

## Continuation of Calibration Certificate

Cert. No. : ACL22092  
Job No. : VC65AC0045  
Pages : 6 of 8

## 7. Level linearity on the reference level range

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

เอกสารไม่ควบคุม

T. R. Pich

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL22092  
Job No. : VC65AC0045  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.95)	93.9	0.0	±0.3

## 2. Self-generated noise

## 2.1 Normal test

Measured Value (dB)
14.6

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

Frequency Weighting	Measured value (dB)
A-weight	12.4
C-weight	18.7
Flat	24.3

## 3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			Acceptance Limits
	Flat	C-weight	A-weight	
125	0.1	0.1	0.1	± 1.5
1000	-0.1	-0.1	-0.1	± 1.0
8000	-0.2	-0.2	-0.2	± 3.0

เอกสารไม่ควบคุม

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL22092  
Job No. : VC65AC0045  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			Acceptance Limits
	Flat	C-weight	A-weight	
63	-0.1	-0.2	-0.1	± 2.0
125	-0.1	-0.1	-0.1	± 1.5
250	0.0	-0.1	-0.1	± 1.5
500	-0.1	0.0	-0.1	± 1.5
1000	0.0	0.0	0.0	± 1.0
2000	0.0	0.0	0.0	± 2.0
4000	0.0	0.0	0.0	± 3.0
8000	0.0	0.1	0.1	± 5.0

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

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

## 5.2 Time weighting at 1 kHz

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

## 6. Long-term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	94.0	0.0	± 0.3

เอกสารไม่ควบคุม

T. R. Pich

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL22092  
Job No. : VC65AC0045  
Pages : 3 of 8

## Summary of Measurement Result :

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

เอกสารไม่ควบคุม

QF-TS12-04-04-020664

รายการให้บริการสอบเทียบและข้อมูลทั่วไปของบริการการสอบเทียบ

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
ข้อมูลทั่วไปของบริการการสอบเทียบ									
1	Impedance Analyzer	Impedance	Agilent	4294A	Agilent 4294A	70555-99-0012	7 Apr 22	8 Apr 23	
2	Impedance Analyzer	Impedance	Agilent	4294A	Agilent 4294A	70555-99-0012	7 Apr 22	8 Apr 23	
3	Impedance Analyzer	Impedance	Agilent	4294A	Agilent 4294A	70555-99-0012	7 Apr 22	8 Apr 23	
4	Impedance Analyzer	Impedance	Agilent	4294A	Agilent 4294A	70555-99-0012	7 Apr 22	8 Apr 23	
5	Impedance Analyzer	Impedance	Agilent	4294A	Agilent 4294A	70555-99-0012	7 Apr 22	8 Apr 23	
6	Impedance Analyzer	Impedance	Agilent	4294A	Agilent 4294A	70555-99-0012	7 Apr 22	8 Apr 23	
7	Impedance Analyzer	Impedance	Agilent	4294A	Agilent 4294A	70555-99-0012	7 Apr 22	8 Apr 23	
8	Impedance Analyzer	Impedance	Agilent	4294A	Agilent 4294A	70555-99-0012	7 Apr 22	8 Apr 23	
9	Impedance Analyzer	Impedance	Agilent	4294A	Agilent 4294A	70555-99-0012	7 Apr 22	8 Apr 23	

ฉบับที่ 8-04-14-04  
วันที่สอบเทียบ: 16 กรกฎาคม พ.ศ. 2565

รายการให้บริการสอบเทียบและข้อมูลทั่วไปของบริการการสอบเทียบ

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
10	Impedance Analyzer	Impedance	Agilent	4294A	Agilent 4294A	70555-99-0012	7 Apr 22	8 Apr 23	
11	Impedance Analyzer	Impedance	Agilent	4294A	Agilent 4294A	70555-99-0012	7 Apr 22	8 Apr 23	
12	Impedance Analyzer	Impedance	Agilent	4294A	Agilent 4294A	70555-99-0012	7 Apr 22	8 Apr 23	
13	Impedance Analyzer	Impedance	Agilent	4294A	Agilent 4294A	70555-99-0012	7 Apr 22	8 Apr 23	
14	Impedance Analyzer	Impedance	Agilent	4294A	Agilent 4294A	70555-99-0012	7 Apr 22	8 Apr 23	
15	Impedance Analyzer	Impedance	Agilent	4294A	Agilent 4294A	70555-99-0012	7 Apr 22	8 Apr 23	
16	Impedance Analyzer	Impedance	Agilent	4294A	Agilent 4294A	70555-99-0012	7 Apr 22	8 Apr 23	
17	Impedance Analyzer	Impedance	Agilent	4294A	Agilent 4294A	70555-99-0012	7 Apr 22	8 Apr 23	
18	Impedance Analyzer	Impedance	Agilent	4294A	Agilent 4294A	70555-99-0012	7 Apr 22	8 Apr 23	
19	Impedance Analyzer	Impedance	Agilent	4294A	Agilent 4294A	70555-99-0012	7 Apr 22	8 Apr 23	
20	Impedance Analyzer	Impedance	Agilent	4294A	Agilent 4294A	70555-99-0012	7 Apr 22	8 Apr 23	

SITHIPORN SITHIPORN ASSOCIATES CO.,LTD.  
CALIBRATION LABORATORY  
Continuation of Calibration Certificate

Cert. No. : ACL22092  
Job No. : VC65AC0045  
Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

SITHIPORN SITHIPORN ASSOCIATES CO.,LTD.  
CALIBRATION LABORATORY  
Continuation of Calibration Certificate

Cert. No. : ACL22092  
Job No. : VC65AC0045  
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

Time Weighting	Tone burst duration, 1b ( ms )	Cycle	Anticipated Value ( dB )	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
SEL	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.9	128.0	0.0	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value ( dB )	Measured Value, Lpeak ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Continuous	133.0	133.0	0.0	±
One	126.4	136.0	-0.4	±3.0

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

## Measurement Results

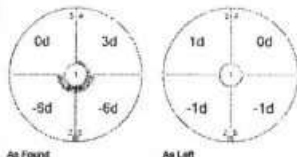
### Repeatability

Test Load: 2 g	As Found	As Left
1	2.000097 g	2.000096 g
2	2.000097 g	2.000096 g
3	2.000096 g	2.000096 g
4	2.000096 g	2.000096 g
5	2.000096 g	2.000096 g
6	2.000096 g	2.000096 g
7	2.000097 g	2.000096 g
8	2.000096 g	2.000096 g
9	2.000096 g	2.000096 g
10	2.000097 g	2.000096 g
Standard Deviation	0.000010 g	0.000008 g

The "d" in the graph represents the readability of the comparison in which the test was performed.  
The results of this graph are based upon the absolute values of the differences from the mean value.

### Eccentricity

Test Load: 2 g	As Found	As Left
1	2.000096 g	2.000096 g
2	2.000096 g	2.000096 g
3	2.000096 g	2.000096 g
4	2.000096 g	2.000096 g
5	2.000096 g	2.000096 g
Maximum Deviation	0.000008 g	0.000007 g




The "d" in the graph represents the readability of the comparison in which the test was performed.

Mettler-Toledo (Thailand) Ltd.  
8464 - 8465 Lamsa Rd., Bangna Tai Sub-District  
Bangna District, Bangkok 10260  
+66 2723 0107  
MT-TH.ServiceSupport@mt.com



## Accuracy Calibration Certificate

### Customer

Company:	United Analyst and Engineering Consultant Co., Ltd.		
Address:	3 So Udon Suk 41, Sukhumvit Rd., Bang Creek		
City:	Phra Khanong	Contact:	Savit Chaiwong
Zip / Postal:	10260		
State / Province:	Bangkok		
Order Number:			

### Weighing Device

Manufacturer:	Mettler Toledo	Instrument Type:	Weighing Instrument
Model:	XP8	Asset Number:	JAE AIR 0190558
Serial No.:	8322373883	Terminal Model:	PAT
Building:	N/A	Terminal Serial No.:	8322373883
Floor:	2	Terminal Asset No.:	N/A
Room:	Balance Room 2 (206)		

Range	Max. Capacity	Readability
1	6.1 g	0.000001 g

### Procedure

Calibration Guideline: EURAMET eg-16 v. 4.0 (11/2015)  
METTLER TOLEDO Work instruction: CPW200220  
This calibration certificate contains measurements for As Found and As Left calibrations.  
The sensitivity/linearity of the weighing instrument was adjusted before As Found and As Left calibrations with a built-in weight.  
In accordance with EURAMET eg-16 (11/2015), the test loads were selected to reflect the specific use of the weighing device or to accommodate specific calibration conditions.

	Temperature	Humidity
As Found	Start: 22.7 °C End: 22.8 °C	Start: 54.2 % End: 53.6 %
As Left	Start: 22.6 °C End: 22.5 °C	Start: 52.0 % End: 50.5 %

As Found Calibration Date:	07-Apr-2022	Calibrator:	
As Left Calibration Date:	07-Apr-2022		
Issue Date:	06-Apr-2022	Approved Signature:	
			<input checked="" type="checkbox"/> Krasorn Tansachachakul <input checked="" type="checkbox"/> Sarit Janyon <input checked="" type="checkbox"/> Surachai Sukkote

Instrument/Equipment	Parameter	Manufacturer	Model/Version No.	Calibrator	Certification No.	Date of Calibration	Due date of Recalibration	Remark
XP8	Mass	Mettler	XP8 / 6.1g/0.0001g	Surachai Tansachachakul (Thailand-Approved)	22042022	17 Feb 22	14 Feb 23	-

## Certificate of Calibration

**DX-120 : (Anion System ID#042)**

This certificate is to verify that instrument below are calibrated

by Archemica Lab Co.,Ltd.

DX-120 S/N : 03010223

for

**UAE Consultant Co.,Ltd.**

Operator Signature : [Signature] Date : Dec 11, 2019

(Mr.Channarong Khiao-un)

Test Engineer

เอกสารไม่ควบคุม

Calibration Certificate ID  
TH055-093-049722-ACC-TH

**METTLER TOLEDO** Service

### Test Equipment

All weights used for metrological testing are traceable to national or international standards. The weights were calibrated and certified by an accredited calibration laboratory.

#### Weight Set 1: OIML E2

Weight Set No.: 10390 Date of Issue: 23 Feb 2022  
 Dev. Code Number: C20551531 Calibration Due Date: 16-Aug-2023  
 Thermo Hygrometer  
 Equipment No.: 18751 Date of Issue: 14-Jun-2021  
 Certificate Number: 2101229 Calibration Due Date: 31-Jul-2022

### Remarks

FACT adjustment functionality avoided

Value of the built-in weight adjusted

Equipment condition: Good

Next calibration according to customer's procedure

Calibration data not copied by calibration laboratory

Test weight by liter: 0.25005 g = 0.85034 g x 0.15012 g = 0.15011 g

End of Accredited Section

The information below and any attachments to this calibration certificate are not part of the accredited calibration.

Calibration Certificate ID  
TH055-093-049722-ACC-TH

**METTLER TOLEDO** Service

### Measurement Uncertainty of the Weighing Instrument in Use

Stated is the expanded uncertainty with  $k=2$  in use. The formula used for the estimation of the uncertainty under consideration of the errors of indication. The value R represents the net load indication in the unit of measure of the device.

Temperature coefficient for the evaluation of the measurement uncertainty in use:  $1.0 \cdot 10^{-4} / K$   
 Temperature range on site for the evaluation of the measurement uncertainty in use:  $3 K$

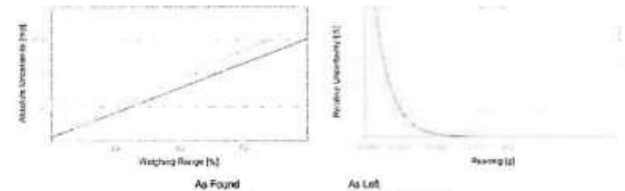
#### Linearization of Uncertainty Equation

Range	Min	Max	As Found	As Left
1	0.000001 g	6.1 g	$U_1 = 0.0021 \text{ mg} + 0.0113 \text{ mg/g} \cdot R$	$U_1 = 0.0018 \text{ mg} + 0.0098 \text{ mg/g} \cdot R$

To estimate the stability of the linearization, besides of the zero load only increasing measurement points with a load load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

#### Absolute and Relative Measurement Uncertainty in Use for Various Net Indications (Examples)

Net Indication	As Found	As Left
0.00010 g	0.0021 mg	0.0018 mg
0.00100 g	0.0022 mg	0.0018 mg
0.001000 g	0.0026 mg	0.0024 mg
0.010000 g	0.0090 mg	0.0077 mg
0.100000 g	0.021 mg	0.017 mg



Software Version: 1.23.026  
 Report Version: 2.10.13  
 Form Number: F103C

© METTLER TOLEDO

Page 5 of 5

This is an original document and may not be partially reproduced without the written permission of the issuing calibration laboratory.

เอกสารไม่ควบคุม

Calibration Certificate ID  
TH055-093-049722-ACC-TH

**METTLER TOLEDO** Service

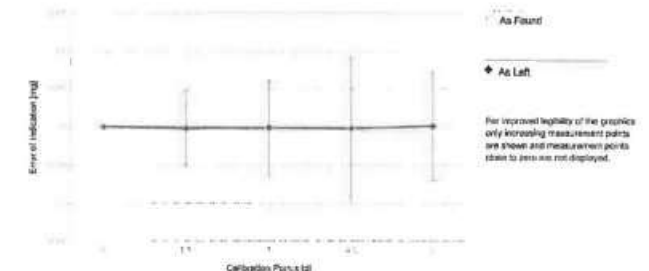
### Error of Indication

As Found	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k=2
1*	0.000000 g	0.000000 g	-0.000000 g	0.0054 mg	2
2	0.010004 g	0.010005 g	0.000001 g	0.0074 mg	2
3*	0.050025 g	0.050003 g	-0.000022 g	0.011 mg	2
4*	0.100037 g	0.100007 g	-0.000030 g	0.015 mg	2
5	0.150012 g	0.150011 g	-0.000001 g	0.025 mg	2
6	0.170013 g	0.170011 g	-0.000002 g	0.034 mg	2
7*	0.200011 g	0.200005 g	-0.000006 g	0.043 mg	2
8	1.500023 g	1.500025 g	0.000002 g	0.049 mg	2
9	3.000021 g	3.000017 g	-0.000004 g	0.062 mg	2
10	4.500031 g	4.500029 g	-0.000002 g	0.071 mg	2
11	6.000026 g	6.000027 g	0.000001 g	0.071 mg	2

As Left	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k=2
1*	0.000000 g	0.000000 g	-0.000000 g	0.0054 mg	2
2	0.010004 g	0.010005 g	0.000001 g	0.0074 mg	2
3*	0.050025 g	0.050005 g	-0.000020 g	0.011 mg	2
4*	0.100037 g	0.100007 g	-0.000030 g	0.015 mg	2
5	0.150012 g	0.150011 g	-0.000001 g	0.025 mg	2
6	0.170013 g	0.170013 g	0.000000 g	0.034 mg	2
7*	0.200011 g	0.200010 g	-0.000001 g	0.043 mg	2
8	1.500023 g	1.500021 g	-0.000002 g	0.049 mg	2
9	3.000021 g	3.000020 g	-0.000001 g	0.062 mg	2
10	4.500031 g	4.500029 g	-0.000002 g	0.071 mg	2
11	6.000026 g	6.000027 g	0.000001 g	0.071 mg	2

\*The calculated uncertainty was rounded by the CMC (Calibration and Measurement Capabilities) value because the calculated uncertainty was smaller than the CMC value.



The uncertainty stated is the expanded uncertainty at calibration obtained by multiplying the standard combined uncertainty by the coverage factor  $k=2$  which can be larger than 2 according to EURAMET cg-18. The value of the measurand lies within the assigned range of values with a probability of approximately 95%.

The user is responsible for maintaining environmental conditions and the settings of the weighing instrument when it was calibrated

Software Version: 1.23.026  
 Report Version: 2.10.13  
 Form Number: F103C

© METTLER TOLEDO

Page 4 of 5

This is an original document and may not be partially reproduced without the written permission of the issuing calibration laboratory.

เอกสารไม่ควบคุม

Software Version: 1.23.026  
 Report Version: 2.10.13  
 Form Number: F103C

© METTLER TOLEDO

Page 3 of 5

This is an original document and may not be partially reproduced without the written permission of the issuing calibration laboratory.

