

ภาคผนวก ก เอกสารสอบเทียบเครื่องมือ

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration
Stack								
1	Pre-Test Console	Total Suspended Particulate	Apex Instruments, USA.	XC-572-V 1701019	Envi Equipment Service Co., Ltd.	E24-060048	18 Jun 24	17 Jun 25
2	Flue gas Analyzer	Sulphur Dioxide Oxide of Nitrogen as Nitrogen Dioxide Carbon Monoxide	Testo	Testo 350 New 02376344/208	Entech Industrial Solution Co., Ltd.	G 680034	20 Jan 25	19 Jan 26

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
Ambient								
1	Mass Flow Meter	VOCs	Alicat Scientific, Inc.	MB-55CCM-D/5M 71015	Mirade International Technology Co.,Ltd.	L202409227-0002	19 Sep 24	18 Sep 25
2	Aneroid Barometer	VOCs	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	24P1856	4 Jun 24	3 Jun 25
3	Dial Thermo-Hygrometer	VOCs	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	25H812	10 Apr 25	9 Apr 26
4	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1201778108	UAE Consultant Co.,Ltd.	-	4 Oct 24	3 Oct 25
5	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1201778110	UAE Consultant Co.,Ltd.	-	17 Oct 24	16 Oct 25
6	Standard Gases (Mixture)	Nitrogen Dioxide	Airgas	EB0159156 201.5 PSIG	Airgas an Air Liquide company	E04NI99E15A01D3	6 Nov 23	5 Nov 26
7	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1201778112	UAE Consultant Co.,Ltd.	-	4 Sep 24	3 Sep 25
8	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1201778113	UAE Consultant Co.,Ltd.	-	4 Sep 24	3 Sep 25
10	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2111DR0072	Thai Meteorological Department	001/25	3 Jan 25	2 Jan 26
11	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2205DT0113	Thai Meteorological Department	002/25	3 Jan 25	2 Jan 26

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
Water								
1	pH Meter	pH	Horiba	LAQUA-PH210 HA0F0026	Technology Promotion Association (Thailand-Japan)	25CH22	9 Jan 25	8 Jan 26

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
Workplace								
1	Primary Flow Calibrator	Calibrate personal pump	TSL Inc	4146 41461813030	Innovative Instrument Co., Ltd.	24-AFM-223	8 Nov 24	7 Nov 25
2	Aneroid Barometer	Benzene Toluene Xylene Ethyl Benzene m-Xylene o-Xylene n-Hexane n-Pentane n-Butane	Barigo, Germany	111MS -	Technology Promotion Association (Thailand-Japan)	24P1370	22 Apr 24	21 Apr 25
3	Digital Thermo - Hygrometer	Benzene Toluene Xylene Ethyl Benzene m-Xylene o-Xylene n-Hexane n-Pentane n-Butane	Digicon	TH-02 395034173	Technology Promotion Association (Thailand-Japan)	25H812	10 Apr 25	9 Apr 26

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
Workplace (Cont.)								
4	Sound Calibrator (Acoustic Calibrator)	Calibrate Sound	SvanteK	CAL31 82795	Innovative Instrument Co.,Ltd.	24-ACT-065	17 May 24	16 May 25
5	Sound Calibrator (Acoustic Calibrator)	Calibrate Sound	SvanteK	SV 36 A 73246	Innovative Instrument Co.,Ltd.	24-ACT-077	30 May 24	29 May 25
6	Sound Calibrator (Acoustic Calibrator)	Calibrate Sound	Larson Davis	CAL150 6307	Innovative Instrument Co.,Ltd.	24-ACT-120	10 Sep 24	9 Sep 25
7	Sound Level Meter	Noise	Rion	NL-42 00409023	Sithiporn Associates Co.,Ltd.	CL24160	4-5 Jun 24	3 Jun 25
8	Sound Level Meter	Noise	Rion	NL-42 01010783	Sithiporn Associates Co.,Ltd.	CL24167	6-7 Jun 24	3 Jun 25
9	Sound Level Meter	Noise	Rion	NL-42 00208876	Sithiporn Associates Co.,Ltd.	CL25018	13-14 Jan 25	12 Jan 26

CERTIFICATE OF CALIBRATION

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

Address : 81 Soi Udomsuk 41, Sukhumvit Road, Banghak, Phrakhanong, Bangkok 10260

Description of Equipment : Console meter

Manufacturer : Apex Instrument

Model Number : XC-572-V

Serial Number : 1701019

ID/Control No. : UAE.EFM 013/2560

Environment Conditions : Temperature (25 ± 2) °C
Humidity (50 ± 15) % RH

Cal. Date : 18/06/2024

Issue Date : 18/06/2024

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 Fuchnoi)

Technical Manager

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

Meter Console Information		Calibration Conditions				Factors/Conversions		
Console Model Number	XC-572-V	Date	Time	18/06/2024	10:00 AM	Std Temp	293	K
Console Serial Number	1701019	Calibration Reference No.	SER24-060018			Std Press	760	mm Hg
DGM Model Number	SK2SEX	Barometric Pressure	755.91	mmHg		K ₁	0.386	
DGM Serial Number	00002028	Calibration Meter Gamma	1.001			Console Leak Check	PASS	

Calibration Data									
Run Time		Metering Console					Calibration Meter		
Elapsed	DGM Orifice DH	Volume Initial	Volume Final	Outlet Temp Initial	Outlet Temp Final	Volume Initial	Volume Final	Outlet Temp Initial	Outlet Temp Final
(Q)	(P ₀)	(V _{in})	(V _{out})	(t _{in})	(t _{out})	(V _{in})	(V _{out})	(t _{in})	(t _{out})
min	mm H ₂ O	m ³	m ³	°C	°C	m ³	m ³	°C	°C
11.82	13.0	2802.112	2802.252	32	32	222.03382	222.17160	29	29
11.85	13.0	2802.252	2802.392	32	32	222.17160	222.30948	29	29
8.42	26.0	2802.399	2802.539	32	32	222.31644	222.45472	29	29
8.43	26.0	2802.539	2802.679	32	32	222.45472	222.59264	29	29
13.80	40.0	2802.686	2802.966	32	32	222.59970	222.87558	28	28
13.78	48.0	2802.966	2803.246	32	32	222.87558	223.15024	27	27
10.32	70.0	2803.261	2803.541	33	33	223.16476	223.43840	27	27
10.33	70.0	2803.541	2803.821	33	33	223.43840	223.71148	27	27
9.00	90.0	2803.835	2804.115	33	33	223.72450	223.99668	27	27
9.00	90.0	2804.115	2804.395	33	33	223.99668	224.26896	27	27



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

Meter Console Information		Calibration Conditions				Factors/Conversions		
Console Model Number	XC-572-V	Date	Time	18/06/2024	10:00 AM	Std Temp	293	K
Console Serial Number	1701019	Calibration Reference No.	SER24-060018			Std Press	760	mm Hg
DGM Model Number	SK2SEX	Barometric Pressure	755.91	mmHg		K ₁	0.386	
DGM Serial Number	00002028	Calibration Meter Gamma	1.001			Console Leak Check	PASS	

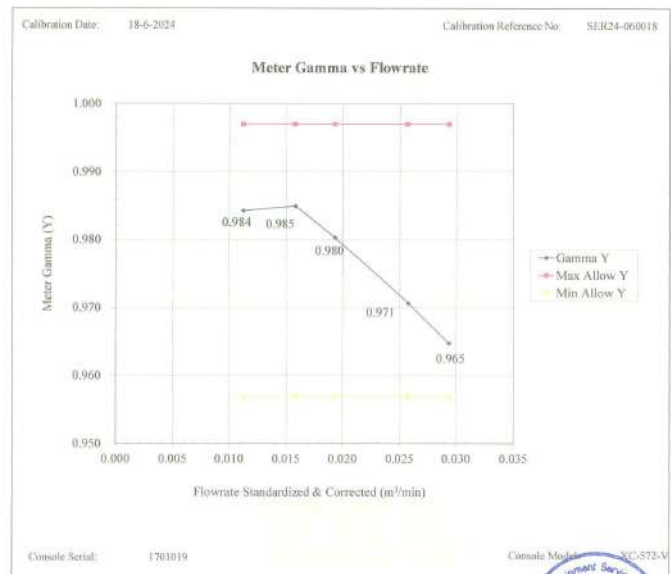
Calibration Data									
Results									
Standardized Data					Dry Gas Meter				
Dry Gas Meter		Calibration Meter		Calibration Factor	Variation	Flowrate		Variation	Variation
(V _{std})	(Q _{std})	(V _{wet})	(Q _{wet})			(Q _{std})	(Q _{wet})		
m ³	m ³ /min	m ³	m ³ /min	(Y)	(ΔY)	(Q _{std})	(Q _{wet})	(ΔH _g)	(ΔH _g)
0.135	0.011	0.133	0.011	0.984	0.007	0.011	44.706	-1.370	
0.135	0.011	0.133	0.011	0.985	0.008	0.011	44.893	-1.182	
0.135	0.016	0.134	0.016	0.986	0.009	0.016	45.148	-0.928	
0.135	0.016	0.133	0.016	0.984	0.007	0.016	45.564	-0.512	
0.272	0.020	0.267	0.019	0.982	0.005	0.019	46.883	0.808	
0.273	0.020	0.267	0.019	0.978	0.001	0.019	47.030	0.954	
0.274	0.027	0.266	0.026	0.972	-0.005	0.026	46.723	0.648	
0.274	0.027	0.266	0.026	0.970	-0.007	0.026	47.067	0.991	
0.274	0.030	0.265	0.029	0.965	-0.012	0.029	46.388	0.313	
0.274	0.030	0.265	0.029	0.965	-0.012	0.029	46.354	0.279	
0.977				Y Average		46.075		ΔH _g 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) L.

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Meter Console Information		Calibration Conditions				Factors/Conversions		
Console Model Number	XC-572-V	Date	Time	18/06/2024	10:00 AM	Std Temp	293	K
Console Serial Number	1701019	Calibration Reference No.	SER24-060018			Std Press	760	mm Hg
DGM Model Number	SK2SEX	Barometric Pressure	755.91	mmHg		K ₁	0.386	
DGM Serial Number	00002028	Calibration Meter Gamma	1.001			Console Leak Check	PASS	



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Meter Console Information		Calibration Conditions				Factors/Conversions		
Console Model Number	XC-572-V	Date	Time	18/06/2024	10:00 AM	Std Temp	293	K
Console Serial Number	1701019	Calibration Reference No.	SER24-060018			Std Press	760	mm Hg
DGM Model Number	SK25EX	Barometric Pressure	755.91 mmHg			K ₁	0.386	
DGM Serial Number	00002028	Calibration Meter Gamma	1.001			Console Leak Check	PASS	



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THERMOCOUPLES SYSTEM CALIBRATION

Sampling System Equipment Information		Calibration Conditions	
Console Model Number	XC-572-V	Date	Time
Console Serial Number	1701019	18/06/2024	00:20 PM
DGM Model Number	SK25EX	Calibration Reference No.	SER24-060018
DGM Serial Number	00002028	Reference Thermometer	DIGICON
Meter Box Model Number	JENCO 765 KF	Serial Number	183169105
Meter Box Serial Number	JC 19777		

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	38.0	93.0	149.0	257.0	368.0	477.0	587.0	806.0
Aux	-17.0	25.0	38.0	93.0	149.0					
Probe	-17.0	25.0	38.0	93.0	149.0					
Filter	-17.0	25.0	38.0	93.0	149.0					
Oven	-17.0	25.0	38.0	93.0	149.0					
Exit	-17.0	25.0	38.0							

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



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Certificate No: G 680034
Date of issue : 20-Jan-25

Instrument description	Flue Gas Analyzer
Instrument model	Testo 350 New
Instrument serial no.	02376344/208
Control unit serial no.	02398589/208
ID no. or control no.	UAE.EMAZ.113/2555
Manufacturer	Testo SE & Co. KGaA
Probe description	-
Probe model	-
Probe serial no.	-
Customer name	UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Customer address	81 SOI UDOMSUKH1, SUKHUMVIT ROAD, BANGCHAK, PRAKANONG, BANGKOK 10260

Total pages of certificate	2 Pages
Receiving no.	L-250114
Receiving date	16-Jan-25
Parameter of calibration	Gas Calibration (Oxygen 2.50, 9.984, 21.02 %vol, Carbon Monoxide 80.45, 302, 1007 ppm) Nitrogen Dioxide 30.68, 81.8, 201.9 ppm, Nitric Oxide 30.0, 151.5, 322.5 ppm, Sulphur Dioxide 50.36, 100.7, 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, Toongsonghong, 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 : 20-Jan-25

Mr. Kwanchai Khamdang
Calibration Technician

Mr. Nongluck Wongsettee
Technical Manager

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Certificate No.: G 680034

Standard References (Table 1)

Standard	Certificate No.	Vendor	Due date
Oxygen (O ₂) 2.50 % Vol	2412/23	Linde	27-Aug-27
Oxygen (O ₂) 9.984 % Vol	CG-0113-24	Nimrt	01-Aug-29
Oxygen (O ₂) 21.02 % Vol	CG-0041-22	Nimrt	10-Feb-27
Carbon monoxide (CO) 80.45 ppm	CG-0132-24	Nimrt	10-Sep-29
Carbon monoxide (CO) 302 ppm	1915/23	Linde	16-Jun-25
Carbon monoxide (CO) 1007 ppm	1870/24	Linde	17-Jun-26
Nitrogen Dioxide (NO ₂) 30.68 ppm	2832/24	Linde	08-Sep-26
Nitrogen Dioxide (NO ₂) 81.8 ppm	2330/24	Linde	01-Aug-26
Nitrogen Dioxide (NO ₂) 201.9 ppm	1975/23	Nimrt	17-Jul-25
Nitric Oxide (NO) 30.0 ppm	CG-0065-24	Linde	06-May-26
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) 100.7 ppm	2662/24	Linde	25-Aug-26
Sulphur Dioxide (SO ₂) 600.8 ppm	2003/23	Linde	17-Jul-25

Measured room conditions

Temperature : 22.3 °C Humidity : 60.5 %RH Pressure : 1010.8 mbar

Calibration conditions

Gas Temperature : 23 °C Flow rate : 1,300 ml/min Gas pressure : 1014.9 mbar

Calibration Results (Without adjustment) (Table 2)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (1)
O ₂ (%Vol)	2.50	2.46	-0.04	0.15
O ₂ (%Vol)	9.984	10.12	0.136	0.20
O ₂ (%Vol)	21.02	21.15	0.13	0.30
CO (ppm)	80.45	81	0.55	3.0
CO (ppm)	302	304	2	6.0
CO (ppm)	1007	1009	2	12
NO ₂ (ppm)	30.68	30.9	0.22	8.0
NO ₂ (ppm)	81.8	83.2	1.4	8.0
NO ₂ (ppm)	201.9	205.1	3.2	12
NO (ppm)	30.0	32	2.0	8.0
NO (ppm)	151.5	155	3.5	8.0
NO (ppm)	322.5	325	2.5	12
SO ₂ (ppm)	50.36	52	1.64	6.0
SO ₂ (ppm)	100.7	103	2.3	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

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

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

Condition As-Received : Used Item

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

Traceability of Certificate :

The International System of Units (SI) through

NIMT Certificate No. MW-0047-24,MW-0048-24 for Gas Flow meter Serial No. MS209179B/MS209179A, Due 03-Jul-25

End of Certificate

Page 3 of 3



CALIBRATION CERTIFICATE

Certificate No. : L202409227-0002

Date Issued : 23-Sep-24

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

Equipment : Mass Flow Meter

Manufacturer : Alicat Scientific
Model : MB-SSCCM-D/5M
Serial No. : 71015
ID No./Tag No. : UAE.EMA2.119/2555
Date Received : 16-Sep-24
Date Calibrated : 19-Sep-24
Calibrated by : Saruth Srichutikul

Calibration Method or Calibration Procedure Used

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

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

Result of Calibration

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

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

Approved by:

Sarayuth T.
(Sarayuth Toehua)



Page 1 of 3

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Certificate No. : L202409227-0002

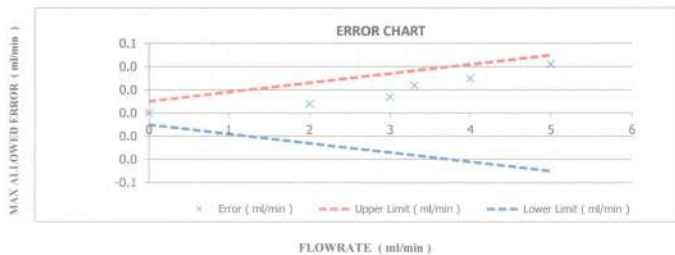
Environment : Ambient temperature : (23 ± 2) °C
Relative humidity : (50 ± 15) % RH
Capacity Range : 5 ml/min
Calibration Media : Air
Type : Mass Flowmeter

Unit Under Calibration Reference Condition : Pressure 101.325 kPa(abs) , 25 °C , Air							
Temperature (°C)	Pressure (kPa)	UUC Reading (ml/min)	STD Reading (ml/min)	Error (ml/min)	Uncertainty (± ml/min)	MPE (± ml/min)	Pass / Fail Simple Acceptance
22.11	99.78	0.000	0.00 *	0.000	0.063	0.010	Pass
21.97	105.25	2.000	1.992 *	0.008	0.094	0.026	Pass
22.25	108.13	3.000	2.986	0.014	0.13	0.034	Pass
22.34	108.97	3.300	3.276	0.024	0.14	0.036	Pass
21.84	111.06	4.000	3.970	0.030	0.16	0.042	Pass
22.30	114.43	5.000	4.958	0.042	0.19	0.050	Pass

Error = Unit Under Calibration - Standard Pass = |error| ≤ |MPE|

MPE = Maximum Permissible Error Fail = |error| > |MPE|

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



Page 2 of 3

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		TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN) CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES 5344 PATTANAKARN ROAD SOI 18, SUANLIANG, SUANLIANG, BANGKOK 10250 TEL. 0-2717-3000-24 FAX. 0-2719-9184			
Certificate of Calibration				Certificate No. : 24P1656 Page : 1 of 2	
Equipment :	Aneroid Barometer				
Manufacturer :	Bargo				
Model :	-				
Serial No. :	-				
ID No. :	UAE.EMA2.110/2555				
Condition As-Received :	Used item				
Received Date :	24 May 2024				
Calibration Date :	04 June 2024				
Reference :	2405-0919WSC		Submitted by : United Analyst and Engineering Consultant Co.,Ltd.		
Ambient Temperature :	(23 ± 2) °C		81 Soi Udomsuk 41, Sukhumvit Road,		
Relative Humidity :	(50 ± 15) %		Bangchak, Phrahanong, Bangkok 10260		
Atmospheric Pressure :	1000 mbar				
Procedure used :	The calibration was conducted by direct comparison method against Pressure Measuring Instruments Standard according to in-house calibration procedure CP-P10, using "DKD-R 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	1422505048	MP-0094-24	03 May 2025	
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 Khankaeew		Approved Signatory :		
Issue Date :	06 June 2024		[] Phalinee Prabpalpal [] Sura Suwanasari [x] Atapol Panurach		

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B 0316956



Cert.No.: 24P1858
Page: 2 of 2

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

Range: 720 mmHg to 800 mmHg
Scale Interval: 1 mmHg (The Fifth Estimate)

Increasing Pressure

Applied Pressure (mmHg)	720.43	730.67	740.34	751.52	756.56	761.83	773.53	798.76
UUC* Indication (mmHg)	720.0	730.0	740.0	750.0	755.0	760.0	770.0	790.0
Error (mmHg)	-0.43	-0.67	-0.34	-1.52	-1.56	-1.83	-3.53	-8.76

Decreasing Pressure

Applied Pressure (mmHg)	798.76	773.60	761.89	756.55	751.59	740.72	730.68	720.59
UUC* Indication (mmHg)	790.0	770.0	760.0	755.0	750.0	740.0	730.0	720.0
Error (mmHg)	-8.76	-3.60	-1.89	-1.55	-1.59	-0.72	-0.68	-0.59

The uncertainty of measurement was ± 0.24 mmHg

* UUC = Unit Under Calibration

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

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Attapol P.
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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
53/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10259
TEL. 0-2717-3000-24 FAX. 0-2719-9484



Certificate of Calibration

Certificate No.: 25H812
Page: 1 of 2

Equipment: Dial Thermo-Hygrometer

Manufacturer: Barigo

Model: -

Serial No.: -

ID No.: UAE.ANV.132/2550

Condition As-Received: Used Item

Received Date: 04 April 2025

Calibration Date: 10 April 2025

Reference: 2504-0193WSC

Ambient Temperature: (25 \pm 3) °C

Relative Humidity: (50 \pm 20) %

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

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

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

Procedure used: Calibration were conducted using in-house calibration procedure CPH02 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) Dew Point Hygrometer	Opdew 401	164756	TH-0005-25	05 Feb 2026
2) Handheld Thermometer With Sensor	1523	5717096	2411241	18 Nov 2025

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

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

Calibrated by: Somchai Dumwor
Issue Date: 18 April 2025

Approved Signatory:

Viporn
[] Chakrit Watanwanjua
[] Pornthippa Tameyaskul
[x] Viporn Tantiyawutti

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Cert. No.: 25H812
Page: 2 of 2

Result of Calibration:- Without Adjustment
Function: Humidity Measurement.

Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Correction (%R.H.)	Uncertainty of Measurement (\pm %R.H.)
25.0	40.1	42	-1.9	1.7
25.0	60.0	60	0.0	1.8
25.0	80.0	76	4.0	1.9

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

Standard Temperature (°C)	UUC* Reading (°C)	Correction (°C)	Uncertainty of Measurement (\pm °C)
20.001	21.0	-0.999	0.72
24.987	25.0	-0.013	0.72
30.021	30.0	0.021	0.72
34.964	34.0	0.964	0.72
40.032	39.0	1.032	0.72

UUC* : Unit Under Calibration

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

-000-

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United Analyst and Engineering Consultant Co., Ltd.

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

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

MULTI-POINT GAS TEST REPORT

Test Date: Oct 4, 2024

Equipment: Gas Analyzer (NO₂)
Manufacturer: Thermo Scientific
Model: 42i
Serial Number: 1201778108

Standard Gas Concentration

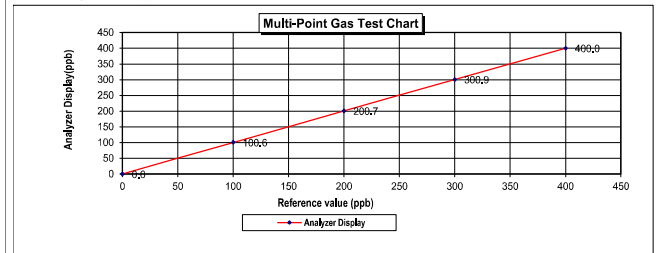
Sulphur Dioxide (SO ₂)	42.89	PPM
Nitric Oxide (NO)	46.77	PPM
Methane (CH ₄)	-	PPM
Carbon Monoxide (CO)	965.9	PPM
Cylinder No.:	EB0159156	
Expiration Date:	Nov 6, 2026	

Dilutor Detail

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

Multi-point gas test data

	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	100.6	0.60	0.60
Level 3	40.00%	200.0	200.7	0.35	0.35
Level 4	60.00%	300.0	300.9	0.30	0.30
Level 5	80.00%	400.0	400.0	0.00	0.00
Remark: Measuring Range	500.0 ppb			Average Difference (%)	0.25
	:Acceptable Limit $\pm 5\%$				



Calculate by
Somchai Dumwor
4 / 10 / 2567

Approve by
Viporn Tantiyawutti
4 / Oct / 2024

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MULTI-POINT GAS TEST REPORT

Test Date : Oct 17, 2024

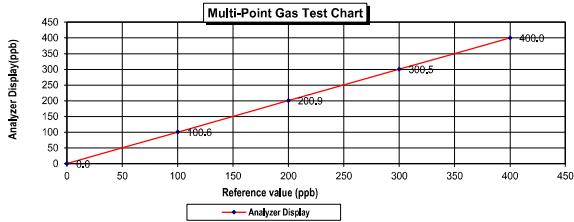
Equipment : Gas Analyzer (NO₂) Model : 42i
Manufacturer : Thermo Scientific Serial Number : 1201778110

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

Multi-point gas test data

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	100.6	0.60	0.60
Level 3	40.00%	200.0	200.9	0.90	0.45
Level 4	60.00%	300.0	300.5	0.50	0.17
Level 5	80.00%	400.0	400.0	0.00	0.00

Remark : Measuring Range 500.0 ppb Average Difference (%) 0.24
:Acceptable Limit $\pm 5\%$



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17 / Oct / 2024

CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

Customer: AIR LIQUIDE (THAILAND) LTD
Part Number: E04N199E15A01D3
Cylinder Number: EB0159156
Laboratory: 124 - Durham (SAP) - NC
PGVP Number: 822023
Gas Code: CO, NO, NOX, SO₂, BALN
Reference Number: 122-402880224-1
Cylinder Volume: 144.0 CF
Cylinder Pressure: 2015 PSIG
Valve Outlet: 660
Certification Date: Nov 06, 2023
Expiration Date: Nov 06, 2026

Certification performed in accordance with EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2017) document EPA 800/R-12/031, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted. The results relate only to the items tested. The report shall not be reproduced except in full without approval of the laboratory. Do Not Use This Cylinder below 100 psig (i.e. 0.7 megapascals).

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	45.00 PPM	46.78 PPM	G1	$\pm 1.3\%$ NIST Traceable	10/30/2023, 11/06/2023
NITRIC OXIDE	45.00 PPM	46.77 PPM	G1	$\pm 1.3\%$ NIST Traceable	10/30/2023, 11/06/2023
SULFUR DIOXIDE	45.00 PPM	42.89 PPM	G1	$\pm 1.0\%$ NIST Traceable	10/30/2023, 11/06/2023
CARBON MONOXIDE	1000 PPM	965.9 PPM	G1	$\pm 0.7\%$ NIST Traceable	10/30/2023
NITROGEN	Balance				

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	21060703	CC707954	48.41 PPM NITRIC OXIDE/NITROGEN	$\pm 1.2\%$	Sep 21, 2025
PRM	PRM	D913660	15.01 PPM NITROGEN DIOXIDE/AIR	$\pm 1.5\%$	Feb 18, 2023
GMIS	124206889	CC322889	4.573 PPM NITROGEN DIOXIDE/NITROGEN	$\pm 1.6\%$	Feb 17, 2026
NTRM	16061005	CC473190	49.02 PPM SULFUR DIOXIDE/NITROGEN	$\pm 0.8\%$	Mar 22, 2028
NTRM	14060154	CC439551	990.9 PPM CARBON MONOXIDE/NITROGEN	$\pm 0.6\%$	Nov 15, 2025

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

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

Triad Data Available Upon Request.

NOTES: GROSS WEIGHT: 28.4 kg

NET WEIGHT: 4.7 kg



Signature on file
Approved for Release

MULTI-POINT GAS TEST REPORT

Test Date : Sep 4, 2024

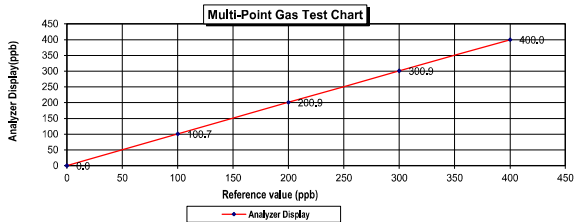
Equipment : Gas Analyzer (SO₂) Model : 43i
Manufacturer : Thermo SCIENTIFIC Serial Number : 1201778112

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

Multi-point gas test data

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	100.7	0.70	0.70
Level 3	40.00%	200.0	200.9	0.90	0.45
Level 4	60.00%	300.0	300.9	0.90	0.30
Level 5	80.00%	400.0	400.0	0.00	0.00

Remark : Measuring Range 500.0 ppb Average Difference (%) 0.29
:Acceptable Limit $\pm 5\%$



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4 / 9 / 2567

Approve by
4 / Sep / 2024

MULTI-POINT GAS TEST REPORT

Test Date : Sep 4, 2024

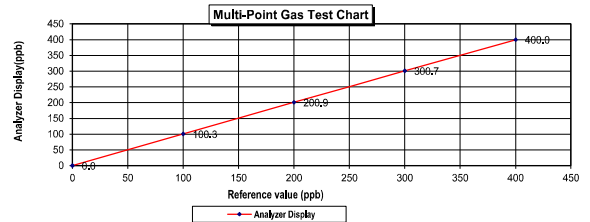
Equipment : Gas Analyzer (SO₂) Model : 43i
Manufacturer : Thermo SCIENTIFIC Serial Number : 1201778113

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

Multi-point gas test data

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	100.3	0.30	0.30
Level 3	40.00%	200.0	200.9	0.90	0.45
Level 4	60.00%	300.0	300.7	0.70	0.23
Level 5	80.00%	400.0	400.0	0.00	0.00

Remark : Measuring Range 500.0 ppb Average Difference (%) 0.20
:Acceptable Limit $\pm 5\%$



Calculate by
4 / 9 / 2567

Approve by
4 / Sep / 2024



THAI METEOROLOGICAL DEPARTMENT

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

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue : 3 January, 2025

Certification No. 001/25

Page : 1 of 5

Object : Wind Speed & Wind Direction Data Logger

Manufacturer : SCARLET/TECH

Type : WL-21

Mfg Code : Wireless Receiver 2111DR0072

Wind Sensor 2111DR0072

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

81 Soi Udomsuk 41, Sukhumvit Road,

Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1012.1 hPa

NATIONAL STANDARD WIND TUNNEL : Wind Aloft Plotting Board

: Micromanometer Theodor Friedrichs FC014 Serial No. 9310119 : HOOK GAGE NO 1425

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

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

Serial Number 110730029 (sensor 120629586)

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

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

: testo, testo 545 Serial No. 02848057 : ThermoSchneider No.918802

STANDARD BAROMETER : Digital Barometer Vaisala Type PTB220 No. V1220015

: Digital Barometer Vaisala Type PTB850 No. V4320001

Calibrated by :

Signed :

Mr. Watcharapol Subwat

Mr. Pisood Promsrit

Mechanical Engineer

(Authorized Signatory)

For the Chief

Sub-Standard Instrument

เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

3 January, 2025

Certification No. 001/25

Page : 2 of 5

Standard	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacuum	Velocity	Velocity	Correction
Ultrasonic Anemometer	m/sec	inches H ₂ O	inches H ₂ O	m/sec	m/sec
1.00	-	-	-	1.0	0.00
3.02	-	-	-	3.0	0.02
5.00	-	-	-	5.0	0.00
7.04	-	-	-	7.0	0.04
9.02	-	-	-	9.0	0.02
11.02	-	-	-	11.0	0.02
13.01	-	-	-	13.0	0.01
15.01	-	-	-	15.0	0.01
17.02	-	-	-	17.1	-0.08
20.02	-	-	-	20.1	-0.08

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

Calibrated by :

Mr. Watcharapol Subwat

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau

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THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 001/25

3 January, 2025

Page : 3 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	mbar
1012.06	1012	0.05
1011.25	1011	0.25
1012.92	1013	-0.08
1010.09	1010	0.09
1008.87	1009	-0.13
1010.43	1010	0.43
1011.39	1011	0.39
1011.05	1011	0.05
1010.72	1011	-0.28
1010.30	1010	0.30
1009.81	1010	-0.19
1008.93	1009	-0.07
1009.35	1009	0.35
1009.89	1010	-0.11
1010.57	1011	-0.43
1011.41	1011	0.41
1012.31	1012	0.31
1009.75	1010	-0.25
1010.67	1011	-0.33
1011.01	1011	0.01

Average

Calibrated by :

Mr. Watcharapol Subwat

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau

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THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

3 January, 2025

Certification No. 001/25

Page : 4 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	mmHg
759.10	759	0.10
758.50	759	-0.50
769.75	760	-0.25
757.63	758	-0.37
756.71	757	-0.29
757.88	758	-0.12
758.60	759	-0.40
758.35	758	0.35
758.10	758	0.10
757.79	758	-0.21
757.42	757	0.42
756.76	757	-0.24
757.07	757	0.07
757.48	757	0.48
757.99	758	-0.01
758.62	759	-0.38
759.29	759	0.29
757.37	757	0.37
758.06	758	0.06
758.32	758	0.32

Average

Calibrated by :

Mr. Watcharapol Subwat

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau

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THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

3 January, 2025

Certification No. 001/25

Page : 5 of 5

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.5	45	0.5
30.4	30	0.4
15.6	16	-0.4

Calibrated by:

Mr. Watcharapol Subwat
Mechanical Engineer



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THAI METEOROLOGICAL DEPARTMENT

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

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue : 3 January, 2025

Certification No. 002/25

Page : 1 of 5

Object : Wind Speed & Wind Direction Data Logger

Manufacturer : SCARLET/TECH

Type : WL-21

Mfg Code : Wireless Receiver 2205DR0113
Wind Sensor 2205DT0113

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

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1012.8 hPa

NATIONAL STANDARD WIND TUNNEL : Wind Aloft Plotting Board

: Micromanometer Theodor Friedrichs FC014 Serial No. 9310119 : HOOK GAGE NO 1425

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

: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)
Serial Number 110730029 (sensor 120629586)

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

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

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

STANDARD BAROMETER : Digital Barometer Vaisala Type PTB220 No. V1220015

: Digital Barometer Vaisala Type PTB335 No. K4320001

Calibrated by:

Signed:

Mr. Watcharapol Subwat

Mr. Pradit Promsat

Mechanical Engineer

(Authorized Signatory)

For The Chief

Sub-Standard Instrument

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THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

3 January, 2025

Certification No. 002/25

Page : 2 of 5

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

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

Calibrated by:

Mr. Watcharapol Subwat
Mechanical Engineer



เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

3 January, 2025

Certification No. 002/25

Page : 3 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	mbar
1012.05	1012	0.05
1011.25	1011	0.25
1012.92	1013	-0.08
1010.09	1010	0.09
1008.87	1009	-0.13
1010.43	1010	0.43
1011.39	1011	0.39
1011.05	1011	0.05
1010.72	1011	-0.28
1010.30	1010	0.30
1009.81	1010	-0.19
1008.93	1009	-0.07
1009.35	1009	0.35
1009.89	1010	-0.11
1010.57	1011	-0.43
1011.41	1012	-0.59
1012.31	1012	0.31
1009.75	1010	-0.25
1010.67	1011	-0.33
1011.01	1011	0.01

Average

Calibrated by:

Mr. Watcharapol Subwat
Mechanical Engineer



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The Result of Calibration

Certification No. 002/25

3 January, 2025

Page : 4 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	mmHg
759.10	759	0.10
758.50	759	-0.50
759.75	760	-0.25
757.63	757	0.63
756.71	757	-0.29
757.88	758	-0.12
758.60	758	0.60
758.35	758	0.35
758.10	758	0.10
757.79	758	-0.21
757.42	757	0.42
758.76	757	-0.24
757.07	757	0.07
757.48	758	-0.52
757.99	758	-0.01
758.62	759	-0.38
759.29	759	0.29
757.37	757	0.37
758.06	758	0.06
758.32	758	0.32

Average

Calibrated by :

Mr. Watcharapol Subwat
Mechanical Engineer

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The Result of Calibration

Certification No. 002/25

3 January, 2025

Page : 5 of 5

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.5	45	0.5
30.4	30	0.4
15.6	15	0.6

Calibrated by :

Mr. Watcharapol Subwat
Mechanical Engineer

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.: 25CH22
Page.: 1 of 3

Equipment : pH Meter
Manufacturer : Horiba
Model : LAQUA-PH210
Serial No. : HA0F0026
ID No. : UAE.EFM.068/2564(EFM.pH.01/64)
Condition As-Received: Used Item
Received Date : 08 January 2025
Calibration Date : 09 January 2025
Reference : 2501-0223WSC-1
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong, Bangkok 10260

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

Calibrated by : Warakorn Lerngagatrakul
Approved by :
Approved Signatory

() Pornthippa Tameyakul
() Ponpan Paipim
(✓) Saithip Meangmai
Issue Date : 10 January 2025

The Uncertainties are for a confidence probability of approximately 95%

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

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Cert.No.: 25CH22
Page.: 2 of 3

Condition of this calibration result

1. Reference Standard Instrument

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC116	24E2759	25 Aug 2025
2) Ref. Standard Thermometer	4982054	110RC044	24I757	14 July 2025

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

2. Certified Reference Materials

:The measurement results are traceable to SI through Hach Lenge GmbH Ltd.,
Deutsche Akkreditierungsstelle, Accredited No.D-RM-15184-01-00
:The measurement results are traceable to SI through CPA chem Ltd.,
ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	1034203	27 Sep 2026
pH 7.000	Hach Lenge GmbH	C03185	09 July 2026
pH 10.010	CPA chem	1034205	27 Sep 2025

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

Calibration Results

Function : mV Measurement

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

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (±mV)	Coverage factor k
	pH	mV	mV	pH		
pH Meter S/N: HA0F0026	4.00	177.48	177.5	4.01	0.058	2.00
	7.00	0.00	0.1	7.00	0.058	2.00
	7.00	0.00	0.1	7.00	0.058	2.00
	10.00	-177.48	-177.3	10.01	0.058	2.00

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Cert.No.: 25CH22
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	186.1	0.0071	2.00
	7.000	7.00	10.2	0.0095	2.00
	7.000	7.00	10.0	0.0095	2.00
	10.010	10.01	-164.3	0.0092	2.00

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : -

- Serial No. : -

Dimension of probe

- Length : 104 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
15.0	15.002	15.0	-0.002	0.13	2.00
30.0	30.002	30.0	-0.002	0.13	2.00
45.0	45.004	45.0	-0.004	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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Page 2/3

Certificate No : 24-AFM-223

Request No : Req-2024-1952

Result of Calibration : Without Adjustment

Temperature (°C)	Pressure (kPa)	STD (l/min)	UUC (l/min)	Error (l/min)	Uncertainty (l/min)	MPE (l/min)	Result
23.30	101.30	0.022	0.020	-0.002	0.0013	0.005	N/A
23.50	101.30	0.051	0.050	-0.001	0.0033	0.005	N/A
23.53	101.30	0.102	0.100	-0.002	0.0028	0.005	N/A
23.30	100.68	0.202	0.200	-0.002	0.0056	0.005	N/A
23.50	101.30	0.508	0.500	-0.008	0.0073	0.010	N/A
23.60	101.30	1.910	1.900	-0.010	0.014	0.020	N/A
23.30	101.40	1.717	1.702	-0.015	0.025	0.034	N/A
23.10	101.40	2.026	2.000	-0.026	0.029	0.040	N/A
23.60	101.61	3.014	3.000	-0.014	0.043	0.060	N/A
23.70	101.72	4.023	4.000	-0.023	0.056	0.080	N/A
23.90	101.95	5.025	5.001	-0.024	0.072	0.100	N/A

Note STD : Standard UUC : Unit Under Calibration

- UUC Reference Condition : 21.1 °C, 101.3 kPa, Air

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

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

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

* Indicates non accredited

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

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

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Page 1/3

Certificate of Calibration

Customer

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

Certificate No : 24-AFM-223

Request No : Req-2024-1952

Unit Under Calibration Details

Measurement Item : Air Flow Meter
Manufacturer : TSI Accuracy : 2% or 0.005 lpm, whichever is greater
Model : 4146 Sensor Model : -
Serial Number : 41461813030 Sensor Serial Number : -
ID : UAE-EFM.102/2561 Instrument Status : Used

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 : 28 August 2024
Calibration Date : 8 November 2024

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

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Gilibrator 3 Low flow	18501010066	Sensidyne	6 August 2025
Air Flow Meter	Gilibrator 3 Standard flow	19031011003	Sensidyne	2 August 2025
Temperature meter	GT 11	08000057	Qreborn	1 March 2025
Pressure meter	CPG2400	41000KDU/651882	TPA	21 October 2025

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 Luangatt
Service Calibration Engineer

Approved By : Mr. Paci Mathavorn
Calibration Engineer Supervisor
Issue Date : 8 November 2024

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

FM-708-AFM-01 Rev.04 Issue date 17/6/24

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Page 2/3

Certificate No : 24-AFM-223

Request No : Req-2024-1952

Decision Rule for Statements of Conformity

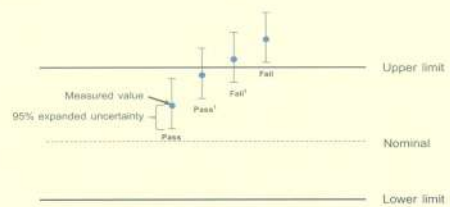
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09-2019: Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

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

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

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

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



End of Certificate

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

FM-708-AFM-01 Rev.04 Issue date 17/6/24

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Certificate of Calibration

Certificate No.: 24P1370
Page: 1 of 2

Equipment : Aneroid Barometer
Manufacturer: Barigo
Model : 111MS
Serial No.: -
ID No.: UAE,EMA2,065/2552

Condition As-Received: Used Item
Received Date: 05 April 2024
Calibration Date: 22 April 2024

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

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

Condition of this result of calibration

1.Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Standard Barometer	DPI142	1422505046	MP-0094-23	03 May 2024

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

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

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

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

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

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

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

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Suksan Khankaew
Issue Date : 23 April 2024

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

เอกสารไม่ควบคุม



Cert.No.: 24P1370
Page: 2 of 2

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

Range : 720 mmHg to 770 mmHg
Scale Interval : 1 mmHg (The Fifth Estimate)

Applied Pressure (mmHg)	715,75	726,88	738,53	749,84	761,99	774,19
UUC* Indication (mmHg)	720,0	730,0	740,0	750,0	760,0	770,0
Error (mmHg)	4,25	3,12	1,47	0,16	-1,99	-4,19

Applied Pressure (mmHg)	774,19	761,85	749,40	738,00	726,53	715,75
UUC* Indication (mmHg)	770,0	760,0	750,0	740,0	730,0	720,0
Error (mmHg)	-4,19	-1,85	0,60	2,00	3,47	4,25

The uncertainty of measurement was ± 0,24 mmHg

* UUC = Unit Under Calibration

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

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Certificate of Calibration

Certificate No.: 24H716
Page: 1 of 2

Equipment : Digital Thermo-Hygrometer
Manufacturer: Digicon
Model : TH-02
Serial No.: 395034173
ID No.: UAE-EFM,162/2565

Condition As-Received: Used Item
Received Date: 05 April 2024
Calibration Date: 10 April 2024
to 11 April 2024

Reference: 2404-0245WSC
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 were conducted using in-house calibration procedure CP-H03 according to comparison with standard chilled mirror sensor for humidity measurement function and comparison with standard temperature probe for temperature measurement function into humidity / temperature chamber.

