

ภาคผนวก จ

เอกสารสอบเทียบความถูกต้องของเครื่องมือ



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 Hydrogen Chloride Antimony Arsenic Cadmium Chromium Lead Manganese Dioxin	Apex Instruments, USA.	XC-572-V 0807048	Envi Equipment Service Co., Ltd.	E21-0821	2 Sep 21	1 Sep 22	-
2	Pre-Test Console	Total Suspended Particulate Hydrogen Chloride Antimony Arsenic Cadmium Chromium Lead Manganese Dioxin	Apex Instruments, USA.	XC-572-V 1701018	Envi Equipment Service Co., Ltd.	E21-0610	27 Jul 21	26 Jul 22	-

List of Instruments Certification for Water Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Water									
1	pH Meter	pH	Horiba	LAQUA-PH210 HA0A0020	Technology Promotion Association (Thailand-Japan)	21CH1137	2 Sep 21	1 Sep 22	-
2	DO Meter	DO	YSI	Pro 20i 18K104053	Technology Promotion Association (Thailand-Japan)	21TW170	18 Aug 21	17 Aug 22	-
3	Conductivity Meter	Conductivity	YSI	Pro30 18K100974	Technology Promotion Association (Thailand-Japan)	21CH1021	17 Aug 21	16 Aug 22	-

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 : 0807048
ID/Control No. : -
Environment Conditions : Temperature (25 ± 2) °C
: Humidity (50 ± 15) % RH
Cal. Date : 02/09/2021
Issue Date : 02/09/2021

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. Mans Fuchlud)
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	Std Temp	293 K
Console Serial Number	0807048	Calibration Reference No.	-	Std Press	760 mm Hg
DGM Model Number	SK25EX	Barometric Pressure	761.00 mm Hg	K ₁	0.386
DGM Serial Number	00003811	Calibration Meter Gamma	0.999	Console Leak Check	PASS

Calibration Data									
Run Time		Metering Console				Calibration Meter			
Elapsed	DGM Orifice DH	Volume Initial	Volume Final	Outlet Temp Initial	Outlet Temp Final	Volume Initial	Volume Final	Outlet Temp Initial	Outlet Temp Final
(Q)	(P _{in})	(V _{in})	(V _{out})	(t _{in})	(t _{out})	(V _{wf})	(V _{wf})	(t _{in})	(t _{out})
min	mm H ₂ O	m ³	m ³	°C	°C	m ³	m ³	°C	°C
12.27	13.0	544.3460	544.4860	25	25	32.17136	32.30750	24	24
12.40	13.0	544.4860	544.6260	24	24	32.30750	32.44346	24	24
8.77	26.0	544.6320	544.7720	24	24	32.44932	32.58574	24	24
8.58	26.0	544.7720	544.9120	24	24	32.58574	32.72218	24	24
14.17	40.0	544.9190	545.1990	24	24	32.72886	33.00296	23	23
14.17	40.0	545.1990	545.4790	24	24	33.00296	33.27582	23	23
10.45	70.0	545.4860	545.7670	25	25	33.28250	33.55462	23	23
10.42	70.0	545.7670	546.0470	26	26	33.55462	33.82509	23	23
9.18	90.0	546.0590	546.3390	26	26	33.83612	34.10576	23	23
9.15	90.0	546.3390	546.6190	27	27	34.10576	34.37388	23	23

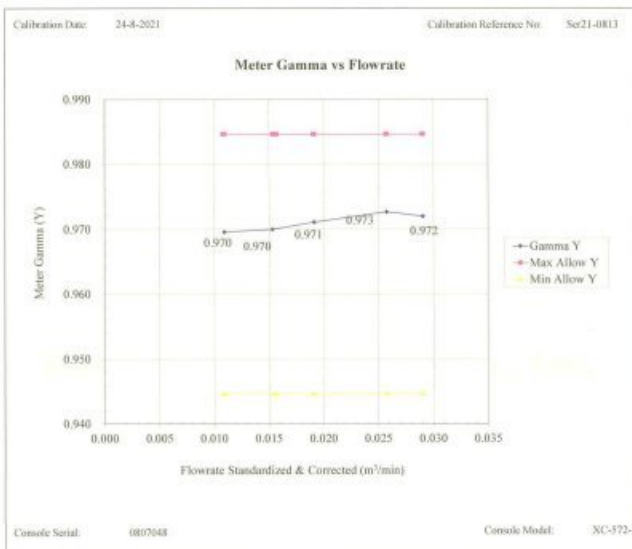
เอกสารไม่ควบคุม

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

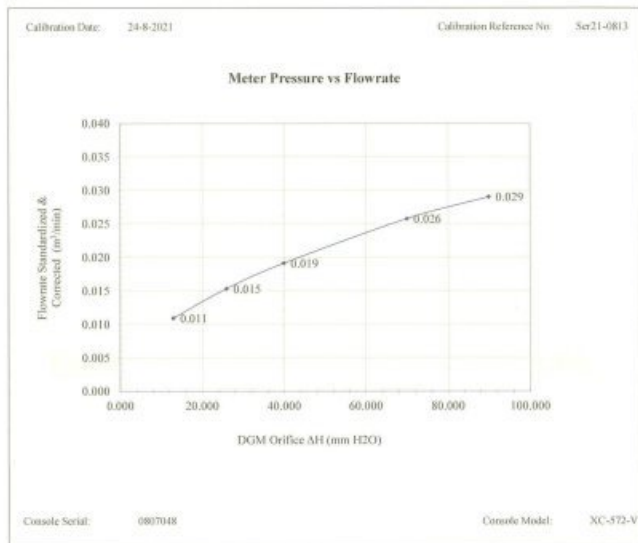
Calibration Data									
Results									
Standardized Data				Dry Gas Meter					
Dry Gas Meter		Calibration Meter		Calibration Factor		Flowrate		Variation	
(V _{read})	(Q _{read})	(V _{wat})	(Q _{wat})	(Y)	(ΔY)	Std & Corr	(Q _{read/corr})	(ΔH _g)	(ΔH _g)
m ³	m ³ /min	m ³	m ³ /min			m ³ /min	mm H ₂ O		
0.138	0.011	0.134	0.011	0.970	0.006	0.011	48.394	-0.204	
0.138	0.011	0.134	0.011	0.969	0.004	0.011	49.583	0.985	
0.139	0.016	0.135	0.015	0.971	0.006	0.015	49.356	0.758	
0.139	0.016	0.135	0.016	0.971	0.007	0.016	47.300	-1.298	
0.279	0.020	0.271	0.019	0.974	0.010	0.019	49.084	0.486	
0.279	0.020	0.270	0.019	0.970	0.005	0.019	49.531	0.933	
0.280	0.027	0.269	0.026	0.961	-0.004	0.026	47.696	-0.902	
0.279	0.027	0.268	0.026	0.958	-0.006	0.026	48.004	-0.594	
0.280	0.030	0.267	0.029	0.954	-0.011	0.029	48.418	-0.180	
0.280	0.031	0.265	0.029	0.948	-0.016	0.029	48.614	0.016	
				0.965	Y Average	48.598		DH@ Average	

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

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THERMOCOUPLES SYSTEM CALIBRATION

Sampling System Equipment Information		Calibration Conditions	
Console Model Number	XC-572-V	Date	02/9/2021
Console Serial Number	0807048	Time	03:30 PM
DGM Model Number	SK25EX	Calibration Reference No.	
DGM Serial Number	00003811	Reference Thermometer	DIGICON
Meter Box Model Number	JENCO 765 KF	Serial Number	183169105
Meter Box Serial Number	JC 08944		

Results										
Console Thermocouple Simulator										
Channel and test point	Meter Box Channel Temperature Reading (°C)									
	-18.0	25.0	38.0	93.0	149.0	260.0	371.0	482.0	593.0	816.0
Stack	-17.0	26.0	39.0	94.0	150.0	261.0	372.0	482.0	593.0	816.0
Aux	-17.0	26.0	39.0	94.0	150.0					
Probe	-17.0	26.0	39.0	94.0	150.0					
Filter	-17.0	26.0	39.0	94.0	150.0					
Oven	-	-	-	-	-					
Exit	-17.0	26.0	39.0							

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

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Envi Equipment Service Co., Ltd.
110/254 Moo 3, Tumbon Bang Rak Phatthana, Amphur Bang Bua Thong, Nonthaburi 11110
Tel. 098 362 9152, 089 478 7885
E-mail: sales@envi-ees.com

Certificate No. : E21-0610
Page : 1 of 6

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 : 1701018

ID/Control No. : -

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

Cal. Date : 27/07/2021

Issue Date : 27/07/2021

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

Calibrated by : Mr. Sanja Sangnil

Approved by :
(Mr. Mana Fuekhud)
Technical Manager

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Certificate No. : E21-0610
Page : 2 of 6

**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	27/7/2021	Std Temp	293 K
Console Serial Number	1701018	Time	09:45 AM	Std Press	760 mm Hg
DGM Model Number	SK25EX	Calibration Reference No.	-	K _i	0.386
DGM Serial Number	00002030	Barometric Pressure	761.00 mm Hg	Console Leak Check	PASS
		Calibration Meter Gamma	0.999		

Calibration Data									
Run Time	Metering Console				Calibration Meter				
	DGM Orifice DH	Volume Initial	Volume Final	Outlet Temp Initial	Volume Initial	Volume Final	Outlet Temp Initial	Outlet Temp Final	
Elapsed (Q)	(Pa)	(V _{in})	(V _{out})	(t _{in})	(V _{wi})	(V _{wf})	(t _{in})	(t _{out})	
min	mm H ₂ O	m ³	m ³	°C	m ³	m ³	°C	°C	
12.43	13.0	1512.485	1512.625	27	11.01632	11.15746	26	26	
12.40	13.0	1512.625	1512.765	27	11.15746	11.29738	26	26	
8.75	26.0	1512.773	1512.913	27	11.30058	11.44278	26	26	
8.75	26.0	1512.913	1513.053	28	11.44278	11.58366	26	26	
14.33	40.0	1513.064	1513.344	28	11.70192	11.98092	25	25	
14.32	40.0	1513.344	1513.624	29	11.98092	12.25992	25	25	
10.72	70.0	1513.634	1513.914	29	12.26492	12.54328	24	24	
10.73	70.0	1513.914	1514.194	29	12.54328	12.82364	24	24	
9.42	90.0	1514.205	1514.485	30	12.82358	13.11482	24	24	
9.40	90.0	1514.485	1514.765	30	13.11482	13.39496	24	24	

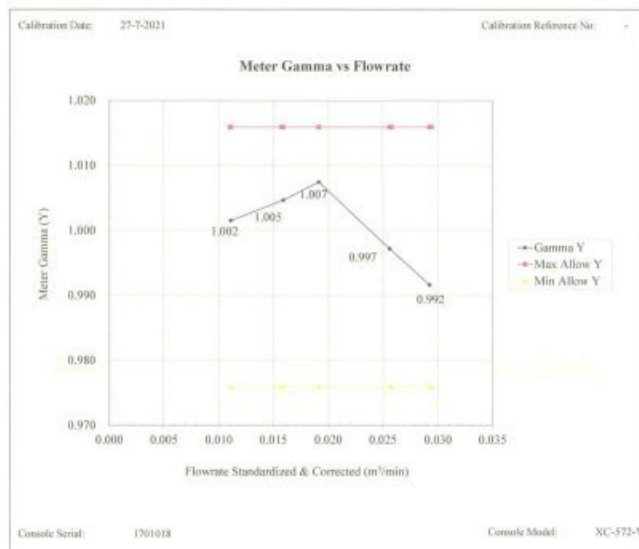
เอกสารไม่ควบคุม

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

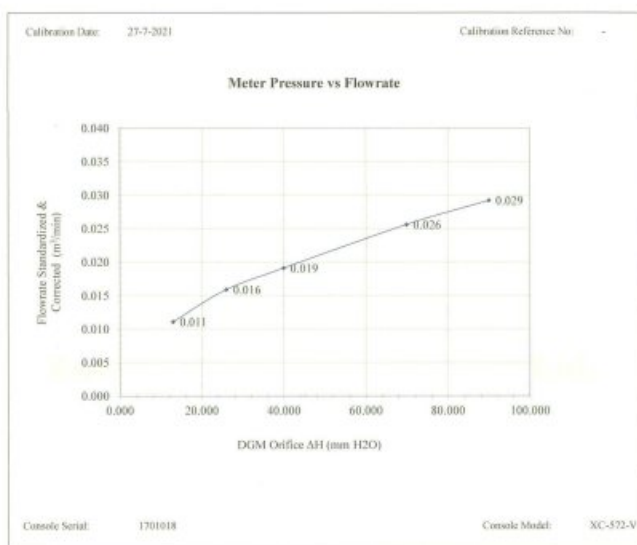
Calibration Data								
Results								
Standardized Data				Dry Gas Meter				
Dry Gas Meter		Calibration Meter		Calibration Factor		Flowrate	Variation	
				Value	Variation	Std & Corr		.0212 m ³ /g/min
(V _{act})	(Q _{act})	(V _{std})	(Q _{std})	(Y)	(ΔY)	(Q _{act/corr})	(ΔH _g)	
m ³	m ³ /min	m ³	m ³ /min			m ³ /min	mm H ₂ O	
0.138	0.011	0.138	0.011	1.006	0.010	0.011	46.569	-0.803
0.138	0.011	0.137	0.011	0.997	0.001	0.011	47.131	-0.241
0.138	0.016	0.139	0.016	1.012	0.016	0.016	45.558	-1.815
0.138	0.016	0.138	0.016	1.003	0.007	0.016	46.415	-0.957
0.277	0.019	0.274	0.019	0.992	-0.004	0.019	48.824	1.451
0.277	0.019	0.274	0.019	0.992	-0.004	0.019	48.711	1.338
0.278	0.026	0.275	0.026	0.986	-0.009	0.026	48.099	0.726
0.278	0.026	0.277	0.026	0.994	-0.002	0.026	47.563	0.190
0.279	0.030	0.275	0.029	0.987	-0.009	0.029	47.698	0.326
0.279	0.030	0.276	0.029	0.991	-0.005	0.029	47.157	-0.216
				0.996	Y Average		47.373	DH@ 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_{95} , 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 (5.1 mm) H₂O.

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THERMOCOUPLES SYSTEM CALIBRATION

Sampling System Equipment Information		Calibration Conditions	
Console Model Number	XC-572-V	Date	27/7/2021
Console Serial Number	1701018	Time	12:00 PM
DGM Model Number	SK25EX	Calibration Reference No.	
DGM Serial Number	00002030	Reference Thermometer	
Meter Box Model Number	JENCO 765 KF	Serial Number	
Meter Box Serial Number	JC 16103	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	814.0	1038.0
Stack	-17.0	24.0	37.0	93.0	149.0	258.0	371.0	482.0	593.0	814.0	1036.0
Aux	-17.0	24.0	37.0	93.0	149.0						
Probe	-17.0	24.0	37.0	93.0	149.0						
Filter	-17.0	24.0	37.0	93.0	149.0						
Oven	-17.0	24.0	37.0	93.0	149.0						
Exit	-16.0	24.0	38.0								

		<u>Tolerance Range</u>			
Stack	± 1.50%	Absolute		Meter	± 3.0 °C
Probe	± 3.0 °C			Exit	± 2.0 °C
Filter	± 3.0 °C				

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Cert.No.: 21CH1137
Page.: 1 of 3

Certificate of Calibration

Equipment : pH Meter
Manufacturer : Horiba
Model : LAQUA-PH210
Serial No. : HA0A0020
ID No. : UAE.EFM.165/2563(EFM pH.08/53)
Condition As-Received: Used Item
Received Date : 30 August 2021
Calibration Date : 02 September 2021
Reference : 2108-0913WSC-3
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udumuk 41, Sukhumvit Road,
Bangchak, Phrakhanong, Bangkok 10260
Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 15) %
Calibration Procedure : In - house method :
- CP-CH8 by direct measurement with standard
voltage calibrator and direct measurement with
certified reference material (CRM)
- CP-CH8 by comparison with standard thermometer

Calibrated by : Warakorn Lemgagtrakul

Approved by :
Approved Signatory

(/) Malee Butkruea
() Saitip Meangmal
() Warakorn Lemgagtrakul

Issue Date : 10 September 2021

The Uncertainties are for a confidence probability of approximately 95%

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

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Cert.No.: 21CH1137
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 43160066 130RC092 21E1223/1 27 Apr 2022
2) Ref. Standard Thermometer 4862054 110RC044 2011233 15 Oct 2021
This certification is traceable to the International System of Unit maintained at:-
- Traceable to National Institute of Metrology (Thailand), NIMT
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.
pH 4.008	CPA chem	754028
pH 6.985	CPA chem	725927
pH 10.015	CPA chem	781018

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

Calibration Results

Function : mV Measurement

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

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading	Uncertainty of Measurement	Coverage factor
	pH	mV	mV	(± mV)	k
pH Meter	4.00	177.48	177.6	0.058	2.00
S/N.: HA0A0020	7.00	0.00	0.1	0.058	2.00
	7.00	0.00	0.1	0.058	2.00
	10.00	-177.48	-177.3	0.058	2.00

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Calibration Results

Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH measurement (±)	Coverage factor
pH Electrode	4.008	4.01	155	0.0079	2.00
S/N.: 99C0039	6.985	6.98	-18	0.0099	2.00
	6.985	7.00	-18	0.0093	2.00
	10.015	10.01	-196	0.013	2.00

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : 9652

- Serial No. : 99C0039

Dimension of probe;

- Length : 93 mm.

- Diameter : 16 mm.

- Immersion Depth : 90 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement (± °C)	Coverage factor
25.0	25.002	25.0	-0.002	0.20	2.00
30.0	30.003	30.0	-0.003	0.20	2.00
35.0	35.004	35.0	-0.004	0.20	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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534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
0-2717-3000 FAX. 0-2719-9484

Cert.No.: 21TW170
Page.: 1 of 2

Certificate of Testing

Equipment : DO Meter
Manufacturer : YSI
Model : Pro 20i
Serial No. : 18K104053
ID No. : UAE.EFM.066/2562 (ENV.D0.01/62)
Received Date : 04 August 2021
Test Date : 18 August 2021
Reference : 2108-0109WSC-1
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udumuk 41, Sukhumvit Road, Bangchak,
Phrakhanong, Bangkok 10260
Laboratory Condition : Temperature (25 ± 5) °C
Humidity (50 ± 20) %
Test Procedure : In - house method : CP-CH8
by Comparison Technique with Azide Modification Method

Tested by : Walalak Sinithean

Approved Signatory

(/) Malee Butkruea
() Saitip Meangmal
() Warakorn Lemgagtrakul

Issue Date : 23 August 2021

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Cert.No.: 21TW170
Page.: 2 of 2

Result : Dissolved Oxygen Meter Adjustment With Air 100 %

Dissolved Oxygen Probe No.: 18K100663

Titration Method (Azide Modification Method)	DO Meter Reading	Standard Deviation
(mg/L)	(mg/L)	(mg/L)
8.26	8.26	0.0055

This report was certified only for the instrument we tested. It is allowable to use for study the system efficiency, The environmental impact control and present to organization it may concerned intend to use for advertising and referral purpose is prohibited. This report may not be reproduced other in full, without written approval of the laboratory.

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-27 FAX. 0-2719-9484



REC-T08-T01-T023
CALIBRATION 0006

Cert. No.: 21TM1443
Page.: of 2

Certificate of Calibration

Equipment : DO Meter with Sensor
Manufacturer : YSI
Model : Pro 20i
Serial No. : 18K104053
ID No. : UAE.EFM.066/2562 (ENV.DO.01/62)
Submitted by : United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : TPA On Site Calibration Laboratory
Received Order : 4 August 2021
Calibrated Date : 20 August 2021
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
AC Line Voltage : (220 ± 22) V
Calibrated by : Khit Rutanaprapachai
Approved by :
() Pornthippa Tamayakul
() Malee Butkruea
() Suwit Imjai
Issue Date : 25 August 2021

The Uncertainties are for a confidence probability of approximately 95%

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

Approved Signatory

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Equipment : DO Meter with Sensor
Condition As-Received : Used Item
Reference : 2108-0109WSC-2
Procedure Used :-

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

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Digital Thermometer	1502A	A52847	20/1246	14 Oct 2021

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.

Result of Calibration :- (*) Without Adjustment

Function : Temperature measurement

This instrument was connected with temperature sensor, S/N.: 18K100663

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertain (± °C)	Coverage Factor k
25.0	100	25.006	24.9	-0.106	0.16	2.00
30.0	100	30.004	29.9	-0.104	0.16	2.00
35.0	100	35.006	34.9	-0.106	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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Malee

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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. 0-2717-3000-27 FAX. 0-2719-9484



REC-T08-T01-T023
CALIBRATION 0006

Cert.No.: 21CH1021
Page.: 1 of 3

Certificate of Calibration

Equipment : Conductivity Meter
Manufacturer : YSI
Model : Pro 30
Serial No. : 18K100974
ID No. : UAE.EFM.070/2562(ENV.SCT.06/51)
Condition As-Received: Used Item
Received Date : 04 August 2021
Calibration Date : 17 August 2021
Reference : 2108-0109WSC-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-CH6 by direct measurement
with certified reference material (CRM)
- CP-CH6 by comparison with standard thermometer

Calibrated by : Warakorn Lemgagtrakul

Approved by :
() Malee Butkruea
() Saithip Meangmai
() Warakorn Lemgagtrakul

Issue Date : 23 August 2021

The Uncertainties are for a confidence probability of approximately 95%

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

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Cert.No.: 21CH1021

Page.: 2 of 3

Condition of this result of calibration

1. Reference Standard Instrument :-

Instrument	Serial No.	ID No.	Certificate No.	Due date
1) Thermometer	1963878	130RC095	2011119	15 Sep 2021
2) Ref. Std. Thermometer	2188080	130RC044	2011389	19 Nov 2021

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

- Traceable to National Institute of Metrology (Thailand), NIMT

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.	Ex. date
1413.0 μ S/cm	CPA Chem	754036	28 Jun 2022
12.8806 mS/cm	CPA Chem	725924	12 Jan 2022

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

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

Calibration results

Function : Conductivity Measurement

(*) After Adjustment at 1413.0 μ S/cm

Conductivity Electrode Serial No.: 18L100008

Standard Conductivity Solution	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement (\pm)	Coverage factor k
1413.0 μ S/cm	1163 μ S/cm	1413 μ S/cm	9.0 μ S/cm	2.00
12.8806 mS/cm	10.79 mS/cm	12.77 mS/cm	0.082 mS/cm	2.00

Remark - UUC* = Unit Under Calibration

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Cert.No.: 21CH1021

Page.: 3 of 3

Calibration Results

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : PROC0 CON-T

- Serial No. 18L100008

Dimension of probe;

- Length : 8 mm.

- Diameter : 2 mm.

- Immersion Depth : 80 mm.

Calibration Point ($^{\circ}$ C)	Standard Temperature ($^{\circ}$ C)	UUC* Reading ($^{\circ}$ C)	Error ($^{\circ}$ C)	Uncertainty of Measurement (\pm $^{\circ}$ C)	Coverage factor k
25.0	25.006	24.9	-0.106	0.20	2.00
30.0	30.004	29.9	-0.104	0.20	2.00
35.0	35.003	34.8	-0.203	0.20	2.00

Remark : - UUC* = Unit Under Calibration

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

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รายการใบรับรองสอบเทียบ/ทวนสอบ เครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์ สำหรับวิเคราะห์คุณภาพอากาศ

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
เครื่องมือหลักประจำห้องปฏิบัติการสำหรับวิเคราะห์คุณภาพอากาศ									
1	Analytical Balance (Readability 0.1 mg)	TSP	Mettler-Toledo	AB204-S / 1128312528	National Food Institute, Ministry of Industry, Thailand	2200704-001	24 Nov 21	24 Nov 22	-
2	UV-VIS Spectrophotometer	NO _x as NO ₂	Agilent Technologies	Cary60 / MY15410009	Technology Promotion Association (Thailand-Japan)	SP22-016	26 May 22	26 May 23	-
3	UV-VIS Spectrophotometer		Hitachi	U-1900 / 2021-064	DQE Services Co.,Ltd.	SP22-007	24 Jan 22	24 Jan 23	-
4	Atomic Absorption Spectrometer (AAS)	Sb, As, Cd, Cr, Pb, Hg	Agilent Technologies	AA240FS / MY13160001	Thailand Institute of Scientific and Technological Research (TISTR)	MTC.ALC.No. 486/65	3 Feb 22	3 Feb 23	-
5	Inductively Coupled Plasma (ICP)		Agilent Technologies	System ID:G8432A AA240FS/ MY13160001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	28 Jan 22	28 Jan 23	-
6	Ion Chromatrography (IC)	HCl	Dionex	DX-120 / 03010223	Archemica Lab Co.Ltd.	DX120 : Anion (ID#042)	8 Dec 21	8 Dec 22	-
เครื่องมือหลักประจำห้องปฏิบัติการสำหรับวิเคราะห์คุณภาพน้ำ									
1	UV-VIS Spectrophotometer	Nitrate, Sulphate, Total Phosphate	Agilent Technologies	Cary60 / MY15410009	Technology Promotion Association (Thailand-Japan)	SP22-016	26 May 22	26 May 23	-
2	UV-VIS Spectrophotometer		Hitachi	U-2900 / 21E22-009	DQE Services Co.,Ltd.	SP22-008	24 Jan 22	24 Jan 23	-
3	Atomic Absorption Spectrophotometer (AAS)	Iron, Calcium, Mercury, Silica	Agilent Technologies	System ID:G8432A AA240FS / MY13160001	Thailand Institute of Scientific and Technological Research (TISTR)	MTC.ALC.No. 886/65	3 Feb 22	3 Feb 23	-
4	Inductively Coupled Plasma (ICP)		Agilent Technologies	AA240FS / MY13160001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance	28 Jan 22	28 Jan 23	-

บริษัท ยูไนเต็ด แอนนาลิสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด
ห้องปฏิบัติการวิเคราะห์มาตรฐาน ISO/IEC 17025 : 2017

Certificate Page 1/2

รายการใบรับรองสอบเทียบ/ทวนสอบ เครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์ สำหรับวิเคราะห์คุณภาพอากาศ

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No. Checklist	Date of Calibration	Due date of Calibration*	Remark
เครื่องมือหลักประจำห้องปฏิบัติการสำหรับวิเคราะห์คุณภาพน้ำ									
5	Conductivity Meter	Conductivity	SI Analytics	Lab955 / 16300356	SPC Calibration Center Co.,Ltd.	C24020084	22 Mar 22	21 Mar 23	-
6	Incubator	Total Coliform Bacteria	Memmert	IPP 260 / V616.0066	Technology Promotion Association (Thailand-Japan)	21TM1874	28 Nov 21	27 Nov 22	-
7	Water Bath		Memmert	WNE 14 / L416.0606	Technology Promotion Association (Thailand-Japan)	22TM333	22 Feb 22	22 Feb 23	-
8	Water Bath		Memmert	WNE 14 / L416.0612	Technology Promotion Association (Thailand-Japan)	22TM334	22 Jan 22	22 Jan 23	-
9	Analytical Balance		Mettler-Toledo	M5603S / B0070110311	National Food Institute, Ministry of Industry, Thailand	2200705-001	24 Nov 21	24 Nov 22	-
10	Auto Clave		ALP	CL-40L / 808763	Technology Promotion Association (Thailand-Japan)	22TM681	2 Jun 22	1 Jun 23	-
11	Turbidity Meter	Turbidity	Oakton	T100IR / 1120501017	Technology Promotion Association (Thailand-Japan)	21CH1017	17 Aug 21	16 Aug 22	-

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

รายการใบรับรองสอบเทียบ/ทวนสอบ เครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์ สำหรับวิเคราะห์คุณภาพน้ำใต้ดิน

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
เครื่องมือหลักประจำห้องปฏิบัติการสำหรับวิเคราะห์คุณภาพน้ำใต้ดิน									
1	Gas Chromatography - Mass Spectrometer (GC-MS)	TPH (C ₅ -C ₈)	Bruker Scion	451-GC / BR1201M099 Scion-SQ / GQS1203F021 CP8400 / BR1203M331	World Tech Enterprise Co.,Ltd.	Certificate of Calibration PM/VOQ	19 May 22	19 May 23	-
2	Gas Chromatography (GC)	TPH (C ₈ -C ₁₆) TPH (C ₁₆ -C ₃₅)	Agilent Technologies	System ID:CN11021007 7890 / CN11021007	Agilent Technologies (Thailand) Co.,Ltd.	Certificate of System Qualification GC-OQ	11 Feb 22	11 Feb 23	-
3	Gas Chromatography (GC)		Agilent Technologies	System ID:CN13113001 7890 / CN13113001	Agilent Technologies (Thailand) Co.,Ltd.	Certificate of System Qualification GC-OQ	22 Apr 22	22 Apr 23	-
4	UV-VIS Spectrophotometer	Nitrate	Agilent Technologies	Cary60 G6860A / MY15410009	Technology Promotion Association (Thailand-Japan)	SP22-016	26 May 22	26 May 23	-
5	UV-VIS Spectrophotometer		Hitachi	U-1900 / 21E22-009	DQE Services Co.,Ltd.	SP22-008	24 Jan 22	24 Jan 23	-
6	Atomic Absorption Spectrophotometer (AAS)	Cadmium Chromium Nickel	Agilent Technologies	AA240FS / MY13160001	Thailand Institute of Scientific and Technological Research (TISTR)	MTC.ALC.No. 486/65	3 Feb 22	3 Feb 23	-
7	Inductively Coupled Plasma (ICP)	Lead Zinc Mercury	Agilent Technologies	System ID:G8445A AA280FS / MY21140002	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	9 May 22	9 May 23	-
8	pH Meter	pH	Hanna Instrument	HI2211 / 8165345	National Food Institute, Ministry of Industry, Thailand	2202097-001	21 Mar 22	20 Mar 23	-

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

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Calibration Report

Certificate No.: 2200704-001-01
Equipment: Electronic Balance
Model: AB204-S
Serial No.: 1128312528
Capacity: 200 g
Manufacturer: Mettler Toledo
Resolution: 0.0001 g
ID No.: UAE-AUR.018/2550

Date of Calibration: 24 November 2021 Page 5 of 5
Calibration Results: (Continued)
Calibration Range: 0-200 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
Unladen	0.0000	0.0000	0.0000	0.000092	2.00
0.1	0.10000	0.10000	0.00000	0.000092	2.00
0.5	0.50000	0.50000	0.00000	0.000093	2.00
1	1.00001	1.00001	0.00000	0.000093	2.00
5	5.00000	4.99999	0.00001	0.000094	2.00
10	9.99998	9.99999	0.00001	0.000097	2.00
20	19.99999	19.99999	0.00001	0.000099	2.00
50	49.99990	49.99990	0.00000	0.00012	2.00
70	69.99989	69.99990	0.00001	0.00014	2.00
100	100.00000	99.99999	0.00001	0.00017	2.00
120	119.99999	119.99999	0.00001	0.00019	2.00
150	149.99990	149.99999	0.00009	0.00022	2.00
200	200.00009	199.99999	0.00010	0.00029	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 %.

P-CS-012 Revision: 00 Date: 14-12-01

เอกสารไม่ควบคุม

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

CERTIFICATE OF CALIBRATION

Certificate No.: SP22-016 Page 1 of 5
Customer: United Analyst and Engineering Consultant Co.,Ltd. (Head Office)
Address: 3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong,
 Bangkok 10260
Location of calibration: Laboratory 315
Equipment: UV-Vis Spectrophotometer
Manufacturer: Agilent Technologies
Model: Cary 60
Serial No.: MY15410009
ID No.: N/A
Received Date: 23 May 2022
Calibration Date: 23 May 2022
Issue Date: 26 May 2022
Condition Instrument: Good

Calibrated by:  **Approved by:** 
 (Mr. Tanawat Rimdach) (Ms. Chonhicha Sangngern)
 Technical Manager Quality Manager

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

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

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PM-708-02 R01 1/11/2021

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

REPORT OF CALIBRATION

Certificate No.: SP22-016 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	95935	22 October 2023
Absorbance Standard set	25757	95929	22 October 2023
Wavelength Standard set	25806	95916	22 October 2023
Wavelength Standard set	25758	95915	22 October 2023

Traceability: This certification is traceable to the International System of Unit maintained at National -
 Institute of Standards and Technology (NIST) through Sarna Scientific Limited
Spectral Band Width of UUC: 1.5 nm.
Scan Speed of UUC: 90 nm/min
Scan Interval of UUC: 0.15 nm.
Resolution of UUC: Photometric 0.0001 Abs.
 Wavelength 0.1 nm.

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PM-708-02 R01 1/11/2021

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

REPORT OF CALIBRATION

Certificate No.: SP22-016 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
	0.5787	0.5755	0.0032	0.0031	2.00
	1.0490	1.0436	0.0054	0.0029	2.00
	2.1900	2.1847	0.0053	0.0075	2.00
440	0.0000	0.0000	0.0000	0.0028	2.00
	0.5607	0.5588	0.0019	0.0034	2.00
	1.0247	1.0232	0.0015	0.0035	2.00
	2.1229	2.1211	0.0018	0.0082	2.00
465	0.0000	0.0000	0.0000	0.0028	2.00
	0.5236	0.5197	0.0039	0.0029	2.00
	0.9634	0.9625	0.0009	0.0028	2.00
	1.9763	1.9752	0.0011	0.0070	2.00
546.1	0.0000	-0.0001	0.0001	0.0028	2.00
	0.5191	0.5171	0.0020	0.0031	2.00
	1.0003	0.9984	0.0019	0.0033	2.00
	1.9987	1.9946	0.0041	0.0084	2.00
590	0.0000	0.0000	0.0000	0.0028	2.00
	0.5523	0.5509	0.0014	0.0030	2.00
	1.0809	1.0799	0.0010	0.0029	2.00
	2.0391	2.0329	0.0062	0.0080	2.00
635	0.0000	0.0000	0.0000	0.0028	2.00
	0.5601	0.5584	0.0017	0.0031	2.00
	1.0512	1.0498	0.0014	0.0029	2.00
	1.9294	1.9265	0.0029	0.0082	2.00

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PM-708-02 R01 1/11/2021

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

REPORT OF CALIBRATION

Certificate No. : SP22-016 Page 4 of 5

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000 0.7478	0.0001 0.7421	-0.0001 0.0057	0.0050 0.0056	2.00 2.00
257	0.0000 0.8686	0.0000 0.8619	0.0000 0.0067	0.0050 0.0059	2.00 2.00
313	0.0000 0.2912	0.0000 0.2896	0.0000 0.0016	0.0050 0.0051	2.00 2.00
350	0.0000 0.6448	0.0000 0.6403	0.0000 0.0045	0.0050 0.0055	2.00 2.00

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REPORT OF CALIBRATION

Certificate No. : SP22-016 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	287.5	0.31	0.18	2.00
334.06	333.5	0.56	0.18	2.00
360.93	360.5	0.43	0.18	2.00
418.59	418.0	0.59	0.18	2.00
445.94	445.4	0.54	0.18	2.00
453.66	453.2	0.46	0.18	2.00
460.02	459.7	0.32	0.18	2.00
536.59	536.2	0.39	0.18	2.00
637.98	638.3	-0.32	0.18	2.00
431.38	431.0	0.38	0.18	2.00
472.50	472.5	0.00	0.18	2.00
513.47	513.5	-0.03	0.18	2.00
528.88	528.5	0.38	0.18	2.00
573.17	573.0	0.17	0.18	2.00
585.35	585.0	0.35	0.20	2.00
684.40	684.7	-0.30	0.18	2.00
740.72	740.8	-0.08	0.20	2.00
748.55	748.5	0.05	0.18	2.00
807.03	807.3	-0.27	0.18	2.00
879.28	879.0	0.28	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 not TISI accredited

- End of Certificate -

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FM-708-02 R01 1/11/2021

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. : SP22-007 Page 1 of 5

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

Address : 3 Soi Udomsak 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 : 20 January 2022

Calibration Date : 20 January 2022

Issue Date : 24 January 2022

Condition Instrument : Good

Calibrated by : ทินวัฒน์ รัตนเดช (Mr.Tanasut Ritadach) Technical Manager
Approved by : ชลวิจิตร (Ms.Chonhicha 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 measurability to recognized national standards and to the task of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the DQE Services Co., Ltd.

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FM-708-02 R01 1/11/2021

DQE Services 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. : SP22-007 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	95935	22 October 2023
Absorbance Standard set	25757	95929	22 October 2023
Wavelength Standard set	25806	95916	22 October 2023
Wavelength Standard set	25758	95915	22 October 2023

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

Spectral Band Width of UUC : 4.0 nm.

Scan Speed of UUC : 200 nm/min

Scan Interval of UUC : 0.1 nm.

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

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FM-708-02 R01 1/11/2021


DQE

Services

DQE Services Co.,Ltd.

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

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



ISO 9001:2015 CERTIFIED

ISO 14001:2015 CERTIFIED

REPORT OF CALIBRATION

Certificate No. : SP22-007

Page 3 of 5

Calibration Results : Without adjustment

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
420	0.0000	0.000	0.0000	0.0028	2.00
	0.5787	0.577	0.0017	0.0031	2.00
	1.0490	1.050	-0.0010	0.0029	2.00
	2.1900	2.183	0.0070	0.0080	2.00
440	0.0000	0.000	0.0000	0.0028	2.00
	0.5607	0.560	0.0007	0.0034	2.00
	1.0247	1.023	0.0017	0.0035	2.00
	2.1229	2.118	0.0049	0.0079	2.00
465	0.0000	0.000	0.0000	0.0028	2.00
	0.5236	0.521	0.0026	0.0030	2.00
	0.9634	0.963	0.0004	0.0029	2.00
	1.9763	1.974	0.0023	0.0070	2.00
546.1	0.0000	0.000	0.0000	0.0028	2.00
	0.5191	0.518	0.0011	0.0031	2.00
	1.0003	1.000	0.0003	0.0033	2.00
	1.9987	1.996	0.0027	0.0084	2.00
590	0.0000	0.000	0.0000	0.0028	2.00
	0.5523	0.552	0.0003	0.0030	2.00
	1.0809	1.082	-0.0011	0.0030	2.00
	2.0391	2.033	0.0061	0.0079	2.00
635	0.0000	0.000	0.0000	0.0028	2.00
	0.5601	0.562	-0.0019	0.0031	2.00
	1.0512	1.052	-0.0008	0.0030	2.00
	1.9294	1.925	0.0044	0.0079	2.00

PM-708-02 R01 1/11/2021

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DQE Services Co.,Ltd.

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



REPORT OF CALIBRATION

Certificate No. : SP22-007

Page 4 of 5

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000	0.000	0.0000	0.0050	2.00
	0.7478	0.746	0.0018	0.0057	2.00
257	0.0000	0.000	0.0000	0.0050	2.00
	0.8686	0.861	0.0076	0.0059	2.00
313	0.0000	0.000	0.0000	0.0050	2.00
	0.2912	0.291	0.0002	0.0051	2.00
350	0.0000	0.000	0.0000	0.0050	2.00
	0.6448	0.638	0.0068	0.0055	2.00

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ISO 9001:2015

ISO 17025

CALIBRATION UNIT

REPORT OF CALIBRATION

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Page 5 of 5

Wavelength Accuracy :

CRMs Values	UUC Reading	Correction	Uncertainty	Coverage factor
(nm.)	(nm.)	(nm.)	(nm.)	k
241.54	240.8	0.74	0.18	2.00
279.40	278.5	0.90	0.18	2.00
288.70	288.0	0.70	0.18	2.00
334.22	333.5	0.72	0.18	2.00
361.26	360.5	0.76	0.18	2.00
418.48	418.0	0.48	0.18	2.00
446.70	446.0	0.70	0.18	2.00
453.20	453.0	0.20	0.18	2.00
460.06	459.5	0.56	0.18	2.00
536.90	536.0	0.90	0.18	2.00
637.94	637.2	0.74	0.18	2.00
440.74	440.0	0.74	0.18	2.00
472.22	471.6	0.62	0.18	2.00
513.70	513.0	0.70	0.18	2.00
528.72	528.0	0.72	0.18	2.00
574.60	573.8	0.80	0.18	2.00
585.48	584.6	0.88	0.20	2.00
684.63	684.0	0.63	0.18	2.00
740.27	739.8	0.47	0.20	2.00
748.28	747.8	0.48	0.18	2.00
807.16	806.4	0.76	0.18	2.00
879.70	878.8	0.90	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.

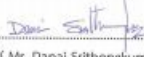

which for a normal distribution corresponds to a coverage probability of approximately 95%

- * Indicates non TISI accredited

- End of Certificate -

PM-708-02 R01 1/11/2021

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Request No. 25-65 / 0398	MTC. ACL.No. 486 / 65
CALIBRATION CERTIFICATE NOMENCLATURE : 1. Atomic Absorption Spectrophotometer "Agilent Technologies" Model AA240FS, Serial No. MY13160001 2. Working standard solution "Inorganic Ventures" Multi Analyte Custom Grade Solution, Lot No. P2-MEB675610 SUBMITTED BY : United Analyst and Engineering Consultant Co., Ltd. 3. Soi Udomsuk41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260	
CALIBRATION PROCEDURE : 1. Performance Verification of Atomic Absorption Spectrophotometer (WI-500-02-30) 2. Estimation Uncertainty of Measurement in Analytical Chemistry (QP-513)	
REFERENCE MATERIAL : Traceable to NIST "Agilent Technologies", "Carlo Erba" Cadmium Lot No. 0108047046, Chromium Lot No. 0106315418, Copper Lot No. 0107480530, Iron Lot No. 0104697566, Lead Lot No. 0104659473, Manganese Lot No. T109228A, Nickel Lot No. 0104978044, Zinc Lot No. 0100792297 CALIBRATION RANGE : 0.02,0.10,0.30,0.50,0.70 mg/l at 228.8 nm.Cd, 0.10,0.20,0.30,0.50,0.70 mg/l at 357.9 nm.Cr, 0.05,0.10,0.30,0.50,0.70 mg/l at 324.7 nm.Cu, 0.10,0.30,0.50,0.70,1.00 mg/l at 248.3 nm.Fe, 0.20,0.50,0.70,1.00,1.50 mg/l at 217.0 nm.Pb, 0.05,0.10,0.30,0.50,0.70 mg/l at 279.5 nm.Mn, 0.10,0.30,0.50,0.70,1.00 mg/l at 232.0 nm.Ni, 0.05,0.10,0.30,0.50,0.70 mg/l at 213.9 nm.Zn AMBIENT CONDITIONS : Temperature 22 °C Relative humidity 60 %	
The Atomic Absorption Spectrophotometer set has been calibrated against Reference Material traceable to National Institute of Standards and Technology (NIST) by The Analytical Chemistry Laboratory. The results are attached herewith.	
Calibrated by  (Mr. Danai Srithongkum)	Approved by  (Mr. Thippaya Junee Fortune) Director of Analytical Chemistry Laboratory Ref. 2025265020400522001 Calibration Date : 3 February 2022
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Request No. 25-65 / 0398

1 / 5

MTC. ACL. No. 486 / 65

CALIBRATION DATA

1. Noise Level in term of standard deviation

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

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Request No. 25-65 / 0398

2 / 5

MTC. ACL. No. 486 / 65

2. Precision

Element	Conc. (mg/l)	Absorbance										Ave. Abs.	SD	%RSD
Cd	0.02	0.0074	0.0062	0.0065	0.0062	0.0070	0.0068	0.0070	0.0065	0.0065	0.0069	0.007	0.0004	5.76
	0.30	0.0952	0.0959	0.0951	0.0957	0.0952	0.0950	0.0952	0.0948	0.0956	0.0943	0.095	0.0005	0.49
	0.70	0.2213	0.2180	0.2203	0.2208	0.2234	0.2211	0.2196	0.2219	0.2201	0.2194	0.221	0.0015	0.67
Cr	0.10	0.0096	0.0098	0.0097	0.0102	0.0106	0.0097	0.0098	0.0099	0.0103	0.0093	0.010	0.0004	3.83
	0.30	0.0309	0.0302	0.0300	0.0316	0.0306	0.0299	0.0309	0.0297	0.0311	0.0296	0.030	0.0007	2.20
	0.70	0.0659	0.0667	0.0664	0.0648	0.0656	0.0662	0.0658	0.0638	0.0638	0.0669	0.066	0.0011	1.70
Cu	0.05	0.0080	0.0075	0.0078	0.0075	0.0077	0.0081	0.0080	0.0075	0.0074	0.0076	0.008	0.0003	3.26
	0.30	0.0417	0.0419	0.0412	0.0421	0.0424	0.0420	0.0423	0.0403	0.0418	0.0415	0.042	0.0006	1.47
	0.70	0.0969	0.0965	0.0972	0.0957	0.0961	0.0958	0.0961	0.0963	0.0959	0.0972	0.096	0.0006	0.58
Fe	0.10	0.0090	0.0105	0.0078	0.0099	0.0091	0.0093	0.0096	0.0094	0.0093	0.0084	0.009	0.0007	8.11
	0.50	0.0462	0.0470	0.0464	0.0464	0.0467	0.0462	0.0467	0.0460	0.0468	0.0466	0.047	0.0003	0.67
	1.00	0.0867	0.0886	0.0910	0.0892	0.0897	0.0873	0.0892	0.0885	0.0888	0.0874	0.089	0.0013	1.43
Pb	0.20	0.0091	0.0095	0.0088	0.0087	0.0082	0.0094	0.0090	0.0087	0.0082	0.0090	0.009	0.0004	4.94
	0.70	0.0322	0.0321	0.0324	0.0318	0.0335	0.0326	0.0327	0.0315	0.0336	0.0321	0.032	0.0007	2.09
	1.50	0.0653	0.0645	0.0663	0.0664	0.0652	0.0671	0.0662	0.0666	0.0657	0.0648	0.066	0.0008	1.28
Mn	0.05	0.0092	0.0092	0.0097	0.0087	0.0085	0.0079	0.0096	0.0085	0.0084	0.0099	0.009	0.0007	7.33
	0.30	0.0616	0.0630	0.0632	0.0633	0.0634	0.0628	0.0640	0.0633	0.0640	0.0629	0.063	0.0007	1.08
	0.70	0.1396	0.1366	0.1386	0.1377	0.1386	0.1396	0.1380	0.1374	0.1383	0.138	0.138	0.0009	0.67
Ni	0.10	0.0102	0.0092	0.0097	0.0104	0.0091	0.0105	0.0105	0.0096	0.0098	0.0102	0.010	0.0005	5.22
	0.50	0.0488	0.0489	0.0489	0.0495	0.0484	0.0490	0.0481	0.0492	0.0495	0.0492	0.049	0.0004	0.91
	1.00	0.0976	0.0979	0.0975	0.0992	0.0977	0.0973	0.0986	0.0962	0.0985	0.0982	0.098	0.0008	0.85
Zn	0.05	0.0340	0.0349	0.0340	0.0352	0.0337	0.0351	0.0344	0.0346	0.0349	0.0343	0.035	0.0005	1.49
	0.30	0.1669	0.1653	0.1628	0.1642	0.1657	0.1637	0.1659	0.1652	0.1654	0.1657	0.165	0.0012	0.72
	0.70	0.3456	0.3467	0.3445	0.3430	0.3422	0.3404	0.3437	0.3438	0.3435	0.3438	0.344	0.0013	0.37

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Request No. 25-65 / 0398

3 / 5

MTC. ACL. No. 486 / 65

3. Trueness

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

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Cd	0.02004	0.019	-0.001	5.19	± 0.004
	0.30060	0.291	-0.010	3.19	± 0.006
	0.70140	0.678	-0.023	3.34	± 0.012

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

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Cr	0.1002	0.101	0.001	0.80	± 0.007
	0.3006	0.298	-0.003	0.86	± 0.012
	0.7014	0.635	-0.066	9.47	± 0.023

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

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Cu	0.0502	0.046	-0.004	8.37	± 0.006
	0.3012	0.295	-0.006	2.06	± 0.010
	0.7028	0.694	-0.009	1.25	± 0.021

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Request No. 25-65 / 0398

4 / 5

MTC. ACL. No. 486 / 65

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

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Fe	0.1003	0.106	0.006	5.68	± 0.008
	0.5015	0.522	0.021	4.09	± 0.017
	1.0030	0.993	-0.010	1.00	± 0.032

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

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Pb	0.1988	0.197	-0.002	0.91	± 0.014
	0.6958	0.722	0.026	3.77	± 0.022
	1.4910	1.463	-0.028	1.88	± 0.041

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

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Mn	0.04955	0.054	0.004	8.98	± 0.004
	0.29730	0.317	0.0197	6.63	± 0.006
	0.69370	0.682	-0.0117	1.69	± 0.012

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Request No. 25-65 / 0398

5 / 5

MTC, ACL No. 486 / 65

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

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Ni	0.099	0.102	0.003	3.03	± 0.007
	0.495	0.489	-0.006	1.21	± 0.010
	0.990	0.975	-0.015	1.52	± 0.020

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

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Zn	0.050	0.050	0.000	0.00	± 0.012
	0.300	0.307	0.007	2.33	± 0.011
	0.700	0.660	-0.040	5.71	± 0.015

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

Calibrated by: *Devi Sathya*
(Mr. Danai Srithongkum)

Approved by: *Dr. Thippaya Junvee Fortune*
Dr. (Mrs. Thippaya Junvee Fortune)
Director of Analytical Chemistry Laboratory
Calibration date : 3 February 2022

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Agilent 55/240/280 Series Atomic Absorption Spectroscopy Systems

Preventive Maintenance Checklist

Agilent Preventive Maintenance provides factory recommended services for your Agilent systems to ensure reliable operation and the accuracy of your results.

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

Note: While instrument production (AA) instrument and/or accessory models are not covered by this checklist, it can be used as a reference service.

For more information about Agilent Technologies service, please visit our website at <http://www.agilent.com/en-us/services> or by calling UML <http://www.agilent.com/en-us/services>

INTRODUCTION

Customer Information

- Customer service 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 List section of this document, are not part of the recommended Preventive Maintenance services, nor are they included in the price of this service.
- If a system requires the use of extra optional procedures and/or parts for the maintenance service, then these must be ordered separately and checked as a repair, which may incur additional charges.

Revision: 10/00, Issued November 2021

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Instrument Preventive Maintenance Checklist

Important Customer Web Links

- For more information about Agilent technical services, please visit our website using the following URL: <http://www.agilent.com/chem/products/analytical/instrumentation/service/technical>
- To access Agilent webinars, visit <http://www.agilent.com/chem/education> to learn about training options which include on-line, classroom and on-site delivery. A training specialist can work directly with you to help determine your best options.
- A useful Agilent Resource Center webpage is available, which includes short videos, on maintenance, quick starts of consumables for new instruments, and other valuable information. Click on the Resource Page here: <https://www.agilent.com/chem/ast/agilentresources>
- Need technical support, FAQs, supplies? Visit our Agilent website at <http://www.agilent.com/chem/ast/agilentresources>
- Get answers, Share insights, Build connections. Join the Agilent Community to help improve our Agilent products.

Service Engineer's Responsibilities

- Contact the customer and ensure that all necessary supplies are available before the preventive maintenance visit.
- Confirm the ability of the instrument to deliver continued safe operation as established via the Agilent AA safe operation flow chart (Refer directly to the AA 55/240/280 Preventive Maintenance Scope of Work to make this decision).
- Only accept this pages that relate to the system or module being serviced.
- Complete only a field with the relevant information.
- Complete the relevant checkboxes in the checklist using either a "X" or tick mark.
- Check the condition of applicable check boxes to indicate service tasks not performed as appropriate.
- Complete the Preventive Maintenance service in the order of the tasks listed.
- Complete the Service Review section of the checklist to close.
- Complete the fields for page numbers at the foot of each worksheet.
- Complete the date and number of pages read in the Service Completion section.
- Ask the customer to sign the Service Completion section including the name and signature of the signatory.

This information is subject to change without notice.

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Instrument Preventive Maintenance Checklist

Instrument Maintenance

System Information

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

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

List System Component Product Numbers	List the Serial Numbers of each Component
1. G 2402 A	MY 13160001
2.	
3.	
4.	
5.	
6.	
7.	
8.	

Preparation, Safe operation and Initial performance checks

Revision: 10/00, Issued November 2021

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Agilent AA-PM procedure flow chart. Inspect and fix as required. The PM can be discontinued.

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

- ☒ Discuss any specific issues with the customer before starting.
- ☒ For HF applications systems, if a required sample introduction system was not installed ask the customer to install it **N/A**.
- ☒ Review the instrument logbook for reported 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, consumables.
- ☒ Check logs for any reported fault data or components still flagged by current Service Notes.
- ☒ Check for required firmware updates and verify with customers if they would like them installed.
- ☒ Use SVD to perform the **Flame Height Scan for Dual HC** - "As found test."
- ☒ Perform a **Basic Cu ABS test** - "As found test."
- ☒ Final the "Initial" stage of service and record of "As found" data, after the the end of the checklist.

Preventive Maintenance Procedures

FLAME SYSTEM section

☐ Section not applicable

Electronic components

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

Mechanical components

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

Optics components

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

Sample Introduction and Atomization

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

Gas handling components and safety interlocks

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

Analytical performance for Flame systems

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

FURNACE SYSTEM section

☒ Section not applicable

Electronic components

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

Mechanical components

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

Optics components

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

Gas handling, water system and workhead component checks

- ☐ Inspect the CTA workhead gas lines and connections for leaks.
- ☐ Pressure test for gas leaks.
- ☐ If the cooling system is accessible (and locked) check for correct operation and cooling water level. This includes any temperature and pressure settings plus filter checking (if the manufacturer).
- ☐ Inspect the CTA workhead water hoses and connections for leaks.
- ☐ Check all gaseous components and replace if necessary.

- ☐ Tube
- ☐ Electrodes
- ☐ Shroud

☐ Clean and clear the end windows of the workhead.

☐ Check safety interlock operation.

Analytical performance for Furnace systems

- ☐ Optimize the line number ready to perform 60 or 100 cycles.
- ☐ Run the sensitivity test for a 20 ppb copper sample and record the results in the results table.

PSD autosampler accessory for Furnace systems

- ☐ Section 600 Applicable
- ☐ Check condition of the PSD capillary – replace if necessary.
- ☐ Check condition and operation of PSD syringe – ensure it does not have air locks and bubbles.
- ☐ Change PSD rinse bottle setting.
- ☐ Check and clean the rinse vessel.
- ☐ Check the drain tube for good drainage. Ensure that tube tight, secure, kinked or exposed and the lower end must be above the fluid level in the waste vessel.
- ☐ Ensure that the waste vessel is suitable to reuse with the furnace system.

Sample introduction pump system (SIPS) accessory

- ☐ Section 600 Applicable
- ☐ Use torque screws securing the tubes, presser arms and pump tubes.
- ☐ Adjust each roller so that it rotates freely.
- ☐ When installing pump tubes, ensure pump bands with a dry clean cloth.
- ☐ Ensure that the presser arms and the surfaces near the pump are free from dirt and spills.
- ☐ Remove the pump manifold cover and check for the indication of fluids and any signs of corrosion.
- ☐ Reconnect the manifold, install the motor mounting plates to the chassis.
- ☐ Check gaskets securing the manifold holder if replacement is necessary.
- ☐ Disconnect, clean, replace and reassemble the tubing using the following steps:

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- ☐ Remove the 1 piece by disconnecting the pump tubes, the pump arms and all other tubing.
- ☐ Place the 1 piece in a small container containing cleaning detergent 1:15% Decon 90 or similar for approximately 10 minutes.
- ☐ Wash the 1 piece under a spray with a strong flow of water.
- ☐ Rinse with deionized water through all of the ports in the reverse direction to normal sample flow.
- ☐ Reassemble.

Sample preparation system (SPS 4) accessory

☒ Section 600 Applicable

The Agilent SPS 4 autosampler is designed for routine scheduled maintenance.

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

- ☐ Clean the spill tray, rack location mat, and furnace and chassis components with damp cloth and mild household detergent.
- ☐ Clean the external autosampler cover panels with domestic window cleaner.
- ☐ Check the X-axis and Z-axis drive belts for cracks, tears, damage, wear, loose, fraying, bulge, changes or degradation from fumes.
- ☐ Check the X-axis, Y-axis, and Z-axis PSD cables for cracks, damaged, bending, damaged edges or damaged connectors.

NOTE: The autosampler requires no extra lubrication throughout its lifetime. For further data, refer to the SPS 4 service manual 08410-10050.

Sample preparation system (SPS 3) accessory

☒ Section 600 Applicable

- ☐ Check the screws and fastening belts. Replace if there are any cracks, splits or other abnormal conditions found.
- ☐ Check belt tensions, adjust if required.
- ☐ Check the lubrication and for sample acids in the fluid sample chamber. If a customer has observed any vibration or abnormal movements of the X-axis or stage, add 1 mL of Dow Corning 900 or Fluin 200-05 into the well.
- ☐ Check the autosampler body for fluid leaks, leaks or calibration required.
- ☐ Clean the exterior surfaces of the accessories with soft lint free cloth. This cloth can be dampened with warm water or a mild detergent. Do not use organic solvents or abrasive cleaning agents.

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Vapor generation accessory VGA (hydride generator)

- ☐ Section 600 Applicable
- ☒ Inspect VGA gas supply hose.
- ☒ Inspect replace VGA pump tubing.
- ☒ Check flow gas process, replace and set up as required.
- ☒ Check gas flow meter gas flow setting – adjust if required.
- ☒ Check gas regulator pressure to 0.15 (32.7 kPa) – adjust if required.
- ☐ Clean the exterior surfaces of the accessory with soft lint free cloth. This cloth can be dampened with warm water or a mild detergent. Do not use organic solvents or abrasive cleaning agents.

UltrAA lamp accessory (external)

- ☒ Section 600 Applicable
- ☐ Check the condition of the power cable.
- ☐ Clean the exterior surfaces of the accessory with soft lint free cloth. This cloth can be dampened with warm water or a mild detergent. Do not use organic solvents or abrasive cleaning agents.

Restore System

- ☐ If you have opened the instrument's internal panel during the course of PM, restore to the original factory-installed configuration by re-installing the manual calibration (e.g., reload the customer's method).

Guidance

If the PM service is performed only by a qualification service, then use the qualification procedure as guidance for final instrument test and check-out.

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Signature Page

Service Review

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

Test Results

Test Description	Expected Test Result	Actual Test Result
Flame optics PMT Gain test		
For copper at 324.8 nm, 4 mA, 0.5 nm slit width	< 55 %	42 %
Flame performance test with 5 ppm copper sample		
Air/acetylene, mixing paddle removed	Abs value > 0.5	0.5963
Air/acetylene, mixing paddle installed, 10 replicates	%RSD < 1.0	0.4
Deuterium furnace optics PMT Gain test		
For copper at 324.8 nm, 4 mA, 0.5 nm slit width	< 55 %	
Deuterium furnace performance test with 25 ppb copper sample (324.8 nm)		
Precision %RSD	≤ 4.0%	—
Abs value	≥ 0.15	—
Zeeman furnace analytical performance: 25 ppb copper sample (327.4 nm)		
Precision %RSD	≤ 4.0%	—
Abs value	≥ 0.10	—
MSR%	≤ 70 %	—
AS VGA-77 test Abs.	0.2 Abs	0.2156 Abs

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AA consumable and parts list table

Part Description	Part Number	Product/Model # where used	PM supplied or Consumable	Instrument-Type
Test Solution - Cu Spm solution	6610030100	50 55 140 240 280	PM supplied	Common
Test Solution - Blank solution	5190-7001	50 55 140 240 280	PM supplied	Common
Copper, 1000 ug/ml, 100ml	5190-6279	50 55 140 240 280	*	Common
Kit, Mk 7 O-rings, aqueous, complete set	9910093400	50 55 140 240 280	PM supplied	Flame
Organic Kit	9910093500	50 55 140 240 280	PM supplied	Flame
Wire Nebulizer Cleaning	9910024700	50 55 140 240 280	consumable	Flame
Tubing-Capillary Std Nebis	9910024800	50 55 140 240 280	consumable	Flame
Capillary Tube Hvac Neb (3) (organics only)	9910044000	50 55 140 240 280	consumable	Flame
Glass impact beads (5/pk)	9910025700	50 55 140 240 280	consumable	Flame
Teflon impact beads (5/pk) (organics only)	9910053300	50 55 140 240 280	consumable	Flame
Burner cleaning strip (100/pk)	9910053900	50 55 140 240 280	consumable	Flame
Window UV silica - round (right side)	2010082600	50 55 140 240 280	PM supplied	Common
Window UV silica - rectangular (left side)	2010082500	50 55 140 240 280	PM supplied	Common
Pad adhesive window (round)	4910012700	50 55 140 240 280	PM supplied	Common
Pad adhesive window (rectangular)	4910012800	50 55 140 240 280	PM supplied	Common
Electrode kit (1 pr) (D2)	6310003400	GTA120	PM supplied	Furnace
Shroud (D2)	6310003100	GTA120	PM supplied	Furnace
Zeeman electrode kit (1 pr)	6310003500	GTA120	PM supplied	Furnace
Zeeman shroud	6310003600	GTA120	PM supplied	Furnace
O-ring PSD rinse bottle	6910025900	PSD120	PM supplied	Furnace

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

Items classified as PM supplied in the above table are included in the standard PM
Those classified as consumable should be provided by the customer or charged to the customer if supplied by the Agilent service engineer.

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Service Engineer Comments (optional)

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

Service Completion

Service request number: 6004901032 Date service completed: 26 Jan 2022
Agilent signature: Kanyakorn S. Customer signature: Chanthanan A.
Total number of pages in this document: 13

Revision: 10.00, Issued: November 2021

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SVD Results Report



Report ID: 1 Diagnostic Start Time: 28/01/2022 8:40:57 AM Diagnostic End Time: 28/01/2022 9:07:34 AM
Customer: UAC Service Engineer: Kanyakorn S.
Address: Contact Details: 09-63153824

Instrument Configuration

Configuration:

Serial Number: MY15150007 Turret Type: Automatic
Instrument Model: Varian AA-43240x280 Number Of Lamps: 1
Flame Instrument: True Mono Type: Automatic
Furnace Instrument: True Gasbox Type: No Gas Box
Zeeman Present: False Auto Burner Adjuster: True
Internal Zeeman: False Mains Frequency: 60
Internal UltraAA: False Firmware Version: 2.15
Optics Type: Double Beam Photomultiplier Type: Normal(300 nm)
D2 BG Correction Fitted: True PWB Version: 45
Boot Block Version: 1.05

EEPROM Data:

Instrument Run Hours: 48958.834 D2 Run Hours: 38139.630
Zero Wavelength Offset: 30.07 D2 Serial Number: 161661
Mono Correction: 0.765 D2 Install Date: 01/01/1970
Flame Hours: 23519.173 D2 Original Intensity: 1.000
D2 Last Intensity: 475.000

Frequency:

Averaging Period: 30.0
Datapoint Count: 20

Upper Limit: 51.03 Highest Measured Frequency: 50.00
Average Frequency: 50.00
Lower Limit: 48.00 Lowest Measured Frequency: 50.00

Result: **Passed**

Power Supply:

Averaging Period: 30.0
Datapoint Count: 20

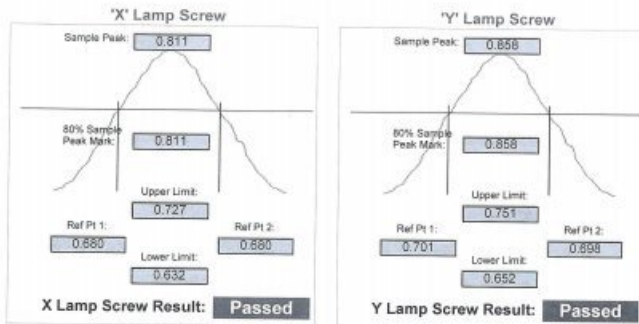
	Lower Limit (V)	Actual (V)	Upper Limit (V)	Result:
12.00V Rail	-0.83	12.20	13.20	Passed
-12.00V Rail	13.20	-11.90	-13.80	Passed
5.00V Rail	4.50	5.01	5.50	Passed
310.00V Rail	279.50	320.00	341.00	Passed

Optics

Beam Balance:

Lamp Type: Copper
Lamp Socket Used: 3

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



Grating Squareness:

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

	Lower Limit (nm)	Actual (nm)	Upper Limit (nm)	Result:
Zero Order	-0.10	0.00	0.10	Passed
First Order	324.45	324.75	325.15	Passed
Second Order	649.23	649.52	649.97	Passed

Report Generated At: 28/01/2022 9:52:26 AM

3

SVD Result Report SVD
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Wavelength Repeatability:

Lamp Used: Copper
Peak Used(nm): 324.750
Connected to Socket: 3

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

Lamp Alignment: **Performed**

Lower Limit(nm): 324.703 324.803 Upper Limit(nm)

(Actual Peak Zero Order)

(Sample Peak Wavelength)

Sample 1: 324.823

Sample 2: 324.823

Sample 3: 324.823

Sample 4: 324.819

Sample 5: 324.819

Sample 6: 324.819

Sample 7: 324.819

Sample 8: 324.819

Sample 9: 324.819

Sample 10: 324.819

Mean: 324.821

Standard Deviation: 0.002

Result: **Passed**

Report Generated At: 28/01/2022 9:52:26 AM

4

SVD Result Report SVD
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Mechanical

Wavelength Drive:

Passed

Slit Drive:

Passed

Turret Drive:

Passed

Auto Burner Adjuster Drive:

Untested

Miscellaneous

Signal Processing Linearity:

Calculate Mode: New Calc Mode

	Lower Limit	Actual	Upper Limit	Result:
S0	114	260	237	Passed
S1	155	154	151	Passed
S2	271	295	332	Passed
S3	474	505	575	Passed
S4	945	913	1008	Passed
S5	1455	1519	1751	Passed
S6	2455	2753	3055	Passed
S7	4317	4724	5513	Passed

Interlocks:

Burner Fitted: **Working** Flame Detect: **Working**
N2O Burner Fitted: **Untested** GCU Active: **Working**
Flame Shield Closed: **Working** Oxidant Pressure: **Working**
Gas Control Fitted: **Untested** Oxidant Changeover: **Untested**
Pressure Release Bung Fitted: **Working** Ignition: **Working**
Liquid Trap Fitted: **Working**

Report Generated At: 28/01/2022 9:52:26 AM

5

SVD Result Report SVD
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Auto Lamp Recognition:

Lamp 1: 12 - Chromium (Cr) Lamp 5: Not Supported
Lamp 2: Uncoded Lamp/Not Connected Lamp 6: Not Supported
Lamp 3: 14 - Copper (Cu) Lamp 7: Not Supported
Lamp 4: 87 - Silver/Cadmium/Lead/Zinc(UltrAA) (Ag/C Lamp 8: Not Supported

Result: **Passed**

GTA Temperature Monitoring:

Not Performed

Notes:

Signatures:

Chomthanan A. 28 Jan 2022
UAE Date

Kanyakorn S. 28 Jan 2022
Kanyakorn S. Date

Report Generated At: 28/01/2022 9:52:26 AM

6

SVD Result Report SVD
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Analyst: ...
Date Started: 28/01/2022 9:56 AM GMT+08:00 (UTC+8)
Worksheet: PM 28/01/2022 3 - Sensitivity test
Comments:
Method: Cu
Computer name: HBM212
Serial Number: 4711100361

Method: Cu (Flame)

Sample ID	Exp. Abs	%PbD	New Abs			
Cu 5 ppm	0.562	0.4	0.5614			
Recovery						
0.0047	0.1102	0.4878	0.0805	0.5021	0.4383	
0.0019	0.0304	0.4216	0.0486	0.5012	0.4022	

เอกสารไม่ควบคุม

Analyst: ...
Date Started: 28/01/2022 11:04 AM GMT+08:00 (UTC+8)
Worksheet: As 14/1/22
Comments:
Method: As
Computer name: HBM212
Serial Number: 4711100361

Method: As (Vapor)

Sample ID	Exp. Abs	%PbD	New Abs			
As 10 ppm	0.22	1.1	0.219			
Recovery						
0.2185	0.2171	0.2163	0.2145	0.2125	0.2107	

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Certificate of Calibration DX-120 : Anion (ID#042)

This certificate is to verify that instrument below are calibrated
by Archemica Lab Co.,Ltd.