เอกสารไม่ควบคุม





## General Inspection Checklist

Item	Description	Result		Action Taken	N.A.
		Pass	Fail		
1	Power line 220 Vac	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
2	Pneumatic Line	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
3	Pressure outlet 80-100 psi	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
4	Barbed fitting and tee fitting	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
5	Crimped and blocked tubing	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
6	Rheodyne Valve for Leak	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check&Clean	<input type="checkbox"/>
7	Slider valve for leak	<input type="checkbox"/>	<input type="checkbox"/>	-	<input checked="" type="checkbox"/>
8	Inspect slider	<input type="checkbox"/>	<input type="checkbox"/>	-	<input checked="" type="checkbox"/>
9	Inspect port face	<input type="checkbox"/>	<input type="checkbox"/>	-	<input checked="" type="checkbox"/>
10	Inspect pressure bolt	<input type="checkbox"/>	<input type="checkbox"/>	-	<input checked="" type="checkbox"/>
11	Inspect fitting and ferrule	<input type="checkbox"/>	<input type="checkbox"/>	-	<input checked="" type="checkbox"/>
12	Suppressor for leak	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
13	Crill for leak	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
14	Electronic cable connected	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
15	Column selection valve for leak	<input type="checkbox"/>	<input type="checkbox"/>	-	<input checked="" type="checkbox"/>
16	Inspect all fitting and line	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
17	Eluent reservoir	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
18	Inspect cap o-ring	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
19	Inspect air for leak	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
20	Piston seal has been replaced	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
21	Back up seal has been replaced	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
22	Pump Lubricate	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
23	Front panel test	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
24	Low limit alarm	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
25	Hi limit alarm	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
26	Conductivity electronic test 100±1 uS	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
27	Check noise for suppressor (pk to pk <0.005uS)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
28	Check column	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
29	Check suppressor	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check&Clean	<input type="checkbox"/>
30	Check pump	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
31	Check cell	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
32	Check leak sensor	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
33	Flow rate	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
34	System pressure	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
35	Detectiv background	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>

เอกสารไม่ควบคุม

## Preventive Maintenance Check List

เอกสารไม่ควบคุม

Dionex Ion Chromatography  
Preventive Maintenance Report

Customer Organization	Name/ Department
UAE (2nd Contract)	Khun Suwan
Engineer Name	Date
Mr. Channarong Khiao-un	11-Dec-2019

## 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

Archemica Lab Co., Ltd  
Date 11-Dec-19

Customer  
Date 11-Dec-19

## Qualification Report

CM\_OQ , PQ and PM Check list  
DX-120 : Anion (ID#042)  
For  
UAE  
( 2<sup>nd</sup> Contract)



ARCHEMICA LAB CO., LTD.  
39 Soi Sukhumvit 63 (Ekamai) Sukhumvit Rd.,  
North Klongton, Wattana, Bangkok 10110  
Tel. (66)-2714-8399 (Automatic) Fax. (66)-2714-8393

เอกสารไม่ควบคุม



## Chromeleon 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 (AIA)	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok

เอกสารไม่ควบคุม



## Chromeleon Operational Qualification, Part 1

### Verification of Selected Results

Calibration Type:	LOff	
Integration Type:	Area	
Standard Method:	External	
Calibration Mode:	Total	
Auto Recalibrate:	ON	
Report Variable	Peak Name	Status
Offset (c0)	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	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



## Chromeleon Operational Qualification

### General Information

Computer Name (Server): LAB\_IC  
Computer Name (Client): LAB\_IC  
Version Number: 6.80 SR10 Build 2818 (196959)  
Operator: Mr.Channarong Khiso-un

General System Suitability Test: Test passed

### Comparison Formats:

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

Reviewer's Signature // Date

Operator's Signature // Date

เอกสารไม่ควบคุม

## Chromeleon Operational Qualification (CM\_OQ)

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%)	Methylparabene	ok
	Peak Width (50%)	Ethylparabene	ok
	Peak Width (50%)	Propylparabene	ok
	Left Width (0%)	Methylparabene	ok
	Left Width (0%)	Ethylparabene	ok
	Left Width (0%)	Propylparabene	ok
	Right Width (0%)	Methylparabene	ok
	Right Width (0%)	Ethylparabene	ok
	Right Width (0%)	Propylparabene	ok
	Peak Start	Methylparabene	ok
	Peak Start	Ethylparabene	ok
	Peak Start	Propylparabene	ok
	Peak Stop	Methylparabene	ok
	Peak Stop	Ethylparabene	ok
	Peak Stop	Propylparabene	ok
	Peak Start Value	Methylparabene	ok
	Peak Start Value	Ethylparabene	ok
	Peak Start Value	Propylparabene	ok
	Peak Stop Value	Methylparabene	ok
	Peak Stop Value	Ethylparabene	ok
	Peak Stop Value	Propylparabene	ok
	BL-Value Peak Start	Methylparabene	ok
	BL-Value Peak Start	Ethylparabene	ok
	BL-Value Peak Start	Propylparabene	ok
	BL-Value Peak Stop	Methylparabene	ok
	BL-Value Peak Stop	Ethylparabene	ok
	BL-Value Peak Stop	Propylparabene	ok
	Type	Methylparabene	ok
	Type	Ethylparabene	ok
	Type	Propylparabene	ok
	Resolution(EP)	Methylparabene	ok
	Resolution(EP)	Ethylparabene	ok
	Resolution(USP)	Methylparabene	ok
	Resolution(USP)	Ethylparabene	ok
	Asymmetry(EP)	Methylparabene	ok
	Asymmetry(EP)	Ethylparabene	ok
	Asymmetry(EP)	Propylparabene	ok

เอกสารไม่ควบคุม



## Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Results	Ret.Dev.(abs)	Methylparabene	ok
	Ret.Dev.(abs)	Ethylparabene	ok
	Ret.Dev.(abs)	Propylparabene	ok
	Ret.Dev.(rel)	Methylparabene	ok
	Ret.Dev.(rel)	Ethylparabene	ok
	Ret.Dev.(rel)	Propylparabene	ok
	Area	Methylparabene	ok
	Area	Ethylparabene	ok
	Area	Propylparabene	ok
	Rel.Area (Total)	Methylparabene	ok
	Rel.Area (Total)	Ethylparabene	ok
	Rel.Area (Total)	Propylparabene	ok
	Height	Methylparabene	ok
	Height	Ethylparabene	ok
	Height	Propylparabene	ok
	Rel.Height (Total)	Methylparabene	ok
	Rel.Height (Total)	Ethylparabene	ok
	Rel.Height (Total)	Propylparabene	ok
	Amount	Methylparabene	ok
	Amount	Ethylparabene	ok
	Amount	Propylparabene	ok
	Concentration	Methylparabene	ok
	Concentration	Ethylparabene	ok
	Concentration	Propylparabene	ok
	Rel.Amount	Methylparabene	ok
	Rel.Amount	Ethylparabene	ok
	Rel.Amount	Propylparabene	ok
	Peak Width (0%)	Methylparabene	ok
	Peak Width (0%)	Ethylparabene	ok
	Peak Width (0%)	Propylparabene	ok
	Peak Width (5%)	Methylparabene	ok
	Peak Width (5%)	Ethylparabene	ok
	Peak Width (5%)	Propylparabene	ok
	Peak Width (10%)	Methylparabene	ok
	Peak Width (10%)	Ethylparabene	ok
	Peak Width (10%)	Propylparabene	ok

เอกสารไม่ควบคุม



## Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Calibration Type: LOF  
Integration Type: Area  
Standard Method: External  
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 Dimension		ok
	Noise 2.1-2.3		ok
Peak Results	No.	Methylparabene	ok
	No.	Ethylparabene	ok
	No.	Propylparabene	ok
	Peak Name	Methylparabene	ok
	Peak Name	Ethylparabene	ok
	Peak Name	Propylparabene	ok
	Ret.Time	Methylparabene	ok
	Ret.Time	Ethylparabene	ok
	Ret.Time	Propylparabene	ok

เอกสารไม่ควบคุม



## Chromeleon Operational Qualification, Part 1

Verification of Selected Results

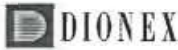
Report Variable	Peak Name	Status
Theoretical Plates (EP)	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Theoretical Plates (USP)	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Theoretical Plates (JP)	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok

Test Result: Passed

Signature 8-Dec-19  
Reviewer's Signature & Date

Signature 8-Dec-19  
Operator's Signature & Date

เอกสารไม่ควบคุม



## Chromeleon 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	ok
	RSD Match	Ethylparabene	ok
	RSD Match	Propylparabene	ok
	Rel.Max at	Methylparabene	ok
	Rel.Max at	Ethylparabene	ok
	Rel.Max at	Propylparabene	ok

Test Result: Passed

*Signature*  
Reviewer's Signature & Date

*Signature*  
Operator's Signature & Date

เอกสารไม่ควบคุม



## Chromeleon 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	Methylparabene	ok
	Peak Tab. Peak Type	Methylparabene	ok
	Peak Tab. Left Limit	Methylparabene	ok
	Peak Tab. Right Limit	Methylparabene	ok
	Peak Tab. Group	Methylparabene	ok
	Peak Tab. Resp.Factor	Methylparabene	ok
	Peak Tab. Amount	Methylparabene	ok
	Peak Tab. Amnt.Dim	Methylparabene	ok

เอกสารไม่ควบคุม



## Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Calibration	No. of Points	Propylparabene	ok
	No. of Points(disabled)	Methylparabene	ok
	No. of Points(disabled)	Ethylparabene	ok
	No. of Points(disabled)	Propylparabene	ok
	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.	Methylparabene	ok
	Corr.Coeff.	Ethylparabene	ok
	Corr.Coeff.	Propylparabene	ok
	Coeff.Det.	Methylparabene	ok
	Coeff.Det.	Ethylparabene	ok
	Coeff.Det.	Propylparabene	ok
	Adj. Coeff.Det.	Methylparabene	ok
	Adj. Coeff.Det.	Ethylparabene	ok
	Adj. Coeff.Det.	Propylparabene	ok
	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
	F(X)	Methylparabene	ok
	F(X)	Ethylparabene	ok
	F(X)	Propylparabene	ok

เอกสารไม่ควบคุม



## Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Results	Asymmetry(AIA)	Methylparabene	ok
	Asymmetry(AIA)	Ethylparabene	ok
	Asymmetry(AIA)	Propylparabene	ok
	Theoretical Plates(EP)	Methylparabene	ok
	Theoretical Plates(EP)	Ethylparabene	ok
	Theoretical Plates(EP)	Propylparabene	ok
	Theoretical Plates(USP)	Methylparabene	ok
	Theoretical Plates(USP)	Ethylparabene	ok
	Theoretical Plates(USP)	Propylparabene	ok
	Theoretical Plates(JP)	Methylparabene	ok
	Theoretical Plates(JP)	Ethylparabene	ok
	Theoretical Plates(JP)	Propylparabene	ok
Peak Calibration	Cal.Mode	Methylparabene	ok
	Cal.Mode	Ethylparabene	ok
	Cal.Mode	Propylparabene	ok
	Auto.Recal.	Methylparabene	ok
	Auto.Recal.	Ethylparabene	ok
	Auto.Recal.	Propylparabene	ok
	Cal.Type	Methylparabene	ok
	Cal.Type	Ethylparabene	ok
	Cal.Type	Propylparabene	ok
	Weights	Methylparabene	ok
	Weights	Ethylparabene	ok
	Weights	Propylparabene	ok
	Offset	Methylparabene	ok
	Offset	Ethylparabene	ok
	Offset	Propylparabene	ok
Peak Calibration	Slope	Methylparabene	ok
	Slope	Ethylparabene	ok
	Slope	Propylparabene	ok
	RF-Value	Methylparabene	ok
	RF-Value	Ethylparabene	ok
	RF-Value	Propylparabene	ok
Peak Calibration	No. of Points	Methylparabene	ok
	No. of Points	Ethylparabene	ok

เอกสารไม่ควบคุม



### Chromeleon Operational Qualification, Part 5

#### Fraction Collection: Comparison with Expected Results

Calibration Type: LOF  
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

*Signature*  
Reviewer's Signature // Date

*Signature*  
Operator's Signature // Date

เอกสารไม่ควบคุม



### Chromeleon Operational Qualification, Part 4

#### System Suitability Test: Comparison with Expected Results

Calibration Type: LOF  
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

*Signature*  
Reviewer's Signature // Date

*Signature*  
Operator's Signature // Date

เอกสารไม่ควบคุม



### 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

*Signature*  
Reviewer's Signature // Date

*Signature*  
Operator's Signature // Date

เอกสารไม่ควบคุม



### Chromeleon Operational Qualification, Part 3

#### Post-Acquisition Steps: Comparison with Expected Results

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

Channel Name	Report Variable	Peak Name	Status
Extract UV Channel:			
EXT230NM	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
EXT290NM	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
Smooth Data:			
UV_VIS_1_MA_005_001	Noise (1.9-2.4 min)		ok
UV_VIS_1_OI_051_001	Noise (1.9-2.4 min)		ok
EXT290NM_SG_005_010	Noise (1.9-2.4 min)		ok

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: Khun.Suwan / UAE Consultant Co.,Ltd. Date: 11-Dec-2019  
Qualification Executor: Mr.Channarong / Archemica Next Qualification: Jun-2020

#### Test Results Summary

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

Customer Signature:  Qualification Executor:  Date: 11-Dec-19




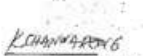
## Performance Qualification

#### 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
PeakNet Datasystem	6.80 SR10 Build 2618 (166959)	Dionex	33308	n.a.

#### Accessories:

Name	Description	Lot / Serial Number	
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	190122	Jan-2020
Sample 2	Nitrate, 10 ppm	190122	Jan-2020
Sample 3	Nitrate, 25 ppm	190122	Jan-2020
Sample 4	Nitrate, 50 ppm	190122	Jan-2020
Sample 5	Nitrate, 100 ppm	190122	Jan-2020
Sample 6	Nitrate, 1000 ppm	190122	Jan-2020
Eluent	Water	n.a.	n.a.
Autosampler Reservoir A	Water	-	-
CD Validation Test Cell	-	-	-
EG40 Validation Test Cell	-	-	-

Customer Signature:  Qualification Executor:  Date: 11-Dec-19

#### Limits:

Test	Customized Limit	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: Khun.Suwan / UAE Consultant Co.,Ltd. Date: 11-Dec-2019  
Qualification Executor: Mr.Channarong / Archemica Time between Qualifications: 6 months  
Next Qualification: Jun-2020

Customer Signature:  Qualification Executor:  Date: 11-Dec-19

Performance Qualification (PQ)  
(Anion)

# Data for Injector Precision test

Name	Area uS*min Nitrate ECD_1
Inj Precision_1	2.097
Inj Precision_2	2.096
Inj Precision_3	2.107
Inj Precision_4	2.094
Inj Precision_5	2.096
Inj Precision_6	2.088
Inj Precision_7	2.114
Inj Precision_8	2.097
Inj Precision_9	2.093
Inj Precision_10	2.088
Average:	2.097
Std. Dev:	0.008
% RSD:	0.384 %
Limit:	1.0 %
Result:	PASS

Customer Signature

Qualification Executor

Date



## 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: Khon.Suwan / UAE Consultant Co.,Ltd. Date: 11-Dec-2019  
Qualification Executor: Mr.Channarong / Archemica Next Qualification: Jun-2020

#### Test Results Summary

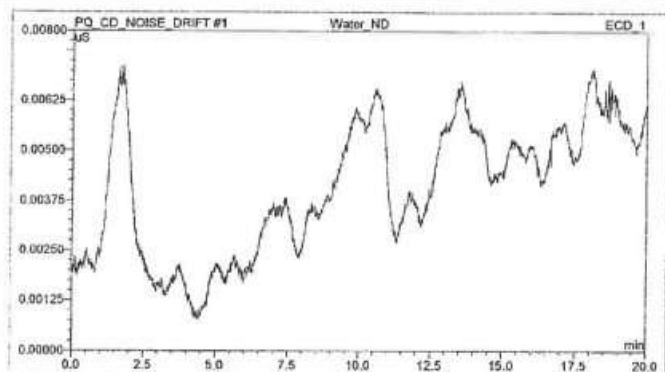
Test	Result
Injector Precision (Area %RSD)	PASS

Customer Signature

Qualification Executor

Date

# Chromatogram of Detector Noise and Drift



Customer Signature

Qualification Executor

Date

# Data for detector noise

Segment number	Noise, nS
1	0.680
2	3.376
3	1.744
4	0.772
5	1.031
6	0.358
7	0.591
8	1.012
9	0.968
10	0.615
11	1.044
12	1.913
13	1.165
14	1.350
15	0.935
16	0.906
17	1.334
18	1.895
19	1.043
20	1.351
Average, nS	1.185
Limit, nS	2
Result	PASS

