9	108.9	112.9	118.9	128.9	138.9	
	Level A	(dB)			89.0	99.0	109.0	112.9	119.0	129.0	139.0	
	Error	(dB)			0.1	0.1	0.1	0.0	-0.1	0.0	0.0	
63 Hz	Ref	(dB)						87.8	93.8	103.8	113.8	
	Level A	(dB)						87.8	93.8	103.8	113.8	
	Error	(dB)						0.0	0.0	0.0	0.0	
Tolerances Limit		(dB)	1.0									
UNCERTAINTY		(dB)	0.3									

b. Sound exposure meter linearity of error

UUC Setting		Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
FAST / A / 60-140	Ref	UUC		Ref	UUC	Error		
Calibrator Setting	(s)	(s)		(Pa ² h)	(Pa ² h)	(%)	(%)	(%)
1000 Hz 110 dB	27	27		0.30	0.30	0.00	5.6	-21, +26
1000 Hz 110 dB	45	45		0.50	0.50	0.00		
1000 Hz 110 dB	90	90		1.00	0.99	-1.00		
1000 Hz 110 dB	180	180		2.00	2.02	+1.00		
1000 Hz 120 dB	36	36		4.00	3.94	-1.50		
1000 Hz 120 dB	72	72		8.00	8.05	+0.63		
1000 Hz 120 dB	90	90		10.00	9.90	-1.00		
1000 Hz 120 dB	180	180		20.00	19.76	-1.20		
1000 Hz 120 dB	360	360		40.00	39.42	-1.45		
1000 Hz 120 dB	720	720		80.00	80.49	+0.61		

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PM-700-NDM-01 Rev.02 Issue 07/11/23

4. Response to short duration

a. Response for sinusoidal signals - reference level

UUC Setting		Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
FAST / A / 60-140	Ref	UUC		Ref	UUC	Error		
Calibrator Setting	(s)	(s)		(Pa ² h)	(Pa ² h)	(%)	(%)	(%)
4000 Hz 95 dB	2846	2846		1.00	1.00	0.00	0.052	+0.29 -0.41

b. Sound exposure meter response for series of toneburst impulses

UUC Setting		Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
FAST / A / 60-140	Ref	UUC		Ref	UUC	Error		
Calibrator Setting	(s)	(s)		(Pa ² h)	(Pa ² h)	(%)	(%)	(%)
Burst 1 ms, 95 dB	2846	2846		1.00	1.00	0.00	5.6	-21 -+26
Burst 1 ms, 100 dB	900	900		1.00	1.00	0.00		-29 -+41
Burst 1 ms, 108 dB	143	143		1.00	1.01	+1.00		-29 -+41

5. Response to unipolar pulse

UUC Setting		Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
FAST / A / 60-140	Ref	UUC		Ref	UUC	Error		
Calibrator Setting	(s)	(s)		(Pa ² h)	(Pa ² h)	(%)	(%)	(%)
Continuous Rectangle +				10.13			+2.37	3.7
Continuous Rectangle -	29			10.37				

* Indicates non accredited

End of Certificate

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

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PM-700-NDM-01 Rev.02 Issue 07/11/23

Certificate of Calibration

Customer
Name UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260
Certificate No : 23-NDM-179
Request No : Req-2023-1488

Unit Under Calibration Details

Measurement Item : Noise Dosimeter
Manufacturer : SVANTEK
Model : SV 104
Serial Number : 140325
ID : *
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : SV 27
Microphone S/N : 139831
Preamplifier Model : -
Preamplifier S/N : -
Instrument Status : New

Calibration Environment and Details


Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 12 July 2023
Calibrated Date : 7 August 2023
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration : Lab Acoustic


Reference Standard

Instrument	Brand	Model	SN.	Due calibration	Traceability
Multifrequency Calibrator	Quest	Quest-cal	188272	25 July 2024	TSI
Standard Microphone	GRAS	40AN	188273	6 October 2023	GRAS
Sine Generator	Svantek	Svan401	131	12 October 2023	WK Electric
Timer	EXTECH	-	05-ACT	20 March 2024	TPA

Note

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

Calibrated By : 
Mr. Noppadol Luangtan
Calibration Officer

Approved By : 
Mr. Pacht Mathavorn
Calibration Engineer Supervisor
Issue Date : 7 August 2023

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

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Certificate No : 23-NDM-179

Request No : Req-2023-1488

1. Absolute acoustical sensitivity

UUC Setting		Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
FAST / A / 55-140	Ref	UUC		Ref	UUC	Error		
Calibrator Setting	(s)	(s)		(Pa ² h)	(Pa ² h)	(%)	(%)	(%)
1000 Hz 114 dB	120	120		3.18	3.13	-1.57	3.1	-21, +26

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

2. Frequency weightings

UUC Setting		Deviation from various Frequency Weighting		UNCERTAINTY	Tolerances Limit
FAST / 55-140	A	C			
STD Setting	(dB)	(dB)		(± dB)	(± dB)
63 Hz	0.0	0.1		0.40	2.0
125 Hz	0.7	0.9		0.40	1.5
250 Hz	0.3	0.8		0.40	1.5
500 Hz	0.3	0.7		0.40	1.5
1000 Hz	0.0	0.0		0.40	-
2000 Hz	-0.6	-0.2		0.40	2.0
4000 Hz	2.3	2.4		0.40	3.0
8000 Hz	-2.9	-2.9		0.40	5.0

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Certificate No : 23-NDM-179
Request No : Req-2023-1488

3. Linearity of response to steady signals

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

UUC Setting		FAST / A / High									
1000 Hz	Ref	[dB]	55.0	80.0	90.0	100.0	110.0	114.0	120.0	130.0	140.0
	Level A	[dB]	54.5	80.1	90.1	100.1	110.1	114.0	120.0	130.0	140.0
	Error	[dB]	-0.5	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
8000 Hz	Ref	[dB]			88.9	98.9	108.9	112.9	118.9	128.9	138.9
	Level A	[dB]			89.0	98.9	108.9	112.9	118.9	128.9	138.8
	Error	[dB]			0.1	0.0	0.0	0.0	0.0	0.0	-0.1
63 Hz	Ref	[dB]						87.8	93.8	103.8	113.8
	Level A	[dB]						87.8	93.8	103.8	113.8
	Error	[dB]						0.0	0.0	0.0	0.0
Tolerances Limit		[±dB]	1.0								
UNCERTAINTY		[±dB]	0.3								

b. Sound exposure meter linearity of error

UUC Setting		Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
FAST / A / 55-140		Ref	UUC	Ref	UUC	Error		
Calibrator Setting		(s)	(s)	(Pa ² h)	(Pa ² h)	(%)	(%)	(%)
1000 Hz 110 dB		27	27	0.30	0.30	0.00	5.6	-21, +26
1000 Hz 110 dB		45	45	0.50	0.50	0.00		
1000 Hz 110 dB		90	90	1.00	1.01	+1.00		
1000 Hz 110 dB		180	180	2.00	2.02	+1.00		
1000 Hz 120 dB		36	36	4.00	4.03	+0.75		
1000 Hz 120 dB		72	72	8.00	8.05	+0.63	5.6	-21, +26
1000 Hz 120 dB		90	90	10.00	9.90	-1.00		
1000 Hz 120 dB		180	180	20.00	20.22	+1.10		
1000 Hz 120 dB		360	360	40.00	40.34	+0.85		
1000 Hz 120 dB		720	720	80.00	80.49	+0.61		

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เอกสารไม่ควบคุม

Certificate No : 23-NDM-179
Request No : Req-2023-1488

4. Response to short duration

a. Response for sinusoidal signals - reference level

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

b. Sound exposure meter response for series of toneburst impulses

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

5. Response to unipolar pulse

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

* Indicates non accredited

End of Certificate

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

เอกสารไม่ควบคุม

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260
Certificate No : 23-NDM-185
Request No : Req-2023-1488

Unit Under Calibration Details

Measurement item : Noise Dosimeter
Manufacturer : SVANTEK
Model : SV 104
Serial Number : 140331
ID : *
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : SV 27
Microphone S/N : 136863
Preamplifier Model : -
Preamplifier S/N : -
Instrument Status : New

Calibration Environment and Details

Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 12 July 2023
Calibrated Date : 7 August 2023
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration : Lab Acoustic

Reference Standard

Instrument	Brand	Model	S/N	Due calibration	Traceability
Multifrequency Calibrator	Quest	Quest-cal	188272	25 July 2024	TSI
Standard Microphone	GRAS	40AN	188273	6 October 2023	GRAS
Sine Generator	SvanteK	Svsn401	131	12 October 2023	WK Electric
Timer	EXTECH	-	05-ACT	20 March 2024	TPA

Note

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

Calibrated By : 
Mr. Noppadon Luangtan
Calibration Officer
Approved By : 
Mr. Paet Mathavorn
Calibration Engineer Supervisor
Issue Date : 7 August 2023

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

เอกสารไม่ควบคุม

Certificate No : 23-NDM-185
Request No : Req-2023-1488

1. Absolute acoustical sensitivity

UUC Setting		Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
FAST / A / 55-140		Ref	UUC	Ref	UUC	Error		
Calibrator Setting		(s)	(s)	(Pa ² h)	(Pa ² h)	(%)	(%)	(%)
1000 Hz 114 dB		120	120	3.18	3.13	-1.57	3.1	-21, +26

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

2. Frequency weightings

UUC Setting		Deviation from various Frequency Weighting		UNCERTAINTY	Tolerances Limit
FAST / 55-140		A	C		
STD Setting		(dB)	(dB)	(± dB)	(± dB)
*63 Hz		0.0	0.1	0.40	2.0
125 Hz		0.3	0.6	0.40	1.5
250 Hz		0.0	0.5	0.40	1.5
500 Hz		0.1	0.5	0.40	1.5
1000 Hz		0.0	0.0	0.40	-
2000 Hz		-0.4	0.0	0.40	2.0
4000 Hz		1.7	1.8	0.40	3.0
8000 Hz		-2.9	-2.9	0.40	5.0

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เอกสารไม่ควบคุม

Certificate No : 23-NDM-183
Request No : Req-2023-1488

3. Linearity of response to steady signals

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

UUC Setting		FAST / A / High									
1000 Hz	Ref	(dB)	55.0	80.0	90.0	100.0	110.0	124.0	120.0	130.0	140.0
	Level A	(dB)	54.6	80.1	90.1	100.0	110.0	124.0	120.0	130.0	140.0
	Error	(dB)	-0.4	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
8000 Hz	Ref	(dB)			88.9	98.9	108.9	112.9	118.9	128.9	138.9
	Level A	(dB)			88.9	98.9	108.9	112.9	118.9	128.9	138.9
	Error	(dB)			0.0	0.0	0.0	-0.1	-0.1	-0.1	-0.1
63 Hz	Ref	(dB)						87.8	93.8	103.8	113.8
	Level A	(dB)						87.8	93.8	103.8	113.8
	Error	(dB)						0.0	0.0	0.0	0.0
Tolerances Limit		(dB)	1.0								
UNCERTAINTY		(dB)	0.3								

b. Sound exposure meter linearity of error

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

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

เอกสารไม่ควบคุม

Certificate No : 23-NDM-183
Request No : Req-2023-1488

4. Response to short duration

a. Response for sinusoidal signals - reference level

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

b. Sound exposure meter response for series of toneburst impulses

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

5. Response to unipolar pulse

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

* Indicates non accredited

End of Certificate

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

เอกสารไม่ควบคุม

Certificate of Calibration

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

Certificate No : 23-AFM-144
Request No : Req-2023-1509

Unit Under Calibration Details

Measurement Item : Primary Flow Calibrator
Manufacturer : TSI
Model : 4146
Serial Number : 41462327002
ID : -
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 : 18 July 2023
Calibration Date : 24 July 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	11 July 2024
Temperature meter	GT 11	12000077	Quhem	27 February 2024
Pressure meter	CPG2400	41009KDU/651882	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. Noppadon Luangart
Service Calibration Engineer

Approved By : 
Mr. Paet Mathavon
Calibration Engineer Supervisor
Issue Date : 24 July 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 Calibration Lab.

เอกสารไม่ควบคุม

Certificate No : 23-AFM-144
Request No : Req-2023-1509

Result of Calibration :

Temperature	Pressure	STD	UUC	Error	Uncertainty
(°C)	(kPa)	(L/min)	(L/min)	(L/min)	(L/min)
25.40	100.84	0.020	0.020	0.000	0.001
25.40	100.83	0.050	0.051	0.001	0.003
25.40	100.84	0.101	0.104	0.003	0.003
25.40	100.82	0.203	0.213	0.008	0.006
25.40	100.81	0.506	0.509	0.003	0.007
25.40	100.81	1.004	1.004	0.000	0.014
25.30	100.80	1.707	1.706	-0.001	0.024
25.30	100.81	2.803	2.806	0.003	0.028
25.20	100.80	3.009	3.038	0.029	0.042
25.20	100.79	4.003	4.029	0.026	0.055
25.30	100.79	5.004	5.027	0.023	0.069

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 :

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

where Q = Flow Rate P = Absolute Pressure T = Absolute Temperature
Mean = 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 Innovative Instrument Calibration Lab.

เอกสารไม่ควบคุม



Certificate of Calibration

Certificate No.: 23P1859
Page: 1 of 2

Equipment: Aneroid Barometer
Manufacturer: Barigo
Model: -
Serial No.: -
ID No.: UAE.ANV.123/2550

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: 26 May 2023
Calibration Date: 02 June 2023
Reference: 2305-0919WSC
Ambient Temperature: (25 ± 2) °C
Relative Humidity: (50 ± 15) %
Atmospheric Pressure: 1007 mbar

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

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

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

Condition of this result of calibration

1. Reference standards instruments :

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

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

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

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

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

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

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

-National Institute of Metrology Thailand (NIMT)

Calibrated by: Suksan Khankaew
Issue Date: 08 June 2023

Approved Signatory: *Attapol P.*
[] Phalinee Prabpai
[] Sura Suwannasri
[x] Attapol Panurach

เอกสารไม่ควบคุม
B 0316959



Result of calibration:- Without adjustment

Function:- Absolute Pressure Measurement

Range: 950 hPa to 1030 hPa

Scale Interval: 1 hPa (The Fifth Estimate)

Increasing Pressure

Applied Pressure (hPa)	958.80	968.94	981.10	991.82	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	958.03
UUC* Indication (hPa)	1030.0	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 %.

-000-

Attapol P.

เอกสารไม่ควบคุม
a 1165505



Certificate of Calibration

Certificate No.: 23H1102
Page: 1 of 2

Equipment: Digital Thermo-Hygrometer
Manufacturer: Digicon
Model: TH-02
Serial No.: 395034174
ID No.: UAE.EFM.185/2565

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

Condition As-Received: Used Item
Received Date: 18 May 2023
Calibration Date: 22 May 2023
to 24 May 2023
Reference: 2305-0641WSC
Ambient Temperature: (25 ± 3) °C
Relative Humidity: (50 ± 20) %

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

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

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

Condition of this result of calibration

1. Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Chilled Mirror Hygrometer	Dew Master	44730	20563A	14 Jun 2023
2) Handheld Thermometer With Sensor	1521	ASA339	2211251	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: Kralpop Onrat
Issue Date: 25 May 2023

Approved Signatory: *Kralpop Onrat*
[x] Chakrit Waewwanjua
[] Pornthippa Tamayakul
[] Vipom Tantiyawutti

เอกสารไม่ควบคุม
B 0314980



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	40	-0.1	1.3
25.0	50.1	50	-0.1	1.6
25.0	60.0	59	-1.0	1.6
25.0	70.2	68	-2.2	1.6

Result of Calibration:-

Function:

Without Adjustment

Temperature Measurement

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
20.014	20.4	0.386	0.42
25.022	25.6	0.578	0.42
30.033	30.2	0.167	0.42
40.000	39.9	-0.100	0.42

UUC* : Unit Under Calibration

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

-000-

Kralpop Onrat

เอกสารไม่ควบคุม
a 1162979



Certificate of Calibration

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

Certificate No : 24-TPM-150
Request No : Req-2024-0543
Page : 1/2

Unit Under Calibration Details

Calibration Parameter : Temperature
Instrument Name : Thermal Environment Monitor
Manufacturer : TSI QUEST
Model : QT-34
Serial Number : TEH020027
Resolution : 0.1 °C
ID Number : UAE.ANV.125/2551

Range Calibration : 20 °C to 60 °C
Type of Sensor : RTD
Sensor Diameter (mm) : 4.5
Calibration Position (mm) : 67.5
Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 15 %RH
Received Date : 5 March 2024
Calibrated Date : 21 March 2024
Calibration Procedure : In-house method CP-TPM-01 by Comparison with Standard Thermometer.

