

ภาคผนวก ง
เอกสารสอบเทียบเครื่องมือ

บริษัท ทีพีไอ โพลีน จำกัด (มหาชน)



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 :

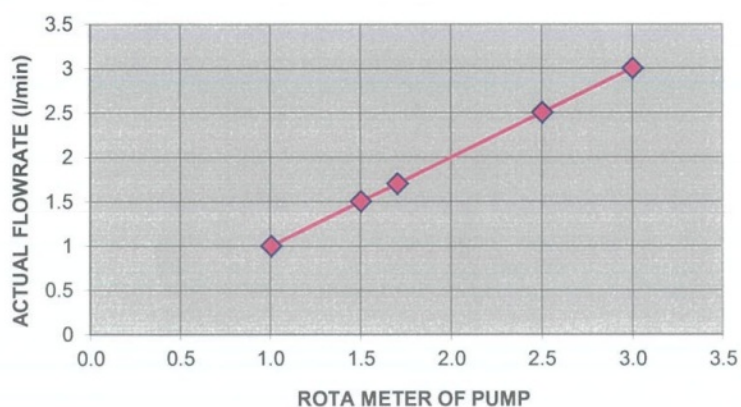
PRIMARY FLOW STANDARD (WET CELL)

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	± 0.03	PASS
1.5	1.503	1.506	1.501	1.503	0.003	± 0.03	PASS
1.7	1.708	1.706	1.704	1.706	0.006	± 0.03	PASS
2.5	2.507	2.502	2.504	2.504	0.004	± 0.03	PASS
3	3.005	3.001	3.007	3.004	0.004	± 0.03	PASS

CALIBRATION CURVE



บริษัท ยูไนเต็ด แอนนาลิสต์ แอนด์ เอ็นจิเนียริง
คอนซัลแตนท์ จำกัด

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Stack									
1	Pre-Test Console	Total Suspended Particulate Particular Matter (PM10)	Apex Instruments, USA.	XC-572-V 1701019	Envi Equipment Service Co., Ltd.	E24-060048	18 Jun 24	17 Jun 25	-
2	Flue gas Analyzer	Sulphur Dioxide Oxide of Nitrogen as Nitrogen Dioxide	Testo	Testo 350 60899698/701	Entech Industrial Sulation Co., Ltd.	G 670083	8 Feb 24	7 Feb 25	-

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 Fuchin)

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 ₁	0.386	
DGM Serial Number	00002028	Calibration Meter Gamma	1.001			Console Leak Check	PASS	

Calibration Data									
Run Time		Metering Console				Calibration Meter			
Elapsed	DGM Orifice DH	Volume Initial	Volume Final	Outlet Temp Initial	Outlet Temp Final	Volume Initial	Volume Final	Outlet Temp Initial	Outlet Temp Final
(Q)	(P _{at})	(V _{in})	(V _{out})	(t _{in})	(t _{out})	(V _{in})	(V _{out})	(t _{in})	(t _{out})
min	mm H ₂ O	m ³	m ³	°C	°C	m ³	m ³	°C	°C
11.82	13.0	2802.112	2802.252	32	32	222.03382	222.17160	29	29
11.85	13.0	2802.252	2802.392	32	32	222.17160	222.30948	29	29
8.42	26.0	2802.399	2802.539	32	32	222.31644	222.45472	29	29
8.43	26.0	2802.539	2802.679	32	32	222.45472	222.59264	29	29
13.80	40.0	2802.686	2802.966	32	32	222.59970	222.87558	28	28
13.78	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 ₁	0.386	
DGM Serial Number	00002028	Calibration Meter Gamma	1.001			Console Leak Check	PASS	

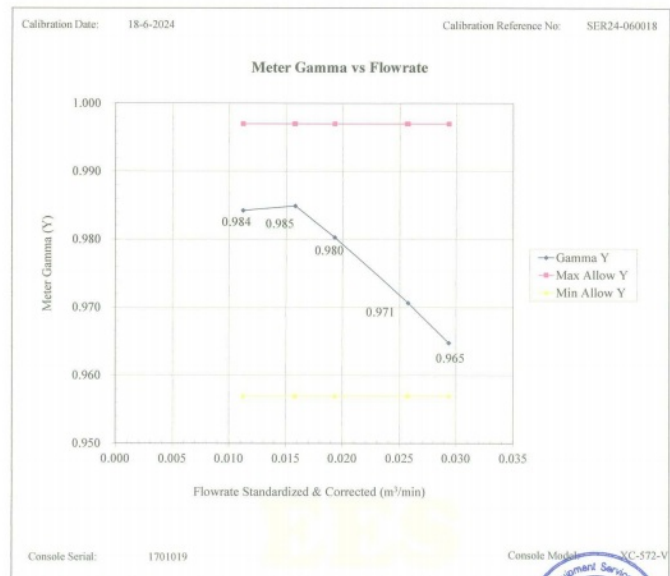
Calibration Data									
Results									
Standardized Data		Dry Gas Meter							
Dry Gas Meter	Calibration Meter	Calibration Factor		Flowrate		Std & Corr	.0212 m ³ /min	Variation	
		Value	Variation	Value	Variation				
(V _{act})	(Q _{act})	(V _W)	(Q _W)	(Y)	(ΔY)	(Q _{act})	(ΔH _g)	(ΔH _g)	
m ³	m ³ /min	m ³	m ³ /min			m ³ /min	mm H ₂ O		
0.135	0.011	0.133	0.011	0.984	0.007	0.011	44.706	-1.370	
0.135	0.011	0.133	0.011	0.985	0.008	0.011	44.893	-1.182	
0.135	0.016	0.134	0.016	0.986	0.009	0.016	45.148	-0.928	
0.135	0.016	0.133	0.016	0.984	0.007	0.016	45.564	-0.512	
0.272	0.020	0.267	0.019	0.982	0.005	0.019	46.883	0.808	
0.273	0.020	0.267	0.019	0.978	0.001	0.019	47.030	0.954	
0.274	0.027	0.266	0.026	0.972	-0.005	0.026	46.723	0.648	
0.274	0.027	0.266	0.026	0.970	-0.007	0.026	47.067	0.991	
0.274	0.030	0.265	0.029	0.965	-0.012	0.029	46.388	0.313	
0.274	0.030	0.265	0.029	0.965	-0.012	0.029	46.354	0.279	
		0.977	Y Average			46.075	ΔH _g Average		

Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is ±0.02.

For ΔH_g, orifice pressure differential that equates to 0.75 cfm (0.0212 m³/min) at standard temperature and pressure, acceptable tolerance of individual values from the average is ±0.2 inches (5.1mm) L.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 ₁	0.386	
DGM Serial Number	00002028	Calibration Meter Gamma	1.001			Console Leak Check	PASS	



เอกสารไม่ควบคุม

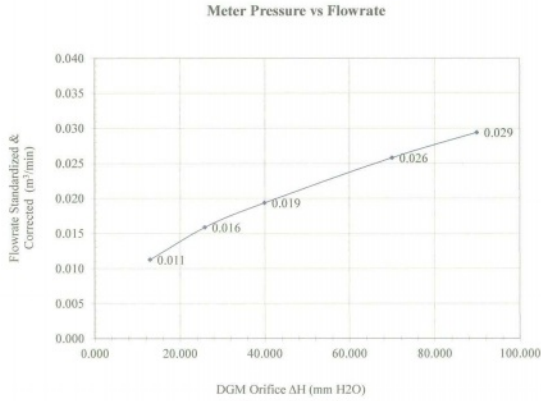
Meter Console Information	
Console Model Number	XC-572-V
Console Serial Number	1701019
DGM Model Number	SK25EX
DGM Serial Number	00002028

Calibration Conditions			
Date	Time	18/06/2024	10:00 AM
Calibration Reference No.	SER24-060018		
Barometric Pressure	755.91	mmHg	
Calibration Meter Gamma	1.001		

Factors/Conversions		
Std Temp	293	K
Std Press	760	mm Hg
K ₁	0.386	
Console Leak Check	PASS	

Calibration Date: 18-6-2024

Calibration Reference No: SER24-060018



Console Serial: 1701019

Console Model: XC-572-V



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THERMOCOUPLES SYSTEM CALIBRATION

Sampling System Equipment Information	
Console Model Number	XC-572-V
Console Serial Number	1701019
DGM Model Number	SK25EX
DGM Serial Number	00002028
Meter Box Model Number	JENCO 765 KF
Meter Box Serial Number	JC 19777

Calibration Conditions			
Date	Time	18/06/2024	00:20 PM
Calibration Reference No.	SER24-060018		
Reference Thermometer	DIGICON		
Serial Number	183169105		

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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Certificate No: G 670083
Date of issue : 08-Feb-24

Instrument description	Flue Gas Analyzer
Instrument model	Testo 350 New
Control unit serial no.	03099393/701
Instrument serial no.	60899698/701
ID no. or control no.	UAE.EFM.008/2560
Manufacturer	Testo SE & Co. KGaA
Probe description	-
Probe model	-
Probe serial no.	-
Customer name	UNITED ANALYST CONSULTANT CO.,LTD.
Customer address	81 SOI UDOMSUK41, SUKHUMVIT ROAD, BANGCHAK PRAKANONG BANGKOK 10260
Total pages of certificate	2 Pages
Receiving no.	L-240430
Receiving date.	05-Feb-24
Parameter of calibration	Gas Calibration (Oxygen 2.50, 10.04, 21.02 %vol, Carbon Monoxide 80.14, 302, 1003 ppm, Nitrogen Dioxide 30.34, 81.32, 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, Lakki, Bangkok 10210
Calibration procedure no.	This instrument was calibrated by comparison with Standard gas mixture according to calibration Work Instruction no. WI-CL-28-C

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

This Calibration Certificate may not be reproduced other than in full except with the permission of the issuing laboratory. Calibration certificates without signature and seal not valid and The results relate only to the items tested/calibrated.

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

Date of calibration : 08-Feb-24

Mr. Kwanchai Khamsoung
Calibration Technician

Mrs. Nongluck Wongsettee
Technical Manager

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Certificate No.: G 670083

Standard References (Table 1)

Standard	Certificate No.	Vendor	Due date
Oxygen (O ₂) 2.50 % Vol	2412/23	Linde	27-Aug-27
Oxygen (O ₂) 10.04 % Vol	CG-0153-21	Nimt	18-Nov-26
Oxygen (O ₂) 21.02 % Vol	CG-0041-22	Nimt	10-Feb-27
Carbon monoxide (CO) 80.14 ppm	CG-0040-22	Nimt	14-Feb-27
Carbon monoxide (CO) 302 ppm	1915/23	Linde	16-Jun-25
Carbon monoxide (CO) 1003 ppm	2584/23	Linde	10-Sep-25
Nitrogen Dioxide (NO ₂) 30.34 ppm	2703/22	Linde	22-Aug-24
Nitrogen Dioxide (NO ₂) 81.32 ppm	3546/23	Linde	14-Jan-26
Nitrogen Dioxide (NO ₂) 201.9 ppm	1975/23	Linde	17-Jul-25
Nitric Oxide (NO) 30.01 ppm	CG-0014-23	Nimt	19-Feb-25
Nitric Oxide (NO) 151.5 ppm	0161/23	Linde	22-Jan-25
Nitric Oxide (NO) 322.5 ppm	1974/23	Linde	17-Jul-25
Sulphur Dioxide (SO ₂) 50.36 ppm	2004/23	Linde	17-Jul-25
Sulphur Dioxide (SO ₂) 100.8 ppm	3507/22	Linde	09-Nov-24
Sulphur Dioxide (SO ₂) 600.8 ppm	2003/23	Linde	17-Jul-25

Measured room conditions

Temperature : 23.5 °C Humidity : 64.1 %RH Pressure : 1011.7 mbar

Calibration conditions

Gas Temperature : 23 °C Flow rate : 1,200 ml/min Gas pressure : 1016.4 mbar

Calibration Results (Without adjustment) (Table 2)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (±)
O ₂ (%Vol)	2.50	2.57	0.07	0.15
O ₂ (%Vol)	10.04	10.09	0.05	0.20
O ₂ (%Vol)	21.02	21.08	0.06	0.30
CO (ppm)	80.14	81	0.86	3.0
CO (ppm)	302	302	0	6.0
CO (ppm)	1003	1002	-1	12
NO ₂ (ppm)	30.34	30.2	0.14	8.0
NO ₂ (ppm)	81.32	82.4	1.08	8.0
NO ₂ (ppm)	201.9	202.8	0.9	12
NO (ppm)	30.01	29	-1.01	8.0
NO (ppm)	151.5	150	-1.5	8.0
NO (ppm)	322.5	320	-2.5	12
SO ₂ (ppm)	50.36	49	-1.36	6.0
SO ₂ (ppm)	100.8	100	-0.8	6.0
SO ₂ (ppm)	600.8	599	-1.8	13

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

End of Report

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List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
1	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	Svantek	SV36 107224	Innovative Instrument Co.,Ltd.	24-ACT-091	26 Jun 24	25 Jun 25	-
2	Sound Level Meter	L _{Aeq} 1 hours, L _{Aeq} 24 hrs, L _{Amax} , L _{A90}	Larson Davis	LxT2 0005348	Electrical And Electronics Institute Foundation For Industrial Development	CP20240292EA	6 Aug 24	5 Aug 25	-
3	Sound Level Meter	L _{Aeq} 1 hours, L _{Aeq} 24 hrs, L _{Amax} , L _{A90}		LxT2 0005393	Innovative Instrument Co.,Ltd.				
4	Sound Level Meter	L _{Aeq} 1 hours, L _{Aeq} 24 hrs, L _{Amax} , L _{A90}	Larson Davis	LxT2 0005396	Electrical And Electronics Institute Foundation For Industrial Development	CP20240291EA	5 Aug 24	4 Aug 25	-

Certificate of Calibration

Customer

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

Certificate No : 24-ACT-091
Request No : Req-2024-1380

Unit Under Calibration Details

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

Calibration Environment and Details

Temperature : (23 ±2 °C)
Humidity : (50 ± 20 %RH)
Barometric Pressure : (1013 ±10.0 hPa)
Received Date : 24 June 2024
Calibration Date : 26 June 2024
Location of Calibration : LAB 1 Acoustic
Calibration Procedure : In-house method CP-ACT-02 based on IEC 60942:2017 Electroacoustics - Sound calibrators

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

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

Note

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

Calibrated By : Mr. Noppadon Luangart
Service Calibration Engineer

Approved By : Mr. Pacit Mathavorn
Calibration Engineer Supervisor
Issue Date : 26 June 2024

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Issuing Laboratory.
FM-708-ACT-02 Rev.03 Issue date 5/6/24

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Certificate No : 24-ACT-091

Request No : Req-2024-1380

Sound pressure level

Calibration Results : Without Adjustment

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty (± dB)	Acceptance limit Class 1 (± dB)	Result
	Measured	Deviated value	Measured	Deviated value			
94 dB / 1000 Hz	94.02	0.02	-	-	0.14	0.25	Pass
114 dB / 1000 Hz	114.05	0.05	-	-	0.13	0.25	Pass

Frequency of Sound pressure level

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

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

Calibration Range (Hz)	Without Adjustment	Adjustment	Uncertainty (± %)	Acceptance limit Class 1 (± %)	Result
	Measured (%)	Measured (%)			
94 dB / 1000 Hz	0.24	-	0.40	2.5	Pass
114 dB / 1000 Hz	0.44	-	0.40	2.5	Pass

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

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Issuing Laboratory.
FM-708-ACT-02 Rev.03 Issue date 5/6/24

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Certificate No : 24-ACT-091

Request No : Req-2024-1380

Decision Rule for Statements of Conformity

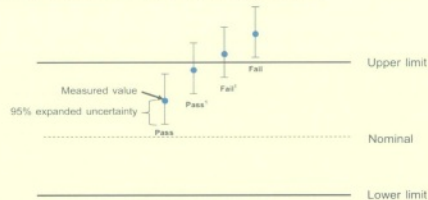
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09/2019: Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

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

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

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

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



End of Calibration

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Issuing Laboratory.
FM-708-ACT-02 Rev.03 Issue date 5/6/24

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Certificate No.: CP20240292EA
Operation No.: CP2024070255

Certificate of Calibration

Equipment: Sound Level Meter

Manufacturer: Larson Davis (Meter), PCB (Microphone), PCB (Preamplifier)

Model/Type: LxT2 (Meter), 375B02 (Microphone), PRLxT2B (Preamplifier)

Serial No.: 0005348 (Meter), 11800 (Microphone), 056140 (Preamplifier)

ID No.: UAE.EFM.045/2563

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

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

Received Date: 25 July 2024

Calibrated Date: 6 - 7 August 2024

Issued Date: 7 August 2024

Calibrated by: Ms. Juntaporn Kunhakom

Approved by: 
(Mr. Sittichai Swaksuriyawong)
Group Manager

This report was prepared electronically using applicable electronic signature. Printing or copy of file are considered as a copy of the document.
The reported uncertainty of measurement was based on standard uncertainty multiplied by a coverage factor (k) providing a level of confidence of approximately 95%. This certificate may not be reproduced other than in full except with the prior written approval of the Electrical and Electronics Institute, Foundation for Industrial Development.

