

ภาคผนวก ง

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เอกสารสอบเทียบเครื่องมือ

### List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
<b>Ambient</b>									
1	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	Svantek	SV35A 73246	Innovative Instrument Co.,Ltd.	24-ACT-077	30 May 24	29 May 25	-
2	Sound Level Meter	$L_{Aeq\ 24\ hours}$ , $L_{Amax}$ , $L_{A90}$ , $L_{Adn}$	Larson Davis	LxT2 0005286	Innovative Instrument Co.,Ltd.	24-SLM-234	10 Jul 24	9 Jul 25	-
3	Sound Level Meter	$L_{Aeq\ 24\ hours}$ , $L_{Amax}$ , $L_{A90}$ , $L_{Adn}$	Larson Davis	LxT2 0005290	Innovative Instrument Co.,Ltd.	24-SLM-238	11 Jul 24	10 Jul 25	-
4	Sound Level Meter	$L_{Aeq\ 24\ hours}$ , $L_{Amax}$ , $L_{A90}$ , $L_{Adn}$	Larson Davis	LxT2 0005293	Innovative Instrument Co.,Ltd.	24-SLM-231	10 Jul 24	9 Jul 25	-
5	Sound Level Meter	$L_{Aeq\ 24\ hours}$ , $L_{Amax}$ , $L_{A90}$ , $L_{Adn}$	Larson Davis	LxT2 0005290	Innovative Instrument Co.,Ltd.	24-SLM-240	11 Jul 24	10 Jul 25	-
6	Sound Level Meter	$L_{Aeq\ 24\ hours}$ , $L_{Amax}$ , $L_{A90}$ , $L_{Adn}$	Larson Davis	LxT2 0005372	Innovative Instrument Co.,Ltd.	24-SLM-229	9 Jul 24	8 Jul 25	-
7	Sound Level Meter	$L_{Aeq\ 24\ hours}$ , $L_{Amax}$ , $L_{A90}$ , $L_{Adn}$	Larson Davis	LxT2 0005341	Innovative Instrument Co.,Ltd.	24-SLM-232	10 Jul 24	9 Jul 25	-
8	Sound Level Meter	$L_{Aeq\ 24\ hours}$ , $L_{Amax}$ , $L_{A90}$ , $L_{Adn}$	Larson Davis	LxT2 0005346	Innovative Instrument Co.,Ltd.	24-SLM-235	10 Jul 24	9 Jul 25	-
9	Sound Level Meter	$L_{Aeq\ 24\ hours}$ , $L_{Amax}$ , $L_{A90}$ , $L_{Adn}$	Larson Davis	LxT2 0005393	Innovative Instrument Co.,Ltd.	24-SLM-237	10 Jul 24	9 Jul 25	-

### List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
<b>Stack</b>									
1	Pre-Test Console	Total Suspended Particulate Xylene Chlorine Hydrogen Chloride Hydrogen Fluoride Hydrogen Sulfide Sulphuric Acid Particles Smaller Than 2.5 microns Cresol Antimony Argon Beryllium Cadmium Chromium Copper Lead Magnesium Mercury Nickel Vanadium TOC Cobalt	Apex Instruments,  USA.	XC-572-V  1701019	Envi Equipment Service Co., Ltd.	E24-060048	18 Jun 24	17 Jun 25	-
2	Pre-Test Console	Total Suspended Particulate Xylene Chlorine	Apex Instruments,  USA.	XC-572-V  0803018	Envi Equipment Service Co., Ltd.	E23-12097	24 Dec 23	23 Dec 24	-

### List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
<b>Stack</b>									
		Hydrogen Chloride Hydrogen Fluoride Hydrogen Sulfide Sulphuric Acid Particles Smaller Than 2.5 microns Cresol Antimony Argon Beryllium Cadmium Chromium Copper Lead Magnesium Mercury Nickel Vanadium TOC Cobalt							
3	Flue gas Analyzer	Sulphur Dioxide Oxide of Nitrogen as Nitrogen Dioxide Carbon Monoxide	Testo	Testo 350 2376344	Entech Industrial Sulation Co., Ltd.	G 660610	4 Oct 23	3 Oct 24	-
4	Flue gas Analyzer	Sulphur Dioxide Oxide of Nitrogen as Nitrogen Dioxide Carbon Monoxide	Testo	Testo 350 60899617	Entech Industrial Sulation Co., Ltd.	G 660614	5 Oct 23	4 Oct 24	-



List of Opacity Training Certification for Opacity Mesurement

No.	Name	Training Couse	Train	Date	Remark
1	Mr.Kannikorn Raso	Opacity	Pollution Control Department	30-31 March 2017	-
2	Mr.Natthapong Mounghchai	Opacity	Pollution Control Department	22-23 March 2018	-
3	Mr.Rattanachai Laoma	Opacity	Pollution Control Department	28-29 March 2019	-
4	Mr.Kitipong Sonchayaphum	Opacity	Pollution Control Department	28-29 March 2019	-
5	Mr.Natthachai Proma-Rak	Opacity	Pollution Control Department	3-4 December 2020	-
6	Mr.Watcharin San-Ngam	Opacity	Pollution Control Department	22-23 December 2022	-
7	Mr.Teerawat Tamsuvan	Opacity	Pollution Control Department	22-23 December 2022	-

## CERTIFICATE OF CALIBRATION

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

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

Description of Equipment : Console meter

Manufacturer : Apex Instrument

Model Number : XC-572-V

Serial Number : 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 Fuchun)

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	SK25EX	Barometric Pressure	755.91			K <sub>1</sub>	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 <sub>at</sub> )	(V <sub>in</sub> )	(V <sub>out</sub> )	(t <sub>in</sub> )	(t <sub>out</sub> )	(V <sub>wf</sub> )	(V <sub>wf</sub> )	(t <sub>in</sub> )	(t <sub>out</sub> )
min	mm H <sub>2</sub> O	m <sup>3</sup>	m <sup>3</sup>	°C	°C	m <sup>3</sup>	m <sup>3</sup>	°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	40.0	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	SK25EX	Barometric Pressure	755.91			K <sub>1</sub>	0.386	
DGM Serial Number	00002028	Calibration Meter Gamma	1.001			Console Leak Check	PASS	

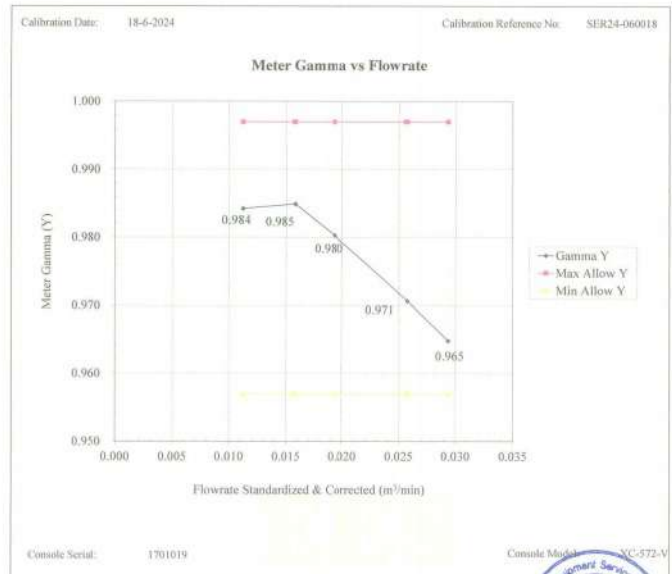
Calibration Data									
Results									
Standardized Data					Dry Gas Meter				
Dry Gas Meter		Calibration Meter		Calibration Factor	Flowrate		Std & Corr	.0212 m <sup>3</sup> /min	Variation
(V <sub>cal</sub> )	(Q <sub>cal</sub> )	(V <sub>wf</sub> )	(Q <sub>wf</sub> )		(Y)	(ΔY)			
m <sup>3</sup>	m <sup>3</sup> /min	m <sup>3</sup>	m <sup>3</sup> /min						
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 <sub>0</sub> 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<sub>0</sub>, orifice pressure differential that equates to 0.75 cfm (0.0212 m<sup>3</sup>/min) at standard temperature and pressure, acceptable tolerance of individual values from the average is ±0.2 inches (5.1mm) L.C.

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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			K <sub>1</sub>	0.386	
DGM Serial Number	00002028	Calibration Meter Gamma	1.001			Console Leak Check	PASS	



เอกสารไม่ควบคุม

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			K <sub>1</sub>	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	18/06/2024	00:20 PM
Console Serial Number	1701019	Calibration Reference No.	SER24-060018		
DGM Model Number	SK25EX	Reference Thermometer	DIGICON		
DGM Serial Number	00002028	Serial Number	183169105		
Meter Box Model Number	JENCO 765 KF				
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	1038.0
Stack	-17.0	25.0	38.0	93.0	149.0	257.0	368.0	477.0	587.0	806.0	1024.0
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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Envi Equipment Service Co., Ltd.  
110/254 Moo 3, Tumbon Bang Rak Phathana, Amphur Bang Bua Thong, Nonthaburi 11110  
Tel. 098 362 9152, 089 478 7885  
E-mail: sales@envi-een.com

Certificate No. : E23-12097  
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## CERTIFICATE OF CALIBRATION

Customer	: United Analyst and Engineering Consultant Co., Ltd.
Address	: 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Description of Equipment	: Console meter
Manufacturer	: Apex Instrument
Model Number	: XC-572-V
Serial Number	: 0803018
ID/Control No.	: UAE.ANV.193/2551 S/N 0803018
Environment Conditions	: Temperature (25 ± 2) °C
	: Humidity (50 ± 15) % RH
Cal. Date	: 24/12/2023
Issue Date	: 24/12/2023

### Calibration Method or Calibration Procedure Used

US EPA Method (United State Environmental Protection Agency)

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

### Result of Calibration

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

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

Calibrated by : Mr. Sanya Sangnil

Approved by : (Mr. Mana Fuekhu)

Technical Manger

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Certificate No. : E23-12097  
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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	24/12/2023	10:45 AM	Std Temp	293	K
Console Serial Number	0803018	Calibration Reference No.	SER23-12040			Std Press	760	mm Hg
DGM Model Number	SK25EX	Barometric Pressure	765.81			K <sub>1</sub>	0.386	
DGM Serial Number	00009766	Calibration Meter Gamma	0.999			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 <sub>0</sub> )	(V <sub>in</sub> )	(V <sub>out</sub> )	(t <sub>in</sub> )	(t <sub>out</sub> )	(V <sub>wi</sub> )	(V <sub>wf</sub> )	(t <sub>in</sub> )	(t <sub>out</sub> )
min	mm H <sub>2</sub> O	m <sup>3</sup>	m <sup>3</sup>	°C	°C	m <sup>3</sup>	m <sup>3</sup>	°C	°C
12.30	13.0	0.1650	0.3050	27	27	186.76006	186.89848	25	25
12.27	13.0	0.3050	0.4450	27	27	186.89848	187.03686	25	25
8.55	26.0	0.4520	0.5920	27	27	187.04374	187.18152	25	25
8.55	26.0	0.5920	0.7320	28	28	187.18152	187.31926	25	25
14.05	40.0	0.7430	1.0230	28	28	187.32982	187.60284	25	25
14.02	40.0	1.0230	1.3030	28	28	187.60284	187.87292	25	25
10.33	70.0	1.3160	1.5960	28	28	187.88578	188.15852	25	25
10.30	70.0	1.5960	1.8760	28	28	188.15852	188.43032	25	25
9.03	90.0	1.8870	2.1670	29	29	188.44084	188.71052	24	24
9.02	90.0	2.1670	2.4470	29	29	188.71052	188.97928	24	24

เอกสารไม่ควบคุม



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

Meter Console Information		Calibration Conditions				Factors/Conversions		
Console Model Number	XC-572-V	Date	Time	24/12/2023	10:45 AM	Std Temp	293	K
Console Serial Number	0803018	Calibration Reference No.	SER23-12040			Std Press	760	mm Hg
DGM Model Number	SK25EX	Barometric Pressure	765.81	mmHg		K <sub>1</sub>	0.386	
DGM Serial Number	00009766	Calibration Meter Gamma	0.999			Console Leak Check	PASS	

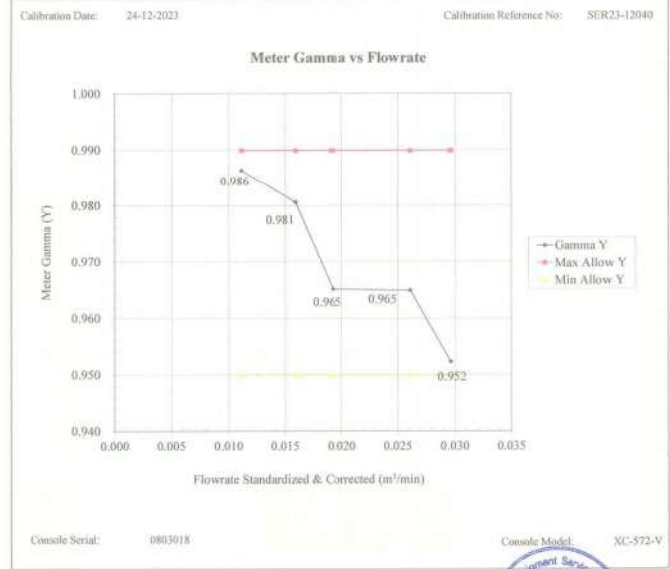
Calibration Data									
Results									
Standardized Data				Dry Gas Meter					
Dry Gas Meter		Calibration Meter		Calibration Factor		Flowrate		Std & Corr	
(V <sub>scndt</sub> )	(Q <sub>scndt</sub> )	(V <sub>wstdt</sub> )	(Q <sub>wstdt</sub> )	(Y)	(ΔY)	(Q <sub>scndt</sub> )	(ΔH <sub>g</sub> )	(ΔH <sub>g</sub> )	(ΔH <sub>g</sub> )
m <sup>3</sup>	m <sup>3</sup> /min	m <sup>3</sup>	m <sup>3</sup> /min			m <sup>3</sup> /min	mm H <sub>2</sub> O		
0.139	0.011	0.137	0.011	0.986	0.017	0.011	46.929	-0.077	
0.139	0.011	0.137	0.011	0.986	0.016	0.011	46.702	-0.304	
0.139	0.016	0.136	0.016	0.981	0.011	0.016	45.888	-1.118	
0.139	0.016	0.136	0.016	0.980	0.011	0.016	45.915	-1.091	
0.278	0.020	0.270	0.019	0.970	0.001	0.019	48.680	1.674	
0.278	0.020	0.267	0.019	0.960	-0.010	0.019	49.510	2.504	
0.279	0.027	0.270	0.026	0.967	-0.003	0.026	46.441	-0.565	
0.279	0.027	0.269	0.026	0.963	-0.007	0.026	46.462	-0.545	
0.281	0.031	0.268	0.030	0.954	-0.016	0.030	46.694	-0.313	
0.281	0.031	0.267	0.030	0.951	-0.019	0.030	46.840	-0.166	
				0.970	Y Average			47.006	ΔH <sub>g</sub> 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.

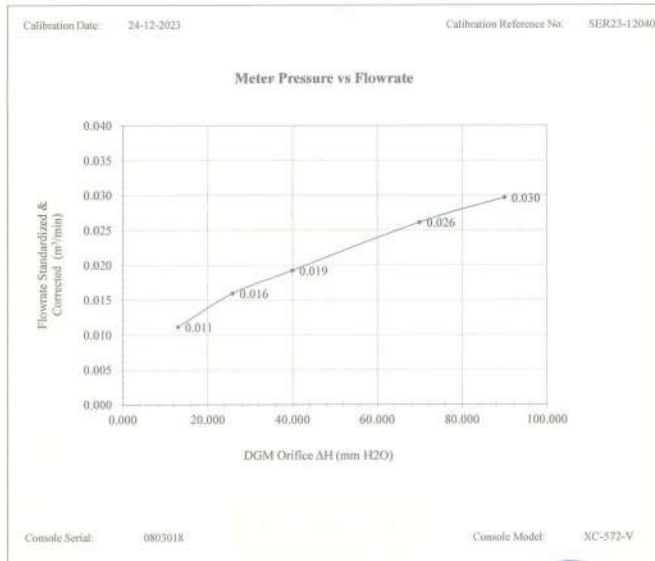
For ΔH<sub>g</sub>, orifice pressure differential that equates to 0.75 cfm (0.0212 m<sup>3</sup>/min) at standard temperature and pressure, acceptable tolerance of individual values from the average is ±0.2 inches (5.1mm) H<sub>2</sub>O.



Meter Console Information		Calibration Conditions				Factors/Conversions		
Console Model Number	XC-572-V	Date	Time	24/12/2023	10:45 AM	Std Temp	293	K
Console Serial Number	0803018	Calibration Reference No.	SER23-12040			Std Press	760	mm Hg
DGM Model Number	SK25EX	Barometric Pressure	765.81	mmHg		K <sub>1</sub>	0.386	
DGM Serial Number	00009766	Calibration Meter Gamma	0.999			Console Leak Check	PASS	



Meter Console Information		Calibration Conditions				Factors/Conversions		
Console Model Number	XC-572-V	Date	Time	24/12/2023	10:45 AM	Std Temp	293	K
Console Serial Number	0803018	Calibration Reference No.	SER23-12040			Std Press	760	mm Hg
DGM Model Number	SK25EX	Barometric Pressure	765.81	mmHg		K <sub>1</sub>	0.386	
DGM Serial Number	00009766	Calibration Meter Gamma	0.999			Console Leak Check	PASS	



THERMOCOUPLES SYSTEM CALIBRATION

Sampling System Equipment Information		Calibration Conditions			
Console Model Number	XC-572-V	Date	Time	24/12/2023	00:45 PM
Console Serial Number	0803018	Calibration Reference No.	SER23-12040		
DGM Model Number	SK25EX	Reference Thermometer	DIGICON		
DGM Serial Number	00009766	Serial Number	183169105		
Meter Box Model Number	JENCO 765 KF				
Meter Box Serial Number	JC 16095				

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	94.0	150.0	259.0	371.0	482.0	593.0	816.0
Aux	-17.0	25.0	38.0	94.0	150.0					
Probe	-17.0	25.0	38.0	94.0	150.0					
Filter	-17.0	26.0	38.0	94.0	150.0					
Oven	-	-	-	-	-					
Exit	-17.0	26.0	38.0							

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



Certificate No: G 660610  
Date of issue : 05-Oct-23

Certificate No.: G 660610

Instrument description : Flue Gas Analyzer  
Instrument model : Testo 350 New  
Control unit serial no. : 02398589/208  
Instrument serial no. : 02376344/208  
ID no. or control no. : UAE.EMA2.113/2555  
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 UDOMSUK41,SUKHUMVIT ROAD,BANGCHAK PRAKANONG BANGKOK 10260

Total pages of certificate : 2 Pages  
Receiving no. : L-233244  
Receiving date. : 28-Sep-23  
Parameter of calibration : Gas Calibration(Oxygen 2.498,10.04,21.02 %vol, Carbon Monoxide 80.14,302,1003 ppm, Nitrogen Dioxide 30.34,80.96,201.9 ppm, Nitric Oxide 30.01,151.5,322.5 ppm, Sulphur Dioxide 50.36,100.8,600.8 ppm)

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

Calibration place : 17/121 Soi Ngamwongwan 47 Yaek 48, Toongsonghong, Laksi, 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 : 04-Oct-23

  
Mr. Kwanchai Khairoung  
Calibration Technician

  
Mrs. Nongluck Wongsettee  
Technical Manager

FM-CL-09-C Rev.8

Page 1 of 2

Issued Date 26/02/16

Entech Industrial Solution Co.,Ltd.

17/121 Soi Ngamwongwan 47 Yaek 48, Toongsonghong, Laksi, Bangkok 10210 THAILAND Tel. 0-2779-8888 Calibration@entech.co.th  
Tax ID : 0105536035591 www.entech.co.th

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#### Standard References (Table 1)

Standard	Certificate No.	Vendor	Due date
Oxygen ( O2 ) 2.498 % Vol	4219/21	Linde	30-Sep-25
Oxygen ( O2 ) 10.04 % Vol	CG-0153-21	Nimt	18-Nov-26
Oxygen ( O2 ) 21.02 % Vol	CG-0041-22	Nimt	10-Feb-27
Carbon monoxide ( CO ) 80.14 ppm	CG-0040-22	Nimt	14-Feb-27
Carbon monoxide ( CO ) 302 ppm	1915/23	Linde	16-Jun-25
Carbon monoxide ( CO ) 1003 ppm	2584/23	Linde	10-Sep-25
Nitrogen Dioxide ( NO2 ) 30.34 ppm	2703/22	Linde	22-Aug-24
Nitrogen Dioxide ( NO2 ) 80.96 ppm	3240/21	Linde	26-Jun-24
Nitrogen Dioxide ( NO2 ) 201.9 ppm	1975/23	Linde	17-Jul-25
Nitric Oxide ( NO ) 30.01 ppm	CG-0014-23	Nimt	19-Feb-25
Nitric Oxide ( NO ) 151.5 ppm	0161/23	Linde	22-Jan-25
Nitric Oxide ( NO ) 322.5 ppm	1974/23	Linde	17-Jul-25
Sulphur Dioxide ( SO2 ) 50.36 ppm	2004/23	Linde	17-Jul-25
Sulphur Dioxide ( SO2 ) 100.8 ppm	3507/22	Linde	09-Nov-24
Sulphur Dioxide ( SO2 ) 600.8 ppm	2003/23	Linde	17-Jul-25

#### Measured room conditions

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

#### Calibration conditions

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

#### Calibration Results (Without adjustment) (Table 2)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (+)
O2 (%Vol)	2.498	2.53	0.032	0.15
O2 (%Vol)	10.04	10.09	0.05	0.20
O2 (%Vol)	21.02	21.11	0.09	0.30
CO (ppm)	80.14	81	0.86	3.0
CO (ppm)	302	302	0	6.0
CO (ppm)	1003	1000	-3	12
NO2 (ppm)	30.34	28.2	-2.14	8.0
NO2 (ppm)	80.96	79.4	-1.56	8.0
NO2 (ppm)	201.9	200.8	-1.1	12
NO (ppm)	30.01	28	-2.01	8.0
NO (ppm)	151.5	153	1.5	8.0
NO (ppm)	322.5	325	2.5	12
SO2 (ppm)	50.36	51	0.64	6.0
SO2 (ppm)	100.8	101	0.2	6.0
SO2 (ppm)	600.8	600	-0.8	13

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

End of Report

FM-CL-09-C Rev.8

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Issued Date 26/02/16

Entech Industrial Solution Co.,Ltd.

17/121 Soi Ngamwongwan 47 Yaek 48, Toongsonghong, Laksi, Bangkok 10210 THAILAND Tel. 0-2779-8888 Calibration@entech.co.th  
Tax ID : 0105536035591 www.entech.co.th

เอกสารไม่ควบคุม

Certificate No: G 660614  
Date of issue : 06-Oct-23

Certificate No.: G 660614

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

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

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

Calibration place : 17/121 Soi Ngamwongwan 47 Yaek 48, Toongsonghong, Laksi, 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.

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

Date of calibration : 05-Oct-23

  
Mr. Kwanchai Khairoung  
Calibration Technician

  
Mrs. Nongluck Wongsettee  
Technical Manager

FM-CL-09-C Rev.8

Page 1 of 2

Issued Date 26/02/16

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เอกสารไม่ควบคุม

#### Standard References (Table 1)

Standard	Certificate No.	Vendor	Due date
Oxygen ( O2 ) 2.498 % Vol	4219/21	Linde	30-Sep-25
Oxygen ( O2 ) 10.04 % Vol	CG-0153-21	Nimt	18-Nov-26
Oxygen ( O2 ) 21.02 % Vol	CG-0041-22	Nimt	10-Feb-27
Carbon monoxide ( CO ) 80.14 ppm	CG-0040-22	Nimt	14-Feb-27
Carbon monoxide ( CO ) 302 ppm	1915/23	Linde	16-Jun-25
Carbon monoxide ( CO ) 1003 ppm	2584/23	Linde	10-Sep-25
Nitrogen Dioxide ( NO2 ) 30.34 ppm	2703/22	Linde	22-Aug-24
Nitrogen Dioxide ( NO2 ) 80.96 ppm	3240/21	Linde	26-Jun-24
Nitrogen Dioxide ( NO2 ) 201.9 ppm	1975/23	Linde	17-Jul-25
Nitric Oxide ( NO ) 30.01 ppm	CG-0014-23	Nimt	19-Feb-25
Nitric Oxide ( NO ) 151.5 ppm	0161/23	Linde	22-Jan-25
Nitric Oxide ( NO ) 322.5 ppm	1974/23	Linde	17-Jul-25
Sulphur Dioxide ( SO2 ) 50.36 ppm	2004/23	Linde	17-Jul-25
Sulphur Dioxide ( SO2 ) 100.8 ppm	3507/22	Linde	09-Nov-24
Sulphur Dioxide ( SO2 ) 600.8 ppm	2003/23	Linde	17-Jul-25

#### Measured room conditions

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

#### Calibration conditions

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

#### Calibration Results (Without adjustment) (Table 2)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (+)
O2 (%Vol)	2.498	2.48	-0.018	0.15
O2 (%Vol)	10.04	10.07	0.03	0.20
O2 (%Vol)	21.02	21.10	0.08	0.30
CO (ppm)	80.14	81	0.86	3.0
CO (ppm)	302	304	2	6.0
CO (ppm)	1003	1008	5	12
NO2 (ppm)	30.34	28.2	-2.14	8.0
NO2 (ppm)	80.96	80.5	-0.46	8.0
NO2 (ppm)	201.9	204.7	2.8	12
NO (ppm)	30.01	29	-1.01	8.0
NO (ppm)	151.5	152	0.5	8.0
NO (ppm)	322.5	322	-0.5	12
SO2 (ppm)	50.36	50	-0.36	6.0
SO2 (ppm)	100.8	103	2.2	6.0
SO2 (ppm)	600.8	606	5.2	13

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

End of Report

FM-CL-09-C Rev.8

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Issued Date 26/02/16

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เอกสารไม่ควบคุม



Certificate of Calibration


**Customer**  
Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.  
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260  
Unit Under Calibration Details  
Measurement item : Acoustic Calibrator  
Manufacturer : SVANTEK  
Model : SV 35A  
Serial Number : 73246  
ID : UAE EFM.104/2561  
Certificate No : 24-ACT-077  
Request No : Req-2024-1138  
Range : 94, 114 dB / 1000 Hz  
Instrument Status : Used  
Class : 1


**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	EFL	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. Noppadol Luangart  
Service Calibration Engineer

**Approved By :**   
Mr. Pachi 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 Calibration Laboratory.  
เอกสารไม่ควบคุม FM-708-ACT-02 Rev.03 Issue date 8/23

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

Sound pressure level					
Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Acceptance limit ( ± dB)
	Measured	Deviated value	Measured	Deviated value	
94 dB / 1000 Hz	93.83	-0.17	-	-	0.13
114 dB / 1000 Hz	113.80	-0.20	-	-	0.13

Frequency of Sound pressure level					
Calibration Range (Hz)	Without Adjustment		Adjustment		Acceptance limit ( ± %)
	Measured (Hz)	Deviated value	Measured (Hz)	Deviated value	
94 dB / 1000 Hz	1000.00	0.00	-	-	0.01
114 dB / 1000 Hz	1000.00	0.00	-	-	0.01

Total Harmonic Distortion plus Noise of Sound pressure level (THD+N %)				
Calibration Range (Hz)	Without Adjustment		Adjustment	
	Measured (%)		Measured (%)	
94 dB / 1000 Hz	0.09		-	
114 dB / 1000 Hz	0.28		-	

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 Calibration Laboratory.  
เอกสารไม่ควบคุม FM-708-ACT-02 Rev.03 Issue date 8/23


Certificate of Calibration

**Customer**  
Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.  
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260  
Unit Under Calibration Details  
Measurement item : Sound Level Meter  
Manufacturer : Larson Davis  
Model : LX72  
Serial Number : 0005286  
ID : UAE EFM.102/2562  
Resolution : 0.1 dB  
Certificate No : 24-SLM-234  
Request No : Req-2024-1453  
Microphone Class : 2  
Microphone Model : 375H02  
Microphone S/N : 001740  
Preamplifier Model : PRMLX12H  
Preamplifier S/N : 056087  
Instrument Status : Used

**Calibration Environment and Details**  
Temperature : 23 °C ± 2 °C  
Humidity : 50 %RH ± 20 %RH  
Barometric Pressure : 1013 hPa ± 10 hPa  
Received Date : 1 July 2024  
Calibrated Date : 10 July 2024  
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests  
Location of Calibration : Lab Acoustic

Instrument	Brand	Model	SN	Due calibration	Traceability
Standard Microphone	GRAS	40AN	188273	20 August 2024	GRAS
Multifrequency Calibrator	Quest	Quest-cal	EFA000234	26 July 2024	TSI
Audio Generator	Svanvik	Svan401	131	8 October 2024	WK Electric

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

**Calibrated By :**   
Mr. Noppadol Luangart  
Service Calibration Engineer

**Approved By :**   
Mr. Pachi Mathavorn  
Calibration Engineer Supervisor

**Issue Date :** 10 July 2024

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Calibration Laboratory.  
เอกสารไม่ควบคุม FM-708-SLM-01 Rev.04 Issue date 5/24

Certificate No : 24-SLM-234  
Request No : Req-2024-1453

1. Indication at the calibration check frequency

UUC Setting	Nominal Level	Before Adjust		After Adjust		UNCERTAINTY ( ± dB)	Acceptance Limit ( ± dB)	Result
		UUC (dB)	ERR (dB)	UUC (dB)	ERR (dB)			
FAST / A / 37-139								
Calibrator Setting	(dB)	(dB)	(dB)	(dB)	(dB)			
1000 Hz 114 dB	113.76	114.4	0.64	113.8	+0.04	0.20	0.30	Pass

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

2. Self-generated noise, Microphone installed

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139		
UUC Weighting	(dB)	( ± dB)
A	31.3	0.10

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

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139		
UUC Weighting	(dB)	( ± dB)
A	31.1	0.10
C	30.6	0.10
Z	34.9	0.10

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

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY ( ± dB)	Acceptance Limit ( ± dB)	Result
	A	C	Z			
FAST / 37-139						
STD Setting	(dB)	(dB)	(dB)	( ± dB)	( ± dB)	
125 Hz	0.0	0.1	0.1	0.60	1.5	Pass
1000 Hz	0.0	0.0	0.0	0.60	1.0	Pass
4000 Hz	1.2	1.2	1.2	0.60	3.0	Pass
8000 Hz	2.7	2.8	2.9	0.70	5.0	Pass

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Calibration Laboratory.  
เอกสารไม่ควบคุม FM-708-SLM-01 Rev.04 Issue date 5/24

Certificate No : 24-SLM-234  
Request No : Req-2024-1453

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

UUC Setting		Deviation from various Frequency			UNCERTAINTY	Acceptance Limit	Result
FAST / 37-139		Weighting Response curve					
STD Setting		A (dB)	C (dB)	Z (dB)	( $\pm$ dB)	( $\pm$ dB)	
63 Hz		-0.1	0.0	0.0	0.20	2.0	Pass
125 Hz		-0.1	0.0	0.0		1.5	Pass
250 Hz		-0.1	0.0	0.0		1.5	Pass
500 Hz		0.0	0.1	0.0		1.5	Pass
1000 Hz		0.0	0.0	0.0		1.0	Pass
2000 Hz		0.0	0.1	0.0		2.0	Pass
4000 Hz		0.0	0.0	0.0		3.0	Pass
8000 Hz		0.0	0.0	0.0		5.0	Pass
16000 Hz		0.0	-0.1	-0.1		+5, -INF	Pass

6. Frequency and time weightings at 1kHz

UUC Setting	STD	Measured		UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)	Result
FAST / 37-139	REF	UUC	ERR			
UUC Weighting	(dB)	(dB)	(dB)			
A	114.00	114.0	0.0	0.20	0.20	Pass
C	114.00	114.0	0.0		0.20	Pass
Z	114.00	114.0	0.0		0.20	Pass

UUC Setting	STD	Measured		UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)	Result
37-139 / A	REF	UUC	ERR			
UUC Time Response	(dB)	(dB)	(dB)			
Fast	114.00	114.0	0.0	0.20	0.10	Pass
Slow	114.00	114.0	0.0		0.10	Pass
Log	114.00	114.0	0.0		0.10	Pass

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

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FMS-708-SLM-01 Rev.04 Issue date: 5/6/24

Certificate No : 24-SLM-234  
Request No : Req-2024-1453

7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)	Result
FAST / A / 37-139	UUC			
STD Setting	(dB)			
Initial	114.0	6.10	0.30	Pass
Final	114.0			
Deviated	0.0			

8. Level linearity on the reference level range

UUC Setting	Anticipated	Deviation		UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)	Result
FAST / A / 37-139	REF	UUC	ERR			
STD dB	(dB)	(dB)	(dB)			
139.00	139	139.0	0.0	0.30	1.1	Pass
134.00	134	134.0	0.0		1.1	Pass
129.00	129	129.0	0.0		1.1	Pass
124.00	124	124.0	0.0		1.1	Pass
119.00	119	119.0	0.0		1.1	Pass
114.00	114	114.0	0.0		1.1	Pass
109.00	109	109.0	0.0		1.1	Pass
104.00	104	104.0	0.0		1.1	Pass
99.00	99	99.0	0.0		1.1	Pass
94.00	94	94.0	0.0		1.1	Pass
89.00	89	89.0	0.0		1.1	Pass
84.00	84	84.0	0.0		1.1	Pass
79.00	79	79.0	0.0		1.1	Pass
74.00	74	74.0	0.0		1.1	Pass
69.00	69	69.0	0.0		1.1	Pass
64.00	64	64.0	0.0		1.1	Pass
59.00	59	59.0	0.0		1.1	Pass
54.00	54	54.0	0.0		1.1	Pass
49.00	49	49.1	0.1		1.1	Pass
44.00	44	44.2	0.2		1.1	Pass
43.00	43	43.3	0.3		1.1	Pass
42.00	42	42.3	0.3		1.1	Pass
41.00	41	41.4	0.4		1.1	Pass

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

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FMS-708-SLM-01 Rev.04 Issue date: 5/6/24

Certificate No : 24-SLM-234  
Request No : Req-2024-1453

9. Level linearity including the level range control

UUC Setting	STD	Measured		UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)	Result
FAST / A	REF	UUC	ERR			
UUC Range	(dB)	(dB)	(dB)			
37-139	46.30	46.4	0.1	0.30	1.1	Pass
	114	114.0	0.0		1.1	Pass

10. Tone burst response

UUC Setting	STD	Anticipated	Measured		UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)	Result
A / 37-139	Toneburst	Ref	UUC	ERR			
UUC Time Response	(ms)	(dB)	(dB)	(dB)			
Fast	200	135.0	134.9	-0.1	0.20	1.0	Pass
	2	118.0	117.6	-0.4		+1.0, -2.5	Pass
	0.25	109.0	108.6	-0.4		+1.5, -5.0	Pass
Slow	200	128.6	128.5	-0.1		1.0	Pass
	2	109.0	108.9	-0.1		+1.0, -5.0	Pass
	200	129.0	129.0	0.0		1.0	Pass
SEL	2	109.0	109.0	0.0		+1.0, -2.5	Pass
	0.25	100.0	99.8	-0.2		+1.5, -5.0	Pass

11. Peak C Sound level

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

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

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FMS-708-SLM-01 Rev.04 Issue date: 5/6/24

Certificate No : 24-SLM-234  
Request No : Req-2024-1453

12. Overload indication

UUC Setting	Measured	UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)	Result
FAST / A / 37-139	UUC			
STD Setting	(dB)			
Positive one-half cycle	145.5	0.20	1.5	Pass
Negative one-half cycle	145.4			
Deviated	0.1			

13. High Level Stability

UUC Setting	Measured	UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)	Result
FAST / A / 37-139	UUC			
STD Setting	(dB)			
Initial	138.0	0.10	0.30	Pass
Final	138.0			
Deviated	0.0			

Note :

Function	Maximum-permitted Uncertainty of measurement
1. Indication at the calibration check frequency	Not applicable
2. Self-generated noise, Microphone installed	Not applicable
3. Self-generated noise, Microphone replaced by the electrical input signal device	Not applicable
4. Acoustic signal test of frequency weightings at 10 Hz to 4 kHz	0.60 dB
4. Acoustic signal test of frequency weightings at >4 kHz to 10 kHz	0.70 dB
5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz	0.20 dB
6. Frequency and time weightings at 1kHz	0.20 dB
7. Long Term Stability	0.10 dB
8. Level linearity on the reference level range	0.30 dB
9. Level linearity including the level range control	0.30 dB
10. Tone burst response	0.30 dB
11. Peak C Sound level	0.35 dB
12. Overload indication	0.25 dB
13. High Level Stability	0.10 dB

\* Acceptance limit and Maximum-permitted Uncertainty was IEC 61872-1:2013

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

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FMS-708-SLM-01 Rev.04 Issue date: 5/6/24



Certificate No : 24-SLM-234  
Request No : Req-2024-1453

Decision Rule for Statements of Conformity

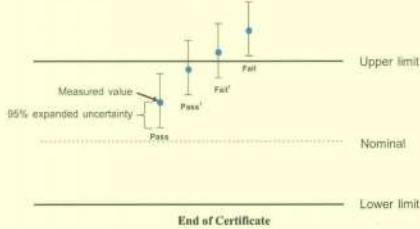
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09/2019: Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

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

Pass<sup>1</sup> = The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.

Fail<sup>1</sup> = 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

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FM-T08-SLM-01 Rev.04 Issue date 5/6/24

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.  
Address : 31 Soi Udomsak 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok  
10260

Certificate No : 24-SLM-238  
Request No : Req-2024-1457

Unit Under Calibration Details

Measurement Item : Sound Level Meter  
Microphone Class : 2  
Manufacturer : Larson Davis  
Microphone Model : 375A04  
Model : 1xT2  
Microphone S/N : 351857  
Serial Number : 0005290  
Preamplifier Model : PKML xT2B  
ID : UAE-EFM-106/2562  
Preamplifier S/N : 056077  
Resolution : 0.1 dB  
Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 2 °C  
Humidity : 50 %RH ± 20 %RH  
Barometric Pressure : 1013 hPa ± 10 hPa  
Received Date : 2 July 2024  
Calibrated Date : 11 July 2024  
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests  
Location of Calibration : Lab Acoustic

Reference Standard

Instrument	Brand	Model	S/N	Due calibration	Traceability
Standard Microphone	GRAS	40AN	183273	20 August 2024	GRAS
Multifrequency Calibrator	Quest	Quest-cal	EFA000234	26 July 2024	TSI
Audio Generator	SvanteK	Svan401	131	8 October 2024	WK Electric

Note

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

Calibrated By :

Mr. Noppadol Luangrit  
Service Calibration Engineer

Approved By :

Mr. Paitt Mathavorn  
Calibration Engineer Supervisor

Issue Date : 11 July 2024

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FM-T08-SLM-01 Rev.04 Issue date 5/6/24

Certificate No : 24-SLM-238  
Request No : Req-2024-1457

1. Indication at the calibration check frequency

UUC Setting	Nominal	Before Adjust		After Adjust		UNCERTAINTY	Acceptance	Result
FAST / A / 37-139	Level	UUC	ERR	UUC	ERR		Limit	
Calibrator Setting	(dB)	(dB)	(dB)	(dB)	(dB)	(± dB)	(± dB)	
1000 Hz 114 dB	113.76	114.1	0.34	113.8	+0.04	0.20	0.30	Pass

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

2. Self-generated noise, Microphone installed

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139		
UUC Weighting	(dB)	(± dB)
A	25.4	0.10

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

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139		
UUC Weighting	(dB)	(± dB)
A	24.8	0.10
C	24.3	0.10
Z	28.6	0.10

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

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY	Acceptance Limit	Result
	A	C	Z			
	FAST / 37-139	(dB)	(dB)	(dB)	(± dB)	
STD Setting						
125 Hz	0.1	0.2	0.2	0.60	1.5	Pass
1000 Hz	0.0	0.0	0.0	0.60	1.0	Pass
4000 Hz	0.6	0.6	0.6	0.60	3.0	Pass
8000 Hz	0.8	0.8	0.9	0.70	5.0	Pass

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FM-T08-SLM-01 Rev.04 Issue date 5/6/24

Certificate No : 24-SLM-238  
Request No : Req-2024-1457

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

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY	Acceptance	
FAST / 37-139	Weighting Response curve				Limit	Result
STD Setting	A (dB)	C (dB)	Z (dB)	(± dB)	(± dB)	
63 Hz	-0.2	-0.1	-0.1	0.20	2.0	Pass
125 Hz	-0.1	0.0	-0.1		1.5	Pass
250 Hz	-0.1	0.0	-0.1		1.5	Pass
500 Hz	-0.1	0.0	-0.1		1.5	Pass
1000 Hz	0.0	0.0	-0.1		1.0	Pass
2000 Hz	0.0	0.0	0.0		2.0	Pass
4000 Hz	0.0	0.0	0.0		3.0	Pass
8000 Hz	-0.1	-0.1	0.0		5.0	Pass
16000 Hz	-0.1	-0.1	-0.1		>5, <INF	Pass

6. Frequency and time weightings at 1kHz

UUC Setting	STD	Measured		UNCERTAINTY  ( ± dB)	Acceptance Limit ( ± dB)	Result	
FAST / 37-139		REF	UUC				ERR
UUC Weighting		(dB)	(dB)				(dB)
A	114.00	114.0	0.0	0.20	0.20	Pass	
C	114.00	114.0	0.0		0.20	Pass	
Z	114.00	114.0	0.0		0.20	Pass	

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance	
37-139 / A	REF	UUC	ERR		Limit	Result
UUC Time Response	(dB)	(dB)	(dB)	(± dB)	(± dB)	
Fast	114.00	114.0	0.0	0.20	0.10	Pass
Slow	114.00	114.0	0.0		0.10	Pass
Log	114.00	114.0	0.0		0.10	Pass

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FM-T08-SLM-01 Rev.04 Issue date 5/6/24



Certificate No : 24-SLM-238  
Request No : Req-2024-1457

7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance	Result
FAST / A / 37-139	UUC		Limit	
STD Setting	(dB)	(± dB)	(± dB)	
Initial	114.0			
Final	114.0			
Deviated	0.0	0.10	0.30	Pass

8. Level linearity on the reference level range

UUC Setting	Anticipated	Deviation	UNCERTAINTY	Acceptance	Result
FAST / A / 37-139	REF	UUC	ERR	Limit	
STD dB	(dB)	(dB)	(dB)	(± dB)	
137.00	137	137.0	0.0	1.1	Pass
134.00	134	134.0	0.0	1.1	Pass
129.00	129	129.0	0.0	1.1	Pass
124.00	124	124.0	0.0	1.1	Pass
119.00	119	119.0	0.0	1.1	Pass
114.00	114	114.0	0.0	1.1	Pass
109.00	109	109.0	0.0	1.1	Pass
104.00	104	104.0	0.0	1.1	Pass
99.00	99	99.0	0.0	1.1	Pass
94.00	94	93.9	-0.1	1.1	Pass
89.00	89	88.9	-0.1	1.1	Pass
84.00	84	83.9	-0.1	1.1	Pass
79.00	79	78.9	-0.1	1.1	Pass
74.00	74	73.9	-0.1	1.1	Pass
69.00	69	68.9	-0.1	1.1	Pass
64.00	64	63.9	-0.1	1.1	Pass
59.00	59	58.9	-0.1	1.1	Pass
54.00	54	53.9	-0.1	1.1	Pass
49.00	49	48.9	-0.1	1.1	Pass
44.00	44	44.0	0.0	1.1	Pass
39.00	39	39.1	0.1	1.1	Pass
34.00	34	34.2	0.2	1.1	Pass
29.00	29	29.2	0.2	1.1	Pass
24.00	24	24.3	0.3	1.1	Pass
19.00	19	19.4	0.4	1.1	Pass

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FM/708-SLM-01 Rev.04 Issue date 5/6/24

Certificate No : 24-SLM-238  
Request No : Req-2024-1457

9. Level linearity including the level range control

UUC Setting	STD	Measured	UNCERTAINTY	Acceptance	Result
FAST / A	REF	UUC	ERR	Limit	
UUC Range	(dB)	(dB)	(dB)	(± dB)	
37-139	40.10	40.2	0.1	1.1	Pass
	114	114.0	0.0	1.1	Pass

10. Tone burst response

UUC Setting	STD	Anticipated	Measured	UNCERTAINTY	Acceptance	Result
A / 37-139	Toneburst	Ref	UUC	ERR	Limit	
UUC Time Response	(ms)	(dB)	(dB)	(dB)	(± dB)	
Fast	200	135.0	135.0	0.0	1.0	Pass
	2	118.0	117.9	-0.1	+1.0, -2.5	Pass
	0.25	109.0	108.6	-0.4	+1.5, -5.0	Pass
Slow	200	128.6	128.5	-0.1	1.0	Pass
	2	109.0	108.9	-0.1	+1.0, -5.0	Pass
SEL	200	129.0	129.0	0.0	1.0	Pass
	2	109.0	109.0	0.0	+1.0, -2.5	Pass
	0.25	100.0	99.8	-0.2	+1.5, -5.0	Pass

11. Peak C Sound level

UUC Setting	Anticipated	Measured	UNCERTAINTY	Acceptance	Result
FAST / C / 95-142	REF	UUC	ERR	Limit	
STD Setting	(dB)	(dB)	(dB)	(± dB)	
Complete cycle	137.4	136.6	-0.80	3.0	Pass
Positive half cycle	136.4	136.2	-0.20	2.0	Pass
Negative half cycle	136.4	136.2	-0.20	2.0	Pass

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FM/708-SLM-01 Rev.04 Issue date 5/6/24

Certificate No : 24-SLM-238  
Request No : Req-2024-1457

12. Overload indication

UUC Setting	Measured	UNCERTAINTY	Acceptance	Result
FAST / A / 37-139	UUC		Limit	
STD Setting	(dB)	(± dB)	(± dB)	
Positive one-half cycle	138.8			
Negative one-half cycle	138.7			
Deviated	0.1	0.20	1.5	Pass

13. High Level Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance	Result
FAST / A / 37-139	UUC		Limit	
STD Setting	(dB)	(± dB)	(± dB)	
Initial	138.0			
Final	138.0			
Deviated	0.0	0.10	0.30	Pass

Note:

Function	Maximum-permitted Uncertainty of measurement
1. Indication at the calibration check frequency	Not applicable
2. Self-generated noise, Microphone installed	Not applicable
3. Self-generated noise, Microphone replaced by the electrical input signal device	Not applicable
4. Acoustic signal test of frequency weightings at 10 Hz to 4 kHz	0.60 dB
4. Acoustic signal test of frequency weightings at >4 kHz to 10 kHz	0.70 dB
5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz	0.20 dB
6. Frequency and time weightings at 1kHz	0.20 dB
7. Long Term Stability	0.10 dB
8. Level linearity on the reference level range	0.30 dB
9. Level linearity including the level range control	0.30 dB
10. Tone burst response	0.30 dB
11. Peak C Sound level	0.35 dB
12. Overload indication	0.25 dB
13. High Level Stability	0.10 dB

- Acceptance limit and Maximum-permitted Uncertainty was IEC 61672-1:2013

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FM/708-SLM-01 Rev.04 Issue date 5/6/24

Certificate No : 24-SLM-238  
Request No : Req-2024-1457

Decision Rule for Statements of Conformity

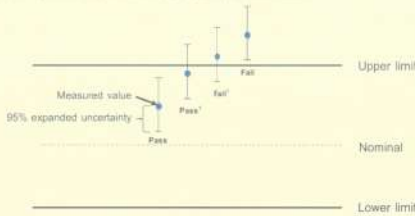
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:2010 Guidelines in the Reporting of Compliance with Specifications as following Fig. and statements

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

Pass<sup>1</sup> - The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.