DX-120 S/N : 03010223



Operator Signature : Channarong Khiao-un Date : Dec 08, 2021

(Mr.Channarong Khiao-un)

Test Engineer

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Qualification Report

PM Check list ,CM_OQ and PQ
DX-120 : Anion (ID#042)
For
UAE
(2nd Contract)

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Preventive Maintenance Check List

เอกสารไม่ควบคุม



Preventive Maintenance Checklist

Dionex Ion Chromatography Preventive Maintenance Report

Customer Organization	Name/ Department
UAE (2nd Contract)	Khun Suwan
Engineer Name	Date
Mr.Channarong Khiao-un	8-Dec-2021

Instrument Detail

Instrument Model	Application
DX-120 (ID#042)	Anion
Instrument components	Serial Number
DX-120	03010223

Consumable Detail

Columns	Guard Columns	Suppressors	Concentrators	Etc.
AS22	AG22	ASRS 300	-	-

Remark:

Perform By
Archemica Lab Co.,Ltd

Channarong
Archemica Lab Co.,Ltd
8-Dec-21
Date

Suwan
Customer
8-Dec-21
Date

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Preventive Maintenance Checklist

General Inspection Checklist

Item	Description	Result		Action Taken	N/A
		Pass	Fail		
1	Power line 220V/50Hz	X		Check	
2	Pressure 1.5 bar	X		Check	
3	Flow rate 0.2-0.3 ml/min	X		Check	
4	Failed 10 min and 10 min	X		Check	
5	Changed and checked 10 min	X		Check	
6	Injection Valve no Leak	X		Check & Clean	
7	Electrode contact	X		-	
8	Sample plate	X		-	
9	Sample vial	X		-	
10	Sample vial	X		-	
11	Sample vial	X		-	
12	Sample vial	X		-	
13	Sample vial	X		-	
14	Electrode contact	X		Check	
15	Column selection valve	X		Check	
16	Injection of 100 µl sample	X		Check	
17	Flow rate	X		Check	
18	Injection of 100 µl sample	X		Check	
19	Injection of 100 µl sample	X		Check	
20	Injection of 100 µl sample	X		Check	
21	Injection of 100 µl sample	X		Check	
22	Injection of 100 µl sample	X		Check	
23	Injection of 100 µl sample	X		Check	
24	Injection of 100 µl sample	X		Check	
25	Injection of 100 µl sample	X		Check	
26	Injection of 100 µl sample	X		Check	
27	Injection of 100 µl sample	X		Check	
28	Injection of 100 µl sample	X		Check	
29	Injection of 100 µl sample	X		Check	
30	Injection of 100 µl sample	X		Check	
31	Injection of 100 µl sample	X		Check	
32	Injection of 100 µl sample	X		Check	
33	Injection of 100 µl sample	X		Check	
34	Injection of 100 µl sample	X		Check	
35	Injection of 100 µl sample	X		Check	

เอกสารไม่ควบคุม

Chromelcon Operational Qualification (CM OQ)

เอกสารไม่ควบคุม

DIONEX
Chromleon Operational Qualification

General Information

Computer Name (Server): LAB-IC
Computer Name (Client): LAB-IC
Version Number: 6.80 SR12 Build 3578 (207169)
Operator: Mr.Channarong Khiao-Un

General System Suitability Test: Test passed

Comparison Formats:

All Parameters: (Exceptions see below)	Significant Digits: (They must match exactly)	10
Time Related Frac. Coll. Parameters: (The parameters are marked with "-")	Max. Deviation:	0.02 s


Reviewer's Signature // Date


Operator's Signature // Date

เอกสารไม่ควบคุม



Chromleon Operational Qualification, Part 1
Verification of Selected Results

Calibration Type:	LOD	
Integration Type:	Area	
Standard Method:	6.00.00.00	
Calibration Model:	Total	
Auto Reanalysis:	Off	
Report Variable	Peak Name	Status
Offset (s)	1.4	OK
	1.5	OK
	1.6	OK
Slope (c1)	Methylparabene	OK
	Ethylparabene	OK
	Propylparabene	OK
Correlation Coeff.	Methylparabene	OK
	Ethylparabene	OK
	Propylparabene	OK
Variance	Methylparabene	OK
	Ethylparabene	OK
	Propylparabene	OK
Std. Deviation	Methylparabene	OK
	Ethylparabene	OK
	Propylparabene	OK
Rel. Std. Dev.	Methylparabene	OK
	Ethylparabene	OK
	Propylparabene	OK
Variance Coeff.	Methylparabene	OK
	Ethylparabene	OK
	Propylparabene	OK

เอกสารไม่ควบคุม

DIONEX
Chromleon Operational Qualification, Part 1
Verification of Selected Results

Report Variable	Peak Name	Status
Calibration Point X	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Calibration Point Y	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Amount (ng)	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Resolution (EP)	Methylparabene	ok
	Ethylparabene	ok
Resolution (USP)	Methylparabene	ok
	Ethylparabene	ok
Peak Asymmetry (EP/USP)	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Peak Asymmetry (AA)	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok

เอกสารไม่ควบคุม



Chromleon Operational Qualification, Part 1
Verification of Selected Results

Report Variable	Peak Name	Status
Theoretical Plates (EP)	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Theoretical Plates (USP)	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Theoretical Plates (JP)	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok

Test Result: Passed


Reviewer's Signature // Date


Operator's Signature // Date

เอกสารไม่ควบคุม



Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Calibration Type:	LOD		
Integration var:	Area		
Standard Method:	Indicate:		
Calibration Mode:	Total		
Auto Recalibrate:	On		

Variable Category	Report Variable	Peak Name	Status
Sample	No.		ok
	Name		ok
	Sample Type		ok
	Position		ok
	Status		ok
	Inj.Vol.		ok
	Dil.Fac.		ok
	Weight		ok
	Amount		ok
	Program		ok
Quantification Method		ok	
Chromatogram	Channel		ok
	No. of Peaks		ok
	Start Time		ok
	Signal Min.		ok
	Signal Max.		ok
	Signal Direction		ok
	Noise 2.1 2.3		ok
Peak Results	No.	Methylcyclopent	ok
	No.	1,2-dichlorobenz	ok
	No.	Propylbenzene	ok
	Peak Name	Methylcyclopent	ok
	Peak Name	1,2-dichlorobenz	ok
	Peak Name	Propylbenzene	ok
	Ret.Time	None variance	ok
	Ret.Time	2.741 s. 2.816 s	ok
Ret.Time	Propylbenzene	ok	

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J. Forecast. 26, 1031–1042 (2007)
DOI: 10.1002/for

CTS ID: secretUM -art 2
 Date: 12/20/21 11:42

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Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Results	Ret.Dew.(abs)	Methylarsene	ok
	Ret.Dew.(abs)	Ethylarsene	ok
	Ret.Dew.(abs)	Propylarsene	ok
	Ret.Dew.(rel)	Methylarsene	ok
	Ret.Dew.(rel)	Ethylarsene	ok
	Ret.Dew.(rel)	Propylarsene	ok
	Area	Methylarsene	ok
	Area	Ethylarsene	ok
	Area	Propylarsene	ok
	Ret.Area (Total)	Methylarsene	ok
	Ret.Area (Total)	Ethylarsene	ok
	Ret.Area (Total)	Propylarsene	ok
	Height	Methylarsene	ok
	Height	Ethylarsene	ok
	Height	Propylarsene	ok
	Ret.Height (Total)	Methylarsene	ok
	Ret.Height (Total)	Ethylarsene	ok
	Ret.Height (Total)	Propylarsene	ok
	Amount	Methylarsene	ok
	Amount	Ethylarsene	ok
	Amount	Propylarsene	ok
	Concentration	Methylarsene	ok
	Concentration	Ethylarsene	ok
	Concentration	Propylarsene	ok
	Ret.Amount	Methylarsene	ok
	Ret.Amount	Ethylarsene	ok
	Ret.Amount	Propylarsene	ok
	Peak Width (5%)	Methylarsene	ok
Peak Width (5%)	Ethylarsene	ok	
Peak Width (5%)	Propylarsene	ok	
Peak Width (10%)	Methylarsene	ok	
Peak Width (10%)	Ethylarsene	ok	
Peak Width (10%)	Propylarsene	ok	
Peak Width (15%)	Methylarsene	ok	
Peak Width (15%)	Ethylarsene	ok	
Peak Width (15%)	Propylarsene	ok	
Peak Width (20%)	Methylarsene	ok	
Peak Width (20%)	Ethylarsene	ok	
Peak Width (20%)	Propylarsene	ok	

Chromatogram (2) 204=8.2005
 Weight 6.019824 g, 1.830175 g

22 CO / Robert CM -Part 2
 11/20/2017 12:11 PM

เอกสารไม่ควบคุม



Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Results	Peak Width (50%)	Hydrocarbons	OK
	Peak Width (50%)	Hydrocarbons	OK
	Peak Width (50%)	Hydrocarbons	OK
	Left Width (95%)	Methy paraffins	OK
	Left Width (95%)	Hydrocarbons	OK
	Left Width (95%)	Hydrocarbons	OK
	Right Width (95%)	Hydrocarbons	OK
	Right Width (95%)	Methy paraffins	OK
	Right Width (95%)	Hydrocarbons	OK
	Right Width (95%)	Hydrocarbons	OK
	Peak Start	Methy paraffins	OK
	Peak Start	Hydrocarbons	OK
	Peak Start	Hydrocarbons	OK
	Peak Stop	Hydrocarbons	OK
	Peak Stop	Hydrocarbons	OK
	Peak Start Value	Methy paraffins	OK
	Peak Start Value	Hydrocarbons	OK
	Peak Start Value	Hydrocarbons	OK
	Peak Stop Value	Methy paraffins	OK
	Peak Stop Value	Hydrocarbons	OK
	Peak Stop Value	Hydrocarbons	OK
	UL Value Peak Start	Methy paraffins	OK
	BL Value Peak Start	Hydrocarbons	OK
	UL Value Peak Stop	Methy paraffins	OK
	BL Value Peak Stop	Hydrocarbons	OK
	UL Value Peak Stop	Methy paraffins	OK
	BL Value Peak Stop	Hydrocarbons	OK
	Type	Methy paraffins	OK
	Type	Hydrocarbons	OK
	Type	Hydrocarbons	OK
Resolution(EPI)	Methy paraffins	OK	
Resolution(EPI)	Hydrocarbons	OK	
Resolution(USP)	Methy paraffins	OK	
Resolution(USP)	Hydrocarbons	OK	
Asymmetry(EPI)	Methy paraffins	OK	
Asymmetry(EPI)	Hydrocarbons	OK	
Asymmetry(EPI)	Hydrocarbons	OK	

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Chromleon Operational Qualification, Part 2

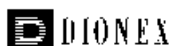
Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Results	Asymmetry(A1A)	Asymmetry(A1A)	OK
	Asymmetry(A1A)	Asymmetry(A1A)	OK
	Asymmetry(A1A)	Asymmetry(A1A)	OK
	Theoretical Plates(EPI)	Theoretical Plates(EPI)	OK
	Theoretical Plates(EPI)	Theoretical Plates(EPI)	OK
	Theoretical Plates(EPI)	Theoretical Plates(EPI)	OK
	Theoretical Plates(USP)	Theoretical Plates(USP)	OK
	Theoretical Plates(USP)	Theoretical Plates(USP)	OK
	Theoretical Plates(USP)	Theoretical Plates(USP)	OK
	Theoretical Plates(JP1)	Theoretical Plates(JP1)	OK
	Theoretical Plates(JP1)	Theoretical Plates(JP1)	OK
	Theoretical Plates(JP1)	Theoretical Plates(JP1)	OK
Peak Calibration	Cal.Mode	Calibration Mode	OK
	Cal.Mode	Calibration Mode	OK
	Cal.Mode	Calibration Mode	OK
	Auto.Recal.	Auto.Recal.	OK
	Auto.Recal.	Auto.Recal.	OK
	Auto.Recal.	Auto.Recal.	OK
	Cal.Type	Calibration Type	OK
	Cal.Type	Calibration Type	OK
	Cal.Type	Calibration Type	OK
	Weights	Weights	OK
	Weights	Weights	OK
	Weights	Weights	OK
	Offset	Offset	OK
	Offset	Offset	OK
	Offset	Offset	OK
	Slope	Slope	OK
	Slope	Slope	OK
	Slope	Slope	OK
	Int-Value	Integration Value	OK
	RF-Value	Retention Factor	OK
	RF-Value	Retention Factor	OK
	RF-Value	Retention Factor	OK
	No. of Points	Number of Points	OK
	No. of Points	Number of Points	OK
	No. of Points	Number of Points	OK

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$$2\text{Al} + 3\text{Cl}_2 \rightarrow 2\text{AlCl}_3 \quad \Delta H_f^\circ = -705 \text{ kJ}$$

เอกสารไม่ควบคุม



Chromleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Calibration	No. of Points	Methylparabene	ok
	No. of Points(disabled)	Ethylparabene	ok
	No. of Points(disabled)	Propylparabene	ok
Variance	Variance	Methylparabene	ok
	Variance	Ethylparabene	ok
	Variance	Propylparabene	ok
	Var.Coeff	Methylparabene	ok
	Var.Coeff	Ethylparabene	ok
	Var.Coeff	Propylparabene	ok
	Std.Dev.	Methylparabene	ok
	Std.Dev.	Ethylparabene	ok
	Std.Dev.	Propylparabene	ok
	Rel.Std.Dev.	Methylparabene	ok
	Rel.Std.Dev.	Ethylparabene	ok
	Rel.Std.Dev.	Propylparabene	ok
Corr.Coeff.	Corr.Coeff.	Methylparabene	ok
	Corr.Coeff.	Ethylparabene	ok
	Corr.Coeff.	Propylparabene	ok
	Coeff.Det.	Methylparabene	ok
	Coeff.Det.	Ethylparabene	ok
	Coeff.Det.	Propylparabene	ok
	Coeff.Det.	Methylparabene	ok
	Coeff.Det.	Ethylparabene	ok
	Coeff.Det.	Propylparabene	ok
	Coeff.Det.	Methylparabene	ok
	Coeff.Det.	Ethylparabene	ok
	Coeff.Det.	Propylparabene	ok
X	X	Methylparabene	ok
	X	Ethylparabene	ok
	X	Propylparabene	ok
	Y	Methylparabene	ok
	Y	Ethylparabene	ok
	Y	Propylparabene	ok
	W	Methylparabene	ok
	W	Ethylparabene	ok
	W	Propylparabene	ok
	Fit	Methylparabene	ok
	Fit	Ethylparabene	ok
	Fit	Propylparabene	ok

เอกสารไม่ควบคุม



Chromleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Calibration	Residual for Cal. Point X	Methylparabene	ok
	Residual for Cal. Point X	Ethylparabene	ok
	Residual for Cal. Point X	Propylparabene	ok
	Calibration Point Status	Methylparabene	ok
	Calibration Point Status	Ethylparabene	ok
	Calibration Point Status	Propylparabene	ok
	Amount	Methylparabene	ok
	Amount	Ethylparabene	ok
	Amount	Propylparabene	ok
	Amount	Propylparabene	ok
Peak Table	Peak Tab. Cal. Type	Ethylparabene	ok
	Peak Tab. Peak Type	Methylparabene	ok
	Peak Tab. Left Limit	Ethylparabene	ok
	Peak Tab. Right Limit	Ethylparabene	ok
	Peak Tab. Group	Ethylparabene	ok
	Peak Tab. Reap. Factor	Ethylparabene	ok
	Peak Tab. Amount	Ethylparabene	ok
	Peak Tab. Amnt.Dim	Ethylparabene	ok

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Chromleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Purity	PPI	Methylparabene	ok
	PPI	Ethylparabene	ok
	PPI	Propylparabene	ok
	RSD PPI	Methylparabene	ok
	RSD PPI	Ethylparabene	ok
	RSD PPI	Propylparabene	ok
	Match	Methylparabene	ok
	Match	Ethylparabene	ok
	Match	Propylparabene	ok
	RSD Match	Methylparabene	Deviation
	RSD Match	Ethylparabene	Deviation
	RSD Match	Propylparabene	Deviation
Rel.Max at	Rel.Max at	Methylparabene	ok
	Rel.Max at	Ethylparabene	ok
	Rel.Max at	Propylparabene	ok

Test Result: Failed

Reviewer's Signature // Date
 Simon 8-Dec-21

Operator's Signature // Date
 Khammaras 8-Dec-21

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Chromleon Operational Qualification, Part 3

Post-Acquisition Steps: Comparison with Expected Results

Calibration Type	LC1			
Integration Type	Area			
Standard Method	External			
Calibration Model	Ratio			
Auto Peak Table	On			
Channel Name	Report Variable	Peak Name	Status	
Extract UV Channel: EXT250NM	Area	Methylparabene	ok	
	Area	Ethylparabene	ok	
	Area	Propylparabene	ok	
	Height	Methylparabene	ok	
	Height	Ethylparabene	ok	
	Height	Propylparabene	ok	
	Base Peak Width	Methylparabene	ok	
	Base Peak Width	Ethylparabene	ok	
	Base Peak Width	Propylparabene	ok	
	EXT250NM	Area	Methylparabene	ok
		Area	Ethylparabene	ok
		Area	Propylparabene	ok
Height		Methylparabene	ok	
Height		Ethylparabene	ok	
Height		Propylparabene	ok	
Base Peak Width		Methylparabene	ok	
Base Peak Width		Ethylparabene	ok	
Base Peak Width		Propylparabene	ok	
Smoothing Filter		UV_VIS_1_MA_005_001	Noise (1.9-2.4 min)	ok
		UV_VIS_1_OL_004_001	Noise (1.9-2.4 min)	ok
		EXT250NM_SG_003_001	Noise (1.9-2.4 min)	ok

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Chromeleon Operational Qualification, Part 3

Post-Acquisition Steps: Comparison with Expected Results

Channel Name	Report Variable	Peak Name	Status
Arith. Comb. of Channels:			
ADD_UV_VIS_1_UV_VIS_1	Area	Methylparabene	ok
ADD_UV_VIS_1_UV_VIS_1	Area	Ethylparabene	ok
ADD_UV_VIS_1_UV_VIS_1	Area	Propylparabene	ok
MUL_UV_VIS_1_UV_VIS_1	Area	Methylparabene	ok
MUL_UV_VIS_1_UV_VIS_1	Area	Ethylparabene	ok
MUL_UV_VIS_1_UV_VIS_1	Area	Propylparabene	ok

Test Result: Passed


Reviewer's Signature // Date 8-Dec-21


Operator's Signature // Date 8-Dec-21

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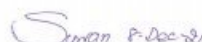
Chromeleon Operational Qualification, Part 4

System Suitability Test: Comparison with Expected Results

Calibration Type: LOFF
Integration Type: Area
Standard Method: External
Calibration Mode: Total
Auto Recalibrate: ON

Variable Category	Report Variable	Status
SST	Test No.	ok
	Test Name	ok
	Sample Condition	ok
	Sample Condition Result	ok
	Test Condition	ok
	Peak Condition	ok
	Aggregate Condition	ok
	Compare Operator	ok
	Compare Value	ok
	Result of Compare Value	ok
	Channel	ok
	Aggregated Samples	ok
	List of Aggr. Smp.	ok
	Result List for Aggr. Smp.	ok
	Result of Test Condition or Aggregate	ok
	N.A.	ok
	Test Result	ok
	Fail-Action	ok

Test Result: Passed


Reviewer's Signature // Date 8-Dec-21


Operator's Signature // Date 8-Dec-21

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Performance Qualification (PQ)



Chromeleon Operational Qualification, Part 5

Fraction Collection: Comparison with Expected Results

Calibration Type: LOFF
Integration Type: Area
Standard Method: External
Calibration Mode: Total
Auto Recalibrate: ON

Variable Category	Report Variable	Status
Fraction Report	Fract. No.	ok
	Fract. Starttime *)	ok
	Fract. Endtime *)	ok
	No. of Tubes	ok
	Position	ok
	Peak Name	ok
	No. of Peaks	ok
Tube Report	Position	ok
	Tube Starttime *)	ok
	Tube Endtime *)	ok
	Max. Tube Volume	ok
	Peak Name	ok
	No. of Peaks	ok
	Fract. No.	ok
	Fract. Starttime *)	ok
	Fract. Endtime *)	ok
	No. of Tubes	ok
	No. of Peaks	ok

Test Result: Passed


Reviewer's Signature // Date 8-Dec-21


Operator's Signature // Date 8-Dec-21

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เอกสารไม่ควบคุม



Performance Qualification

Instruments:

Instrument Name	Model	Supplier	Serial Number	Moduleware Version
Pump	DX120	Dionex	03010223	3.03
Detector	DX120	Dionex	03010223	3.03
Autosampler	AS40 or man. inj.	Dionex	n.a.	0.00
Eluent Generator	n.a.	Dionex	n.a.	0.00
Chromleon	6.80 SR12 Build 3578 (207169)	Dionex	33308	n.a.

Accessories:

Name	Description	Lot / Serial Number	Expire Date
Backpressure Tubing	0.13 mm (0.005") ID PEEK, 13 m (512")	n.a.	n.a.
Blank	Water	n.a.	n.a.
Sample 1	Nitrate, 5 ppm	210719	Jul-2022
Sample 2	Nitrate, 10 ppm	210719	Jul-2022
Sample 3	Nitrate, 25 ppm	210719	Jul-2022
Sample 4	Nitrate, 50 ppm	210719	Jul-2022
Sample 5	Nitrate, 100 ppm	210719	Jul-2022
Sample 6	Nitrate, 1000 ppm	210719	Jul-2022
Eluent	Water	n.a.	n.a.
Autosampler Reservoir A	Water	n.a.	n.a.

Simon
Customer Signature

K. Channarong
Qualification Executor

8-Dec-21
Date

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Limits:

Test	Customized Limits	Dionex Recommended Limits
DX120 Conductivity Noise (nS)	2	2
DX120 Conductivity Drift (nS/hr)	20	20
Injector Precision (Area %RSD)	1.0	1.0
Injector Carry Over (Area %)	0.1	0.1
DX120 Detector Linearity (Corr.)	0.999	0.999
DX120 Detector Linearity (%RSD)	5	5

Additional Information:

Customer/Company:	UAE Consultant Co.,Ltd.	Date:	8-Dec-2021
Qualification Executor:	Mr.Channarong / Archemica	Period between Qualifications:	6 months
		Next Qualification:	Jun-2022

Simon
Customer Signature

K. Channarong
Qualification Executor

8-Dec-21
Date

เอกสารไม่ควบคุม



Performance Qualification

Detector Noise and Drift

Instruments:

Instrument Name	Model	Supplier	Serial Number	Moduleware Version
Pump	DX120	Dionex	03010223	3.03
Detector	DX120	Dionex	03010223	3.03
Autosampler	AS40 or man. inj.	Dionex	n.a.	0.00
Eluent Generator	n.a.	Dionex	n.a.	0.00

Accessories

Name	Description
Backpressure Tubing	0.13 mm (0.005") ID PEEK, 13 m (512")
Eluent	Water

Additional Information

Customer/Company:	UAE Consultant Co.,Ltd.	Date:	8-Dec-2021
Qualification Executor:	Mr.Channarong / Archemica	Next Qualification:	Jun-2022

Test Results Summary

Test	Result
DX120 Conductivity Noise (nS)	PASS
DX120 Conductivity Drift (nS/hr)	PASS

Simon
Customer Signature

K. Channarong
Qualification Executor

8-Dec-21
Date

เอกสารไม่ควบคุม

Data for detector noise

Segment number	Noise, nS
1	2.696
2	2.231
3	1.111
4	2.130
5	2.284
6	0.960
7	2.415
8	2.031
9	2.138
10	2.622
11	0.719
12	1.270
13	1.671
14	1.444
15	1.699
16	2.892
17	1.850
18	1.950
19	1.379
20	2.295
Average, nS	1.885
Limit, nS	2
Result	PASS

Data for detector drift

20 Minute drift, nS	Drift, nS/hr	Limit, nS/hr	Result
0.427	1.280	20.000	PASS

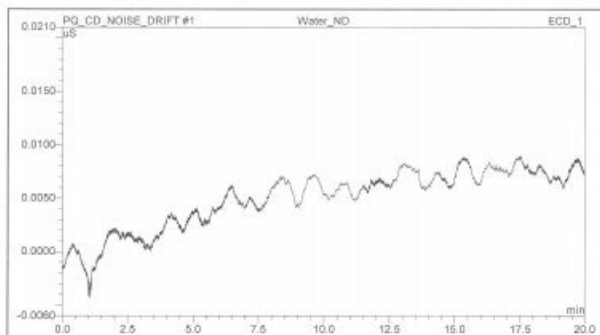
Simon
Customer Signature

K. Channarong
Qualification Executor

8-Dec-21
Date

เอกสารไม่ควบคุม

Chromatogram of Detector Noise and Drift



Customer Signature:  Sunan
Qualification Executor:  Khammarong
Date: 8-Dec-21

PeakNet (c) DIONEX 2001
Version 6.80 SR12 Build 3578 (207169)

OQ_PQ_DIX20_Validation / Detector Noise and Drift
Printed: 12/8/2021 11:33 AM

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Performance Qualification

Injector Precision

Instruments:

Instrument Name	Model	Supplier	Serial Number	Moduleware Version
Pump	DX120	Dionex	03010223	3.03
Detector	DX120	Dionex	03010223	3.03
Autosampler	AS40 or man. inj.	Dionex	n.a.	0.00
Eluent Generator	n.a.	Dionex	n.a.	0.00

Accessories

Name	Description
Backpressure Tubing	0.13 mm (0.005") ID PEEK, 13 m (512")
Sample 5	Nitrate, 100 ppm
Eluent	Water

Additional Information

Customer/Company:	UAE Consultant Co.,Ltd.	Date:	8-Dec-2021
Qualification Executor:	Mr.Channarong / Archemica	Next Qualification:	Jun-2022

Test Results Summary

Test	Result
Injector Precision (Area %RSD)	PASS

Customer Signature:  Sunan
Qualification Executor:  Khammarong
Date: 8-Dec-21

PeakNet (c) DIONEX 2001
Version 6.80 SR12 Build 3578 (207169)

OQ_PQ_DIX20_Validation / Injector Precision
Printed: 12/8/2021 11:04 AM

เอกสารไม่ควบคุม

Data for Injector Precision test

Name	Area uS*min Nitrate ECD_1
Inj Precision_1	1.665
Inj Precision_2	1.688
Inj Precision_3	1.691
Inj Precision_4	1.698
Inj Precision_5	1.699
Inj Precision_6	1.699
Inj Precision_7	1.689
Inj Precision_8	1.711
Inj Precision_9	1.711
Inj Precision_10	1.700
Average:	1.695
Std. Dev:	0.013
% RSD:	0.783 %
Limit:	1.0 %
Result:	PASS

Customer Signature:  Sunan
Qualification Executor:  Khammarong
Date: 8-Dec-21

PeakNet (c) DIONEX 2001
Version 6.80 SR12 Build 3578 (207169)

OQ_PQ_DIX20_Validation / Injector Precision
Printed: 12/8/2021 11:04 AM

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Performance Qualification

Injector Carry Over

Instruments:

Instrument Name	Model	Supplier	Serial Number	Moduleware Version
Pump	DX120	Dionex	03010223	3.03
Detector	DX120	Dionex	03010223	3.03
Autosampler	AS40 or man. inj.	Dionex	n.a.	0.00
Eluent Generator	n.a.	Dionex	n.a.	0.00

Accessories

Name	Description
Backpressure Tubing	0.13 mm (0.005") ID PEEK, 13 m (512")
Sample 6	Nitrate, 1000 ppm
Blank	Water
Eluent	Water

Additional Information

Customer/Company:	UAE Consultant Co.,Ltd.	Date:	8-Dec-2021
Qualification Executor:	Mr.Channarong / Archemica	Next Qualification:	Jun-2022

Test Results Summary

Test	Result
Injector Carry Over (Area %)	PASS

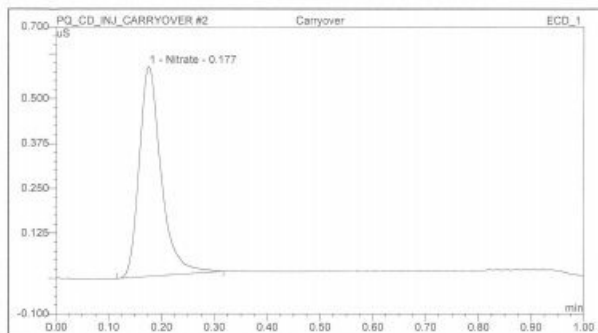
Customer Signature:  Sunan
Qualification Executor:  Khammarong
Date: 8-Dec-21

PeakNet (c) DIONEX 2001
Version 6.80 SR12 Build 3578 (207169)

OQ_PQ_DIX20_Validation / Injector Carry Over
Printed: 12/8/2021 11:07 AM

เอกสารไม่ควบคุม

Chromatogram for Carry Over test



Data for Carry Over test

Name	Ret. Time (detected) min Nitrate ECD_1	Area uS*min Nitrate ECD_1
High Level	0.18	30.991
Carryover	0.18	0.028
Water	0.18	0.022
Carry over:		0.078 %
Limit:		0.1 %
Result:		PASS

Customer Signature

Qualification Executor

Date

เอกสารไม่ควบคุม



Performance Qualification

Detector Linearity

Instruments:

Instrument Name	Model	Supplier	Serial Number	Moduleware Version
Pump	DX120	Dionex	03010223	3.03
Detector	DX120	Dionex	03010223	3.03
Autosampler	AS40 or man. inj.	Dionex	n.a.	0.00
Eluent Generator	n.a.	Dionex	n.a.	0.00

Accessories

Name	Description
Backpressure Tubing	0.13 mm (0.005") ID PEEK, 13 m (512")
Sample 1	Nitrate, 5 ppm
Sample 2	Nitrate, 10 ppm
Sample 3	Nitrate, 25 ppm
Sample 4	Nitrate, 50 ppm
Sample 5	Nitrate, 100 ppm
Eluent	Water

Additional Information

Customer/Company:	UAE Consultant Co.,Ltd.	Date:	8-Dec-2021
Qualification Executor:	Mr.Channarong J Archemica	Next Qualification:	Jun-2022

Test Results Summary

Test	Result
DX120 Detector Linearity (Cor.)	PASS
DX120 Detector Linearity (%RSD)	PASS

Customer Signature

Qualification Executor

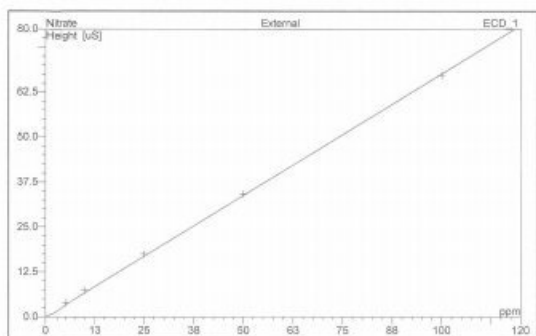
Date

เอกสารไม่ควบคุม

Data for Detector Linearity

Name	Amount ppm Nitrate ECD_1	Height uS Nitrate ECD_1
Detector Linearity_1	5.000	3.962
Detector Linearity_2	10.000	7.384
Detector Linearity_3	25.000	17.462
Detector Linearity_4	50.000	34.143
Detector Linearity_5	100.000	67.127

Linearity Plot



Calibration Type	Number of Points	Offset	Slope
Lin	5	0.000	0.675

	Correlation Coefficient	% RSD
Linearity:	1.000	2.260
Limit:	0.999	5
Result:	PASS	PASS

Customer Signature

Qualification Executor

Date

เอกสารไม่ควบคุม

CERTIFICATE

เอกสารไม่ควบคุม

Certificate of Completion

This certifies that

Channarong Khiao-Un

Has successfully completed

eLearn: RPG IC-Specific Qualification Service Training

APPROVED BY
K. Channarong Khiao-Un
ARCHAICAL LAB CO., LTD.

Issued electronically and
approved by:

TFS - Learning Management
System, Training, Mentoring,
and Certification Group
tmc.training@thermofisher.com

Valid for 3 years from:
Nov/19/2021

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Certificate of Analysis

Better Separations Through
Better Chemistry

Dionex Nitrate OQ/PQ IC Standards Kit (Set of 6)

Product Number 060254
Certificate of Analysis

Lot Number 210719

Expiration of Certification
July 2022

The Dionex Nitrate Standard was developed to aid the analysis of anions by Ion Chromatography (IC). The single-ion standard was prepared by the dissolution of high-purity salt in ≥ 18.2 megohm deionized water, which was tested by IC for ionic contaminants. The bottle label states the nominal concentration value of the ionic component for informational purposes only. The actual ion concentration value was determined by Ion Chromatography. The IC system was standardized using the National Institute of Standards & Technology (NIST), Standard Reference Material, SRM 3185 (Nitrate Standard Solution). Actual concentration values determined for the single-ion is listed below.

Dionex Nitrate Standard

Vial #	Concentration (mg/L)
1	5.07 \pm 0.03
2	9.95 \pm 0.07
3	24.49 \pm 0.10
4	49.16 \pm 0.13
5	99.0 \pm 1
6	993 \pm 4

The concentration value is based a proven reliable method of analysis. The estimated uncertainties are two standard deviations of the concentration value. The concentration value is warranted to be stable for one year from the date of manufacture.

The preparation and analyses of the Dionex Nitrate Standard was performed with extreme care by Thermo Scientific Corporation Consumables Manufacturing Department in Sunnyvale California.

Document No. 078659-01

20-Dec-2011

thermoscientific.com/dionex

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10021145-EN-021055 001210-10

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Sunnyvale, CA 94088-2003
(408) 732-3000



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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. : SP22-016 Page 1 of 5

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

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

Location of calibration : Laboratory 315

Equipment : UV-Vis Spectrophotometer

Manufacturer : Agilent Technologies

Model : Cary 60

Serial No. : MY15410009

ID No. : N/A

Received Date : 23 May 2022

Calibration Date : 23 May 2022

Issue Date : 26 May 2022

Condition Instrument : Good

Calibrated by : Mr. Tanawat Ritidsach Approved by : Ms. Chonthicha Sangnern

Technical Manager 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 price written approval of the DQE Services Co., Ltd.

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PM-708-02 R01 1/11/2021

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

REPORT OF CALIBRATION

Certificate No. : SP22-016 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	95935	22 October 2023
Absorbance Standard set	25757	95929	22 October 2023
Wavelength Standard set	25806	95916	22 October 2023
Wavelength Standard set	25758	95915	22 October 2023

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 : 90 nm/min

Scan Interval of UUC : 0.15 nm.

Resolution of UUC : Photometric 0.0001 Abs.


Wavelength 0.1 nm.

เอกสารไม่ควบคุม

PM-708-02 R01 1/11/2021

DQE Services

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



ISO 17025:2017
CALIBRATION DATA

REPORT OF CALIBRATION

Certificate No. : SP22-016

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
	0.5787	0.5755	0.0032	0.0031	2.00
	1.0490	1.0436	0.0054	0.0029	2.00
	2.1900	2.1847	0.0053	0.0075	2.00
440	0.0000	0.0000	0.0000	0.0028	2.00
	0.5607	0.5588	0.0019	0.0034	2.00
	1.0247	1.0232	0.0015	0.0035	2.00
	2.1229	2.1211	0.0018	0.0082	2.00
465	0.0000	0.0000	0.0000	0.0028	2.00
	0.5236	0.5197	0.0039	0.0029	2.00
	0.9634	0.9625	0.0009	0.0028	2.00
	1.9763	1.9752	0.0011	0.0070	2.00
546.1	0.0000	-0.0001	0.0001	0.0028	2.00
	0.5191	0.5171	0.0020	0.0031	2.00
	1.0003	0.9984	0.0019	0.0033	2.00
	1.9987	1.9946	0.0041	0.0084	2.00
590	0.0000	0.0000	0.0000	0.0028	2.00
	0.5523	0.5509	0.0014	0.0030	2.00
	1.0809	1.0799	0.0010	0.0029	2.00
	2.0391	2.0329	0.0062	0.0080	2.00
635	0.0000	0.0000	0.0000	0.0028	2.00
	0.5601	0.5584	0.0017	0.0031	2.00
	1.0512	1.0498	0.0014	0.0029	2.00
	1.9294	1.9265	0.0029	0.0082	2.00

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021

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ISO 17025:2017
CALIBRATION DATA

REPORT OF CALIBRATION

Certificate No. : SP22-016

Page 4 of 5

Photometric Accuracy :


Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000	0.0001	-0.0001	0.0050	2.00
	0.7478	0.7421	0.0057	0.0056	2.00
257	0.0000	0.0000	0.0000	0.0050	2.00
	0.8686	0.8619	0.0067	0.0059	2.00
313	0.0000	0.0000	0.0000	0.0050	2.00
	0.2912	0.2896	0.0016	0.0051	2.00
350	0.0000	0.0000	0.0000	0.0050	2.00
	0.6448	0.6403	0.0045	0.0055	2.00

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FM-708-02 R01 1/11/2021

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ISO 17025:2017
CALIBRATION DATA

REPORT OF CALIBRATION

Certificate No. : SP22-016

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	287.5	0.31	0.18	2.00
334.06	333.5	0.56	0.18	2.00
360.93	360.5	0.43	0.18	2.00
418.59	418.0	0.59	0.18	2.00
445.94	445.4	0.54	0.18	2.00
453.66	453.2	0.46	0.18	2.00
460.02	459.7	0.32	0.18	2.00
536.59	536.2	0.39	0.18	2.00
637.98	638.3	-0.32	0.18	2.00
431.38	431.0	0.38	0.18	2.00
472.50	472.5	0.00	0.18	2.00
513.47	513.5	-0.03	0.18	2.00
528.88	528.5	0.38	0.18	2.00
573.17	573.0	0.17	0.18	2.00
585.35	585.0	0.35	0.20	2.00
684.40	684.7	-0.30	0.18	2.00
740.72	740.8	-0.08	0.20	2.00
748.55	748.5	0.05	0.18	2.00
807.03	807.3	-0.27	0.18	2.00
879.28	879.0	0.28	0.18	2.00

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021

Remark :

- UUC = Unit Under Calibration

- N/A = Not Available

- The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor k , which for a normal distribution corresponds to a coverage probability of approximately 95%

- * Indicates non TISI accredited

- End of Certificate -

DQE Services

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ISO 17025:2017
CALIBRATION DATA

CERTIFICATE OF CALIBRATION

Certificate No. : SP22-008

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 213

Equipment : UV-Vis Spectrophotometer

Manufacturer : Hitachi

Model : U-2900

Serial No. : 21E22-009

ID No. : UAE.WAT.051/2564

Received Date : 20 January 2022

Calibration Date : 20 January 2022

Issue Date : 24 January 2022

Condition Instrument : Good

Calibrated by : 

Approved by : 

(Mr. Tanawat Rittidach)

(Ms. Chenticha Sangsorn)

Technical Manager

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.

FM-708-02 R01 1/11/2021

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REPORT OF CALIBRATION

Certificate No. : SP22-008Page 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	95935	22 October 2023
Absorbance Standard set	25757	95929	22 October 2023
Wavelength Standard set	25806	95916	22 October 2023
Wavelength Standard set	25758	95915	22 October 2023

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

Spectral Band Width of UUC : 1.5 nm.

Scan Speed of UUC : 200 nm/min

Scan Interval of UUC : 0.1 nm.


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

PM-708-02 R01 1/11/2021

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DQE Services

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



REPORT OF CALIBRATION

Certificate No. : SP22-008Page 3 of 5

Calibration Results : Without adjustment

Photometric Accuracy :


Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
420	0.0000	0.000	0.0000	0.0028	2.00
	0.5787	0.576	0.0027	0.0031	2.00
	1.0490	1.046	0.0030	0.0029	2.00
	2.1900	2.182	0.0080	0.0075	2.00
440	0.0000	0.000	0.0000	0.0028	2.00
	0.5607	0.559	0.0017	0.0034	2.00
	1.0247	1.023	0.0017	0.0035	2.00
	2.1229	2.116	0.0069	0.0079	2.00
465	0.0000	0.000	0.0000	0.0028	2.00
	0.5236	0.521	0.0026	0.0030	2.00
	0.9634	0.962	0.0014	0.0029	2.00
	1.9763	1.970	0.0063	0.0070	2.00
546.1	0.0000	0.000	0.0000	0.0028	2.00
	0.5191	0.519	0.0001	0.0031	2.00
	1.0003	0.999	0.0013	0.0033	2.00
	1.9987	1.992	0.0067	0.0084	2.00
590	0.0000	0.000	0.0000	0.0028	2.00
	0.5523	0.552	0.0003	0.0030	2.00
	1.0809	1.080	0.0009	0.0030	2.00
	2.0391	2.031	0.0081	0.0079	2.00
635	0.0000	0.000	0.0000	0.0028	2.00
	0.5601	0.560	0.0001	0.0031	2.00
	1.0512	1.052	-0.0008	0.0030	2.00
	1.9294	1.922	0.0074	0.0079	2.00

PM-708-02 R01 1/11/2021

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



REPORT OF CALIBRATION

Certificate No. : SP22-008Page 4 of 5

Photometric Accuracy :


Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000	0.000	0.0000	0.0050	2.00
	0.7478	0.747	0.0008	0.0057	2.00
257	0.0000	0.000	0.0000	0.0050	2.00
	0.8686	0.865	0.0036	0.0059	2.00
313	0.0000	0.000	0.0000	0.0050	2.00
	0.2912	0.290	0.0012	0.0051	2.00
350	0.0000	0.000	0.0000	0.0050	2.00
	0.6448	0.640	0.0048	0.0055	2.00

PM-708-02 R01 1/11/2021

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DQE Services

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



REPORT OF CALIBRATION

Certificate No. : SP22-008Page 5 of 5

Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor k
241.72	241.0	0.72	0.18	2.00
279.45	279.0	0.45	0.18	2.00
287.81	287.0	0.81	0.18	2.00
334.06	333.5	0.56	0.18	2.00
360.93	360.0	0.93	0.18	2.00
418.59	418.0	0.59	0.18	2.00
445.94	445.5	0.44	0.18	2.00
453.66	453.0	0.66	0.18	2.00
460.02	459.5	0.52	0.18	2.00
536.59	536.0	0.59	0.18	2.00
637.98	637.5	0.48	0.18	2.00
431.38	431.0	0.38	0.18	2.00
472.50	472.0	0.50	0.18	2.00
513.47	513.0	0.47	0.18	2.00
528.88	528.5	0.38	0.18	2.00
573.17	573.0	0.17	0.18	2.00
585.35	585.0	0.35	0.20	2.00
684.40	684.0	0.40	0.18	2.00
740.72	740.5	0.22	0.20	2.00
748.55	748.5	0.05	0.18	2.00
807.03	807.0	0.03	0.18	2.00
879.28	879.5	-0.22	0.18	2.00

Remark : - UUC = Unit Under Calibration

- N/A = Not Available

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

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

- * Indicates not ISO accredited

- End of Certificate -

PM-708-02 R01 1/11/2021

เอกสารไม่ควบคุม



Request No. 25-65 / 0398

MTC. ACL.No. 486 / 65

CALIBRATION CERTIFICATE

NOMENCLATURE : 1. Atomic Absorption Spectrophotometer "Agilent Technologies"

Model AA240FS, Serial No. MY13160001

2. Working standard solution "Inorganic Ventures"

Multi Analyte Custom Grade Solution, Lot No. P2-MEB675610

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

3. Soi Udomsuk41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260


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

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

REFERENCE MATERIAL : Traceable to NIST "Agilent Technologies", "Carlo Erba"

Cadmium Lot No. 0108047046, Chromium Lot No. 0106315418, Copper Lot No. 0107480530, Iron Lot No. 0104697566,
Lead Lot No. 0104659473, Manganese Lot No. T109228A, Nickel Lot No. 0104978044, Zinc Lot No. 0100792297CALIBRATION RANGE: 0.02,0.10,0.30,0.50,0.70 mg/l at 228.8 nm.Cd, 0.10,0.20,0.30,0.50,0.70 mg/l at 357.9 nm.Cr,
0.05,0.10,0.30,0.50,0.70 mg/l at 324.7 nm.Cu, 0.10,0.30,0.50,0.70,1.00 mg/l at 248.3 nm.Fe, 0.20,0.50,0.70,1.00,1.50 mg/l
at 217.0 nm.Pb, 0.05,0.10,0.30,0.50,0.70 mg/l at 279.5 nm.Mn, 0.10,0.30,0.50,0.70,1.00 mg/l at 232.0 nm.Ni,
0.05,0.10,0.30,0.50,0.70 mg/l at 213.9 nm.Zn

AMBIENT CONDITIONS : Temperature 22 °C Relative humidity 60 %

The Atomic Absorption Spectrophotometer set. has been calibrated against
Reference Material traceable to National Institute of Standards and Technology (NIST) by The Analytical
Chemistry Laboratory. The results are attached herewith.Calibrated by 
(Mr. Danai Srithongkum)Approved by 
Mrs. Thippaya Juvisee Fortune
Director of Analytical Chemistry Laboratory
Ref. 202526502400522001
Calibration Date : 3 February 2022

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1 / 5

MTC. ACL. No. 486 / 65

CALIBRATION DATA

1. Noise Level in term of standard deviation

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

Continue 2 / 5

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Request No. 25-65 / 0398

2 / 5

MTC. ACL. No. 486 / 65

2. Precision

Element	Conc. (mg/l)	Absorbance										Ave. Abs.	SD	%RSD
Cd	0.02	0.0074	0.0062	0.0065	0.0062	0.0070	0.0068	0.0070	0.0065	0.0065	0.0069	0.007	0.0004	5.76
	0.30	0.0952	0.0959	0.0951	0.0957	0.0952	0.0950	0.0952	0.0948	0.0956	0.0943	0.095	0.0005	0.49
	0.70	0.2213	0.2180	0.2203	0.2208	0.2234	0.2211	0.2196	0.2219	0.2201	0.2194	0.221	0.0015	0.67
Cr	0.10	0.0096	0.0098	0.0097	0.0102	0.0106	0.0097	0.0098	0.0099	0.0103	0.0093	0.010	0.0004	3.83
	0.30	0.0309	0.0302	0.0300	0.0316	0.0306	0.0299	0.0309	0.0297	0.0311	0.0296	0.030	0.0007	2.20
	0.70	0.0659	0.0667	0.0664	0.0648	0.0656	0.0652	0.0658	0.0638	0.0669	0.066	0.066	0.0011	1.70
Cu	0.05	0.0080	0.0075	0.0078	0.0075	0.0077	0.0081	0.0080	0.0075	0.0074	0.0076	0.008	0.0003	3.26
	0.30	0.0417	0.0419	0.0412	0.0421	0.0424	0.0420	0.0423	0.0403	0.0418	0.0415	0.042	0.0006	1.47
	0.70	0.0969	0.0965	0.0972	0.0957	0.0961	0.0963	0.0959	0.0972	0.096	0.096	0.096	0.0006	0.58
Fe	0.10	0.0090	0.0105	0.0078	0.0099	0.0091	0.0093	0.0096	0.0094	0.0093	0.0084	0.009	0.0007	8.11
	0.50	0.0462	0.0470	0.0464	0.0464	0.0467	0.0462	0.0467	0.0460	0.0468	0.0466	0.047	0.0003	0.67
	1.00	0.0867	0.0886	0.0910	0.0892	0.0897	0.0873	0.0892	0.0885	0.0888	0.0874	0.089	0.0013	1.43
Pb	0.20	0.0091	0.0095	0.0088	0.0087	0.0082	0.0094	0.0090	0.0087	0.0082	0.0090	0.009	0.0004	4.94
	0.70	0.0322	0.0321	0.0324	0.0318	0.0335	0.0326	0.0327	0.0315	0.0336	0.0321	0.032	0.0007	2.09
	1.50	0.0653	0.0645	0.0663	0.0664	0.0652	0.0671	0.0662	0.0666	0.0657	0.0648	0.066	0.0008	1.28
Mn	0.05	0.0092	0.0092	0.0097	0.0087	0.0085	0.0079	0.0096	0.0085	0.0084	0.0099	0.009	0.0007	7.33
	0.30	0.0616	0.0630	0.0632	0.0633	0.0634	0.0628	0.0640	0.0633	0.0640	0.0629	0.063	0.0007	1.08
	0.70	0.1396	0.1366	0.1386	0.1377	0.1386	0.1386	0.1396	0.1380	0.1374	0.1383	0.138	0.0009	0.67
Ni	0.10	0.0102	0.0092	0.0097	0.0104	0.0091	0.0105	0.0105	0.0096	0.0098	0.0102	0.010	0.0005	5.22
	0.50	0.0488	0.0489	0.0489	0.0495	0.0484	0.0490	0.0481	0.0492	0.0495	0.0492	0.049	0.0004	0.91
	1.00	0.0976	0.0979	0.0975	0.0992	0.0977	0.0973	0.0986	0.0962	0.0985	0.0982	0.098	0.0008	0.85
Zn	0.05	0.0340	0.0349	0.0340	0.0352	0.0337	0.0351	0.0344	0.0346	0.0349	0.0343	0.035	0.0005	1.49
	0.30	0.1669	0.1653	0.1628	0.1642	0.1657	0.1637	0.1659	0.1652	0.1654	0.1657	0.165	0.0012	0.72
	0.70	0.3456	0.3467	0.3445	0.3430	0.3422	0.3444	0.3437	0.3438	0.3435	0.3438	0.344	0.0013	0.37

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Request No. 25-65 / 0398

3 / 5

MTC. ACL. No. 486 / 65

3. Trueness

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

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Cd	0.02004	0.019	-0.001	5.19	± 0.004
	0.30060	0.291	-0.010	3.19	± 0.006
	0.70140	0.678	-0.023	3.34	± 0.012

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

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Cr	0.1002	0.101	0.001	0.80	± 0.007
	0.3006	0.298	-0.003	0.86	± 0.012
	0.7014	0.635	-0.066	9.47	± 0.023

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

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Cu	0.0502	0.046	-0.004	8.37	± 0.004
	0.3012	0.295	-0.006	2.06	± 0.010
	0.7028	0.694	-0.009	1.25	± 0.021

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4 / 5

MTC, ACL, No. 486 / 65

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

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Fe	0.1003	0.106	0.006	5.68	± 0.008
	0.5015	0.522	0.021	4.09	± 0.017
	1.0030	0.993	-0.010	1.00	± 0.032

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

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Pb	0.1988	0.197	-0.002	0.91	± 0.014
	0.6958	0.722	0.026	3.77	± 0.022
	1.4910	1.463	-0.028	1.88	± 0.041

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

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Mn	0.04955	0.054	0.004	8.98	± 0.004
	0.29730	0.317	0.0197	6.63	± 0.006
	0.69370	0.682	-0.0117	1.69	± 0.012

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5 / 5

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

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Ni	0.099	0.102	0.003	3.03	± 0.007
	0.495	0.489	-0.006	1.21	± 0.010
	0.990	0.975	-0.015	1.52	± 0.020

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

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Zn	0.050	0.050	0.000	0.00	± 0.012
	0.300	0.307	0.007	2.33	± 0.011
	0.700	0.660	-0.040	5.71	± 0.015

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

Calibrated by Dr. Sathit
(Mr. Danai Srithongkum)

Approved by Dr. Thippaya Junvee Fortune
Director of Analytical Chemistry Laboratory
Calibration date : 3 February 2022

INDUSTRIAL METROLOGY AND TESTING SERVICE CENTRE

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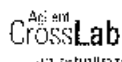
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Agilent 240/280 Series Atomic Absorption Spectroscopy Systems

Preventive Maintenance Checklist

Agilent Preventive Maintenance provides factory recommended service on your Agilent AA system to ensure reliable operation and the longevity 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 downtime, avoid repeat service calls, and prevent breakdowns. This checklist will be completed at the end of the service and provided to you as a report of the service.

Note: While not current production AA instrument and/or accessory models are not covered by this checklist. For more information, contact Agilent Technology services department. For technical training, visit our online URL: <http://www.agilent.com/chem/us/services>

Introduction

Customer Information

- One service engineer will be necessary depending upon the scope of the engineer's work.
- A customer representative should be available to the engineer while performing the preventive maintenance checklist.
- Any parts not included in the Factory Recommended Checklist must be ordered prior to the recommended Preventive Maintenance service, as they are included in the price of this service.
- The system engineer will use a series of operational procedures and displays for the maintenance service. These procedures are included in the Agilent AA Preventive Maintenance manual, which may incur additional costs.

Product: AA 240/280 Series Atomic Absorption Spectroscopy Systems
Agilent Technology Inc. 2021



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Instrument Preventive Maintenance Checklist

Important Customer Web Links

- For more information about Agilent's resources, please visit our website using the following URL: <http://www.agilent.com/chem/products/aa/aa-preventive-maintenance>
- To access Agilent's online training, go to www.agilent.com/chem/training and select the training options which include online, classroom and on-site delivery. A training specialist can work directly with you to help determine your best options.
- A useful Agilent Resource Center webpage is available, which includes information on maintenance, quick lists of consumables for new instruments, and other valuable information. Click on the Resource Page here: <http://www.agilent.com/chem/us/agilent/resources>
- Need technical support, FAQs, supplies? Visit the Agilent website at <http://www.agilent.com/chem/us/agilent>
- Get answers, share insights, build connections. Join the Agilent Community at <http://www.agilent.com/chem/us/agilent/community>

Service Engineer's Responsibilities

- Contact the customer and ensure that all necessary supplies are available before the preventive maintenance visit.
- Confirm the ability of the instrument to deliver continued safe operation as established by the Agilent AA safe operation flowchart (Refer directly to the AA 55/240/280 Preventive Maintenance Scope of Work to make this decision).
- Only access those pages that relate to the system or module being serviced.
- Complete only the items with the relevant information.
- Complete the relevant checkboxes in the checklist using either a "X" or tick mark "✓".
- Check the condition of each checkbox to indicate service tasks not performed 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 relevant page.
- Complete the date and number of pages read in the Service Completion section.
- Ask the customer to sign the Service Completion section including their name and analysis signature.

This information is subject to change without notice.

Product: AA 240/280 Series Atomic Absorption Spectroscopy Systems
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Instrument Maintenance

System Information

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

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

List System Component Product Numbers	List the Serial Numbers of each Component
1. G 3432 A	MY 13160001
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	

Preparation, Safe operation and Initial performance checks

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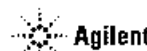
- ☐ Agilent AAS's operation flowchart. Inspect sample assemblies if the PM can be performed.

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

- ☒ Discuss any specific issues with the customer before starting.
- ☒ For HF applications, inform the customer of any required sample introduction system and install it ask the customer to install it N/A
- ☒ Review the instrument logbook for resolved 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, consumables.
- ☒ Check logs for required installation of consumables (all logs set by current Service Engineer)
- ☒ Check for required firmware updates and verify with customers if they would like them installed.
- ☒ Use SVD to perform a Full Wavelength Scan for Cu HCL - "As found test 1"
- ☒ Perform a Basic Cu ABS test - "As found test 2"
- ☒ Final the "Initial" stage of operation and record the test results and return to the end of the checklist.

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Preventive Maintenance Procedures

FLAME SYSTEM section

- ☐ Section not applicable

Electronic components

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

Mechanical components

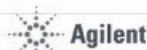
- ☒ Check the burner adjuster controls for complete and free movement. If the burner adjuster needs lubrication, use Molykote 321 or mineral-based molybdenum disulphide grease.
- ☒ Run SVD tests to exercise all motor drives over the full range of their travel.
 - ☒ Monochromator drive
 - ☒ Slit drive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

Optics components

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

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Sample Introduction and Atomization

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

Gas handling components and safety interlocks

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

Analytical performance for Flame systems

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

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FURNACE SYSTEM section

Section NOT Applicable

Electronic components

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

Mechanical components

- ☐ Run SVD tests to exercise all motor drives over the full range of the travel:
 - ☐ Microchromator drive
 - ☐ S/T drive
 - ☐ Lamp selector

Optics components

- ☐ Check that external optical surfaces are clean. Clean coated surfaces as required.
- ☐ Use SVD and perform Mono Wavelength Correction.
- ☐ Use SVD and perform Slit Calibration.
- ☐ Use SVD and perform Grating Squaresness Diagnostic.
- ☐ Use SVD and perform Zero Order Offset/Mono Correction.
- ☐ Use SVD and perform Wavelength Repeatability.
- ☐ Physically inspect selected HCL lamps (customer to supply per the protocol) and measure. If the SVD lamp health lamp module customer flags are showing emission degradation due to age.

Gas handling, water system and workhead component checks

- ☐ Inspect the GTA workhead gas hoses and connections for leaks.
- ☐ Pressure test for gas leaks.
- ☐ If the water system is accessible (stand-alone), check for correct operation and condition (as needed – this includes any components and pressure setting as per their cleaning fluid flow and weight).
- ☐ Inspect the GTA workhead water hoses and connections for leaks.
- ☐ Check all gaskets and replace if necessary.

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- ☐ Tube
- ☐ Electrodes
- ☐ Shroud

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

Analytical performance for Furnace systems

- ☐ Optimize the instrument ready to perform Customer Specific.
- ☐ Run the sensitivity test for a blank probe/cocker sample and record the results in the results table.

PSD autosampler accessory for Furnace systems

- ☐ Section NOT Applicable
- ☐ Check condition of the PSD capillary – replace if necessary.
- ☐ Check condition and operation of PSD syringe – ensure it does not have air locks and bubbles.
- ☐ Change PSD rinse bottle/ring.
- ☐ Check and clean the rinse vessel.
- ☐ Check the drain tube for good drainage. Ensure that the light fence, ink filter, cap and the lower end must be above the fluid level in the waste vessel.
- ☐ Ensure that the waste vessel is suitable to use with the furnace system.

Sample introduction pump system (SIPS) accessory

- ☐ Section NOT Applicable
- ☐ Tighten screws securing the tube, presser arms and pump tubes.
- ☐ Adjust each roller so that it rotates freely.
- ☐ Wipe down the pump tubes and roller pump bands with a dry clean cloth.
- ☐ Ensure that the presser arms and the surfaces near the pump are free from dirt and spills.
- ☐ Remove the pump head, cover motor and check for lubrication oil leaks and any signs of overheating.
- ☐ Re-apply the rule that isolates the motor housing plates to the chassis.
- ☐ Check clips securing the pump shoulder and replace if necessary.
- ☐ Disconnect clean – piece and reassemble the tubing using the following steps:

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- ☐ Remove the T-piece by disconnecting the pump tubes, the pump bands and all other tubing.
- ☐ Place the T-piece in an ultrasonic bath (or in a jacking category 145°C Detergent) for approximately 15 minutes.
- ☐ Wash the T-piece under a tap with a strong flow of water.
- ☐ Test with distilled water through one of the inlets in the reverse direction to normal sample flow.
- ☐ Reassemble.

Sample preparation system (SPS 4) accessory

Section NOT Applicable

The Agilent SPS 4 autosampler is designed to need minimal maintenance. The following maintenance requirements are suggested to maintain the performance of the autosampler.

- ☐ Cleaning the spill tray, rack for reagent, and chambers and the waste reservoirs with a detergent brush and dilute mild detergent.
- ☐ Cleaning the autosampler glass panels with domestic window cleaner.
- ☐ Check the X-axis and Z-axis drive belts for wear, slack, damage, or other wear/tear, and change or replace degraded or broken belts.
- ☐ Check the X-axis, Z-axis, and Z-axis FPC cables for cracks, fraying, or other damage, damaged edge or damaged connectors.

NOTE: The autosampler requires no extra lubrication throughout its lifetime. For further details refer to the SPS 4 service manual 58410-90050.

Sample preparation system (SPS 3) accessory

Section NOT Applicable

- ☐ Check the X-axis and Z-axis timing belts. Replace if there are any cracks, signs of color deterioration and belt tension.
- ☐ Check belt tension – adjust if required.
- ☐ Check the lubrication performance of X-axis shaft. If necessary to create new lubrication, apply vibration or probe movement of the waste carriage add 1 ml of Dow Corning 930 or HPLC VACUOS into the well.
- ☐ Check the autosampler assembly for tube disconnection. Calibrate if required.
- ☐ Clean the exterior surfaces of the accessory with soft lint free cloth. This cloth can be dampened with warm water or a mild detergent. Do not use organic solvents or abrasive cleaning agents.

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Agilent Technologies Inc. 2021

Vapor generation accessory VGA (hydride generator)

- ☐ Section NOT Applicable
- ☒ Inspect VGA gas supply hose.
- ☒ Inspect VGA pump tubing.
- ☒ Check clasp gas pressure, replace rock setting adjust if required.
- ☒ Check gas pressure for flow setting – adjust if required.
- ☒ Under gas regulator pressure to 40 ps (321 kPa) – adjust if required.
- ☐ Clean the exterior surfaces of the accessory with soft lint free cloth. This cloth can be dampened with warm water or a mild detergent. Do not use organic solvents or abrasive cleaning agents. **WFA**

UltraAA lamp accessory (external)

Section NOT Applicable

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

Restore System

- ☐ If you have used the autosampler for manual calibration during the course of this test, refer to the original manual to follow the manual recalibration procedure (e.g., about the customer's method).

Guidance

If the PMA device is performed prior to qualification service, then use the qualification procedure as a guide for final instrument set-up and check-out.

Version 1.00, Issue Number 01.1
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Signature Page

Service Review

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

Test Results

Test Description	Expected Test Result	Actual Test Result
Flame optics PMT Gain test		
For copper at 324.8 nm, 4 mA, 0.5 nm slit width	< 55 %	42 %
Flame performance test with 5 ppm copper sample		
Air /acetylene, mixing paddle removed	Abs value > 0.5	0.5963
Air /acetylene, mixing paddle installed, 10 replicates	%RSD < 1.0	0.4
Deuterium furnace optics PMT Gain test		
For copper at 324.8 nm, 4 mA, 0.5 nm slit width	< 55 %	
Deuterium furnace performance test with 25 ppb copper sample (324.8 nm)		
Precision %RSD	≤ 4.0 %	—
Abs value	≥ 0.15	—
Zeeman furnace analytical performance: 25 ppb copper sample (327.4 nm)		
Precision %RSD	≤ 4.0 %	—
Abs value	≥ 0.10	—
MSR%	≥ 70 %	—

AS VGA-77 test Abs.

0.2 Abs

0.2156 Abs

Revision: 10.00, Issued: November 2021

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AA consumable and parts list table

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

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

Items classified as PM supplied in the above table are included in the standard PM. Those classified as consumable should be provided by the customer or charged to the customer if supplied by the Agilent service engineer.

Revision: 10.00, Issued: November 2021

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Service Engineer Comments (optional)

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

Service Completion

Service request number: 6004901032 Date service completed: 28 Jan 2022

Agilent signature: Kanyakorn S. Customer signature: Chomthanan A.

Total number of pages in this document: 13

Revision: 10.00, Issued: November 2021

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SVD Results Report



Report ID: 1 Diagnostic Start Time: 28/01/2022 14:40:57 PM Diagnostic End Time: 28/01/2022 15:05:13 PM

Customer: VAC Service Engineer: Kanyakorn S.