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F-CAL-004 Ed.1



Certificate No.: CP20240292EA

Calibration Report

Equipment: Sound Level Meter

Manufacturer: Larson Davis (Meter), PCB (Microphone), PCB (Preamplifier)

Model/Type: LxT2 (Meter), 375B02 (Microphone), PRLxT2B (Preamplifier)

Serial No.: 0005348 (Meter), 11800 (Microphone), 056140 (Preamplifier)

ID No.: UAE.EFM.045/2563

Ambient Temperature: (23 ± 2) °C

Relative Humidity: (50 ± 15) %

Pressure: (101.3 ± 1.5) kPa

Method of Calibration :-
IEC 61672-3:2013.

Condition of this result of calibration

1. Reference standards instrument :-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Standard microphone	4180	2787490	AA-1012-23	12 November 2024
2) Arbitrary Function Generator	AFG2021	C010063	CK20240048EA	23 June 2025
3) Programmable Attenuator	PA5	2755	EF-0040-23	1 October 2024
4) 6.5 Digit precision multimeter	8846A	9610014	CB20230200EA	15 November 2024
5) Pressure humidity and Temperature Transmitter	PTU301	L3950483	CD20240142EA	12 June 2025
6) Pressure humidity and Temperature Transmitter	PTU301	L3950484	CL1-P240030 CD20240143EA	11 April 2025 12 June 2025
7) Performance Audio Analyzer	U8903B	MY56510003	CB20240035EB CK20230072EA	13 February 2025 13 September 2024

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

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

Reference standards instrument for Acoustic function

- National Institute of Metrology (Thailand)

Reference standards instrument for Electrical function

- National Institute of Metrology (Thailand)

- Electrical and Electronics Institute; NSC Accredited Calibration No.0119

Result of Calibration:-

Function : 1. Indication at the calibration check frequency

Reference Acoustic Signal (dB)	Measured value (dB)	Deviation (dB)	Acceptance limits (dB)
-	-	-	-

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F-CAL-005 Ed.1

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Certificate No.: CP20240292EA

Calibration Report

Function : 2. Self-generated Noise

2.1 Microphone Installed

Measured value (dB)
31.6

2.2 Microphone replaced by the electrical input signal device

Frequency Weighting	Measured value (dB)
A-weighting	31.5
C-weighting	31.6
Z-weighting	36.6

Function : 3. Acoustical signal tests of frequency weightings (Without Windscreen)

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

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve			
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance limits (dB)
125	0.3	0.2	0.2	±1.5
1000	-0.2	-0.2	-0.2	±1.0
8000	2.9	2.9	2.9	±5.0

Function : 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve			
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance limits (dB)
63	0.0	0.0	0.0	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.1	0.0	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.1	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.0	0.1	±5.0

Function : 5. Frequency and time weighting at 1 kHz

5.1 Frequency weighting at 1 kHz

Frequency Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
C-weighting	94.0	0.0	±0.2
A-weighting	94.0	0.0	±0.2
Z-weighting	94.0	0.0	±0.2

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Certificate No.: CP20240292EA

Calibration Report

5.2 Time weighting at 1 kHz

Time Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	94.0	0.0	±0.1
Slow	94.0	0.0	±0.1
LAeq	94.0	0.0	±0.1

Function : 6. Long-Term Stability

Long-term stability over 30 minutes, with steady 1 kHz signal at reference level.

Time Period to Apply Signal (min)	Reference SPL (dB)	Record SPL at Conclusion of Time Period (dB)	Deviated value (dB)	Acceptance limits (dB)
30	94.0	94.0	0.0	±0.3

Function : 7. Level Linearity on the reference level range

7.1 Level Linearity on the reference level range, Upper

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±1.1
99.0	99.0	0.0	±1.1
104.0	104.0	0.0	±1.1
109.0	109.0	0.0	±1.1
114.0	114.0	0.0	±1.1
119.0	119.0	0.0	±1.1
124.0	124.0	0.0	±1.1
129.0	129.0	0.0	±1.1
134.0	134.1	0.1	±1.1
139.0	139.1	0.1	±1.1
140.0	140.1	0.1	±1.1
141.0	141.1	0.1	±1.1
142.0	142.1	0.1	±1.1

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Certificate No.: CP20240292EA

Calibration Report

7.2 Level Linearity on the reference level range, Lower

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.1	0.1	±1.1
43.0	43.2	0.2	±1.1
42.0	42.3	0.3	±1.1
41.0	41.4	0.4	±1.1
40.0	40.5	0.5	±1.1

Function : 8. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	200	136.0	0.0	±1.0
	2	118.8	-0.2	+1.0 ; -2.5
	0.25	109.7	-0.3	+1.5 ; -5.0
Slow	200	129.5	-0.1	±1.0
	2	109.9	-0.1	+1.0 ; -5.0
	0.25	100.9	-0.1	+1.5 ; -5.0

Function : 9. Peak C sound level

Number of cycles in test signal	Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Complete cycle	135.4	134.8	-0.6	±3.0
Positive half cycle	134.4	134.1	-0.3	±2.0
Negative half cycle	134.4	134.1	-0.3	±2.0

Function : 10. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limits (dB)
Positive one-half cycle	Negative one-half cycle		
145.3	145.2	-0.1	±1.5

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Certificate No.: CP20240292EA

Calibration Report

Function : 11. High-Level Stability

High-level stability over 5 minutes, with steady 1 kHz signal, 1 dB below upper boundary.

Time Period to Apply Signal (min)	Reference SPL (dB)	Record SPL at Conclusion of Time Period (dB)	Deviated value (dB)	Acceptance limits (dB)
5	139.0	139.0	0.0	±0.3

Uncertainty of measurement

Function	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1) Indication at the calibration check frequency	0.30	Not applicable
2) Self-generated Noise	0.10	Not applicable
3) Acoustical signal tests of frequency weightings - Free-field sound pressure response level	0.30	0.60 (10Hz to 4kHz) 0.70 (>4kHz to 10kHz)
4) Electrical signal tests of frequency weightings	0.20	0.20
5) Frequency and time weighting at 1 kHz	0.20	0.20
6) Long-Term Stability	0.10	0.10
7) Level Linearity on the reference level range	0.30	0.30
8) Tone burst response	0.20	0.30
9) Peak C sound level	0.20	0.35
10) Overload indication	0.20	0.25
11) High-Level Stability	0.10	0.10

- Remarks:
1. Indication at the calibration check frequency can not measured because customer does not provide a sound calibrator.
 2. The acceptance limit is for the deviated value.
 3. Acceptance limits was IEC61672-3:2013 Class 2.
 4. The coverage factor $k = 2.00$

-- End of Report --

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Certificate of Calibration

Customer

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

Unit Under Calibration Details

Measurement item : Sound Level Meter
Manufacturer : Larson Davis
Model : LX12
Serial Number : 0005393
ID : UAE.EFM.0302564
Resolution : 0.1 dB

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	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 %.

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

Calibrated By : 
Mr. Noppadon Luangrat
Service Calibration Engineer

Approved By : 
Mr. Pait Mathavorn
Calibration Engineer Supervisor




Issue Date : 10 July 2024

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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
7/139 MOO 13, SOI SUTINAKORN 11 TAMBON BANG KAEO,
AMPHOE BANG PHI SAMUT PRAKAN PROVINCE 10540 THAILAN
TEL: 0660-2116-5860-1 FAX: 0660-2116-7140



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

1. Indication at the calibration check frequency

UUC Setting	Nominal Level	Before Adjust	After Adjust	UNCERTAINTY	Acceptance Limit	Result		
FAST / A / 37-139	(dB)	UUC (dB)	ERR (dB)	UUC (dB)	ERR (dB)	(± dB)	(± dB)	
Calibrator Setting								
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		
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)	(± dB)
UUC Weighting		
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 Responce curve	UNCERTAINTY	Acceptance Limit	Result
FAST / 37-139	A (dB) C (dB) Z (dB)	(± dB)	(± dB)	
STD Setting				
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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Certificate No : 24-SLM-237
Request No : Req-2024-1456

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

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

6. Frequency and time weightings at 1kHz

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

7. Long Term Stability




UUC Setting	Anticipated	Deviation	UNCERTAINTY	Acceptance Limit	Result
FAST / A / 37-139	REF	UUC (dB) ERR (dB)	(± dB)	(± dB)	
STD dB					
139.00	139	139.0 0.0	0.10	0.30	Pass
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	49.0 0.0			
44.00	44	44.1 0.1			
39.00	39	39.4 0.4			
38.00	38	38.5 0.5			

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

INNOVATIVE INSTRUMENT CALIBRATION LAB
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TEL: 0660-2116-5860-1 FAX: 0660-2116-7140



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

8. Level linearity on the reference level range

UUC Setting	Anticipated	Deviation	UNCERTAINTY	Acceptance Limit	Result
FAST / A / 37-139	REF	UUC (dB) ERR (dB)	(± dB)	(± dB)	
STD dB					
139.00	139	139.0 0.0	0.10	0.30	Pass
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	49.0 0.0			
44.00	44	44.1 0.1			
39.00	39	39.4 0.4			
38.00	38	38.5 0.5			

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



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

9. Level linearity including the level range control

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

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)	(± 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
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	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)	0.20	3.0	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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FM-700-SLM-01 Rev.04 Issue date 5/6/24



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

12. Overload indication

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

13. High Level Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance Limit	Result
FAST / A / 37-139	UUC	(± dB)	(± dB)	
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

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FM-700-SLM-01 Rev.04 Issue date 5/6/24



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

Decision Rule for Statements of Conformity

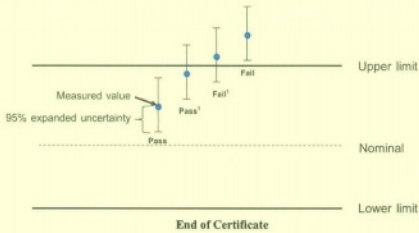
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09-2019; Guidelines on the Reporting of Compliance with Specification as following Fig. and statements:

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

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

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

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



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FM-700-SLM-01 Rev.04 Issue date 5/6/24



Certificate No.: CP20240291EA
Operation No.: CP2024070254

Certificate of Calibration

Equipment: Sound Level Meter

Manufacturer: Larson Davis (Meter), PCB (Microphone), PCB (Preamplifier)

Model/Type: LxT2 (Meter), 375A04B02 (Microphone), PRLxT2C (Preamplifier)

Serial No.: 0005396 (Meter), 329350 (Microphone), 073805 (Preamplifier)

ID No.: UAE.EFM.033/2564

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

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

Received Date: 25 July 2024

Calibrated Date: 5 - 6 August 2024

Issued Date: 7 August 2024

Calibrated by: Ms. Juntaporn Kunhakom

Approved by: 
(Mr. Sittichai Swaksuriyawong)
Group Manager

This report was prepared electronically using applicable electronic signature. Printing or copy of file are considered as a copy of the document.
The reported uncertainty of measurement was based on standard uncertainty multiplied by a coverage factor (k) providing a level of confidence of approximately 95%. This certificate may not be reproduced other than in full except with the prior written approval of the Electrical and Electronics Institute, Foundation for Industrial Development.

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F-CAL-004 Ed.1



Certificate No.: CP20240291EA

Calibration Report

Equipment: Sound Level Meter

Manufacturer: Larson Davis (Meter), PCB (Microphone), PCB (Preamplifier)

Model/Type: LxT2 (Meter), 375A04B02 (Microphone), PRLxT2C (Preamplifier)

Serial No.: 0005396 (Meter), 329350 (Microphone), 073805 (Preamplifier)

ID No.: UAE.EFM.033/2564

Ambient Temperature: (23 ± 2) °C

Relative Humidity: (50 ± 15) %

Pressure: (101.3 ± 1.5) kPa

Method of Calibration :-
IEC 61672-3:2013.

Condition of this result of calibration

1. Reference standards instrument :-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Standard microphone	4180	2787490	AA-1012-23	12 November 2024
2) Arbitrary Function Generator	AFG2021	C010063	CK20240048EA	23 June 2025
3) Programmable Attenuator	PA5	2755	EF-0040-23	1 October 2024
4) 6.5 Digit precision multimeter	8846A	9610014	CB20230200EA	15 November 2024
5) Pressure humidity and Temperature Transmitter	PTU301	L3950483	CL1-P240023 CD20240142EA	24 March 2025 12 June 2025
6) Pressure humidity and Temperature Transmitter	PTU301	L3950484	CL1-P240030 CD20240143EA	11 April 2025 12 June 2025
7) Performance Audio Analyzer	U8903B	MY56510003	CB20240035EB CK20230072EA	13 February 2025 13 September 2024

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

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

Reference standards instrument for Acoustic function

- National Institute of Metrology (Thailand)

Reference standards instrument for Electrical function

- National Institute of Metrology (Thailand)

- Electrical and Electronics Institute; NSC Accredited Calibration No.0119

Result of Calibration:-

Function : 1. Indication at the calibration check frequency

Reference Acoustic Signal (dB)	Measured value (dB)	Deviation (dB)	Acceptance limits (dB)
-	-	-	-

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F-CAL-005 Ed.1

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Certificate No.: CP20240291EA

Calibration Report

Function : 2. Self-generated Noise

2.1 Microphone Installed

Measured value (dB)
29.3

2.2 Microphone replaced by the electrical input signal device

Frequency Weighting	Measured value (dB)
A-weighting	29.1
C-weighting	28.8
Z-weighting	34.1

Function : 3. Acoustical signal tests of frequency weightings (Without Windscreen)

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

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve			
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance limits (dB)
125	0.3	0.1	0.3	±1.5
1000	-0.1	-0.1	-0.1	±1.0
8000	0.2	0.2	0.2	±5.0

Function : 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve			
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance limits (dB)
63	0.0	0.0	0.0	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.0	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	-0.1	0.0	±5.0

Function : 5. Frequency and time weighting at 1 kHz

5.1 Frequency weighting at 1 kHz

Frequency Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
C-weighting	94.0	0.0	±0.2
A-weighting	94.0	0.0	±0.2
Z-weighting	94.0	0.0	±0.2

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F-CAL-005 Ed.1



Certificate No.: CP20240291EA

Calibration Report

5.2 Time weighting at 1 kHz

Time Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	94.0	0.0	±0.1
Slow	94.0	0.0	±0.1
LAeq	94.0	0.0	±0.1

Function : 6. Long-Term Stability

Long-term stability over 30 minutes, with steady 1 kHz signal at reference level.