Reference Standard : Digital Thermometer with Sensor, Manufacturer: GINGO/INGO, Model: GT11/RTD100, SN: 12090077, ID: AR-TPM Which was calibrated on 27 October 2023, Calibration Certificate No.: QRC23-2574
Traceability : This Certificate is traceable to SI Unit through Quality Reborn Co., Ltd., NSC-ONSC Accreditation No.: Calibration 0292

Note

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

Approved By :
Mr. Noppadol Luangrat
Technical Manager
Issue Date : 21 March 2024

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
PSE-708-TPM-01 Rev.01 Issue 01, 15/02/20

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Calibration Note
UUC Adjustment : Not Adjust

Certificate No : 24-TPM-150
Request No : Req-2024-0543
Page : 2/2

Result of Calibration :

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (°C)
WET	20.030	20.0	0.0	0.13
	25.035	25.0	0.0	0.13
	30.035	30.1	-0.1	0.13
	35.036	35.1	-0.1	0.13
	40.038	40.1	-0.1	0.13
	45.041	45.2	-0.2	0.13
	50.044	50.2	-0.2	0.13
	60.047	60.2	-0.2	0.13
DRY	20.031	20.0	0.0	0.13
	25.033	25.0	0.0	0.13
	30.034	30.1	-0.1	0.13
	35.036	35.1	-0.1	0.13
	40.038	40.1	-0.1	0.13
	45.039	45.2	-0.2	0.13
	50.043	50.2	-0.2	0.13
	60.047	60.2	-0.2	0.13
GLOBE	20.032	20.0	0.0	0.13
	25.033	25.0	0.0	0.13
	30.034	30.1	-0.1	0.13
	35.037	35.1	-0.1	0.13
	40.038	40.1	-0.1	0.13
	45.041	45.2	-0.2	0.13
	50.044	50.2	-0.2	0.13
	60.048	60.2	-0.2	0.13

End of Certificate

Calibrated By :
Mr. Sirichok Jirapaksakul

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.
PSE-708-TPM-01 Rev.01 Issue 01, 15/02/20

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Certificate of Calibration

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

Certificate No : 23-TPM-502
Request No : Req-2023-2230
Page : 1/2

Unit Under Calibration Details

Calibration Parameter : Temperature
Instrument Name : Thermal Environment Monitor
Manufacturer : TSI QUEST
Model : QT-32
Serial Number : TPT030008
Resolution : 0.1 °C
ID Number : UAE.EFM.219/2562

Range Calibration : 20 °C to 60 °C
Type of Sensor : RTD
Sensor Diameter (mm) : 4.5
Calibration Position (mm) : 67.5
Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 15 %RH
Received Date : 18 October 2023
Calibrated Date : 2 November 2023
Calibration Procedure : In-house method CP-TPM-01 by Comparison with Standard Thermometer.

Reference Standard : Digital Thermometer with Sensor, Manufacturer: GINGO/INGO, Model: GT11/RTD100, SN: 0800057, ID: 02-TPM Which was calibrated on 27 February 2023, Calibration Certificate No.: QRC23-0494
Traceability : This Certificate is traceable to SI Unit through Quality Reborn Co., Ltd., NSC-ONSC Accreditation No.: Calibration 0292

Note

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

Approved By :
Mr. Noppadol Luangrat
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.
PSE-708-TPM-01 Rev.01 Issue 01, 15/02/20

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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
	30.035	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
	25.036	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
	35.035	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 Jirapaksakul

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.
PSE-708-TPM-01 Rev.01 Issue 01, 15/02/20

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Certificate of Calibration

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

Certificate No : 23-LXM-139
Request No : Req-2023-0706
Page : 1/2

Unit Under Calibration Details

Instrument Name : Digital Lux Meter
Manufacturer : EXTECH
Model : 407026
Serial Number : A056652
Resolution : 1 lx
ID Number : UAE.EFM.126/2565

Range Calibration : 2000 , 20000 lx
Instrument Status : Used

Calibration Environment and Details


Temperature : 25 °C ± 2 °C
Humidity : 60 %RH ± 20 %RH
Received Date : 28 March 2023
Calibrated Date : 20 April 2023
Calibration Procedure : The measurement was done in accordance with CP-LXM-01

Reference Standard : Photometer and Illuminance Sensor, Serial No.: 30663/2, 30592/2, which was calibrated on 11 November 2022, Certificate No.: TP-1027-22

Traceability : This Certificate is traceable to International System of Unit (SI) Unit through National Institute of Metrology (Thailand)

Note

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

Approved By : 
Mr. Pasi Mathavorn
Calibration Engineer Supervisor
Issue Date : 20 April 2023

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

เอกสารไม่ควบคุม

Calibration Note

UUC Adjustment : Zero adjustment before use

Certificate No : 23-LXM-139

Request No : Req-2023-0706


Page : 2/2

Result of Calibration :

UUC Range (lx)	Standard (lx)	UUC Reading (lx)	Correction (lx)	Uncertainty (± lx)
2000	0	0	0	0.0050
	50	50	0	2.2 % of Reading
	100	100	0	2.2 % of Reading
	200	201	-1	2.2 % of Reading
	300	302	-2	2.2 % of Reading
	400	402	-2	2.2 % of Reading
	600	603	-3	2.2 % of Reading
	800	806	-6	2.2 % of Reading
	1000	1008	-8	2.2 % of Reading
	1200	1207	-7	2.2 % of Reading
	1400	1408	-8	2.2 % of Reading
	1600	1610	-10	2.2 % of Reading
	1800	1804	-4	2.2 % of Reading
	2000	1991	9	2.2 % of Reading
20000	3000	2980	20	2.2 % of Reading
	4000	3970	30	2.2 % of Reading
	5000	4950	50	2.2 % of Reading

* Indicates non accredited

End of Certificate

Calibrated By : 
Mr. Noppadon Luangrat

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

เอกสารไม่ควบคุม

List of Instruments Certification for Air Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Air									
1	Analytical Balance (Readability 0.1 mg)	ฝุ่นละอองรวม (TSP) ฝุ่นละอองขนาดไม่เกิน 10 ไมครอน (PM-10)	Mettler-Toledo	AB204-S / 1128312528	Mettler-Toledo (Thailand) Ltd.	23MM331	7 Apr 23	5 Apr 24	-
2	Analytical Balance (Readability 0.1 mg)		Mettler-Toledo	AB204-S/FACT / B108115858	Mettler-Toledo (Thailand) Ltd.	23MM332	7 Apr 23	5 Apr 24	-



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



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

Certificate of Calibration

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

The Uncertainties are for a confidence probability of approximately 95%

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

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

เอกสารไม่ควบคุม



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

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

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

Condition of this result of calibration

1. Reference standard instruments:-

Instruments	Model	Serial No.	ID No.	Test report No.	Due date
1) Standard Weight Set (EZ)	15884	24053	70RC007	MM-0010-22	20 Jan 2024

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

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

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

Before Adjustment :

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

After Adjustment :

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

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

เอกสารไม่ควบคุม



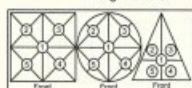
Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2304-0015OC-1

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

Result of calibration

2. Effect of off center loading

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



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

Position 1	Position 2	Position 3	Position 4	Position 5	
(g)	(g)	(g)	(g)	(g)	(g)
-0.0001	-0.0002	+0.0004	-0.0001	-0.0006	0.0005

3. Departure from nominal value

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

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

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เอกสารไม่ควบคุม



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.: 23MM332
Page.: 1 of 3

Certificate of Calibration

Equipment : Electronic Balance
Manufacturer : Mettler Toledo
Model : AB204-S /FACT
Serial No. : B108115858
ID No. : UAE.AIR.016/2555
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Balance Room 2
Received order : 07 April 2023
Calibration Date : 07 April 2023
Ambient Temperature : 15 °C to 40 °C
Relative Humidity : 30 % to 90 %
Calibrated by : Suwit Imjai
Approved by :
() Pornthipha Tameyakul
() Malee Butkruea
Issue Date : 10 April 2023

The Uncertainties are for a confidence probability of approximately 95%

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

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

เอกสารไม่ควบคุม



Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2304-0015OC-2
Cert.No.: 23MM332
Page: 2 of 3

Procedure used :-

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

Condition of this result of calibration

1. Reference standard instruments:-

Instruments	Model	Serial No.	ID No.	Test report No.	Due date
1) Standard Weight Set (E2)	15884	24053	70RC007	MM-0010-22	20 Jan 2024

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

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

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

Before Adjustment :

Applied Weight	Balance Reading	Correction	Measurement Uncertainty	Coverage Factor
(g)	(g)	(g)	(\pm mg)	(k)
100	100.0002	-0.0002	0.21	2.06
200	200.0003	-0.0003	0.29	2.00

After Adjustment :

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

Applied Weight	Standard Deviation of Reading (g)
(g)	
100	0.00009
200	0.00007

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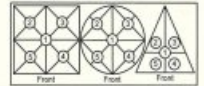


Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2304-0015OC-2
Cert.No.: 23MM332
Page: 3 of 3

Result of calibration

2. Effect of off center loading

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



Maximum difference between off-center and central loading

Position 1	Position 2	Position 3	Position 4	Position 5	
(g)	(g)	(g)	(g)	(g)	(g)
+0.0001	-0.0003	+0.0003	+0.0006	+0.0002	0.0005

3. Departure from nominal value

Applied Weight	Balance Reading	Correction	Measurement Uncertainty	Coverage Factor
(g)	(g)	(g)	(\pm mg)	(k)
Unload	0.0000	0.0000	0.18	2.17
0.1	0.0999	+0.0001	0.18	2.17
1	0.9998	+0.0002	0.18	2.17
5	5.0000	0.0000	0.18	2.17
10	10.0000	0.0000	0.18	2.17
20	20.0000	0.0000	0.18	2.15
50	50.0001	-0.0001	0.19	2.11
70	70.0001	-0.0001	0.20	2.07
100	100.0002	-0.0002	0.21	2.06
150	150.0004	-0.0004	0.29	2.00
200	200.0005	-0.0005	0.29	2.00

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

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เอกสารไม่ควบคุม

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	ความเป็นกรด-ด่าง (pH) อุณหภูมิ(Temperature)	Mettler-Toledo	Seven Easy S20 / 1231155210	National Food Institute, Ministry of Industry, Thailand	2401718-001-01	11 Mar 24	10 Mar 25	-
2	Ion Selective Electrode Meter (ISE)		Orion	Star A214 / X36836	Science Tech Co.,Ltd.	FT005/22	29 May 23	28 May 24	-
3	BOD Incubator	Biochemical Oxygen Demand (BOD)		UR-1320 / (UAE.WAO.018/2551)	Technology Promotion Association (Thailand-Japan)	24TM587	1 Apr 24	31 Mar 25	-
4	BOD Incubator	Biochemical Oxygen Demand (BOD)	Arco	UR-1320 / (UAE.WAO.006/2553)	Technology Promotion Association (Thailand-Japan)	24TM588	1 Apr 24	31 Mar 25	-
5	Analytical Balance (Repeatability 0.1 mg)	น้ำมันและไขมัน (Oil & Grease)	Mettler-Toledo	XSR204 / C117635043	National Food Institute, Ministry of Industry, Thailand	24MM293	11 May 24	10 May 25	
6	COD Reactor (Heating Block)	ซีโอดี (COD)	Hanna	HI839800-02 / H018500I	Hanna Instruments (Thailand) Ltd.	HIT-2312-0342	10 Mar 23	9 Mar 24	-
7	Analytical Balance (Repeatability 0.01 mg)	ของแข็งแขวนลอยทั้งหมด (TSS) ของแข็งละลายทั้งหมด (TDS)	Mettler-Toledo	XSR205DU / C009071872	Technology Promotion Association (Thailand-Japan)	2402283-001-01	2 Apr 24	1 Apr 25	-
8	Hot Air Oven	ของแข็งทั้งหมด (TS)	Memmert	UF55 / B216.1666	Technology Promotion Association (Thailand-Japan)	2400141-001-01	11 Oct 23	10 Oct 24	-
9	Digestor Unit	ทีเคเอ็น (TKN)	FOSS TECATOR	DT2520 / 91794469	FOSS South East Asia	9809	8 Feb 24	7 Feb 25	-
10	Distillation Unit (Kjeldahl Method)	ทีเคเอ็น (TKN)	FOSS TECATOR	KT8100/ 91889052	FOSS South East Asia	8411	29 May 23	28 May 24	-
11	Conductivity Meter	ความเค็ม (Salinity)	SI Analytics	Lab955 / 16300356	DKSH Technology Limited	C24240057	11 Mar 24	10 Mar 25	-
12	UV-VIS Spectrophotometer	ฟอสฟอรัสทั้งหมด (Total P), สี (Color), ไนโตรเจนทั้งหมด (Total N),	Agilent Technologies	Cary60 G6860A / MY15410009	DQE Services Co.,Ltd.	SP24-018	7 May 24	6 May 25	
13	UV-VIS Spectrophotometer	ซัลเฟต (Sulfate)	Hitachi	U-1900 / 2021-064	DQE Services Co.,Ltd.	SP24-008	16 Jan 24	15 Jan 25	-

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									
14	Turbidity Meter	Turbidity	Oakton	T100IR / 1120501017	Technology Promotion Association (Thailand-Japan)	23CH1184	14 Sep 23	13 Sep 24	-
15	Gas Chromatography - Mass Spectrometer (GC-MS)	สารประกอบอินทรีย์ระเหยง่าย (VOCs)	Agilent Technologies	System ID: CN17100005 Qu 9000 (G3950A) / CN1710 5977B MSD (G7077B) / US1715M030	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	1 Mar 24	1 Mar 25	-
16	Inductively Coupled Plasma (ICP)	เหล็ก (Fe)	Agilent Technologies	System ID:G8015A G8015AA / MY18030001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	13 Nov 23	12 Nov 24	-
17	Cold Vapor Atomic Absorption Spectrophotometer (CVAAS)	ปรอท (Mercury)	Milestone	DMA-80 / 11030982	Sithiporn Associates Co.,Ltd.	Service Protocol Report	17 Nov 23	16 Nov 24	-
18	Cold Vapor Atomic Absorption Spectrophotometer (CVAAS)	ปรอท (Mercury)	Analytik Jena	mercur DUO plus / K170A0153	Analytik Jena FarEast Thailand Ltd.	Maintenance Protocol	12 Feb 24	10 Feb 25	-
19	Incubator	โคลิฟอร์มแบคทีเรียทั้งหมด (Coliform Bacteria)	Memmert	IPP 260 / V615.0187	Technology Promotion Association (Thailand-Japan)	24TM648	1 Apr 24	31 Mar 25	-
20	Incubator	ฟีคัลโคลิฟอร์มแบคทีเรีย (Fecal Coliform Bacteria)	Memmert	IPP 260 / V618.0033	Technology Promotion Association (Thailand-Japan)	24TM651	2 Apr 24	1 Apr 25	-
21	Water Bath		Memmert	WNE 14 / L407.0756	Technology Promotion Association (Thailand-Japan)	23TM1079	10 Jul 23	9 Jul 24	-
22	Analytical Balance		OHAUS	PX623 / C236754745	DKSH (Thailand) Ltd.	C01223732	7 Dec 23	6 Dec 24	-

Calibration Certificate

Certificate No.: 2401718-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakanong, Bangkok 10260

Page 1 of 5

Equipment: pH Meter
Manufacturer: METTLER TOLEDO
Model: SevenEasy pH
Serial No.: 1231155210
ID No.: UAE.WAT.010/2553
Order No.: 2401718
Operation No.: 2401718-001
Date of Receipt: 27 February 2024
Date of Calibration: 11 March 2024

Calibrated by Mr.Manas Somsak Specialist
Approved by (Mr.Pheraphat Tuanjit)
Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team
Date of Issue: 12 March 2024

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

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

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



Calibration Report

Certificate No.: 2401718-001-01
Equipment: pH Meter
Resolution: 0.01 pH ; 1 mV
Manufacturer: METTLER TOLEDO
Model: SevenEasy pH
Serial No.: 1231155210
Type: Bench top
ID No.: UAE.WAT.010/2553

Date of Calibration: 11 March 2024 Page 2 of 5

Location: Chemical Calibration Laboratory, National Food Institute
Environment Condition: Ambient Temperature: (23.4 ± 1.5) °C Relative Humidity: (51 ± 3) %
Condition of Equipment: Good Condition
Condition of this Results of Calibration
1. Calibration Method: W-CC-002: In house method based on direct measurement by using standard voltage calibrator and certified reference material (CRM)
2. Reference Standards / Certified Reference Material
Instruments
2.1 DC Voltage Calibrator 2709007 Fluke Z9E2003 14 June 2024
2.2 Digital Thermometer 2709007 Fluke CC-660570-01 30 October 2024
2.3 Thermo-Hygro Meter NPLBTH 014/23 testo CC-660353-01 3 April 2024
Certified Reference Material
2.4 pH buffer 4.008 (Primary pH buffer Solution) 888842 CPachem PH216.L5 13 April 2025
2.5 pH buffer 6.865 (Primary pH buffer Solution) 888843 CPachem PH217.L5 13 April 2025
2.6 pH buffer 10.01 (Primary pH buffer Solution) 888844 CPachem PH220.L5 13 April 2024
2.7 pH buffer 7.00 (Standard pH buffer Solution) 033109 HACH LANGE GmbH S11M004 16 October 2023
3. This certificate is traceable to The International System of Unit (SI Unit)
3.1 Instruments Ng.2.1 through NSC-TISI-TS 17025 Laboratory Accreditation of Calibration No.0008
3.2 Instruments Ng.2.2 and 2.3 through NSC-TISI-TS 17025 Laboratory Accreditation of Calibration No.0061
3.3 Certified Reference Material Ng.2.4 to 2.6 traceable to Primary measurement method - Harned cell using calibrated thermometer, barometer, and nanovoltmeter. The Standard Solution preparation and certified by CPachem Ltd is accredited to ISO 17034 and ISO/IEC 17025
3.4 Certified Reference Material Ng.2.7 traceable to PTB Certificate Nr. PTB-PHCA-563/2009423 and Certificate Nr. PTB-PHOB-555/30520/22 (PTB: Physikalisch-Technische Bundesanstalt, Braunschweig, Germany)
4. This certificate was certified only for the instrument we calibrated.
5. This result of calibration was found accurate as shown on date and place of calibration only.