Condition of this result of calibration

1.Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Chilled Mirror Hygrometer	Dew Master	44730	21658	02 Aug 2024
2) Handheld Thermometer With Sensor	1521	ASA339	2311238	16 Oct 2024

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

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

-Thunder Scientific Corporation, NV/LAB Accreditation No. Calibration 200582-0

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

Calibrated by : Vipom Tantiyawutti
Issue Date : 17 April 2024

Approved Signatory :
[✓] Chalott Wanwanjui
[] Vipom Tantiyawutti
[] Unnopphol Harachai

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Cert. No.: 24H716
Page: 2 of 2

Result of Calibration:- Without Adjustment
Function:- Humidity Measurement.

Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (±%R.H.)
25.0	40.1	41	0.9	1.3
25.0	50.1	50	-0.1	1.6
25.0	60.0	58	-2.0	1.6
25.0	70.2	66	-4.2	1.6

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

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
19.996	20.3	0.302	0.42
25.031	25.6	0.569	0.42
30.045	30.2	0.155	0.42
40.023	39.9	-0.123	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%.

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Certificate of Calibration

Customer

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

Certificate No : 24-ACT-065
Request No : Req-2024-1022

Unit Under Calibration Details

Measurement item : Acoustic Calibrator
Manufacturer : 01dB
Model : CAL31
Serial Number : 82795
ID : UAE EFM.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 : 8 May 2024
Calibration Date : 17 May 2024
Location of Calibration : LAB 1 Acoustic
Calibration Procedure : In-house method CP-ACT-02 based on IEC 60942:2017 Electroacoustics - Sound calibrators


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

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

Note

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

Calibrated By : 
Mr. Noppadon Luangart
Service Calibration Engineer

Approved By : 
Mr. Pacit Mathavorn
Calibration Engineer Supervisor
Issue Date : 17 May 2024

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the body.
FM-708-ACT-02 Rev.01 Issue date:8/23

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Certificate No : 24-ACT-065

Request No : Req-2024-1022

Sound pressure level

Calibration Results : Without Adjustment

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty (± dB)	Acceptance limit Class 1 (± dB)
	Measured	Deviated value	Measured	Deviated value		
94 dB / 1000 Hz	94.17	0.17	-	-	0.13	0.25

Frequency of Sound pressure level

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

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

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

Note :

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

- Acceptance limit was IEC60942:2017 Class 1

- The calibration results exclude the calibrator pressure correction

- The calibration results exclude the microphone volume correction

End of Calibration

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the body.
FM-708-ACT-02 Rev.01 Issue date:8/23

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Certificate of Calibration

Customer

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

Certificate No : 24-ACT-077
Request No : Req-2024-1138

Unit Under Calibration Details

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

Calibration Environment and Details

Temperature : (23 ±2 °C)
Humidity : (50 ± 20 %RH)
Barometric Pressure : (1013 ±10.0 hPa)
Received Date : 23 May 2024
Calibration Date : 30 May 2024
Location of Calibration : LAB 1 Acoustic
Calibration Procedure : In-house method CP-ACT-02 based on IEC 60942:2017 Electroacoustics - Sound calibrators


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

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

Note

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

Calibrated By : 
Mr. Noppadon Luangart
Service Calibration Engineer

Approved By : 
Mr. Pacit Mathavorn
Calibration Engineer Supervisor
Issue Date : 30 May 2024

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the body.
FM-708-ACT-02 Rev.01 Issue date:8/23

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Certificate No : 24-ACT-077

Request No : Req-2024-1138

Sound pressure level

Calibration Results : Without Adjustment

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty (± dB)	Acceptance limit Class 1 (± dB)
	Measured	Deviated value	Measured	Deviated value		
94 dB / 1000 Hz	93.83	-0.17	-	-	0.13	0.25
114 dB / 1000 Hz	113.80	-0.20	-	-	0.13	0.25

Frequency of Sound pressure level

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

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

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

Note :

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

- Acceptance limit was IEC60942:2017 Class 1

- The calibration results exclude the calibrator pressure correction

- The calibration results exclude the microphone volume correction

End of Calibration

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the body.
FM-708-ACT-02 Rev.01 Issue date:8/23

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Certificate of Calibration

Customer

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

Certificate No : 24-ACT-120
Request No : Req-2024-1896

Unit Under Calibration Details

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

Calibration Environment and Details


Temperature : (23 ± 2 °C)
Humidity : (50 ± 20 %RH)
Barometric Pressure : (1013 ± 10.0 hPa)
Received Date : 26 August 2024
Calibration Date : 10 September 2024
Location of Calibration : LAB 1 Acoustic
Calibration Procedure : In-house method CP-ACT-02 based on IEC 60942:2017 Electroacoustics - Sound calibrators


Reference Standard	Model	Serial Number	Traceable	Due Calibration
Sound Calibrator	SV 35A	58079	EEI	12 June 2025
THD Multimeter	2015	1047765	NIMT	16 January 2025

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

Note

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

Calibrated By : 
Mr. Noppadon Luangart
Service Calibration Engineer

Approved By : 
Mr. Pacit Mathavorn
Calibration Engineer Supervisor
Issue Date : 10 September 2024

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the head of Calibration Laboratory.
FM-70B-ACT-02 Rev.03 Issue date 5/6/24

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Certificate No : 24-ACT-120
Request No : Req-2024-1896

Sound pressure level

Calibration Results : Without Adjustment

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty (± dB)	Acceptance limit Class 2 (± dB)	Result
	Measured	Deviated value	Measured	Deviated value			
94 dB / 1000 Hz	93.96	-0.04	-	-	0.13	0.40	Pass
114 dB / 1000 Hz	114.04	0.04	-	-	0.13	0.40	Pass

Frequency of Sound pressure level

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)	Acceptance limit Class 2 (± %)	Result
	Measured (Hz)	Deviated	Measured (Hz)	Deviated			
94 dB / 1000 Hz	999.14	0.09	-	-	0.01	1.7	Pass
114 dB / 1000 Hz	999.11	0.09	-	-	0.01	1.7	Pass

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

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

Note :

Function	Maximum-permitted Uncertainty of measurement
Sound pressure level	0.35 dB
Frequency	0.20%
Total distortion+noise	1.00%

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

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the head of Calibration Laboratory.
FM-70B-ACT-02 Rev.03 Issue date 5/6/24

เอกสารไม่ควบคุม

Certificate No : 24-ACT-120
Request No : Req-2024-1896

Decision Rule for Statements of Conformity

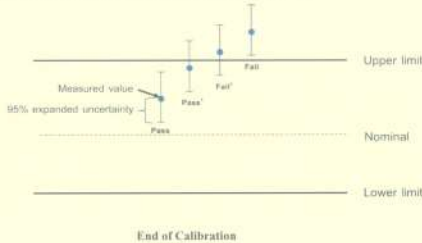
The standard decision rule employed for the statements of conformity in each calibration result will be applied using ILAC-G8:09/2019: Guidelines on the Reporting of Compliance with Specification as following Fig. and statements:

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

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

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

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



End of Calibration

SITHIPORN ASSOCIATES CO., LTD. CALIBRATION LABORATORY

481-491/1 Srinthorn Road, Bangbunru, Bangkok, 10700 Thailand
Tel: +66 2433 8331 Email: calibration@sithiporn.com



Cert. No. : ACL24160
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00409023 / 185669 / 90468
ID No.: UAE.EFM.011/2564

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 : 
(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.

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the head of Calibration Laboratory.
FM-70B-ACT-02 Rev.03 Issue date 5/6/24

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Cert. No. : ACL24160
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).

เอกสารไม่ควบคุม
F. KehnCert. No. : ACL24160
Job No. : VC67AC0071
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
15.6

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

Frequency Weighting	Measured value (dB)
A - weight	14.2
C - weight	20.5
Flat	26.0

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	0.0	0.0	0.0	± 1.0
8000	2.0	2.0	2.1	±5.0

เอกสารไม่ควบคุม
F. KehnCert. No. : ACL24160
Job No. : VC67AC0071
Pages : 3 of 8

Summary of Measurement Result :

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

เอกสารไม่ควบคุม
F. KehnCert. No. : ACL24160
Job No. : VC67AC0071
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

เอกสารไม่ควบคุม
F. Kehn

Cert. No. : ACL24160
Job No. : VC67AC0071
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	137.1	0.1	± 1.1
136.0	136.1	0.1	± 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	129.1	0.1	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.1	0.1	± 1.1
114.0	114.1	0.1	± 1.1
109.0	109.1	0.1	± 1.1
104.0	104.1	0.1	± 1.1
99.0	99.1	0.1	± 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	28.1	0.1	± 1.1
27.0	27.1	0.1	± 1.1
26.0	26.2	0.2	± 1.1
25.0	25.2	0.2	± 1.1

เอกสารไม่ควบคุม
T. Petchur

Cert. No. : ACL24160
Job No. : VC67AC0071
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

Cert. No. : ACL24160
Job No. : VC67AC0071
Pages : 8 of 8

Cert. No. : ACL24167
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No. : 01010783 / 194538 / 14661
ID No. : UAE.EFM.086/2565

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 : 15 MAY 2024
Calibration Date : 06 - 07 JUNE 2024
Date of Issue : 07 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

เอกสารไม่ควบคุม
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-42KA1	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

เอกสารไม่ควบคุม

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)
14.8

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	16.7
Flat	22.3

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.1	0.1	0.1	± 1.5
1000	-0.1	-0.1	-0.1	± 1.0
8000	-0.9	-0.8	-0.7	±5.0

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Cert. No. : ACL24167
Job No. : VC67AC0090
Pages : 6 of 8

Cert. No. : ACL24167
Job No. : VC67AC0090
Pages : 7 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	136.1	0.1	± 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	129.1	0.1	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.1	0.1	± 1.1
114.0	114.1	0.1	± 1.1
109.0	109.1	0.1	± 1.1
104.0	104.1	0.1	± 1.1
99.0	99.1	0.1	± 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	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 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

เอกสารไม่ควบคุม

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	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	136.2	-0.2	±3.0

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

เอกสารไม่ควบคุม

Cert. No. : ACL24167
Job No. : VC67AC0090
Pages : 8 of 8

Cert. No. : ACL25018
Pages : 1 of 8

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00208876 / 157966 / 90321
ID No.: UAE.EFM.005/2564

Condition As Found : GOOD

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

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

Received Date : 03 JANUARY 2025
Calibration Date : 13 - 14 JANUARY 2025
Date of Issue : 15 JANUARY 2025

Calibrated by : Naphakorn Pisutpaisan

Approved by : 
(Thanakul Petchuraj)

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

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Cert. No. : ACL25018
Job No. : VC68AC0056
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).

เอกสารไม่ควบคุม
J. KetchCert. No. : ACL25018
Job No. : VC68AC0056
Page : 4 of 8**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)
20.6

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

Frequency Weighting	Weighting (dB)
A - weight	16.3
C - weight	22.1
Flat	28.0

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	0.4	0.4	0.4	± 1.5
1000	0.1	0.1	0.1	± 1.0
8000	1.7	1.7	1.7	±5.0

เอกสารไม่ควบคุม
J. KetchCert. No. : ACL25018
Job No. : VC68AC0056
Pages : 3 of 8**Summary of Measurement Result :**

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

เอกสารไม่ควบคุม
J. KetchCert. No. : ACL25018
Job No. : VC68AC0056
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz:

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	0.0	0.0	±2.0
125	0.0	0.0	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	± 0.1

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J. Ketch

Cert. No. : ACL25018
Job No. : VC68AC0056
Pages : 6 of 8

Cert. No. : ACL25018
Job No. : VC68AC0056
Pages : 7 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.1	0.1	± 1.1
30.0	30.2	0.2	± 1.1
29.0	29.2	0.2	± 1.1
28.0	28.2	0.2	± 1.1
27.0	27.3	0.3	± 1.1
26.0	26.4	0.4	± 1.1
25.0	25.5	0.5	± 1.1

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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)
130	94.0	94.0	0.0	±1.1

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	29.0	29.1	0.1	±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

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Cert. No. : ACL25018
Job No. : VC68AC0056
Pages : 8 of 8

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	130.0	130.0	0.0	±3.0
One	133.4	133.3	-0.1	±3.0

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

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.5	89.6	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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List of Instrument Certificates for Environmental Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*
1	Atomic Absorption Spectrometer	Cd, Cr ⁶⁺ , Cr ³⁺ , Cu, Pb, Ni, Zn, Mn, Fe	Agilent Technologies	AA200FS / MY13160001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	30 Jan 25	29 Jan 26
		AS	Perkin Elmer	PinAAcle 900F / PFB20031902	Perkin Elmer Co.,Ltd.	Preventive Maintenance Report	29 Apr 25	28 Apr 26
2	Mercury Analyzer	Hg	NIC. Japan	RA-4500 / 17780278	Coax Group Corporation Ltd.	Preventive Maintenance Report	9 Jul 24	8 Jul 25
3	Analytical Balance	FAT OIL AND GREASE	Mettler Toledo	AB204-SFACT / 1129361010	United Analyst and Engineering Consultant Co.,Ltd.	250422 1 BL002 25	23 Apr 25	22 Apr 26
		TOTAL SUSPENDED SOLIDS	Mettler Toledo	XSR205DU / C09071872	National Food Institute,Ministry of Industry,Thailand	2502226-001-01	20 Mar 25	19 Mar 26
		TOTAL DISSOLVED SOLIDS	YSI	5100 / 118 101863	Technology Promotion Association (Thailand-Japan)	25TW29	18 Feb 25	16 Feb 26
		TOTAL DISSOLVED SOLIDS	Mettler Toledo	XSR205DU / C210685394	National Food Institute,Ministry of Industry,	2502226-002-01	20 Mar 25	19 Mar 26
4	DO Meter	BIOCHEMICAL OXYGEN DEMAND	YSI	5100 / 118 101863	Technology Promotion Association (Thailand-Japan)	25TW29	18 Feb 25	16 Feb 26
5	Hot Air Oven	TOTAL SUSPENDED SOLIDS	Memmert	UF55 / B212.0411	Technology Promotion Association (Thailand-Japan)	25TM579	19 Mar 25	18 Mar 26
6	pH Meter	pH	Horiba	LAQUA-PH210 / HA9M0047	Technology Promotion Association (Thailand-Japan)	25CH354	20 Mar 25	18 Mar 26
		pH	EcoSense	pH100A / JC04744	Technology promotion association (thailand-japan)	25CH408	3 Apr 25	2 Apr 26
7	UV/VIS Spectrophotometer	CHEMICAL OXYGEN DEMAND	Hitachi	U-5100 / 23A4-008	DOE Services Co.,Ltd.	SP24-028	11 Sep 24	9 Sep 25
		FLUORIDE NITRATE SULPHATE	Hitachi	U-2900 / 21E22-009	DOE Services Co.,Ltd.	SP25-001	3 Jan 25	2 Jan 26
8	Gas Chromatography/Mass Spectrometer	VOCs	Brüker	450GC / BR1201M099	Thai Unique Co.,Ltd	SV2407/21898	16 Jul 24	15 Jul 25
9	Incubator	FECAL COLIFORM BACTERIA	Binder	K8400 / 2022000022479	Technology Promotion Association (THAILAND-JAPAN)	24TM938	9 Jul 24	8 Jul 25
		TOTAL COLIFORM BACTERIA						
10	Turbidity Meter (Portable)	TURBIDITY (NTU)	T100IR / 1120501017	Technology Promotion Association (Thailand-japan)	24CH1115	45541	6 Sep 24	5 Sep 25

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

List of Instrument Certificates for Environmental Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*
11	COD Reactor	CHEMICAL OXYGEN DEMAND	HANNA	HI839800-02 / H0185001	Hanna Instruments (Thailand) Ltd.	HIT-2510-0375	7 Mar 25	6 Mar 26
12	Gas Chromatography	BENZENE, TOLUENE, ETHYL BENZENE,	Agilent Technologies	System ID:CN11021007 7890 / CN11021007	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance	18 Feb 25	17 Feb 26
13	Inductively Coupled Plasma-Optical Emission Spectrometer (ICP-OES)	Co	Agilent Technologies	AA240FS /MY1316001	Thailand Institute of Scientific and Technological Research	ITC-ACL NO. 372/68	3 Feb 25	2 Feb 26

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

Agilent 55 240 280 Series Atomic Absorption Spectroscopy Systems

Preventive Maintenance Checklist

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

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

Note: While non-current production AA instrument and/or accessory models are not covered specifically in this document it can be used as a basic reference.

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

Introduction

Customer Information

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

Revision: 10.00, Issued: November 2021

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Important Customer Web Links

- For more information about Agilent Technologies services, please visit our website using the following URL: <http://www.agilent.com/en-us/products/crosslab-instrument-services/service-repair>
- To access Agilent University, visit <http://www.agilent.com/crosslab/university/> to learn about training options, which include online, classroom and onsite delivery. A training specialist can work directly with you to help determine your best options.
- A useful Agilent Resource Center web page is available, which includes short videos on maintenance, quick lists of consumables for new instruments, and other valuable information. Check out the Resource Page here: <https://www.agilent.com/en-us/agilentresources>
- Need technical support, FAQs, supplies? – visit our Support Home page at <http://www.agilent.com/search/support>
- Get answers. Share insights. Build connections. Join the Agilent Community at <https://community.agilent.com/welcome>

Service Engineer's Responsibilities

- Contact the customer and ensure that all necessary supplies are available before the preventive maintenance visit.
 - Confirm the ability of the instrument to deliver continued safe operation as established via the Agilent AA safe operation flow chart. (Refer directly to the AA 55/240/280 Preventive Maintenance Scope of Work to make this decision.)
 - Only select those pages that relate to the system or module being serviced.
 - Complete empty fields with the relevant information.
 - Complete the relevant checkboxes in the checklist using either a "X" or tick mark "✓".
 - Check "Section not applicable" check boxes to indicate services/tasks not delivered, as appropriate.
 - Complete the Preventive Maintenance service in the order of the tasks listed.
 - Complete the Service Review section together with the customer.
 - Complete the fields for page numbers at the foot of each selected page
 - Complete the total number of pages field in the Service Completion section
 - Ask the customer to sign the Service Completion section including the customer's and your signature.
- This information is subject to change without notice.

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Instrument Maintenance

System Information

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

Instrument System Name and ID	240 FS AAS
Instrument System Site and Location	United Analyst and Engineering Consultant

List System Component Product Numbers	List the Serial Numbers of each Component
1. G 9432 A	M 13160001
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	

Preparation, Safe operation and Initial performance checks

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- ☐ Agilent AA safe operation flow chart inspections (to determine if the PM can be performed).

NOTE: If by following the flow chart the instrument is deemed to be unsafe for continued use you MUST NOT continue PM work. Inform the customer immediately of the Agilent recommendation that use of the instrument be discontinued.

- ☒ Discuss any specific issues with the customer before starting.
- ☐ For HF application systems, if standard sample introduction system was not installed, ask the customer to install it. **NA**
- ☒ 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.
- ☒ Use SVD to perform a Full Wavelength Scan for Cu HCL - "As found test_1"
- ☒ Perform a Basic Cu ABS test - "As found test_2"
- ☒ Print the Details page or screen captures of the test results and attach to the end of this checklist.