Time Period to Apply Signal (min)	Reference SPL (dB)	Record SPL at Conclusion of Time Period (dB)	Deviated value (dB)	Acceptance limits (dB)
30	94.0	94.0	0.0	±0.3

Function : 7. Level Linearity on the reference level range

7.1 Level Linearity on the reference level range, Upper

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±1.1
99.0	99.0	0.0	±1.1
104.0	104.0	0.0	±1.1
109.0	109.0	0.0	±1.1
114.0	114.0	0.0	±1.1
119.0	119.0	0.0	±1.1
124.0	124.0	0.0	±1.1
129.0	129.0	0.0	±1.1
134.0	134.1	0.1	±1.1
139.0	139.1	0.1	±1.1
140.0	140.1	0.1	±1.1
141.0	141.1	0.1	±1.1

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F-CAL-005 Ed.1

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Certificate No.: CP20240291EA

Calibration Report

7.2 Level Linearity on the reference level range, Lower

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.1	0.1	±1.1
43.0	43.1	0.1	±1.1
42.0	42.2	0.2	±1.1
41.0	41.2	0.2	±1.1
40.0	40.3	0.3	±1.1

Function : 8. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	200	135.9	-0.1	±1.0
	2	118.8	-0.2	+1.0 ; -2.5
	0.25	109.8	-0.2	+1.5 ; -5.0
Slow	200	129.5	-0.1	±1.0
	2	109.9	-0.1	+1.0 ; -5.0
	0.25	101.0	0.0	+1.5 ; -5.0

Function : 9. Peak C sound level

Number of cycles in test signal	Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Complete cycle	135.4	134.8	-0.6	±3.0
Positive half cycle	134.4	134.0	-0.4	±2.0
Negative half cycle	134.4	134.0	-0.4	±2.0

Function : 10. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limits (dB)
Positive one-half cycle	Negative one-half cycle		
143.4	143.4	0.0	±1.5

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Certificate No.: CP20240291EA

Calibration Report

Function : 11. High-Level Stability

High-Level stability over 5 minutes, with steady 1 kHz signal, 1 dB below upper boundary.

Time Period to Apply Signal (min)	Reference SPL (dB)	Record SPL at Conclusion of Time Period (dB)	Deviated value (dB)	Acceptance limits (dB)
5	139.0	139.0	0.0	±0.3

Uncertainty of measurement

Function	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1) Indication at the calibration check frequency	0.30	Not applicable
2) Self-generated Noise	0.10	Not applicable
3) Acoustical signal tests of frequency weightings - Free-field sound pressure response level	0.30	0.60 (10Hz to 4kHz) 0.70 (>4kHz to 10kHz)
4) Electrical signal tests of frequency weightings	0.20	0.20
5) Frequency and time weighting at 1 kHz	0.20	0.20
6) Long-Term Stability	0.10	0.10
7) Level Linearity on the reference level range	0.30	0.30
8) Tone burst response	0.20	0.30
9) Peak C sound level	0.20	0.55
10) Overload indication	0.20	0.25
11) High-Level Stability	0.10	0.10

- Remarks:
1. Indication at the calibration check frequency can not measured because customer does not provide a sound calibrator.
 2. The acceptance limit is for the deviated value.
 3. Acceptance limits was IEC61672-3:2013 Class 2.
 4. The coverage factor $k = 2.00$

-- End of Report --

เอกสารไม่ควบคุม

List of Instruments Certification for Water Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Water									
1	pH Meter	pH	Ecosence	pH100A JC04740	Technology Promotion Association (Thailand-Japan)	24CH311	13 Mar 24	12 Mar 25	-
2	DO Meter	DO	Horiba	LAQUA-DO210 HE2L0040	Technology Promotion Association (Thailand-Japan)	24TW58	13 Mar 24	12 Mar 25	-
3	Conductivity Meter	Conductivity	Horiba	LAQUA-EC210 HC9L0015	Technology Promotion Association (Thailand-Japan)	24CH322	14 Mar 24	13 Mar 25	-



Cert.No.: 24CH311
Page.: 1 of 3

Certificate of Calibration

Equipment : pH Meter
Manufacturer : EcoSense
Model : pH100A
Serial No. : JC04740
ID No. : UAE.EF.V.062/2566(EFM.pH.03/66)
Condition As-Received : Used Item
Received Date : 12 March 2024
Calibration Date : 13 March 2024
Reference : 2403-0366WSC 4
Submitted by : United Analyst and Engineering Consultant Co.,Ltd
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong, Bangkok 10260

Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 15) %
Calibration Procedure : In-house method :
- CP-CH5 by direct measurement with 100 voltage standard and direct measurement with certified reference material (CRM)
CP-CH6 by comparison with temperature standard

Calibrated by : Warakorn Lemgagtrakul

Approved by :

Saithip
Approved Signatory

() Ponthippa Tameyakul
() Unanopphol Harachai
(x) Saithip Meangmae

Issue Date : 15 March 2024

The Uncertainties are for a confidence probability of approximately 95%

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Approved on behalf of Corporate Services & Equipment Calibration and Testing Services

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A 0064528



Cert.No.: 24CH311
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	64030049	130RC116	23E2602	27 Aug 2024
2) Ref. Standard Thermometer	4982054	110RC044	23E008	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 Results

Function : mV Measurement

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

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (±mV)	Coverage factor k
			mV	pH		
pH Meter S/N.: JC04740	4.00	177.45	177	4.01	0.58	2.00
	7.00	0.00	0	7.00	0.58	2.00
	7.00	0.00	0	7.00	0.58	2.00
	10.00	-177.48	-177	10.01	0.58	2.00

เอกสารไม่ควบคุม

a 1206339



Cert.No.: 24CH311
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.: 230906SIA605377	4.008	4.01	172	0.0071	2.00
	6.986	7.00	-2	0.0099	2.00
	6.986	7.00	-2	0.011	2.00
	9.997	10.01	-177	0.0096	2.00

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : -
- Serial No. : 230906SIA605377

Dimension of probe

- Length : 110 mm.
- Diameter : 12 mm.
- Immersion Depth : 100 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement (± °C)	Coverage factor k
25.0	25.004	24.9	-0.104	0.13	2.00
30.0	30.002	29.9	-0.102	0.13	2.00
35.0	35.002	34.9	-0.102	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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เอกสารไม่ควบคุม

a 1206340



Cert.No.: 24TW58
Page.: 1 of 2

Certificate of Testing

Equipment : DO Meter
Manufacturer : Horiba
Model : LAQUA-DO210
Serial No. : HE2LC040
ID No. : UAE.EFM.017/2568(EFM.DO.02/46)
Received Date : 12 March 2024
Test Date : 13 March 2024
Reference : 2403-0385WSC-6
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road, Bangkok.
Phrakhanong, Bangkok 10260
Laboratory Condition : Temperature : (25 ± 5) °C
Humidity : (50 ± 20) %
Test Procedure : In - house method : CP-CH3
by Comparison Technique with Azide Modification Method
Tested by : Walalak Sirithuan
Approved by :
() Pornthippa Tamayakul
() Unnopphol Harachai
(✓) Saitip Meangmai
Issue Date : 15 March 2024

เอกสารไม่ควบคุม



Cert.No.: 24TW58
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 | 23MW405 | 16 July 2024 |
2. Standard Material :

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

Result : Dissolved Oxygen Meter Adjustment With Air 100 %
Dissolved Oxygen Probe No.: 0K2L0010

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.18	8.19	0.0045

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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เอกสารไม่ควบคุม



Cert. No.: 24LM43
Page.: 1 of 2

Certificate of Calibration

Equipment : DO Meter With Sensor
Manufacturer : Horiba
Model : LAQUA-DO210
Serial No. : HE2LC040
ID No. : UAE.FFM.017/2568(EFM.DO.02/46)
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangkok, Phrakhanong,
Bangkok 10260
Location : TPA Chemistry Calibration Laboratory
Received Order : 12 March 2024
Calibrated Date : 14 March 2024
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
AC Line Voltage : (220 ± 22) V
Calibrated by : Praecha Huih'o
Approved by :
() Pornthippa Tamayakul
() Unnopphol Harachai
(✓) Suwit Imjai
Issue Date : 29 March 2024

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced or used in any way without the prior written
Approval of the user of Corporate Services : Equipment Calibration and Testing Services.

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Equipment : DO Meter With Sensor
Condition As-Received : Used Item
Reference : 2403-0385WSC-5
Procedure Used :

Cert. No.: 24LM43
Page.: 2 of 2

Calibration were conducted using In house calibration procedure CP-OT01 according to comparison with
Industrial Platinum Resistance Thermometer (IPT) 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	A62R47	23H222	TPA	10 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: 9K2L0010

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty (± °C)	Coverage Factor k
25.0	100	25.002	25.0	-0.002	0.16	2.00
30.0	100	30.003	30.0	-0.003	0.16	2.00
35.0	100	35.004	35.0	-0.004	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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เอกสารไม่ควบคุม



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & PROMPT CALIBRATION AND TESTING SERVICES
334/1 PATTANAKARN ROAD SOI 19, SIANJITJANG SUBURBAN BANGKOK 10230
TEL: 02-7163000-2 FAX: 02-7193484




Cert.No.: 24CH322
Page: 1 of 3

Certificate of Calibration

Equipment : Conductivity Meter
Manufacturer : Horiba
Model : I AQUA-EC210
Serial No. : HCSL0015
ID No. : UAE.EFM.010/2583(EFM.SCT.04/63)
Condition As-Received: Used Item
Received Date : 12 March 2024
Calibration Date : 14 March 2024
Reference : 2403-0087WSC-2
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangdichak, Phraekhanong, Bangkok 10200
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 : 
Approved Signatory

() Pornthippan Taneyakul
() Unnopphol Harachai
(x) Saitip Meangmai

Issue Date : 15 March 2024

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

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Approval of Technology Promotion Association's Calibration and Testing Services.

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A 0064532



Cert.No.: 24CH322
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	1963876	130RC085	2311051	05 Sep 2024
2) Ref. Std. Thermometer	4982054	110RC044	231008	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 ± 0.1) °C

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

Calibration results

Function : Conductivity Measurement

(*) After Adjustment at 1413.0 µS/cm

Conductivity Electrode Serial No.: 9B9FD277

Standard Conductivity Solution	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement (±)	Coverage factor k
1413.0 µS/cm	1436 µS/cm	1413 µS/cm	9.2 µS/cm	2.00
12.880 mS/cm	13.22 mS/cm	12.95 mS/cm	0.066 mS/cm	2.00

Remark : - UUC* = Unit Under Calibration

เอกสารไม่ควบคุม

a 1206347



Cert.No.: 24CH322
Page: 3 of 3

Calibration Results

Function : Temperature Measurement

This equipment was connected with Temperature Probe;

- Model : 9383
- Serial No. : 9B9FC277

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	25.003	25.0	-0.003	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 %.

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เอกสารไม่ควบคุม

a 1206348

List of Instruments Certification for Water Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Water									
1	pH Meter	ความเป็นกรด-ด่าง (pH) อุณหภูมิ(Temperature)	Mettler-Toledo	Seven Easy S20 / 1231155210	National Food Institute, Ministry of Industry, Thailand	2401718-001-01	11 Mar 24	10 Mar 25	-
2	Ion Selective Electrode Meter (ISE)		Orion	Star A214 / X36836	Science Tech Co.,Ltd.	FT004/24	27 May 24	26 May 25	-
3	BOD Incubator	Biochemical Oxygen Demand (BOD)		UR-1320 / (UAE.WAO.018/2551)	Technology Promotion Association (Thailand-Japan)	24TM587	1 Apr 24	31 Mar 25	-
4	BOD Incubator	Biochemical Oxygen Demand (BOD)	Arco	UR-1320 / (UAE.WAO.006/2553)	Technology Promotion Association (Thailand-Japan)	24TM588	1 Apr 24	31 Mar 25	-
5	Analytical Balance (Repeatability 0.1 mg)	น้ำมันและไขมัน (Oil & Grease)	Mettler-Toledo	XSR204 / C117635043	National Food Institute, Ministry of Industry, Thailand	24MM293	11 May 24	10 May 25	
6	COD Reactor (Heating Block)	ซีโอดี (COD)	Hanna	HI839800 / 1147807	Hanna Instruments (Thailand) Ltd.	HIT-2417-0568	25 Apr 24	24 Apr 25	-
7	Analytical Balance (Repeatability 0.01 mg)	ของแข็งแขวนลอยทั้งหมด (TSS) ของแข็งละลายทั้งหมด (TDS)	Mettler-Toledo	XSR205DU / C009071872	Technology Promotion Association (Thailand-Japan)	2402283-001-01	2 Apr 24	1 Apr 25	-
8	Hot Air Oven	ของแข็งทั้งหมด (TS)	Memmert	UF55 / B216.1666	Technology Promotion Association (Thailand-Japan)	2500116-001-01	8 Oct 24	7 Oct 25	-
9	Digestor Unit	ทีเคเอ็น (TKN)	FOSS TECATOR	DT2520 / 91794469	FOSS South East Asia	9809	8 Feb 24	7 Feb 25	-
10	Distillation Unit (Kjeldahl Method)	ทีเคเอ็น (TKN)	FOSS TECATOR	KT200 / 91790524	FOSS South East Asia	9810	9 Feb 24	7 Feb 25	-
11	Conductivity Meter	ความเค็ม (Salinity)	SI Analytics	Lab955 / 16300356	DKSH Technology Limited	C24240057	11 Mar 24	10 Mar 25	-
12	UV-VIS Spectrophotometer	ฟอสฟอรัสทั้งหมด (Total P), สี (Color), ไนโตรเจนทั้งหมด (Total N),	Agilent Technologies	Cary60 G6860A / MY15410009	DQE Services Co.,Ltd.	SP24-018	7 May 24	6 May 25	
13	UV-VIS Spectrophotometer	ซัลเฟต (Sulfate)	Hitachi	U-1900 / 2021-064	DQE Services Co.,Ltd.	SP24-008	16 Jan 24	15 Jan 25	-