Address: Contact Details: 0963453624

Instrument Configuration

Configuration:

Serial Number: MY15150507 Turret Type: Automatic

Instrument Model: Varian AA 43/240/280 Number Of Lamps: 4

Flame Instrument: True Mono Type: Automatic

Furnace Instrument: True Gasbox Type: 1" Gas Box

Zeeman Present: False Auto Burner Adjuster: False

Internal Zeeman: False Mains Frequency: 60

Internal UltraAA: False Firmware Version: 2.15

Optics Type: Double Beam Photomultiplier Type: Hamamatsu R928

D2 BG Correction Fitted: True PWB Version: 45

Boot Block Version: 1.05

EEPROM Data:

Instrument Run Hours: 48959.834 D2 Run Hours: 38039.630

Zero Wavelength Offset: 20.07° D2 Serial Number: 161661

Mono Correction: 0.05 D2 Install Date: 01/01/1979

Flame Hours: 23519.178 D2 Original Intensity: 1.000

D2 Last Intensity: 475.502

Frequency:

Averaging Period: 20.0

Datapoint Count: 20

Upper Limit: 51.03 Highest Measured Frequency: 50.00

Average Frequency: 50.00

Lower Limit: 49.00 Lowest Measured Frequency: 50.00

Result: **Passed**

Report Generated At: 28/01/2022 15:02:25 PM

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Power Supply:

Averaging Period: 20.0
Datapoint Count: 20

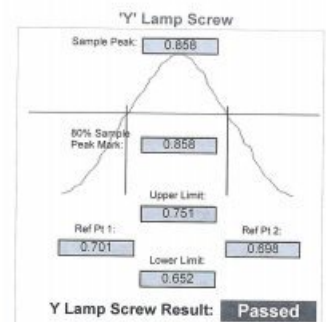
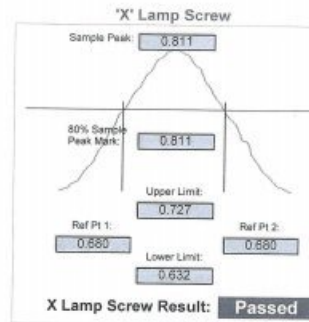
	Lower Limit (V)	Actual (V)	Upper Limit (V)	Result:
12.00 V Rail	10.83	12.00	13.20	Passed
-12.00 V Rail	-13.20	-11.90	-10.80	Passed
5.00 V Rail	4.50	5.01	5.50	Passed
310.00 V Rail	278.00	320.00	341.00	Passed

Optics

Beam Balance:

Lamp Type: Copper
Lamp Socket Used: 3

Peak Selected: 324.80
Lamp Alignment: Performed



Grating Squareness:

Lamp Element(s): Copper
Lamp Turret Position: 3
Lamp Current(mA): 4.00
Slit Width(nm): 0.5
1st Order Wavelength(nm): 324.80
Lamp Alignment: Performed

	Lower Limit (nm)	Actual (nm)	Upper Limit (nm)	Result:
Zero Order	-0.10	0.00	0.10	Passed
First Order	324.45	324.75	325.15	Passed
Second Order	649.23	649.52	649.97	Passed

Wavelength Repeatability:

Lamp Used: Copper
Peak Used(nm): 324.750
Connected to Socket: 3
Lamp Current(mA): 4
Slit Width(nm): 0.5
Slit Height: Normal
Lamp Alignment: Performed

Lower Limit(nm)	324.753	324.883	Upper Limit(nm)
(Sample 1)	Sample 1: 324.823	Sample 2: 324.823	
	Sample 3: 324.823	Sample 4: 324.819	
	Sample 5: 324.819	Sample 6: 324.819	
	Sample 7: 324.819	Sample 8: 324.819	
	Sample 9: 324.819	Sample 10: 324.819	

Mean: 324.821
Standard Deviation: 0.002

Result: **Passed**

Mechanical

Wavelength Drive:

Passed

Slit Drive:

Passed

Turret Drive:

Passed

Auto Burner Adjuster Drive:

Untested

Miscellaneous

Signal Processing Linearity:

Calculate Mode: New Calc Mode

	Lower Limit	Actual	Upper Limit	Result:
S0	114	260	237	Passed
S1	155	164	181	Passed
S2	271	295	330	Passed
S3	474	505	575	Passed
S4	325	913	1008	Passed
S5	1456	1519	1751	Passed
S6	2489	2753	3053	Passed
S7	4347	4724	5513	Passed

Interlocks:

Burner Fitted: Working	Flame Detect: Working
N2O Burner Fitted: Untested	GCU Active: Working
Flame Shield Closed: Working	Oxidant Pressure: Working
Gas Control Fitted: Untested	Oxidant Changeover: Untested
Pressure Release Bung Fitted: Working	Ignition: Working
Liquid Trap Fitted: Working	

Auto Lamp Recognition:

Lamp 1: 12 - Chromium (Cr) Lamp 5: Not Supported
Lamp 2: Uncoded Lamp/Not Connected Lamp 6: Not Supported
Lamp 3: 14 - Copper (Cu) Lamp 7: Not Supported
Lamp 4: 87 - Silver/Cadmium/Lead/Zinc(UltraAA) (Ag/C Lamp 8: Not Supported

Result: **Passed**

GTA Temperature Monitoring:

Not Performed

Notes:

Signatures:

Chomthanan A. 28 Jan 2022 Kanyakorn S. 28 Jan 2022
UAE Date Kanyakorn S. Date

Report Generated At: 28/01/2022 9:52:26 AM

6

SVD Result Report SVD
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Sequential by time report

28/01/2022 11:03 AM

SpectrAA

Page 1 of 1

Analysis: 28/01/2022 9:56:44 AM GMT: 28/01/2022 9:56:44 AM
Worksheet: 28/01/2022 3 - Scrubby test
Comments:
Method: Cu
Computer name: 31212
Serial Number: 410210001

Method: Cu (Flame)

Sample ID	Exp. Aft	WPSD	WPSD	WPSD	WPSD	WPSD
0.5 ppm	0.500	0.4	0.500			
0.5 ppm	0.500	0.4	0.500	0.400	0.500	0.400
0.5 ppm	0.500	0.4	0.500	0.400	0.500	0.400

เอกสารไม่ควบคุม

Sequential by time report

28/01/2022 12:22 PM

SpectrAA

Page 1 of 1

Analysis: 28/01/2022 12:22 PM GMT: 28/01/2022 12:22 PM
Worksheet: 28/01/2022 3 - Scrubby test
Comments:
Method: As
Computer name: 31212
Serial Number: 410210001

Method: As (Vapor)

Sample ID	Exp. Aft	WPSD	WPSD	WPSD	WPSD	WPSD
0.22	0.22	0.22	0.22	0.22	0.22	0.22
0.22	0.22	0.22	0.22	0.22	0.22	0.22

SPC Calibration Center

SERT
Part of DKSH Group



Certificate of Calibration

Equipment: CONDUCTIVITY METER
Model: Lab955
Serial No. (or ID.): 16300358
Manufacturer: SI Analytics
Electrode Serial No.: 16070067
Condition: In Condition
Certificate No.: C24220084
Issued Date: 22 March 2022
Job No.: KSPR2203267
Page: 1 of 2
Model: LF413T
Brand: SI Analytics

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

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

Calibration Place: Environment Laboratory, SPC RT Co., Ltd.
1194 Soi Wachirathamsathit 57, Sukhumvit 101/1 Rd.,
Bangchak, Prakanong, Bangkok 10260 Thailand

Calibration By: Mr. Wasan Nuchnabee
Calibration Date: 22 March 2022
The Method used: In house method, SPCC-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. 794135, 794136, 772624

(Mr. Wasan Nuchnabee)
Person in charge

SERT
บริษัท เอสอาร์ที จำกัด
SPC RT Co., Ltd.

(Mr. Dumrong Boonsopon)
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 in 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 SPC RT Co., Ltd.

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Branch 00000 1194 Soi Wachirathamsathit 57, Sukhumvit 101/1 Road, Bangchak, Prakanong, Bangkok 10260 Thailand
Tel: 0 285 4333 Ext: 3300-3308 Fax: 0 285 4424 E-mail: info@spcrt.co.th Website: www.spcrt.co.th

SPCC-FM-C24-06: 23 Nov 2020

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Calibration Results:

Before Adjustment

Standard Conductivity Solution	Unit Under Calibration Reading	Correction	Coverage Factor (k)	Uncertainty (±)
25.000 µS/cm	25.9 µS/cm	-0.900 µS/cm	2.00	0.22 µS/cm
1413.0 µS/cm	1444 µS/cm	-31.0 µS/cm	2.00	8.9 µS/cm
111.3 mS/cm	107.9 mS/cm	3.40 mS/cm	2.00	0.66 mS/cm

After Adjustment; at 1413 µS/cm

Standard Conductivity Solution	Unit Under Calibration Reading	Correction	Coverage Factor (k)	Uncertainty (±)
25.000 µS/cm	25.0 µS/cm	0.000 µS/cm	2.00	0.22 µS/cm
1413.0 µS/cm	1413 µS/cm	0.0 µS/cm	2.00	8.9 µS/cm
111.3 mS/cm	107.2 mS/cm	4.10 mS/cm	2.00	0.66 mS/cm

The End of Certificate

ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: KSPR2203267

ชนิดเครื่องมือ: CONDUCTIVITY METER

รุ่น: Lab955

หมายเลขเครื่อง: 16300356

ตรวจสอบ (รับ)	ตรวจสอบ (ส่ง)	หมายเหตุ
22 Mar 2022	22 Mar 2022	
ปกติ	ปกติ	
ไม่ปกติ	ไม่ปกติ	
General		
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	1. ความสมบูรณ์เครื่อง
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	2. ความสะอาด (ช่องใส่ตัวอย่าง, ภายใน-นอกเครื่อง)
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	3. สวิตช์ เปิด - ปิด เครื่อง (On-Off Switch)
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	4. ปุ่มกด (Keypad)
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	5. หน้าจอ (Display, Screen Contrast)
Spectrophotometer		
<input type="checkbox"/>	<input type="checkbox"/>	6. แรงดันไฟฟ้า (Battery Backup) >= 2.5 VDC
<input type="checkbox"/>	<input type="checkbox"/>	7. ตัวควบคุมความยาวคลื่น (Wavelength Control)
<input type="checkbox"/>	<input type="checkbox"/>	8. ความยาวคลื่น (Wavelength Check)
<input type="checkbox"/>	<input type="checkbox"/>	9. แสงยูวี (UV < 3,000 hour)
<input type="checkbox"/>	<input type="checkbox"/>	10. แสงที่มองเห็น (Visible < 5,000 hour)
<input type="checkbox"/>	<input type="checkbox"/>	11. ช่องใส่ตัวอย่าง (Carousel Module)
pH Meter and Conductivity Meter		
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	12. อิเล็กโทรด (Electrode and Connection Cable)
<input type="checkbox"/>	<input type="checkbox"/>	13. ระดับสารละลายใน Electrode (Level KCl)
<input type="checkbox"/>	<input type="checkbox"/>	14. ฝาปิดกันเปื้อน Electrode (Dust Protection Hood)
<input type="checkbox"/>	<input type="checkbox"/>	15. ขาตั้งอิเล็กโทรด (Stand)
Turbidimeter		
<input type="checkbox"/>	<input type="checkbox"/>	16. ค่าความขุ่นไฟลุต (No Sample)
<input type="checkbox"/>	<input type="checkbox"/>	17. ระดับการส่องสว่างของแสง (>= 2.5 ไม่น้อย 3.0)
Automatic titrator		
<input type="checkbox"/>	<input type="checkbox"/>	18. สลัก Piston Burettes
<input type="checkbox"/>	<input type="checkbox"/>	19. Function Rinsing and Dosing
<input type="checkbox"/>	<input type="checkbox"/>	20. ระบบท่อสายยางและอุปกรณ์ประกอบ

ข้อแนะนำ : Electrode วัดอุณหภูมิได้ 24.9 °C โดย Control Waterbath ที่ 25.0 ± 0.1 °C

Mr. Wasan Nuchrabee
Service Engineer

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL: 0-2717-3000-21 FAX: 0-2719-9494

Cert. No.: 21TM1874
Page.: 1 of 3

Certificate of Calibration

Equipment : Incubator
Manufacturer : Memmert
Model : IPP 260
Serial No. : V616.0066
ID No. : UAE.MIC.032/2559
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 : 28 October 2021
Calibration Date : 28 - 29 October 2021
Ambient Temperature : (28 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Kunchit Promprat
Approved by : 
Approved Signatory
() Pomthippa Tameyakul
() Malee Butkruea
() Suwit Imjai
Issue Date : 4 November 2021

The Uncertainties are for a confidence probability of approximately 95%

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



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2110-0698OC-1

Cert. No.: 21TM1874
Page.: 2 of 3

Procedure Used :-

Calibration were conducted using calibration procedure CP-OT02 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 Model Serial No. Cert. No. Due Date
1) Data Acquisition 34970A MY44067817 21LM10 20 Jul 2022

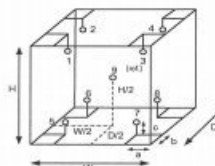
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available



Probe Installation Details :

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

Dimension of Chamber :

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

Environment during calibration		
	Beginning	Finished
Temp. (°C)	22	22
REL.Humid. (%)	59	60
AC Supply (Volt)	226	226

Position :	Ref. Std. ID No.:
1	15RTD2/11
2	15RTD2/12
3	15RTD2/13
4	15RTD2/14
5	15RTD2/15
6	15RTD2/20
7	15RTD2/17
8	15RTD2/16
9 (ref.)	15RTD2/19



Equipment : Incubator
 Condition As-Received : Used Item
 Reference : 2110-0698OC-1
 Result of Calibration :- (*) Without Adjustment
 Function of UUC* : Temperature Source
 Fresh air setting : Not Available

Cert. No.: 21TM1874
 Page.: 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (± °C)	Coverage Factor k
25.0	25.0	24.5	0.053	0.25	0.42	0.30	2
35.0	35.0	35.0	0.029	0.43	0.75	0.30	2

Calibration Point (°C)	Measured Temperature (°C)								
	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
25.0	25.007	24.986	24.943	24.894	24.653	24.806	24.672	24.694	24.786
35.0	35.340	35.384	35.336	35.307	34.680	35.120	34.813	34.996	35.088

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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Wale

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. 0-2713-3000-27 FAX. 0-2719-9484



Cert. No.: 22TM333
 Page.: 1 of 3

Certificate of Calibration

Equipment : Water Bath
 Manufacturer : Memmert
 Model : WNE 14
 Serial No. : L416.0606
 ID No. : UAE.MIG.002/2560
 Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
 3 Soi Udomsuk 41, Sukhumvit Road,
 Bangchak, Phrakhanong,
 Bangkok 10260
 Location : Microbiology Laboratory
 Received Order : 17 February 2022
 Calibration Date : 17 February 2022
 Ambient Temperature : (26 ± 10) °C
 Relative Humidity : (50 ± 30) %
 Calibrated by : Suwit Imjai

Approved by : 
 Approved Signatory

(/) Pornthippa Tameyakul
 (/) Malee Butkruea

Issue Date : 22 February 2022
 The Uncertainties are for a confidence probability of approximately 95 %

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

เอกสารไม่ควบคุม



Equipment : Water Bath
 Condition As-Received : Used Item
 Reference : 2202-0444OC-3
 Procedure Used :-

Cert. No.: 22TM333
 Page.: 2 of 3

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34970A	MY44067817	21LM10	20 Jul 2022

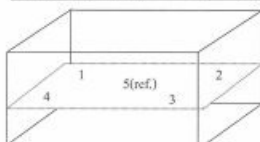
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

	Environmental		AC Voltage Supply
	(°C)	(%R.H.)	(Volt)
Beginning of Calibration	21	65	229
Finished of Calibration	22	58	230



Front

Position :	Ref. Std. ID No.:
1	70RC143
2	70RC144
3	70RC145
4	70RC146
5 (ref.)	70RC147

เอกสารไม่ควบคุม



Equipment : Water Bath
 Condition As-Received : Used Item
 Reference : 2202-0444OC-3
 Result of Calibration :- (*) Without Adjustment
 Function of UUC* : Temperature Source

Cert. No.: 22TM333
 Page.: 3 of 3

Calibration point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Average* Standard Reading (°C)				
			Position				
			1	2	3	4	5 (ref.)
44.5	44.5	44.5	44.496	44.481	44.482	44.518	44.534

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Uncertainty (± °C)	Coverage Factor k
44.5	0.13	0.057	0.15	2

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

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

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เอกสารไม่ควบคุม



Cert. No.: 22TM334
Page.: 1 of 3

Certificate of Calibration

Equipment : Water Bath
Manufacturer : Memmert
Model : WNE 14
Serial No. : L416.0612
ID No. : UAE.MIC.003/2560
Submitted by : United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Microbiology Laboratory
Received Order : 17 February 2022
Calibration Date : 17 February 2022
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Suwit Imjai
Approved by :
() Pernthippa Tameyakul
() Malee Butkruea
Issue Date : 22 February 2022

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 & Equipment Calibration and Testing Services.

เอกสารไม่ควบคุม

A 0038095



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2202-0444OC-4
Procedure Used :-

Cert. No.: 22TM334
Page.: 2 of 3

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34970A	MY44067817	21LM10	20 Jul 2022

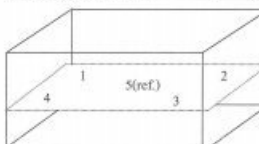
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

	Environmental		AC Voltage Supply
	(°C)	(%R.H.)	(Volt)
Beginning of Calibration	21	65	229
Finished of Calibration	22	57	230



Front

Position :	Ref. Std. ID No.:
1	70RC143
2	70RC144
3	70RC145
4	70RC146
5(ref.)	70RC147

เอกสารไม่ควบคุม

a 1096055



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2202-0444OC-4
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source

Cert. No.: 22TM334
Page.: 3 of 3

Calibration point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Average* Standard Reading (°C)				
			1	2	3	4	5 (ref.)
44.5	44.5	44.5	44.572	44.514	44.507	44.530	44.565

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Uncertainty (± °C)	Coverage Factor k
44.5	0.10	0.042	0.15	2

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

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

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

UUC* : Unit Under Calibration

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

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

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เอกสารไม่ควบคุม

a 1096054



Calibration Certificate

Certificate No.: 2200705-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong, Bangkok 10260

Page 1 of 3

Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: MS6035/01
Serial No.: B007010311
ID No.: UAE.MIC.008/2553
Order No.: 2200705
Operation No.: 2200705-001
Date of Receipt: 24 November 2021
Date of Calibration: 24 November 2021

Calibrated by Mr.Jumpon Pimsri
Scientist

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

Date of Issue: 30 November 2021

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: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2200705-001-01
Equipment: Electronic Balance
Model: M5603S/01
Serial No.: B007010311
Capacity: 620 g g
Manufacturer: METTLER TOLEDO
Resolution: 0.001 g
ID No.: UAE.MIC.008/2553

Date of Calibration: 24 November 2021 **Page 2 of 3**

Environment Condition: Ambient Temperature: 24.1 ± 0.6 °C Relative Humidity: 48 ± 2.5 %

Place of Calibration: 306 Balance Room, UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

1. Calibration Method: NFI Method W-PA-003 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	1-500mg	B308068554	TCS	M21010975	12 January 2022
Standard Weight Class E2	1-500g	B308068128	TCS	M21010985	13 January 2022
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	PONPE 490	NP18TH 931/17	Quality Reborn	QR21-4299	15 February 2022

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	0.00052
600	0.00063

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)
200.001	200.000	200.002	200.001	200.000	200.002	0.002

F-CS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2200705-001-01
Equipment: Electronic Balance
Model: M5603S/01
Serial No.: B007010311
Capacity: 620 g g
Manufacturer: METTLER TOLEDO
Resolution: 0.001 g
ID No.: UAE.MIC.008/2553

Date of Calibration: 24 November 2021 **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
Unloaded	0.0000	0.000	0.000	0.00000	2.00
0.1	0.1000	0.099	0.001	0.00000	2.00
0.5	0.5000	0.500	0.000	0.00000	2.00
1	1.0000	1.000	0.000	0.00000	2.00
5	5.0000	5.000	0.000	0.00000	2.00
10	10.0000	10.000	0.000	0.00000	2.00
20	20.0000	20.000	0.000	0.00000	2.00
50	50.0000	50.001	-0.001	0.00000	2.00
70	70.0000	70.000	0.000	0.00000	2.00
100	100.0000	100.000	0.000	0.00000	2.00
150	150.0000	150.000	0.000	0.00000	2.00
200	200.0000	200.000	0.000	0.00000	2.00
300	300.0000	300.000	0.000	0.00000	2.00
400	400.0000	400.001	-0.001	0.00011	2.00
500	500.0000	500.001	-0.001	0.00012	2.00
600	600.0000	600.000	0.000	0.00013	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: 00 Date: 14-12-61

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2711-3000-27 FAX. 0-2719-8484



Cert. No.: 22TM681
Page: 1 of 3

Certificate of Calibration

Equipment: Autoclave
Manufacturer: ALP
Model: CL-40L
Serial No.: 808763
ID No.: UAE.MIC.026/2563
Submitted by: United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location: Microbiology Laboratory (301)
Received Order: 27 May 2022
Calibration Date: 27 May 2022
Ambient Temperature: (26 ± 10) °C
Relative Humidity: (50 ± 30) %
Calibrated by: Preecha Hiahib
Approved by:
(/) Porthippa Tameyakul
(/) Mailee Bulkruea
(/) Suwit Imjai

Issue Date: 2 June 2022

The Uncertainties are for a confidence probability of approximately 95%

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

เอกสารไม่ควบคุม



Equipment: Autoclave
Condition As-Received: Used Item
Reference: 2205-0784QC-2

Cert. No.: 22TM681
Page: 2 of 3

Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-OT03 according to direct measurement method with Data Acquisition which connected with Thermocouple Type T
The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34970A	MY44060450	22LM46	28 Mar 2023

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

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

4. This result of calibration covers laboratory autoclaves for the sterilization of goods and material which

could be infected with organisms categorized as Hazard Group 1, 2 and 3**

(** = Categorization of pathogens according to hazard and categories of containment, second edition, 1993)

It does not cover autoclaves for use with material infect with organisms in Hazard Group 4, for which

complete containment and sterilization of infected condensate is considered to be essential.

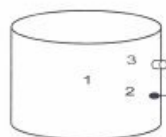
This result of calibration does not apply to sterilizers or disinfectors used for medical, dental, pharmaceutical

or veterinary purposes which are directly concerned with patient care, or those used for fabrics subjected to

sterilization which are required to be dry at the end of cycle.

Result of Calibration :- (°) Without Adjustment

Function of UUC* : Temperature Source



	Environmental		
	(°C)	(%R.H.)	(Volt)
Beginning of Calibration	27	56	220
Finished of Calibration	27	59	221

Position	Description	Ref. Std. ID No.:
1 =	Center of chamber	22-14TC-01
2 =	Temperature sensor	22-14TC-02
3 =	Exhaust port	22-14TC-03

เอกสารไม่ควบคุม



Equipment : Autoclave
 Condition As-Received : Used Item
 Reference : 2205-0764OC-2
 Result of Calibration :- (*) Without Adjustment

Cert. No.: 22TM881
 Page.: 3 of 3

Operating parameter Set : Temperature = 115.0 °C
 Sterilization period = 15 minute

UUC* Setting (°C)	UUC* Reading (°C)	Position	Average* Standard Reading (°C)	Stability (± °C)	Pressure Reading (MPa)	Uncertainty (± °C)	Coverage Factor k
115.0	115.0	1	115.553	0.4	0.08	0.82	2
		2	115.582				
		3	115.325				

Operating parameter Set : Temperature = 121 °C
 Sterilization period = 30 minute

UUC* Setting (°C)	UUC* Reading (°C)	Position	Average* Standard Reading (°C)	Stability (± °C)	Pressure Reading (MPa)	Uncertainty (± °C)	Coverage Factor k
121.0	121.0	1	121.484	0.21	1.1	0.75	2
		2	121.581				
		3	121.311				

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

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

UUC* : Unit Under Calibration

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

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

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เอกสารไม่ควบคุม



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
 CALIBRATION AND TESTING EQUIPMENT SERVICES
 3344 PATTANAKARN ROAD SOI 14, SUANLUANG, SUANLUANG BANGKOK 10250
 TEL. 0-2717-3000-34 FAX. 0-2719-9484

Cert.No.: 21CH1017
 Page.: 1 of 2

Certificate of Calibration

Equipment : Turbidity Meter
 Manufacturer : Oakton
 Model : T100IR
 Serial No. : 1120501017
 ID. No. : UAE.WAT.056/2563
 Condition As-Received : Used Item
 Received Date : 09 August 2021
 Calibration Date : 17 August 2021
 Reference : 2108-0201WSC-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
 based on direct measurement by
 using Formazin standard solution

Calibrated by : Walalak Sirtthean

Approved by :
 Approved Signatory

(✓) Malee Butkrua
 () Saitthip Meangmai
 () Warakorn Lemgagtrakul

Issue Date : 23 August 2021

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

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เอกสารไม่ควบคุม
 A 0007434



Cert.No.: 21CH1017
 Page.: 2 of 2

Condition of this calibration result

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

Instruments	Serial No.	ID No.	Certificate No.	Due date
1) Thermo-Hygrograph	1103328	130EC010	21H1462	27 June 2022
2) Electronic Balance	1126143764	140RC004	20MM595	27 Sep 2021

- Standard Material : The Formazin suspension has been prepared gravimetric from

Material	Manufacturer	Lot No.	Assay
1) Hexamethylenetetramine	HIMEDIA	0000343342	99.5%
2) Hydrazinium Sulfate	HIMEDIA	0000332928	99.2%

- 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	0.0062	2.00
20	20.2	0.39	2.00
100	101	0.72	2.00
400	403	1.5	2.09
800	803	2.1	2.13

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

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

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เอกสารไม่ควบคุม
 A 1066930



บริษัท ไทยยูนิค จำกัด THAI UNIQUE CO., LTD.

80-82 ถนนประชาธิปไตย แขวงบางขุนพรหม เขตพระนคร กรุงเทพฯ 10200
 80-82 Prachathipatani Rd., Bangkhunphrom, Pranakorn, Bangkok 10200
 Tel. 0-2629-0191-6, 0-2280-1787, Fax. 0-2280-1788, E-mail : thauunique@thaiunique.com, Website : www.thaiunique.com

CERTIFICATE OF CALIBRATION GAS CHROMATOGRAPH MASS SPECTROMETER

Certificate No.: SV2205/20385
 Customer: United Analyst and Engineering Consultant Co., Ltd.
 Address: 3 Soi Udomsuk 41 Sukhumvit Rd. Bangchak
 Phrakhanong Bangkok Thailand 10260

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

Standard Reference Number: 393065201
 Procedure Document Number: 394207000

System Test

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

Engineer
 Somchai Pohtongkam

Date : 19 May 2022

Thai Unique Co., Ltd.

Service Division

เอกสารไม่ควบคุม

Operational Qualification Protocol

For SCION Instrument:

Name and Model:

Serial Number:

System ID Number:

Publication No. 30423700

Revision A

November 2011

Contact

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

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



www.scion.com/support.html

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เอกสารไม่ควบคุม

Table of Contents

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

เอกสารไม่ควบคุม

5.2 Operational Qualification Protocol Assignment (5.2.....	27
Protocol Acceptance / Protocol Approval by Scion (5.4.....	27
Remarks.....	28
Appendices.....	29
A.1 Qualification Representative Details.....	30
B.1 Exceptions.....	31
Operational Qualification Protocol Certification.....	36

เอกสารไม่ควบคุม

2.0 Qualification Representative and Reviewer Details

2.1 Qualification Representative Details

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

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

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

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

Name (Print)	SOMCHAI POHTONGKAM
Title	ENGINEER
Signature	
Initials	SOMCHAI
Date	19 MAY 22

Name (Print)	
Title	
Signature	
Initials	
Date	

เอกสารไม่ควบคุม

1.0 Revision History

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

Issue Number	Date	Comments

เอกสารไม่ควบคุม

2.2 Reviewer Details

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

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

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

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

Name (Print)	CHANA CHANSRI
Title	ENGINEER
Signature	
Initials	
Date	19 MAY 2022

Name (Print)	
Title	
Signature	
Initials	
Date	

เอกสารไม่ควบคุม

2.3 Quality Assurance/Control Details

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

Name (Print)	
Title	
Signature	
Initials	
Date	

Name (Print)	
Title	
Signature	
Initials	
Date	

เอกสารไม่ควบคุม

3.0 Customer Responsibilities

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

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

Qualification Rep. Initials	<i>Sachin P.</i>	Reviewer Initials		QA/QC Initials	
Date	19 MAY 22	Date		Date	

เอกสารไม่ควบคุม

4.0 Qualification Guidelines and GMP Documentation

4.1 Qualification Summary

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

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

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

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

4.2 Qualification Guidelines

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

- Read the guidelines before starting the qualification.
- Perform all tests exactly as written.
- Use a pen with permanent blue or black ink unless otherwise specified by company policy.
- Neatly strike out any incorrect words or numbers, made while writing comments or recording results. If a mistake is made while in this protocol with a single line, the word(s) crossed out must remain legible. Write the correction as close as possible to the original entry. Write a brief description of the error. For example, write "Transcription error" or "Re-written for clarity". Initials and date the change.
- Entering initials where a signature is requested and vice versa is permitted. The exception to this is in 2.2 : Qualification Representative and Reviewer Details on page 5, where examples of each person's signature and initials are required.
- Use the date format dd Mon yyyy (e.g. 09 Mar 2011) unless otherwise specified by company policy.

เอกสารไม่ควบคุม

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

4.3 Page Numbering of Appendices

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

For example, pages inserted after Appendix C are numbered

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

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

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

Qualification Rep. Initials	<i>Sachin P.</i>	Reviewer Initials		QA/QC Initials	
Date	19 MAY 22	Date		Date	

เอกสารไม่ควบคุม

4.4 Exception Reports

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

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

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

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

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

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

Qualification Rep. Initials	<i>Sachin P.</i>	Reviewer Initials		QA/QC Initials	
Date	19 MAY 22	Date		Date	

เอกสารไม่ควบคุม

4.5 Reference Documents

The following documents are relevant to this Qualification:

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

Qualification Rep. Initials	Sachin P.	Reviewer Initials		QA/QC Initials	
Date	19 MAY 22	Date		Date	

เอกสารไม่ควบคุม

4.6 Required Materials

The following stock solutions are required:

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

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

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

Qualification Rep. Initials	Sachin P.	Reviewer Initials		QA/QC Initials	
Date	19 MAY 22	Date		Date	

เอกสารไม่ควบคุม

4.7 General Guidelines

The following are general cGMP guidelines:

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

Qualification Rep. Initials	Sachin P.	Reviewer Initials		QA/QC Initials	
Date	19 MAY 22	Date		Date	

4.8 Specific Instructions for Documentation

The Reviewer designates specific documentation instructions as follows.

Permanent Ink Color	Blue
Preferred Date Format	19 MAY 22

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

Qualification Rep. Initials	Sachin P.	Reviewer Initials		QA/QC Initials	
Date	19 MAY 22	Date		Date	

เอกสารไม่ควบคุม

4.9 Documentation Corrections

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

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

Qualification Rep. Initials	Sachin P.	Reviewer Initials		QA/QC Initials	
Date	19 MAY 22	Date		Date	

4.10 Marking Procedures Not Applicable

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

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

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

Qualification Rep. Initials	Sachin P.	Reviewer Initials		QA/QC Initials	
Date	19 MAY 22	Date		Date	

เอกสารไม่ควบคุม

4.11 Addendums

The following are reasons to complete an addendum sheet:

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

Qualification Rep. Initials	Sachai P.	Reviewer Initials		QA/QC Initials	
Date	19 MAY 22	Date		Date	

4.12 Addendum Example

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

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

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

Qualification Rep. Initials	Sachai P.	Reviewer Initials		QA/QC Initials	
Date	19 MAY 22	Date		Date	

เอกสารไม่ควบคุม

5.0 Operational Qualification

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

5.1 OQ Preparation

The following must be done before starting the OQ:

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

Addendum P.M. Protocol

Qualification Rep. Initials	Sachai P.	Reviewer Initials		QA/QC Initials	
Date	19 MAY 22	Date		Date	

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

Qualification Rep. Initials	Sachai P.	Reviewer Initials		QA/QC Initials	
Date	19 MAY 22	Date		Date	

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

Qualification Rep. Initials	Sachai P.	Reviewer Initials		QA/QC Initials	
Date	19 MAY 22	Date		Date	

เอกสารไม่ควบคุม

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

Qualification Rep. Initials	Sachai P.	Reviewer Initials		QA/QC Initials	
Date	19 MAY 22	Date		Date	

เอกสารไม่ควบคุม

5.2 System Description

5.2.1 SCION Description

Installation Date: 2015	Principal Operator:	Phone Number:
Company Information		
Company: United Analyst and Engineering		
Installation Site: LAB		
Name:	Building:	
Address: 3 Soi Udorn Suk A1	Address/Location: Sukhumvit Rd.	
City, State: Bangkok, Bangkok	City, State: Bangkok	
Zip/Country: Thailand	Zip/Country: 10260	
System Description		
SCION: SQ	Serial Number: GQS 1203F021	
Sales Order Number:	Sales Order Addendum Number:	
GC		
Module Type: Scion 151	Serial Number: BR1203M099	
AutoSampler		
Module Type: GP 8400	Serial Number: BR1203M331	
MS Workstation		
Version: MSWS 8.2.1	Serial Number: 01106-6711-BBQ-150C	
Computer Operating System		
Operating System: Windows 7	Version: Pro	Serial No.: 60366-150-436-1578
Computer		
Make: Dell	Model: optiplex	Serial No.: DNNYHSI
Addendum Number(s): 2. System description		Hard Drive: 1TB Size / RAM: 16GB

Qualification Rep. Initials	Sachai P.	Reviewer Initials		QA/QC Initials	
Date	19 MAY 22	Date		Date	

เอกสารไม่ควบคุม

5.3 Data Sheet Specifications

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

Table 5-1 TQ Specification

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

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

† CI tests use methane gas as reagent gas.

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

Qualification Rep. Initials	<i>Soudan P.</i>	Reviewer Initials		QA/QC Initials	
Date	19 MAY 22	Date		Date	

Table 5-2 SQ Specification

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

Qualification Rep. Initials	<i>Soudan P.</i>	Reviewer Initials		QA/QC Initials	
Date	19 MAY 22	Date		Date	

เอกสารไม่ควบคุม

5.4 EI Precision Test TQ

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

The following is the required precision for 10 consecutive injections:

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

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

Addendum *N/A*

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

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

Addendum *N/A*

เอกสารไม่ควบคุม

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

5.5 EI Precision Test SQ

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

The following is the required precision for 10 consecutive injections:

Injection	Retention Time	Peak Area
1	3.670	74230
2	3.668	80953
3	3.669	73432
4	3.667	75423
5	3.668	74060
6	3.669	81491
7	3.670	81644
8	3.671	72531
9	3.670	79852
10	3.668	81366
% RSD	0.03	1.16

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

Addendum

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

เอกสารไม่ควบคุม

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

Addendum *N/A*

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

Addendum *N/A*

เอกสารไม่ควบคุม

5.6 Final Evaluation

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

Qualification Rep. Initials	Somchai P. Reviewer Initials	QA/QC Initials	
Date	19 MAY 22	Date	

เอกสารไม่ควบคุม

6.0 Protocol Approval

6.1 Protocol Acceptance / Approval by Customer

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

Instrument(s): Scion 451 SQ with dPS400

Serial Number(s): GQS1203F021

Sales Order Number:

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

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

Authorized Customer Representative

Name (Print)	
Title	
Signature	
Initials	
Date	

เอกสารไม่ควบคุม

6.2 Operational Qualification Protocol Assignment

This Operational Qualification Protocol document is used for:

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

6.3 Protocol Acceptance / Protocol Approval by Scion

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

Instrument(s): Scion 451 SQ with dPS400

Serial Number(s): GQS1203F21

Sales Order Number:

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

เอกสารไม่ควบคุม

Scion Certified Engineer

Name (Print)	SOMCHAI POHTONGKAM
Title	ENGINEER
Signature	Somchai P.
Initials	SOMCHAI
Date	

6.4 Remarks

เอกสารไม่ควบคุม

Appendices

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

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

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

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

Revised on: 04/02/2016, Revision A, November 2016

Page 25 of 30

เอกสารไม่ควบคุม

A.1 Qualification Representative Details

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

No. of Pages Inserted

This area is intentionally left blank.

Revised on: 04/02/2016, Revision A, November 2016

Page 31 of 33

เอกสารไม่ควบคุม



เอกสารไม่ควบคุม

B.1 Exceptions

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

For example, if an exception occurs on page 31, it shall be identified as Exception Report 'CRD-34-1'. If another exception occurs on page 34, the second exception shall be identified as 'CRD-34-2'. This identification number should be recorded in the provided field after each insert.

Insert Exception Reports (if any) after this page.

No. of Pages Inserted

N/A

This area is intentionally left blank.

Revised on: 04/02/2016, Revision A, November 2016

Page 31 of 33

เอกสารไม่ควบคุม

Version information

About 451-GC | Details

Auxiliary EFCs:

Software Version

Front: 0.0

Middle: 0.0

Rear: 0.0

Serial number

Front: 0

Middle: 0

Rear: 0

Ok

Version information

About 451-GC | Details

Autosampler:

CP84xxMbus: 2.0

CP84xxTS1: 1.0

CP84xxTS6: 1.20

CP84xxTray: 1.20

CP84xxTower: 1.20

CP84xxSyringe: 1.21

CP84xxPlunger: 1.20

GC Application build info:

Ok

เอกสารไม่ควบคุม

Version information

About 451-GC | Details

CP84xxTray: 1.20

CP84xxTower: 1.20

CP84xxSyringe: 1.21

CP84xxPlunger: 1.20

GC Application build info:

User: autobuilder

IP address: 10.190.65.195

Mac address: 00:26:b9:86:6a:c4

Timestamp: 19-09-2011 18:25

Ok

451-GC Setup

Column Oven Zone: Temp Limit 260.0 C; No Coolant

Zone 1: Front S/S/L: Temp Limit 260.0 C; No Coolant

Zone 2: Mid PTV: Temp Limit 325.0 C; LND Coolant

Zone 3: Not Configured

Zone 4: Not Configured

Zone 5: Not Configured

Zone 6: Not Configured

Valve 01 is Unused

Valve 02 is Unused

Valve 03 is Unused

Valve 04 is Unused

Valve 05 is Unused

Valve 06 is Unused

Valve 07 is Unused

Valves 8-15 not installed, require option board

Front S/S/L Injector is associated with zone 1

Mid PTV Injector is associated with zone 2

Front Injector EPC Type 21 Outlet: Vacuum, Units: psi, Splitless Vent: 20 ml/min, Gas Saver: 20 ml/min after 0.00 min, Backflush Disabled

Mid Injector EPC Type 21 Outlet: Atm, Units: psi, Splitless Vent: 20 ml/min, Gas Saver: 20 ml/min after 0.00 min, Backflush Disabled

Front Column (Type WCOT) is Configured with L=3000 cm, D=250 microns, He Carrier Gas DB624

Mid Column (Type WCOT) is Configured with L=3000 cm, D=250 microns, He Carrier Gas BR Gas

Rear Column not Configured

8400 Autosampler connected to SID-2 is Configured with 10 ul Springs, Inj Ports in Both Positions

Nothing connected to SID-1

8400 Dual Mode Setup Prev OK

เอกสารไม่ควบคุม

MSWS 8.2.1 for 1Q MS

BRUKER Daltonics

MS Workstation

System Control Version 8.2.1

Copyright © 2016, Bruker Service Code: MSvS-01105

Enabled Module Drivers:

Bruker GC-MS

451-GC

Bruker CTC PAL-4e

Installation History:

MS Workstation

S/N: 01106-6711-880-450C

Installed by Bruker

Organization: Microsoft

Installation date: 14/9/2563 9:27

Validate Installed Files Close

เอกสารไม่ควบคุม

SCION Operational Qualification Protocol

Addendum Procedure: 2. System description Page Number: 5

Qualification Rep. Initials	<i>Sauhin P.</i>	Reviewer Initials	QA/QC Initials
Date	19 MAY 22	Date	Date

เอกสารไม่ควบคุม

Qualification Rep. Initials	<i>Snodden P.</i>	Reviewer Initials		QA/QC Initials	
Date	19 MAY 22	Date		Date	

เอกสารไม่ควบคุม

Test date: 08/20/77

[illegible]

Please: 1. Print name & job
 2. Print name using only a + first

1. 从 1 到 100 中，找出所有能被 3 整除的数。

 2. 从 1 到 100 中，找出所有能被 5 整除的数。

Left valve can only be tested when engine pressure 50000 and pneumatic rail tested in single used system.
 Packed in the waste list

and while the

5 12-2027

Prüfung: 1.4.2019

CEC Techs will be awarded a 5.7% increase

±1.00, 1.00, 1.00

1. 8-257

10257d -> IT Dept: Publishing B: not done

PASADENA 3 11 1965 - 4:00
 PASADENA 3 11 1965 - 4:00

```

PAGES 100
PROCESSED 100

```

PAVANI, J. L. 2007. *Phylogeny*

CC-0.0. Only permitted on a CC-0 system

Let $\mathbf{A} \in \mathbb{R}^{n \times n}$ be

1000

-m-d-1-1-1-7-q-m-m-m-m-d-1-1-1-7-q-m-m-m-m
getter method

INDEXED - FINGER - 425 TEST

PASSIVE - 45 DEGREE SUPPLY
P-200 - 45 DEGREE SUPPLY

Param: - Detecting acceleration via
 Param: - Behavior based on the rest

```

PROMPT => D:\CC201\H-test>
C:\CC5 -> Directory validation (see msg)

```

[illegible]

— 123 —

2000

ॐ नमो भगवते वासुदेवाय

3' end: 100%

9-10-2022

Praxis -> Q1 2010 11.1

Prüfungstermin 2014/15

3. R-2822

2000年 12月 12日

Added to Spencer Text
 Deleted to Spencer Text

20270 6 non user analog
24381 2 analog module test

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

```
GP write = test
-----
T=16-0827

Passed -> Power supply OK
Passed -> GP full voltage OK cell test
Passed -> GP OK low temp
Passed -> Gas at chosen point
Passed -> HP status OK test
Passed -> TF measurement low
Passed -> IF CURRENT TEST
Passed -> water current leak

Passed ----- GP module load
```

Print Date: 19 May 2022 13:08:30 Target Compound Report for #1 from dm1pgv06.xml

Sample ID:	ofn1pg	Operator:	TU
Instrument ID:	Bruker GC/MS #1	Last Calibration:	26/11/2557 15:55
Measurement Type:	Area	Calibration Type:	External Standard
Acquisition Date:	19/5/2565 12:23	Data File:	...022iqofn1pg008.xmls
Calculation Date:	19/5/2565 12:28	Method:	...dsipm2017fvs_plv.mth
Sample Type:	Analysis		
Ini. Sample Notes:	Nong		

Compound Information

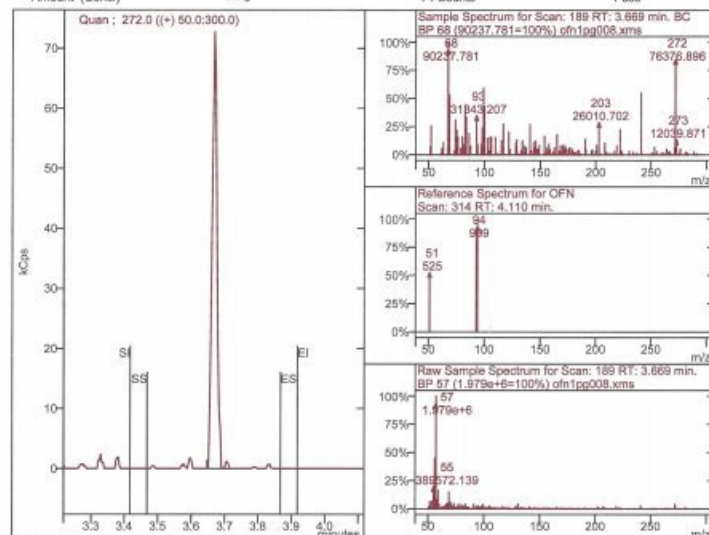
Peak Name:	OFN	Compound Number:	1	CAS Number:	None	Identified
Result Index:	1					

identification

Parameter	Specification	Actual	Status
Search Type	Highest		
Retention Time	3.668 +/- 0.200	3.670 min.	Pass
Match Result		N/A	

Integration and Quantitation

Parameter	Specification	Actual	Status
Quant Ions	272.0		
Calibration Equation	Average		
Area	>=10	74230	Pass
Height		72761	
Amount (Conc.)	>= 0	74 Counts	Pass



เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Print Date: 19 May 2022 13:08:59 Target Compound Report for #1 from dm1pguuv9.xml

Sample ID:	ofn1pg	Operator:	TU
Instrument ID:	Bruker GC/MS #1	Last Calibration:	26/11/2557 15:55
Measurement Type:	Area	Calibration Type:	External Standard
Acquisition Date:	19/5/2565 12:36	Data File:	...022xofn1pg009.xmls
Calculation Date:	19/5/2565 12:41	Method:	...da1pm2017fs_ptv.mth
Sample Type:	Analysis		
Int. Sample Notes:	None		

Compound Information

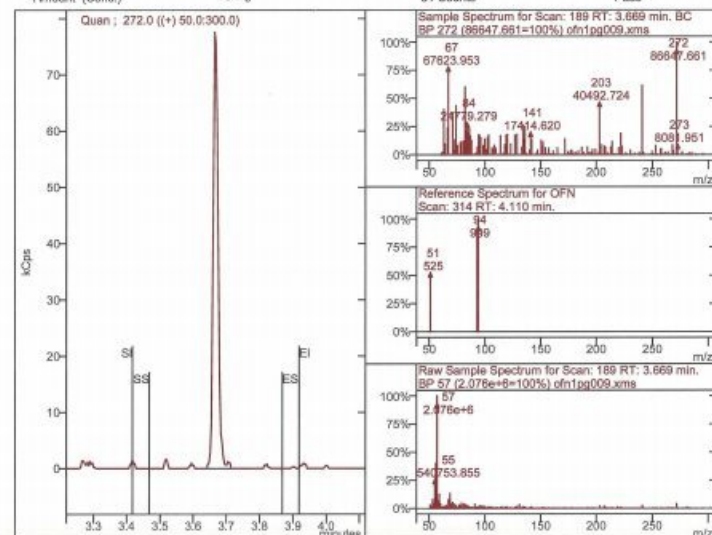
Peak Name:	OFN	Compound Number:	1	CAS Number:	None	Identified
Result Index:	1					

Identification

Parameter	Specification	Actual	Status
Search Type	Highest		
Retention Time	3.668 +/- 0.200	3.668 min.	Pass
Match Result		N/A	

Integration and Quantitation

Parameter	Specification	Actual	Status
Quam Ions	272.0		
Calibration Equation	Average		
Area	≥ 10	80953	Pass
Height		76589	
Amount (Conc.)	≥ 0	81 Counts	Pass



เอกสารไม่ควบคุม

Print Date: 18 May 2022 13:09:21 Target Compound Report for #1 from dm1pgu11u.xml

Sample ID:	ofn1pg	Operator:	TU
Instrument ID:	Bruker GC/MS #1	Last Calibration:	26/11/2057 15:55
Measurement Type:	Area	Calibration Type:	External Standard
Acquisition Date:	19/5/2565 12:49	Data File:	...022log\ofn1pg010.xmls
Calculation Date:	19/5/2565 12:55	Method:	...ds\pm2017\fs_gtv.mth
Sample Type:	Analysis		
Inj. Sample Notes:	None		

Compound Information

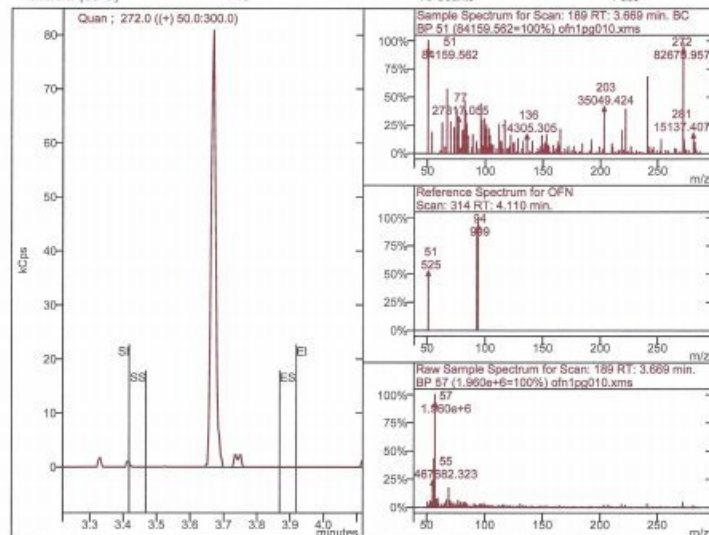
Peak Name:	OFN	Compound Number:	CAS Number:	Identified
Result Index:	1	1	None	

Identification

Parameter	Specification	Actual	Status
Search Type	Highest		
Retention Time	3.668 +/- 0.200	3.669 min.	Pass
Match Result		N/A	

Integration and Quantitation

Parameter	Specification	Actual	Status
Quantions	272.0		
Calibration Equation	Average		
Area	>=10	78832	Pass
Height		80882	
Amount (Conc.)	>= 0	79 Counts	Pass



เอกสารไม่ควบคุม

Print Date: 19 May 2022 13:17:45

Target Compound Report for #1 from cfm1pg011.xms

Sample ID:	cfm1pg	Operator:	TU
Instrument ID:	Brucker GC/MS #1	Last Calibration:	26/11/2557 15:55
Measurement Type:	Area	Calibration Type:	External Standard
Acquisition Date:	19/5/2565 13:03	Data File:	...022oc\ofm1pg011.xms
Calculation Date:	19/5/2565 13:08	Method:	...d\pm2017\fs_ptv.mth
Sample Type:	Analysis		
Inj. Sample Notes:	None		

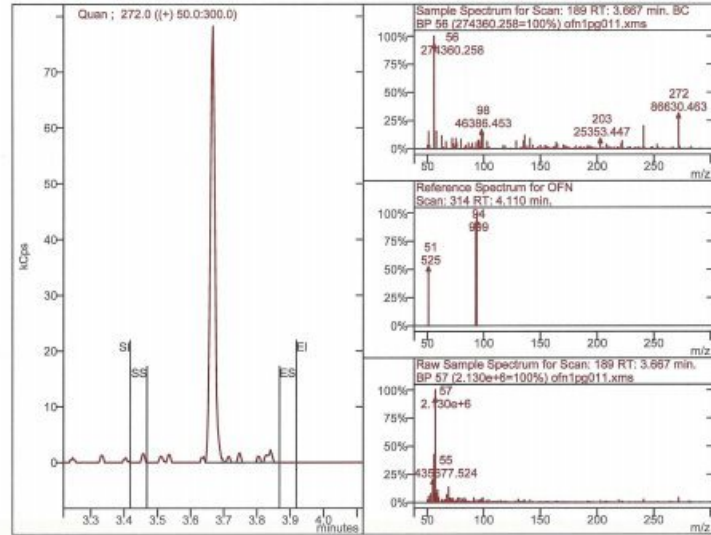
Compound Information

Peak Name:	OFN	Compound Number:	1	CAS Number:	None	Identified
------------	-----	------------------	---	-------------	------	------------

Identification			
Parameter	Specification	Actual	Status
Search Type	Highest		
Retention Time	3.668 +/- 0.200	3.667 min.	Pass
Match Result		N/A	

Integration and Quantitation

Parameter	Specification	Actual	Status
Quan Ions	272.0		
Calibration Equation	Average		
Area		75823	Pass
Height		78279	
Amount (Conc.)	>= 0	76 Counts	Pass



เอกสารไม่ควบคุม

Print Date: 19 May 2022 13:32:34

Target Compound Report for #1 from cfm1pg012.xms

Sample ID:	cfm1pg	Operator:	TU
Instrument ID:	Brucker GC/MS #1	Last Calibration:	26/11/2557 15:55
Measurement Type:	Area	Calibration Type:	External Standard
Acquisition Date:	19/5/2565 13:16	Data File:	...022oc\ofm1pg012.xms
Calculation Date:	19/5/2565 13:21	Method:	...d\pm2017\fs_ptv.mth
Sample Type:	Analysis		
Inj. Sample Notes:	None		

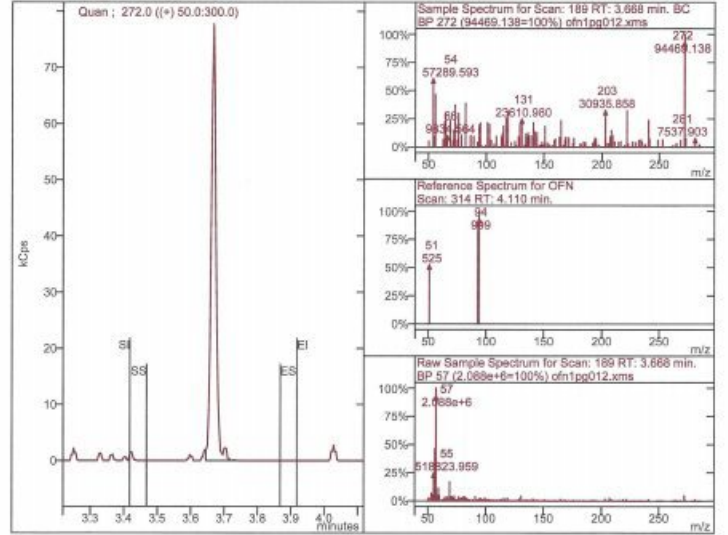
Compound Information

Peak Name:	OFN	Compound Number:	1	CAS Number:	None	Identified
------------	-----	------------------	---	-------------	------	------------

Identification			
Parameter	Specification	Actual	Status
Search Type	Highest		
Retention Time	3.668 +/- 0.200	3.668 min.	Pass
Match Result		N/A	

Integration and Quantitation

Parameter	Specification	Actual	Status
Quan Ions	272.0		
Calibration Equation	Average		
Area		79080	Pass
Height		77781	
Amount (Conc.)	>= 0	79 Counts	Pass



เอกสารไม่ควบคุม

Print Date: 19 May 2022 13:39:49

Target Compound Report for #1 from cfm1pg013.xms

Sample ID:	cfm1pg	Operator:	TU
Instrument ID:	Brucker GC/MS #1	Last Calibration:	26/11/2557 15:55
Measurement Type:	Area	Calibration Type:	External Standard
Acquisition Date:	19/5/2565 13:29	Data File:	...022oc\ofm1pg013.xms
Calculation Date:	19/5/2565 13:34	Method:	...d\pm2017\fs_ptv.mth
Sample Type:	Analysis		
Inj. Sample Notes:	None		

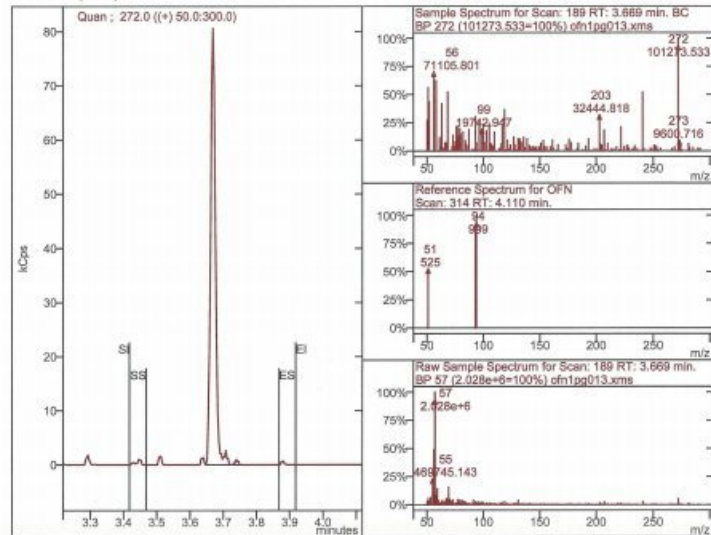
Compound Information

Peak Name:	OFN	Compound Number:	1	CAS Number:	None	Identified
------------	-----	------------------	---	-------------	------	------------

Identification			
Parameter	Specification	Actual	Status
Search Type	Highest		
Retention Time	3.669 +/- 0.200	3.669 min.	Pass
Match Result		N/A	

Integration and Quantitation

Parameter	Specification	Actual	Status
Quan Ions	272.0		
Calibration Equation	Average		
Area		81481	Pass
Height		80643	
Amount (Conc.)	>= 0	81 Counts	Pass



เอกสารไม่ควบคุม

Print Date: 19 May 2022 14:07:07

Target Compound Report for #1 from cfm1pg014.xms

Sample ID:	cfm1pg	Operator:	TU
Instrument ID:	Brucker GC/MS #1	Last Calibration:	26/11/2557 15:55
Measurement Type:	Area	Calibration Type:	External Standard
Acquisition Date:	19/5/2565 13:56	Data File:	...022oc\ofm1pg014.xms
Calculation Date:	19/5/2565 14:06	Method:	...d\pm2017\fs_ptv.mth
Sample Type:	Analysis		
Inj. Sample Notes:	None		

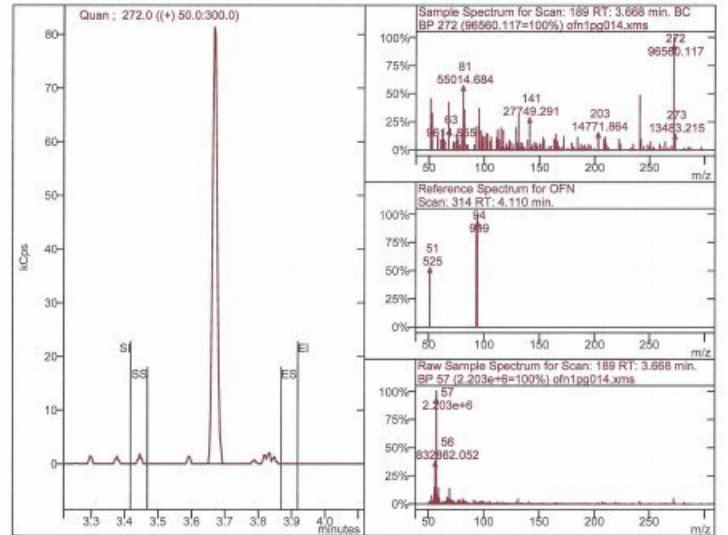
Compound Information

Peak Name:	OFN	Compound Number:	1	CAS Number:	None	Identified
------------	-----	------------------	---	-------------	------	------------

Identification			
Parameter	Specification	Actual	Status
Search Type	Highest		
Retention Time	3.670 +/- 0.200	3.670 min.	Pass
Match Result		N/A	

Integration and Quantitation

Parameter	Specification	Actual	Status
Quan Ions	272.0		
Calibration Equation	Average		
Area		81884	Pass
Height		81381	
Amount (Conc.)	>= 0	82 Counts	Pass



เอกสารไม่ควบคุม

Print Date: 19 May 2022 14:19:08

Target Compound Report for #1 from cfm1pg015.xml

Sample ID:	cfm1pg	Operator:	TU
Instrument ID:	Brucker GC/MS #1	Last Calibration:	26/11/2557 15:55
Measurement Type:	Area	Calibration Type:	External Standard
Acquisition Date:	19/5/2565 14:09	Data File:	...022\cfm1pg015.xml
Calculation Date:	19/5/2565 14:14	Method:	...dipm2017fs_ptv.mth
Sample Type:	Analysis		
Inj. Sample Notes:	None		

Compound Information

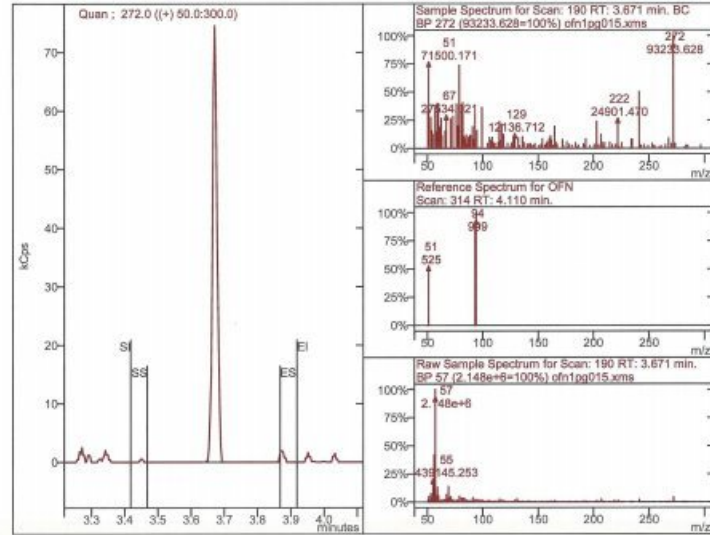
Peak Name:	OFN	Compound Number:	1	CAS Number:	None	Identified
------------	-----	------------------	---	-------------	------	------------

Identification

Parameter	Specification	Actual	Status
Search Type	Highest		
Retention Time	3.668 +/- 0.200	3.671 min.	Pass
Match Result		N/A	

Integration and Quantitation

Parameter	Specification	Actual	Status
Quan Ions	272.0		
Calibration Equation	Average		
Area		72531	Pass
Height		74567	
Amount (Conc.)	>= 0	73 Counts	Pass



เอกสารไม่ควบคุม

Print Date: 19 May 2022 14:33:56

Target Compound Report for #1 from cfm1pg016.xml

Sample ID:	cfm1pg	Operator:	TU
Instrument ID:	Brucker GC/MS #1	Last Calibration:	26/11/2557 15:55
Measurement Type:	Area	Calibration Type:	External Standard
Acquisition Date:	19/5/2565 14:22	Data File:	...022\cfm1pg016.xml
Calculation Date:	19/5/2565 14:27	Method:	...dipm2017fs_ptv.mth
Sample Type:	Analysis		
Inj. Sample Notes:	None		

Compound Information

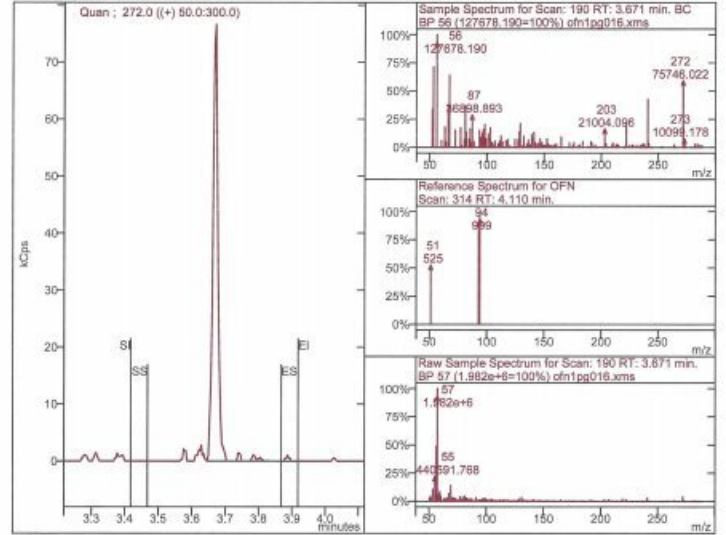
Peak Name:	OFN	Compound Number:	1	CAS Number:	None	Identified
------------	-----	------------------	---	-------------	------	------------

Identification

Parameter	Specification	Actual	Status
Search Type	Highest		
Retention Time	3.668 +/- 0.200	3.670 min.	Pass
Match Result		N/A	

Integration and Quantitation

Parameter	Specification	Actual	Status
Quan Ions	272.0		
Calibration Equation	Average		
Area		79652	Pass
Height		78548	
Amount (Conc.)	>= 0	78 Counts	Pass



เอกสารไม่ควบคุม

Print Date: 19 May 2022 14:49:24

Target Compound Report for #1 from cfm1pg017.xml

Sample ID:	cfm1pg	Operator:	TU
Instrument ID:	Brucker GC/MS #1	Last Calibration:	26/11/2557 15:55
Measurement Type:	Area	Calibration Type:	External Standard
Acquisition Date:	19/5/2565 14:37	Data File:	...022\cfm1pg017.xml
Calculation Date:	19/5/2565 14:42	Method:	...dipm2017fs_ptv.mth
Sample Type:	Analysis		
Inj. Sample Notes:	None		

Compound Information

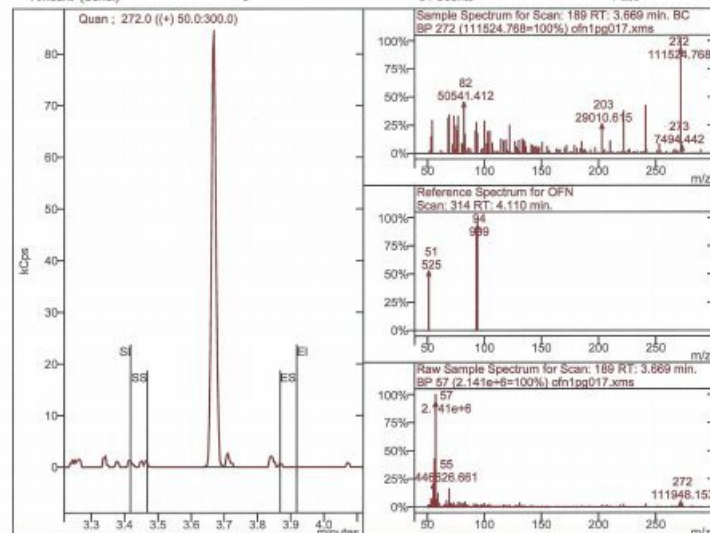
Peak Name:	OFN	Compound Number:	1	CAS Number:	None	Identified
------------	-----	------------------	---	-------------	------	------------

Identification

Parameter	Specification	Actual	Status
Search Type	Highest		
Retention Time	3.668 +/- 0.200	3.669 min.	Pass
Match Result		N/A	

Integration and Quantitation

Parameter	Specification	Actual	Status
Quan Ions	272.0		
Calibration Equation	Average		
Area		81366	Pass
Height		84532	
Amount (Conc.)	>= 0	81 Counts	Pass



เอกสารไม่ควบคุม

Print Date: 19 May 2022 14:37:33

Chromatogram Plots

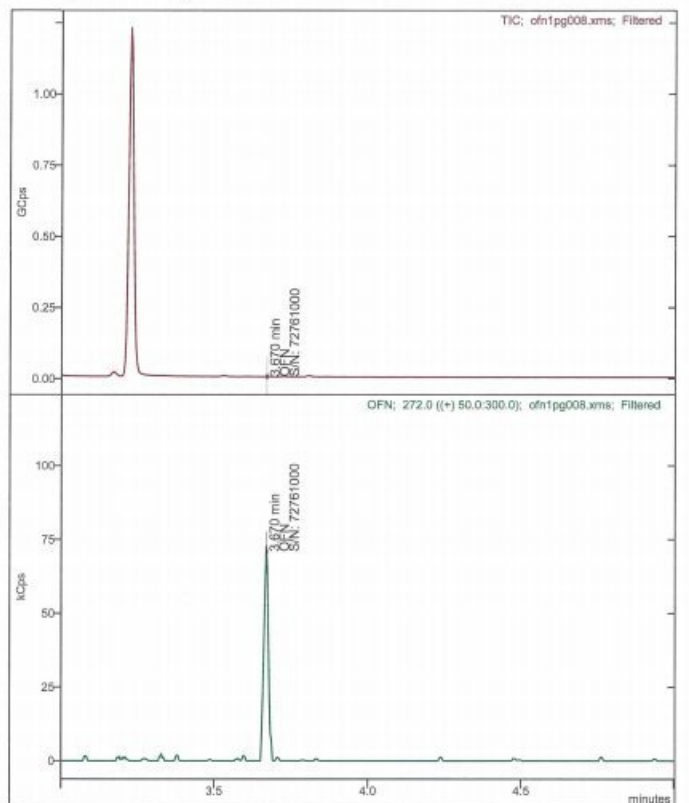
File: e:\tu\pm2022\cfm1pg008.xml

Sample: cfm1pg

Scan Range: 1 - 585 Time Range: 3.00 - 5.00 min.

Operator: TU

Date: 19/5/2565 12:23



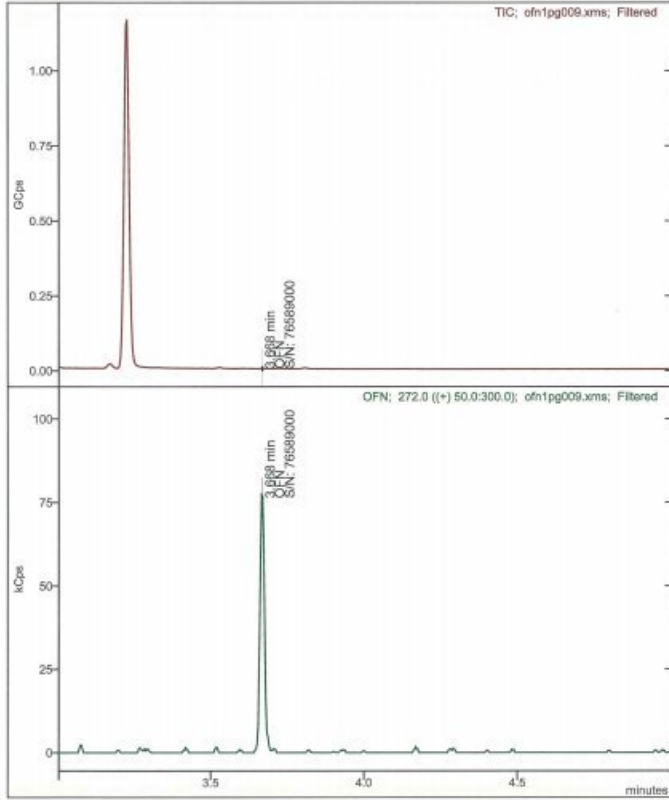
เอกสารไม่ควบคุม

Print Date: 19 May 2022 14:29:55

Chromatogram Plots

File: e:\tu\pm2022\oq\ofn1pg009.xmls
Sample: ofn1pg
Scan Range: 1 - 564 Time Range: 3.00 - 5.00 min.