Fail<sup>1</sup> - 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.



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FM/708-SLM-01 Rev.04 Issue date 5/6/24

Certificate of Calibration

Certificate No : 24-SLM-231

Request No : Req-2024-1450

Customer

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

Address : 81 Soi Udomrak 41, Sukhumvit Road, Bangchak, Prakomong, Bangkok 10260.

Unit Under Calibration Details

Measurement Item : Sound Level Meter

Manufacturer : Larson Davis

Model : LxT2

Serial Number : 0005293

ID : UAE-EFM.106/262

Resolution : 0.1 dB

Microphone Class : 2

Microphone Model : 375B02

Microphone S/N : 11792

Preamplifier Model : PRMLx12B

Preamplifier S/N : 056073

Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 2 °C

Humidity : 50 %RH ± 20 %RH

Barometric Pressure : 1013 hPa ± 10 hPa

Received Date : 1 July 2024

Calibrated Date : 10 July 2024

Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests


Location of Calibration : Lab Acoustic

Reference Standard


Instrument	Brand	Model	SN.	Due calibration	Traceability
Standard Microphone	GRAS	40AN	188273	20 August 2024	GRAS
Multifrequency Calibrator	Quest	Quest-cal	EFA000234	26 July 2024	TSI
Audio Generator	Svaniek	Svan401	131	8 October 2024	WK Electric

Note

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

Calibrated By : 

Mr. Noppadol Laungan  
Service Calibration Engineer

Approved By : 

Mr. Pachi Mathavorn  
Calibration Engineer Supervisor

Issue Date : 10 July 2024

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FSM-708-SLM-01 Rev.04 Issue date 5/6/24

Certificate No : 24-SLM-231

Request No : Req-2024-1450

1. Indication at the calibration check frequency

UUC Setting	Nominal	Before Adjust	After Adjust	UNCERTAINTY	Acceptance	Result
FAST / A / 37-139	Level	UUC	ERR	UUC	ERR	
Calibrator Setting	(dB)	(dB)	(dB)	(dB)	(dB)	
1000 Hz 114 dB	113.76	114.3	0.54	113.8	+0.04	0.20 0.30 Pass

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

2. Self-generated noise, Microphone installed

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139	(dB)	(± dB)
UUC Weighting	(dB)	(± dB)
A	29.8	0.10

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

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139	(dB)	(± dB)
UUC Weighting	(dB)	(± dB)
A	29.4	0.10
C	28.8	0.10
Z	32.9	0.10

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




UUC Setting	Deviation from various Frequency	UNCERTAINTY	Acceptance	Result
FAST / 37-139	Weighting Response curve		Limit	
STD Setting	A (dB) C (dB) Z (dB)	(± dB)	(± dB)	
125 Hz	0.0 0.1 0.1	0.60	1.5	Pass
1000 Hz	0.0 0.0 0.0	0.60	1.0	Pass
4000 Hz	0.7 0.7 0.7	0.60	3.0	Pass
8000 Hz	1.4 1.4 1.5	0.70	5.0	Pass

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FSM-708-SLM-01 Rev.04 Issue date 5/6/24

INNOVATIVE INSTRUMENT CALIBRATION LAB  
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE  
7/19 MOO 13, SOI SUTINTAKORN 11 TAMBON BANG KAO,  
AMPHOE BANG PHU SAHUT PRAKAN PROVINCE 10540 THAILAN  
TEL : 0669-2116-5809-1 FAX: 0669-2116-7140



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Certificate No : 24-SLM-231

Request No : Req-2024-1450

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

UUC Setting	Deviation from various Frequency	UNCERTAINTY	Acceptance	Result
FAST / 37-139	Weighting Response curve		Limit	
STD Setting	A (dB) C (dB) Z (dB)	(± dB)	(± dB)	
63 Hz	-0.2 -0.1 -0.1	0.20	2.0	Pass
125 Hz	-0.1 0.0 -0.1		1.5	Pass
250 Hz	-0.1 0.0 -0.1		1.5	Pass
500 Hz	-0.1 0.0 -0.1		1.5	Pass
1000 Hz	0.0 0.0 -0.1		1.0	Pass
2000 Hz	0.0 0.0 0.0		2.0	Pass
4000 Hz	0.0 0.0 0.0		3.0	Pass
8000 Hz	-0.1 -0.1 0.0		5.0	Pass
16000 Hz	-0.1 -0.1 -0.1		+5, -INF	Pass

6. Frequency and time weightings at 1kHz

UUC Setting	STD	Measured	UNCERTAINTY	Acceptance	Result
FAST / 37-139	REF	UUC	ERR	Limit	
UUC Weighting	(dB)	(dB)	(dB)	(± dB)	
A	114.00	114.0	0.0	0.20	Pass
C	114.00	114.0	0.0	0.20	Pass
Z	114.00	114.0	0.0	0.20	Pass




UUC Setting	STD	Measured	UNCERTAINTY	Acceptance	Result
37-139 / A	REF	UUC	ERR	Limit	
UUC Time Response	(dB)	(dB)	(dB)	(± dB)	
Fast	114.00	114.0	0.0	0.10	Pass
Slow	114.00	114.0	0.0	0.10	Pass
Leq	114.00	114.0	0.0	0.10	Pass

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FSM-708-SLM-01 Rev.04 Issue date 5/6/24

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Certificate No : 24-SLM-231

Request No : Req-2024-1450

7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance	Result
FAST / A / 37-139	UUC		Limit	
STD Setting	(dB)	(± dB)	(± dB)	
Initial	114.0			
Final	114.0			
Deviated	0.0	0.10	0.30	Pass

8. Level linearity on the reference level range

UUC Setting	Anticipated	Deviation	UNCERTAINTY	Acceptance	Result
FAST / A / 37-139	REF	UUC	ERR	Limit	
STD dB	(dB)	(dB)	(dB)	(± dB)	
139.00	139	139.0	0.0	1.1	Pass
134.00	134	134.0	0.0	1.1	Pass
129.00	129	129.0	0.0	1.1	Pass
124.00	124	124.0	0.0	1.1	Pass
119.00	119	119.0	0.0	1.1	Pass
114.00	114	114.0	0.0	1.1	Pass
109.00	109	109.0	0.0	1.1	Pass
104.00	104	104.0	0.0	1.1	Pass
99.00	99	98.9	-0.1	1.1	Pass
94.00	94	93.9	-0.1	1.1	Pass
89.00	89	88.9	-0.1	1.1	Pass
84.00	84	83.9	-0.1	1.1	Pass
79.00	79	78.9	-0.1	1.1	Pass
74.00	74	73.9	-0.1	1.1	Pass
69.00	69	68.9	-0.1	1.1	Pass
64.00	64	63.9	-0.1	1.1	Pass
59.00	59	58.9	-0.1	1.1	Pass
54.00	54	53.9	-0.1	1.1	Pass
49.00	49	48.8	0.0	1.1	Pass
44.00	44	44.1	0.1	1.1	Pass
39.00	39	39.5	0.5	1.1	Pass

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FSM-708-SLM-01 Rev.04 Issue date 5/6/24



Certificate No : 24-SLM-231  
Request No : Req-2024-1450

9. Level linearity including the level range control

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance	Result
	REF	UUC	ERR		Limit	
UUC Range	(dB)	(dB)	(dB)	(± dB)	(± dB)	
37-139	44.80	44.9	0.1	0.30	1.1	Pass
	114	114.0	0.0		1.1	Pass

10. Tone burst response

UUC Setting	STD	Anticipated	Measured		UNCERTAINTY	Acceptance	Result
	Toneburst	Ref	UUC	ERR		Limit	
UUC Time Response	(ms)		(dB)	(dB)	(± dB)	(± dB)	
Fast	200	135.0	135.0	0.0	0.20	1.0	Pass
	2	118.0	117.9	-0.1		+1.0, -2.5	Pass
	0.25	109.0	108.6	-0.4		+1.5, -5.0	Pass
Slow	200	128.6	128.5	-0.1		1.0	Pass
	2	109.0	108.9	-0.1		+1.0, -5.0	Pass
	0.25	109.0	109.1	+0.1		+1.0, -2.5	Pass
SEL	200	129.0	129.0	0.0	0.20	1.0	Pass
	2	109.0	109.1	+0.1		+1.0, -2.5	Pass
	0.25	100.0	99.8	-0.2		+1.5, -5.0	Pass

11. Peak C Sound level

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

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ISM-708-SLM-01 Rev.04 Issue date:5/6/24

Certificate No : 24-SLM-231  
Request No : Req-2024-1450

12. Overload indication

UUC Setting	Measured	UNCERTAINTY	Acceptance	Result
FAST / A / 37-139	UUC		Limit	
STD Setting	(dB)	(± dB)	(± dB)	
Positive one-half cycle	143.7			
Negative one-half cycle	143.8			
Deviated	-0.1	0.20	1.5	Pass

13. High Level Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance	Result
FAST / A / 37-139	UUC		Limit	
STD Setting	(dB)	(± dB)	(± dB)	
Initial	138.0			
Final	138.0			
Deviated	0.0	0.10	0.30	Pass

Note :

Function	Maximum-permitted Uncertainty of measurement
1. Indication at the calibration check frequency	Not applicable
2. Self-generated noise, Microphone installed	Not applicable
3. Self-generated noise, Microphone replaced by the electrical input signal device	Not applicable
4. Acoustic signal test of frequency weightings at 10 Hz to 4 kHz	0.60 dB
4. Acoustic signal test of frequency weightings at >4 kHz to 10 kHz	0.70 dB
5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz	0.20 dB
6. Frequency and time weightings at 1kHz	0.20 dB
7. Long Term Stability	0.10 dB
8. Level linearity on the reference level range	0.30 dB
9. Level linearity including the level range control	0.30 dB
10. Tone burst response	0.30 dB
11. Peak C' Sound level	0.35 dB
12. Overload indication	0.25 dB
13. High Level Stability	0.10 dB

- Acceptance limit and Maximum-permitted Uncertainty was IEC 61672-1:2013

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ISM-708-SLM-01 Rev.04 Issue date:5/6/24

Certificate No : 24-SLM-231  
Request No : Req-2024-1450

Decision Rule for Statements of Conformity

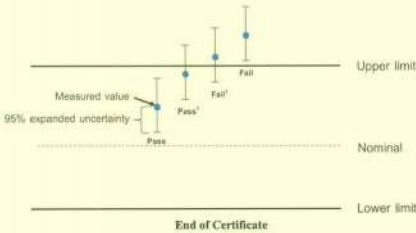
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-QR-09:2019, Guidelines on the Reporting of Compliance with Specification as following Fig. and statements:

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

Pass<sup>1</sup> = The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.

Fail<sup>1</sup> = 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.



The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of **เอกสารไม่ควบคุม**  
ISM-708-SLM-01 Rev.04 Issue date:5/6/24

Certificate of Calibration

Customer		Certificate No : 24-SLM-240			
Name	UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.	Request No : Req-2024-1459			
Address	81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260				
Unit Under Calibration Details					
Measurement item :	Sound Level Meter	Microphone Class :	2		
Manufacturer	Larson Davis	Microphone Model :	375A04		
Model	1xT2	Microphone S/N :	323471		
Serial Number	0805299	Preamplifier Model :	PRMLxT2C		
ID	IAEJFM.1142562	Preamplifier S/N :	071493		
Resolution	0.1 dB	Instrument Status :	Used		
Calibration Environment and Details					
Temperature :	23 °C ± 2 °C				
Humidity	50 %RH ± 20 %RH				
Barometric Pressure	1013 hPa ± 10 hPa				
Received Date	2 July 2024				
Calibrated Date	11 July 2024				
Calibration Procedure	In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests				
Location of Calibration	Lab Acoustic				
Reference Standard					
Instrument	Brand	Model	S/N	Due calibration	Traceability
Standard Microphone	GRAS	40AN	188273	29 August 2024	GRAS
Multi-frequency Calibrator	Quest	Quest-cal	EFA000234	26 July 2024	TST
Audio Generator	SvanteK	Svan401	131	8 October 2024	WK Electric

Note

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

Calibrated By :   
Mr. Noppadol Luangrit  
Service Calibration Engineer

Approved By :   
Mr. Pacit Mathavorn  
Calibration Engineer Supervisor  
Issue Date : 11 July 2024

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ISM-708-SLM-01 Rev.04 Issue date:5/6/24

Certificate No : 24-SLM-240  
Request No : Req-2024-1459

1. Indication at the calibration check frequency

UUC Setting	Nominal	Before Adjust		After Adjust		UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
FAST / A / 37-139 Calibrator Setting (dB)	Level	UUC (dB)	ERR (dB)	UUC (dB)	ERR (dB)			
1000 Hz 114 dB	113.76	115.3	1.54	113.8	-0.04	0.20	0.30	Pass

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

2. Self-generated noise, Microphone installed

UUC Setting	Measured (dB)	UNCERTAINTY (± dB)
FAST / 37-139		
Calibrator Setting		
A	27.1	0.10

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

UUC Setting	Measured (dB)	UNCERTAINTY (± dB)
FAST / 37-139		
Calibrator Setting		
A	26.6	0.10
C	26.2	0.10
Z	30.6	0.10

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

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
	A (dB)	C (dB)	Z (dB)			
FAST / 37-139						
STD Setting	(dB)	(dB)	(dB)			
125 Hz	0.0	0.2	0.1	0.60	1.5	Pass
1000 Hz	0.0	0.0	0.0	0.60	1.0	Pass
4000 Hz	0.2	0.3	0.4	0.60	3.0	Pass
8000 Hz	-0.5	-0.4	-0.2	0.70	5.0	Pass

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PM-208-SLM-01 Rev.04 Issue date 3/6/24

Certificate No : 24-SLM-240  
Request No : Req-2024-1459

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

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
FAST / 37-139	A (dB)	C (dB)	Z (dB)			
STD Setting						
63 Hz	-0.2	0.0	0.0	0.20	2.0	Pass
125 Hz	-0.1	0.0	0.0		1.5	Pass
250 Hz	-0.1	0.0	0.0		1.5	Pass
500 Hz	-0.1	0.0	0.0		1.5	Pass
1000 Hz	0.0	0.0	0.0		1.0	Pass
2000 Hz	0.0	0.0	0.0		2.0	Pass
4000 Hz	0.0	0.0	0.0		3.0	Pass
8000 Hz	0.0	0.0	0.0		5.0	Pass
16000 Hz	-0.1	-0.1	-0.1		+5. -INF	Pass

6. Frequency and time weightings at 1kHz

UUC Setting	STD	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
FAST / 37-139	REF	UUC (dB)	ERR (dB)			
UUC Weighting						
A	114.00	114.0	0.0	0.20	0.20	Pass
C	114.00	114.0	0.0		0.20	Pass
Z	114.00	114.0	0.0		0.20	Pass

UUC Setting	STD	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
37-139 / A	REF	UUC (dB)	ERR (dB)			
UUC Time Response						
Fast	114.00	114.0	0.0	0.20	0.10	Pass
Slow	114.00	114.0	0.0		0.10	Pass
Eq	114.00	114.0	0.0		0.10	Pass

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PM-208-SLM-01 Rev.04 Issue date 3/6/24

Certificate No : 24-SLM-240  
Request No : Req-2024-1459

7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
FAST / A / 37-139	UUC (dB)			
STD Setting				
Initial	114.0			
Final	114.0			
Deviated	0.0			
		0.10	0.30	Pass

8. Level linearity on the reference level range

UUC Setting	Anticipated	Deviation		UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
FAST / A / 37-139	REF	UUC (dB)	ERR (dB)			
STD dB	(dB)	(dB)	(dB)			
139.00	139	139.0	0.0	0.30	1.1	Pass
134.00	134	134.0	0.0		1.1	Pass
129.00	129	129.0	0.0		1.1	Pass
124.00	124	124.0	0.0		1.1	Pass
119.00	119	119.0	0.0		1.1	Pass
114.00	114	114.0	0.0		1.1	Pass
109.00	109	109.0	0.0		1.1	Pass
104.00	104	104.0	0.0		1.1	Pass
99.00	99	99.0	0.0		1.1	Pass
94.00	94	94.0	0.0		1.1	Pass
89.00	89	89.0	0.0	0.30	1.1	Pass
84.00	84	84.0	0.0		1.1	Pass
79.00	79	79.0	0.0		1.1	Pass
74.00	74	74.0	0.0		1.1	Pass
69.00	69	69.0	0.0		1.1	Pass
64.00	64	64.0	0.0		1.1	Pass
59.00	59	59.0	0.0		1.1	Pass
54.00	54	54.0	0.0		1.1	Pass
49.00	49	49.0	0.0		1.1	Pass
44.00	44	44.0	0.0		1.1	Pass
39.00	39	39.2	0.2		1.1	Pass
34.00	34	34.3	0.3		1.1	Pass
29.00	29	29.4	0.4		1.1	Pass
24.00	24	24.7	0.7		1.1	Pass

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PM-208-SLM-01 Rev.04 Issue date 3/6/24

Certificate No : 24-SLM-240  
Request No : Req-2024-1459

9. Level linearity including the level range control

UUC Setting	STD	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
FAST / A	REF	UUC (dB)	ERR (dB)			
UUC Range						
37-139	41.90	42.1	0.2	0.30	1.1	Pass
	114	114.0	0.0		1.1	Pass

10. Tone burst response

UUC Setting	STD	Anticipated	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
A / 37-139	Toneburst	Ref	UUC (dB)	ERR (dB)			
UUC Time Response	(ms)						
Fast	200	135.0	134.9	-0.1	0.20	1.0	Pass
	2	138.0	137.9	-0.1		+1.0, -2.5	Pass
	0.25	109.0	108.8	-0.2		+1.5, -5.0	Pass
	200	128.6	128.5	-0.1		1.0	Pass
Slow	2	109.0	108.9	-0.1		+1.0, -5.0	Pass
	200	129.0	129.0	0.0		1.0	Pass
SEL	2	109.0	109.1	+0.1		+1.0, -2.5	Pass
	0.25	100.0	100.0	0.0		+1.5, -5.0	Pass

11. Peak C Sound level

UUC Setting	Anticipated	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
FAST / C / 95-142	REF	UUC (dB)	ERR (dB)			
STD Setting	(dB)					
Complete cycle	137.4	136.6	-0.80	0.20	3.0	Pass
Positive half cycle	136.4	136.2	-0.20		2.0	Pass
Negative half cycle	136.4	136.2	-0.20		2.0	Pass

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PM-208-SLM-01 Rev.04 Issue date 3/6/24



Certificate No : 24-SLM-240  
Request No : Req-2024-1459

12. Overload indication

UUC Setting	Measured	UNCERTAINTY ( ± dB)	Acceptance	Result
FAST / A / 37-139	UUC		Limit	
STD Setting	(dB)		( ± dB)	
Positive one-half cycle	140.6			
Negative one-half cycle	140.7			
Deviated	-0.1	0.20	1.5	Pass

13. High Level Stability

UUC Setting	Measured	UNCERTAINTY ( ± dB)	Acceptance	Result
FAST / A / 37-139	UUC		Limit	
STD Setting	(dB)		( ± dB)	
Initial	138.0			
Final	138.0			
Deviated	0.0	0.10	0.30	Pass

Note :

Function	Maximum-permitted Uncertainty of measurement
1. Indication at the calibration check frequency	Not applicable
2. Self-generated noise, Microphone installed	Not applicable
3. Self-generated noise, Microphone replaced by the electrical input signal device	Not applicable
4. Acoustic signal test of frequency weightings at 10 Hz to 4 kHz	0.60 dB
4. Acoustic signal test of frequency weightings at >4 kHz to 10 kHz	0.70 dB
5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz	0.20 dB
6. Frequency and time weightings at 1kHz	0.20 dB
7. Long Term Stability	0.10 dB
8. Level linearity on the reference level range	0.30 dB
9. Level linearity including the level range control	0.30 dB
10. Tone burst response	0.30 dB
11. Peak C Sound level	0.35 dB
12. Overload indication	0.25 dB
13. High Level Stability	0.10 dB

~ Acceptance limit and Maximum permitted Uncertainty was IEC 61072-1:2013

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FM-708-SLM-01 Rev.04 Issue date 5/6/24

Certificate No : 24-SLM-240  
Request No : Req-2024-1459

Decision Rule for Statements of Conformity

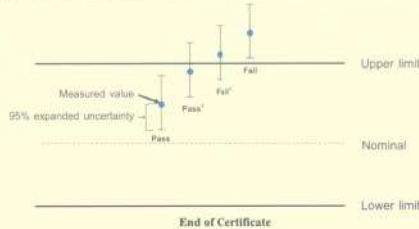
The standard decision rule employed for the statements of conformity in each calibration result will be applied using ILAC-G8:2019. Guidance on the Reporting of Compliance with Specification as following Fig. and statements

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

Pass<sup>1</sup> ~ The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.

Fail<sup>1</sup> ~ 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.



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FM-708-SLM-01 Rev.04 Issue date 5/6/24

Certificate of Calibration

Customer

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

Certificate No : 24-SLM-229  
Request No : Req-2024-1448

Unit Under Calibration Details

Measurement item : Sound Level Meter  
Manufacturer : Larson Davis  
Model : LAT2  
Serial Number : 0005372  
ID : UAE-EFM-0372563  
Resolution : 0.1 dB  
Microphone Class : 2  
Microphone Model : J75B02  
Microphone S/N : 11792  
Preamplifier Model : PRMLXT2B  
Preamplifier S/N : 056132  
Instrument Status : Used

Calibration Environment and Details


Temperature : 23 °C ± 1 °C  
Humidity : 50 %RH ± 20 %RH  
Barometric Pressure : 1013 hPa ± 10 hPa  
Received Date : 1 July 2024  
Calibrated Date : 9 July 2024  
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests  
Location of Calibration : Lab Acoustic

Reference Standard

Instrument	Brand	Model	SN	Due calibration	Traceability
Standard Microphone	GRAS	40AN	188273	20 August 2024	GRAS
Multifrequency Calibrator	Quest	Quest-cal	EFA000234	26 July 2024	TSI
Audio Generator	Scantek	Scan401	131	8 October 2024	WK Electric

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

Calibrated By :   
Mr. Noppadon Luangrit  
Service Calibration Engineer

Approved By :   
Mr. Puch Mathavorn  
Calibration Engineer Supervisor  
Issue Date : 9 July 2024

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FM-708-SLM-01 Rev.04 Issue date 5/6/24

Certificate No : 24-SLM-229  
Request No : Req-2024-1448

1. Indication at the calibration check frequency

UUC Setting	Nominal Level (dB)	Before Adjust			After Adjust		UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
		UUC	ERR	ERR	UUC	ERR			
Calibrator Setting	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)			
1000 Hz 114 dB	113.76	114.7	0.94		113.8	+0.04	0.20	0.30	Pass

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SYANTEX, Model SV 35A, SN. 59079

2. Self-generated noise, Microphone installed

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139		(± dB)
UUC Weighting	(dB)	(± dB)
A	32.0	0.10

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

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139		(± dB)
UUC Weighting	(dB)	(± dB)
A	31.8	0.10
C	31.7	0.10
Z	35.0	0.10

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

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
	A	C	Z			
FAST / 37-139	(dB)	(dB)	(dB)	(± dB)	(± dB)	
STD Setting	(dB)	(dB)	(dB)			
125 Hz	0.1	0.2	0.1	0.60	1.5	Pass
1000 Hz	0.0	0.0	0.0	0.60	1.0	Pass
4000 Hz	0.3	0.3	0.4	0.60	3.0	Pass
8000 Hz	0.3	0.3	0.5	0.70	5.0	Pass

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FM-708-SLM-01 Rev.04 Issue date 5/6/24

Certificate No : 24-SLM-229  
Request No : Req-2024-1448

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

UUC Setting	Deviation from various Frequency			UNCERTAINTY	Acceptance	Result
FAST / 37-139	Weighting Response curve					
STD Setting	A (dB)	C (dB)	Z (dB)	(± dB)		
63 Hz	-0.1	0.0	0.0	0.20	2.0	Pass
125 Hz	-0.1	0.0	0.0		1.5	Pass
250 Hz	-0.1	0.0	0.0		1.5	Pass
500 Hz	0.0	0.0	0.0		1.5	Pass
1000 Hz	0.0	0.0	0.0		1.0	Pass
2000 Hz	0.0	0.1	0.0		2.0	Pass
4000 Hz	0.0	0.0	0.0		3.0	Pass
8000 Hz	0.0	0.0	0.1		5.0	Pass
16000 Hz	0.0	0.0	0.0		+5, -INF	Pass

6. Frequency and time weightings at 1kHz

UUC Setting	STD	Measured		UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)	Result
FAST / 37-139	REF	UUC	ERR			
UUC Weighting	(dB)	(dB)	(dB)	0.20	0.20	Pass
A	114.00	114.0	0.0			
C	114.00	114.0	0.0			
Z	114.00	114.0	0.0			

UUC Setting	STD	Measured		UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)	Result
37-139 / A	REF	UUC	ERR			
UUC Time Response	(dB)	(dB)	(dB)	0.20	0.10	Pass
Fast	114.00	114.0	0.0			
Slow	114.00	114.0	0.0			
Loq	114.00	114.0	0.0			

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F54-708-SLM-01 Rev.04 Issue date 5/6/24

Certificate No : 24-SLM-229  
Request No : Req-2024-1448

7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)	Result
FAST / A / 37-139	UUC			
STD Setting	(dB)	0.10	0.30	Pass
Initial	114.0			
Final	114.0			
Deviated	0.0			

8. Level linearity on the reference level range

UUC Setting	Anticipated	Deviation		UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)	Result
FAST / A / 37-139	REF	UUC	ERR			
STD dB	(dB)	(dB)	(dB)	0.30	1.1	Pass
139.00	139	139.0	0.0			
134.00	134	134.0	0.0			
129.00	129	129.0	0.0			
124.00	124	124.0	0.0			
119.00	119	119.0	0.0			
114.00	114	114.0	0.0			
109.00	109	109.0	0.0			
104.00	104	104.0	0.0			
99.00	99	99.0	0.0			
94.00	94	93.6	-0.4			
89.00	89	88.6	-0.4			
84.00	84	83.6	-0.4			
79.00	79	78.6	-0.4			
74.00	74	73.6	-0.4			
69.00	69	68.6	-0.4			
64.00	64	63.6	-0.4			
59.00	59	58.6	-0.4			
54.00	54	53.6	-0.4			
49.00	49	48.7	-0.3			
44.00	44	43.9	-0.1			
39.00	39	39.3	0.3			
34.00	34	34.9	0.9			

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

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F54-708-SLM-01 Rev.04 Issue date 5/6/24

Certificate No : 24-SLM-229  
Request No : Req-2024-1448

9. Level linearity including the level range control

UUC Setting	STD	Measured		UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)	Result
FAST / A	REF	UUC	ERR			
UUC Range	(dB)	(dB)	(dB)	0.30	1.1	Pass
37-139	39.10	39.6	0.5			
	134	134.0	0.0			

10. Tone burst response

UUC Setting	STD	Anticipated	Measured		UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)	Result
A / 37-139	Toneburst	Ref	UUC	ERR			
UUC Time Response	(ms)	(dB)	(dB)	(dB)	0.20	1.0	Pass
Fast	200	135.0	135.0	0.0			
	2	118.0	117.9	-0.1			
	0.25	109.0	108.8	-0.2			
Slow	200	128.6	128.5	-0.1			
	2	109.0	108.9	-0.1			
	200	129.0	129.0	0.0			
SEL	2	109.0	109.1	+0.1			
	0.25	100.0	100.0	0.0			

11. Peak C Sound level

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

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F54-708-SLM-01 Rev.04 Issue date 5/6/24

Certificate No : 24-SLM-229  
Request No : Req-2024-1448

12. Overload indication

UUC Setting	Measured	UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)	Result
FAST / A / 37-139	UUC			
STD Setting	(dB)	0.20	1.5	Pass
Positive one-half cycle	140.7			
Negative one-half cycle	140.7			
Deviated	0.0			

13. High Level Stability

UUC Setting	Measured	UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)	Result
FAST / A / 37-139	UUC			
STD Setting	(dB)	0.10	0.30	Pass
Initial	138.0			
Final	138.0			
Deviated	0.0			

Note :

Function	Maximum-permitted Uncertainty of measurement
1. Indication at the calibration check frequency	Not applicable
2. Self-generated noise, Microphone installed	Not applicable
3. Self-generated noise, Microphone replaced by the electrical input signal device	Not applicable
4. Acoustic signal test of frequency weightings at 10 Hz to 4 kHz	0.60 dB
4. Acoustic signal test of frequency weightings at >4 kHz to 10 kHz	0.70 dB
5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz	0.20 dB
6. Frequency and time weightings at 1kHz	0.20 dB
7. Long Term Stability	0.10 dB
8. Level linearity on the reference level range	0.30 dB
9. Level linearity including the level range control	0.30 dB
10. Tone burst response	0.30 dB
11. Peak C Sound level	0.35 dB
12. Overload indication	0.25 dB
13. High Level Stability	0.10 dB

- Acceptance limit and Maximum-permitted Uncertainty was IEC 61672-1:2013

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

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F54-708-SLM-01 Rev.04 Issue date 5/6/24

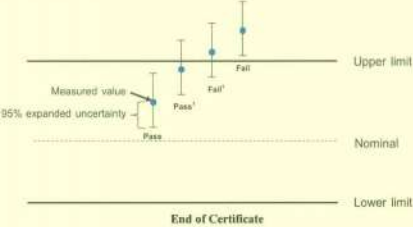


Certificate No : 24-SLM-229  
Request No : Req-2024-1448

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.  
Fail<sup>1</sup> = The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.  
Fail<sup>2</sup> = 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.



Certificate of Calibration

Customer  
Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.LTD.  
Address : 81 Soi Udomaui 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260  
Certificate No : 24-SLM-232  
Request No : Req-2024-1451

Unit Under Calibration Details  
Measurement item : Sound Level Meter  
Microphone Class : 2  
Manufacturer : Larson Davis  
Microphone Model : 375902  
Model : LX72  
Microphone S/N : 11793  
Serial Number : 0005341  
Preamplifier Model : P9MLX12B  
ID : UAE-EFM 038/2563  
Preamplifier S/N : 056133  
Resolution : 0.1 dB  
Instrument Status : Used

Calibration Environment and Details  
Temperature : 23 °C ± 1 °C  
Humidity : 50 %RH ± 20 %RH  
Barometric Pressure : 1013 hPa ± 10 hPa  
Received Date : 1 July 2024  
Calibrated Date : 10 July 2024  
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests  
Location of Calibration : Lab Acoustic

Instrument	Brand	Model	SN	Due calibration	Traceability
Standard Microphone	GRAS	40AN	188273	29 August 2024	GRAS
Multifrequency Calibrator	Quest	Quest-cal	EFA000234	26 July 2024	TSI
Audio Generator	SvanteK	Svan401	131	8 October 2024	WK Electric

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

Calibrated By :   
Mr. Noppon Luangrat  
Service Calibration Engineer  
Approved By :   
Mr. Pachi Mathavorn  
Calibration Engineer Supervisor  
Issue Date : 10 July 2024

Certificate No : 24-SLM-232  
Request No : Req-2024-1451

1. Indication at the calibration check frequency

UUC Setting	Nominal	Before Adjust		After Adjust		UNCERTAINTY	Acceptance Limit	Result
	Level	UUC	ERR	UUC	ERR			
Calibrator Setting	(dB)	(dB)	(dB)	(dB)	(dB)	(± dB)	(± dB)	
1000 Hz 114 dB	113.76	114.3	0.54	113.8	+0.04	0.20	0.30	Pass

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTER, Model SV 35A, SN. 58979

2. Self-generated noise, Microphone installed

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139		
	(dB)	(± dB)
A	29.7	0.10

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

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139		
	(dB)	(± dB)
A	29.4	0.10
C	29.0	0.10
Z	33.0	0.10

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

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
	A	C	Z			
FAST / 37-139	(dB)	(dB)	(dB)			
STD Setting	(dB)	(dB)	(dB)			
125 Hz	0.0	0.1	0.1	0.60	1.5	Pass
1000 Hz	0.0	0.0	0.0	0.60	1.0	Pass
4000 Hz	0.6	0.5	0.6	0.60	3.0	Pass
8000 Hz	1.0	0.9	1.0	0.70	5.0	Pass

Certificate No : 24-SLM-232  
Request No : Req-2024-1451

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

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
FAST / 37-139	A (dB)	C (dB)	Z (dB)			
STD Setting	(dB)	(dB)	(dB)			
63 Hz	-0.2	-0.1	-0.1	0.20	2.0	Pass
125 Hz	-0.1	0.0	-0.1		1.5	Pass
250 Hz	-0.1	0.0	-0.1		1.5	Pass
500 Hz	-0.1	0.0	-0.1		1.5	Pass
1000 Hz	0.0	0.0	-0.1		1.0	Pass
2000 Hz	0.0	0.0	0.0		2.0	Pass
4000 Hz	0.0	0.0	0.0		3.0	Pass
8000 Hz	-0.1	-0.1	0.0		5.0	Pass
16000 Hz	-0.1	-0.1	-0.1		+5, -INF	Pass

6. Frequency and time weightings at 1kHz

UUC Setting	STD	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
FAST / 37-139	REF	UUC	ERR			
	(dB)	(dB)	(dB)			
A	114.00	114.0	0.0	0.20	0.20	Pass
C	114.00	114.0	0.0		0.20	Pass
Z	114.00	114.0	0.0		0.20	Pass

UUC Setting	STD	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
37-139 / A	REF	UUC	ERR			
	(dB)	(dB)	(dB)			
UUC Time Response	(dB)	(dB)	(dB)			
Fast	114.00	114.0	0.0	0.20	0.10	Pass
Slow	114.00	114.0	0.0		0.10	Pass
Leq	114.00	114.0	0.0		0.10	Pass

Certificate No : 24-SLM-232  
Request No : Req-2024-1451

7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY ( ± dB)	Acceptance Limit ( ± dB)	Result
FAST / A / 37-139	UUC			
STD Setting	(dB)			
Initial	114.0	0.10	0.30	Pass
Final	114.0			
Deviated	0.0			

8. Level linearity on the reference level range

UUC Setting	Anticipated	Deviation		UNCERTAINTY ( ± dB)	Acceptance Limit ( ± dB)	Result
FAST / A / 37-139	REF	UUC	ERR			
STD dB	(dB)	(dB)	(dB)	0.30	1.1	Pass
139.00	139	139.0	0.0			
134.00	134	134.0	0.0			
129.00	129	129.0	0.0			
124.00	124	124.0	0.0			
119.00	119	119.0	0.0			
114.00	114	114.0	0.0			
109.00	109	109.0	0.0			
104.00	104	104.0	0.0			
99.00	99	99.0	0.0			
94.00	94	94.0	0.0			
89.00	89	89.0	0.0			
84.00	84	84.0	0.0			
79.00	79	79.0	0.0			
74.00	74	74.0	0.0			
69.00	69	69.0	0.0			
64.00	64	64.0	0.0			
59.00	59	59.0	0.0			
54.00	54	54.0	0.0			
49.00	49	49.1	0.1			
44.00	44	44.2	0.2			
39.00	39	39.3	0.3			

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FSM-709-SLM-01 Rev.04 Issue date 5/6/24

Certificate No : 24-SLM-232  
Request No : Req-2024-1451

12. Overload indication

UUC Setting	Measured	UNCERTAINTY ( ± dB)	Acceptance Limit ( ± dB)	Result
FAST / A / 37-139	UUC			
STD Setting	(dB)			
Positive one-half cycle	143.2	0.20	1.5	Pass
Negative one-half cycle	143.3			
Deviated	-0.1			

13. High Level Stability

UUC Setting	Measured	UNCERTAINTY ( ± dB)	Acceptance Limit ( ± dB)	Result
FAST / A / 37-139	UUC			
STD Setting	(dB)			
Initial	138.0	0.10	0.30	Pass
Final	138.0			
Deviated	0.0			

Note :

Function	Maximum-permitted Uncertainty of measurement
1. Indication at the calibration check frequency	Not applicable
2. Self-generated noise, Microphone installed	Not applicable
3. Self-generated noise, Microphone replaced by the electrical input signal device	Not applicable
4. Acoustic signal test of frequency weightings at 10 Hz to 4 kHz	0.60 dB
4. Acoustic signal test of frequency weightings at >4 kHz to 10 kHz	0.70 dB
5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz	0.20 dB
6. Frequency and time weightings at 1kHz	0.20 dB
7. Long Term Stability	0.10 dB
8. Level linearity on the reference level range	0.30 dB
9. Level linearity including the level range control	0.30 dB
10. Tone burst response	0.30 dB
11. Peak C Sound level	0.35 dB
12. Overload indication	0.25 dB
13. High Level Stability	0.10 dB

~ Acceptance limit and Maximum-permitted Uncertainty was IEC 61672-1:2013

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FSM-709-SLM-01 Rev.04 Issue date 5/6/24

Certificate No : 24-SLM-232  
Request No : Req-2024-1451

9. Level linearity including the level range control

UUC Setting	STD	Measured		UNCERTAINTY ( ± dB)	Acceptance Limit ( ± dB)	Result
FAST / A	REF	UUC	ERR			
UUC Range	(dB)	(dB)	(dB)			
37-139	44.20	44.3	0.1	0.30	1.1	Pass
	114	114.0	0.0			

10. Tone burst response

UUC Setting	STD	Anticipated	Measured		UNCERTAINTY ( ± dB)	Acceptance Limit ( ± dB)	Result
A / 37-139	Toneburst	Ref	UUC	ERR			
UUC Time Response	(ms)		(dB)	(dB)	0.20	1.0	Pass
Fast	200	135.0	135.0	0.0			
	2	118.0	117.8	-0.2			
	0.25	109.0	108.5	-0.5			
Slow	200	128.6	128.4	-0.2			
	2	109.0	108.8	-0.2			
	200	129.0	129.0	0.0			
SEL	2	109.0	109.0	0.0			
	0.25	100.0	99.7	-0.3			

11. Peak C Sound level

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

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FSM-709-SLM-01 Rev.04 Issue date 5/6/24

Certificate No : 24-SLM-232  
Request No : Req-2024-1451

Decision Rule for Statements of Conformity

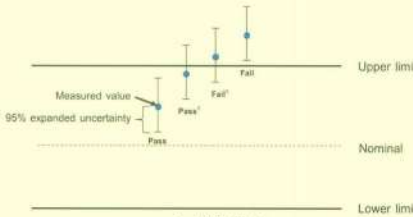
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09/2019, Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

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

Pass<sup>1</sup> ~ The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.

Fail<sup>1</sup> ~ 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.



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FSM-709-SLM-01 Rev.04 Issue date 5/6/24



Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.LTD.

Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260

Certificate No : 24-SLM-235

Request No : Req-2024-1454

Unit Under Calibration Details

Measurement item : Sound Level Meter

Manufacturer : Larson Davis

Model : LxT2

Serial Number : 0005346

ID : UAE-EFM.0432563

Resolution : 0.1 dB

Microphone Class : 2

Microphone Model : 375B02

Microphone S/N : 11798

Preamplifier Model : PRMLxT2B

Preamplifier S/N : 056138

Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 2 °C

Humidity : 50 %RH ± 20 %RH

Barometric Pressure : 1013 hPa ± 10 hPa

Received Date : 1 July 2024

Calibrated Date : 10 July 2024


Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests

Location of Calibration : Lab Acoustic

Instrument	Brand	Model	SN	Due calibration	Traceability
Standard Microphone	GRAS	40AN	188273	29 August 2024	GRAS
Multifrequency Calibrator	Quest	Quest-cal	EFA000234	26 July 2024	TSI
Audio Generator	SvanteK	Svan401	131	8 October 2024	WK Electric

Note

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

Calibrated By : 

Mr. Nopadon Luangrit

Service Calibration Engineer

Approved By : 

Mr. Paci Mathavorn

Calibration Engineer Supervisor

Issue Date : 10 July 2024

### 1. Indication at the calibration check frequency

UUC Setting FAST / A 37-139	Nominal	Before Adjust		After Adjust		UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
	Level	UUC (dB)	ERR (dB)	UUC (dB)	ERR (dB)			
1000 Hz 114 dB	113.76	115.3	1.54	113.8	+0.04	0.20	0.30	Pass

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

### 2. Self-generated noise, Microphone installed

UUC Setting FAST / 37-139	Measured	UNCERTAINTY
UUC Weighting	(dB)	(± dB)
A	31.4	0.10

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

UUC Setting FAST / 37-139	Measured	UNCERTAINTY
UUC Weighting	(dB)	(± dB)
A	31.1	0.10
C	30.5	0.10
Z	35.0	0.10

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

UUC Setting FAST / 37-139	Deviation from various Frequency Weighting Response curve			UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
	A (dB)	C (dB)	Z (dB)			
STD Setting	(dB)	(dB)	(dB)	(± dB)	(± dB)	
125 Hz	0.0	0.1	0.1	0.60	1.5	Pass
1000 Hz	0.0	0.0	0.0	0.60	1.0	Pass
4000 Hz	1.1	1.1	1.1	0.60	3.0	Pass
8000 Hz	2.6	2.5	2.6	0.70	5.0	Pass

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

UUC Setting FAST / 37-139	Deviation from various Frequency Weighting Response curve			UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
	A (dB)	C (dB)	Z (dB)			
STD Setting	(dB)	(dB)	(dB)	(± dB)	(± dB)	
63 Hz	-0.1	0.0	0.1	0.20	2.0	Pass
125 Hz	-0.1	0.0	0.0		1.5	Pass
250 Hz	-0.1	0.0	0.0		1.5	Pass
500 Hz	0.0	0.1	0.0		1.5	Pass
1000 Hz	0.0	0.0	0.0		1.0	Pass
2000 Hz	0.0	0.1	0.0		2.0	Pass
4000 Hz	0.0	-0.1	0.0		3.0	Pass
8000 Hz	-0.1	-0.1	0.0		5.0	Pass
16000 Hz	-0.1	-0.1	-0.1		+5, -INF	Pass

### 6. Frequency and time weightings at 1kHz

UUC Setting FAST / 37-139	STD	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
	REF	UUC	ERR			
UUC Weighting	(dB)	(dB)	(dB)	(± dB)	(± dB)	
A	114.00	114.0	0.0	0.20	0.20	Pass
C	114.00	114.0	0.0		0.20	Pass
Z	114.00	114.0	0.0		0.20	Pass

UUC Setting 37-139 / A	STD	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
	REF	UUC	ERR			
UUC Time Response	(dB)	(dB)	(dB)	(± dB)	(± dB)	
Fast	114.00	114.0	0.0	0.20	0.10	Pass
Slow	114.00	114.0	0.0		0.10	Pass
Leq	114.00	114.0	0.0		0.10	Pass

### 7. Long Term Stability

UUC Setting FAST / A 37-139	Measured	UNCERTAINTY	Acceptance Limit	Result
STD Setting	UUC (dB)	(± dB)	(± dB)	
Initial	114.0			
Final	114.0			
Deviated	0.0			
		0.10	0.30	Pass

### 8. Level linearity on the reference level range

UUC Setting FAST / A 37-139	Anticipated	Deviation		UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
STD dB	REF (dB)	UUC (dB)	ERR (dB)			
139.00	139	139.0	0.0	0.30	1.1	Pass
134.00	134	134.0	0.0		1.1	Pass
129.00	129	129.0	0.0		1.1	Pass
124.00	124	124.0	0.0		1.1	Pass
119.00	119	119.0	0.0		1.1	Pass
114.00	114	114.0	0.0		1.1	Pass
109.00	109	109.0	0.0		1.1	Pass
104.00	104	104.0	0.0		1.1	Pass
99.00	99	99.0	0.0		1.1	Pass
94.00	94	94.0	0.0		1.1	Pass
89.00	89	89.0	0.0		1.1	Pass
84.00	84	84.0	0.0		1.1	Pass
79.00	79	79.0	0.0		1.1	Pass
74.00	74	74.0	0.0		1.1	Pass
69.00	69	69.0	0.0		1.1	Pass
64.00	64	64.0	0.0		1.1	Pass
59.00	59	59.0	0.0		1.1	Pass
54.00	54	54.0	0.0		1.1	Pass
49.00	49	49.1	0.1		1.1	Pass
44.00	44	44.2	0.2		1.1	Pass
41.00	41	41.3	0.3		1.1	Pass
42.00	42	42.3	0.3		1.1	Pass
41.00	41	41.4	0.4		1.1	Pass

Certificate No : 24-SLM-235  
Request No : Req-2024-1454

9. Level linearity including the level range control

UUC Setting	STD	Measured		UNCERTAINTY ( ± dB)	Acceptance	Result
FAST / A	REF	UUC (dB)	ERR (dB)		Limit ( ± dB)	
UUC Range	(dB)	(dB)	(dB)	( ± dB)	( ± dB)	
37-139	46.40	46.5	0.1	0.30	1.1	Pass
	114	114.0	0.0		1.1	Pass

10. Tone burst response

UUC Setting	STD	Anticipated Ref	Measured		UNCERTAINTY  ( ± dB)	Acceptance	Result
	Toneburst		UUC	ERR		Limit	
A / 37-139	(ms)	(dB)	(dB)	(dB)		( ± dB)	
UUC Time Response							
Fast	200	135.0	134.9	-0.1	0.20	1.0	Pass
	2	118.0	117.6	-0.4		+1.0, -2.5	Pass
	0.25	109.0	108.5	-0.5		+1.5, -5.0	Pass
Slow	200	128.6	128.4	-0.2		1.0	Pass
	2	109.0	108.8	-0.2		+1.0, -5.0	Pass
	200	129.0	129.0	0.0		1.0	Pass
SEL	2	109.0	108.8	-0.2		+1.0, -2.5	Pass
	0.25	100.0	99.7	-0.3		+1.5, -5.0	Pass

11. Peak C Sound level

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

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

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FM-709-SLM-01 Rev.04 Issue date 5/6/24

Certificate No : 24-SLM-235  
Request No : Req-2024-1454

12. Overload indication

UUC Setting	Measured	UNCERTAINTY	Acceptance Limit	Result
FAST / A / 37-139	UUC	( $\pm$ dB)	( $\pm$ dB)	
STD Setting	(dB)	( $\pm$ dB)	( $\pm$ dB)	
Positive one-half cycle	145.4			
Negative one-half cycle	145.3			
Deviated	0.1	0.20	1.5	Pass

13. High Level Stability

UUC Setting	Measured	UNCERTAINTY  ( ± dB)	Acceptance	Result
FAST / A / 37-139	UUC		Limit	
STD Setting	(dB)		( ± dB)	
Initial	138.0			
Final	138.0			
Deviated	0.0	0.10	0.30	Pass

Note :

Function	Maximum-permitted Uncertainty of measurement
1. Indication at the calibration check frequency	Not applicable
2. Self-generated noise, Microphone installed	Not applicable
3. Self-generated noise, Microphone replaced by the electrical input signal device	Not applicable
4. Acoustic signal test of frequency weightings at 10 Hz to 4 kHz	0.60 dB
4. Acoustic signal test of frequency weightings at >4 kHz to 10 kHz	0.70 dB
5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz	0.20 dB
6. Frequency and time weightings at 1kHz	0.20 dB
7. Long Term Stability	0.10 dB
8. Level linearity on the reference level range	0.30 dB
9. Level linearity including the level range control	0.30 dB
10. Tone burst response	0.30 dB
11. Peak C Sound level	0.35 dB
12. Overload indication	0.25 dB
13. High Level Stability	0.10 dB

\* Acceptance limit and Maximum-permitted Uncertainty was IEC 61672-1:2013

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FM-709-SLM-01 Rev.04 Issue date 5/6/24

Certificate No : 24-SLM-235  
Request No : Req-2024-1454

Decision Rule for Statements of Conformity

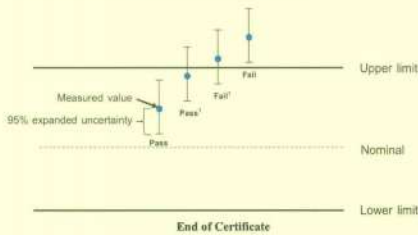
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-QR09:2019: Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

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

Pass<sup>1</sup> - The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.

Fail<sup>1</sup> - 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

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FM-709-SLM-01 Rev.04 Issue date 5/6/24

Certificate of Calibration

Customer

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

Certificate No : 24-SLM-237  
Request No : Req-2024-1456

Unit Under Calibration Details

Measurement item : Sound Level Meter  
Manufacturer : Larson Davis  
Model : LX72  
Serial Number : 0005393  
ID : UAE-EFM.0302564  
Resolution : 0.1 dB  
Microphone Class : 2  
Microphone Model : 375A04  
Microphone S/N : 329354  
Preamplifier Model : PRMLX72C  
Preamplifier S/N : 073808  
Instrument Status : Used

Calibration Environment and Details

Temperature : 23.7°C  $\pm$  1.7°C  
Humidity : 50 %RH  $\pm$  20 %RH  
Barometric Pressure : 1013 hPa  $\pm$  10 hPa  
Received Date : 1 July 2024  
Calibrated Date : 10 July 2024  
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-1:2013 Electroacoustics - Sound level meters - Part 3: Periodic tests  
Location of Calibration : Lab Acoustic

Reference Standard

Instrument	Brand	Model	SN	Due calibration	Traceability
Standard Microphone	GRAS	40AN	188273	20 August 2024	GRAS
Multifrequency Calibrator	Quest	Quest-cal	EFA000234	26 July 2024	TSI
Audio Generator	Svanteck	Svan401	131	8 October 2024	WK Electric

Note

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

Calibrated By :   
Mr. Noppadon Luangnam  
Service Calibration Engineer

Approved By :   
Mr. Panch Mahavorn  
Calibration Engineer Supervisor  
Issue Date : 10 July 2024

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

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FM-709-SLM-01 Rev.04 Issue date 5/6/24

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FM-709-SLM-01 Rev.04 Issue date 5/6/24



1. Indication at the calibration check frequency

UUC Setting	Nominal	Before Adjust		After Adjust		UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
	Level	UUC	ERR	UUC	ERR			
Calibrator Setting	(dB)	(dB)	(dB)	(dB)	(dB)			
1000 Hz 114 dB	113.76	114.3	0.54	113.8	+0.04	0.20	0.30	Pass

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

2. Self-generated noise, Microphone installed

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139		(± dB)
UUC Weighting	(dB)	(± dB)
A	28.7	0.10

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

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139		(± dB)
UUC Weighting	(dB)	(± dB)
A	28.4	0.10
C	28.4	0.10
Z	32.9	0.10

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

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
	A	C	Z			
FAST / 37-139	(dB)	(dB)	(dB)			
STD Setting	(dB)	(dB)	(dB)			
125 Hz	0.0	0.1	0.1	0.60	1.5	Pass
1000 Hz	0.0	0.0	0.0	0.60	1.0	Pass
4000 Hz	0.6	0.6	0.6	0.60	3.0	Pass
8000 Hz	0.3	0.3	0.4	0.70	5.0	Pass

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FSM-709-SLM-01 Rev.04 Issue date 5/6/24

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

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
FAST / 37-139	A (dB)	C (dB)	Z (dB)			
STD Setting	(dB)	(dB)	(dB)			
63 Hz	-0.1	0.0	0.0	0.20	2.0	Pass
125 Hz	-0.1	0.0	0.0		1.5	Pass
250 Hz	-0.1	0.0	0.0		1.5	Pass
500 Hz	0.0	0.0	0.0		1.5	Pass
1000 Hz	0.0	0.0	0.0		1.0	Pass
2000 Hz	0.0	0.1	0.0		2.0	Pass
4000 Hz	0.0	0.0	0.0		3.0	Pass
8000 Hz	0.0	0.0	0.0		5.0	Pass
16000 Hz	-0.1	-0.1	-0.1		+5, -INF.	Pass

6. Frequency and time weightings at 1kHz

UUC Setting	STD	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
FAST / 37-139	REF	UUC	ERR			
UUC Weighting	(dB)	(dB)	(dB)			
A	114.00	114.0	0.0	0.20	0.20	Pass
C	114.00	114.0	0.0		0.20	Pass
Z	114.00	114.0	0.0		0.20	Pass

UUC Setting	STD	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
37-139 / A	REF	UUC	ERR			
UUC Time Response	(dB)	(dB)	(dB)			
Fast	114.00	114.0	0.0	0.20	0.10	Pass
Slow	114.00	114.0	0.0		0.10	Pass
Log	114.00	114.0	0.0		0.10	Pass

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7. Long Term Stability

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

8. Level linearity on the reference level range

UUC Setting	Anticipated	Deviation		UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
FAST / A / 37-139	REF	UUC	ERR			
STD dB	(dB)	(dB)	(dB)			
139.00	139	139.0	0.0	0.30	1.1	Pass
134.00	134	134.0	0.0		1.1	Pass
129.00	129	129.0	0.0		1.1	Pass
124.00	124	124.0	0.0		1.1	Pass
119.00	119	119.0	0.0		1.1	Pass
114.00	114	114.0	0.0		1.1	Pass
109.00	109	109.0	0.0		1.1	Pass
104.00	104	104.0	0.0		1.1	Pass
99.00	99	99.0	0.0		1.1	Pass
94.00	94	94.0	0.0		1.1	Pass
89.00	89	89.0	0.0		1.1	Pass
84.00	84	84.0	0.0		1.1	Pass
79.00	79	79.0	0.0		1.1	Pass
74.00	74	74.0	0.0		1.1	Pass
69.00	69	69.0	0.0		1.1	Pass
64.00	64	64.0	0.0		1.1	Pass
59.00	59	59.0	0.0		1.1	Pass
54.00	54	54.0	0.0		1.1	Pass
49.00	49	49.0	0.0		1.1	Pass
44.00	44	44.1	0.1		1.1	Pass
39.00	39	39.4	0.4		1.1	Pass
34.00	34	34.5	0.5		1.1	Pass

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9. Level linearity including the level range control

UUC Setting	STD	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
FAST / A	REF	UUC	ERR			
UUC Range	(dB)	(dB)	(dB)			
37-139	43.80	43.9	0.1	0.30	1.1	Pass
	114	114.0	0.0		1.1	Pass

10. Tone burst response

UUC Setting	STD	Anticipated	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
A / 37-139	Toneburst	Ref	UUC	ERR			
UUC Time Response	(ms)	(dB)	(dB)	(dB)			
Fast	200	135.0	134.9	-0.1	0.20	1.0	Pass
	2	118.0	117.9	-0.1		+1.0, -2.5	Pass
	0.25	109.0	108.7	-0.3		+1.5, -5.0	Pass
	200	128.6	128.4	-0.2		1.0	Pass
Slow	2	109.0	108.8	-0.2		+1.0, -5.0	Pass
	200	129.0	129.0	0.0		1.0	Pass
	2	109.0	109.1	+0.1		+1.0, -2.5	Pass
	0.25	100.0	99.9	-0.1		+1.5, -5.0	Pass

11. Peak C Sound level

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

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12. Overload indication

UUC Setting	Measured	UNCERTAINTY	Acceptance Limit	Result
FAST / A / 37-139	UUC	( ± dB)	( ± dB)	
STD Setting	(dB)			
Positive one-half cycle	142.6			
Negative one-half cycle	142.6			
Deviated	0.0	0.20	1.5	Pass

13. High Level Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance Limit	Result
FAST / A / 37-139	UUC	( ± dB)	( ± dB)	
STD Setting	(dB)			
Initial	138.0			
Final	138.0			
Deviated	0.0	0.10	0.30	Pass

Note :

Function	Maximum-permitted Uncertainty of measurement
1. Indication at the calibration check frequency	Not applicable
2. Self-generated noise, Microphone installed	Not applicable
3. Self-generated noise, Microphone replaced by the electrical input signal device	Not applicable
4. Acoustic signal test of frequency weightings at 10 Hz to 4 kHz	0.60 dB
4. Acoustic signal test of frequency weightings at >4 kHz to 10 kHz	0.70 dB
5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz	0.20 dB
6. Frequency and time weightings at 1kHz	0.20 dB
7. Long Term Stability	0.10 dB
8. Level linearity on the reference level range	0.30 dB
9. Level linearity including the level range control	0.30 dB
10. Tone burst response	0.30 dB
11. Peak C Sound level	0.35 dB
12. Overload indication	0.25 dB
13. High Level Stability	0.10 dB

- Acceptance limit and Maximum-permitted Uncertainty was IEC 61672-1:2013

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Decision Rule for Statements of Conformity

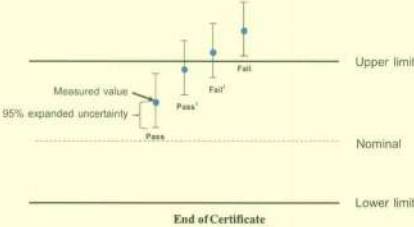
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09/2019: Guidelines on the Reporting of Compliance with Specification as following Fig. and statements:

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

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

Fail' - 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.



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ISS-709-SLM-01 Rev.04 Issue date 5/6/24

### 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	CADMIUM CHROMIUM HEXAVALENT COPPER IRON LEAD MANGANESE NICKEL ZINC	Agilent Technologies	AA240FS / MY13160001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	24 Jan 24	23 Jan 25
2	Atomic Absorption Spectrometer	ARSENIC SELENIUM	Perkin Elmer	PinAAcle 900F / PFB20031902	Perkin Elmer Co.,Ltd.	WO-02787590	14 May 24	13 May 25
3	Analytical Balance	FAT OIL AND GREASE	Mettler Toledo	AB204-S/FACT / 1129361010	Technology Promotion Association (Thailand-Japan)	24MM292	11 May 24	10 May 25
4	Analytical Balance	TOTAL DISSOLVED SOLIDS	Mettler Toledo	XSR205DU / C210685394	National Food Institute,Ministry of Industry, Thailand	2402283-002-01	2 Apr 24	1 Apr 25
5	Analytical Balance	TOTAL SUSPENDED SOLIDS	Mettler Toledo	XSR205DU / C009071872	National Food Institute,Ministry of Industry, Thailand	2402283-001-01	2 Apr 24	1 Apr 25
6	DO Meter	BIOCHEMICAL OXYGEN DEMAND	YSI	5100 / 11B 101863	Technology Promotion Association (Thailand-Japan)	24TW39	21 Feb 24	20 Feb 25
7	Mercury Analyzer	MERCURY	NIC. Japan	RA-4500 / 17780278	Coax Group Corporation Ltd.	Preventive Maintenance Report	9 Jul 24	8 Jul 25
8	Hot Air Oven	TOTAL SUSPENDED SOLIDS	Memmert	UF55 / B212.0411	Technology Promotion Association (Thailand-Japan)	24TM589	1 Apr 24	31 Mar 25
9	Cooled Incubator	TOTAL COLIFORM BACTERIA	Binder	KB400 / WTB20200000015535	Technology Promotion Association (Thailand-Japan)	24TM647	1 Apr 24	31 Mar 25
10	Inductively Coupled Plasma- Optical Emission Spectrometer(ICP-OES)	BARIUM SODIUM ADSORPTION RATIO TITANIUM	Agilent Technologies, USA	5110 VDV(G8015AA) / MY8030001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	13 Nov 23	12 Nov 24

### 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*
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2	Atomic Absorption Spectrometer	ARSENIC SELENIUM	Perkin Elmer	PinAAcle 900F / PFB20031902	Perkin Elmer Co.,Ltd.	WO-02787590	14 May 24	13 May 25
3	Analytical Balance	FAT OIL AND GREASE	Mettler Toledo	AB204-S/FACT / 1129361010	Technology Promotion Association (Thailand-Japan)	24MM292	11 May 24	10 May 25
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5	Analytical Balance	TOTAL SUSPENDED SOLIDS	Mettler Toledo	XSR205DU / C009071872	National Food Institute,Ministry of Industry, Thailand	2402283-001-01	2 Apr 24	1 Apr 25
6	DO Meter	BIOCHEMICAL OXYGEN DEMAND	YSI	5100 / 11B 101863	Technology Promotion Association (Thailand-Japan)	24TW39	21 Feb 24	20 Feb 25
7	Mercury Analyzer	MERCURY	NIC. Japan	RA-4500 / 17780278	Coax Group Corporation Ltd.	Preventive Maintenance Report	9 Jul 24	8 Jul 25
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10	Inductively Coupled Plasma- Optical Emission Spectrometer(ICP-OES)	BARIUM SODIUM ADSORPTION RATIO TITANIUM	Agilent Technologies, USA	5110 VDV(G8015AA) / MY8030001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	13 Nov 23	12 Nov 24

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	SCT Meter	CONDUCTIVITY (umhos/cm) SALINITY	YSI Environmental	Pro 30 / 17B101802	Technology Promotion Association (Thailand-Japan)	24CH823	11 Jul 24	9 Jul 25
12	UV-VIS Spectrophotometer	NITRATE NITROGEN SULPHATE	Hitachi	U-2900 / 21E22-009	DQE Services Co.,Ltd.	SP24-001	4 Jan 24	3 Jan 25
13	Turbidity Meter (Portable)	TURBIDITY (NTU)	Oakton Instruments(China)	T100IR / 1120501017	Technology Promotion Association (Thailand-Japan)	23CH1148	15 Sep 23	13 Sep 24

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*
1	Atomic Absorption Spectrometer	CADMIUM COPPER IRON LEAD MANGANESE NICKEL ZINC	Agilent Technologies	AA240FS / MY13160001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	24 Jan 24	23 Jan 25
2	Atomic Absorption Spectrometer	ARSENIC SELENIUM	Perkin Elmer	PinAAde 900F / PFB20031902	Perkin Elmer Co.,Ltd.	WO-02787590	14 May 24	13 May 25
3	Analytical Balance	FAT OIL AND GREASE	Mettler Toledo	AB204-S/FACT / 1129361010	Technology Promotion Association (Thailand-Japan)	24MM292	11 May 24	10 May 25
4	Analytical Balance	TOTAL DISSOLVED SOLIDS	Mettler Toledo	XSR205DU / C210685394	National Food Institute,Ministry of Industry, Thailand	2402283-002-01	2 Apr 24	1 Apr 25
5	Analytical Balance	TOTAL SUSPENDED SOLIDS	Mettler Toledo	XSR205DU / C009071872	National Food Institute,Ministry of Industry, Thailand	2402283-001-01	2 Apr 24	1 Apr 25
6	DO Meter	BIOCHEMICAL OXYGEN DEMAND	YSI	5100 / 11B 101863	Technology Promotion Association (Thailand-Japan)	24TW39	21 Feb 24	20 Feb 25
7	Mercury Analyzer	MERCURY	NIC. Japan	RA-4500 / 17780278	Coax Group Corporation Ltd.	Preventive Maintenance Report	9 Jul 24	8 Jul 25
8	Hot Air Oven	TOTAL SUSPENDED SOLIDS	Memmert	UF55 / B212,0411	Technology Promotion Association (Thailand-Japan)	24TM589	1 Apr 24	31 Mar 25
9	Inductively Coupled Plasma- Optical Emission Spectrometer(ICP-OES)	BARIUM SODIUM ADSORPTION RATIO TITANIUM	Agilent Technologies, USA	5110 VDV(G8015AA) / MY8030001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	13 Nov 23	12 Nov 24
10	pH Meter	pH	Horiba	LAQUA-PH210 / HA0D0082	technology promotion association (thailand-japan)	24CH727	19 Jun 24	17 Jun 25

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	SCT Meter	CONDUCTIVITY (umhos/cm) SALINITY	YSI Environmental	Pro 30 / 17B101802	Technology Promotion Association (Thailand-Japan)	24CH823	11 Jul 24	9 Jul 25
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13	Turbidity Meter (Portable)	TURBIDITY (NTU)	Oakton Instruments(China)	T100IR / 1120501017	Technology Promotion Association (Thailand-Japan)	23CH1148	15 Sep 23	13 Sep 24

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

List of Instrument Certificates for Environmental Quality Analysis

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

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7	Mercury Analyzer	MERCURY	NIC. Japan	RA-4500 / 17780278	Coax Group Corporation Ltd.	Preventive Maintenance Report	9 Jul 24	8 Jul 25
8	Hot Air Oven	TOTAL SUSPENDED SOLIDS	Memmert	UF55 / B212,0411	Technology Promotion Association (Thailand-Japan)	24TM589	1 Apr 24	31 Mar 25
9	Inductively Coupled Plasma- Optical Emission Spectrometer(ICP-OES)	BARIUM SODIUM ADSORPTION RATIO TITANIUM	Agilent Technologies, USA	5110 VDV(G8015AA) / MY8030001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	13 Nov 23	12 Nov 24
10	pH Meter	pH	Horiba	LAQUA-PH210 / HA0D0082	technology promotion association (thailand-japan	24CH727	19 Jun 24	17 Jun 25

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	SCT Meter	CONDUCTIVITY (umhos/cm) SALINITY	YSI Environmental	Pro 30 / 17B101802	Technology Promotion Association (Thailand-Japan)	24CH823	11 Jul 24	9 Jul 25
12	UV-VIS Spectrophotometer	NITRATE NITROGEN SULPHATE	Hitachi	U-2900 / 21E22-009	DQE Services Co.,Ltd.	SP24-001	4 Jan 24	3 Jan 25
13	Turbidity Meter (Portable)	TURBIDITY (NTU)	Oakton Instruments(China)	T100IR / 1120501017	Technology Promotion Association (Thailand-Japan)	23CH1148	15 Sep 23	13 Sep 24

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*
1	Atomic Absorption Spectrometer	CADMIUM COPPER LEAD MANGANESE NICKEL TOTAL IRON ZINC	Agilent Technologies	AA240FS / MY13160001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	24 Jan 24	23 Jan 25
2	Atomic Absorption Spectrometer	ARSENIC MERCURY SELENIUM	Perkin Elmer	PinAAde 900F / PFB20031902	Perkin Elmer Co.,Ltd.	WO-02787590	14 May 24	13 May 25
3	Analytical Balance	FAT OIL AND GREASE	Mettler Toledo	AB204-S/FACT / 1129361010	Technology Promotion Association (Thailand-Japan)	24MM292	11 May 24	10 May 25
4	Analytical Balance	TOTAL DISSOLVED SOLIDS	Mettler Toledo	XSR205DU / C210685394	National Food Institute,Ministry of Industry, Thailand	2402283-002-01	2 Apr 24	1 Apr 25
5	Analytical Balance	TOTAL SUSPENDED SOLIDS	Mettler Toledo	XSR205DU / C009071872	National Food Institute,Ministry of Industry, Thailand	2402283-001-01	2 Apr 24	1 Apr 25
6	DO Meter	BIOCHEMICAL OXYGEN DEMAND	YSI	5100 / 11B 101863	Technology Promotion Association (Thailand-Japan)	24TW39	21 Feb 24	20 Feb 25
7	Hot Air Oven	TOTAL SUSPENDED SOLIDS	Memmert	UF55 / B212.0411	Technology Promotion Association (Thailand-Japan)	24TM589	1 Apr 24	31 Mar 25
8	Incubator	TOTAL COLIFORM BACTERIA	Binder	KB400 / 20220000000391	Technology Promotion Association (Thailand-Japan)	24TM884	7 Jun 24	6 Jun 25
9	Inductively Coupled Plasma- Optical Emission Spectrometer(ICP-OES)	BARIIUM SODIUM SODIUM ADSORPTION RATIO TITANIUM	Agilent Technologies, USA	5110 VDV(G8015AA) / MY8030001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	13 Nov 23	12 Nov 24

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*
10	pH Meter	pH	Horiba	LAQUA-PH210 / HA0A0005	technology promotion association (thailand-japan)	24CH39	10 Jan 24	8 Jan 25
11	SCT Meter	CONDUCTIVITY (umhos/cm)	YSI Environmental	Pro 30 / 17B101801	Technology Promotion Association (Thailand-Japan)	24CH718	19 Jun 24	17 Jun 25
12	UV-VIS Spectrophotometer	NITRATE NITROGEN SULPHATE	Hitachi	U-2900 / 21E22-009	DQE Services Co.,Ltd.	SP24-001	4 Jan 24	3 Jan 25
13	Turbidity Meter (Portable)	TURBIDITY (NTU)	Oakton Instruments(China)	T100IR / 1120501017	Technology Promotion Association (Thailand-Japan)	24CH1115	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*
1	Atomic Absorption Spectrometer	CADMIUM COPPER LEAD MANGANESE MERCURY NICKEL TOTAL IRON ZINC	Agilent Technologies	AA240FS / MY13160001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	24 Jan 24	23 Jan 25
2	Atomic Absorption Spectrometer	ARSENIC SELENIUM	Perkin Elmer	PinAAcle 900F / PFB20031902	Perkin Elmer Co.,Ltd.	WO-02787590	14 May 24	13 May 25
3	Analytical Balance	FAT OIL AND GREASE	Mettler Toledo	AB204-S/FACT / 1129361010	Technology Promotion Association (Thailand-Japan)	24MM292	11 May 24	10 May 25
4	Analytical Balance	TOTAL DISSOLVED SOLIDS	Mettler Toledo	XSR205DU / C210685394	National Food Institute,Ministry of Industry, Thailand	2402283-002-01	2 Apr 24	1 Apr 25
5	BOD Incubator	BIOCHEMICAL OXYGEN DEMAND	ARCO	UR-1320 / -	Technology Promotion Association (Thailand-Japan)	24TM587	1 Apr 24	31 Mar 25
6	DO Meter	DO	Horiba	LAQUA-DO210 / HE9M0021	Technology Promotion Association (Thailand-Japan)	24TW128	19 Jun 24	17 Jun 25
7	DO Meter	BIOCHEMICAL OXYGEN DEMAND	YSI	5100 / 11B 101863	Technology Promotion Association (Thailand-Japan)	24TW39	21 Feb 24	20 Feb 25
8	SCT Meter	SALINITY	Horiba	LAQUA-EC210 / HC9L0012	Technology Promotion Association (Thailand-Japan)	24CH321	12 Mar 24	10 Mar 25
9	Hot Air Oven	TOTAL DISSOLVED SOLIDS	Memmert	UF55 / B212,0411	Technology Promotion Association (Thailand-Japan)	24TM589	1 Apr 24	31 Mar 25
10	Incubator	TOTAL COLIFORM BACTERIA	Binder	KB400 / 20220000000391	Technology Promotion Association (Thailand-Japan)	24TM884	7 Jun 24	6 Jun 25

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	Inductively Coupled Plasma- Optical Emission Spectrometer(ICP-OES)	BARIUM SODIUM SODIUM ADSORPTION RATIO TITANIUM	Agilent Technologies, USA	5110 VDV(G8015AA) / MY8030001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	13 Nov 23	12 Nov 24
12	pH Meter	pH	Horiba	LAQUA-PH210 / HA9M0047	technology promotion association (thailand-japan)	24CH400	3 Apr 24	1 Apr 25
13	UV-VIS Spectrophotometer	NITRATE NITROGEN SULPHATE	Hitachi	U-2900 / 21E22-009	DQE Services Co.,Ltd.	SP24-001	4 Jan 24	3 Jan 25
14	Turbidity Meter (Portable)	TURBIDITY (NTU)	Oakton Instruments(China)	T100IR / 1120501017	Technology Promotion Association (Thailand-Japan)	24CH1115	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*
1	Atomic Absorption Spectrometer	CADMIUM CHROMIUM TRIVALENT COPPER LEAD MANGANESE MERCURY NICKEL TOTAL IRON ZINC	Agilent Technologies	AA240FS / MY13160001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	24 Jan 24	23 Jan 25
2	Atomic Absorption Spectrometer	ARSENIC SELENIUM	Perkin Elmer	PinAAcle 900F / PFB20031902	Perkin Elmer Co.,Ltd.	WO-02787590	14 May 24	13 May 25
3	Analytical Balance	FAT OIL AND GREASE	Mettler Toledo	AB204-S/FACT / 1129361010	Technology Promotion Association (Thailand-Japan)	24MM292	11 May 24	10 May 25
4	Analytical Balance	TOTAL DISSOLVED SOLIDS TOTAL SUSPENDED SOLIDS	Mettler Toledo	XSR205DU / C009071872	National Food Institute,Ministry of Industry, Thailand	2402283-001-01	2 Apr 24	1 Apr 25
5	Continuous Flow Analyzer(CFA)	CYANIDE	Skalar Analytical B.V., the Netherlands	San++5000-02 / 182688	DKSH (Thailand) Ltd.	Service Report/Test Report WO-00018067	20 Feb 24	19 Feb 25
6	DO METER	DO	Horiba	LAQUA-DO210 / HE0L0004	Technology Promotion Association (Thailand-Japan)	23TW263	14 Dec 23	10 Dec 24
7	DO Meter	BIOCHEMICAL OXYGEN DEMAND	YSI	5100 / 11B 101863	Technology Promotion Association (Thailand-Japan)	24TW39	21 Feb 24	20 Feb 25
8	Digestion Units	TOTAL KJELDAHL NITROGEN	Foss Tecator	2520 Auto / 91794469	National Food Institute Ministry of Industry, Thailand	2402957-001-02	23 May 24	22 May 25

**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*
9	Gas Chromatography	a-BHC ALDRIN b-BHC d-BHC DIELDRIN ENDOSULFAN I ENDOSULFAN II ENDOSULFAN SULFATE ENDRIN ENDRIN ALDEHYDE g-BHC HEPTACHLOR HEPTACHLOR EPOXIDE pp-DDD pp-DDE pp-DDT	Agilent	GC 7890A / CN11021007	Agilent Technologies (Thailand) Co.,Ltd.	Certificate of System Qualification GC-OQ	21 Feb 24	19 Feb 25
10	Hot Air Oven	TOTAL DISSOLVED SOLIDS	Memmert	UF55 / B212,0411	Technology Promotion Association (Thailand-Japan)	24TM589	1 Apr 24	31 Mar 25
11	Cooled Incubator	TOTAL COLIFORM BACTERIA	Binder	KB400 / WTB20200000015535	Technology Promotion Association (Thailand-Japan)	24TM647	1 Apr 24	31 Mar 25
12	Inductively Coupled Plasma- Optical Emission Spectrometer(ICP-OES)	BARIIUM SODIUM SODIUM ADSORPTION RATIO TITANIUM	Agilent Technologies, USA	5110 VDV(G8015AA) / MY8030001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	4 Nov 24	3 Nov 25
13	Kjeltec System Distilling Unit	TOTAL KJELDAHL NITROGEN	Foss Tecator (Labtec)	KT200 / 91790524	FOSS South East Asia	9810	8 Feb 24	7 Feb 25
14	Kjeltec Distillation Unit	TOTAL KJELDAHL NITROGEN	FOSS	Kjeltec 8100 / 91889052	FOSS South East Asia	9807	8 Feb 24	7 Feb 25

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*
15	pH Meter	pH	Horiba	LAQUA-PH210 / HA9M0047	technology promotion association (thailand-japan	24CH400	3 Apr 24	1 Apr 25
16	SCT Meter	SALINITY	YSI Environmental	Pro 30 / 17A102921	Technology Promotion Association (Thailand-Japan)	24CH1158	18 Sep 24	16 Sep 25
17	UV-VIS Spectrophotometer	FORMALDEHYDE	Hitachi	U-1900 / 2021-J064	DQE Services Co.,Ltd.	SP24-008	16 Jan 24	15 Jan 25
18	UV-VIS Spectrophotometer	NITRATE NITROGEN SULPHATE	Hitachi	U-2900 / 21E22-009	DQE Services Co.,Ltd.	SP24-001	4 Jan 24	3 Jan 25
19	Turbidity Meter (Portable)	TURBIDITY (NTU)	Oakton Instruments(China)	T100IR / 1120501017	Technology Promotion Association (Thailand-Japan)	24CH1115	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*
1	Atomic Absorption Spectrometer	CADMIUM COPPER LEAD MANGANESE MERCURY NICKEL SELENIUM TOTAL IRON ZINC	Agilent Technologies	AA240FS / MY13160001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	24 Jan 24	23 Jan 25
2	Atomic Absorption Spectrometer	ARSENIC	Perkin Elmer	PinAAcle 900F / PFB20031902	Perkin Elmer Co.,Ltd.	WO-02787590	14 May 24	13 May 25
3	Analytical Balance	FAT OIL AND GREASE	Mettler Toledo	AB204-S/FACT / 1129361010	Technology Promotion Association (Thailand-Japan)	24MM292	11 May 24	10 May 25
4	Analytical Balance	TOTAL DISSOLVED SOLIDS	Mettler Toledo	XSR205DU / C210685394	National Food Institute,Ministry of Industry, Thailand	2402283-002-01	2 Apr 24	1 Apr 25
5	Analytical Balance	TOTAL SUSPENDED SOLIDS	Mettler Toledo	XSR205DU / C009071872	National Food Institute,Ministry of Industry, Thailand	2402283-001-01	2 Apr 24	1 Apr 25
6	DO Meter	BIOCHEMICAL OXYGEN DEMAND	YSI	5100 / 11B 101863	Technology Promotion Association (Thailand-Japan)	24TW39	21 Feb 24	20 Feb 25
7	Heating Block	CHEMICAL OXYGEN DEMAND	Hanna Instruments Italia Srl.	HI 839800-Q2 / H 018500 I	Hanna Instruments (Thailand) Ltd.	HIT-2412-0389	18 Mar 24	17 Mar 25
8	Hot Air Oven	TOTAL SUSPENDED SOLIDS	Memmert	UF55 / B212.0411	Technology Promotion Association (Thailand-Japan)	24TM589	1 Apr 24	31 Mar 25
9	Incubator	TOTAL COLIFORM BACTERIA	Binder	KB400 / 20220000000391	Technology Promotion Association (Thailand-Japan)	24TM884	7 Jun 24	6 Jun 25

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*
10	Inductively Coupled Plasma- Optical Emission Spectrometer(ICP-OES)	BARIUM SODIUM SODIUM ADSORPTION RATIO TITANIUM	Agilent Technologies, USA	5110 VDV(G8015AA) / MY8030001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	4 Nov 24	3 Nov 25
11	pH Meter	pH	YSI Environmental	pH 100A / JC03354	Technology Promotion Association (Thailand-Japan)	24CH1379	5 Nov 24	6 Nov 25
12	SCT Meter	CONDUCTIVITY (umhos/cm) SALINITY	YSI Environmental	Pro 30 / 17B101802	Technology Promotion Association (Thailand-Japan)	24CH823	11 Jul 24	9 Jul 25
13	UV-VIS Spectrophotometer	NITRATE NITROGEN SULPHATE	Hitachi	U-2900 / 21E22-009	DQE Services Co.,Ltd.	SP25-001	3 Jan 25	2 Jan 26
14	Turbidity Meter (Portable)	TURBIDITY (NTU)	Oakton Instruments(China)	T100IR / 1120501017	Technology Promotion Association (Thailand-Japan)	24CH1115	6 Sep 24	5 Sep 25

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



Cert.No.: 24CH39  
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## Certificate of Calibration

Equipment : pH Meter  
Manufacturer : Horiba  
Model : LAQUA-PH210  
Serial No. : HA0A0005  
ID No. : UAE EFM.004/2563(EFM.PH.04/63)  
Condition As-Received: Used Item  
Received Date : 09 January 2024  
Calibration Date : 10 January 2024  
Reference : 2401-0219WSC-2  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41 Sukhumvit Road,  
Bangchak, Phrakhanong, Bangkok 10260  
Ambient Temperature : (25 ± 2.5) °C  
Relative Humidity : (50 ± 15) %  
Calibration Procedure : In-house method :  
- CP-CH5 by direct measurement with standard  
voltage calibrator and direct measurement with  
certified reference material (CRM)  
- CP-CH6 by comparison with standard thermometer

Calibrated by : Warakorn Lemgagtrakul

Approved by :

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

Issue Date : 15 January 2024

The Uncertainties are for a confidence probability of approximately 95%

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A 0062455



Cert.No.: 24CH39  
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### Condition of this calibration result

#### 1. Reference Standard Instrument

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC116	23E2602	27 Aug 2024
2) Ref. Standard Thermometer	4982054	110RC044	23I908	26 July 2024

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

#### 2. Certified Reference Materials

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

Buffer Solution	Manufacturer	Lot No.	Exp date
pH 4.008	CPA chem	940102	27 Nov 2025
pH 6.986	CPA chem	931959	01 Oct 2024
pH 9.997	CPA chem	940106	02 Nov 2024

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

### Calibration Results

#### Function : mv Measurement

#### Performing standard curve by Fluke at pH (4.7)(7.10)

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (± mV)	Coverage factor k
			mV	pH		
pH Meter S/N : HA0A0005	4.00	177.48	177.4	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	-177.2	10.01	0.058	2.00

Saithip

a 1197727



Cert.No.: 24CH39  
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: 9911.0051	4.008	4.02	155.5	0.0085	2.05
	6.986	7.00	-18.4	0.0093	2.00
	6.986	7.00	-18.2	0.011	2.00
	9.997	10.01	-189.0	0.0096	2.00

#### Function : Temperature Measurement

##### (\*) without adjustment

This equipment was connected with Temperature Probe;

Model : 9652  
- Serial No. : 9911.0051  
Dimension of probe:  
- Length : 103 mm  
- Diameter : 16 mm  
- Immersion Depth : 90 mm

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement (± °C)	Coverage factor k
25.0	25.002	25.0	-0.002	0.13	2.00
30.0	30.002	30.0	-0.002	0.13	2.00
35.0	35.003	34.9	-0.103	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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Saithip

a 1197726



Cert.No.: 24CH321  
Page: 1 of 3

## Certificate of Calibration

Equipment : Conductivity Meter  
Manufacturer : Horiba  
Model : LAQUA-EC210  
Serial No. : HC9L0012  
ID No. : UAE EFM.008/2563(EFM.SCT.02/63)  
Condition As-Received: Used Item  
Received Date : 12 March 2024  
Calibration Date : 14 March 2024  
Reference : 2403-0387WSC-1  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong, Bangkok 10260  
Ambient Temperature : (25 ± 2.5) °C  
Relative Humidity : (50 ± 15) %  
Calibration Procedure : In-house method :  
- CP-CH6 by direct measurement with  
certified reference material (CRM)  
- CP-CH8 by Comparison with temperature standard

Calibrated by : Warakorn Lemgagtrakul

Approved by :

( ) Pomthippa Tameyakul  
( ) Unnopphol Harachai  
(✓) Saithip Meangmai

Issue Date : 15 March 2024

The Uncertainties are for a confidence probability of approximately 95%

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Cert.No.: 24CH321

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Condition of this result of calibration

## 1. Reference Standard instrument :-

Instrument	Serial No.	ID No.	Certificate No.	Due date
1) Thermometer	1963878	130RC085	231051	05 Sep 2024
2) Ref. Std Thermometer	4982054	110RC044	231908	26 July 2024

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

## 2. Certified Reference Materials :-

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

Conductivity Solution	Manufacturer	Lot No.	Exp. date
1413.0 µS/cm	CPA Chem	936624	19 Oct 2024
12.880 mS/cm	CPA Chem	931956	30 Sep 2024

- Control Conductivity calibration solution temperature by Water bath ( $25 \pm 0.1$  °C)

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

Calibration resultsFunction : Conductivity Measurement

(\*) After Adjustment at 1413.0 µS/cm

Conductivity Electrode Serial No.: 9B9F0276

Standard Conductivity Solution	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement ( $\pm$ )	Coverage factor k
1413.0 µS/cm	1340 µS/cm	1413 µS/cm	9.2 µS/cm	2.00
12.880 mS/cm	13.70 mS/cm	14.27 mS/cm	0.086 mS/cm	2.00

**Remark** : - UUC\* = Unit Under Calibration

Sailhip

a 1206345



Cert.No.: 24CH321

Page.: 3 of 3

Calibration ResultsFunction : Temperature Measurement

This equipment was connected with Temperature Probe,

- Model :	9383
- Serial No.	9B9F0276

Dimension of probe;

- Length :	110 mm
- Diameter :	10 mm
- Immersion Depth :	90 mm

Calibration Result : Without adjustment

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement ( $\pm$ °C)	Coverage factor k
25.0	25.002	25.0	-0.002	0.13	2.00
30.0	30.001	30.0	-0.001	0.13	2.00
35.0	35.002	35.0	-0.003	0.13	2.00

**Remark** : - UUC\* = Unit Under Calibration

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

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Sailhip

a 1206346



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



Cert.No.: 24CH400

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## Certificate of Calibration

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 : 01 April 2024  
Calibration Date : 02 April 2024  
Reference : 2404-0037WSC-2  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangkok, Phraknanong, Bangkok 10260

Ambient Temperature : ( $25 \pm 2.5$  °C  
Relative Humidity : ( $50 \pm 15$  ) %  
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 Lemgagtrakul

Approved by :   
Approved Signatory

( ) Pornthippa Tameyakul  
( ) Unnopphol Harachai  
(✓) Sailhip Meangmai

Issue Date : 06 April 2024

The Uncertainties are for a confidence probability of approximately 95%

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A 0062140



Cert.No.: 24CH400

Page.: 2 of 3

Condition of this calibration result

## 1. Reference Standard instrument

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC116	23E2802	27 Aug 2024
2) Ref. Standard Thermometer	4982054	110RC044	231908	26 July 2024

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

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

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	940102	27 Nov 2025
pH 6.986	CPA chem	940104	02 Nov 2024
pH 9.997	CPA chem	940106	02 Nov 2024

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

Calibration ResultsFunction : mV Measurement

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

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement ( $\pm$ mV)	Coverage factor k
			mV	pH		
pH Meter S/N.: HA9M0047	4.00	177.48	177.3	4.01	0.058	2.00
	7.00	0.00	0.0	7.01	0.058	2.00
	7.00	0.00	0.0	7.01	0.058	2.00
	10.00	-177.48	-177.4	10.01	0.058	2.00

Sailhip

a 1209883



Cert.No.: 24CH400  
Page.: 3 of 3

#### Calibration Results

Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH Measurement ( $\pm$ )	Coverage factor $k$
pH Electrode S/N: -	4.008	4.01	171.6	0.0079	2.00
	6.986	6.99	-8.4	0.0099	2.00
	6.986	7.00	-9.6	0.011	2.00
	9.997	10.02	-173.8	0.0096	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 ( $^{\circ}\text{C}$ )	Standard Temperature ( $^{\circ}\text{C}$ )	UUC* Reading ( $^{\circ}\text{C}$ )	Error ( $^{\circ}\text{C}$ )	Uncertainty of measurement ( $\pm$ $^{\circ}\text{C}$ )	Coverage factor $k$
25.0	25.002	25.0	-0.002	0.13	2.00
30.0	30.002	30.0	-0.002	0.13	2.00
35.0	35.003	35.0	-0.003	0.13	2.00

Remark : UUC\* = Unit Under Calibration

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

-o0o-

Sathip

a 1209884



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 16, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL 0-2717-3000-29 FAX 0-2719-9484



## Certificate of Calibration

Cert.No.: 24CH718  
Page.: 1 of 3

Equipment : Conductivity Meter

Manufacturer : YSI

Model : Pro 30

Serial No. : 17B101801

ID No. : UAE.EFM.121/2560(ENV SCT.01/60)

Condition As-Received: Used Item

Received Date : 18 June 2024

Calibration Date : 19 June 2024

Reference : 2406-0572WSC-1

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

Ambient Temperature : (25  $\pm$  2.5)  $^{\circ}\text{C}$

Relative Humidity : (50  $\pm$  15) %

Calibration Procedure: in-house method ;

- CP-CH6 by direct measurement with certified reference material. (CRM)
- CP-CH8 by comparison with temperature standard

Calibrated by : Warakorn Lemgagrakul

Approved by :

( ) Unnopphol Harachai  
( ) Ponpan Paipim  
(✓) Sathip Meangmai

Issue Date : 20 June 2024

The Uncertainties are for a confidence probability of approximately 95%

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Cert.No.: 24CH718  
Page.: 2 of 3

#### Condition of this result of calibration

1. Reference Standard Instrument :-

Instrument Serial No. ID No. Certificate No. Due date

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

2. Certified Reference Materials :-

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

Conductivity Solution	Manufacturer	Lot No.	Exp. date
1413.0 $\mu\text{S/cm}$	CPA Chem	940111	02 Nov 2024
12.880 $\text{mS/cm}$	CPA Chem	936625	19 Oct 2024

- Control Conductivity calibration solution temperature by Water bath (25  $\pm$  0.1)  $^{\circ}\text{C}$

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

#### Calibration results

Function : Conductivity Measurement

(\*) After Adjustment at 1413.0  $\mu\text{S/cm}$

Conductivity Electrode Serial No.: 17B100319

Standard Conductivity Solution	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement ( $\pm$ )	Coverage factor $k$
1413.0 $\mu\text{S/cm}$	1044 $\mu\text{S/cm}$	1412 $\mu\text{S/cm}$	9.2 $\mu\text{S/cm}$	2.00
12.880 $\text{mS/cm}$	9.33 $\text{mS/cm}$	12.64 $\text{mS/cm}$	0.086 $\text{mS/cm}$	2.00

Remark : - UUC\* = Unit Under Calibration



Cert.No.: 24CH718  
Page.: 3 of 3

#### Calibration Results

Function : Temperature Measurement

This equipment was connected with Temperature Probe.