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Preventive Maintenance Procedures

FLAME SYSTEM section

☐ Section not applicable

Electronic components

- ☒ Review and confirm instrument configuration data in SVD
- ☒ Confirm power supply voltages using the *SVD Power Supply diagnostic*.
- ☒ For Dual Beam Instruments - Confirm RBC frequency using the *SVD RBC frequency diagnostic*.

Mechanical components

- ☒ Check the burner adjuster controls for complete and free movement. If the burner adjuster needs lubrication, use Molykote 321 or mineral-based molybdenum disulphide grease.
- ☒ Run SVD tests to exercise all motor drives over the full range of their travel:
 - ☒ Monochromator drive
 - ☒ Slit drive
 - ☒ Lamp selector
 - ☐ ABA

Optics components

- ☒ Check that external optical surfaces are clean – Clean or replace as required.
- ☒ Use SVD and perform *Mono Wavelength Correction*.
- ☒ Use SVD and perform *Slit Calibration*.
- ☒ Use SVD and perform *Grating Squareness Diagnostic*.
- ☒ Use SVD and perform *Zero Order Offset/Mono Correction*.
- ☒ Use SVD and perform *Wavelength Repeatability*.
- ☒ Physically inspect selected HC lamps (customer to supply per their choice) and measure the % Gain for each lamp. Advise customer if lamps are showing emission degradation due to age.
- ☒ Check that the signal energy of the D2 and HC lamps track properly. Advise customer if their D2 lamp is showing emission degradation due to age.

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Sample Introduction and Atomization

- ☒ Inspect the burner interlock plate to ensure that the interlock pin is secure and correct for the burner type.
- ☒ Clean the burner slot with a clean white card.
- ☒ Check the uniformity of the slot width.
- ☒ Clean the burner if required.
- ☒ Change the burner o-ring.
- ☒ Clean the nebulizer, spray chamber and liquid trap.
- ☒ Change all o-rings and seals in the nebulizer, nebulizer block and spray chamber.
- ☒ Check that the pressure relief bung releases readily.
- ☒ Change o-rings on the fuel and oxidant delivery bars.
- ☒ Leave the liquid trap EMPTY and verify the flame will not ignite in this state.
- ☒ Refill liquid trap and check that overflow drains freely into the drain/waste tube.
- ☒ Check the drain/waste tube for good drainage. It should not have tight bends, kinks or loops and the lower end must be above the liquid level in the waste vessel
- ☒ Check and clean the igniter electrode

Gas handling components and safety interlocks

- ☒ Pressure test for leaks
- ☒ Leak test gasbox internal components and connections
- ☒ Check safety interlock status and operation using the *SVD Interlock monitoring diagnostic*.

Analytical performance for Flame systems

- ☒ Ignite a flame.
- ☒ Check that you can adjust the nebulizer uptake rate from 4 to 6.5 mL per minute.
- ☒ Optimize the instrument ready to perform Cu sensitivity test.
- ☒ Create a manual method to perform a Basic Cu ABS test - "Final Performance Testing"
- ☒ Run a PM completed sensitivity test for a 5 ppm copper sample and record the results in the AA PM Performance test results and measurements table.

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FURNACE SYSTEM section

☒ Section not applicable

Electronic components

- ☐ Review and confirm instrument configuration data in SVD
- ☐ Confirm power supply voltages using the *SVD Power Supply diagnostic*.

Mechanical components

- ☐ Run SVD tests to exercise all motor drives over the full range of their travel:
 - ☐ Monochromator drive
 - ☐ Slit drive
 - ☐ Lamp selector

Optics components

- ☐ Check that external optical surfaces are clean – Clean or replace as required.
- ☐ Use SVD and perform *Mono Wavelength Correction*.
- ☐ Use SVD and perform *Slit Calibration*.
- ☐ Use SVD and perform *Grating Squareness Diagnostic*.
- ☐ Use SVD and perform *Zero Order Offset/Mono Correction*.
- ☐ Use SVD and perform *Wavelength Repeatability*.
- ☐ Physically inspect selected HC lamps (customer to supply per their choice) and measure the % Gain for each lamp. Advise customer if lamps are showing emission degradation due to age.

Gas handling, water system and workhead component checks

- ☐ Inspect the GTA workhead gas hoses and connections for leaks.
- ☐ Pressure test for gas leaks
- ☐ If the cooler system is accessible (stand-alone) check for correct operation and coolant/water level – this includes any temperature and pressure settings plus filter cleaning (air flow and water).
- ☐ Inspect the GTA workhead water hoses and connections for leaks.
- ☐ Check all graphite components and replace if necessary.

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- ☐ Tube
- ☐ Electrodes
- ☐ Shroud

- ☐ Check and clean the end windows on the workhead.
- ☐ Check safety interlock operation.

Analytical performance for Furnace systems

- ☐ Optimize the instrument ready to perform Cu sensitivity test.
- ☐ Run the sensitivity test for a 25 ppb copper sample and record the results in the results table.

PSD autosampler accessory for Furnace systems

☒ Section NOT Applicable

- ☐ Check condition of the PSD capillary – replace if necessary
- ☐ Check condition and operation of PSD syringe – ensure it does not have air locks and bubbles.
- ☐ Change PSD rinse bottle o-ring.
- ☐ Check and clean the rinse vessel.
- ☐ Check the drain tube for good drainage. It should not have tight bends, kinks or loops and the lower end must be above the liquid level in the waste vessel.
- ☐ Ensure that the waste vessel is suitable for use with the furnace system.

Sample introduction pump system (SIPS) accessory

☒ Section NOT Applicable

- ☐ Re-torque screws securing the hubs, presser arms and pump rotors.
- ☐ Adjust each roller so that it rotates freely.
- ☐ Wipe clean the pump rotor rollers and pump bands with a dry clean cloth.
- ☐ Ensure that the presser arms and the surfaces near the pump are free from dirt and spills.
- ☐ Remove the pump module rear cover and check for the incursion of liquids and any signs of corrosion.
- ☐ Re-torque the nuts that fasten the motor mounting plates to the chassis.
- ☐ Check clips securing the diluents holder and replace if necessary.
- ☐ Disconnect, clean T-piece, and reassemble the tubing using the following steps.

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- ☐ Remove the T-piece by disconnecting the pump tubes, the pump bands and all other tubing.
- ☐ Place the T-piece in an ultrasonic bath containing strong detergent 1-5% Decon 30 or similar, for approximately 5-10 minutes.
- ☐ Wash the T-piece under a tap with a strong flow of water.
- ☐ Rinse with distilled water through all of the inlets in the reverse direction to normal sample flow.
- ☐ Reassemble.

Sample preparation system (SPS 4) accessory

☒ Section NOT Applicable

The Agilent SPS 4 autosampler is designed to need minimal maintenance.

The following maintenance requirements are suggested to maintain the performance of the autosampler.

- ☐ Cleaning the spill tray, rack location mat, end frames and chassis accessories with a damp soft cloth and diluted mild detergent.
- ☐ Cleaning the autosampler cover panels with domestic window cleaner.
- ☐ Checking the X- axis and Z- axis drive belts for cracks, splits, damaged teeth, excessive fraying, color changes or degradation from fumes.
- ☐ Check the X- axis, Theta- axis and Z- axis FFC cables for cracks, incorrect positioning, damaged edge or damaged connectors.

NOTE: The autosampler requires no extra lubrication throughout its lifetime.

For further details refer to the SPS 4 service manual G8410-90050.

Sample preparation system (SPS 3) accessory

☒ Section NOT Applicable

- ☐ Check the x-axis and z-axis timing belts – Replace if there is any cracks, splits or color deterioration and belt tension.
- ☐ Check belt tensions - adjust if required
- ☐ Check the lubrication pad for single x-axis shaft. If pad is dry or customer has observed any vibration or erratic movements of the x-axis carriage, add 1 mL of Dow Corning 200 @ Fluid, 200 CS into the well.
- ☐ Check the auto-sampler ability to find tube positions - Calibrate if required.
- ☐ Clean the exterior surfaces of the accessory with soft lint free cloth. This cloth can be dampened with warm water or a mild detergent. Do not use organic solvents or abrasive cleaning agents.

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Vapor generation accessory VGA (hydride generator)

☒ Section NOT Applicable

- ☐ Inspect VGA gas supply hose.
- ☐ Inspect/replace VGA pump tubing.
- ☐ Check low gas pressure interlock setting – adjust if required.
- ☐ Check precision orifice gas flow setting – adjust if required.
- ☐ Check gas regulator pressure to 46 psi (325 kPa) – adjust if required.
- ☐ Clean the exterior surfaces of the accessory with soft lint free cloth. This cloth can be dampened with warm water or a mild detergent. Do not use organic solvents or abrasive cleaning agents.

UltrAA lamp accessory (external)

☒ Section NOT Applicable

- ☐ Check the condition of the power cable.
- ☐ Clean the exterior surfaces of the accessory with soft lint free cloth. This cloth can be dampened with warm water or a mild detergent. Do not use organic solvents or abrasive cleaning agents.

Restore System

- ☐ If you have altered the customer's instrumentation during the course of PM, restore to the original status to allow the customer to conduct their normal activities (e.g., reload the customer's method.)

Guidance

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

Revision: 10.00, Issued: November 2021

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

Test Results

Test Description	Expected Test Result	Actual Test Result
Flame optics PMT Gain test		
For copper at 324.8 nm, 4 mA, 0.5 nm slit width	< 55 %	49 %
Flame performance test with 5 ppm copper sample		
Air /acetylene, mixing paddle removed	Abs value > 0.5	0.5599
Air /acetylene, mixing paddle installed, 10 replicates	%RSD < 1.0	0.2 %
Deuterium furnace optics PMT Gain test		
For copper at 324.8 nm, 4 mA, 0.5 nm slit width	< 55 %	—
Deuterium furnace performance test with 25 ppb copper sample (324.8 nm)		
Precision %RSD	≤ 4.0%	—
Abs value	≥ 0.15	—
Zeeman furnace analytical performance: 25 ppb copper sample (327.4 nm)		
Precision %RSD	≤ 4.0%	—
Abs value	≥ 0.10	—
MSR%	≥ 70 %	—

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AA consumable and parts list table

Part Description	Part Number	Product/Model # where used	PM supplied or Consumable	Instrument-Type
Test Solution – Cu 5ppm solution	6610030100	50 55 140 240 280	PM supplied	Common
Test Solution - Blank solution	5190-7001	50 55 140 240 280	PM supplied	Common
Copper, 1000 ug/ml, 100ml	5190-8279	50 55 140 240 280	*	Common
Kit, Mk 7 O-rings, aqueous, complete set	9910093400	50 55 140 240 280	PM supplied	Flame
Organic Kit	9910093500	50 55 140 240 280	PM supplied	Flame
Wire Nebulizer Cleaning	9910024700	50 55 140 240 280	consumable	Flame
Tubing-Capillary Std Nebs	9910024800	50 55 140 240 280	consumable	Flame
Capillary Tube Hivac Neb (3) (organics only)	9910044000	50 55 140 240 280	consumable	Flame
Glass impact beads (5/pk)	9910025700	50 55 140 240 280	consumable	Flame
Teflon impact beads (5/pk): (organics only)	9910053300	50 55 140 240 280	consumable	Flame
Burner cleaning strip (100/pk)	9910053900	50 55 140 240 280	consumable	Flame
Window UV silica – round (right side)	2010082600	50 55 140 240 280	PM supplied	Common
Window UV silica – rectangular (left side)	2010082500	50 55 140 240 280	PM supplied	Common
Pad adhesive window (round)	4910012700	50 55 140 240 280	PM supplied	Common
Pad adhesive window (rectangular)	4910012800	50 55 140 240 280	PM supplied	Common
Electrode kit (1 pr) (D2)	6310003400	GTA120	PM supplied	Furnace
Shroud (D2)	6310003100	GTA120	PM supplied	Furnace
Zeeman electrode kit (1 pr)	6310003500	GTA120	PM supplied	Furnace
Zeeman shroud	6310003600	GTA120	PM supplied	Furnace
O-ring PSD rinse bottle	6910025900	PSD120	PM supplied	Furnace

* For engineers who only service AA instruments 5190-8279 can be used as a cheaper alternative for 6610030100.

Items classified as PM supplied in the above table are included in the standard PM

Those classified as consumable should be provided by the customer or charged to the customer if supplied by the Agilent service engineer.

Revision: 10.00, Issued: November 2021

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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.

Report ID: Diagnostic Start Time: 1/30/2025 9:14:28 AM Diagnostic End Time: 1/30/2025 9:46:08 AM
Customer: UAE Service Engineer: Kanyakorn S.
Address: Soi Udumuk 41, Sukhumvit Rd, Bangkok Contact Details: 026376363#1

Configuration:

Serial Number: MY13160001 Turret Type: Automatic
Instrument Model: Varian AA140/240/280 Number Of Lamps: 4
Flame Instrument: True Mono Type: Automatic
Furnace Instrument: True Gasbox Type: Y Gas Box
Zeeman Present: False Auto Burner Adjuster: False
Internal Zeeman: False Mains Frequency: 50
Internal UltraAA: False Firmware Version: 2.11
Optics Type: Double Beam Photomultiplier Type: Normal(900nm)
D2 BG Correction Fitted: True PWB Version: 45
Boot Block Version: 1.00

EEPROM Data:

Instrument Run Hours: 62819.180 D2 Run Hours: 53396.500
Zero Wavelength Offset: 0.133 D2 Serial Number: not set!
Mono Correction: 0.770 D2 Install Date: 1/1/1970
Flame Hours: 32411.634 D2 Original Intensity: 1.000
D2 Last Intensity: 475.000

Service Completion

Service request number: 6007549143 Date service completed: 30 Jan 2025
Agilent signature: Kanyakorn S. Customer signature: David Y.
Total number of pages in this document: 13



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Frequency:

Averaging Period: 30.0
Datapoint Count: 20
Upper Limit: 51.00 Highest Measured Frequency: 50.00
Average Frequency: 50.00
Lower Limit: 49.00 Lowest Measured Frequency: 50.00
Result: **Passed**

Power Supply:

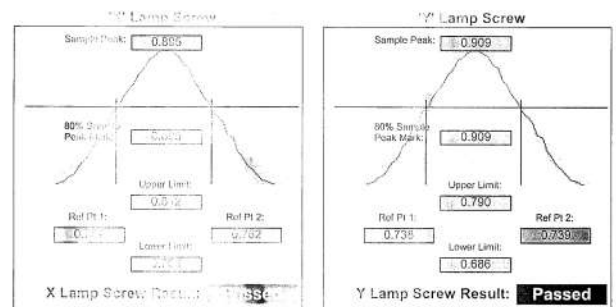
Averaging Period: 30.0
Datapoint Count: 20

	Lower Limit (V)	Actual (V)	Upper Limit (V)	Result:
12.00 V Rail	10.80	12.12	13.20	Passed
-12.00 V Rail	-13.20	-11.90	-10.80	Passed
5.00 V Rail	4.50	5.04	5.50	Passed
310.00 V Rail	279.00	330.00	341.00	Passed

Beam Balance:

Lamp Type: Copper
Lamp Socket Used: 3

Peak Selected: 324.80
Lamp Alignment: **Performed**



Grating Scattering:

Lamp Element(s): Copper
Lamp Turret Position: 3
Lamp Current(mA): 4.00
Scan Wavelength(nm): 0.5
1st Scattered Wavelength(nm): 324.80
Lamp Alignment: **Performed**

	Lower Limit (nm)	Actual (nm)	Upper Limit (nm)	Result:
Zero Order	-0.10	0.00	0.10	Passed
First Order	324.45	324.75	325.15	Passed
Second Order	648.90	649.50	649.97	Passed

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Wavelength Repeats: 2

Lamp Used: Copper
Peak Used(nm): 324.759
Connected to Socket: 3

Lamp Current(mA): 4
Slit Width(nm): 0.2
Slit Height: Normal

Lamp Alignment:

Lower Limit(nm) 324.759 Upper Limit(nm) 324.888

(Approach from Zero Drive) (Approach from end)

Sample 1: 324.823 Sample 2: 324.823
Sample 3: 324.823 Sample 4: 324.823
Sample 5: 324.823 Sample 6: 324.819
Sample 7: 324.819 Sample 8: 324.819
Sample 9: 324.823 Sample 10: 324.819

Absorbance: 0.000 Standard Deviation: 0.003

Result:

เอกสารไม่ควบคุม

Auto Lamp Recognition:

Lamp 1: Un-coded Lamp/Not Connected Lamp 5: Not Supported
Lamp 2: 87 - Silver/Cadmium/Lamp/Not/Used/Not/Supported Lamp 6: Not Supported
Lamp 3: 14 - Copper (Cu) Lamp 7: Not Supported
Lamp 4: Un-coded Lamp/Not Connected Lamp 8: Not Supported

Result:

GTA Temperature Monitoring:

Notes:

Signatures:

Signature: Kanyakorn S. 30 Jan 2025

เอกสารไม่ควบคุม

Wavelength Drive:

Slit Drive:

Turret Drive:

Auto Burner/Turret Motor:

Signal Processing Linearity:

Calculated Results: New Data Mode

	Lower Limit	Absorbance	Upper Limit	Result:
Q2	114	1	297	
Q1	198	114	191	
Q1	271	114	332	
Q2	474	114	579	
Q3	936	114	1008	
Q1	1455	114	1754	
Q2	2108	114	3053	
Q3	4547	114	5313	

Interlocks:

Burner Flame:

WFO Burner Flame:

Flame Shield Closed:

Gas Control Flame:

Pressure Release During Flame:

Liquid Trap Status:

Flame Detect:

SCU Active:

Oxidant Pressure:

Oxidant Changeover:

Ignition:

เอกสารไม่ควบคุม

Sequential by time report 1/30/2025 10:53 AM SpectraAA
Page 1 of 1

Analyst:
Date Started: 1/30/2025 10:33 AM GMT: 1/30/2025 3:33 AM
Worksheet: Sensitivity Test 01
Comment:
Methods: Cu
Computer name: DESKTOP-R3UFRS
Serial Number: MY13160001

Method: Cu (Flame)

Sample ID	Conc. mg/L	%RSD	Mean Abs
CAL ZERO	0.000	38.8	0.0002
Readings			
	0.0002	0.0003	0.0001
1/30/2025 10:51:46 AM			
STANDARD 1	5.000	0.1	0.5571
Readings			
	0.5574	0.5563	0.5575
1/30/2025 10:52:22 AM			

Abs Linear Origin - Cal. Set 1

Curve Fit = Linear Origin
Characteristic Conc = 0.030 mg/L
r = 1.0000
Calculated Conc = 0.002 5.000
Residuals = -0.007 0.000

Abs = 0.11141 x C

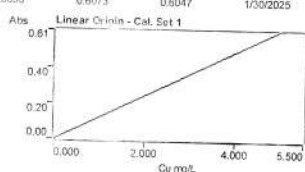
5 ppm Cu	Abs	%RSD	Mean Abs
5.025	0.3	0.5558	
Readings			
	0.5582	0.5596	0.5615
1/30/2025 10:52:54 AM			

เอกสารไม่ควบคุม

Analyst:
Date Started: 1/30/2025 10:33 AM GMT: 1/30/2025 3:33 AM
Worksheet: Precision Test
Comment:
Methods: Cu
Computer name: DESKTOP-19UFRS
Serial Number: MY13160001

Method: Cu (Flame)

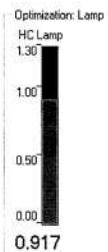
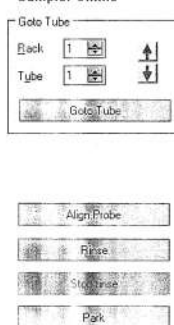
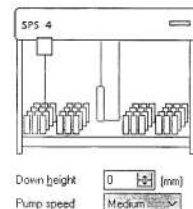
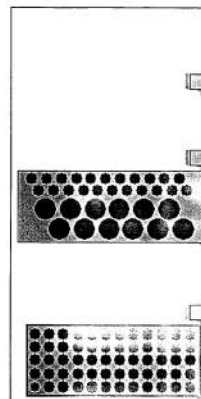
Sample ID	Conc. mg/L	%RSD	Mean Abs
CAL ZERO	0.000	64.1	-0.0002
Readings	-0.0003	-0.0003	-0.0001
STANDARD 1	5.000	0.3	0.6052
Readings	0.6036	0.6073	0.6047



Curve Fit = Linear Origin
Characteristic Conc = 0.000 mg/L
r = 1.0000
Calculated Conc = -0.002 5.000
Residuals = 0.002 0.000

Abs = 0.12105 x C

5 ppm Cu	5.007	0.2	0.6051
Readings:	0.6005	0.5952	0.6047
	0.6055	0.6076	0.6064
			0.6079
			1/30/2025 10:48:32 AM



Sensitivity Check 1.5 mg/L gives about 0.2 Abs at 324.8 nm, A/A burner

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม



PinAAcle 900F Preventive Maintenance Report

Company Name: UAE Consultant Co., LTD.