Operator: TU
Date: 19/5/2565 12:36



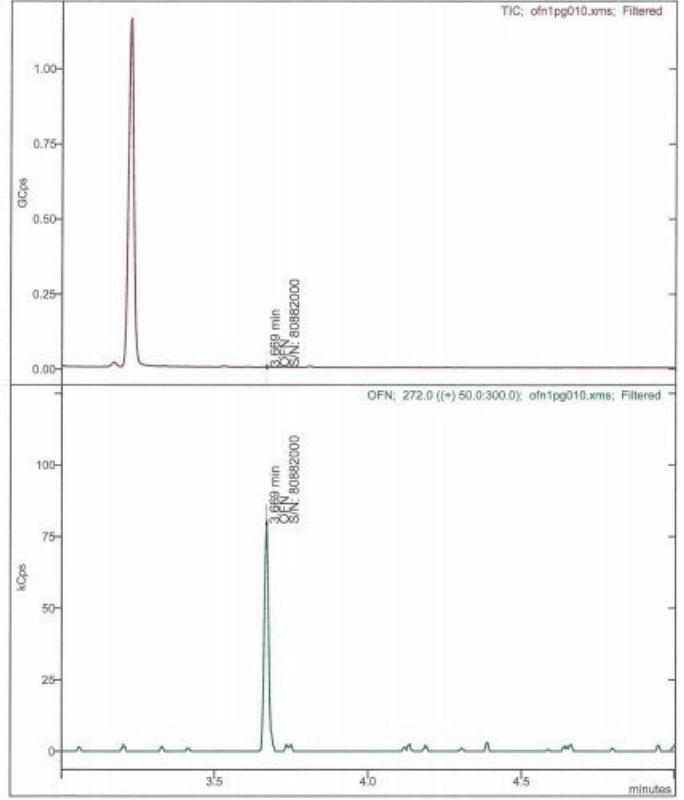
เอกสารไม่ควบคุม

Print Date: 19 May 2022 14:31:34

Chromatogram Plots

File: e:\tu\pm2022\oq\ofn1pg010.xmls
Sample: ofn1pg
Scan Range: 1 - 565 Time Range: 3.00 - 5.00 min.

Operator: TU
Date: 19/5/2565 12:49



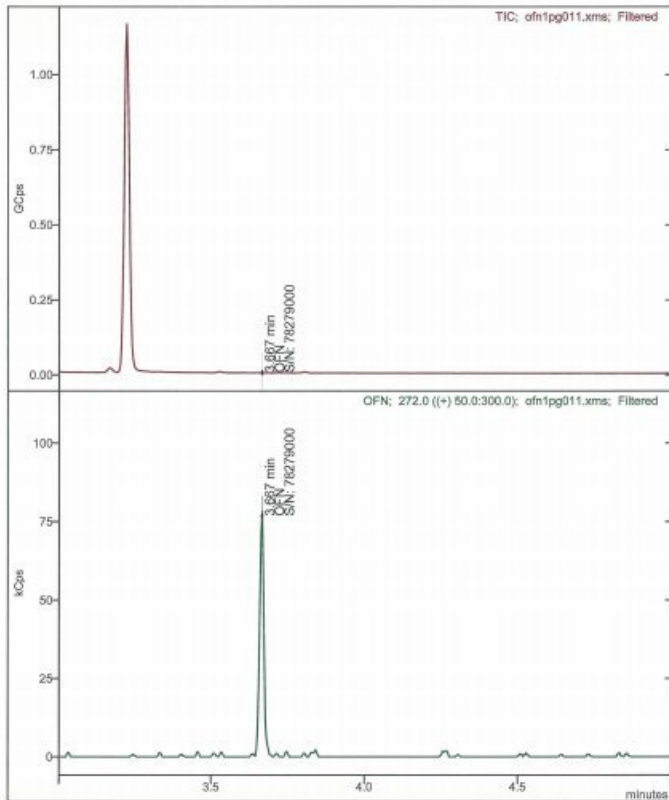
เอกสารไม่ควบคุม

Print Date: 19 May 2022 14:32:00

Chromatogram Plots

File: e:\tu\pm2022\oq\ofn1pg011.xmls
Sample: ofn1pg
Scan Range: 1 - 566 Time Range: 3.00 - 5.00 min.

Operator: TU
Date: 19/5/2565 13:03



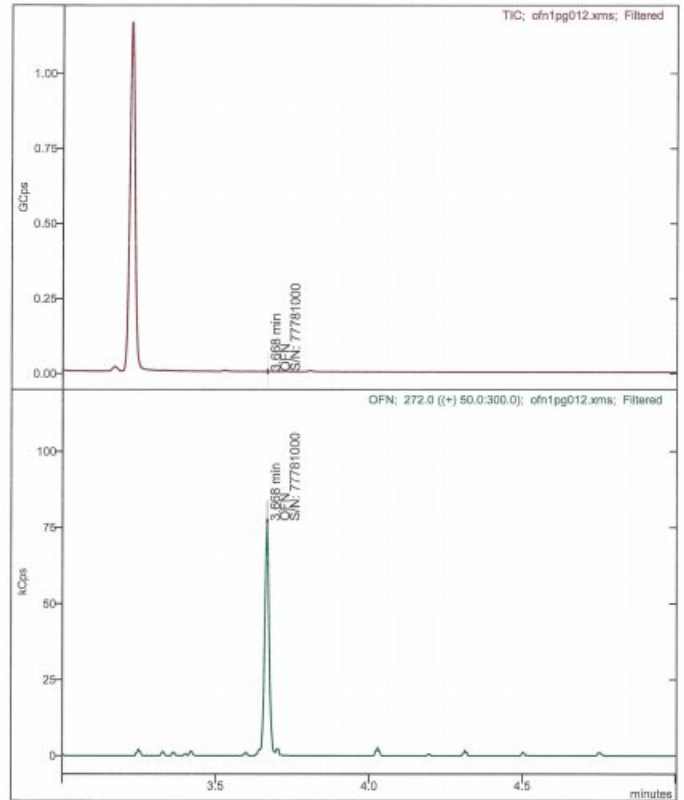
เอกสารไม่ควบคุม

Print Date: 19 May 2022 14:32:23

Chromatogram Plots

File: e:\tu\pm2022\oq\ofn1pg012.xmls
Sample: ofn1pg
Scan Range: 1 - 566 Time Range: 3.00 - 5.00 min.

Operator: TU
Date: 19/5/2565 13:16



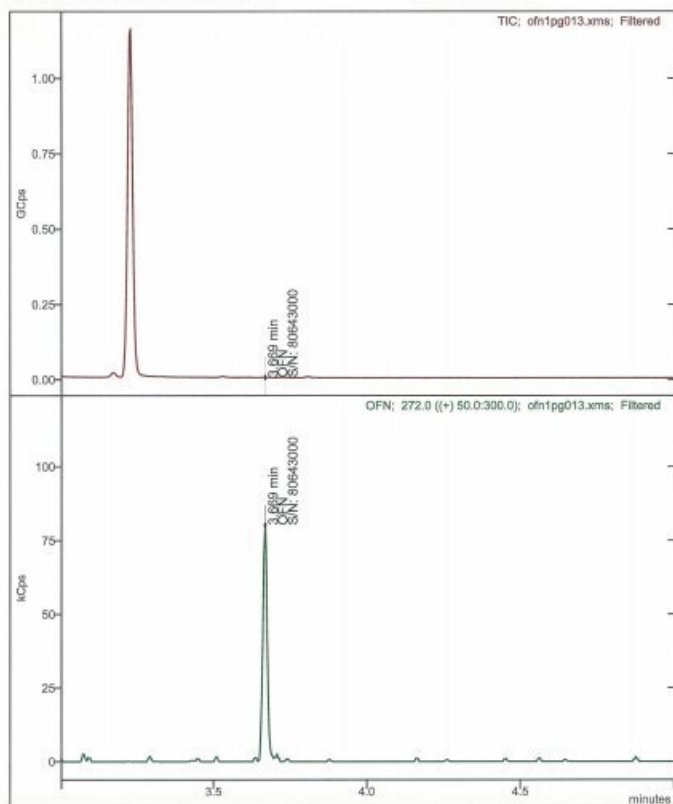
เอกสารไม่ควบคุม

Print Date: 19 May 2022 14:32:44

Chromatogram Plots

File: e:\tu\pm2022\oq\ofn1pg013.xms
Sample: ofn1pg
Scan Range: 1 - 566 Time Range: 3.00 - 5.00 min.

Operator: TU
Date: 19/5/2565 13:29



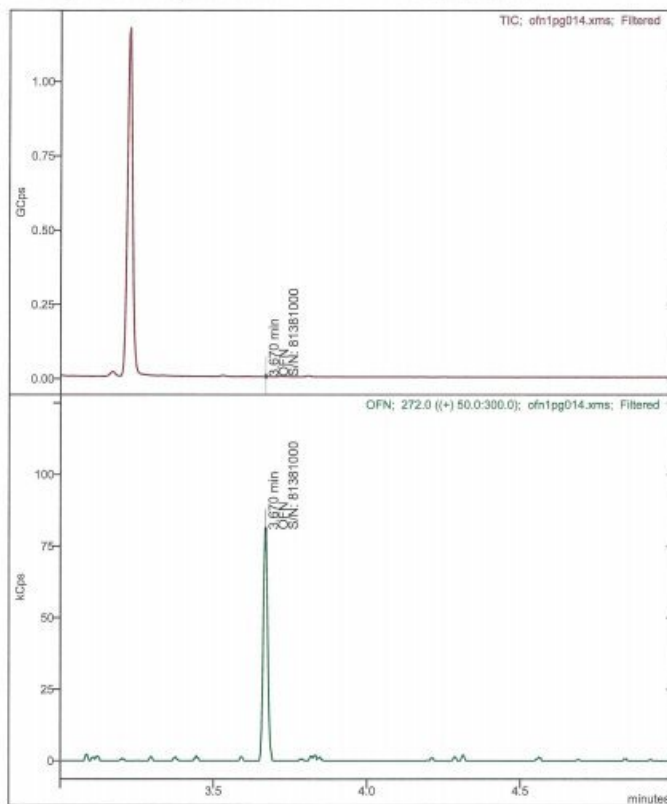
เอกสารไม่ควบคุม

Print Date: 19 May 2022 14:33:09

Chromatogram Plots

File: e:\tu\pm2022\oq\ofn1pg014.xms
Sample: ofn1pg
Scan Range: 1 - 565 Time Range: 3.00 - 5.00 min.

Operator: TU
Date: 19/5/2565 13:56



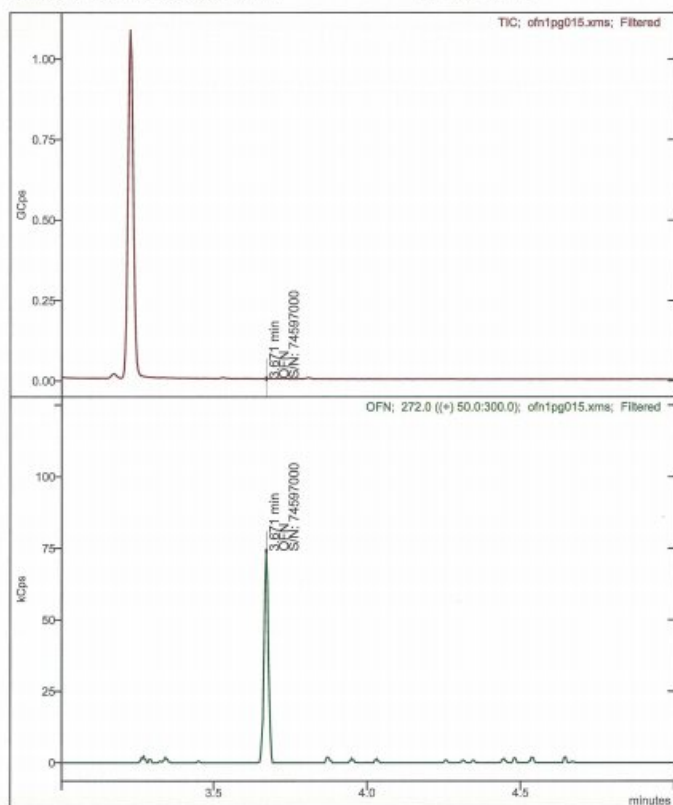
เอกสารไม่ควบคุม

Print Date: 19 May 2022 14:33:38

Chromatogram Plots

File: e:\tu\pm2022\oq\ofn1pg015.xms
Sample: ofn1pg
Scan Range: 1 - 566 Time Range: 3.00 - 5.00 min.

Operator: TU
Date: 19/5/2565 14:09



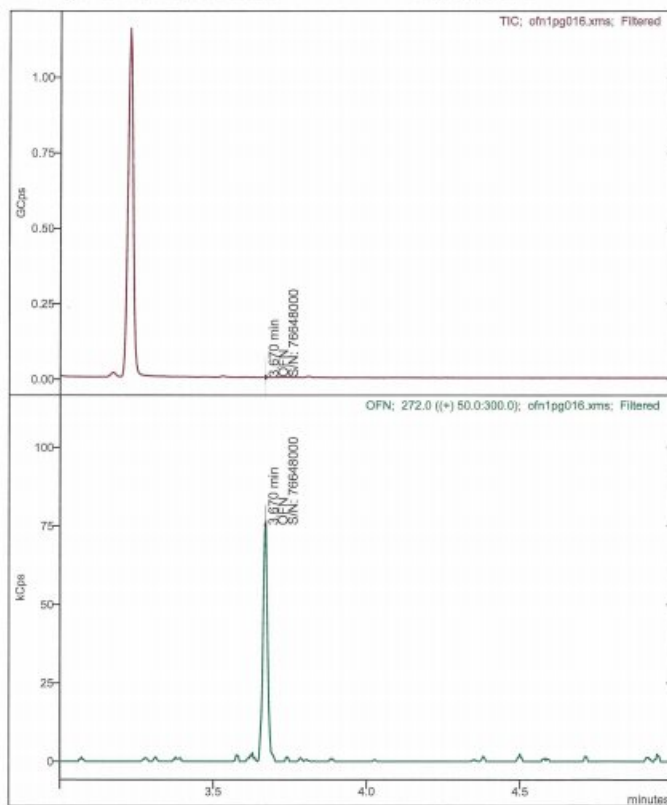
เอกสารไม่ควบคุม

Print Date: 19 May 2022 14:34:33

Chromatogram Plots

File: e:\tu\pm2022\oq\ofn1pg016.xms
Sample: ofn1pg
Scan Range: 1 - 566 Time Range: 3.00 - 5.00 min.

Operator: TU
Date: 19/5/2565 14:22

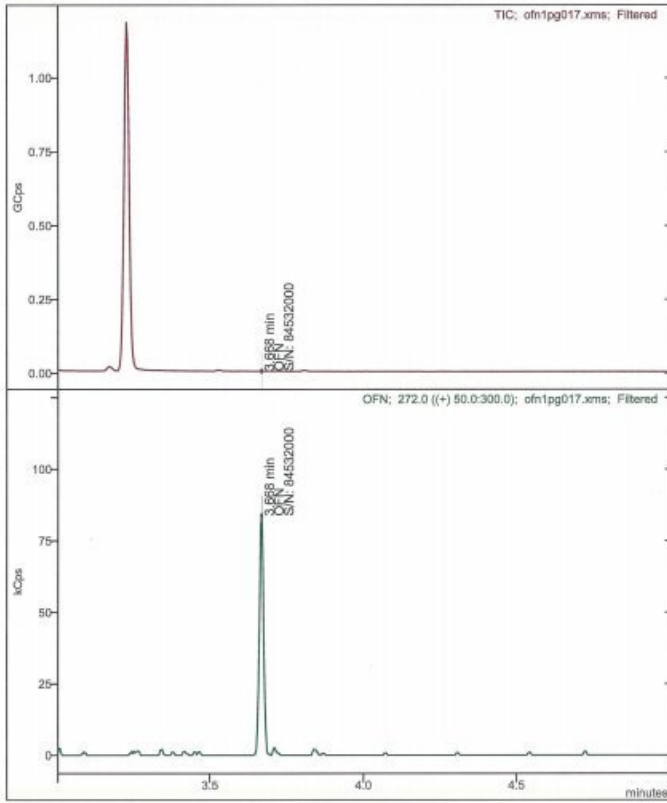


เอกสารไม่ควบคุม

Chromatogram Plots

File: e:\u\pm2022\o\ofn1pg017.xms
 Sample: ofn1pg
 Scan Range: 1 - 565 Time Range: 3.00 - 5.00 min.

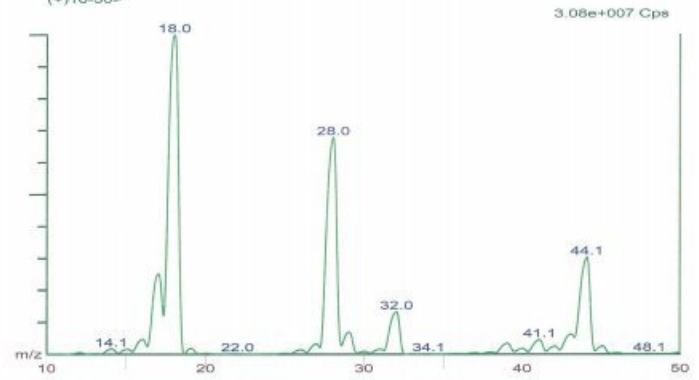
Operator: TU
 Date: 19/5/2565 14:37



เอกสารไม่ควบคุม

scan 267853 (15 scans) (Spentaged)
 Notes: EI, EDR On (1)
 Compounds: OFN
 (+)10-50>

Date: 19 MAY 22 9:17 AM



28 absolute size (cps)

- Normal < 9.0e7
- Measured 2.12e7

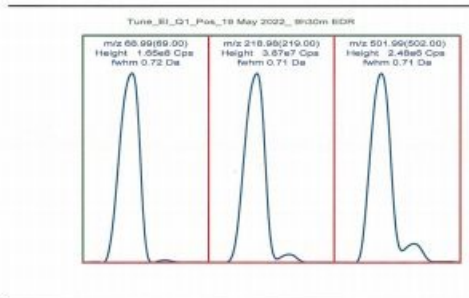
28/32 Ratio

- Normal < 2.8:1 or > 4.2:1
- Measured 5.3:1

28/18 Ratio

- Normal < 2.0:1
- Measured 0.7:1

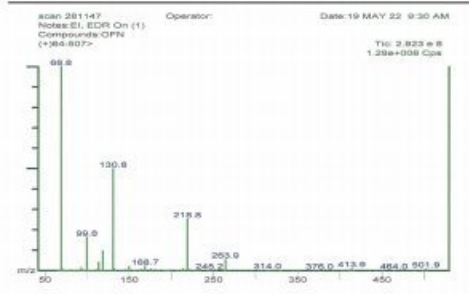
เอกสารไม่ควบคุม



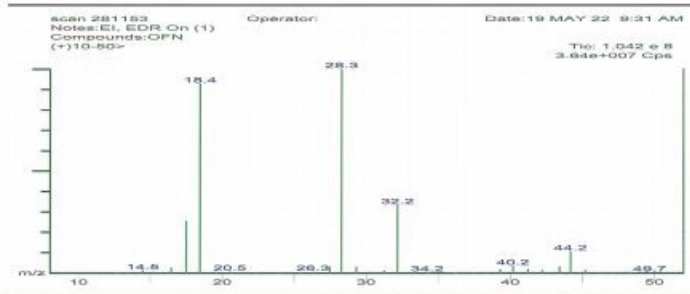
Instrument: SCION SQ
 Location:
 Operator:
 Date/Time: 19 May 2022 9:30:53

SCION Operational Qualification Protocol

Addendum Procedure: 1. Certificate Page Number: _____



EI
 Temperature 250C
 Filament 2
 Emission 40uA
 Electron Energy 69eV
 Q0 Helium On
 Transferline 250C
 Detector Max 1.78KV
 Repeller Max 23V



เอกสารไม่ควบคุม

Qualification Rep. Initials	<i>Sadun P.</i>	Reviewer Initials	QA/QC Initials
Date	19 MAY 22	Date	Date

เอกสารไม่ควบคุม

Operational Qualification Protocol Certification

for
SCION

with the serial number

GQS1203 F21has successfully completed all criteria for hardware Operational Qualification Protocol
as detailed in this document.

Scion Certified Engineer

SOMCHAI ROHTONGKAM

Name (please print)

Somchai P.

Signature

19 MAY 22

Date

Authorized Customer Representative

Name / Function (please print)

Signature

Date

Customer Address

United Analyst and Engineering Consultant Co.Ltd.

เอกสารไม่ควบคุม

Certificate of System Qualification

GC-02

System ID: GN1101010
Company Name: United Analyst and Engineering Consultant Co.Ltd.
System Location: 3 East Avenue #11 Suite 1101A, Bangkok, Bangkok, Thailand 10200
Date: Feb 11 2022 3:57:27 PM
FOP Name: Agilent System Qualification
LQ# Revision: GC-02.1
Overall Qualification Status: Pass

System Inspection and Basic Safety and Operation

Name: GC00
Setpoint Status: Pass

Overall System Inspection and Basic Safety and Operation Test Status

Pass

Inlet Pressure Decay

Name: GC00
Flow: 5SL
Setpoint Status: Pass
Pressure: 25.0 psi
Pressure Decay: 0.1 psi / 15 minutes
Agilent Recommended: ≤ 0.2 psi / 15 minutes

Overall Inlet Pressure Decay Test Status

Pass

Inlet Pressure Accuracy

Name: GC00
Flow: 5SL

Date: February 11 2022 3:57:27 PM
System ID: GC-02.001

Page 1 of 2

เอกสารไม่ควบคุม

Setpoint Status: Pass
Inlet Pressure: 25.0 psi
Accuracy: 0.1 psi
Agilent Recommended: ≤ 0.2 psi

Overall Inlet Pressure Accuracy Test Status

Pass

Detector Flow Accuracy

Name: 7890
Flow: 1.00 mL/min
Setpoint Status: Pass
Flow Type: Flow
Setpoint: 30.0 mL/min
Measured Flow: 30.1 mL/min
Accuracy: 0.1 mL/min
Agilent Recommended: ≤ 1.0 mL/min
Limit is percentage of setpoint or 0.5 mL/min, whichever is largest.

Setpoint Status: Pass
Flow Type: Flow
Setpoint: 400.0 mL/min
Measured Flow: 399.4 mL/min
Accuracy: 0.6 mL/min
Agilent Recommended: ≤ 1.0 mL/min
Limit is percentage of setpoint or 0.5 mL/min, whichever is largest.

Setpoint Status: Pass
Flow Type: Flow
Setpoint: 25.0 mL/min
Measured Flow: 24.8 mL/min
Accuracy: 0.2 mL/min
Agilent Recommended: ≤ 1.0 mL/min
Limit is percentage of setpoint or 0.5 mL/min, whichever is largest.

Date: February 11 2022 3:57:27 PM
System ID: GN1101010

Page 2 of 2

เอกสารไม่ควบคุม

Overall Detector Flow Accuracy Test Status

Pass

Detector Flow Accuracy

Name: 7890
Flow: 1.00 mL/min
Setpoint Status: Pass
Flow Type: Flow
Setpoint: 25.0 mL/min
Measured Flow: 24.8 mL/min
Accuracy: 0.2 mL/min
Agilent Recommended: ≤ 1.0 mL/min
Limit is percentage of setpoint or 0.5 mL/min, whichever is largest.

Overall Detector Flow Accuracy Test Status

Pass

GC Oven Temperature Accuracy

Name: 7890
Setpoint Status: Pass
Flow: Flow
Setpoint: 25.0 mL/min
Measured Flow: 24.8 mL/min
Accuracy: 0.2 mL/min
Agilent Recommended: ≤ 1.0 mL/min
Limit is percentage of setpoint or 0.5 mL/min, whichever is largest.

Setpoint Status: Pass
Flow: Flow
Setpoint: 25.0 mL/min
Measured Flow: 24.8 mL/min
Accuracy: 0.2 mL/min
Agilent Recommended: ≤ 1.0 mL/min
Limit is percentage of setpoint or 0.5 mL/min, whichever is largest.

Date: February 11 2022 3:57:27 PM
System ID: GN1101010

Page 1 of 2

เอกสารไม่ควบคุม

Overall GC Oven Temperature Accuracy Test Status

Pass

GC Oven Temperature Stability

Name: 759C

Setpoint Status: Pass

Temperature: 100.0 100.017 °C

Stability: 0.1 °C

Agilent Recommended: ≤ 0.5

Overall GC Oven Temperature Stability Test Status

Pass

Scouting Run

Tested Combination1 Front SSL / Back FID

Name: Injection Tower

Setpoint Status: Completed

Injection Volume on Column: 0.3 µL

Overall Scouting Run Status

Conclusion: Pass

Noise and Drift

Tested Combination1 Front SSL / Back FID

Name: 7893

Setpoint Status: Pass

Signal to Noise: 784901

Agilent Recommended: ≥ 300000

Overall Signal to Noise Test Status

Pass

Date: February 11, 2022 3:57:27 PM

System ID: CN1021007

เอกสารไม่ควบคุม

Setpoint Status: Pass

Base Signal: 11.2 pA

ASTM Noise: 0.06 pA

Drift: 0.31 pA/hr

Agilent Recommended: ≤ 0.10

Status: Pass

Overall Noise and Drift Test Status

Pass

Injection Precision

Tested Combination1 Front SSL / Back FID

Name: 7883A

Setpoint Status: Pass

Injection Volume on Column: 1.0 µL

Area RSD: 0.38 %

Retention Time RSD: 0.65 %

Agilent Recommended: ≤ 3.00

Overall Injection Precision Test Status

Pass

Signal to Noise

Tested Combination1 Front SSL / Back FID

Name: Injection Tower

Setpoint Status: Pass

Signal to Noise: 784901

Agilent Recommended: ≥ 300000

Overall Signal to Noise Test Status

Pass

Date: February 11, 2022 3:57:27 PM

System ID: CN1021007

เอกสารไม่ควบคุม

Scouting Run

Tested Combination2 Front SSL / Front UECD

Name: 7893

Setpoint Status: Completed

Injection Volume on Column: 0.3 µL

Overall Scouting Run Status

Conclusion: Pass

Noise and Drift

Tested Combination2 Front SSL / Front UECD

Name: 7893

Setpoint Status: Pass

Base Signal: 232.3

ASTM Noise: 0.02

Drift: 15.19

Agilent Recommended: ≤ 3.00

Status: Pass

Overall Noise and Drift Test Status

Pass

Injection Precision

Tested Combination2 Front SSL / Front UECD

Name: 7883A

Setpoint Status: Pass

Injection Volume on Column: 1.0 µL

Area RSD: 0.38 %

Retention Time RSD: 0.65 %

Agilent Recommended: ≤ 3.00

Overall Injection Precision Test Status

Pass

Date: February 11, 2022 3:57:27 PM

System ID: CN1021007

เอกสารไม่ควบคุม

Setpoint Status: Pass

Injection Volume on Column: 1.0 µL

Area RSD: 0.14 %

Retention Time RSD: 0.34 %

Agilent Recommended: ≤ 3.00

Overall Injection Precision Test Status

Pass

Signal to Noise

Tested Combination2 Front SSL / Front UECD

Name: Injection Tower

Setpoint Status: Pass

Signal to Noise: 2250

Agilent Recommended: ≥ 1500

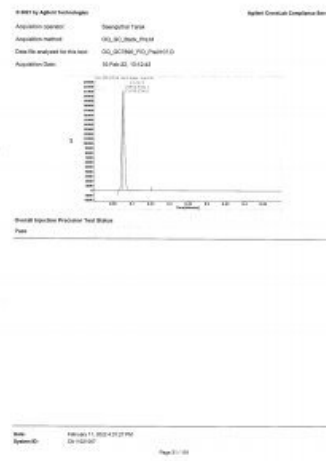
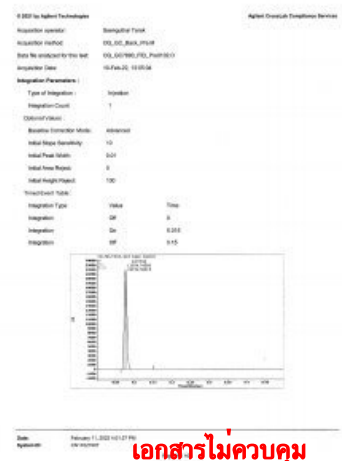
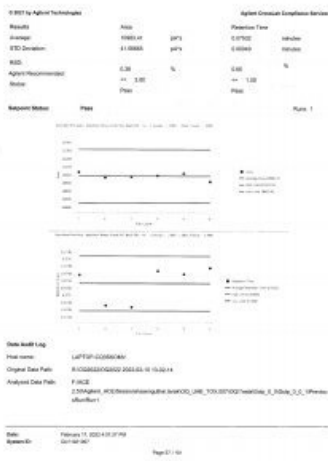
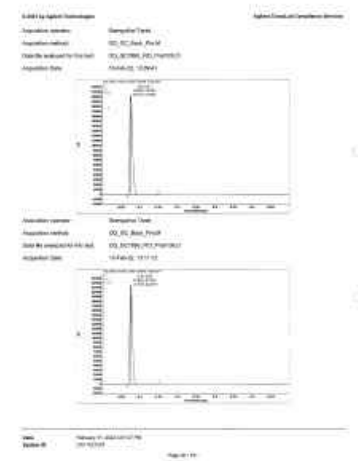
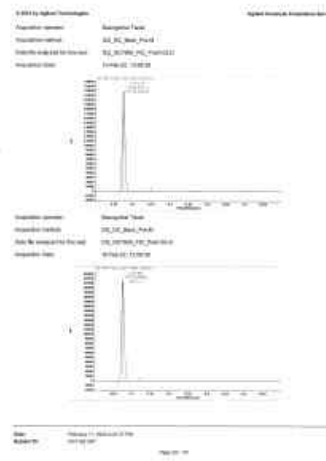
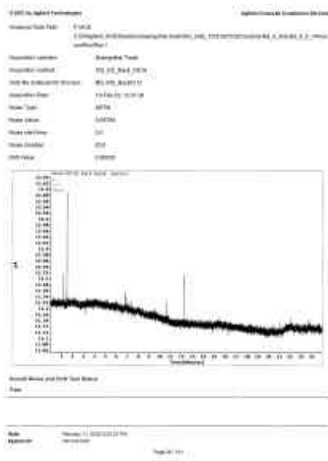
Overall Signal to Noise Test Status

Pass

Date: February 11, 2022 3:57:27 PM

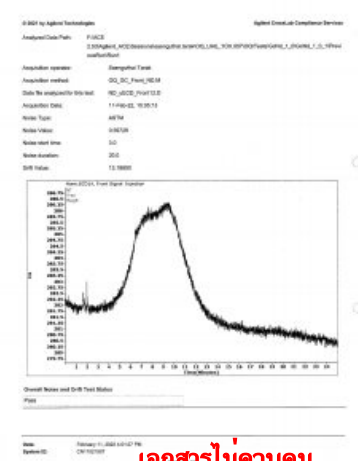
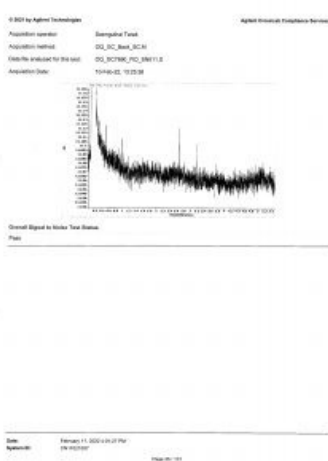
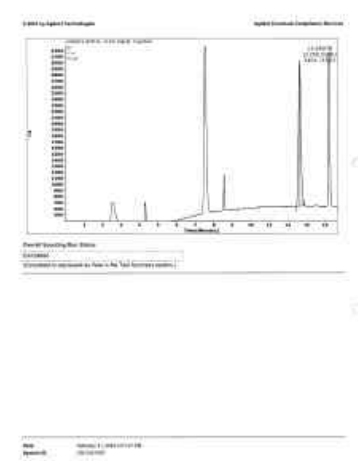
System ID: CN1021007

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เอกสารไม่ควบคุม

เอกสารไม่ควบคุม



เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Setpoint Status: Pass

Setpoint Allowance:

Temperature Limit: 100.0 100.4388 100

Stability: 0.5 10

Agilent Recommended: 0.5 0.5

Overall GC Oven Temperature Stability Test Status

Pass

Scouting Run

Tested Combination 1: Front BSL 1 Back FID

Name: 78304

Setpoint Status: Completed

Injection Volume on Column: 10 0

Mode: P Mode

Overall Scouting Run Status

Completed

Noise and Drift

Tested Combination 1: Front BSL 1 Back FID

Name: 78304

Setpoint Status: Pass

Mode: P Mode

Base Signal: 10.0 10.0

ASTM Noise: 0.0

DL: 0.0

DUHF: 0.0

Agilent Recommended: 0.0 0.0

Signal: Pass Peak

Date: Apr 12, 2022 2:52 PM

System ID: CH13112347

เอกสารไม่ควบคุม

Page 1 of 1

Overall Noise and Drift Test Status

Pass

Injection Precision

Tested Combination 1: Front BSL 1 Back FID

Name: 78304

Setpoint Status: Pass

Injection Volume on Column: 10 0

Mode: P Mode

Area RSD: 0.68 % Retention Time RSD: 0.02 %

Agilent Recommended: 0.5 0.0

Overall Injection Precision Test Status

Pass

Signal to Noise

Tested Combination 1: Front BSL 1 Back FID

Name: 78304

Mode: P Mode

Setpoint Status: Pass

Signal to Noise: 11029

Agilent Recommended: 0.5 2000

Overall Signal to Noise Test Status

Pass

Scouting Run

Tested Combination 2: Front BSL 1 Back FID

Name: 78304

Date: Apr 12, 2022 2:52 PM

System ID: CH13112347

เอกสารไม่ควบคุม

Page 2 of 2

Setpoint Status: Completed

Injection Volume on Column: 10 0

Overall Scouting Run Status

Completed

Noise and Drift

Tested Combination 1: Front BSL 1 Back FID

Name: 78304

Setpoint Status: Pass

Base Signal: 20.0 0.0

ASTM Noise: 0.0

DL: 0.0

DUHF: 0.0

Agilent Recommended: 0.0 0.0

Signal: Pass Peak

Overall Noise and Drift Test Status

Pass

Injection Precision

Tested Combination 2: Front BSL 1 Back FID

Name: 78304

Setpoint Status: Pass

Injection Volume on Column: 10 0

Area RSD: 0.64 % Retention Time RSD: 0.24 %

Agilent Recommended: 0.5 0.0

Overall Injection Precision Test Status

Pass

Signal to Noise

Date: Apr 12, 2022 2:52 PM

System ID: CH13112347

เอกสารไม่ควบคุม

Page 1 of 2

Tested Combination 2: Front BSL 1 Back FID

Name: 78304

Injection Volume on Column: 10 0

Mode: P Mode

Setpoint Status: Pass

Signal to Noise: 501845

Agilent Recommended: 0.5 20000

Overall Signal to Noise Test Status

Pass

Date: Apr 12, 2022 2:52 PM

System ID: CH13112347

เอกสารไม่ควบคุม

Page 2 of 2

Instrument Details

5. 结论

This article does not discuss a religious tradition.

Details

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Enthalpy: 6.171, 1.771, 1.771, 1.771, 1.771
System ID: CH₂CH₂CH₂

เอกสารไม่ควบคุม

27

Camp of A

Vendor/Line	Agilent Technologies
Type	Trace
Name	7890A
Model Number	64611A
Serial Number	CN1346199
Dimensions (mm)	A:10 x B:
Weight (kg)	Not installed
Hardware 1	
Manufacturer	Agilent Technologies
Name	7890
Model Number	65440B
Serial Number	CN1313461
Dimensions (mm)	5.20 (5.2
Color Type	Black/GR
F12:	
Manufacturer	Agilent Technologies
Name	7890
Type	SS
Labeler	ONE
Center/Ges	4400
Control Type	Electronics/Software Control (EPIC
Package Size	Yes
Detector 1	
Manufacturer	Agilent Technologies
Name	7890
Type	FID
Adapter	Capillary
Control Type	Software/Software Control (EPIC
Labeler	ONE
Detector Size	4400

From: Andreas.Lindner@univie.ac.at
 Subject: [PATCH] 2007-01-15: Fix

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Page: 10 of 21

Electronic Signature

P41EC25

The document was prepared on a standard computer and the AGE sign-off action was checked, which is valid for the entire main menu returning statements. The AGE sign-off action is signed and stamped with a dated identification on a document, if the user wants to return a statement. The AGE representative has also provided the same information on the main menu and local status of the document. If the user has not signed the document, the AGE representative has a unique sign-off action in the AGE and it is automatically signed by the document. (This document is not required to be a document, using a Document Content Management or other electronic methods, either in a document process or control system.)

Limitations

Full Name of Signer	Seung-Ho Park
Upper Of The Name	seung_ho.park@ncl.com
Signature Creation Date:	April 2, 2022
Reason in Signer is	Execute protocol and published this original version of document

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Warranty

As a result, to agree makes no sense, if it is due to the reason, that the rule is not valid. The reason cannot be a condition of validity and thus is not a part of the reasons. If the rule is not valid, it is not a rule and thus is not a condition of validity. If the rule is not valid, it is not a rule and thus is not a condition of validity. If the rule is not valid, it is not a rule and thus is not a condition of validity.

Date: Apr 12 2022 03:55 PM
Version: 1.0

เอกสารไม่ควบคุม

8888-22-1-0000

User Name: admin@flowtech.com				Report ID: RPT-2024-001	
Report Title: Q3 2024 Project Performance Analysis				Generated Date: 2024-09-28 10:30 AM	
Overall Summary: This report provides a comprehensive overview of project performance across various departments and projects for the third quarter of 2024.					
Time	Department	Project Name	Status	Assigned To	Updated Information
2024-09-01 08:00:00 AM	Admin	Task Completed	Success	John Doe	
2024-09-05 10:30:00 AM	Team A	Project Alpha	In Progress	Jane Smith	
2024-09-10 14:15:00 PM	Team B	Task Beta	Warning	Mike Johnson	Task Beta requires urgent attention. Review status with client.
2024-09-15 09:45:00 AM	Team C	Project Gamma	Success	Sarah Lee	Completed successfully. Review feedback from client. Next steps: Review Project Delta progress. Monitor Project Beta status. Update Project Gamma timeline.
2024-09-20 11:00:00 AM	Team D	Task Delta	Success	David Kim	
2024-09-25 16:30:00 PM	Team E	Project Epsilon	On Hold	Emily White	System integration and testing. Review progress with stakeholders. Re-evaluate timeline.
2024-09-28 12:00:00 PM	Team F	Task Epsilon	Success	Frank Green	Project Epsilon completed. Review feedback from client. Next steps: Review Project Zeta progress. Monitor Project Epsilon status. Update Project Epsilon timeline.
2024-09-30 15:00:00 PM	Team G	Project Zeta	On Hold	Grace Brown	Task Zeta requires urgent attention. Review status with client. Next steps: Review Project Eta progress. Monitor Project Zeta status. Update Project Zeta timeline.
2024-10-01 08:00:00 AM	Team H	Task Zeta	Success	Henry Black	Task Zeta completed. Review feedback from client. Next steps: Review Project Theta progress. Monitor Project Zeta status. Update Project Zeta timeline.
2024-10-05 10:30:00 AM	Team I	Project Theta	In Progress	Ivy White	

Date: 4-4-77 20:22:35 PM
Session ID: 00000000000000000000000000000000

เอกสารไม่ควบคุม

9-00000

[illegible]

Date: Apr 12, 2022 2:32: 5 PM
System ID: C:\191130*

เอกสารไม่ควบคุม

92H '4' 2'

New York University			Student ID: 123456789	
Registration ID: NYU-REG-2023-001			Enrollment Status: Active	
NYU Student Information				
Date	Transaction Date	Activity Performed	Type of Transaction	Optional Information
2023-09-01 09:30:15 AM	2023-09-01	Enroll	Admission to Undergraduate School of Arts and Sciences	Admission to Undergraduate School of Arts and Sciences
2023-09-01 10:45:30 AM	2023-09-01	Enroll	Enrollment in General Education Course	Enrollment in General Education Course
2023-09-01 11:00:00 AM	2023-09-01	Enroll	Enrollment in Major Course	Enrollment in Major Course
2023-09-01 11:15:00 AM	2023-09-01	Enroll	Enrollment in Minor Course	Enrollment in Minor Course
2023-09-01 11:30:00 AM	2023-09-01	Enroll	Enrollment in Language Course	Enrollment in Language Course
2023-09-01 11:45:00 AM	2023-09-01	Enroll	Enrollment in Elective Course	Enrollment in Elective Course
2023-09-01 12:00:00 PM	2023-09-01	Enroll	Enrollment in Honors Course	Enrollment in Honors Course
2023-09-01 12:15:00 PM	2023-09-01	Enroll	Enrollment in Internship Course	Enrollment in Internship Course
2023-09-01 12:30:00 PM	2023-09-01	Enroll	Enrollment in Study Abroad Course	Enrollment in Study Abroad Course
2023-09-01 12:45:00 PM	2023-09-01	Enroll	Enrollment in Research Course	Enrollment in Research Course
2023-09-01 13:00:00 PM	2023-09-01	Enroll	Enrollment in Capstone Course	Enrollment in Capstone Course
2023-09-01 13:15:00 PM	2023-09-01	Enroll	Enrollment in Thesis Course	Enrollment in Thesis Course
2023-09-01 13:30:00 PM	2023-09-01	Enroll	Enrollment in Dissertation Course	Enrollment in Dissertation Course
2023-09-01 13:45:00 PM	2023-09-01	Enroll	Enrollment in Postgraduate Course	Enrollment in Postgraduate Course
2023-09-01 14:00:00 PM	2023-09-01	Enroll	Enrollment in Certificate Course	Enrollment in Certificate Course
2023-09-01 14:15:00 PM	2023-09-01	Enroll	Enrollment in Diploma Course	Enrollment in Diploma Course
2023-09-01 14:30:00 PM	2023-09-01	Enroll	Enrollment in Degree Course	Enrollment in Degree Course
2023-09-01 14:45:00 PM	2023-09-01	Enroll	Enrollment in Honorary Course	Enrollment in Honorary Course
2023-09-01 15:00:00 PM	2023-09-01	Enroll	Enrollment in Special Course	Enrollment in Special Course
2023-09-01 15:15:00 PM	2023-09-01	Enroll	Enrollment in Guest Course	Enrollment in Guest Course
2023-09-01 15:30:00 PM	2023-09-01	Enroll	Enrollment in Exchange Course	Enrollment in Exchange Course
2023-09-01 15:45:00 PM	2023-09-01	Enroll	Enrollment in Joint Course	Enrollment in Joint Course
2023-09-01 16:00:00 PM	2023-09-01	Enroll	Enrollment in Dual Course	Enrollment in Dual Course
2023-09-01 16:15:00 PM	2023-09-01	Enroll	Enrollment in Double Course	Enrollment in Double Course
2023-09-01 16:30:00 PM	2023-09-01	Enroll	Enrollment in Triple Course	Enrollment in Triple Course
2023-09-01 16:45:00 PM	2023-09-01	Enroll	Enrollment in Quadruple Course	Enrollment in Quadruple Course
2023-09-01 17:00:00 PM	2023-09-01	Enroll	Enrollment in Quintuple Course	Enrollment in Quintuple Course
2023-09-01 17:15:00 PM	2023-09-01	Enroll	Enrollment in Sextuple Course	Enrollment in Sextuple Course
2023-09-01 17:30:00 PM	2023-09-01	Enroll	Enrollment in Septuple Course	Enrollment in Septuple Course
2023-09-01 17:45:00 PM	2023-09-01	Enroll	Enrollment in Octuple Course	Enrollment in Octuple Course
2023-09-01 18:00:00 PM	2023-09-01	Enroll	Enrollment in Undecuple Course	Enrollment in Undecuple Course
2023-09-01 18:15:00 PM	2023-09-01	Enroll	Enrollment in Duodeuple Course	Enrollment in Duodeuple Course
2023-09-01 18:30:00 PM	2023-09-01	Enroll	Enrollment in Tredecuple Course	Enrollment in Tredecuple Course
2023-09-01 18:45:00 PM	2023-09-01	Enroll	Enrollment in Quatuordecuple Course	Enrollment in Quatuordecuple Course
2023-09-01 19:00:00 PM	2023-09-01	Enroll	Enrollment in Quindecuple Course	Enrollment in Quindecuple Course
2023-09-01 19:15:00 PM	2023-09-01	Enroll	Enrollment in Sexdecuple Course	Enrollment in Sexdecuple Course
2023-09-01 19:30:00 PM	2023-09-01	Enroll	Enrollment in Septuaginta Course	Enrollment in Septuaginta Course
2023-09-01 19:45:00 PM	2023-09-01	Enroll	Enrollment in Octoginta Course	Enrollment in Octoginta Course
2023-09-01 20:00:00 PM	2023-09-01	Enroll	Enrollment in Nonaginta Course	Enrollment in Nonaginta Course
2023-09-01 20:15:00 PM	2023-09-01	Enroll	Enrollment in Centesima Course	Enrollment in Centesima Course
2023-09-01 20:30:00 PM	2023-09-01	Enroll	Enrollment in Centesima Course	Enrollment in Centesima Course
2023-09-01 20:45:00 PM	2023-09-01	Enroll	Enrollment in Centesima Course	Enrollment in Centesima Course
2023-09-01 21:00:00 PM	2023-09-01	Enroll	Enrollment in Centesima Course	Enrollment in Centesima Course
2023-09-01 21:15:00 PM	2023-09-01	Enroll	Enrollment in Centesima Course	Enrollment in Centesima Course
2023-09-01 21:30:00 PM	2023-09-01	Enroll	Enrollment in Centesima Course	Enrollment in Centesima Course
2023-09-01 21:45:00 PM	2023-09-01	Enroll	Enrollment in Centesima Course	Enrollment in Centesima Course
2023-09-01 22:00:00 PM	2023-09-01	Enroll	Enrollment in Centesima Course	Enrollment in Centesima Course
2023-09-01 22:15:00 PM	2023-09-01	Enroll	Enrollment in Centesima Course	Enrollment in Centesima Course
2023-09-01 22:30:00 PM	2023			

Date: 1/11/2025 10:02:10 AM
System D: C:\N1\11\2025

เอกสารไม่ควบคุม

1999

[illegible]

Date: April 20, 2022 2:52:10 PM
 Session ID: CH13-1375

เอกสารไม่ควบคุม

2000

[illegible]

Date	Apr 12, 2022 2:55:15 PM
Filename	CS1111087

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1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032, 2033, 2034, 2035, 2036, 2037, 2038, 2039, 2040, 2041, 2042, 2043, 2044, 2045, 2046, 2047, 2048, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2058, 2059, 2060, 2061, 2062, 2063, 2064, 2065, 2066, 2067, 2068, 2069, 2070, 2071, 2072, 2073, 2074, 2075, 2076, 2077, 2078, 2079, 2080, 2081, 2082, 2083, 2084, 2085, 2086, 2087, 2088, 2089, 2090, 2091, 2092, 2093, 2094, 2095, 2096, 2097, 2098, 2099, 2100, 2101, 2102, 2103, 2104, 2105, 2106, 2107, 2108, 2109, 2110, 2111, 2112, 2113, 2114, 2115, 2116, 2117, 2118, 2119, 2120, 2121, 2122, 2123, 2124, 2125, 2126, 2127, 2128, 2129, 2130, 2131, 2132, 2133, 2134, 2135, 2136, 2137, 2138, 2139, 2140, 2141, 2142, 2143, 2144, 2145, 2146, 2147, 2148, 2149, 2150, 2151, 2152, 2153, 2154, 2155, 2156, 2157, 2158, 2159, 2160, 2161, 2162, 2163, 2164, 2165, 2166, 2167, 2168, 2169, 2170, 2171, 2172, 2173, 2174, 2175, 2176, 2177, 2178, 2179, 2180, 2181, 2182, 2183, 2184, 2185, 2186, 2187, 2188, 2189, 2190, 2191, 2192, 2193, 2194, 2195, 2196, 2197, 2198, 2199, 2200, 2201, 2202, 2203, 2204, 2205, 2206, 2207, 2208, 2209, 2210, 2211, 2212, 2213, 2214, 2215, 2216, 2217, 2218, 2219, 2220, 2221, 2222, 2223, 2224, 2225, 2226, 2227, 2228, 2229, 2230, 2231, 2232, 2233, 2234, 2235, 2236, 2237, 2238, 2239, 2240, 2241, 2242, 2243, 2244, 2245, 2246, 2247, 2248, 2249, 2250, 2251, 2252, 2253, 2254, 2255, 2256, 2257, 2258, 2259, 2260, 2261, 2262, 2263, 2264, 2265, 2266, 2267, 2268, 2269, 2270, 2271, 2272, 2273, 2274, 2275, 2276, 2277, 2278, 2279, 2280, 2281, 2282, 2283, 2284, 2285, 2286, 2287, 2288, 2289, 2290, 2291, 2292, 2293, 2294, 2295, 2296, 2297, 2298, 2299, 2300, 2301, 2302, 2303, 2304, 2305, 2306, 2307, 2308, 2309, 2310, 2311, 2312, 2313, 2314, 2315, 2316, 2317, 2318, 2319, 2320, 2321, 2322, 2323, 2324, 2325, 2326, 2327, 2328, 2329, 2330, 2331, 2332, 2333, 2334, 2335, 2336, 2337, 2338, 2339, 2340, 2341, 2342, 2343, 2344, 2345, 2346, 2347, 2348, 2349, 2350, 2351, 2352, 2353, 2354, 2355, 2356, 2357, 2358, 2359, 2360, 2361, 2362, 2363, 2364, 2365, 2366, 2367, 2368, 2369, 2370, 2371, 2372, 2373, 2374, 2375, 2376, 2377, 2378, 2379, 2380, 2381, 2382, 2383, 2384, 2385, 2386, 2387, 2388, 2389, 2390, 2391, 2392, 2393, 2394, 2395, 2396, 2397, 2398, 2399, 2400, 2401, 2402, 2403, 2404, 2405, 2406, 2407, 2408, 2409, 2410, 2411, 2412, 2413, 2414, 2415, 2416, 2417, 2418, 2419, 2420, 2421, 2422, 2423, 2424, 2425, 2426, 2427, 2428, 2429, 2430, 2431, 2432, 2433, 2434, 2435, 2436, 2437, 2438, 2439, 2440, 2441, 2442, 2443, 2444, 2445, 2446, 2447, 2448, 2449, 2450, 2451, 2452, 2453, 2454, 2455, 2456, 2457, 2458, 2459, 2460, 2461, 2462, 2463, 2464, 2465, 2466, 2467, 2468, 2469, 2470, 2471, 2472, 2473, 2474, 2475, 2476, 2477, 2478, 2479, 2480, 2481, 2482, 2483, 2484, 2485, 2486, 2487, 2488, 2489, 2490, 2491, 2492, 2493, 2494, 2495, 2496, 2497, 2498, 2499, 2500, 2501, 2502, 2503, 2504, 2505, 2506, 2507, 2508, 2509, 2510, 2511, 2512, 2513, 2514, 2515, 2516, 2517, 2518, 2519, 2520, 2521, 2522, 2523, 2524, 2525, 2526, 2527, 2528, 2529, 2530, 2531, 2532, 2533, 2534, 2535, 2536, 2537, 2538, 2539, 2540, 2541, 2542, 2543, 2544, 2545, 2546, 2547, 2548, 2549, 2550, 2551, 2552, 2553, 2554, 2555, 2556, 2557, 2558, 2559, 2560, 2561, 2562, 2563, 2564, 2565, 2566, 2567, 2568, 2569, 2570, 2571, 2572, 2573, 2574, 2575, 2576, 2577, 2578, 2579, 2580, 2581, 2582, 2583, 2584, 2585, 2586, 2587, 2588, 2589, 2590, 2591, 2592, 2593, 2594, 2595, 2596, 2597, 2598, 2599, 2600, 2601, 2602, 2603, 2604, 2605, 2606, 2607, 2608, 2609, 2610, 2611, 2612, 2613, 2614, 2615, 2616, 2617, 2618, 2619, 2620, 2621, 2622, 2623, 2624, 2625, 2626, 2627, 2628, 2629, 2630, 2631, 2632, 2633, 2634, 2635, 2636, 2637, 2638, 2639, 2640, 2641, 2642, 2643, 2644, 2645, 2646, 2647, 2648, 2649, 2650, 2651, 2652, 2653, 2654, 2655, 2656, 2657, 2658, 2659, 2660, 2661, 2662, 2663, 2664, 2665, 2666, 2667, 2668, 2669, 2670, 2671, 2672, 2673, 2674, 2675, 2676

[illegible]

Date: Jun 22, 2022 2:32:10 PM
Session ID: CH-3a-3021

เอกสารไม่ควบคุม

[illegible][illegible]

Date: April 15, 2025 2:35 PM
Session ID: CH 74 2024

เอกสารไม่ควบคุม

21-4 '5 '21

[illegible]

Urtic	$\phi_{\text{pr}} = 2.20 \times 10^{-2} \text{ s}^{-1} \text{ m}^{-1}$
Swelling (Dr)	1.835 (30%)

เอกสารไม่ควบคุม

2025.03.21

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

Agilent Preventive Maintenance provides factory recommended service for your Agilent GC. It is to assure reliable operation and the accuracy of your results.

Performed only by trained and certified service engineers using genuine Agilent parts and supplies, Agilent Preventive Maintenance provides everything you need to reduce GC 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.

Date: _____
System ID: _____

เอกสารไม่ควบคุม

Page 2 of 7

เอกสารไม่ควบคุม

Agilent 7890 GC Preventive Maintenance Checklist

Introduction

Customer Information

- Customers should provide all necessary operating supplies upon request of the engineer.
- A customer representative will be available to the engineer while performing the preventive maintenance procedures.
- Any signs, not indicated in the Parts Lists section of this document, are not part of the Agilent 7890 GC Preventive Maintenance service, nor are they included in the fee of this service.
- If a system requires the use of test data 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

- To view information about Agilent Technologies services, please visit our website using the following URL: <http://www.agilent.com>. Product literature and documentation can be downloaded.
- The Agilent Community is an excellent place to get advice, ask questions, and share about applications and Agilent products. Find it deeply engaging and relevant to Agilent technologies. Visit it frequently to make sure you are up to date.
- To access Agilent University, visit <http://www.agilent.com/learning> 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. It includes short videos on maintenance, quick access to manuals for new instruments, and other valuable information. Check out the Resource Requester: <http://www.agilent.com/learning> website.
- Need technical support? FAQs, eSolutions, or our Support Home page: <http://www.agilent.com/support>.
- Videos about accreditation requirements for your instrument can be found by searching the Agilent YouTube channel at: <https://www.youtube.com/user/agilent>.
- 7890B Manuals are also available on Agilent.com:
 - Safety: http://www.agilent.com/chem/library.com/manuals/public/7890B_Safety.pdf
 - Installation and First Startup: http://www.agilent.com/chem/library.com/manuals/public/7890B_Installation.pdf
 - Operation Manual: http://www.agilent.com/chem/library.com/manuals/public/7890B_Operation.pdf
 - Maintaining Your GC: http://www.agilent.com/chem/library.com/manuals/public/7890B_MaintainingYourGC.pdf

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Agilent 7890 GC Preventive Maintenance Checklist

Service Engineer's Responsibilities

- Contact the customer and ensure that all necessary supplies are available before the preventive maintenance visit.
- Only collect those degrees of data related to the system or module being serviced.
- Complete data fields with the relevant information.
- Complete all relevant checkboxes in the checklist and enter a "Y" or tick mark "✓".
- Check "Section not applicable" check boxes to indicate any checkboxes 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 holds 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 signatures.

Additional Instruction Notes

- Check for any active service notes for this GC. If there are any applicable "Safety" or "Modification Required" Service notes, print and implement the changes on a sign before doing any on-site work.
- Do not implement any software updates, unless you get approval from the customer and are sure they are compatible with the instrument control software.

เอกสารไม่ควบคุม

System Information

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

Instrument System Name and ID	Q7890B	CN13113001
Instrument System Site and Location	VAE	Instrument room

List System Component Product Numbers	List the Serial Numbers of each Component
1. 094405	CN13113001
2. 64519A	CN13260018
3. 64914A	CN13200169
4.	
5.	
6.	
7.	
8.	
9.	
10.	

Preparation

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

Revision: 2.01, Issued: September 15, 2021
 Agile Document Number: D0013618
 DE number: 44166.759722222
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Page 4 of 9

เอกสารไม่ควบคุม

Preventive Maintenance Procedure

Clean and inspect GC

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

Inlet and detector consumable replacement

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

Zero Sensors and Leak test

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

Revision: 2.01, Issued: September 15, 2021
 Agile Document Number: D0013618
 DE number: 44166.759722222
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Page 5 of 9

เอกสารไม่ควบคุม

A.I.S Maintenance

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

Restore Instrument

- ☒ Restore the normal operating conditions or a different method using the state system.
- ☒ Purge the system with carrier flow for 15 minutes.
- ☒ Take out the system, then restore the normal operating conditions.
- ☒ After applying all updates, record the last 20 detector signal output values. Raw data should be similar to those from the detector outputs recorded prior to PM.
- ☒ Perform a detector check. If it is in a routine PM, inject the customer's sample using the A.I.S. syringe. This is not a final checkout or set for the A.I.S. and the GC.

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

Revision: 2.01, Issued: September 15, 2021
 Agile Document Number: D0013618
 DE number: 44166.759722222
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Page 6 of 9

เอกสารไม่ควบคุม

Signature Page

Service Review

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

7890 GC Test Results Table

Detector Signal Outputs	Before PM Service	After PM Service
Front detector output	N/A	21.6
Back detector output	N/A	12.4
AUX detector output	N/A	N/A
Pressure decay test	Expected test result	Actual test result
Front inlet pressure decay test	Pass	Pass
Back inlet pressure decay test	Pass	N/A

Revision: 2.01, Issued: September 15, 2021
 Agile Document Number: D0013618
 DE number: 44166.759722222
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Page 7 of 9

เอกสารไม่ควบคุม

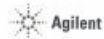
7890 Parts List Table

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

Part description	Part number	Product or models where used	Quantity consumed
SSL Capillary Inlet PM kit, Splitless	5188-6497	7890A/B	1
SSL Capillary Inlet PM kit, split	5188-6496	7890A/B	1
SSL Capillary Ultra Inert Inlet Gold Seal with Washer	5190-6144	7890A/B	N/A
SSL Capillary Ultra Inert Inlet Splitless Liner - Single taper with Glass Wool	5190-2293	7890A/B	N/A
SSL Capillary Ultra Inert Inlet Low Pressure Drop Split Liner - with Glass Wool	5190-2295	7890A/B	N/A
PP Inlet PM Kit	5188-6498	7890A/B	N/A
Split vent trap PM kit, single cartridge (for MMI, PTV & VI)	5188-6495	7890A/B	N/A
MMI Cleaning Kit	G3510-60820	7890A/B	N/A
PTV Septumless Head Rebuild Kit	5182-9747	7890A/B	N/A
PTV Septumless Head Teflon Guide	5182-9748	7890A/B	N/A
Ignitor (glow plug) assembly with O-ring	19231-60680	7890A/B	1
FID Collector Rebuild/Cleaning Kit	G1531-67000	7890A/B	N/A
Standard .011-inch FID Jet for capillary FID base	G1531-80560	7890A/B	1
High Temperature .018-inch FID Jet for capillary FID base	G1531-80620	7890A/B	N/A
Standard .018-inch FID Jet for packed column with packed FID base	18710-20119	7890A/B	N/A
Standard .011-inch FID Jet for capillary column with packed/adaptable FID base	19244-80560	7890A/B	N/A
High Temperature .018-inch FID Jet for capillary column with packed/adaptable FID base	19244-80620	7890A/B	N/A
NPD Jet, universal fit, .011-inch ID	G1534-80580	7890A/B	N/A
NPD Jet, universal fit, .011-inch ID Extended tip	G1534-80590	7890A/B	N/A
SSL Capillary Ultra Inert Inlet Gold Seal with Washer	5190-6144	7890A/B	N/A
SSL Capillary Ultra Inert Inlet Splitless Liner - Single taper with Glass Wool	5190-2293	7890A/B	N/A
**FID Collector Replacement Kit, if needed	G1531-67001	7890A/B	N/A

Revision: 2.01, Issued: September 15, 2021
Agile Document Number: D0013618
DE number: 44166.759722222
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Page 6 of 9



เอกสารไม่ควบคุม

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 600496548 Date service completed 22 April 2022
 Agilent signature [Signature] Customer signature [Signature]
 Total number of pages in this document 9 pages

Revision: 2.01, Issued: September 15, 2021
Agile Document Number: D0013618
DE number: 44166.759722222
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Page 9 of 9



เอกสารไม่ควบคุม



EQP Name: Agilent Recommended

Service Type: GC

Company Name: บริษัท อีคิว เทคโนโลยี จำกัด (มหาชน)

Customer Name/Title: คุณ อ. อภิชาติ อภิสิทธิ์ ผู้จัดการฝ่ายปฏิบัติการ

EQP Effective: 10/1/2021

EQP Release Date: November 2, 2021

Print Date: November 2, 2021 8:29 PM

เอกสารไม่ควบคุม

Table of Contents

Section	Page
Scope and Purpose	3
CrossLab Compliance	6
ACE Delivery Options	8
ACE Delivery Use Cases	10
ISO17025	12
Report and Schedule Options	17
Selected Signature Options	17
Customer Approval	18
Legal Notice	19
Product Details	20

เอกสารไม่ควบคุม

Legal Notice

Agilent CrossLab Compliance and its primary component ACE software tool, procedures, test designs, methodology have adhered to reference standards and standards during the entire time been designed, tested, validated, and released to the market, as following Agilent's Life Cycle Development Quality Assurance methodology.

Agilent CrossLab Group (HKT) and United Technology, Ltd. (USA), Santa Clara, California, USA.
Agilent CrossLab Group Quality Manager, Jonathan H. Smith, Santa Clara, California, USA.

Agilent CrossLab Compliance is endorsed by Dr. Ludwig Huber, published in Microchem J.

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Protocol Details

Protocol Revision Used for this Document

001.00.00

Protocol Revision Release Date

November 2, 2020

NOTE: The Reader History (EQR) file in equipment has been deleted from software and data provided to the customer.

เอกสารไม่ควบคุม



Agilent CrossLab Compliance

Qualification Type	GC-GC
System ID	0K13775001
EQR Name	Agilent-Banana-Manual
EQR Revision	000001
EQR Approval Date	November 2020
Date	April 27, 2022 7:55:49 PM
Report Type	Report
Org. Name	United Analyst and Engineering Consultant
Org. Location	1 So. Jidomask 41 Sukhumvit Road, Bangkok, Phrakharong, Bangkok 10260

เอกสารไม่ควบคุม

Table of Contents

Section	Page
Cover	1
Table of Contents	2
Test Summary	3
Service Details	5
Instrument Details	8
Calculator Formulas	9
Method Details	10
Test	2
System Inspection and Recalibration and Operation - USB	19
Inlet Pressure Accuracy - Front SSL	19
Inlet Pressure Accuracy - Front SSL	19
Detection Flow Accuracy - Back FID+	15
Detection Flow Accuracy - Front FID	17
GC Oven Temperature Accuracy - 75.0C	19
GC Oven Temperature Stability - 75.0C	2
GC Splitting Ratio - Injection Tower, Front SSL, Back FID+	22
Response Time - Back FID+	22
Injection Precision - Injection Tower, Front SSL, Back FID+	27
Signal to Noise - Injection Tower, Front SSL, Back FID+	30
GC Splitting Ratio - Injection Tower, Front SSL, Back FID+	37

เอกสารไม่ควบคุม

Table of Contents

Section	Page
Microsoft SQL Server FID	40
Injection Protection Injection cover, Intel SGX, FID, FID	40
Signature Based Injection Attack FID, Intel SGX, FID	49
Documentation of Group Policy	62
Antivirus	63
System Administrator's Manual (SADM)	82
System's Signature	90
Transaction Log	94

Date: /Jun 22, 2022 2:30:45 PM
System ID: CN-3-3001

เอกสารไม่ควบคุม

23-63, 23

Test Summary

15.1720

This screen includes a status for each scheduled test and the overall qualification. For each test that is run, (1) the status is successfully completed, failed or pending. In 2, a (3) the duration of time the test was run is displayed. For detailed results and specifications for each refer to the section on this FOR.

Details	Status	Run
Test		
System Inspection and Block Safety and Operation - 7800	Pass	1
Inlet Pressure Decay - Flow SSL	Pass	1
Inlet Pressure Accuracy - Inlet SSL	Pass	1
Detector Flow Accuracy - Flow FID+	Pass	1
Detector Flow Accuracy - Inlet FID	Pass	1
GC Oven Temperature Accuracy - 7800	Pass	1
GC Oven Temperature Stability - 7800	Pass	1
GC Sampling Rate - Injection Time - Flow SSL, Back FID+	Pass	1
Kaloid and Diff - Back FID+	Pass	1
Injection Precision - Injection Tower - Flow SSL, Back FID	Pass	1
Signal to Noise - Injection Tower - Flow SSL - Back FID+	Pass	1
GC Sampling Rate - Injection Time - Flow SSL - Back FID	Pass	1
Kaloid and Diff - Flow FID	Pass	1
Injection Precision - Injection Tower - Flow SSL, Inlet FID	Pass	1
Signal to Noise - Injection Tower - Flow SSL - Inlet FID	Pass	1

Overall Cushingation Index

Date: 2017-03-15 14:00
System ID: 1503151400

เอกสารไม่ควบคุม

 2.7×10^3

2000.01.29

Service Details

2. LIFE CYCLE

As shown in Table 1, the correlation coefficient r for the α_1 is negative

Generalization

Device Identifier/Recall:	5004683448
LAP Name:	Agfa (Risc) model
FOP Revision:	5003230
Reset Type:	Normal
Programmer Details:	
Name:	J. Ben Arroyo and Engineering Division
Address:	C/O Udo-Schulz 4, Salsbrunn Road, Samsara, Thakurani, Bhangal, N.Y.O.
Unit Owner Details:	
Name:	K. M. Sagar Technology
Address:	Chennai
Qualification Details:	Information Technology
Comments:	
Programmer Details:	
Name:	Subsequent Tools
Job Title:	Field Service Engineer
Units Acquisition Details:	
Acquirer Software Name:	ChenSoft v1
Acquirer Software Version:	0.01.0 (beta 02)
Acquirer Date/Time:	2008/04/09

Date: Apr 177, 2 1777 12:46:15
System ID: CN141-1-1-1

เอกสารไม่ควบคุม

Fig. 5. 100.