List of Instruments Certification for Water Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Water									
14	Turbidity Meter	Turbidity	Oakton	T100IR / 1120501017	Technology Promotion Association (Thailand-Japan)	24CH1115	6 Sep 24	5 Sep 25	-
15	Gas Chromatography - Mass Spectrometer (GC-MS)	สารประกอบอินทรีย์ระเหยง่าย (VOCs)	Agilent Technologies	System ID: CN17100005 หรือ 9000 (G3950A) / CN1710 5977B MSD (G7077B) / US1715M030	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	1 Mar 24	1 Mar 25	-
16	Inductively Coupled Plasma (ICP)	เหล็ก (Fe)	Agilent Technologies	System ID:G8015A G8015AA / MY18030001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	4 Nov 24	3 Nov 25	-
17	Cold Vapor Atomic Absorption Spectrophotometer (CVAAS)	ปรอท (Mercury)	Nippon Instrument Corporation	RA-4500 / 17780278	Coax Group Corporation Ltd.	Preventive Maintenance Report	9 Jul 24	8 Jul 25	-
18	Cold Vapor Atomic Absorption Spectrophotometer (CVAAS)	ปรอท (Mercury)	Analytik Jena	mercur DUO plus / K170A0153	Analytik Jena FarEast Thailand Ltd.	Maintenance Protocol	12 Feb 24	10 Feb 25	-
19	Incubator	โคลิฟอร์มแบคทีเรียทั้งหมด (Coliform Bacteria)	Memmert	IPP 260 / V615.0187	Technology Promotion Association (Thailand-Japan)	24TM648	1 Apr 24	31 Mar 25	-
20	Incubator	ฟีคัลโคลิฟอร์มแบคทีเรีย (Fecal Coliform Bacteria)	Memmert	IPP 260 / V618.0033	Technology Promotion Association (Thailand-Japan)	24TM651	2 Apr 24	1 Apr 25	-
21	Water Bath		Memmert	WNE 14 / L416.0614	Technology Promotion Association (Thailand-Japan)	24TM306/1	10 Feb 24	9 Feb 25	-
22	Analytical Balance		OHAUS	PX623 / C236754745	DKSH (Thailand) Ltd.	2402419-001-01	19 Apr 24	18 Apr 25	-

Calibration Certificate

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

Page 1 of 5

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

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

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

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

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

2008 ตบะธรรมะธรรม 35 ถนนธรรมะธรรม แขวงบางนาใต้ เขตบางนา กรุงเทพมหานคร **เอกสารไม่ควบคุม**
2008 So. 35, Arun Amarin Road, Bang Yi Khan Subdistrict, Bang Phlat District, Bangkok 10700, Thailand
Tel. +66(0) 2422 8588 Fax +66(0) 2422 8545

Calibration Report

F-CS-012 Revision: 01 Date: 20-04-69

2008 ตะเยสภานุสุนทร 36 ตะเยสภานุสุนทร แขวงบางยี่สิบ เขตบางเขน กรุงเทพมหานคร **เอกสารไม่ควบคุม**
2008 Sol 36, Arun Amarin Road, Bang Yi Khan Subdistrict, Bang Phat District, Bangkok 10700, Thailand
Tel: +66(0) 2422 8688 Fax: +66(0) 2422 8545

Calibration Report

Certificate No.:	2401719-001-01		
Equipment:	pH Meter	Resolution:	0.01 pH ; 1 mV
	Manufacturer:	METTLER TOLEDO	
	Serial No.:	1231155210	Type: Bench top
	ID No.:	UAE.WAT.0102553	
Date of Calibration:	11 March 2024		
	Page 3 of 5		

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

Offset value before adjust: -0.4 mV		Average Indicator Reading		Uncertainty (\pm mV)	Coverage Factor (k)
Nominal pH	DC Voltage Standard (mV)	mV	pH		
0	414.121	414	0.00	0.58	2.00
2	295.814	296	2.00	0.58	2.00
4	177.464	178	4.00	0.58	2.00
6	59.160	59	6.00	0.58	2.00
7	0.001	0	7.00	0.58	2.00
8	-59.159	-59	8.00	0.58	2.00
10	-177.461	-177	10.00	0.58	2.00
12	-295.811	-296	12.00	0.58	2.00
14	-414.118	-414	14.00	0.58	2.00

2. Calibration of pH Meter with Electrode [Manual Temperature Compensation at 25 °C]

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

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

Certified Value (25 °C (pH)	Average Indicator Reading		Relative Slope (%)	Uncertainty (± pH)	Coverage Factor (k)
	pH	mV			
4.008	4.01	158	-	0.0071	2.00
7.001	7.00	13	98.9	0.0086	2.00
10.010	10.01	-160	97.2	0.0085	2.00
6.865	6.87	21	-	0.0074	2.00

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

2008 ซะฮะรุลอิสลาม 35 ถนนสาทรใต้ 10 แขวงสาทร เขตสาทร กรุงเทพมหานคร **เอกสารไม่ควบคุม**
2008 Soi 35, Arun Amarin Road, Bang Yi Khan Subdistrict, Bang Phlat District, Bangkok 10700, Thailand
Tel +66(0) 2422 8588 Fax +66(0) 2422 8545

Calibration Report

Certificate No.:	2401716-001-01		
Equipment:	Digital Thermometer with RTD (pH Meter)		
Resolution:	0.1	°C	Model: SevenEasy pH
Serial No.:	123155210	ID No.:	UAE.WAT.010/2553
Manufacturer:	METTLER TOLEDO		
Date of Calibration:	11 March 2024		

Page 4 of 5

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

Condition of this results of Calibration

1. Calibration Method :
- In house method: W-TE-Q25 by comparison with standard thermometer.
 - The Calibration is determined by comparing with a known temperature from a standard resistance thermometer.
 - The temperature scale in use at this laboratory is the International Temperature scale of 1990 (ITS-90).

2. Reference Standard Instrument :

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
HANDHELD THERMOMETER	1523	218154	PSL-T 0877/66	06-Jun-24	TISTR
Platinum Resistance Thermometer (PRT)	5627A	877332			

Support Equipment : - Low Temperature Bath (ISOCAL-6), Model: Europa-6 Plus Basic, S/N: 341592/2

3. This certificate is traceable to International System of Units (SI Units).
4. This certificate was certified only for the instrument we calibrated.
5. This result of calibration was found accurate as shown on date and place of calibration only.
6. Condition of Calibrated item : Good
7. Result of Calibration :

X

 Without adjustment

--

 After adjustment

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

2008 baasgruasungr 36 numasgruasungr bangkokin chonburi kangnamungr
2008 Sol 36, Arun Amarin Road, Bang Yi Khan Subdistrict, Bang Phlat District, Bangkok 10700, Thailand
Tel: +66(0) 2422 8668 Fax: +66(0) 2422 8545

Calibration Report

Certificate No.: 2401718-001-01
Equipment: Digital Thermometer with RTD (pH Meter)
Resolution: 0.1 °C Model: SevenEasy pH
Serial No.: 1231155210 ID No.: UAE.WAT.010/2553
Manufacturer: METTLER TOLEDO
Date of Calibration: 11 March 2024 Page 5 of 5

Calibration point: 15.0, 25.0 and 35.0 °C

Calibration result:

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

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

Note

- UUC* : Unit Under Calibration

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

----- End -----

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

2008 35/36 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10110
2008 Soi 35, Aun Amai Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10110 Thailand
Tel: +66(0) 2442 8688 Fax: +66(0) 2442 8545

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SCIENCE TECH CO., LTD.

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

Job No. : JF004/24

Certificate No. : FT004/24

Page : 1 of 2

Certificate of Calibration

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

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Certificate of Calibration

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

Condition of this calibration result

- 1 Reference standard materials : Certified Fluoride standard reference solution (Directly measured by differential potentiometry with the aid of potassium fluoride "quasi without transference" against solutions prepared from primary reference materials from NIST)
- 2 This certificate was certified only for the instrument we calibrated
- 3 This result of calibration was found accurate as shown on date and place of calibration only

Result of Calibration

Function : pH/ISE Meter with Probe

Direct Measurement

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

Channel : I

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

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



Cert. No.: 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 ± 1) °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.

เอกสารไม่ควบคุม

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

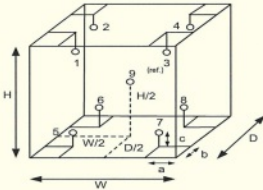
2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This certification is traceable to the International System of Unit.

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 :

Dimension of Chamber :	
a = 10 cm	D = 0.62 m
b = 10 cm	W = 1.2 m
c = 10 cm	H = 1.2 m
	Capacity = 0.89 m ³

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

เอกสารไม่ควบคุม
a 1209743



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

Cert. No.: 24TM587
Page : 3 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

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 1209742



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



NSC-TS1-TS17025
CALIBRATION 0018

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

Certificate of Calibration

Equipment : BOD Incubator

Manufacturer : ARCO

Model : UR-1320

Serial No. : -

ID No. : UAE.WAO.006/2553

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

Location : Lab Floor 2

Received Order : 01 April 2024

Calibration Date : 01 April 2024

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 30) %

Calibrated by : Krisda Malee

Approved by :
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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A 0065064



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

Cert. No.: 24TM588
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.

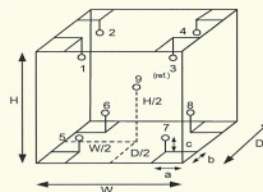
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available

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



Probe Installation Details :

Dimension of Chamber :	
a = 10 cm	D = 0.62 m
b = 10 cm	W = 1.2 m
c = 10 cm	H = 1.2 m
	Capacity = 0.89 m ³

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

เอกสารไม่ควบคุม
a 1209741



Equipment : BOD Incubator
 Condition As-Received : Used Item
 Reference : 2404-0004OC-2
 Result of Calibration :-
 Function of UUC* : Temperature Source
 Fresh air setting : Not Available

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

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

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

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

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

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

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

UUC* : Unit Under Calibration

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

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

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เอกสารไม่ควบคุม

a 1209740

กำหนดจุดห้ามใช้งาน

References Certificate Number. : 234TM588

Equipment : BOD Incubator

Model : UR-1320

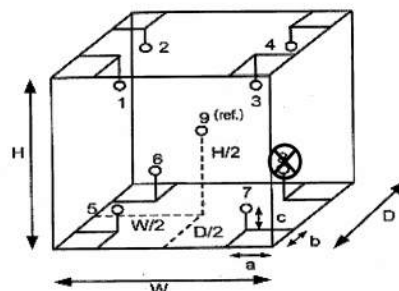
Serial No. : -

ID No. : UAE.WAO.006/2553

Manufacturer : ARCO

Calibration Point : 20.0 °C

Unit Under Calibration Setting : 20.0 °C



รูปภาพเครื่องมือ แสดงจุดที่ได้รับการสอบเทียบ และสัญลักษณ์ ⊗ แสดงจุดห้ามใช้งาน

กำหนดจุดห้ามใช้งานตำแหน่งที่....8.....

หมายเลข เก็บใบแน้ม.....

\\vare.netapp\lab-BON\INSTRUMENT 01-29\6.4\Certificate\ใบห้ามใช้งานเครื่องวัดอุณหภูมิใช้งานเครื่องวัด 2567\กำหนดจุดห้ามใช้งาน.doc

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



Certificate of Calibration

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

Equipment : Electronic Balance

Manufacturer : Mettler Toledo

Model : XSR204

Serial No. : C117635043

ID No. : UAE.WAS.012/2564

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 :

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

Issue Date : 15 May 2024

The Uncertainties are for a confidence probability of approximately 95%

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

เอกสารไม่ควบคุม



Equipment : Electronic Balance
 Condition As-Received : Used Item
 Reference : 2405-0166OC-2
 Procedure used :-

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

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

Condition of this result of calibration

1. Reference standard instruments:-

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

2. This certificate is valid only to the item calibrated on date and place of calibration.
 3. This result of calibration was made on requested at the point specified by customer.

4. This certificate is not certified for any commercial transaction.

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

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

Range capacity : 0 g to 220 g Resolution 0.0001 g

Before Adjustment :

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (± mg)	Coverage Factor (k)
100	100.0000	0.0000	0.27	2.03
200	200.0001	-0.0001	0.31	2

After Adjustment :

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

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

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Calibration Report

Certificate No.: 2402283-001-01
Equipment: Electronic Balance
Model: XSR2050U
Serial No.: C09071872
Capacity: 220 g
Manufacturer: METTLER TOLEDO
Resolution: 0.00001 g / 0.0001 g
ID No.: UAE.WAO.012/2563

Date of Calibration: 2 April 2024 Page 2 of 4

Environment Condition: Ambient Temperature: 24.5 ± 0.5 °C Relative Humidity: 47.5 ± 2.5 %

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

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

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

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1mg to 200g	8505567572	TCS	M23040535	8 April 2024
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	608-H1	NFI.BTH 016/23	Quality Reborn	QR24-0343	9 February 2025

3. This certificate is traceable to SI UNIT

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

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

Calibration Results:

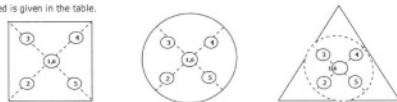
1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
40	0.000052
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 (g)	2 (g)	3 (g)	4 (g)	5 (g)	6 (g)	(Maximum Difference) (g)
100.0002	100.0001	100.0002	99.9999	100.0001	100.0001	0.0003

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

2008 ๒๕๔๙ ณ กรุงเทพมหานคร 35 หมู่ ๑๐ ถนนสุขุมวิท แขวงบางนาใต้ เขตบางนา กรุงเทพมหานคร 10700 ประเทศไทย
2008 Soi 35, Arun Amarin Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand
Tel: +66(0) 2422 8588 Fax: +66(0) 2422 8545 nfi.co.th



Calibration Report

Certificate No.: 2402283-001-01
Equipment: Electronic Balance
Model: XSR2050U
Serial No.: C09071872
Capacity: 220 g
Manufacturer: METTLER TOLEDO
Resolution: 0.00001 g / 0.0001 g
ID No.: UAE.WAO.012/2563

Date of Calibration: 2 April 2024 Page 3 of 4

Calibration Results: (Continued)

Calibration Range: 0 - 80 g

Calibration Adjustment: Internal Calibration

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

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor
Unload	0.000000	0.00000	0.00000	0.0000088	2.00
0.001	0.001003	0.00101	-0.00001	0.0000091	2.00
0.005	0.005003	0.00499	0.00001	0.0000094	2.00
0.01	0.010003	0.01000	0.00000	0.0000091	2.00
0.05	0.049996	0.05000	0.00000	0.0000098	2.00
0.1	0.100011	0.10000	0.00001	0.000011	2.00
0.5	0.500016	0.50001	0.00001	0.000014	2.00
1	1.000003	1.00002	-0.00002	0.000016	2.00
2	2.000023	2.00001	0.00001	0.000017	2.00
5	5.000017	5.00002	0.00000	0.000020	2.00
10	10.000009	10.00000	0.00001	0.000026	2.00
20	20.000031	20.00002	0.00001	0.000037	2.00
30	30.000040	30.00003	0.00001	0.000052	2.00
50	50.000028	50.00004	-0.00001	0.000068	2.00
80	80.000068	80.00005	0.00002	0.00011	2.00