# Data for detector drift

20 Minute drift, nS	Drift, nS/hr	Limit, nS/hr	Result
0.198	0.593	20.000	PASS

Customer Signature

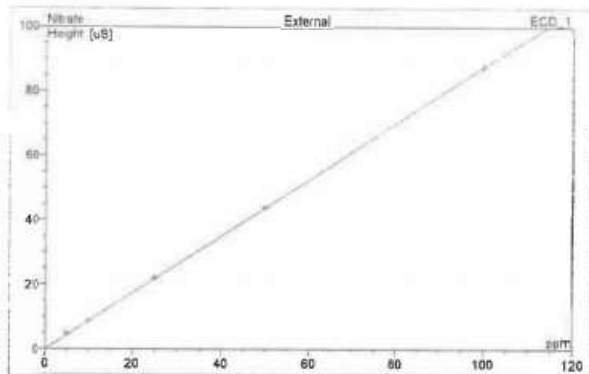
Qualification Executor

Date

# Data for Detector Linearity

Name	Amount ppm Nitrate ECD_1	Height uS Nitrate ECD_1
Detector linearity_1	5.000	4.887
Detector linearity_2	10.000	8.845
Detector linearity_3	25.000	22.040
Detector linearity_4	50.000	43.922
Detector linearity_5	100.000	87.425

## Linearity Plot



Calibration Type	Number of Points	Offset	Slope
Lin	5	0.000	0.876

	Correlation Coefficient	% RSD
Linearity:	1.000	0.856
Limit:	0.999	5
Result:	PASS	PASS

Customer Signature

Qualification Executor

Date



## 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: Khun.Suwan / UAE Consultant Co.,Ltd. Date: 11-Dec-2019

Qualification Executor: Mr.Channarong / Archemica Next Qualification: Jun-2020

#### Test Results Summary

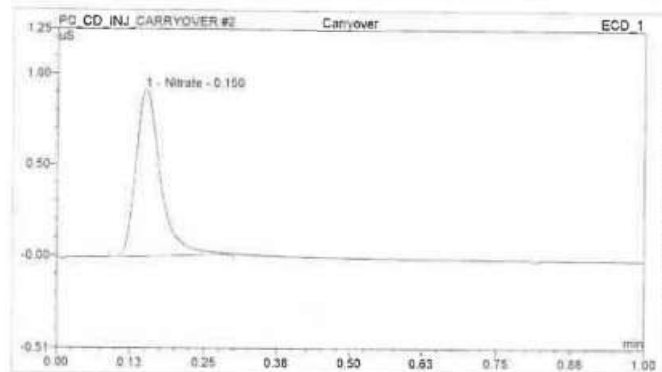
Test	Result
DX120 Detector Linearity (Corr.)	PASS
DX120 Detector Linearity (%RSD)	PASS

Customer Signature

Qualification Executor

Date

# 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	0.15	40.548
Carryover	0.15	0.044
Wwater	0.15	0.022
Carry over:		0.054 %
Limit:		0.1 %
Result:		PASS

Customer Signature

Qualification Executor

Date



## 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: Khun.Suwan / UAE Consultant Co.,Ltd. Date: 11-Dec-2019

Qualification Executor: Mr.Channarong / Archemica Next Qualification: Jun-2020

#### Test Results Summary

Test	Result
Injector Carry Over (Area %)	PASS

Customer Signature

Qualification Executor

Date

## Certificate of System Qualification

GC-OQ

System ID: CN11021007  
 Organization Name: United Analyst and Engineering Consultan Co., Ltd.  
 Organization Location: 3 Soi Udomsak 41 Sukhumvit Rd., Bangkok, Bangkok Thailand 10260  
 Date: February 11, 2022 3:57:27 PM  
 EQP Name: Agilent Recommended  
 EQP Revision: GC.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 Decay

Name: 7890  
 Front SSL  
 Setpoint Status: Pass  
 Pressure: 25.0 psi  
 Pressure Change: -0.1 psi / 5 minutes  
 Agilent Recommended: >= -2.0 and <= 0.5

## Overall Inlet Pressure Decay Test Status

Pass

## Inlet Pressure Accuracy

Name: 7890  
 Front SSL

Date: February 11, 2022 3:57:27 PM  
 System ID: CN11021007

Page 1/21

เอกสารไม่ควบคุม

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

Product Number 060254  
 Certificate of Analysis

Lot Number 190122

Expiration of Certification  
 January 2026

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  $\geq 18.2$  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	5.06 $\pm$ 0.06
2	10.11 $\pm$ 0.12
3	25.36 $\pm$ 0.26
4	49.36 $\pm$ 0.25
5	100.0 $\pm$ 1
6	1017 $\pm$ 5

*Handwritten signature*  
 11-Dec-22

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. 071600-01

26 Dec 2011

Electrochemical, NIST, and Primary  
 Standard Reference Materials are available from NIST. For more information, visit [www.nist.gov](http://www.nist.gov).  
 NIST is not responsible for the accuracy of the data presented in this document.

Thermo Fisher Scientific  
 1000 Lakeside Drive  
 P.O. Box 2000  
 Sunnyvale, CA 94088-1000  
 (408) 291-0000



Thermo Fisher Scientific  
 1000 Lakeside Drive  
 P.O. Box 2000  
 Sunnyvale, CA 94088-1000  
 (408) 291-0000

thermo  
 scientific

เอกสารไม่ควบคุม

ThermoFisher  
 SCIENTIFIC

Channarong Khiao-Un

Archemica  
 Thailand

has successfully completed the course

## IC Systems Qualification Service Training

Description:
 

- Software Installation Qualification
- Software Operation Qualification
- Hardware Installation Qualification
- Hardware Operation Qualification
- Hardware Performance Qualification
- GLP /GMP/ GDP Compliance

*Handwritten signature*  
 11-Dec-22

Training date(s): 15-Oct-2018 — 26-Oct-2018  
 Location: Bangkok, Thailand  
 Issued on: 26-Oct-2018 Expires on: 25-Oct-2021

Certificate issued by:

*Handwritten signature*

Worapong Worawunwong  
 Manager, ICSP Technical Support

The certificate is only valid during employment with the Thermo Fisher Scientific including its subsidiaries and certified contractors. The original certificate is filed and stored at the company file.

the world leader in serving science

## CERTIFICATE

เอกสารไม่ควบคุม

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

Agilent Recommended: <= 2.50

## 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: 0.58 %

Retention Time RSD: 0.65 %

Agilent Recommended: <= 3.00

Agilent Recommended: <= 1.00

## Overall Injection Precision Test Status

Pass

## Signal to Noise

Tested Combination1: Front Injection Tower

Name: 7890

Setpoint Status: Pass

Signal to Noise: 784901

Agilent Recommended: >= 392000

## Overall Signal to Noise Test Status

Pass

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

System ID: CN11021007

Page 3 / 21

เอกสารไม่ควบคุม

## Overall GC Oven Temperature Accuracy Test Status

Pass

## GC Oven Temperature Stability

Name: 7890

Setpoint Status: Pass

Setpoint/Average: 100.0 100.2167 °C

Temperature: 100.0 100.2167 °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: 1.0 µL

## Overall Scouting Run Status

Completed

## Noise and Drift

Tested Combination1: Front SSL / Back FID

Name: 7890

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

System ID: CN11021007

Page 4 / 21

เอกสารไม่ควบคุม

## Overall Detector Flow Accuracy Test Status

Pass

## Detector Flow Accuracy

Name: 7890

Front UECO

Setpoint Status: Pass

Flow Type: Makeup

Setpoint: 25.0 mL/min

Measured Flow: 24.8 mL/min

Accuracy: 0.2 mL/min

Agilent Recommended: <= 10.0 % setpoint ( 2.5 mL/min )

Limit is percentage of setpoint or 0.5 mL/minute, whichever is largest.

## Overall Detector Flow Accuracy Test Status

Pass

## GC Oven Temperature Accuracy

Name: 7890

Setpoint Status: Pass

Zone: Oven

Setpoint/Average: 230.0 230.3 °C

Temperature: 230.0 230.3 °C

Accuracy: 0.3 °C

Agilent Recommended: >= -1.0 % setpoint in K ( -5.0 °C )

Agilent Recommended: <= 1.0 % setpoint in K ( 5.0 °C )

Setpoint Status: Pass

Zone: Oven

Setpoint/Average: 100.0 100.2 °C

Temperature: 100.0 100.2 °C

Accuracy: 0.2 °C

Agilent Recommended: >= -1.0 % setpoint in K ( -3.7 °C )

Agilent Recommended: <= 1.0 % setpoint in K ( 3.7 °C )

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

System ID: CN11021007

Page 3 / 21

เอกสารไม่ควบคุม

## Setpoint Status: Pass

Setpoint: 25.0 psi

Actual: 25.0 psi

Accuracy: 0.0 psi

Agilent Recommended: <= 1.2

## Overall Inlet Pressure Accuracy Test Status

Pass

## Detector Flow Accuracy

Name: 7890

Back FID

Setpoint Status: Pass

Flow Type: Fuel

Setpoint: 30.0 mL/min

Measured Flow: 30.1 mL/min

Accuracy: 0.1 mL/min

Agilent Recommended: <= 10.0 % setpoint ( 3.0 mL/min )

Limit is percentage of setpoint or 0.5 mL/minute, whichever is largest.

## Setpoint Status: Pass

Flow Type: Oxidizer

Setpoint: 400.0 mL/min

Measured Flow: 396.4 mL/min

Accuracy: 3.6 mL/min

Agilent Recommended: <= 10.0 % setpoint ( 40.0 mL/min )

Limit is percentage of setpoint or 0.5 mL/minute, whichever is largest.

## Setpoint Status: Pass

Flow Type: Makeup

Setpoint: 25.0 mL/min

Measured Flow: 24.8 mL/min

Accuracy: 0.2 mL/min

Agilent Recommended: <= 10.0 % setpoint ( 2.5 mL/min )

Limit is percentage of setpoint or 0.5 mL/minute, whichever is largest.

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

System ID: CN11021007

Page 2 / 21

เอกสารไม่ควบคุม



Sampler 2	
Manufacturer	Agilent Technologies
Type	Tray
Name	7883A
Model Number	G2614A
Serial Number	CN82248787
Firmware Revision	A.02.01
Mainframe 1	
Manufacturer	Agilent Technologies
Name	7890
Model Number	G3440A
Serial Number	CN11021007
Firmware Revision	A.01.11
Oven Type	Standard
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	7890
Type	FID
Adapter	Capillary
Control Type	Electronic Pressure Control (EPC)
Location	Back
Makeup Gas	Nitrogen

Date: February 11, 2022 3:57:27 PM  
System ID: CN11021007

Page 9 / 21

เอกสารไม่ควบคุม

## Instrument Details

## Purpose

This section describes the as found system configuration.

## Details

System	
System ID	UAE.TOX.007
Manufacturer	Agilent Technologies
Name	7890
Flow Data Input	Manual Data
Temperature Data Input	Manual Data or Other Data Logging
Tested Combination1	
Injection Technique	Injection Tower
Inlet	Front
Detector	Back
LTM Included?	No
Tested Combination2	
Injection Technique	Injection Tower
Inlet	Front
Detector	Front
LTM Included?	No
Sampler 1	
Manufacturer	Agilent Technologies
Type	Injection Tower
Name	7883A
Model Number	G2613A
Serial Number	CN82149436
Firmware Revision	A.11.02
Usage	Sample Injection
Location	Front
Syringe Volume (µL)	10

Date: February 11, 2022 3:57:27 PM  
System ID: CN11021007

Page 8 / 21

เอกสารไม่ควบคุม

Setpoint Status:	Pass			
Injection Volume on Column:	1.0	µL		
Area RSD:	1.14	%	Retention Time RSD:	0.04 %
Agilent Recommended:	<= 3.00		<= 1.00	

Overall Injection Precision Test Status  
Pass

## Signal to Noise

Tested Combination2	Front	SSL	/ Front	UECD
Injection Tower				
Name:	7890			

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: CN11021007

Page 7 / 21

เอกสารไม่ควบคุม

## Scouting Run

Tested Combination2	Front	SSL	/ Front	UECD
Injection Tower				

Name: 7883A

Setpoint Status: Completed

Injection Volume on Column: 1.0 µL

## Overall Scouting Run Status

Completed

## Noise and Drift

Tested Combination2	Front	SSL	/ Front	UECD
7890				

Setpoint Status: Pass

Base Signal: 282.3 Hz

ASTM Noise		Drift	
Hz		Hz/Hr	
0.60		13.19	
3.00		15.00	
Agilent Recommended:		<= 15.00	
Status:		Pass	

## Overall Noise and Drift Test Status

Pass

## Injection Precision

Tested Combination2	Front	SSL	/ Front	UECD
7883A				

Date: February 11, 2022 3:57:27 PM  
System ID: CN11021007

Page 6 / 21

เอกสารไม่ควบคุม

Time	Transaction Date	Activity Performed	Type of Transaction	Optional Information
February 11, 2022 2:00:20 PM	Auto PM	Service/Inspection	Session	None
February 11, 2022 2:06:21 PM	Auto PM	ECU/Control	Session	GDP details for primary technique (G) - File path: (Photos)\VehicleECUConfig\kvaUSD \$1V6a.02.01.jpg, GDP File Name: (G).02.01.jpg, GDP Name: (Agiler-Power) (revised)
February 11, 2022 2:08:35 PM	End PM	Configuration	Session	None
February 11, 2022 2:06:59 PM	Start PM	Qualification	Session	CO
February 11, 2022 2:04:59 PM	Start PM	Execution	System Inspection and Basic Safety and Operation - T800 - Qualitative Test - No response associated	None
February 11, 2022 2:07:18 PM	End PM	Execution	System Inspection and Basic Safety and Operation - T800 - Qualitative Test - No response associated	Run Count: 1
February 11, 2022 2:27:21 PM	Start PM	Execution	Test Pressure Decay - F1001 SSL - Pressure Controlled (not) - R: 25.0 psi - L: -- -0.5 psi and -- 0.6 psi	None
February 11, 2022 2:07:38 PM	End PM	Execution	Test Pressure Decay - F1001 SSL - Pressure Controlled (not) - R: 25.0 psi - L: -- -0.5 psi and -- 0.6 psi	Run Count: 1
February 11, 2022 2:07:57 PM	Start PM	Execution	Test Pressure Accuracy - F1001 SSL - Pressure Controlled (not)	None

Page 3 of 10

Date: February 11, 2022 3:57:27 PM  
System ID: CN11021007

Page 13 / 21

## เอกสารไม่ควบคุม

**Electronic Signature**

### Purpose

This signature page was created and published because the ACE sign-off action was executed, which is valid for the entire document, including attachments. The ACE sign-off is an electronic signature that requires two distinct identification components: unique username and personal password. The Agilent representative who has delivered this service understands the meaning and legal status of an electronic signature. As a trained official operator, the Agilent representative has a unique password and login to access ACE and electronically sign this document. (Other e-signatures can be applied to this document using a Document Content Management or other suitable method defined in your data access and control procedures.)

### Details

Full Name of Signer:	Saenguthai Tarak
Logged On User Name:	saenguthai.tarak@non.agilent.com
Signature Creation Date:	February 11, 2022
Reason for Signature:	Executed protocol and published this original version of document

## Regulatory Disclaimer

This document provides a protocol to verify and record instrument configuration and evidence of proper operation. It has been prepared from our interpretation of applicable regulations as well as industry best practices. The document is designed to provide an important component of a complete compliance package. Compliance depends upon many factors and use of this protocol alone does not assure compliance. Agilent Technologies makes no guarantee or representation as to its sufficiency for any specific regulatory program.

### Warranty

Agilent Technologies makes no warranty of any kind to this material, including but not limited to, the implied warranties of merchantability and fitness for a particular purpose. Agilent Technologies shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material.