Model : PRO 30 COND-T

Serial No. : 17B100319

Dimension of probe:

- Length : 7 mm

- Diameter : 2.5 mm

- Immersion Depth : 90 mm

Calibration Result : Without adjustment

Calibration Point ( $^{\circ}\text{C}$ )	Standard Temperature ( $^{\circ}\text{C}$ )	UUC* Reading ( $^{\circ}\text{C}$ )	Error ( $^{\circ}\text{C}$ )	Uncertainty of Measurement ( $\pm$ $^{\circ}\text{C}$ )	Coverage factor $k$
25.0	25.002	24.7	0.303	0.13	2.00
30.0	30.001	29.7	-0.301	0.13	2.00
35.0	35.002	34.7	-0.302	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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## Certificate of Calibration

Cert.No.: 24CH727  
Page.: 1 of 3

Equipment : pH Meter  
Manufacturer : Horiba  
Model : LAQUA-PH210  
Serial No. : HA0D0082  
ID No. : UAE.EFM.072/2564(EFM.pH.05/64)  
Condition As-Received: Used Item  
Received Date : 18 June 2024  
Calibration Date : 19 June 2024  
Reference : 2406-0570WSC-5  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road  
Bangchak, Phrakhanong, Bangkok 10260

Ambient Temperature : (25 ± 2.5) °C  
Relative Humidity : (50 ± 15) %  
Calibration Procedure : In-house method :  
- CP-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 Lengagrakul

Approved by :

Approved Signatory

( ) Unnopphol Harachai  
( ) Ponpan Paipim  
(✓) Saithip Meangmai

Issue Date : 20 June 2024

The Uncertainties are for a confidence probability of approximately 95%

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### Condition of this calibration result

#### 1. Reference Standard Instrument

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC116	23E2802	27 Aug 2024
2) Ref. Standard Thermometer	4962054	110RC044	23I908	26 July 2024

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

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

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	970851	25 Apr 2026
pH 6.986	CPA chem	970852	25 Apr 2025
pH 9.997	CPA chem	970853	25 Apr 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	Coverage factor
	pH	mV	mV	pH	( mV )	k
pH Meter S/N.: HA0D0082	4.00	177.48	177.5	4.01	0.058	2.00
	7.00	0.00	0.2	7.00	0.058	2.00
	7.00	0.00	0.2	7.00	0.058	2.00
	10.00	-177.48	-177.0	10.01	0.058	2.00

Cert.No.: 24CH727  
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.: Q9AA0036	4.008	4.01	179.9	0.0079	2.00
	6.986	7.00	4.6	0.0099	2.00
	6.986	7.00	3.2	0.0093	2.00
	9.997	10.01	-171.2	0.0092	2.00

#### Function : Temperature Measurement

( \* ) Without adjustment

This equipment was connected with Temperature Probe.

- Model : 9652-10D

- Serial No. : Q9AA0036

Dimension of probe

- Length : 103 mm

- Diameter : 16 mm

- Immersion Depth : 80 mm

Calibration Point ( °C )	Standard Temperature ( °C )	UUC* Reading ( °C )	Error ( °C )	Uncertainty of measurement ( ± °C )	Coverage factor k
25.0	25.001	25.0	-0.001	0.13	2.00
30.0	30.004	30.0	-0.004	0.13	2.00
35.0	35.002	35.0	-0.002	0.13	2.00

Remark : - UUC\* = Unit Under Calibration

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

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## Certificate of Calibration

Cert.No.: 24CH823  
Page.: 1 of 3

Equipment : Conductivity Meter  
Manufacturer : YSI  
Model : Pro 30  
Serial No. : 17B101802  
ID No. : UAE.EFM.122/2560(ENV.SCT.02/60)  
Condition As-Received: Used Item  
Received Date : 09 July 2024  
Calibration Date : 11 July 2024  
Reference : 2407-0333WSC-1  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong, Bangkok 10260  
Ambient Temperature : (25 ± 2.5) °C  
Relative Humidity : (50 ± 15) %  
Calibration Procedure : In-house method :  
- CP-CH6 by direct measurement with certified reference material (CRM)  
- CP-CH8 by comparison with temperature standard

Calibrated by : Warakorn Lengagrakul

Approved by :

Approved Signatory

( ) Unnopphol Harachai  
( ) Ponpan Paipim  
(✓) Saithip Meangmai

Issue Date : 11 July 2024

The Uncertainties are for a confidence probability of approximately 95%

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Cert.No.: 24CH823

Page.: 2 of 3

**Condition of this result of calibration**

## 1. Reference Standard Instrument :-

Instrument	Serial No.	ID No.	Certificate No.	Due date
1) Thermometer	1963878	130RC095	2311051	05 Sep 2024
2) Ref. Std. Thermometer	2188080	130RC044	2211285	20 Oct 2023

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

## 2. Certified Reference Materials :-

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

Conductivity Solution	Manufacturer	Lot No.	Exp. date
1413.0 $\mu$ S/cm	CPA Chem	940111	02 Nov 2024
12,880 mS/cm	CPA Chem	940112	02 Nov 2024

- Control Conductivity calibration solution temperature by Water bath ( $25 \pm 0.1$ ) °C

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

**Calibration results****Function : Conductivity Measurement**(\*) After Adjustment at 1413.0  $\mu$ S/cm

Conductivity Electrode Serial No.: 18L100008

Standard Conductivity Solution	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement ( $\pm$ )	Coverage factor k
1413.0 $\mu$ S/cm	1327 $\mu$ S/cm	1412 $\mu$ S/cm	9.2 $\mu$ S/cm	2.00
12,880 mS/cm	11.39 mS/cm	12.22 mS/cm	0.086 mS/cm	2.00

Remark : - UUC\* = Unit Under Calibration



Cert.No.: 24CH823

Page.: 3 of 3

**Calibration Results****Function : Temperature Measurement**

This equipment was connected with Temperature Probe;

- Model : PRO30 COND-T

- Serial No. : 18L100008

Dimension of probe;

- Length : 7 mm

- Diameter : 2.5 mm

- Immersion Depth : 90 mm

**Calibration Result : Without adjustment**

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement ( $\pm$ °C)	Coverage factor k
25.0	25.002	24.6	-0.402	0.13	2.00
30.0	30.002	29.6	-0.402	0.13	2.00
35.0	35.003	34.6	-0.403	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)  
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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.058/2563  
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 : ( $25 \pm 2.5$ ) °C  
Relative Humidity : ( $50 \pm 20$ ) %  
Calibration Procedure : In - house method : CP-CH11  
Direct measurement by  
using Formazin standard solution  
Calibrated by : Walalak Sirithean  
Approved by :   
( ) Unnopphol Harachai  
( ) Ponpan Palpim  
(✓) Saithip Meangmai  
Issue Date : 9 September 2024

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Calibration and Testing Equipment Services.

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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-Hygograph	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 ( $\pm$ 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 %.

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## Certificate of Calibration

Cert.No.: 24CH1158  
Page.: 1 of 3

Equipment : Conductivity Meter  
Manufacturer : YSI  
Model : Pro30  
Serial No. : 17A102921  
ID No. : UAE.EFM.123/2560(ENV.SCT.03/60)  
Condition As-Received: Used Item  
Received Date : 17 September 2024  
Calibration Date : 18 September 2024  
Reference : 2409-0635WSC-2  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong, Bangkok 10260  
Ambient Temperature : (25 ± 2.5) °C  
Relative Humidity : (50 ± 15) %  
Calibration Procedure: In-house method :  
- CP-CH6 by direct measurement  
with certified reference material (CRM)  
- CP-CH8 by comparison with temperature standard  
Calibrated by : Warakorn Lemgagtrakul  
Approved by :  
( ) Unnopphol Harachai  
( ) Ponpan Paipim  
(✓) Saithip Meangmai  
Issue Date : 23 September 2024

The Uncertainties are for a confidence probability of approximately 95%

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

Cert.No.: 24CH1158

Page.: 2 of 3

### Condition of this result of calibration

1. Reference Standard Instrument :-

Instrument	Serial No.	ID No.	Certificate No.	Due date
1) Thermometer	9549224	130RC003	24426	24 Apr 2025
2) Ref. Std. Thermometer	2188080	130RC044	231216	10 Oct 2024

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

2. Certified Reference Materials :-

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

Conductivity Solution	Manufacturer	Lot No.	Exp. date
1412.9 µS/cm	CPA Chem	1005307	15 June 2025
12.880 mS/cm	CPA Chem	940112	02 Nov 2024

- Control Conductivity calibration solution temperature by Water bath (25 ± 0.1) °C

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

### Calibration results

Function : Conductivity Measurement

(\*) After Adjustment at 1412.9 µS/cm

Conductivity Electrode Serial No.: 17A100315

Standard Conductivity Solution	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement (±)	Coverage factor k
1412.9 µS/cm	1317 µS/cm	1414 µS/cm	9.2 µS/cm	2.00
12.880 mS/cm	10.60 mS/cm	11.99 mS/cm	0.086 mS/cm	2.00

Remark : - UUC\* = Unit Under Calibration

Cert.No.: 24CH1158  
Page.: 3 of 3

### Calibration Results

Function : Temperature Measurement

This equipment was connected with Temperature Probe;

- Model : PRO 30 COND-T  
- Serial No. : 17A100315

Dimension of probe;

- Length : 95 mm  
- Diameter : 2.5 mm  
- Immersion Depth : 90 mm

Calibration Result : Without adjustment

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (± °C)	Coverage factor k
25.0	25.003	24.7	-0.303	0.13	2.00
30.0	30.002	29.7	-0.302	0.13	2.00
35.0	35.002	34.7	-0.302	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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## Certificate of Calibration

Cert.No.: 24CH1379  
Page.: 1 of 3

Equipment : pH Meter  
Manufacturer : EcoSense  
Model : pH100A  
Serial No. : JC03354  
ID No. : UAE.EFM.063/2562(ENV.pH03/62)  
Condition As-Received: Used Item  
Received Date : 05 November 2024  
Calibration Date : 06 November 2024  
Reference : 2411-0122WSC-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 Lemgagtrakul  
Approved by :  
( ) Unnopphol Harachai  
(✓) Ponpan Paipim  
( ) Saithip Meangmai  
Issue Date : 8 November 2024

The Uncertainties are for a confidence probability of approximately 95%

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Cert.No.: 24CH1379  
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 Thought 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

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	1034203	27 Sep 2026
pH 6.999	Hach Lenge GmbH	C03145	28 Feb 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 ( $\pm$ mV)	Coverage factor k
	pH	mV	mV	pH		
pH Meter S/N.: JC03354	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	-178	10.01	0.58	2.00



Cert.No.: 24CH1379  
Page.: 3 of 3

#### Calibration Results

##### Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH Measurement ( $\pm$ )	Coverage factor k
pH Electrode S/N.:240710SIA605377	4.008	4.01	173	0.0079	2.00
	6.999	7.00	-2	0.0092	2.00
	6.999	7.00	-2	0.0095	2.00
	10.010	10.01	-178	0.0092	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 ( $\pm$ °C)	Coverage factor k
15.0	15.003	14.9	-0.103	0.13	2.00
30.0	30.001	29.9	-0.101	0.13	2.00
45.0	45.003	44.8	-0.203	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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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.: 24MM292  
Page.: 1 of 3

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

Issue Date : 15 May 2024

The Uncertainties are for a confidence probability of approximately 95%

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Equipment : Electronic Balance  
Condition As-Received : Used Item  
Reference : 2405-0166OC-1  
Procedure used :-

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

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

#### Condition of this result of calibration

##### 1. Reference standard instruments:-

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

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

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

Range capacity : 0 g to 220 g Resolution 0.0001 g

Before Adjustment :

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

After Adjustment :

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

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

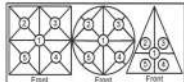
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Equipment : Electronic Balance  
Condition As-Received : Used Item  
Reference : 2405-0166OC-1

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



Maximum difference between off-center and central loading

Position 1 (g)	Position 2 (g)	Position 3 (g)	Position 4 (g)	Position 5 (g)	(g)
-0.0004	-0.0004	-0.0003	-0.0003	-0.0004	0.0001

### 3. Departure from nominal value

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (± mg)	Coverage Factor (k)
Unload	0.0000	0.0000	0.15	2.13
0.01	0.0100	0.0000	0.15	2.13
0.05	0.0500	0.0000	0.15	2.13
0.1	0.1000	0.0000	0.15	2.13
0.5	0.5000	0.0000	0.15	2.13
1	1.0000	0.0000	0.15	2.13
10	10.0000	0.0000	0.15	2.11
50	49.9999	+0.0001	0.17	2.06
100	99.9999	+0.0001	0.19	2.03
150	149.9998	+0.0002	0.29	2
200	199.9990	+0.0010	0.30	2

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

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
334/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL. 0-2717-3000-29 FAX. 0-2719-9484



Cert. No.: 24TM587  
Page : 1 of 3

## Certificate of Calibration

Equipment : BOD Incubator  
Manufacturer : ARCO  
Model : UR-1320  
Serial No. : -  
ID No. : UAE.WAO.018/2551  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong,  
Bangkok 10260  
Location : Lab Floor 2  
Received Order : 01 April 2024  
Calibration Date : 01 April 2024  
Ambient Temperature : ( 26 ± 10 ) °C  
Relative Humidity : ( 50 ± 30 ) %

Calibrated by : Krisda Malee

Approved by :   
Approved Signatory

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

Issue Date : 5 April 2024

The Uncertainties are for a confidence probability of approximately 95%

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

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A 0065063



Equipment : BOD Incubator  
Condition As-Received : Used Item  
Reference : 2404-0004OC-1

Cert. No.: 24TM587  
Page : 2 of 3

### Procedure Used :-

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

### Condition of this result of calibration

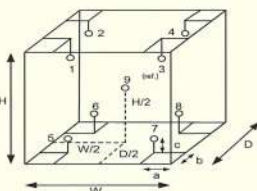
#### 1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1 ) Data Acquisition	MY57013711	23LM115	TPA	11 Jul 2024

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

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

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



Probe Installation Details :  
a = 10 cm  
b = 10 cm  
c = 10 cm  
Dimension of Chamber :  
D = 0.62 m  
W = 1.2 m  
H = 1.2 m  
Capacity = 0.89 m³

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

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



Equipment : BOD Incubator  
Condition As-Received : Used Item  
Reference : 2404-0004OC-1  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Not Available

Cert. No.: 24TM587  
Page : 3 of 3

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

Calibration Point ( °C )	Measured Temperature ( °C )									Uncertainty ( ± °C )
	1	2	3	4	5	6	7	8	9 (ref.)	
20.0	19.954	20.183	20.235	19.707	19.706	19.739	19.785	19.821	19.828	0.66

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

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

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

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

UUC\* : Unit Under Calibration

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

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

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a 1209743

เอกสารไม่ควบคุม  
a 1209742





Cert. No.: 24TM589  
Page : 1 of 3

## Certificate of Calibration

Equipment : Hot Air Oven  
Manufacturer : Mamert  
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 : 01 April 2024  
Calibration Date : 01 - 02 April 2024  
Ambient Temperature :  $(26 \pm 10) ^\circ\text{C}$   
Relative Humidity :  $(50 \pm 30) \%$

Calibrated by : Krisda Malee

Approved by :

Approved Signatory

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

Issue Date : 5 April 2024

The Uncertainties are for a confidence probability of approximately 95%

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

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A 0065065



Equipment : Hot Air Oven  
Condition As-Received : Used Item  
Reference : 2404-0004OC-3  
Procedure Used :-

Cert. No.: 24TM589  
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

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY57013711	23LM115	TPA	11 Jul 2024

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

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

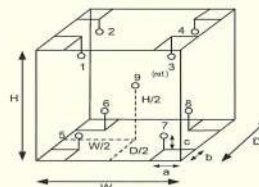
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- ( ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Close

Environment during calibration		
	Beginning	Finished
Temp. (°C)	27	26
REL.Humid. (%)	47	48
AC Supply (Volt)	221	220



Probe Installation Details : Dimension of Chamber :  
a = 5.0 cm D = 0.50 m  
b = 5.0 cm W = 0.80 m  
c = 5.0 cm H = 0.75 m  
Capacity = 0.30 m<sup>3</sup>

Ref. Std. ID No.: @ Calibration Point		
Position :	(120 to 180) °C	(104) °C
1	21-18TC-01	22-18RTD-2/1
2	21-18TC-02	18RTD-2/2
3	21-18TC-03	18RTD-2/3
4	21-18TC-04	18RTD-2/4
5	21-18TC-05	18RTD-2/5
6	21-18TC-06	18RTD-2/6
7	21-18TC-07	18RTD-2/7
8	21-18TC-08	18RTD-2/8
9 (ref.)	21-18TC-09	18RTD-2/9

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a 1209739



Equipment : Hot Air Oven  
Condition As-Received : Used Item  
Reference : 2404-0004OC-3  
Result of Calibration :- ( ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Close

Cert. No.: 24TM589  
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	0.032	0.47	0.84	2
120.0	120.0	120.0	0.12	0.72	1.3	2
180.0	180.0	180.0	0.13	1.2	1.5	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	1	2	3	4	5	6	7	8	9 (ref.)	
104.0	104.464	103.847	104.226	104.232	104.106	103.691	104.275	104.127	104.013	0.42
120.0	120.486	120.089	120.635	120.596	119.531	119.644	120.364	120.144	120.158	1.1
180.0	180.574	179.769	180.285	180.870	179.594	179.790	180.287	179.961	179.802	1.1

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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a 1209738



## Certificate of Calibration

Cert. No.: 24TM647  
Page : 1 of 3

Equipment : Incubator  
Manufacturer : Binder  
Model : KB 400 E6  
Serial No. : 20200000015535  
ID No. : UAE.MIC.018/2564  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong,  
Bangkok 10260  
Location : Microbiology Laboratory (302)  
Received Order : 01 April 2024  
Calibration Date : 01 April 2024  
Ambient Temperature :  $(26 \pm 10) ^\circ\text{C}$   
Relative Humidity :  $(50 \pm 30) \%$

Calibrated by : Man Pattanapongpaiboon

Approved by :

Approved Signatory

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

Issue Date : 7 April 2024

The Uncertainties are for a confidence probability of approximately 95%

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

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Equipment : Incubator  
Condition As-Received : Used Item  
Reference : 2404-0003OC-6  
Procedure Used :-

Cert. No.: 24TM647  
Page : 2 of 3

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

#### Condition of this result of calibration

##### 1. Reference standard instrument:-

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

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

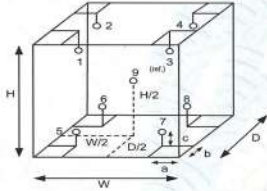
3. This certification is traceable to the International System of Unit.

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

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Close



#### Probe Installation Details :

Dimension of Chamber :	
a = 10 cm	D = 0.48 m
b = 10 cm	W = 0.65 m
c = 10 cm	H = 1.2 m
	Capacity = 0.37 m <sup>3</sup>

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	24	24
REL.Humid. ( % )	54	57
AC Supply ( Volt )	221	223

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



Equipment : Incubator  
Condition As-Received : Used Item  
Reference : 2404-0003OC-6  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Close

Cert. No.: 24TM647  
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	0.035	0.19	0.22	2

Calibration Point ( °C )	Measured Temperature ( °C )									Uncertainty  ( ± °C )
	Position									
	1	2	3	4	5	6	7	8	9 (ref.)	
35.0	35.000	35.022	34.841	34.851	35.027	35.011	35.023	35.028	35.007	0.30

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

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

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

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

UUC\* : Unit Under Calibration

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

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

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



## Certificate of Calibration

Cert. No.: 24TM884  
Page : 1 of 3

Equipment : Incubator  
Manufacturer : Binder  
Model : KB 400  
Serial No. : 20220000000391  
ID No. : UAE.MIC.029/2565  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong,  
Bangkok 10260  
Location : Microbiology Laboratory  
Received Order : 07 June 2024  
Calibration Date : 07 June 2024  
Ambient Temperature : ( 26 ± 10 ) °C  
Relative Humidity : ( 50 ± 30 ) %  
Calibrated by : Tawatchai Pama  
Kunchit  
Approved by :  
( ) Ponpan Paipim  
( ) Suwit Imjai  
(✓) Kunchit Promprat

Issue Date : 11 June 2024

The Uncertainties are for a confidence probability of approximately 95%

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Equipment : Incubator  
Condition As-Received : Used Item  
Reference : 2406-0190OC-2  
Procedure Used :-

Cert. No.: 24TM884  
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.

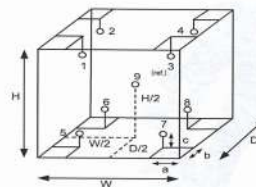
Remark : TPA : Technology Promotion Association ( Thailand - Japan )

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Close

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	21	19
REL.Humid. ( % )	77	75
AC Supply ( Volt )	228	229



#### Probe Installation Details :

Dimension of Chamber :	
a = 10 cm	D = 0.50 m
b = 10 cm	W = 0.65 m
c = 10 cm	H = 1.2 m
	Capacity = 0.39 m <sup>3</sup>

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 : 2406-0190OC-2  
 Result of Calibration :- ( \* ) Without Adjustment  
 Function of UUC\* : Temperature Source  
 Fresh air setting : Close

Cert. No.: 24TM884  
 Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
35.0	35.0	35.0	0.028	0.28	0.53	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (±°C)
	Position									
	1	2	3	4	5	6	7	8	9 (ref.)	
35.0	35.317	35.184	35.142	35.064	35.098	35.093	34.894	34.826	35.056	0.30

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

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

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

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

UUC\* : Unit Under Calibration

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

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

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## กำหนดจุดห้ามใช้งาน

References Certificate Number. : 24TM884

Equipment : Incubator

Model : KB 400

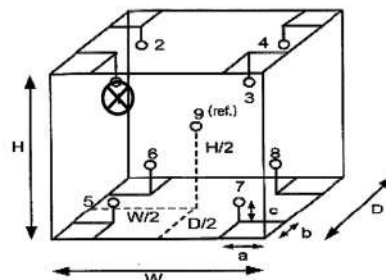
Serial No. : 20220000000391

ID No. : UAE.MIC.029/2565

Manufacturer : Binder

Calibration Point : 35.0 °C

Unit Under Calibration Setting : 35.0 °C



รูปภาพเครื่องมือ แสดงจุดที่ได้รับการสอบเทียบ และสัญลักษณ์ ⊗ แสดงจุดห้ามใช้งาน

กำหนดจุดห้ามใช้งานตำแหน่งที่.....1.....

หมายเหตุ เก็บใบแนบ.....

Uae.netapp\Netapp\_LAB\Lab-BK\INSTRUMENT\01-276-A\Certificate\ใบห้ามใช้งานเครื่องวัดอุณหภูมิ 2567\กำหนดจุดห้ามใช้งาน

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

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

## Certificate of Testing

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

Tested by : Walailak Sirinthean

Approved by :

*Saithip*  
 Approved Signatory

( ) Pornthippa Tameyakul  
 ( ) Unnopphol Harachai  
 (✓) Saithip Meangmai

Issue Date : 22 February 2024

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

### Condition of this result of calibration

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

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

### 2. Standard Material :-

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

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

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

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

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Cert.No.: 24TW128  
Page.: 1 of 2

## Certificate of Testing

Equipment : DO Meter  
Manufacturer : Horiba  
Model : LAQUA-DO210  
Serial No. : HE9M0021  
ID No. : UAE.EFM.014/2563 (EFM.DO.03/63)  
Received Date : 18 June 2024  
Test Date : 19 June 2024  
Reference : 2406-0571WSC-1  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd  
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak,  
Phraknanong, Bangkok 10260  
Laboratory Condition : Temperature (  $25 \pm 5$  ) °C  
Humidity (  $50 \pm 20$  ) %  
Test Procedure : In - house method : GP-CHT  
by Compensation Technique with Azide Modification Method

Tested by : Walatak Sirinthean

Approved by :   
Approved Signatory

( ) Unnopphol Hatachrai  
( ) Ponpan Paipim  
(✓) Saitip Meangmai

Issue Date : 20 June 2024



Cert.No.: 24TW128  
Page.: 2 of 2

### Condition of this result of calibration

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

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

### 2. Standard Material :-

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

Result : Dissolved Oxygen Meter Adjustment With Air 100 %  
Dissolved Oxygen Probe No.: 9K2H0067

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.10	8.10	0.0071

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

-000-



Cert.No.: 24LM97  
Page.: 1 of 2

## Certificate of Calibration

Equipment : DO Meter with Sensor  
Manufacturer : Horiba  
Model : LAQUA-DO210  
Serial No. : HE9M0021  
ID No. : UAE.EFM.014/2563 (EFM.DO.03/63)  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phraknanong,  
Bangkok 10260  
Location : TPA On Site Calibration Laboratory  
Received Order : 18 June 2024  
Calibrated Date : 20 June 2024  
Ambient Temperature : (  $26 \pm 10$  ) °C  
Relative Humidity : (  $50 \pm 30$  ) %  
AC Line Voltage : (  $220 \pm 22$  ) V

Calibrated by : Warakorn Leringatrakul

Approved by :   
Approved Signatory

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

Issue Date : 24 June 2024



Equipment : DO Meter with Sensor  
Condition As-Received : Used Item  
Reference : 2406-0571WSC-2  
Procedure Used :-

Calibration were conducted using in-house calibration procedure GP-OT01 according to comparison with Industrial Platinum Resistance Thermometer (IPRT) into Temperature Bath.  
The temperature scale used was based on ITS-90.

### Condition of this result of calibration

1. Reference standard instrument:
- | Instrument             | Serial No. | Cert. No. | Traceable | Due Date    |
|------------------------|------------|-----------|-----------|-------------|
| 1) Digital Thermometer | 2188080    | 2311216   | TPA       | 11 Oct 2024 |
2. This certificate is valid only to the item calibrated on date and place of calibration.  
3. This certification is traceable to the International System of Unit.

Remark : TPA Technology Promotion Association (Thailand - Japan)

Result of Calibration :- ( " ) Without Adjustment

Function : Temperature measurement.

This instrument was connected with temperature sensor, S/N: 9K2H0067

Calibration Point ( °C )	Immersion Depth ( mm )	Standard Temperature ( °C )	UUC* Reading ( °C )	Error ( °C )	Uncertainty ( ± °C )	Coverage Factor K
25.0	80	25.002	25.0	-0.002	0.16	2.00
30.0	80	30.002	30.0	-0.002	0.16	2.00
35.0	80	35.003	35.0	-0.003	0.16	2.00

UUC\* : Unit Under Calibration

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

-000-

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



## Certificate of Testing

Cert.No.: 24TW241  
Page.: 1 of 2

Equipment : DO Meter  
Manufacturer : Horiba  
Model : LAQUA-DO210  
Serial No. : HE0L0004  
ID No. : UAE.EFM.087/2564(EFM.DO.06/64)  
Received Date : 05 November 2024  
Test Date : 06 November 2024  
Reference : 2411-0123WSC-3  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak,  
Phrakhanong, Bangkok 10260  
Laboratory Condition : Temperature (  $25 \pm 5$  ) °C  
Humidity (  $50 \pm 20$  ) %  
Test Procedure : In - house method : CP-CH9  
by Comparison Technique with Azide Modification Method  
Tested by : Walalak Sirithean  
Approved by :   
Approved Signatory  
( ) Unnopphol Harachai  
( ) Ponpan Paipim  
(✓) Saitip Meangmai  
Issue Date : 9 November 2024



Cert.No.: 24TW241  
Page.: 2 of 2

### Condition of this result of calibration

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

Instruments	Serial No.	ID No.	Certificate No.	Due Date
1. Burette	-	130BU10	23CG1172	22 Mar 2025
2. Balance	14233821	110RC001	24MM131	04 July 2025

2. Standard Material :-

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

Result : Dissolved Oxygen Meter Adjustment With Air 100 %  
Dissolved Oxygen Probe No.: 9K0E0257

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.20	8.19	0.0084

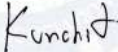
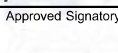
This report was certified only for the instrument we tested. It is allowable to use for study  
Intend to use for advertising and referral purpose is prohibited. This report may not be reproduced  
other in full, without written approval of the laboratory

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## Certificate of Calibration

Cert. No.: 24LM173  
Page.: 1 of 2

Equipment : DO Meter with Sensor  
Manufacturer : Horiba  
Model : LAQUA-DO210  
Serial No. : HE0L0004  
ID No. : UAE.EFM.087/2564(EFM.DO.06/64)  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong, Bangkok 10260  
Location : TPA On Site Calibration Laboratory  
Received Order : 05 November 2024  
Calibrated Date : 06 November 2024  
Ambient Temperature : (  $26 \pm 10$  ) °C  
Relative Humidity : (  $50 \pm 30$  ) %  
AC Line Voltage : (  $220 \pm 22$  ) V  
Calibrated by : Warakorn Lernagatrakul  
  
Approved by :   
Approved Signatory  
( ) Ponpan Paipim  
( ) Suwit Imjai  
(✓) Kunchit Promprat  
Issue Date : 07 November 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.



Equipment : DO Meter with Sensor  
Condition As-Received : Used Item  
Reference : 2411-0123WSC-4  
Procedure Used :-

Cert. No.: 24LM173  
Page.: 2 of 2

Calibration were conducted using in-house calibration procedure CP-OT01 according to comparison with Industrial Platinum Resistance Thermometer ( IPRT ) into Temperature Bath.  
The temperature scale used was based on ITS-90.

### Condition of this result of calibration

1. Reference standard instrument:-  
Instrument Serial No. Cert. No. Traceable Due Date  
1) Digital Thermometer 3240076 24I317 TPA 21 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 : Temperature measurement.

This instrument was connected with temperature sensor, S/N.: 9K0E0257

Calibration Point ( °C )	Immersion Depth ( mm )	Standard Temperature ( °C )	UUC* Reading ( °C )	Error ( °C )	Uncertainty ( ± °C )	Coverage Factor k
15.0	100	15.002	15.0	-0.002	0.16	2.00
30.0	100	30.003	30.0	-0.003	0.16	2.00
45.0	100	45.003	45.0	-0.003	0.16	2.00

UUC\* : Unit Under Calibration

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

-000-



FOSS

## Customer Service Report

Date: 8-9 Feb 2024  
Customer: UAE  
Instrument: KT100

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

Report No: 9807

Address: BANGKOK

Serial: 91889052

Hours Start Finish  
Travel To Customer 08:00 16:00  
Labour 09:30 12:00  
Travel From Customer 15:00 16:00

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

PO/Quote Number: If applicable

PMA Type: FOSScare If applicable Contract No. If applicable

Details of Work / Test	Condition / Status
# PM KT100	
- ตรวจเช็คความพร้อมอุปกรณ์ PM	
- วัดค่า pH value 50 - 50 ml	
- วัดค่า pH value 50 ml - 180 ml	
- วัดค่า pH value PM kit	
- Follow up PM protocol	
- ตรวจเช็คความพร้อมอุปกรณ์ PM	
Blanch - 0.14	
Protein - 10.6 %	
Instrument Ready for Use	OK Not OK

Part No.	Batch	Description	Qty
60031807	13-10-2023	FOSS PM kit 8100/8100 12.00	1

I confirm this report is accurate and complete

Signed FOSS: [Signature] Signed Customer: [Signature]

Name: [Name] Name: [Name]

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

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FOSS

## Customer Service Report

Date: 9 Feb 2024  
Customer: UAE  
Instrument: KJ200

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

Report No: 9810

Address: BANGKOK

Serial: 91790524

Hours Start Finish  
Travel To Customer 08:00 16:00  
Labour 09:30 12:00  
Travel From Customer 15:00 16:00

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

PO/Quote Number: If applicable

PMA Type: FOSScare If applicable Contract No. If applicable

Details of Work / Test	Condition / Status
# PM KJ200	
- ตรวจเช็คความพร้อมอุปกรณ์ PM	
- วัดค่า pH value 3 ml 100 ml	
- pH value 50 ml - 20 ml	
- วัดค่า pH value PM kit	
- ตรวจเช็คความพร้อมอุปกรณ์ PM	
# ตรวจเช็ค SOPH Head ตรวจสอบความพร้อมอุปกรณ์	
10000 729 Serial Not Complete 1 PC	
Instrument Ready for Use	OK Not OK

Part No.	Batch	Description	Qty
10009965	14.12.2020	FOSS PM kit KJ200 Lelelot Analyser 8100	1

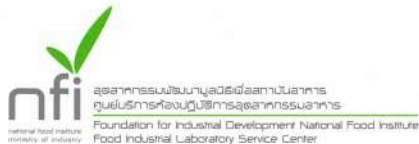
I confirm this report is accurate and complete

Signed FOSS: [Signature] Signed Customer: [Signature]

Name: [Name] Name: [Name]

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

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## Calibration Certificate

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

Page 1 of 4

Equipment: Electronic Balance  
Manufacturer: METTLER TOLEDO  
Model: XSR205DU  
Serial No.: C009071872  
ID No.: UAE.WAO.012/2563  
Order No.: 2402283  
Operation No.: 2402283-001  
Date of Receipt: 2 April 2024  
Date of Calibration: 2 April 2024

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

The uncertainties are for a confidence probability of approximately 95%

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

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

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## Calibration Report

Certificate No.: 2402283-001-01  
Equipment: Electronic Balance  
Manufacturer: METTLER TOLEDO  
Model: XSR205DU  
Serial No.: C009071872  
Capacity: 220 g  
Resolution: 0.00001 g / 0.0001 g  
ID No.: UAE.WAO.012/2563

Page 2 of 4

Date of Calibration: 2 April 2024  
Environment Condition: Ambient Temperature: 24.5 ± 0.5 °C Relative Humidity: 47.5 ± 2.5 %

Place of Calibration: Laboratory, UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

1. Calibration Method:	NFI Method W-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	8505567572	TCS	M23040535	8 April 2024
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	608-H1	NFI.BTH 016/23	Quality Reborn	QR24-0343	9 February 2025

3. This 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:

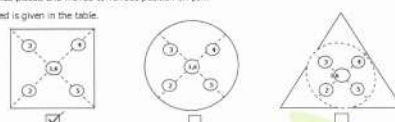
## 1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
40	0.0000052
80	0.0000063
100	0.000048
200	0.000053

## 2. Off-Center Error:

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

The balance reading obtained is given in the table.



1	2	3	4	5	6	(Maximum Difference)
(g)	(g)	(g)	(g)	(g)	(g)	(g)
100.0002	100.0001	100.0002	99.9999	100.0001	100.0001	0.0003

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

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## Verification Report

**Certificate No.:** 2402957-001-02  
**Equipment:** HEATING BLOCK DIGESTION  
Model: 2520 Serial No.: 91794469  
Resolution: 1 °C ID No.: UAE.WAS.011/2560  
Manufacturer: FOSS  
**Date of Calibration:** 23-24 May 2024 **Page 3 of 4**  
**Calibration point:** 380 °C  
**Calibration result:**

Block No.	UUC* Setting (°C)	UUC* Reading (°C)	Stability (±°C)	Standard Thermometer (°C)	Uncertainty (±°C)
1	380	380	0.96	378.86	2.1
2	380	380	0.40	378.41	2.1
3	380	380	1.18	378.94	2.1
4	380	380	0.44	377.64	1.6
5	380	380	0.11	377.75	1.6
6	380	380	0.14	378.35	1.6
7	380	380	1.17	377.09	2.1
8	380	380	0.33	377.08	2.1
9	380	380	0.14	376.61	2.1
10	380	380	0.96	377.74	2.1
11	380	380	0.40	377.17	2.1
12	380	380	1.18	377.71	2.1
13	380	380	0.44	379.07	1.6
14	380	380	0.11	379.19	1.6
15	380	380	0.14	379.78	1.6
16	380	380	1.17	378.74	2.1
17	380	380	0.33	378.74	2.1
18	380	380	0.14	378.27	2.1
19	380	380	0.96	379.53	2.1
20	380	380	0.40	378.96	2.1

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

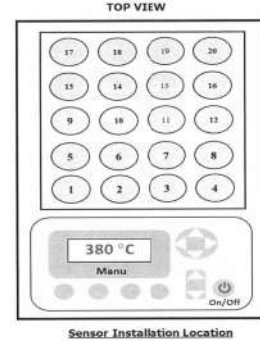
F-CS-012 Revision: 01 Date: 20-04-65



## Verification Report

**Certificate No.:** 2402957-001-02  
**Equipment:** HEATING BLOCK DIGESTION  
Model: 2520 Serial No.: 91794469  
Resolution: 1 °C ID No.: UAE.WAS.011/2560  
Manufacturer: FOSS  
**Date of Calibration:** 23-24 May 2024 **Page 4 of 4**  
**Calibration point:** 380 °C  
**Calibration result:** Continued

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

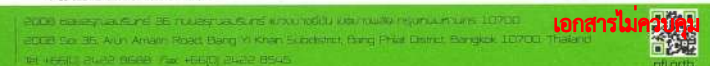


Remark: Edited Date of Calibration from 23-24 May 204 to 23-24 May 2024.

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

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

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



## 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.

### 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](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](https://www.agilent.com/cs/library/usermanuals/Public/7890B_Installation.pdf)
  - Operation Manual**  
[https://www.agilent.com/cs/library/usermanuals/Public/7890B\\_Operation.pdf](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](https://www.agilent.com/cs/library/usermanuals/public/G3430-90052%207890B_Maintaining%20Guide.pdf)

Revision: 2.00, Issued: December 30, 2020  
Agilent Document Number: D0007063  
DE number: 44166.759722222  
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เอกสารไม่ควบคุม



## Service Engineer's Responsibilities

- Contact the customer and ensure that all necessary supplies are available before the preventive maintenance visit.
- Only select those pages that relate to the system or module being serviced.
- Complete empty fields with the relevant information.
- Complete the relevant checkboxes in the checklist using either a "X" or tick mark "✓".
- Check "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.

Revision: 2.00, Issued: December 30, 2020  
Agile Document Number: D0007063  
DE number: 44166.7597222222  
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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	CN11021007
Instrument System Site and Location	Instrument Room

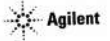
List System Component Product Numbers	List the Serial Numbers of each Component
1. G3440A	CN11021007
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	

## Preparation

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

Revision: 2.00, Issued: December 30, 2020  
Agile Document Number: D0007063  
DE number: 44166.7597222222  
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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

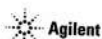
- ☒ For the inlets installed, perform inlet maintenance as defined in the 7890 manual - "Maintaining Your GC" - for the inlet(s) installed.
- ☒ Replace the split vent trap cartridge filter on units with these inlets: Split/Splitless Capillary (SSL), Multi-Mode Inlet (MMI), Programmed Temperature Vaporizer (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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## ALS Maintenance

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

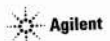
## Restore Instrument

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

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

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## Signature Page

## Service Review

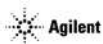
- ☒ Attach available reports/printouts of all tests to this documentation.
- ☒ Record the Preventive Maintenance service activity in the customer's records/logbook.
- ☒ Update/reset Instrument maintenance counters as appropriate.
- ☒ Affix the PM sticker to the system or instrument logbook based on the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

## 7890 GC Test Results Table

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

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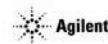
## 7890 Parts List Table

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	63510-60820	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	61531-67000	7890A/B	
Standard .011-inch FID Jet for capillary FID base	61531-80560	7890A/B	1
High Temperature .018-inch FID Jet for capillary FID base	61531-80620	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	
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	61534-80580	7890A/B	
NPD Jet, universal fit, .011-inch ID Extended tip	61534-80590	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	61531-67001	7890A/B	

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## Service Engineer Comments

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

## Service Completion

Service request number 8006748380 Date service completed 21Feb2024  
Agilent signature Phuwana Yoktragul Customer signature  
Total number of pages in this document 9

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Certificate No. : HIT-2412-0389

Page : 1 of 2

## CERTIFICATE OF CALIBRATION

Equipment : COD Test Tube Heater

Meter Model : HI839800-02 Serial No. : H018500I

Tube Heater : 25 Vial Capacity Resolution : 0.1°C

Temperature Range : (-10 to 160)°C Temperature of Reaction : 150°C

Manufacturer : Hanna Instruments Made in : Romania

Condition As-Received : Used Product Reference : RE240478

Ambient Temperature : (25 ± 2)°C Relative Humidity : (50 ± 15)%RH

Customer name : United Analyst and Engineering Consultant Co., Ltd.  
3 Soi Udomsuk 41, Sukhumvit Rd., Bangehak,  
Phrakhanong, Bangkok 10260

Received date : 18 March 2024


Calibrate date : 18 March 2024

Issue date : 20 March 2024

Calibrated Location : Hanna Instruments (Thailand) Ltd.

Calibration Procedure : This calibrator was conducted by using in-house calibration procedure  
CP-04 by using certified reference standard instruments.

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

Approved by :   
Mr. Anan Suwanchaisakul  
Authorized Signatory



This certificate was certified only for the instrument we calibrated.

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

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

approval of the head of Hanna Instrument (Thailand). เอกสารไม่ควบคุม

## Condition of this calibration result:

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

Instruments	Model	Serial No.	Certificate No.	Traceable
Data Acquisition Switch Unit	34970A	MY44665265	WK2307-164-1	WK Electric Co., Ltd.
Digital Thermo-Hygrometer	HT-771SD	AL07155	24H41	Technology Promotion Association (Thailand-Japan).

## Calibration Result:

Measurement Temperature Source Accuracy for COD Reactor.

Capacity (Vial)	Nominal Value (°C)	Average Value (°C)	Uncertainty of Measurement (±°C)
25 Vial	150.0	150.0	0.50

Unit : °C

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

Figure: Shows the location of the temperature source.

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

\*\* End of certificate \*\*

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## Agilent CrossLab Start Up Services

Agilent 5100 5110 ICP-OES  
Preventive Maintenance

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

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

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

## Introduction

## Customer Information

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

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## Important Customer Web Links

- To access **Agilent University**, visit <http://www.agilent.com/crosslab/university/> to learn about training options, which include online, classroom and onsite delivery. A training specialist can work directly with you to help determine your best options.
- To access the **Agilent Resource Center** web page, visit <https://www.agilent.com/en-us/agilentresources>. The following information topics are available:
  - Sample Prep and Containment
  - Chemical Standards
  - Analysis
  - Service and Support
  - Application Workflows
- The **Agilent Community** is an excellent place to get answers, collaborate with others about applications and Agilent products, and find in-depth documents and videos relevant to Agilent technologies. Visit <https://community.agilent.com/welcome>
- Videos about specific preparation requirements for your instrument can be found by searching the **Agilent YouTube** channel at <https://www.youtube.com/user/agilent>
- Need to place a service call?** [Flexible Repair Options | Agilent](#)

## Service Engineer's Responsibilities

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

## Instrument Maintenance

## System Information

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

Instrument System Name and ID	5110 VDV ICP-OES
Instrument System Site and Location	United Analyst and Engineering Consultant

List System Component Product Numbers	List the Serial Numbers of each Component
1. G 3059	77 19030001
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	

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

## Preparation

- ☒ Discuss any specific issues with the customer before starting.
- ☒ Review the instrument logbook for recorded problems and comments.
- ☒ Save instrument control settings before starting the procedure.
- ☒ Perform a general inspection of the system for cleanliness.
- ☒ Check for proper installation of parts, assemblies, sensors etc.
- ☒ Check system for required installation of components and implementation of Service Notes
- ☒ Check for required firmware/software updates and verify with customers if they would like them installed.
- ☐ For HF application systems, if standard sample introduction system was not installed, ask the customer to install it. [p.18](#)
- ☒ Ask the customer to remove any samples from the ICP-OES sample introduction area, auto sampler or around the ICP-OES.