Instrument Details

Purpose

This section describes the at hand system configuration.

Details

System ID	353313001
Manufacturer	Agilent Technologies
Name	7820
Flux Data Input	Manual Data
Temperature Data Input	Manual Data or Other Data Logging
Detector Components	
Inp 1 Name	1310 nm Laser
Inp 1	None
Detector	ESR
LIM Inp 1 det	Yes
Test 1 Components	
Inp 1 Name	1310 nm Laser
Inp 1	None
Detector	None
LIM Inp 1 det	Yes
Sample 1	
Manufacturer	Agilent Technologies
Type	1310 nm Laser
Name	7820
Model Number	353313001
Serial Number	78399708
Firmware Revision	A.15.02
Usage	Sample Injection
Location	None
Synch Volume (uL)	10

Date: Apr 22 2015 2:31:45 PM
 Session ID: 153318231

เอกสารไม่ควบคุม

2000.01.29

Sensor 2

Manufacturer	Agilent Technologies
Type	Tag
Name	7826A
Identification	645145
Serial Number	1791270109
Firmware Revision	A.03.1F
Site Header	Not Installed

Mainframe 1

Manufacturer	Agilent Technologies
Name	789D
Model Number	65440E
Serial Number	0101123101
Firmware Revision	B.05.03.2
Unit Type	Standard

Module 1

Manufacturer	Agilent Technologies
Name	789D
Type	SSL
Location	Front
Control Class	44444
Control Type	Electronics Pressure Control (EPC)
Temperature	Yes

Detector 1

Manufacturer	Agilent Technologies
Name	789D
Type	FD
Applier	Capillary
Control Type	Electronics Pressure Control (EPC)
Location	Front
Makeup Gas	Nitrogen

Date: April 22, 2022 12:48:17 PM
System ID: CN121320

เอกสารไม่ควบคุม

Page 72/102

Detector 2

Manufacturer	Agilent Technologies
Name	789D
Type	EPC
Applier	Capillary
Control Type	Electronics Pressure Control (EPC)
Location	Back
Makeup Gas	Nitrogen
Flow Rate Control	Flow Rate

Date: April 22, 2022 12:48:17 PM
System ID: CN121320

เอกสารไม่ควบคุม

Page 73/102

Calculation Formulas

Formulas

The calculator needs identification formulas for data sets before depending upon which tests are calculated, all or some apply to your data set.

$$\text{Average} = \frac{X_1 + X_2 + \dots + X_n}{n} \quad \text{Average} = \frac{X_1 + X_2 + \dots + X_n}{n} \quad \text{Average} = \frac{X_1 + X_2 + \dots + X_n}{n}$$

$$X_1 = \text{Mean value} \quad X_2 = \text{Mean value} \quad X_3 = \text{Mean value} \quad X_4 = \text{Mean value} \quad X_5 = \text{Mean value} \quad X_6 = \text{Mean value} \quad X_7 = \text{Mean value} \quad X_8 = \text{Mean value} \quad X_9 = \text{Mean value} \quad X_{10} = \text{Mean value}$$

$$X_{11} = \text{Mean value} \quad X_{12} = \text{Mean value} \quad X_{13} = \text{Mean value} \quad X_{14} = \text{Mean value} \quad X_{15} = \text{Mean value} \quad X_{16} = \text{Mean value} \quad X_{17} = \text{Mean value} \quad X_{18} = \text{Mean value} \quad X_{19} = \text{Mean value} \quad X_{20} = \text{Mean value}$$

$$X_{21} = \text{Mean value} \quad X_{22} = \text{Mean value} \quad X_{23} = \text{Mean value} \quad X_{24} = \text{Mean value} \quad X_{25} = \text{Mean value} \quad X_{26} = \text{Mean value} \quad X_{27} = \text{Mean value} \quad X_{28} = \text{Mean value} \quad X_{29} = \text{Mean value} \quad X_{30} = \text{Mean value}$$

$$X_{31} = \text{Mean value} \quad X_{32} = \text{Mean value} \quad X_{33} = \text{Mean value} \quad X_{34} = \text{Mean value} \quad X_{35} = \text{Mean value} \quad X_{36} = \text{Mean value} \quad X_{37} = \text{Mean value} \quad X_{38} = \text{Mean value} \quad X_{39} = \text{Mean value} \quad X_{40} = \text{Mean value}$$

$$X_{41} = \text{Mean value} \quad X_{42} = \text{Mean value} \quad X_{43} = \text{Mean value} \quad X_{44} = \text{Mean value} \quad X_{45} = \text{Mean value} \quad X_{46} = \text{Mean value} \quad X_{47} = \text{Mean value} \quad X_{48} = \text{Mean value} \quad X_{49} = \text{Mean value} \quad X_{50} = \text{Mean value}$$

$$X_{51} = \text{Mean value} \quad X_{52} = \text{Mean value} \quad X_{53} = \text{Mean value} \quad X_{54} = \text{Mean value} \quad X_{55} = \text{Mean value} \quad X_{56} = \text{Mean value} \quad X_{57} = \text{Mean value} \quad X_{58} = \text{Mean value} \quad X_{59} = \text{Mean value} \quad X_{60} = \text{Mean value}$$

$$X_{61} = \text{Mean value} \quad X_{62} = \text{Mean value} \quad X_{63} = \text{Mean value} \quad X_{64} = \text{Mean value} \quad X_{65} = \text{Mean value} \quad X_{66} = \text{Mean value} \quad X_{67} = \text{Mean value} \quad X_{68} = \text{Mean value} \quad X_{69} = \text{Mean value} \quad X_{70} = \text{Mean value}$$

$$X_{71} = \text{Mean value} \quad X_{72} = \text{Mean value} \quad X_{73} = \text{Mean value} \quad X_{74} = \text{Mean value} \quad X_{75} = \text{Mean value} \quad X_{76} = \text{Mean value} \quad X_{77} = \text{Mean value} \quad X_{78} = \text{Mean value} \quad X_{79} = \text{Mean value} \quad X_{80} = \text{Mean value}$$

$$X_{81} = \text{Mean value} \quad X_{82} = \text{Mean value} \quad X_{83} = \text{Mean value} \quad X_{84} = \text{Mean value} \quad X_{85} = \text{Mean value} \quad X_{86} = \text{Mean value} \quad X_{87} = \text{Mean value} \quad X_{88} = \text{Mean value} \quad X_{89} = \text{Mean value} \quad X_{90} = \text{Mean value}$$

$$X_{91} = \text{Mean value} \quad X_{92} = \text{Mean value} \quad X_{93} = \text{Mean value} \quad X_{94} = \text{Mean value} \quad X_{95} = \text{Mean value} \quad X_{96} = \text{Mean value} \quad X_{97} = \text{Mean value} \quad X_{98} = \text{Mean value} \quad X_{99} = \text{Mean value} \quad X_{100} = \text{Mean value}$$

$$X_{101} = \text{Mean value} \quad X_{102} = \text{Mean value} \quad X_{103} = \text{Mean value} \quad X_{104} = \text{Mean value} \quad X_{105} = \text{Mean value} \quad X_{106} = \text{Mean value} \quad X_{107} = \text{Mean value} \quad X_{108} = \text{Mean value} \quad X_{109} = \text{Mean value} \quad X_{110} = \text{Mean value}$$

$$X_{111} = \text{Mean value} \quad X_{112} = \text{Mean value} \quad X_{113} = \text{Mean value} \quad X_{114} = \text{Mean value} \quad X_{115} = \text{Mean value} \quad X_{116} = \text{Mean value} \quad X_{117} = \text{Mean value} \quad X_{118} = \text{Mean value} \quad X_{119} = \text{Mean value} \quad X_{120} = \text{Mean value}$$

$$X_{121} = \text{Mean value} \quad X_{122} = \text{Mean value} \quad X_{123} = \text{Mean value} \quad X_{124} = \text{Mean value} \quad X_{125} = \text{Mean value} \quad X_{126} = \text{Mean value} \quad X_{127} = \text{Mean value} \quad X_{128} = \text{Mean value} \quad X_{129} = \text{Mean value} \quad X_{130} = \text{Mean value}$$

$$X_{131} = \text{Mean value} \quad X_{132} = \text{Mean value} \quad X_{133} = \text{Mean value} \quad X_{134} = \text{Mean value} \quad X_{135} = \text{Mean value} \quad X_{136} = \text{Mean value} \quad X_{137} = \text{Mean value} \quad X_{138} = \text{Mean value} \quad X_{139} = \text{Mean value} \quad X_{140} = \text{Mean value}$$

$$X_{141} = \text{Mean value} \quad X_{142} = \text{Mean value} \quad X_{143} = \text{Mean value} \quad X_{144} = \text{Mean value} \quad X_{145} = \text{Mean value} \quad X_{146} = \text{Mean value} \quad X_{147} = \text{Mean value} \quad X_{148} = \text{Mean value} \quad X_{149} = \text{Mean value} \quad X_{150} = \text{Mean value}$$

Date: April 22, 2022 12:48:17 PM
System ID: CN121320

เอกสารไม่ควบคุม

Page 74/102

NOTE: For many tests performed by the Advanced Compliance Engine multiple calculations are employed to reduce the overall calculation time. These calculations are performed in a sequential manner and the results are passed through the required calculation. Where intermediate calculations are required, these are displayed in the report to provide the proper display values. Assembling the calculations based on these display modified intermediate values, this is a small fraction of the total results. These calculations are presented in a simple table to show clear the progress through the calculator and not intended to be a means of algorithm verification. Beginning with Q001.35, users are not allowed to use the same number of decimal places as defined in the test, which must be less than or equal to the resolution provided by the measuring equipment.

Date: April 22, 2022 12:48:17 PM
System ID: CN121320

เอกสารไม่ควบคุม

Page 75/102

Detector Flow Accuracy

Purpose

Detector flow accuracy is determined by measuring the flow with a calibrated mass flowmeter and comparing that to the setpoint value and the values displayed by the GC (if applicable).

Configuration Details

Name	7890
Flow Type	Flow
Setpoint	60.0 mL/min

Measurements and Results

Time	Flow	Setpoint	60.0 mL/min
Accuracy	60.0	60.0	100.0 %
Agilent Recommendation	± 10.0	% setpoint	± 8.0 mL/min

Limit: percentage of setpoint or 0.5 mL/min, whichever is largest

Setpoint Status: Pass Rule: 1

Setpoint	Flow Type	Offset	60.0 mL/min
----------	-----------	--------	-------------

Measurements and Results

Time	Flow	Setpoint	60.0 mL/min
Accuracy	60.0	60.0	100.0 %
Agilent Recommendation	± 10.0	% setpoint	± 8.0 mL/min

Limit: percentage of setpoint or 0.5 mL/min, whichever is largest

Setpoint Status: Pass Rule: 1

Setpoint	Flow Type	Value	30.0 mL/min
Range Offset		20	% setpoint
Adjusted Flow Setpoint		32.0	mL/min

Measurements and Results

Time	Flow	Setpoint	30.0 mL/min
Accuracy	30.0	30.0	100.0 %
Agilent Recommendation	± 10.0	% setpoint	± 3.2 mL/min

Limit: percentage of setpoint or 0.5 mL/min, whichever is largest

Setpoint Status: Pass Rule: 1

Overall Detector Flow Accuracy Test Status

Pass

Detector Flow Accuracy

Purpose

Detector flow accuracy is determined by measuring the flow with a calibrated mass flowmeter and comparing that to the test setpoint and the values displayed by the GC (if applicable).

Configuration Details

Name	7890
Flow Type	Flow
Setpoint	30.0 mL/min

Measurements and Results

Time	Flow	Setpoint	30.0 mL/min
Accuracy	30.0	30.0	100.0 %
Agilent Recommendation	± 10.0	% setpoint	± 3.0 mL/min

Limit: percentage of setpoint or 0.5 mL/min, whichever is largest

Setpoint Status: Pass Rule: 1

Setpoint	Flow Type	Offset	30.0 mL/min
----------	-----------	--------	-------------

Measurements and Results

Time	Flow	Setpoint	30.0 mL/min
Accuracy	30.0	30.0	100.0 %
Agilent Recommendation	± 10.0	% setpoint	± 3.0 mL/min

Limit: percentage of setpoint or 0.5 mL/min, whichever is largest

Setpoint Status: Pass Rule: 1

Setpoint	Flow Type	Value	25.0 mL/min
----------	-----------	-------	-------------

Measurements and Results

Time	Flow	Setpoint	25.0 mL/min
Accuracy	25.0	25.0	100.0 %
Agilent Recommendation	± 10.0	% setpoint	± 2.5 mL/min

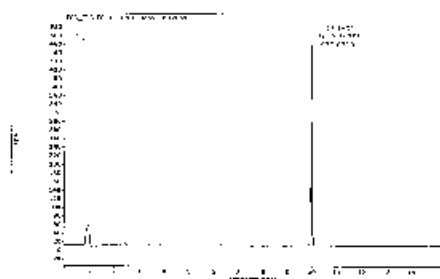
Limit: percentage of setpoint or 0.5 mL/min, whichever is largest

Setpoint Status: Pass Rule: 1

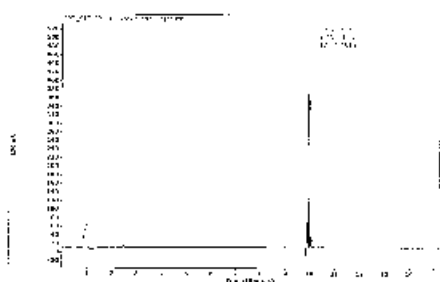
Overall Detector Flow Accuracy Test Status

Pass

Acquisition Operator: Saengchai Tanti
 Acquisition Method: Q22022.FPDM
 Data File Analyzed For: FPD_Protein-0111-1
 Acquisition Date: 2024-02-18 08:34



Acquisition Operator: Saengchai Tanti
 Acquisition Method: Q22022.FPDM
 Data File Analyzed For: FPD_Protein-0111-1
 Acquisition Date: 2024-02-18 08:34

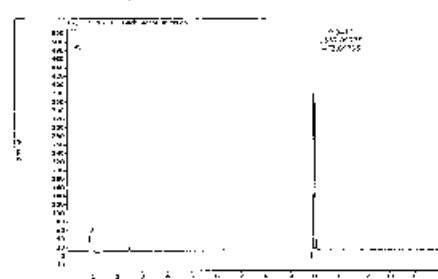


Date: Apr 12, 2025 2:15:46 PM
 System ID: QV1311200

เอกสารไม่ควบคุม

Page 32 / 102

Acquisition Operator: Saengchai Tanti
 Acquisition Method: Q22022.FPDM
 Data File Analyzed For: FPD_Protein-0111-1
 Acquisition Date: 2024-02-18 08:34



Overall Acquisition Precision Test Status

Pass

Date: Apr 12, 2025 2:23:35 PM
 System ID: QV1311200

เอกสารไม่ควบคุม

Page 32 / 102

Signal to Noise

Purpose

This test assesses baseline noise in the sample signal traces.

Sequence

L12-1 Evaluation and acceptance

Configuration Details

Parameter Combination	Flow	RFI	Sample	Injection
Injection: 1000				

Sample	Mode	Flow

Conditions

Injection Volume (µL)	10
Injection Time (min)	7

Configuration

Y-Axis Unit	151 µA
Sample	FPD-Std Kit C-58-5028
Excluded Compound	Metoprolol
Peak-to-Peak Concentration	3.0 µg/L (Peak-to-Peak Average)

Measurements

Noise Type/Level	AF / 10.000	DU
Baseline Time (min)	2.56341	min
Peak Height (µA)	12.4175	µA

(Corrected for baseline and differences between noise and signal, noise level is measured relative to the applied signal reduction for baseline noise.)

Results

Signal to Noise	1:620
Agilent Recommendation	> 1:200

ACE uses automated signal-to-noise (S/N) calculations, for example, therefore for high signal-to-noise ratios (10:1 peak-to-noise), ACE may appear to have higher S/N than your manual calculations, as the software can detect high and low

Setup Status	Pass	Run: 1
--------------	------	--------

Data Audit Log

Date: Apr 12, 2025 2:23:46 PM
 System ID: QV1311200

เอกสารไม่ควบคุม

Page 33 / 102

Hardware: L12TOP-COSY-001V

Original Data Path: F1

Analyzed Data Path: E:\ACE
 2.524g12x-ACE-Session\data\agilent\2024\04\12\1311200\test\data\12x_0_0_12x_Protein-0111-1_Raw1

Date: Apr 12, 2025 2:23:46 PM
 System ID: QV1311200

เอกสารไม่ควบคุม

Page 34 / 102

Acquisition operator: Srirachai Tanak
 Acquisition method: GC2022_FID.M
 Data file analyzed for this test: FID4.D
 Acquisition Date: 22-Apr-2022 09:27:10

Integration Parameters:

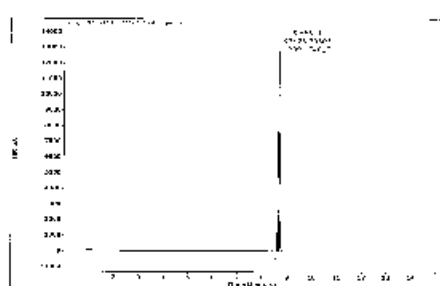
Type of Integration: Integration
 Integration Count: 3

Options Values:

Baseline Correction Model: Advanced
 Initial Slope Sensitivity: 10
 Initial Peak Width: 6.00
 Initial Area Reject: 0
 Initial Height Reject: 1.00

Threshold Evaluation Table

Integration Type	Value	Time
Integration	OFF	0
Integration	ON	7

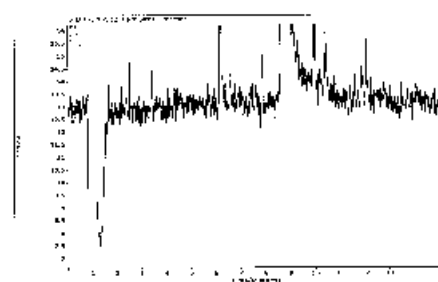


Date: April 22, 2022 09:27 PM
 System ID: GC2022_FID

เอกสารไม่ควบคุม

Page 26 / 100

Acquisition operator: Srirachai Tanak
 Acquisition method: GC2022_FID.M
 Data file analyzed for this test: SN4.D
 Acquisition Date: 22-Apr-2022 09:27:10



Threshold Signal to Noise Test Status

Pass

Date: April 22, 2022 09:46 PM
 System ID: GC2022_FID

เอกสารไม่ควบคุม

Page 26 / 100

Scouting Run

Purpose:

The test is used to determine the chromatogram data retention times, peak widths, and proper integration settings prior to the start of the qualification runs.

Sequence:

The test is used to determine the peak widths, and proper integration settings.

Baseline: Baseline, 1.0000

Integration Data:

Integration Data	Integration Count	Integration Count	Integration Count
Integration Count	1.0000	1.0000	1.0000

Name:

FID4.D

Integration Count	Integration Count	Integration Count
Integration Count	1.0000	1.0000

Conditions

Y Axis Unit: µA

Configuration

Sample: FID MCL 80/20 5154-5870

Evaluated Compound: Sample Peak

Final Active Compound Concentration: 100 % (See Qualification Analysis)

Measurements

Does the data file contain the baseline for the test?	Yes
How many baseline signals (in minutes)?	4
Baseline signal (in minutes)?	6.5
Run time for baseline signal (in minutes)?	7

Setup Status: Completed Run: 1

Data Audit Log

Test Name:	LAPTOP-GC2022_FID
Operator:	1.1
Analysis Date:	2022/04/22 09:46 PM

Date: April 22, 2022 09:46 PM
 System ID: LAPTOP-GC2022_FID

เอกสารไม่ควบคุม

Page 27 / 100

Acquisition operator: Srirachai Tanak
 Acquisition method: GC2022_FID.M
 Data file analyzed for this test: FID_S00B11.D
 Acquisition Date: 22-Apr-2022 12:10:57

Integration Parameters:

Type of Integration: Integration
 Integration Count: 0

Options Values:

Baseline Correction Model: Advanced
 Initial Slope Sensitivity: 10
 Initial Peak Width: 6.00
 Initial Area Reject: 0
 Initial Height Reject: 1.00

Threshold Evaluation Table

Integration Type	Value	Time
Integration	OFF	0
Integration	ON	6.15
Integration	OFF	6.5

Date: April 22, 2022 12:10 PM
 System ID: GC2022_FID

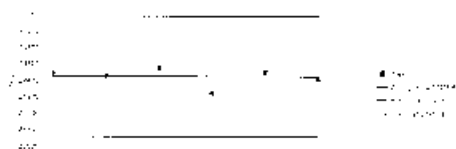
เอกสารไม่ควบคุม

Page 26 / 100

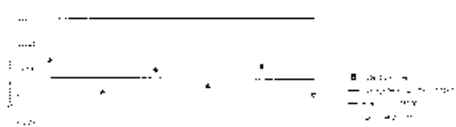
Results	Analyze		Reference Time	
Average	27140.52	pm/s	0.22070	minutes
STD Deviation	1374.11	pm/s	0.00000	minutes
RSD	0.44	%	0.21	%
Agilent Results	OK	Pass	OK	Pass
Notes	Pass		Pass	

Baseline Status: Pass Time: 00:00:00

Baseline Status: Pass Time: 00:00:00



Baseline Status: Pass Time: 00:00:00



Data Audit Log

File Name: LAPTOP-0038K0M9
 Software Version: 1.0.0.0
 Acquisition Date: 22-Apr-22, 18:22:06
 File Path: C:\ProgramData\Agilent\CrossLab\Compliance\0038K0M9\1.0.0.0\0038K0M9_1.0.0.0_PreviewRun1

Date: Apr 22, 2022 7:31:10 PM
 System ID: 0038K0M9

Page 41 of 120

เอกสารไม่ควบคุม

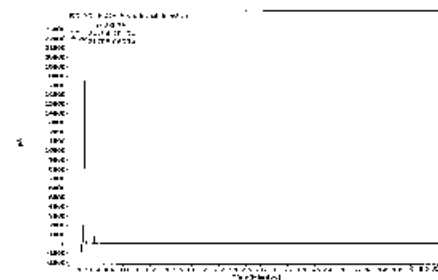
Acquisition Parameters: Sampled Time
 Acquisition Method: C00022_FID.M
 Data file analyzed for this test: FID_Preview0038K0M9
 Acquisition Date: 22-Apr-22, 18:15:57

Integration Parameters:

Type of Integration: Injection
 Integration Count: 1
 Options Values:
 Injection Correction Method: Automatic
 Initial Slope Sensitivity: 10
 Initial Peak Width: 0.01
 Initial Area Weight: 0
 Initial Delay Before: 0.00

Table Event Table

Integration Type	Value	Time
Integration	0.27	0
Integration	OK	0.13
Integration	OK	0.5

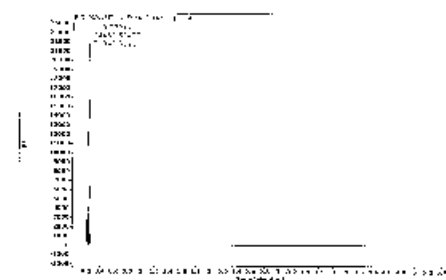


Date: Apr 22, 2022 2:31:45 PM
 System ID: 0038K0M9

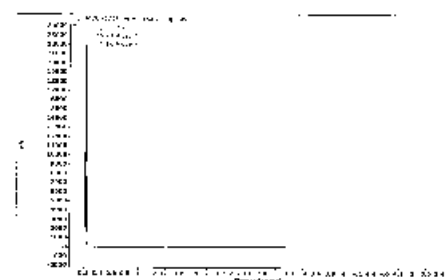
Page 46 of 120

เอกสารไม่ควบคุม

Acquisition Parameters: Sampled Time
 Acquisition Method: C00022_FID.M
 Data file analyzed for this test: FID_Preview0038K0M9
 Acquisition Date: 22-Apr-22, 18:22:06



Acquisition Parameters: Sampled Time
 Acquisition Method: C00022_FID.M
 Data file analyzed for this test: FID_Preview0038K0M9
 Acquisition Date: 22-Apr-22, 18:22:06

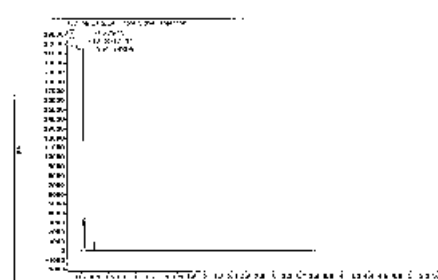


Date: Apr 22, 2022 7:31:10 PM
 System ID: 0038K0M9

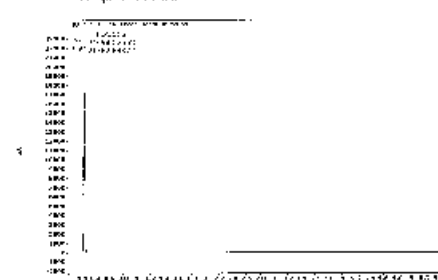
Page 55 of 120

เอกสารไม่ควบคุม

Acquisition Parameters: Sampled Time
 Acquisition Method: C00022_FID.M
 Data file analyzed for this test: FID_Preview0038K0M9
 Acquisition Date: 22-Apr-22, 18:15:57



Acquisition Parameters: Sampled Time
 Acquisition Method: C00022_FID.M
 Data file analyzed for this test: FID_Preview0038K0M9
 Acquisition Date: 22-Apr-22, 18:15:57

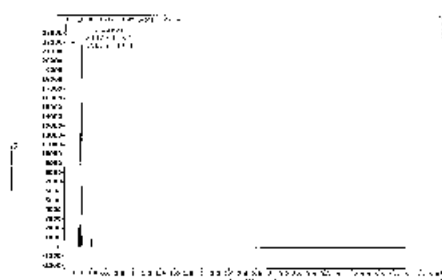


Date: Apr 22, 2022 2:31:45 PM
 System ID: 0038K0M9

Page 56 of 120

เอกสารไม่ควบคุม

Acquisition Operator: Scott J. Huijibon
Acquisition Method: GC2022.FID.M
Data File Analyzed For This Test: FID_2022_0329.FID
Acquisition Date: 22 Apr 22, 12:47:54



Current Injection Volume on Last Injection:

None

Date: 2022/04/22 12:48:27 PM
System ID: 01811120

Page 10 of 10

เอกสารไม่ควบคุม

Signal to Noise

Purpose

This test uses a known standard to determine signal to noise.

Sequence

Line 1: Evaluation standard injection

Configuration Details

Injection 2	1 min	5 S	1 min	FID
Injection Tower				
Flow	1.00			

Conditions

Injection Volume (µL)	1.00	1.00	1.00	1.00
Noise Evaluation Start Time (min)	1.00	1.00	1.00	1.00

Configuration

Y-Axis Unit	µV
Sample	1.00 mL Std K1, N180-4329
Injection Volume (µL)	1.00
Injection Concentration	1.00
Evaluation Standard Concentration	1.00

Measurements

Name (Type/Value)	ASTM	1.004731	µV
Retention Time of Evaluated Peak	2.5440	2.5440	min
Peak Height (Area under Normalized)	2.52522	2.52522	µV

(Corrected for dilution and difference between normalized injected concentration among data sets used for %RSD signal analysis [using dilution])

Results

Signal to Noise	221545
Agilent Recommendation	>= 50000

ACE uses unrounded values in its calculations; only the final reported numerical Time-time, for example, is rounded. (High peak-to-baseline noise, ACE calculations may appear to differ slightly from your manual calculations using the response height and noise.)

Setpoint Status: Pass

Data Audit Log

Date: 2022/04/22 12:48:27 PM
System ID: 01811120

Page 46 of 120

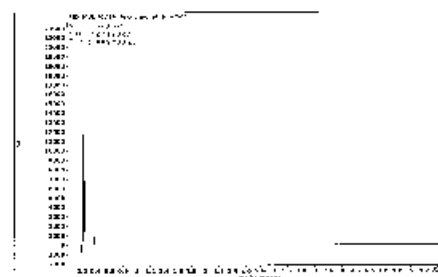
เอกสารไม่ควบคุม

Host Name: LAPTOP-Q28E8KMY
Original Data Path: C:\1
Acquisition Data Path: C:\1
2.525222 µV (Area under Normalized)
Injection Volume (µL): 1.00
Injection Concentration: 1.00
Injection Standard Concentration: 1.00

Acquisition Operator: Scott J. Huijibon
Acquisition Method: GC2022.FID.M
Data File Analyzed For This Test: FID_2022_0329.FID
Acquisition Date: 22 Apr 22, 12:47:54

Integration Parameters

Type of Integration	Integration	
Integration Count	1	
Op and Val Loc		
Baseline Conversion Mode	Advanced	
Initial Slope Sensitivity	10	
Initial Peak Width	1.00	
Peak Area Factor	1	
Initial Height Reject	100	
Time Event Table:		
Integration Type	Value	Time
Integration	OFF	0
Integration	ON	0.10
Integration	OFF	0.20



Date: 2022/04/22 12:48:27 PM
System ID: 01811120

Page 10 of 10

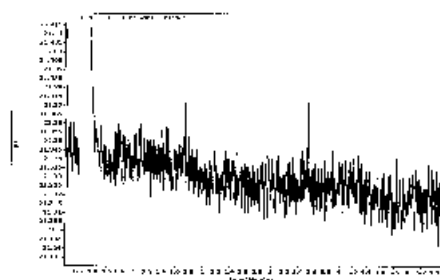
เอกสารไม่ควบคุม

Date: 2022/04/22 12:48:27 PM
System ID: 01811120

Page 10 of 120

เอกสารไม่ควบคุม

Acquisitor operator:	Saeed Alinifard
Acquisition office:	UCO222 - D.M.
Data File name and file location:	FILE_N=0721.D
Acquisition Date:	27-Sep-2014 08:04



Howard S. Grier, Jr., Editor, *East South*,
Knox

Date: April 2 1972 2:30 PM
System III: UN 1000

เอกสารไม่ควบคุม

1991:10:23

Declaration of Change Control

The documents are under review and are being held in confidence until a final decision is reached as to the proper disposition of the files to protect the government's policy and cannot be given greater weight or value. The policies are being reviewed according to the applicable criteria contained in the document management system and will be reviewed by the policy and legal management committee. The documents are being held in confidence until a final decision is reached as to the proper disposition of the files to protect the government's policy and cannot be given greater weight or value. The policies are being reviewed according to the applicable criteria contained in the document management system and will be reviewed by the policy and legal management committee. The documents are being held in confidence until a final decision is reached as to the proper disposition of the files to protect the government's policy and cannot be given greater weight or value. The policies are being reviewed according to the applicable criteria contained in the document management system and will be reviewed by the policy and legal management committee.

Date: Apr 12 22:23:46 PM
System ID: C-1911300

เอกสารไม่ควบคุม

Page 2 of 3

Attachments

The following equations form the theoretical background of the *SPIN* technique specific to the coefficients in the Eq. (1) and (2). Cells from different *SPIN* configurations are used to obtain a number of new relationships that define integrity. General expressions for GVP , C_1 , C_2 , AUC_{GVP} , and the other fundamental software components and the *SPIN* technical tools. The theoretical background and the proposed software components are described in the *SPIN* Learning Module "Cell Specific Model Simulation".

Location	Category	Document Name	Page
ECR	General	ACE Self-Declaration Card Table	51
ECR	General	Operator's Training Self-Declaration and Qualification	55
ECR	General	Operator's Training Certificate and Qualifications	58
ECR	General	Specialty Training Certificate and Qualifications	57
ECR	General	Specialty Training Certificate and Qualifications	58
ECR	General	Operator's Training Certificate and Qualifications	56
ECR	Tool	Certificate of Cellblock Gas Flowmeter	80
ECR	Tool	Certificate of Cellblock Metermaster	84
ECR	Tool	Certificate of Cellblock Thermometer	88
ECR	Tool	Certificate of Cellblock Thermometer Table	84
ECR	Tool	Certificate of Cellblock Thermometer Table	78
ECR	Material	Certificate Analysis of BULK Solid at 5163 CB72	82
ECR	Material	Certificate Analysis of BULK Solid at 5163 CB72	83
ECR	General	Certificate of System Qualification	87
ECR	General	Certificate of System Qualification	88
ECR	General	Certificate of System Qualification	86
ECR	General	Certificate of System Qualification	89
ECR	General	Certificate of System Qualification	87
ECR	General	Certificate of System Qualification	90

Date	Aug 12, 2007
System ID	00111716

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E-mail: NLE@ICJ

উপসংহা

Dominant Names: ACE 831 2nd Resistor Certificate

[illegible]

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User:          A..422, 2022-2-22:46 PM
System ID:     2022-2-22:46

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1991-92: 10.9

General

Document Name: One week's training certificate and qualifications

AgileIT Technologies

Certificate of Completion

Course Name:	Scrum Master Course
Course ID:	AN-SC-MS-1001 - Agile Scrum Master Training
Completion Date:	February 2021
Completed by:	Learning Management

All Students and Support Training staff have achieved qualification.

AgileIT Technologies is a leading provider of Agile IT training and consulting services. We are proud to have completed this course and achieved the qualification. This qualification is a testament to the hard work and dedication of the students and support training staff. We are committed to providing the highest quality training and consulting services to our clients.

Date: April 22, 2021 2:25:46 PM
System ID: CM-21-0001

เอกสารไม่ควบคุม

Page 02 / 100

General

Document Name: One week's training certificate and qualifications

AgileIT Technologies

Certificate of Completion

Course Name:	Scrum Master Course
Course ID:	AN-SC-MS-1001 - Agile Scrum Master Training
Completion Date:	February 2021
Completed by:	Learning Management

All Students and Support Training staff have achieved qualification.

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Date: April 22, 2021 2:25:46 PM
System ID: CM-21-0001

เอกสารไม่ควบคุม

Page 02 / 100

General

Document Name: One week's training certificate and qualifications

AgileIT Technologies

Certificate of Completion

Course Name:	Scrum Master Course
Course ID:	AN-SC-MS-1001 - Agile Scrum Master Training
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Date: April 22, 2021 2:25:46 PM
System ID: CM-21-0001

เอกสารไม่ควบคุม

Page 02 / 100

General

Document Name: One week's training certificate and qualifications

AgileIT Technologies

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Date: April 22, 2021 2:25:46 PM
System ID: CM-21-0001

เอกสารไม่ควบคุม

Page 02 / 100

Lieners,

Document Name: Complaints against catheters and a catheter bag

2. Golden Techniques

Certificate of Completion

15005 HALL	Virginia Tech
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[illegible]

Journal of Management Inquiry 23(1) 3-16
© The Author(s) 2014

Author: J. Harper Date: 2010

if the user is a developer, the following link is provided:

Abstract: This study examined the effects of a 12-week, low-intensity, low-impact exercise program on the physical and psychological health of older adults. The program was designed to improve cardiovascular fitness, muscle strength, and balance. Results showed that participants experienced significant improvements in cardiovascular fitness, muscle strength, and balance. Additionally, participants reported improvements in mood and self-esteem. The findings suggest that a low-intensity, low-impact exercise program can be an effective intervention for improving the physical and psychological health of older adults.

Date: 6-11-2012 2:03:45 PM
System ID: 10176 2012

เอกสารไม่ควบคุม

2005-06-10

Toets

Document Name: Certificate of Collaboration (CCL) form letter

Trescal

— Certificate of Calibration —

RECEIPTAIRE DU CERTIFICATE DE CALIBRATION DES MESURES

NUMERO DU **MESURE** Cert. No. **PSVP- 21048577(S)**

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Path: /usr/share/doc/ncurses-1.9.20110308
System ID: 20110308

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เอกสารไม่ควบคุม

9500 K22 1018

Document Name: Certificate of Completion for Ekwunwe

[illegible]

$\gamma = 0.50$ (95% CI 0.45–0.55)
 50% (95% CI 45–55) of the total sample had a low level of agreement with the majority of the sample (i.e., 50% of the sample) for the majority of the sample.

1. Fe^{2+} and Fe^{3+} are both present in the solution. The concentration of Fe^{2+} is $1.0 \times 10^{-2} \text{ M}$ and the concentration of Fe^{3+} is $1.0 \times 10^{-3} \text{ M}$. The standard reduction potential for the $\text{Fe}^{3+}/\text{Fe}^{2+}$ couple is $E^\circ = 0.77 \text{ V}$. Calculate the cell potential for the following cell at 25°C .

SECRET

[illegible]

bioRxiv preprint doi: <https://doi.org/10.1101/000000>; this version posted January 1, 2016. The copyright holder for this preprint (which was not certified by peer review) is the author/funder, who has granted bioRxiv a license to display the preprint in perpetuity. It is made available under aCC-BY-NC-ND 4.0 International license.

Environ.	April 2022 7:11:46 PM
Downloaded	133.130.237.117

เอกสารไม่ควบคุม

1994 21: 222

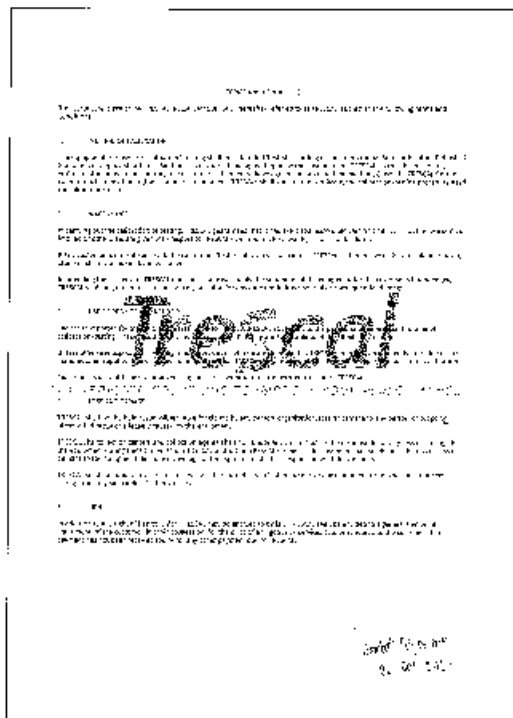
Document Name: Gas Dates of Calibration Gas Examined

[illegible]

Date: Apr 22 2022 2:32:42 PM
System ID: Cn13-13-1

เอกสารไม่ควบคุม

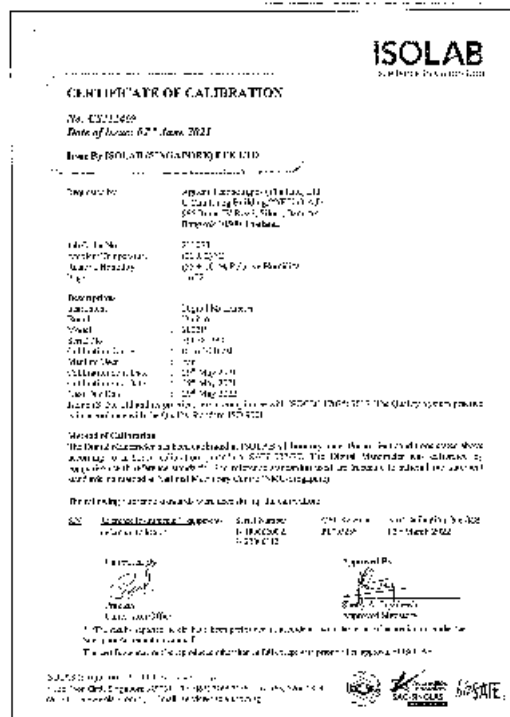
1000



Date: Apr 23 2022 2:03:40 PM
 System ID: C:\32 13701

เอกสารไม่ควบคุม

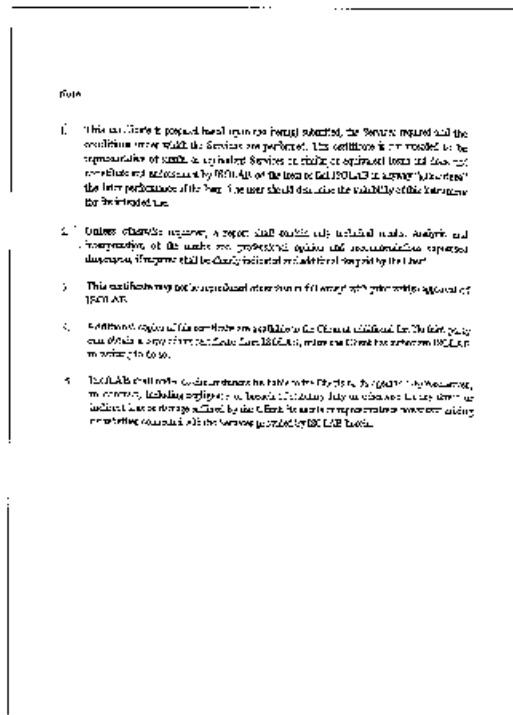
Fig. 2.3: 02



Date: 6-17-2022 2:11:45 PM
System ID: 28631750

เอกสารไม่ควบคุม

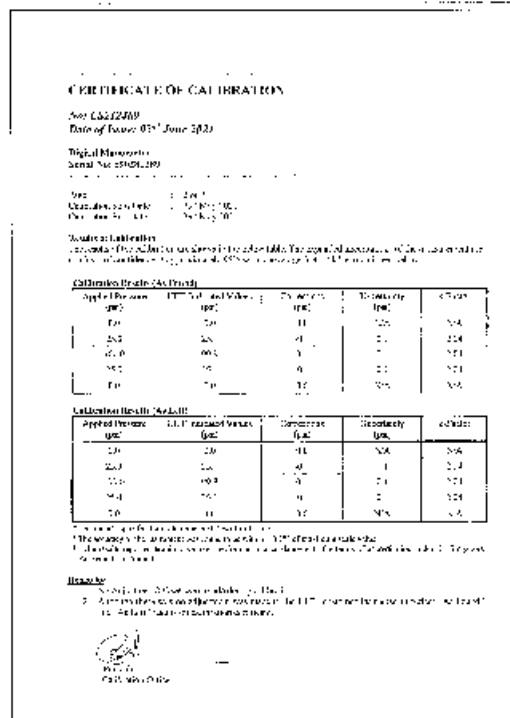
Page 54; 103



Time:	6:01:22, 2002 2.5940 PM
System Dr:	74 31 300

เอกสารไม่ควบคุม

Page 62 of 103



Expo: Apr 22 '81 22:31:45 PM
 Server ID: 0513-1139

เอกสารไม่ควบคุม

Page 22 of 23

Document Name: Certificate of Calibration Thermocouples

Date: April 22, 2022 2:31:41 PM
System ID: 12412_13774

Page 21 of 110

เอกสารไม่ควบคุม

Document Name: Certificate of Calibration Thermocouples

Date: April 22, 2022 2:31:40 PM
System ID: 12412_13774

Page 22 of 110

เอกสารไม่ควบคุม

Document Name: Certificate of Calibration Thermocouples

Date: April 22, 2022 2:31:41 PM
System ID: 12412_13774

Page 23 of 110

เอกสารไม่ควบคุม

Tools

Document Name: Certificate of Calibration Thermocouples

Date: April 22, 2022 2:31:40 PM
System ID: 12412_13774

Page 24 of 110

เอกสารไม่ควบคุม

CERTIFICATE OF CALIBRATION

No: CS/2127

Date of Issue: 09th June 2021

Agilent Part Name:

Serial No: 601370962

Rev:

1.0

Calibration Date: 09th June 2021Calibration Due: 09th June 2023

Remarks:

The calibration certificate is issued in accordance with the requirements of the ISO 9001:2015 standard.

Calibration Results:

Applied Value	Reference Temperature	Average RTD Resistance	Correction	Uncertainty	Resistance
(mV)	(°C)	(Ω)	(mV)	(mV)	(Ω)
0.220	0.0	1.0	0.0	0.2	1.0
0.240	10.0	1.0	0.0	0.2	1.0
0.260	20.0	1.0	0.0	0.2	1.0
0.280	30.0	1.0	0.0	0.2	1.0

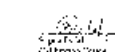
Calibration Results:

Applied Value	Reference Temperature	Average RTD Resistance	Correction	Uncertainty	Resistance
(mV)	(°C)	(Ω)	(mV)	(mV)	(Ω)
0.220	0.0	1.0	0.0	0.2	1.0
0.240	10.0	1.0	0.0	0.2	1.0
0.260	20.0	1.0	0.0	0.2	1.0
0.280	30.0	1.0	0.0	0.2	1.0

The calibration certificate is issued in accordance with the requirements of the ISO 9001:2015 standard.

Notes:

1. The calibration certificate is issued in accordance with the requirements of the ISO 9001:2015 standard.
2. The calibration certificate is issued in accordance with the requirements of the ISO 9001:2015 standard.


 Calibration Engineer

Date: April 22, 2022 2:31:40 PM

System ID:

Page 25 of 110

เอกสารไม่ควบคุม

CERTIFICATE OF CALIBRATION

No: CS/2127

Date of Issue: 09th June 2021

Remarks:

The calibration certificate is issued in accordance with the requirements of the ISO 9001:2015 standard.

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The calibration certificate is issued in accordance with the requirements of the ISO 9001:2015 standard.

P.N. 66-12016

Document Name: C:\Program Files\Autodesk\LT - Plot\Plot\Plot.dwg

[illegible]

Index:	Ant 12%, 20% + N100, 10%
Spawer L:	CH ₂ + 1 N100

เอกสารไม่ควบคุม

Journal of Interpersonal Violence

General

Document Name: Certificate of Design Continuity

[illegible]

Date: Apr 22, 2022 9:40 PM
System ID: Q6121150

เอกสารไม่ควบคุม

1 May 2004

Document Name: Certificate of System Ownership

[illegible]


Date: Apr 12, 2021 1:55:06 PM
System D: C:\311350

เอกสารไม่ควบคุม

Page 51 53

General

Document Name: General Fund Expense - Qualifications



Agilent Technologies

Agilent Compliance Engine Self Qualification

Date: Apr 22 2022 12:02 PM

Order Serial #	STANDARD	Product Name(s)	Status
Item		Product Name(s)	Status
Prepared by: Agilent Consultant	300-2252		Completed
Security Risk Review: Yes/No/NA	300-2252		Complete
Planning and Analysis: Yes/No/NA/Consult	300-2252		Complete
Planning and Analysis: Hazard: Unassessed	300-2252		Complete
Control Plan: Yes/No/NA	300-2252		Complete
Control Plan: Characterization	300-2252		Complete

Control Characterization Data:

Page 1 of 1

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Link:          /usr/lib/udev/rules.d/60-persistent-net.rules
System ID:     33:30:30:30:30:30

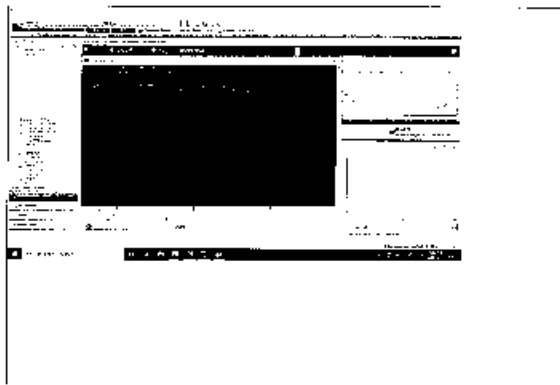
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เอกสารไม่ควบคุม

Page 26 of 105

General

Document Name: Certificate of System Qualification

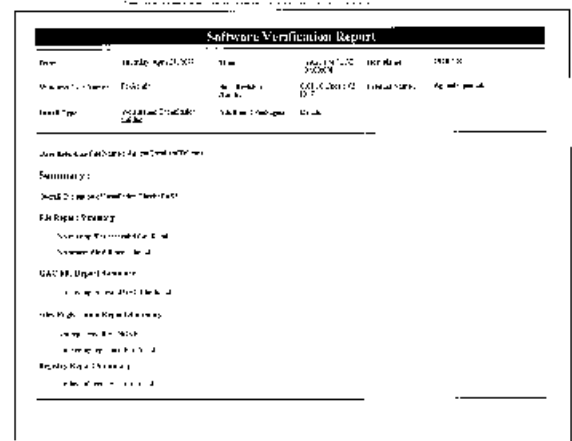
Date: April 22, 2022 2:34:46 PM
System ID: CNF-01-0021

Page 07/102

เอกสารไม่ควบคุม

General

Document Name: Certificate of System Qualification

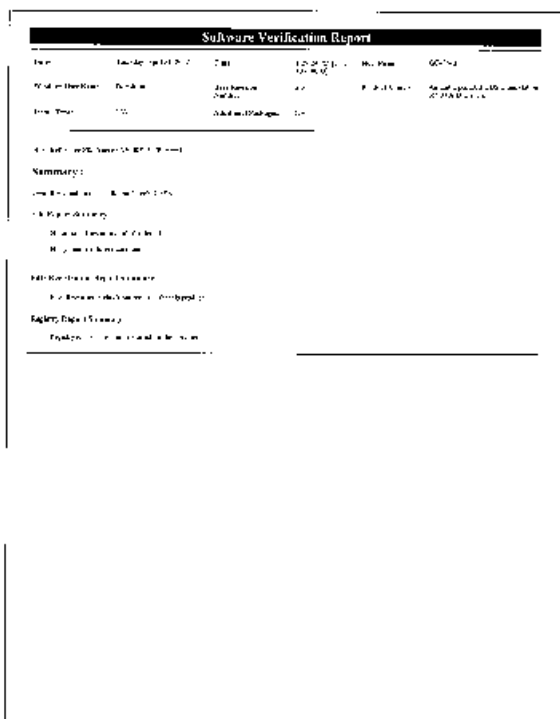
Date: April 22, 2022 2:35:40 PM
System ID: CNF-01-0021

Page 08/102

เอกสารไม่ควบคุม

General

Document Name: Certificate of System Qualification

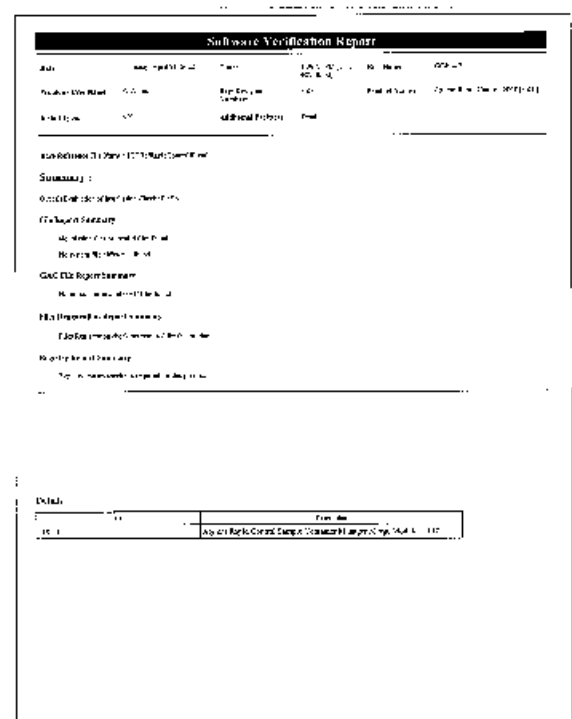
Date: April 22, 2022 2:35:46 PM
System ID: CNF-01-0021

Page 09/102

เอกสารไม่ควบคุม

General

Document Name: Certificate of System Qualification

Date: April 22, 2022 2:35:46 PM
System ID: CNF-01-0021

Page 10/102

เอกสารไม่ควบคุม

1.1. Revision 02/2021
 20210523 10:00:00

Document ID: 00123456789
 20210523 10:00:00

1.2. Revision 02/2021

1.3. Revision 02/2021

1.4. Revision 02/2021

1.5. Revision 02/2021

1.6. Revision 02/2021

1.7. Revision 02/2021

1.8. Revision 02/2021

1.9. Revision 02/2021

1.10. Revision 02/2021

1.11. Revision 02/2021

1.12. Revision 02/2021

1.13. Revision 02/2021

1.14. Revision 02/2021

1.15. Revision 02/2021

1.16. Revision 02/2021

1.17. Revision 02/2021

1.18. Revision 02/2021

1.19. Revision 02/2021

1.20. Revision 02/2021

1.21. Revision 02/2021

1.22. Revision 02/2021

1.23. Revision 02/2021

1.24. Revision 02/2021

1.25. Revision 02/2021

1.26. Revision 02/2021

1.27. Revision 02/2021

1.28. Revision 02/2021

1.29. Revision 02/2021

1.30. Revision 02/2021

1.31. Revision 02/2021

1.32. Revision 02/2021

1.33. Revision 02/2021

1.34. Revision 02/2021

1.35. Revision 02/2021

1.36. Revision 02/2021

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1.43. Revision 02/2021

1.44. Revision 02/2021

1.45. Revision 02/2021

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1.62. Revision 02/2021

1.63. Revision 02/2021

1.64. Revision 02/2021

1.65. Revision 02/2021

Date: 2021-05-23 10:00:00
 By: 00123456789

Page 1 of 1

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

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

CERTIFICATE OF CALIBRATION

Certificate No. : SP22-016 Page 1 of 5

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

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

Location of calibration : Laboratory 315

Equipment : UV-Vis Spectrophotometer

Manufacturer : Agilent Technologies

Model : Cary 60

Serial No. : MY15410009

ID No. : N/A

Received Date : 23 May 2022

Calibration Date : 23 May 2022

Issue Date : 26 May 2022

Condition Instrument : Good

Calibrated by : ทนาย (Mr. Tanawat Ritidach) Approved by : ชลธิชา (Ms. Chonthicha Sangern) Quality Manager

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

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

เอกสารไม่ควบคุม

PM-708-02 R01 1/11/2021

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. : SP22-016 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	95935	22 October 2023
Absorbance Standard set	25757	95929	22 October 2023
Wavelength Standard set	25806	95916	22 October 2023
Wavelength Standard set	25758	95915	22 October 2023

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 : 90 nm/min

Scan Interval of UUC : 0.15 nm.

Resolution of UUC : Photometric 0.0001 Abs.


Wavelength 0.1 nm.

เอกสารไม่ควบคุม

PM-708-02 R01 1/11/2021

DQE Services

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



ISO 17025:2017
CALIBRATION DATA

REPORT OF CALIBRATION

Certificate No. : SP22-016

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
	0.5787	0.5755	0.0032	0.0031	2.00
	1.0490	1.0436	0.0054	0.0029	2.00
	2.1900	2.1847	0.0053	0.0075	2.00
440	0.0000	0.0000	0.0000	0.0028	2.00
	0.5607	0.5588	0.0019	0.0034	2.00
	1.0247	1.0232	0.0015	0.0035	2.00
	2.1229	2.1211	0.0018	0.0082	2.00
465	0.0000	0.0000	0.0000	0.0028	2.00
	0.5236	0.5197	0.0039	0.0029	2.00
	0.9634	0.9625	0.0009	0.0028	2.00
	1.9763	1.9752	0.0011	0.0070	2.00
546.1	0.0000	-0.0001	0.0001	0.0028	2.00
	0.5191	0.5171	0.0020	0.0031	2.00
	1.0003	0.9984	0.0019	0.0033	2.00
	1.9987	1.9946	0.0041	0.0084	2.00
590	0.0000	0.0000	0.0000	0.0028	2.00
	0.5523	0.5509	0.0014	0.0030	2.00
	1.0809	1.0799	0.0010	0.0029	2.00
	2.0391	2.0329	0.0062	0.0080	2.00
635	0.0000	0.0000	0.0000	0.0028	2.00
	0.5601	0.5584	0.0017	0.0031	2.00
	1.0512	1.0498	0.0014	0.0029	2.00
	1.9294	1.9265	0.0029	0.0082	2.00

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FM-708-02 R01 1/11/2021

DQE Services

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ISO 17025:2017
CALIBRATION DATA

REPORT OF CALIBRATION

Certificate No. : SP22-016

Page 4 of 5

Photometric Accuracy :


Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000	0.0001	-0.0001	0.0050	2.00
	0.7478	0.7421	0.0057	0.0056	2.00
257	0.0000	0.0000	0.0000	0.0050	2.00
	0.8686	0.8619	0.0067	0.0059	2.00
313	0.0000	0.0000	0.0000	0.0050	2.00
	0.2912	0.2896	0.0016	0.0051	2.00
350	0.0000	0.0000	0.0000	0.0050	2.00
	0.6448	0.6403	0.0045	0.0055	2.00

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FM-708-02 R01 1/11/2021

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ISO 17025:2017
CALIBRATION DATA

REPORT OF CALIBRATION

Certificate No. : SP22-016

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	287.5	0.31	0.18	2.00
334.06	333.5	0.56	0.18	2.00
360.93	360.5	0.43	0.18	2.00
418.59	418.0	0.59	0.18	2.00
445.94	445.4	0.54	0.18	2.00
453.66	453.2	0.46	0.18	2.00
460.02	459.7	0.32	0.18	2.00
536.59	536.2	0.39	0.18	2.00
637.98	638.3	-0.32	0.18	2.00
431.38	431.0	0.38	0.18	2.00
472.50	472.5	0.00	0.18	2.00
513.47	513.5	-0.03	0.18	2.00
528.88	528.5	0.38	0.18	2.00
573.17	573.0	0.17	0.18	2.00
585.35	585.0	0.35	0.20	2.00
684.40	684.7	-0.30	0.18	2.00
740.72	740.8	-0.08	0.20	2.00
748.55	748.5	0.05	0.18	2.00
807.03	807.3	-0.27	0.18	2.00
879.28	879.0	0.28	0.18	2.00

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FM-708-02 R01 1/11/2021

Remark :

- UUC = Unit Under Calibration

- N/A = Not Available

- The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor k , which for a normal distribution corresponds to a coverage probability of approximately 95%

- * Indicates non TISI accredited

- End of Certificate -

DQE Services

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



ISO 17025:2017
CALIBRATION DATA

CERTIFICATE OF CALIBRATION

Certificate No. : SP22-008

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 213

Equipment : UV-Vis Spectrophotometer

Manufacturer : Hitachi

Model : U-2900

Serial No. : 21E22-009

ID No. : UAE.WAT.051/2564

Received Date : 20 January 2022

Calibration Date : 20 January 2022

Issue Date : 24 January 2022

Condition Instrument : Good

Calibrated by : 

Approved by : 

(Mr. Tanawat Rittidach)

(Ms. Chenticha Sangsarn)

Technical Manager

Quality Manager

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

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

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REPORT OF CALIBRATION

Certificate No. : SP22-008

Page 2 of 5

Environment Condition : Ambient Temperature 25 ± 5 °C

Relative humidity 55 ± 20 %RH

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

Certified Reference Materials :

Material	Serial No.	Certificate No.	Due date
Absorbance Standard set	25760	95935	22 October 2023
Absorbance Standard set	25757	95929	22 October 2023
Wavelength Standard set	25806	95916	22 October 2023
Wavelength Standard set	25758	95915	22 October 2023

Traceability

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

Spectral Band Width of UUC : 1.5 nm.

Scan Speed of UUC : 200 nm/min

Scan Interval of UUC : 0.1 nm.

Resolution of UUC : Photometric 0.001 Abs.


Wavelength 0.1 nm.

PM-708-02 R01 1/11/2021

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REPORT OF CALIBRATION

Certificate No. : SP22-008

Page 3 of 5

Calibration Results : Without adjustment

Photometric Accuracy :


Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
420	0.0000	0.000	0.0000	0.0028	2.00
	0.5787	0.576	0.0027	0.0031	2.00
	1.0490	1.046	0.0030	0.0029	2.00
	2.1900	2.182	0.0080	0.0075	2.00
440	0.0000	0.000	0.0000	0.0028	2.00
	0.5607	0.559	0.0017	0.0034	2.00
	1.0247	1.023	0.0017	0.0035	2.00
	2.1229	2.116	0.0069	0.0079	2.00
465	0.0000	0.000	0.0000	0.0028	2.00
	0.5236	0.521	0.0026	0.0030	2.00
	0.9634	0.962	0.0014	0.0029	2.00
	1.9763	1.970	0.0063	0.0070	2.00
546.1	0.0000	0.000	0.0000	0.0028	2.00
	0.5191	0.519	0.0001	0.0031	2.00
	1.0003	0.999	0.0013	0.0033	2.00
	1.9987	1.992	0.0067	0.0084	2.00
590	0.0000	0.000	0.0000	0.0028	2.00
	0.5523	0.552	0.0003	0.0030	2.00
	1.0809	1.080	0.0009	0.0030	2.00
	2.0391	2.031	0.0081	0.0079	2.00
635	0.0000	0.000	0.0000	0.0028	2.00
	0.5601	0.560	0.0001	0.0031	2.00
	1.0512	1.052	-0.0008	0.0030	2.00
	1.9294	1.922	0.0074	0.0079	2.00

PM-708-02 R01 1/11/2021

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REPORT OF CALIBRATION

Certificate No. : SP22-008

Page 4 of 5

Photometric Accuracy :


Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000	0.000	0.0000	0.0050	2.00
	0.7478	0.747	0.0008	0.0057	2.00
257	0.0000	0.000	0.0000	0.0050	2.00
	0.8686	0.865	0.0036	0.0059	2.00
313	0.0000	0.000	0.0000	0.0050	2.00
	0.2912	0.290	0.0012	0.0051	2.00
350	0.0000	0.000	0.0000	0.0050	2.00
	0.6448	0.640	0.0048	0.0055	2.00

PM-708-02 R01 1/11/2021

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REPORT OF CALIBRATION

Certificate No. : SP22-008

Page 5 of 5

Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor k
241.72	241.0	0.72	0.18	2.00
279.45	279.0	0.45	0.18	2.00
287.81	287.0	0.81	0.18	2.00
334.06	333.5	0.56	0.18	2.00
360.93	360.0	0.93	0.18	2.00
418.59	418.0	0.59	0.18	2.00
445.94	445.5	0.44	0.18	2.00
453.66	453.0	0.66	0.18	2.00
460.02	459.5	0.52	0.18	2.00
536.59	536.0	0.59	0.18	2.00
637.98	637.5	0.48	0.18	2.00
431.38	431.0	0.38	0.18	2.00
472.50	472.0	0.50	0.18	2.00
513.47	513.0	0.47	0.18	2.00
528.88	528.5	0.38	0.18	2.00
573.17	573.0	0.17	0.18	2.00
585.35	585.0	0.35	0.20	2.00
684.40	684.0	0.40	0.18	2.00
740.72	740.5	0.22	0.20	2.00
748.55	748.5	0.05	0.18	2.00
807.03	807.0	0.03	0.18	2.00
879.28	879.5	-0.22	0.18	2.00

Remark : - UUC = Unit Under Calibration

- N/A = Not Available

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

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

- * Indicates not ISO accredited

- End of Certificate -

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Request No. 25-65 / 0398

4 / 5

MTC, ACL No. 486 / 65

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

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Fe	0.1003	0.106	0.006	5.68	± 0.008
	0.5015	0.522	0.021	4.09	± 0.017
	1.0030	0.993	-0.010	1.00	± 0.032

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

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Pb	0.1988	0.197	-0.002	0.91	± 0.014
	0.6958	0.722	0.026	3.77	± 0.022
	1.4910	1.463	-0.028	1.88	± 0.041

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

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Mn	0.04955	0.054	0.004	8.98	± 0.004
	0.29730	0.317	0.0197	6.63	± 0.006
	0.69370	0.682	-0.0117	1.69	± 0.012

Continue 5 / 5

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Request No. 25-65 / 0398

5 / 5

MTC, ACL No. 486 / 65

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

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Ni	0.099	0.102	0.003	3.03	± 0.007
	0.495	0.489	-0.006	1.21	± 0.010
	0.990	0.975	-0.015	1.52	± 0.020

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

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Zn	0.050	0.050	0.000	0.00	± 0.012
	0.300	0.307	0.007	2.33	± 0.011
	0.700	0.660	-0.040	5.71	± 0.015

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

Calibrated by Dr. Sathit
(Mr. Danai Srithongkum)

Approved by Dr. Thippaya Junvee Fortune
Director of Analytical Chemistry Laboratory
Calibration date : 3 February 2022

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Agilent 65 240 / 860 Series Atomic Absorption Spectroscopy Systems

Preventive Maintenance Checklist

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

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

Note: When non-current production AA instrument and/or accessory models are not covered specifically in this document, it is assumed as a valid reference.

For more information about Agilent, visit our website or contact us via our website using the following URL : <http://www.agilent.com/us/services>

Introduction

Customer Information

1. Guide that should provide all necessary identifying supplies upon request of the engineer.
2. A valid email address that should be available to the engineer while performing the preventive maintenance procedures.
3. All parts, not included in the Parts Lists section of this document, are not part of the Preventive Maintenance service and are they included in the price of this service.
4. 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 separate item, which may incur additional costs.

Part No. : 997, 998, 999, 1000, 1001

Agilent 65 240 / 860 Series

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Introduction, Preventive Maintenance Checklist

Important Customer Web Links

- 1. For more information about Agilent technology services, please visit our website using the following URL : <http://www.agilent.com/service>
- 2. To access Agilent University, visit <http://www.agilent.com/chem/education> to learn about training options, including on-line, classroom and on-site delivery. A training specialist can work directly with you to help determine your best options.
- 3. A useful Agilent Resource Center web page is available, which includes short videos on maintenance, quick fix and consumables for new instrument. Use and other valuable information. Check out the Resource Page here : <http://www.agilent.com/chem/agilent/resources>
- 4. Non-current support, FAQs, supplies - visit our Support Home page at <http://www.agilent.com/support>
- 5. Get answers, share insights, build connections. Join the Agilent Community at community.agilent.com

Service Engineer's Responsibilities

- 1. Contact the customer and ensure that a technician will arrive and available before the preventive maintenance visit.
- 2. Confirm the ability of the technician to deliver the service safely and as assigned via the Agilent AA safe operation flow chart. (Refer directly to the AA 55/240/280 Preventive Maintenance Scope of Work to make this decision)
- 3. Only select those pages that relate to the system or model, including services.
- 4. Complete only those with the relevant information.
- 5. Complete the relevant checkboxes in the checklist using either a "X" or tick mark "✓".
- 6. Check Section 4 of applicable checkboxes for non-delivered services/issues not delivered as requested.
- 7. Complete the Preventive Maintenance service in the order of the task listed.
- 8. Complete the Service Review section together with the customer.
- 9. Complete the fields for page number on the foot of each selected page.
- 10. Complete the total number of pages for the Service Completion section.
- 11. Ask the customer to sign the Review Completion section and using the statements and your signature.
- 12. This information is subject to change without notice.