Date: February 11, 2022 3:57:27 PM  
System ID: CN11021007

Page 11 / 29

## เอกสารไม่ควบคุม

Time	Transaction Date	Activity Performed	Type of Transaction	Optional Information
February 10, 2022 1:31:07 PM	Audit	Session/Created	Session	None
February 10, 2022 1:21:02 PM	Start	Configuration	Session	None
February 10, 2022 1:31:02 PM	Audit	Entitlement	Licensing	User is nonpaying and does not require an unlock code.
February 10, 2022 1:30:58 PM	Audit	EggsLoaded	Session	EGP details for primary technique [Eq]:  File path: [ProcessPath\Software\Configuration\GSL\SIG\GSL1.asp], EGP File Name: [SIG.GS1.asp, EGP Name: AgentAccessMonitor]
February 10, 2022 1:30:48 PM	Audit	AccClosed	Session	None
February 10, 2022 1:41:08 PM	Audit	AccFinished	Session	None
February 10, 2022 1:41:56 PM	Audit	Sensor/Retrieved	Session	None
February 10, 2022 1:41:10 PM	Audit	EggsLoaded	Session	EGP details for primary technique [Eq]:  File path: [ProcessPath\Software\Configuration\GSL\SIG\GSL1.asp], EGP File Name: [SIG.GS1.asp, EGP Name: AgentAccessMonitor]
February 10, 2022 1:47:12 PM	Audit	AccClosed	Session	None
February 11, 2022 9:54:43 AM	Audit	AccFinished	Session	None

Page 1 / 10

Date: February 11, 2022 3:57:27 PM  
System ID: CN11021007

Page 12 / 21

## เอกสารไม่ควบคุม

## Detector 2

Manufacturer	Agilent Technologies
Name	7890
Type	UECD
Serial Number	U116688
Adaptor	Capillary
Control Type	Electronic Pressure Control (EPC)
Location	Front
Makeup Gas	Nitrogen

Date: February 11, 2022 3:57:27 PM  
System ID: CN1021037

Page 10 / 21

## เอกสารไม่ควบคุม

User Name: xiangp@th.lan			System ID: CH11021007	
Hostname: LAPTOP-G2550DMV			Print Date: February 11, 2022 3:57:38 PM	
OQ_UAE_TOX897 Transaction log:				
Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
February 11, 2022 2:15:57 PM	Auto	None and DRI - Back PID - Detector PID - L (Notes): $\pm 0.10 \mu\text{A} - \text{L (DRI)} \pm 2.30 \mu\text{A/hour}$	Data File Path: E:\OQ\2022\OQ_FID_BuildIt	
February 11, 2022 2:16:08 PM	End	None and DRI - Back PID - Detector PID - L (Notes): $\pm 0.10 \mu\text{A} - \text{L (DRI)} \pm 2.30 \mu\text{A/hour}$	Run Count: 1	
February 11, 2022 2:16:09 PM	Start	Injection Precision - Injection Tower, Front SGL, Back PID - GC - L (Notes): $\pm 3.00\% - \text{L (Rel. Time)} \pm 1.00\%$	None	
February 11, 2022 2:16:47 PM	Start	Injection Precision - Injection Tower, Front SGL, Back PID - GC - L (Notes): $\pm 3.00\% - \text{L (Rel. Time)} \pm 1.00\%$	None	
February 11, 2022 2:17:12 PM	Auto	Injection Precision - Injection Tower, Front SGL, Back PID - GC - L (Notes): $\pm 3.00\% - \text{L (Rel. Time)} \pm 1.00\%$	Data File Path: E:\OQ\2022\OQ_FID_BuildIt	
February 11, 2022 2:17:12 PM	Auto	Injection Precision - Injection Tower, Front SGL, Back PID - GC - L (Notes): $\pm 3.00\% - \text{L (Rel. Time)} \pm 1.00\%$	Run Count: 1	
February 11, 2022 2:17:12 PM	Auto	Injection Precision - Injection Tower, Front SGL, Back PID - GC - L (Notes): $\pm 3.00\% - \text{L (Rel. Time)} \pm 1.00\%$	Data File Path: E:\OQ\2022\OQ_FID_BuildIt	

Page 8 / 10

Date: February 11, 2022 3:57:27 PM  
System ID: CH11021007

Page 17 / 21

เอกสารไม่ควบคุม

User Name: xiangp@th.lan			System ID: CH11021007	
Hostname: LAPTOP-G2550DMV			Print Date: February 11, 2022 3:57:38 PM	
OQ_UAE_TOX897 Transaction log:				
Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
February 11, 2022 2:13:43 PM	End	Execution	GC Oven Temperature Accuracy - 7890 - Temperature : Oven - B: 150.0°C - L: $\pm 1.0$ AND $\pm 1.0$ % septum in K	Run Count: 1
February 11, 2022 2:16:46 PM	Start	Execution	GC Oven Temperature Stability - 7890 - Temperature : Oven - B: 150.0°C - L: $\pm 0.5$ °C	None
February 11, 2022 2:17:27 PM	Auto	Data	GC Oven Temperature Stability - 7890 - Temperature : Oven - B: 150.0°C - L: $\pm 0.5$ °C	Manual Data Entry
February 11, 2022 2:17:38 PM	End	Execution	GC Oven Temperature Stability - 7890 - Temperature : Oven - B: 150.0°C - L: $\pm 0.5$ °C	Run Count: 1
February 11, 2022 2:17:44 PM	Start	Execution	GC Bleeding Run - Injection Tower, Front SGL, Back PID - Part of System Preparation - No leaks associated	None
February 11, 2022 2:14:13 PM	Start	Execution	GC Bleeding Run - Injection Tower, Front SGL, Back PID - Part of System Preparation - No leaks associated	None
February 11, 2022 2:14:45 PM	Auto	Data	GC Bleeding Run - Injection Tower, Front SGL, Back PID - Part of System Preparation - No leaks associated	Data File Path: E:\OQ\2022\OQ_FID_BuildIt
February 11, 2022 2:16:18 PM	End	Execution	GC Bleeding Run - Injection Tower, Front SGL, Back PID - Part of System Preparation - No leaks associated	Run Count: 1
February 11, 2022 2:16:22 PM	Start	Execution	None and DRI - Back PID - Detector PID - L (Notes): $\pm 0.10 \mu\text{A} - \text{L (DRI)} \pm 2.30 \mu\text{A/hour}$	None

Page 9 / 10

Date: February 11, 2022 3:57:27 PM  
System ID: CH11021007

Page 16 / 21

เอกสารไม่ควบคุม

User Name: xiangp@th.lan		System ID: CH11021007		
Hostname: LAPTOP-G2550DMV		Print Date: February 11, 2022 3:57:38 PM		
OQ_UAE_TOX897 Transaction log:				
Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
February 11, 2022 2:09:25 PM	Start	Execution	Detector Flow Accuracy - Front UECD - Type: Makeup - S: 25.0 mL/min - L: $\pm 10.0\%$ septum	None
February 11, 2022 2:09:50 PM	Auto	Data	Detector Flow Accuracy - Front UECD - Type: Makeup - S: 25.0 mL/min - L: $\pm 10.0\%$ septum	Manual Data Entry
February 11, 2022 2:09:54 PM	End	Execution	Detector Flow Accuracy - Front UECD - Type: Makeup - S: 25.0 mL/min - L: $\pm 10.0\%$ septum	Run Count: 1
February 11, 2022 2:09:56 PM	Start	Execution	GC Oven Temperature Accuracy - 7890 - Temperature : Oven - B: 150.0°C - L: $\pm 1.0$ AND $\pm 1.0$ % septum in K	None
February 11, 2022 2:10:19 PM	Auto	Data	GC Oven Temperature Accuracy - 7890 - Temperature : Oven - B: 150.0°C - L: $\pm 1.0$ AND $\pm 1.0$ % septum in K	Manual Data Entry
February 11, 2022 2:10:20 PM	End	Execution	GC Oven Temperature Accuracy - 7890 - Temperature : Oven - B: 150.0°C - L: $\pm 1.0$ AND $\pm 1.0$ % septum in K	Run Count: 1
February 11, 2022 2:10:22 PM	Start	Execution	GC Oven Temperature Accuracy - 7890 - Temperature : Oven - B: 150.0°C - L: $\pm 1.0$ AND $\pm 1.0$ % septum in K	None
February 11, 2022 2:10:41 PM	Auto	Data	GC Oven Temperature Accuracy - 7890 - Temperature : Oven - B: 150.0°C - L: $\pm 1.0$ AND $\pm 1.0$ % septum in K	Manual Data Entry

Page 4 / 10

User Name: xiangp@th.lan			System ID: CH11021007	
Hostname: LAPTOP-G2550DMV			Print Date: February 11, 2022 3:57:38 PM	
OQ_UAE_TOX897 Transaction log:				
Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
February 11, 2022 2:07:42 PM	End	Inlet Pressure Accuracy - Front SGL - Pressure: 30.00 psi - S: 25.0 psi - L: $\pm 1.2$ psi	Run Count: 1	
February 11, 2022 2:07:44 PM	Start	Detector Flow Accuracy - Back PID - Type: Fuel - S: 30.0 mL/min - L: $\pm 10.0\%$ septum	None	
February 11, 2022 2:08:20 PM	Auto	Detector Flow Accuracy - Back PID - Type: Fuel - S: 30.0 mL/min - L: $\pm 10.0\%$ septum	Manual Data Entry	
February 11, 2022 2:08:10 PM	End	Detector Flow Accuracy - Back PID - Type: Fuel - S: 30.0 mL/min - L: $\pm 10.0\%$ septum	Run Count: 1	
February 11, 2022 2:08:13 PM	Start	Detector Flow Accuracy - Back PID - Type: Oxidizer - S: 400.0 mL/min - L: $\pm 10.0\%$ septum	None	
February 11, 2022 2:08:40 PM	Auto	Detector Flow Accuracy - Back PID - Type: Oxidizer - S: 400.0 mL/min - L: $\pm 10.0\%$ septum	Manual Data Entry	
February 11, 2022 2:09:02 PM	End	Detector Flow Accuracy - Back PID - Type: Oxidizer - S: 400.0 mL/min - L: $\pm 10.0\%$ septum	Run Count: 1	
February 11, 2022 2:09:04 PM	Start	Detector Flow Accuracy - Back PID - Type: Makeup - S: 25.0 mL/min - L: $\pm 10.0\%$ septum	None	
February 11, 2022 2:09:18 PM	Auto	Detector Flow Accuracy - Back PID - Type: Makeup - S: 25.0 mL/min - L: $\pm 10.0\%$ septum	Manual Data Entry	
February 11, 2022 2:09:23 PM	End	Detector Flow Accuracy - Back PID - Type: Makeup - S: 25.0 mL/min - L: $\pm 10.0\%$ septum	Run Count: 1	

Page 5 / 10

Date: February 11, 2022 3:57:27 PM  
System ID: CH11021007

Page 15 / 21

เอกสารไม่ควบคุม

Date: February 11, 2022 3:57:27 PM  
System ID: CH11021007

Page 14 / 21

เอกสารไม่ควบคุม

User Name: saangthai.lark  
Host Name: LAPTOP-CQ25K0MY  
System ID: CN11021007  
Print Date: February 11, 2022 3:57:30 PM

OQ\_UAE\_TOX.897 Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
February 11, 2022 3:35:50 PM	Start	Execution	Signal to Noise - Injection	None
			Tower, Front ISS, Front UECD	
			- Detector UECD - L -> 1500	
February 11, 2022 3:38:13 PM	Auto	Data	Signal to Noise - Injection	Data File Path:
			Tower, Front ISS, Front UECD	E:\OQ\OQ22\OQ_UCD_Protocol
			- Detector UECD - L -> 1500	CD_8981.D\CD1A.ch
February 11, 2022 3:38:38 PM	End	Execution	Signal to Noise - Injection	Run Count: 1
			Tower, Front ISS, Front UECD	
			- Detector UECD - L -> 1500	
February 11, 2022 3:37:32 PM	End	Qualification	Session	OQ
February 11, 2022 3:37:32 PM	Start	Reporting	Session	None
February 11, 2022 3:53:59 PM	Auto	Reporting	Session	Report Generated: CarBState
February 11, 2022 3:55:03 PM	Auto	Reporting	Session	Report Generated: Report

Page 10 / 10

Date: February 11, 2022 3:57:27 PM  
System ID: CN11021007

Page 21 / 21

เอกสารไม่ควบคุม

User Name: saangthai.lark  
Host Name: LAPTOP-CQ25K0MY  
System ID: CN11021007  
Print Date: February 11, 2022 3:57:30 PM

OQ\_UAE\_TOX.897 Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
February 11, 2022 3:34:01 PM	Start	Execution	Injection Precision - Injection	None
			Tower, Front ISS, Front UECD	
			- GC - L (Area) -> 3.00% - L	
			(Rel. Time) -> 1.00%	
February 11, 2022 3:34:42 PM	Auto	Data	Injection Precision - Injection	Data File Path:
			Tower, Front ISS, Front UECD	E:\OQ\OQ22\OQ_UCD_Protocol
			- GC - L (Area) -> 3.00% - L	CD_Protocol.D\CD1A.ch
			(Rel. Time) -> 1.00%	
February 11, 2022 3:34:42 PM	Auto	Data	Injection Precision - Injection	Data File Path:
			Tower, Front ISS, Front UECD	E:\OQ\OQ22\OQ_UCD_Protocol
			- GC - L (Area) -> 3.00% - L	CD_Protocol.D\CD1A.ch
			(Rel. Time) -> 1.00%	
February 11, 2022 3:34:42 PM	Auto	Data	Injection Precision - Injection	Data File Path:
			Tower, Front ISS, Front UECD	E:\OQ\OQ22\OQ_UCD_Protocol
			- GC - L (Area) -> 3.00% - L	CD_Protocol.D\CD1A.ch
			(Rel. Time) -> 1.00%	
February 11, 2022 3:34:42 PM	Auto	Data	Injection Precision - Injection	Data File Path:
			Tower, Front ISS, Front UECD	E:\OQ\OQ22\OQ_UCD_Protocol
			- GC - L (Area) -> 3.00% - L	CD_Protocol.D\CD1A.ch
			(Rel. Time) -> 1.00%	
February 11, 2022 3:34:42 PM	Auto	Data	Injection Precision - Injection	Data File Path:
			Tower, Front ISS, Front UECD	E:\OQ\OQ22\OQ_UCD_Protocol
			- GC - L (Area) -> 3.00% - L	CD_Protocol.D\CD1A.ch
			(Rel. Time) -> 1.00%	
February 11, 2022 3:35:03 PM	End	Execution	Injection Precision - Injection	Run Count: 1
			Tower, Front ISS, Front UECD	
			- GC - L (Area) -> 3.00% - L	
			(Rel. Time) -> 1.00%	

Page 9 / 10

Date: February 11, 2022 3:57:27 PM  
System ID: CN11021007

Page 20 / 21

เอกสารไม่ควบคุม

User Name: saangthai.lark  
Host Name: LAPTOP-CQ25K0MY  
System ID: CN11021007  
Print Date: February 11, 2022 3:57:30 PM

OQ\_UAE\_TOX.897 Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
February 11, 2022 2:18:15 PM	End	Execution	Signal to Noise - Injection	Run Count: 1
			Tower, Front ISS, Back FID	
			- Detector FID - L -> 300000	
February 11, 2022 2:21:49 PM	Start	Execution	GC Sampling Run - Injection	None
			Tower, Front ISS, Front UECD	
			- Part of System Preparation	No limits associated
February 11, 2022 2:22:19 PM	Auto	Data	GC Sampling Run - Injection	Data File Path:
			Tower, Front ISS, Front UECD	E:\OQ\OQ22\OQ_UCD_Protocol
			- Part of System Preparation	01.D\CD1A.ch
			- No limits associated	
February 11, 2022 2:23:01 PM	Auto	Data	GC Sampling Run - Injection	Data File Path:
			Tower, Front ISS, Front UECD	E:\OQ\OQ22\OQ_UCD_Protocol
			- Part of System Preparation	CD_8981.D\CD1A.ch
			- No limits associated	
February 11, 2022 2:23:23 PM	End	Execution	GC Sampling Run - Injection	Run Count: 1
			Tower, Front ISS, Front UECD	
			- Part of System Preparation	No limits associated
February 11, 2022 2:33:36 PM	Start	Execution	Noise and DRB - Front UECD	None
			- Detector UECD - L (Area) -> 3.00 Hz - L (DRB) -> 15.00 Hz	
February 11, 2022 2:33:47 PM	Auto	Data	Noise and DRB - Front UECD	Data File Path:
			- Detector UECD - L (Area) -> 3.00 Hz - L (DRB) -> 15.00 Hz	E:\OQ\OQ22\OQ_UCD_Protocol
			- No limits associated	12.D\CD1A.ch
February 11, 2022 2:33:58 PM	End	Execution	Noise and DRB - Front UECD	Run Count: 1
			- Detector UECD - L (Area) -> 3.00 Hz - L (DRB) -> 15.00 Hz	

Page 8 / 10

Date: February 11, 2022 3:57:27 PM  
System ID: CN11021007

Page 19 / 21

เอกสารไม่ควบคุม

User Name: saangthai.lark  
Host Name: LAPTOP-CQ25K0MY  
System ID: CN11021007  
Print Date: February 11, 2022 3:57:30 PM

OQ\_UAE\_TOX.897 Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
February 11, 2022 2:11:12 PM	Auto	Data	Injection Precision - Injection	Data File Path:
			Tower, Front ISS, Back FID	E:\OQ\OQ22\OQ_UCD_Protocol
			- GC - L (Area) -> 3.00% - L	2022-02-10
			(Rel. Time) -> 1.00%	13-02-14\OQ_UCD_Protocol
February 11, 2022 2:17:12 PM	Auto	Data	Injection Precision - Injection	Data File Path:
			Tower, Front ISS, Back FID	E:\OQ\OQ22\OQ_UCD_Protocol
			- GC - L (Area) -> 3.00% - L	2022-02-10
			(Rel. Time) -> 1.00%	13-02-14\OQ_UCD_Protocol
February 11, 2022 2:17:13 PM	Auto	Data	Injection Precision - Injection	Data File Path:
			Tower, Front ISS, Back FID	E:\OQ\OQ22\OQ_UCD_Protocol
			- GC - L (Area) -> 3.00% - L	2022-02-10
			(Rel. Time) -> 1.00%	13-02-14\OQ_UCD_Protocol
February 11, 2022 2:17:35 PM	End	Execution	Injection Precision - Injection	Run Count: 1
			Tower, Front ISS, Back FID	
			- GC - L (Area) -> 3.00% - L	
			(Rel. Time) -> 1.00%	
February 11, 2022 2:17:48 PM	Start	Execution	Signal to Noise - Injection	None
			Tower, Front ISS, Back FID	
			- Detector FID - L -> 300000	
February 11, 2022 2:18:06 PM	Start	Execution	Signal to Noise - Injection	None
			Tower, Front ISS, Back FID	
			- Detector FID - L -> 300000	
February 11, 2022 2:18:23 PM	Auto	Data	Signal to Noise - Injection	Data File Path:
			Tower, Front ISS, Back FID	E:\OQ\OQ22\OQ_UCD_Protocol
			- Detector FID - L -> 300000	2022-02-10
			(Rel. Time) -> 1.00%	13-02-14\OQ_UCD_Protocol
February 11, 2022 2:18:33 PM	Start	Execution	Signal to Noise - Injection	None
			Tower, Front ISS, Back FID	
			- Detector FID - L -> 300000	