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



Calibration Report

Certificate No.: 2401718-001-01
Equipment: pH Meter
Resolution: 0.01 pH ; 1 mV
Manufacturer: METTLER TOLEDO
Model: SevenEasy pH
Serial No.: 1231155210
Type: Bench top
ID No.: UAE.WAT.010/2553

Date of Calibration: 11 March 2024 Page 3 of 5

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

Nominal pH	DC Voltage Standard (mV)	Average Indicator Reading		Uncertainty (±mV)	Coverage Factor (k)
		mV	pH		
0	414.121	414	0.00	0.58	2.00
2	296.814	296	2.00	0.58	2.00
4	177.464	178	4.00	0.58	2.00
6	59.160	59	6.00	0.58	2.00
7	0.001	0	7.00	0.58	2.00
8	-59.159	-59	8.00	0.58	2.00
10	-177.461	-177	10.00	0.58	2.00
12	-296.811	-296	12.00	0.58	2.00
14	-414.118	-414	14.00	0.58	2.00

2. Calibration of pH Meter with Electrode (Manual Temperature Compensation at 25 °C)

Equipment: pH Electrode Type: Combined Electrode
Manufacturer: METTLER TOLEDO Model: InLab Solids
Serial No.: 3065701 ID No.: N/A

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

Certified Value (25 °C (pH))	Average Indicator Reading		Relative Slope (%)	Uncertainty (± pH)	Coverage Factor (k)
	pH	mV			
4.008	4.01	188	-	0.0071	2.00
7.001	7.00	13	95.9	0.0086	2.00
10.010	10.01	-160	97.2	0.0085	2.00
6.865	6.87	21	-	0.0074	2.00

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



Calibration Report

Certificate No.: 2401718-001-01
Equipment: Digital Thermometer with RTD (pH Meter)
Resolution: 0.1 °C Model: SevenEasy pH
Serial No.: 1231155210 ID No.: UAE.WAT.010/2553
Manufacturer: METTLER TOLEDO

Date of Calibration: 11 March 2024 Page 4 of 5

Location: Chemical Calibration Laboratory, National Food Institute
Environment Condition: Ambient Temperature 23 °C ± 1 °C
Relative Humidity 51 % ± 2 %

Condition of this results of Calibration:

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

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
HANDHELD THERMOMETER	1523	2118154	PSL-T 087766	06-Jun-24	TBTR
Platinum Resistance Thermometer (PRT)	5627A	877332			

Support Equipment : - Low Temperature Bath (EBCAL-6), Model: Europa-6 Plus Basic, S/N: 341582/2

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

6. Condition of Calibrated item : Good
7. Result of Calibration : ☒ Without adjustment ☐ After adjustment

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



Calibration Report

Certificate No.: 2401718-001-01
Equipment: Digital Thermometer with RTD (pH Meter)
Resolution: 0.1 °C Model: SevenEasy pH
Serial No.: 1231155210 ID No.: UAE.WAT.010/0553
Manufacturer: METTLER TOLEDO
Date of Calibration: 11 March 2024 Page 5 of 5

Calibration point: 15.0, 25.0 and 35.0 °C

Calibration result:
- The probe was immersed in liquid bath or dry bath to a minimum depth of 100 mm.
- Description of probe, model: N/A SN: N/A
Dimension of probe: Diameter 4 mm, Length 120 mm.
Sheath material: Stainless Steel

UUC Reading (°C)	Standard Temperature (°C)	Correction Value (°C)	Uncertainty ± (°C)
15.1	14.998	0.1	0.099
25.1	24.998	0.1	0.099
35.1	34.997	0.1	0.099

Note

- UUC : Unit Under Calibration

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

----- End -----

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

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SCIENCE TECH CO., LTD.

Head Office : 321/43 Nanglinchee Rd. Chongnondsee Yannawa Bangkok 10120
Thailand Tel. 0-2285-4101 Fax. 0-2285-4856 www.sciencetech.th.com
Science Tech Laboratory : 279/27-29 Soi Watpoman Sathupradit 19 Rd.
Chongnondsee Yannawa Bangkok 10120 Tel. 0-2285-4101 Fax. 0-2285-4856

Job No. : JF004/24

Certificate No. : FT004/24

Page : 1 of 2

Certificate of Calibration

Equipment : pH/ISE Meter
Manufacturer : Orion
Made in : USA
Model : STAR A214
Serial No. : X36836
ID No. : UAE.WAT.025/2560
Ion Selective Model : 9409BN
Serial No. : ZW1-18420
Reference Electrode Model : 900100
Serial No. : ZW1-16834
Range : 0 to 14 pH
Resolution : 0.001 pH 0.1 mV
Submitted by : บริษัท ยูนิค แอนาไลติกส์ แอนด์ อินชิตีวรี คอนซัลแตนท์ จำกัด
3 ซอยอุดมสุข 41 ถนนสุขุมวิท แขวงบางจาก
เขตพระโขนง กรุงเทพฯ 10260
Ambient Temperature : (25 ± 3) °C
Relative Humidity : (50 ± 15)%
Issue date : Monday, May 27, 2024
Calibrated by : Khannika Sangkham
Approved by :
(Khannika Sangkham)
Laboratory manager

เอกสารไม่ควบคุม



Certificate of Calibration

Job No. : JF004/24 Certificate No. : FT004/24
Received date : Thursday, May 23, 2024 Page : 2 of 2
Calibration date : Thursday, May 23, 2024

Condition of this calibration result

1 Reference standard materials : Certified Fluoride standard reference solution (Directly measured by differential potentiometry with the aid of potassium fluoride "quasi without transference" against solutions prepared from primary reference materials from NIST)

2 This certificate was certified only for the instrument we calibrated

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

Result of Calibration

Function : pH/ISE Meter with Probe

Direct Measurement

First Standard concentrated = 0.1 ppm
Secondary Standard concentrated = 1 ppm
Tertiary Standard concentrated = 10 ppm
Fourthly Standard concentrated = 100 ppm
Slope = -55.1 mV/Dec.

Channel : 1

Unit Under Calibration	Standard Concentrated (ppm)	UUC Reading (ppm)	Correction (ppm)	Stdev (ppm)
Model :	0.1	0.104	-0.004	0.00
9409BN S/N. ZW1-18420	1	1.03	-0.03	0.01
900100 S/N. ZW1-16834	10	10.2	-0.2	-0.16
	100	100	0	0.48

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SCIENCE TECH CO., LTD.

Head Office : 321/43 Nanglinchee Rd. Chongnondsee Yannawa Bangkok 10120 Thailand Tel. 0-2285-4101 Fax. 0-2285-4856 www.sciencetech.th.com
Science Tech Laboratory : 279/27-29 Soi Watpoman Sathupradit 19 Rd.
Chongnondsee Yannawa Bangkok 10120 Tel. 0-2285-4101 Fax. 0-2285-4856



Job No. : J020/24

Certificate No. : ST020/24

Page : 1 of 2

Certificate of Calibration

Equipment : pH/ISE Meter
Manufacturer : Orion
Made in : USA
Model : STAR A214
Serial No. : X36836
ID No. : UAE.WAT.025/2560
Range : 0 to 14 pH
Resolution : 0.001 pH 0.1 mV
UUC Condition As-Received : Good
Submitted by : บริษัท ยูนิค แอนาไลติกส์ แอนด์ อินชิตีวรี คอนซัลแตนท์ จำกัด
3 ซอยอุดมสุข 41 ถนนสุขุมวิท แขวงบางจาก
เขตพระโขนง กรุงเทพฯ 10260
Ambient Temperature : (25 ± 3) °C
Relative Humidity : (50 ± 15)%
Calibration Procedure : In - house method : WI-ST-LAB-7.2/1 based on direct measurement by using standard voltage calibrator
Issue date : Monday, May 27, 2024

Calibrated by : Khannika Sangkham

Approved by :
(Khannika Sangkham)
Laboratory manager

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 Science Tech Laboratory.

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Certificate of Calibration

Job No. : J020/24

Received date : Thursday, May 23, 2024

Calibration date : Thursday, May 23, 2024

Condition of this calibration result

1 Reference standard instrument : Voltage calibrator Yokogawa 7651 S/N. 91H441999 Certificate No. 23E3894

Due date 12 June 2024 TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)

2 This certificate was certified only for the instrument we calibrated

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

Result of Calibration

Function : pH meter

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

Unit Under Calibration	Applied Voltage (mV)	Nominal Value (pH)	UUC Reading (mV)	Correction (mV)	Uncertainty (± mV)	k Factor
pH Meter	177.48	4	177.4	0.1	0.060	2.00
Model STAR A214	0.0	7	0.0	0.0	0.064	2.00
S/N. X36836	-177.48	10	-177.4	-0.1	0.078	2.00

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

-0000- End of Certificate of Calibration -0000-

[Signature]

E/W-ST-LAB-1.2/1 # 3

เอกสารไม่ควบคุม
ฉบับพิมพ์ 00 วันที่ขึ้นระบบ 17/5/23



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2713-3000-29 FAX. 0-2719-0484



Cert. No.: 24TM587

Page : 1 of 3

Certificate of Calibration

Equipment : BOD Incubator

Manufacturer : ARCO

Model : UR-1320

Serial No. : -

ID No. : UAE.WAO.018/2551

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

Location : Lab Floor 2

Received Order : 01 April 2024

Calibration Date : 01 April 2024

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 30) %

Calibrated by : Krisda Malee

Approved by :

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

[Signature]
Approved Signatory

Issue Date : 5 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
A 0065063



Equipment : BOD Incubator

Condition As-Received : Used Item

Reference : 2404-0004OC-1

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	MY57013711	23LM115	TPA	11 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.

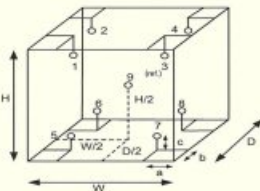
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available

Environment during calibration		
	Beginning	Finished
Temp. (°C)	27	26
REL.Humid. (%)	48	49
AC Supply (Volt)	221	220



Probe Installation Details :

Dimension of Chamber :

a = 10 cm	D = 0.62 m
b = 10 cm	W = 1.2 m
c = 10 cm	H = 1.2 m
	Capacity = 0.89 m ³

Position :	Ref. Std. ID No.:
1	18-18RTD-01
2	18-18RTD-02
3	18-18RTD-03
4	18-18RTD-04
5	18-18RTD-05
6	23-18RTD-06
7	18-18RTD-07
8	22-18RTD-08
9 (ref.)	18-18RTD-09

เอกสารไม่ควบคุม
a 1209743



Equipment : BOD Incubator

Condition As-Received : Used Item

Reference : 2404-0004OC-1

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
20.0	20.0	20.0	0.45	0.55	1.3	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	1	2	3	4	5	6	7	8	9 (ref.)	
20.0	19.954	20.183	20.235	19.707	19.708	19.739	19.785	19.821	19.828	0.66

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

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

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

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

UUC* : Unit Under Calibration

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

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

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เอกสารไม่ควบคุม
a 1209742



Cert. No.: 24TM588
Page : 1 of 3

Certificate of Calibration

Equipment : BOD Incubator
Manufacturer : ARCO
Model : UR-1320
Serial No. : -
ID No. : UAE.WAO.006/2553
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Lab Floor 2
Received Order : 01 April 2024
Calibration Date : 01 April 2024
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Krisda Malee
Approved by :
() Porpan Paipim
(✓) Suwit Injai
() Kunchit Promprat

Issue Date : 5 April 2024

The Uncertainties are for a confidence probability of approximately 95 %

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

เอกสารไม่ควบคุม

A 0065064



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2404-0004OC-2
Procedure Used :-

Cert. No.: 24TM588
Page : 2 of 3

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

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY57013711	23LM115	TPA	11 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.

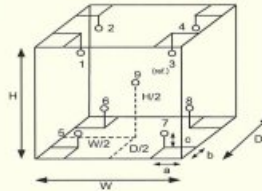
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available

Environment during calibration		
	Beginning	Finished
Temp. (°C)	28	27
REL.Humid. (%)	45	47
AC Supply (Volt)	220	221



Probe Installation Details :

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

Dimension of Chamber :

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

Position :	Ref. Std. ID No.:
1	22-18RTD-2/1
2	18RTD-2/2
3	18RTD-2/3
4	18RTD-2/4
5	18RTD-2/5
6	18RTD-2/6
7	18RTD-2/7
8	18RTD-2/8
9 (ref.)	18RTD-2/9

เอกสารไม่ควบคุม

a 1209741



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2404-0004OC-2
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Not Available

Cert. No.: 24TM588
Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
20.0	20.0	19.9	0.47	0.69	1.4	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	Position									
	1	2	3	4	5	6	7	8	9 (ref.)	
20.0	20.289	19.835	20.129	19.985	20.190	20.180	20.300	20.457	20.248	0.67

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 %.

-oOo-

เอกสารไม่ควบคุม

a 1209740

กำหนดจุดห้ามใช้งาน

References Certificate Number. : 234TM588

Equipment : BOD Incubator

Model : UR-1320

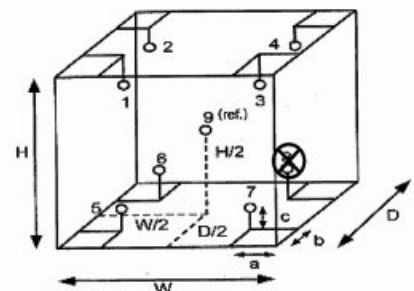
Serial No. : -

ID No. : UAE.WAO.006/2553

Manufacturer : ARCO

Calibration Point : 20.0 °C

Unit Under Calibration Setting : 20.0 °C



รูปภาพเครื่องมือ แสดงจุดที่ได้รับการสอบเทียบ และสัญลักษณ์ X แสดงจุดห้ามใช้งาน

กำหนดจุดห้ามใช้งานตำแหน่งที่...8.....

หมายเลข ใบรับแจ้ง.....

ใบรับรองการสอบเทียบฉบับนี้จัดทำขึ้นโดยมีผลใช้บังคับตั้งแต่วันที่ 25/07/2567 จนถึงวันที่ 25/07/2568

เอกสารไม่ควบคุม



Certificate of Calibration

Cert.No.: 24MM293
Page.: 1 of 3

Equipment : Electronic Balance
Manufacturer : Mettler Toledo
Model : XSR204
Serial No. : C117635043
ID No. : UAE.WAS.012/2584
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 : Khiti Rutanaprapachai
Approved by :
() Porpan Palpim
() 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-2
Procedure used :-

Cert.No.: 24MM293
Page: 2 of 3

Calibration were conducted using in-house calibration procedure CP-OB01 based on UKAS LAB 14 according to direct measurement method against standard weight.