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

2008 ๒๕๔๙ ณ กรุงเทพมหานคร 35 หมู่ ๑๐ ถนนสุขุมวิท แขวงบางนาใต้ เขตบางนา กรุงเทพมหานคร 10700 ประเทศไทย
2008 Soi 35, Arun Amarin Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand
Tel: +66(0) 2422 8588 Fax: +66(0) 2422 8545 nfi.co.th



Calibration Report

Certificate No.: 2402283-001-01
Equipment: Electronic Balance
Model: XSR2050U
Serial No.: C09071872
Capacity: 220 g
Manufacturer: METTLER TOLEDO
Resolution: 0.00001 g / 0.0001 g
ID No.: UAE.WAO.012/2563

Date of Calibration: 2 April 2024 Page 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
90	90.00010	90.0000	0.0001	0.00015	2.00
100	100.00006	100.0000	0.0001	0.00015	2.00
110	110.00007	110.0001	0.0000	0.00017	2.00
120	120.00009	120.0000	0.0001	0.00018	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	200.0000	0.0002	0.00028	2.00

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

***** End *****

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

2008 ๒๕๔๙ ณ กรุงเทพมหานคร 35 หมู่ ๑๐ ถนนสุขุมวิท แขวงบางนาใต้ เขตบางนา กรุงเทพมหานคร 10700 ประเทศไทย
2008 Soi 35, Arun Amarin Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand
Tel: +66(0) 2422 8588 Fax: +66(0) 2422 8545 nfi.co.th



Calibration Certificate

Certificate No.: 2500116-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road, Bangchack, Prakhonong, Bangkok 10260

Equipment: CHAMBER (Hot Air Oven)

Manufacturer: MEMMERT

Model: UF55

Serial No.: B216.1666

ID No.: UAE.WAO.027/2559

Order No.: 2500116

Operation No.: 2500116-001

Date of Receipt: 8 October 2024

Date of Calibration: 8 October 2024

Calibrated by Mr.Yothin Charoensuk
Scientist

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

Date of Issue: 15 October 2024

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

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

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

2008 ๒๕๔๙ ณ กรุงเทพมหานคร 35 หมู่ ๑๐ ถนนสุขุมวิท แขวงบางนาใต้ เขตบางนา กรุงเทพมหานคร 10700 ประเทศไทย
2008 Soi 35, Arun Amarin Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand
Tel: +66(0) 2422 8588 Fax: +66(0) 2422 8545 nfi.co.th



Calibration Report

Certificate No.: 2500116-001-01
Equipment: CHAMBER (Hot Air Oven)
Model: UF55 Serial No.: B216.1666
Resolution: 0.1 °C ID No.: UAE.WAO.027/2559
Manufacturer: MEMMERT
Date of Calibration: 8 October 2024 Page 2 of 3

Location: Laboratory, UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Environment Condition: Ambient Temperature (30.3 ± 1) °C
Relative Humidity (55 ± 1) %
Line Voltage (230 ± 3) Volt

Condition of this results of Calibration:

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

2. Reference Standard Instrument :

Instrument	Model	Serial No./ID No.	Certificate No.	Due Date	Through
Digital Thermometer with sensor	RTD	CHP201-209/RTD#201-209	TE 670486-01	8 June 2025	NATIONAL FOOD INSTITUTE

- 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.
- Condition of Calibrated item : Good

UUC Description :

Time of Record 1 Hour 9 Minute At 104.0,140.0 and 180.0 °C
Fresh air Damper - Open Position -
- X Close Fan 40%
- Not Available

- Result of Calibration : ☒ Without adjustment ☐ After adjustment

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



Calibration Report

Certificate No.: 2500116-001-01
Equipment: CHAMBER (Hot Air Oven)
Model: UF55 Serial No.: B216.1666
Resolution: 0.1 °C ID No.: UAE.WAO.027/2559
Manufacturer: MEMMERT
Date of Calibration: 8 October 2024 Page 3 of 3

Calibration point: 104.0,140.0 and 180.0 °C

Calibration result:

Calibration Condition	Temperature (°C)	Relative Humidity (%)	Line Voltage (Volt)
MIN	29.3	54	227.0
MAX	31.2	56	232.0

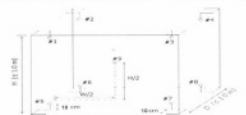


Table1 : Reporting of Temperature

Calibration point (°C)	Measured Temperature (°C) @ Sensor No. (Sensor No.9 is REF)									Uncertainty ± (°C)
	# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8	# 9	
104.0	103.89	103.66	103.88	103.89	104.40	103.98	103.70	104.10	104.15	0.53
140.0	139.85	139.53	139.87	139.88	140.67	140.00	139.60	140.25	140.23	0.73
180.0	179.63	179.22	179.71	179.76	181.03	180.06	179.41	180.87	180.39	0.90

Table 2 : Reporting of Characterization Result

UUC* Setting (°C)	UUC* Reading (°C)			Stability ± (°C)	Uniformity (°C)	Overall Variation (°C)
	MIN	MAX	Average			
104.0	104.0	104.0	104.0	0.15	0.49	0.88
140.0	140.0	140.0	140.0	0.13	0.71	1.2
180.0	180.0	180.0	180.0	0.13	1.2	1.9

Note The quoted uncertainty include " Stability " and " Loading effect (20% of Temp Uniformity) "

UUC* = Unit Under Calibration

Stability = One-half of the greatest maximum difference of measured temperatures at any one sensors, for at least half an hour after reaching steady state.

Uniformity = The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time.

Overall Variation = The difference of the maximum and minimum measured temperatures throughout observation time.

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

----- End -----

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



FOSS Customer Service Report

Date: 8 Feb 2024
Customer: UAE
Instrument: DT2520

Hours	Travel To Customer	Labour	Travel From Customer
Start	08:00	14:00	16:00
Finish	09:10	16:00	17:00

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

PO/Quote Number: If applicable

PMA Type: FOSScare If applicable Contract No. If applicable

Details of Work / Test		Condition / Status
# PM DT2520		
- ทำความสะอาดภายใน		
- ตรวจสอบ connection		
- ตรวจสอบ cable kit, temp cut out		
- ตรวจสอบ cable kit		
- 30°C - 100°C = 10 min		
- 30°C - 400°C = 37 min		
- Instrument 419.0 °C		
Instrument Ready for Use		OK

Part No.	Batch	Description	Qty
60079652	13.09.2023	Cable kit digester	1
100116654	08.01.2023	Temperature control	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: [Email]

เอกสารไม่ควบคุม

FOSS Customer Service Report

Date: 9 Feb 2024
Customer: UAE
Instrument: K7200

Hours	Travel To Customer	Labour	Travel From Customer
Start	08:30	09:30	16:00
Finish	09:30	16:00	17:00

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

PO/Quote Number: If applicable

PMA Type: FOSScare If applicable Contract No. If applicable

Details of Work / Test		Condition / Status
# PM K7200		
- ทำความสะอาดภายใน		
- ตรวจสอบ connection		
- ตรวจสอบ cable kit, temp cut out		
- ตรวจสอบ cable kit		
- 30°C - 100°C = 10 min		
- 30°C - 400°C = 37 min		
- Instrument 419.0 °C		
Instrument Ready for Use		OK

Part No.	Batch	Description	Qty
10009965	14.12.2020	Foss PM kit for 1000 16101 Analysys 6100	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: [Email]

เอกสารไม่ควบคุม



Certificate of Calibration

Certificate No.: C24240057

Page: 2 of 2

Equipment: CONDUCTIVITY METER Certificate No.: C24240057
Model: Lab 955 Issued Date: 11 March 2024
Serial No. (or ID.): 16300356 Job No.: WO-0020309
Manufacturer: SI Analytic Page: 1 of 2
Electrode Serial No. 16070067 Model: LF413T Brand: SI Analytic
Condition: In Condition

Customer: United Analyst and Engineering Consultant Company Limited
3 Soi Udomsuk 41 Sukhumvit Road,
Bangkok, Prakanong, Bangkok 10260 Thailand

Environment Condition: Temperature 23 °C ± 2 °C
Humidity 50 %RH ± 15 %RH

Calibration Place: Environment Laboratory, DKSH Technology Limited.
2533 Sukhumvit Road, Bangkok,
Phrakhanong, Bangkok 10260 Thailand

Calibration By: Mr. Pongpisut Suebchantha
Calibration Date: 11 March 2024
The Method used: In house method, CAL-WI-49, base on ASTM D 1125-14 and D 5391-14
Traceability: This certificate is traceable to the SI Units maintained by CRM of NIST(SRM) through CPA chem Co., Ltd. (ISO/IEC 17034) Certificate No. 960753, 890591, 890593

(Mr. Pongpisut Suebchantha)

Person in charge

(Mr. Nitinun Srihawan)

Authorized signatory

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

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

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

บริษัท ดีเคเอส อีเซีย จำกัด
DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangkok, Phrakhanong, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

Delivering Growth - in Asia and Beyond.

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CAL-FM-CZ-09: 12 Sep 2022

Calibration Results:

Before Adjustment

Standard	Unit Under Calibration	Correction	Coverage Factor	Uncertainty (±)
Conductivity Solution	Reading		(k)	
25.000 µS/cm	26.7 µS/cm	-1.700 µS/cm	2.00	0.21 µS/cm
1413.0 µS/cm	1428 µS/cm	-15.0 µS/cm	2.00	9.0 µS/cm
111.3 mS/cm	108.4 mS/cm	2.9 mS/cm	2.00	0.67 mS/cm

After Adjustment ; at 1413 µS/cm

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

The End of Certificate

บริษัท ดีเคเอส อีเซีย จำกัด
DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
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CAL-FM-CZ-09: 12 Sep 2022

DQE Services Co.,Ltd.

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

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



CERTIFICATE OF CALIBRATION

Certificate No. : SP24-018 Page 1 of 5

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

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

Location of calibration : Laboratory 315

Equipment : UV-Vis Spectrophotometer

Manufacturer : Agilent Technologies

Model : Cary 60

Serial No. : MY15410009

ID No. : UAE.WAT.020/2558

Received Date : 7 May 2024

Calibration Date : 7 May 2024

Issue Date : 9 May 2024

Condition Instrument : Good

Calibrated by :

(Mr. Tanawat Rittidach)

Technical Manager

Approved by :

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

เอกสารไม่ควบคุม

DQE Services Co.,Ltd.

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

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



REPORT OF CALIBRATION

Certificate No. : SP24-018 Page 2 of 5

Environment Condition : Ambient Temperature 25 ± 5 °C

Relative humidity 55 ± 20 %RH

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

Certified Reference Materials :

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

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

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

Spectral Band Width of UUC : 1.5 nm.

Scan Speed of UUC : 60 nm/min

Scan Interval of UUC : 0.15 nm.

Resolution of UUC : Photometric 0.0001 Abs.

Wavelength 0.1 nm.

เอกสารไม่ควบคุม

REPORT OF CALIBRATION

Certificate No. : SP24-018

Page 3 of 5

Calibration Results : Without adjustment

Photometric Accuracy :

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

เอกสารไม่ควบคุม

REPORT OF CALIBRATION

Certificate No. : SP24-018

Page 4 of 5

Photometric Accuracy :

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


เอกสารไม่ควบคุม

DQE

Services

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

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



ISO 17025

17025

CALIBRATION 0404

REPORT OF CALIBRATION

Certificate No. : SP24-018

Page 5 of 5



Wavelength Accuracy :

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

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

- End of Certificate -

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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.Tanawat Rittidach) Technical Manager	Approved by :  (Ms. Chonthicha Sangnern) Quality Manager
The calibration result is applied only to the above calibrated item and was found accurate as shown on date and place of calibration only.	
The measurement capability of the laboratory and its traceability to recognized national standards used to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the DQE Services Co., Ltd.	

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REPORT OF CALIBRATION

Certificate No. : SP24-008

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

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

Certified Reference Materials :

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

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

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

Spectral Band Width of UUC : 4.0 nm.

Scan Speed of UUC : 200 nm/min

Scan Interval of UUC : 0.1 nm.

Resolution of UUC : Photometric 0.001 Abs.

Wavelength 0.1 nm.

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REPORT OF CALIBRATION

Certificate No. : SP24-008

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

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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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Certificate of Calibration

Cert.No.: 24CH1115
Page.: 1 of 2

Equipment : Turbidity Meter
Manufacturer : Oakton
Model : T100IR
Serial No. : 1120501017
ID. No. : UAE.WAT.056/2563
Condition As-Received: Used Item
Received Date : 05 September 2024
Calibration Date : 06 September 2024
Reference : 2409-0177DSC-1
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong, Bangkok 10260
Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 20) %
Calibration Procedure : In - house method : CP-CH11
Direct measurement by
using Formazin standard solution
Calibrated by : Walalak Sirithean
Approved by :
Approved Signatory
() Unnopphol Harachai
() Ponpan Paipim
(✓) Saithip Meangmai
Issue Date : 9 September 2024

The Uncertainties are for a confidence probability of approximately 95%

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

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Agilent Preventive Maintenance Services

Agilent GCMS Preventive Maintenance

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

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

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



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-Hygraph	1103328	130EC010	24H1372	12 July 2025
2) Electronic Balance	1126143764	140RC004	22MM22	20 Feb 2025

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

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

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

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

Calibration result

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

Standard Formazine suspension (NTU)	UUC* Reading (NTU)	Uncertainty of Measurement (± NTU)	Coverage Factor k
0	0.00	0.0081	2.06
20	20.2	0.39	2.00
100	100	0.75	2.00
400	401	1.5	2.06
800	801	2.1	2.17

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

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

-o0o-

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Agilent GCMS Preventive Maintenance Checklist

Introduction

This checklist covers the following model(s):

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

Customer Information

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

Customer Responsibilities

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



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

Additional Instruction Notes

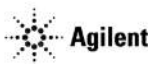
- Preventive maintenance is a factory recommended procedure designed to reduce the likelihood of electromechanical failures. Failure to perform preventive maintenance may reduce the long-term reliability of certain instruments and systems. **Two preventative maintenances (PMs) per year are recommended,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

Definition of the Task/Recommended items within the document

Task		Recommended			
Yes	No	Interim	Major	As Needed	
✓					Yes selected means that the task was done or the part was required
	✓				No selected means that the task was not done or the part was not required.
		✓			Interim selected means that this task is recommended to be done at 6-month intervals
			✓		Major selected means that this task is recommended to be done yearly, if the customer would like a service to be done at the 6-month interval then the service could be purchased
				✓	As needed selected means that the task was done, or the part was used as needed. For example, there could be two types of filters that could be used, and this was the one selected.

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Important notice for customers

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

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

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

Important Customer Web Links

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

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

Service Engineer's Responsibilities

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

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Instrument Maintenance

Select the appropriate service to be performed.

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

System Information

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

Instrument System Name and ID	US2009M037
Instrument System Site and Location	United Analyst And Engineering / GCMS

List System Component Product Numbers	List the Serial Numbers of each Component
1. G 7077B	US2009M037
2.	
3.	
4.	
5.	
6.	