## Preventive Maintenance Procedures

### Record Pre-PM instrument performance

- ☒ Run Instrument Performance test.
- ☒ Record results in Instrument Performance Test Results Table – Pre-PM.

### Clean and inspect ICP-OES system

- ☒ Look for any obvious external damage or problems.
- ☒ Inspect water cooling hoses, gas lines and power cord for excessive wear or damage.
- ☒ Perform a general internal inspection of the system for excessive dust accumulation, clean if necessary.
- ☒ Inspect sample introduction components and record any required maintenance in the Service Engineer Comments and notify the customer as the required actions required.
- ☒ Record the instrument operating conditions in the ICP-OES Status Results Table.
- ☒ Replace the polychromator purge filter.
- ☒ Replace the radial pre-optics window
- ☒ Replace the axial pre-optics window for SVDV and VDV instruments.
- ☒ Check exhaust flow for the correct positive extraction at the exhaust duct to insure they meet minimum specifications.
- ☒ Replace air inlet dust filter.
- ☐ Replace high capacity air inlet dust filter element if installed. <sup>N18</sup>
- ☒ Remove and clean instrument water inlet filter.

### Agilent Water Recirculator

- ☐ **Service not applicable**
- ☒ Drain cooling fluid and remove any particles from the chiller reservoir
- ☒ Remove, clean and reinstall water inlet metal mesh filter if present.
- ☒ Re fill with Agilent Cool Clear cooling fluid.
- ☒ Clean the cooling system Air filter and the condenser.

### SPS 3 Auto Sampler

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

### SPS 4 Auto sampler

- ☒ **Service not applicable**
- ☐ Clean the spill tray, rack location mat, end frames and chassis with a damp soft cloth and diluted mild detergent.
- ☐ Clean the auto sampler cover panels, if cover kit is installed, with domestic window cleaner.
- ☐ Check the X-axis and Z-axis drive belts for cracks, splits, damaged teeth, excessive fraying, color changes or degradation from fumes.
- ☐ Check the X-axis, Theta-axis and Z-axis FFC cables for cracks, incorrect positioning, damaged edges or damaged connectors.
- ☐ Pump Tubing Replacement. Replace peristaltic pump tubing. Replace all tubing that goes from the rinse station to the pump and from the pump to the waste/rinse bottles
- ☐ Test using customer's tray and move the sample probe to the sample vial 1, wash vial and rinse port and ensure that the probe is centered in the vial. If not use calibration wizard and calibrate the position.

### AVS 4, 6, 7 Advanced Valve System

- ☒ **Service not applicable**
- ☐ Replace valve rotor seal
- ☐ Check fittings for signs of leaks
- ☐ Check tubing including autosampler tubing for kinks or excessive wear
- ☐ Check high flow pump for signs of leaks

### ICP-OES adjustment

- ☒ Check position of Zn peak, adjust if required.
- ☒ Check Argon Ratio, adjust to specified value if required.
- ☒ Perform Detector Calibration.
- ☒ Perform Instrument Calibration.

### Record Post-PM instrument performance

- ☒ Run Instrument Performance test.
- ☒ Record results in Instrument Performance Test Results Table - Post PM.
- ☒ For systems using ICP Expert version 7.3 and above, run the following Instrument tests
  - ☒ Subsystem Communications Test
  - ☒ Air Flow
  - ☒ Water Flow
  - ☒ Gas Flows
  - ☒ RF Generator
  - ☒ Camera Test
  - ☒ Optics Test
  - ☒ Nebulizer Test
- ☒ Record the result in the Instrument Test Results Table

### Restore Instrument

- ☐ For HF applications, ask the customer to reinstall their sample introduction system. <sup>N18</sup>
- ☒ Leave system in an idle state: on and purging.
- ☒ Guidance: If the PM service is performed prior to a qualification service, then use the qualification procedure as a guide for final instrument set up and checkout.

### Service Review

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



## Test Results

## Instrument Performance Test Results Table

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

	Pre PM Sensitivity Check		Post PM Sensitivity Check	
	Radial	Axial *	Radial	Axial*
Zn 213.857 nm SRBR	1500.7	2213.4	1124.9	6969.9
Mn 257.610 nm SRBR	2915.0	7492.1	13017.9	31127.6
Al 396.152 nm SBR	9.9	10.7	9.7	21.1
K 766.491 nm SBR	5.7	28.1	4.8	45.3

\* Axial result is not applicable for G8016AA, G8012AA Radial View instruments.

## Instrument Test Results Table

Note: The Instrument Test results are for systems using ICP Expert version 7.3 and above only.

Instrument Test	Result
Subsystem Communications Test	Pass
Air Flow	Pass
Water Flow	Pass
Gas Flows	Pass
RF Generator	Pass
Camera Test	Pass
Optics Test	Pass
Nebulizer test	Pass

## ICP-OES Status Results Table

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

Measurement	Standby Mode	Plasma On
Mains Voltage	231.417 VAC	226.971 VAC
Mains Current	0.031 A	0.105 A
Instrument Temperature	22.1 °C	23.5 °C
RF Air Flow (sensor speed)	14.0 Hz	19.0 Hz
Plasma Exhaust Temperature	No measurement	63.6 °C
Water Flow Oscillator	No measurement	1.34 L/min
Water Flow Detector	0.96 L/min	0.61 L/min
Water Inlet Temperature	19.7 °C	19.7 °C
Polychromator Temperature	35.0 °C	35.0 °C
CCD Temperature	-40.1 °C	-39.8 °C
Thermal Stabilizer	35.0 °C	35.0 °C
Argon Supply Pressure	648.92 kPa	591.55 kPa
Purge Gas Supply Pressure*1	646.66 kPa	612.41 kPa
Option Gas Supply Pressure*1	— kPa	— kPa
Nebulizer Flow	No measurement	0.70 L/min
Nebulizer Back Pressure	No measurement	128.43 kPa
Plasma Gas Flow	No measurement	11.91 L/min
Auxiliary Gas Flow	No measurement	1.00 L/min
RF Power	No measurement	1204.7 W
RF Supply Current	No measurement	7.658 A
RF Supply Voltage	No measurement	204.417 V

\*1 If option installed

## Consumed PM Parts

Part Description	Part Number	Product or Model# where used	Quantity consumed
Axial Pre-Optic Window	G8010-68014	G8010A, G8011A, G8014A/G8015A	1
Radial Pre-Optic Window	G8010-68015	All	1
Agilent Cool Clear Coolant Fluid	5799-0037	Agilent Water Recirculator	—
Purge Gas Filter	G8010-60136	All	1
Air inlet filter	G8000-68002	All	1
High Capacity Air Filter	G8010-60189	Optional	—
Rotor seal for 6-7 port valve for AVS6/7	G8494-60002	G8494A/G8495	—
Rotor seal for 4 port valve for AVS4	G8493-60002	G8493A	—
Rinse solution to rinse station 2.5mm id x 1m	G8410-80123	SPS 4	—
Barb connector 2.5mm-1.5mm ID	G8410-80124	SPS 4	—
PVC waste tubing, 8mm od x 5mm id, 2m	G8410-80122	SPS 4	—
Additional Parts may be required from engineer's stock:			
X axis drive belt	5410047500	SPS 3	—
Z axis drive belt	5410047400	SPS 3	—
Peristaltic pump tubing, PVC SolvaFlex, 3 bridged,	3710049000	SPS 4	—

Consumed Parts Reference  
(Purchased by customer, not included as part of PM)

Section Not Applicable.

Part Description	Part Number	Product or Model# where used	Quantity consumed

## Signature Page

## Service Engineer Comments (optional)

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

## Service Verification

Service Request Number:

6007197100

Service Engineer Name:

Kenya S.

Service Engineer Signature:

Kenya S.

Total number of pages in this document:

14

Date Service Completed:

04 Nov 2024

Customer Name:

Aphorn Onkong

Customer Signature:

Aphorn Onkong

Report Summary	
Instrument Model	Agilent 5100/5110 VDV ICP-OES
Instrument ID	G8011A/G8015A
Instrument Serial Number	MY18030001
Software Version	7.3.1.9507
Firmware Version	3442
Tested By	Pre Test_PM_Kanyakorn S.
Test Completed On	11/4/2024 9:19:10 AM
Result Summary	
Subsystem Communications Test	Skipped
Air Flow Test	Skipped
Water Flow Test	Skipped
Gas Flows Test	Skipped
RF Generator Test	Skipped
Camera Test	Skipped
Optics Test	Skipped
Advanced Valve System Test	Skipped
Resolution Test	Pass
Sensitivity Test	Fail
Precision Test	Pass

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Resolution Test			Pass
Element Wavelength	Specification	Width	
N (174.213 nm)	≤ 9.40	6.98	
As (188.980 nm)	≤ 8.20	6.17	
C (193.027 nm)	≤ 11.50	8.30	
Mo (202.032 nm)	≤ 8.20	6.38	
Cr (206.158 nm)	≤ 13.40	8.98	
Zn (213.857 nm)	≤ 8.70	6.60	
Pb (220.353 nm)	≤ 9.50	7.09	
Co (228.615 nm)	≤ 17.20	11.67	
Ba (230.424 nm)	≤ 9.40	7.20	
Mn (257.610 nm)	≤ 13.30	9.43	
Mn (260.568 nm)	≤ 20.30	14.11	
Cr (267.716 nm)	≤ 11.00	8.04	
Cu (324.754 nm)	≤ 25.00	18.97	
Cu (327.395 nm)	≤ 14.20	11.23	
Sr (338.071 nm)	≤ 33.50	24.30	
Ba (455.403 nm)	≤ 44.00	33.47	
Sr (460.733 nm)	≤ 36.00	17.23	
Ba (493.408 nm)	≤ 36.00	25.37	
Ba (614.171 nm)	≤ 42.00	25.54	
Ar (675.283 nm)	≤ 74.00	56.51	
K (766.491 nm)	≤ 80.00	65.86	

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Sensitivity Test			Fail		
Radial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 46.0	SRBR	104.1	793.0	50.8
Se (196.026 nm)	≥ 41.0	SRBR	87.6	862.0	79.7
Zn (213.857 nm)	≥ 1421.0	SRBR	1500.8	41823.3	749.0
Pb (220.353 nm)	≥ 46.0	SRBR	170.7	2432.0	174.9
Mn (257.610 nm)	≥ 3518.0	SRBR	3915.0	264700.2	4420.0
Al (396.152 nm)	≥ 3.4	SBR	7.7	48454.6	5563.2
Ba (493.408 nm)	≥ 34.0	SBR	45.9	1966719.7	41903.8
K (766.491 nm)	≥ 1.8	SBR	5.7	99038.2	14687.7
Axial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 208.0	SRBR	126.5	1498.8	119.0
Se (196.026 nm)	≥ 159.0	SRBR	112.0	1773.6	197.8
Zn (206.200 nm)	≥ 234.0	SRBR	466.0	6784.2	199.7
Zn (213.857 nm)	≥ 1743.0	SRBR	2217.4	95597.6	1789.7
Cd (214.439 nm)	≥ 4227.0	SRBR	1919.3	68724.6	1236.4
Pb (220.353 nm)	≥ 320.0	SRBR	332.6	7929.5	499.0
Mn (257.610 nm)	≥ 10625.0	SRBR	7492.2	991238.3	16911.7
Cr (267.716 nm)	≥ 1048.0	SRBR	2254.6	129706.6	3150.9
Cu (324.754 nm)	≥ 19.0	SBR	26.9	290746.3	10407.5
Al (396.152 nm)	≥ 6.0	SBR	10.7	211329.2	18005.0
Ba (493.408 nm)	≥ 60.0	SBR	49.3	6956460.4	138336.9
K (766.491 nm)	≥ 24.0	SBR	28.1	1395190.2	47996.2

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เอกสารไม่ควบคุม

Precision Test		Pass
Radial		
Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 2.60	0.73
Se (196.026 nm)	≤ 2.60	0.95
Zn (213.857 nm)	≤ 1.50	0.31
Pb (220.353 nm)	≤ 2.60	0.73
Mn (257.610 nm)	≤ 1.50	0.39
Al (396.152 nm)	≤ 1.50	0.39
Ba (493.408 nm)	≤ 1.50	0.87
K (766.491 nm)	≤ 1.50	0.32
Axial		
Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 1.50	1.21
Se (196.026 nm)	≤ 1.50	0.84
Zn (206.200 nm)	≤ 1.50	0.56
Zn (213.857 nm)	≤ 1.50	0.96
Cd (214.439 nm)	≤ 1.50	0.26
Pb (220.353 nm)	≤ 1.50	0.51
Mn (257.610 nm)	≤ 1.50	0.97
Cr (267.716 nm)	≤ 1.50	0.22
Cu (324.754 nm)	≤ 1.50	0.24
Al (396.152 nm)	≤ 1.50	0.33
Ba (493.408 nm)	≤ 1.50	0.40
K (766.491 nm)	≤ 1.50	0.65

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เอกสารไม่ควบคุม

Report Summary		
Instrument Model	Agilent 5100/5110 VDV ICP-OES	
Instrument ID	G8011A/G8015A	
Instrument Serial Number	MY18030001	
Software Version	7.3.1.9507	
File Name	3442	
Tested By	Post Test_PM_Kanyakorn S.	
Test Completed On	11/4/2024 11:07:24 AM	
Result Summary		
Subsystem Communications Test		Pass
Air Flow Test		Skipped
Water Flow Test		Skipped
Gas Flows Test		Skipped
RF Generator Test		Skipped
Camera Test		Skipped
Optics Test		Pass
Advanced Valve System Test		Skipped
Resolution Test		Pass
Sensitivity Test		Fail
Precision Test		Pass
Subsystem Communications Test		Pass
Optics Test		Pass
	Radial	Axial
Intensity	3184054	3177175
Wavelength	737.212	737.212

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เอกสารไม่ควบคุม

Resolution Test		Pass
Element Wavelength	Specification	Width
N (174.213 nm)	≤ 9.40	6.97
As (188.980 nm)	≤ 8.20	6.14
C (193.027 nm)	≤ 11.50	8.33
Mo (202.032 nm)	≤ 8.20	6.33
Cr (206.133 nm)	≤ 13.40	9.06
Zn (213.637 nm)	≤ 8.70	6.70
Pb (220.353 nm)	≤ 9.50	7.03
Co (228.615 nm)	≤ 17.20	11.72
Ba (230.424 nm)	≤ 9.40	7.32
Mn (257.610 nm)	≤ 13.30	9.44
Mn (260.568 nm)	≤ 20.30	14.21
Cr (267.716 nm)	≤ 11.00	7.94
Cu (324.754 nm)	≤ 25.00	18.99
Cu (327.395 nm)	≤ 14.20	11.27
Sr (338.071 nm)	≤ 33.50	24.40
Ba (455.403 nm)	≤ 44.00	33.50
Sr (460.733 nm)	≤ 36.00	17.31
Ba (493.408 nm)	≤ 36.00	25.44
Ba (614.171 nm)	≤ 42.00	25.18
Ar (675.283 nm)	≤ 74.00	56.15
K (766.491 nm)	≤ 80.00	65.56

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เอกสารไม่ควบคุม

Sensitivity Test			Fail		
Radial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 46.0	SRBR	130.6	977.1	50.4
Se (196.026 nm)	≥ 41.0	SRBR	106.0	958.7	70.2
Zn (213.857 nm)	≥ 1421.0	SRBR	4124.8	44037.7	113.4
Pb (220.353 nm)	≥ 46.0	SRBR	207.2	2554.7	136.2
Mn (257.610 nm)	≥ 3518.0	SRBR	13017.8	271846.6	434.7
Al (396.152 nm)	≥ 3.4	SBR	9.7	50615.5	4717.0
Ba (493.408 nm)	≥ 34.0	SBR	133.7	2069203.0	15359.3
K (766.491 nm)	≥ 1.8	SBR	4.8	100199.5	17235.5
Axial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 208.0	SRBR	174.9	1566.7	73.0
Se (196.026 nm)	≥ 159.0	SRBR	167.0	1863.4	110.2
Zn (206.200 nm)	≥ 234.0	SRBR	740.9	6836.0	83.1
Zn (213.857 nm)	≥ 1743.0	SRBR	6965.9	101568.1	211.7
Cd (214.439 nm)	≥ 4227.0	SRBR	5781.0	72852.9	158.1
Pb (220.353 nm)	≥ 320.0	SRBR	501.0	8464.3	267.7
Mn (257.610 nm)	≥ 10625.0	SRBR	31121.6	1006637.8	1044.0
Cr (267.716 nm)	≥ 1048.0	SRBR	4424.8	132202.9	880.8
Cu (324.754 nm)	≥ 19.0	SBR	68.7	302907.8	4345.6
Al (396.152 nm)	≥ 6.0	SBR	21.1	218771.0	9892.3
Ba (493.408 nm)	≥ 60.0	SBR	250.6	7137380.9	28367.3
K (766.491 nm)	≥ 24.0	SBR	45.3	1435050.6	31025.0

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เอกสารไม่ควบคุม

Precision Test		Pass
Radial		
Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 2.60	0.81
Se (196.026 nm)	≤ 2.60	0.98
Zn (213.857 nm)	≤ 1.50	0.22
Pb (220.353 nm)	≤ 2.60	0.37
Mn (257.610 nm)	≤ 1.50	0.27
Al (396.152 nm)	≤ 1.50	0.25
Ba (493.408 nm)	≤ 1.50	0.53
K (766.491 nm)	≤ 1.50	0.15
Axial		
Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 1.50	0.81
Se (196.026 nm)	≤ 1.50	0.65
Zn (206.200 nm)	≤ 1.50	0.79
Zn (213.857 nm)	≤ 1.50	0.81
Cd (214.439 nm)	≤ 1.50	0.35
Pb (220.353 nm)	≤ 1.50	0.33
Mn (257.610 nm)	≤ 1.50	1.02
Cr (267.716 nm)	≤ 1.50	0.32
Cu (324.754 nm)	≤ 1.50	0.51
Al (396.152 nm)	≤ 1.50	0.37
Ba (493.408 nm)	≤ 1.50	0.68
K (766.491 nm)	≤ 1.50	0.74

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เอกสารไม่ควบคุม



Report Summary		
Instrument Model	Agilent 5100/5110 VDV ICP-OES	
Instrument ID	G8011A/G8015A	
Instrument Serial Number	MY18030001	
Software Version	7.3.1.9507	
Firmware Version	3442	
Tested By	Post Test_PM_Kanyakorn S.	
Test Completed On	11/4/2024 11:30:15 AM	
Result Summary		
Subsystem Communications Test		Pass
Air Flow Test		Pass
Water Flow Test		Pass
Gas Flows Test		Pass
RF Generator Test		Pass
Camera Test		Pass
Optics Test		Skipped
Advanced Valve System Test		Skipped
Resolution Test		Skipped
Sensitivity Test		Skipped
Precision Test		Skipped
Subsystem Communications Test		Pass
Air Flow Test		Pass
30% Air Flow (relative speed)	75% Air Flow (relative speed)	
15.00	19.00	
Water Flow Test		Pass
RF Water Flow(L/min)	Camera Water Flow (L/min)	Water Inlet Temperature (°C)
1.30	0.81	20.55

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เอกสารไม่ควบคุม

Gas Flows Test			Pass		
Nebulizer Target Flow	Actual Flow	Back Pressure	Auxiliary Target Flow	Actual Flow	Back Pressure
0.70	0.70	154.65	2.00	2.00	110.92
Makeup Target Flow	Actual Flow	Back Pressure	Plasma Target Flow	Actual Flow	Back Pressure
2.00	2.00	115.38	18.00	17.97	21.48
RF Generator Test			Pass		
RF Power Supply Test		Passed			
RF Power Supply (V)		128.554			
RF Oscillator Test		Passed			
RF Oscillator Frequency (MHz)		25.834			
Work Coil Current (A)		44.660			
RF Power Supply Current (A)		1.999			
Camera Test			Pass		
	Integration Time (ms)	Standard Deviation	Status		
Electronic Offset Test	1000	5.228	Passed		
Dark Current Test	6000	1.168	Passed		
Array Test	5	0.024	Passed		
Linearity Test		0.118	Passed		

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เอกสารไม่ควบคุม

Report Summary		
Instrument Model	Agilent 5100/5110 VDV ICP-OES	
Instrument ID	G8011A/G8015A	
Instrument Serial Number	MY18030001	
Software Version	7.3.1.9507	
Firmware Version	3442	
Tested By	change mirror	
Test Completed On	11/6/2024 10:35:26 AM	
Result Summary		
Subsystem Communications Test		Skipped
Air Flow Test		Skipped
Water Flow Test		Skipped
Gas Flows Test		Skipped
RF Generator Test		Skipped
Camera Test		Skipped
Optics Test		Skipped
Advanced Valve System Test		Skipped
Resolution Test		Pass
Sensitivity Test		Pass
Precision Test		Pass

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เอกสารไม่ควบคุม

Resolution Test		
Pass		
Element Wavelength	Specification	Width
N (174.213 nm)	≤ 9.40	6.79
As (188.980 nm)	≤ 8.20	5.80
C (193.027 nm)	≤ 11.50	8.15
Mo (202.032 nm)	≤ 8.20	5.90
Cr (206.158 nm)	≤ 13.40	8.85
Zn (213.857 nm)	≤ 8.70	6.77
Pb (220.353 nm)	≤ 9.50	6.61
Co (228.615 nm)	≤ 17.20	11.79
Ba (230.424 nm)	≤ 9.40	7.25
Mn (257.610 nm)	≤ 13.30	9.47
Mn (260.568 nm)	≤ 20.30	14.50
Cr (267.716 nm)	≤ 11.00	7.91
Cu (324.754 nm)	≤ 25.00	18.72
Cu (327.395 nm)	≤ 14.20	11.09
Sr (338.071 nm)	≤ 33.50	25.39
Ba (455.403 nm)	≤ 44.00	33.09
Sr (460.793 nm)	≤ 36.00	18.54
Ba (493.408 nm)	≤ 36.00	25.74
Ba (614.171 nm)	≤ 42.00	25.23
Ar (675.283 nm)	≤ 74.00	58.92
K (766.491 nm)	≤ 80.00	63.16

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เอกสารไม่ควบคุม

Sensitivity Test					
Pass					
Radial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 46.0	SRBR	110.5	868.9	54.3
Se (196.026 nm)	≥ 41.0	SRBR	88.3	934.7	91.3
Zn (213.857 nm)	≥ 1421.0	SRBR	3535.4	44017.7	153.9
Pb (220.353 nm)	≥ 46.0	SRBR	184.5	2492.3	159.8
Mn (257.610 nm)	≥ 3518.0	SRBR	11099.6	249595.3	503.6
Al (396.152 nm)	≥ 3.4	SBR	8.7	50274.4	5172.0
Ba (493.408 nm)	≥ 34.0	SBR	124.5	1903164.1	15186.0
K (766.491 nm)	≥ 1.8	SBR	6.9	110041.4	13991.2
Axial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 208.0	SRBR	253.3	3744.3	196.3
Se (196.026 nm)	≥ 159.0	SRBR	206.7	4199.7	347.2
Zn (206.200 nm)	≥ 234.0	SRBR	923.0	12282.3	172.1
Zn (213.857 nm)	≥ 1743.0	SRBR	6398.3	157551.5	601.7
Cd (214.439 nm)	≥ 4227.0	SRBR	5069.2	99873.7	385.2
Pb (220.353 nm)	≥ 320.0	SRBR	389.0	10641.1	658.6
Mn (257.610 nm)	≥ 10625.0	SRBR	21190.4	985528.7	2153.6
Cr (267.716 nm)	≥ 1048.0	SRBR	3054.1	131797.6	1811.5
Cu (324.754 nm)	≥ 19.0	SBR	36.3	301401.4	8082.9
Al (396.152 nm)	≥ 6.0	SBR	10.8	228359.5	19280.5
Ba (493.408 nm)	≥ 60.0	SBR	106.5	6460421.5	60122.8
K (766.491 nm)	≥ 24.0	SBR	30.2	1639840.6	52562.1

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เอกสารไม่ควบคุม

Precision Test		
Pass		
Radial		
Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 2.60	1.56
Se (196.026 nm)	≤ 2.60	1.16
Zn (213.857 nm)	≤ 1.50	0.50
Pb (220.353 nm)	≤ 2.60	0.74
Mn (257.610 nm)	≤ 1.50	0.63
Al (396.152 nm)	≤ 1.50	0.54
Ba (493.408 nm)	≤ 1.50	0.78
K (766.491 nm)	≤ 1.60	0.44
Axial		
Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 1.50	0.82
Se (196.026 nm)	≤ 1.50	0.82
Zn (206.200 nm)	≤ 1.50	0.35
Zn (213.857 nm)	≤ 1.50	0.34
Cd (214.439 nm)	≤ 1.50	0.44
Pb (220.353 nm)	≤ 1.50	0.48
Mn (257.610 nm)	≤ 1.50	0.83
Cr (267.716 nm)	≤ 1.50	0.53
Cu (324.754 nm)	≤ 1.50	0.69
Al (396.152 nm)	≤ 1.50	0.56
Ba (493.408 nm)	≤ 1.50	1.29
K (766.491 nm)	≤ 1.50	0.74

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เอกสารไม่ควบคุม

# UNITED ANALYST AND ENGINEERING CONSULTANT COMPANY Ltd.

Automatic Mercury Analyzer

Model RA-4500

Preventive Maintenance Report

Serial No. : 17780278

Soft version : Ver 2.0.7

ROM version : Ver 2.0.1

Date : 09 July 2024

PM by : Pradit M. )

Approved by : Kitichai S. )



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

เอกสารไม่ควบคุม

## Inspection result

ITEM	STANDARD	RESULT	JUDGE
1. Self Check			
1.1 Heating		PASS	OK
1.2 Cooling		PASS	OK
1.3 Leak		PASS	OK
1.4 Optical system		PASS	OK
1.5 Drift		PASS	OK
2. Analytical curve inspection(AREA)			
2.1 No Pretreatment (Low Conc.)	Correlation coefficient (r) ≥ 0.9990	0.9999	OK
3. Repeatability(AREA)			
3.1 No Pretreatment 100ppb, n=3		1. 99.60 ppb 2. 101.84 ppb 3. 101.22 ppb C.V. ≤ 5% 1.15%	OK
4. Blank	Below 1.0 (AREA)	0.1002	OK

เอกสารไม่ควบคุม

Counter

Maintenance

MATH

IC

Counter

Parameter

Measurement Count

2017102-06-08

Clear

F1 Subst(0:2000h)

0x00m24-07-08

Clear

Memory Exhaust Filter Amount(mg)(1500mg)

102-08-08

Clear

F2 Subst(0:2000h)

0x01m24-07-08

Clear

Lamp Active Time(2000h)

1h13m24-07-08

Clear

F3 Subst(0:2000h)

0x00m24-07-08

Clear

Membrane Filter Usage Time(2000h)

0h50m24-07-08

Clear

F4 Subst(0:2000h)

0x00m24-07-08

Clear

Main Pump Subst(750h)

0h53m24-07-08

Clear

F5 Subst(0:2000h)

0x00m24-07-08

Clear

Heating Lamp Time

580h23m22-08-08

Clear

F6 Subst(0:2000h)

0x00m24-07-08

Clear

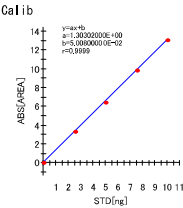
F7 Subst(0:2000h)

0x00m24-07-08

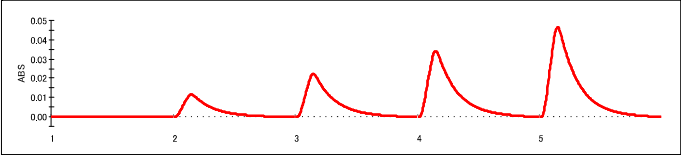
Clear

Exit

Title : Preventive Maintenance RA-4500 sn:17780278  
Date : 2024-07-09  
Name : Coax Group  
Memo : Calibration Curve 0-10ng



No.	STD [ppb]	SVOL [mL]	CVOL [mL]	DVOL [mL]	STD [ng]	AREA [ON]	MEAS [ng]	Dev [%]	Note
1	100.000	0.000	5.000	5.000	0.000	0.0846	0.0265	-	
2	100.000	0.025	5.000	5.000	2.500	3.3464	2.5298	1.2	
3	100.000	0.050	5.000	5.000	5.000	6.4170	4.8863	2.3	
4	100.000	0.075	5.000	5.000	7.500	9.8647	7.5322	0.4	
5	100.000	0.100	5.000	5.000	10.000	13.1132	10.0253	0.3	



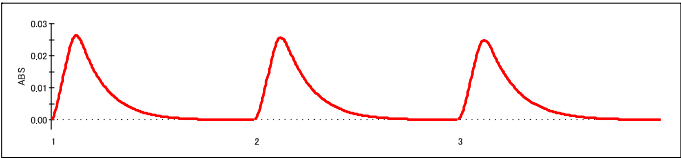
No.	NAME	SVOL [mL]	CVOL [mL]	DVOL [mL]	AREA [ON]	MEAS [ng]	CONC [ug/L]	Note
1	100ppb	0.050	5.000	5.000	6.5389	4.9798	99.60	
2	100ppb	0.050	5.000	5.000	6.6848	5.0918	101.84	
3	100ppb	0.050	5.000	5.000	6.6446	5.0610	101.22	

No.	NAME	TRY	AV [ug/L]	SD [ug/L]	Cv [%]
1	100ppb	3	100.887	1.15660	1.15

เอกสารไม่ควบคุม

-1-

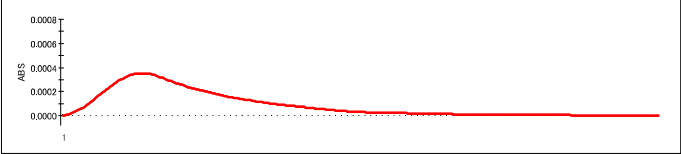
เอกสารไม่ควบคุม



Self Check  
Heat check:PASS!! ( 26.3degC[05:00] -> 30.3degC[02:29])  
Sensor check:PASS!! ( 53-10= 43)  
Leak check:PASS!! (0.19L/min)  
Sig/Ref check:PASS!! (Sig:4.00V, Ref:4.02V)  
Drift check:PASS!! ( 0.000061 - -0.0000179 = 0.0000240)

Title : Preventive Maintenance RA-4500 sn:17780278  
Date : 2024-07-09  
Name : Coax Group  
Memo : Blank

No.	NAME	SVOL [mL]	CVOL [mL]	DVOL [mL]	AREA [ON]	MEAS [ng]	CONC [ug/L]	Note
1	Blank DI				0.1002	0.0385		



-2-

เอกสารไม่ควบคุม



-3-

เอกสารไม่ควบคุม







Service Report

TO	FOR
Company: United Analyst and Engineering Consultant Co., Ltd. _ Bangkok-HQ Address: 700/2 หมู่ที่ 1 Phrakhanong District, Bangkok, 10260	Work Order Number: WO-00018067 Contact: Kamphong Boonpuang Email: kamphong.b@uaeconsultant.co.th Tel: +66 2763 2828 (7021), +66 8 6347 7390

WORK ORDER INFORMATION			
Top-Level		Order Type	Preventive Maintenance
Installed Product ID	IB-00105024	Billing Type	Paid
Product	SKALAR SAN++ Classic 2SAN59000	PO No.	SSPR2400629
Serial No.	182688	Warranty No.	
		Contract No.	

PRODUCTS SERVICED		
Installed Product Id	Serial Number	Product

PROBLEM DESCRIPTION	
PM 1/1	

Line Number	Engineer	Start Date And Time	End Date And Time	Billable Labor Hour	Billable Travel Hour	Travel KM
WL-00071161	Yongyuth Chanphong	02/20/2024 8:53 AM	02/20/2024 6:07 PM	9,23333		
WL-00092966	Ronnarit Dechnawarat	02/20/2024 8:53 AM	02/20/2024 6:07 PM	9,23333		
Total				18,46666	0	0

! Reach us at DKSH Service-Hotline : +66 2 639 7000  
2533 Sukhumvit Road, Bangchak, 10260, Phrakhanong, Bangkok, Thailand  
Phone +66 2 639 7000 Fax +66 2 333 1026

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เอกสารไม่ควบคุม Page 1 of 2



Line Number	Work Description
WL-00071161	ท่า PM เรียบร้อย
WL-00092966	ท่า PM เรียบร้อย

PARTS CONSUMED		
Part No	Part Description	Quantity

EXPENSES			
Part No	Expense Type	Description	Line Quantity

RECOMMENDED PARTS	
แนะนำอะไหล่ที่ต้องสั่งซื้อเพิ่มเติมดังนี้ , อะไหล่ พาราไมเตอร์ Ammonia จำนวน 2 รายการ (9220, 3026) , อะไหล่ พาราไมเตอร์ Phenol และ Cyanide จำนวน 6 รายการ (5454, 3028, 3031, 3034, 3036, 3150)	

REMARKS
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Travel Time Disclaimer:  
Please note that the travel time in this report only includes time taken to reach the installed equipment location. It does not include our engineer's return travel time.

Customer Signature:	Technician: Yongyuth Chanphong Job Title: Service Manager Email: yongyuth.yc@dksh.com
	
Customer Signature	
Date: 04/10/2024	

! Reach us at DKSH Service-Hotline : +66 2 639 7000  
2533 Sukhumvit Road, Bangchak, 10260, Phrakhanong, Bangkok, Thailand  
Phone +66 2 639 7000 Fax +66 2 333 1026

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เอกสารไม่ควบคุม Page 2 of 2



Job No. WO-00018067

Test Report

Customers	United Analyst and Engineering Consultant Co., Ltd.		
Equipment	Continuous Flow Analyzer	Manufacturer	SKALAR
Controller Mdel	SA5000	Auto Sample Model	SA1052
Controller Serial No.	182688	Auto Sample Serial No.	181729
Date of test	20-Feb-2024	Period	12 Month
Environment temperature	24.7 °C	Humidity	62.2 %RH

Results

Instrument Checked		Before		After		Remark
Item	Characteristic					
1	Visual inspect	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	
2	Power supply (210 - 240 VAC)	220	VAC	220	VAC	
3	Computer	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	
4	Program	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	
5	Auto sampler	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	
6	Module holder					
	- Motor pump	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	
	- Pump tube	<input type="checkbox"/> Pass	<input checked="" type="checkbox"/> Fail	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	*
	- Air-injection	<input type="checkbox"/> Pass	<input checked="" type="checkbox"/> Fail	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	*
	- Chemistry manifolds, Switching valve, Coil, Membrane	<input type="checkbox"/> Pass	<input checked="" type="checkbox"/> Fail	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	**,**
7	Detector					
	- Filter	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	
	- Flow cell	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	
	- Lamp	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	
8	Interface	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	
9	Rinsing valves	<input type="checkbox"/> Pass	<input checked="" type="checkbox"/> Fail	<input type="checkbox"/> Pass	<input checked="" type="checkbox"/> Fail	N/A
10	Temperature / Reactor	<input type="checkbox"/> Pass	<input checked="" type="checkbox"/> Fail	<input type="checkbox"/> Pass	<input checked="" type="checkbox"/> Fail	N/A
11	Flame photometer	<input type="checkbox"/> Pass	<input checked="" type="checkbox"/> Fail	<input type="checkbox"/> Pass	<input checked="" type="checkbox"/> Fail	N/A
12	UPS / Stabilizer	<input type="checkbox"/> Pass	<input checked="" type="checkbox"/> Fail	<input type="checkbox"/> Pass	<input checked="" type="checkbox"/> Fail	N/A

Warning and Error Checked			
Item	Event	Before	After
13	Error list	<input type="checkbox"/> None <input type="checkbox"/> Appear : _____	<input type="checkbox"/> None <input type="checkbox"/> Appear : _____

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Check with Standard				
Item	Characteristic	Before	After	Remark
14	Base Line Test	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A	
15	Detector Signal Test	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A	

Summary of checked  
☒ The instrument can work normally and efficiently. (เครื่องมือวัดสามารถทำงานได้ปกติและประสิทธิภาพ)  
☐ The instrument can work but it's requiring to maintenance. (เครื่องมือวัดสามารถทำงานได้แต่ต้องบำรุงรักษา)  
☐ The instrument could not work it's requiring to repair. (เครื่องมือวัดไม่สามารถทำงานได้แต่ต้องการซ่อมบำรุง)

Remark :

\* Pump tube และ Air tube เริ่มเสื่อมสภาพ ได้เปลี่ยนอะไหล่ทั้งหมดแล้วตามระยะเวลาใช้งาน  
\*\* อะไหล่ 9220 (Manifold T, SiS needle) ขาดไม่สามารถซ่อมได้ และได้เปลี่ยนมาใช้ 5216 ทดแทนชั่วคราว  
\*\*\* อะไหล่ 5454 (Nipple polyethylene N5) เสีย ได้ทำการเปลี่ยนใหม่แล้ว

หมายเหตุ แนะนำอะไหล่ที่ควรสั่งซื้อเพิ่มเติม  
1. อะไหล่ พาราไมเตอร์ Ammonia จำนวน 2 รายการ (9220, 3026)  
2. อะไหล่ พาราไมเตอร์ Phenol และ Cyanide จำนวน 6 รายการ (5454, 3028, 3031, 3034, 3036, 3150)

Standard Equipment Used		
Equipment	Equipment I.D.	
Digital multi meter	S/N 57600592	Due date : 8-Jul-2024
Thermo hygrometer	S/N 39520444	Due date : 27-Dec-2024

Test By : 	Approved by : 
( Mr. Yongyuth Chanphong )	( Mr. Eknasong Wankliang )
Position : Supervisor, Technical Service	Position : Manager, Technical Services

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DQEServices

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

  
MBC-T80-710 11225  
CALIBRATION DATA

CERTIFICATE OF CALIBRATION

Certificate No. : SP24-001Page 1 of 5

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

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

Location of calibration : Laboratory 213

Equipment : UV-Vis Spectrophotometer

Manufacturer : Hitachi

Model : U-2900

Serial No. : 21E22-009

ID No. : UAE.WAT.051/2564


Received Date : 4 January 2024

Calibration Date : 4 January 2024


Issue Date : 5 January 2024

Condition Instrument : Good

Calibrated by :

  
( Mr.Tanawut Rittidach )  
Technical Manager

Approved by :

  
( Ms.Chonthicha Sangngern )  
Quality Manager

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


THE (IN)CAPABILITY OF THE LABORATORY AND ITS UNCAPABILITY 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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MBC-T80-710 11225  
CALIBRATION DATA

REPORT OF CALIBRATION

Certificate No. : SP24-001Page 2 of 5

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

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

Certified Reference Materials :

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

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

Spectral Band Width of UUC : 1.5 nm.

Scan Speed of UUC : 200 nm/min

Scan Interval of UUC : 0.1 nm.


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

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FM-708-02 R01 1/11/2021

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MBC-T80-710 11225  
CALIBRATION DATA

REPORT OF CALIBRATION

Certificate No. : SP24-001Page 3 of 5

Calibration Results : Without adjustment

Photometric Accuracy :


Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
420	0.0000	0.000	0.0000	0.0028	2.00
	0.5780	0.575	0.0030	0.0031	2.00
	1.0484	1.045	0.0034	0.0029	2.00
	2.1876	2.192	-0.0044	0.0080	2.00
440	0.0000	0.000	0.0000	0.0028	2.00
	0.5595	0.558	0.0015	0.0034	2.00
	1.0239	1.023	0.0009	0.0035	2.00
	2.1230	2.125	-0.0020	0.0079	2.00
465	0.0000	0.000	0.0000	0.0028	2.00
	0.5230	0.520	0.0030	0.0030	2.00
	0.9633	0.961	0.0023	0.0029	2.00
	1.9753	1.975	0.0003	0.0070	2.00
546.1	0.0000	0.000	0.0000	0.0028	2.00
	0.5181	0.516	0.0021	0.0031	2.00
	1.0002	0.997	0.0032	0.0033	2.00
	1.9973	1.993	0.0043	0.0084	2.00
590	0.0000	0.000	0.0000	0.0028	2.00
	0.5517	0.550	0.0017	0.0030	2.00
	1.0803	1.079	0.0013	0.0030	2.00
	2.0373	2.032	0.0053	0.0080	2.00
635	0.0000	0.000	0.0000	0.0028	2.00
	0.5591	0.558	0.0011	0.0031	2.00
	1.0518	1.050	0.0018	0.0030	2.00
	1.9274	1.923	0.0044	0.0079	2.00

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CALIBRATION DATA

REPORT OF CALIBRATION

Certificate No. : SP24-001Page 4 of 5

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000	0.000	0.0000	0.0050	2.00
	0.7469	0.743	0.0039	0.0057	2.00
257	0.0000	0.000	0.0000	0.0050	2.00
	0.8674	0.862	0.0054	0.0059	2.00
313	0.0000	0.000	0.0000	0.0050	2.00
	0.2919	0.289	0.0029	0.0051	2.00
350	0.0000	0.000	0.0000	0.0050	2.00
	0.6430	0.641	0.0020	0.0055	2.00

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FM-708-02 R01 1/11/2021





## REPORT OF CALIBRATION

Certificate No. : SP24-001

Page 5 of 5

## Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor k
241.72	241.2	0.52	0.18	2.00
279.45	279.0	0.45	0.18	2.00
287.81	287.4	0.41	0.18	2.00
334.06	333.8	0.26	0.18	2.00
360.93	360.6	0.33	0.18	2.00
418.59	418.4	0.19	0.18	2.00
445.94	445.8	0.14	0.18	2.00
453.66	453.4	0.26	0.18	2.00
460.02	459.8	0.22	0.18	2.00
536.59	536.4	0.19	0.18	2.00
637.98	638.0	-0.02	0.18	2.00
431.38	431.2	0.18	0.18	2.00
472.50	472.5	0.00	0.18	2.00
513.47	513.4	0.07	0.18	2.00
528.88	528.9	-0.02	0.18	2.00
573.17	573.4	-0.23	0.18	2.00
585.35	585.2	0.15	0.20	2.00
684.40	684.4	0.00	0.18	2.00
740.72	741.0	-0.28	0.20	2.00
748.55	748.8	-0.25	0.18	2.00
807.03	807.1	-0.07	0.18	2.00
879.28	879.5	-0.22	0.18	2.00

Remark : - UUC = Unit Under Calibration

- N/A = Not Available

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

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

- \* Indicates non TISI accredited

- End of Certificate -

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FM-708-02 R01 1/11/2021



## CERTIFICATE OF CALIBRATION

Certificate No. : SP24-008

Page 1 of 5

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

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

Location of calibration : Laboratory 315

Equipment : UV-Vis Spectrophotometer

Manufacturer : Hitachi

Model : U-1900

Serial No. : 2021-064

ID No. : UAE.WAS.006/2552

Received Date : 16 January 2024

Calibration Date : 16 January 2024

Issue Date : 19 January 2024

Condition Instrument : Good

Calibrated by :

(Mr.Tanawut Rittidach)

Technical Manager

Approved by :

(Ms.Chonthicha Sangngern)

Quality Manager

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

The measurement capability of the laboratory and its traceability to recognized national standards used 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



## REPORT OF CALIBRATION

Certificate No. : SP24-008

Page 2 of 5

Environment Condition : Ambient Temperature  $25 \pm 5$  °CRelative humidity  $55 \pm 20$  %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 : 4.0 nm.

Scan Speed of UUC : 200 nm/min

Scan Interval of UUC : 0.1 nm.

Resolution of UUC : Photometric 0.001 Abs.

Wavelength 0.1 nm.

เอกสารไม่ควบคุม

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## REPORT OF CALIBRATION

Certificate No. : SP24-008

Page 3 of 5

Calibration Results : Without adjustment

## Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
420	0.0000	0.000	0.0000	0.0028	2.00
	0.5780	0.575	0.0030	0.0031	2.00
	1.0484	1.046	0.0024	0.0029	2.00
	2.1876	2.186	0.0016	0.0080	2.00
440	0.0000	0.000	0.0000	0.0028	2.00
	0.5595	0.558	0.0015	0.0034	2.00
	1.0239	1.024	-0.0001	0.0035	2.00
	2.1230	2.121	0.0020	0.0079	2.00
465	0.0000	0.000	0.0000	0.0028	2.00
	0.5230	0.520	0.0030	0.0030	2.00
	0.9633	0.961	0.0023	0.0029	2.00
	1.9753	1.975	0.0003	0.0070	2.00
546.1	0.0000	0.000	0.0000	0.0028	2.00
	0.5181	0.516	0.0021	0.0031	2.00
	1.0002	0.999	0.0012	0.0033	2.00
	1.9973	1.994	0.0033	0.0084	2.00
590	0.0000	0.000	0.0000	0.0028	2.00
	0.5517	0.550	0.0017	0.0030	2.00
	1.0803	1.080	0.0003	0.0030	2.00
	2.0373	2.032	0.0053	0.0080	2.00
635	0.0000	0.000	0.0000	0.0028	2.00
	0.5591	0.558	0.0011	0.0031	2.00
	1.0518	1.051	0.0008	0.0030	2.00
	1.9274	1.923	0.0044	0.0079	2.00

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FM-708-02 R01 1/11/2021

## REPORT OF CALIBRATION

Certificate No. : SP24-008

Page 4 of 5

## Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000 0.7469	0.000 0.748	0.0000 -0.0011	0.0050 0.0057	2.00 2.00
257	0.0000 0.8674	0.000 0.865	0.0000 0.0024	0.0050 0.0059	2.00 2.00
313	0.0000 0.2919	0.000 0.293	0.0000 -0.0011	0.0050 0.0051	2.00 2.00
350	0.0000 0.6430	0.000 0.641	0.0000 0.0020	0.0050 0.0055	2.00 2.00

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FM-708-02 R01 1/11/2021

## REPORT OF CALIBRATION

Certificate No. : SP24-008

Page 5 of 5

## Wavelength Accuracy :

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

Remark : - UUC = Unit Under Calibration

- N/A = Not Available

- The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor k, which for a normal distribution corresponds to a coverage probability of approximately 95%

- \* Indicates non TISI accredited

- End of Certificate -

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FM-708-02 R01 1/11/2021

## CERTIFICATE OF CALIBRATION

Certificate No. : SP25-001

Page 1 of 5

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

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

Location of calibration : Laboratory 213

Equipment : UV-Vis Spectrophotometer

Manufacturer : Hitachi

Model : U-2900

Serial No. : 21E22-009

ID No. : UAE.WAT.051/2564

Received Date : 3 January 2025

Calibration Date : 3 January 2025

Issue Date : 8 January 2025

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 consent of DQE Services Co., Ltd.