Condition of this result of calibration

1. Reference standard instruments:-

Instruments	Model	Serial No.	ID No.	Test report No.	Due date
1) Standard Weight Set (E2)	15884	24053	70RC007	MM-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	0.27	2.03
200	200.0001	-0.0001	0.31	2

After Adjustment :

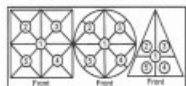
1. Determination of the standard deviation of weighing machine (n = 10)

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



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

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



Maximum difference between off-center and central loading

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

3. Departure from nominal value

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

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

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เอกสารไม่ควบคุม



Hanna Instruments (Thailand) Ltd.

410/67-68 Soi Ratchadapisek 24, Ratchadapisek Rd., Samsen-nok,
Huaykwang, Bangkok 10310 Tel: 0-2541-4199 Fax: 0-2541-4198



Certificate No. : HIT-2412-0389

Page : 1 of 2

CERTIFICATE OF CALIBRATION

Equipment : COD Test Tube Heater
Meter Model : HI839800-02
Tube Heater : 25 Vial Capacity
Temperature Range : (-10 to 160)°C
Manufacturer : Hanna Instruments
Condition As-Received : Used Product
Ambient Temperature : (25 ± 2)°C
Customer name : United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Rd., Bangchak,
Phrakhanong, Bangkok 10260
Received date : 18 March 2024
Calibrate date : 18 March 2024
Issue date : 20 March 2024
Calibrated Location : Hanna Instruments (Thailand) Ltd.
Calibration Procedure : This calibrator was conducted by using in-house: calibration procedure CP-04 by using certified reference standard instruments.

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

Approved by :
Mr. Anan Suwanchaisakul
Authorized Signatory



This certificate was certified only for the instrument we calibrated.

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

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

approval of the head of Hanna Instrument (Thailand).

เอกสารไม่ควบคุม

Condition of this calibration result:

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

Instruments	Model	Serial No.	Certificate No.	Traceable
Data Acquisition Switch Unit	34970A	MY44065265	WK2307-164-1	WK Electric Co., Ltd.
Digital Thermo-Hygrometer	HIT-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	150.0	0.50

Unit : °C

(1A)	(2A)	(3A)	(4A)	(5A)
150.308	150.221	150.101	150.121	149.738
(1B)	(2B)	(3B)	(4B)	(5B)
150.011	149.395	150.792	149.934	150.178
(1C)	(2C)	(3C)	(4C)	(5C)
150.071	150.052	150.477	150.400	150.451
(1D)	(2D)	(3D)	(4D)	(5D)
149.235	149.601	149.411	150.014	149.708
(1E)	(2E)	(3E)	(4E)	(5E)
150.096	149.107	150.024	150.002	149.342

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

Calibration Certificate

Certificate No.: 2402283-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhonong, Bangkok 10260

Page 1 of 4

Equipment: Electronic Balance

Manufacturer: METTLER TOLEDO

Model: XSR205DU

Serial No.: C009071872

ID No.: UAE.WAO.012/2563

Order No.: 2402283

Operation No.: 2402283-001

Date of Receipt: 2 April 2024

Date of Calibration: 2 April 2024

Calibrated by Mr.Jerawut Prapawuttipong
Scientist

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

Date of Issue: 9 April 2024

The uncertainties are for a confidence probability of approximately 95%

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

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

2008 ซอยอุดมสุข 41 ถนนสุขุมวิท แขวงคลองเตย เขตวัฒนา กรุงเทพมหานคร 10110 เอกสารไม่ควบคุม
2008 Soi 41, Aun Aum Road, Bang Yi Khan Subdive, Bang Phai District, Bangkok 10700, Thailand
Tel : +66(0) 2422 8568 Fax : +66(0) 2422 8545



Calibration Report

Certificate No.: 2402283-001-01

Equipment: Electronic Balance

Model: XSR205DU

Serial No.: C009071872

Capacity: 220 g

Manufacturer: METTLER TOLEDO

Resolution: 0.00001 g / 0.0001 g

ID No.: UAE.WAO.012/2563

Date of Calibration: 2 April 2024

Page 2 of 4

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

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1mg to 200g	8505967572	TCS	M23040525	8 April 2024
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	608-H1	NFLBTH 016/23	Quality Reborn	QR24-0343	9 February 2025

3. This certification is traceable to SI UNIT

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

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

Calibration Results:

1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
40	0.000052
80	0.000063
100	0.000048
200	0.000053

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)
100.0002	100.0001	100.0002	99.9999	100.0001	100.0001	0.0003

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

Calibration Report

Certificate No.: 2402283-001-01

Equipment: Electronic Balance

Model: XSR205DU

Serial No.: C009071872

Capacity: 220 g

Manufacturer: METTLER TOLEDO

Resolution: 0.00001 g / 0.0001 g

ID No.: UAE.WAO.012/2563

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	0.000000	0.000000	0.000000	0.00000008	2.00
0.001	0.001003	0.001001	-0.000001	0.00000091	2.00
0.005	0.0050001	0.004999	0.000001	0.00000094	2.00
0.01	0.0100003	0.010000	0.000000	0.00000091	2.00
0.05	0.0499996	0.050000	0.000000	0.00000098	2.00
0.1	0.1000011	0.100000	0.000001	0.0000011	2.00
0.5	0.5000016	0.500001	0.000001	0.0000014	2.00
1	1.0000003	1.000002	-0.000002	0.0000016	2.00
2	2.0000021	2.000001	0.000001	0.0000017	2.00
5	5.0000017	5.000002	0.000000	0.0000020	2.00
10	10.0000009	10.000000	0.000001	0.0000026	2.00
20	20.0000031	20.000002	0.000001	0.0000037	2.00
30	30.0000040	30.000003	0.000001	0.0000052	2.00
50	50.0000028	50.000004	-0.000001	0.0000068	2.00
80	80.0000068	80.000005	0.000002	0.000011	2.00

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

FOSS

Customer Service Report

Date: 8 Feb 2024
Customer: UAE
Instrument: DT2510

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

Report No: 9809

Address: Bangkok

Serial: 91394469

Hours Start 07:00 Finish 07:10

Travel To Customer 14:00

Labour 14:00 2 hrs

Travel From Customer 16:00 1 hr

Application		Special		Job Type		Standard	
Normal	x	Courtesy Visit	x	Installation	x	Training	x
Distributor	x	PMA Onboarding	x	Quote	x	In House	x
Internal	x	Warranty	x	Repair	x	PM	x
Digital Service	x	Sales Support	x	Remote	x	Other	x

PO/Quote Number: If applicable

PMA Type: FOSScare If applicable Contract No. If applicable

Details of Work / Test	Condition / Status
H PM DT2510	
<ul style="list-style-type: none">- ตรวจสอบเครื่องวัด- ตรวจสอบ connection- นำมาวัด cable kit, temp cut out- นำมาวัด gain- 300 - 100 °C = 10 min- 200 - 400 °C = 57 min- Instrument gain & factor = 419.0	<div>OK done</div>
Instrument Ready for Use	<div>OK Not OK If not OK - Comment</div>

Part No.	Batch	Description	Qty
60079492	13.04.2023	Cable kit digester	1
10011654	08.01.2023	Temperature probe	1

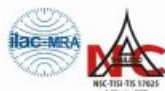
I confirm this report is accurate and complete

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? Email:

เอกสารไม่ควบคุม



Certificate of Calibration

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. 906753, 890591, 890593

[Signature]
(Mr. Pongpisut Suebchantha)

[Signature]
(Mr. Nitinun Srihawan)

Person in charge

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.

White Signature and Seal of DKSH Technology Limited
2533 Sukhumvit Road, Bangkok, Prakanong, Bangkok 10260
Phone: +66 2639 7930 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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เอกสารไม่ควบคุม

CAL-FM-CA-09: 12 Sep 2022

FOSS

Customer Service Report

Date: 29/05/23
Customer: UAE
Instrument: KT8100

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

Report No: 8411

Address: Bangkok, Thailand

Serial: 91394469

Hours Start 07:00 Finish 08:30

Travel To Customer 14:00

Labour 14:00 2 hrs

Travel From Customer 16:00 1 hr

Application		Special		Job Type		Standard	
Normal	x	Courtesy Visit	x	Installation	x	Training	x
Distributor	x	PMA Onboarding	x	Quote	x	In House	x
Internal	x	Warranty	x	Repair	x	PM	x
Digital Service	x	Sales Support	x	Remote	x	Other	x

PO/Quote Number: If applicable

PMA Type: PMAcare If applicable Contract No. If applicable

Details of Work / Test		Condition / Status
- ตรวจสอบ Function Test เครื่องวัด PM		OK
- ตรวจสอบ Function Test เครื่องวัด PM - kit 200/200 12 m		OK
- ตรวจสอบ Function Test เครื่องวัด PM - Heating Coil 2 3.2 m		OK
- ตรวจสอบ Function Test เครื่องวัด PM - Steam Generator		OK
- ตรวจสอบ Function Test เครื่องวัด PM - Steam Valve 2 4.8 m		OK
- ตรวจสอบ Function Test เครื่องวัด PM - Condenser Valve Cooling Valve 4.8 m		OK
- ตรวจสอบ Function Test เครื่องวัด PM - Water level 100 ml 100 ml 100 ml		OK
- ตรวจสอบ Function Test เครื่องวัด PM - 120 ml 120 ml 120 ml		OK
- ตรวจสอบ Function Test เครื่องวัด PM - 120 ml 120 ml 120 ml		OK
Instrument Ready for Use		OK Not OK If not OK - Comment

Part No.	Batch	Description	Qty
60079492	13.04.2023	Function PM kit 200/200 12 m	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? Email:

เอกสารไม่ควบคุม



Certificate No.: C24240057

Page: 2 of 2

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

White Signature and Seal of DKSH Technology Limited
2533 Sukhumvit Road, Bangkok, Prakanong, Bangkok 10260
Phone: +66 2639 7930 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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เอกสารไม่ควบคุม

CAL-FM-CA-09: 12 Sep 2022

DQEServices

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



ISO 17025:2017
CALIBRATION DATA

CERTIFICATE OF CALIBRATION

Certificate No. : SP24-018

Page 1 of 5

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

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

Location of calibration : Laboratory 315

Equipment : UV-Vis Spectrophotometer

Manufacturer : Agilent Technologies

Model : Cary 60

Serial No. : MY15410009

ID No. : UAE.WAT.020/2558

Received Date : 7 May 2024

Calibration Date : 7 May 2024

Issue Date : 9 May 2024

Condition Instrument : Good

Calibrated by : 
(Mr.Tanawat Rittidach)
Technical Manager

Approved by : 
(Ms.Chonhicha Sangnern)
Quality Manager


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

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

เอกสารไม่ควบคุม

DQEServices

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



ISO 17025:2017
CALIBRATION DATA

REPORT OF CALIBRATION

Certificate No. : SP24-018

Page 2 of 5

Environment Condition : Ambient Temperature 25 ± 5 °C

Relative humidity 55 ± 20 %RH

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

Certified Reference Materials :

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

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

Spectral Band Width of UUC : 1.5 nm.

Scan Speed of UUC : 60 nm/min

Scan Interval of UUC : 0.15 nm.

Resolution of UUC : Photometric 0.0001 Abs.

Wavelength 0.1 nm.

เอกสารไม่ควบคุม

DQE

Services

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

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

REPORT OF CALIBRATION

Certificate No. : SP24-018

Page 3 of 5

Calibration Results : Without adjustment

Photometric Accuracy :


Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
420	0.0000	0.0000	0.0000	0.0028	2.00
	0.5780	0.5747	0.0033	0.0031	2.00
	1.0484	1.0438	0.0046	0.0029	2.00
	2.1876	2.1832	0.0044	0.0080	2.00
440	0.0000	0.0000	0.0000	0.0028	2.00
	0.5595	0.5581	0.0014	0.0034	2.00
	1.0239	1.0231	0.0008	0.0035	2.00
	2.1230	2.1219	0.0011	0.0080	2.00
465	0.0000	0.0000	0.0000	0.0028	2.00
	0.5230	0.5184	0.0046	0.0030	2.00
	0.9633	0.9614	0.0019	0.0029	2.00
	1.9753	1.9731	0.0022	0.0070	2.00
546.1	0.0000	0.0000	0.0000	0.0028	2.00
	0.5181	0.5150	0.0031	0.0031	2.00
	1.0002	0.9964	0.0038	0.0033	2.00
	1.9973	1.9914	0.0059	0.0088	2.00
590	0.0000	0.0000	0.0000	0.0028	2.00
	0.5517	0.5485	0.0032	0.0030	2.00
	1.0803	1.0772	0.0031	0.0030	2.00
	2.0373	2.0293	0.0080	0.0080	2.00
635	0.0000	0.0000	0.0000	0.0028	2.00
	0.5591	0.5565	0.0026	0.0031	2.00
	1.0518	1.0482	0.0036	0.0030	2.00
	1.9274	1.9202	0.0072	0.0079	2.00

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REPORT OF CALIBRATION

Certificate No. : SP24-018

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Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000	0.0000	0.0000	0.0050	2.00
	0.7469	0.7435	0.0034	0.0057	2.00
257	0.0000	0.0000	0.0000	0.0050	2.00
	0.8674	0.8639	0.0035	0.0060	2.00
313	0.0000	0.0000	0.0000	0.0050	2.00
	0.2919	0.2907	0.0012	0.0051	2.00
350	0.0000	0.0000	0.0000	0.0050	2.00
	0.6430	0.6402	0.0028	0.0055	2.00

เอกสารไม่ควบคุม

REPORT OF CALIBRATION

Certificate No. : SP24-018

Page 5 of 5

Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor k
241.72	242.0	-0.28	0.18	2.00
279.45	279.5	-0.05	0.18	2.00
287.81	287.9	-0.09	0.18	2.00
334.06	333.9	0.16	0.18	2.00
360.93	360.5	0.43	0.18	2.00
418.59	418.1	0.49	0.18	2.00
445.94	445.6	0.34	0.18	2.00
453.66	453.3	0.36	0.18	2.00
460.02	459.8	0.22	0.18	2.00
536.59	536.0	0.59	0.18	2.00
637.98	638.7	-0.72	0.18	2.00
431.38	430.8	0.58	0.18	2.00
472.50	472.4	0.10	0.18	2.00
513.47	513.7	-0.23	0.18	2.00
528.88	529.1	-0.22	0.18	2.00
573.17	573.5	-0.33	0.18	2.00
585.35	585.2	0.15	0.20	2.00
684.40	685.1	-0.70	0.18	2.00
740.72	741.4	-0.68	0.20	2.00
748.55	749.1	-0.55	0.18	2.00
807.03	807.3	-0.27	0.18	2.00
879.28	879.3	-0.02	0.18	2.00

Remark : - UUC = Unit Under Calibration

- N/A = Not Available

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

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

- * Indicates non TISI accredited

- End of Certificate -

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021

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.Chonthicha Sangngern)

Quality Manager

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

The measurement capability of the laboratory and its 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.

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FM-708-02 R01 1/11/2021

REPORT OF CALIBRATION

Certificate No. : SP24-008

Page 2 of 5

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

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

Certified Reference Materials :

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

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

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

Spectral Band Width of UUC : 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.