Preparation

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

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Preventive Maintenance Procedures

☐ Service Not Applicable

Interim / Major Preventive Maintenance – GCMS

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

Interim / Major Preventive Maintenance – System Checks

☐ Service Not Applicable

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

Interim / Major Preventive Maintenance – Wet Mechanical vacuum pumps

☐ Service Not Applicable

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

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

Interim / Major Preventive Maintenance – Dry Mechanical vacuum pumps - Diaphragm☒ Service Not Applicable

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

Interim / Major Preventive Maintenance – Dry Mechanical vacuum pumps - Scroll☒ Service Not Applicable

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

Interim / Major Preventive Maintenance – System Post Check☐ Service Not Applicable

		System post-check	
Yes/No	Interim/Major	Description	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
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Guidance: If the PM Service is performed prior to a qualification service, then use the qualification procedure as a guide for final instrument setup and checkout.

Service Review

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

Test Results

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

Signature Page**Service Engineer Comments (optional)**

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

Service Verification

Service Request Number:

6006790785

Service Engineer Name:

[Signature]

Service Engineer Signature:

Date of Service Completion:

27 May 2024

Customer Name:

Total number of pages in this document:

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Agilent CrossLab Start Up Services

Agilent 8890 Gas Chromatograph

Preventive Maintenance Checklist

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

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

Introduction

Customer Information

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

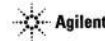
Important Customer Web Links

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



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

List System Component Product Numbers	List the Serial Numbers of each Component
1. G3542A	CN1945A066
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	

Preparation

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

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Preventive Maintenance Procedure

Clean and inspect GC.

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

Inlet and detector consumable replacement

- ☒ Replace the split vent trap cartridge filter using the Maintenance procedure from either the Browser User interfaces on units with these inlets: Split/Splitless Capillary (SSL), Multi-Mode Inlet (MMI), Programmed Temperature Vaporizer (PTV), Volatiles Interface (VI).
- ☒ If the inlet system is used in Split Mode with viscous samples, inspect and clean the split vent tube on the inlet and flush or replace the tubing between the inlet and the split vent trap.
- ☐ For the inlets installed, perform inlet maintenance using the Maintenance procedure from the Browser User interfaces. Record the results. (Leak and Restriction Test)
- ☐ If the GC includes a Flame Ionization Detector (FID), replace the jet. If the ignitor shows any buildup of sample or corrosion, replace the ignitor. Examine the FID collector and castle assemblies for contamination - clean as necessary.

Zero Sensors and Leak test

- ☒ Zero all pressure sensors using the Browser interface.
- ☒ Perform inlet pressure decay test(s) from the diagnostics screen on the Browser User interface. Record if test passed or failed in the results table.

Note: If the PM is done in preparation for an Operational Qualification, then the pressure decay test defined within that protocol can be used for the PM.

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ALS Maintenance

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

Restore Instrument

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

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

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Signature Page

Service Review

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

PM Test Results Table

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

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PM Parts List Table

Note: The following kits are recommended for capillary and purged packed inlets. If this is a general PM and the customer has a preferred set of consumables, you may use the customer's consumables.

Part description	Part number	Product or models where used	Quantity consumed
SSL Capillary Inlet PM kit, Splitless	5188-6497	8890 GC	—
SSL Capillary Inlet PM kit, Split	5188-6496	8890 GC	1
SSL Capillary Ultra Inert Inlet Gold Seal with Washer	5190-6144	8890 GC	N/A
SSL Capillary Ultra Inert Inlet Splitless Liner - Single taper with Glass Wool	5190-2293	8890 GC	N/A
SSL Capillary Ultra Inert Inlet Low Pressure Drop Split Liner - with Glass Wool	5190-2295	8890 GC	N/A
PP Inlet PM kit	5188-6498	8890 GC	N/A
Split vent trap PM kit, single cartridge (for MMI, PTV & VI)	5188-6495	8890 GC	N/A
MMI Cleaning Kit	G3510-60820	8890 GC	N/A
PTV Septumless Head Rebuild Kit	5182-9747	8890 GC	N/A
PTV Septumless Head Teflon Guide	5182-9748	8890 GC	N/A
Ignitor (glow plug) assembly with O-ring	19231-60680	8890 GC	N/A
FID Collector Rebuild/Cleaning Kit	G1531-67000	8890 GC	N/A
FID Collector Replacement Kit	G1531-67001	8890 GC	N/A
Standard .011-inch FID Jet	5200-0176	8890 GC	N/A
Universal .018-inch FID Jet	5200-0177	8890 GC	N/A
FPD Ignitor Assy	19256-60800	8890 GC	N/A

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Do not include this section/page in the published, customer-facing PDF version.

This page is only relevant for Agilent source documents for document control purposes and is NOT intended for customer viewing. Refer to the SPIFPM checklist Authoring Guide for more information.

Document Control Logs

Revision Log

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


Approval Log

Revision	Approver	Title of approver
Add revision number	Add approver name here	Add approver's function or title here
1.00	Suneetha Tippireddy	GC and GCMS Product Support Manager
2.00	Josh Roark	GC and GCMS Product Support Manager

Designated Evaluation Log

Revision	Designated Evaluator (DE)	Title of DE	DE Number
Add revision number	Add name	Add function or title	Add DE number here
2.00	Michael Zumwalt	CrossLab Start Up Services Application Consulting Lead	44166.759722222

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Service Engineer Comments

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

Service Completion

Service request number 6006790785 Date service completed 27 May 2024
Agilent signature [Signature] Customer signature _____
Total number of pages in this document 10 Page.

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Agilent 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.

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 8015A	77 16030001
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. 1118
- ☒ 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. *W11*
- ☒ 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. *W11*
- ☒ 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	1500.9	2213.4	4124.9	6965.9
Mn 257.610 nm SRBR	3915.0	7492.2	13017.9	31121.6
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	226.871	VAC
Mains Current	0.081	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		63.9	°C
Water Flow Oscillator	No measurement		1.34	L/min
Water Flow Detector	0.86	L/min	0.81	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		158.43	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		7.858	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:

6003197100

Service Engineer Name:

Kenwalekorn S.

Service Engineer Signature:

Kenwalekorn 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

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

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	

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	

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 (213.857 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	25.16
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		

Page 2 of 2

เอกสารไม่ควบคุม

Report Summary		
Instrument Model	Agilent 5100/5110 VDV ICP-OES	
Instrument ID	G8011A/G8015A	
Instrument Serial Number	MY18030001	
Software Version	7.3.1.9507	
Firmware Version	3442	
Tested By	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

Page 1 of 4

เอกสารไม่ควบคุม

Resolution Test		
Pass		
Element Wavelength	Specification	Width
N (174.213 nm)	≤ 9.40	6.79
As (188.980 nm)	≤ 8.20	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	15166.0
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

Page 3 of 4

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)	≤ 1.50	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

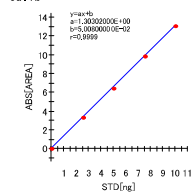
Counter

MAIN	SC	Counter	Parameter		
Measurement Count	2057122 (08-08)	Clear	F1 tube9 (02009)	(000m(24-07-08)	Clear
Mercury Exhaust Filter Amount(mg)(1300mg)	1022 (08-08)	Clear	F2 tube9 (02009)	(001m(24-07-08)	Clear
Lamp Active time(0000h)	1813m(24-07-08)	Clear	F3 tube9 (02009)	(000m(24-07-08)	Clear
Membrane Filter Usage Time(000h)	0650m(24-07-08)	Clear	F4 tube9 (02009)	(000m(24-07-08)	Clear
Main Pump tube(750h)	0650m(24-07-08)	Clear	F5 tube9 (02009)	(000m(24-07-08)	Clear
Heating Lamp Time	56092m(22-08-08)	Clear	F6 tube9 (02009)	(000m(24-07-08)	Clear
			F7 tube9 (02009)	(000m(24-07-08)	Clear

Exit

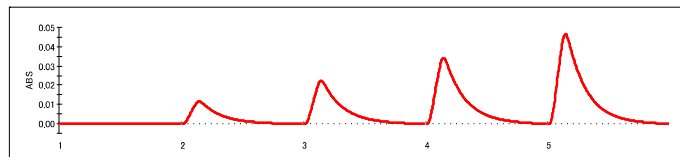
Title : Preventive Maintenance RA-4500 sn:17780278
Date : 2024-07-09
Name : Coax Group
Memo : Calibration Curve 0-10ng

Calib



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

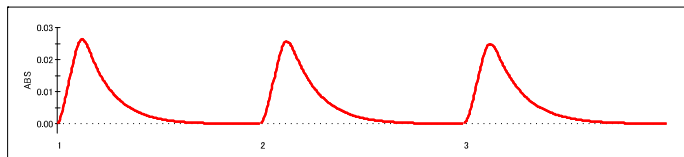
No.	NAME	TRY	AV [ug/L]	SD [ug/L]	Cv [%]
1	100ppb	3	100.887	1.15660	1.15

เอกสารไม่ควบคุม

-1-

เอกสารไม่ควบคุม

NIC NIPPON INSTRUMENTS CORPORATION



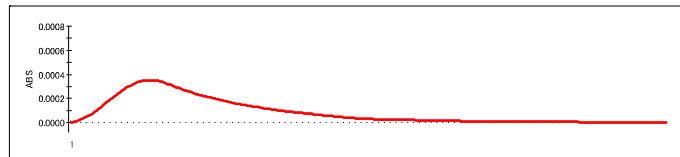
Self Check

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

NIC NIPPON INSTRUMENTS CORPORATION

-3-

เอกสารไม่ควบคุม

NIC NIPPON INSTRUMENTS CORPORATION

Serial-No.: K170A0153 Customer-No.: C04-006
Date: 12 February 2024 Carried out by: Mr. Srichai Fak-On

Maintenance with following Operational Qualification (OQ)
(requires a separate OQ protocol)



Maintenance Protocol

Atomic Fluorescence Spectrometer mercur DUO / mercur DUO plus

เอกสารไม่ควบคุม

Company	บริษัท ยูนิเทค แอนาไลซิส แอนด์ เอ็นจิเนียริ่งคอนซัลแตนท์ จำกัด
User	คุณกรวิทย์
Department	ห้องปฏิบัติการ (Mercur Analysis)
Street	3 ซอยอุดมสุข 41 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง
Zip Code, City	กรุงเทพมหานคร 10260
Country	ประเทศไทย
Phone	
Fax	
E-mail	

Maintenance Protocol mercur DUO / mercur DUO plus | update 27.06.2016 Version 2.1 Koex
Analytik Jena AG | Konrad-Zuse-Str. 1 | 07745 Jena, Germany

เอกสารไม่ควบคุม

Maintenance works basic unit

tightness visual check inside the Mercur	<input checked="" type="checkbox"/>
visual check if gold-traps are broken	<input checked="" type="checkbox"/>
visual check if spectrometer is contaminated	<input checked="" type="checkbox"/>
visual check of the fluorescence cell	<input checked="" type="checkbox"/>
visual check of the absorption cell, incl. window	<input checked="" type="checkbox"/>
reactor cleaning	<input checked="" type="checkbox"/>
check pump-hose, if necessary change it	<input checked="" type="checkbox"/>
check swivel drive (SEV)	<input checked="" type="checkbox"/>
check drying-hose, output gas-liquid-separator	<input checked="" type="checkbox"/>
test Bubble-Sensor	<input checked="" type="checkbox"/>
check gas flows	<input checked="" type="checkbox"/>
check volume flows, reagents	<input checked="" type="checkbox"/>
recording stray light values	<input checked="" type="checkbox"/>
measurement with 30 ng/l	<input checked="" type="checkbox"/>

Maintenance works Autosampler

Serial No.: N/A

lubricate the dosing-winding (Teflon-grease-spray)	<input type="checkbox"/>
clean the dosing cylinder, if necessary exchange it	<input type="checkbox"/>
lubricate the winding system of the height drive with some drops of oil	<input type="checkbox"/>
check the toothed belt	<input type="checkbox"/>
check the position of the mechanical stopper (height: 13mm)	<input type="checkbox"/>
check the pump rate of mixing pump (<14s AS52, typ.7s/<20s AS52S, typ.10s)	<input type="checkbox"/>
check the pump rate of washing cup	<input type="checkbox"/>
check the electrical hose connections for good contact	<input type="checkbox"/>
check the connectors of the magnetic valves	<input type="checkbox"/>
check the dosing hose for buckling, if necessary exchange it	<input type="checkbox"/>

Maintenance Protocol mercur DUO / mercur DUO plus | update 27.06.2016 Version 2.1 Koex
Analytik Jena AG | Konrad-Zuse-Str. 1 | 07745 Jena, Germany

เอกสารไม่ควบคุม

Device parameter	nominal value	actual value
visual check general tightness inside the Mercur	o.k.: <input checked="" type="checkbox"/>	changed: <input type="checkbox"/>
visual check Goldtraps	o.k.: <input checked="" type="checkbox"/>	changed: <input type="checkbox"/>
visual check spectrometer		
Fluorescence cell	o.k.: <input checked="" type="checkbox"/>	changed: <input type="checkbox"/>
Absorption cell, incl. window	o.k.: <input checked="" type="checkbox"/>	changed: <input type="checkbox"/>
lens	o.k.: <input checked="" type="checkbox"/>	changed: <input type="checkbox"/>
Swivel drive (SEV)	o.k.: <input checked="" type="checkbox"/>	changed: <input type="checkbox"/>
check pump hoses	o.k.: <input checked="" type="checkbox"/>	changed: <input type="checkbox"/>
check hoses and hose connectors	o.k.: <input checked="" type="checkbox"/>	changed: <input type="checkbox"/>
check and clean reactor	o.k.: <input checked="" type="checkbox"/>	changed: <input type="checkbox"/>
check drying hose output Gas-liquid-separator	o.k.: <input checked="" type="checkbox"/>	changed: <input type="checkbox"/>
check bubble-sensor	o.k.: <input checked="" type="checkbox"/>	not o.k.: <input type="checkbox"/>
Check gasflow		
Argon pressure valve 4	1.2 – 1.5 bar	1.5 bar
Valve 1	10 Nl/h or 0.166 NL/min	0.166 NL/min
Valve 2	50 Nl/h or 0.833 NL/min	0.833 NL/min
Valve 3	5 Nl/h or 0.083 NL/min	0.083 NL/min
Valve 4	10 Nl/h or 0.166 NL/min	0.166 NL/min
Check liquidflow		
Acid	2.5ml/min ± 1 ml	2.5 ml/min
Red.-agent	2.5ml/min ± 1 ml	2.5 ml/min
Sample	10ml/min ± 2 ml	10 ml/min
Adventitious light - values (V)	from file	
100	0	0
200	0	0
300	0	0
350	0	0
400	1	1
450	3	3
500	8	8
550	18	17
575	26	25
600	36	35

Maintenance Protocol mercur DUO / mercur DUO plus | update 27.06.2016 Version 2.1 Koex
Analytik Jena AG | Konrad-Zuse-Str. 1 | 07745 Jena, Germany