Part No. : 997, 998, 999, 1000, 1001

Agilent 65 240 / 860 Series

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Instrument Maintenance

System Information

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

Instrument System Name and ID	AA 280 FS / 08434 AA
Instrument System Site and Location	UAE / 3rd Fl Laboratory

List System Component Product Numbers	List the Serial Numbers of each Component
1. 08434 AA (AA)	MY81140002
2. 08444 A (VDA 77)	MY81160002
3. ETC 60	94029842
4. 08445 A (CUMVAA Comp)	MY81050002
5.	
6.	
7.	
8.	
9.	

Preparation, Safe operation and Initial performance checks

Revision: 10.00, Issued: November 2021

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☒ Agilent App is required for these instructions (to determine if the PM can be performed)

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

- ☒ Discuss any specific issues with the customer before starting.
- ☒ For HPLC applications systems: If standard sample introduction system was not installed, ask the customer to install it.
- ☒ Review the instrument logbook for recent observations and user queries.
- ☒ Save instrument serial number before commencing the procedure.
- ☒ Perform a general inspection of the system for cleanliness.
- ☒ Check and properly installation of parts, assemblies, sensors etc.
- ☒ Check system for required installation of components, settings as defined by current Service Notes.
- ☒ Check for missing firmware updates and verify with customers if they would like them installed.
- ☒ Use SVD to perform a Full Wavelength Scan for Cutoff Wavelengths.
- ☒ Perform a Basic Full ABS test - As follows in 21.
- ☒ Print the file while keeping screen captures of the test results and attach to the end of this recordist.

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Preventive Maintenance Procedures

FLAME SYSTEM section

☐ Section not applicable

Electronic components

- ☒ Review and confirm instrument configuration data in SVD.
- ☒ Confirm power supply voltages using the SVD Power Supply diagnostic.
- ☒ For Dual Beam instruments: Confirm ASD frequency using the SVD RSC frequency diagnostic.

Mechanical components

- ☒ Check the burner adjustment controls for complete and free movement. If the burner adjuster needs lubrication, use Molykote G21 or Mineral-based multi-purpose molybdenum disulphide grease.
- ☒ Run SVD tests to examine all motor drives over the full range of their travel:
 - ☒ Monochromator drive
 - ☒ Slit drive
 - ☒ Lamp selector
 - ☒ ALSA

Optics components

- ☒ Check that external optical surfaces are clean. Clean only if necessary, as required.
- ☒ Use SVD and perform Mono Wavelength Correction.
- ☒ Use SVD and perform Slit Calibration.
- ☒ Use SVD and perform Grating Squintness Diagnostic.
- ☒ Use SVD and perform Zero Order Offset/Mono Correction.
- ☒ Use SVD and perform Wavelength Repeatability.
- ☒ Physically inspect, suspected 10 ppm (customer to supply per their choice) and measure the 5 AA test results using Atomic Absorption lamps and showing emission degradation due to age.
- ☒ Check that the aging change of the D2 and Hg lamps track properly. Advise customer of 1000 Hg lamp showing emission degradation due to age.

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Sample Introduction and Atomization

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

Gas handling components and safety interlocks

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

Analytical performance for Flame systems

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

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FURNACE SYSTEM section

☒ Section NOT Applicable

Electronic components

- ☐ Review and confirm instrument configuration on an SW7.
- ☐ Confirm power supply voltage using the SWD Power Supply diagnostic.

Mechanical components

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

Optics components

- ☐ Check that external optical surfaces are clean. Clean or replace as required.
- ☐ Use SWD and perform Mono Wavelength Correction.
- ☐ Use SWD and perform Slit Calibration.
- ☐ Use SWD and perform Grating Squares Diagnostic.
- ☐ Use SWD and perform Zero Order Offset/Mono Correction.
- ☐ Use SWD and perform Wavelength Repeatability.
- ☐ Physically inspect and adjust HC lamps (customers supply per their choice) and measure the % Ga for each lamp. Adjust calibration if lamps are showing signs of degradation due to age.

Gas handling, water system and workhead component checks

- ☐ Inspect the GFA workhead gas hoses and connections for leaks.
- ☐ Pressure test for gas leaks.
- ☐ If the copper system is assessed as (exhausted) or close to correct operation and needs to be replaced, this includes any temperature and pressure settings for oil/gas cleaning (if flow and water).
- ☐ Inspect the GFA workhead water hoses and connections for leaks.
- ☐ Check all gas and water components and replace if necessary.

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- ☐ Tube
- ☐ Electrodes
- ☐ Stirrer

- ☐ Check and clean the air windows on the workhead.
- ☐ Check carefully for leaks operation.

Analytical performance for Furnace systems

- ☐ Optimize the instrument ready to perform Customer's tests.
- ☐ Run the sensitivity test for 23 ppt copper sample and record the results in the results table.

PSD autosampler accessory for Furnace systems

- ☒ Section NOT Applicable
- ☐ Check condition of the PSD accessory – replace if necessary.
- ☐ Check condition and operation of PSD syringe – ensure syringe not have air locks and bubbles.
- ☐ Change PSD tube before drying.
- ☐ Check and clean the waste vessel.
- ☐ Check the drain tube for good drainage. It should not have tight bends, kinks or loops and the lower end must be above the liquid level in the waste vessel.
- ☐ Ensure that the waste vessel is suitable for use with the furnace system.

Sample introduction pump system (SIPS) accessory

- ☒ Section NOT Applicable
- ☐ Torque screws securing the roller pump arms and pump rotors.
- ☐ Adjust each roller so that it rotates freely.
- ☐ Wipe clean the pump rotor rollers and pump handle with a dry clean cloth.
- ☐ Ensure that the pressure and the regulator near the pump are free from oil and grease.
- ☐ Remove the pump module rear cover and check for the inclusion of liquids and any alignment variation.
- ☐ Re-adjust the pump rollers on the motor mounting bases to the correct levels.
- ☐ Check for and replace the diluent holder and replace if necessary.
- ☐ Disassemble the pump tipcock and reassemble the tubing using the following steps.

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- ☐ Remove the T piece by disconnecting the pump tubes, the pump hoses and all other tubing.
- ☐ Place the T piece in an ultrasonic bath containing slaking detergent 1-5% for about 30 minutes, for approximately 6-10 minutes.
- ☐ Wash the T piece under a tap with a strong flow of water.
- ☐ Rinse with distilled water through a 0.2 µm filter in the previous direction to normal sample flow.
- ☐ Reassemble.

Sample preparation system (SPS 4) accessory

☒ Section NOT Applicable

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

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

- ☐ Cleaning the top of the rack location mat, and frames and cross axis accessories with a damp soft cloth and mild detergent.
- ☐ Cleaning the autosampler cover panels with compressed window cleaner.
- ☐ Check the X-axis and Z-axis drive belts for cracks, splits, damaged teeth, excessive fraying, or other changes or degradation from use.
- ☐ Check the X-axis, Y-axis, and Z-axis FFC cables for cracks or correct positioning of damaged edge or damaged connectors.

NOTE: The autosampler requires no extra lubrication throughout its lifetime. For further details refer to the SPS 4 service manual G5410-90053.

Sample preparation system (SPS 3) accessory

☒ Section NOT Applicable

- ☐ Check the X-axis and Z-axis timing belts – replace if there are any cracks, splits or color change and ball tension.
- ☐ Check the X-axis and Z-axis drive belts for cracks, splits, damaged teeth, excessive fraying, or other changes or degradation from use.
- ☐ Check the X-axis, Y-axis, and Z-axis FFC cables for cracks or correct positioning of damaged edge or damaged connectors.
- ☐ Check the X-axis, Y-axis, and Z-axis FFC cables for cracks or correct positioning of damaged edge or damaged connectors.
- ☐ Clean the exterior surfaces of the accessory with soft lint free cloth. This cloth can be dampened with warm water or mild detergent. Do not use organic solvents or other abrasive cleaning agents.

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Vapor generation accessory VGA (hyride generator)

- ☐ Section NOT Applicable
- ☒ Inspect VGA gas supply hose
- ☒ Inspect/replace VGA pump tubing
- ☐ Check the gas pressure in the gas supply – replace if required.
- ☐ Check the precision orifice gas flow setting – adjust if required.
- ☐ Check the gas regulator pressure to 45 psi (3.1 bar) – adjust if required.
- ☒ Clean the exterior surfaces of the accessory with soft lint free cloth. This cloth can be dampened with warm water or mild detergent. Do not use organic solvents or other abrasive cleaning agents.

UltraAA lamp accessory (external)

- ☐ Section NOT Applicable
- ☒ Check the external lamp power supply.
- ☒ Clean the exterior surfaces of the accessory with soft lint free cloth. This cloth can be dampened with warm water or mild detergent. Do not use organic solvents or other abrasive cleaning agents.

Restore System

- ☒ If you have altered the customer's instrument during the course of PM, restore to the original status to review the customer's control of the instrument to the (your) agreed the customer's method.

Guidance

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

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Signature Page

Service Review

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

Test Results

Test Description	Expected Test Result	Actual Test Result
Flame optics PMT Gain test		
For copper at 324.8 nm, 4 mA, 0.5 nm slit width	< 55 %	38 %
Flame performance test with 5 ppm copper sample	(0.667 A) CC value	
Air/acetylene, mixing paddle removed	Abs value > 0.5	0.6324 A
Air/acetylene, mixing paddle installed, 10 replicates	%RSD < 1.0	0.7 %
Deuterium furnace optics PMT Gain test		
For copper at 324.8 nm, 4 mA, 0.5 nm slit width	< 55 %	N/A
Deuterium furnace performance test with 25 ppb copper sample (324.8 nm)		
Precision %RSD	≤ 4.0 %	N/A
Abs value	≥ 0.15	N/A
Zeeman furnace analytical performance: 25 ppb copper sample (327.4 nm)		
Precision %RSD	≤ 4.0 %	N/A
Abs value	≥ 0.10	N/A
MSR%	≥ 70 %	N/A

Test 10 ppb Hg sense = 0.1732 A (0.1391 - 0.203 A)

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AA consumable and parts list table

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

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

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

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

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Service Engineer Comments (optional)

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

Service Completion

Service request number: 6004646205 Date service completed: 9 MAY 2022
Agilent signature: Worachit T. Customer signature: Sathida S.
Total number of pages in this document: 22

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SVD Results Report



Report ID: 6004646205-2022-05-09
Customer: Service Engineer: Worachit T.
Address: Contact Details:

Instrument Configuration

Configuration:

Serial Number: Turb Type: Autotune
Instrument Model: Varian AA140024102RE Number Of Lamps: 5
Flame Instrument: True Mono Type: Automatic 1.333m
Furnace Instrument: True Gasbox Type: V Gas Box
Zeeman Present: False Auto Burner Adjuster: True
Internal Zeeman: False Melna Frequency: 50
Internal UltraAA: False Firmware Version: 2.12
Optics Type: Double beam Photomultiplier Type: Varian300Cr
D2 BG Correction Fitted: True PWB Version: 1.61
Boot Block Version:

EEPROM Data:

Instrument Run Hours: 1464350 D2 Run Hours: 406510
Zero Wavelength Offset: 6.003 D2 Serial Number: 000541
Mono Correction: 0.240 D2 Install Date: 1/11/2020
Flame Hours: 78260 D2 Original Intensity: 1.000
D2 Last Intensity: 1.000

Frequency:

Averaging Period: 10.0
Datapoint Count: 20
Upper Limit: 51.33 Highest Measured Frequency: 50.00
Average Frequency: 50.00
Lower Limit: 49.33 Lowest Measured Frequency: 50.00

Result: Passed

Report Generated At: 2022-05-09 14:22:00

1

AA140024102RE SVD

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Power Supply:

Averaging Period: 30.0
Datapoint Count: 25

	Lower Limit (V)	Actual (V)	Upper Limit (V)	Result:
12.00V Rail	10.80	11.99	13.20	Passed
-12.00V Rail	10.20	-11.40	-13.80	Passed
5.00V Rail	4.50	5.10	5.50	Passed
310.00V Rail	275.00	318.00	341.00	Passed

Report Generated At: 1/25/2022 10:34:21 AM

2

310V Rail Voltage Monitor

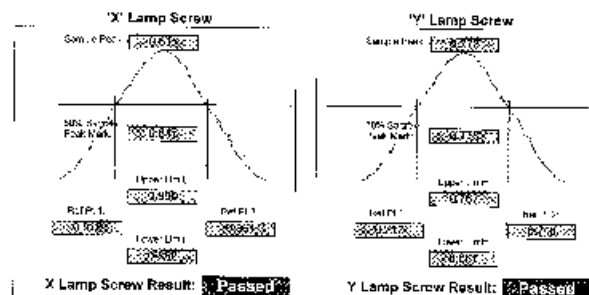
เอกสารไม่ควบคุม

Beam Balance:

Beam Balance:

Lamp Type: Copper
Lamp Socket Used: 1

Peak Selected: 324.80
Lamp Alignment: Horizontal



Grating Squareness:

Lamp Element(s): Copper
Lamp Turret Position: 4
Lamp Current(mA): 4.00
Slit Width(nm): 0.5
1st Order Wavelength(nm): 324.80
Lamp Alignment: Horizontal

	Lower Limit (nm)	Actual (nm)	Upper Limit (nm)	Result:
Zero Order	-0.10	0.00	0.10	Passed
First Order	324.48	324.68	325.15	Passed
Second Order	648.22	648.48	649.07	Passed

Report Generated At: 1/25/2022 10:34:21 AM

3

310V Rail Voltage Monitor

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Wavelength Repeatability:

Lamp Used: Copper
Peak Used(nm): 324.750
Connected to Socket: 1
Lamp Current(mA): 4
Slit Width(nm): 0.2
Slit Height: Normal
Lamp Alignment: Horizontal

Lower Limit(nm)	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6	Sample 7	Sample 8	Sample 9	Sample 10	Upper Limit(nm)
324.629	324.639	324.639	324.639	324.639	324.639	324.639	324.639	324.639	324.639	324.639	324.746

Mean: 324.639
Standard Deviation: 0.000

Result: Passed

Report Generated At: 1/25/2022 10:34:21 AM

4

310V Rail Voltage Monitor

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Mechanical:

Wavelength Drive:

Passed

Slit Drive:

Passed

Turret Drive:

Passed

Auto Burner Adjuster Drive:

Passed

Diagnoses:

Signal Processing Linearity:

Calculate Mode: New Calc Mode

	Lower Limit	Actual	Upper Limit	Result:
S0	111	240	297	Passed
S1	158	156	191	Passed
S2	271	298	338	Passed
S3	474	511	570	Passed
S4	828	822	1006	Passed
S5	1435	1538	1754	Passed
S6	2473	2772	3055	Passed
S7	4047	4754	5213	Passed

Interlocks:

Burner Fitted: Working
N2O Burner Fitted: Working
Flame Shield Closed: Working
Gas Control Fitted: Working
Pressure Release Bung Fitted: Working
Liquid Trap Fitted: Working
Flame Detector: Working
GCU Active: Working
Oxidant Pressure: Working
Oxidant Changeover: Working
Ignition: Working

Report Generated At: 1/25/2022 10:34:21 AM

5

310V Rail Voltage Monitor

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Result: **Passed**

Not Performed

PM 5:48:2522

_____ Only _____ 9 MAY 1954
MURRAY ? 1340

Document generated on: 25/07/2024 09:08:52

E

See [Non-Linear Control](#) 

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Sequential by time report

5/3/2022 11:47 AM

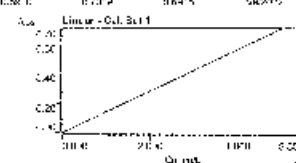
Spectra

Page 1 of 1

Analyst:
Data Start/End: 5/3/2022 11:27 AM - 6/1/2022 4:27 AM
Worksheet: C:\G:\PC\Send\My
Comment:
Methods: G
GenBank Name: DES-CCP-LEW01P
Serial Number: 122111322

אורמא; ג'ל (Antidi)

Series ID	Cow Age	FEB	Mar/Apr
74 / 189	0.00	0.00	0.00
	Recovery		
	0.00	0.00	0.00
STANDARD	0.00	0.00	0.00



Crude FI	~ 100%
Cholesterol Conc	~ 0.01 mg/L
"	~ 1.00%
Calcitriol Conc	~ 0.003 - 0.005
Residuals	~ 0.003 - 0.005

Size = 0.05 inch x 0.10 inch			
370K x 64	6.500	0.8	1.6624
Readings			
0.0047	0.0007	0.0000	0.0000

เอกสารไม่ควบคุม

Sequential by time report

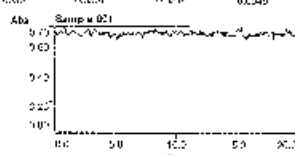
5/3/2022 11:56 AM

Spectra A4

Analyst	
Date Started	05/20/2012 11:55 AM C:\ProgramData\4465 688
Worksheet	CU3 Exp 1 Page 31
Comment	
Method	CU
Computer name	D66-CTCP-UGACTJF
Serial Number	W21110002

Method 5: (Five)

Variable	Population	Mean	Standard Deviation
Gender	Male	0.54	0.50
Age	25-34	28.5	5.5
Education	High School	0.15	0.35
Income	\$10,000-\$19,999	0.25	0.43
Marital Status	Married	0.65	0.48
Occupation	Service	0.35	0.48
Religion	Christian	0.75	0.43
Political Affiliation	Democrat	0.55	0.50
Health Status	Good	0.60	0.49
Exercise Frequency	Weekly	0.20	0.40
Dietary Habits	Vegetarian	0.10	0.30
Stress Level	Low	0.15	0.35
Sleeping Hours	7-8 hours	0.40	0.50
Work Satisfaction	Satisfied	0.30	0.45
Life Satisfaction	Satisfied	0.50	0.50



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Sequential by time report

5/3/2022 1:54 PM

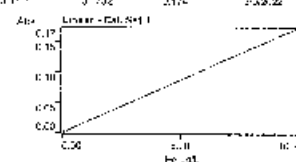
Spencer

Page 1 of 1

Address	
Date Started	2009-11-19 08:00 AM GMT-08:00Z 09:00 AM
Walkabout	ing Petalut
Comment	
Latitude	10
Course, Azimuth	090KTS 0.0 "00011"
Boat's Number	MY-14302

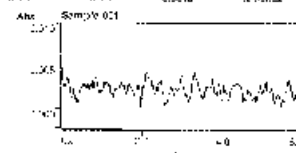
Method Hydroxy-

Sample #	Conc. (g/L)	RFSD	RFSD After
CHL ZERO	0.00	0.00	0.00
	0.0000	0.0000	0.0000
CHL 0.001	0.001	0.001	0.001



Control	- 1 year
Orthodontic Care	- 0.28 mm
r	- 0.009
Correlated Corr.	- 0.03 (98%)
Residuals	- 0.05 (0.06)

Sample ID	Age	Sex	Height	Weight	Body Fat (%)	VO2max (ml/kg/min)	VO2peak (ml/kg/min)	VO2max/VO2peak (%)
1	20.0	M	1.75	70.0	15.0	35.0	45.0	77.8
2	21.0	F	1.65	55.0	18.0	30.0	40.0	75.0
3	22.0	M	1.80	75.0	12.0	38.0	50.0	76.0
4	23.0	F	1.70	60.0	20.0	28.0	35.0	79.4
5	24.0	M	1.85	80.0	10.0	40.0	55.0	72.7
6	25.0	F	1.60	50.0	22.0	25.0	30.0	83.3
7	26.0	M	1.90	85.0	8.0	42.0	60.0	70.0
8	27.0	F	1.75	65.0	16.0	32.0	42.0	76.2
9	28.0	M	1.85	90.0	6.0	45.0	65.0	69.2
10	29.0	F	1.65	58.0	19.0	27.0	33.0	81.8
11	30.0	M	1.95	95.0	5.0	48.0	70.0	68.6
12	31.0	F	1.70	62.0	17.0	31.0	40.0	77.5
13	32.0	M	1.80	88.0	4.0	50.0	75.0	66.7
14	33.0	F	1.60	52.0	21.0	26.0	32.0	81.3
15	34.0	M	1.90	92.0	3.0	52.0	80.0	65.0
16	35.0	F	1.75	68.0	15.0	33.0	45.0	73.3
17	36.0	M	1.85	98.0	2.0	55.0	85.0	64.7
18	37.0	F	1.65	60.0	18.0	30.0	40.0	75.0
19	38.0	M	1.95	100.0	1.0	58.0	90.0	64.4
20	39.0	F	1.70	65.0	16.0	32.0	45.0	71.4
21	40.0	M	1.80	105.0	0.5	60.0	95.0	63.2
22	41.0	F	1.60	62.0	17.0	31.0	42.0	73.8
23	42.0	M	1.90	110.0	0.2	62.0	100.0	62.0
24	43.0	F	1.75	70.0	14.0	34.0	48.0	70.8
25	44.0	M	1.85	115.0	0.1	65.0	105.0	61.9
26	45.0	F	1.65	68.0	15.0	35.0	50.0	70.0
27	46.0	M	1.95	120.0	0.0	68.0	110.0	61.8
28	47.0	F	1.70	75.0	12.0	36.0	55.0	65.5
29	48.0	M	1.80	125.0	0.0	70.0	115.0	60.9
30	49.0	F	1.75	80.0	10.0	38.0	60.0	63.3
31	50.0	M	1.90	130.0	0.0	72.0	120.0	60.0
32	51.0	F	1.60	78.0	9.0	40.0	65.0	61.5
33	52.0	M	1.95	135.0	0.0	75.0	125.0	59.5
34	53.0	F	1.70	85.0	8.0	42.0	70.0	60.0
35	54.0	M	1.80	140.0	0.0	78.0	130.0	59.2
36	55.0	F	1.75	90.0	7.0	45.0	75.0	60.0
37	56.0	M	1.90	145.0	0.0	80.0	135.0	59.3
38	57.0	F	1.65	95.0	6.0	48.0	80.0	60.0
39	58.0	M	1.95	150.0	0.0	82.0	140.0	58.6
40	59.0	F	1.70	100.0	5.0	50.0	85.0	58.8
41	60.0	M	1.80	155.0	0.0	85.0	145.0	58.6
42	61.0	F	1.75	105.0	4.0	52.0	90.0	57.8
43	62.0	M	1.90	160.0	0.0	88.0	150.0	58.7
44	63.0	F	1.60	110.0	3.0	55.0	95.0	57.9



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Calibration Certificate

Certificate No.: 2202097-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhonong, Bangkok 10260

Page 1 of 5

Equipment: pH Meter
Manufacturer: HANNA INSTRUMENTS
Model: HI 2211
Serial No.: 08165345
ID No.: UAE.WAT.004/2556
Order No.: 2202097
Operation No.: 2202097-001
Date of Receipt: 11 March 2022
Date of Calibration: 16 March 2022

Calibrated by Mr.Manan Somsak Specialist
Approved by (Mr.Pheraphat Tuanjit)
Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team
Date of Issue: 21 March 2022

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: 00 Date: 14-12-61

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Calibration Report

Certificate No.: 2202097-001-01
Equipment: pH Meter
Resolution: 0.01 pH ; 0.1 mV
Manufacturer: HANNA INSTRUMENTS
Model: HI 2211
Serial No.: 08165345
Type: Bench top
ID No.: UAE.WAT.004/2556

Page 2 of 5

Date of Calibration: 16 March 2022
Location: Chemical Calibration Laboratory, National Food Institute.
Environment Condition: Ambient Temperature : 23.0 ± 1.5 °C Relative Humidity : (45.5 ± 5) %
Condition of Equipment: Good Condition
Condition of this Results of Calibration:

1. Calibration Method : In house method : W-CG-002 based on direct measurement by using standard voltage calibrator and certified reference material (CRM)

2. Reference Standards / Certified Reference Material

Instruments	Serial / ID No.	Manufacturer	Certificate No.	Due Date
2.1 DC Voltage Calibrator	2709007	Fuke	SCL-21F-0887	24 June 2022
2.2 Digital Thermometer	2709007	Fuke	CC-440889-01	30 October 2022
2.3 Thermo-Hygro Meter	ans.kit.BTH-00558	PONPE	QR21-2787	18 November 2022

Certified Reference Material	Lot No.	Manufacturer	Ref No.	Expiry Date
2.4 pH buffer 4.008 (Primary pH buffer Solution)	780012	CPAchem	PH216 L5	21 November 2023
2.5 pH buffer 6.860 (Primary pH buffer Solution)	780013	CPAchem	PH217 L5	21 November 2023
2.6 pH buffer 10.01 (Primary pH buffer Solution)	780015	CPAchem	PH220 L5	21 November 2022
2.7 pH buffer 7.00 (Standard pH buffer Solution)	776940	CPAchem	PH207 L5	8 November 2022

3. This certification is traceable to The International System of Unit (SI Unit)

3.1 Instruments No.2.1	through	NSC-TIS-TIS 17025 Laboratory Accreditation of Calibration No.0075
3.2 Instruments No.2.2	through	NSC-TIS-TIS 17025 Laboratory Accreditation of Calibration No.0061
3.3 Instruments No.2.3	through	NSC-TIS-TIS 17025 Laboratory Accreditation of Calibration No.0262
3.4 Certified Reference Material No. 2.4 to 2.6	traceable to	Primary measurement method: Harned cell using calibrated thermometer, barometer, and nanovoltmeter. The Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025.
3.5 Certified Reference Material No. 2.7	traceable to	BSM Ref H-10 L-10 31.04.2022; BSM Ref H-10 L-10 28.05.2020; BSM Ref H-10 L-10 31.04.2022; BSM Ref H-10 L-10 28.05.2020. The Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025

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

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

F-CS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2202097-001-01
Equipment: pH Meter
Resolution: 0.01 pH ; 0.1 mV
Manufacturer: HANNA INSTRUMENTS
Model: HI 2211
Serial No.: 08165345
Type: Bench top
ID No.: UAE.WAT.004/2556

Date of Calibration: 16 March 2022 Page 3 of 5

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

Nominal pH	DC Voltage Standard (mV)	Average Indicator Reading		Uncertainty (±mV)	Coverage Factor (K)
		mV	pH		
9	414.117	414	0.00	0.58	2.00
2	295.811	295.7	2.00	0.063	2.00
4	177.462	177.4	-4.00	0.063	2.00
6	99.159	99.2	6.00	0.063	2.00
7	-0.001	0.1	7.50	0.063	2.00
8	-99.159	-99.1	8.50	0.063	2.00
10	-177.463	-177.3	10.00	0.063	2.00
12	-295.812	-295.6	12.00	0.063	2.00
14	-414.115	-414	14.00	0.58	2.00

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

Equipment: pH Electrode
Manufacturer: METTLER TOLEDO
Model: LE420
Serial No.: 1142602
ID No.: N/A

Performance of Electrode system (Three-Point Calibration at pH4, pH7 and pH10)

Certified Value @25 °C (pH)	Average Indicator Reading		Relative Slope (%)	Uncertainty (± pH)	Coverage Factor (K)
	pH	mV			
4.000	4.01	180.5	96.3	0.0071	2.00
6.860	6.87	12.5	-	0.0074	2.00
10.015	10.01	-171.5	96.1	0.0060	2.00
6.860	6.86	5.2	-	0.0062	2.00

F-CS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2202097-001-01
Equipment: Digital Thermometer with RTD (pH Meter)
Resolution: 0.1 °C
Model: HI 2211
Serial No.: 08165345
ID No.: UAE.WAT.004/2556
Manufacturer: HANNA INSTRUMENTS

Date of Calibration: 16 March 2022 Page 4 of 5

Location: Chemical Calibration Laboratory, National Food Institute.

Environment Condition: Ambient Temperature : 23.0 ± 1.0 °C
Relative Humidity : (50 ± 4) %

Condition of this results of Calibration:

- Calibration Method :
 - In house method : W-TE-005 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	2118154	PSLT-066164	24-Jun-22	T8TR
Platinum Resistance Thermometer (PRT)	5627A	877332			

Support Equipment : Low Temperature Bath (BDOAL-6) Model: Europa-6 Plus Basic, S/N: 3415922

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 : ☒ Without adjustment ☐ After adjustment

F-CS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2202097-001-01
 Equipment: Digital Thermometer with RTD (pH Meter)
 Resolution: 0.1 °C Model: HI 2211
 Serial No.: D6155345 ID No.: UAE.WAT.004/2556
 Manufacturer: HANNA INSTRUMENTS
 Date of Calibration: 16-March 2022

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 3.5 mm, Length 100 mm,
 Sheath material : Stainless Steel

UUC* Reading (°C)	Standard Temperature (°C)	Correction Value (°C)	Uncertainty ± (°C)
15.0	15.001	0.0	0.009
25.0	25.002	0.0	0.009
35.0	35.002	0.0	0.009

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 %.

F-CS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

บริษัท อินทิเกรตเต็ด รีเสิร์ช เซ็นเตอร์ จำกัด



Certificate of Calibration

Calibration Certification Information			
Cal. Date: May 25, 2022	Rootsometer S/N: 438320	Ta: 296	°K
Operator: Jim Tisch		Pa: 751.08	mm Hg
Calibration Model #: TE-5028A	Calibrator S/N: 1836		

Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H2O)
1	1	2	1	1.2210	4.5	1.50
2	3	4	1	0.9550	7.3	2.50
3	5	6	1	0.8660	8.8	3.00
4	7	8	1	0.7980	10.3	3.50
5	9	10	1	0.6080	17.5	6.00

Data Tabulation					
Vstd (m3)	Qstd (x-axis)	$\sqrt{\Delta H \left(\frac{Pa}{Pstd} \right) \left(\frac{Tstd}{Ta} \right)}$ (y-axis)	Va (x-axis)	Qa (y-axis)	$\sqrt{\Delta H \left(\frac{Ta}{Pa} \right)}$ (y-axis)
0.9800	0.8100	1.2216	0.9940	0.8341	0.7680
0.9853	1.0317	1.5771	0.9903	1.0369	0.9926
0.9833	1.1354	1.7277	0.9883	1.1412	1.0873
0.9813	1.2297	1.8661	0.9863	1.2359	1.1745
0.9718	1.5983	2.4433	0.9767	1.6064	1.5377
QSTD		m= 1.54378	QA		m= 0.96669
		b= -0.02519			b= -0.01585
		r= 0.99990			r= 0.99990

Calculations			
Vstd= ΔVol(Pa-ΔP)/Pstd(Tstd/Ta)	Va= ΔVol(Pa-ΔP)/Pa		
Qstd= Vstd/ΔTime	Qa= Va/ΔTime		
For subsequent flow rate calculations:			
Qstd= 1/m $\left(\sqrt{\Delta H \left(\frac{Pa}{Pstd} \right) \left(\frac{Tstd}{Ta} \right)} - b \right)$	Qa= 1/m $\left(\sqrt{\Delta H \left(\frac{Ta}{Pa} \right)} - b \right)$		

Standard Conditions	
Tstd:	298.15 °K
Pstd:	760 mm Hg
Key	
ΔH:	calibrator manometer reading (in H2O)
ΔP:	rootsometer manometer reading (mm Hg)
Ta:	actual absolute temperature (°K)
Pa:	actual barometric pressure (mm Hg)
b:	intercept
m:	slope

RECALIBRATION
US EPA recommends annual recalibration per 1998 40 Code of Federal Regulations Part 50 to S1, Appendix B to Part 50, Reference Method for the Determination of Suspended Particulate Matter in the Atmosphere, 9.2.17, page 30.

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Village of Cleves, OH 45062

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CERTIFICATE OF ANALYSIS Grade of Product: EPA Protocol

Part Number: E03N195E80A0020	Reference Number: 82-401285019-1
Cylinder Number: LL193324	Cylinder Volume: 83.4 CF
Laboratory: 124 - Riverton (SAP) - NJ	Cylinder Pressure: 2215 PSIG
PGVP Number: B52018	Valve Outlet: 560
Gas Code: NO,NOX,SO2,BALN	Certification Date: Sep 05, 2018

Expiration Date: Sep 05, 2026

Certification performed in accordance with EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012) document EPA-600/R-12/531, using the assay procedures listed. Analytical Metrology does not require correction for analytical interference. This cylinder has a valid analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volumetric basis unless otherwise noted.
Do Not Use This Cylinder before 100 ppm, i.e. 5.7 megagrams.

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Date
NOX	50.00 PPM	50.71 PPM	G1	±1.4% NIST Traceable	08/27/2018, 09/05/2018
NITRIC OXIDE	50.00 PPM	50.67 PPM	G1	±1.4% NIST Traceable	08/27/2018, 09/05/2018
SULFUR DIOXIDE	50.00 PPM	50.54 PPM	G1	±1.0% NIST Traceable	08/27/2018, 09/05/2018
NITROGEN	Balance				

CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	18060523	CD442505	50.42 PPM NITRIC OXIDE/NITROGEN	±1.0%	Jun 27, 2020
PRM	12366	5604119	29.86 PPM NITROGEN DIOXIDE/AIR	±1.0%	Jun 02, 2017
GRMS	7942010194	CC525841	5.101 PPM NITROGEN DIOXIDE/NITROGEN	±1.0%	Jun 01, 2020
NTRM	14010327	KAL504378	49.08 PPM SULFUR DIOXIDE/NITROGEN	±1.0%	Apr 17, 2024

ANALYTICAL EQUIPMENT		
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicoret 6730 APW1100381 NO	FTIR	Aug 09, 2018
Nicoret 6730 APW1100381 NO2	FTIR	Aug 31, 2018
Nicoret 6730 APW1100381 SO2	FTIR	Aug 30, 2018

Triad Data Available Upon Request

NOTES: PO# 5218003935

Net weight: 2736 grams
Gross weight: 17363 grams

This calibration std. has been certified in accordance with the May 2012 EPA Traceability Protocol Document EPA-600/R-12/531. All testing processes and measurements conform to the requirements of ISO/IEC 17025 and to Airgas ISO 9001:2008 and relate only to items identified on this certificate. Values are certified to be NIST Traceable with total uncertainty as detailed under Analytical Uncertainty. This document shall not be reproduced in full without written approval of the issuer.



Approved for Release

Page 1 of 82-401285019-1



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0155

MTC No. EEL, BP. 13/1264

CALIBRATION CERTIFICATE

Submitted by: Integrated Research Center Company Limited
Address: 122 Moo 2, T.Thatoom, A.Srinahaphote, Prachinburi 25140.
Calibrated at: Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., A.Muang, Samutprakan 10280.

Instrument Calibrated:		Ambient Environment	
Description:	Integrating Sound Level Meter	Temperature:	(23 ± 3) °C
Manufacturer:	ACO	Relative Humidity:	(50 ± 15) %
Model:	6226	Ambient Pressure:	(101.325 ± 1.5) kPa
Serial No.:	100142		
Microphone:	Type 7052 No.79842		
Preamplifier:	-		

- Standards used:**
1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
 2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871.
 3. Decade Attenuator Ando AL-205 S/N 00464602.
 4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
 5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
 6. Digital Multimeter Fluke 8520A S/N 4985007.
 7. Pistonphone Rion NC-72 S/N 00402446.
 8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt: 3 Dec. 2021
Date of Calibration: 10-11 Jan. 2022

1 / 8

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

FM.B.MTC.002 Rev.4

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0155

MTC No. EEL, BP. 13/1264

9. Power Amplifier Brüel&Kjær 2706 S/N 1517650.
10. Spenser Tannoy Limited, Great Britain British Patent No. 215300.
11. Digital Multimeter Agilent 34401A S/N MY44005560.
12. Programmable Attenuator Yamagawa TPA-303A S/N 2212.

Calibration Procedure:

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2006). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

This instrument has been calibrated against standards maintained at the Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

The reported expanded uncertainty is based upon a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%.

Date of Calibration: 10-11 Jan. 2022

2 / 8

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1. Absolute Sensitivity

Reference	Unit Under Test				Tolerance
Acoustic Signal (dB)	Measured Value (dB)		Deviation (dB)	Uncertainty (±dB)	Limit Class 2 (±dB)
	Before adjust	After adjust			
	113.97	114.4	114.0	0.0	

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 113.9 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)
21.2	0.10

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

Frequency Weighting	Measured Value (dB)	Uncertainty (±dB)
A-Weighting	15.4	0.10
C-Weighting	23.6	0.10
Flat	26.5	0.10

Date of Calibration : 10-11 Jan, 2022

3/8

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3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
	A-weighting (dB)	C-weighting (dB)	Flat (dB)		
125	0.3	0.1	0.1	0.40	2.0
1 000	-0.8	-0.7	-0.7	0.40	1.4
4 000	-0.4	-0.4	-0.2	0.40	3.6

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
	A-weighting (dB)	C-weighting (dB)	Flat (dB)		
63	0.1	0.1	0.1	0.20	2.5
125	0.1	0.2	0.2	0.20	2.0
250	0.1	0.1	0.1	0.20	1.9
500	0.1	0.0	0.0	0.20	1.9
1 000	0.0	0.0	0.0	0.20	1.4
2 000	-0.2	0.0	0.1	0.20	2.6
4 000	-0.3	-0.2	0.1	0.20	3.6
8 000	-0.3	-0.1	-0.1	0.20	5.6

Date of Calibration : 10-11 Jan, 2022

4/8

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5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
A-weighting	94.0	0.0	0.20	0.4
C-weighting	94.0	0.0	0.20	0.4
Flat	94.0	0.0	0.20	0.4

5.2 Time weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
Fast	94.0	0.0	0.20	0.3
Slow	94.0	0.0	0.20	0.3
Leq	94.0	0.0	0.20	0.3

6. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
122	122.0	0.0	0.30	1.4
121	121.0	0.0	0.30	1.4
120	120.0	0.0	0.30	1.4
119	119.0	0.0	0.30	1.4
114	113.9	-0.1	0.30	1.4
109	108.9	-0.1	0.30	1.4

Date of Calibration : 10-11 Jan, 2022

5/8

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6. Level linearity on the reference level range (cont.)

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
104	103.9	-0.1	0.30	1.4
99	99.0	0.0	0.30	1.4
94	94.0	0.0	0.30	1.4
89	88.9	-0.1	0.30	1.4
84	84.0	0.0	0.30	1.4
79	78.9	-0.1	0.30	1.4
74	74.0	0.0	0.30	1.4
69	69.0	0.0	0.30	1.4
64	63.8	-0.2	0.30	1.4
59	58.8	-0.2	0.30	1.4
54	53.9	-0.1	0.30	1.4
49	48.8	-0.2	0.30	1.4
44	43.9	-0.1	0.30	1.4
39	38.8	-0.2	0.30	1.4
34	33.9	-0.1	0.30	1.4
33	33.0	0.0	0.30	1.4
32	32.0	0.0	0.30	1.4
31	31.0	0.0	0.30	1.4
30	30.1	0.1	0.30	1.4

Date of Calibration : 10-11 Jan, 2022

6/8

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7. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
40-130	125	125.0	0.0	0.30	1.4
50-120	115	115.0	0.0	0.30	1.4
20-110	105	105.0	0.0	0.30	1.4
20-100	95	95.0	0.0	0.30	1.4
20-90	85	84.9	-0.1	0.30	1.4
20-80	75	74.9	-0.1	0.30	1.4

8. Tone burst response

Time Weighting	Toneburst Duration, Tb (ms)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (dB)
Fast	200	115.7	-0.3	0.20	±1.3
	2	98.7	-0.3	0.20	+1.3; -2.8
	0.25	89.5	-0.5	0.20	+1.8; -5.3
Slow	200	109.5	-0.1	0.20	±1.3
	2	89.9	-0.1	0.20	+1.3; -5.3
	0.25	81.3	0.3	0.20	+1.8; -5.3

Date of Calibration : 10-11 Jan. 2022

7 / 8

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9. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (±dB)	Tolerance limits Class 2 (±dB)
Complete cycle	125.4	125.7	0.3	0.20	2.4
Positive half cycle	124.4	124.2	-0.2	0.20	1.4
Negative half cycle	124.4	124.2	-0.2	0.20	1.4

10. Overload indication

Measured value (dB)		Deviated value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
Positive one-half cycle	Negative one-half cycle			
133.2	133.2	0.0	0.30	1.8

Calibrated by :

Danya Phasingon
(Mr. Panya Phasingon)
(Mr. Tawakiat Iamsamran)

Approved by :

(Mr. Pawan Khunja)
(Mr. Pawan Khunja)
Acting Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 10-11 Jan. 2022

Date of Issue : 12 Jan. 2022

Ref : 2011264120305034004

End of Certificate

8 / 8

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Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
Fax. (66) 0 2579 8592
E-mail : suran@tistr.or.th

CALIBRATION CERTIFICATE

Submitted by : Integrated Research Center Company Limited.
Address : 122 Moo 2, T.Thasoom, A.Srimahaphote, Prachinburi 25140
Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre,
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., A.Muang, Samutprakan 10280,

Instrument Calibrated :

Description : Sound Level Meter

Manufacturer : Delta OHM

Model : HD 2010UC

Serial No. : 11040842479

Microphone : Type UC-52 No.114674

Preamplifier : Delta Type HD2010PNE2 No.11001018

Ambient Environment

Temperature : (23 ± 3) °C

Relative Humidity : (50 ± 15) %

Ambient Pressure : (101.325 ± 1.5) kPa

Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY4402668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Digital Multimeter Fluke 8520A S/N 4985007.
7. Pistophone Rion NC-72 S/N 00402446.
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 3 Dec. 2021

Date of Calibration : 17 Jan. 2022

1 / 8

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E-mail : suran@tistr.or.th

9. Power Amplifier Brüel&Kjær 2706 S/N 1517650.
10. Speaker Tannoy Limited, Great Britain British Patent No. 215300.
11. Digital Multimeter Agilent 34401A S/N MY44005560.
12. Programmable Attenuator Tamagawa TPA-303A S/N 2212.

Calibration Procedure :

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2006). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

This instrument has been calibrated against standards maintained at the Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

The reported expanded uncertainty is based upon a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%.

Date of Calibration : 17 Jan. 2022

2 / 8

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1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Unit Under Test				Tolerance Limit Class 2 (±dB)
	Measured Value (dB)		Deviation (dB)	Uncertainty (±dB)	
	Before adjust	After adjust			
113.94	113.8	113.9	0.0	0.30	1.4

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 114.0 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)
23.5	0.10

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

Frequency Weighting	Measured Value (dB)	Uncertainty (±dB)
A-Weighting	19.5	0.10
C-Weighting	25.2	0.10
Flat	27.3	0.10

Date of Calibration : 17 Jan. 2022

3 / 8

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3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
	A-weighting (dB)	C-weighting (dB)	Flat (dB)		
	(dB)	(dB)	(dB)		
125	0.3	0.3	0.2	0.40	2.0
1 000	-0.8	-0.8	-0.8	0.40	1.4
4 000	-0.1	0.0	-0.1	0.40	3.6

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
	A-weighting (dB)	C-weighting (dB)	Flat (dB)		
	(dB)	(dB)	(dB)		
63	0.1	-0.1	-0.3	0.20	2.5
125	0.1	0.0	-0.1	0.20	2.0
250	0.1	0.0	-0.1	0.20	1.9
500	0.0	0.0	0.0	0.20	1.9
1 000	0.0	0.0	0.0	0.20	1.4
2 000	-0.1	0.1	-0.1	0.20	2.6
4 000	0.0	0.2	-0.4	0.20	3.6
8 000	0.0	0.1	-0.8	0.20	5.6

Date of Calibration : 17 Jan. 2022

4 / 8

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5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
A-weighting	94.0	0.0	0.20	0.4
C-weighting	94.0	0.0	0.20	0.4
Flat	94.0	0.0	0.20	0.4

5.2 Time weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
Fast	94.0	0.0	0.20	0.3
Slow	94.0	0.0	0.20	0.3
Leq	94.0	0.0	0.20	0.3

6. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
120	119.9	-0.1	0.30	1.4
119	119.0	0.0	0.30	1.4
114	114.0	0.0	0.30	1.4
109	109.0	0.0	0.30	1.4
104	104.0	0.0	0.30	1.4
99	98.9	-0.1	0.30	1.4
94	94.0	0.0	0.30	1.4
89	88.9	-0.1	0.30	1.4
84	84.0	0.0	0.30	1.4

Date of Calibration : 17 Jan. 2022

5 / 8

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6. Level linearity on the reference level range (cont.)

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
79	79.0	0.0	0.30	1.4
74	73.9	-0.1	0.30	1.4
69	68.9	-0.1	0.30	1.4
64	63.9	-0.1	0.30	1.4
59	58.9	-0.1	0.30	1.4
54	53.9	-0.1	0.30	1.4
49	48.9	-0.1	0.30	1.4
44	43.9	-0.1	0.30	1.4
43	43.0	0.0	0.30	1.4
42	41.9	-0.1	0.30	1.4
41	41.0	0.0	0.30	1.4
40	39.9	-0.1	0.30	1.4
39	38.9	-0.1	0.30	1.4

Date of Calibration : 17 Jan. 2022

6 / 8

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Request No. 21-65/0155

MTC No. EEL. BP. 17/1264

7. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 2 (\pm dB)
60-140	135	135.2	0.2	0.30	1.4
50-130	125	125.1	0.1	0.30	1.4
40-120	115	115.0	0.0	0.30	1.4
30-110	105	105.0	0.0	0.30	1.4
20-100	95	94.9	-0.1	0.30	1.4

8. Tone burst response

Time Weighting	Toneburst Duration, Tb (ms)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 2 (dB)
Fast	200	115.9	-0.1	0.20	± 1.3
	2	98.8	-0.2	0.20	$+1.3; -2.8$
	0.25	89.7	-0.3	0.20	$+1.8; -5.3$
Slow	200	109.4	-0.2	0.20	± 1.3
	2	89.6	-0.4	0.20	$+1.3; -5.3$
SEL	200	110.0	0.0	0.20	± 1.3
	2	89.9	-0.1	0.20	$+1.3; -2.8$
	0.25	80.8	-0.2	0.20	$+1.8; -5.3$

Date of Calibration : 17 Jan. 2022

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Request No. 21-65/0155

MTC No. EEL. BP. 17/1264

9. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (\pm dB)	Tolerance limits Class 2 (\pm dB)
Complete cycle	135.4	135.3	-0.1	0.20	2.4
Positive half cycle	134.4	134.2	-0.2	0.20	1.4
Negative half cycle	134.4	134.2	-0.2	0.20	1.4

10. Overload indication

Measured value (dB)		Deviated value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 2 (\pm dB)
Positive one-half cycle	Negative one-half cycle			
141.0	141.0	0.0	0.30	1.8

Calibrated by:

Panya Phumngun
(Mr. Panya Phumngun)

Approved by:

Panya Phumngun
(Mr. Panya Phumngun)
Acting Director

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Calibration : 17 Jan. 2022

Date of Issue : 17 Jan. 2022

Ref: 2011264120305034007

End of Certificate

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Request No. 21-65/0155

MTC No. EEL. BP. 21/1264

CALIBRATION CERTIFICATE

Submitted by : Integrated Research Center Company Limited

Address : 122 Moo 2, T.Thatoom, A.Srinakaphote, Prachinburi 25140.

Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., A.Muang, Samutprakan 10280.

Instrument Calibrated : **Ambient Environment**
Description : Integrating Sound Level Meter Temperature : (23 ± 3) °C
Manufacturer : ACO Relative Humidity : (50 ± 15) %
Model : 6236 Ambient Pressure : (101.325 ± 1.5) kPa
Serial No. : 192015
Microphone : Type 7052NR No.73304
Preamplifier : -

Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Digital Multimeter Fluke 8520A S/N 4985007.
7. Pistophone Rion NC-72 S/N 00402446.
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 3 Dec. 2021

Date of Calibration : 10-11 Jan. 2022

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10. Speaker Tannoy Limited, Great Britain British Patent No. 215300.
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The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

The reported expanded uncertainty is based upon a standard uncertainty multiplied by a coverage factor $k=2$, providing a level of confidence of approximately 95%.

Date of Calibration : 10-11 Jan. 2022

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Fax. (66) 0 2579 8592
E-mail: suran@tistr.or.th

1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Unit Under Test				Tolerance
	Measured Value (dB)		Deviation (dB)	Uncertainty (±dB)	Limit Class 2 (±dB)
	Before adjust	After adjust			
113.96	113.0	114.0	0.0	0.30	1.4

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 115.3 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)
16.8	0.10

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

Frequency Weighting	Measured Value (dB)	Uncertainty (±dB)
A-Weighting	14.8	0.10
C-Weighting	21.1	0.10
Flat	25.7	0.10

Date of Calibration : 10-11 Jan. 2022

3 / 8

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FMIL/MTC.002 Rev.4

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E-mail : sumalee@tistr.or.th

3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
	A-weighting (dB)	C-weighting (dB)	Flat (dB)		
125	0.2	0.1	0.1	0.40	2.0
1 000	-0.8	-0.7	-0.7	0.40	1.4
4 000	-0.1	-0.1	0.3	0.40	3.6

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
	A-weighting (dB)	C-weighting (dB)	Flat (dB)		
63	0.2	0.0	0.0	0.20	2.5
125	0.0	0.1	0.1	0.20	2.0
250	0.0	0.0	0.0	0.20	1.9
500	0.0	0.0	0.0	0.20	1.9
1 000	0.0	0.0	0.0	0.20	1.4
2 000	-0.2	0.0	0.0	0.20	2.6
4 000	-0.5	-0.3	0.0	0.20	3.6
8 000	-0.6	-0.5	-0.1	0.20	5.6

Date of Calibration : 10-11 Jan. 2022

4 / 8

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5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
A-weighting	94.0	0.0	0.20	0.4
C-weighting	94.0	0.0	0.20	0.4
Flat	94.1	0.1	0.20	0.4

5.2 Time weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
Fast	94.0	0.0	0.20	0.3
Slow	94.0	0.0	0.20	0.3
Leq	94.0	0.0	0.20	0.3

6. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
122	122.1	0.1	0.30	1.4
121	121.1	0.1	0.30	1.4
120	120.0	0.0	0.30	1.4
119	119.0	0.0	0.30	1.4
114	114.0	0.0	0.30	1.4
109	108.9	-0.1	0.30	1.4
104	104.0	0.0	0.30	1.4
99	99.0	0.0	0.30	1.4

Date of Calibration : 10-11 Jan. 2022

5 / 8

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6. Level linearity on the reference level range (cont.)

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
94	94.0	0.0	0.30	1.4
89	89.0	0.0	0.30	1.4
84	83.9	-0.1	0.30	1.4
79	78.9	-0.1	0.30	1.4
74	74.2	0.2	0.30	1.4
69	69.2	0.2	0.30	1.4
64	64.1	0.1	0.30	1.4
59	59.0	0.0	0.30	1.4
54	54.1	0.1	0.30	1.4
49	49.1	0.1	0.30	1.4
44	44.1	0.1	0.30	1.4
39	39.0	0.0	0.30	1.4
34	34.2	0.2	0.30	1.4
33	33.2	0.2	0.30	1.4
32	32.3	0.3	0.30	1.4
31	31.3	0.3	0.30	1.4
30	30.4	0.4	0.30	1.4

Date of Calibration : 10-11 Jan. 2022

6 / 8

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Request No. 21-65/0155 MTC No. EEL, BP, 21/1264

7. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
40-130	125	125.1	0.1	0.30	1.4
30-120	115	115.0	0.0	0.30	1.4
20-110	105	105.0	0.0	0.30	1.4
20-100	95	95.0	0.0	0.30	1.4
20-90	85	85.0	0.0	0.30	1.4
20-80	75	75.0	0.0	0.30	1.4

8. Tone burst response

Time Weighting	Toneburst Duration, Tb (ms)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (dB)
Fast	200	115.7	-0.3	0.20	±1.3
	2	98.8	-0.2	0.20	+1.3; -2.8
	0.25	88.3	-1.7	0.20	+1.8; -5.3
Slow	200	109.4	-0.2	0.20	±1.3
	2	89.8	-0.2	0.20	+1.3; -5.3
	0.25	80.9	-0.1	0.20	+1.8; -5.3

Date of Calibration : 10-11 Jan. 2022

7/8

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Request No. 21-65/0155 MTC No. EEL, BP, 21/1264

9. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (±dB)	Tolerance limits Class 2 (±dB)
Complete cycle	125.4	125.8	0.4	0.20	2.4
Positive half cycle	124.4	124.3	-0.1	0.20	1.4
Negative half cycle	124.4	124.3	-0.1	0.20	1.4

10. Overload indication

Measured value (dB)		Deviated value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
Positive one-half cycle	Negative one-half cycle			
133.1	133.1	0.0	0.30	1.8

Calibrated by :

Approved by :

Panya Phasingsri
(Mr. Panya Phasingsri)

Prasanna Khinyra
(Mr. Prasanna Khinyra)

Tawikiat Jamsaran
(Mr. Tawikiat Jamsaran)

Prasanna Khinyra
(Mr. Prasanna Khinyra)
Acting Director

Date of Calibration : 10-11 Jan. 2022

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Issue : 12 Jan. 2022

Ref : 2011264120305034012

End of Certificate

8/8

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Request No. 21-65/0155 MTC No. EEL, BP, 10/1264

CALIBRATION CERTIFICATE

Submitted by : Integrated Research Center Company Limited.
Address : 122 Moo 2 T.Thatoom A.Srinualaphote Prachinburi 25140.
Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.
: Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., Muang, Samutprakan 10280.

Instrument Calibrated :
Description : Sound Calibrator
Manufacturer : ACO
Model : 2127
Serial No. : 100012

Ambient Environment
Temperature : (23 ± 3) °C
Relative Humidity : (50 ± 15) %
Ambient Pressure : (101.325 ± 1.500) kPa

Standards used :
1. Digital Function Synthesizer NF Electronic DF-193A S/N 122037.
2. Measuring Amplifier Brüel&Kjaer 2636 S/N 1537484.
3. Programmable Attenuator Tamagawa TPA-303A S/N OF 2214.
4. Digital Multimeter Agilent 34401A S/N MY44005560.
5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.
6. Audio Analyzer Keithley 2015-P S/N 4106495.
7. Condenser Microphone Brüel&Kjaer 4180 S/N 2889871.

Calibration Procedure: CP-102-04 based on IEC 60942:2003; The sound pressure level generated by sound calibrator under test shall be measured by standard microphone using an insert voltage technique.

This instrument has been calibrated against standards maintained at Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

Date of Receipt : 3 Dec. 2021

Date of Calibration : 15 Dec. 2021

1/2

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Request No. 21-65/0155 MTC No. EEL, BP, 10/1264

The reported expanded uncertainty is based upon a standard uncertainty multiplied by a coverage factor k = 2, providing a level of confidence of approximately 95%.

Nominal Output of Unit Under Test = 94 dB re 20µPa at 1000 Hz

Acoustic Output in dB re 20µPa, Corrected to Reference Conditions: 101.325 kPa, 23.0 °C and 50 %RH.

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC 60942:2003 Class 1
1/2 inch Brüel&Kjaer 4180	93.92	-0.08	± 0.10	±0.40 dB

2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC 60942:2003 Class 1
1/2 inch Brüel&Kjaer 4180	1008.4	8.4	± 1.5	±1.0%

3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC 60942:2003 Class 1
1/2 inch Brüel&Kjaer 4180	1.70	± 0.50	±3.0%

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :

Approved by :

Weerachai Deechaiyae
(Mr. Weerachai Deechaiyae)

Prasanna Khinyra
(Mr. Prasanna Khinyra)
Acting Director

Date of Calibration : 15 Dec. 2021

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Issue : 20 Dec. 2021

Ref : 2011264120305034001

End of Certificate

2/2

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Request No. 21-65/0155 MTC No. EEL. BP. 12/1264

CALIBRATION CERTIFICATE

Submitted by : Integrated Research Center Company Limited.

Address : 122 Moo 2 T.Thatoom A.Srinahapoth Prachinburi 25140.

Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.
: Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., Muang, Samutprakan 10280.

Instrument Calibrated : **Ambient Environment**

Description : Sound Calibrator Temperature : $(23 \pm 3) ^\circ\text{C}$

Manufacturer : Delta Ohm Relative Humidity : $(50 \pm 15) \%$

Model : HD9102 Ambient Pressure : $(101.325 \pm 1.500) \text{ kPa}$

Serial No. : 10038483

Standards used : 1. Digital Function Synthesizer NF Electronic DF-193A S/N 122037.
2. Measuring Amplifier Bruel&Kjaer 2636 S/N 1537484.
3. Programmable Attenuator Tamagawa TPA-303A S/N OF 2214.
4. Digital Multimeter Agilent 34401A S/N MY4405560.
5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.
6. Audio Analyzer Keithley 2015-P S/N 4106495.
7. Condenser Microphone Bruel&Kjaer 4180 S/N 2889871.

Calibration Procedure : CP-102-04 based on IEC 60942:2003. The sound pressure level of instrument was measured by standard microphone using an insert voltage technique.

This instrument has been calibrated against standards maintained at Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

Date of Receipt : 3 Dec. 2021

Date of Calibration : 17 Dec. 2021

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Request No. 21-65/0155 MTC No. EEL. BP. 12/1264

The reported expanded uncertainty is based upon a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95%.

Nominal Output of Unit Under Test = 94 dB re 20 μ Pa at 1000 Hz

Acoustic Output in dB re 20 μ Pa, Corrected to Reference Conditions : 101.325 kPa, 23.6 $^\circ\text{C}$ and 50 %RH

1. Sound Pressure Level

Standard Microphone	Measured Sound Pressure	Deviated value	Uncertainty	Tolerance limit
Type	Level (dB)	(dB)	(dB)	IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	93.94	-0.06	± 0.10	$\pm 0.75 \text{ dB}$

2. Frequency

Standard Microphone	Measured Frequency	Deviated value	Uncertainty	Tolerance limit
Type	(Hz)	(Hz)	(Hz)	IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	988.8	-11.2	± 1.5	$\pm 2.0\%$

3. Total distortion

Standard Microphone	Measured Total distortion	Uncertainty	Tolerance limit
Type	(%)	(%)	IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	1.22	± 0.50	$\pm 4.0\%$

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Date of Calibration : 17 Dec. 2021

2 / 3

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E-mail : sumalee@tistr.or.th

Request No. 21-65/0155 MTC No. EEL. BP. 12/1264

Nominal Output of Unit Under Test = 114 dB re 20 μ Pa at 1000 Hz

Acoustic Output in dB re 20 μ Pa, Corrected to Reference Conditions : 101.325 kPa, 23.0 $^\circ\text{C}$ and 50 %RH

1. Sound Pressure Level

Standard Microphone	Measured Sound Pressure	Deviated value	Uncertainty	Tolerance limit
Type	Level (dB)	(dB)	(dB)	IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	113.92	-0.08	± 0.10	$\pm 0.75 \text{ dB}$

2. Frequency

Standard Microphone	Measured Frequency	Deviated value	Uncertainty	Tolerance limit
Type	(Hz)	(Hz)	(Hz)	IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	988.8	-11.2	± 1.5	$\pm 2.0\%$

3. Total Distortion

Standard Microphone	Measured Total Distortion	Uncertainty	Tolerance limit
Type	(%)	(%)	IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	0.18	± 0.50	$\pm 4.0\%$

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by : 
(Mr. Weerachai Deechaiyue)

Approved by : 
(Mr. P. W. K. Klayap)

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Calibration : 17 Dec. 2021

Date of Issue : 20 Dec. 2021

Ref : 2011264120305034003

End of Certificate

3 / 3

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E-mail : mtg@tistr.or.th

Office : 136 Phahonyothin Road, Chatuchak, Bangkok 10900, Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
Fax. (66) 0 2579 8392
E-mail : sumalee@tistr.or.th



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
3344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250
TEL. 0-2715-3800-24 FAX. 0-2719-9484



Certificate of Calibration

Certificate No. : 21102540
Page : 1 of 2

Equipment : Heat Stress Monitor

Manufacturer : Delta Ohm

Model : HD 32.2

Serial No. : 10027485

ID No. : -

Condition As-Received : Used Item

Received Date : 24 December 2021

Calibration Date : 28 December 2021

Reference : 2112-0996WC

Submitted by : Integrated Research Center Co., Ltd.

Ambient Temperature : $(25 \pm 3) ^\circ\text{C}$

122 Moo 2, T.Thatoom, A.Srinahapoth, Prachinburi 25140

Relative Humidity : $(50 \pm 20) \%$

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

Condition of this result of calibration


1. Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Handheld Thermometer With Sensor	1521	ASA339	211842	19 Aug 2022

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

3. This Certification is traceable to the International System of Unit maintained at -National Institute of Metrology Thailand (NIMT)

Calibrated by : Krapong Onrat
Issue Date : 29 December 2021

Approved Signatory : 
[] Chakrit Waseung
[] Pornthippa Tameyaykul
[] Pitak Srimongkoi

11 0277474



Cert. No.: 21H2649
Page: 2 of 2

This instrument was connected with temperature probe Serial No. 10028254.

Result of Calibration:

Without Adjustment

Function:

Temperature measurement for T_h.

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (°C)
20.023	20.0	-0.023	0.42
30.026	30.1	0.074	0.42
40.036	40.1	0.084	0.42

This instrument was connected with temperature probe Serial No. 10028231.

Result of Calibration:

Without Adjustment

Function:

Temperature measurement for T_g.

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (°C)
20.023	20.0	-0.023	0.42
30.026	30.0	-0.026	0.42
40.036	39.9	-0.136	0.42

This instrument was connected with temperature probe Serial No. 10031667.

Result of Calibration:

Without Adjustment

Function:

Temperature measurement for T_h.

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (°C)
20.023	20.1	0.077	0.42
30.026	30.1	0.074	0.42
40.036	40.0	-0.036	0.42

UUC* : Unit Under Calibration

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

-000-

[Signature]

1088286



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
514/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250
TEL. 0-2717-3000-24 FAX. 0-2719-9484



Certificate of Calibration

Certificate No.: 21H2648
Page: 1 of 2

Equipment : Heat Stress Monitor

Manufacturer : Delta Ohm

Model : HD 32.2

Serial No.: 10027484

ID No.: -

Condition As-Received: Used Item

Received Date: 24 December 2021

Calibration Date: 28 December 2021

Reference: 2112-0696WC

Submitted by: Integrated Research Center Co., Ltd.

Ambient Temperature: (25 ± 3) °C

122 Moo 2, T.Thakoon, A.Srinahaphote, Prachinburi 25140

Relative Humidity: (50 ± 20) %

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

Condition of this result of calibration

1. Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Handheld Thermometer With Sensor	1521	ASA339	21B42	19 Aug 2022

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

3. This Certification is traceable to the International System of Unit maintained at:-
-National Institute of Metrology Thailand (NIMT)

Calibrated by : Kraisop Onrat
Issue Date : 29 December 2021

Approved Signatory :

[Signature]
✓ Chakrit Wamwajua
| Pomsippa Tameyakul
| Pitak Srimongkol

0277435



Cert. No.: 21H2648
Page: 2 of 2

This instrument was connected with temperature probe Serial No. 17011154.

Result of Calibration:

Without Adjustment

Function:

Temperature measurement for T_h.

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (°C)
20.023	19.9	-0.123	0.42
30.026	29.9	-0.126	0.42
40.036	40.0	-0.036	0.42

This instrument was connected with temperature probe Serial No. 10028228.

Result of Calibration:

Without Adjustment

Function:

Temperature measurement for T_g.

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (°C)
20.023	20.0	-0.023	0.42
30.026	30.0	-0.026	0.42
40.036	40.0	-0.036	0.42

This instrument was connected with temperature probe Serial No. 10031669.

Result of Calibration:

Without Adjustment

Function:

Temperature measurement for T_h.

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (°C)
20.023	20.0	-0.023	0.42
30.026	30.0	-0.026	0.42
40.036	40.0	-0.036	0.42

UUC* : Unit Under Calibration

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

-000-

[Signature]

1088286



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
514/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250
TEL. 0-2717-3000-24 FAX. 0-2719-9484



Certificate of Calibration

Certificate No.: 21H2650
Page: 1 of 2

Equipment : Heat Stress Monitor

Manufacturer : Delta Ohm

Model : HD 32.2

Serial No.: 10027486

ID No.: -

Condition As-Received: Used Item

Received Date: 24 December 2021

Calibration Date: 28 December 2021

Reference: 2112-0696WC

Submitted by: Integrated Research Center Co., Ltd.

Ambient Temperature: (25 ± 3) °C

122 Moo 2, T.Thakoon, A.Srinahaphote, Prachinburi 25140

Relative Humidity: (50 ± 20) %

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

Condition of this result of calibration

1. Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Handheld Thermometer With Sensor	1521	ASA339	21B42	19 Aug 2022

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

3. This Certification is traceable to the International System of Unit maintained at:-
-National Institute of Metrology Thailand (NIMT)

Calibrated by : Kraisop Onrat
Issue Date : 29 December 2021

Approved Signatory :

[Signature]
✓ Chakrit Wamwajua
| Pomsippa Tameyakul
| Pitak Srimongkol

0277435



Cert. No.: 21H2550
Page: 2 of 2

This instrument was connected with temperature probe Serial No. 19028513.

Result of Calibration:

Without Adjustment

Function:

Temperature measurement for T_n.

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (°C)
20.023	20.0	-0.023	0.42
30.026	30.0	-0.026	0.42
40.036	40.0	-0.036	0.42

This instrument was connected with temperature probe Serial No. 10028232.

Result of Calibration:

Without Adjustment

Function:

Temperature measurement for T_g.

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (°C)
20.023	20.1	0.077	0.42
30.026	30.1	0.074	0.42
40.036	40.0	-0.036	0.42

This instrument was connected with temperature probe Serial No. 10031655.

Result of Calibration:

Without Adjustment

Function:

Temperature measurement for T_n.

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (°C)
20.023	19.9	-0.123	0.42
30.026	29.9	-0.126	0.42
40.036	39.9	-0.136	0.42

UUC* : Unit Under Calibration

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

-000-

1088284



Certificate of Calibration

Equipment:

Balance

Certificate No.: C01213272

Model:

ME36S

Issued Date: 16 November 2021

Serial No. (or ID.):

27206085

Job No.: KSPR2116020

Manufacturer:

Sartorius

Page: 1 of 3

Condition:

In condition

Customer:

Integrated Research Center Co., Ltd.
122 Moo 2, Tambol Thatoom,
Amphur Srimahaphote, Prachinburi 25140 Thailand

Environment Condition:

Temperature 25 °C ± 0.3 °C
Humidity 54 %RH ± 2.4 %RH

Calibration Place:

Integrated Research Center Co., Ltd. (พอลเคอรี่เซ็น)
122 Moo 2, Tambol Thatoom,
Amphur Srimahaphote, Prachinburi 25140 Thailand

Calibration By:

Mr. Adnan Ninviboon

Calibration Date:

11 November 2021

The Method used:

In house method, SPCC-WI-47, base on UKAS Lab 14

Traceability:

This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through SPC RT Co., Ltd. Certificate No. C02210500, C02210714

(Mr. Adnan Ninviboon)

Person in charge

SERT
บริษัท เอสอาร์ที จำกัด
SPC RT Co., Ltd.

(Mr. Rungrod Jenkitrakulchai)

Authorized signatory

This certificate is issued by 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 valid only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of SPC RT Co., Ltd.