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FM-708-02 R01 1/11/2021

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

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FM-708-02 R01 1/11/2021



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 0.7469	0.000 0.748	0.0000 -0.0011	0.0050 0.0057	2.00 2.00
257	0.0000 0.8674	0.000 0.865	0.0000 0.0024	0.0050 0.0059	2.00 2.00
313	0.0000 0.2919	0.000 0.293	0.0000 -0.0011	0.0050 0.0051	2.00 2.00
350	0.0000 0.6430	0.000 0.641	0.0000 0.0020	0.0050 0.0055	2.00 2.00

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FM-708-02 R01 1/11/2021



REPORT OF CALIBRATION

Certificate No. : SP24-008

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Wavelength Accuracy :

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

Remark : - UUC = Unit Under Calibration

- N/A = Not Available

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

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

- * Indicates non TISI accredited

- End of Certificate -

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FM-708-02 R01 1/11/2021

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3 : EQUIPMENT CALIBRATION AND TESTING SERVICES

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

TEL. 0-2717-3000-29 FAX. 0-2719-9484

Certificate of Calibration

Cert.No.: 23CH1148

Page.: 1 of 2

Equipment : Turbidity Meter
 Manufacturer : Oakton
 Model : T100IR
 Serial No. : 1120501017
 ID. No. : UAE.WAT.056/2563
 Condition As-Received : Used Item
 Received Date : 13 September 2023
 Calibration Date : 14 September 2023
 Reference : 2309-0458DSC-1
 Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
 3 Soi Udumuk 41, Sukhumvit Road,
 Bangchak, Phrakhanong, Bangkok 10260

Ambient Temperature : (25 ± 2.5) °C
 Relative Humidity : (50 ± 20) %
 Calibration Procedure : In-house method : CP-CH11
 based on direct measurement by
 using Formazin standard solution

Calibrated by : Walalak Sirthean

Approved by : Approved Signatory

() Saithip Meangmai
 (✓) Warakorn Lemgagtrakul
 () Ponpan Paipim

Issue Date : 15 September 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 Calibration and Testing Equipment Services.

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A 0011853



Cert.No.: 23CH1148

Page.: 2 of 2

Condition of this calibration result

1. Reference Standard Instruments :

This certification is traceable to the International System of unit (SI unit) through:-
 - Technology Promotion Association (Thailand-Japan).

Instruments	Serial No.	ID No.	Certificate No.	Due date
1) Thermo-Hygrograph	1103328	130EC010	23C1361	13 June 2024
2) Electronic Balance	1124013382	140RC006	23MM18	20 Feb 2024

2. Standard Material : The Formazin suspension has been prepared gravimetric from

Material	Manufacturer	Lot No.	Assay
1) Hexamethylenetetramine	HIMEDIA	0000493947	99.65%
2) Hydrazinium Sulfate	HIMEDIA	0000522014	99.40%

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

Calibration result

Performing five - Formazin suspension standard curve by using 0,20,100,400,800 NTU
 Turbidity Meter Serial Number : 1120501017

Standard Formazine suspension (NTU)	UUC* Reading (NTU)	Uncertainty of Measurement (± NTU)	Coverage Factor k
0	0.00	0.0067	2.00
20	20.3	0.39	2.00
100	101	0.76	2.00
400	401	1.5	2.05
800	800	2.1	2.23

Remark

- UUC* = Unit Under Calibration
 - NTU = Nephelometric Turbidity Units

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

-000-

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Agilent Preventive Maintenance Services

Agilent GCMS Preventive Maintenance

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

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

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



Introduction

This checklist covers the following model(s):

Type	Model
SQ	5973 Series MSD
SQ	5975 Series MSD
SQ	5977 Series MSD
TQ	7000 Series MS/MS
TQ	7010 Series MS/MS
QTOF	7200 Series QTOF
QTOF	7250 Series QTOF

Customer Information

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

Customer Responsibilities

Customers should ensure that all necessary operating supplies, consumables, and usage-dependent items such as gases, vials, syringes, calibrant solution and solvents required for successful preventive maintenance are available. A customer representative should be available while the preventive maintenance is being performed.



- Complete the relevant checkboxes in the checklist using either a "X" or tick mark "✓".
- Check "Service not applicable" check boxes to indicate services/tasks not delivered, as appropriate.
- Complete the Preventive Maintenance services in order by sections: Review, System Checks, Pump maintenance, Cleaning System and Filters, then System Post Check.
 - The tasks in each section may be completed in the most logical order relevant to the system. Complete the **Service Review** section together with the customer.
- Complete the fields for page numbers at the foot of each selected page
- Add relevant page numbers to selected pages and complete the total number of pages field in the Service Verification section
- Complete Signature Page and attach Signature Page to Service Order.

Additional Instruction Notes

- Preventive maintenance is a factory recommended procedure designed to reduce the likelihood of electromechanical failures. Failure to perform preventive maintenance may reduce the long-term reliability of certain instruments and systems. **Two preventative maintenances (PMs) per year are recommended, the Major PM Service will be performed annually with an Interim PM performed 6 months after the Major PM.**

Definition of the Task/Recommended items within the document

Task		Recommended		
Yes	No	Interim	Major	As Needed
✓				
	✓			
		✓		
			✓	
				✓

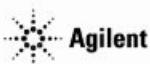
Yes selected means that the task was done or the part was required

No selected means that the task was not done or the part was not required.

Interim selected means that this task is recommended to be done at 6-month intervals

Major selected means that this task is recommended to be done yearly, if the customer would like a service to be done at the 6-month interval then the service could be purchased

As needed selected means that the task was done, or the part was used as needed. For example, there could be two types of filters that could be used, and this was the one selected.



Important notice for customers

The customer should complete the following before the Support Provider arrives on site:

- Perform an autotune and retain the printed tune report just prior to the start of the PM to verify performance of the equipment.

Note: It is recommended to have the customer run the autotune and tune evaluation prior to the PM and then start the vent cycle so that the instrument will be ready for the service representative.

Important Customer Web Links

- To access Agilent training and education, visit <http://www.agilent.com/chem/training> to learn about training options, which include online, classroom and onsite delivery. A training specialist can work directly with you to help determine your best options.
- To access the **Agilent Resource Center** web page, visit <https://www.agilent.com/en-us/agilentresources>. The following information topics are available:
 - Sample Prep and Containment
 - Chemical Standards
 - Analysis
 - Service and Support
 - Application Workflows

- The **Agilent Community** is an excellent place to get answers, collaborate with others about applications and Agilent products, and find in-depth documents and videos relevant to Agilent technologies. Visit <https://community.agilent.com/welcome>
- Videos about specific preparation requirements for your instrument can be found by searching the **Agilent YouTube** channel at <https://www.youtube.com/user/agilent>
- Need to place a service call?** Flexible Repair Options | Agilent

Service Engineer's Responsibilities

- Contact the customer and ensure that all necessary supplies are available before the preventive maintenance visit.
- Only select those pages that relate to the system or module being serviced.
- Complete empty fields with the relevant information.



Instrument Maintenance

Select the appropriate service to be performed.

- ☐ Interim Preventive Maintenance (when available, is typically 6 months or at the request of the customer)
- ☒ Major Preventive Maintenance (Yearly)
- ☐ Enhanced Preventive Maintenance (when available, is provided "As needed")

System Information

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

Instrument System Name and ID	US2009.M037
Instrument System Site and Location	United Analyst And Engineering / GCMS

List System Component Product Numbers	List the Serial Numbers of each Component
1. 67077B	US2009.M037
2.	
3.	
4.	
5.	
6.	

Preparation

- ☒ Discuss any specific issues with the customer before starting.
- ☒ Review the instrument logbook for recorded problems and comments.
- ☒ Save instrument control settings before starting the procedure.
- ☒ Perform a general inspection of the system for cleanliness.
- ☒ Check for proper installation of parts, assemblies, sensors etc.
- ☒ Check system for required installation of components and implementation of Service Notes
- ☒ Check firmware version(s). Updating to the most current versions is strongly recommended. Verify with the customer before updating.

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Preventive Maintenance Procedures

☐ Service Not Applicable

Interim / Major Preventive Maintenance – GCMS

Yes/No	Interim/Major	Description
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Perform general inspection of system for cleanliness
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Discuss any problems the customer is having with the instrument
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Review customer maintenance records and exclude maintenance on recently serviced items
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Review the most recent autotune report. This will give a starting point for evaluating spectral peaks, baseline noise, peak shape, mass assignments and resolution.

Interim / Major Preventive Maintenance – System Checks

☐ Service Not Applicable

Yes/No	Interim/Major	Description
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Verify that calibration peaks were seen prior to starting the PM
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Vent the instrument
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Inspect vacuum hoses, pump, exhaust tubing, and power cords for excessive wear.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Visually inspect calibrant levels – PFTBA PFOTD (if appl.), IRM (if appl.). Refill if available.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Look for any obvious external damage or problems.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Clean air intake(s). Cosmetic cover(s) may need to be removed.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Verify system line voltage meets instrument specifications: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	For HydroInert systems, verify customer is running hydrogen: Yes <input type="checkbox"/> No <input type="checkbox"/>

Interim / Major Preventive Maintenance – Wet Mechanical vacuum pumps

☐ Service Not Applicable

Yes/No	Interim/Major	Description
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Check for evidence of oil leakage. Check pump gasket for leakage.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	GC/MS SQ with diffusion pump, drain and replace diffusion pump oil.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Drain and replace mechanical pump oil.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Replace Oil Mist Filter if applicable.

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Yes/No	Interim/Major	Description
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Discuss with customer the need for more frequent oil changes if the oil is dirty
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Don't use mist filters with Chemical Ionization.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Perform anti-suckback valve test. Power on until side plate is held closed, power off and check that side plate holds closed. Visually confirm that no oil returns up vacuum hose.

Interim / Major Preventive Maintenance – Dry Mechanical vacuum pumps - Diaphragm

☒ Service Not Applicable

Yes/No	Interim/Major	Description
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Check for evidence of poor vacuum – Turbo power demand, poor manifold vacuum, etc.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Clear air flow paths of dust.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	If vacuum is poor, then replace the diaphragm pump.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Perform anti-suckback valve test. Power on until side plate is held closed, power off and check that side plate holds closed.

Interim / Major Preventive Maintenance – Dry Mechanical vacuum pumps - Scroll

☒ Service Not Applicable

Yes/No	Interim/Major	Description
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Replace the tips seal on the IDP pump.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Check for evidence of poor vacuum – Rough vac pressure, turbo power demand, poor manifold vacuum, etc.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Replace the Exhaust Filter if required.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Discuss with customer the need for more frequent changes, if needed.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Inform customer that pump gas ballast should be installed all the time.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Perform anti-suckback valve test. Power on until side plate is held closed, power off and check that side plate holds closed.

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Interim / Major Preventive Maintenance – Cleaning System and Filters

☐ Service Not Applicable

Yes/No	Interim/Major	Description
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Remove dust from fans and vent covers.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Verify fans are functional and that there is enough space around the instrument for proper cooling.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Source cleaning (all sources except HydroInert)
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Open analyzer and remove the source.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Disassemble, Clean, Re-assemble source. (7200, also, remove and clean entrance lens)
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Re-install source and close analyzer.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	HydroInert Source
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Source NOT to be abrasively cleaned. No cleaning required at PM. If a decrease in performance is observed, recommend to the customer that filaments, insulators (repeller and extractor), extractor lens, and repeller lens may need to be replaced to restore performance. HydroInert source should not be run with helium carrier.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Filters
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Replace RMSH-2 Helium gas filter (collision cell gas) – if applicable.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Replace RMSN-2 Nitrogen gas filter (collision cell gas) – if applicable.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Replace RMSHY-2 Hydrogen gas filter (HydroInert and JetClean) – if applicable.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	CP17973 – Gas Clean GS/MS Filter (for He, N2 or H2 carrier) – if required
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	S190-9071 – Methane Gas Filter (CI systems) – if applicable

Guidance: Gas filters need to be changed only if required (ie indicating traps show color change, or if Big Universal Trap are approaching saturation based on time installed or number of gas cylinders changed for that trap)

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Interim / Major Preventive Maintenance – System Post Check

☐ Service Not Applicable

Yes/No Interim/Major	System post-check	
	Description	
<input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Pump system back down. Wait until system stability has been achieved.	
<input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Verify system vacuum reading(s) via the gauge controller.	
<input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Leak Check	
<input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>		Verify system in manual tune
<input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>		Compare against previous tune file report(s)
<input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Change to Tune and verify that all temperatures, pressures, and gas flows reach method set points	
<input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Check manually that you have calibration peaks.	
<input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	EI Autotune Performed	

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

Service Review

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

Test Results

Test Description	Expected Test Result	Actual Test Result
------------------	----------------------	--------------------

Signature Page

Service Engineer Comments (optional)

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

Service Verification

Service Request Number:

Date of Service Completion:

1006790785

27 May 2024

Service Engineer Name

Customer Name

Service Engineer Signature

Total number of pages in this document:

Agilent CrossLab Start Up Services
**Agilent 8890 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.

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>.

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.

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System Information

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

Instrument System Name and ID	CN1945A066
Instrument System Site and Location	United Analyst And Engineering / GCMS

List System Component Product Numbers	List the Serial Numbers of each Component
1. 63542A	CN1945A066
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.

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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

- ✓ Replace the split vent trap cartridge filter using the Maintenance procedure from either the Browser User interfaces 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.
- ✓ For the inlets installed, perform inlet maintenance using the Maintenance procedure from the Browser User interfaces. Record the results. (Leak and Restriction Test)
- ✓ 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 using the Browser interface.
- ✓ Perform inlet pressure decay test(s) from the diagnostics screen on the Browser User interface. Record if test passed or failed in the results table.

Note: 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.

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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

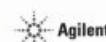
Restore Instrument

- ✓ 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
- ✓ 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.

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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.

PM Test Results Table

Test description	Before PM Service	After PM Service
Front detector output	N/A	N/A
Back detector output	N/A	N/A
AUX 1 detector output	N/A	N/A
AUX 2 detector output	N/A	N/A
Test description	Expected test result	Actual test result
Leak and Restriction Test after front inlet maintenance	Pass	Pass
Leak and Restriction Test after back inlet maintenance	Pass N/A	N/A
Leak and Restriction Test after front inlet Split Vent Trap replacement	Pass	Pass
Leak and Restriction Test after back inlet Split Vent Trap replacement	Pass N/A	N/A
Front inlet pressure decay test	Pass	Pass
Back inlet pressure decay test	Pass N/A	N/A

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Document Control Logs

Revision Log

Revision	Date	Author	Reason for update
Revision of document	Date of issuance	Author of document	Author to describe main features/changes made for this specific revision
1.00	02-Jan-2019	Dave McKenica	Initial Release
2.00	30-Dec-2020	Gary Boardman	Updated New Template and terminology change: Familiarization to Introduction. Create New Agile Document Number: D0007039


Approval Log

Revision	Approver	Title of approver
Add revision number	Add approver name here	Add approver's function or title here
1.00	Suneetha Tippireddy	GC and GCMS Product Support Manager
2.00	Josh Roark	GC and GCMS Product Support Manager

Designated Evaluation Log

Revision	Designated Evaluator (DE)	Title of DE	DE Number
Add revision number	Add name	Add function or title	Add DE number here
2.00	Michael Zumwalt	CrossLab Start Up Services Application Consulting Lead	44166.759722222

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PM Parts List Table

Note: The following kits are recommended for capillary and purged packed inlets. If this is a general PM and the customer has a preferred set of consumables, you may use the customer's consumables.

Part description	Part number	Product or model# where used	Quantity consumed
SSL Capillary Inlet PM kit, Splitless	5188-6497	8890 GC	1
SSL Capillary Inlet PM kit, Split	5188-6496	8890 GC	1
SSL Capillary Ultra Inert Inlet Gold Seal with Washer	5190-6144	8890 GC	N/A
SSL Capillary Ultra Inert Inlet Splitless Liner - Single taper with Glass Wool	5190-2293	8890 GC	N/A
SSL Capillary Ultra Inert Inlet Low Pressure Drop Split Liner - with Glass Wool	5190-2295	8890 GC	N/A
PP Inlet PM kit	5188-6498	8890 GC	N/A
Split vent trap PM kit, single cartridge (for MMI, PTV & VI)	5188-6495	8890 GC	N/A
MMI Cleaning Kit	G3510-60820	8890 GC	N/A
PTV Septumless Head Rebuild Kit	5182-9747	8890 GC	N/A
PTV Septumless Head Teflon Guide	5182-9748	8890 GC	N/A
Ignitor (glow plug) assembly with O-ring	19231-60680	8890 GC	N/A
FID Collector Rebuild/Cleaning Kit	G1531-67000	8890 GC	N/A
FID Collector Replacement Kit	G1531-67001	8890 GC	N/A
Standard .011-inch FID Jet	5200-0176	8890 GC	N/A
Universal .018-inch FID Jet	5200-0177	8890 GC	N/A
FPD Ignitor Assy	19256-60800	8890 GC	N/A

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Service Engineer Comments

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

Service Completion

Service request number 6006790785 Date service completed 27 May 2024
Agilent signature [Signature] Customer signature _____
Total number of pages in this document 10 Page.

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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.