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FM-708-02 R01 1/11/2021

## REPORT OF CALIBRATION

Certificate No. : SP25-001

Page 2 of 5

Environment Condition : Ambient Temperature  $25 \pm 5$  °CRelative humidity  $55 \pm 20$  %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.

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021

DQE Services Co.,Ltd.

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DQE Services

ISO 17025:2017  
CALIBRATION DATA

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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FM-708-02 R01 1/11/2021

DQE Services Co.,Ltd.

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

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

DQE Services

ISO 17025:2017  
CALIBRATION DATA

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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DQE Services

ISO 17025:2017  
CALIBRATION DATA

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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FM-708-02 R01 1/11/2021

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 -

PerkinElmer

For the Better

PinAAcle 900F

Preventive Maintenance Report

Company Name:UAE Consultant Co., LTD.

Instrument Location: 41 Sukumvit Rd.,  
Phra Khanong, Bangkok 10260

Instrument Serial No.:PFBS20031902

Date:14-May-2024


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เอกสารไม่ควบคุม



# 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:	PF8520031902	PM Number:	2 of 2
Customer Name (if applicable):	K. Yainda	Telephone Number:	095-5580049
Customer Support Engineer Name:	K. Chayanan	Service Order Number:	WO-02787590
Date PM Performed: (DD-MM-YYYY)	14-May-2024	Next PM Due Date: (DD-MM-YYYY)	14-Nov-2024
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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# Component List

Component / Specific Model	Serial #	Configuration Notes
PinAAcle900F	PF8520031902	Syngistix V.4.0.1.1935
Fias100(New Install)	100524040501	

# Parts Lists

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

# 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	27-39CUV1	Apr 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 <sub>3</sub>	250 mL	AR	AR

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# Procedure Checklist

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

## 1. General:

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

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## 7. Flame Interlock Check:

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

Parameter	Specification	Test Results	Pass/Fail
Flame Sensor	Air/C <sub>2</sub> H <sub>2</sub> Flame correctly shuts down	Active	Passed
Drain Sensor	Air/C <sub>2</sub> H <sub>2</sub> Flame correctly shuts down	Active	Passed
Nebulizer Sensor	Air/C <sub>2</sub> H <sub>2</sub> Flame correctly shuts down	Active	Passed
C <sub>2</sub> H <sub>2</sub> Pressure Sensor	Air/C <sub>2</sub> H <sub>2</sub> Flame correctly shuts down	Active	Passed
Air Pressure Sensor	Air/C <sub>2</sub> H <sub>2</sub> 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.	0.9995	1.0143	Passed
0.2 A ND Filter	± 5% from Cert.	0.1936	0.1966	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	0.002	Passed

### 8.3 AA Baseline Noise with Copper

Description: Check baseline noise.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.001	0.0002	Passed

## 8.4 D<sub>2</sub> Background Compensation with Copper

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

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.010	0.0001	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	0.002	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	0.0022	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.	0.8005	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.

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## 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:	Date:
<i>Chayaman K.</i>	14-May-2024 (DD-MM-YYYY)
Authorized Customer Representative:	Date:
<i>สุวิทย์ หงษ์</i>	14-May-2024 (DD-MM-YYYY)

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**TPI POLENE PUBLIC CO.,LTD.**  
**CEMENT QUALITY DEPARTMENT**  
**PRODUCT CONTROL 3 SECTION (ENVIRONMENTAL)**  
**CERTIFICATE OF CALIBRATION**

NO. 033/67

PAGE 1/1

INSTRUMENT NAME : WORKING AREA DUST SAMPLER

INSTRUMENT CODE : Q1300 / 01 / 023 / 008

MODEL : GILAIR - 5RP

SERIAL NO : 20041202016

PARAMETER RANGE : 1 - 3 L / MIN

CAL DATE : 24 / JUL / 2024

NEXT DUE TIME : 24/ JAN / 2025

STRANDARD USED :

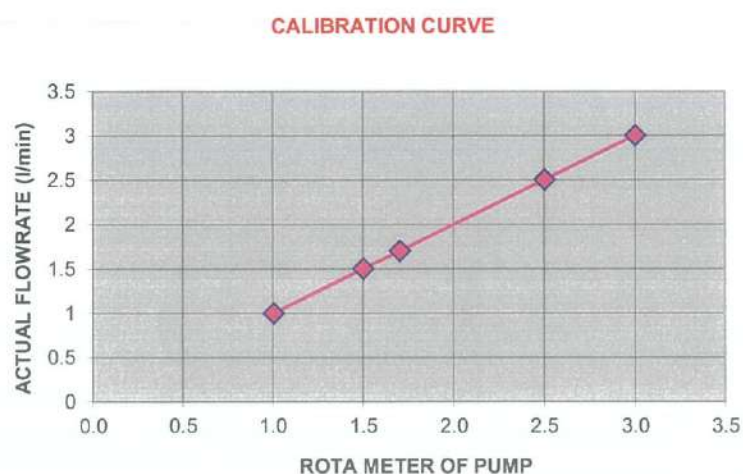
AMBIENT CONDITIONS :

PRIMARY FLOW STANDARD (WET CELL)

TEMPERATURE ( °C ) : 25 °C

CALIBRATION DATA :

ROTA METER OF PUMP	ACTUAL FLOWRATE (l/min)				DEVIATION (l/min)	PERMISSIBLE DEVIATION (l/min)	PASS / NOT PASS
	1	2	3	AVERAGE			
1	1.004	1.006	1.008	1.006	0.006	$\pm 0.03$	PASS
1.5	1.503	1.506	1.501	1.503	0.003	$\pm 0.03$	PASS
1.7	1.708	1.706	1.704	1.706	0.006	$\pm 0.03$	PASS
2.5	2.507	2.502	2.504	2.504	0.004	$\pm 0.03$	PASS
3	3.005	3.001	3.007	3.004	0.004	$\pm 0.03$	PASS



CAL BY :

(TECHNICIAN)

24 / 07 / 24

CHECKED BY :

(ENGINEER / SUPERVISOR)

24 JUL 2567

APPROVED BY :

(SECTION MANAGER)

24 / 07 / 24



### 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	CADMIUM CHROMIUM HEXAVALENT COPPER IRON LEAD MANGANESE NICKEL ZINC	Agilent Technologies	AA240FS / MY13160001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	24 Jan 24	23 Jan 25
2	Atomic Absorption Spectrometer	ARSENIC SELENIUM	Perkin Elmer	PinAAcle 900F / PFB20031902	Perkin Elmer Co.,Ltd.	WO-02787590	14 May 24	13 May 25
3	Analytical Balance	FAT OIL AND GREASE	Mettler Toledo	AB204-S/FACT / 1129361010	Technology Promotion Association (Thailand-Japan)	24MM292	11 May 24	10 May 25
4	Analytical Balance	TOTAL DISSOLVED SOLIDS	Mettler Toledo	XSR205DU / C210685394	National Food Institute,Ministry of Industry, Thailand	2402283-002-01	2 Apr 24	1 Apr 25
5	Analytical Balance	TOTAL SUSPENDED SOLIDS	Mettler Toledo	XSR205DU / C009071872	National Food Institute,Ministry of Industry, Thailand	2402283-001-01	2 Apr 24	1 Apr 25
6	DO Meter	BIOCHEMICAL OXYGEN DEMAND	YSI	5100 / 11B 101863	Technology Promotion Association (Thailand-Japan)	24TW39	21 Feb 24	20 Feb 25
7	Mercury Analyzer	MERCURY	NIC. Japan	RA-4500 / 17780278	Coax Group Corporation Ltd.	Preventive Maintenance Report	9 Jul 24	8 Jul 25
8	Hot Air Oven	TOTAL SUSPENDED SOLIDS	Memmert	UF55 / B212.0411	Technology Promotion Association (Thailand-Japan)	24TM589	1 Apr 24	31 Mar 25
9	Cooled Incubator	TOTAL COLIFORM BACTERIA	Binder	KB400 / WTB20200000015535	Technology Promotion Association (Thailand-Japan)	24TM647	1 Apr 24	31 Mar 25
10	Inductively Coupled Plasma- Optical Emission Spectrometer(ICP-OES)	BARIUM SODIUM ADSORPTION RATIO TITANIUM	Agilent Technologies, USA	5110 VDV(G8015AA) / MY8030001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	13 Nov 23	12 Nov 24

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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*
11	SCT Meter	CONDUCTIVITY (umhos/cm) SALINITY	YSI Environmental	Pro 30 / 17B101802	Technology Promotion Association (Thailand-Japan)	24CH823	11 Jul 24	9 Jul 25
12	UV-VIS Spectrophotometer	NITRATE NITROGEN SULPHATE	Hitachi	U-2900 / 21E22-009	DQE Services Co.,Ltd.	SP24-001	4 Jan 24	3 Jan 25
13	Turbidity Meter (Portable)	TURBIDITY (NTU)	Oakton Instruments(China)	T100IR / 1120501017	Technology Promotion Association (Thailand-Japan)	23CH1148	15 Sep 23	13 Sep 24

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

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2	Atomic Absorption Spectrometer	ARSENIC SELENIUM	Perkin Elmer	PinAAde 900F / PFB20031902	Perkin Elmer Co.,Ltd.	WO-02787590	14 May 24	13 May 25
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6	DO Meter	BIOCHEMICAL OXYGEN DEMAND	YSI	5100 / 11B 101863	Technology Promotion Association (Thailand-Japan)	24TW39	21 Feb 24	20 Feb 25
7	Mercury Analyzer	MERCURY	NIC. Japan	RA-4500 / 17780278	Coax Group Corporation Ltd.	Preventive Maintenance Report	9 Jul 24	8 Jul 25
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10	pH Meter	pH	Horiba	LAQUA-PH210 / HA0D0082	technology promotion association (thailand-japan)	24CH727	19 Jun 24	17 Jun 25

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7	Mercury Analyzer	MERCURY	NIC. Japan	RA-4500 / 17780278	Coax Group Corporation Ltd.	Preventive Maintenance Report	9 Jul 24	8 Jul 25
8	Hot Air Oven	TOTAL SUSPENDED SOLIDS	Memmert	UF55 / B212,0411	Technology Promotion Association (Thailand-Japan)	24TM589	1 Apr 24	31 Mar 25
9	Inductively Coupled Plasma- Optical Emission Spectrometer(ICP-OES)	BARIUM SODIUM ADSORPTION RATIO TITANIUM	Agilent Technologies, USA	5110 VDV(G8015AA) / MY8030001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	13 Nov 23	12 Nov 24
10	pH Meter	pH	Horiba	LAQUA-PH210 / HA0D0082	technology promotion association (thailand-japan	24CH727	19 Jun 24	17 Jun 25

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	SCT Meter	CONDUCTIVITY (umhos/cm) SALINITY	YSI Environmental	Pro 30 / 17B101802	Technology Promotion Association (Thailand-Japan)	24CH823	11 Jul 24	9 Jul 25
12	UV-VIS Spectrophotometer	NITRATE NITROGEN SULPHATE	Hitachi	U-2900 / 21E22-009	DQE Services Co.,Ltd.	SP24-001	4 Jan 24	3 Jan 25
13	Turbidity Meter (Portable)	TURBIDITY (NTU)	Oakton Instruments(China)	T100IR / 1120501017	Technology Promotion Association (Thailand-Japan)	23CH1148	15 Sep 23	13 Sep 24

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*
1	Atomic Absorption Spectrometer	CADMIUM COPPER LEAD MANGANESE NICKEL TOTAL IRON ZINC	Agilent Technologies	AA240FS / MY13160001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	24 Jan 24	23 Jan 25
2	Atomic Absorption Spectrometer	ARSENIC MERCURY SELENIUM	Perkin Elmer	PinAAde 900F / PFB20031902	Perkin Elmer Co.,Ltd.	WO-02787590	14 May 24	13 May 25
3	Analytical Balance	FAT OIL AND GREASE	Mettler Toledo	AB204-S/FACT / 1129361010	Technology Promotion Association (Thailand-Japan)	24MM292	11 May 24	10 May 25
4	Analytical Balance	TOTAL DISSOLVED SOLIDS	Mettler Toledo	XSR205DU / C210685394	National Food Institute,Ministry of Industry, Thailand	2402283-002-01	2 Apr 24	1 Apr 25
5	Analytical Balance	TOTAL SUSPENDED SOLIDS	Mettler Toledo	XSR205DU / C009071872	National Food Institute,Ministry of Industry, Thailand	2402283-001-01	2 Apr 24	1 Apr 25
6	DO Meter	BIOCHEMICAL OXYGEN DEMAND	YSI	5100 / 11B 101863	Technology Promotion Association (Thailand-Japan)	24TW39	21 Feb 24	20 Feb 25
7	Hot Air Oven	TOTAL SUSPENDED SOLIDS	Memmert	UF55 / B212.0411	Technology Promotion Association (Thailand-Japan)	24TM589	1 Apr 24	31 Mar 25
8	Incubator	TOTAL COLIFORM BACTERIA	Binder	KB400 / 20220000000391	Technology Promotion Association (Thailand-Japan)	24TM884	7 Jun 24	6 Jun 25
9	Inductively Coupled Plasma- Optical Emission Spectrometer(ICP-OES)	BARIIUM SODIUM SODIUM ADSORPTION RATIO TITANIUM	Agilent Technologies, USA	5110 VDV(G8015AA) / MY8030001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	13 Nov 23	12 Nov 24

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*
10	pH Meter	pH	Horiba	LAQUA-PH210 / HA0A0005	technology promotion association (thailand-japan)	24CH39	10 Jan 24	8 Jan 25
11	SCT Meter	CONDUCTIVITY (umhos/cm)	YSI Environmental	Pro 30 / 17B101801	Technology Promotion Association (Thailand-Japan)	24CH718	19 Jun 24	17 Jun 25
12	UV-VIS Spectrophotometer	NITRATE NITROGEN SULPHATE	Hitachi	U-2900 / 21E22-009	DQE Services Co.,Ltd.	SP24-001	4 Jan 24	3 Jan 25
13	Turbidity Meter (Portable)	TURBIDITY (NTU)	Oakton Instruments(China)	T100IR / 1120501017	Technology Promotion Association (Thailand-Japan)	24CH1115	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*
1	Atomic Absorption Spectrometer	CADMIUM COPPER LEAD MANGANESE MERCURY NICKEL TOTAL IRON ZINC	Agilent Technologies	AA240FS / MY13160001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	24 Jan 24	23 Jan 25
2	Atomic Absorption Spectrometer	ARSENIC SELENIUM	Perkin Elmer	PinAAcle 900F / PFB20031902	Perkin Elmer Co.,Ltd.	WO-02787590	14 May 24	13 May 25
3	Analytical Balance	FAT OIL AND GREASE	Mettler Toledo	AB204-S/FACT / 1129361010	Technology Promotion Association (Thailand-Japan)	24MM292	11 May 24	10 May 25
4	Analytical Balance	TOTAL DISSOLVED SOLIDS	Mettler Toledo	XSR205DU / C210685394	National Food Institute,Ministry of Industry, Thailand	2402283-002-01	2 Apr 24	1 Apr 25
5	BOD Incubator	BIOCHEMICAL OXYGEN DEMAND	ARCO	UR-1320 / -	Technology Promotion Association (Thailand-Japan)	24TM587	1 Apr 24	31 Mar 25
6	DO Meter	DO	Horiba	LAQUA-DO210 / HE9M0021	Technology Promotion Association (Thailand-Japan)	24TW128	19 Jun 24	17 Jun 25
7	DO Meter	BIOCHEMICAL OXYGEN DEMAND	YSI	5100 / 11B 101863	Technology Promotion Association (Thailand-Japan)	24TW39	21 Feb 24	20 Feb 25
8	SCT Meter	SALINITY	Horiba	LAQUA-EC210 / HC9L0012	Technology Promotion Association (Thailand-Japan)	24CH321	12 Mar 24	10 Mar 25
9	Hot Air Oven	TOTAL DISSOLVED SOLIDS	Memmert	UF55 / B212,0411	Technology Promotion Association (Thailand-Japan)	24TM589	1 Apr 24	31 Mar 25
10	Incubator	TOTAL COLIFORM BACTERIA	Binder	KB400 / 20220000000391	Technology Promotion Association (Thailand-Japan)	24TM884	7 Jun 24	6 Jun 25

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	Inductively Coupled Plasma- Optical Emission Spectrometer(ICP-OES)	BARIUM SODIUM SODIUM ADSORPTION RATIO TITANIUM	Agilent Technologies, USA	5110 VDV(G8015AA) / MY8030001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	13 Nov 23	12 Nov 24
12	pH Meter	pH	Horiba	LAQUA-PH210 / HA9M0047	technology promotion association (thailand-japan)	24CH400	3 Apr 24	1 Apr 25
13	UV-VIS Spectrophotometer	NITRATE NITROGEN SULPHATE	Hitachi	U-2900 / 21E22-009	DQE Services Co.,Ltd.	SP24-001	4 Jan 24	3 Jan 25
14	Turbidity Meter (Portable)	TURBIDITY (NTU)	Oakton Instruments(China)	T100IR / 1120501017	Technology Promotion Association (Thailand-Japan)	24CH1115	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*
1	Atomic Absorption Spectrometer	CADMIUM CHROMIUM TRIVALENT COPPER LEAD MANGANESE MERCURY NICKEL TOTAL IRON ZINC	Agilent Technologies	AA240FS / MY13160001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	24 Jan 24	23 Jan 25
2	Atomic Absorption Spectrometer	ARSENIC SELENIUM	Perkin Elmer	PinAAcle 900F / PFB20031902	Perkin Elmer Co.,Ltd.	WO-02787590	14 May 24	13 May 25
3	Analytical Balance	FAT OIL AND GREASE	Mettler Toledo	AB204-S/FACT / 1129361010	Technology Promotion Association (Thailand-Japan)	24MM292	11 May 24	10 May 25
4	Analytical Balance	TOTAL DISSOLVED SOLIDS TOTAL SUSPENDED SOLIDS	Mettler Toledo	XSR205DU / C009071872	National Food Institute,Ministry of Industry, Thailand	2402283-001-01	2 Apr 24	1 Apr 25
5	Continuous Flow Analyzer(CFA)	CYANIDE	Skalar Analytical B.V., the Netherlands	San++5000-02 / 182688	DKSH (Thailand) Ltd.	Service Report/Test Report WO-00018067	20 Feb 24	19 Feb 25
6	DO METER	DO	Horiba	LAQUA-DO210 / HE0L0004	Technology Promotion Association (Thailand-Japan)	23TW263	14 Dec 23	10 Dec 24
7	DO Meter	BIOCHEMICAL OXYGEN DEMAND	YSI	5100 / 11B 101863	Technology Promotion Association (Thailand-Japan)	24TW39	21 Feb 24	20 Feb 25
8	Digestion Units	TOTAL KJELDAHL NITROGEN	Foss Tecator	2520 Auto / 91794469	National Food Institute Ministry of Industry, Thailand	2402957-001-02	23 May 24	22 May 25

**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*
9	Gas Chromatography	a-BHC ALDRIN b-BHC d-BHC DIELDRIN ENDOSULFAN I ENDOSULFAN II ENDOSULFAN SULFATE ENDRIN ENDRIN ALDEHYDE g-BHC HEPTACHLOR HEPTACHLOR EPOXIDE pp-DDD pp-DDE pp-DDT	Agilent	GC 7890A / CN11021007	Agilent Technologies (Thailand) Co.,Ltd.	Certificate of System Qualification GC-OQ	21 Feb 24	19 Feb 25
10	Hot Air Oven	TOTAL DISSOLVED SOLIDS	Memmert	UF55 / B212,0411	Technology Promotion Association (Thailand-Japan)	24TM589	1 Apr 24	31 Mar 25
11	Cooled Incubator	TOTAL COLIFORM BACTERIA	Binder	KB400 / WTB20200000015535	Technology Promotion Association (Thailand-Japan)	24TM647	1 Apr 24	31 Mar 25
12	Inductively Coupled Plasma- Optical Emission Spectrometer(ICP-OES)	BARIIUM SODIUM SODIUM ADSORPTION RATIO TITANIUM	Agilent Technologies, USA	5110 VDV(G8015AA) / MY8030001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	4 Nov 24	3 Nov 25
13	Kjeltec System Distilling Unit	TOTAL KJELDAHL NITROGEN	Foss Tecator (Labtec)	KT200 / 91790524	FOSS South East Asia	9810	8 Feb 24	7 Feb 25
14	Kjeltec Distillation Unit	TOTAL KJELDAHL NITROGEN	FOSS	Kjeltec 8100 / 91889052	FOSS South East Asia	9807	8 Feb 24	7 Feb 25

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*
15	pH Meter	pH	Horiba	LAQUA-PH210 / HA9M0047	technology promotion association (thailand-japan	24CH400	3 Apr 24	1 Apr 25
16	SCT Meter	SALINITY	YSI Environmental	Pro 30 / 17A102921	Technology Promotion Association (Thailand-Japan)	24CH1158	18 Sep 24	16 Sep 25
17	UV-VIS Spectrophotometer	FORMALDEHYDE	Hitachi	U-1900 / 2021-J064	DQE Services Co.,Ltd.	SP24-008	16 Jan 24	15 Jan 25
18	UV-VIS Spectrophotometer	NITRATE NITROGEN SULPHATE	Hitachi	U-2900 / 21E22-009	DQE Services Co.,Ltd.	SP24-001	4 Jan 24	3 Jan 25
19	Turbidity Meter (Portable)	TURBIDITY (NTU)	Oakton Instruments(China)	T100IR / 1120501017	Technology Promotion Association (Thailand-Japan)	24CH1115	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*
1	Atomic Absorption Spectrometer	CADMIUM COPPER LEAD MANGANESE MERCURY NICKEL SELENIUM TOTAL IRON ZINC	Agilent Technologies	AA240FS / MY13160001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	24 Jan 24	23 Jan 25
2	Atomic Absorption Spectrometer	ARSENIC	Perkin Elmer	PinAAcle 900F / PFB20031902	Perkin Elmer Co.,Ltd.	WO-02787590	14 May 24	13 May 25
3	Analytical Balance	FAT OIL AND GREASE	Mettler Toledo	AB204-S/FACT / 1129361010	Technology Promotion Association (Thailand-Japan)	24MM292	11 May 24	10 May 25
4	Analytical Balance	TOTAL DISSOLVED SOLIDS	Mettler Toledo	XSR205DU / C210685394	National Food Institute,Ministry of Industry, Thailand	2402283-002-01	2 Apr 24	1 Apr 25
5	Analytical Balance	TOTAL SUSPENDED SOLIDS	Mettler Toledo	XSR205DU / C009071872	National Food Institute,Ministry of Industry, Thailand	2402283-001-01	2 Apr 24	1 Apr 25
6	DO Meter	BIOCHEMICAL OXYGEN DEMAND	YSI	5100 / 11B 101863	Technology Promotion Association (Thailand-Japan)	24TW39	21 Feb 24	20 Feb 25
7	Heating Block	CHEMICAL OXYGEN DEMAND	Hanna Instruments Italia Srl.	HI 839800-02 / H 018500 I	Hanna Instruments (Thailand) Ltd.	HIT-2412-0389	18 Mar 24	17 Mar 25
8	Hot Air Oven	TOTAL SUSPENDED SOLIDS	Memmert	UF55 / B212.0411	Technology Promotion Association (Thailand-Japan)	24TM589	1 Apr 24	31 Mar 25
9	Incubator	TOTAL COLIFORM BACTERIA	Binder	KB400 / 20220000000391	Technology Promotion Association (Thailand-Japan)	24TM884	7 Jun 24	6 Jun 25

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*
10	Inductively Coupled Plasma- Optical Emission Spectrometer(ICP-OES)	BARIUM SODIUM SODIUM ADSORPTION RATIO TITANIUM	Agilent Technologies, USA	5110 VDV(G8015AA) / MY8030001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	4 Nov 24	3 Nov 25
11	pH Meter	pH	YSI Environmental	pH 100A / JC03354	Technology Promotion Association (Thailand-Japan)	24CH1379	5 Nov 24	6 Nov 25
12	SCT Meter	CONDUCTIVITY (umhos/cm) SALINITY	YSI Environmental	Pro 30 / 17B101802	Technology Promotion Association (Thailand-Japan)	24CH823	11 Jul 24	9 Jul 25
13	UV-VIS Spectrophotometer	NITRATE NITROGEN SULPHATE	Hitachi	U-2900 / 21E22-009	DQE Services Co.,Ltd.	SP25-001	3 Jan 25	2 Jan 26
14	Turbidity Meter (Portable)	TURBIDITY (NTU)	Oakton Instruments(China)	T100IR / 1120501017	Technology Promotion Association (Thailand-Japan)	24CH1115	6 Sep 24	5 Sep 25

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





Cert.No.: 24CH39  
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## Certificate of Calibration

Equipment : pH Meter  
Manufacturer : Horiba  
Model : LAQUA-PH210  
Serial No. : HA0A0005  
ID No. : UAE EFM.004/2563(EFM.PH.04/63)  
Condition As-Received: Used Item  
Received Date : 09 January 2024  
Calibration Date : 10 January 2024  
Reference : 2401-0219WSC-2  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41 Sukhumvit Road,  
Bangchak, Phrakhanong, Bangkok 10260  
Ambient Temperature : (25 ± 2.5) °C  
Relative Humidity : (50 ± 15) %  
Calibration Procedure : In-house method :  
- CP-CH5 by direct measurement with standard  
voltage calibrator and direct measurement with  
certified reference material (CRM)  
- CP-CH6 by comparison with standard thermometer

Calibrated by : Warakorn Lemgagrakul

Approved by :

(✓) Saithip Meangmai  
( ) Warakorn Lemgagrakul  
( ) Ponpan Papim

Issue Date : 15 January 2024

The Uncertainties are for a confidence probability of approximately 95%

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Cert.No.: 24CH39  
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### Condition of this calibration result

#### 1. Reference Standard Instrument

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC116	23E2602	27 Aug 2024
2) Ref. Standard Thermometer	4982054	110RC044	23I908	26 July 2024

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

#### 2. Certified Reference Materials

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

Buffer Solution	Manufacturer	Lot No.	Exp date
pH 4.008	CPA chem	940102	27 Nov 2025
pH 6.986	CPA chem	931959	01 Oct 2024
pH 9.997	CPA chem	940106	02 Nov 2024

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

### Calibration Results

#### Function : mv Measurement

#### Performing standard curve by Fluke at pH (4.7)(7.10)

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (± mV)	Coverage factor k
			mV	pH		
pH Meter S/N : HA0A0005	4.00	177.48	177.4	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	-177.2	10.01	0.058	2.00

Saithip

a 1197727



Cert.No.: 24CH39  
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### 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: 9911.0051	4.008	4.02	155.5	0.0085	2.05
	6.986	7.00	-18.4	0.0093	2.00
	6.986	7.00	-18.2	0.011	2.00
	9.997	10.01	-189.0	0.0096	2.00

#### Function : Temperature Measurement

#### (\*) without adjustment

This equipment was connected with Temperature Probe;

Model : 9652  
- Serial No. : 9911.0051  
Dimension of probe:  
- Length : 103 mm  
- Diameter : 16 mm  
- Immersion Depth : 90 mm

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement (± °C)	Coverage factor k
25.0	25.002	25.0	-0.002	0.13	2.00
30.0	30.002	30.0	-0.002	0.13	2.00
35.0	35.003	34.9	-0.103	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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Saithip

a 1197726



Cert.No.: 24CH321  
Page: 1 of 3

## Certificate of Calibration

Equipment : Conductivity Meter  
Manufacturer : Horiba  
Model : LAQUA-EC210  
Serial No. : HC9L0012  
ID No. : UAE EFM.008/2563(EFM.SCT.02/63)  
Condition As-Received: Used Item  
Received Date : 12 March 2024  
Calibration Date : 14 March 2024  
Reference : 2403-0387WSC-1  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong, Bangkok 10260  
Ambient Temperature : (25 ± 2.5) °C  
Relative Humidity : (50 ± 15) %  
Calibration Procedure : In-house method :  
- CP-CH6 by direct measurement with  
certified reference material (CRM)  
- CP-CH8 by Comparison with temperature standard

Calibrated by : Warakorn Lemgagrakul

Approved by :

( ) Pomthippa Tameyakul  
( ) Unnopphol Harachai  
(✓) Saithip Meangmai

Issue Date : 15 March 2024

The Uncertainties are for a confidence probability of approximately 95%

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A 0064531



Cert.No.: 24CH321

Page.: 2 of 3

Condition of this result of calibration

## 1. Reference Standard instrument :-

Instrument	Serial No.	ID No.	Certificate No.	Due date
1) Thermometer	1963878	130RC085	231051	05 Sep 2024
2) Ref. Std Thermometer	4982054	110RC044	231908	26 July 2024

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

## 2. Certified Reference Materials :-

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

Conductivity Solution	Manufacturer	Lot No.	Exp. date
1413.0 µS/cm	CPA Chem	936624	19 Oct 2024
12.880 mS/cm	CPA Chem	931956	30 Sep 2024

- Control Conductivity calibration solution temperature by Water bath ( $25 \pm 0.1$  °C)

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

Calibration resultsFunction : Conductivity Measurement

(\*) After Adjustment at 1413.0 µS/cm

Conductivity Electrode Serial No.: 9B9F0276

Standard Conductivity Solution	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement (±)	Coverage factor k
1413.0 µS/cm	1340 µS/cm	1413 µS/cm	9.2 µS/cm	2.00
12.880 mS/cm	13.70 mS/cm	14.27 mS/cm	0.086 mS/cm	2.00

**Remark** : - UUC\* = Unit Under Calibration

Sailhip

a 1206345



Cert.No.: 24CH321

Page.: 3 of 3

Calibration ResultsFunction : Temperature Measurement

This equipment was connected with Temperature Probe,

- Model :	9383
- Serial No.	9B9F0276

Dimension of probe;

- Length :	110 mm
- Diameter :	10 mm
- Immersion Depth :	90 mm

Calibration Result : Without adjustment

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (± °C)	Coverage factor k
25.0	25.002	25.0	-0.002	0.13	2.00
30.0	30.001	30.0	-0.001	0.13	2.00
35.0	35.002	35.0	-0.003	0.13	2.00

**Remark** : - UUC\* = Unit Under Calibration

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

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Sailhip

a 1206346



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



Cert.No.: 24CH400

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## Certificate of Calibration

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 : 01 April 2024  
Calibration Date : 02 April 2024  
Reference : 2404-0037WSC-2  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangkok, Phraknanong, Bangkok 10260

Ambient Temperature : ( $25 \pm 2.5$  °C  
Relative Humidity : ( $50 \pm 15$  %  
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 Lemgagtrakul

Approved by :

Sailhip  
Approved Signatory

( ) Pornthippa Tameyakul  
( ) Unnopphol Harachai  
(✓) Sailhip Meangmai

Issue Date : 06 April 2024

The Uncertainties are for a confidence probability of approximately 95%

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A 0062140



Cert.No.: 24CH400

Page.: 2 of 3

Condition of this calibration result

## 1. Reference Standard instrument

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC116	23E2802	27 Aug 2024
2) Ref. Standard Thermometer	4982054	110RC044	231908	26 July 2024

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

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

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	940102	27 Nov 2025
pH 6.986	CPA chem	940104	02 Nov 2024
pH 9.997	CPA chem	940106	02 Nov 2024

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

Calibration ResultsFunction : mV Measurement

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

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (± mV)	Coverage factor k
			mV	pH		
pH Meter S/N: HA9M0047	4.00	177.48	177.3	4.01	0.058	2.00
	7.00	0.00	0.0	7.01	0.058	2.00
	7.00	0.00	0.0	7.01	0.058	2.00
	10.00	-177.48	-177.4	10.01	0.058	2.00

Sailhip

a 1209883



Cert.No.: 24CH400  
Page.: 3 of 3

#### Calibration Results

Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH Measurement ( $\pm$ )	Coverage factor $k$
pH Electrode S/N: -	4.008	4.01	171.6	0.0079	2.00
	6.986	6.99	-8.4	0.0099	2.00
	6.986	7.00	-9.6	0.011	2.00
	9.997	10.02	-173.8	0.0096	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 ( $^{\circ}\text{C}$ )	Standard Temperature ( $^{\circ}\text{C}$ )	UUC* Reading ( $^{\circ}\text{C}$ )	Error ( $^{\circ}\text{C}$ )	Uncertainty of measurement ( $\pm$ $^{\circ}\text{C}$ )	Coverage factor $k$
25.0	25.002	25.0	-0.002	0.13	2.00
30.0	30.002	30.0	-0.002	0.13	2.00
35.0	35.003	35.0	-0.003	0.13	2.00

Remark : UUC\* = Unit Under Calibration

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

-o0o-

Sathip

a 1209884



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 16, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL 0-2717-3000-29 FAX 0-2719-9484



## Certificate of Calibration

Cert.No.: 24CH718  
Page.: 1 of 3

Equipment : Conductivity Meter  
Manufacturer : YSI  
Model : Pro 30  
Serial No. : 17B101801  
ID No. : UAE.EFM.121/2560(ENV SCT.01/60)

Condition As-Received: Used Item  
Received Date : 18 June 2024  
Calibration Date : 19 June 2024  
Reference : 2406-0572WSC-1  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak Phraknangng Bangkok 10260

Ambient Temperature : (25  $\pm$  2.5)  $^{\circ}\text{C}$   
Relative Humidity : (50  $\pm$  15) %  
Calibration Procedure: in-house method ;  
- CP-CH6 by direct measurement  
with certified reference material. (CRM)  
- CP-CH8 by comparison with temperature standard

Calibrated by : Warakorn Lemgagrakul

Approved by :  
( ) Unnopphol Harachai  
( ) Ponpan Paipim  
(✓) Sathip Meangmai

Issue Date : 20 June 2024

The Uncertainties are for a confidence probability of approximately 95%

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Cert.No.: 24CH718  
Page.: 2 of 3

#### Condition of this result of calibration

1. Reference Standard Instrument :-

Instrument Serial No. ID No. Certificate No. Due date

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

2. Certified Reference Materials :-

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

Conductivity Solution	Manufacturer	Lot No.	Exp. date
1413.0 $\mu\text{S/cm}$	CPA Chem	940111	02 Nov 2024
12.880 $\text{mS/cm}$	CPA Chem	936625	19 Oct 2024

- Control Conductivity calibration solution temperature by Water bath (25  $\pm$  0.1)  $^{\circ}\text{C}$

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

#### Calibration results

Function : Conductivity Measurement

(\*) After Adjustment at 1413.0  $\mu\text{S/cm}$

Conductivity Electrode Serial No.: 17B100319

Standard Conductivity Solution	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement ( $\pm$ )	Coverage factor $k$
1413.0 $\mu\text{S/cm}$	1044 $\mu\text{S/cm}$	1412 $\mu\text{S/cm}$	9.2 $\mu\text{S/cm}$	2.00
12.880 $\text{mS/cm}$	9.33 $\text{mS/cm}$	12.64 $\text{mS/cm}$	0.086 $\text{mS/cm}$	2.00

Remark : - UUC\* = Unit Under Calibration



Cert.No.: 24CH718  
Page.: 3 of 3

#### Calibration Results

Function : Temperature Measurement

This equipment was connected with Temperature Probe.

Model : PRO 30 COND-T

Serial No. : 17B100319

Dimension of probe:

- Length : 7 mm

- Diameter : 2.5 mm

- Immersion Depth : 90 mm

Calibration Result : Without adjustment

Calibration Point ( $^{\circ}\text{C}$ )	Standard Temperature ( $^{\circ}\text{C}$ )	UUC* Reading ( $^{\circ}\text{C}$ )	Error ( $^{\circ}\text{C}$ )	Uncertainty of Measurement ( $\pm$ $^{\circ}\text{C}$ )	Coverage factor $k$
25.0	25.002	24.7	0.303	0.13	2.00
30.0	30.001	29.7	-0.301	0.13	2.00
35.0	35.002	34.7	-0.302	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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## Certificate of Calibration

Cert.No.: 24CH727  
Page.: 1 of 3

Equipment : pH Meter  
Manufacturer : Horiba  
Model : LAQUA-PH210  
Serial No. : HA0D0082  
ID No. : UAE.EFM.072/2564(EFM.pH.05/64)  
Condition As-Received: Used Item  
Received Date : 18 June 2024  
Calibration Date : 19 June 2024  
Reference : 2406-0570WSC-5  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road  
Bangchak, Phrakhanong, Bangkok 10260

Ambient Temperature : (25 ± 2.5) °C  
Relative Humidity : (50 ± 15) %  
Calibration Procedure : In-house method :  
- CP-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 Lengagrakul

Approved by :

*Saithip*  
Approved Signatory

( ) Unnopphol Harachai  
( ) Ponpan Paipim  
(✓) Saithip Meangmai

Issue Date : 20 June 2024

The Uncertainties are for a confidence probability of approximately 95%

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### Condition of this calibration result

#### 1. Reference Standard Instrument

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC116	23E2802	27 Aug 2024
2) Ref. Standard Thermometer	4962054	110RC044	23I908	26 July 2024

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

#### 2. Certified Reference Materials

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

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	970851	25 Apr 2026
pH 6.986	CPA chem	970852	25 Apr 2025
pH 9.997	CPA chem	970853	25 Apr 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	Coverage factor
	pH	mV	mV	pH	( mV )	k
pH Meter S/N.: HA0D0082	4.00	177.48	177.5	4.01	0.058	2.00
	7.00	0.00	0.2	7.00	0.058	2.00
	7.00	0.00	0.2	7.00	0.058	2.00
	10.00	-177.48	-177.0	10.01	0.058	2.00

Cert.No.: 24CH727  
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.: Q9AA0036	4.008	4.01	179.9	0.0079	2.00
	6.986	7.00	4.6	0.0099	2.00
	6.986	7.00	3.2	0.0093	2.00
	9.997	10.01	-171.2	0.0092	2.00

#### Function : Temperature Measurement

( \* ) Without adjustment

This equipment was connected with Temperature Probe.

- Model : 9652-10D

- Serial No. : Q9AA0036

Dimension of probe

- Length : 103 mm

- Diameter : 16 mm

- Immersion Depth : 80 mm

Calibration Point ( °C )	Standard Temperature ( °C )	UUC* Reading ( °C )	Error ( °C )	Uncertainty of measurement ( ± °C )	Coverage factor k
25.0	25.001	25.0	-0.001	0.13	2.00
30.0	30.004	30.0	-0.004	0.13	2.00
35.0	35.002	35.0	-0.002	0.13	2.00

Remark : - UUC\* = Unit Under Calibration

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

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## Certificate of Calibration

Cert.No.: 24CH823  
Page.: 1 of 3

Equipment : Conductivity Meter  
Manufacturer : YSI  
Model : Pro 30  
Serial No. : 17B101802  
ID No. : UAE.EFM.122/2560(ENV.SCT.02/60)  
Condition As-Received: Used Item  
Received Date : 09 July 2024  
Calibration Date : 11 July 2024  
Reference : 2407-0333WSC-1  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong, Bangkok 10260

Ambient Temperature : (25 ± 2.5) °C  
Relative Humidity : (50 ± 15) %  
Calibration Procedure : In-house method :  
- CP-CH6 by direct measurement with certified reference material (CRM)  
- CP-CH8 by comparison with temperature standard

Calibrated by : Warakorn Lengagrakul

Approved by :

*Saithip*  
Approved Signatory

( ) Unnopphol Harachai  
( ) Ponpan Paipim  
(✓) Saithip Meangmai

Issue Date : 11 July 2024

The Uncertainties are for a confidence probability of approximately 95%

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Cert.No.: 24CH823

Page.: 2 of 3

**Condition of this result of calibration**

## 1. Reference Standard Instrument :-

Instrument	Serial No.	ID No.	Certificate No.	Due date
1) Thermometer	1963878	130RC095	2311051	05 Sep 2024
2) Ref. Std. Thermometer	2188080	130RC044	2211285	20 Oct 2023

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

## 2. Certified Reference Materials :-

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

Conductivity Solution	Manufacturer	Lot No.	Exp. date
1413.0 $\mu$ S/cm	CPA Chem	940111	02 Nov 2024
12,880 mS/cm	CPA Chem	940112	02 Nov 2024

- Control Conductivity calibration solution temperature by Water bath ( $25 \pm 0.1$ ) °C

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

**Calibration results****Function : Conductivity Measurement**(\*) After Adjustment at 1413.0  $\mu$ S/cm

Conductivity Electrode Serial No.: 18L100008

Standard Conductivity Solution	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement ( $\pm$ )	Coverage factor k
1413.0 $\mu$ S/cm	1327 $\mu$ S/cm	1412 $\mu$ S/cm	9.2 $\mu$ S/cm	2.00
12,880 mS/cm	11.39 mS/cm	12.22 mS/cm	0.086 mS/cm	2.00

Remark : - UUC\* = Unit Under Calibration



Cert.No.: 24CH823

Page.: 3 of 3

**Calibration Results****Function : Temperature Measurement**

This equipment was connected with Temperature Probe;

- Model : PRO30 COND-T

- Serial No. : 18L100008

Dimension of probe;

- Length : 7 mm

- Diameter : 2.5 mm

- Immersion Depth : 90 mm

**Calibration Result : Without adjustment**

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement ( $\pm$ °C)	Coverage factor k
25.0	25.002	24.6	-0.402	0.13	2.00
30.0	30.002	29.6	-0.402	0.13	2.00
35.0	35.003	34.6	-0.403	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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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 : ( $25 \pm 2.5$ ) °C  
Relative Humidity : ( $50 \pm 20$ ) %  
Calibration Procedure : In - house method : CP-CH11  
Direct measurement by  
using Formazin standard solution  
Calibrated by : Walalak Sirithean  
Approved by :   
( ) Unnopphol Harachai  
( ) Ponpan Palpim  
(✓) Saithip Meangmai  
Issue Date : 9 September 2024

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Calibration and Testing Equipment Services.

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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-Hygograph	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 ( $\pm$ 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 %.