เอกสารไม่ควบคุม

Device parameter	nominal value	actual value
Analytical parameters Fluorescence cell		
Conditions.: max.conc.: 10µg/L PMT-voltage: 451 V		
Blank-solution	Int > 0.0015	Int 0.0005
without enrichment / FBR 30 ng/L	RSD < 3 %	Int 0.0027 RSD 1.81 %
Conditions.: max.conc.: 1.7µg/L PMT-voltage: 444 V		
Blank-solution	Int > 0.008	Int 0.0043
with enrichment / FBR 30 ng/L	RSD < 3 %	Int 0.0171 RSD 3.17 %
Fok.- factor (Int ₂ / Int ₁)	> 3.5	6.33
Analytical parameters Absorption cell		
Blank-solution	Ext. > 0.0012	Ext. 0.0004
without enrichment / FBR 100 ng/L	RSD < 5 %	Ext. 0.0025 RSD 3.17 %
Comments		
# Sensitivity check (Without enrichment / FBR / 100 ng/L)		
Int. Blank = 0.0008		
Int. 100 ng/L = 0.0097		
RSD % = 0.96		

Service Report

Customer's address:		Customer's Ref. No. 0014 SP1248-038	
E-mail:		Phone:	Fax:
Job No. 24020701	User: 940015	Service Engineer: 1516/1500	Date: 12/12/2024 Page: 1/1
Instrument model: K190A0153		Software Version No. 4.7.9.0	
<input type="checkbox"/> Repair (RE) <input checked="" type="checkbox"/> Maintenance (PM) <input type="checkbox"/> Installation (IN) <input type="checkbox"/> Warranty <input type="checkbox"/> Application (AP) <input type="checkbox"/> Site Prep.(SP) <input type="checkbox"/> Visit(VI)			
Fault / Claim: Preventive Maintenance (PM 0/6)			
Action taken: <ul style="list-style-type: none"> - Maintenance not Basic Unit - Check device parameter. - Check gas flow. - Check liquid flow - Check Admittance light - values 			
# Test run Analytical parameter Fluorescence cell Test run Analytical parameter Absorption cell			
Action Performing / Recommendation: <ul style="list-style-type: none"> # Sensitivity check (Without enrichment / FBR / 100 ng/L) Int. Blank = 0.0008 Int. 100 ng/L = 0.0089 RSD % = 0.69 			
<input type="checkbox"/> Spare Part <input type="checkbox"/> Instrument Configuration:			
Item No.	Name	Quantity	Unit Price
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
Herewith the undersigned confirm the time devoted, the work performed, the perfect function of the device, and the receipt/delivery of the specified spare parts. *Traveled hours and kilometers can only be entered after the return of the service engineer.		Date / Signature of Customer	Date / Signature of Service Engineer
		12/02/2024	12/02/2024
		Work completed?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No

Services are subject to the General Terms and Conditions of Analytik Jena AG, which will be sent on request.

Signature Technician

Signature Customer

Place, Date (DD/MM/YYYY)

Place, Date (DD/MM/YYYY)

Maintenance Protocol mercur DVO mercur DVO plus (update 27.06.2016 Version 2.1 Kios)
Analytik Jena AG (Kios) - Zeta-Str. 1, 07745 Jena, Germany

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

12/02/2024 16:11 Page 1/4

Mercur

Report file: C:\WinAAS\TMP\2024\Result\WO\Pro_009
 Program version: 4.7.9.0 Printed on: 12/02/2024 16:11
 Recording started on 12/02/2024 16:00 GMT+7.0
 Operator:
 Laboratory:
 Code:
 Remarks:

Method parameters

Method Without Enr. /FBR/0.10 ng/L_12-02-2024
 Created on 12/02/2024 Time 15:54
 Program ---

Parameters Mercur Technique: Hg fluorescence

Line	253.7 nm		
Lamp type	Hg-LP		
Integr. mode	Peak height	Integr. time	35 s
PMT	464 V		
AZ time	5 s	Peak smoothing	12/5
Delay	0 s		
Working mode	w/o enrich.	System cleaning	Off
FBR technique	on	Wash time acid	10 s
Pump speed	3	Soaking time	20 s
Sample load time	10 s	Gas load time	5 NL/h
Reaction time	6 s		
Waiting time AZ	5 s		
Delay	0 s		
Purge time1	30 s		
Purge time2	15 s	Gas wash time2	10 NL/h

Hg

QC parameters

QC type	Conc. check		
QC check samp. 1	---	QC check samp. 2	---
Conc.	---	Conc.	---
Error limit	---	Error limit	---
Rep. measurement	off	Reaction	flag + continue
QC std.1 no.	1(100.000 µg/L)	QC std.2 no.	3(0.100 µg/L)
QC std.1 limit	± 20.00%	QC std.2 limit	± 20.00%
QC std. act.	flag + continue		
Expect. blank abs.	0.0100± 0.0100	Reaction	flag + continue
QC precision	off	Reaction	off
		QC Recal.factor	Off

Calibration settings

Calib. meth	Standard calib.	Calibr. unit	µg/L
No. standards	1	Conversion fac.	1000
Type of standards	---	Standard prep.	Premixed
		Blank correct.	---
		Recalib. std. no.	---
Output unit	µg/L	Conversion fac.	1000
Calib. stat.	Mean	Meas. cycles	3
		Blind cycles	1
Stock sol. 1	---	Stock sol. 2	---
Stock sol. 3	---	Stock sol. 4	---
Type of cal. curve	linear	Intercept	Zero
Weighted cal.	off	Grubbs stat.	off
Check of cal. curve	no outlier test		

Sample statistics

Stat. mode	Mean	Meas. cycles	3
Confid. level	95.4 %	Blind cycles	1
Grubbs stat.	off		

Calibration standards

No	Name	State	Pos	Conc./µg/L	Ints	SD	RSD/%
1	Cal-Zero	(--)	##	0.000	H: 0.000878 A: 0.01968	0.000052 0.001015	6.030 5.081
2	Cal-Std1	(--)	##	100.000	H: 0.009799 A: 0.1316	0.000084 0.000882	0.969 0.670

Hg

12/02/2024 16:11 Page 2/4

Calibration function 1

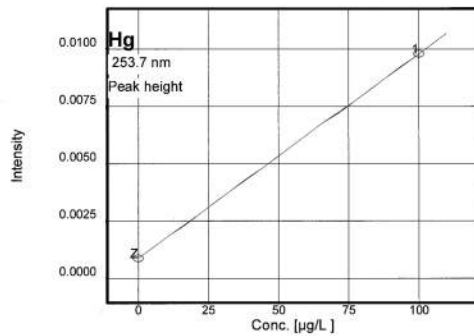
12/02/2024 16:10 Calibration (Peak height)

Ints=k1+k2*conc

k1=0.000878 k2=0.000089

Recal. factor: ---

Slope	0.00009 Ints/(µg/L)	R2-adjusted	1.0000
sc0	1.00000 µg/L		
Lower limit	0 µg/L	Upper limit	110. µg/L
Detection limit	---	Deter. limit	---



Measurements and events (sorted by time)

Hg	Without Enr. /FBR/0.10 ng/L_12-02-2024	12/02/2024 16:00
ID	Conc.	Ints BG SD RSD/% Int. type Time
Cal-Zero		0.000939 PkH 16:03
		0.000845 16:04
		0.000849 16:05
	0µg/L	0.000878 0.000052940 6.030 16:05
Cal-Std1		0.009896 PkH 16:08
		0.009706 16:09
		0.009794 16:10
	100.0µg/L	0.009799 0.000094990 0.969 16:10
Calibration	Calibration function: 01	16:10

Mercur

เอกสารไม่ควบคุม

Mercur

Report file: C:\WinAAS\TMP\2024\Result\WO\Pro_006

Program version: 4.7.9.0 Printed on: 12/02/2024 14:32

Recording started on 12/02/2024 14:21 GMT+7.0

Operator:

Laboratory:

Code:

Remarks:

Method parameters

Method Without Enrichment / FBR / 30 µg/L_PM_12-02-2024

Created on 12/02/2024 Time 11:09

Program ---

Parameters Mercur Technique: Hg fluorescence

Line	253.7 nm		
Lamp type	Hg-LP		
Integr. mode	Peak height	Integr. time	35 s
PMT	451 V		
AZ time	5 s	Peak smoothing	12/5
Delay	0 s		

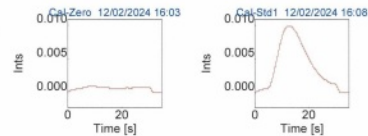
Working mode	w/o enrich.	System cleaning	Off
FBR technique	on	Wash time acid	10 s
Pump speed	3	Soaking time	20 s
Sample load time	12 s	Gas load time	10 NL/h
Reaction time	12 s		
Waiting time AZ	5 s		
Delay	0 s		
Purge time1	30 s		
Purge time2	15 s	Gas wash time2	10 NL/h

Mercur

เอกสารไม่ควบคุม

Peak plots

Hg



Mercur

เอกสารไม่ควบคุม

QC parameters

QC type	Conc. check		
QC check samp. 1	---	QC check samp. 2	---
Conc.	---	Conc.	---
Error limit	---	Error limit	---
Rep. measurement	off	Reaction	flag + continue
QC std.1 no.	1(30.000 ng/L)	QC std.2 no.	3(0.100 ng/L)
QC std.1 limit	± 20.00%	QC std.2 limit	± 20.00%
QC std. act.	flag + continue		
Expect. blank abs.	0.0100± 0.0100	Reaction	flag + continue
QC precision	off		
		Reaction	off
		QC Recal.factor	Off

Calibration settings

Calib. meth	Standard calib.	Calibr. unit	ng/L
No. standards	1	Conversion fac.	1000000
Type of standards	---	Standard prep.	Premixed
		Blank correct.	---
		Recalib. std. no.	---
Output unit	µg/L	Conversion fac.	1000
Calib. stat.	Mean	Meas. cycles	3
		Blind cycles	1
Stock sol. 1	---	Stock sol. 2	---
Stock sol. 3	---	Stock sol. 4	---
Type of cal. curve	linear	Intercept	Zero
Weighted cal.	off	Grubbs stat.	off
Check of cal. curve	no outlier test		

Sample statistics

Stat. mode	Mean	Meas. cycles	3
Confid. level	95.4 %	Blind cycles	1
Grubbs stat.	off		

Calibration standards

Hg

No	Name	State	Pos	Conc./ng/L	Ints	SD	RSD/%
1	Cal-Zero	(--)	##	0.000	H: 0.000587 A: 0.01383	0.000024 0.000359	4.137 2.597
2	Cal-Std1	(--)	##	30.000	H: 0.002754 A: 0.04276	0.000049 0.000186	1.814 0.437

Mercur

เอกสารไม่ควบคุม

Calibration function 1

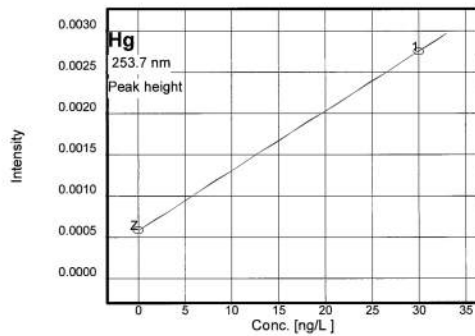
12/02/2024 14:31 Calibration (Peak height)

Ints=k1+k2*conc

k1=0.000588 k2=0.000072

Recal. factor: ---

Slope	0.00007 Ints/(ng/L)	R2-adjusted	1.0000
sc0	1.00000 ng/L		
Lower limit	0 ng/L	Upper limit	33.0 ng/L
Detection limit	---	Deter. limit	---



Measurements and events (sorted by time)

Hg ID	Without Enrichment / FBR / 30 µg/L_PM_12-02-2024	12/02/2024 14:21
Conc.	Ints	BG
Cal-Zero	0.000586	
	0.000564	
	0.000612	
0ng/L	0.000587	0.000024310 4.137
Cal-Std1	0.002810	
	0.002740	
	0.002713	
30.00ng/L	0.002754	0.000049960 1.814
Calibration	Calibration function: 01	14:31

Mercur

เอกสารไม่ควบคุม

Mercur

Report file: C:\WinAAS\TMP\2024\Result\WO\Pro_007

Program version: 4.7.9.0 Printed on: 12/02/2024 14:55

Recording started on 12/02/2024 14:41 GMT+7.0

Operator:

Laboratory:

Code:

Remarks:

Method parameters

Method With Enrichment / FBR / 30 µg/L_PM_12-02-2024

Created on 12/02/2024 Time 11:37

Program ---

Parameters Mercur Technique: Hg fluorescence

Line	253.7 nm		
Lamp type	Hg-LP		
Integr. mode	Peak height	Integr. time	20 s
PMT	444 V	Peak smoothing	12/5
AZ time	5 s		
Delay	0 s		

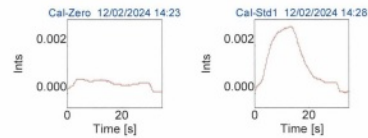
Working mode	Enr. w/o reload.	System cleaning	Off
FBR technique	on	Wash time acid	10 s
Pump speed	3	Soaking time	20 s
Sample load time	10 s	Gas load time	5 NL/h
Reaction time	10 s		
Waiting time AZ	5 s		
Delay	0 s		
Purge time1	20 s		
Purge time2	15 s	Gas wash time2	5 NL/h
Purge time3	10 s	Gas wash time3	10 NL/h
Heat.time coll.1	20 s	Cool. time coll.1	25 s

Mercur

เอกสารไม่ควบคุม

Peak plots

Hg



Mercur

เอกสารไม่ควบคุม

QC parameters

QC type	Conc. check	
QC check samp. 1	---	QC check samp. 2
Conc.	---	Conc.
Error limit	---	Error limit
Rep. measurement	off	Reaction
QC std.1 no.	1(30.000 µg/L)	QC std.2 no.
QC std.1 limit	± 50.00%	QC std.2 limit
QC std. act.	flag + continue	
Expect. blank abs.	0.0100± 0.0100	Reaction
QC precision	off	flag + continue
		Reaction
		QC Recal.factor
		Off

Calibration settings

Calib. meth	Standard calib.	Calibr. unit	µg/L
No. standards	1	Conversion fac.	1000
Type of standards	---	Standard prep.	Premixed
		Blank correct.	---
		Recalib. std. no.	---
Output unit	µg/L	Conversion fac.	1000
Calib. stat.	Mean	Meas. cycles	3
		Blind cycles	1
Stock sol. 1	---	Stock sol. 2	---
Stock sol. 3	---	Stock sol. 4	---
Type of cal. curve	linear	Intercept	Zero
Weighted cal.	off	Grubbs stat.	off
Check of cal. curve	no outlier test		

Sample statistics

Stat. mode	off	Meas. cycles	1
Confid. level	95.4 %	Blind cycles	1
Grubbs stat.	---		

Calibration standards

Hg

No	Name	State	Pos	Conc./ µg/L	Ints	SD	RSD/%
1	Cal-Zero	(--)	##	0.000	H: 0.004358 A: 0.01859	0.000018 0.000277	0.417 1.673
2	Cal-Std1	(--)	##	30.000	H: 0.01710 A: 0.06278	0.000152 0.000516	0.889 0.982