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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. MY 18030001
2. G 8015 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 <u>OneNeb</u> other
Spray Chamber	Cyclonic Single Pass <u>Cyclonic Double Pass</u> other
Torch	Radial <u>Dual View</u> other
Injector Diameter	2.4mm <u>1.8mm</u> 1.4mm 0.8mm other
Injector Material	Quartz <u>Ceramic</u> other

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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. ☒
- 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. ☒
- 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.

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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 is necessary.
- Clean X and Z axis slide shafts.
- Using customer's racks and the Agilent software move the sample probe to the 4 outermost corners and rinse port, ensure that the probe is approximately centered in the vial.

SPS 4 Auto Sampler

- 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 FFC cables for cracks, incorrect positioning, damaged edges or damaged connectors.
- Pump Tubing Replacement. Replace peristaltic pump tubing. Replace all tubing that goes from the rinse station to the pump and from the pump to the waste/rinse bottles

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

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**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	8364.8	4375.0	8400.8
Mn 257.610 nm SRBR	11064.7	31842.1	12801.7	30846.2
Al 396.152 nm SBR	7.5	14.9	9.9	16.8
K 766.491 nm SBR	5.1	36.8	6.4	29.7

* 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

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**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	224.913 VAC
Mains Current	0.204 A	0.184 A
Instrument Temperature	22.8 °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
CCD Temperature	-39.8 °C	-39.8 °C
Thermal Stabilizer	35.0 °C	35.0 °C
Argon Supply Pressure	671.34 kPa	627.33 kPa
Purge Gas Supply Pressure*1	674.90 kPa	645.40 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	11.92 L/min
Auxiliary Gas Flow	No measurement	1.00 L/min
RF Power	No measurement	1200 W
RF Supply Current	No measurement	8.663 A
RF Supply Voltage	No measurement	184.66 V

*1 If option installed

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**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.

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**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 6005625287 Date service completed 30 Nov 2022

Agilent signature Woravit T. Customer signature Jim

Document part number: G8014-90075

Issued: 3 February 2017, Revision: 1.1

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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

Pass

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	59.82
K (766.491 nm)	≤ 80.00	64.94

เอกสารไม่ควบคุม

Sensitivity Test

Pass

Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 46.0	SRBR	147.7	1156.5	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	294165.0	567.6
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

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	3855.1	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	14465.2	580.4
Mn (257.610 nm)	≥ 10625.0	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	38.8	1922163.4	50858.1

เอกสารไม่ควบคุม

Precision Test

Pass

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

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

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	18.51

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เอกสารไม่ควบคุม

Gas Flows Test			Pass		
Nebulizer Target Flow	Actual Flow	Back Pressure	Auxiliary Target Flow	Actual Flow	Back Pressure
0.70	0.70	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		

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เอกสารไม่ควบคุม

Report Summary		
Instrument Model	Agilent 5100/5110 VDV ICP-OES	
Instrument ID	G8011A/G8015A	
Instrument Serial Number	MY18030001	
Software Version	7.3.1.9507	
Firmware Version	3442	
Tested By	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		Pass
	Radial	Axial
Intensity	5674608	5823476
Wavelength	737.212	737.212

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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	6.30			
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 (614.171 nm)	≤ 42.00	24.96			
Ar (675.283 nm)	≤ 74.00	59.38			
K (766.491 nm)	≤ 80.00	65.63			

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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	52688.6	4873.6
Ba (493.408 nm)	≥ 34.0	SBR	154.6	2287291.6	14698.1
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	1287989.0	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

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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	

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เอกสารไม่ควบคุม

Milestone DMA-80 Service Protocol

SITHIPORN
associates

DMA-80 DIRECT MERCURY ANALYZER System



Milestone DMA-80 Service Protocol

DMA-80 Direct Mercury Analyzer

SERVICE PROTOCOL REPORT

To be filled in before service visit (1st page)

Customer information:

Company:	บ.ยูไนเต็ด แอนาไลติกส์ จก. (สนง.ใหญ่)
Department:	LAB
Person in charge:	คุณ ภูซงค์ พานิชย์เลิศอำไพ
Address:	ซอยอุดมสุข 41 ถนนสุขุมวิท กรุงเทพมหานคร 10260
Tel.:	+66 (86) 3191292
E-mail:	bhuchonk@uaeconsultant.co.th

Technical data:

Unit Serial Number:	11030982		
Terminal type or USB-640 Gateway:	Terminal-640	SN	1012000091
Software, type and revision:	Easy Control	Rev.	
Air Compressor (if present)	-	SN	-
Gas system pump (if present)	-	SN	-
Installation and last maintenance dates:	Inst. on: -	Maint. on:	17-11-66

NOTE: after achievement of the following protocol a filled and signed copy of this report has to be sent to Milestone srl at: service@milestonesrl.com

For the best result of the test below we recommended to use the Milestone DMA-80 Service Kit (PN DMA-SKIT).

1. VISUAL INSPECTION

	Good	Damaged	Corroded/Dirty
External chassis	✓		
Inside	✓		
Electric parts	✓		
Screws	✓		

2. ELECTRICAL SAFETY TEST

Using a suitable testing device check the below reported parameters and take note of the results.

Parameter	Result	OK	Not OK
Voltage : 230 VAC (±10%)	Actual value : 224 VAC	✓	
Ground : ≤ 2	Actual value: 0.9 VAC	✓	

3. PRESSURE CHECK

	Oxygen (purity O ₂ >99,95%)	Milestone air compressor
Gas carrier	Purity:	✓

The pressure at the supply source manometer should be approx. 4.0bar
The flow rate depends by type of cuvette installed on the DMA-80 unit.

	Correct value	Actual value	Final value	Correct value	Actual value	Final value	Correct value	Actual value	Final value
Inlet pressure	3,1 bar	-	-	3,1 bar	-	-	3,1 bar	3,1 bar	Pass
Flow rate	10-12 l/h	-	-	8-10 l/h	-	-	6-8 l/h	6 l/h	Pass

Check all possible leakage points and their conditions:

	Good	Damaged	Corroded
Tubing	✓		
Silicon joints	✓		
O-rings	✓		
Cuvette sealing O-rings	✓		
Gas connections	✓		
Valves	✓		
Sample boat carrier	✓		
Catalyst flange	✓		

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4. AUTOSAMPLER SYSTEM

	OK	Not OK	Re-Adjusted
Calibration of autosampler motor	✓		
Cylinders alignment	✓		

	Fast	Slow	Normal
Speed of pneumatic cylinders			✓

Using the maintenance grease, periodically lightly lubricate all exposed steel rods of the horizontal and vertical cylinders.

5. COMPONENTS CHECK

Conditions of the different parts used/installed on DMA unit:


	OK	Not OK	Replaced	Cleaned
Catalyst tube	✓			
Amalgamator	✓			
Quartz boats	✓			
Nickel boats	-			
Autosampler plate	✓			
Gas kit accessories	-			

6. TEMPERATURES

		Correct value	Actual value	Final value (Pass)
Drying/ Decomposition furnace	If controlled by Infrared sensor	850°C ± 10°C	-	-
	If controlled by thermocouple	650°C ± 10°C	650	Pass
Catalyst furnace	Type 1	515°C ± 5°C	-	-
	Type 2,3	565°C ± 10°C	565°C	Pass





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Amalgamator stand by temperature	If controlled by Infrared sensor	170°C ± 10°C	170°C	Pass
	If IR sensor is not present	145°C ± 25°C	-	-
Amalgamator heating temperature	850°C ± 10°C		850°C	Pass
Cuvette	125°C ± 5°C		125°C	Pass

7. SPECTROMETER

The spectrometer can be equipped with a single beam system (ducon lamp) or with a dual beam system (tricon lamp)

	Old cuvette type						Actual cuvette type					
												
	Gain			Offset			Gain			Offset		
	Correct value	Actual value	Final value	Correct value	Actual value	Final value	Correct value	Actual value	Final value	Correct value	Actual value	Final value
Dualcell system	3,6VDC	-	-	0,015VDC ± 0,005VDC	-	-	3,93VDC	3,9V	Pass	0,015VDC ± 0,005VDC	0,015V	Pass
Tricell system*	-	-	-	-	-	-	3,96VDC	-	-	-	-	-

(*)The recommended Hg lamp operating signal should be around 3,96VDC (for detector 2) and 3,93VDC (for detector 1).

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	OK	Not OK
Conditions of the spectrometer system	✓	
Alignment between lamp, cuvette and detector	✓	
Cuvette cleaning (glass windows, sealing O-rings...)	✓	
Lamp intensity	✓	
Operation of the mechanical shutter (if present)	✓	

8. MILESTONE AIR COMPRESSOR (N.A.)

Maintenance	OK	Date last service
Drain (compressor)		
Replacing air filters (air purification module)		
Check sealing connections		

9. PARTS TO BE REPLACED

PN	DESCRIPTION	Replaced	Not Replaced
DMA8133	Catalyst tube: 6 months if the unit runs daily, 1 year if the unit is used rarely. <i>In case of analyse of sample with high organic concentration the lifetime of the catalyst can be less than 6 months.</i>	✓	
DMA8134	Amalgamator: 6 months if the unit runs daily 1 year if the unit is used rarely	✓	
DMA8195A	Hg lamp tri-cell (model 2011): 5 years		✓
DMA8137	Hg lamp dual-cell: 5 years	-	-
70200	Hg trap 1 year		✓
DMA8058/B	Amalgamator coil 6 months/1 year or as soon as the heating is not more homogeneous		✓
DMA8142	Nickel sample boats (set of 40pcs) 2 years if strongly used, replace after 1 year	-	-
DMA8347	Quartz sample boats (set of 10pcs) 2/3 years		✓
DMA8335	Metal sample boat carrier 2 years		✓
SL0108	PU-tube diam. 6/4 mm for internal O ₂ /air supply 2 years		✓
SO0376D	Heating coil for drying/decomposition 2 years		✓

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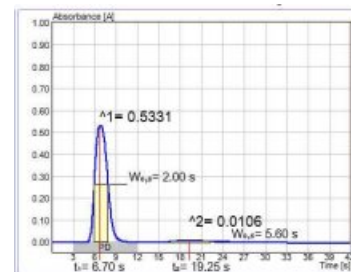
เอกสารไม่ควบคุม

10. TESTING PROCEDURE

It consists to run some measurements for the evaluation of the analytical performance of the unit, like: absorbance, peaks shape, temperatures, lamp signal and verify the proper working of whole system.

- 1) Run minimum 2 blanks on the same sample boat (quartz if possible) in manner to clean it
- 2) Run blanks until absorbance value (Height) decrease under 0.0030 in cell 1
- 3) Set a fresh and stabilized 100µg/L Hg standard according to the prescriptions reported on the DMA80 User Manual. The quality of the used standard is fundamental for the success of the entire procedure
- 4) Weight approximately 100µg of the fresh 100µg/L – Standard (10ng) and start the analysis as a single measurement mode
- 5) Repeat five times the test
- 6) Run again two blanks measurements

Pos	Sample name	Amount	State	Remarks
1	clean boat	1.0000g		POINT 1-2
2	clean boat	1.0000g		
3	10ng	0.1000g		POINT 4 - 5
4	10ng	0.1000g		
5	10ng	0.1000g		
6	10ng	0.1000g		
7	10ng	0.1000g		POINT 6
8	clean boat	1.0000g		
9	clean boat	1.0000g		



- The shape of the peak must be regular.
- The distance between Peak Cell 1 and Peak Cell 2 must be between 11 to 15 seconds.

- Results

Pos	Sample name	Amount	State	Height	Hg [ng]	[µg/kg]	Cal. Factor	Σ
1	Stability 10ng		M			100.290	0.92%	
2	Stability 10ng	0.1000g	✓	0.4931	9.9095	99.0951	1.0000	Σ
3	Stability 10ng	0.1000g	✓	0.4965	9.9934	99.9335	1.0000	Σ
4	Stability 10ng	0.1000g	✓	0.4991	10.059	100.597	1.0000	Σ
5	Stability 10ng	0.1000g	✓	0.4976	10.022	100.221	1.0000	Σ
6	Stability 10ng	0.1000g	✓	0.5031	10.160	101.602	1.0000	Σ

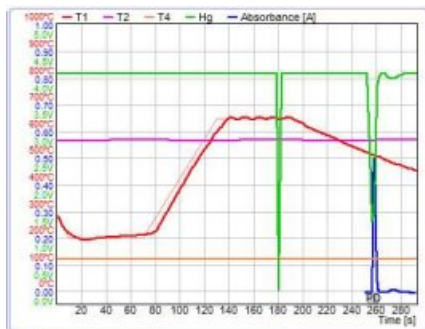
- The obtained absorbance (height) must be > 0.42 in cell 1 for each 100ppb analysis (0.22 with cuvette installed until December 2005, DMA s/n 05120292.)
- The relative standard deviation (rsd) is < 3 %.
- After two blanks (after 10ng measurements), the absorbance is < 0.0030 in cell 1(*).

(*) This condition is valid only in case the unit has: catalyst and amalgamator new, conditioned and never use before, sample boat carrier new and/or perfectly cleaned, catalyst flange new and/or perfectly cleaned, cuvette new and/or perfectly cleaned, tubes, silicon joints and o-rings replaced. Otherwise other blanks (more than 2) might be necessary.

- Temperatures & signal profiles

Now, it is possible to evaluate:

- Peaks



- The Hg lamp signal must be between 3,8 and 4,5V and stable. A few minutes after the start of the analysis the lamp does switch off because of the zero detection but then it instantly returns to the original condition. In case of Tricell configuration two green colour graphics are reported. After the zero shuttering the time necessary to return to full signal is longer on Tricell compare to Ducon lamp.
- During the run the catalyst oven temperature must be stable around to 565°C or 515°C.
- The drying and ashing furnace must be follow the set temperature method.
- During the run the Amalgamator furnace temperature must be stable at the stand by temperature (170°C or 145°C). Then at the release step it must raise up to 850/900°C.
- The Cuvette temperature must be stable at approximately 125°C.
- The Hg absorbance peaks must be correctly detected and reported.

11. FINAL REPORT

All screws inserted and tightened	✓
All tubing sealing connections checked, cleaned or replaced and tightened	✓
All heating elements are working	✓
Sensors installed, checked and tightened	✓
Safety devices (thermo switch) fully checked	✓
All cooling fans are functioning	✓
Testing procedure successfully passed	✓
Necessary tools available at customer's site	✓
Last revision of User Manual available at customer's site	✓
Advised customer about care and maintenance instructions	✓

Remarks:

Working hours of Service Engineer	
-----------------------------------	--

Service Engineer Name	Signature	Date
ชานมเฉลิม วิสัยศรี	ชานมเฉลิม วิสัยศรี	17-11-2023

Laboratory Manager / Operator acceptance signature:	
---	--

Serial-No.: K170A0153 Customer-No.: C04-006
Date: 12 February 2024 Carried out by: Mr. Srichai Fak-On

Maintenance with following Operational Qualification (OQ)
(requires a separate OQ protocol)



Maintenance Protocol

Atomic Fluorescence Spectrometer mercur DUO / mercur DUO plus

เอกสารไม่ควบคุม

Company	บริษัท ยูโนเค็ด แอนนาไลซิส แอนด์ เอ็นจิเนียริ่งคอนซัลแตนท์ จำกัด
User	คุณกรวิทย์
Department	ห้องปฏิบัติการ (Mercur Analysis)
Street	3 ซอยอุดมสุข 41 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง
Zip Code, City	กรุงเทพมหานคร 10260
Country	ประเทศไทย
Phone	
Fax	
E-mail	

Maintenance Protocol mercur DUO, mercur DUO plus | update 27.06.2016 Version 2.1 K166
Analytik Jena AG | Konrad-Zuse-Straße 1 | 07745 Jena, Germany

เอกสารไม่ควบคุม

Maintenance works basic unit

tightness visual check inside the Mercur	<input checked="" type="checkbox"/>
visual check if gold-traps are broken	<input checked="" type="checkbox"/>
visual check if spectrometer is contaminated	<input checked="" type="checkbox"/>
visual check of the fluorescence cell	<input checked="" type="checkbox"/>
visual check of the absorption cell, incl. window	<input checked="" type="checkbox"/>
reactor cleaning	<input checked="" type="checkbox"/>
check pump-hose, if necessary change it	<input checked="" type="checkbox"/>
check swivel drive (SEV)	<input checked="" type="checkbox"/>
check drying-hose, output gas-liquid-separator	<input checked="" type="checkbox"/>
test Bubble-Sensor	<input checked="" type="checkbox"/>
check gas flows	<input checked="" type="checkbox"/>
check volume flows, reagents	<input checked="" type="checkbox"/>
recording stray light values	<input checked="" type="checkbox"/>
measurement with 30 ng/l	<input checked="" type="checkbox"/>