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## Certificate of Calibration

Cert.No.: 24CH1158  
Page.: 1 of 3

**Equipment :** Conductivity Meter  
**Manufacturer :** YSI  
**Model :** Pro30  
**Serial No. :** 17A102921  
**ID No. :** UAE.EFM.123/2560(ENV.SCT.03/60)  
**Condition As-Received:** Used Item  
**Received Date :** 17 September 2024  
**Calibration Date :** 18 September 2024  
**Reference :** 2409-0635WSC-2  
**Submitted by :** United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong, Bangkok 10260  
**Ambient Temperature :** (25 ± 2.5) °C  
**Relative Humidity :** (50 ± 15) %  
**Calibration Procedure:** In-house method :  
- CP-CH6 by direct measurement  
with certified reference material (CRM)  
- CP-CH8 by comparison with temperature standard  
**Calibrated by :** Warakorn Lemgagtrakul  
**Approved by :** \_\_\_\_\_  
( ) Unnoppol Harachai  
( ) Ponpan Paipim  
(✓) Saithip Meangmai  
**Issue Date :** 23 September 2024

The Uncertainties are for a confidence probability of approximately 95%

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

Cert.No.: 24CH1158

Page.: 2 of 3

### Condition of this result of calibration

1. Reference Standard Instrument :-

Instrument	Serial No.	ID No.	Certificate No.	Due date
1) Thermometer	9549224	130RC003	24426	24 Apr 2025
2) Ref. Std.Thermometer	2188080	130RC044	231216	10 Oct 2024

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

2. Certified Reference Materials :-

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

Conductivity Solution	Manufacturer	Lot No.	Exp. date
1412.9 µS/cm	CPA Chem	1005307	15 June 2025
12.880 mS/cm	CPA Chem	940112	02 Nov 2024

- Control Conductivity calibration solution temperature by Water bath (25 ± 0.1) °C

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

### Calibration results

Function : Conductivity Measurement

(\*) After Adjustment at 1412.9 µS/cm

Conductivity Electrode Serial No.: 17A100315

Standard Conductivity Solution	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement (±)	Coverage factor k
1412.9 µS/cm	1317 µS/cm	1414 µS/cm	9.2 µS/cm	2.00
12.880 mS/cm	10.60 mS/cm	11.99 mS/cm	0.086 mS/cm	2.00

Remark : - UUC\* = Unit Under Calibration

Cert.No.: 24CH1158  
Page.: 3 of 3

### Calibration Results

Function : Temperature Measurement

This equipment was connected with Temperature Probe;

- Model : PRO 30 COND-T  
- Serial No. : 17A100315

Dimension of probe;

- Length : 95 mm  
- Diameter : 2.5 mm  
- Immersion Depth : 90 mm

Calibration Result : Without adjustment

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (± °C)	Coverage factor k
25.0	25.003	24.7	-0.303	0.13	2.00
30.0	30.002	29.7	-0.302	0.13	2.00
35.0	35.002	34.7	-0.302	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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## Certificate of Calibration

Cert.No.: 24CH1379  
Page.: 1 of 3

**Equipment :** pH Meter  
**Manufacturer :** EcoSense  
**Model :** pH100A  
**Serial No. :** JC03354  
**ID No. :** UAE.EFM.063/2562(ENV.pH03/62)  
**Condition As-Received:** Used Item  
**Received Date :** 05 November 2024  
**Calibration Date :** 06 November 2024  
**Reference :** 2411-0122WSC-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 Lemgagtrakul  
**Approved by :** \_\_\_\_\_  
( ) Unnoppol Harachai  
(✓) Ponpan Paipim  
( ) Saithip Meangmai  
**Issue Date :** 8 November 2024

The Uncertainties are for a confidence probability of approximately 95%

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Cert.No.: 24CH1379  
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 Thought 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

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	1034203	27 Sep 2026
pH 6.999	Hach Lenge GmbH	C03145	28 Feb 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 ( $\pm$ mV)	Coverage factor k
	pH	mV	mV	pH		
pH Meter S/N.: JC03354	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	-178	10.01	0.58	2.00



Cert.No.: 24CH1379  
Page.: 3 of 3

#### Calibration Results

##### Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH Measurement ( $\pm$ )	Coverage factor k
pH Electrode S/N.: 240710SIA605377	4.008	4.01	173	0.0079	2.00
	6.999	7.00	-2	0.0092	2.00
	6.999	7.00	-2	0.0095	2.00
	10.010	10.01	-178	0.0092	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 ( $\pm$ °C)	Coverage factor k
15.0	15.003	14.9	-0.103	0.13	2.00
30.0	30.001	29.9	-0.101	0.13	2.00
45.0	45.003	44.8	-0.203	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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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.: 24MM292  
Page.: 1 of 3

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

Issue Date : 15 May 2024

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เอกสารไม่ควบคุม



Equipment : Electronic Balance  
Condition As-Received : Used Item  
Reference : 2405-0166OC-1  
Procedure used :-

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

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

#### Condition of this result of calibration

##### 1. Reference standard instruments:-

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

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

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

Range capacity : 0 g to 220 g Resolution 0.0001 g

Before Adjustment :

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

After Adjustment :

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

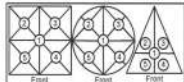
Applied Weight (g)	Standard Deviation of Reading (g)
100	0.00007
200	0.00005

เอกสารไม่ควบคุม



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

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



Maximum difference between off-center and central loading

Position 1 (g)	Position 2 (g)	Position 3 (g)	Position 4 (g)	Position 5 (g)	(g)
-0.0004	-0.0004	-0.0003	-0.0003	-0.0004	0.0001

### 3. Departure from nominal value

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (± mg)	Coverage Factor (k)
Unload	0.0000	0.0000	0.15	2.13
0.01	0.0100	0.0000	0.15	2.13
0.05	0.0500	0.0000	0.15	2.13
0.1	0.1000	0.0000	0.15	2.13
0.5	0.5000	0.0000	0.15	2.13
1	1.0000	0.0000	0.15	2.13
10	10.0000	0.0000	0.15	2.11
50	49.9999	+0.0001	0.17	2.06
100	99.9999	+0.0001	0.19	2.03
150	149.9998	+0.0002	0.29	2
200	199.9990	+0.0010	0.30	2

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

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เอกสารไม่ควบคุม



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
33/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL. 0-2717-3000-29 FAX. 0-2719-9484



Cert. No.: 24TM587  
Page : 1 of 3

## Certificate of Calibration

Equipment : BOD Incubator  
Manufacturer : ARCO  
Model : UR-1320  
Serial No. : -  
ID No. : UAE.WAO.018/2551  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong,  
Bangkok 10260  
Location : Lab Floor 2  
Received Order : 01 April 2024  
Calibration Date : 01 April 2024  
Ambient Temperature : ( 26 ± 10 ) °C  
Relative Humidity : ( 50 ± 30 ) %

Calibrated by : Krisda Malee

Approved by :   
Approved Signatory

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

Issue Date : 5 April 2024

The Uncertainties are for a confidence probability of approximately 95%

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

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A 0065063



Equipment : BOD Incubator  
Condition As-Received : Used Item  
Reference : 2404-0004OC-1

Cert. No.: 24TM587  
Page : 2 of 3

### Procedure Used :-

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

### Condition of this result of calibration

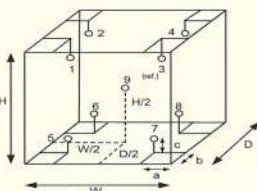
#### 1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1 ) Data Acquisition	MY57013711	23LM115	TPA	11 Jul 2024

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

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

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



Probe Installation Details :  
a = 10 cm  
b = 10 cm  
c = 10 cm  
Dimension of Chamber :  
D = 0.62 m  
W = 1.2 m  
H = 1.2 m  
Capacity = 0.89 m³

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

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



Equipment : BOD Incubator  
Condition As-Received : Used Item  
Reference : 2404-0004OC-1  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Not Available

Cert. No.: 24TM587  
Page : 3 of 3

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

Calibration Point ( °C )	Measured Temperature ( °C )									Uncertainty ( ± °C )
	1	2	3	4	5	6	7	8	9 (ref.)	
20.0	19.954	20.183	20.235	19.707	19.706	19.739	19.785	19.821	19.828	0.66

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

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

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

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

UUC\* : Unit Under Calibration

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

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

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a 1209743

เอกสารไม่ควบคุม  
a 1209742





Cert. No.: 24TM589  
Page : 1 of 3

## Certificate of Calibration

Equipment : Hot Air Oven  
Manufacturer : Mamert  
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 : 01 April 2024  
Calibration Date : 01 - 02 April 2024  
Ambient Temperature :  $(26 \pm 10) ^\circ\text{C}$   
Relative Humidity :  $(50 \pm 30) \%$

Calibrated by : Krisda Malee

Approved by :

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

Issue Date : 5 April 2024

The Uncertainties are for a confidence probability of approximately 95%

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

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A 0065065



Equipment : Hot Air Oven  
Condition As-Received : Used Item  
Reference : 2404-0004OC-3  
Procedure Used :-

Cert. No.: 24TM589  
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

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY57013711	23LM115	TPA	11 Jul 2024

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

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

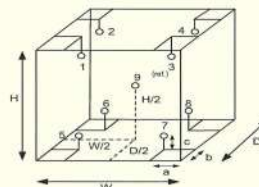
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- ( ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Close

Environment during calibration		
	Beginning	Finished
Temp. (°C)	27	26
REL.Humid. (%)	47	48
AC Supply (Volt)	221	220



Probe Installation Details : Dimension of Chamber :  
a = 5.0 cm D = 0.50 m  
b = 5.0 cm W = 0.80 m  
c = 5.0 cm H = 0.75 m  
Capacity = 0.30 m<sup>3</sup>

Ref. Std. ID No.: @ Calibration Point		
Position :	(120 to 180) °C	(104) °C
1	21-18TC-01	22-18RTD-2/1
2	21-18TC-02	18RTD-2/2
3	21-18TC-03	18RTD-2/3
4	21-18TC-04	18RTD-2/4
5	21-18TC-05	18RTD-2/5
6	21-18TC-06	18RTD-2/6
7	21-18TC-07	18RTD-2/7
8	21-18TC-08	18RTD-2/8
9 (ref.)	21-18TC-09	18RTD-2/9

เอกสารไม่ควบคุม  
a 1209739



Equipment : Hot Air Oven  
Condition As-Received : Used Item  
Reference : 2404-0004OC-3  
Result of Calibration :- ( ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Close

Cert. No.: 24TM589  
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	0.032	0.47	0.84	2
120.0	120.0	120.0	0.12	0.72	1.3	2
180.0	180.0	180.0	0.13	1.2	1.5	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	1	2	3	4	5	6	7	8	9 (ref.)	
104.0	104.464	103.847	104.226	104.232	104.106	103.691	104.275	104.127	104.013	0.42
120.0	120.486	120.089	120.635	120.596	119.531	119.644	120.364	120.144	120.158	1.1
180.0	180.574	179.769	180.285	180.870	179.594	179.790	180.287	179.961	179.802	1.1

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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a 1209738



## Certificate of Calibration

Cert. No.: 24TM647  
Page : 1 of 3

Equipment : Incubator  
Manufacturer : Binder  
Model : KB 400 E6  
Serial No. : 20200000015535  
ID No. : UAE.MIC.018/2564  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong,  
Bangkok 10260  
Location : Microbiology Laboratory (302)  
Received Order : 01 April 2024  
Calibration Date : 01 April 2024  
Ambient Temperature :  $(26 \pm 10) ^\circ\text{C}$   
Relative Humidity :  $(50 \pm 30) \%$

Calibrated by : Man Pattanapongpaiboon

Approved by :

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

Issue Date : 7 April 2024

The Uncertainties are for a confidence probability of approximately 95%

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

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Equipment : Incubator  
Condition As-Received : Used Item  
Reference : 2404-0003OC-6  
Procedure Used :-

Cert. No.: 24TM647  
Page : 2 of 3

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

#### Condition of this result of calibration

##### 1. Reference standard instrument:-

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

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

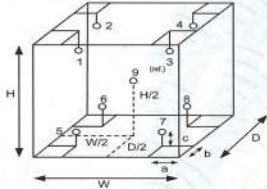
3. This certification is traceable to the International System of Unit.

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

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Close



#### Probe Installation Details :

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

#### Dimension of Chamber :

D = 0.48 m  
W = 0.65 m  
H = 1.2 m  
Capacity = 0.37 m<sup>3</sup>

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	24	24
REL.Humid. ( % )	54	57
AC Supply ( Volt )	221	223

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



Equipment : Incubator  
Condition As-Received : Used Item  
Reference : 2404-0003OC-6  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Close

Cert. No.: 24TM647  
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	0.035	0.19	0.22	2

Calibration Point ( °C )	Measured Temperature ( °C )									Uncertainty ( ± °C )
	1	2	3	4	5	6	7	8	9 (ref.)	
35.0	35.000	35.022	34.841	34.851	35.027	35.011	35.023	35.028	35.007	0.30

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

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

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

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

UUC\* : Unit Under Calibration

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

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

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เอกสารไม่ควบคุม

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.: 24TM884  
Page : 1 of 3

Equipment : Incubator  
Manufacturer : Binder  
Model : KB 400  
Serial No. : 20220000000391  
ID No. : UAE.MIC.029/2565  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong,  
Bangkok 10260  
Location : Microbiology Laboratory  
Received Order : 07 June 2024  
Calibration Date : 07 June 2024  
Ambient Temperature : ( 26 ± 10 ) °C  
Relative Humidity : ( 50 ± 30 ) %  
Calibrated by : Tawatchai Pama  
Kunchit  
Approved by :  
( ) Ponpan Paipim  
( ) Suwit Imjai  
(✓) Kunchit Promprat

Issue Date : 11 June 2024

The Uncertainties are for a confidence probability of approximately 95%

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Equipment : Incubator  
Condition As-Received : Used Item  
Reference : 2406-0190OC-2  
Procedure Used :-

Cert. No.: 24TM884  
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.

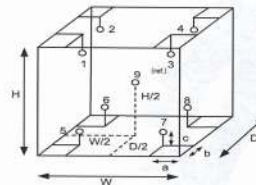
Remark : TPA : Technology Promotion Association ( Thailand - Japan )

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Close

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	21	19
REL.Humid. ( % )	77	75
AC Supply ( Volt )	228	229



#### Probe Installation Details :

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

#### Dimension of Chamber :

D = 0.50 m  
W = 0.65 m  
H = 1.2 m  
Capacity = 0.39 m<sup>3</sup>

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 : 2406-0190OC-2  
 Result of Calibration :- ( \* ) Without Adjustment  
 Function of UUC\* : Temperature Source  
 Fresh air setting : Close

Cert. No.: 24TM884  
 Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
35.0	35.0	35.0	0.028	0.28	0.53	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty  (±°C)
	Position									
	1	2	3	4	5	6	7	8	9 (ref.)	
35.0	35.317	35.184	35.142	35.064	35.098	35.093	34.894	34.826	35.056	0.30

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

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

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

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

UUC\* : Unit Under Calibration

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

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

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### กำหนดจุดห้ามใช้งาน

References Certificate Number. : 24TM884

Equipment : Incubator

Model : KB 400

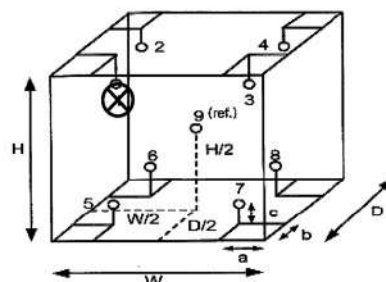
Serial No. : 20220000000391

ID No. : UAE.MIC.029/2565

Manufacturer : Binder

Calibration Point : 35.0 °C

Unit Under Calibration Setting : 35.0 °C



รูปภาพเครื่องมือ แสดงจุดที่ได้รับการสอบเทียบ และสัญลักษณ์ ⊗ แสดงจุดห้ามใช้งาน

กำหนดจุดห้ามใช้งานตำแหน่งที่.....1.....

หมายเหตุ เก็บใบแนบ.....

Uae.netapp\Netapp\_LAB\Lab-BK\INSTRUMENT\01-276-A\Certificateฉบับที่1ฉบับนี้หรือฉบับที่ห้ามใช้ตามเงื่อนไข 2567/กำหนดจุดห้ามใช้งาน

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

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

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

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

### Certificate of Testing

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

Tested by : Walailak Sirinthean

Approved by :

*Saithip*  
 Approved Signatory

( ) Pornthippa Tameyakul  
 ( ) Unnopphol Harachai  
 (✓) Saithip Meangmai

Issue Date : 22 February 2024

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

#### Condition of this result of calibration

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

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

#### 2. Standard Material :-

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

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

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

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

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Cert.No.: 24TW128  
Page.: 1 of 2

## Certificate of Testing

Equipment : DO Meter  
Manufacturer : Horiba  
Model : LAQUA-DO210  
Serial No. : HE9M0021  
ID No. : UAE.EFM.014/2563 (EFM.DO.03/63)  
Received Date : 18 June 2024  
Test Date : 19 June 2024  
Reference : 2406-0571WSC-1  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd  
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak,  
Phraknanong, Bangkok 10260  
Laboratory Condition : Temperature ( 25 ± 5 ) °C  
Humidity ( 50 ± 20 ) %  
Test Procedure : In - house method : GP-CHT  
by Compensation Technique with Azide Modification Method

Tested by : Walatak Sirinthean

Approved by :   
Approved Signatory

( ) Unnopphol Hatachrai  
( ) Ponpan Paipim  
(✓) Saitip Meangmai

Issue Date : 20 June 2024



Cert.No.: 24TW128  
Page.: 2 of 2

### Condition of this result of calibration

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

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

### 2. Standard Material :-

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

Result : Dissolved Oxygen Meter Adjustment With Air 100 %  
Dissolved Oxygen Probe No.: 9K2H0067

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.10	8.10	0.0071

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

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Cert.No.: 24LM97  
Page.: 1 of 2

## Certificate of Calibration

Equipment : DO Meter with Sensor  
Manufacturer : Horiba  
Model : LAQUA-DO210  
Serial No. : HE9M0021  
ID No. : UAE.EFM.014/2563 (EFM.DO.03/63)  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phraknanong,  
Bangkok 10260  
Location : TPA On Site Calibration Laboratory  
Received Order : 18 June 2024  
Calibrated Date : 20 June 2024  
Ambient Temperature : ( 26 ± 10 ) °C  
Relative Humidity : ( 50 ± 30 ) %  
AC Line Voltage : ( 220 ± 22 ) V

Calibrated by : Warakorn Leringatrakul

Approved by :   
Approved Signatory

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

Issue Date : 24 June 2024



Equipment : DO Meter with Sensor  
Condition As-Received : Used Item  
Reference : 2406-0571WSC-2  
Procedure Used :-

Calibration were conducted using in-house calibration procedure GP-OT01 according to comparison with Industrial Platinum Resistance Thermometer (IPRT) into Temperature Bath.  
The temperature scale used was based on ITS-90.

### Condition of this result of calibration

1. Reference standard instrument:  

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Digital Thermometer	2188080	2311216	TPA	11 Oct 2024
2. This certificate is valid only to the item calibrated on date and place of calibration.  
3. This certification is traceable to the International System of Unit.

Remark : TPA Technology Promotion Association (Thailand - Japan)

Result of Calibration :- ( " ) Without Adjustment

Function : Temperature measurement.

This instrument was connected with temperature sensor, S/N: 9K2H0067

Calibration Point ( °C )	Immersion Depth ( mm )	Standard Temperature ( °C )	UUC* Reading ( °C )	Error ( °C )	Uncertainty ( ± °C )	Coverage Factor K
25.0	80	25.002	25.0	-0.002	0.16	2.00
30.0	80	30.002	30.0	-0.002	0.16	2.00
35.0	80	35.003	35.0	-0.003	0.16	2.00

UUC\* : Unit Under Calibration

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

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## Certificate of Testing

Cert.No.: 24TW241  
Page.: 1 of 2

Equipment : DO Meter  
Manufacturer : Horiba  
Model : LAQUA-DO210  
Serial No. : HE0L0004  
ID No. : UAE.EFM.087/2564(EFM.DO.06/64)  
Received Date : 05 November 2024  
Test Date : 06 November 2024  
Reference : 2411-0123WSC-3  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak,  
Phrakhanong, Bangkok 10260  
Laboratory Condition : Temperature (  $25 \pm 5$  ) °C  
Humidity (  $50 \pm 20$  ) %  
Test Procedure : In - house method : CP-CH9  
by Comparison Technique with Azide Modification Method  
Tested by : Walalak Sirithean  
Approved by :   
Approved Signatory  
( ) Unnopphol Harachai  
( ) Ponpan Paipim  
(✓) Saithip Meangmai  
Issue Date : 9 November 2024



Cert.No.: 24TW241  
Page.: 2 of 2

### Condition of this result of calibration

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

Instruments	Serial No.	ID No.	Certificate No.	Due Date
1. Burette	-	130BU10	23CG1172	22 Mar 2025
2. Balance	14233821	110RC001	24MM131	04 July 2025

2. Standard Material :-

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

Result : Dissolved Oxygen Meter Adjustment With Air 100 %  
Dissolved Oxygen Probe No.: 9K0E0257

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.20	8.19	0.0084

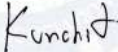
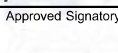
This report was certified only for the instrument we tested. It is allowable to use for study  
Intend to use for advertising and referral purpose is prohibited. This report may not be reproduced  
other in full, without written approval of the laboratory

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## Certificate of Calibration

Cert. No.: 24LM173  
Page.: 1 of 2

Equipment : DO Meter with Sensor  
Manufacturer : Horiba  
Model : LAQUA-DO210  
Serial No. : HE0L0004  
ID No. : UAE.EFM.087/2564(EFM.DO.06/64)  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong, Bangkok 10260  
Location : TPA On Site Calibration Laboratory  
Received Order : 05 November 2024  
Calibrated Date : 06 November 2024  
Ambient Temperature : (  $26 \pm 10$  ) °C  
Relative Humidity : (  $50 \pm 30$  ) %  
AC Line Voltage : (  $220 \pm 22$  ) V  
Calibrated by : Warakorn Lernagatrakul  
  
Approved by :   
Approved Signatory  
( ) Ponpan Paipim  
( ) Suwit Imjai  
(✓) Kunchit Promprat  
Issue Date : 07 November 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.



Equipment : DO Meter with Sensor  
Condition As-Received : Used Item  
Reference : 2411-0123WSC-4  
Procedure Used :-

Cert. No.: 24LM173  
Page.: 2 of 2

Calibration were conducted using in-house calibration procedure CP-OT01 according to comparison with  
Industrial Platinum Resistance Thermometer ( IPRT ) into Temperature Bath.  
The temperature scale used was based on ITS-90.

### Condition of this result of calibration

1. Reference standard instrument:-  
Instrument Serial No. Cert. No. Traceable Due Date  
1) Digital Thermometer 3240076 24I317 TPA 21 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 : Temperature measurement.

This instrument was connected with temperature sensor, S/N.: 9K0E0257

Calibration Point ( °C )	Immersion Depth ( mm )	Standard Temperature ( °C )	UUC* Reading ( °C )	Error ( °C )	Uncertainty ( $\pm$ °C )	Coverage Factor k
15.0	100	15.002	15.0	-0.002	0.16	2.00
30.0	100	30.003	30.0	-0.003	0.16	2.00
45.0	100	45.003	45.0	-0.003	0.16	2.00

UUC\* : Unit Under Calibration

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

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FOSS

## Customer Service Report

Date: 8-9 Feb 2024  
Customer: UAE  
Instrument: KT1100

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

Report No: 9807

Address: BANGKOK

Serial: 91889052

Hours Start Finish  
Travel To Customer 08:30 16:30  
Labour 09:30 12:00  
Travel From Customer 15:00 16:00

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

PO/Quote Number: If applicable

PMA Type: FOSScare If applicable Contract No. If applicable

Details of Work / Test	Condition / Status
# PM KT1100	
- ตรวจเช็คความพร้อมอุปกรณ์ PM	
- วัดค่า pH value 50 - 50 ml	
- วัดค่า pH value 50 ml - 180 ml	
- วัดค่า pH value PM kit	
- Follow up PM protocol	
- ตรวจเช็คความพร้อมอุปกรณ์ PM	
Blank - 0.14	
Recovery - 10.6 %	
Instrument Ready for Use	OK Not OK

Part No.	Batch	Description	Qty
60031807	13-10-2023	FOSS PM kit 8100/8100 12.00	1

I confirm this report is accurate and complete

Signed FOSS: [Signature] Signed Customer: [Signature]

Name: [Name] Name: [Name]

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

เอกสารไม่ควบคุม

FOSS

## Customer Service Report

Date: 9 Feb 2024  
Customer: UAE  
Instrument: KJ200

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

Report No: 9810

Address: BANGKOK

Serial: 91790524

Hours Start Finish  
Travel To Customer 08:30 16:30  
Labour 09:30 12:00  
Travel From Customer 15:00 16:00

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

PO/Quote Number: If applicable

PMA Type: FOSScare If applicable Contract No. If applicable

Details of Work / Test	Condition / Status
# PM KJ200	
- ตรวจเช็คความพร้อมอุปกรณ์ PM	
- วัดค่า pH value 3 ml 100 ml	
- pH value 50 ml - 20 ml	
- วัดค่า pH value PM kit	
- ตรวจเช็คความพร้อมอุปกรณ์ PM	
# ตรวจพบ SOPH Head ตรวจสอบความพร้อม อุปกรณ์	
10000 729 Serial Not Complete 1 PC	
Instrument Ready for Use	OK Not OK

Part No.	Batch	Description	Qty
10009965	14.12.2020	FOSS PM kit KT100 Lelelot Analyser 8100	1

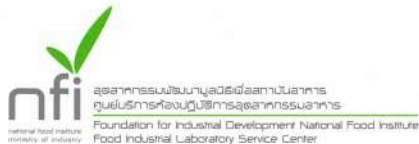
I confirm this report is accurate and complete

Signed FOSS: [Signature] Signed Customer: [Signature]

Name: [Name] Name: [Name]

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

เอกสารไม่ควบคุม



## Calibration Certificate



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

Page 1 of 4

Equipment: Electronic Balance  
Manufacturer: METTLER TOLEDO  
Model: XSR205DU  
Serial No.: C009071872  
ID No.: UAE.WAO.012/2563  
Order No.: 2402283  
Operation No.: 2402283-001  
Date of Receipt: 2 April 2024  
Date of Calibration: 2 April 2024

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

The uncertainties are for a confidence probability of approximately 95%

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

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

เอกสารไม่ควบคุม



## Calibration Report



Certificate No.: 2402283-001-01  
Equipment: Electronic Balance  
Model: XSR205DU  
Serial No.: C009071872  
Capacity: 220 g  
Manufacturer: METTLER TOLEDO  
Resolution: 0.00001 g / 0.0001 g  
ID No.: UAE.WAO.012/2563

Page 2 of 4

Date of Calibration: 2 April 2024  
Environment Condition: Ambient Temperature: 24.5 ± 0.5 °C Relative Humidity: 47.5 ± 2.5 %

Place of Calibration: Laboratory, UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

1. Calibration Method:	NFI Method W-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	8505567572	TCS	M23040535	8 April 2024
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	608-H1	NFI.BTH 016/23	Quality Reborn	QR24-0343	9 February 2025

3. This certification is traceable to SI UNIT  
4. This certificate was certified only for the instrument we calibrated.  
5. This result of calibration was found accurate as shown on date and place of calibration only.

## Calibration Results:

## 1. Repeatability of Reading:

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

## 2. Off-Center Error:

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

The balance reading obtained is given in the table.

1	2	3	4	5	6	(Maximum Difference)
(g)	(g)	(g)	(g)	(g)	(g)	(g)
100.0002	100.0001	100.0002	99.9999	100.0001	100.0001	0.0003

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

เอกสารไม่ควบคุม





## Calibration Report

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

Date of Calibration: 2 April 2024 Page 3 of 4

Calibration Results: (Continued)

Calibration Range: 0 - 80 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value: (Range: 0 - 80 g ; Resolution: 0.0001 g )

Nominal Value ( g )	Standard Value ( g )	Average Reading ( g )	Correction ( g )	Uncertainty ( ± g )	Coverage Factor k
Unloaded	0.000000	0.000000	0.000000	0.0000086	2.00
0.001	0.001003	0.001011	-0.000011	0.0000089	2.00
0.005	0.005003	0.005000	0.000003	0.0000092	2.00
0.01	0.010003	0.010000	0.000003	0.0000089	2.00
0.05	0.049996	0.050000	0.000004	0.0000096	2.00
0.1	0.100011	0.100000	0.000011	0.000011	2.00
0.5	0.500016	0.500001	0.000015	0.000014	2.00
1	1.000003	1.000002	-0.000002	0.000016	2.00
2	2.000023	2.000001	0.000022	0.000017	2.00
5	5.000017	5.000002	0.000015	0.000020	2.00
10	10.000009	10.000000	0.000009	0.000026	2.00
20	20.000031	20.000000	0.000031	0.000037	2.00
30	30.000040	30.000001	0.000039	0.000050	2.00
50	50.000028	50.000002	0.000026	0.000068	2.00
80	80.000068	80.000002	0.000066	0.000111	2.00

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

2008 ๒๕๕๑-๒๕๕๒ ๒๕๕๓-๒๕๕๔ ๒๕๕๕-๒๕๕๖ ๒๕๕๗-๒๕๕๘ ๒๕๕๙-๒๕๖๐  
2008-2009 2010-2011 2012-2013 2014-2015 2016-2017 2018-2019 2020-2021 2022-2023 2024-2025  
2008-2009 2010-2011 2012-2013 2014-2015 2016-2017 2018-2019 2020-2021 2022-2023 2024-2025  
Tel: +66(0) 2422 8669 Fax: +66(0) 2422 8545



## Verification Certificate

Substitute for Certificate No.: 2402957-001-01  
Certificate No.: 2402957-001-02  
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.  
Address: 3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchack, Prakhonong, Bangkok 10260

Page 1 of 4

Equipment: HEATING BLOCK DIGESTION  
Manufacturer: FOSS  
Model: 2520  
Serial No.: 91794469  
ID No.: UAE.WAS.011/2560  
Order No.: 2402957  
Operation No.: 2402957-001  
Date of Receipt: 23 May 2024  
Date of Calibration: 23-24 May 2024

Calibrated by Mr.Jerawut Prapawuttipong  
Scientist  
Approved by (Mr.Pheraphat Tuanjit )  
Manager, Division of Calibration Laboratory  
Responsible for the Technical Management Team  
Date of Issue: 18 June 2024

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

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

F-CS-011 Revision: 01 Date: 20-04-65

2008 ๒๕๕๑-๒๕๕๒ ๒๕๕๓-๒๕๕๔ ๒๕๕๕-๒๕๕๖ ๒๕๕๗-๒๕๕๘ ๒๕๕๙-๒๕๖๐  
2008-2009 2010-2011 2012-2013 2014-2015 2016-2017 2018-2019 2020-2021 2022-2023 2024-2025  
2008-2009 2010-2011 2012-2013 2014-2015 2016-2017 2018-2019 2020-2021 2022-2023 2024-2025  
Tel: +66(0) 2422 8669 Fax: +66(0) 2422 8545



## Calibration Report

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

Date of Calibration: 2 April 2024 Page 4 of 4

Calibration Results: (Continued)

Calibration Range: 81 - 200 g

Calibration Adjustment: Internal Calibration

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

Nominal Value ( g )	Standard Value ( g )	Average Reading ( g )	Correction ( g )	Uncertainty ( ± g )	Coverage Factor k
90	90.00010	90.0001	0.0000	0.00015	2.00
100	100.00006	100.0001	0.0000	0.00015	2.00
110	110.00007	110.0001	0.0000	0.00016	2.00
120	120.00009	120.0000	0.0001	0.00017	2.00
130	130.00010	130.0000	0.0001	0.00019	2.00
140	140.00014	140.0000	0.0001	0.00020	2.00
150	150.00009	150.0001	0.0000	0.00020	2.00
160	160.00010	160.0001	0.0000	0.00022	2.00
170	170.00012	170.0001	0.0000	0.00023	2.00
200	200.00016	200.0002	0.0000	0.00028	2.00

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

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

2008 ๒๕๕๑-๒๕๕๒ ๒๕๕๓-๒๕๕๔ ๒๕๕๕-๒๕๕๖ ๒๕๕๗-๒๕๕๘ ๒๕๕๙-๒๕๖๐  
2008-2009 2010-2011 2012-2013 2014-2015 2016-2017 2018-2019 2020-2021 2022-2023 2024-2025  
2008-2009 2010-2011 2012-2013 2014-2015 2016-2017 2018-2019 2020-2021 2022-2023 2024-2025  
Tel: +66(0) 2422 8669 Fax: +66(0) 2422 8545

## Verification Report

Certificate No.: 2402957-001-02  
Equipment: HEATING BLOCK DIGESTION  
Model: 2520  
Serial No.: 91794469  
Resolution: 1 °C  
ID No.: UAE.WAS.011/2560  
Manufacturer: FOSS  
Date of Calibration: 23-24 May 2024

Page 2 of 4

Location: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.  
Environment Condition:  
Ambient Temperature ( 25 ± 3 ) °C  
Relative Humidity ( 55 ± 15 ) %  
Line Voltage ( 220 ± 10 ) Volt

Condition of this results of Calibration:

- This instrument was calibrated by insert standard thermocouples type R into its heating block digestion and compared to temperature obtained from reference standards thermometer at calibrated point.  
- The temperature scale used was based on ITS - 90 .  
- All data show below were final values and the initial data may be obtained upon request.

2. Reference Standard Instrument :

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
Digital Thermometer with Thermocouple	34970A	MY4405576/PT100/139403	TC23/0048	2-Jun-2024	N.M. Technical Center Laboratory
	Type R	TC1101-103 / CH1101-103			

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

6. Condition of Calibrated item : Good

UUC\* Description

Time of Record - Hour 30 Minute At 380 °C

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

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

2008 ๒๕๕๑-๒๕๕๒ ๒๕๕๓-๒๕๕๔ ๒๕๕๕-๒๕๕๖ ๒๕๕๗-๒๕๕๘ ๒๕๕๙-๒๕๖๐  
2008-2009 2010-2011 2012-2013 2014-2015 2016-2017 2018-2019 2020-2021 2022-2023 2024-2025  
2008-2009 2010-2011 2012-2013 2014-2015 2016-2017 2018-2019 2020-2021 2022-2023 2024-2025  
Tel: +66(0) 2422 8669 Fax: +66(0) 2422 8545





## Verification Report

**Certificate No.:** 2402957-001-02  
**Equipment:** HEATING BLOCK DIGESTION  
Model: 2520 Serial No.: 91794469  
Resolution: 1 °C ID No.: UAE.WAS.011/2560  
Manufacturer: FOSS  
**Date of Calibration:** 23-24 May 2024 **Page 3 of 4**  
**Calibration point:** 380 °C  
**Calibration result:**

Block No.	UUC* Setting (°C)	UUC* Reading (°C)	Stability (±°C)	Standard Thermometer (°C)	Uncertainty (±°C)
1	380	380	0.96	378.86	2.1
2	380	380	0.40	378.41	2.1
3	380	380	1.18	378.94	2.1
4	380	380	0.44	377.64	1.6
5	380	380	0.11	377.75	1.6
6	380	380	0.14	378.35	1.6
7	380	380	1.17	377.09	2.1
8	380	380	0.33	377.08	2.1
9	380	380	0.14	376.61	2.1
10	380	380	0.96	377.74	2.1
11	380	380	0.40	377.17	2.1
12	380	380	1.18	377.71	2.1
13	380	380	0.44	379.07	1.6
14	380	380	0.11	379.19	1.6
15	380	380	0.14	379.78	1.6
16	380	380	1.17	378.74	2.1
17	380	380	0.33	378.74	2.1
18	380	380	0.14	378.27	2.1
19	380	380	0.96	379.53	2.1
20	380	380	0.40	378.96	2.1

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

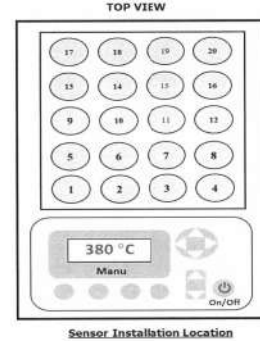
FCS-012 Revision: 01 Date: 20-04-65



## Verification Report

**Certificate No.:** 2402957-001-02  
**Equipment:** HEATING BLOCK DIGESTION  
Model: 2520 Serial No.: 91794469  
Resolution: 1 °C ID No.: UAE.WAS.011/2560  
Manufacturer: FOSS  
**Date of Calibration:** 23-24 May 2024 **Page 4 of 4**  
**Calibration point:** 380 °C  
**Calibration result:** Continued

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

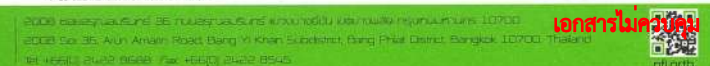


Remark: Edited Date of Calibration from 23-24 May 204 to 23-24 May 2024.

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

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

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



## 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.

### 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](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](https://www.agilent.com/cs/library/usermanuals/Public/7890B_Installation.pdf)
  - Operation Manual**  
[https://www.agilent.com/cs/library/usermanuals/Public/7890B\\_Operation.pdf](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](https://www.agilent.com/cs/library/usermanuals/public/G3430-90052%207890B_Maintaining%20Guide.pdf)

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## 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	CN11021007
Instrument System Site and Location	Instrument Room

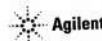
List System Component Product Numbers	List the Serial Numbers of each Component
1. G3440A	CN11021007
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	

## Preparation

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

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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

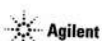
- ☒ For the inlets installed, perform inlet maintenance as defined in the 7890 manual - "Maintaining Your GC" - for the inlet(s) installed.
- ☒ Replace the split vent trap cartridge filter on units with these inlets: Split/Splitless Capillary (SSL), Multi-Mode Inlet (MMI), Programmed Temperature Vaporizer (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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## ALS Maintenance

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

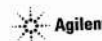
## Restore Instrument

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

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

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## Signature Page

## Service Review

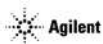
- ☒ Attach available reports/printouts of all tests to this documentation.
- ☒ Record the Preventive Maintenance service activity in the customer's records/logbook.
- ☒ Update/reset Instrument maintenance counters as appropriate.
- ☒ Affix the PM sticker to the system or instrument logbook based on the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

## 7890 GC Test Results Table

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

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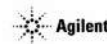
## 7890 Parts List Table

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	63510-60820	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	61531-67000	7890A/B	
Standard .011-inch FID Jet for capillary FID base	61531-80560	7890A/B	1
High Temperature .018-inch FID Jet for capillary FID base	61531-80620	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	
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	61534-80580	7890A/B	
NPD Jet, universal fit, .011-inch ID Extended tip	61534-80590	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	61531-67001	7890A/B	

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## Service Engineer Comments

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

## Service Completion

Service request number 8006748380 Date service completed 21Feb2024  
Agilent signature Phuwana Yoktragul Customer signature  
Total number of pages in this document 9

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Certificate No. : HIT-2412-0389

Page : 1 of 2

## CERTIFICATE OF CALIBRATION

Equipment : COD Test Tube Heater

Meter Model : HI839800-02 Serial No. : H018500I

Tube Heater : 25 Vial Capacity Resolution : 0.1°C

Temperature Range : (-10 to 160)°C Temperature of Reaction : 150°C

Manufacturer : Hanna Instruments Made in : Romania

Condition As-Received : Used Product Reference : RE240478

Ambient Temperature : (25 ± 2)°C Relative Humidity : (50 ± 15)%RH

Customer name : United Analyst and Engineering Consultant Co., Ltd.  
3 Soi Udomsuk 41, Sukhumvit Rd., Bangehak,  
Phrakhanong, Bangkok 10260

Received date : 18 March 2024


Calibrate date : 18 March 2024

Issue date : 20 March 2024

Calibrated Location : Hanna Instruments (Thailand) Ltd.

Calibration Procedure : This calibrator was conducted by using in-house calibration procedure  
CP-04 by using certified reference standard instruments.

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

Approved by :   
Mr. Anan Suwanchaisakul  
Authorized Signatory



This certificate was certified only for the instrument we calibrated.

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

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

approval of the head of Hanna Instrument (Thailand). เอกสารไม่ควบคุม

## Condition of this calibration result:

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

Instruments	Model	Serial No.	Certificate No.	Traceable
Data Acquisition Switch Unit	34970A	MY44665265	WK2307-164-1	WK Electric Co., Ltd.
Digital Thermo-Hygrometer	HT-771SD	AL07155	24H41	Technology Promotion Association (Thailand-Japan).

## Calibration Result:

Measurement Temperature Source Accuracy for COD Reactor.

Capacity (Vial)	Nominal Value (°C)	Average Value (°C)	Uncertainty of Measurement (±°C)
25 Vial	150.0	150.0	0.50

Unit : °C

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

Figure: Shows the location of the temperature source.

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

\*\* End of certificate \*\*

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## Agilent CrossLab Start Up Services

Agilent 5100 5110 ICP-OES  
Preventive Maintenance

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

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

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

## Introduction

## Customer Information

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

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## Important Customer Web Links

- To access **Agilent University**, visit <http://www.agilent.com/crosslab/university/> to learn about training options, which include online, classroom and onsite delivery. A training specialist can work directly with you to help determine your best options.
- To access the **Agilent Resource Center** web page, visit <https://www.agilent.com/en-us/agilentresources>. The following information topics are available:
  - Sample Prep and Containment
  - Chemical Standards
  - Analysis
  - Service and Support
  - Application Workflows
- The **Agilent Community** is an excellent place to get answers, collaborate with others about applications and Agilent products, and find in-depth documents and videos relevant to Agilent technologies. Visit <https://community.agilent.com/welcome>
- Videos about specific preparation requirements for your instrument can be found by searching the **Agilent YouTube** channel at <https://www.youtube.com/user/agilent>
- Need to place a service call?** [Flexible Repair Options | Agilent](#)

## Service Engineer's Responsibilities

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

## Instrument Maintenance

### System Information

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

Instrument System Name and ID	5110 VDV ICP-OES
Instrument System Site and Location	United Analyst and Engineering Consultant

List System Component Product Numbers	List the Serial Numbers of each Component
1. G 3059	77 19030001
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	

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

## Preparation

- ☒ Discuss any specific issues with the customer before starting.
- ☒ Review the instrument logbook for recorded problems and comments.
- ☒ Save instrument control settings before starting the procedure.
- ☒ Perform a general inspection of the system for cleanliness.
- ☒ Check for proper installation of parts, assemblies, sensors etc.
- ☒ Check system for required installation of components and implementation of Service Notes
- ☒ Check for required firmware/software updates and verify with customers if they would like them installed.
- ☐ For HF application systems, if standard sample introduction system was not installed, ask the customer to install it. [p.18](#)
- ☒ Ask the customer to remove any samples from the ICP-OES sample introduction area, auto sampler or around the ICP-OES.

## Preventive Maintenance Procedures

### Record Pre-PM instrument performance

- ☒ Run Instrument Performance test.
- ☒ Record results in Instrument Performance Test Results Table – Pre-PM.

### Clean and inspect ICP-OES system

- ☒ Look for any obvious external damage or problems.
- ☒ Inspect water cooling hoses, gas lines and power cord for excessive wear or damage.
- ☒ Perform a general internal inspection of the system for excessive dust accumulation, clean if necessary.
- ☒ Inspect sample introduction components and record any required maintenance in the Service Engineer Comments and notify the customer as the required actions required.
- ☒ Record the instrument operating conditions in the ICP-OES Status Results Table.
- ☒ Replace the polychromator purge filter.
- ☒ Replace the radial pre-optics window
- ☒ Replace the axial pre-optics window for SVDV and VDV instruments.
- ☒ Check exhaust flow for the correct positive extraction at the exhaust duct to insure they meet minimum specifications.
- ☒ Replace air inlet dust filter.
- ☐ Replace high capacity air inlet dust filter element if installed. <sup>118</sup>
- ☒ Remove and clean instrument water inlet filter.

### Agilent Water Recirculator

- ☐ **Service not applicable**
- ☒ Drain cooling fluid and remove any particles from the chiller reservoir
- ☒ Remove, clean and reinstall water inlet metal mesh filter if present.
- ☒ Re fill with Agilent Cool Clear cooling fluid.
- ☒ Clean the cooling system Air filter and the condenser.

### SPS 3 Auto Sampler

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

### SPS 4 Auto sampler

- ☒ **Service not applicable**
- ☐ Clean the spill tray, rack location mat, end frames and chassis with a damp soft cloth and diluted mild detergent.
- ☐ Clean the auto sampler cover panels, if cover kit is installed, with domestic window cleaner.
- ☐ Check the X-axis and Z-axis drive belts for cracks, splits, damaged teeth, excessive fraying, color changes or degradation from fumes.
- ☐ Check the X-axis, Theta-axis and Z-axis FFC cables for cracks, incorrect positioning, damaged edges or damaged connectors.
- ☐ Pump Tubing Replacement. Replace peristaltic pump tubing. Replace all tubing that goes from the rinse station to the pump and from the pump to the waste/rinse bottles
- ☐ Test using customer's tray and move the sample probe to the sample vial 1, wash vial and rinse port and ensure that the probe is centered in the vial. If not use calibration wizard and calibrate the position.

### AVS 4, 6, 7 Advanced Valve System

- ☒ **Service not applicable**
- ☐ Replace valve rotor seal
- ☐ Check fittings for signs of leaks
- ☐ Check tubing including autosampler tubing for kinks or excessive wear
- ☐ Check high flow pump for signs of leaks

### ICP-OES adjustment

- ☒ Check position of Zn peak, adjust if required.
- ☒ Check Argon Ratio, adjust to specified value if required.
- ☒ Perform Detector Calibration.
- ☒ Perform Instrument Calibration.

### Record Post-PM instrument performance

- ☒ Run Instrument Performance test.
- ☒ Record results in Instrument Performance Test Results Table - Post PM.
- ☒ For systems using ICP Expert version 7.3 and above, run the following Instrument tests
  - ☒ Subsystem Communications Test
  - ☒ Air Flow
  - ☒ Water Flow
  - ☒ Gas Flows
  - ☒ RF Generator
  - ☒ Camera Test
  - ☒ Optics Test
  - ☒ Nebulizer Test
- ☒ Record the result in the Instrument Test Results Table

### Restore Instrument

- ☐ For HF applications, ask the customer to reinstall their sample introduction system. <sup>118</sup>
- ☒ Leave system in an idle state: on and purging.
- ☒ Guidance: If the PM service is performed prior to a qualification service, then use the qualification procedure as a guide for final instrument set up and checkout.

### Service Review

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

## Test Results

## Instrument Performance Test Results Table

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

	Pre PM Sensitivity Check		Post PM Sensitivity Check	
	Radial	Axial *	Radial	Axial*
Zn 213.857 nm SRBR	1500.7	2213.4	1124.9	6969.9
Mn 257.610 nm SRBR	3915.0	7492.1	13017.9	31127.6
Al 396.152 nm SBR	9.9	10.7	9.7	21.1
K 766.491 nm SBR	5.7	28.1	4.8	45.3

\* Axial result is not applicable for G8016AA, G8012AA Radial View instruments.