Mercur

เอกสารไม่ควบคุม

Calibration function 1

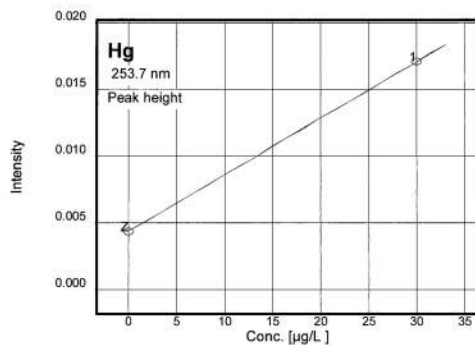
12/02/2024 14:55 Calibration (Peak height)

Ints=k1+k2*conc

k1=0.004358 k2=0.000425

Recal. factor: ---

Slope	0.00042 Ints/(µg/L)	R2-adjusted	1.0000
sc0	1.00000 µg/L		
Lower limit	0 µg/L	Upper limit	33.0 µg/L
Detection limit	---	Deter. limit	---

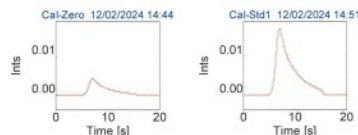


Measurements and events (sorted by time)

Hg ID	With Enrichment / FBR / 30 µg/L_PM_12-02-2024	12/02/2024 14:41
Cal-Zero	Ints 0.004343 BG 0.004378 SD 0.004352	PkH 14:44
	0 µg/L	0.004358 0.000018180 0.417 14:47
Cal-Std1	Ints 0.01726 BG 0.01695 SD 0.01708	PkH 14:51
	30.00 µg/L	0.01710 0.0001520 0.889 14:54
Calibration	Calibration function: 01	14:55

Peak plots

Hg



Mercur

เอกสารไม่ควบคุม

Mercur

เอกสารไม่ควบคุม

Mercur

Report file: C:\WinAAS\TMP\2024\Result\WO\Pro_008

Program version: 4.7.9.0 Printed on: 12/02/2024 15:22

Recording started on 12/02/2024 15:10 GMT+7.0

Operator:
Laboratory:
Code:

Remarks:

Method parameters

Method Without enrichment / FBR 100 ng/L PM_12-02-2024
Created on 12/02/2024 Time 11:54
Program ---

Parameters Mercur Technique: Hg absorption

Line	253.7 nm		
Lamp type	Hg-LP		
Integr. mode	Peak height	Integr. time	40 s
PMT	238 V		
AZ time	5 s	Peak smoothing	12/5
Delay	0 s		

Working mode	w/o enrich.	System cleaning	Acid
FBR technique	off	Wash time acid	15 s
Pump speed	4	Soaking time	20 s
Sample load time	8 s	Gas load time	10 NL/h
Reaction time	12 s		
Waiting time AZ	15 s		
Purge time1	40 s		

QC parameters

QC type	Conc. check	QC check samp. 2	---
QC check samp. 1	---	Conc.	---
Conc.	---	Error limit	---
Error limit	---	Reaction	flag + continue
Rep. measurement	off	QC std.2 no.	1(100.00 ng/L)
QC std.1 no.	1(100.00 ng/L)	QC std.2 limit	± 0.00%
QC std.1 limit	± 50.00%		
QC std. act.	flag + continue	Reaction	flag + continue
Expect. blank abs.	0.0100± 0.0100		
QC precision	off	Reaction	off
		QC Recal.factor	Off

Mercur

เอกสารไม่ควบคุม

Calibration settings

Calibr. meth	Standard calib.	Calibr. unit	ng/L
No. standards	1	Conversion fac.	1000000
Type of standards	---	Standard prep.	Premixed
		Blank correct.	---
		Recalib. std. no.	---
Output unit	µg/L	Conversion fac.	1000
Calib. stat.	Mean	Meas. cycles	3
		Blind cycles	1
Stock sol. 1	---	Stock sol. 2	---
Stock sol. 3	---	Stock sol. 4	---
Type of cal. curve	linear	Intercept	calculated
Weighted cal.	off	Grubbs stat.	off
Check of cal. curve	no outlier test		

Sample statistics

Stat. mode	Mean	Meas. cycles	2
Confid. level	95.4 %	Blind cycles	1
Grubbs stat.	---		

Calibration standards

Hg

No	Name	State	Pos	Conc./ng/L	Abs	SD	RSD/%
1	Cal-Zero	(--)	##	0.00	H: 0.000478 A: 0.005393	0.000331 0.002260	69.26 41.90
2	Cal-Std1	(--)	##	100.00	H: 0.002580 A: 0.034199	0.000081 0.002697	3.171 7.887

Calibration function 1

12/02/2024 15:22 Calibration (Peak height)

Abs=k1+k2*conc

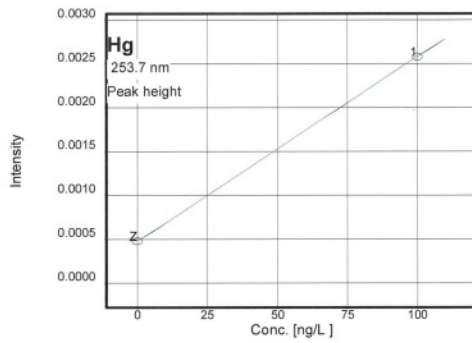
k1=0.000478 k2=0.000021

Recal. factor: ---

Slope	0.00002 Abs/(ng/L)	R2-adjusted	1.0000
sc0	1.00000 ng/L	Charact. conc.	207.402 (ng/L)/1%
Lower limit	0 ng/L	Upper limit	110. ng/L
Detection limit	---	Deter. limit	---

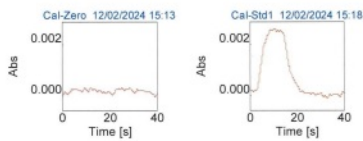
Mercur

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Measurements and events (sorted by time)

Hg	Without enrichment / FBR 100 ng/L PM ₁₀ -12-02-2024					12/02/2024	15:10
ID	Conc.	Abs	BG	SD	RSD/%	Int. type	Time
Cal-Zero		0.000328				PkH	15:13
		0.000248					15:14
		0.000858					15:15
	0ng/L	0.000478		0.00033131	69.26		15:15
Cal-Std1		0.002638				PkH	15:18
		0.002615					15:19
		0.002487					15:21
	100ng/L	0.002580		0.000081841	3.171		15:21
Calibration	Calibration function: 01						15:22
Peak plots						Hg	



Mercur

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



Certificate of Calibration

Cert. No.: 24TM648
Page : 1 of 3

Equipment : Incubator
Manufacturer : Memmert
Model : IPP 260
Serial No. : V615.0187
ID No. : UAE.MIC.003/2559
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Microbiology Laboratory
Received Order : 01 April 2024
Calibration Date : 01 April 2024
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Man Pattanapongpaiboon
Approved by :
() Ponpan Paipim
(✓) Suwit Imjal
() Kunchit Promprat

Issue Date : 7 April 2024

The Uncertainties are for a confidence probability of approximately 95%

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

เอกสารไม่ควบคุม



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2404-0003OC-1

Cert. No.: 24TM648
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	MY49023932	23LM122	TPA	26 Jul 2024

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

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

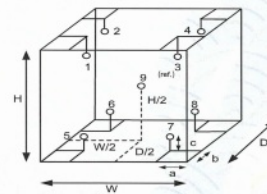
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close

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



Probe Installation Details :

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

Dimension of Chamber :

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

Position :	Ref. Std. ID No.:
1	19-16RTD-01
2	19-16RTD-02
3	19-16RTD-03
4	19-16RTD-04
5	19-16RTD-05
6	19-16RTD-06
7	21-16RTD-07
8	19-16RTD-08
9 (ref.)	19-16RTD-09

เอกสารไม่ควบคุม



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

Cert. No.: 24TM648
Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor <i>k</i>
35.0	35.0	35.0	0.028	0.13	0.24	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	Position									
	1	2	3	4	5	6	7	8	9 (ref.)	
35.0	34.908	35.004	34.989	35.099	35.089	35.095	34.921	34.936	35.002	0.30

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

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

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

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

UUC* : Unit Under Calibration

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

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

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เอกสารไม่ควบคุม



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



Certificate of Calibration

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

Equipment : Incubator
Manufacturer : Memmert
Model : IPP 260
Serial No. : V618.0033
ID No. : UAE.MIC.021/2561
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Microbiology Laboratory (302)
Received Order : 01 April 2024
Calibration Date : 02 April 2024
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Man Pattanapongpaiboon
Approved by :
Approved Signatory
() Ponpan Paipim
(✓) Suwit Imjai
() Kunchit Promprat

Issue Date : 7 April 2024

The Uncertainties are for a confidence probability of approximately 95%

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เอกสารไม่ควบคุม



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

Cert. No.: 24TM651
Page : 2 of 3

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument-

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

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

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

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

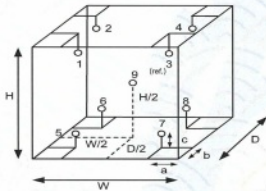
Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close

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

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



Probe Installation Details :

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

Dimension of Chamber :

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

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เอกสารไม่ควบคุม



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

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

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor <i>k</i>
22.0	22.0	22.0	0.039	0.22	0.42	2
44.0	44.0	44.0	0.048	0.50	0.90	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	1	2	3	4	5	6	7	8	9 (ref.)	
22.0	22.008	22.034	22.039	22.021	21.746	21.698	21.668	21.668	21.846	0.30
44.0	44.267	44.602	44.293	44.402	44.004	43.961	43.756	44.000	44.205	0.30

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

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

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

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

UUC* : Unit Under Calibration

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

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

เอกสารไม่ควบคุม



Cert. No.: 24TM306/1
Page : 1 of 3

Certificate of Calibration

This Certificate was issued to replace to the Certificate No. 24TM306
Equipment : Water Bath

Manufacturer : Memmert

Model : WNE 14

Serial No. : L416.0614

ID No. : UAE.MIC.020/2561

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

Location : Microbiology Laboratory

Received Order : 10 February 2024

Calibration Date : 10 - 11 February 2024

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 30) %

Calibrated by : Krisda Malee

Approved by :

() Pornthippa Tameyakul
() Unnopphol Harachai
(✓) Suwit Imjai

Issue Date : 12 February 2024

The Uncertainties are for a confidence probability of approximately 95%

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

A 0064399



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2402-0232OC-4
Procedure Used :-

Cert. No.: 24TM306/1
Page : 2 of 3

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

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

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

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

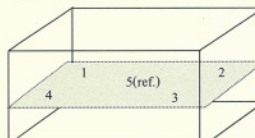
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Heat transfer medium used : Water

	Environmental		AC Voltage Supply
	(°C)	(%R.H.)	
Beginning of Calibration	24	52	221
Finished of Calibration	23	54	220



Front

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

a 1205493



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2402-0232OC-4
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source

Cert. No.: 24TM306/1
Page : 3 of 3

Calibration point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Average* Standard Reading (°C)					Uncertainty (± °C)
			1	2	3	4	5 (ref.)	
44.5	44.5	44.5	44.516	44.483	44.481	44.505	44.504	0.15
50.0	50.0	50.0	50.062	50.016	50.008	50.035	50.044	0.15

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Coverage Factor k
44.5	0.090	0.048	2
50.0	0.11	0.058	2

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

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

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

UUC* : Unit Under Calibration

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

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

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a 1205492



จุฬาลงกรณ์มหาวิทยาลัยเพื่อสถาบันอาหาร
ศูนย์บริการห้องปฏิบัติการอาหารจุฬาลงกรณ์มหาวิทยาลัย
Foundation for Industrial Development National Food Institute
Food Industrial Laboratory Service Center



Calibration Certificate

Certificate No.: 2402419-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Phrakhanong, Bangkok 10260

Page 1 of 3

Equipment: Electronic Balance
Manufacturer: OHAUS
Model: PX623
Serial No.: C236754745
ID No.: UAE.MIC.055/2565
Order No.: 2402419
Operation No.: 2402419-001
Date of Receipt: 19 April 2024
Date of Calibration: 19 April 2024

Calibrated by Mr.Pheraphat Tuanjit
Scientist

Approved by
(Miss Preeyaporn Jaengkarnkit)
Vice President, Department of Laboratory Services
Responsible for the Technical Management Team

Date of Issue: 23 April 2024

The uncertainties are for a confidence probability of approximately 95%

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

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

Calibration Report

Certificate No.: 2402419-001-01
Equipment: Electronic Balance
Model: PX623
Serial No.: C236754745
Capacity: 620 g
Manufacturer: OHAUS
Resolution: 0.001 g
ID No.: UAE.MIC.055/2565

Date of Calibration: 19 April 2024 Page 2 of 3

Environment Condition: Ambient Temperature: 26.0 ± 0.3 °C Relative Humidity: 57 ± 8.4 %

Place of Calibration: Room 301, UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

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

2. Reference Standards:

Reference Standard Model Serial No. Calibrated By Certificate No. Due Date
Standard Weight Class E2 1-500g 15882 TCS M23111825 28 November 2024

Instrument Model Serial No. Calibrated By Certificate No. Due Date
Thermo-Hygro Meter 608-H1 NFI.BTH 019/23 Quality Reborn QR24-0492 4 March 2025

3. This certification is traceable to SI UNIT

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

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

Calibration Results:

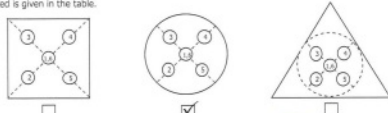
1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
300	0.00067
600	0.0010

2. Off-Center Error:

A mass of 200 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)
200.000	200.002	200.001	199.999	200.000	200.000	0.002

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

2008 ต.วิทยุพาณิชย์ 35 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10700

2008 Soi 35, Aun Amarn Road, Bang Yi Khan Subdistrict, Bang Phat District, Bangkok 10700, Thailand

Tel: +66(0) 2422 8558 Fax: +66(0) 2422 8545

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nfi.cdm

Calibration Report

Certificate No.: 2402419-001-01
Equipment: Electronic Balance
Model: PX623
Serial No.: C236754745
Capacity: 620 g
Manufacturer: OHAUS
Resolution: 0.001 g
ID No.: UAE.MIC.055/2565

Date of Calibration: 19 April 2024 Page 3 of 3

Calibration Results: (Continued)

Calibration Range: 0-600 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value:

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (g)	Coverage Factor k
Unload	0.0000	0.000	0.000	0.00093	2.00
1	1.0000	1.000	0.000	0.00093	2.00
5	5.0000	5.000	0.000	0.00093	2.00
10	10.0000	10.000	0.000	0.00093	2.00
20	20.0000	20.000	0.000	0.00093	2.00
50	50.0000	50.001	-0.001	0.00093	2.00
100	100.0000	100.001	-0.001	0.00094	2.00
200	200.0000	200.001	-0.001	0.0011	2.00
300	300.0000	300.003	-0.003	0.0011	2.00
400	399.9999	400.003	-0.003	0.0012	2.00
500	499.9999	500.003	-0.003	0.0013	2.00
600	599.9999	600.002	-0.002	0.0014	2.00

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

----- End -----

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

2008 ต.วิทยุพาณิชย์ 35 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10700

2008 Soi 35, Aun Amarn Road, Bang Yi Khan Subdistrict, Bang Phat District, Bangkok 10700, Thailand

Tel: +66(0) 2422 8558 Fax: +66(0) 2422 8545

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nfi.cdm