Page 7 / 10

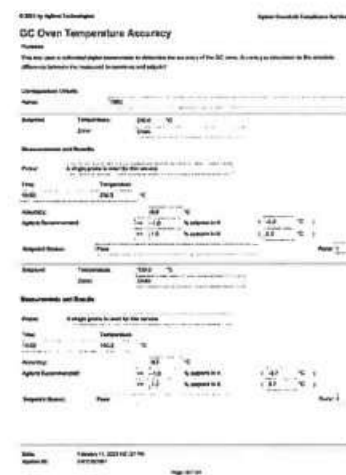
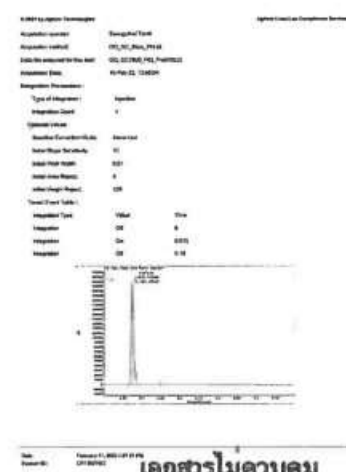
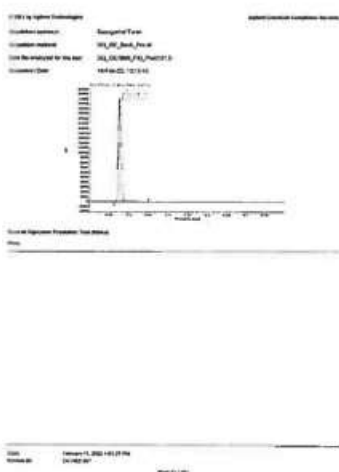
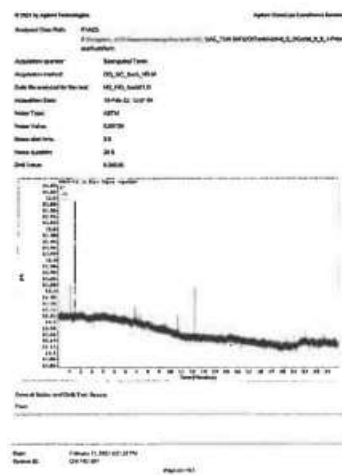
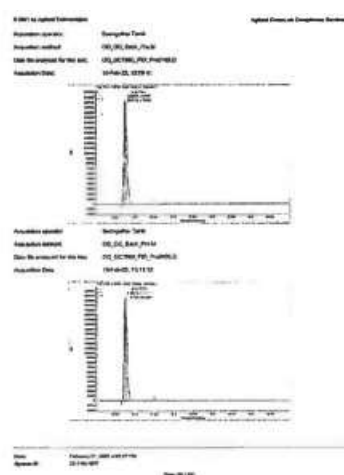
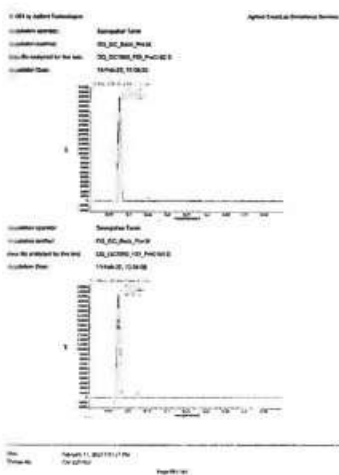
Date: February 11, 2022 3:57:27 PM  
System ID: CN11021007

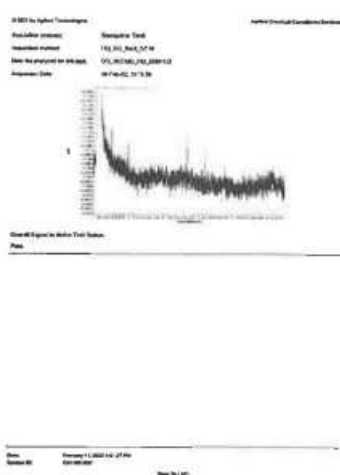
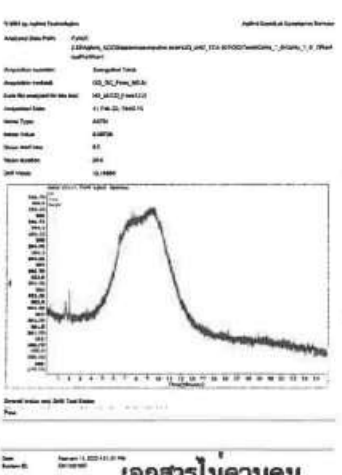
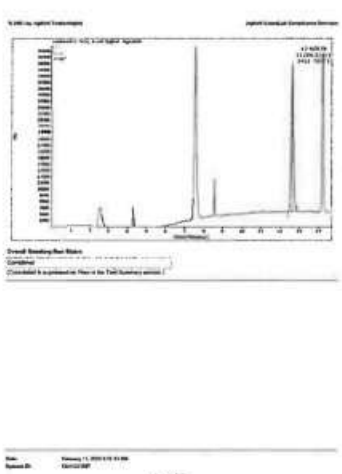
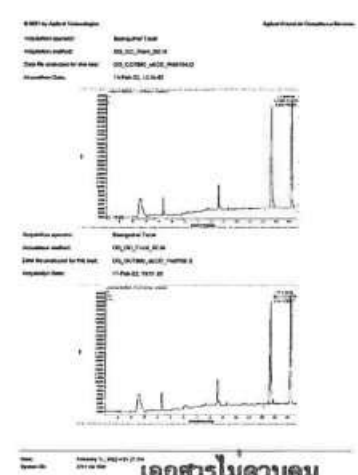
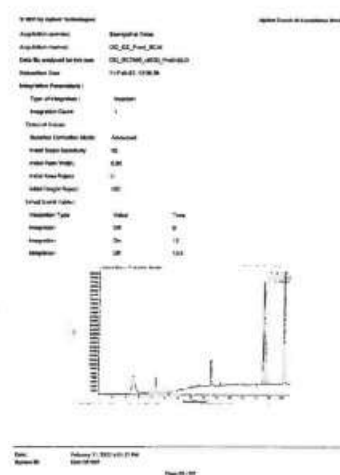
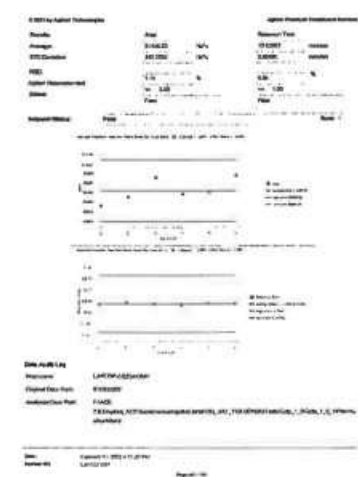
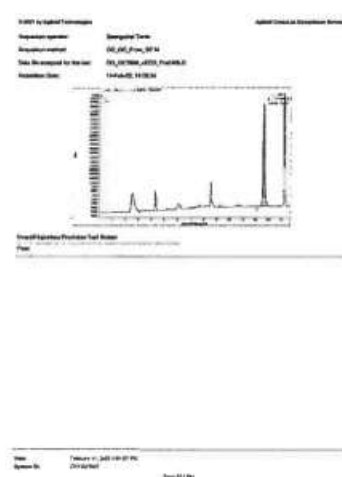
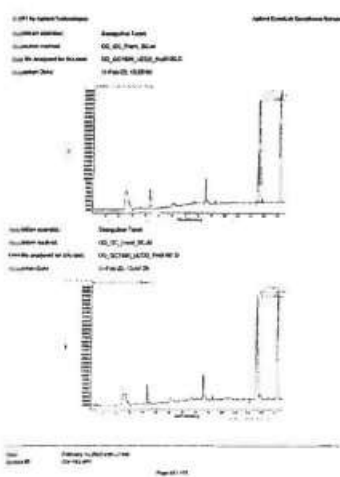
Page 18 / 21

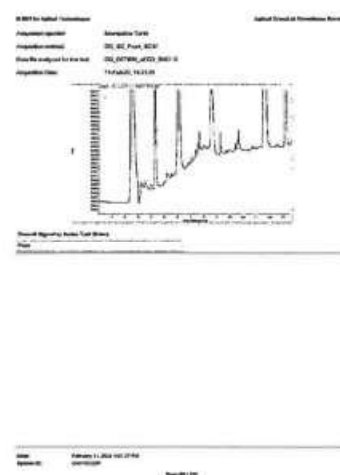
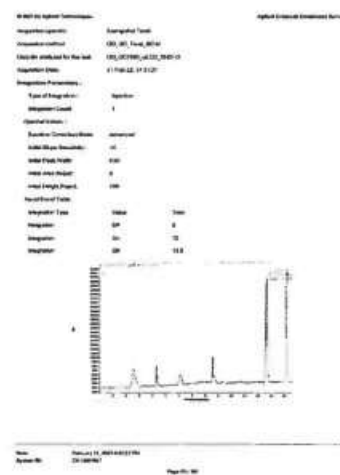
เอกสารไม่ควบคุม

















Setpoint Status: **Pass**

Setpoint: **25.0** psi Actual: **25.0** psi

Inlet Pressure: **25.0** psi

Accuracy: **0.0** psi

Agilent Recommended: **1.2**

Overall Inlet Pressure Accuracy Test Status: **Pass**

Detector Flow Accuracy

Name: **7890**

Back **FID**

Setpoint Status: **Pass**

Flow Type: **Fuel**

Setpoint: **30.0** mL/min Measured Flow: **30.1** mL/min

Accuracy: **0.1** mL/min

Agilent Recommended: **10.0** % setpoint ( **3.0** mL/min )

Limit is percentage of setpoint or 0.5 mL/min, whichever is largest.

Setpoint Status: **Pass**

Flow Type: **Carrier**

Setpoint: **400.0** mL/min Measured Flow: **396.4** mL/min

Accuracy: **3.6** mL/min

Agilent Recommended: **10.0** % setpoint ( **40.0** mL/min )

Limit is percentage of setpoint or 0.5 mL/min, whichever is largest.

Setpoint Status: **Pass**

Flow Type: **Makup**

Setpoint: **25.0** mL/min Measured Flow: **24.8** mL/min

Accuracy: **0.2** mL/min

Agilent Recommended: **10.0** % setpoint ( **2.5** 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: CN11021007

Page 2 / 21

เอกสารไม่ควบคุม

## Certificate of System Qualification

GC-OQ

System ID: CN11021007  
Organization Name: United Analyst and Engineering Consult Co., Ltd.  
Organization Location: 3 Soi Udomsak 41 Sukhumvit Rd., Bangkok, Bangkok Thailand 10260

Date: February 11, 2022 3:57:27 PM  
EQP Name: Agilent Recommended  
EQP Revision: GC.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 Decay

Name: **7890**

Front **SSL**

Setpoint Status: **Pass**

Pressure: **25.0** psi

Pressure Change: **-0.1** psi / 5 minutes

Agilent Recommended: **>= -2.0** and **<= 0.5**

Overall Inlet Pressure Decay Test Status: **Pass**

### Inlet Pressure Accuracy

Name: **7890**

Front **SSL**

Date: February 11, 2022 3:57:27 PM  
System ID: CN11021007

Page 1 / 21

เอกสารไม่ควบคุม

Test	System	Setpoint	Actual	Accuracy	Agilent Recommended	Limit
1	7890	25.0	25.0	0.0	1.2	0.5
2	7890	30.0	30.1	0.1	10.0	0.5
3	7890	400.0	396.4	3.6	10.0	0.5
4	7890	25.0	24.8	0.2	10.0	0.5

Page 10 / 10

Test	System	Setpoint	Actual	Accuracy	Agilent Recommended	Limit
1	7890	25.0	25.0	0.0	1.2	0.5
2	7890	30.0	30.1	0.1	10.0	0.5
3	7890	400.0	396.4	3.6	10.0	0.5
4	7890	25.0	24.8	0.2	10.0	0.5

Page 11 / 11

Date: February 11, 2022 3:57:27 PM  
System ID: CN11021007

Page 10 / 10

Test	System	Setpoint	Actual	Accuracy	Agilent Recommended	Limit
1	7890	25.0	25.0	0.0	1.2	0.5
2	7890	30.0	30.1	0.1	10.0	0.5
3	7890	400.0	396.4	3.6	10.0	0.5
4	7890	25.0	24.8	0.2	10.0	0.5

Page 12 / 12

Date: February 11, 2022 3:57:27 PM  
System ID: CN11021007

Page 10 / 10

Test	System	Setpoint	Actual	Accuracy	Agilent Recommended	Limit
1	7890	25.0	25.0	0.0	1.2	0.5
2	7890	30.0	30.1	0.1	10.0	0.5
3	7890	400.0	396.4	3.6	10.0	0.5
4	7890	25.0	24.8	0.2	10.0	0.5

Page 13 / 13

Date: February 11, 2022 3:57:27 PM  
System ID: CN11021007

Page 10 / 10

Test	System	Setpoint	Actual	Accuracy	Agilent Recommended	Limit
1	7890	25.0	25.0	0.0	1.2	0.5
2	7890	30.0	30.1	0.1	10.0	0.5
3	7890	400.0	396.4	3.6	10.0	0.5
4	7890	25.0	24.8	0.2	10.0	0.5

Page 14 / 14

Date: February 11, 2022 3:57:27 PM  
System ID: CN11021007

Page 10 / 10

เอกสารไม่ควบคุม

Test	System	Setpoint	Actual	Accuracy	Agilent Recommended	Limit
1	7890	25.0	25.0	0.0	1.2	0.5
2	7890	30.0	30.1	0.1	10.0	0.5
3	7890	400.0	396.4	3.6	10.0	0.5
4	7890	25.0	24.8	0.2	10.0	0.5

Date: February 11, 2022 3:57:27 PM  
System ID: CN11021007

Page 10 / 10

Test	System	Setpoint	Actual	Accuracy	Agilent Recommended	Limit
1	7890	25.0	25.0	0.0	1.2	0.5
2	7890	30.0	30.1	0.1	10.0	0.5
3	7890	400.0	396.4	3.6	10.0	0.5
4	7890	25.0	24.8	0.2	10.0	0.5

Date: February 11, 2022 3:57:27 PM  
System ID: CN11021007

เอกสารไม่ควบคุม

## Scouting Run

Tested Combination2	Front	SSL	/ Front	UECD
Name:	7890A			
Setpoint Status:	Completed			
Injection Volume on Column:	1.0 $\mu$ L			
Overall Scouting Run Status	Completed			

## Noise and Drift

Tested Combination2	Front	SSL	/ Front	UECD
Name:	7890			
Setpoint Status:	Pass			
Base Signal:	282.3 Hz			
ASTM Noise	Drift			
Hz	Hz/Hr			
0.60	13.19			
$\leq$ 3.00	$\leq$ 15.00			
Agilent Recommended:				
Status:	Pass			

## Overall Noise and Drift Test Status

Pass

## Injection Precision

Tested Combination2	Front	SSL	/ Front	UECD
Name:	7893A			

Date: February 11, 2022 3:57:27 PM  
System ID: CN11021007

Page 6 / 21

เอกสารไม่ควบคุม

Setpoint Status:	Pass			
Base Signal:	11.2	pA	ASTM Noise	Drift
			pA/Hr	
			0.06	0.31
Agilent Recommended:	$\leq$	0.10	$\leq$	2.50
Status:	Pass		Pass	

## Overall Noise and Drift Test Status

Pass

## Injection Precision

Tested Combination1	Front	SSL	/ Back	FID
Name:	7893A			
Setpoint Status:	Pass			
Injection Volume on Column:	1.0	$\mu$ L		
Area RSD:	0.38	%	Retention Time RSD:	0.55 %
Agilent Recommended:	$\leq$	3.00	$\leq$	1.00

## Overall Injection Precision Test Status

Pass

## Signal to Noise

Tested Combination1	Front	SSL	/ Back	FID
Name:	7890			
Setpoint Status:	Pass			
Signal to Noise:	784901			
Agilent Recommended:	$\geq$ 300000			

## Overall Signal to Noise Test Status

Pass

Date: February 11, 2022 3:57:27 PM  
System ID: CN11021007

Page 5 / 21

เอกสารไม่ควบคุม

## Overall GC Oven Temperature Accuracy Test Status

Pass

## GC Oven Temperature Stability

Name:	7890			
Setpoint Status:	Pass			
Setpoint/Average				
Temperature:	100.0	100.2187	$^{\circ}$ C	
Stability:	0.1 $^{\circ}$ C			
Agilent Recommended:	$\leq$ 0.5			

## Overall GC Oven Temperature Stability Test Status

Pass

## Scouting Run

Tested Combination1	Front	SSL	/ Back	FID
Name:	7893A			
Setpoint Status:	Completed			
Injection Volume on Column:	1.0 $\mu$ L			
Overall Scouting Run Status	Completed			

## Noise and Drift

Tested Combination1	Front	SSL	/ Back	FID
Name:	7890			

Date: February 11, 2022 3:57:27 PM  
System ID: CN11021007

Page 4 / 21

เอกสารไม่ควบคุม

## Overall Detector Flow Accuracy Test Status

Pass

## Detector Flow Accuracy

Name:	7890			
	Front	UECD		
Setpoint Status:	Pass			
Flow Type:	Makeup			
Setpoint:	25.0	mL/min	Measured Flow:	24.8 mL/min
Accuracy:	0.2 mL/min			
Agilent Recommended:	$\leq$	10.0	% setpoint	( 2.5 mL/min )
Limit is percentage of setpoint or 0.5 mL/minute, whichever is largest.				