## Instrument Test Results Table

Note: The Instrument Test results are for systems using ICP Expert version 7.3 and above only.

Instrument Test	Result
Subsystem Communications Test	Pass
Air Flow	Pass
Water Flow	Pass
Gas Flows	Pass
RF Generator	Pass
Camera Test	Pass
Optics Test	Pass
Nebulizer test	Pass

## ICP-OES Status Results Table

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

Measurement	Standby Mode	Plasma On
Mains Voltage	231.417 VAC	226.971 VAC
Mains Current	0.031 A	0.105 A
Instrument Temperature	22.1 °C	23.5 °C
RF Air Flow (sensor speed)	14.0 Hz	19.0 Hz
Plasma Exhaust Temperature	No measurement	63.6 °C
Water Flow Oscillator	No measurement	1.34 L/min
Water Flow Detector	0.96 L/min	0.61 L/min
Water Inlet Temperature	19.7 °C	19.7 °C
Polychromator Temperature	35.0 °C	35.0 °C
CCD Temperature	-40.1 °C	-39.8 °C
Thermal Stabilizer	35.0 °C	35.0 °C
Argon Supply Pressure	648.92 kPa	591.55 kPa
Purge Gas Supply Pressure*1	646.66 kPa	612.41 kPa
Option Gas Supply Pressure*1	- kPa	- kPa
Nebulizer Flow	No measurement	0.70 L/min
Nebulizer Back Pressure	No measurement	128.43 kPa
Plasma Gas Flow	No measurement	11.91 L/min
Auxiliary Gas Flow	No measurement	1.00 L/min
RF Power	No measurement	1204.7 W
RF Supply Current	No measurement	7.658 A
RF Supply Voltage	No measurement	204.417 V

\*1 If option installed

## Consumed PM Parts

Part Description	Part Number	Product or Model# where used	Quantity consumed
Axial Pre-Optic Window	G8010-68014	G8010A, G8011A, G8014A/G8015A	1
Radial Pre-Optic Window	G8010-68015	All	1
Agilent Cool Clear Coolant Fluid	5799-0037	Agilent Water Recirculator	-
Purge Gas Filter	G8010-60136	All	1
Air inlet filter	G8000-68002	All	1
High Capacity Air Filter	G8010-60189	Optional	-
Rotor seal for 6-7 port valve for AVS6/7	G8494-60002	G8494A/G8495	-
Rotor seal for 4 port valve for AVS4	G8493-60002	G8493A	-
Rinse solution to rinse station 2.5mm id x 1m	G8410-80123	SPS 4	-
Barb connector 2.5mm-1.5mm ID	G8410-80124	SPS 4	-
PVC waste tubing 8mm od x 5mm id, 2m	G8410-80122	SPS 4	-
Additional Parts may be required from engineer's stock:			
X axis drive belt	5410047500	SPS 3	-
Z axis drive belt	5410047400	SPS 3	-
Peristaltic pump tubing, PVC SolvaFlex, 3 bridged,	3710049000	SPS 4	-

## Consumed Parts Reference

(Purchased by customer, not included as part of PM)

Section Not Applicable.

Part Description	Part Number	Product or Model# where used	Quantity consumed

## Signature Page

## Service Engineer Comments (optional)

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

## Service Verification

Service Request Number:

6007197100

Service Engineer Name:

Kenjaporn S.

Service Engineer Signature:

Kenjaporn S.

Total number of pages in this document:

14

Date Service Completed:

04 Nov 2024

Customer Name:

Aphorn Onkong

Customer Signature:

Aphorn Onkong



Report Summary	
Instrument Model	Agilent 5100/5110 VDV ICP-OES
Instrument ID	G8011A/G8015A
Instrument Serial Number	MY18030001
Software Version	7.3.1.9507
Firmware Version	3442
Tested By	Pre Test_PM_Kanyakorn S.
Test Completed On	11/4/2024 9:19:10 AM
Result Summary	
Subsystem Communications Test	Skipped
Air Flow Test	Skipped
Water Flow Test	Skipped
Gas Flows Test	Skipped
RF Generator Test	Skipped
Camera Test	Skipped
Optics Test	Skipped
Advanced Valve System Test	Skipped
Resolution Test	Pass
Sensitivity Test	Fail
Precision Test	Pass

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เอกสารไม่ควบคุม

Resolution Test			Pass
Element Wavelength	Specification	Width	
N (174.213 nm)	≤ 9.40	6.98	
As (188.980 nm)	≤ 8.20	6.17	
C (193.027 nm)	≤ 11.50	8.30	
Mo (202.032 nm)	≤ 8.20	6.38	
Cr (206.158 nm)	≤ 13.40	8.98	
Zn (213.857 nm)	≤ 8.70	6.60	
Pb (220.353 nm)	≤ 9.50	7.09	
Co (228.615 nm)	≤ 17.20	11.67	
Ba (230.424 nm)	≤ 9.40	7.20	
Mn (257.610 nm)	≤ 13.30	9.43	
Mn (260.568 nm)	≤ 20.30	14.11	
Cr (267.716 nm)	≤ 11.00	8.04	
Cu (324.754 nm)	≤ 25.00	18.97	
Cu (327.395 nm)	≤ 14.20	11.23	
Sr (338.071 nm)	≤ 33.50	24.30	
Ba (455.403 nm)	≤ 44.00	33.47	
Sr (460.733 nm)	≤ 36.00	17.23	
Ba (493.408 nm)	≤ 36.00	25.37	
Ba (614.171 nm)	≤ 42.00	25.54	
Ar (675.283 nm)	≤ 74.00	56.51	
K (766.491 nm)	≤ 80.00	65.86	

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เอกสารไม่ควบคุม

Sensitivity Test			Fail		
Radial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 46.0	SRBR	104.1	793.0	50.8
Se (196.026 nm)	≥ 41.0	SRBR	87.6	862.0	79.7
Zn (213.857 nm)	≥ 1421.0	SRBR	1500.8	41823.3	749.0
Pb (220.353 nm)	≥ 46.0	SRBR	170.7	2432.0	174.9
Mn (257.610 nm)	≥ 3518.0	SRBR	3915.0	264700.2	4420.0
Al (396.152 nm)	≥ 3.4	SBR	7.7	48454.6	5563.2
Ba (493.408 nm)	≥ 34.0	SBR	45.9	1966719.7	41903.8
K (766.491 nm)	≥ 1.8	SBR	5.7	99038.2	14687.7
Axial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 208.0	SRBR	126.5	1498.8	119.0
Se (196.026 nm)	≥ 159.0	SRBR	112.0	1773.6	197.8
Zn (206.200 nm)	≥ 234.0	SRBR	466.0	6784.2	199.7
Zn (213.857 nm)	≥ 1743.0	SRBR	2217.4	95597.6	1789.7
Cd (214.439 nm)	≥ 4227.0	SRBR	1919.3	68724.6	1236.4
Pb (220.353 nm)	≥ 320.0	SRBR	332.6	7929.5	499.0
Mn (257.610 nm)	≥ 10625.0	SRBR	7492.2	991238.3	16911.7
Cr (267.716 nm)	≥ 1048.0	SRBR	2254.6	129706.6	3150.9
Cu (324.754 nm)	≥ 19.0	SBR	26.9	290746.3	10407.5
Al (396.152 nm)	≥ 6.0	SBR	10.7	211329.2	18005.0
Ba (493.408 nm)	≥ 60.0	SBR	49.3	6956460.4	138336.9
K (766.491 nm)	≥ 24.0	SBR	28.1	1395190.2	47996.2

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เอกสารไม่ควบคุม

Precision Test		Pass
Radial		
Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 2.60	0.73
Se (196.026 nm)	≤ 2.60	0.95
Zn (213.857 nm)	≤ 1.50	0.31
Pb (220.353 nm)	≤ 2.60	0.73
Mn (257.610 nm)	≤ 1.50	0.39
Al (396.152 nm)	≤ 1.50	0.39
Ba (493.408 nm)	≤ 1.50	0.87
K (766.491 nm)	≤ 1.50	0.32
Axial		
Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 1.50	1.21
Se (196.026 nm)	≤ 1.50	0.84
Zn (206.200 nm)	≤ 1.50	0.56
Zn (213.857 nm)	≤ 1.50	0.96
Cd (214.439 nm)	≤ 1.50	0.26
Pb (220.353 nm)	≤ 1.50	0.51
Mn (257.610 nm)	≤ 1.50	0.97
Cr (267.716 nm)	≤ 1.50	0.22
Cu (324.754 nm)	≤ 1.50	0.24
Al (396.152 nm)	≤ 1.50	0.33
Ba (493.408 nm)	≤ 1.50	0.40
K (766.491 nm)	≤ 1.50	0.65

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เอกสารไม่ควบคุม

Report Summary		
Instrument Model	Agilent 5100/5110 VDV ICP-OES	
Instrument ID	G8011A/G8015A	
Instrument Serial Number	MY18030001	
Software Version	7.3.1.9507	
File Name	3442	
Tested By	Post Test_PM_Kanyakorn S.	
Test Completed On	11/4/2024 11:07:24 AM	
Result Summary		
Subsystem Communications Test		Pass
Air Flow Test		Skipped
Water Flow Test		Skipped
Gas Flows Test		Skipped
RF Generator Test		Skipped
Camera Test		Skipped
Optics Test		Pass
Advanced Valve System Test		Skipped
Resolution Test		Pass
Sensitivity Test		Fail
Precision Test		Pass
Subsystem Communications Test		Pass
Optics Test		Pass
	Radial	Axial
Intensity	3184054	3177175
Wavelength	737.212	737.212

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เอกสารไม่ควบคุม

Resolution Test		Pass
Element Wavelength	Specification	Width
N (174.213 nm)	≤ 9.40	6.97
As (188.980 nm)	≤ 8.20	6.14
C (193.027 nm)	≤ 11.50	8.33
Mo (202.032 nm)	≤ 8.20	6.33
Cr (206.133 nm)	≤ 13.40	9.06
Zn (213.637 nm)	≤ 8.70	6.70
Pb (220.353 nm)	≤ 9.50	7.03
Co (228.615 nm)	≤ 17.20	11.72
Ba (230.424 nm)	≤ 9.40	7.32
Mn (257.610 nm)	≤ 13.30	9.44
Mn (260.568 nm)	≤ 20.30	14.21
Cr (267.716 nm)	≤ 11.00	7.94
Cu (324.754 nm)	≤ 25.00	18.99
Cu (327.395 nm)	≤ 14.20	11.27
Sr (338.071 nm)	≤ 33.50	24.40
Ba (455.403 nm)	≤ 44.00	33.50
Sr (460.733 nm)	≤ 36.00	17.31
Ba (493.408 nm)	≤ 36.00	25.44
Ba (614.171 nm)	≤ 42.00	25.18
Ar (675.283 nm)	≤ 74.00	56.15
K (766.491 nm)	≤ 80.00	65.56

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เอกสารไม่ควบคุม

Sensitivity Test			Fail		
Radial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 46.0	SRBR	130.6	977.1	50.4
Se (196.026 nm)	≥ 41.0	SRBR	106.0	958.7	70.2
Zn (213.857 nm)	≥ 1421.0	SRBR	4124.8	44037.7	113.4
Pb (220.353 nm)	≥ 46.0	SRBR	207.2	2554.7	136.2
Mn (257.610 nm)	≥ 3518.0	SRBR	13017.8	271846.6	434.7
Al (396.152 nm)	≥ 3.4	SBR	9.7	50615.5	4717.0
Ba (493.408 nm)	≥ 34.0	SBR	133.7	2069203.0	15359.3
K (766.491 nm)	≥ 1.8	SBR	4.8	100199.5	17235.5
Axial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 208.0	SRBR	174.9	1566.7	73.0
Se (196.026 nm)	≥ 159.0	SRBR	167.0	1863.4	110.2
Zn (206.200 nm)	≥ 234.0	SRBR	740.9	6836.0	83.1
Zn (213.857 nm)	≥ 1743.0	SRBR	6965.9	101568.1	211.7
Cd (214.439 nm)	≥ 4227.0	SRBR	5781.0	72852.9	158.1
Pb (220.353 nm)	≥ 320.0	SRBR	501.0	8464.3	267.7
Mn (257.610 nm)	≥ 10625.0	SRBR	31121.6	1006637.8	1044.0
Cr (267.716 nm)	≥ 1048.0	SRBR	4424.8	132202.9	880.8
Cu (324.754 nm)	≥ 19.0	SBR	68.7	302907.8	4345.6
Al (396.152 nm)	≥ 6.0	SBR	21.1	218771.0	9892.3
Ba (493.408 nm)	≥ 60.0	SBR	250.6	7137380.9	28367.3
K (766.491 nm)	≥ 24.0	SBR	45.3	1435050.6	31025.0

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เอกสารไม่ควบคุม

Precision Test		Pass
Radial		
Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 2.60	0.81
Se (196.026 nm)	≤ 2.60	0.98
Zn (213.857 nm)	≤ 1.50	0.22
Pb (220.353 nm)	≤ 2.60	0.37
Mn (257.610 nm)	≤ 1.50	0.27
Al (396.152 nm)	≤ 1.50	0.25
Ba (493.408 nm)	≤ 1.50	0.53
K (766.491 nm)	≤ 1.50	0.15
Axial		
Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 1.50	0.81
Se (196.026 nm)	≤ 1.50	0.65
Zn (206.200 nm)	≤ 1.50	0.79
Zn (213.857 nm)	≤ 1.50	0.81
Cd (214.439 nm)	≤ 1.50	0.35
Pb (220.353 nm)	≤ 1.50	0.33
Mn (257.610 nm)	≤ 1.50	1.02
Cr (267.716 nm)	≤ 1.50	0.32
Cu (324.754 nm)	≤ 1.50	0.51
Al (396.152 nm)	≤ 1.50	0.37
Ba (493.408 nm)	≤ 1.50	0.68
K (766.491 nm)	≤ 1.50	0.74

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เอกสารไม่ควบคุม

Report Summary		
Instrument Model	Agilent 5100/5110 VDV ICP-OES	
Instrument ID	G8011A/G8015A	
Instrument Serial Number	MY18030001	
Software Version	7.3.1.9507	
Firmware Version	3442	
Tested By	Post Test_PM_Kanyakorn S.	
Test Completed On	11/4/2024 11:30:15 AM	
Result Summary		
Subsystem Communications Test	Pass	
Air Flow Test	Pass	
Water Flow Test	Pass	
Gas Flows Test	Pass	
RF Generator Test	Pass	
Camera Test	Pass	
Optics Test	Skipped	
Advanced Valve System Test	Skipped	
Resolution Test	Skipped	
Sensitivity Test	Skipped	
Precision Test	Skipped	
Subsystem Communications Test	Pass	
Air Flow Test	Pass	
30% Air Flow (relative speed)	75% Air Flow (relative speed)	
15.00	19.00	
Water Flow Test	Pass	
RF Water Flow(L/min)	Camera Water Flow (L/min)	Water Inlet Temperature (°C)
1.30	0.81	20.55

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เอกสารไม่ควบคุม

Gas Flows Test					
Pass					
Nebulizer Target Flow	Actual Flow	Back Pressure	Auxiliary Target Flow	Actual Flow	Back Pressure
0.70	0.70	154.65	2.00	2.00	110.92
Makeup Target Flow	Actual Flow	Back Pressure	Plasma Target Flow	Actual Flow	Back Pressure
2.00	2.00	115.38	18.00	17.97	21.48
RF Generator Test					
Pass					
RF Power Supply Test		Passed			
RF Power Supply (V)		128.554			
RF Oscillator Test		Passed			
RF Oscillator Frequency (MHz)		25.834			
Work Coil Current (A)		44.660			
RF Power Supply Current (A)		1.999			
Camera Test					
Pass					
	Integration Time (ms)	Standard Deviation	Status		
Electronic Offset Test	1000	5.228	Passed		
Dark Current Test	6000	1.168	Passed		
Array Test	5	0.024	Passed		
Linearity Test		0.118	Passed		

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เอกสารไม่ควบคุม

Report Summary		
Instrument Model	Agilent 5100/5110 VDV ICP-OES	
Instrument ID	G8011A/G8015A	
Instrument Serial Number	MY18030001	
Software Version	7.3.1.9507	
Firmware Version	3442	
Tested By	change mirror	
Test Completed On	11/6/2024 10:35:26 AM	
Result Summary		
Subsystem Communications Test	Skipped	
Air Flow Test	Skipped	
Water Flow Test	Skipped	
Gas Flows Test	Skipped	
RF Generator Test	Skipped	
Camera Test	Skipped	
Optics Test	Skipped	
Advanced Valve System Test	Skipped	
Resolution Test	Pass	
Sensitivity Test	Pass	
Precision Test	Pass	

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เอกสารไม่ควบคุม

Resolution Test		
Pass		
Element Wavelength	Specification	Width
N (174.213 nm)	≤ 9.40	6.79
As (188.980 nm)	≤ 8.20	5.80
C (193.027 nm)	≤ 11.50	8.15
Mo (202.032 nm)	≤ 8.20	5.90
Cr (206.158 nm)	≤ 13.40	8.85
Zn (213.857 nm)	≤ 8.70	6.77
Pb (220.353 nm)	≤ 9.50	6.61
Co (228.615 nm)	≤ 17.20	11.79
Ba (230.424 nm)	≤ 9.40	7.25
Mn (257.610 nm)	≤ 13.30	9.47
Mn (260.568 nm)	≤ 20.30	14.50
Cr (267.716 nm)	≤ 11.00	7.91
Cu (324.754 nm)	≤ 25.00	18.72
Cu (327.395 nm)	≤ 14.20	11.09
Sr (338.071 nm)	≤ 33.50	25.39
Ba (455.403 nm)	≤ 44.00	33.09
Sr (460.793 nm)	≤ 36.00	18.54
Ba (493.408 nm)	≤ 36.00	25.74
Ba (614.171 nm)	≤ 42.00	25.23
Ar (675.283 nm)	≤ 74.00	58.92
K (766.491 nm)	≤ 80.00	63.16

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เอกสารไม่ควบคุม



Sensitivity Test					
Pass					
Radial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 46.0	SRBR	110.5	868.9	54.3
Se (196.026 nm)	≥ 41.0	SRBR	88.3	934.7	91.3
Zn (213.857 nm)	≥ 1421.0	SRBR	3535.4	44017.7	153.9
Pb (220.353 nm)	≥ 46.0	SRBR	184.5	2492.3	159.8
Mn (257.610 nm)	≥ 3518.0	SRBR	11099.6	249595.3	503.6
Al (396.152 nm)	≥ 3.4	SBR	8.7	50274.4	5172.0
Ba (493.408 nm)	≥ 34.0	SBR	124.5	1903164.1	15186.0
K (766.491 nm)	≥ 1.8	SBR	6.9	110041.4	13991.2
Axial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 208.0	SRBR	253.3	3744.3	196.3
Se (196.026 nm)	≥ 159.0	SRBR	206.7	4199.7	347.2
Zn (206.200 nm)	≥ 234.0	SRBR	923.0	12282.3	172.1
Zn (213.857 nm)	≥ 1743.0	SRBR	6398.3	157551.5	601.7
Cd (214.439 nm)	≥ 4227.0	SRBR	5069.2	99873.7	385.2
Pb (220.353 nm)	≥ 320.0	SRBR	389.0	10641.1	658.6
Mn (257.610 nm)	≥ 10625.0	SRBR	21190.4	985528.7	2153.6
Cr (267.716 nm)	≥ 1048.0	SRBR	3054.1	131797.6	1811.5
Cu (324.754 nm)	≥ 19.0	SBR	36.3	301401.4	8082.9
Al (396.152 nm)	≥ 6.0	SBR	10.8	228359.5	19280.5
Ba (493.408 nm)	≥ 60.0	SBR	106.5	6460421.5	60122.8
K (766.491 nm)	≥ 24.0	SBR	30.2	1639840.6	52562.1

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เอกสารไม่ควบคุม

Precision Test		
Pass		
Radial		
Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 2.60	1.56
Se (196.026 nm)	≤ 2.60	1.16
Zn (213.857 nm)	≤ 1.50	0.50
Pb (220.353 nm)	≤ 2.60	0.74
Mn (257.610 nm)	≤ 1.50	0.63
Al (396.152 nm)	≤ 1.50	0.54
Ba (493.408 nm)	≤ 1.50	0.78
K (766.491 nm)	≤ 1.60	0.44
Axial		
Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 1.50	0.82
Se (196.026 nm)	≤ 1.50	0.82
Zn (206.200 nm)	≤ 1.50	0.35
Zn (213.857 nm)	≤ 1.50	0.34
Cd (214.439 nm)	≤ 1.50	0.44
Pb (220.353 nm)	≤ 1.50	0.48
Mn (257.610 nm)	≤ 1.50	0.83
Cr (267.716 nm)	≤ 1.50	0.53
Cu (324.754 nm)	≤ 1.50	0.69
Al (396.152 nm)	≤ 1.50	0.56
Ba (493.408 nm)	≤ 1.50	1.29
K (766.491 nm)	≤ 1.50	0.74

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เอกสารไม่ควบคุม

# UNITED ANALYST AND ENGINEERING CONSULTANT COMPANY Ltd.

Automatic Mercury Analyzer  
Model RA-4500  
Preventive Maintenance Report

Serial No. : 17780278

Soft version : Ver 2.0.7

ROM version : Ver 2.0.1

Date : 09 July 2024

PM by : Pradit M. )

Approved by : Kitichai S. )



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

เอกสารไม่ควบคุม

## Inspection result

ITEM	STANDARD	RESULT	JUDGE
1. Self Check			
1.1 Heating		PASS	OK
1.2 Cooling		PASS	OK
1.3 Leak		PASS	OK
1.4 Optical system		PASS	OK
1.5 Drift		PASS	OK
2. Analytical curve inspection(AREA)			
2.1 No Pretreatment (Low Conc.)	Correlation coefficient ( r ) ≥ 0.9990	0.9999	OK
3. Repeatability(AREA)			
3.1 No Pretreatment 100ppb, n=3		1. 99.60 ppb 2. 101.84 ppb 3. 101.22 ppb C.V. ≤ 5% 1.15%	OK
4. Blank	Below 1.0 (AREA)	0.1002	OK

เอกสารไม่ควบคุม

Counter

Maintenance

MATH

IC

Counter

Parameter

Measurement Count

2017102-06-08

Clear

F1 Subst(0:2000h)

0x00m24-07-08

Clear

Memory Exhaust Filter Amount(mg)(1500mg)

102-08-08

Clear

F2 Subst(0:2000h)

0x01m24-07-08

Clear

Lamp Active Time(2000h)

1h13m24-07-08

Clear

F3 Subst(0:2000h)

0x00m24-07-08

Clear

Membrane Filter Usage Time(2000h)

0h50m24-07-08

Clear

F4 Subst(0:2000h)

0x00m24-07-08

Clear

Main Pump Subst(750h)

0h53m24-07-08

Clear

F5 Subst(0:2000h)

0x00m24-07-08

Clear

Heating Lamp Time

580h23m22-08-08

Clear

F6 Subst(0:2000h)

0x00m24-07-08

Clear

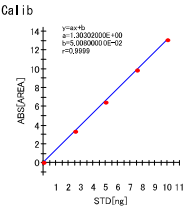
F7 Subst(0:2000h)

0x00m24-07-08

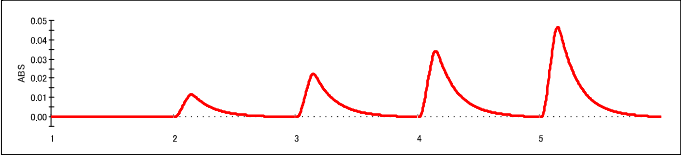
Clear

Exit

Title : Preventive Maintenance RA-4500 sn:17780278  
Date : 2024-07-09  
Name : Coax Group  
Memo : Calibration Curve 0-10ng



STD									
No.	STD [ppb]	SVOL [mL]	CVOL [mL]	DVOL [mL]	STD [ng]	AREA [ON]	MEAS [ng]	Dev [%]	Note
1	100.000	0.000	5.000	5.000	0.000	0.0846	0.0265	-	
2	100.000	0.025	5.000	5.000	2.500	3.3464	2.5298	1.2	
3	100.000	0.050	5.000	5.000	5.000	6.4170	4.8863	2.3	
4	100.000	0.075	5.000	5.000	7.500	9.8647	7.5322	0.4	
5	100.000	0.100	5.000	5.000	10.000	13.1132	10.0253	0.3	



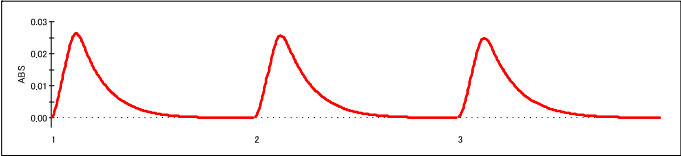
SMP								
No.	NAME	SVOL [mL]	CVOL [mL]	DVOL [mL]	AREA [ON]	MEAS [ng]	CONC [ug/L]	Note
1	100ppb	0.050	5.000	5.000	6.5389	4.9798	99.60	
2	100ppb	0.050	5.000	5.000	6.6848	5.0918	101.84	
3	100ppb	0.050	5.000	5.000	6.6446	5.0610	101.22	

Statistics				
No.	NAME	TRY	AV [ug/L]	SD [ug/L]
1	100ppb	3	100.887	1.15660

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-1-

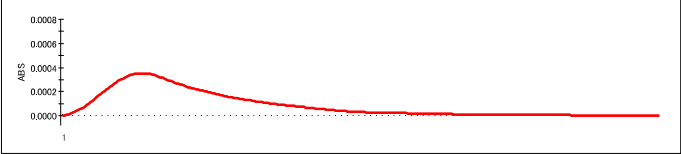
เอกสารไม่ควบคุม



Self Check  
Heat check:PASS!! ( 26.3degC[05:00] -> 30.3degC[02:29])  
Sensor check:PASS!! ( 53-10= 43)  
Leak check:PASS!! (0.19L/min)  
Sig/Ref check:PASS!! (Sig:4.00V, Ref:4.02V)  
Drift check:PASS!! ( 0.000061 - -0.0000179 = 0.0000240)

Title : Preventive Maintenance RA-4500 sn:17780278  
Date : 2024-07-09  
Name : Coax Group  
Memo : Blank

SMP								
No.	NAME	SVOL [mL]	CVOL [mL]	DVOL [mL]	AREA [ON]	MEAS [ng]	CONC [ug/L]	Note
1	Blank DI				0.1002	0.0385		



-2-

เอกสารไม่ควบคุม



-3-

เอกสารไม่ควบคุม





Service Report

TO	FOR
Company: United Analyst and Engineering Consultant Co., Ltd. _ Bangkok-HQ Address: 700/2 หมู่ที่ 1 Phrakhanong District, Bangkok, 10260	Work Order Number: WO-00018067 Contact: Kamphong Boonpuang Email: kamphong.b@uaeconsultant.co.th Tel: +66 2763 2828 (7021), +66 8 6347 7390

WORK ORDER INFORMATION			
Top-Level		Order Type	Preventive Maintenance
Installed Product ID	IB-00105024	Billing Type	Paid
Product	SKALAR SAN++ Classic 2SAN59000	PO No.	SSPR2400629
Serial No.	182688	Warranty No.	
		Contract No.	

PRODUCTS SERVICED		
Installed Product Id	Serial Number	Product

PROBLEM DESCRIPTION	
PM 1/1	

Line Number	Engineer	Start Date And Time	End Date And Time	Billable Labor Hour	Billable Travel Hour	Travel KM
WL-00071161	Yongyuth Chanphong	02/20/2024 8:53 AM	02/20/2024 6:07 PM	9,23333		
WL-00092966	Ronnarit Dechnawarat	02/20/2024 8:53 AM	02/20/2024 6:07 PM	9,23333		
Total				18,46666	0	0

! Reach us at DKSH Service-Hotline : +66 2 639 7000  
2533 Sukhumvit Road, Bangchak, 10260, Phrakhanong, Bangkok, Thailand  
Phone +66 2 639 7000 Fax +66 2 333 1026

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เอกสารไม่ควบคุม Page 1 of 2



Line Number	Work Description
WL-00071161	ท่า PM เรียบร้อย
WL-00092966	ท่า PM เรียบร้อย

PARTS CONSUMED		
Part No	Part Description	Quantity

EXPENSES			
Part No	Expense Type	Description	Line Quantity

RECOMMENDED PARTS	
แนะนำอะไหล่ที่ต้องสั่งซื้อเพิ่มเติมดังนี้ , อะไหล่ พาราไมเตอร์ Ammonia จำนวน 2 รายการ (9220, 3026) , อะไหล่ พาราไมเตอร์ Phenol และ Cyanide จำนวน 6 รายการ (5454, 3028, 3031, 3034, 3036, 3150)	

REMARKS
---------

Travel Time Disclaimer:  
Please note that the travel time in this report only includes time taken to reach the installed equipment location. It does not include our engineer's return travel time.

Customer Signature:	Technician: Yongyuth Chanphong Job Title: Service Manager Email: yongyuth.yc@dksh.com
	
Customer Signature	
Date: 04/10/2024	

! Reach us at DKSH Service-Hotline : +66 2 639 7000  
2533 Sukhumvit Road, Bangchak, 10260, Phrakhanong, Bangkok, Thailand  
Phone +66 2 639 7000 Fax +66 2 333 1026

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เอกสารไม่ควบคุม Page 2 of 2



Job No. WO-00018067

Test Report

Customers	United Analyst and Engineering Consultant Co., Ltd.		
Equipment	Continuous Flow Analyzer	Manufacturer	SKALAR
Controller Mdel	SA5000	Auto Sample Model	SA1052
Controller Serial No.	182688	Auto Sample Serial No.	181729
Date of test	20-Feb-2024	Period	12 Month
Environment temperature	24.7 °C	Humidity	62.2 %RH

Results

Instrument Checked		Before		After		Remark
Item	Characteristic					
1	Visual inspect	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	
2	Power supply (210 - 240 VAC)	220	VAC	220	VAC	
3	Computer	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	
4	Program	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	
5	Auto sampler	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	
6	Module holder					
	- Motor pump	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	
	- Pump tube	<input type="checkbox"/> Pass	<input checked="" type="checkbox"/> Fail	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	*
	- Air-injection	<input type="checkbox"/> Pass	<input checked="" type="checkbox"/> Fail	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	*
	- Chemistry manifolds, Switching valve, Coil, Membrane	<input type="checkbox"/> Pass	<input checked="" type="checkbox"/> Fail	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	**,**
7	Detector					
	- Filter	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	
	- Flow cell	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	
	- Lamp	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	
8	Interface	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	
9	Rinsing valves	<input type="checkbox"/> Pass	<input checked="" type="checkbox"/> Fail	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	N/A
10	Temperature / Reactor	<input type="checkbox"/> Pass	<input checked="" type="checkbox"/> Fail	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	N/A
11	Flame photometer	<input type="checkbox"/> Pass	<input checked="" type="checkbox"/> Fail	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	N/A
12	UPS / Stabilizer	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	N/A

Warning and Error Checked			
Item	Event	Before	After
13	Error list	<input type="checkbox"/> None <input type="checkbox"/> Appear : _____	<input type="checkbox"/> None <input type="checkbox"/> Appear : _____

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Check with Standard				
Item	Characteristic	Before	After	Remark
14	Base Line Test	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A	
15	Detector Signal Test	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A	

Summary of checked  
☒ The instrument can work normally and efficiently. (เครื่องมือวัดสามารถทำงานได้ปกติและประสิทธิภาพ)  
☐ The instrument can work but it's requiring to maintenance. (เครื่องมือวัดสามารถทำงานได้แต่ต้องบำรุงรักษา)  
☐ The instrument could not work it's requiring to repair. (เครื่องมือวัดไม่สามารถทำงานได้แต่ต้องการซ่อมบำรุง)

Remark :

* Pump tube และ Air tube เริ่มเสื่อมสภาพ ได้เปลี่ยนอะไหล่ทั้งหมดแล้วตามระยะเวลาใช้งาน
** อะไหล่ 9220 (Manifold T, SiS needle) ขาดไม่สามารถซ่อมได้ และได้เปลี่ยนมาใช้ 5216 ทดแทนชั่วคราว
*** อะไหล่ 5454 (Nipple polyethylene N5) เสีย ได้ทำการเปลี่ยนใหม่แล้ว
หมายเหตุ แนะนำอะไหล่ที่ควรสั่งซื้อเพิ่มเติมดังนี้
1. อะไหล่ พาราไมเตอร์ Ammonia จำนวน 2 รายการ (9220, 3026)
2. อะไหล่ พาราไมเตอร์ Phenol และ Cyanide จำนวน 6 รายการ (5454, 3028, 3031, 3034, 3036, 3150)

Standard Equipment Used		
Equipment	Equipment I.D.	
Digital multi meter	S/N 57600592	Due date : 8-Jul-2024
Thermo hygrometer	S/N 39520444	Due date : 27-Dec-2024

Test By : 	Approved by : 
( Mr. Yongyuth Chanphong )	( Mr. Eknasong Wankliang )
Position : Supervisor, Technical Service	Position : Manager, Technical Services

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DQEServices

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

  
MBC-T80-T8 11225  
CALIBRATION DATA

CERTIFICATE OF CALIBRATION

Certificate No. : SP24-001Page 1 of 5

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

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

Location of calibration : Laboratory 213

Equipment : UV-Vis Spectrophotometer

Manufacturer : Hitachi

Model : U-2900

Serial No. : 21E22-009

ID No. : UAE.WAT.051/2564


Received Date : 4 January 2024

Calibration Date : 4 January 2024


Issue Date : 5 January 2024

Condition Instrument : Good

Calibrated by :

  
( Mr.Tanawut Rittidach )  
Technical Manager

Approved by :

  
( Ms.Chonthicha Sangngern )  
Quality Manager

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


THE (IN)CAPABILITY OF THE LABORATORY AND ITS UNCAPABILITY 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

DQEServices

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MBC-T80-T8 11225  
CALIBRATION DATA

REPORT OF CALIBRATION

Certificate No. : SP24-001Page 2 of 5

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

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

Certified Reference Materials :

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

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

Spectral Band Width of UUC : 1.5 nm.

Scan Speed of UUC : 200 nm/min

Scan Interval of UUC : 0.1 nm.


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

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FM-708-02 R01 1/11/2021

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MBC-T80-T8 11225  
CALIBRATION DATA

REPORT OF CALIBRATION

Certificate No. : SP24-001Page 3 of 5

Calibration Results : Without adjustment

Photometric Accuracy :


Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
420	0.0000	0.000	0.0000	0.0028	2.00
	0.5780	0.575	0.0030	0.0031	2.00
	1.0484	1.045	0.0034	0.0029	2.00
	2.1876	2.192	-0.0044	0.0080	2.00
440	0.0000	0.000	0.0000	0.0028	2.00
	0.5595	0.558	0.0015	0.0034	2.00
	1.0239	1.023	0.0009	0.0035	2.00
	2.1230	2.125	-0.0020	0.0079	2.00
465	0.0000	0.000	0.0000	0.0028	2.00
	0.5230	0.520	0.0030	0.0030	2.00
	0.9633	0.961	0.0023	0.0029	2.00
	1.9753	1.975	0.0003	0.0070	2.00
546.1	0.0000	0.000	0.0000	0.0028	2.00
	0.5181	0.516	0.0021	0.0031	2.00
	1.0002	0.997	0.0032	0.0033	2.00
	1.9973	1.993	0.0043	0.0084	2.00
590	0.0000	0.000	0.0000	0.0028	2.00
	0.5517	0.550	0.0017	0.0030	2.00
	1.0803	1.079	0.0013	0.0030	2.00
	2.0373	2.032	0.0053	0.0080	2.00
635	0.0000	0.000	0.0000	0.0028	2.00
	0.5591	0.558	0.0011	0.0031	2.00
	1.0518	1.050	0.0018	0.0030	2.00
	1.9274	1.923	0.0044	0.0079	2.00

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FM-708-02 R01 1/11/2021

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MBC-T80-T8 11225  
CALIBRATION DATA

REPORT OF CALIBRATION

Certificate No. : SP24-001Page 4 of 5

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000	0.000	0.0000	0.0050	2.00
	0.7469	0.743	0.0039	0.0057	2.00
257	0.0000	0.000	0.0000	0.0050	2.00
	0.8674	0.862	0.0054	0.0059	2.00
313	0.0000	0.000	0.0000	0.0050	2.00
	0.2919	0.289	0.0029	0.0051	2.00
350	0.0000	0.000	0.0000	0.0050	2.00
	0.6430	0.641	0.0020	0.0055	2.00

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FM-708-02 R01 1/11/2021



## REPORT OF CALIBRATION

Certificate No. : SP24-001

Page 5 of 5

## Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor k
241.72	241.2	0.52	0.18	2.00
279.45	279.0	0.45	0.18	2.00
287.81	287.4	0.41	0.18	2.00
334.06	333.8	0.26	0.18	2.00
360.93	360.6	0.33	0.18	2.00
418.59	418.4	0.19	0.18	2.00
445.94	445.8	0.14	0.18	2.00
453.66	453.4	0.26	0.18	2.00
460.02	459.8	0.22	0.18	2.00
536.59	536.4	0.19	0.18	2.00
637.98	638.0	-0.02	0.18	2.00
431.38	431.2	0.18	0.18	2.00
472.50	472.5	0.00	0.18	2.00
513.47	513.4	0.07	0.18	2.00
528.88	528.9	-0.02	0.18	2.00
573.17	573.4	-0.23	0.18	2.00
585.35	585.2	0.15	0.20	2.00
684.40	684.4	0.00	0.18	2.00
740.72	741.0	-0.28	0.20	2.00
748.55	748.8	-0.25	0.18	2.00
807.03	807.1	-0.07	0.18	2.00
879.28	879.5	-0.22	0.18	2.00

Remark : - UUC = Unit Under Calibration

- N/A = Not Available

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

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

- \* Indicates non TISI accredited

- End of Certificate -

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FM-708-02 R01 1/11/2021



## CERTIFICATE OF CALIBRATION

Certificate No. : SP24-008

Page 1 of 5

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

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

Location of calibration : Laboratory 315

Equipment : UV-Vis Spectrophotometer

Manufacturer : Hitachi

Model : U-1900

Serial No. : 2021-064

ID No. : UAE.WAS.006/2552

Received Date : 16 January 2024

Calibration Date : 16 January 2024

Issue Date : 19 January 2024

Condition Instrument : Good

Calibrated by :

(Mr.Tanawut Rittidach)

Technical Manager

Approved by :

(Ms.Chonthicha Sangngern)

Quality Manager

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

The measurement capability of the laboratory and its traceability to recognized national standards used 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



## REPORT OF CALIBRATION

Certificate No. : SP24-008

Page 2 of 5

Environment Condition : Ambient Temperature  $25 \pm 5$  °CRelative humidity  $55 \pm 20$  %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 : 4.0 nm.

Scan Speed of UUC : 200 nm/min

Scan Interval of UUC : 0.1 nm.

Resolution of UUC : Photometric 0.001 Abs.

Wavelength 0.1 nm.

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021



## REPORT OF CALIBRATION

Certificate No. : SP24-008

Page 3 of 5

Calibration Results : Without adjustment

## Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
420	0.0000	0.000	0.0000	0.0028	2.00
	0.5780	0.575	0.0030	0.0031	2.00
	1.0484	1.046	0.0024	0.0029	2.00
	2.1876	2.186	0.0016	0.0080	2.00
440	0.0000	0.000	0.0000	0.0028	2.00
	0.5595	0.558	0.0015	0.0034	2.00
	1.0239	1.024	-0.0001	0.0035	2.00
	2.1230	2.121	0.0020	0.0079	2.00
465	0.0000	0.000	0.0000	0.0028	2.00
	0.5230	0.520	0.0030	0.0030	2.00
	0.9633	0.961	0.0023	0.0029	2.00
	1.9753	1.975	0.0003	0.0070	2.00
546.1	0.0000	0.000	0.0000	0.0028	2.00
	0.5181	0.516	0.0021	0.0031	2.00
	1.0002	0.999	0.0012	0.0033	2.00
	1.9973	1.994	0.0033	0.0084	2.00
590	0.0000	0.000	0.0000	0.0028	2.00
	0.5517	0.550	0.0017	0.0030	2.00
	1.0803	1.080	0.0003	0.0030	2.00
	2.0373	2.032	0.0053	0.0080	2.00
635	0.0000	0.000	0.0000	0.0028	2.00
	0.5591	0.558	0.0011	0.0031	2.00
	1.0518	1.051	0.0008	0.0030	2.00
	1.9274	1.923	0.0044	0.0079	2.00

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FM-708-02 R01 1/11/2021



## REPORT OF CALIBRATION

Certificate No. : SP24-008

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## Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000 0.7469	0.000 0.748	0.0000 -0.0011	0.0050 0.0057	2.00 2.00
257	0.0000 0.8674	0.000 0.865	0.0000 0.0024	0.0050 0.0059	2.00 2.00
313	0.0000 0.2919	0.000 0.293	0.0000 -0.0011	0.0050 0.0051	2.00 2.00
350	0.0000 0.6430	0.000 0.641	0.0000 0.0020	0.0050 0.0055	2.00 2.00

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FM-708-02 R01 1/11/2021

## REPORT OF CALIBRATION

Certificate No. : SP24-008

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## Wavelength Accuracy :

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

Remark : - UUC = Unit Under Calibration

- N/A = Not Available

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

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

- \* Indicates non TISI accredited

- End of Certificate -

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FM-708-02 R01 1/11/2021

## CERTIFICATE OF CALIBRATION

Certificate No. : SP25-001

Page 1 of 5

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

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

Location of calibration : Laboratory 213

Equipment : UV-Vis Spectrophotometer

Manufacturer : Hitachi

Model : U-2900

Serial No. : 21E22-009

ID No. : UAE.WAT.051/2564

Received Date : 3 January 2025

Calibration Date : 3 January 2025

Issue Date : 8 January 2025

Condition Instrument : Good

Calibrated by :



(Mr. Tanawut Rittidach)

Technical Manager

Approved by :



(Ms. Chonthicha Sangnern)

Quality Manager

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

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

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## REPORT OF CALIBRATION

Certificate No. : SP25-001

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Environment Condition : Ambient Temperature  $25 \pm 5$  °CRelative humidity  $55 \pm 20$  %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

DQE Services Co.,Ltd.

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

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

DQE Services

ISO 17025:2017  
CALIBRATION DATA

REPORT OF CALIBRATION

Certificate No. : SP25-001

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	0.578	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
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	1.0518	1.050	0.0018	0.0030	2.00
	1.9274	1.923	0.0044	0.0079	2.00

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FM-708-02 R01 1/11/2021

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DQE Services

ISO 17025:2017  
CALIBRATION DATA

REPORT OF CALIBRATION

Certificate No. : SP25-001

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Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000	0.000	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. : SP25-001

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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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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 -

PerkinElmer

For the Better

PinAAcle 900F

Preventive Maintenance Report

Company Name: UAE Consultant Co., LTD.

Instrument Location: 41 Sukumvit Rd.,  
Phra Khanong, Bangkok 10260

Instrument Serial No.: PFBS20031902


Date: 14-May-2024

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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:	PF8520031902	PM Number:	2 of 2
Customer Name (if applicable):	K. Yainda	Telephone Number:	095-5580049
Customer Support Engineer Name:	K. Chayanan	Service Order Number:	WO-02787590
Date PM Performed: (DD-MM-YYYY)	14-May-2024	Next PM Due Date: (DD-MM-YYYY)	14-Nov-2024
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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Component List

Component / Specific Model	Serial #	Configuration Notes
PinAAcle900F	PF8520031902	Syngistix V.4.0.1.1935
Fias100(New Install)	100524040501	

Parts Lists

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

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	Apr 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 <sub>3</sub>	250 mL	AR	AR

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Procedure Checklist

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

1. General:

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

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## 7. Flame Interlock Check:

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

Parameter	Specification	Test Results	Pass/Fail
Flame Sensor	Air/C <sub>2</sub> H <sub>2</sub> Flame correctly shuts down	Active	Passed
Drain Sensor	Air/C <sub>2</sub> H <sub>2</sub> Flame correctly shuts down	Active	Passed
Nebulizer Sensor	Air/C <sub>2</sub> H <sub>2</sub> Flame correctly shuts down	Active	Passed
C <sub>2</sub> H <sub>2</sub> Pressure Sensor	Air/C <sub>2</sub> H <sub>2</sub> Flame correctly shuts down	Active	Passed
Air Pressure Sensor	Air/C <sub>2</sub> H <sub>2</sub> 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.	0.9995	1.0143	Passed
0.2 A ND Filter	± 5% from Cert.	0.1936	0.1966	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	0.002	Passed

### 8.3 AA Baseline Noise with Copper

Description: Check baseline noise.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.001	0.0002	Passed

## 8.4 D<sub>2</sub> Background Compensation with Copper

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

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.010	0.0001	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	0.002	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	0.0022	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.	0.8005	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.

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## 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:	Date:
<i>Chayaman K.</i>	14-May-2024 (DD-MM-YYYY)
Authorized Customer Representative:	Date:
<i>สุวิทย์ หงษ์</i>	14-May-2024 (DD-MM-YYYY)

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