Maintenance works Autosampler

Serial No.: N/A

lubricate the dosing-winding (Teflon-grease-spray)	<input type="checkbox"/>
clean the dosing cylinder, if necessary exchange it	<input type="checkbox"/>
lubricate the winding system of the height drive with some drops of oil	<input type="checkbox"/>
check the toothed belt	<input type="checkbox"/>
check the position of the mechanical stopper (height: 13mm)	<input type="checkbox"/>
check the pump rate of mixing pump (<14s AS52, typ.7s/<20s AS52S, typ.10s)	<input type="checkbox"/>
check the pump rate of washing cup	<input type="checkbox"/>
check the electrical hose connections for good contact	<input type="checkbox"/>
check the connectors of the magnetic valves	<input type="checkbox"/>
check the dosing hose for buckling, if necessary exchange it	<input type="checkbox"/>

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เอกสารไม่ควบคุม

Device parameter	nominal value	actual value
visual check general tightness inside the Mercur	o.k.: <input checked="" type="checkbox"/>	changed: <input type="checkbox"/>
visual check Goldtraps	o.k.: <input checked="" type="checkbox"/>	changed: <input type="checkbox"/>
visual check spectrometer		
Fluorescence cell	o.k.: <input checked="" type="checkbox"/>	changed: <input type="checkbox"/>
Absorption cell, incl. window	o.k.: <input checked="" type="checkbox"/>	changed: <input type="checkbox"/>
lens	o.k.: <input checked="" type="checkbox"/>	changed: <input type="checkbox"/>
Swivel drive (SEV)	o.k.: <input checked="" type="checkbox"/>	changed: <input type="checkbox"/>
check pump hoses	o.k.: <input checked="" type="checkbox"/>	changed: <input type="checkbox"/>
check hoses and hose connectors	o.k.: <input checked="" type="checkbox"/>	changed: <input type="checkbox"/>
check and clean reactor	o.k.: <input checked="" type="checkbox"/>	changed: <input type="checkbox"/>
check drying hose output Gas-liquid-separator	o.k.: <input checked="" type="checkbox"/>	changed: <input type="checkbox"/>
check bubble-sensor	o.k.: <input checked="" type="checkbox"/>	not o.k.: <input type="checkbox"/>
Check gasflow		
Argon pressure valve 4	1.2 – 1.5 bar	1.5 bar
Valve 1	10 Nl/h or 0.166 NL/min	0.166 NL/min
Valve 2	50 Nl/h or 0.833 NL/min	0.833 NL/min
Valve 3	5 Nl/h or 0.083 NL/min	0.083 NL/min
Valve 4	10 Nl/h or 0.166 NL/min	0.166 NL/min
Check liquidflow		
Acid	2.5ml/min ± 1 ml	2.5 ml/min
Red.-agent	2.5ml/min ± 1 ml	2.5 ml/min
Sample	10ml/min ± 2 ml	10 ml/min
Adventitious light - values (V)	from file	
100	0	0
200	0	0
300	0	0
350	0	0
400	1	1
450	3	3
500	8	8
550	18	17
575	26	25
600	36	35

Maintenance Protocol mercur DUO, mercur DUO plus | update 27.06.2016 Version 2.1 K166
Analytik Jena AG | Konrad-Zuse-Straße 1 | 07745 Jena, Germany

เอกสารไม่ควบคุม

Device parameter	nominal value	actual value
Analytical parameters Fluorescence cell		
Conditions.: max.conc.: 10µg/L PMT-voltage:451.....V		
Blank-solution		Int ...0.0005...
without enrichment / FBR 30 ng/L	Int > 0.0015 RSD < 3 %	Int...0.0027... RSD...1.81...%
Conditions.: max.conc.: 1.7µg/L PMT-voltage:444.....V		
Blank-solution		Int...0.0043...
with enrichment / FBR 30 ng/L	Int > 0.008 RSD < 3 %	Int...0.0171... RSD...1.81...%
Fok.- factor (Int ₂ / Int ₁)	> 3.5	6.33
Analytical parameters Absorption cell		
Blank-solution		Ext.0.0004
without enrichment / FBR 100 ng/L	Ext. > 0.0012 RSD < 5 %	Ext.0.0025 RSD 3.17 %
Comments		
# Sensitivity check (Without enrichment / FBR / 100 ng/L)		
Int. Blank = 0.0008		
Int. 100 ng/L = 0.0097		
RSD % = 0.96		

Signature Technician

Place, Date (DD/MM/YYYY) 12/02/2024



กรวิทย์
Signature Customer

12/02/2024
Place, Date (DD/MM/YYYY)

Maintenance Protocol for the DUK model DUK plus | update 27.06.2016-Version 2.1 Kass
Analytik Jena AG | Jena, Thüringen | 07745 Jena, Germany

เอกสารไม่ควบคุม

Service Report

Customer's address : Sri Lanka Petroleum Corporation Ltd Petroleum Development Division P.O. Box 115, Maruthanagar, Colombo 05		Customer's Ref. No.: CO-PL-SPT-2006-036	
<input checked="" type="checkbox"/> Analytik Jena Instruments (Thailand) Ltd.		<input type="checkbox"/> Analytik Jena Far East (Thailand) Ltd.	
E-mail :	Phone :	Fax :	
Job No. : SPE0707PM	User : pandey	Service Engineer : Nishi Shinde	Date : 12/12/12 Page : 1/1
Instrument model :	Serial No. : K1790A0153	Software Version No. : 4.7.9.0	
<input type="checkbox"/> Repair (RE)	<input checked="" type="checkbox"/> Maintenance (PM)	<input type="checkbox"/> Installation (IN)	<input type="checkbox"/> Warranty
<input type="checkbox"/> Application (AP)	<input type="checkbox"/> Site Prep (SP)	<input type="checkbox"/> Visit(VI)	<input type="checkbox"/> Error Code
Fault / Claim : Reactive Maintenance (PM o/e)			
Action taken :		 <input checked="" type="checkbox"/> Instrumentation (e.g. ODS, PFT, etc.) <input checked="" type="checkbox"/> Method Validation <input checked="" type="checkbox"/> Calibration <input checked="" type="checkbox"/> Reagent Preparation <input checked="" type="checkbox"/> Instrumentation (e.g. ODS, PFT, etc.) <input checked="" type="checkbox"/> Method Validation <input checked="" type="checkbox"/> Calibration <input checked="" type="checkbox"/> Reagent Preparation	
- Maintenance and Basic Unit - Check Device parameter. - Check gas flow. - Check liquid flow. - Check Adventitious light - values # Test run Analytical parameter Fluorescence cell # Test run Analytical parameter Absorption cell		 # Test run # Test run # Test run # Test run	
Action Performed / Recommendation :			
# Sensitivity check (Without enrichment / FBR / 100 ng/L) Int. Blank = 0.0006 Int. 100 ng/L = 0.0089 RSD % = 0.69		# Strontium PFT cell # Strontium PFT cell # Strontium PFT cell # Strontium PFT cell	
<input type="checkbox"/> Spare Part	<input type="checkbox"/> Instrument Configuration :		
Item No.	Name	Quantity	Unit Price
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
Herewith the undersigned confirm the time devoted, the work performed, the perfect function of the device, and the responsibility of the specified spare parts. Traveled hours and kilometers can only be entered after the return of the service engineer.		Date / Signature of Customer : Nishi Shinde	
		Date / Signature of Service Engineer : Nishi Shinde	
		Work completed? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	

Services are subject to the General Terms and Conditions of Analytik Jena AG, which will be sent on request.

เอกสารไม่ควบคุม

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Mercur

Report file: C:\WinAAS\TMP\2024\Result\WOIPro_009
 Program version: 4.7.9.0 Printed on: 12/02/2024 16:11
 Recording started on 12/02/2024 16:00 GMT+7.0
 Operator:
 Laboratory:
 Code:
 Remarks:

Method parameters

Method	Without Enr. /FBR/0.10 ng/L_12-02-2024
Created on	12/02/2024 Time 15:54
Program	XXXX

Parameters Mercur Technique: Hg fluorescence

Line	253.7 nm		
Lamp type	Hg-LP		
Integr. mode	Peak height	Integr. time	35 s
PMT	464 V		
AZ time	5 s	Peak smoothing	12/5
Delay	0 s		

Working mode	w/o enrich.	System cleaning	Off
FBR technique	on	Wash time acid	10 s
Pump speed	3	Soaking time	20 s
Sample load time	10 s	Gas load time	5 NL/h
Reaction time	6 s		
Waiting time AZ	5 s		
Delay	0 s		
Purge time1	30 s		
Purge time2	15 s	Gas wash time2	10 NL/h

Hg

QC parameters

QC type	Conc. check		
QC check samp. 1	---	QC check samp. 2	---
Conc.		Conc.	---
Error limit	---	Error limit	---
Rep. measurement	off	Reaction	flag + continue
QC std.1 no.	1(100.000 µg/L)	QC std.2 no.	3(0.100 µg/L)
QC std.1 limit	± 20.00%	QC std.2 limit	± 20.00%
QC std. act.	flag + continue		
Expect. blank abs.	0.0100± 0.0100	Reaction	flag + continue
QC precision	off	Reaction	off
		QC Recal.factor	Off

Calibration settings

Calib. meth	Standard calib.	Calibr. unit	µg/L
No. standards	1	Conversion fac.	1000
Type of standards	---	Standard prep.	Premixed
		Blank correct.	---
		Recalib. std. no.	---
Output unit	µg/L	Conversion fac.	1000
Calib. stat.	Mean	Meas. cycles	3
		Blind cycles	1
Stock sol. 1	---	Stock sol. 2	---
Stock sol. 3	---	Stock sol. 4	---
Type of cal. curve	linear	Intercept	Zero
Weighted cal.	off	Grubbs stat.	off

Sample statistics

Stat. mode	Mean	Meas. cycles	3
Confid. level	95.4 %	Blind cycles	1
Grubbs stat.	off		

Calibration standards

No	Name	State	Pos	Conc./ µg/L	Ints	SD	RSD/%
1	Cal-Zero	(--)	##	0.000	H: 0.000878 A: 0.01998	0.000052 0.001015	6.030 5.081
2	Cal-Std1	(--)	##	100.000	H: 0.009799 A: 0.1336	0.000094 0.000682	0.969 0.820

Ha

Mercur

Mercur

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เอกสารไม่ควบคุม

Calibration function 1

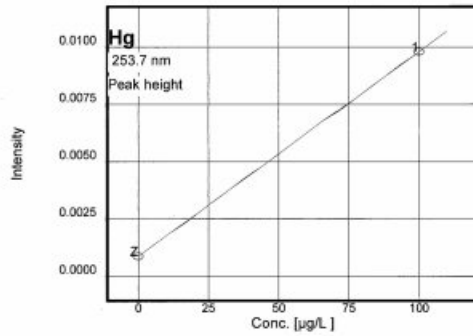
12/02/2024 16:10 Calibration (Peak height)

Ints=k1+k2*conc

k1=0.000878 k2=0.000089

Recal. factor: ---

Slope	0.00009 Ints/(µg/L)	R2-adjusted	1.0000
sc0	1.00000 µg/L		
Lower limit	0 µg/L	Upper limit	110. µg/L
Detection limit	---	Deter. limit	---



Measurements and events (sorted by time)

Hg	Without Enr. / FBR/0.10 ng/L_12-02-2024	12/02/2024 16:00
ID	Conc.	Ints BG SD RSD/% Int. type Time
Cal-Zero		0.000939 PkH 16:03
		0.000845 16:04
		0.000849 16:05
	0µg/L	0.000878 0.000052940 6.030 16:05
Cal-Std1		0.008896 PkH 16:08
		0.008706 16:09
		0.008794 16:10
	100.0µg/L	0.008799 0.000094890 0.989 16:10
Calibration	Calibration function: D1	16:10

Mercur

เอกสารไม่ควบคุม

Mercur

Report file: C:\WinAAS\TMP\2024\Result\WO\Pro_006

Program version: 4.7.9.0

Printed on: 12/02/2024 14:32

Recording started on 12/02/2024 14:21 GMT+7.0

Operator:

Laboratory:

Code:

Remarks:

Method parameters

Method Without Enrichment / FBR / 30 µg/L_PM_12-02-2024

Created on 12/02/2024 Time 11:09

Program ---

Parameters Mercur Technique: Hg fluorescence

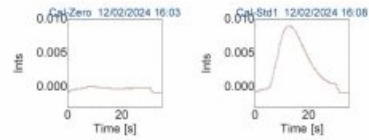
Line	253.7 nm		
Lamp type	Hg-LP		
Integr. mode	Peak height	Integr. time	35 s
PMT	451 V		
AZ time	5 s	Peak smoothing	12/5
Delay	0 s		
Working mode	w/o enrich.	System cleaning	Off
FBR technique	on	Wash time acid	10 s
Pump speed	3	Soaking time	20 s
Sample load time	12 s	Gas load time	10 NL/h
Reaction time	12 s		
Waiting time AZ	5 s		
Delay	0 s		
Purge time1	30 s		
Purge time2	15 s	Gas wash time2	10 NL/h

Mercur

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Peak plots

Hg



Mercur

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QC parameters

QC type	Conc. check		
QC check samp. 1	---	QC check samp. 2	---
Conc.	---	Conc.	---
Error limit	---	Error limit	---
Rep. measurement	off	Reaction	flag + continue
QC std.1 no.	1(30.000 ng/L)	QC std.2 no.	3(0.100 ng/L)
QC std.1 limit	± 20.00%	QC std.2 limit	± 20.00%
QC std. act.	flag + continue		
Expect. blank abs.	0.0100± 0.0100	Reaction	flag + continue
QC precision	off		
		Reaction	off
		QC Recal. factor	Off

Calibration settings

Calib. meth	Standard calib.	Calibr. unit	ng/L
No. standards	1	Conversion fac.	1000000
Type of standards	---	Standard prep.	Premixed
		Blank correct.	---
		Recalib. std. no.	---
Output unit	µg/L	Conversion fac.	1000
Calib. stat.	Mean	Meas. cycles	3
		Blind cycles	1
Stock sol. 1	---	Stock sol. 2	---
Stock sol. 3	---	Stock sol. 4	---
Type of cal. curve	linear	Intercept	Zero
Weighted cal.	off	Grubbs stat.	off
Check of cal. curve	no outlier test		

Sample statistics

Stat. mode	Mean	Meas. cycles	3
Confid. level	95.4 %	Blind cycles	1
Grubbs stat.	off		

Calibration standards

No	Name	State	Pos	Conc./ng/L	Ints	SD	RSD/%
1	Cal-Zero	(--)	##	0.000	H: 0.000587 A: 0.01383	0.000024 0.000359	4.137 2.597
2	Cal-Std1	(--)	##	30.000	H: 0.002754 A: 0.04276	0.000049 0.000186	1.814 0.437

Hg

Mercur

เอกสารไม่ควบคุม

Calibration function 1

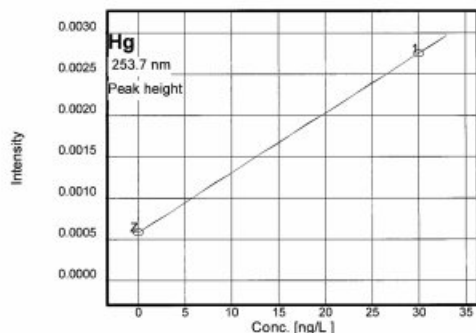
12/02/2024 14:31 Calibration (Peak height)

Ints=k1+k2*conc

k1=0.000588 k2=0.000072

Recal. factor: ---

Slope	0.00007 Ints/(ng/L)	R2-adjusted	1.0000
sc0	1.00000 ng/L		
Lower limit	0 ng/L	Upper limit	33.0 ng/L
Detection limit	---	Deter. limit	---

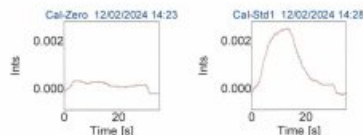


Measurements and events (sorted by time)