## Overall Detector Flow Accuracy Test Status

Pass

## GC Oven Temperature Accuracy

Name:	7890			
Setpoint Status:	Pass			
Zone:	Oven			
Setpoint/Actual				
Temperature:	230.0	230.3	$^{\circ}$ C	
Accuracy:	0.3 $^{\circ}$ C			
Agilent Recommended:	$\geq$	-1.0	% setpoint in K	( -5.0 $^{\circ}$ C )
	$\leq$	1.0	% setpoint in K	( 5.0 $^{\circ}$ C )
Setpoint Status:	Pass			
Zone:	Oven			
Setpoint/Actual				
Temperature:	100.0	100.2	$^{\circ}$ C	
Accuracy:	0.2 $^{\circ}$ C			
Agilent Recommended:	$\geq$	-1.0	% setpoint in K	( -3.7 $^{\circ}$ C )
	$\leq$	1.0	% setpoint in K	( 3.7 $^{\circ}$ C )

Date: February 11, 2022 3:57:27 PM  
System ID: CN11021007

Page 3 / 21

เอกสารไม่ควบคุม

Detector 2	
Manufacturer	Agilent Technologies
Name	7890
Type	UECD
Serial Number	U16886
Adapter	Capillary
Control Type	Electronic Pressure Control (EPC)
Location	Front
Makeup Gas	Nitrogen

Sampler 2	
Manufacturer	Agilent Technologies
Type	Tray
Name	7683A
Model Number	G2614A
Serial Number	CN82246787
Firmware Revision	A.02.01
Mainframe 1	
Manufacturer	Agilent Technologies
Name	7890
Model Number	G3440A
Serial Number	CN11021007
Firmware Revision	A.01.11
Oven Type	Standard
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	7690
Type	FID
Adapter	Capillary
Control Type	Electronic Pressure Control (EPC)
Location	Back
Makeup Gas	Nitrogen

Date: February 11, 2022 3:57:27 PM  
System ID: CN11021007

Page 10 / 21

เอกสารไม่ควบคุม

Date: February 11, 2022 3:57:27 PM  
System ID: CN11021007

Page 9 / 21

เอกสารไม่ควบคุม

## Instrument Details

Purpose  
This section describes the as found system configuration.

Details	
System	
System ID	UAE.TOX.007
Manufacturer	Agilent Technologies
Name	7890
Flow Data Input	Manual Data
Temperature Data Input	Manual Data or Other Data Logging
Tested Combination1	
Injection Technique	Injection Tower
Inlet	Front
Detector	Back
LTM Included?	No
Tested Combination2	
Injection Technique	Injection Tower
Inlet	Front
Detector	Front
LTM Included?	No
Sampler 1	
Manufacturer	Agilent Technologies
Type	Injection Tower
Name	7683A
Model Number	G2613A
Serial Number	CN82149436
Firmware Revision	A.11.02
Usage	Sample Injection
Location	Front
Syringe Volume (µL)	10

Setpoint Status:	Pass			
Injection Volume on Column:	1.0	µL		
Ava RSD:	1.14	%	Retention Time RSD:	0.04 %
Agilent Recommended:	<=	3.00	<=	1.00

Overall Injection Precision Test Status  
Pass

## Signal to Noise

Tested Combination2	Front	SSL	/ Front	UECD
Injection Tower				
Name:	7890			
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: CN11021007

Page 6 / 21

เอกสารไม่ควบคุม

Date: February 11, 2022 3:57:27 PM  
System ID: CN11021007

Page 7 / 21

เอกสารไม่ควบคุม

User Name: asengulal.sarav

Hardware: LAPTOP-CQ3J65M5

System ID: CV11031967

Print Date: February 11, 2023 5:57:48 PM

DQ\_UAE\_TOX081 Transaction log :

Time	Transaction Date	Activity performed	Type of Transaction	Optional Information
February 11, 2023 5:57:48 PM	End	Execution	Weld Pressure Accuracy - Front SIL - Pressure Controlled state - S: 25.0 psi-L: <= 1.2 psi	Run Count : 1
February 11, 2023 5:57:54 PM	Start	Execution	Detector Flow Accuracy - Back FID - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	None
February 11, 2023 5:58:02 PM	Avail	Date	Detector Flow Accuracy - Back FID - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
February 11, 2023 5:58:10 PM	End	Execution	Detector Flow Accuracy - Back FID - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
February 11, 2023 5:58:12 PM	Start	Execution	Detector Flow Accuracy - Back FID - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	None
February 11, 2023 5:58:48 PM	Avail	Date	Detector Flow Accuracy - Back FID - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
February 11, 2023 5:58:52 PM	End	Execution	Detector Flow Accuracy - Back FID - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
February 11, 2023 5:58:56 PM	Start	Execution	Detector Flow Accuracy - Back FID - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	None
February 11, 2023 5:59:16 PM	Avail	Date	Detector Flow Accuracy - Back FID - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
February 11, 2023 5:59:20 PM	End	Execution	Detector Flow Accuracy - Back FID - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Run Count : 1

Page 23 / 100

Date: February 11, 2022 3:57:27 PM  
System ID: CN11021007

Page 14 / 21

## เอกสารไม่ควบคุม

User Name: saasgudraJarak

Host Name: LAPTOP-G83XGJ0K

System ID: CM1021967

Print Date: February 11, 2022 3:57:39 PM

CQ\_MAIL\_TOOL407 Troubleshoot log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
February 09, 2022 1:31:52 PM	Auth	SessionCreated	Session	None
February 09, 2022 1:31:52 PM	Start	Configuration	Session	None
February 09, 2022 1:31:52 PM	AuthN	Establishment	Licensing	User is verifying and does not create an unlock code
February 09, 2022 1:30:00 PM	AuthN	ExpireLock	Session	EQP details for primary technique [CQ - File path: [ProtocolPathSet/Config/lock/02.51/0c.02.51.asp], EQP File Name: [0c.02.51.asp], EQP Name: [yellow@recommended]
February 10, 2022 1:30:49 PM	AuthN	AccClosed	Session	None
February 10, 2022 1:41:08 PM	AuthN	AccRestricted	Session	None
February 10, 2022 1:41:08 PM	AuthN	SessionReleased	Session	None
February 10, 2022 1:41:00 PM	AuthN	ExpireLock	Session	EQP details for primary technique [CQ - File path: [ProtocolPathSet/Config/lock/02.51/0c.02.51.asp], EQP File Name: [0c.02.51.asp], EQP Name: [yellow@recommended]
February 10, 2022 1:47:52 PM	AuthN	AccClosed	Session	None
February 11, 2022 5:04:03 PM	AuthN	AccRestricted	Session	None

Page 1 / 10

Date: February 11, 2022 3:57:27 PM  
System ID: CN110321007

Page 12/29

## เอกสารไม่ควบคุม

Time	Transaction Date	Activity Performed	Type of Transaction	Optional Information
February 11, 2022 2:08:25 PM	Auto	Smoker Released	Session	None
February 11, 2022 2:06:21 PM	Auto	Exp. Loaded	Session	EQP. Visible for primary activities [OK] - File path: [ProcessFolder]\Config\Control\one62.6156.02.01.asp, [EQP File Name]: [On.02.01.asp], EQP Name: [qwert\Recommend]
February 11, 2022 2:09:50 PM	End	Configuration	Session	None
February 11, 2022 2:06:58 PM	Start	Qualification	Session	OK
February 11, 2022 2:06:09 PM	Start	Execution	System Inspection and Basic Safety and Operation - 7890 - Qualitative Test - No response associated	None
February 11, 2022 2:07:18 PM	End	Execution	System Inspection and Basic Safety and Operation - 7890 - Qualitative Test - No response associated	Run Count: 1
February 11, 2022 2:07:21 PM	Start	Execution	Hot Pressure Decay - Front SQL - Pressure Controlled Init. - 0. 25.0 psi - L: == -0.0 psi and == 0.0 psi	None
February 11, 2022 2:07:26 PM	End	Execution	Hot Pressure Decay - Front SQL - Pressure Controlled Init. - 0. 25.0 psi - L: == -0.0 psi and == 0.0 psi	Run Count: 1
February 11, 2022 2:07:07 PM	Start	Execution	Hot Pressure Accuracy - Front SQL - Pressure Controlled Init.	None

Page 2410

Date: February 11, 2022 3:57:27 PM  
System ID: CN11121007

Page 13 / 29

## เอกสารไม่ควบคุม

### Electronic Signature

### Purpose

This signature page was created and published because the ACE sign-off action was executed, which is valid for the entire document, including attachments. The ACE sign-off is an electronic signature that requires two distinct identification components: unique username and personal password. The Agent representative who has delivered this service understands the meaning and legal status of an electronic signature. As a trained official operator, the Agent representative has a unique password and logo to access ACE and electronically sign this document. (Other e-signatures can be applied to this document using a Document Content Management or other suitable method defined in your data access and control procedures.)

### Details

Full Name of Signer:	Saenguthai Tanik
Logged On User Name:	saenguthai.tanik@econ.agilent.com
Signature Creation Date:	February 11, 2022
Reason for Signature:	Executed protocol and published this original version of document

### Regulatory Disclaimer

This document provides a protocol to verify and record instrument configuration and evidence of proper operation. It has been prepared from our interpretation of applicable regulations as well as industry best practices. The document is designed to provide an impartial component of a complete compliance package. Validation depends upon many factors and use of this protocol alone does not assure compliance. Apogee Technologies makes no promises or representations as to its sufficiency for any specific regulatory program.

### Warranty

Agilent Technologies makes no warranty of any kind to this material, including but not limited to, the implied warranties or merchantability and fitness for a particular purpose. Agilent Technologies shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material.

Date: February 11, 2022 3:57:27 PM  
System ID: CN11021007

Page 11 / 21

## เอกสารไม่ควบคุม

Time	Transaction Date	Activity Performed	Type of Transaction	Optional Information
February 11, 2022 2:17:12 PM	Auto	Data	Injection Precision - Injection Tower, Front SIS, Back PID - GC - L (Ave) => 3.00% - L (Rel. Time) => 1.00%	Data File Path : E:\QC2022\QC2022-2022-02-10-13-42-14QC_GCTRM_PID_Pvt103.D\FID103.ch
February 11, 2022 2:17:13 PM	Auto	Data	Injection Precision - Injection Tower, Front SIS, Back PID - GC - L (Ave) => 3.00% - L (Rel. Time) => 1.00%	Data File Path : E:\QC2022\QC2022-2022-02-10-13-42-14QC_GCTRM_PID_Pvt105.D\FID105.ch
February 11, 2022 2:17:15 PM	Auto	Data	Injection Precision - Injection Tower, Front SIS, Back PID - GC - L (Ave) => 3.00% - L (Rel. Time) => 1.00%	Data File Path : E:\QC2022\QC2022-2022-02-10-15-43-14QC_GCTRM_PID_Pvt157.D\FID15.ch
February 11, 2022 2:17:35 PM	End	Execution	Injection Precision - Injection Tower, Front SIS, Back PID - GC - L (Ave) => 3.00% - L (Rel. Time) => 1.00%	Run Count : 1
February 11, 2022 2:17:48 PM	Start	Execution	Signal to Release - Injection Tower, Front SIS, Back PID - Detector FID - L => 300000	None
February 11, 2022 2:18:08 PM	Start	Execution	Signal to Release - Injection Tower, Front SIS, Back PID - Detector FID - L => 300000	None
February 11, 2022 2:18:23 PM	Auto	Data	Signal to Release - Injection Tower, Front SIS, Back PID - Detector FID - L => 300000	Data File Path : E:\QC2022\QC2022-2022-02-10-15-43-14QC_GCTRM_PID_Pvt111.D\FID11.ch
February 11, 2022 2:18:52 PM	Start	Execution	Signal to Release - Injection Tower, Front SIS, Back PID - Detector FID - L => 300000	None

Page 7 / 10

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
February 11, 2022 2:15:57 PM	AcqB	Data	Noise and Drift - Back PID -> Detector PID - L (Noise) => 9.10 $\mu$ A - L (Drift) => 2.90 $\mu$ A/hour	Data File Path : E:\OG2022\NOG_PID_BackDrift.D\FID18.ch
February 11, 2022 2:16:06 PM	End	Execution	Noise and Drift - Back PID -> Detector PID - L (Noise) => 9.10 $\mu$ A - L (Drift) => 2.90 $\mu$ A/hour	Run Count : 1
February 11, 2022 2:16:39 PM	Start	Execution	Injection Procedure - Injection Tower, Front SIS, Back PID -> GC - L (Flow) => 3.00% - L (Ret. Time) => 1.00%	None
February 11, 2022 2:16:47 PM	Start	Execution	Injection Procedure - Injection Tower, Front SIS, Back PID -> GC - L (Flow) => 3.00% - L (Ret. Time) => 1.00%	None
February 11, 2022 2:17:12 PM	AcqB	Data	Injection Procedure - Injection Tower, Front SIS, Back PID -> GC - L (Flow) => 3.00% - L (Ret. Time) => 1.00%	Data File Path : E:\OG2022\NOG10312022-02-10 13-00-14\OG_SCTERR_PID_Prob18.D\FID18.ch
February 11, 2022 2:17:12 PM	AcqB	Data	Injection Procedure - Injection Tower, Front SIS, Back PID -> GC - L (Flow) => 3.00% - L (Ret. Time) => 1.00%	Data File Path : E:\OG2022\OG2022-02-10 13-00-14\OG_SCTERR_PID_Prob18.D\FID18.ch
February 11, 2022 2:17:12 PM	AcqB	Data	Injection Procedure - Injection Tower, Front SIS, Back PID -> GC - L (Flow) => 3.00% - L (Ret. Time) => 1.00%	Data File Path : E:\OG2022\OG2022-02-10 13-00-14\OG_SCTERR_PID_Prob18.D\FID18.ch

Page 6 of 10

Date: February 11, 2022 3:57:27 PM  
System ID: CN11021037

Page 18 / 21

## เอกสารไม่ควบคุม

Date: February 11, 2022 3:57:27 PM  
System ID: CN18021007

Page 17 / 21

## เอกสารไม่ควบคุม

User Name: samsgrubbs@nsls			System ID: D011001007	
Host Name: LAPTOP-QG58MD6V			Print Date: February 11, 2022 2:57:30 PM	
OG_UAS_TDC.M7 Transaction log:				
Time	Transaction Date	Activity Performed	Type of Transaction	Optional Information
February 11, 2022 2:10:43	End PM	Execution	GC Oven Temperature Accuracy - TERN - Temperature Oven - 5: 350.0°C - L: +/- 1.0 AND +/- 1.0 % setpoint is 5	Run Count: 1
February 11, 2022 2:10:46	Start PM	Execution	GC Oven Temperature Stability - TERN - Temperature - Oven - 8: 350.0°C - L: +/- 0.5°C	None
February 11, 2022 2:11:37	Audit PM	Data	GC Oven Temperature Stability - TERN - Temperature - Oven - 8: 350.0°C - L: +/- 0.5°C	Manual Data Entry
February 11, 2022 2:11:38	End PM	Execution	GC Oven Temperature Stability - TERN - Temperature - Oven - 8: 350.0°C - L: +/- 0.5°C	Run Count: 1
February 11, 2022 2:11:44	Start PM	Execution	GC Sampling Run - Injection Tower, Front SLS, Back FID - Part of System Preparation - No bottle associated	None
February 11, 2022 2:14:12	Block PM	Execution	GC Sampling Run - Injection Tower, Front SLS, Back FID - Part of System Preparation - No bottle associated	None
February 11, 2022 2:16:45	Audit PM	Data	GC Sampling Run - Injection Tower, Front SLS, Back FID - Part of System Preparation - No bottle associated	Date Time Path: ENCLOSURE_TDC_FID_Batch.
February 11, 2022 2:16:18	End PM	Execution	GC Sampling Run - Injection Tower, Front SLS, Back FID - Part of System Preparation - No bottle associated	Run Count: 1
February 11, 2022 2:16:22	Start PM	Execution	Valve and DB - Back FID - Detector FID - L (Flow) -> 0.5ml/min - L (Flow) -> 0.5	None