Instrument Location: 41 Sukumvit Rd.,

Phra Khanong, Bangkok 10260

Instrument Serial No.: PFB520031902

Date: 29-Apr-2025

PinAAcle 900F Preventive Maintenance (PM)

Company Name:	United Analyst and Engineering Consultant Co., LTD.		
Address (Instrument Location):	41 Sukumvit Rd., Phra Khanong, Bangkok 10260		
Serial Number:	PFB520031902	PM Number:	1 of 2
Customer Name (if applicable):	K. Yinda	Telephone Number:	095-5580049
Customer Support Engineer Name:	K. Chayanon	Service Order Number:	WO-03126047
Date PM Performed: (DD-MM-YYYY)	29-Apr-2025	Next PM Due Date: (DD-MM-YYYY)	29-Oct-2025
Standard Labor Hours to Complete PM :		5 hours	

Part Number	Release	Publication Date	
09370145 Rev.9	A	January 2018	

Scope

The purpose of this PM is to ensure the continued functionality of the PinAAcle 900F by inspecting and replacing any worn or damaged parts. This service should only be performed by a trained representative of PerkinElmer.

The customer should save their method before the PM begins.

General Instructions:

The customer must provide the engineer operational data to demonstrate recent instrument performance prior to starting the PM.

Always check with the customer before making any changes that may affect the customer's analysis or calibration, including a current back-up of system software and/or data files.

The completed document should be signed by an authorized PerkinElmer and customer representative and left with the customer.

Update the PM sticker and instrument logbook as required.

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เอกสารไม่ควบคุม

Component List

Component / Specific Model	Serial #	Configuration Notes
PinAAcle900F	PFBS20031902	Syngistix V4.0.1.1935
FIAS100	100524040501	

Parts Lists

Parts Included with the PM		
Part Number (if applicable)	Description	Quantity
B0501696	Fan Filters	2
N3160156	O-Ring Kits for Sampling Introduction (Stainless Steels Nebulizer)	N/A
N3160157	O-Ring Kits for Sampling Introduction (Plastic Nebulizer)	1
N9301714	Replacement Acetylene Filter Cartridge	1
TH001022	Replacement Air Filter Cartridge	1

Additional Reagents and Standards Required for PM				
Part Number (if applicable)	Description	Quality	Batch/Lot #	Expired Date (MM/YY)
N9300183	1000 mg/L Copper Standard	AR	27-39CUY1	Nov 2025

Additional Reagents and Standards Required for PM (Customer Support Solution)				
Part Number (if applicable)	Description	Quantity	Batch/Lot #	Expiration Date (MM/YY)
N/A	DI Water	250 mL	AR	AR
N/A	0.5% HNO ₃	250 mL	AR	AR

เอกสารไม่ควบคุม

Additional Tools Required for PM

Part Number (if applicable)	Description	Quantity	Serial #
N1013000	0.2A Neutral density filter	1	101N0089015
N1013002	1.0A Neutral density filter	1	101N0089015
03030997	System 2 EDL Driver	1	03030997
N3050605	As System 2 EDL	1	16148
N3050121	Cu Lumina HCL	1	060419-030180
N3050109	Ba Lumina HCL	1	061219-020041
N3050139	K Lumina HCL	1	030819-010130
N3050152	Ni Lumina HCL	1	052719-020020

เอกสารไม่ควบคุม

Procedure Checklist

Use (✓) to check off those steps in the checklist that have been completed.

1. General:

- ☒ Review the instrument performance with the customer and document any recent problems.
- ☒ Inspect the customer log book and make any appropriate PM entries.
- ☒ Perform general inspection of system for cleanliness.

2. PC Instrument Software:

- ☒ Instrument Software user files/databases archived, packed, and/or deleted as needed.

3. Mechanical:

- ☒ Inspect and clean all fans and filters. Replace filters if necessary
- ☒ Inspect all gas lines for leaks and/or wear. Replace if needed.
- ☒ Clean exterior of the instrument.
- ☒ Inspect the burner head, burner chamber, and nebulizer. Clean if needed as stated in the Hardware Guide.
- ☒ Check burner head dimensions with the feeler gauge as stated in the Hardware Guide in the Maintenance chapter section on cleaning the burner head and checking sloth width. Replace if out of specification
- ☒ Check the condition of the end cap, burner head, and nebulizer O-rings. Replace if necessary.
- ☒ Check the drain system for signs of wear. Replace worn or damaged parts.
- ☒ Visually check for proper flame conditions when igniting the Air-C2H2 and N2O-C2H2 flames (if applicable).

4. Electrical:

- ☒ Inspect PC boards. Clean if necessary.
- ☒ Carefully check all internal and external cable connections.
- ☒ Check instrument firmware revisions upgrade to current levels (if necessary)
- ☒ Run Diagnostics Test within the Advanced function of the Spectrometer page. Check the results in the service log folder in the Spectrometer BM Log Viewer.

5. Optics:

- ☒ Inspect and clean the sample compartment windows, if needed.
- ☒ Inspect optics. Clean or replace if necessary.

6. Gasses:

- ☒ Verify that the Gasses supplied to the instrument are within the pressure and purity specifications found in the PinAAcle 900 Series Pre-Installation Checklist SDB.
- ☒ Verify that the acetylene filter and air filter element is dry. Replace if necessary.

7. Flame Interlock Check:

Description: Check to ensure that all safety interlocks are closed.

Parameter	Specification	Test Results	Pass/Fail
Flame Sensor	Air/C ₂ H ₂ Flame correctly shuts down	Active	Passed
Drain Sensor	Air/C ₂ H ₂ Flame correctly shuts down	Active	Passed
Nebulizer Sensor	Air/C ₂ H ₂ Flame correctly shuts down	Active	Passed
C ₂ H ₂ Pressure Sensor	Air/C ₂ H ₂ Flame correctly shuts down	Active	Passed
Air Pressure Sensor	Air/C ₂ H ₂ Flame correctly shuts down	Active	Passed
Burner Head Sensor	Choosing Nitrous Oxide as the oxidant should trigger an interlock shuts down	Active	Passed

8. After PM Performance tests:

8.1 Detector Linearity with Barium

Description: Ensures that the detector is linear in the Visible Range.

Parameter	Specification	Certificate Value at 553.6 nm (Abs.)	Test Results	Pass/Fail
1.0 A ND Filter	± 5% from Cert.	0.9668	0.9878	Passed
0.2 A ND Filter	± 5% from Cert.	0.1953	0.1876	Passed

8.2 Baseline Noise at 1.0 Absorbance with Barium

Description: Ensures that a high absorbance will not produce excessive noise.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.010	0.0005	Passed

8.3 AA Baseline Noise with Copper

Description: Check baseline noise.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.001	0.0001	Passed

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8.4 D₂ Background Compensation with Copper

Description: Verifies the instruments ability to compensate for Background absorption.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.010	0.009	Passed

8.5 AA-BG Baseline Noise with Copper

Description: Ensures that background correction does not produce excessive noise.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.005	0.0001	Passed

8.6 AA-BG Baseline Noise with Arsenic

Description: Ensures that background correction does not produce excessive noise at a low wavelength.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.005	0.0004	Passed

8.7 Flame Sensitivity

Description: Instrument Sensitivity checked against Copper standard.

Standard Copper Sensitivity	Specification	Results (Abs.)	Pass/Fail
5 mg/L Sensitivity SS Neb (if applicable)	> 0.250 Abs.	N/A	Not Applicable
2 mg/L Sensitivity HS Neb (if applicable)	> 0.250 Abs.	N/A	Passed

10. Review:

- ☒ Review with the customer PM work performed.
☒ Review with the customer routine maintenance procedures.
☒ Discuss recommended customer supplied materials to have on hand.
☒ Attach PM sticker.

Additional Comments

Additional Comments Regarding the PM

Review

The preventive maintenance checks and if applicable performance tests for PinAAcle 900F have been completed.

This PinAAcle 900F Passes ☒ Fails ☐ the preventive maintenance.

Review of Preventive Maintenance:

Authorized PerkinElmer Representative: <i>Chayanon K.</i>	Date: 29 Apr 2025 (DD-MMM-YYYY)
Authorized Customer Representative: <i>Syngrom</i>	Date: 29 Apr 2025 (DD-MMM-YYYY)

PinAAcle 900F Preventive Maintenance Report (PM)

Page 6 of 7

PinAAcle 900F Preventive Maintenance Report (PM)

Page 7 of 7

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เอกสารไม่ควบคุม



PerkinElmer Scientific (Thailand) Co., Ltd.
290 Soi Soomjai 4
Khwaeng Bangkok, Khet Huay Kwang
Bangkok 10310
Thailand
Tel: 66 2719 6420 ; Fax: +66 2 319 7900
http://www.perkinelmer.com

Service Report

Work Order Number	Activity Code	Billing Type	Requested Start Date	Model	Serial Number
WO-03126047	Planned Maintenance	Contract	10/01/2568 11:08 น.	AAN300051	PFB530031902
Service Representative Name	Contract Number	Expiry Date	Equipment ID	System ID	
Kanan, Chayanon	SC-003664109	31/10/2025	N/A	N/A	
UDI Number					
N/A					
Equipment Location			Bill To Name		
บริษัท ชูนิค เทคโนโลยี จำกัด อาคาร 51 ถนนพหลโยธิน กรุงเทพมหานคร 51 10260 TH			บริษัท ชูนิค เทคโนโลยี จำกัด อาคาร 51 ถนนพหลโยธิน กรุงเทพมหานคร 51 10260 TH		
Customer Contact	Phone Number	Fax Number	Email	Purchase Order	
K. ญานาน ชัยนันท์ (Kanan)	095-5580049	N/A	nichakorn.praemrattana@gmail.com	HPO-230100002	

Work Description

PM 2/2 (Main/Service) - Cleaning Cell, Chamber, Filter - Wavelength Calibrate : Pass - Wavelength Scan As.Cu.Ba.K.Ni : Pass - Align cell with Hg : OK	Start Date 28/04/2025	End Date 08/05/2025	Work Description
---	--------------------------	------------------------	------------------

Tools Used

Quantity	Calibrated Tool	Description	Serial Number	Last Calibration Date	Next Calibration Date
*** No Calibrated Tools Used ***					

Material Used

Part Number	Part Description	Note	Lot/Serial Number	Quantity
*** No Parts Used ***				

Labour Details

Part Number	Part Description	Start Date	Quantity
SVB00013	Preventative maintenance	28/04/2025	4

Work Complete Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	Customer Signature <i>ญานาน ชัยนันท์</i> 9/5/2568 K. ญานาน ชัยนันท์ (Kanan)	Technician Signature <i>Chayanon K.</i> 9/5/2568 Kanan, Chayanon
PMOQ/PPV Left with Customer Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>		

Terms & Conditions

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Customer Acknowledgment of receipt of the above repair / replacement.

Special Terms and Conditions: This is not an invoice.


Terms will be applied to your invoice if applicable.

9/5/2568 WO-03126047

Page 2 of 2

เอกสารไม่ควบคุม

Atomic Absorption/FIAS 100/400 Preventive Maintenance (PM)			
Company Name:	United Analyst and Engineering Consultant Co., LTD.		
Address (Instrument Location):	41 Sukumvit Rd., Phra Khanong, Bangkok 10260		
Room Number:	Lab		
Asset Number (if applicable):	2 of 2W	Customer System ID:	K. Yanida
Service Engineer Name:	K. Chayanan	Service Order Number:	WO-03051971
Date PM Performed: (DD-MMM-YYYY)	29-Apr-2025	Next PM Due Date: (DD-MMM-YYYY)	29-Oct-2025

Part Number	Release	Publication Date	
09370005	C	January 2013	

Scope

The purpose of this PM is to ensure the continued functionality of the Atomic Absorption/FIAS 100/400 by inspecting and replacing any worn or damaged parts. This service should only be performed by a trained representative of PerkinElmer. The customer should save their method before the PM begins.

General Instructions:

Always check with the customer before making any changes that may affect the customer's analysis or calibration. The completed document should be signed by an authorized PerkinElmer and customer representative and left with the customer. Update the PM sticker and instrument logbook as required.

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Component List

Component / Specific Model	Serial #	Firmware Version	Configuration Notes
FIAS100	100S24040501	2.20	Syngistix V4.0.1.1935

Parts Lists

Parts Included with the PM				
Part Number (if applicable)	Description	Quantity	Batch/Lot #	Expiration Date (MM/YY)
B050 2706	Fan Filter	1	N/A	N/A

Additional Tools Required for PM				
Part Number (if applicable)	Description	Quantity	Serial #	Calibration Due Date (MM/YY)
N/A	Digital Volt Meter	1	N/A	N/A

Additional Reagents and Standards Required for PM				
Part Number (if applicable)	Description	Quantity	Batch/Lot #	Expiration Date (MM/YY)
N/A	N/A	N/A	N/A	N/A

เอกสารไม่ควบคุม

Procedure Checklist

Use (✓) to check off those steps in the checklist that have been completed.

1. General:

- ☒ Review the instrument performance with the customer and document any recent problems.

- ☒ Is the Working Environment Acceptable? If not, document.

- ☐ Visual Damage (if yes, describe)

- ☒ Check incoming AC line voltage for proper levels and grounding.
☒ Verify Voltage switch on back of instrument is correct.
☒ Perform general inspection of system for cleanliness. Clean if needed.
☒ Gas supply cylinders secured, lines leak checked and argon or nitrogen supply pressure verified (45 – 58 psi).
☒ Inspect the customer log book and make any appropriate PM entries.
☒ Fan checked and filter cleaned
☒ Heating mantle or Universal Cell Holder checked

2. Instrument components

- ☒ Non-return valve checked/repared/replaced if needed (B019 8111). Clean the valve if there is any liquid in it. Replace the rubber sleeve (B013 5123) if it is worn. Check the flow meter for any signs of fluid in it. Clean the flow meter if needed.
☒ Verify condition of pump pressure adjustment levers (B050 7794 - look for cracks or problems with the springs), pump rollers (B300 0251 check for wear), and thumb screws (B050 7796).
☒ Check the Multiport valve for proper switching, flow, and insure there are no leaks. Clean valve parts and replace o-rings if needed (large o-ring: B050 1250, small o-ring: B004 5095). Use a squirt bottle & fishing line to try to dislodge clogs.
☒ Firmware Version checked. Latest is 2.20.

3. Mixing/Separation Assembly & Pump Tubing:

- ☒ Mixing separator assembly checked
☒ Filter/membrane checked (B050 8306)
☒ Condition of the pump tubing (replace if necessary), correct pump tubing for the solutions being run. Make sure the correct magazines are being used. B050 7791 for 0.13 – 1.80 mm tubing; B050 7792 for 1.60 – 3.18 mm tubing.

เอกสารไม่ควบคุม

4. Cell, Cell Windows, Transfer Line:

- ☒ Cell checked
☒ Cell windows checked
☒ Transfer line checked for moisture (if moisture is a problem, the Nafion dryer might be needed)

5. Operational Tests:

- ☒ Run DI water through the carrier/reductant/sample system. Verify smooth flow of liquid throughout without leaks. Replace tubing & fittings if needed.

6. Review:

- ☒ Review with the customer PM work performed.
☒ Review with the customer routine maintenance procedures.
☒ Discuss recommended customer-supplied materials to have on hand.
☒ Attach PM sticker.
☒ Update Logbook.

เอกสารไม่ควบคุม

Additional Comments

Additional Comments Regarding the PM

Document History

Revision	Description of Change	Page(s)	Date
A	First release		May 2008
B	Addition of Batch/Lot Number, Expiration Date, and Report Fields.	2,7	February 2009
C	Update to new format	All	January 2013

Review

<p>The preventive maintenance checks and if applicable performance tests for FIAS 100/400 have been completed.</p> <p>This FIAS 100/400 Passes <input checked="" type="checkbox"/> Fails <input type="checkbox"/> the preventive maintenance.</p>	
<p>Review of Preventive Maintenance:</p>	
<p>Authorized PerkinElmer Representative:</p> <p><i>Chayman k.</i></p>	<p>Date:</p> <p>29 Apr 2025 (DD-MMM-YYYY)</p>
<p>Authorized Customer Representative:</p> <p><i>สุวิทย์ หอจ</i></p>	<p>Date:</p> <p>29 Apr 2025 (DD-MMM-YYYY)</p>

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เอกสารไม่ควบคุม



PerkinElmer Scientific (Thailand) Co., Ltd.
290 Soi Sornjai 4
Khwang Bangkapi, Khet Huay Kwang
Bangkok 10310
Thailand
Tel: 66 2719 6420 ; Fax: +66 2 319 7900
<http://www.perkinelmer.com>

Customer Acknowledgment of receipt of the above repair / replacement.
Special Terms and Conditions: This is not an invoice.
Taxes will be applied to your invoice if applicable.

Service Report

Work Order Number	Activity Code	Billing Type	Requested Start Date	Model	Serial Number
WG-03051971	Planned Maintenance	Contract	10/03/2568 23.06 u.	B0508570	100524040501
Service Representative Name	Contract Number	Expiry Date	Equipment ID	System ID	
Kanan, Chayanon	SC-003569090	24/05/2025	N/A	N/A	
UDI Number					
N/A					
Equipment Location			Bill To Name		
บริษัท สุวิทย์ หอจ จำกัด อาคารพาณิชย์ 51/10260 TH			บริษัท สุวิทย์ หอจ จำกัด อาคารพาณิชย์ 51/10260 TH		
Customer Contact	Phone Number	Fax Number	Email	Purchase Order	
K. Nitchakorn user	085-5580568	N/A	perkitohar42@gmail.com	HPO-240400211	

Work Description		
<p>- PM 202 Warranty</p> <p>- Cleaning Port Vals, Manifold, Tuning</p> <p>- Run Hq test : Pass</p>		
Start Date	End Date	Work Description
29/04/2025	29/04/2025	
29/04/2025	29/04/2025	

Tools Used					
Quantity	Calibrated Tool	Description	Serial Number	Last Calibration Date	Next Calibration Date
*** No Calibrated Tools Used ***					

Material Used				
Part Number	Part Description	Note	Lot/Serial Number	Quantity
*** No Parts Used ***				

Labour Details			
Part Number	Part Description	Start Date	Quantity
SV000013	Preventative maintenance	29/04/2025	3
SV000002	Service Travel	29/04/2025	1

Work Complete	Customer Signature	Technician Signature
<p>Yes <input checked="" type="checkbox"/> No <input type="checkbox"/></p> <p>PM/QC/PIV Left with Customer</p> <p>Yes <input type="checkbox"/> No <input checked="" type="checkbox"/></p>	<p><i>สุวิทย์ หอจ</i></p> <p>9/5/2568 K. Nitchakorn user</p>	<p><i>Chayman k.</i></p> <p>9/5/2568 Kanan, Chayanon</p>

Terms & Conditions

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เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Terms & Conditions

Customer Acknowledgment of receipt of the above repair / replacement.

Special Terms and Conditions: This is not an invoice.

Taxes will be applied to your invoice if applicable.

Calibration Certificate

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

Page 1 of 4

Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: XSR205DU
Serial No.: C009071872
ID No.: UAE.WAO.012/2563
Order No.: 2502226
Operation No.: 2502226-001
Date of Receipt: 19 March 2025
Date of Calibration: 20 March 2025

Calibrated by Mr.Yothin Charoensuk
Scientist

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

Date of Issue: 25 March 2025

The uncertainties are for a confidence probability of approximately 95%

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

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

2008 Sol 35, Anin Anom Road, Bang 11 Khun Subdistrict, Bang Phli District, Bangkok 10700, Thailand
Tel: +66(0) 2522 8548 Fax: +66(0) 2522 8545



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เอกสารไม่ควบคุม

Calibration Report

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

Date of Calibration: 20 March 2025

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

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

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

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

2. Reference Standards:

Reference Standard Model Serial No. Calibrated By Certificate No. Due Date
Standard Weight Class E2 1mg to 200g B505567572 TCS M24041005 19 April 2025

Instrument Model Serial No. Calibrated By Certificate No. Due Date
Thermo-Hygro Meter 608-H1 NFI.BTH 017/23 Quality Reborn QR25-0542 10 February 2026

3. This certification is traceable to SI UNIT

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

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

Calibration Results:

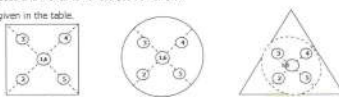
1. Repeatability of Reading:

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

2. Off-Center Error:

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

The balance reading obtained is given in the table.