SPC RT CO., LTD.
111/111 หมู่ 11 ถนนพหลโยธิน ซ. 111 ถนนพหลโยธิน แขวงจตุจักร กรุงเทพฯ 10130 Thailand
Tel: 0 2885 4333 Fax: 0 2885 4334 E-mail: info@spcrt.com Website: www.spcrt.com

SPCC-FM-C01-10: 23 Nov 2020

Certificate No.: C01213272

Page: 2 of 3

Calibration Results:

Before Adjustment

Eccentric Error: Weight to be 1/4 or 1/3 of Maximum capacity, taken from the center of the pan as a zero reference.

			Nominal Test Value	10000	(mg)
			Reference Points (mg)		
A	B	C	D	E	
-	-0.002	0.001	0.000	-0.001	

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

Nominal test value (mg)	Standard Deviation
2000	0.0012
20000	0.0012

Departure of indication from nominal value., Readability 0.001 (mg)




Nominal Value (mg)	Conventional Mass (mg)	Displayed Value (mg)	Correction of Balance (mg)	Uncertainty (mg)	k
1	1.0020	1.002	0.000	0.0035	2.01
5	5.0020	5.002	0.000	0.0035	2.01
10	10.0010	10.001	0.000	0.0049	2.00
50	50.0040	50.003	0.001	0.0063	2.00
100	99.9990	99.997	0.001	0.0082	2.00
500	499.9940	499.995	-0.001	0.013	2.00
1000	1000.0050	1000.002	0.003	0.016	2.00
5000	5000.0050	5000.002	0.003	0.027	2.00
10000	9999.9810	9999.976	0.005	0.033	2.00
20000	20000.0070	19999.981	0.026	0.048	2.00
30000	29999.9880	29999.933	0.055	0.080	2.00

Certificate No.: C01213272

Page: 3 of 3

After Adjustment

Eccentric Error: Weight to be 1/4 or 1/3 of Maximum capacity, taken from the center of the pan as a zero reference.

			Nominal Test Value	10000	(mg)
			Reference Points (mg)		
A	B	C	D	E	
-	-0.001	0.000	0.000	-0.001	

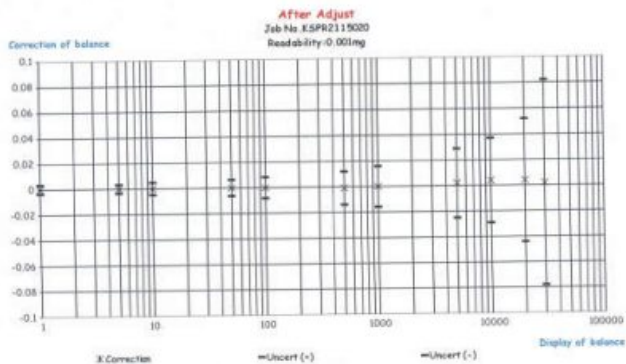
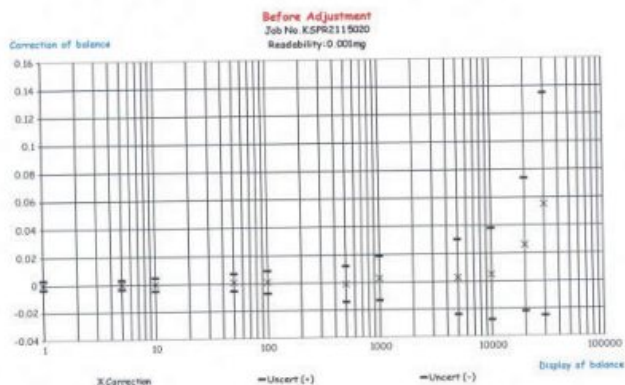
Repeatability: Determination of the standard deviation of weighing balance., Readability 0.001 (mg)

Nominal test value (mg)	Standard Deviation
2000	0.0011
20000	0.0012

Departure of indication from nominal value., Readability 0.001 (mg)

Nominal Value (mg)	Conventional Mass (mg)	Displayed Value (mg)	Correction of Balance (mg)	Uncertainty (mg)	k
1	1.0020	1.002	0.000	0.0035	2.01
5	5.0020	5.002	0.000	0.0035	2.01
10	10.0010	10.001	0.000	0.0049	2.00
50	50.0040	50.004	0.000	0.0063	2.00
100	99.9980	99.998	0.000	0.0082	2.00
500	499.9940	499.995	-0.001	0.013	2.00
1000	1000.0050	1000.005	0.000	0.016	2.00
5000	5000.0050	5000.003	0.002	0.027	2.00
10000	9999.9810	9999.977	0.004	0.033	2.00
20000	20000.0070	20000.003	0.004	0.048	2.00
30000	29999.9880	29999.986	0.002	0.080	2.00

The End of Certificate



ใบรับรองการสอบเทียบ “เครื่อง Atomic Adsorption Spectrophotometer”
(Calibration Certificate of Atomic Adsorption Spectrophotometer)



WO-01645398

PREVENTIVE MAINTENANCE REPORT
ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL
AAAnalyst 200/400

Customer : บริษัท เคเอ็มอีซี และโซลูชั่นส์ จำกัด Date Tested: 08-Mar-2022
Address : 27,29 ซอย พงษ์โพธิ์ 2 แขวง 30
อ.พุดซาบึง 2 ต.พุดซาบึง
พ.ต.ท.เมือง ภูเก็ต 83150
User Name: คุณกฤษณ์ ชื่นใจ
Phone: 02-8671128 PerkinElmer Phone: 02-719-6420 ext 311
Fax/Email: emex_srv@yahoo.com PerkinElmer Fax: 02-319-7900

CONFIGURATION TESTED

MODEL	SERIAL NUMBER	SOFTWARE
AAAnalyst 200	200S9030303	AA WinLab32 Version 6.5

TEST STANDARD USED

PART NUMBER	EXPIRATION DATE
Copper N930-0183	OCT 30 2022
GFAAS Mixed N930-0244	JUN 30 2023
MG0-141 N101-3000	
MG2-045	

ห้องปฏิบัติการวิเคราะห์เอกชน
เลขที่ใบอนุญาต 7-244

Page 3 of 5



WO-01645398

PREVENTIVE MAINTENANCE REPORT
ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL
AAAnalyst 200/400

SERIAL NUMBER 200S9030303 DATE TESTED 08-Mar-2022

1. INSTRUMENT CHECKS

- A. The mirror, prism and lenses condition. Clean if necessary. ☐
- B. Inspect the grating. ☐
- C. Inspect and clean or replace the dust filter. ☐
- D. Clean the burner head, chamber and end cap. ☐
- E. Clean the nebulizer. ☐
- F. Check the condition of the end cap, chamber and nebulizer o-rings. ☐
- G. Clean the drain system. ☐
- H. Clean exterior the instrument. ☐

2. GAS SYSTEM CHECKS

- A. Leak test all internal and external gas box joints. ☐
- B. Inspect the acetylene cartridge filter. (Replacement cartridge filter every 1 year) ☐
- C. Inspect the air cartridge filter. (Replacement cartridge filter every 6 months) ☐

3. ELECTRICAL

- A. Check incoming AC line voltage for proper levels and grounding. ☐
- B. Check unit's software and firmware revisions and upgrade if necessary. ☐

4. FIAS CHECKS

- A. Pump and S Port Valve ☐
- B. Chemifold and Tubing ☐
- C. Power Supply ☐
- D. Flow meter and Gas system ☐

ห้องปฏิบัติการวิเคราะห์เอกชน
เลขที่ใบอนุญาต 7-244

Page 2 of 5

PREVENTIVE MAINTENANCE REPORT
ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL
AAAnalyst 200/400

SERIAL NUMBER	200S9030303	DATE TESTED	08-Mar-2022
PARAMETER	SPECIFICATION	ACTUAL VALUE	
5. PERFORMANCE TESTS			
1. Detector-Linearity with Barium (553.55 nm).			
Neutral Density Filter 0.2 :	0.1903 Abs. $\pm 5\%$	0.1814 Abs.	
Neutral Density Filter 1.0 :	1.0547 Abs. $\pm 5\%$	1.0373 Abs.	
2. Baseline Noise at 1 Abs with Barium (553.55 nm). (at an integration time of 0.5 seconds and 99 replicates)			
	SD ≤ 0.010 Abs.	0.0014 Abs.	
3. AA Baseline with Copper (Cu 324.75 nm). (at an integration time of 0.5 seconds and 99 replicates)			
	SD ≤ 0.001 Abs.	0.0002 Abs.	
4. D ₂ Background Compensation (Copper 324.75 nm). with Neutral Density Filter 1.0			
	Absorbance ≤ 0.010 Abs.	-0.0100 Abs.	
5. AA-BG Baseline Noise with Copper (324.75 nm). (at an integration time of 2.0 seconds and 99 replicates)			
	SD ≤ 0.005 Abs.	0.0008 Abs.	
6. Flame Safety Interlock all Functions.			
		OK	

EMEX Environmental
and Medical Expert
EMEX ASSOCIATION CO.,LTD.
ห้องปฏิบัติการวิเคราะห์เอกชน
เลขทะเบียน 7-244

Page 3 of 5

PerkinElmer Ltd. 290 Soi 17 Rama 9 Road, Khwang Bangkok, Khet Huay Kwang, Bangkok 10310, Thailand

PREVENTIVE MAINTENANCE REPORT
ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL
AAAnalyst 200/400

SERIAL NUMBER	200S9030303	DATE TESTED	08-Mar-2022
PARAMETER	SPECIFICATION	ACTUAL VALUE	
7. Wavelength Accuracy with Nickel (232.00 nm).			
Nickel Prism Position	± 190 steps	0 Steps	
Nickel Grating Position	$\pm 380, -260$ steps	-48 Steps	
3 mg/L Ni Standard Mean Abs	≥ 0.200 Abs.	0.239 Abs.	
8. Flame Sensitivity with Copper (324.75 nm).			
Cu Prism Position	± 120 steps	0 Steps	
Cu Grating Position	± 380 steps	0 Steps	
(2 mg/L Cu Standard at an integration time of 10 seconds and 10 replicates)			
	Mean Absorbance ≥ 0.250 Abs.	0.386 Abs.	
	Capacitance value ≥ 1.0 pF.	2.5 pF.	

EMEX Environmental
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ห้องปฏิบัติการวิเคราะห์เอกชน
เลขทะเบียน 7-244

Page 4 of 5

PerkinElmer Ltd. 290 Soi 17 Rama 9 Road, Khwang Bangkok, Khet Huay Kwang, Bangkok 10310, Thailand

PREVENTIVE MAINTENANCE REPORT
ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL
AAAnalyst 200/400

SERIAL NUMBER	200S9030303	DATE TESTED	08-Mar-2022
Remarks :			
- Neutral Density Filter refer to data sheet			
This is to certify that the above tests have been performed and the configuration tested			
<input checked="" type="checkbox"/> meets <input type="checkbox"/> does not meet			
the PerkinElmer Specifications listed on this certificate.			
This certificate does not modify PerkinElmer's standard terms and condition of sale, including warranty terms.			
Service Department PerkinElmer Ltd.			
Customer Service Engineer: <u>จิรณรงค์ ชื่นนิมิต</u>			
(Chiramong Tharin)			
Service Engineer			

EMEX Environmental
and Medical Expert
EMEX ASSOCIATION CO.,LTD.
ห้องปฏิบัติการวิเคราะห์เอกชน
เลขทะเบียน 7-244

Page 5 of 5

PerkinElmer Ltd. 290 Soi 17 Rama 9 Road, Khwang Bangkok, Khet Huay Kwang, Bangkok 10310, Thailand

ใบรับรองการสอบเทียบ “เครื่อง Gas Chromatography–Mass Spectrometry”
(Calibration Certificate of Gas Chromatography–Mass Spectrometry)

EMEX Environmental
and Medical Expert
EMEX ASSOCIATION CO.,LTD.
ห้องปฏิบัติการวิเคราะห์เอกชน
เลขทะเบียน 7-244

Certificate of System Qualification

GC-QQ • GCMS-QQ

System ID: CN15263109
Organization Name: Emex Association Co., Ltd.
Organization Location: 29 Rama 2 Soi.30, Bangmod, Jomthong, Bangkok 10150 Thailand

Date: May 25, 2022 5:13:44 PM
EQP Name: AgilentRecommended, AgilentRecommended
EQP Revision: GC.02.51, GCMS.02.51
Overall Qualification Status: Pass

System Inspection and Basic Safety and Operation

Name: 7890

Setpoint Status: Pass

Overall System Inspection and Basic Safety and Operation Test Status

Pass

Inlet Pressure Accuracy

Name: 7890

Front SSL

Setpoint Status: Pass

Setpoint Actual

Inlet Pressure: 25.0 psi 25.2 psi

Accuracy: 0.2 psi

Agilent Recommended: <= 1.2

Overall Inlet Pressure Accuracy Test Status

Pass

GC Oven Temperature Accuracy

Name: 7890

Date: May 25, 2022 5:13:44 PM
System ID: CN15263109



29 Rama 2
29 Rama 2

Setpoint Status:

Pass

Zone:

Oven

Temperature:

Setpoint/Actual 230.0 230.8 °C

Accuracy:

0.6 °C

Agilent Recommended:

>= -1.0 % setpoint in K (-5.0 °C)

<= 1.0 % setpoint in K (5.0 °C)

Setpoint Status:

Pass

Zone:

Oven

Temperature:

Setpoint/Actual 100.0 100.5 °C

Accuracy:

0.5 °C

Agilent Recommended:

>= -1.0 % setpoint in K (-3.7 °C)

<= 1.0 % setpoint in K (3.7 °C)

Overall GC Oven Temperature Accuracy Test Status

Pass

GC Oven Temperature Stability

Name: 7890

Setpoint Status:

Pass

Temperature:

Setpoint/Average 100.0 100.5167 °C

Stability:

0.1 °C

Agilent Recommended:

<= 0.5

Overall GC Oven Temperature Stability Test Status

Pass

Log Amp

Tested Combination1

Front SSL / External SQ

Name:

5977A

Setpoint Status:

Pass

Date: May 25, 2022 5:13:44 PM
System ID: CN15263109



29 Rama 2
29 Rama 2

Overall Log Amp Test Status

Pass

RFPA

Tested Combination1

Front SSL / External SQ

Name:

5977A

Setpoint Status:

Pass

Amu 1050 m/z

Drift After Five Minutes

RFPA Voltage:

1 mV 481 mV

Agilent Recommended: >= -100 and <= 100 <= 1100

Overall RFPA Test Status

Pass

Tune EI

Tested Combination1

Front SSL / External SQ

Name:

5977A

Setpoint Status:

Pass

Filament

1

Setpoint Status:

Pass

Filament

2

Overall Tune EI Test Status

Pass

Scouting Run

Tested Combination1

Front SSL / External SQ

Name:

7850A

Source:

EI - Inert

Date: May 25, 2022 5:13:44 PM
System ID: CN15263109



29 Rama 2
29 Rama 2

Setpoint Status:

Completed

Injection Volume on Column:

1.0 uL

Overall Scouting Run Status

Completed

Instrument Detection Limit

Tested Combination1

Front SSL / External SQ

Name:

7850A

Source:

EI - Inert

Setpoint Status:

Pass

Injection Volume on Column:

1.0 uL

Minimum RSD:

4.50 %

Agilent Recommended:

<= 8.00

Status:

Pass

Instrument Detection Limit:

15.15350 fg

Agilent Recommended:

<= 26.92000

Status:

Pass

Overall Instrument Detection Limit Test Status

Pass

Slope Ratio Precision

Tested Combination1

Front SSL / External SQ

Name:

7850A

Source:

EI - Inert

Date: May 25, 2022 5:13:44 PM
System ID: CN15263109



29 Rama 2
29 Rama 2

Setpoint Status:

Pass

Injection Volume on Column:

1.0 μ L

RSD

Area Mass 1

Abundance's

1.27 %

Agilent Recommended:

<= 5.00

Pass

Mass Ratio

0.18 %

<= 5.00

Pass

Overall Mass Ratio Precision Test Status

Pass



Date: May 25, 2022 5:13:44 PM
System ID: CN15263109

Page 5 / 15

Instrument Details

Purpose

This section describes the as found system configuration.

Details

System

System ID	CN15263109
Manufacturer	Agilent Technologies
Name	7890
Flow Data Input	Manual Data
Temperature Data Input	Manual Data or Other Data Logging

Tested Combination 1

Injection Technique	Injection Tower
Inlet	Front
Detector	External
LTM Included?	No

Sampler 1

Manufacturer	Agilent Technologies
Type	Injection Tower
Name	7650A
Model Number	G4567A
Serial Number	CN15210043
Firmware Revision	A.10.02
Usage	Sample Injection
Location	Front
Syringe Volume (μ L)	10

Mainframe 1

Manufacturer	Agilent Technologies
Name	7890
Model Number	G3440B
Serial Number	CN15263109
Firmware Revision	B.02.02.2
Oven Type	Standard

Date: May 25, 2022 5:13:44 PM
System ID: CN15263109



Inlet 1

Manufacturer	Agilent Technologies
Name	7890
Type	SSL
Location	Front
Carrier Gas	Helium
Control Type	Electronic Pressure Control (EPC)
Purged Inlet	Yes

Detector 1

Manufacturer	Agilent Technologies
Name	Mass Spectrometer
Type	Mass Spectrometer
Location	External

Mass Spectrometer 1

Manufacturer	Agilent Technologies
Type	SD
Name	5977A
Serial Number	US1524L444
Firmware Revision	B.00.25
High Vacuum System	Turbo Pump
Scouting Run Standard	OFN Std

MS EI Source 1

Manufacturer	Agilent Technologies
Source Type	EI - Inert
Number of filaments	2



Date: May 25, 2022 5:13:44 PM
System ID: CN15263109

Electronic Signature

Purpose

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Details

Full Name of Signer	Saenguthai Tarak
Logged On User Name	saenguthai.tarak@non.agilent.com
Signature Creation Date	May 25, 2022
Reason for Signature	Executed protocol and published this original version of document

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Date: May 25, 2022 5:13:44 PM
System ID: CN15263109

User Name: karegaffa@bank
Workstation: LAPTOP-Q238AC867System ID: CN15263109
Print Date: May 25, 2022 9:13:47 PM

EMEX_CN15263109 Transaction Log

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
April 26, 2022 9:29:20 AM	Audit	SessionCreated	Session	None
April 26, 2022 9:29:20 AM	Start	Configuration	Session	None
April 26, 2022 9:29:20 AM	Audit	EndSession	Session	User is Nonpaying and does not require an unlock code
April 26, 2022 9:37:13 AM	Audit	EQP Leased	Session	EQP details for primary technique (S): File path: [Protocol\Facility\Go\Configure\02.51\eqp] EQP File Name: [02.51\eqp, EQP Name: [AgilentRecommended] EQP details for hyphenated technique (SCM): File path: [Protocol\Facility\Go\Configure\02.51\eqp] EQP File Name: [02.51\eqp, EQP Name: [AgilentRecommended]
April 26, 2022 9:37:15 AM	End	Configuration	Session	None
April 26, 2022 9:37:20 AM	Start	Qualification	Session	QQ
April 26, 2022 9:37:20 AM	Start	Execution	System Inspection and Basic Safety and Operation - 7890 - Qualitative Test - No septums associated	None
April 26, 2022 9:37:43 AM	End	Execution	System Inspection and Basic Safety and Operation - 7890 - Qualitative Test - No septums associated	Run Count: 1
April 26, 2022 9:37:48 AM	Start	Execution	Initial Pressure Accuracy - Front SSI, - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	None

Page 1/7

Date: May 25, 2022 5:13:44 PM
System ID: CN15263109

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เลขทะเบียน 7-244

23 May 2022

User Name: karegaffa@bank
Workstation: LAPTOP-Q238AC867System ID: CN15263109
Print Date: May 25, 2022 1:10:47 PM

EMEX_CN15263109 Transaction Log

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
April 26, 2022 9:37:52 AM	End	Execution	Initial Pressure Accuracy - Front SSI, - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	Run Count: 1
April 26, 2022 9:37:54 AM	Start	Execution	GC Oven Temperature Accuracy - 7890 - Temperature Oven - S: 235.0°C - L: <= -1.0 AND <= 1.0 % septum in K	None
April 26, 2022 9:38:14 AM	Audit	Data	GC Oven Temperature Accuracy - 7890 - Temperature Oven - S: 235.0°C - L: <= -1.0 AND <= 1.0 % septum in K	Manual Data Entry
April 26, 2022 9:38:18 AM	End	Execution	GC Oven Temperature Accuracy - 7890 - Temperature Oven - S: 235.0°C - L: <= -1.0 AND <= 1.0 % septum in K	Run Count: 1
April 26, 2022 9:38:18 AM	Start	Execution	GC Oven Temperature Accuracy - 7890 - Temperature Oven - S: 180.0°C - L: <= -1.0 AND <= 1.0 % septum in K	None
April 26, 2022 9:38:39 AM	Audit	Data	GC Oven Temperature Accuracy - 7890 - Temperature Oven - S: 180.0°C - L: <= -1.0 AND <= 1.0 % septum in K	Manual Data Entry
April 26, 2022 9:38:42 AM	End	Execution	GC Oven Temperature Accuracy - 7890 - Temperature Oven - S: 180.0°C - L: <= -1.0 AND <= 1.0 % septum in K	Run Count: 1
April 26, 2022 9:38:43 AM	Start	Execution	GC Oven Temperature Stability - 7890 - Temperature Oven - S: 180.0°C - L: <= 0.5°C	None
April 26, 2022 9:40:08 AM	Audit	Data	GC Oven Temperature Stability - 7890 - Temperature Oven - S: 180.0°C - L: <= 0.5°C	Manual Data Entry

Page 2/7

Date: May 25, 2022 5:13:44 PM
System ID: CN15263109

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23 May 2022

User Name: karegaffa@bank
Workstation: LAPTOP-Q238AC867System ID: CN15263109
Print Date: May 25, 2022 5:13:47 PM

EMEX_CN15263109 Transaction Log

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
April 26, 2022 9:40:01 AM	End	Execution	GC Oven Temperature Stability - 7890 - Temperature Oven - S: 180.0°C - L: <= 0.5°C	Run Count: 1
April 26, 2022 11:31:17 AM	Audit	AcceClosed	Session	None
April 26, 2022 12:28:21 PM	Audit	AcceRestarted	Session	None
April 26, 2022 12:28:23 PM	Audit	SessionRelocated	Session	None
April 26, 2022 12:28:24 PM	Start	Qualification	Session	QQ
April 26, 2022 1:26:44 PM	Audit	AcceClosed	Session	None
May 17, 2022 3:17:18 PM	Audit	AcceRestarted	Session	None
May 17, 2022 3:17:20 PM	Audit	SessionRelocated	Session	None
May 17, 2022 3:17:26 PM	Start	Qualification	Session	QQ
May 17, 2022 3:31:51 PM	Audit	AcceClosed	Session	None
May 18, 2022 9:10:10 AM	Audit	AcceRestarted	Session	None
May 18, 2022 9:48:38 AM	Audit	AcceClosed	Session	None
May 20, 2022 11:42:05 AM	Audit	AcceRestarted	Session	None
May 20, 2022 11:42:55 AM	Audit	SessionRelocated	Session	None
May 20, 2022 11:42:55 AM	Start	Qualification	Session	QQ
May 20, 2022 1:46:14 PM	Audit	AcceClosed	Session	None
May 26, 2022 9:58:44 AM	Audit	AcceRestarted	Session	None
May 26, 2022 9:58:48 AM	Audit	SessionRelocated	Session	None
May 26, 2022 9:58:48 AM	Start	Qualification	Session	QQ
May 26, 2022 2:51:12 PM	Start	Execution	Log Amp - 8877A SQ - Source: None	None
May 26, 2022 2:52:09 PM	End	Execution	Log Amp - 8877A SQ - Source: None	Run Count: 1

Page 3/7

Date: May 25, 2022 5:13:44 PM
System ID: CN15263109

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เลขทะเบียน 7-244

23 May 2022

User Name: karegaffa@bank
Workstation: LAPTOP-Q238AC867System ID: CN15263109
Print Date: May 25, 2022 5:13:47 PM

EMEX_CN15263109 Transaction Log

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
May 25, 2022 2:52:11 PM	Start	Execution	RWPA - 8877A SQ - Source: E1 None	- Inert
May 25, 2022 2:53:05 PM	Start	Execution	RWPA - 8877A SQ - Source: E1 None	- Inert
May 25, 2022 2:54:02 PM	End	Execution	RWPA - 8877A SQ - Source: E1 None	- Inert
May 25, 2022 2:54:05 PM	Start	Execution	Tune E1 - 8877A SQ - Source: None	E1 - Inert Filament 1 (Qualitative - No septums associated)
May 25, 2022 2:54:28 PM	End	Execution	Tune E1 - 8877A SQ - Source: None	E1 - Inert Filament 1 (Qualitative - No septums associated)
May 25, 2022 2:54:30 PM	Start	Execution	Tune E1 - 8877A SQ - Source: None	E1 - Inert Filament 2 (Qualitative - No septums associated)
May 25, 2022 2:54:47 PM	End	Execution	Tune E1 - 8877A SQ - Source: None	E1 - Inert Filament 2 (Qualitative - No septums associated)
May 25, 2022 2:54:57 PM	Start	Execution	Scouting Run - Injection Tower	None
May 25, 2022 2:55:37 PM	Audit	Data	Scouting Run - Injection Tower	Details Path: F:\007\0
May 25, 2022 2:56:19 PM	End	Execution	Scouting Run - Injection Tower	Run Count: 1

Page 4/7

Date: May 25, 2022 5:13:44 PM
System ID: CN15263109

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เลขทะเบียน 7-244

23 May 2022

User Name: karegprof@bmc
Hostname: LAPTOP-Q239Q28V

System ID: CN15263109
Print Date: May 25, 2022 5:13:47 PM

EMEX_CN15263109 Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
May 25, 2022 2:58:23 PM	Start	Execution	Instrument Detection Limit - Injection Tower: Front SSL, SQ - Source: E1 - Inlet - RSD L (Area): <= 8.00% - RSD L (Ret. Time): <= 1.00%	None
May 25, 2022 2:57:03 PM	Audit	Data	Instrument Detection Limit - Injection Tower: Front SSL, SQ - Source: E1 - Inlet - RSD L (Area): <= 8.00% - RSD L (Ret. Time): <= 1.00%	Data File Path: F:\Phd03.D
May 25, 2022 2:57:03 PM	Audit	Data	Instrument Detection Limit - Injection Tower: Front SSL, SQ - Source: E1 - Inlet - RSD L (Area): <= 8.00% - RSD L (Ret. Time): <= 1.00%	Data File Path: F:\Phd04.D
May 25, 2022 2:57:03 PM	Audit	Data	Instrument Detection Limit - Injection Tower: Front SSL, SQ - Source: E1 - Inlet - RSD L (Area): <= 8.00% - RSD L (Ret. Time): <= 1.00%	Data File Path: F:\Phd05.D
May 25, 2022 2:57:03 PM	Audit	Data	Instrument Detection Limit - Injection Tower: Front SSL, SQ - Source: E1 - Inlet - RSD L (Area): <= 8.00% - RSD L (Ret. Time): <= 1.00%	Data File Path: F:\Phd06.D
May 25, 2022 2:57:03 PM	Audit	Data	Instrument Detection Limit - Injection Tower: Front SSL, SQ - Source: E1 - Inlet - RSD L (Area): <= 8.00% - RSD L (Ret. Time): <= 1.00%	Data File Path: F:\Phd07.D
May 25, 2022 2:57:03 PM	Audit	Data	Instrument Detection Limit - Injection Tower: Front SSL, SQ - Source: E1 - Inlet - RSD L (Area): <= 8.00% - RSD L (Ret. Time): <= 1.00%	Data File Path: F:\Phd08.D

Page 5 / 7



Date: May 25, 2022 5:13:44 PM
System ID: CN15263109

เลขทะเบียน 7-244

Page 13 / 15

User Name: karegprof@bmc
Hostname: LAPTOP-Q239Q28V

System ID: CN15263109
Print Date: May 25, 2022 5:13:47 PM

EMEX_CN15263109 Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
May 25, 2022 2:57:03 PM	Audit	Data	Instrument Detection Limit - Injection Tower: Front SSL, SQ - Source: E1 - Inlet - RSD L (Area): <= 8.00% - RSD L (Ret. Time): <= 1.00%	Data File Path: F:\Phd09.D
May 25, 2022 2:57:03 PM	Audit	Data	Instrument Detection Limit - Injection Tower: Front SSL, SQ - Source: E1 - Inlet - RSD L (Area): <= 8.00% - RSD L (Ret. Time): <= 1.00%	Data File Path: F:\Phd10.D
May 25, 2022 2:57:03 PM	Audit	Data	Instrument Detection Limit - Injection Tower: Front SSL, SQ - Source: E1 - Inlet - RSD L (Area): <= 8.00% - RSD L (Ret. Time): <= 1.00%	Data File Path: F:\Phd11.D
May 25, 2022 2:57:03 PM	Audit	Data	Instrument Detection Limit - Injection Tower: Front SSL, SQ - Source: E1 - Inlet - RSD L (Area): <= 8.00% - RSD L (Ret. Time): <= 1.00%	Data File Path: F:\Phd12.D
May 25, 2022 2:58:05 PM	End	Execution	Instrument Detection Limit - Injection Tower: Front SSL, SQ - Source: E1 - Inlet - RSD L (Area): <= 8.00% - RSD L (Ret. Time): <= 1.00%	Run Count: 1
May 25, 2022 4:00:35 PM	Audit	AcqClosed	Session	None
May 25, 2022 4:01:11 PM	Audit	AcqRestarted	Session	None
May 25, 2022 4:05:09 PM	Audit	SessionResumed	Session	None
May 25, 2022 4:55:10 PM	Start	Qualification	Session	00
May 25, 2022 4:55:17 PM	Start	Execution	Mass Ratio Precision - Injection Tower: Front SSL, SQ - Source: E1 - Inlet - L (RSD): <= 5.00%	None

Page 6 / 7



Date: May 25, 2022 5:13:44 PM
System ID: CN15263109

เลขทะเบียน 7-244

Page 14 / 15

User Name: karegprof@bmc
Hostname: LAPTOP-Q239Q28V

System ID: CN15263109
Print Date: May 25, 2022 5:13:47 PM

EMEX_CN15263109 Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
May 25, 2022 4:55:36 PM	Audit	Data	Mass Ratio Precision - Injection Tower: Front SSL, SQ - Source: E1 - Inlet - L (RSD): <= 5.00%	Data File Path: F:\MRP7.D
May 25, 2022 4:55:36 PM	Audit	Data	Mass Ratio Precision - Injection Tower: Front SSL, SQ - Source: E1 - Inlet - L (RSD): <= 5.00%	Data File Path: F:\MRP8.D
May 25, 2022 4:55:36 PM	Audit	Data	Mass Ratio Precision - Injection Tower: Front SSL, SQ - Source: E1 - Inlet - L (RSD): <= 5.00%	Data File Path: F:\MRP9.D
May 25, 2022 4:55:36 PM	Audit	Data	Mass Ratio Precision - Injection Tower: Front SSL, SQ - Source: E1 - Inlet - L (RSD): <= 5.00%	Data File Path: F:\MRP10.D
May 25, 2022 4:55:36 PM	Audit	Data	Mass Ratio Precision - Injection Tower: Front SSL, SQ - Source: E1 - Inlet - L (RSD): <= 5.00%	Data File Path: F:\MRP11.D
May 25, 2022 4:55:36 PM	Audit	Data	Mass Ratio Precision - Injection Tower: Front SSL, SQ - Source: E1 - Inlet - L (RSD): <= 5.00%	Data File Path: F:\MRP12.D
May 25, 2022 4:56:43 PM	End	Execution	Mass Ratio Precision - Injection Tower: Front SSL, SQ - Source: E1 - Inlet - L (RSD): <= 5.00%	Run Count: 1
May 25, 2022 4:56:03 PM	End	Qualification	Session	00
May 25, 2022 4:56:03 PM	Start	Reporting	Session	None
May 25, 2022 5:13:05 PM	Audit	Reporting	Session	Report Generated: Certificate

Page 7 / 7



Date: May 25, 2022 5:13:44 PM
System ID: CN15263109

เลขทะเบียน 7-244

Page 15 / 15

ใบรับรองการสอบเทียบ “เครื่อง Ion chromatography”
(Calibration Certificate of Ion chromatography)





Certificate of Calibration

Aquion: Anion (ID#822)

This certificate is to verify that instrument below are calibrated
by Archemica Lab Co., Ltd.

Aquion S/N: 180344663

For

Emex Association Co., Ltd.



Operator Signature:

(Mr.Thitipong Piromkripuk)

Applications Chemist

Date: January 10, 2022
เลขที่ใบขึ้น 7-244



Dionex Ion Chromatography Preventive Maintenance Report

Customer Organization	Name/ Department
Emex Association Co., Ltd.	K.Karnchana
Engineer	Date
Thitipong Piromkripuk	10-Jan-2022

Instrument Detail

Instrument Model	Application
Aquion (ID#822, 1st Contract)	Anion
Instrument components	Serial Number
Aquion	180344663

Consumable Detail

Columns	Guard Columns	Suppressors	Concentrators	Etc.
AS22 (4mm)	AG22 (4mm)	AERS 500 (4mm)	-	-

Remark: -



Perform By
Archemica Lab Co., Ltd

Archemica Lab
10/1/22
Date



ห้องปฏิบัติการวิเคราะห์เอกสาร
เลขที่ใบขึ้น 7-244

Customer
05/01/22
Date

Thermo Fisher SCIENTIFIC Chromeleon Operational Qualification

General Information

Computer Name: Version Number:
Instrument Controller: DESKTOP-D97001E 7.2.7 Build 10369 (290782)
Client: DESKTOP-D97001E 7.2.7.10369
Operator: Thitipong Piromkripuk
Overall Test Result: Passed

Comparison Format:

All Parameters:	Significant Digits:	10
-----------------	---------------------	----



Reviewer's Signature / Date

Operator's Signature / Date



ห้องปฏิบัติการวิเคราะห์เอกสาร
เลขที่ใบขึ้น 7-244

ใบรับรองการสอบเทียบ “เครื่อง Inductively Coupled Plasma (ICP-OES)”
(Calibration Certificate of Inductively Coupled Plasma (ICP-OES))



ห้องปฏิบัติการวิเคราะห์เอกสาร
เลขที่ใบขึ้น 7-244

Optima8300 Preventive Maintenance Report

Company Name: Emex Association Co., LTD.
Instrument Location: 27, 29 Soi Pharam2, Soi 30 Bang Mot, Chom Thong, Bangkok 10150
Instrument Serial No.: 07851604262
Date: 2-Mar-2022



ICP-OES/Optima8300 Preventive Maintenance (PM)

Company Name:	Emex Association Co., LTD.		
Address (Instrument Location):	27, 29 Soi Pharam2, Soi 30 Bang Mot, Chom Thong, Bangkok 10150		
Serial Number:	07851604262	PM Number:	1 of 2
Customer Name (if applicable):	K. Kanchana	Telephone Number:	02-867-1128
Service Engineer Name:	K. Chayanon	Service Order Number:	WO-01612540
Date PM Performed:	2-Mar-2022	Next PM Due Date:	2-Aug-2022
Standard Labor Hours to Complete PM :		4 hours	

Part Number	Release	Publication Date
09370141 Rev.5	A	January 2018



Scope

The purpose of this PM is to ensure the continued functionality of the PerkinElmer / Optima8300 by inspecting and replacing any worn or damaged parts. This service should only be performed by a trained representative of PerkinElmer.

The customer should save their method before the PM begins.

General Instructions:

The customer must provide the engineer operational data to demonstrate recent instrument performance prior to starting the PM. Always check with the customer before making any changes that may affect the customer's analysis or calibration, including a current back-up of system software and/or data files. The completed document should be signed by an authorized PerkinElmer and customer representative and left with the customer. Update the PM sticker and instrument logbook as required.

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ICP-OES/Optima8300 Preventive Maintenance (PM)

Page 1 of 7

โทร 02-244

Component List

Component / Specific Model	Serial #	Configuration Notes
Optima8300	07851604262	Syngistix V 1.0.1.1275

Parts Lists

Parts Included with the PM		
Part Number (if applicable)	Description	Quantity
09995098	Air Filter-Spectrometer	1
N077520	Air Filter-RF Generator	1
09992751	Axial Window	1
B0810377	Radial Window	1
N0770438	O-ring kit, injector support adapter	2
N0780437	O-ring kit, torch	2

Additional Reagents and Standards Required for PM				
Part Number (if applicable)	Description	Quality	Batch/Lot #	Expired Date (mm/yy)
N0692579	Multi-Element Standard	AR	57-024CRX1	30-Mar-2023
N9300221	Dil. Standard diluted 100 X	AR	54-134CRY1	30-Aug-2022
N0582152	Wave Cal Solution	AR	3-207MIX1	30-Nov-2022
N9302946	VIS Wavecal Solution	AR	57-023CRT1	30-APR-2023



ICP-OES/Optima8300 Preventive Maintenance (PM)

Page 2 of 7

Procedure Checklist

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

1. General:

- ☒ Ask customer about unit's performance since last visit.
- ☒ Check incoming AC line voltage under load for proper levels and grounding.
- ☒ Is the instrument operational? If not, please comment.

2. Mechanical:

- ☒ Inspect and clean all fans and filters.
- ☒ Inspect and replace torch components and necessary.

Torch Components Replaced: ☐ Yes ☒ No
- ☒ Inspect all tubing for signs of cracking or leaking and replace as necessary.

Tubing Replaced: ☒ Yes ☐ No
- ☒ Inspect the peristaltic pump for proper operation.
- ☒ Check and adjust if necessary, the external nitrogen, argon shear gas and water supply pressures.
- ☒ Check and adjust if necessary, the internal nitrogen, main argon, torch argon and shear gas pressures.

Regulator	Measured Pressure	Set Pressure
Nitrogen	NA	NA (calibrated in factory)
Main Argon	76	76 psig
Torch Argon	67	67 psig
Shear Gas	65	65 psig
Water	35	35 psi

- ☒ Check shear gas nozzle for blockages and proper, uniform flow.
- ☒ Inspect nitrogen Hi/Low purge and shear gas solenoids for proper function.
 - ☒ Inspect the function of all spectrometer motors. Drive the motors from the Spectrometer DCM. (slits, XY motor)
- ☒ Inspect the function of the pneumatic shutter for proper operation.
- ☒ Perform preventative maintenance on the chiller as required. Make the customer aware of the importance of maintaining the chiller fluid level and filter replacement.
- ☒ Drain air compressor surge tank.
- ☒ Clean exterior of instrument.
- ☒ Visually inspect all PC boards for cleanliness and signs of corrosion.



ICP-OES/Optima8300 Preventive Maintenance (PM)

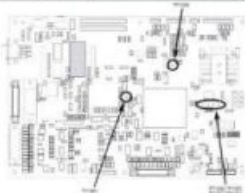
Page 3 of 7

3. Electrical

- Check all RF generator and spectrometer power supply voltages.

Spectrometer Control/Interface PCB Test Points

TP	Voltage (DC)	Tolerance	Description
1	+24V	± 500mV	From Main Supply
2	+12V	± 25mV	Onboard - For View X/Y Motor
3	+15V	± 600mV	Onboard - For Spectrometer Control Electronics
4	-15V	± 600mV	Onboard - For Spectrometer Control Electronics
5	+3.3V	± 100mV	Onboard - Source of 3.3V for Icarus Engine and SCB elect.
6	+2.5V	± 25mV	Onboard - For Xilinx FPGA
7	+5.0V		From Main Supply
8		± 5.0 GND	
9		± 5.0 GND	
10		± 5.0 GND	
11		± 5.0 GND	
12		± 5.0 GND	
13	+1.5V	± 45mV	Onboard - For Icarus Engine
22	+6.5V	-0mV, + 100mV	UV TEC
23	+6.5V	-0mV, + 100mV	VIS TEC



RF Controller PCB Test Points

TP	Voltage (DC)	RF Control PCB Location
1005	-14 to -16 (-15)	Right of U1001
1006	23-25 (24)	Right of U1001
1008	4.75-5.25 (5)	Upper Right of U1001
1003	14-16 (15)	Upper Left of U1001
1004	Ground	Right of U1001

- Run instrument diagnostic checks from the appropriate Device Control Module.

RF Generator:

- Check the RF generator status screens.
- Check the function of all interlocks.

Spectrometer:

- Check the spectrometer status screens. Ensure Ready mode with no fetal errors.
- Check the spectrometer optical tub temperatures (top, bottom, fin, optical base).
- Check detector temperatures.
- Check TEC voltages (6.5VDC)

4. Optical:

- Clean or replace the axial and radial view windows as necessary.

Axial Window Replaced: ☐ Yes ☒ No

Radial Window Replaced: ☐ Yes ☒ No

5. PM Performance Tests:

- Perform View Align.

5.1 Spectral Resolution:

- Measure the spectrometers ability to separate two adjacent wavelengths.

Parameter	Specification	Test Result	Pass/Fail
As 193.696 - Resolution	≤0.007	0.005	Passed
Ni 231.604 - Resolution	≤0.008	0.005	Passed
Ni 341.476 - Resolution	≤0.012	0.007	Passed
La 408.672 - Resolution	≤0.020	0.015	Passed
Ba 455.403 - Resolution	≤0.025	0.019	Passed

5.2 Precision:

- Test for reproducibility of a set of measurement.

Parameter	Specification	Test Result	Pass/Fail
As 193.696	NRSD ≤ 1 %	0.47	Passed
Zn 213.856	NRSD ≤ 1 %	0.34	Passed
Mn 257.610	NRSD ≤ 1 %	0.53	Passed
La 379.478	NRSD ≤ 1 %	0.51	Passed
Ba 455.403	NRSD ≤ 1 %	0.48	Passed
Ba 483.408	NRSD ≤ 1 %	0.48	Passed

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- Run an Axial & Radial BEC according to the A&T spec.

5.1 Axial BEC Calc:

Method "BEC-XL" For Samples "IB (25HNO3)" and "IS (N930-0221/100)", record intensities.

Calculated BEC: BEC = (IB * Conc of Std) / (IS - IB). Where Conc of Std = 500 PPB

Element	Conc.	IB	IS	
Cd 226	500	6467	114620.6	
IB*Conc	IS-IB	BEC	Spec	Pass/Fail
3233500	108133.6	29.9	<150 PPB	Passed

5.2 Radial BEC Calc:

Method "BEC-RL" For Samples "IB (25HNO3)" and "IS (N606-1579)", record intensities.

Calculated BEC: BEC = (IB * Conc of Std) / (IS - IB). Where Conc of Std = 1,000 PPB

Element	Conc.	IB	IS	
Mn 257	1,000	3617	101942.7	
IB*Conc	IS-IB	BEC	Spec	Pass/Fail
3617000	98325.7	36.78	<45 PPB	Passed

7. Review:

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

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Additional Comments

Additional Comments Regarding the PM

Review

The preventive maintenance checks and (if applicable) performance tests for ICP-OES/Optima8300 have been completed.

This ICP-OES/Optima8300 Passes ☒ Fails ☐ the preventive maintenance.

Review of Preventive Maintenance:

Authorized PerkinElmer Representative:

Chaiyaporn K.

Date:

2 March 2022

Authorized Customer Representative:

Wanwadee

Date:

(20-03-2022)

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Analysis Begun

Logged In Analyst: user Technique: AA Flame
Spectrometer Model: AAnalyst 200, S/N 20089030303 Autosampler Model:

Sample Information File: C:\data-AA\user\Sample Information\PM.sif

Batch ID:
Results Data Set: PM 08Mar2022

Results Library: C:\data-AA\Service\Results.mdb

Method Loaded

Method Name: FT_Sens & Prec 2-400 Method Last Saved: 1/4/2563 11:20:05
Method Description: Using 2 ug/L Cu Standard - AA 2/400

Analyte	Calibration Equation	Wavelength	Slit Width	Lamp Current	Energy
Cu 324.75	Non Lin Thru 0	324.75	2.7/0.8	15	69

Sequence No.: 2

Sample ID: Calib Blank 1

Analyst:

Autosampler Location:

Date Collected: 8/3/2563 10:51:57

Data Type: Original

Replicate Data: Calib Blank 1

Repl #	Sample Conc ug/L	Std Conc ug/L	Blank Corr Signal	Time	Signal Stored
1	[0.00]	0.000	0.000	10:51:58	Yes
2	[0.00]	0.000	0.000	10:52:10	Yes
3	[0.00]	0.000	0.000	10:52:22	Yes
4	[0.00]	0.000	0.000	10:52:33	Yes
5	[0.00]	0.000	0.000	10:52:45	Yes
6	[0.00]	0.000	0.000	10:52:57	Yes
7	[0.00]	0.000	0.000	10:53:09	Yes
8	[0.00]	0.000	0.000	10:53:20	Yes
9	[0.00]	0.000	0.000	10:53:32	Yes
10	[0.00]	0.000	0.000	10:53:44	Yes
Mean:	[0.00]	0.000			
SD:	0.00	0.0001			
%RSD:	0.00	23.69			

Auto-zero performed.

Sequence No.: 3

Sample ID: 2ppm Cu std

Analyst: Service PM

Autosampler Location:

Date Collected: 8/3/2563 10:54:11

Data Type: Original

Replicate Data: 2ppm Cu std

Repl #	Sample Conc ug/L	Std Conc ug/L	Blank Corr Signal	Time	Signal Stored
1	0.387	0.387	0.387	10:54:12	Yes
2	0.388	0.388	0.388	10:54:24	Yes
3	0.389	0.389	0.389	10:54:36	Yes
4	0.390	0.390	0.390	10:54:48	Yes
5	0.387	0.387	0.387	10:55:00	Yes
6	0.388	0.388	0.388	10:55:12	Yes
7	0.389	0.389	0.389	10:55:24	Yes
8	0.388	0.388	0.388	10:55:36	Yes
9	0.388	0.388	0.388	10:55:47	Yes
10	0.386	0.386	0.386	10:55:59	Yes
Mean:	0.388				
SD:	0.0011				
%RSD:	0.29				

Cu 324.75 - Measured Characteristic Concentration: 0.002 ug/L

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ภาคผนวก จ

สำเนาหนังสืออนุญาตขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

บริษัท ยูไนเต็ด แอนนาลิสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด





ที่ อก ๐๓๓๐(๓)/ ๑๘๗ ๙

กรมโรงงานอุตสาหกรรม
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท
เขตราชเทวี กรุงเทพฯ ๑๐๕๐๐

๐ ๙ กุมภาพันธ์ ๒๕๖๕

เรื่อง ต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

เรียน กรรมการผู้จัดการ บริษัท ยูโนเด็ต แอนนาลิสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน
ลงวันที่ ๒๗ ธันวาคม ๒๕๖๔

สิ่งที่ส่งมาด้วย ๑. รายชื่อผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๔๐ ราย
๒. รายชื่อเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๐๖ ราย
๓. ขอบข่ายสารมลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม

ตามหนังสือที่ย่างถึง บริษัท ยูโนเด็ต แอนนาลิสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด
ขอต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ๖-๑๔๕ สถานที่ตั้งเลขที่ ๓
ซอยอุดมสุข ๔๓ ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพมหานคร ต่อกรมโรงงานอุตสาหกรรม นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว ให้บริษัท ยูโนเด็ต แอนนาลิสต์ แอนด์ เอ็นจิเนียริง
คอนซัลแตนท์ จำกัด ต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน โดยมีองค์ประกอบดังนี้
ก. ผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๔๐ ราย ตามสิ่งที่ส่งมาด้วย ๑
ข. เจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๐๖ ราย ตามสิ่งที่ส่งมาด้วย ๒
ค. ขอบข่ายสารมลพิษที่ได้รับขึ้นทะเบียนให้วิเคราะห์ในน้ำเสีย น้ำใต้ดิน อากาศเสีย สิ่งปฏิกูล
หรือวัสดุที่ไม่ใช้แล้ว และดิน ตามสิ่งที่ส่งมาด้วย ๓

หนังสือฉบับนี้จะหมดอายุในวันที่ ๒ กุมภาพันธ์ ๒๕๖๘ หากประสงค์จะต่ออายุหนังสือ
รับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน ให้ยื่นคำขอต่ออายุพร้อมเอกสารประกอบคำขอต่อ
กรมโรงงานอุตสาหกรรมภายใน ๓๐ วัน ก่อนวันสิ้นอายุของหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน
ทั้งนี้ สามารถยื่นคำขอผ่านระบบอิเล็กทรอนิกส์ได้ที่หน้าเว็บไซต์กรมโรงงานอุตสาหกรรม ตาม QR Code หาย
หนังสือฉบับนี้

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ



(นางจินดา เดชะศรีนทร์)

ผู้อำนวยการกองวิจัยและเตือนภัยมลพิษโรงงาน
ปฏิบัติราชการแทนอธิบดีกรมโรงงานอุตสาหกรรม



ยื่นคำขอผ่านระบบอิเล็กทรอนิกส์

กองวิจัยและเตือนภัยมลพิษโรงงาน

กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ

โทร. ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๓๐๓-๕

โทรสาร ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๔๕

ไปรษณีย์อิเล็กทรอนิกส์ saraban@div.gmail.go.th

สิ่งที่ส่งมาด้วย ๑

เอกสารแนบท้ายหนังสือรับต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

บริษัท ยูโนเด็ต แอนนาลิสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด เลขทะเบียน ๖-๑๔๕

ที่ อก ๐๓๓๐(๓)/ ๑๘๗ ๙ ลงวันที่ ๐ ๙ กุมภาพันธ์ ๒๕๖๕

ก. ผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๔๐ ราย

๑) นางสาวกชวรรณ ภัทรธีรกุล	ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๐๑
๒) นายณรงค์ นิมาพัล	ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๐๒
๓) นางสาวนันท์ดา บุญไสย	ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๐๓
๔) นางปิยะพัชร สุทมนัสวงษ์	ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๐๔
๕) นางมานิดา แยมไย	ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๐๕
๖) นางสาวเบญจวรรณ วิริโยทัย	ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๐๖
๗) นายณพรัตน์ วงศ์อนุรักษชัย	ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๐๗
๘) นางสาวอวีวรรณ บุญลา	ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๐๘
๙) นายสุวิทย์ จอดนอก	ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๐๙
๑๐) นางสาวโชติภา สมบูรณ์	ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๑๐
๑๑) นางสาวบุษกร เลิศภาณุมาศ	ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๑๑
๑๒) นางสาววิไลลักษณ์ ศรีสุข	ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๑๒
๑๓) นางสาวปวีณา จรัสโชติพิณิต	ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๑๓
๑๔) นายศิลา บรรจงใจรักษ์	ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๑๔
๑๕) นายปฏิกรณ์ คณะนา	ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๑๕
๑๖) นายธีรวัฒน์ ชมมิ่ง	ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๑๖
๑๗) นางสาวศิริพร ศรีประดิษฐ์	ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๑๗
๑๘) นางสาวสวริตรี ธีรวิง	ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๑๘
๑๙) นางสาวนพวรรณ อูราภักษ์	ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๑๙
๒๐) นายภูษงค์ พานิชย์เลิศอำไพ	ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๒๐
๒๑) นายณัฐวัฒน์ แดงสวัสดิ์	ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๒๑
๒๒) นายเอกรัตน์ ปละคามินทร์	ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๒๒
๒๓) นางสาวนิศาวัฒน์ ศรีสกุลสิทธิโชค	ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๒๓
๒๔) นางสาวเจตจรินทร์ ทำสะอาด	ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๒๔
๒๕) นางสาวสุวรรณ คงทอง	ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๒๕
๒๖) นางสาววรกร พัดสองชั้น	ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๒๖
๒๗) นายวิรัชยุทธ โมกแก้ว	ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๒๗
๒๘) นายวัชรพงษ์ เทพดนตรี	ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๒๘
๒๙) นายอนุศาสน์ สยดี	ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๒๙
๓๐) นายกรวิทย์ เจียศิริสกุล	ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๓๐
๓๑) นางสาวอริกา รงค์สวัสดิ์	ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๓๑
๓๒) นางสาวนภวรรณ คงข้า	ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๓๒
๓๓) นายสุทธิระ อรุณจันทร์	ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๓๓
๓๔) นางสาวทัศนีย์ อ่อนคำ	ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๓๔
๓๕) นางสาวพริ้มพรรณ สมบูรณ์ธรรม	ทะเบียนเลขที่ ๖-๑๔๕-ค-๐๐๓๕


(นางจินดา เดชะศรีนทร์)

ผู้อำนวยการกองวิจัยและเตือนภัยมลพิษโรงงาน
ปฏิบัติราชการแทนอธิบดีกรมโรงงานอุตสาหกรรม

๓๖) นายศุภณัฐ...

- ๓๖) นายสุภณัฐ คุณธนกาญจน์
๓๗) นางสาวศิริภาพร เหมือนเร
๓๘) นางศิวานัส ชำนิล
๓๙) นางสาวพรนิกา ชีระจินตาสล
๔๐) นายนาเคนทร์ พันธุ์ชาติกุล

- ทะเบียนเลขที่ ว-๑๔๕-ค-๐๐๓๖
ทะเบียนเลขที่ ว-๑๔๕-ค-๐๐๓๗
ทะเบียนเลขที่ ว-๑๔๕-ค-๐๐๓๘
ทะเบียนเลขที่ ว-๑๔๕-ค-๐๐๓๙
ทะเบียนเลขที่ ว-๑๔๕-ค-๐๐๔๐


(นางจินดา เดชะศรีรินทร์)

ผู้อำนวยการกองวิจัยและพัฒนาศักยภาพ
ปฏิบัติการแทนอธิบดีกรมโรงงานอุตสาหกรรม

เอกสารแนบท้ายหนังสือรับต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน
บริษัท ยูไนเต็ท แอนนาลิสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด เลขทะเบียน ว-๑๔๕
ที่ ออก ๐๓๑๐(๑)/ ๑๘๗ ๕ ลงวันที่ ๐๙ กุมภาพันธ์ ๒๕๖๕

ข. เจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๐๖ ราย

- | | |
|---------------------------------|----------------------------|
| ๑) นายสุสันต์ พันสิงห์ | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๐๑ |
| ๒) นางสุธรรมา แก้วซ้อนอก | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๐๒ |
| ๓) นายพีรณัฐ เจริญผล | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๐๓ |
| ๔) นางสาววิไลลักษณ์ เกไชสง | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๐๔ |
| ๕) นายสมชาติ อุทุมรัตน์ | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๐๕ |
| ๖) นางสาวปรมาภรณ์ ทองแก้ว | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๐๖ |
| ๗) นางสาวกัลยา สมพงษ์ | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๐๗ |
| ๘) นายอรรถพร เทพทอง | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๐๘ |
| ๙) นางสาวอมรรัตน์ พุทธาสี | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๐๙ |
| ๑๐) นางสาววรรณ สายบุญเรือน | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๑๐ |
| ๑๑) นายกฤษณพงษ์ นามทิพย์ | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๑๑ |
| ๑๒) นางสาวอาภรณ์ อ่อนคง | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๑๒ |
| ๑๓) นายกิตติศักดิ์ ทรงจำรัส | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๑๓ |
| ๑๔) นางสาวอักษรินทร์ บุญคง | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๑๔ |
| ๑๕) นางสาวพรพิมล แวนทอง | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๑๕ |
| ๑๖) นายวิชณุ สุวรรณราช | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๑๖ |
| ๑๗) นายอภิวิชญ์ ท่วงที | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๑๗ |
| ๑๘) นายมานิตย์ ปานโชติ | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๑๘ |
| ๑๙) นายทศพร ธนะพิรุฬห์ | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๑๙ |
| ๒๐) นางสาวกัลยาณี โยธา | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๒๐ |
| ๒๑) นางสาวเกวลี สุขศรี | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๒๑ |
| ๒๒) นางสาวชมธณัญ อภิพัทธ์ปภา | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๒๒ |
| ๒๓) นายศิริพัชร จงผดุงเกียรติ | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๒๓ |
| ๒๔) นางสาวสุภาวดี อินยาศรี | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๒๔ |
| ๒๕) นายพงศ์เทพ เหล่าขจร | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๒๕ |
| ๒๖) นายขวัญชัย พันทุกซ์ | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๒๖ |
| ๒๗) นางสาวพัชจิรา คดีพิศาล | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๒๗ |
| ๒๘) นางสาวเมธิกา เสือคำจันทร์ | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๒๘ |
| ๒๙) นายกานต์พงศ์ บุญพวง | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๒๙ |
| ๓๐) นางสาวพุดิศา เจริญชัยสมบัติ | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๓๐ |
| ๓๑) นายณพรัตน์ จະโต | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๓๑ |
| ๓๒) นายพีระพัฒน์ บัญญัติศิลป์ | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๓๒ |
| ๓๓) นายปริดา ไชยภูมิสกุล | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๓๓ |
| ๓๔) นายชัชวาลย์ เลื่อนส่อง | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๓๔ |
| ๓๕) นายปิยะณัฐ ศรีภูโรจน์ | ทะเบียนเลขที่ ว-๑๔๕-จ-๐๐๓๕ |


(นางจินดา เดชะศรีรินทร์)

ผู้อำนวยการกองวิจัยและพัฒนาศักยภาพ
ปฏิบัติการแทนอธิบดีกรมโรงงานอุตสาหกรรม

๓๖) นายณณสินธุ์...

๓๖) นายณณสินธุ์ ธนธรรมรัตน์
๓๗) นายกันนิกร รัสโ
๓๘) นายจักรพันธ์ ภูมิรินทร์
๓๙) นายปริญญา กลมเกลียว
๔๐) นายธีรวัฒน์ มาตรโพธิ์ศรี
๔๑) นายธีรเมธ สุขศรี
๔๒) นายบุญญฤทธิ์ ก้อนสิน
๔๓) นายพรชวุฒิ ไถสกูล
๔๔) นายอชิตะ แสงจันทร์
๔๕) นายณัฐพงษ์ เมืองชัย
๔๖) นายธนัท เลิศประเสริฐ
๔๗) นางสาวนิภาพร จันทเขตต์
๔๘) นายยุทธพงษ์ อิศระสุข
๔๙) นายณภพ ภูตระกูลพัฒนา
๕๐) นางสาวศิริวรรณ ขอนพา
๕๑) นายสมพงษ์ สกลไทย
๕๒) นายสุริยัน นิธิเขตขุวงศ์
๕๓) นายอัษฎาธร ยนต์ศิริ
๕๔) นายเอกวุฒิ เสนอใจ
๕๕) นายสุสันต์ บุญเลี้ยง
๕๖) นายธนเดช ทวนแสนะ
๕๗) นายพิพัฒน์ ต้นธนกุล
๕๘) นายอภิสิทธิ์ ศรีคงแก้ว
๕๙) นายภูวดล มงคลสูง
๖๐) นายอุทัย แก้วรากมู
๖๑) นางสาววนารินทร์ สานนท์
๖๒) นายศุภกร รินวงศ์
๖๓) นายศักดิ์สิทธิ์ เกิดขัง
๖๔) นางสาวศิริพร อภิการ์ตัน
๖๕) นางสาวจินตสุภา เป็ลยสินศรี
๖๖) นางสาวเนตรนภา กมลบุรณ์
๖๗) นางสาวอารียา ทรารมย์
๖๘) นายจิรวัฒน์ สุขเกษม
๖๙) นายกิตติพงษ์ สอนชัยภูมิ
๗๐) นายจุฬพล สอนเพชร
๗๑) นางสาวพัชราภรณ์ แสงฟ้า
๗๒) นายรัตนชัย เหล้ามา

ทะเบียนเลขที่ ๖-๑๔๕-จ-๐๐๓๖
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ทะเบียนเลขที่ ๖-๑๔๕-จ-๐๐๗๑
ทะเบียนเลขที่ ๖-๑๔๕-จ-๐๐๗๒


(นางจินตา เคชะครินทร์)

ผู้อำนวยการกองวิจัยและเตือนภัยมลพิษโรงงาน
ปฏิบัติการตามแผนปฏิบัติการโรงงานอุตสาหกรรม

๗๓) นายอิทธิพงษ์...