Figure 5.1.10

Time	Transmission State	Activity Performed	Type of Transaction	Optional Information
February 11, 2022 2:59:29 PM	Start	Execution	Detective Flow Accuracy - Front UECG - Type : Makeup - S: 25.0 m/Ank - L: <= 10.0% setpoint	None
February 11, 2022 2:58:50 PM	Awil	Data	Detective Flow Accuracy - Front UECG - Type : Makeup - S: 25.0 m/Ank - L: <= 10.0% setpoint	Manual Data Entry
February 11, 2022 2:58:54 PM	End	Execution	Detective Flow Accuracy - Front UECG - Type : Makeup - S: 25.0 m/Ank - L: <= 10.0% setpoint	Run Count : 1
February 11, 2022 2:09:58 PM	Start	Execution	GC Oven Temperature Accuracy - 7883 - Temperature / Oven - S: 230.0°C - L: <= -1.0 AND <= 1.0 % setpoint in K	None
February 11, 2022 2:10:10 PM	Awil	Data	GC Oven Temperature Accuracy - 7883 - Temperature / Oven - S: 230.0°C - L: <= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry
February 11, 2022 2:10:20 PM	End	Execution	GC Oven Temperature Accuracy - 7882 - Temperature / Oven - S: 230.0°C - L: <= -1.0 AND <= 1.0 % setpoint in K	Run Count : 1
February 11, 2022 2:10:20 PM	Start	Execution	GC Oven Temperature Accuracy - 7860 - Temperature / Oven - S: 108.0°C - L: <= -1.0 AND <= 1.0 % setpoint in K	None
February 11, 2022 2:10:41 PM	Awil	Data	GC Oven Temperature Accuracy - 7860 - Temperature / Oven - S: 100.0°C - L: <= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry

Page 4 / 10

Date: February 11, 2022 3:57:27 PM  
System ID: CN11021007

Page 16 / 21

## เอกสารไม่ควบคุม

Date: February 11, 2022 3:57:27 PM  
System ID: CN11021007

Page 15 / 21

## เอกสารไม่ควบคุม


Page 21 / 21Page 9/10Page 6 / 10







[illegible][illegible][illegible]

9-PPV by Agilent Technologies  
 Acquisition Date: 08/04/2015  
 Acquisition Method: GC-MSD-1  
 Data Directory for this Job: GC-MSD-1\_2015\_08\_04  
 Acquisition File: 01-PPV.D  
  
 Overall Acquisition Parameters: Total Ions  
 (0.000000 - 10.000000)

[illegible][illegible][illegible][illegible][illegible][illegible]

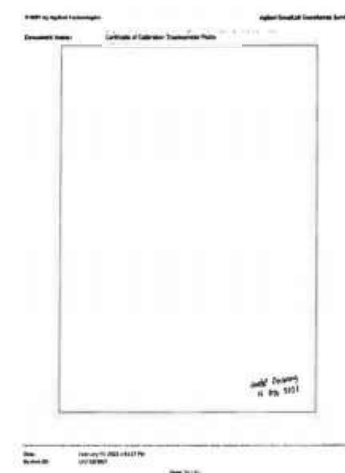
K1001 1 kg, higher Temperature		K1002 500 g, 100 g and 50 g	
Product identifier	Sample Name/Type		
Manufacturer/Supplier	MSD, VET, Zurich, CH-8048		
Date of manufacture or receipt	14/12/2016, lot 0241-12		
Production Date	11/10/16, 12/16/17		
Examination Parameters			
Type of inspection	Inspection		
Inspection method	5		
Media/Matrix			
Statistical distribution/Model	Advanced		
Test or Test as Secondary	15		
Initial Pool Size/Size	50/10		
Initial Pool Depth/2	1		
Initial Sample Number	100		
Test/Exam/ Test			
Inspection Type	Value	Time	
Inspection	1000	0	
Inspection	100	0.5	
Inspection	1000	10	

[illegible]

# 600 Hz 1000 Hz Transposition  
 Acquisition location: Unsupervised Train  
 Acquisition sample: 001\_001\_Peaks\_001.00  
 Acquisition method: 001\_001\_Peaks\_001.00  
 Date file was saved for this job: 001\_001\_Peaks\_001.00  
 Acquisition time: 001\_001\_Peaks\_001.00  
 Acquisition method: 001\_001\_Peaks\_001.00  
 Date file was saved for this job: 001\_001\_Peaks\_001.00  
 Acquisition time: 001\_001\_Peaks\_001.00

[illegible][illegible]





เอกสารไม่ควบคุม

เอกสารไม่ควบคุม



เอกสารไม่ควบคุม

เอกสารไม่ควบคุม





## Calibration Report

Certificate No.: 2202093-001-01  
 Equipment: pH Meter  
 Resolution: 0.01 pH ± 1 mV  
 Manufacturer: METTLER TOLEDO  
 Model: SevenEasy pH  
 Serial No.: 120028212  
 Type: Bench top  
 ID No.: UAE.WAS.003/2553

Date of Calibration: 16 March 2022 Page 2 of 5

### Calibration Results:

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=1)
		mV	pH		
0	414.117	414	0.00	0.03	2.60
2	293.811	296	3.00	0.58	2.50
4	177.452	178	4.00	0.58	2.63
6	59.103	59	6.00	0.58	2.60
7	-0.001	0	7.00	0.58	2.00
8	-89.155	-83	8.00	0.58	2.08
10	-177.453	-177	10.00	0.58	2.50
12	-285.812	-286	12.00	0.58	2.00
14	-414.112	-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: InLab Solids  
 Serial No.: 9453043  
 ID No.: N/A

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

Certified Value (25 °C (ppH))	Average Indicator Reading		Relative Slope (%)	Uncertainty (± pH)	Coverage Factor (k=1)
	pH	mV			
4.008	4.01	173	96.1	0.0071	2.30
6.866	6.87	8	-	0.0074	2.30
10.013	10.01	-175	97.4	0.0090	2.30
6.923	6.98	-8	-	0.0092	2.30

FCS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

## Calibration Report

Certificate No.: 2202093-001-01  
 Equipment: pH Meter  
 Resolution: 0.01 pH ± 1 mV  
 Manufacturer: METTLER TOLEDO  
 Model: SevenEasy pH  
 Serial No.: 120028212  
 Type: Bench top  
 ID No.: UAE.WAS.003/2553

Date of Calibration: 16 March 2022 Page 2 of 8

### Location:

Chemical Calibration Laboratory, National Food Institute

Environment Condition: Ambient Temperature: [ 23.0 ± 1.3 ] °C Relative Humidity: ( 49.3 ± 3.5 ) %

Condition of Equipment: Good Condition

Condition of this Results of Calibration

1. Calibration Method: In house method: WCOD-002 based on direct measurement by using standard voltage calibration and certified reference material (CRM)

2. Reference Standards / Certified Reference Material

Reference	Serial / ID No.	Manufacturer	Certificate No.	Exp. Date
2.1 DC Voltage Calibrator	2709007	Fluke	SCI-217-0067	21 June 2022
2.2 Digital Thermometer	2709007	Fluke	OC-643559-01	30 October 2022
2.3 Thermo-Hygro Meter	area AU181-000558	POMPE	CR21-2787	13 November 2022

Certified Reference Material	Lot No.	Manufacturer	Serial	Expiry Date
2.4 pH buffer 4.008 (Primary pH buffer Solution)	730142	CPAchem	PH218.LS	21 November 2023
2.5 pH buffer 6.862 (Primary pH buffer Solution)	730143	CPAchem	PH217.LS	21 November 2023
2.6 pH buffer 10.01 (Primary pH buffer Solution)	730145	CPAchem	PH220.LS	21 November 2022
2.7 pH buffer 7.00 (Standard pH buffer Solution)	770240	CPAchem	PH107.LS	9 November 2022

3. This calibration is traceable to The International System of Units (SI Unit)

3.1 Instruments No. 3.1	through	NSC-TIS-715 17025 Laboratory Accreditation of Calibration No.0075
3.2 Instruments No. 3.2	through	NSC-TIS-715 17025 Laboratory Accreditation of Calibration No.0061
3.3 Instruments No. 3.3	through	NSC-TIS-715 17025 Laboratory Accreditation of Calibration No.0262
3.4 Certified Reference Material No. 2.4 to 2.6	traceable to	Primary measurement method: Normal cell using calibrated thermometer, barometer, and aneroidometer. 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	RM Water H17 Lot# 10-04-2020, RM Ref# 16-5 Lot# 23-05-2020, RM Ref# H1A Lot# 20-04-2020, RM Ref# H1B Lot# 23-05-2020. 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.

FCS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

## Calibration Certificate

Certificate No.: 2202093-001-01  
 Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.  
 Address: 3 Soi Udonwut 41, Sukhumvit Road,  
 Bangchack, Prakanong, Bangkok 10263

Page 1 of 5

Equipment: pH Meter  
 Manufacturer: METTLER TOLEDO  
 Model: SevenEasy pH  
 Serial No.: 120028212  
 ID No.: UAE.WAS.003/2553  
 Order No.: 2202093  
 Operation No.: 2202093-001  
 Date of Receipt: 11 March 2022  
 Date of Calibration: 16 March 2022

Calibrated by: Mr. Manus Somrak  
 Specialist  
 Approved by: (Mr. Phongsak Tuntit)  
 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 capability to recognize national standards and in the units of measurement relevant to the corresponding national standards laboratory. This certificate may not be reproduced other than in full scope with the prior written approval of the National Food Institute.

FCS-005 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

1. 2021 by Agilent Technologies	Agilent Technologies (Continued)	2. 2021 by Agilent Technologies	Agilent Technologies (Continued)
<p>Agilent Technologies (Continued)</p> <p>Model: 1200 Series</p> <p>Serial: 1200 Series</p> <p>Lot: 1200 Series</p> <p>Calibration: 1200 Series</p> <p>Uncertainty: 1200 Series</p> <p>Coverage Factor: 1200 Series</p>	<p>Agilent Technologies (Continued)</p> <p>Model: 1200 Series</p> <p>Serial: 1200 Series</p> <p>Lot: 1200 Series</p> <p>Calibration: 1200 Series</p> <p>Uncertainty: 1200 Series</p> <p>Coverage Factor: 1200 Series</p>	<p>Agilent Technologies (Continued)</p> <p>Model: 1200 Series</p> <p>Serial: 1200 Series</p> <p>Lot: 1200 Series</p> <p>Calibration: 1200 Series</p> <p>Uncertainty: 1200 Series</p> <p>Coverage Factor: 1200 Series</p>	<p>Agilent Technologies (Continued)</p> <p>Model: 1200 Series</p> <p>Serial: 1200 Series</p> <p>Lot: 1200 Series</p> <p>Calibration: 1200 Series</p> <p>Uncertainty: 1200 Series</p> <p>Coverage Factor: 1200 Series</p>

3. 2021 by Agilent Technologies	Agilent Technologies (Continued)
<p>Agilent Technologies (Continued)</p> <p>Model: 1200 Series</p> <p>Serial: 1200 Series</p> <p>Lot: 1200 Series</p> <p>Calibration: 1200 Series</p> <p>Uncertainty: 1200 Series</p> <p>Coverage Factor: 1200 Series</p>	<p>Agilent Technologies (Continued)</p> <p>Model: 1200 Series</p> <p>Serial: 1200 Series</p> <p>Lot: 1200 Series</p> <p>Calibration: 1200 Series</p> <p>Uncertainty: 1200 Series</p> <p>Coverage Factor: 1200 Series</p>

FCS-005 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

## Calibration Report

Certificate No.: 2203527-001-01  
Equipment: pH Meter  
Manufacturer: METTLER TOLEDO  
Model: Seven Compact 5228  
Serial No.: C113432421  
ID No.: UAE.WAT.008/2564  
Resolution: 0.01 pH ; 1 mV  
Type: Bench top

Date of Calibration: 5 July 2022 Page 2 of 5

Location: Calibration Laboratory, National Food Institute  
Environment Condition: Ambient Temperature: ( 23.0 ± 1.0 ) °C Relative Humidity: ( 53 ± 5 ) %  
Condition of Equipment: Good Condition  
Condition of this Results of Calibration:

1. Calibration Method: In house method: W-CC-025 based on direct measurement by using standard voltage calibration and certified reference material (CRM)

2. Reference Standards / Certified Reference Material:

Instrument	Serial / ID No.	Manufacturer	Certificate No.	Due Date
2.1 DC Voltage Calibrator	2729007	Fluke	22E1369	17 June 2023
2.2 Digital Thermometer	2703007	Fluke	CD-640599-01	30 October 2022
2.3 Tenova Hygro Meter	W147H020716	PCWPE	OK727-0301	18 February 2023
Certified Reference Material				
	Lot No.	Manufacturer	Batch	Expiry Date
2.4 pH buffer 4.008 (Primary pH buffer Solution)	810203	CPAchem	PH016.LS	21 April 2024
2.5 pH buffer 5.005 (Primary pH buffer Solution)	805304	CPAchem	PH017.LS	21 April 2024
2.6 pH buffer 7.001 (Primary pH buffer Solution)	805203	CPAchem	PH020.LS	21 April 2023
2.7 pH buffer 7.00 (Standard pH buffer Solution)	300206	CPAchem	PH017.LS	21 April 2023

3. This calibration is traceable to The International System of Unit (SI Unit)

3.1 Instruments No.2.1	through	NSC-TS1-TIS 17025 Laboratory Accreditation of Calibration No.0075
3.2 Instruments No.2.2	through	NSC-TS1-TIS 17025 Laboratory Accreditation of Calibration No.0091
3.3 Instruments No.2.3	through	NSC-TS1-TIS 17025 Laboratory Accreditation of Calibration No.0292
3.4 Certified Reference Material No. 2.4 to 2.6	traceable to	Primary measurement method: Based on using calibrated thermometer, balances, and nanothermometer. The Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17054 and ISO/IEC 17025
3.5 Certified Reference Material No.2.7	traceable to	SRM Refs H-27 Lot# 04.06.2021; SRM Refs H-28 Lot# 28.03.2021; SRM Refs H-27 Lot# 04.06.2021; SRM Refs H-28 Lot# 28.03.2021, 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-C5-012 Revision: 01 Date: 20-04-65

เอกสารไม่ควบคุม  
3000 Soi 30, Anusara Road, Bang 11, Lat Phah Subdistrict, Bang Phai District, Bangkok 10710, Thailand  
Tel: +66(0) 2462 5500 Fax: +66(0) 2462 5505

## Calibration Certificate

Certificate No.: 2203527-001-01  
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.  
Address: 3 Soi Udomsuk 41, Sukhumvit Road, Bangchack, Prakhnong, Bangkok 10268

Equipment: pH Meter

Manufacturer: METTLER TOLEDO

Model: Seven Compact 5228

Serial No.: C113432421

ID No.: UAE.WAT.008/2564

Order No.: 2203527

Operation No.: 2203527-001

Date of Receipt: 30 June 2022

Date of Calibration: 5 July 2022

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

Date of Issue: 5 July 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 addressed the measurement capability of the laboratory and its traceability to recognized national standards and in the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full, except with the prior written approval of the National Food Institute.

F-C5-009 Revision: 01 Date: 20-04-65

เอกสารไม่ควบคุม  
3000 Soi 30, Anusara Road, Bang 11, Lat Phah Subdistrict, Bang Phai District, Bangkok 10710, Thailand  
Tel: +66(0) 2462 5500 Fax: +66(0) 2462 5505

## Calibration Report

Certificate No.: 2202094-001-01  
Equipment: Digital Thermometer with RTD (pH Meter)  
Resolution: 0.1 °C  
Model: SevenEasy pH  
Serial No.: 1230525212  
ID No.: UAE.WAS.003/2563  
Manufacturer: METTLER TOLEDO  
Date of Calibration: 16 March 2022 Page 3 of 5

Calibration point: 16.0, 25.0 and 35.0 °C  
Calibration result:

- The probe was immersed in liquid bath or dry bath to a minimum depth of 120 mm.  
- Description of probe, model: N/A SN: N/A  
Dimension of probe: Diameter 3.5 mm, Length 138 mm.  
Sheath material: Stainless Steel

UUC Reading (°C)	Standard Temperature (°C)	Correction Value (°C)	Uncertainty ± (°C)
16.2	16.001	-0.2	0.009
25.3	25.002	-0.2	0.009
35.2	35.002	-0.2	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 %.