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

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

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Calibration Report

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

Date of Calibration: 20 March 2025

Calibration Results: (Continued)

Calibration Range: 0-80 g

Calibration Adjustment: Internal Calibration

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

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

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

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Page: 1 of 3

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

3) 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 United Analyst and Engineering Consultant Co., Ltd. (UAE)

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Page: 3 of 3

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



Cert.No.: 25TW29
Page.: 1 of 2

Saithip

Approved Signatory _____

18 February 2025

เอกสารไม่ควบคุม



Cert.No.: 25TW29
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).
- | <u>Instruments</u> | <u>Serial No.</u> | <u>ID No.</u> | <u>Certificate No.</u> | <u>Due Date</u> |
|--------------------|-------------------|---------------|------------------------|-----------------|
| 1. Burette | - | 130BU10 | 23CG1172 | 22 Mar 2025 |
| 2. Balance | 14233821 | 110RC001 | 24MM1131 | 04 July 2025 |

2. Standard Material :-

<u>Material</u>	<u>Manufacturer</u>	<u>Lot.No.</u>	<u>Assay</u>
Sodium Thiosulfate 5-Hydrate AR	KEMAUS	2203162447	99.6%

Result : Dissolved Oxygen Meter Adjustment With Air 100 %
Dissolved Oxygen Probe No.: 24F100202

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.22	8.22	0.0055

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

-909-

เอกสารไม่ควบคุม



Cert. No.: 25TM579
Page : 1 of 3

Equipment : Hot Air Oven

Manufacturer : Memmert

Model : UF 55

Serial No. : B212.0411

ID No. : UAE.WAO.005/2556

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

Location : Lab Floor 2

Received Order : 19 March 2025

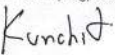
Calibration Date : 19 March 2025

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 30) %

AC Line Voltage : (220 ± 22) V

Calibrated by : Man Pattanapongpaiboon

Approved by : 
Approved Signatory

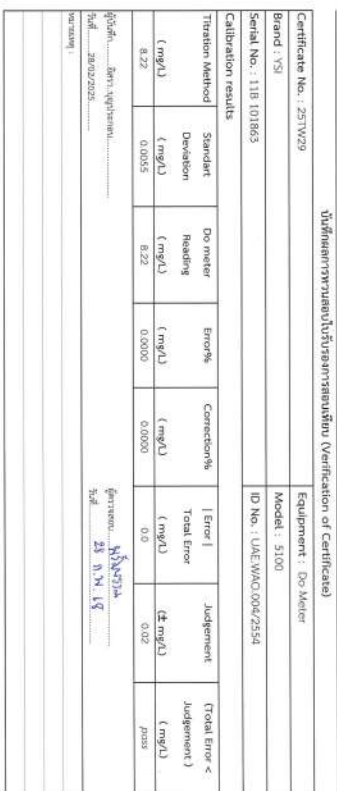
() Chakrit Waewwanjua
() Suwit Imjai
(✓) Kunchit Promprat

Issue Date : 27 March 2025

The Uncertainties are for a confidence probability of approximately 95%

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

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เอกสารไม่ควบคุม



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2503-0437OC-3
Procedure Used :-

Cert. No.: 25TM579
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) and Thermocouple Type T.

The temperature scale used was based on ITS-90.

Condition of this result of calibration

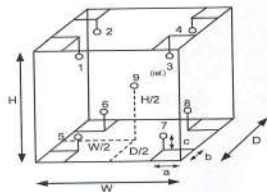
- Reference standard Instrument-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY44073381	24LM73	TPA	18 May 2025

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

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

Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Close



Probe Installation Details :
a = 5.0 cm
b = 5.0 cm
c = 5.0 cm
Dimension of Chamber :
D = 0.50 m
W = 0.80 m
H = 0.75 m
Capacity = 0.30 m³

Environment during calibration		
	Beginning	Finished
Temp. (°C)	27	28
REL.Humid. (%)	49	55
AC Supply (Volt)	221	224

Ref. Std. ID No.: @ Calibration Point		
Position :	(120,180) °C	(104) °C
1	23-01TC-01	1RTD-2/1
2	23-01TC-02	1RTD-2/2
3	23-01TC-03	22-01RTD-03
4	23-01TC-04	1RTD-2/4
5	23-01TC-05	1RTD-2/5
6	23-01TC-06	1RTD-2/6
7	23-01TC-07	23-01RTD-07
8	23-01TC-08	1RTD-2/8
9 (ref.)	23-01TC-09	23-01RTD-09



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2503-0437OC-3
(*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Close

Cert. No.: 25TM579
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
104.0	104.0	104.0	0.040	0.43	0.78	2
120.0	120.0	120.0	0.64	1.3	1.6	2
180.0	180.0	180.0	0.49	1.5	1.8	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	1	2	3	4	5	6	7	8	9 (ref.)	
104.0	104.335	104.135	104.363	104.317	103.649	103.738	104.179	104.229	104.025	0.42
120.0	119.575	119.366	119.807	119.905	118.994	119.194	119.888	119.994	120.064	1.1
180.0	180.286	179.510	180.401	180.551	179.281	179.463	180.196	180.451	180.374	1.2

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, SUANLIANG, SUANLIANG BANGKOK 10250
TEL.0-2717-3009-29 FAX.0-2719-9484



Cert.No.: 25CH354
Page.: 2 of 3

Certificate of Calibration

Cert.No.: 25CH354
Page.: 1 of 3

Equipment : pH Meter
Manufacturer : Horiba
Model : LAQUA-PH210
Serial No. : HA9M0047
ID No. : UAE,EFM.005/2563 (EFM.pH.05/63)
Condition As-Received: Used Item
Received Date : 18 March 2025
Calibration Date : 20 March 2025
Reference : 2503-0612WSC-2
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road, Bangkok,
Phrakhanong, Bangkok 10260

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

Calibrated by : Uthen Kankawi

Approved by :
Approved Signatory

() Chakrit Waewwanjua
() Nonpan Paipim
(✓) Saitip Meangmai

Issue Date : 20 March 2025

Condition of this calibration result

- Reference Standard Instrument

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	43160066	130RC092	24E1320	22 Apr 2025
2) Ref. Standard Thermometer	4982054	110RC044	24I757	14 Jul 2025

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

- Certified Reference Materials :The measurement results are traceable to SI through Hach Lenge GmbH Ltd., Deutsche Akkreditierungsstelle, Accredited No.D-RM-15184-01-00
: The measurement results are traceable to SI through CPA chem Ltd., ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

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

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

Calibration Results

Function : mV Measurement

Performing standard curve by Document Process Calibrator at pH (4.7)(7,10)

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (±mV)	Coverage factor k
	pH	mV	mV	pH		
pH Meter S/N.: HA9M0047	4.00	177.48	177.7	4.01	0.058	2.00
	7.00	0.00	0.3	7.01	0.058	2.00
	7.00	0.00	0.3	7.01	0.058	2.00
	10.00	-177.48	-176.8	10.01	0.058	2.00

The Uncertainties are for a confidence probability of approximately 95%

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Cert.No.: 25CH354
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.: -	4.007	4.01	168.5	0.011	2.13
	6.999	7.00	-5.9	0.012	2.09
	6.999	7.00	-6.1	0.011	2.07
	10.010	10.02	-176.7	0.010	2.00

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : -
- 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
15.0	15.005	15.0	-0.005	0.13	2.00
30.0	30.007	30.0	-0.007	0.13	2.00
45.0	44.995	44.9	-0.095	0.13	2.00

Remark : - UUC* = Unit Under Calibration

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

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



Certificate of Calibration

Cert.No.: 25CH408
Page.: 1 of 3

Equipment : pH Meter
Manufacturer : EcoSense
Model : pH100A
Serial No. : JC04744
ID No. : UAE.EFM.058/2566 (EFM,pH.01/66)
Condition As-Received: Used Item
Received Date : 01 April 2025
Calibration Date : 03 April 2025
Reference : 2504-0031WSC-1
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak,
Phrakhanong, Bangkok 10260
Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 15) %
Calibration Procedure : In - house method :
- CP-CH5 by direct measurement with DC voltage standard and direct measurement with certified reference material (CRM)
- CP-CH8 by comparison with temperature standard

Calibrated by : Walalak Sirithean

Approved by :
Approved Signatory

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

Issue Date : 4 April 2025

The Uncertainties are for a confidence probability of approximately 95%

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



Cert.No.: 25CH408
Page.: 2 of 3

Condition of this calibration result

1. Reference Standard Instrument

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC116	24E2759	25 Aug 2025
2) Ref. Standard Thermometer	4982054	110RC044	24I757	14 July 2025

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

2. Certified Reference Materials :The measurement results are traceable to SI through Hach Lenge GmbH Ltd.,
Deutsche Akkreditierungsstelle, Accredited No.D-RM-15184-01-00
:The measurement results are traceable to SI through CPA chem Ltd.,
ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

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

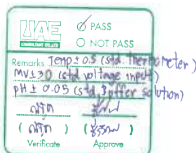
3. This certificate is valid only to the item calibrated on date and place of calibration.

Calibration Results

Function : mV Measurement

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

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (±mV)	Coverage factor k
	pH	mV	mV	pH		
pH Meter S/N.: JC04744	4.00	177.48	177	4.01	0.58	2.00
	7.00	0.00	0	7.00	0.58	2.00
	7.00	0.00	0	7.00	0.58	2.00
	10.00	-177.48	-177	10.01	0.58	2.00





Cert.No.: 25CH408
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.: 240710SIA605377	4.007	4.01	173	0.0085	2.05
	6.999	7.00	-2	0.0095	2.00
	6.999	7.00	-2	0.0085	2.00
	10.010	10.00	-176	0.0095	2.00

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model :

- Serial No. : 240710SIA605377

Dimension of probe

- Length : 110 mm.

- Diameter : 12 mm.

- Immersion Depth : 100 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement (± °C)	Coverage factor k
15.0	15.000	14.9	-0.100	0.13	2.00
30.0	30.001	29.9	-0.101	0.13	2.00
45.0	45.002	45.0	-0.002	0.13	2.00

Remark - UUC* = Unit Under Calibration

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

-o0o-

DQE Services Co.,Ltd.

DQE Services

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

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



CERTIFICATE OF CALIBRATION

Certificate No. : SP24-028

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-5100

Serial No. : 23A4-008

ID No. : UAE.WAS.010/2567

Received Date : 10 September 2024

Calibration Date : 10 September 2024

Issue Date : 13 September 2024

Condition Instrument : Good

Calibrated by :

(Mr.Tanawut Rittidach)

Technical Manager

Approved by :

(Ms.Chonthicha Sangern)

Quality Manager

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

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

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FM-708-02 R01 1/11/2021

DQE Services

DQE Services Co.,Ltd.

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REPORT OF CALIBRATION

Certificate No. : SP24-028

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 Sarna Scientific Limited

Spectral Band Width of UUC : 5.0 nm.

Scan Speed of UUC : 40

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

DQE Services

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REPORT OF CALIBRATION

Certificate No. : SP24-028

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	1.044	0.0044	0.0029	2.00
	2.1876	2.190	-0.0024	0.0075	2.00
440	0.0000	0.000	0.0000	0.0028	2.00
	0.5595	0.557	0.0025	0.0034	2.00
	1.0239	1.021	0.0029	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	0.519	0.0040	0.0029	2.00
	0.9633	0.961	0.0023	0.0028	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	0.515	0.0031	0.0031	2.00
	1.0002	0.997	0.0032	0.0033	2.00
	1.9973	1.996	0.0013	0.0085	2.00
590	0.0000	0.000	0.0000	0.0028	2.00
	0.5517	0.549	0.0027	0.0030	2.00
	1.0803	1.078	0.0023	0.0029	2.00
	2.0373	2.031	0.0063	0.0081	2.00
635	0.0000	0.000	0.0000	0.0028	2.00
	0.5591	0.557	0.0021	0.0031	2.00
	1.0518	1.049	0.0028	0.0029	2.00
	1.9274	1.923	0.0044	0.0080	2.00

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ISO 17025:2017
CALIBRATION DATA


REPORT OF CALIBRATION

Certificate No. : SP24-028Page 4 of 5

Photometric Accuracy :

Wavelength	CRMs Values	UUC Reading	Correction	Uncertainty	Coverage factor
(nm.)	(Abs)	(Abs)	(Abs)	(Abs)	k
235	0.0000	0.000	0.0000	0.0050	2.00
	0.7469	0.743	0.0039	0.0056	2.00
257	0.0000	0.000	0.0000	0.0050	2.00
	0.8674	0.862	0.0054	0.0059	2.00
313	0.0000	0.000	0.0000	0.0050	2.00
	0.2919	0.291	0.0009	0.0051	2.00
350	0.0000	0.000	0.0000	0.0050	2.00
	0.6430	0.639	0.0040	0.0055	2.00

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ISO 17025:2017
CALIBRATION DATA

REPORT OF CALIBRATION

Certificate No. : SP24-028Page 5 of 5

Wavelength Accuracy :


CRMs Values	UUC Reading	Correction	Uncertainty	Coverage factor
(nm.)	(nm.)	(nm.)	(nm.)	k
241.00	240.4	0.60	0.18	2.00
279.30	278.7	0.60	0.18	2.00
288.90	288.5	0.40	0.18	2.00
334.50	334.2	0.30	0.18	2.00
361.40	361.1	0.30	0.18	2.00
418.40	418.0	0.40	0.18	2.00
447.20	446.7	0.50	0.18	2.00
459.30	459.6	-0.30	0.18	2.00
537.00	536.6	0.40	0.18	2.00
638.00	637.4	0.60	0.18	2.00
441.29	440.8	0.49	0.18	2.00
479.88	479.6	0.28	0.18	2.00
513.75	513.5	0.25	0.18	2.00
528.59	528.6	-0.01	0.18	2.00
575.10	574.9	0.20	0.18	2.00
585.56	585.3	0.26	0.20	2.00
684.70	684.1	0.60	0.18	2.00
740.51	740.0	0.51	0.20	2.00
747.61	747.2	0.41	0.18	2.00
807.04	806.3	0.74	0.18	2.00
879.68	878.9	0.78	0.18	2.00

Remark : - UUC = Unit Under Calibration
- N/A = Not Available
- The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor k, which for a normal distribution corresponds to a coverage probability of approximately 95%
- End of Certificate -

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FM-708-02 R01 1/11/2021

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FM-708-02 R01 1/11/2021

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


ISO 17025:2017
CALIBRATION DATA

CERTIFICATE OF CALIBRATION

Certificate No. : SP25-001Page 1 of 5

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

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

Location of calibration : Laboratory 213

Equipment : UV-Vis Spectrophotometer

Manufacturer : Hitachi

Model : U-2900

Serial No. : 21E22-009


ID No. : UAE.WAT.051/2564


Received Date : 3 January 2025

Calibration Date : 3 January 2025

Issue Date : 8 January 2025

Condition Instrument : Good


Calibrated by : 
(Mr.Tanawat Rittidach)
Technical Manager

Approved by : 
(Ms. Chonthicha Sangnern)
Quality Manager

The calibration result is applied only to the above calibrated item and was found accurate as shown on date and place of calibration only.
The measurement capability of the laboratory and its traceability to recognized national standards and to the unit of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written consent of DQE Services Co.,Ltd.

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ISO 17025:2017
CALIBRATION DATA

REPORT OF CALIBRATION

Certificate No. : SP25-001Page 2 of 5

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

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

Certified Reference Materials :

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

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

Spectral Band Width of UUC : 1.5 nm.

Scan Speed of UUC : 200 nm/min

Scan Interval of UUC : 0.1 nm.

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

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FM-708-02 R01 1/11/2021

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REPORT OF CALIBRATION

Certificate No. : SP25-001Page 3 of 5

Calibration Results : Without adjustment

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
420	0.0000	0.000	0.0000	0.0028	2.00
	0.5780	0.578	0.0000	0.0031	2.00
	1.0484	1.045	0.0034	0.0029	2.00
	2.1876	2.192	-0.0044	0.0075	2.00
440	0.0000	0.000	0.0000	0.0028	2.00
	0.5595	0.560	-0.0005	0.0034	2.00
	1.0239	1.023	0.0009	0.0035	2.00
	2.1230	2.125	-0.0020	0.0079	2.00
465	0.0000	0.000	0.0000	0.0028	2.00
	0.5230	0.521	0.0020	0.0030	2.00
	0.9633	0.961	0.0023	0.0029	2.00
	1.9753	1.977	-0.0017	0.0070	2.00
546.1	0.0000	0.000	0.0000	0.0028	2.00
	0.5181	0.518	0.0001	0.0031	2.00
	1.0002	0.998	0.0022	0.0033	2.00
	1.9973	1.993	0.0043	0.0084	2.00
590	0.0000	0.000	0.0000	0.0028	2.00
	0.5517	0.552	-0.0003	0.0030	2.00
	1.0803	1.079	0.0013	0.0030	2.00
	2.0373	2.032	0.0053	0.0079	2.00
635	0.0000	0.000	0.0000	0.0028	2.00
	0.5591	0.559	0.0001	0.0031	2.00
	1.0518	1.050	0.0018	0.0030	2.00
	1.9274	1.923	0.0044	0.0079	2.00

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REPORT OF CALIBRATION

Certificate No. : SP25-001Page 4 of 5

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000	0.000	0.0000	0.0050	2.00
	0.7469	0.744	0.0029	0.0057	2.00
257	0.0000	0.000	0.0000	0.0050	2.00
	0.8674	0.863	0.0044	0.0059	2.00
313	0.0000	0.000	0.0000	0.0050	2.00
	0.2919	0.290	0.0019	0.0051	2.00
350	0.0000	0.000	0.0000	0.0050	2.00
	0.6430	0.640	0.0030	0.0055	2.00

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REPORT OF CALIBRATION

Certificate No. : SP25-001Page 5 of 5

Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor k
241.72	241.1	0.62	0.18	2.00
279.45	279.0	0.45	0.18	2.00
287.81	287.3	0.51	0.18	2.00
334.06	333.8	0.26	0.18	2.00
360.93	360.6	0.33	0.18	2.00
418.59	418.2	0.39	0.18	2.00
445.94	445.5	0.44	0.18	2.00
453.66	453.4	0.26	0.18	2.00
460.02	459.8	0.22	0.18	2.00
536.59	536.6	-0.01	0.18	2.00
637.98	637.7	0.28	0.18	2.00
431.38	431.1	0.28	0.18	2.00
472.50	472.3	0.20	0.18	2.00
513.47	513.4	0.07	0.18	2.00
528.88	528.9	-0.02	0.18	2.00
573.17	573.3	-0.13	0.18	2.00
585.35	585.1	0.25	0.20	2.00
684.40	684.5	-0.10	0.18	2.00
740.72	741.0	-0.28	0.20	2.00
748.55	748.8	-0.25	0.18	2.00
807.03	807.3	-0.27	0.18	2.00
879.28	879.6	-0.32	0.18	2.00

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Thaiunique Co.,LtdOpen Lab Service for Reliability

THAI UNIQUE OPEN LAB SERVICE

OPERATIONAL QUALIFICATION REPORT (OQ)

Equipment Operational Qualification Report

Report No.	SV2407/21898
Equipment	GC-MS
System Model	SQ
System ID	GQS1203F021
Equipment Details	Bruker
Test Protocol	Scion OQ Protocol
Protocol Rev.	A
Date	16-Jul-24
Report Type	Report
Org. Name	United Analyst and Engineering Consultant Co.,Ltd
Org. Location	3 Soi Udomsuk 41 Sukhumvit Rd. Bangchak Phrakhanong Bagkok Thailand 10260

เอกสารไม่ควบคุม



CERTIFICATE OF CALIBRATION
GAS CHROMATOGRAPH MASS SPECTROMETER

Certificate No.: SV2407/21898

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

Address: 3 Soi Udomsuk 41 Sukhumvit Rd. Bangchak
Phrakhanong Bangkok Thailand 10260

Instruments Model: MS Scion-SQ S/N GQS1203F021
GC 451-GC S/N BR1203M099
AUTO SAMPLER CP8400 S/N BR1203M331

Standard Reference Number: 393065201
Procedure Document Number: 394207000

System Test

PM perform and Diagnostic Test	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
Air Water Check Test	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
Tune Test EI	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
Signal to Noise Test (EI) SCAN	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
Injection EI Area Precision Test	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
Injection EI RT Precision Test	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
User Demonstration	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL

Engineer Somchai P.
Somchai Pohtongkam

Date 16 July 2024



Thai Unique Co., Ltd.