๗๓) นายอิทธิพงษ์ ศรีวิเศษ
๗๔) นางสาวกรรณิการ์ สำลีทา
๗๕) นายสุภาภรณ์ พิมพ์ศรี
๗๖) นายพรชัย คุ้มม่วง
๗๗) นางสาวทัศนีย์ ไชยหาร
๗๘) นายอิทธิพงษ์ ศรีคำแหง
๗๙) นางสาวณัฐชา พรหมศิริ
๘๐) นางสาวลัดดาวัลย์ โพธิ์พันธ์
๘๑) นางสาวกมลวรรณ เจริญจันทร์
๘๒) นายณพัทธ์ จันทะคุณ
๘๓) นายปิยวัฒน์ ไหมชู
๘๔) นางสาวพรนัชชา กลิ่นอุณ
๘๕) นายณภสิทธิ์ ศรีพิมพ์
๘๖) นางสาวลักขิกา จันทรสุน
๘๗) นางสาวกรรณัต มาลัยทอง
๘๘) นางสาวสาธิตา แซ่เตียว
๘๙) นายศักดิ์สินธุ์ นุ่มนิม
๙๐) นายวรพงษ์ นนทจันทร์
๙๑) นางสาวชนากา มาคะมาต
๙๒) นางสาวธนธรณ์ คุณานุพันธ์ชัย
๙๓) นายวิระยุทธ สาระภักดี
๙๔) นางสาวธิดิยา วีระพันธุ์วิวัฒน์
๙๕) นายกฤตพล พงศ์สถาพร
๙๖) นายณัฐชัย พรหมอารักษ์
๙๗) นายชนินทร์ พานแก้ว
๙๘) นายปรัชชาพล โสภา
๙๙) นายวิชรินทร์ แสนงาม
๑๐๐) นางสาวธนภรณ์ ลาพรม
๑๐๑) นายอาทิตย์ อุดมผล
๑๐๒) นายปรวร บุณนา
๑๐๓) นายอิทธิเดช ใจบุญ
๑๐๔) นายณณิติน พงษ์อิศรานูพร
๑๐๕) นางสาวสุธารัตน์ จันทร์ประทีต
๑๐๖) นายเสกฐวุฒิ เอ็มกลิ่นบัว

ทะเบียนเลขที่ ๖-๑๔๕-จ-๐๐๗๓
ทะเบียนเลขที่ ๖-๑๔๕-จ-๐๐๗๔
ทะเบียนเลขที่ ๖-๑๔๕-จ-๐๐๗๕
ทะเบียนเลขที่ ๖-๑๔๕-จ-๐๐๗๖
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ทะเบียนเลขที่ ๖-๑๔๕-จ-๐๐๘๐
ทะเบียนเลขที่ ๖-๑๔๕-จ-๐๐๘๑
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ทะเบียนเลขที่ ๖-๑๔๕-จ-๐๑๐๐
ทะเบียนเลขที่ ๖-๑๔๕-จ-๐๑๐๑
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ทะเบียนเลขที่ ๖-๑๔๕-จ-๐๑๐๓
ทะเบียนเลขที่ ๖-๑๔๕-จ-๐๑๐๔
ทะเบียนเลขที่ ๖-๑๔๕-จ-๐๑๐๕
ทะเบียนเลขที่ ๖-๑๔๕-จ-๐๑๐๖


(นางจินตา เคชะครินทร์)

ผู้อำนวยการกองวิจัยและเตือนภัยมลพิษโรงงาน
ปฏิบัติการตามแผนปฏิบัติการโรงงานอุตสาหกรรม

เอกสารแนบท้ายหนังสือรับข้ออายัดขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

บริษัท ยูโนเด็ค แอนนาลิสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด เลขทะเบียน ๖-๑๔๕

ที่ ออก ๐๓๑๐(๑)/ ๑๘๗ ๕ ลงวันที่ ๐๙ กุมภาพันธ์ ๒๕๖๕

ขอข่ายสารมลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๓๕๗ รายการ

น้ำเสีย จำนวน 46 รายการ

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
1	Aldrin	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
2	Arsenic	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
3	Barium	Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
4	α -BHC	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
5	β -BHC	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
6	δ -BHC	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
7	γ -BHC	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
8	Biochemical Oxygen Demand	1) 5-Day BOD Test, Azide Modification Method ⁽⁴⁾ 2) 5-Day BOD Test, Membrane Electrode Method ⁽⁴⁾
9	Cadmium	1) Digestion, Direct Air-Acetylene Flame Method ⁽⁴⁾ 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽⁴⁾ 3) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
10	Chemical Oxygen Demand	1) Closed Reflux, Titrimetric Method ⁽⁴⁾ 2) Closed Reflux, Colorimetric Method ⁽⁴⁾ 3) Open Reflux, Titrimetric Method ⁽⁴⁾
11	Chlordane	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
12	Chromium	1) Digestion, Direct Air-Acetylene Flame Method ⁽⁴⁾ 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽⁴⁾ 3) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
13	Color	ADMI Weighted-Ordinate Spectrophotometric Method ⁽⁴⁾
14	Copper	1) Digestion, Direct Air-Acetylene Flame Method ⁽⁴⁾ 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽⁴⁾ 3) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
15	Cyanide	1) Distillation, Colorimetric Method ⁽⁴⁾ 2) Flow Injection Analysis Method ⁽⁴⁾

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
16	o,p'-DDT	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
17	4,4'-DDD	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
18	4,4'-DDE	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
19	4,4'-DDT	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
20	Dieldrin	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
21	Endosulfan I	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
22	Endosulfan II	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
23	Endosulfan sulfate	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
24	Endrin	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
25	Endrin aldehyde	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
26	Formaldehyde	Distillation, Colorimetric Method ⁽³⁾
27	Free Chlorine	1) Iodometric Method ⁽⁴⁾ 2) DPD Ferrous Titrimetric Method ⁽⁴⁾
28	Heptachlor	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
29	Heptachlor Epoxide	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
30	Hexavalent Chromium	1) Colorimetric Method ⁽⁴⁾ 2) Extraction, Direct Air-Acetylene Flame Method ⁽⁴⁾
31	Lead	1) Digestion, Direct Air-Acetylene Flame Method ⁽⁴⁾ 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽⁴⁾ 3) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
32	Manganese	1) Digestion, Direct Air-Acetylene Flame Method ⁽⁴⁾ 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽⁴⁾ 3) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
33	Mercury	Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ⁽⁴⁾
34	Methoxychlor	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
35	Nickel	1) Digestion, Direct Air-Acetylene Flame Method ⁽⁴⁾ 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽⁴⁾ 3) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
36	Oil & Grease	1) Liquid-Liquid, Partition-Gravimetric Method ⁽⁴⁾ 2) Soxhlet Extraction Method ⁽⁴⁾
37	pH	Electrometric Method ⁽⁴⁾
38	Phenols	1) Distillation, Chloroform Extraction Method ⁽⁴⁾ 2) Distillation, Direct Photometric Method ⁽⁴⁾
39	Selenium	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
40	Sulfide	1) Iodometric Method ⁽⁴⁾ 2) Methylene Blue Method ⁽⁴⁾
41	Temperature	Laboratory and Field Methods ⁽⁴⁾
42	Total Dissolved Solids	Dried at 180 °C ⁽⁴⁾
43	Total Kjeldahl Nitrogen	Semi-Micro-Kjeldahl Method ⁽⁴⁾
44	Total Suspended Solids	Dried at 103-105 °C ⁽⁴⁾
45	Trivalent Chromium	1) Digestion, Direct Air-Acetylene Flame Method; Colorimetric Method; Calculation ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma Method; Colorimetric Method; Calculation ⁽⁴⁾
46	Zinc	1) Digestion, Direct Air-Acetylene Flame Method ⁽⁴⁾ 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽⁴⁾ 3) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾

น้ำใต้ดิน จำนวน 126 รายการ

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
1	Acenaphthene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
2	Acetone	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
3	Aldrin	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ <i>อีกที</i>

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
4	Anthracene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
5	Antimony	Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
6	Arsenic	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
7	Atrazine	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
8	Barium	1) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
9	Benzo(a)anthracene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
10	Benzene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
11	Benzo(b)fluoranthene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
12	Benzo(k)fluoranthene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
13	Benzoic acid	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
14	Benzo(a)pyrene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ <i>อีกที</i>

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
15	Benzo(g,h,i)perylene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
16	Beryllium	Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
17	Bis(2-chloroethyl)ether	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
18	Bis(2-ethylhexyl)phthalate	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
19	Bromodichloromethane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
20	Bromoform	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
21	Butanol	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
22	Butyl benzyl phthalate	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
23	Cadmium	1) Digestion, Direct Air-Acetylene Flame Method ⁽⁴⁾ 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽⁴⁾ 3) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
24	Carbazole	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
25	Carbon disulfide	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
26	Carbon tetrachloride	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
27	Chlordane	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
28	p-Chloroaniline	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
29	Chlorobenzene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
30	Chlorodibromomethane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
31	Chloroform	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
32	2-Chlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
33	Chromium	1) Digestion, Direct Air-Acetylene Flame Method ⁽⁴⁾ 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽⁴⁾ 3) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
34	Chromium (III)	1) Digestion, Direct Air-Acetylene Flame Method; Colorimetric Method; Calculation ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma Method; Colorimetric Method; Calculation ⁽⁴⁾
35	Chromium (VI)	1) Colorimetric Method ⁽⁴⁾ 2) Extraction, Air-Acetylene Flame Method ⁽⁴⁾
36	Chrysene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
37	Cyanide	Distillation, Colorimetric Method ⁽⁴⁾
38	2,4-D	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
39	DDD	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
40	DDE	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
41	DDT	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
42	Dibenz(a,h)anthracene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
43	Di-n-butyl phthalate	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
44	1,2-Dichlorobenzene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
45	1,3-Dichlorobenzene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
46	1,4-Dichlorobenzene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
47	3,3'-Dichlorobenzidine	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
48	1,1-Dichloroethane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
49	1,2-Dichloroethane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
50	1,1-Dichloroethylene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
51	cis-1,2-Dichloroethylene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
52	trans-1,2-Dichloroethylene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
53	2,4-Dichlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
54	1,2-Dichloropropane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
55	1,3-Dichloropropane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
56	1,3-Dichloropropene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
57	Dieldrin	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ <i>เพิ่ม</i>

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
58	Diethyl phthalate	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
59	2,4-Dimethylphenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
60	2,4-Dinitrophenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
61	2,4-Dinitrotoluene	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
62	2,6-Dinitrotoluene	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
63	Di-n-Octyl phthalate	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
64	Endosulfan	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
65	Endrin	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
66	Ethylbenzene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
67	Fluoranthene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
68	Fluorene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
69	Heptachlor	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ <i>เพิ่ม</i>

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
70	Heptachlor epoxide	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
71	Hexachlorobenzene	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
72	Hexachloro-1,3-butadiene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
73	n-Hexane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
74	α -HCH	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
75	β -HCH	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
76	γ -HCH	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
77	Hexachlorocyclopentadiene	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
78	Hexachloroethane	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
79	Indeno(1,2,3-cd)pyrene	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
80	Isophorone	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
81	Lead	1) Digestion, Direct Air-Acetylene Flame Method ⁽⁴⁾ 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽⁴⁾ 3) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
82	Manganese	1) Digestion, Direct Air-Acetylene Flame Method ⁽⁴⁾ 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽⁴⁾ 3) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
83	Mercury	Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ⁽⁴⁾
84	Methanol	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
85	Methoxychlor	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
86	Methyl bromide	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
87	Methylene chloride	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
88	2-Methylphenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
89	2-Methylnaphthalene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
90	Methyl tert-butyl ether	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
91	Naphthalene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
92	Nickel	1) Digestion, Direct Air-Acetylene Flame Method ⁽⁴⁾ 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽⁴⁾ 3) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
93	Nitrobenzene	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
94	N-Nitrosodiphenylamine	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
95	N-Nitrosodi-n-propylamine	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
96	Polychlorinated Biphenyls - PCB 1016 - PCB 1221 - PCB 1232 - PCB-1242 - PCB-1248 - PCB-1254 - PCB-1260	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
97	Pentachlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
98	pH	Electrometric Method ⁽⁴⁾
99	Phenanthrene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
100	Phenol	1) Distillation, Chloroform Extraction Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
101	Pyrene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
102	Selenium	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
103	Silver	Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
104	Styrene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
105	1,1,2,2-Tetrachloroethane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
106	Tetrachloroethylene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
107	Toluene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ <i>วิธีใหม่</i>

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
108	Toxaphene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
109	TPH (C ₅ - C ₈)	1) Purge and Trap, Gas Chromatographic Method ^(11,21) 2) Purge and Trap, Gas Chromatographic/Mass spectrometric Method ^(11,25)
110	TPH (C ₉ - C ₁₆)	Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(9,21)
111	TPH (C ₁₆ - C ₃₅)	Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(9,21)
112	1,2,4-Trichlorobenzene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
113	1,1,1-Trichloroethane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
114	1,1,2-Trichloroethane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
115	Trichloroethylene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
116	2,4,5-Trichlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
117	2,4,6-Trichlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
118	1,3,5-Trimethylbenzene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
119	Vanadium	Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
120	Vinyl acetate	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
121	Vinyl chloride	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
122	m-Xylene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
123	o-Xylene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ <i>วิธีใหม่</i>

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
124	p-Xylene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ^[4]
125	Xylene (Total)	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ^[4]
126	Zinc	1) Digestion, Direct Air-Acetylene Flame Method ^[4] 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ^[4] 3) Digestion, Inductively Coupled Plasma Method ^[4]

อากาศเสีย (ปล่อยระบาย) จำนวน 25 รายการ

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
1	Antimony	Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ^[5]
2	Arsenic	1) Isokinetic Sampling, Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^[5] 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ^[5]
3	Cadmium	1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method ^[5] 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ^[5]
4	Carbon Monoxide	Instrumental Analyzer Method ^[5]
5	Chlorine	Isokinetic Sampling, Ion Chromatographic Method ^[5]
6	Chromium	1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method ^[5] 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ^[5]
7	Cobalt	Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ^[5]
8	Copper	1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method ^[5] 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ^[5]
9	Cresol	Absorption Sampling, Gas Chromatographic Method ^[5]

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
10	Dioxins/Furans	Isokinetic Sampling ^[5]
11	Hydrogen Chloride	Isokinetic Sampling, Ion Chromatographic Method ^[5]
12	Hydrogen Fluoride	Isokinetic Sampling, Ion Chromatographic Method ^[5]
13	Hydrogen Sulfide	Absorption Sampling, Iodometric Method ^[5]
14	Lead	1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method ^[5] 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ^[5]
15	Manganese	1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method ^[5] 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ^[5]
16	Mercury	Isokinetic Sampling, Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ^[5]
17	Nickel	1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method ^[5] 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ^[5]
18	Opacity	Ringelmann's Method ^[1]
19	Oxides of Nitrogen	1) Absorption Sampling, Phenoldisulfonic acid Method ^[5] 2) Instrumental Analyzer Method ^[5]
20	Selenium	1) Isokinetic Sampling, Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^[5] 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ^[5]
21	Sulfur Dioxide	1) Absorption Sampling, Barium-Thorin Titrimetric Method ^[5] 2) Instrumental Analyzer Method ^[5]
22	Sulfuric Acid	Isokinetic Sampling, Barium-Thorin Titrimetric Method ^[5]
23	Total Suspended Particulate	Isokinetic Sampling, Gravimetric Method ^[5]
24	Vanadium	Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ^[5]
25	Xylene	1) Bag Sampling, Gas Chromatographic Method ^[5] 2) Adsorption Sampling, Gas Chromatographic Method ^[5]

สิ่งปฏิกูลหรือวัสดุที่ไม่ใช้แล้ว จำนวน 35 รายการ

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
1	Aldrin	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22)
2	Antimony	Digestion, Inductively Coupled Plasma Method ^(7,13)
3	Arsenic	1) Waste Extraction, Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^(2,6,13) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) 3) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^(7,13) 4) Digestion, Inductively Coupled Plasma Method ^(7,13)
4	Barium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) 2) Digestion, Inductively Coupled Plasma Method ^(7,13)
5	Beryllium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) 2) Digestion, Inductively Coupled Plasma Method ^(7,13)
6	Cadmium	1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^(2,6,14) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) 3) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14) 4) Digestion, Inductively Coupled Plasma Method ^(7,13)
7	Chlordane	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22)
8	Chromium	1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^(2,6,14) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13)

3) Digestion,...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
9	Chromium (III)	3) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14) 4) Digestion, Inductively Coupled Plasma Method ^(7,13) 1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method; Waste Extraction, Colorimetric Method; Calculation ^(2,6,14,16) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method; Waste Extraction, Colorimetric Method; Calculation ^(2,6,13,16) 3) Digestion, Flame Atomic Absorption Spectrometric Method; Alkaline Digestion, Colorimetric Method; Calculation ^(7,8,14,16) 4) Digestion, Inductively Coupled Plasma Method; Alkaline Digestion, Colorimetric Method; Calculation ^(7,8,13,16)
10	Chromium (VI)	1) Waste Extraction, Colorimetric Method ^(2,16) 2) Alkaline Digestion, Colorimetric Method ^(8,16)
11	Cobalt	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) 2) Digestion, Inductively Coupled Plasma Method ^(7,13)
12	Copper	1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^(2,6,14) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) 3) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14) 4) Digestion, Inductively Coupled Plasma Method ^(7,13)
13	2,4-D	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22)
14	DDD	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22)

15 DDE...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
15	DDE	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22)
16	DDT	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22)
17	Dieldrin	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22)
18	Endrin	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22)
19	Heptachlor	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22)
20	Lead	1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^(2,6,14) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) 3) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14) 4) Digestion, Inductively Coupled Plasma Method ^(7,13)
21	Lindane	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22)
22	Mercury	1) Waste Extraction, Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ^(2,17) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) <i>อีก</i>

3) Digestion,...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
		3) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ⁽¹⁸⁾ 4) Digestion, Inductively Coupled Plasma Method ^(7,13) 5) Thermal Decomposition Amalgamation and Atomic Absorption Spectrometric Method ⁽¹⁹⁾
23	Methoxychlor	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22)
24	Molybdenum	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) 2) Digestion, Inductively Coupled Plasma Method ^(7,13)
25	Nickel	1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^(2,6,14) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) 3) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14) 4) Digestion, Inductively Coupled Plasma Method ^(7,13)
26	Polychlorinated Biphenyls - Aroclor 1016 - Aroclor 1221 - Aroclor 1232 - Aroclor 1242 - Aroclor 1248 - Aroclor 1254 - Aroclor 1260 - 2-Chlorobiphenyl - 2,3-Dichlorobiphenyl - 2,2',5-Trichlorobiphenyl - 2,4',5-Trichlorobiphenyl - 2,2',3,5'-Tetrachlorobiphenyl - 2,2',5,5'-Tetrachlorobiphenyl - 2,3',4,4'-Tetrachlorobiphenyl - 2,2',3,4,5'-Pentachlorobiphenyl	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,23) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,23) <i>อีก</i>

- 2,2',4,5,5'...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
27	- 2,2',4,5,5'- Pentachlorobiphenyl	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^[2,9,28] 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^[10,26] Electrometric Method ^[31,32] 3) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^[7,20] 4) Digestion, Inductively Coupled Plasma Method ^[7,13]
	- 2,3,3',4',6'- Pentachlorobiphenyl	
	- 2,2',3,4,4',5'- Hexachlorobiphenyl	
	- 2,2',3,4,5,5'- Hexachlorobiphenyl	
	- 2,2',3,5,5',6'- Hexachlorobiphenyl	
	- 2,2',4,4',5,5'- Hexachlorobiphenyl	
	- 2,2',3,3',4,4',5'- Heptachlorobiphenyl	
	- 2,2',3,4,4',5,5'- Heptachlorobiphenyl	
	- 2,2',3,4,4',5,6'- Heptachlorobiphenyl	
	- 2,2',3,4',5,5',6'- Heptachlorobiphenyl	
	- 2,2',3,3',4,4',5,5',6'- Nonachlorobiphenyl	
	Pentachlorophenol	
28	pH	
29	Selenium	

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
30	Silver	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^[2,6,13]
31	Thallium	2) Digestion, Inductively Coupled Plasma Method ^[7,13] 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^[2,6,13]
32	Toxaphene	2) Digestion, Inductively Coupled Plasma Method ^[7,13] 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^[2,9,22]
33	Trichloroethylene	2) Ultrasonic Extraction, Gas Chromatographic Method ^[10,22] 1) Waste Extraction, Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^[2,12,25]
34	Vanadium	2) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^[12,25] 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^[2,6,13]
35	Zinc	2) Digestion, Inductively Coupled Plasma Method ^[7,13] 1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^[2,6,14] 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^[2,6,13] 3) Digestion, Flame Atomic Absorption Spectrometric Method ^[7,14] 4) Digestion, Inductively Coupled Plasma Method ^[7,13]

ดิน จำนวน 125 รายการ

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
1	Acenaphthene	1) Ultrasonic Extraction, Gas Chromatographic Method ^[10,24] 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^[10,26]
2	Acetone	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^[12,25]

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
3	Aldrin	1) Ultrasonic Extraction, Gas Chromatographic Method ^[10,22] 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^[10,26]
4	Anthracene	1) Ultrasonic Extraction, Gas Chromatographic Method ^[10,26] 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^[10,26]
5	Antimony	Digestion, Inductively Coupled Plasma Method ^[7,13]
6	Arsenic	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^[7,13] 2) Digestion, Inductively Coupled Plasma Method ^[7,13]
7	Atrazine	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^[10,26]
8	Barium	Digestion, Inductively Coupled Plasma Method ^[7,13]
9	Benz(a)anthracene	1) Ultrasonic Extraction, Gas Chromatographic Method ^[10,24] 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^[10,26]
10	Benzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^[12,25]
11	Benzo(b)fluoranthene	1) Ultrasonic Extraction, Gas Chromatographic Method ^[10,24] 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^[10,26]
12	Benzo(k)fluoranthene	1) Ultrasonic Extraction, Gas Chromatographic Method ^[10,24] 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^[10,26]
13	Benzoic acid	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^[10,26]
14	Benzo(a)pyrene	1) Ultrasonic Extraction, Gas Chromatographic Method ^[10,24] 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^[10,26]

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
15	Benzo(g,h,i)perylene	1) Ultrasonic Extraction, Gas Chromatographic Method ^[10,22] 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^[10,26]
16	Beryllium	Digestion, Inductively Coupled Plasma Method ^[7,13]
17	Bis(2-chloroethyl)ether	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^[10,26]
18	Bis(2-ethylhexyl)phthalate	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^[10,26]
19	Bromodichloromethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^[12,25]
20	Bromoform	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^[12,25]
21	Butanol	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^[12,25]
22	Butyl benzyl phthalate	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^[10,26]
23	Cadmium	1) Digestion, Flame Atomic Absorption Spectrometric Method ^[7,14] 2) Digestion, Inductively Coupled Plasma Method ^[7,13]
24	Carbazole	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^[10,26]
25	Carbon disulfide	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^[12,25]
26	Carbon tetrachloride	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^[12,25]
27	Chlordane	1) Ultrasonic Extraction, Gas Chromatographic Method ^[10,22] 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^[10,26]
28	p-Chloroaniline	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^[10,26]
29	Chlorobenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^[12,25]
30	Chlorodibromomethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^[12,25]

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
31	Chloroform	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^[12,25]
32	2-Chlorophenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^[10,26]
33	Chromium	1) Digestion, Flame Atomic Absorption Spectrometric Method ^[7,14] 2) Digestion, Inductively Coupled Plasma Method ^[7,13]
34	Chromium (III)	1) Digestion, Flame Atomic Absorption Spectrometric Method; Alkaline Digestion, Colorimetric Method; Calculation ^[7,8,14,16] 2) Digestion, Inductively Coupled Plasma Method; Alkaline Digestion, Colorimetric Method; Calculation ^[7,8,13,16]
35	Chromium (VI)	Alkaline Digestion, Colorimetric Method ^[8,16]
36	Chrysene	1) Ultrasonic Extraction, Gas Chromatographic Method ^[10,24] 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^[10,26]
37	Cyanide	Extraction, Distillation, Colorimetric Method ^[28,29,30]
38	2,4-D	Ultrasonic Extraction, Gas Chromatographic Method ^[27]
39	DDD	1) Ultrasonic Extraction, Gas Chromatographic Method ^[10,22] 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^[10,26]
40	DDE	1) Ultrasonic Extraction, Gas Chromatographic Method ^[10,22] 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^[10,26]
41	DDT	1) Ultrasonic Extraction, Gas Chromatographic Method ^[10,22] 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^[10,26]
42	Dibenz(a,h)anthracene	1) Ultrasonic Extraction, Gas Chromatographic Method ^[10,24] 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^[10,26]

43 Di-n-butyl phthalate...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
43	Di-n-butyl phthalate	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^[10,26]
44	1,2-Dichlorobenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^[12,25]
45	1,3-Dichlorobenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^[12,25]
46	1,4-Dichlorobenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^[12,25]
47	3,3'-Dichlorobenzidine	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^[10,26]
48	1,1-Dichloroethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^[12,25]
49	1,2-Dichloroethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^[12,25]
50	1,1-Dichloroethylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^[12,25]
51	cis-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^[12,25]
52	trans-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^[12,25]
53	2,4-Dichlorophenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^[10,26]
54	1,2-Dichloropropane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^[12,25]
55	1,3-Dichloropropane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^[12,25]
56	1,3-Dichloropropene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^[12,25]
57	Dieldrin	1) Ultrasonic Extraction, Gas Chromatographic Method ^[10,22] 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^[10,26]
58	Diethyl phthalate	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^[10,26]
59	2,4-Dimethylphenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^[10,26]

60 2,4-Dinitrophenol...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
60	2,4-Dinitrophenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
61	2,4-Dinitrotoluene	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
62	2,6-Dinitrotoluene	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
63	Di-n-Octyl phthalate	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
64	Endosulfan	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
65	Endrin	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
66	Ethylbenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
67	Fluoranthene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,24) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
68	Fluorene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,24) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
69	Heptachlor	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
70	Heptachlor epoxide	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
71	Hexachlorobenzene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
72	Hexachloro-1,3-butadiene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
73	n-Hexane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
74	α -HCH	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
75	β -HCH	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
76	γ -HCH	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
77	Hexachlorocyclopentadiene	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
78	Hexachloroethane	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
79	Indeno(1,2,3-cd)pyrene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,24) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
80	Isophorone	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
81	Lead	1) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14) 2) Digestion, Inductively Coupled Plasma Method ^(7,13)
82	Manganese	1) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14) 2) Digestion, Inductively Coupled Plasma Method ^(7,13)

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
97	- 2,2',3,4',5,5',6-Heptachlorobiphenyl - 2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl Pentachlorophenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
98	Phenanthrene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,24) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
99	Phenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
100	Pyrene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,24) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
101	Selenium	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^(7,22) 2) Digestion, Inductively Coupled Plasma Method ^(7,13)
102	Silver	Digestion, Inductively Coupled Plasma Method ^(7,13)
103	Styrene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
104	1,1,2,2-Tetrachloroethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
105	Tetrachloroethylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
106	Toluene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
107	Toxaphene	Ultrasonic Extraction, Gas Chromatographic Method ^(10,22)
108	TPH (C ₅ -C ₈)	1) Purge and Trap, Gas Chromatographic Method ^(12,21) 2) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
109	TPH (C ₈ -C ₁₆)	Ultrasonic Extraction, Gas Chromatographic Method ^(10,21)
110	TPH (C ₁₆ -C ₃₅)	Ultrasonic Extraction, Gas Chromatographic Method ^(10,21)
111	1,2,4-Trichlorobenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)

112 1,1,1-Trichloroethane...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
112	1,1,1-Trichloroethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
113	1,1,2-Trichloroethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
114	Trichloroethylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
115	2,4,5-Trichlorophenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
116	2,4,6-Trichlorophenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
117	1,3,5-Trimethylbenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
118	Vanadium	Digestion, Inductively Coupled Plasma Method ^(7,13)
119	Vinyl acetate	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
120	Vinyl chloride	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
121	m-Xylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
122	o-Xylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
123	p-Xylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
124	Xylene (Total)	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
125	Zinc	1) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14) 2) Digestion, Inductively Coupled Plasma Method ^(7,13)

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บริษัท อินทิเกรตเต็ด รีเสิร์ช เซ็นเตอร์ จำกัด





๑๓ มกราคม ๒๕๖๓

เรื่อง ต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน และเปลี่ยนแปลงชื่อห้องปฏิบัติการวิเคราะห์
เรียน กรรมการผู้จัดการ บริษัท อินทิเกรตเต็ด รีเสิร์ช เซ็นเตอร์ จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุหนังสืออนุญาตขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน
ลงวันที่ ๒๑ ตุลาคม ๒๕๖๒

สิ่งที่ส่งมาด้วย เอกสารแนบท้ายหนังสือรับต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน
บริษัท อินทิเกรตเต็ด รีเสิร์ช เซ็นเตอร์ จำกัด จำนวน ๒ แผ่น

ตามหนังสือที่อ้างถึง บริษัท อินทิเกรตเต็ด รีเสิร์ช เซ็นเตอร์ จำกัด ขอต่ออายุหนังสือ
รับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน และขอเปลี่ยนแปลงชื่อของห้องปฏิบัติการวิเคราะห์
เลขทะเบียน ๖-๑๙๙ สถานที่ตั้งเลขที่ ๑๒๒ หมู่ที่ ๒ ตำบลท่าสูง อำเภอศรีมหาโพธิ จังหวัดปราจีนบุรี
ต่อกรมโรงงานอุตสาหกรรม นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว มีความเห็นให้เปลี่ยนแปลงชื่อบริษัท จากบริษัท
ดี.เอ.รีเสิร์ช เซ็นเตอร์ จำกัด เป็น บริษัท อินทิเกรตเต็ด รีเสิร์ช เซ็นเตอร์ จำกัด และต่ออายุหนังสือ
รับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน โดยมีองค์ประกอบดังนี้

ก. ผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์

- ๑) นางสาวกัญญา นันทะนัย ทะเบียนเลขที่ ๖-๑๙๙-๙-๖๔๙๓
๒) นางวิภากรรณ์ ผลเจริญ ทะเบียนเลขที่ ๖-๑๙๙-๙-๘๕๖๖

ข. เจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์

- ๑) นายชัยณรงค์ อินวิวัฒน์ ทะเบียนเลขที่ ๖-๑๙๙-๙-๕๖๘๕
๒) นางสาวอนันตพร งามสง่า ทะเบียนเลขที่ ๖-๑๙๙-๙-๕๖๘๖
๓) นางสาวหนึ่งฤทัย อมมาลี ทะเบียนเลขที่ ๖-๑๙๙-๙-๖๔๙๕
๔) นางสาวดวงดา คำสา ทะเบียนเลขที่ ๖-๑๙๙-๙-๖๔๙๗
๕) นายจักรีชัย อินดี ทะเบียนเลขที่ ๖-๑๙๙-๙-๘๕๖๗
๖) นางสาวชนิกานต์ แสนสุข ทะเบียนเลขที่ ๖-๑๙๙-๙-๘๕๘๘
๗) นายกิตติพงษ์ คำกิ่ง ทะเบียนเลขที่ ๖-๑๙๙-๙-๘๕๘๙

ค. ขอบข่ายสารมลพิษที่ได้รับขึ้นทะเบียนวิเคราะห์ในน้ำเสีย จำนวน ๒๒ รายการ
และน้ำใต้ดิน จำนวน ๑๒ รายการ รวมทั้งสิ้นจำนวน ๓๔ รายการ ตามสิ่งที่ส่งมาด้วย

หนังสือ...

-๒-

หนังสือฉบับนี้จะหมดอายุในวันที่ ๑๘ พฤศจิกายน ๒๕๖๕ หากประสงค์จะต่ออายุหนังสือ
รับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน ให้ยื่นคำขอต่ออายุพร้อมเอกสารประกอบคำขอต่อ
กรมโรงงานอุตสาหกรรมภายใน ๓๐ วัน ก่อนวันสิ้นสุดอายุของหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน
ซึ่งคำขอต่ออายุดังกล่าวขอรับได้ที่กรมโรงงานอุตสาหกรรม

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ


(นางจิราดา เตชะศรีนที)
ผู้อำนวยการศูนย์วิจัยและเฝ้าระวังมลพิษทางอากาศ
ผู้อำนวยการกองมลพิษทางอากาศ กรมโรงงานอุตสาหกรรม

กองวิจัยและเฝ้าระวังมลพิษทางอากาศ
ศูนย์วิจัยและเฝ้าระวังมลพิษทางอากาศ กรมโรงงานอุตสาหกรรม
โทร. ๐ ๒๘๐๕ ๗๒๖๑-๓
โทรสาร ๐ ๒๘๐๕ ๗๒๖๓

เอกสารแนบท้ายหนังสือรับต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

บริษัท อินทิเกรตเต็ด รีเสิร์ช เซ็นเตอร์ จำกัด

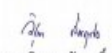
เลขทะเบียน ๖-๑๙๙

ที่ อก ๐๓๑๐(น)/ ๒๕๒

ลงวันที่ ๑๓ มกราคม ๒๕๖๓

ขอบข่ายสารมลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๓๔ รายการ
น้ำเสีย จำนวน ๒๒ รายการ

ลำดับที่	ชนิดสารมลพิษ	วิธีวิเคราะห์
1	Arsenic	Digestion, Inductively Coupled Plasma Method
2	Barium	Digestion, Inductively Coupled Plasma Method
3	Biochemical Oxygen Demand	5-Day BOD Test, Azide Modification Method
4	Cadmium	Digestion, Inductively Coupled Plasma Method
5	Chemical Oxygen Demand	Closed Reflux, Colorimetric Method
6	Color	ADM Weighted - Ordinate Spectrophotometric Method
7	Copper	Digestion, Inductively Coupled Plasma Method
8	Free Chlorine	Iodometric Method
9	Hexavalent Chromium	Filtration, Colorimetric Method
10	Lead	Digestion, Inductively Coupled Plasma Method
11	Manganese	Digestion, Inductively Coupled Plasma Method
12	Nickel	Digestion, Inductively Coupled Plasma Method
13	Oil and Grease	Liquid-Liquid, Partition-Gravimetric Method
14	pH	Electrometric Method
15	Selenium	Digestion, Inductively Coupled Plasma Method
16	Sulfide	ZnS Precipitation, Iodometric Method
17	Temperature	Laboratory and Field Method
18	Total Chromium	Digestion, Inductively Coupled Plasma Method
19	Total Dissolved Solids	Dried at 180 °C
20	Total Suspended Solids	Dried at 103-105 °C
21	Trivalent Chromium	Digestion, Inductively Coupled Plasma Method
22	Zinc	Filtration, Colorimetric Method, Calculation Digestion, Inductively Coupled Plasma Method


(นางสาววิชุดา สัมฤทธิ์ผล)
นักวิทยาศาสตร์ชำนาญการ ทำหน้าที่แทน
ผู้อำนวยการศูนย์วิจัยและเฝ้าระวังมลพิษทางอากาศ กรมโรงงานอุตสาหกรรม

Arsenic...


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น้ำใต้ดิน จำนวน 12 รายการ

ลำดับที่	ชนิดสารมลพิษ	วิธีวิเคราะห์
1	Arsenic	Digestion, Inductively Coupled Plasma Method
2	Barium	Digestion, Inductively Coupled Plasma Method
3	Cadmium	Digestion, Inductively Coupled Plasma Method
4	Chromium	Digestion, Inductively Coupled Plasma Method
5	Hexavalent Chromium	Filtration, Colorimetric Method
6	Lead	Digestion, Inductively Coupled Plasma Method
7	Manganese	Digestion, Inductively Coupled Plasma Method
8	Nickel	Digestion, Inductively Coupled Plasma Method
9	pH	Electrometric Method
10	Selenium	Digestion, Inductively Coupled Plasma Method
11	Trivalent Chromium	Inductively Coupled Plasma Method; Filtration, Colorimetric Method; Calculation
12	Zinc	Digestion, Inductively Coupled Plasma Method

เอกสารอ้างอิง

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(นางสาววิชุดา สัมฤทธิ์ผล)
นักวิทยาศาสตร์ชำนาญการ ทำหน้าที่แทน
ผู้อำนวยการศูนย์วิจัยและเฝ้าระวังมลพิษทางอากาศ กรมโรงงานอุตสาหกรรม

หนังสืออนุญาตขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน



ที่ สก.บค.๑๑๑/๒๕๖ ๓๓๓ ๑๕



กรมการขนส่งทางบก
ถนนพหลโยธิน เขตจตุจักร กรุงเทพฯ ๑๐๑๑๐

๑๕ มีนาคม พ.ศ.๒๕๖๕

มีเรื่อง ขออนุญาตขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

โดย บริษัท อีแม็กซ์ จำกัด (มหาชน) เลขที่ ๑๑๑ ถนนพหลโยธิน กรุงเทพฯ ๑๐๑๑๐

มีเรื่อง ขออนุญาตขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน เลขที่ ๑๑๑ ถนนพหลโยธิน กรุงเทพฯ ๑๐๑๑๐

มีเรื่อง ขออนุญาตขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน เลขที่ ๑๑๑ ถนนพหลโยธิน กรุงเทพฯ ๑๐๑๑๐

โดย บริษัท อีแม็กซ์ จำกัด (มหาชน) เลขที่ ๑๑๑ ถนนพหลโยธิน กรุงเทพฯ ๑๐๑๑๐

ตามหนังสือที่ สก.บค.๑๑๑/๒๕๖ ๓๓๓ ๑๕ ลงวันที่ ๑๕ มีนาคม พ.ศ.๒๕๖๕ เรื่อง ขออนุญาตขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน เลขที่ ๑๑๑ ถนนพหลโยธิน กรุงเทพฯ ๑๐๑๑๐

เพื่อให้เป็นไปตามระเบียบกระทรวงการพาณิชย์ว่าด้วยการขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน พ.ศ.๒๕๖๑

๑. ขออนุญาตขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

- ๑) นายสมชาย ใจดี
- ๒) นายสมชาย ใจดี
- ๓) นายสมชาย ใจดี
- ๔) นายสมชาย ใจดี
- ๕) นายสมชาย ใจดี
- ๖) นายสมชาย ใจดี

ขอขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน เลขที่ ๑๑๑ ถนนพหลโยธิน กรุงเทพฯ ๑๐๑๑๐

๒. เพื่อให้เป็นไปตามระเบียบกระทรวงการพาณิชย์ว่าด้วยการขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน พ.ศ.๒๕๖๑

- ๑) นายสมชาย ใจดี
- ๒) นายสมชาย ใจดี
- ๓) นายสมชาย ใจดี
- ๔) นายสมชาย ใจดี
- ๕) นายสมชาย ใจดี
- ๖) นายสมชาย ใจดี

ขอขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน เลขที่ ๑๑๑ ถนนพหลโยธิน กรุงเทพฯ ๑๐๑๑๐

บริษัท อีแม็กซ์ จำกัด (มหาชน) เลขที่ ๑๑๑ ถนนพหลโยธิน กรุงเทพฯ ๑๐๑๑๐

ห้องปฏิบัติการวิเคราะห์เอกชน เลขที่ ๑๑๑ ถนนพหลโยธิน กรุงเทพฯ ๑๐๑๑๐

-๒-

- ๑) นายสมชาย ใจดี
- ๒) นายสมชาย ใจดี
- ๓) นายสมชาย ใจดี
- ๔) นายสมชาย ใจดี
- ๕) นายสมชาย ใจดี
- ๖) นายสมชาย ใจดี
- ๗) นายสมชาย ใจดี
- ๘) นายสมชาย ใจดี
- ๙) นายสมชาย ใจดี
- ๑๐) นายสมชาย ใจดี

ขอขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน เลขที่ ๑๑๑ ถนนพหลโยธิน กรุงเทพฯ ๑๐๑๑๐

เพื่อให้เป็นไปตามระเบียบกระทรวงการพาณิชย์ว่าด้วยการขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน พ.ศ.๒๕๖๑

เพื่อให้เป็นไปตามระเบียบกระทรวงการพาณิชย์ว่าด้วยการขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน พ.ศ.๒๕๖๑

โดย บริษัท อีแม็กซ์ จำกัด (มหาชน) เลขที่ ๑๑๑ ถนนพหลโยธิน กรุงเทพฯ ๑๐๑๑๐

ขอขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน เลขที่ ๑๑๑ ถนนพหลโยธิน กรุงเทพฯ ๑๐๑๑๐

บริษัท อีแม็กซ์ จำกัด (มหาชน) เลขที่ ๑๑๑ ถนนพหลโยธิน กรุงเทพฯ ๑๐๑๑๐



เลขทะเบียน ว-244

ขอขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน เลขที่ ๑๑๑ ถนนพหลโยธิน กรุงเทพฯ ๑๐๑๑๐

ขอขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน เลขที่ ๑๑๑ ถนนพหลโยธิน กรุงเทพฯ ๑๐๑๑๐

ขอขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน เลขที่ ๑๑๑ ถนนพหลโยธิน กรุงเทพฯ ๑๐๑๑๐

ขอขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน เลขที่ ๑๑๑ ถนนพหลโยธิน กรุงเทพฯ ๑๐๑๑๐

เอกสารแนบท้ายหนังสือขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

บริษัท อีแม็กซ์ จำกัด (มหาชน) เลขที่ ๑๑๑ ถนนพหลโยธิน กรุงเทพฯ ๑๐๑๑๐

เลขที่ ๑๑๑ ถนนพหลโยธิน กรุงเทพฯ ๑๐๑๑๐

ที่ สก.บค.๑๑๑/๒๕๖ ๓๓๓ ๑๕

๑๕ มีนาคม พ.ศ.๒๕๖๕

ขอขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน เลขที่ ๑๑๑ ถนนพหลโยธิน กรุงเทพฯ ๑๐๑๑๐

โดย บริษัท อีแม็กซ์ จำกัด (มหาชน) เลขที่ ๑๑๑ ถนนพหลโยธิน กรุงเทพฯ ๑๐๑๑๐

ลำดับ	สารเคมี	วิธีการตรวจ
1	Acetic	1) Distillation, Inductively Coupled Plasma Method ¹⁾
2	Barium	1) Distillation, Inductively Coupled Plasma Method ¹⁾
3	Biochemical Oxygen Demand	1) 5 Day BOD Test, Azide Modification Method ¹⁾
4	Cadmium	1) Distillation, Direct Air-Acetylene Flame Method ¹⁾ 2) Distillation, Inductively Coupled Plasma Method ¹⁾
5	Chemical Oxygen Demand	1) Closed Reflux, Colorimetric Method ¹⁾ 2) Closed Reflux, Titrimetric Method ¹⁾
6	Chromium	1) Distillation, Direct Air-Acetylene Flame Method ¹⁾ 2) Distillation, Inductively Coupled Plasma Method ¹⁾
7	Cobalt	1) Distillation, Direct Air-Acetylene Flame Method ¹⁾
8	Copper	1) Distillation, Direct Air-Acetylene Flame Method ¹⁾ 2) Distillation, Inductively Coupled Plasma Method ¹⁾
9	Cyanide	1) Distillation, Colorimetric Method ¹⁾
10	Formaldehyde	1) Distillation, Colorimetric Method ¹⁾
11	Free Chlorine	1) Colorimetric Method ¹⁾ 2) J-10 Colorimetric Method ¹⁾
12	Hexavalent Chromium	1) Colorimetric Method ¹⁾
13	Iron	1) Distillation, Direct Air-Acetylene Flame Method ¹⁾ 2) Distillation, Inductively Coupled Plasma Method ¹⁾
14	Manganese	1) Distillation, Direct Air-Acetylene Flame Method ¹⁾ 2) Distillation, Inductively Coupled Plasma Method ¹⁾
15	Mercury	1) Distillation, Cold Vapor Atomic Fluorescence Spectrometric Method ¹⁾
16	Nickel	1) Distillation, Direct Air-Acetylene Flame Method ¹⁾ 2) Distillation, Inductively Coupled Plasma Method ¹⁾
17	Oil & Grease	1) Liquid Phase Extraction, Spectrophotometric Method ¹⁾ 2) Soxhlet Extraction, Gravimetric Method ¹⁾
18	pH	1) Direct Measurement, pH Meter Method ¹⁾

(ในสำเนาฉบับนี้) สก.บค.๑๑๑/๒๕๖ ๓๓๓ ๑๕
(ในสำเนาฉบับนี้) สก.บค.๑๑๑/๒๕๖ ๓๓๓ ๑๕
(ในสำเนาฉบับนี้) สก.บค.๑๑๑/๒๕๖ ๓๓๓ ๑๕

เลขที่ ๑๑๑ ถนนพหลโยธิน กรุงเทพฯ ๑๐๑๑๐

๑๕ มีนาคม พ.ศ.๒๕๖๕

ลำดับที่	สารเคมี	วิธีวิเคราะห์
19	Phenols	Distillation, Direct Photometric Method ⁽⁴⁾
20	Selenium	Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
21	Sulfide	Iodometric Method ⁽⁴⁾
22	Temperature	Laboratory and Field Methods ⁽⁴⁾
23	Total Dissolved Solids	Dried at 180 °C ⁽⁴⁾
24	Total Kjeldahl Nitrogen	Macro Kjeldahl Method ⁽⁴⁾
25	Total Suspended Solids	Dried at 103-105 °C ⁽⁴⁾
26	Trivalent Chromium	1) Digestion, Direct Air-Acetylene Flame Method; Colorimetric Method; Calculation ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma Method; Colorimetric Method; Calculation ⁽⁴⁾
27	Zinc	1) Digestion, Direct Air-Acetylene Flame Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾

น้ำดื่ม จำนวน 125 รายการ

ลำดับที่	สารเคมี	วิธีวิเคราะห์
1	Acenaphthene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
2	Acetone	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
3	Aldrin	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
4	Anthracene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
5	Antimony	Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
6	Arsenic	Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
7	Atrazine	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
8	Barium	Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
9	Benz(a)anthracene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾

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เลขทะเบียน ๖-244
10 Benzene...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
10	Benzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
11	Benzodibromomethane	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
12	Benzodichloromethane	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
13	Benzic Acid	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
14	Benzobenzene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
15	Benzobiphenylene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
16	Benzyl Chloride	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
17	Bis(2-chloroethyl) ether	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
18	Bis(2-ethylhexyl) phosphate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
19	Bis(2-ethylhexyl) sebacate	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
20	Bromobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
21	Bromoform	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
22	Bromobenzene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
23	Bromobenzene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
24	Bromobenzene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
25	Bromobenzene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
26	Bromobenzene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
27	Bromobenzene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
28	Bromobenzene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
29	Bromobenzene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
30	Bromobenzene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
31	Bromobenzene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
32	Bromobenzene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
33	Bromobenzene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
34	Bromobenzene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
35	Bromobenzene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
36	Bromobenzene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
37	Bromobenzene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
38	Bromobenzene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
39	Bromobenzene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
40	Bromobenzene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
41	Bromobenzene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
42	Bromobenzene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
43	Bromobenzene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
44	Bromobenzene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
45	Bromobenzene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
46	Bromobenzene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾

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27 Chlorobenzene...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
27	Chlordane	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
28	p-Chloroaniline	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
29	Chlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
30	Chlorodibromomethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
31	Chloroform	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
32	2-Chlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
33	Chromium	Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
34	Chromium (III)	Digestion, Inductively Coupled Plasma Method; Colorimetric Method; Calculation ⁽⁴⁾
35	Chromium (VI)	Colorimetric Method ⁽⁴⁾
36	Chrysene	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
37	Cyanide	Distillation, Colorimetric Method ⁽⁴⁾
38	DDD	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
39	DDE	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
40	DDT	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
41	Dibenz(a,h)anthracene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
42	Di-n-Butyl phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
43	1,2-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
44	1,3-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
45	1,4-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
46	3,3-Dichlorobenzidine	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾

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47 1,1-Dichloroethane...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
47	1,1-Dichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
48	1,2-Dichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
49	1,1-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
50	cis-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
51	trans-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
52	2,4-Dichlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
53	1,2-Dichloropropane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
54	1,3-Dichloropropane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
55	1,3-Dichloropropene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
56	Dieldrin	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
57	Diethyl Phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
58	2,4-Dimethylphenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
59	2,4-Dinitrophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
60	2,4-Dinitrotoluene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
61	2,6-Dinitrotoluene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
62	Di-n-octyl phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾

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63 Endosulfan...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
63	Endosulfan	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽¹⁾
64	Endrin	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽¹⁾
65	Ethylbenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽¹⁾
66	Fluoranthene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽¹⁾
67	Fluorene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽¹⁾
68	Heptachlor	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽¹⁾
69	Heptachlor epoxide	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽¹⁾
70	Hexachlorobenzene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽¹⁾
71	Hexachloro-1,3-butadiene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽¹⁾
72	n-Hexane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽¹⁾
73	α -HCH	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽¹⁾
74	β -HCH	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽¹⁾
75	γ -HCH	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽¹⁾
76	Hexachlorocyclopentadiene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽¹⁾
77	Hexachloroethane	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽¹⁾
78	Indeno(1,2,3-cd)pyrene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽¹⁾
79	Isophorone	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽¹⁾
80	Lead	Digestion, Inductively Coupled Plasma Method ⁽¹⁾
81	Manganese	Digestion, Inductively Coupled Plasma Method ⁽¹⁾
82	Mercury	Digestion, Cold Vapor Atomic Fluorescence Method ⁽¹⁾

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ห้องปฏิบัติการวิเคราะห์เอกชน
เลขทะเบียน ๖-244

(นางวิภาดา ชัยกรกุลวิไล)
ผู้อำนวยการศูนย์มาตรฐานวิชาการวิเคราะห์สิ่งแวดล้อม
และเคมีอินทรีย์ปิโตรเลียม

83 Methanol...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
83	Methanol	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽¹⁾
84	Methoxychlor	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽¹⁾
85	Methyl bromide	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽¹⁾
86	Methylene chloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽¹⁾
87	2-Methylphenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽¹⁾
88	2-Methylnaphthalene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽¹⁾
89	Methyl tert-butyl ether	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽¹⁾
90	Naphthalene	Purge and Trap Gas Chromatographic/Mass spectrometric Method ⁽¹⁾
91	Nickel	Digestion, Inductively Coupled Plasma Method ⁽¹⁾
92	Nitrobenzene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽¹⁾
93	N-Nitrosodiphenylamine	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽¹⁾
94	N-Nitrosodi-n-propylamine	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽¹⁾
95	Polychlorinated Biphenyls	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽¹⁾
	- Aroclor 1016	
	- Aroclor 1221	
	- Aroclor 1232	
	- Aroclor 1242	
	- Aroclor 1248	
	- Aroclor 1254	
	- Aroclor 1260	
96	Pentachlorophenol	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽¹⁾

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97 pH...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
97	pH	Electrometric Method ⁽¹⁾
98	Phenanthrene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽¹⁾
99	Phenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽¹⁾
100	Pyrene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽¹⁾
101	Selenium	Digestion, Inductively Coupled Plasma Method ⁽¹⁾
102	Silver	Digestion, Inductively Coupled Plasma Method ⁽¹⁾
103	Styrene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽¹⁾
104	1,1,2,2-Tetrachloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽¹⁾
105	Tetrachloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽¹⁾
106	Toluene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽¹⁾
107	Toxaphene	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽¹⁾
108	TPH (C ₅ -C ₈)	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(1,12)
109	TPH (C ₉ -C ₁₆)	Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(1,17)
110	TPH (C ₁₇ -C ₃₃)	Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(1,17)
111	1,2,4-Trichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽¹⁾
112	1,1,1-Trichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽¹⁾
113	1,1,2-Trichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽¹⁾
114	Trichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽¹⁾

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และเคมีอินทรีย์ปิโตรเลียม

115 2,4,5-TrichlorophenoL...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
115	2,4,5-Trichlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽¹⁾
116	2,4,6-Trichlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽¹⁾
117	1,3,5-Trimethylbenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽¹⁾
118	Vanadium	Digestion, Inductively Coupled Plasma Method ⁽¹⁾
119	Vinyl acetate	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽¹⁾
120	Vinyl chloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽¹⁾
121	m-Xylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽¹⁾
122	o-Xylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽¹⁾
123	p-Xylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽¹⁾
124	Xylene (Total)	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽¹⁾
125	Zinc	Digestion, Inductively Coupled Plasma Method ⁽¹⁾

ภาคเชื้อเพลิง (เปลี่ยนขนาด) จำนวน 26 รายการ

ลำดับที่	สารเคมี	วิธีวิเคราะห์
1	Antimony	Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽¹⁾
2	Arsenic	Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽¹⁾
3	Beryllium	Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽¹⁾
4	Cadmium	Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽¹⁾

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5 Carbon Monoxide...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
๑	Carbon Monoxide	Instrumental Analytical Method ^๕
๖	Chlorine	Absorption Sampling, Ion Chromatographic Method ^๕
๗	Chromium	Inductively Coupled Plasma Method ^๕
๘	Cobalt	Inductively Coupled Plasma Method ^๕
๙	Copper	Inductively Coupled Plasma Method ^๕
๑๐	Cresol	Absorption Sampling, Gas Chromatographic Method ^๕
๑๑	Hydrogen Chloride	Absorption Sampling, Ion Chromatographic Method ^๕
๑๒	Hydrogen Fluoride	Absorption Sampling, Ion Chromatographic Method ^๕
๑๓	Lead	Inductively Coupled Plasma Method ^๕
๑๔	Manganese	Inductively Coupled Plasma Method ^๕
๑๕	Mercury	Absorption Sampling, Cold Vapor Atomic Absorption Spectrometric Method ^๕
๑๖	Nickel	Inductively Coupled Plasma Method ^๕
๑๗	Opacity	Ringelmann's Method ^๕
๑๘	Oxides of Nitrogen	Absorption Sampling, Photometric Method ^๕
๑๙	Selenium	Inductively Coupled Plasma Method ^๕
๒๐	Sulfur Dioxide	1) Absorption Sampling, Barium Thiocyanate Method ^๕ 2) Absorption Sampling, Barium Thiocyanate Method ^๕
๒๑	Sulfuric Acid	Absorption Sampling, Barium Thiocyanate Method ^๕
๒๒	Tin	Inductively Coupled Plasma Method ^๕
๒๓	Total Suspended Particulate	Gravimetric Method ^๕
๒๔	Vanadium	Inductively Coupled Plasma Method ^๕
๒๕	Xylene	Absorption Sampling, Gas Chromatographic Method ^๕

ห้องปฏิบัติการวิเคราะห์อากาศ

เลขทะเบียน ๖-244

สำนักงานสิ่งแวดล้อมแห่งชาติ

นางสาวสุวิมล อัครกุลวิไล
ผู้อำนวยการศูนย์ปฏิบัติการวิเคราะห์อากาศ
กรมควบคุมมลพิษ

สิ่งแวดล้อมวัดคุณภาพสิ่งแวดล้อม จำนวน 18 รายการ

ลำดับที่	สารเคมี	วิธีวิเคราะห์
1	Antimony	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^{๕,๑๖} 2) Digestion, Inductively Coupled Plasma Method ^{๕,๑๖}
2	Arsenic	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^{๕,๑๖} 2) Digestion, Inductively Coupled Plasma Method ^{๕,๑๖}
3	Barium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^{๕,๑๖} 2) Digestion, Inductively Coupled Plasma Method ^{๕,๑๖}
4	Beryllium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^{๕,๑๖} 2) Digestion, Inductively Coupled Plasma Method ^{๕,๑๖}
5	Cadmium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^{๕,๑๖} 2) Digestion, Inductively Coupled Plasma Method ^{๕,๑๖}
6	Chromium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^{๕,๑๖} 2) Digestion, Inductively Coupled Plasma Method ^{๕,๑๖}
7	Chromium (III)	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method; Waste Extraction, Colorimetric Method; Calculation Method ^{๕,๑๖,๑๗} 2) Digestion, Inductively Coupled Plasma Method; Alkaline Digestion, Colorimetric Method; Calculation Method ^{๕,๑๖,๑๗}
8	Chromium (VI)	1) Waste Extraction, Colorimetric Method ^{๕,๑๖} 2) Alkaline Digestion, Colorimetric Method ^{๕,๑๖}
9	Cobalt	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^{๕,๑๖} 2) Digestion, Inductively Coupled Plasma Method ^{๕,๑๖}
10	Copper	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^{๕,๑๖} 2) Digestion, Inductively Coupled Plasma Method ^{๕,๑๖}

สำนักงาน

เลขทะเบียน ๖-244

นางสาวสุวิมล อัครกุลวิไล
ผู้อำนวยการศูนย์ปฏิบัติการวิเคราะห์อากาศ
กรมควบคุมมลพิษ

ลำดับที่	สารเคมี	วิธีวิเคราะห์
11	Lead	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^{๕,๑๖} 2) Digestion, Inductively Coupled Plasma Method ^{๕,๑๖}
12	Mercury	1) Waste Extraction, Digestion, Cold Vapor Atomic Absorption Spectrometric Method ^๕ 2) Digestion, Cold Vapor Atomic Absorption Spectrometric Method ^๕
13	Nickel	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^{๕,๑๖} 2) Digestion, Inductively Coupled Plasma Method ^{๕,๑๖}
14	Selenium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^{๕,๑๖} 2) Digestion, Inductively Coupled Plasma Method ^{๕,๑๖}
15	Silver	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^{๕,๑๖} 2) Digestion, Inductively Coupled Plasma Method ^{๕,๑๖}
16	Thallium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^{๕,๑๖} 2) Digestion, Inductively Coupled Plasma Method ^{๕,๑๖}
17	Vanadium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^{๕,๑๖} 2) Digestion, Inductively Coupled Plasma Method ^{๕,๑๖}
18	Zinc	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^{๕,๑๖} 2) Digestion, Inductively Coupled Plasma Method ^{๕,๑๖}

จำนวน 124 รายการ

ลำดับที่	สารเคมี	วิธีวิเคราะห์
1	Acetaldehyde	Sorbent Extraction, Gas Chromatography/ Mass Spectrometric Method ^{๕,๑๖}
2	Acetone	Sorbent Extraction, Gas Chromatography/ Mass Spectrometric Method ^{๕,๑๖}

ห้องปฏิบัติการวิเคราะห์อากาศ

เลขทะเบียน ๖-244

นางสาวสุวิมล อัครกุลวิไล
ผู้อำนวยการศูนย์ปฏิบัติการวิเคราะห์อากาศ
กรมควบคุมมลพิษ

ลำดับที่	สารเคมี	วิธีวิเคราะห์
3	Acrolein	Sorbent Extraction, Gas Chromatography/ Mass Spectrometric Method ^{๕,๑๖}
4	Acrylonitrile	Sorbent Extraction, Gas Chromatography/ Mass Spectrometric Method ^{๕,๑๖}
5	Antimony	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^{๕,๑๖} 2) Digestion, Inductively Coupled Plasma Method ^{๕,๑๖}
6	Arsenic	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^{๕,๑๖} 2) Digestion, Inductively Coupled Plasma Method ^{๕,๑๖}
7	Atrazine	Sorbent Extraction, Gas Chromatography/ Mass Spectrometric Method ^{๕,๑๖}
8	Cadmium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^{๕,๑๖} 2) Digestion, Inductively Coupled Plasma Method ^{๕,๑๖}
9	Carbon Monoxide	Instrumental Analytical Method ^๕
10	Cresol	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^{๕,๑๖} 2) Digestion, Inductively Coupled Plasma Method ^{๕,๑๖}
11	Diethylhexylsebacate	Sorbent Extraction, Gas Chromatography/ Mass Spectrometric Method ^{๕,๑๖}
12	Diethylhexylsebacate	Sorbent Extraction, Gas Chromatography/ Mass Spectrometric Method ^{๕,๑๖}
13	Diethylhexylsebacate	Sorbent Extraction, Gas Chromatography/ Mass Spectrometric Method ^{๕,๑๖}
14	Diethylhexylsebacate	Sorbent Extraction, Gas Chromatography/ Mass Spectrometric Method ^{๕,๑๖}
15	Diethylhexylsebacate	Sorbent Extraction, Gas Chromatography/ Mass Spectrometric Method ^{๕,๑๖}
16	Diethylhexylsebacate	Sorbent Extraction, Gas Chromatography/ Mass Spectrometric Method ^{๕,๑๖}
17	Diethylhexylsebacate	Sorbent Extraction, Gas Chromatography/ Mass Spectrometric Method ^{๕,๑๖}
18	Diethylhexylsebacate	Sorbent Extraction, Gas Chromatography/ Mass Spectrometric Method ^{๕,๑๖}
19	Diethylhexylsebacate	Sorbent Extraction, Gas Chromatography/ Mass Spectrometric Method ^{๕,๑๖}
20	Diethylhexylsebacate	Sorbent Extraction, Gas Chromatography/ Mass Spectrometric Method ^{๕,๑๖}
21	Diethylhexylsebacate	Sorbent Extraction, Gas Chromatography/ Mass Spectrometric Method ^{๕,๑๖}

สำนักงาน

เลขทะเบียน ๖-244

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ลำดับที่	สารเคมี	วิธีการตรวจ
22	Butyl benzyl phthalate	Solvent Extraction, Gas Chromatography/ Mass Spectrometric Method ⁽¹²²⁾
23	Cadmium	Digestion, Inductively Coupled Plasma Method ⁽¹²³⁾
24	Carbazole	Solvent Extraction, Gas Chromatography/ Mass Spectrometric Method ⁽¹²⁴⁾
25	Carbon Disulfide	Purge and Trap, Gas Chromatography/ Mass Spectrometric Method ⁽¹²⁵⁾
26	Carbon tetrachloride	Purge and Trap, Gas Chromatography/ Mass Spectrometric Method ⁽¹²⁶⁾
27	Chloroform	Solvent Extraction, Gas Chromatography Method ⁽¹²⁷⁾
28	p-Chloroaniline	Solvent Extraction, Gas Chromatography/ Mass Spectrometric Method ⁽¹²⁸⁾
29	Chlorobenzene	Purge and Trap, Gas Chromatography/ Mass Spectrometric Method ⁽¹²⁹⁾
30	Chlorodibromomethane	Purge and Trap, Gas Chromatography/ Mass Spectrometric Method ⁽¹³⁰⁾
31	Chloroform	Purge and Trap, Gas Chromatography/ Mass Spectrometric Method ⁽¹³¹⁾
32	2-Chlorophenol	Solvent Extraction, Gas Chromatography/ Mass Spectrometric Method ⁽¹³²⁾
33	Chromium	Digestion, Inductively Coupled Plasma Method ⁽¹³³⁾
34	Chromium (II)	Digestion, Inductively Coupled Plasma Method/ Atomic Absorption, Colorimetric Method, Colorimetric Method ⁽¹³⁴⁾
35	Chromium (VI)	Alkaline Digestion, Colorimetric Method ⁽¹³⁵⁾
36	Chrysene	Solvent Extraction, Gas Chromatography/ Mass Spectrometric Method ⁽¹³⁶⁾
37	Cyanide	Extraction, Distillation, Colorimetric Method ⁽¹³⁷⁾
38	DIB	Solvent Extraction, Gas Chromatography/ Mass Spectrometric Method ⁽¹³⁸⁾
39	DIT	Solvent Extraction, Gas Chromatography/ Mass Spectrometric Method ⁽¹³⁹⁾
40	DOT	Solvent Extraction, Gas Chromatography/ Mass Spectrometric Method ⁽¹⁴⁰⁾

กรมส่งเสริมการค้าระหว่างประเทศ
กระทรวงพาณิชย์
กรมส่งเสริมการค้าระหว่างประเทศ

เลขที่ 244
11 Chaisaith scene.

ลำดับที่	สารเคมี	วิธีการตรวจ
41	Dibenzylhydrazine	Solvent Extraction, Gas Chromatography/ Mass Spectrometric Method ⁽¹⁴¹⁾
42	Dibenzyl phthalate	Solvent Extraction, Gas Chromatography/ Mass Spectrometric Method ⁽¹⁴²⁾
43	1,2-Dichlorobenzene	Purge and Trap, Gas Chromatography/ Mass Spectrometric Method ⁽¹⁴³⁾
44	1,3-Dichlorobenzene	Purge and Trap, Gas Chromatography/ Mass Spectrometric Method ⁽¹⁴⁴⁾
45	1,4-Dichlorobenzene	Purge and Trap, Gas Chromatography/ Mass Spectrometric Method ⁽¹⁴⁵⁾
46	3,5-Dichlorobenzidine	Solvent Extraction, Gas Chromatography/ Mass Spectrometric Method ⁽¹⁴⁶⁾
47	1,2-Dichloroethane	Purge and Trap, Gas Chromatography/ Mass Spectrometric Method ⁽¹⁴⁷⁾
48	1,2-Dichloroethane	Purge and Trap, Gas Chromatography/ Mass Spectrometric Method ⁽¹⁴⁸⁾
49	1,3-Dichloroethylene	Purge and Trap, Gas Chromatography/ Mass Spectrometric Method ⁽¹⁴⁹⁾
50	1,1,2,2-Tetrachloroethane	Purge and Trap, Gas Chromatography/ Mass Spectrometric Method ⁽¹⁵⁰⁾
51	trans-1,2-Dichloroethylene	Purge and Trap, Gas Chromatography/ Mass Spectrometric Method ⁽¹⁵¹⁾
52	2,4-Dichlorophenol	Solvent Extraction, Gas Chromatography/ Mass Spectrometric Method ⁽¹⁵²⁾
53	1,2-Dichloropropane	Purge and Trap, Gas Chromatography/ Mass Spectrometric Method ⁽¹⁵³⁾
54	1,3-Dichloropropane	Purge and Trap, Gas Chromatography/ Mass Spectrometric Method ⁽¹⁵⁴⁾
55	1,3-Dichloropropane	Purge and Trap, Gas Chromatography/ Mass Spectrometric Method ⁽¹⁵⁵⁾
56	Dieldrin	Solvent Extraction, Gas Chromatography/ Mass Spectrometric Method ⁽¹⁵⁶⁾

กรมส่งเสริมการค้าระหว่างประเทศ
กระทรวงพาณิชย์
กรมส่งเสริมการค้าระหว่างประเทศ

เลขที่ 244
11 Chaisaith scene.

ลำดับที่	สารเคมี	วิธีการตรวจ
57	Dibenzyl phthalate	Solvent Extraction, Gas Chromatography/ Mass Spectrometric Method ⁽¹⁵⁷⁾
58	2,4-Dimethyl phenol	Solvent Extraction, Gas Chromatography/ Mass Spectrometric Method ⁽¹⁵⁸⁾
59	2,4-Dinitrophenol	Solvent Extraction, Gas Chromatography/ Mass Spectrometric Method ⁽¹⁵⁹⁾
60	2,4-Dinitrotoluene	Solvent Extraction, Gas Chromatography/ Mass Spectrometric Method ⁽¹⁶⁰⁾
61	2,6-Dinitrotoluene	Solvent Extraction, Gas Chromatography/ Mass Spectrometric Method ⁽¹⁶¹⁾
62	Dibenzyl phthalate	Solvent Extraction, Gas Chromatography/ Mass Spectrometric Method ⁽¹⁶²⁾
63	Dieldrin	Solvent Extraction, Gas Chromatography Method ⁽¹⁶³⁾
64	Dieldrin	Solvent Extraction, Gas Chromatography Method ⁽¹⁶⁴⁾
65	Phthalonitrile	Purge and Trap, Gas Chromatography/ Mass Spectrometric Method ⁽¹⁶⁵⁾
66	Phthalonitrile	Solvent Extraction, Gas Chromatography/ Mass Spectrometric Method ⁽¹⁶⁶⁾
67	Phthalonitrile	Solvent Extraction, Gas Chromatography/ Mass Spectrometric Method ⁽¹⁶⁷⁾
68	Phthalonitrile	Solvent Extraction, Gas Chromatography Method ⁽¹⁶⁸⁾
69	Phthalonitrile	Solvent Extraction, Gas Chromatography Method ⁽¹⁶⁹⁾
70	Phthalonitrile	Solvent Extraction, Gas Chromatography/ Mass Spectrometric Method ⁽¹⁷⁰⁾
71	Phthalonitrile	Solvent Extraction, Gas Chromatography/ Mass Spectrometric Method ⁽¹⁷¹⁾
72	Phthalonitrile	Purge and Trap, Gas Chromatography/ Mass Spectrometric Method ⁽¹⁷²⁾
73	Phthalonitrile	Solvent Extraction, Gas Chromatography/ Mass Spectrometric Method ⁽¹⁷³⁾
74	Phthalonitrile	Solvent Extraction, Gas Chromatography/ Mass Spectrometric Method ⁽¹⁷⁴⁾
75	Phthalonitrile	Solvent Extraction, Gas Chromatography/ Mass Spectrometric Method ⁽¹⁷⁵⁾

กรมส่งเสริมการค้าระหว่างประเทศ
กระทรวงพาณิชย์
กรมส่งเสริมการค้าระหว่างประเทศ

เลขที่ 244
11 Chaisaith scene.

ลำดับที่	สารเคมี	วิธีการตรวจ
76	Phthalonitrile	Solvent Extraction, Gas Chromatography/ Mass Spectrometric Method ⁽¹⁷⁶⁾
77	Phthalonitrile	Solvent Extraction, Gas Chromatography/ Mass Spectrometric Method ⁽¹⁷⁷⁾
78	Phthalonitrile	Solvent Extraction, Gas Chromatography/ Mass Spectrometric Method ⁽¹⁷⁸⁾
79	Phthalonitrile	Solvent Extraction, Gas Chromatography/ Mass Spectrometric Method ⁽¹⁷⁹⁾
80	Phthalonitrile	Digestion, Inductively Coupled Plasma Method ⁽¹⁸⁰⁾
81	Phthalonitrile	Digestion, Inductively Coupled Plasma Method ⁽¹⁸¹⁾
82	Phthalonitrile	Digestion, Cold Vapor Atomic Absorption Spectrometric Method ⁽¹⁸²⁾
83	Phthalonitrile	Absorption, Distillation, Gas Chromatography Method ⁽¹⁸³⁾
84	Phthalonitrile	Solvent Extraction, Gas Chromatography Method ⁽¹⁸⁴⁾
85	Phthalonitrile	Purge and Trap, Gas Chromatography/ Mass Spectrometric Method ⁽¹⁸⁵⁾
86	Phthalonitrile	Purge and Trap, Gas Chromatography/ Mass Spectrometric Method ⁽¹⁸⁶⁾
87	Phthalonitrile	Solvent Extraction, Gas Chromatography/ Mass Spectrometric Method ⁽¹⁸⁷⁾
88	Phthalonitrile	Solvent Extraction, Gas Chromatography/ Mass Spectrometric Method ⁽¹⁸⁸⁾
89	Phthalonitrile	Purge and Trap, Gas Chromatography/ Mass Spectrometric Method ⁽¹⁸⁹⁾
90	Phthalonitrile	Purge and Trap, Gas Chromatography/ Mass Spectrometric Method ⁽¹⁹⁰⁾
91	Phthalonitrile	Digestion, Inductively Coupled Plasma Method ⁽¹⁹¹⁾
92	Phthalonitrile	Solvent Extraction, Gas Chromatography/ Mass Spectrometric Method ⁽¹⁹²⁾
93	Phthalonitrile	Solvent Extraction, Gas Chromatography/ Mass Spectrometric Method ⁽¹⁹³⁾

กรมส่งเสริมการค้าระหว่างประเทศ
กระทรวงพาณิชย์
กรมส่งเสริมการค้าระหว่างประเทศ

เลขที่ 244
11 Chaisaith scene.

ลำดับที่	สารเคมี	วิธีวิเคราะห์
94	N-Nitrosodi-n-propylamine	Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,22)
95	Polychlorinated biphenyls (PCBs)	Soxhlet Extraction, Gas Chromatographic Method ^(13,19)
	- Aroclor 1016	
	- Aroclor 1221	
	- Aroclor 1232	
	- Aroclor 1242	
	- Aroclor 1248	
	- Aroclor 1254	
	- Aroclor 1260	
96	Pentachlorophenol	Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,22)
97	Phenanthrene	Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,22)
98	Phenol	Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,22)
99	Pyrene	Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,22)
100	Selenium	Digestion, Inductively Coupled Plasma Method ^(11,4)
101	Silver	Digestion, Inductively Coupled Plasma Method ^(11,4)
102	Styrene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13,21)
103	1,1,2,2-Tetrachloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13,21)
104	Tetrachloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13,21)
105	Toluene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13,21)
106	Toxaphene	Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,22)
107	TPH (C ₇ -C ₈)	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13,21)

สำนักงาน
(นางวิภากร ชัยกุลกิจ)

เลขทะเบียน 2-244
108 TPH (C₇-C₈)

ลำดับที่	สารเคมี	วิธีวิเคราะห์
08	TPH (C ₇ -C ₈)	Soxhlet Extraction, Gas Chromatographic Method ^(13,21)
09	TPH (C ₇ -C ₈)	Soxhlet Extraction, Gas Chromatographic Method ^(13,21)
10	1,2,4-Trichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13,21)
11	1,1,1-Trichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13,21)
110	1,1,2-Trichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13,21)
113	Trichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13,21)
114	2,3,5-Trichlorophenol	Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,22)
115	2,4,6-Trichlorophenol	Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,22)
116	1,3,5-Trichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13,21)
117	Vanillin	Digestion, Inductively Coupled Plasma Method ^(11,4)
118	Vinyl Acetate	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13,21)
119	Vinyl Chloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13,21)
120	m-Xylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13,21)
121	p-Xylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13,21)
122	o-Xylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13,21)
123	Xylene (Total)	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13,21)
124	2,4-D	Digestion, Inductively Coupled Plasma Method ^(11,4)

สำนักงาน
(นางวิภากร ชัยกุลกิจ)

เลขทะเบียน 2-244
108 TPH (C₇-C₈)

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กรุงเทพมหานครและปริมณฑล
เขตคลองเตย

กรมส่งเสริมการค้าระหว่างประเทศ
กระทรวงพาณิชย์
ห้องปฏิบัติการวิจัยและทดสอบ
เลขที่ทะเบียน ๒-244