Hg ID	Without Enrichment / FBR / 30 µg/L_PM_12-02-2024	12/02/2024 14:21
Cal-Zero	Ints BG SD RSD/%	Int. type Time
	0.000586	PkH 14:23
	0.000564	14:24
	0.000612	14:25
	0 ng/L	0.000587 0.000024310 4.137 14:25
Cal-Std1	0.002810	PkH 14:28
	0.002740	14:29
	0.002713	14:30
	30.00ng/L	0.002754 0.000049960 1.814 14:30
Calibration	Calibration function: 01	14:31

Peak plots

Hg



Mercur

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Mercur

เอกสารไม่ควบคุม

Mercur

Report file: C:\WinAAS\TMP\2024\Result\WO\Pro_007

Program version: 4.7.9.0 Printed on: 12/02/2024 14:55

Recording started on 12/02/2024 14:41 GMT+7.0

Operator:

Laboratory:

Code:

Remarks:

Method parameters

Method With Enrichment / FBR / 30 µg/L_PM_12-02-2024

Created on 12/02/2024 Time 11:37

Program ---

Parameters Mercur Technique: Hg fluorescence

Line	253.7 nm		
Lamp type	Hg-LP		
Integr. mode	Peak height	Integr. time	20 s
PMT	444 V		
AZ time	5 s	Peak smoothing	12/5
Delay	0 s		

Working mode	Enr. w/o reload.	System cleaning	Off
FBR technique	on	Wash time acid	10 s
Pump speed	3	Soaking time	20 s
Sample load time	10 s	Gas load time	5 NL/h
Reaction time	10 s		
Waiting time AZ	5 s		
Delay	0 s		
Purge time1	20 s		
Purge time2	15 s	Gas wash time2	5 NL/h
Purge time3	10 s	Gas wash time3	10 NL/h
Heat time coll.1	20 s	Cool. time coll.1	25 s

Hg

QC parameters

QC type	Conc. check	
QC check samp. 1	---	QC check samp. 2
Conc.	---	Conc.
Error limit	---	Error limit
Rep. measurement	off	Reaction
QC std.1 no.	1(30.000 µg/L)	QC std.2 no.
QC std.1 limit	± 50.00%	QC std.2 limit
QC std. act.	flag + continue	
Expect. blank abs.	0.0100± 0.0100	Reaction
QC precision	off	flag + continue
		Reaction
		QC Recal.factor
		Off

Calibration settings

Calib. meth	Standard calib.	Calibr. unit	µg/L
No. standards	1	Conversion fac.	1000
Type of standards	---	Standard prep.	Premixed
		Blank correct.	---
		Recalib. std. no.	---
Output unit	µg/L	Conversion fac.	1000
Calib. stat.	Mean	Meas. cycles	3
		Blind cycles	1
Stock sol. 1	---	Stock sol. 2	---
Stock sol. 3	---	Stock sol. 4	---
Type of cal. curve	linear	Intercept	Zero
Weighted cal.	off	Grubbs stat.	off
Check of cal. curve	no outlier test		

Sample statistics

Stat. mode	off	Meas. cycles	1
Confid. level	95.4 %	Blind cycles	1
Grubbs stat.	---		

Calibration standards

Hg

No	Name	State	Pos	Conc./ µg/L	Ints	SD	RSD/%
1	Cal-Zero	(--)	##	0.000	H: 0.004358 A: 0.01859	0.000018 0.000277	0.417 1.673
2	Cal-Std1	(--)	##	30.000	H: 0.01710 A: 0.06278	0.000162 0.000516	0.889 0.982

Mercur

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Mercur

เอกสารไม่ควบคุม

Calibration function 1

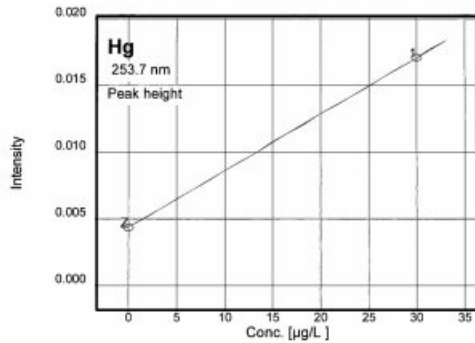
12/02/2024 14:55 Calibration (Peak height)

Ints=k1+k2*conc

k1=0.004358 k2=0.000425

Recal. factor: ---

Slope	0.00042 Ints/(µg/L)	R2-adjusted	1.0000
sc0	1.00000 µg/L		
Lower limit	0 µg/L	Upper limit	33.0 µg/L
Detection limit	---	Deter. limit	---

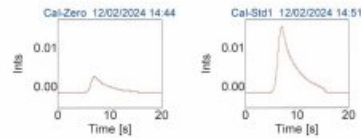


Measurements and events (sorted by time)

Hg ID	With Enrichment / FBR / 30 µg/L_PM_12-02-2024	12/02/2024 14:41
Cal-Zero	Ints BG SD RSD/% Int. type	Time
	0.004343	PkH 14:44
	0.004378	14:46
	0.004352	14:47
	0 µg/L 0.004358 0.000018180 0.417	14:47
Cal-Std1	0.01726	PkH 14:51
	0.01695	14:52
	0.01708	14:54
	30.00 µg/L 0.01710 0.0001520 0.889	14:54
Calibration	Calibration function: 01	14:55

Peak plots

Hg



Mercur

เอกสารไม่ควบคุม

Mercur

Report file: C:\WinAAS\TMP\2024\Result\WO\Pro_008

Program version: 4.7.9.0 Printed on: 12/02/2024 15:22

Recording started on 12/02/2024 15:10 GMT+7.0

Operator:
Laboratory:
Code:

Remarks:

Method parameters

Method Without enrichment / FBR 100 ng/L PM_12-02-2024
Created on 12/02/2024 Time 11:54
Program ---

Parameters Mercur Technique: Hg absorption

Line	253.7 nm		
Lamp type	Hg-LP		
Integr. mode	Peak height	Integr. time	40 s
PMT	238 V		
AZ time	5 s	Peak smoothing	12/5
Delay	0 s		

Working mode	w/o enrich.	System cleaning	Acid
FBR technique	off	Wash time acid	15 s
Pump speed	4	Soaking time	20 s
Sample load time	8 s	Gas load time	10 NL/h
Reaction time	12 s		
Waiting time AZ	15 s		
Purge time1	40 s		

QC parameters

QC type	Conc. check	QC check samp. 2	---
QC check samp. 1	---	Conc.	---
Conc.	---	Error limit	---
Error limit	---	Reaction	flag + continue
Rep. measurement	off	QC std.2 no.	1(100.00 ng/L)
QC std.1 no.	1(100.00 ng/L)	QC std.2 limit	± 0.00%
QC std.1 limit	± 50.00%		
QC std. act.	flag + continue	Reaction	flag + continue
Expect. blank abs.	0.0100± 0.0100		
QC precision	off	Reaction	off
		QC Recal.factor	Off

Mercur

เอกสารไม่ควบคุม

Calibration settings

Calib. meth	Standard calib.	Calibr. unit	ng/L
No. standards	1	Conversion fac.	1000000
Type of standards	---	Standard prep.	Premixed
		Blank correct.	---
		Recalib. std. no.	---
Output unit	µg/L	Conversion fac.	1000
Calib. stat.	Mean	Meas. cycles	3
		Blind cycles	1
Stock sol. 1	---	Stock sol. 2	---
Stock sol. 3	---	Stock sol. 4	---
Type of cal. curve	linear	Intercept	calculated
Weighted cal.	off	Grubbs stat.	off
Check of cal. curve	no outlier test		

Sample statistics

Stat. mode	Mean	Meas. cycles	2
Confid. level	95.4 %	Blind cycles	1
Grubbs stat.	---		

Calibration standards

Hg

No	Name	State	Pos	Conc./ ng/L	Abs	SD	RSD/%
1	Cal-Zero	(--)	#	0.00	H: 0.000478 A: 0.005393	0.000331 0.002260	69.26 41.90
2	Cal-Std1	(--)	#	100.00	H: 0.002580 A: 0.034199	0.000081 0.002897	3.171 7.887

Calibration function 1

12/02/2024 15:22 Calibration (Peak height)

Abs=k1+k2*conc

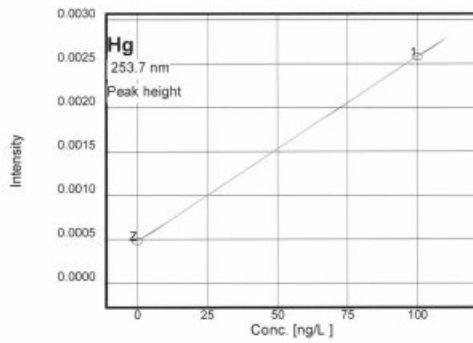
k1=0.000478 k2=0.000021

Recal. factor: ---

Slope	0.00002 Abs/(ng/L)	R2-adjusted	1.0000
sc0	1.00000 ng/L	Charact. conc.	207.402 (ng/L)/1%
Lower limit	0 ng/L	Upper limit	110. ng/L
Detection limit	---	Deter. limit	---

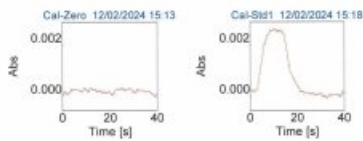
Mercur

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Measurements and events (sorted by time)

Hg	Without enrichment / FBR 100 ng/L PM ₁₀ -12-02-2024					12/02/2024	15:10
ID	Conc.	Abs	BG	SD	RSD/%	Int. type	Time
Cal-Zero		0.000328				PkH	15:13
		0.000248					15:14
		0.000858					15:15
	0ng/L	0.000478		0.00033131	69.26		15:15
Cal-Std1		0.002638				PkH	15:18
		0.002615					15:19
		0.002487					15:21
	100.ng/L	0.002580		0.00081841	3.171		15:21
Calibration	Calibration function: 01						15:22
Peak plots						Hg	



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



Certificate of Calibration

Cert. No.: 24TM648
Page : 1 of 3

Equipment : Incubator
Manufacturer : Memmert
Model : IPP 260
Serial No. : V615.0187
ID No. : UAE.MIC.003/2559
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Sol Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Microbiology Laboratory
Received Order : 01 April 2024
Calibration Date : 01 April 2024
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Man Pattanapongpaiboon
Approved by :
() Ponpan Paipim
(✓) Suwit Imjai
() Kunchit Promprat

Issue Date : 7 April 2024

The Uncertainties are for a confidence probability of approximately 95%

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

เอกสารไม่ควบคุม



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2404-0003OC-1
Procedure Used :-

Cert. No.: 24TM648
Page : 2 of 3

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

Condition of this result of calibration

1. Reference standard instrument-

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

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

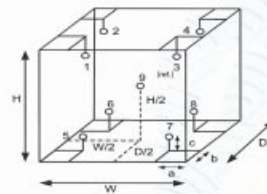
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close

Environment during calibration		
	Beginning	Finished
Temp. (°C)	24	24
REL.Humid. (%)	54	57
AC Supply (Volt)	221	223



Probe Installation Details :

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

Dimension of Chamber :

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

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

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)
	Position									
	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 %.

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เอกสารไม่ควบคุม



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



Certificate of Calibration

Cert. No.: 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 : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Man Pattanapongpaiboon
Approved by : 
Approved Signatory
() Ponpan Paipim
(✓) Suwit Imjai
() Kunchit Promprat

Issue Date : 7 April 2024

The Uncertainties are for a confidence probability of approximately 95%

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

Cert. No.: 24TM651
Page : 2 of 3

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument-

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

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

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

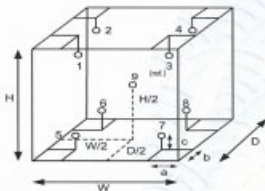
Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close

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



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

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เอกสารไม่ควบคุม



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	21.698	21.668	21.668	21.846	0.30
44.0	44.267	44.602	44.293	44.402	44.004	43.961	43.756	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 %.

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
334/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-29 FAX. 0-2710-9484



Cert. No.: 23TM1079
Page : 1 of 3

Certificate of Calibration

Equipment : Water Bath
Manufacturer : Memmert
Model : WNB 14
Serial No. : L407.0758
ID No. : UAE.MIC.024/2550
Submitted by : United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Microbiology Laboratory
Received Order : 10 July 2023
Calibration Date : 10 July 2023
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %

Calibrated by : Man Pattanapongpaiboon

Approved by :
Approved Signatory

() Pornthippa Tameyakul
(✓) Malee Buksuea
() Suwit Imjai

Issue Date : 20 July 2023

The Uncertainties are for a confidence probability of approximately 95%

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

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Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2307-0087OC-6
Result of Calibration : (*) Without Adjustment
Function of UUC* : Temperature Source

Cert. No.: 23TM1079
Page : 3 of 3

Calibration point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Average* Standard Reading (°C)					Uncertainty (± °C)
			Position					
			1	2	3	4	5 (ref.)	
44.5	45.0	45.0	44.428	44.374	44.397	44.378	44.387	0.15
45.0	45.5	45.5	44.933	44.878	44.902	44.877	44.902	0.15

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Coverage Factor k
44.5	0.084	0.040	2
45.0	0.19	0.076	2

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

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

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

UUC* : Unit Under Calibration

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

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

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เอกสารไม่ควบคุม



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2307-0087OC-6
Procedure Used :-

Cert. No.: 23TM1079
Page : 2 of 3

Calibration were conducted using in-house calibration procedure CP-OT84 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	MY59003411	22LM165	TPA	26 Nov 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.

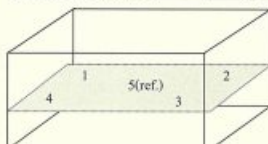
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Heat transfer medium used : Water

	Environmental		AC Voltage Supply (Volt)
	(°C)	(%R.H.)	
Beginning of Calibration	25	57	222
Finished of Calibration	25	58	223



Front

Position :	Ref. Std. ID No.:
1	4804539-001
2	4804539-002
3	4804539-003
4	4804539-004
5(ref.)	4804539-005

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Certificate of Calibration

Equipment : Balance
Model : PX823
Serial No. (or ID.): C236754745
Manufacturer : Ohaus
Condition : New

Certificate No.: C01223732
Issued Date: 09 December 2022
Job No.: KSPR2215576
Page: 1 of 2

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 26 °C ± 0.5 °C
Humidity 53 %RH ± 3.9 %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 : 09 December 2022
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. C02221765

(Mr. Adisai Maknoi)
Person in charge

(Mr. Rungrod Jenkitrakulchai)
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.

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DKSH Technology Limited
2533 สุขุมวิท ถนน, กรุงเทพฯ, กรุงเทพมหานคร 10260
Phone: +66 2050 7000 E-mail: info.asia@dksh.com Website: www.dksh.com/thailand

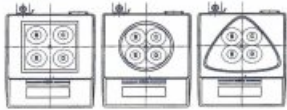
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Calibration Results:

Without 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		200			(g)
Reference Points (g)					
A	B	C	D	E	
-	0.000	0.000	0.000	0.000	

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

Nominal test value (g)	Standard Deviation
50	0.0004
500	0.0005

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	0.0010	2.03
5	5.0001	5.000	0.000	0.0010	2.03
10	10.0001	10.000	0.000	0.0010	2.03
20	20.0001	20.000	0.000	0.0010	2.03
50	50.0001	50.000	0.000	0.0010	2.03
100	100.0001	100.000	0.000	0.0011	2.03
200	200.0004	200.000	0.000	0.0011	2.02
300	300.0005	300.000	-0.001	0.0013	2.01
400	400.0008	400.001	0.000	0.0014	2.01
500	500.0003	500.000	0.000	0.0017	2.00
600	600.0004	600.000	0.000	0.0019	2.00

The End of Certificate

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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

Rungrod
(Mr. Rungrod Jenkitrakulchai)
Authorized signatory

เอกสารไม่ควบคุม

Statements of conformity:

Without Adjustment

Readability: 0.001 g

Nominal Value (g)	Error of indication (g)	Guard band (w) (g)	Tolerance (±) (g)	Conformity
1	0.000	0.0010	0.002	Pass
5	0.000	0.0010	0.010	Pass
10	0.000	0.0010	0.020	Pass
20	0.000	0.0010	0.040	Pass
50	0.000	0.0010	0.100	Pass
100	0.000	0.0011	0.200	Pass
200	0.000	0.0011	0.400	Pass
300	-0.001	0.0013	0.600	Pass
400	0.000	0.0014	0.800	Pass
500	0.000	0.0017	1.000	Pass
600	0.000	0.0019	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

เอกสารไม่ควบคุม

Without Adjustment
Job No. KSPR221 9576
Readability: 0.001g