Service Division

เอกสารไม่ควบคุม

SCION™

Operational Qualification Protocol

For SCION Instrument

Name and Model:

Serial Number:

System ID Number:

Publication no. 394207000

Revision A

November 2011

SCION Operational Qualification Protocol

Contact

Scion Customer Service and Support uses a Customer Relationship Management (CRM) system. The interaction with this system offers the Customer immediate benefits including the contact center or help desk.

Scion worldwide service & support offices can be found from Scion website:



www.scion.com/support.html

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SCION Operational Qualification Protocol

Table of Contents

1.0 Revision History.....	5
2.0 Qualification Representative and Reviewer Details.....	6
2.1 Qualification Representative Details.....	6
2.2 Reviewer Details.....	7
2.3 Quality Assurance/Control Details.....	8
3.0 Customer Responsibilities.....	9
4.0 Qualification Guidelines and GMP Documentation.....	10
4.1 Qualification Summary.....	10
4.2 Qualification Guidelines.....	10
4.3 Page Numbering of Appendices.....	11
4.4 Exception Reports.....	12
4.5 Reference Documents.....	13
4.6 Required Materials.....	14
4.7 General Guidelines.....	15
4.8 Specific Instructions for Documentation.....	15
4.9 Documentation Corrections.....	16
4.10 Marking Procedures Not Applicable.....	16
4.11 Addendums.....	17
4.12 Addendum Example.....	17
5.0 Operational Qualification.....	18
5.1 OQ Preparation.....	18
5.2 System Description.....	20
5.3 Data Sheet Specifications.....	21
5.4 EI Precision Test TQ.....	22
5.5 EI Precision Test SQ.....	23
5.6 Final Evaluation.....	25
6.0 Protocol Approval.....	26
6.1 Protocol Acceptance / Approval by Customer.....	26

6.2 Operational Qualification Protocol Assignment §.3	27
Protocol Acceptance / Protocol Approval by Scion 6.4	27
Remarks	28
Appendices	29
A.1 Qualification Representative Details	30
B.1 Exceptions	31
Operational Qualification Protocol Certification	36

1.0 Revision History

This qualification protocol is updated as necessary, which includes the event of any regulatory changes to Title 21 of the Code of Federal Regulations (21 CFR) Parts 210 and 211 (if applicable), any software or hardware changes, or updates that may impact on regulatory compliance.

Issue Number	Date	Comments

2.0 Qualification Representative and Reviewer Details

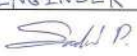
2.1 Qualification Representative Details

Each person responsible for executing any part of this Protocol must complete the table below, providing a sample of their signature and initials, and recording the date the Qualification was performed.

Qualification representatives are nominated to execute and verify the completeness of the test protocol and correctness of all entries.

All testing must be performed in accordance with procedures outlined in this manual. The representative must be trained and qualified to perform the procedures outlined in this document.

A copy of their appropriate qualifications is to be inserted into "Qualification Representative Details" on page 30.

Name (Print)	SOMCHAI POHTONGKAM
Title	ENGINEER
Signature	
Initials	SOMCHAI
Date	16 July 24

Name (Print)	
Title	
Signature	
Initials	
Date	

2.2 Reviewer Details

Each representative responsible for reviewing any part of this protocol must record their details in the following tables, providing a sample of their signature and initials, and recording the date the qualification was performed.

An employee or designee of the company operating the instrument must review these qualification procedures. All calculations and data will be checked by the reviewer. Data review must be performed in accordance with the qualification guidelines "Qualification Guidelines and GMP Documentation" on page 10 and in compliance with current Good Manufacturing Practice (cGMP) as specified by 21 CFR Parts 210 and 211.

Documentation supporting training in the area of data review and cGMP must be carefully maintained and reviewed by the instrument owner.

Reviewer representatives are responsible for reviewing the completeness of the qualification protocol and accuracy of all entries.

Name (Print)	
Title	
Signature	
Initials	
Date	

Name (Print)	
Title	
Signature	
Initials	
Date	

2.3 Quality Assurance/Control Details

As Quality Assurance/Control (QA/QC), who is empowered to approve instrument compliance documents, I approve the procedures in the SCION Operational Qualification Protocol, which I may have amended, I accept the qualification of the Qualification Representative, and I will review and initial the results.

Name (Print)	
Title	
Signature	
Initials	
Date	

Name (Print)	
Title	
Signature	
Initials	
Date	

4.0 Qualification Guidelines and GMP Documentation

4.1 Qualification Summary

At the end of qualification execution, all tables and data entry fields must be completed and all test results, where specified, must be printed and attached to the protocol.

The Qualification Representative and the Reviewer must sign (signature or initials) and date each page that has a signature field. This represents agreement and acceptance of all data and information on the signed page.

Note Scion does not provide instructions for full Qualification of the personal computer (PC) used to operate the SCION. If further qualification of the PC is required the end-user must contact the PC manufacturer.

Note Scion does not provide full qualification instructions for non-Scion manufactured accessories. Limited instructions may be supplied. If qualification of a non-Scion accessory is required, the end user must contact the accessory manufacturer.

4.2 Qualification Guidelines

The following are general guidelines for performing the qualification tests in accordance with cGMP for the Manufacturing, Processing, Packaging, or Holding of Drugs per 21CFR Parts 210 and 211. Additional local requirements may also apply.

- Read the guidelines before starting the qualification.
- Perform all tests exactly as written.
- Use a pen with permanent blue or black ink unless otherwise specified by company policy.
- Neatly strike out any incorrect words or numbers, made while writing comments or recording results, information or data within this Protocol, with a single line. The word(s) crossed out must remain legible. Write the correction as close as possible to the original entry. Write a brief description of the error. For example, write 'Transcription error' or 'Re-written for clarity'. Initial and date the change.
- Entering initials where a signature is requested, and vice versa is permitted. The exception to this is in 2.0 : Qualification Representative and Reviewer Details on page 6, where examples of each person's signature and initials are required.
- Use the date format dd Mon yyyy (e.g. 08 Mar 2011) unless otherwise specified by company policy.

3.0 Customer Responsibilities

The customer shall ensure that the Preventive Maintenance (PM) or Installation Qualification (IQ) up to point 9.11 is completed. A customer representative should be available at all times during the Operational Qualification Protocol.

Note The Operational Qualification Protocol test procedure should be performed after significant repairs, and at least once a year.

Qualification Rep. Initials	<i>Suh P.</i>	Reviewer Initials		QA/QC Initials	
Date	16 July 24	Date		Date	

- Complete all tables and data fields to comply with this protocol. Blank fields are not permitted. For items that are not applicable, draw a line through the field, and write 'N/A' (Not Applicable). If entire tables or sections of tables are not applicable, strike a line either through the entire table or the specific area and enter 'N/A'. Complete the signature fields on the page.
- Write 'Pass', 'Fail' or 'N/A' as applicable to the test requirement or outcome.
- Ensure that results and/or specific documents are printed and attached to the specified appendix.
- The Qualification Representative and Reviewer must both sign (signature or initials) and date the signature fields on each page. This represents agreement and acceptance of all data and information on the page.

4.3 Page Numbering of Appendices

Each page that is inserted after the appendix is numbered with the letter of the appendix and a sequential number. The appendix page number must be initialed and dated by both the Qualification Representative and the Reviewer.

For example, pages inserted after Appendix C are numbered

C-1, C-2, C-3...etc. along with the initials and date.

If the reverse of each appendix page is left blank, it should be marked 'N/A' and signed and dated.

When the IQ is complete the total number of pages inserted after each appendix is written on the front page of the respective appendix sheet.

Qualification Rep. Initials	<i>Suh P.</i>	Reviewer Initials		QA/QC Initials	
Date	16 July 24	Date		Date	

4.4 Exception Reports

An exception to the protocol occurs when the observed result differs from the acceptance criteria or expected result.

All exceptions to the protocol must be documented in the Exception Report. The Exception Report includes a detailed description of the exception and resolution by the Qualification Representative.

Each Exception Report shall be issued with a unique identification number in the form ERID-XX-X. This number is generated by the page number on which the exception occurred followed by a sequential number indicating each exception found on the page.

For example, if an exception occurs on page 34, the Exception Report shall be identified as 'ERID-34-1'. If another exception occurs on page 34, the second report shall be identified as 'ERID-34-2'. This identification number should be recorded in the 'Pass / Fail / N/A' field after each test.

Each Exception Report must be signed by the Qualification Representative and the Reviewer as evidence of approval.

The Exception Report is inserted in the appropriately named appendix and numbered as per Section 4.3 of this protocol.

Qualification Rep. Initials	<i>Sahel P.</i>	Reviewer Initials		QA/QC Initials	
Date	16 July 24	Date		Date	

4.5 Reference Documents

The following documents are relevant to this Qualification:

- Installation Qualification Protocol
- Completed service report from Preventative Maintenance (PM) schedule

Qualification Rep. Initials	<i>Sahel P.</i>	Reviewer Initials		QA/QC Initials	
Date	16 July 24	Date		Date	

4.6 Required Materials

The following stock solutions are required:

- 100 fg/μL OFN 394204200
- 1 pg/μL OFN 393065201
- 100 pg/μL OFN 393110101
- 10 pg/μL BZP 93065301
- 100 pg/μL BZP 394206200

The above solutions will be used to prepare the following working solutions which will be required to execute this OQ:

Note Refer to Appendix 1 for the preparation of the standard solutions.

Qualification Rep. Initials	<i>Sahel P.</i>	Reviewer Initials		QA/QC Initials	
Date	16 July 24	Date		Date	

4.7 General Guidelines

The following are general cGMP guidelines.

- Perform each procedure exactly as written.
- Fill in each item on the form or mark it Not Applicable (N/A).
- If an item is marked N/A, initial it and date it.
- The Reviewer reviews and initials all entries recorded by the Qualification Representative.
- Keep all raw data. The Qualification Representative and the Reviewer will initial it, and date it.
- Do not destroy raw data.
- Attach raw data from an instrument, such as the SCION, as an Addendum using the instructions in the following Addendums section.
- If several instruments are qualified simultaneously, reference shared information, such as standard preparation and chemical information, to the document containing the original information by its model and instrument identification number.
- Label all reference standards as required by local regulations.
- Record the time each reference standard was opened.
- Use reference standards within 24 hours of preparation.

Qualification Rep. Initials	<i>Sahel P.</i>	Reviewer Initials		QA/QC Initials	
Date	16 July 24	Date		Date	

4.8 Specific Instructions for Documentation

The Reviewer designates specific documentation instructions as follows.

Permanent Ink Color	Blue
Preferred Date Format	16 July 24

If more instructions are required: Use an addendum sheet, write the addendum number, and a brief description.

Qualification Rep. Initials	<i>Sahel P.</i>	Reviewer Initials		QA/QC Initials	
Date	16 July 24	Date		Date	

4.9 Documentation Corrections

Note All original entries must remain legible after corrections are made.

1. Draw a line through the incorrect information.
2. Write the correction as close as possible to the original entry, or enter a footnote.
3. Write a brief description of the error. For example, write "transcription error," "rewritten for clarity," or "correcting wrong entry".
4. Initial and date the change.

Qualification Rep. Initials	<i>Sarah P.</i>	Reviewer Initials		QA/QC Initials	
Date	16 July 24	Date		Date	

4.10 Marking Procedures Not Applicable

Some sections may not be relevant for the qualification. To indicate that a procedure or part of a form is unnecessary and that it was not forgotten or inadvertently overlooked:

1. Draw a line through the portion that is not applicable. Write the letters N/A (for not applicable), your initials, and the date near the diagonal line.
2. If a procedural step is unnecessary, select N/A if it is indicated, or write a comment in an Addendum. The Qualification Representative and the Reviewer enter their initials and the date near the line.

Note The Qualification Representative and Reviewer must sign and date all forms, even when part or all of the form is marked N/A.

Qualification Rep. Initials	<i>Sarah P.</i>	Reviewer Initials		QA/QC Initials	
Date	16 July 24	Date		Date	

4.11 Addendums

The following are reasons to complete an addendum sheet:

- A deviation needs documentation.
- Additional information or data needs to be recorded.
- Insufficient space to include the correction on the sheet where the error was made.

Qualification Rep. Initials	<i>Sarah P.</i>	Reviewer Initials		QA/QC Initials	
Date	16 July 24	Date		Date	

4.12 Addendum Example

The following is an example of using an addendum sheet to document a deviation.

If some of the items on the sales order were not present, you could do the following:

1. Use an addendum sheet.
2. Write Instrument Delivery on the Procedure line.
3. Write the addendum page number followed by a letter. For example: page 12A, where 12 is the page and A represents the first addendum on that page.
4. Write the plan to obtain the missing items, which may be the following:
 - Scion notified that Part Number XXXXX and XXXX are missing.
 - Scion replied that the parts are in stock and will be sent overnight. While waiting for the parts to arrive, I will continue to set up the instrument.
5. Review the plan with the Reviewer and make the necessary modifications.
6. Document the arrival of the parts and write that this addendum is resolved. Attach a copy of delivery documents and create addendum pages as required.

Qualification Rep. Initials	<i>Sarah P.</i>	Reviewer Initials		QA/QC Initials	
Date	16 July 24	Date		Date	

5.0 Operational Qualification

This chapter contains the tests to be completed to perform an Operational Qualification for the SCION.

5.1 OQ Preparation

The following must be done before starting the OQ:

1. Preventative Maintenance must have been completed and signed off by the Qualification Representative, Reviewer, and QA/QC person, and attach a copy of the service report and add an addendum number.

Addendum P.M. Protocol

Qualification Rep. Initials	<i>Sarah P.</i>	Reviewer Initials		QA/QC Initials	
Date	16 July 24	Date		Date	

2. OQ must have been completed and signed off by the Qualification Representative, Reviewer, and QA/QC person.

Qualification Rep. Initials	<i>Sarah P.</i>	Reviewer Initials		QA/QC Initials	
Date	16 July 24	Date		Date	

3. The QA/QC person must review, approve, append (if necessary), and sign the Pre-execution Approval.

Qualification Rep. Initials	<i>Sarah P.</i>	Reviewer Initials		QA/QC Initials	
Date	16 July 24	Date		Date	

4. The Qualification Representative and the Reviewer must sign and date the Pre-execution Approval.

Qualification Rep. Initials	<i>Sarah P.</i>	Reviewer Initials		QA/QC Initials	
Date	16 July 24	Date		Date	

5.2 System Description

5.2.1 SCION Description

Installation Date: 2015	Principal Operator:	Phone Number:
Company Information		
Company: United Analyst and Engineering		Installation Site: LAB
Name:	Building:	
Address: 3 Soi Udomsakul 41	Address/Location: Sukhumvit Rd.	
City, State: Bangkok, Prachanong	City, State: Bangkok	
Zip / Country: Thailand	Zip / Country: 10260	
System Description		
SCION: SQ	Serial Number: GQS1203F021	
Sales Order Number:	Sales Order Addendum Number:	
GC		
Module Type: Scion 451	Serial Number: BR1203M099	
AutoSampler		
Module Type: CP8400	Serial Number: BR1203M331	
MS Workstation		
Version: MSWS 8.2.1	Serial Number: 01106-6711-BBQ-450d	
Computer Operating System		
Operating System: Windows 7	Version: Pro	Serial No.: 00386-150-426-159 Pack: -
Computer		
Make: Dell	Model: optiplex	Serial No.: DNNVHSI Hard Drive 1TB Size / RAM: 4GB
Addendum Number(s): 2. System description		
Qualification Rep. Initials: Sumbal P.	Reviewer Initials:	QA/QC Initials:
Date: 16 July 24	Date:	Date:

5.3 Data Sheet Specifications

Run these tests after the instrument has pumped down and is leak free. Use the factory methods. Follow the Installation Procedure; complete this section and the appropriate line of the OQ Summary. Print out the methods and results and attach as addendums. Use the factory test column Br-5ms 15m X 250im X 0.25im.

Table 5-1 TQ Specification

Mode	Concentration	Scan Range	Result †	N/A	Pass	Fail	Addendum
EI Full Scan	1 pg OFN	50-300	S/N ≥500:1				
EI MRM	100 fg OFN	272-222	S/N ≥5000:1				
PCI Full Scan‡	10 pg BZP	80-230	S/N ≥50:1				
NCI Full Scan‡	1 pg OFN	200-300	S/N ≥4000:1				

† The Signal-to-Noise ratio S/N values are based on RMS noise figure.

‡ CI tests use methane gas as reagent gas.

For any tests that did not pass, complete an Addendum for each, write the Addendum number and a brief description.

Qualification Rep. Initials: Sumbal P.	Reviewer Initials:	QA/QC Initials:
Date: 16 July 24	Date:	Date:

Table 5-2 SQ Specification

Mode	Concentration	Scan Range	Result †	N/A	Pass	Fail	Addendum
EI Full Scan	1 pg OFN	50-300	S/N ≥600:1		✓		
PCI Full Scan‡	100 pg BZP	80-230	S/N ≥600:1	✓			
NCI Full Scan‡	200 fg OFN	200-300	S/N ≥1000:1	✓			

Qualification Rep. Initials: Sumbal P.	Reviewer Initials:	QA/QC Initials:
Date: 16 July 24	Date:	Date:

5.4 EI Precision Test TQ

The following precision tests are for systems with autosamplers only. The test solution is 1 pg/μL OFN test mix part number 393065201.

The following is the required precision for 10 consecutive injections:

Injection	Retention Time	Peak Area
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
% RSD		

As an alternative, a % RSD summary report from MSWS can be added as an addendum.

Addendum: N/A				
Observed Mass is between 271.6 m/z to 272.4 m/z, which is ± 0.4 of the expected m/z.	✓			
Retention Time ≤ 1% Relative Standard Deviation (RSD).	✓			
Peak Area ≤ 10% Relative Standard Deviation (RSD).	✓			

To complete this section use the factory MRM method on the system CD. Print a copy of the method and add as an addendum.

Addendum: N/A

If the hardware is not the same as the factory method, then note this in the addendum and how the hardware available has been configured to compensate. The most common variation here is the sampler, where the Combi Pal has been used instead of the 8400. This will have no impact on results and can be tracked and recorded in the addendum.

5.5 EI Precision Test SQ

The following precision tests are for systems with autosamplers only. The test solution is 1 pg/μL OFN test mix part number 393065201.

The following is the required precision for 10 consecutive injections:

Injection	Retention Time	Peak Area
1	3.645	39800
2	3.643	35585
3	3.640	38804
4	3.642	36679
5	3.641	35202
6	3.642	36225
7	3.641	37711
8	3.642	36452
9	3.642	35329
10	3.643	38639
% RSD	0.038	4.343

As an alternative, a % RSD summary report from MSWS can be added as an addendum.

Addendum:				
Observed Mass is between 271.6 m/z to 272.4 m/z, which is ± 0.4 of the expected m/z.		✓		
Retention Time ≤ 1% Relative Standard Deviation (RSD).		✓		
Peak Area ≤ 10% Relative Standard Deviation (RSD).		✓		

To complete this section use the factory Scan method on the system CD. Print a copy of the method and add as an addendum.

Addendum N/A

If the hardware is not the same as the factory method, then note this in the addendum and how the hardware available has been configured to compensate. The most common variation here is the sampler, where the Comb Pal has been used instead of the S400. This will have no impact on results and can be tracked and recorded in the addendum.

Addendum N/A

6.0 Protocol Approval

6.1 Protocol Acceptance / Approval by Customer

I agree that the procedures and information referenced in this document are applicable.

Instrument(s): Scion 451 SQ with CP8400

Serial Number(s): GQS 1203F021

Sales Order Number:

Company Name: United Analyst and Engineering Consultant Co., Ltd.

I agree that the Operational Qualification Protocol has been satisfactorily completed.	<input checked="" type="checkbox"/>
I confirm that the Operational Qualification Protocol has not been completed, because of these failed (non-passed) items	<input type="checkbox"/>

Authorized Customer Representative

Name (Print)	
Title	
Signature	
Initials	
Date	

5.6 Final Evaluation

	N/A	Pass	Fail	Addendum
Is the equipment in normal operation condition?		✓		
Have all of the OQ requirements been completed?		✓		

Qualification Rep. Initials	<u>Sahad P.</u>	Reviewer Initials		QA/QC Initials	
Date	<u>16 July 24</u>	Date		Date	

6.2 Operational Qualification Protocol Assignment

This Operational Qualification Protocol document is used for:

Operational Qualification Protocol as final test at Scion	<input type="checkbox"/>
Operational Qualification Protocol after Installation Qualification	<input type="checkbox"/>
Operational Qualification Protocol after Preventive Maintenance and OQ completion.	<input checked="" type="checkbox"/>

6.3 Protocol Acceptance / Protocol Approval by Scion

I agree that the procedures and information referenced in this document are applicable.

Instrument(s): Scion 451 SQ with CP8400

Serial Number(s): GQS 1203F021

Sales Order Number:

Company Name: United Analyst and Engineering Consultant Co., Ltd.

Scion Certified Engineer

Name (Print)	SOMCHAI POHTONGKAM
Title	ENGINEER
Signature	<i>Somchai P.</i>
Initials	SOMCHAI
Date	

6.4 Remarks

Appendices

Each page that is inserted after the appendix is numbered with the letter of the appendix and a sequential number. The appendix page number must be initialed and dated by both the Qualification Representative and the Reviewer.

For example, pages inserted after Appendix C are numbered C-1, C-2, C-3... etc along with the initials and date.

If the reverse of each appendix page is left blank it should be marked NA and signed and dated.

When the OQ is complete the total number of pages inserted after each appendix is written on the front page of the respective appendix sheet.

A.1 Qualification Representative Details

The Qualification Representative is to insert a copy of their appropriate qualification(s) after this page.

No. of Pages Inserted	
-----------------------	--

This area is intentionally left blank.

	
<h1>Certificate</h1>	
It is hereby certified that	
Mr. Somchai Pohtongkam	
Has successfully completed the Service & Application Training for	
Scion Chromatography Products	
Training Contents were:	
Hardware Operation, Software operation, Data analysis and Installation, & Troubleshooting of Model:	
SCION GC, GCMS SQ, GCMS TQ	
At Techcomp Singapore	
By Mr. Michael Mei (Service Manager)	
On 11 th –15 th July 2016	
	
Hans van den Heuvel Commercial Director Scion Instruments	
Date: 19 July 2016	Cert. No.: TSG-SCIONGC-15011602

B.1 Exceptions

Each Exception Report shall be issued with a unique identification number in the form of ERID-XX-X. This number is generated by the page number on which the exception occurred followed by a sequential number indicating each exception found on the page.

For example, if an exception occurs on page 34, it shall be identified as Exception Report 'ERID-34-1'. If another exception occurs on page 34, the second exception shall be identified as 'ERID-34-2'. This identification number should be recorded in the pass/fail field after each test.

Insert Exception Reports (if any) after this page.

No. of Pages Inserted	N/A
-----------------------	-----

This area is intentionally left blank.

เอกสารไม่ควบคุม

Addendum Procedure: 2. System description Page Number: 5

Qualification Rep. Initials	<i>Sandhu P.</i>	Reviewer Initials		QA/QC Initials	
Date	16 July 24	Date		Date	

เอกสารไม่ควบคุม

Addendum Procedure: P.M. Protocol Page Number: 1

Qualification Rep. Initials	<i>Sandhu P.</i>	Reviewer Initials		QA/QC Initials	
Date	16 July 24	Date		Date	

เอกสารไม่ควบคุม

Addendum Procedure: 3-Test Result Page Number: 30

Qualification Rep. Initials	<i>Sandhu P.</i>	Reviewer Initials		QA/QC Initials	
Date	16 July 24	Date		Date	

เอกสารไม่ควบคุม

Addendum Procedure: A. Certificate Page Number: _____

Operational Qualification Protocol Certification

for

SCION

with the serial number

GQS1203F21

has successfully completed all criteria for hardware Operational Qualification Protocol
as detailed in this document.

Scion Certified Engineer

SOMCHAI PHOTONGKAM
Name (please print)

Somchai P.
Signature

16 July 24
Date

Authorized Customer Representative

Name / Function (please print)

Signature

Date

Customer Address

United Analyst and Engineering Consultant Co., Ltd.

Qualification Rep. Initials	<u>Somchai P.</u>	Reviewer Initials		QA/QC Initials	
Date	<u>16 July 24</u>	Date		Date	

Publication no. 394207000, Revision A, November 2011

Page 35 of 36

เอกสารไม่ควบคุม

Publication no. 394207000, Revision A, November 2011

Page 36 of 36

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.: 24TM938
Page : 1 of 3

Equipment : Incubator
Manufacturer : Binder
Model : KB 400 E6
Serial No. : 2022000022479
ID No. : UAE.MIC.028/2566
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Microbiology Laboratory
Received Order : 09 July 2024
Calibration Date : 09 July 2024
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Khit Rutanaprapachai
Approved by : [Signature]
Approved Signatory
() Ponpan Paipim
(✓) Suwit Imjai
() Kunchit Promprat

Issue Date : 19 July 2024

The Uncertainties are for a confidence probability of approximately 95%

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

เอกสารไม่ควบคุม



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2407-0153OC-4
Procedure Used :-

Cert. No.: 24TM938
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:-

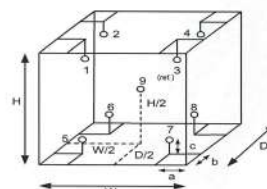
Instrument	Serial No.	Cert. No.	Traceable	Due Date
1.) Data Acquisition	MY49001451	24LM44	TPA	17 Mar 2025

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

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

Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Not Available

Environment during calibration		
	Beginning	Finished
Temp. (°C)	23	24
REL.Humid. (%)	52	54
AC Supply (Volt)	221	222



Probe Installation Details :		Dimension of Chamber :	
a =	10 cm	D =	0.47 m
b =	10 cm	W =	0.65 m
c =	10 cm	H =	1.2 m
		Capacity =	0.37 m ³

Position :	Ref. Std. ID No.:
1	19RTD-2/1
2	19RTD-2/2
3	19RTD-2/3
4	19RTD-2/4
5	19RTD-2/5
6	24-19RTD-2/6
7	19RTD-2/7
8	19RTD-2/8
9 (ref.)	19RTD-2/9

เอกสารไม่ควบคุม



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2407-0153OC-4
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Not Available

Cert. No.: 24TM938
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	0.030	0.31	0.33	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	Position									
	1	2	3	4	5	6	7	8	9 (ref.)	
35.0	35.093	35.011	35.081	35.118	34.840	35.054	34.924	34.978	34.824	0.30

Average* : The average of 30 values in each position.
Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.
Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.
Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.
UUC* : Unit Under Calibration
Note : The reported uncertainty of measurement was included stability and excluded uniformity .

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

-000-

เอกสารไม่ควบคุม



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

Certificate of Calibration

Cert.No.: 24CH1115
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 : 05 September 2024
Calibration Date : 06 September 2024
Reference : 2409-0177DSC-1
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong, Bangkok 10260
Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 20) %
Calibration Procedure : In - house method : CP-CH11
Direct measurement by
using Formazin standard solution
Calibrated by : Walalak Sirthean
Approved by :
Approved Signatory
() Unnopphol Harachai
() Ponpan Paipim
(✓) Salthip Meangmai
Issue Date : 9 September 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 Calibration and Testing Equipment Services.

เอกสารไม่ควบคุม



Cert.No.: 24CH1115
Page : 2 of 2

Condition of this calibration result

1. Reference Standard Instruments :

Instruments	Serial No.	ID No.	Certificate No.	Due date
1) Thermo-Hygrograph	1103328	130EC010	24H1372	12 July 2025
2) Electronic Balance	1126143764	140RC004	22MM22	20 Feb 2025

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

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	0.0081	2.06
20	20.2	0.39	2.00
100	100	0.75	2.00
400	401	1.5	2.06
800	801	2.1	2.17

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-

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-2510-0375

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 : 5 March 2025
Calibrate date : 7 March 2025
Issue date : 7 March 2025
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	WK2407-141-1	WK Electric Co., Ltd.
Digital Thermo-Hygrometer	HT-771SD	AL07155	25H171	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	150.4	0.47

Unit : °C

(1A)	(2A)	(3A)	(4A)	(5A)
150.407	150.377	150.269	150.402	150.422
(1B)	(2B)	(3B)	(4B)	(5B)
150.426	150.394	150.644	150.690	150.542
(1C)	(2C)	(3C)	(4C)	(5C)
150.477	150.303	150.627	150.257	150.176
(1D)	(2D)	(3D)	(4D)	(5D)
150.462	150.456	150.199	150.406	150.102
(1E)	(2E)	(3E)	(4E)	(5E)
150.185	150.513	150.235	150.460	150.442

Figure: Shows the location of the temperature source.

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

** End of certificate **

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

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

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

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Agilent 7890 GC Preventive Maintenance Checklist

Introduction

Customer Information

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

Important Customer Web Links

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

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Agilent 7890 GC Preventive Maintenance Checklist

Service Engineer's Responsibilities

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

Additional Instruction Notes

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

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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	UAE_TOX.007
Instrument System Site and Location	Laboratory

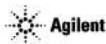
List System Component Product Numbers	List the Serial Numbers of each Component
1. G3440A	CN11021007
2. G4513A	CN20030059
3. G4514A	CN20020060
4.	
5.	
6.	
7.	
8.	
9.	
10.	

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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 Agile Document Number: D0013618
 DE number: 44166.759722222
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Page 3 of 8



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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

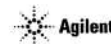
- ☒ For the inlets installed, perform inlet maintenance as defined in the 7890 manual - "Maintaining Your GC" - for the inlet(s) installed.
- ☒ Replace the split vent trap cartridge filter on units with these inlets: Split/Splitless Capillary (SSL), Multi-Mode Inlet (MMI), Programmed Temperature Vaporizer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

Zero Sensors and Leak test

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

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Page 4 of 8



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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 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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Page 5 of 8



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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.

7890 GC Test Results Table

Detector Signal Outputs	Before PM Service	After PM Service
Front detector output	313.5	313.5
Back detector output	24.5	19.3
AUX detector output	n/a	n/a
Pressure decay test	Expected test result	Actual test result
Front inlet pressure decay test	Pass	Pass
Back inlet pressure decay test	Pass	n/a

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 DE number: 44166.759722222
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Page 6 of 8



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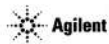
7890 Parts List Table

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	7890A/B	1
SSL Capillary Inlet PM kit, split	5188-6496	7890A/B	-
SSL Capillary Ultra Inert Inlet Gold Seal with Washer	5190-6144	7890A/B	-
SSL Capillary Ultra Inert Inlet Splitless Liner - Single taper with Glass Wool	5190-2293	7890A/B	-
SSL Capillary Ultra Inert Inlet Low Pressure Drop Split Liner - with Glass Wool	5190-2295	7890A/B	-
PP Inlet PM kit	5188-6498	7890A/B	-
Split vent trap PM kit, single cartridge (for MMI, PTV & VI)	5188-6495	7890A/B	-
MMI Cleaning Kit	G3510-60820	7890A/B	-
PTV Septumless Head Rebuild Kit	5182-9747	7890A/B	-
PTV Septumless Head Teflon Guide	5182-9748	7890A/B	-
Ignitor (glow plug) assembly with O-ring	19231-60680	7890A/B	1
FID Collector Rebuild/Cleaning Kit	G1531-67000	7890A/B	-
Standard .011-inch FID Jet for capillary FID base	G1531-80560	7890A/B	-
High Temperature .018-inch FID Jet for capillary FID base	G1531-80620	7890A/B	-
Standard .018-inch FID Jet for packed column with packed FID base	18710-20119	7890A/B	-
Standard .011-inch FID Jet for capillary column with packed/adaptable FID base	19244-80560	7890A/B	1
High Temperature .018-inch FID Jet for capillary column with packed/adaptable FID base	19244-80620	7890A/B	-
NPD Jet, universal fit, .011-inch ID	G1534-80580	7890A/B	-
NPD Jet, universal fit, .011-inch ID Extended tip	G1534-80590	7890A/B	-
SSL Capillary Ultra Inert Inlet Gold Seal with Washer	5190-6144	7890A/B	-
SSL Capillary Ultra Inert Inlet Splitless Liner - Single taper with Glass Wool	5190-2293	7890A/B	-
**FID Collector Replacement Kit, if needed	G1531-67001	7890A/B	-

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Agile Document Number: D0013618
DE number: 44166.759/222222
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Page 7 of 8



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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.

- The Equipment can operate as normally.

Service Completion

Service request number 6007319635 Date service completed 18 Feb 2025
Agilent signature Adirek R. Customer signature _____
Total number of pages in this document 9

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Agile Document Number: D0013618
DE number: 44166.759/222222
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Page 8 of 8



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Request No. 25-68 / 0320

MTC. ACL.No. 372 / 68

CALIBRATION CERTIFICATE

NOMENCLATURE : 1. Atomic Absorption Spectrophotometer "Agilent Technologies"

Model AA240FS, Serial No. MY13160001

2. Working standard solution "CPA chem"

Solution of 29 components, Lot No. 1012852

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

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

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

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

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

CALIBRATION DATE : 3 February 2025

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

Cadmium Lot No. 0001152457, Chromium Lot No. 0106315418, Copper Batch No. 0001268514, Iron Batch No. T126087A,
Lead Lot No. 0123204734, Manganese Batch No. 0106301952, Nickel Batch No. 0104978044, Zinc Batch No. 0100792297

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

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

Calibrated by Atipat
(Mr. Atipat Ratana)

Approved by Suladda
(Miss Suladda Deawong)

Director of Analytical Chemistry Laboratory

Ref. 2015268013000459001

Issued Date : 7 March 2025

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E-mail : mtic@tistr.or.th Website : www.tistr.or.th

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Request No. 25-68 / 0320

1 / 5

MTC. ACL. No. 372 / 68

CALIBRATION DATA

1. Noise Level

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

Continue 2 / 5

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Request No. 25-68 / 0320

2 / 5

MTC. ACL. No. 372 / 68

2. Precision

Element	Conc. (mg/L)	Absorbance										Ave. Abs.	SD	%RSD
Cd	0.02	0.0076	0.0066	0.0071	0.0065	0.0075	0.0066	0.0077	0.0065	0.0065	0.0065	0.007	0.0005	7.39
	0.30	0.0923	0.0921	0.0920	0.0917	0.0919	0.0904	0.0929	0.0910	0.0915	0.0927	0.092	0.0008	0.82
	0.70	0.2083	0.2082	0.2100	0.2114	0.2102	0.2091	0.2096	0.2093	0.2088	0.2082	0.209	0.0010	0.49
Cr	0.10	0.0095	0.0104	0.0097	0.0095	0.0093	0.0091	0.0096	0.0095	0.0082	0.0080	0.009	0.0007	7.63
	0.30	0.0234	0.0243	0.0237	0.0242	0.0214	0.0226	0.0232	0.0233	0.0237	0.0237	0.023	0.0008	3.61
	0.70	0.0474	0.0490	0.0497	0.0516	0.0487	0.0476	0.0474	0.0484	0.0473	0.0474	0.048	0.0014	2.85
Cu	0.05	0.0073	0.0072	0.0060	0.0068	0.0067	0.0065	0.0070	0.0066	0.0068	0.0070	0.007	0.0004	5.53
	0.30	0.0380	0.0385	0.0377	0.0382	0.0394	0.0375	0.0381	0.0392	0.0389	0.0385	0.038	0.0006	1.62
	0.70	0.0888	0.0895	0.0890	0.0902	0.0897	0.0893	0.0899	0.0890	0.0902	0.0898	0.090	0.0005	0.56
Fe	0.10	0.0102	0.0103	0.0100	0.0092	0.0109	0.0094	0.0101	0.0098	0.0092	0.0101	0.010	0.0005	5.39
	0.50	0.0421	0.0421	0.0424	0.0421	0.0425	0.0412	0.0419	0.0425	0.0419	0.0429	0.042	0.0005	1.09
	1.00	0.0791	0.0782	0.0780	0.0780	0.0776	0.0792	0.0780	0.0782	0.0786	0.0794	0.078	0.0006	0.78
Pb	0.20	0.0092	0.0087	0.0081	0.0092	0.0090	0.0087	0.0091	0.0082	0.0091	0.0088	0.009	0.0004	4.49
	0.70	0.0275	0.0290	0.0288	0.0283	0.0272	0.0286	0.0280	0.0285	0.0288	0.0286	0.028	0.0006	2.09
	1.50	0.0592	0.0580	0.0591	0.0596	0.0577	0.0589	0.0591	0.0584	0.0575	0.0595	0.059	0.0008	1.28
Mn	0.05	0.0126	0.0130	0.0123	0.0113	0.0115	0.0126	0.0122	0.0123	0.0114	0.0117	0.012	0.0006	4.81
	0.30	0.0588	0.0582	0.0584	0.0593	0.0582	0.0584	0.0596	0.0602	0.0581	0.0577	0.059	0.0008	1.33
	0.70	0.1320	0.1318	0.1313	0.1306	0.1324	0.1314	0.1320	0.1308	0.1303	0.1305	0.131	0.0007	0.56
Ni	0.10	0.0107	0.0110	0.0102	0.0098	0.0101	0.0106	0.0096	0.0108	0.0100	0.0102	0.010	0.0005	4.44
	0.50	0.0452	0.0454	0.0441	0.0449	0.0452	0.0450	0.0453	0.0452	0.0454	0.0455	0.045	0.0004	0.89
	1.00	0.0848	0.0875	0.0856	0.0853	0.0866	0.0866	0.0865	0.0857	0.0859	0.086	0.086	0.0008	0.92
Zn	0.05	0.0367	0.0370	0.0372	0.0362	0.0369	0.0367	0.0363	0.0367	0.0365	0.0360	0.037	0.0004	1.02
	0.30	0.2022	0.2009	0.2022	0.2017	0.2022	0.2009	0.2001	0.2016	0.2022	0.2023	0.202	0.0008	0.38
	0.70	0.4118	0.4123	0.4107	0.4132	0.4142	0.4157	0.4086	0.4098	0.4101	0.4079	0.411	0.0025	0.60

Continue 3 / 5

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Head Office
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Request No. 25-68 / 0320

4 / 5

MTC. ACL. No. 372 / 68

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

Element	Standard Value of (mg/L)	Reading (mg/L)	Error of Measurement (mg/L)	Error of Measurement (%)	Uncertainty (mg/L)
Fe	0.100	0.107	0.007	7.06	± 0.014
	0.500	0.522	0.022	4.49	± 0.016
	1.000	0.990	-0.010	1.02	± 0.029

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

Element	Standard Value of (mg/L)	Reading (mg/L)	Error of Measurement (mg/L)	Error of Measurement (%)	Uncertainty (mg/L)
Pb	0.200	0.200	0.000	0.15	± 0.014
	0.700	0.701	0.001	0.10	± 0.030
	1.500	1.480	-0.020	1.32	± 0.061

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

Element	Standard Value of (mg/L)	Reading (mg/L)	Error of Measurement (mg/L)	Error of Measurement (%)	Uncertainty (mg/L)
Mn	0.050	0.051	0.001	2.41	± 0.005
	0.300	0.291	-0.009	2.92	± 0.007
	0.700	0.665	-0.035	4.95	± 0.014

Continue 5 / 5

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Request No. 25-68 / 0320

3 / 5

MTC. ACL. No. 372 / 68

3. Trueness

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

Element	Standard Value of (mg/L)	Reading (mg/L)	Error of Measurement (mg/L)	Error of Measurement (%)	Uncertainty (mg/L)
Cd	0.020	0.020	0.000	1.23	± 0.005
	0.300	0.300	0.000	0.11	± 0.005
	0.700	0.688	-0.012	1.67	± 0.008

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

Element	Standard Value of (mg/L)	Reading (mg/L)	Error of Measurement (mg/L)	Error of Measurement (%)	Uncertainty (mg/L)
Cr	0.1000	0.109	0.009	9.39	± 0.009
	0.3000	0.306	0.006	1.98	± 0.012
	0.7000	0.657	-0.043	6.20	± 0.023

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

Element	Standard Value of (mg/L)	Reading (mg/L)	Error of Measurement (mg/L)	Error of Measurement (%)	Uncertainty (mg/L)
Cu	0.050	0.050	0.000	0.68	± 0.003
	0.300	0.292	-0.008	2.70	± 0.009
	0.700	0.684	-0.016	2.31	± 0.020

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5 / 5

MTC. ACL. No. 372 / 68

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

Element	Standard Value of (mg/L)	Reading (mg/L)	Error of Measurement (mg/L)	Error of Measurement (%)	Uncertainty (mg/L)
Ni	0.100	0.098	-0.002	1.60	± 0.013
	0.500	0.490	-0.010	2.00	± 0.018
	1.000	0.951	-0.049	4.90	± 0.032

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

Element	Standard Value of (mg/L)	Reading (mg/L)	Error of Measurement (mg/L)	Error of Measurement (%)	Uncertainty (mg/L)
Zn	0.050	0.048	-0.002	3.37	± 0.013
	0.300	0.325	0.025	8.32	± 0.013
	0.700	0.677	-0.023	3.33	± 0.019

Remark : The reported uncertainty is an expanded uncertainty calculated using a coverage factor of 2 (k = 2)

which gives a level of confidence of approximately 95%

Calibrated by Atipat.
(Mr. Atipat Ratana)Approved by Suladda Deawong
(Miss Suladda Deawong)
Director of Analytical Chemistry Laboratory
Issued Date : 7 March 2025

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End of Certificate

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