— End —

เอกสารไม่ควบคุม

F-C5-012 Revision: 00 Date: 14-12-61

## Calibration Report

Certificate No.: 2202094-001-01  
Equipment: Digital Thermometer with RTD (pH Meter)  
Resolution: 0.1 °C  
Model: SevenEasy pH  
Serial No.: 1230525212  
ID No.: UAE.WAS.003/2563  
Manufacturer: METTLER TOLEDO  
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:

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

2. Reference Standard Instrument:

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
HANDHELD THERMOMETER	1523	2118154	PSL-T 085184	24-Jun-22	TISTR
Platinum Resistance Thermometer (PRT)	5027A	877332			

Support Equipment: Low Temperature Bath (ISOCAL-6), Model: Europa-6 Plus Basic, SN: 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-C5-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม



## Certificate of Calibration

**Equipment:** CONDUCTIVITY METER  
**Model:** Lab956  
**Serial No. (or ID):** 16300356  
**Manufacturer:** SI Analytic  
**Electrode Serial No.** 16070067  
**Condition:** In Condition

**Certificate No.:** C24220094  
**Issued Date:** 22 March 2022  
**Job No.:** KSPR2203267  
**Page:** 1 of 2  
**Model:** LF413T **Brand:** SI Analytic

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

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

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

**Calibration By:** Mr. Wasan Nuchabee  
**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



Part of DKSH Group



## Calibration Report

**Certificate No.:** 2203527-001-01  
**Equipment:** Digital Thermometer with RTD  
**Resolution:** 0.1 °C **Model:** Seven Compact 5220  
**Serial No.:** C113432421 **ID No.:** UAE.WAT.009/2564  
**Manufacturer:** METTLER TOLEDO

**Date of Calibration:** 5 July 2022 Page 5 of 5

**Calibration point:** 15.0, 25.0 and 35.0 °C

**Calibration result:**  
 - The probe was immersed in liquid bath or dry bath to a minimum depth of 120 mm.  
 - Description of probe, model: S/N: -  
 - Dimension of probe: Diameter 9 mm, Length 120 mm,  
 - Sheath material: Stainless Steel

UUC* Reading (°C)	Standard Temperature (°C)	Correction Value (°C)	Uncertainty ± (°C)
15.1	15.038	- 0.1	0.12
25.1	25.038	- 0.1	0.12
35.2	35.024	- 0.2	0.12

**Note**  
 - UUC\* : Unit Under Calibration

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

End

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

SPC RT Co., Ltd.  
 1194 Soi Wachirathamsathit 57, Sukhumvit 101/1 Rd.,  
 Bangchak, Prakanong, Bangkok 10260 Thailand  
 Tel: 0 266 4333 Ext. 3300-3308 Fax: 0 266 4444 Email: info@spcrt.com Website: www.spcrt.com

เอกสารไม่ควบคุม  
 SPCC-FM-C24-06: 23 Nov 2020

เอกสารไม่ควบคุม  
 2203527-001-01  
 1194 Soi Wachirathamsathit 57, Sukhumvit 101/1 Rd.,  
 Bangchak, Prakanong, Bangkok 10260 Thailand  
 Tel: 0 266 4333 Ext. 3300-3308 Fax: 0 266 4444 Email: info@spcrt.com Website: www.spcrt.com



## Calibration Report

**Certificate No.:** 2203527-001-01  
**Equipment:** Digital Thermometer with RTD  
**Resolution:** 0.1 °C **Model:** Seven Compact 5220  
**Sensi No.:** C113432421 **ID No.:** UAE.WAT.009/2564  
**Manufacturer:** METTLER TOLEDO  
**Date of Calibration:** 5 July 2022 Page 4 of 5

**Location:** Calibration Laboratory, National Food Institute  
**Environment Condition:** Ambient Temperature 25 °C ± 1 °C  
 Relative Humidity 48 % ± 3 %

### Condition of this results of Calibration:

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

### 2. Reference Standard Instrument :

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
HANDHELD THERMOMETER	1521	A55997	TE 650057-01	10-Dec-22	NATIONAL FOOD INSTITUTE
Platinum Resistance Thermometer (PRT)	385	509201			

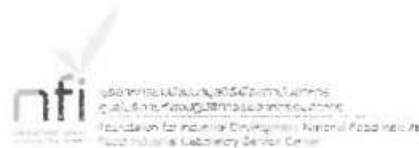
Support Equipment : - Low Temperature Bath (ISOCAL-6), Model: Europa-6 Plus Basic, S/N: 341552/2

- This certificate is traceable to International System of Units (SI Units).
- This certificate was certified only for the instrument we calibrated.
- This result of calibration was found accurate as shown on date and place of calibration only.
- Condition of Calibrated item : Good
- Result of Calibration : ☒ Without adjustment ☐ After adjustment

Handwritten signature

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

เอกสารไม่ควบคุม  
 2203527-001-01  
 1194 Soi Wachirathamsathit 57, Sukhumvit 101/1 Rd.,  
 Bangchak, Prakanong, Bangkok 10260 Thailand



## Calibration Report

**Certificate No.:** 2203527-001-01  
**Equipment:** pH Meter  
**Resolution:** 0.01 pH ± 1 mV  
**Manufacturer:** METTLER TOLEDO **Model:** Seven Compact 5220  
**Serial No.:** C113432421 **Type:** Bench top  
**ID No.:** UAE.WAT.009/2564

**Date of Calibration:** 5 July 2022 Page 2 of 5

**Calibration Result:**  
 1. Calibration of pH Meter (Nominal 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	6.00	0.56	2.00
7	285.811	286	3.00	0.56	2.00
4	177.462	177	4.00	0.56	2.00
6	56.158	56	6.00	0.56	2.00
7	-0.001	0	7.00	0.56	2.00
8	-58.108	58	6.00	0.56	2.00
10	-177.453	177	10.00	0.56	2.00
12	-295.812	296	12.00	0.56	2.00
14	-414.119	414	14.00	0.56	2.00

2. Calibration of pH Meter with Electrode (Nominal Temperature Compensation at 20 °C)

**Equipment:** pH Electrode **Type:** Combined Electrode  
**Manufacturer:** METTLER TOLEDO **Model:** InLab Expert Pro-ISM  
**Serial No.:** 2210418 **ID No.:** N/A

**Performance of Electrode system** (Three Point Calibration at pH4, pH7 and pH10)

Certified Value (20 ± 0.05 pH)	Average Indicator Reading		Relative Slope (%)	Uncertainty (± pH)	Coverage Factor (k)
	pH	mV			
4.008	4.010	132	-	0.0371	2.00
6.855	6.850	14	100.0	0.0075	0.95
10.006	10.010	-169	81.8	0.0093	2.00
6.955	6.950	6	-	0.0087	2.00

Handwritten signature

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

เอกสารไม่ควบคุม  
 2203527-001-01  
 1194 Soi Wachirathamsathit 57, Sukhumvit 101/1 Rd.,  
 Bangchak, Prakanong, Bangkok 10260 Thailand



Cert. No.: 22TM1490  
Page: 1 of 3

## Certificate of Calibration

Equipment: Hot Air Oven  
Manufacturer: Memmert  
Model: UF 55  
Serial No.: B218,1886  
ID No.: UAE.WAO.027/2559  
Submitted by: United Analyst and Engineering Consultant Co., Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong,  
Bangkok 10200  
Location: Lab Floor 2  
Received Order: 19 October 2022  
Calibration Date: 19 October 2022  
Ambient Temperature: (26 ± 10) °C  
Relative Humidity: (50 ± 30) %

Calibrated by: Prascha Hahib

Approved by:   
Approved Signatory

( ) Pornhippa Tameyakul  
( ) Malee Butkruea  
(x) Suwit Imjai

Issue Date: 31 October 2022

The Uncertainties are for a confidence probability of approximately 95%

This certificate is valid only for the item calibrated on date and place of calibration.  
Approval of the use of Corporate Services & Equipment Calibration and Testing Services

เอกสารไม่ควบคุม

A 0046800



Equipment: Electronic Balance  
Condition As-Received: Used Item  
Reference: Z204-G5420C-1  
Procedure used :-

Cert.No.: 22MM210  
Page: 2 of 3

Calibration were conducted using in-house calibration procedure CP-0801 according to direct measurement method against standard weight.

### Condition of this result of calibration

#### 1. Reference standard instruments:-

Instruments	Model	Serial No.	ID No.	Test report No.	Due date
1) Standard Weight Set (E2)	15864	-	70RC138	MM-0009-21	3 Feb 2023

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

#### Result of calibration ( ) Without Adjustment (x) After Adjustment by Internal Calibration

Range capacity:	0 g to 81 g	81 g to 220 g	Resolution	0.00001 g	0.0001 g
-----------------	-------------	---------------	------------	-----------	----------

#### Before Adjustment:

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (± mg)	Coverage Factor (k)
80	80.00004	-0.00004	0.15	2.00
200	199.9999	+0.0001	0.35	2.00

#### After Adjustment:

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

Applied Weight (g)	Standard Deviation of Reading (g)
80	0.000008
200	0.00005



Cert.No.: 22MM210  
Page: 1 of 3

## Certificate of Calibration

Equipment: Electronic Balance  
Manufacturer: Mettler Toledo  
Model: XSR205  
Serial No.: C009071872  
ID No.: UAE.WAO.012/2563  
Submitted by: United Analyst and Engineering Consultant Co., Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong,  
Bangkok 10280  
Location: Balance Room  
Received order: 26 April 2022  
Calibration Date: 26 April 2022  
Ambient Temperature: 15 °C to 40 °C  
Relative Humidity: 30 % to 90 %

Calibrated by: Kunchit Prompratt

Approved by:   
Approved Signatory

( ) Pornhippa Tameyakul  
(x) Malee Butkruea  
( ) Suwit Imjai

Issue Date: 29 April 2022

The Uncertainties are for a confidence probability of approximately 95%

This certificate is valid only for the item calibrated on date and place of calibration.  
Approval of the use of Corporate Services & Equipment Calibration and Testing Services

เอกสารไม่ควบคุม

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

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม



Certificate No.: C24220084

Page: 2 of 2

## Calibration Report

Certificate No.: 2202934-001-01

Equipment:

Electronic Balance

Model: XSR204

Serial No.: C117635043

Capacity: 220 g

Manufacturer: METTLER TOLEDO

Resolution: 0.001 g

ID No.: UAE.WAS.012/2564

Date of Calibration: 13 May 2022

Page 2 of 4

Calibration Results: (Continued)

Calibration Range: 0 - 200 g

Calibration Adjustments: Internal Calibration

3. Departure from Nominal Value:

Nominal Value	Standard Value	Average Reading	Correction	Uncertainty	Coverage Factor
0	0.0000	0.0000	0.0000	0.000005	2.00
0.01	0.0100	0.0100	0.0000	0.000005	2.00
0.02	0.0200	0.0200	0.0000	0.000005	2.00
0.03	0.0300	0.0300	0.0000	0.000005	2.00
0.04	0.0400	0.0400	0.0000	0.000005	2.00
0.05	0.0500	0.0500	0.0000	0.000005	2.00
0.1	0.1000	0.1000	0.0000	0.000005	2.00
0.2	0.2000	0.2000	0.0000	0.000005	2.00
0.5	0.5000	0.5000	0.0000	0.000005	2.00
1	1.0000	1.0000	0.0000	0.000005	2.00
2	2.0000	2.0000	0.0000	0.000005	2.00
3	3.0000	3.0000	0.0000	0.000005	2.00
5	5.0000	5.0000	0.0000	0.000005	2.00
10	10.0000	10.0000	0.0000	0.000005	2.00
20	20.0000	20.0000	0.0000	0.000005	2.00
30	30.0000	30.0000	0.0000	0.000005	2.00
40	40.0000	40.0000	0.0000	0.000005	2.00
45	45.0000	45.0000	0.0000	0.000005	2.00

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

## Calibration Report

Certificate No.: 2202934-001-01

Equipment:

Electronic Balance

Model: XSR204

Serial No.: C117635043

Capacity: 220 g

Manufacturer: METTLER TOLEDO

Resolution: 0.001 g

ID No.: UAE.WAS.012/2564

Date of Calibration: 13 May 2022

Page 2 of 4

Environment Condition: Ambient Temperature: 22.3 ± 0.1 °C Relative Humidity: 47 ± 3 %

Place of Calibration: Balance room (Water Analysis Unit), UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

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

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1mg to 200g	1005567572	TCS	N22041375	23 April 2023
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	HOBO 490	NPI 811 810718	Quality Room	Q022-0250	18 February 2023

3. This certification is traceable to SI UNIT

4. This certification is 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)
100	0.000023
220	0.000032

2. Off-Center Error:

A mass of 50 g was placed and moved to various location 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)
50.000	50.000	50.000	50.000	50.000	50.000	0.000

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

## Calibration Certificate

Certificate No.: 2202934-001-01

Client name:

UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

Address:

3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchack, Prakhong, Bangkok 10260

Page 1 of 4

Equipment: Electronic Balance

Manufacturer: METTLER TOLEDO

Model: XSR204

Serial No.: C117635043

ID No.: UAE.WAS.012/2564

Order No.: 2202934

Operation No.: 2202934-001

Date of Receipt: 13 May 2022

Date of Calibration: 13 May 2022

Calibrated by Mr. Manas Somsak  
Specialist

Approved by (Mr. Pheraphat Tunsit)  
Manager, Division of Calibration Laboratory

Date of Issue: 25 May 2022

Responsible for the Technical Management Team

The uncertainties are for a confidence probability of approximately 95%

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

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



Equipment: Hot Air Oven  
Condition As-Received: Used Item  
Reference: 2210-05750C-1

Cert. No.: 22TM1490

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) and 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	MY41021843	22LM4	10 Jan 2023

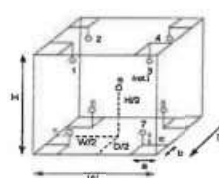
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration :- (°) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Close



Probe Installation Details: Dimension of Chamber:

a = 5.0 cm	D = 0.33 m
b = 5.0 cm	W = 0.40 m
c = 5.0 cm	H = 0.40 m
	Capacity = 0.053 m³

Environment during calibration		
	Beginning	Finished
Temp. (°C)	29	30
REL Humid. (%)	47	40
AC Supply (Volt)	221	220

Ref. Std. ID No. @ Calibration Point		
Position	(104) °C	(140,160) °C
1	18-04RTD-01	21-04TC-01
2	18-04RTD-02	21-04TC-02
3	18-04RTD-03	21-04TC-03
4	18-04RTD-04	21-04TC-04
5	18-04RTD-05	21-04TC-05
6	18-04RTD-06	21-04TC-06
7	18-04RTD-07	21-04TC-07
8	18-04RTD-08	21-04TC-08
9 (ref.)	18-04RTD-09	21-04TC-09



Equipment : BOD Incubator  
Condition As-Received : Used Item  
Reference : 2202-0446OC-1  
Procedure Used :-

Cert. No.: 22TM90  
Page: 2 of 3

Calibration was 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	MY44035217	21LM30	23 Dec 2022

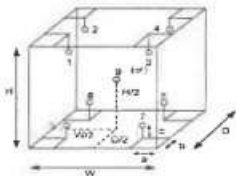
2. This certificate is valid only to the item calibrated on date and place of calibration.

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 = 10 cm  
b = 10 cm  
c = 10 cm

#### Dimension of Chamber :

D = 0.62 m  
W = 1.2 m  
H = 1.2 m  
Capacity = 0.89 m<sup>3</sup>

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	28	28
REL.Humid. ( % )	68	75
AC Supply ( Volt )	226	226

Position :	Ref. Std. ID No.:
1	18-10RTD-01
2	18-10RTD-02
3	18-10RTD-03
4	18-10RTD-04
5	18-10RTD-05
6	22-10RTD-10
7	18-10RTD-07
8	18-10RTD-08
9 (ref.)	18-10RTD-09

## Certificate of Calibration

Cert. No.: 22TM90  
Page: 1 of 3

Equipment : BOD Incubator  
Manufacturer : Arco  
Model : UCA-1320  
Serial No. : 13URC4S013201  
ID No. : UAE.WAO.0152581  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phraekhanong,  
Bangkok 10260  
Location : Lab Floor 2  
Received Order : 17 February 2022  
Calibration Date : 17 February 2022  
Ambient Temperature : ( 26 ± 10 ) °C  
Relative Humidity : ( 50 ± 30 ) %  
Calibrated by : Kunchit Promrat

Approved by :   
Approved Signatory

( ) Pomsipha Tamayakul  
( ) Malee Butkrua  
( ) Suwit Injal

Issue Date : 22 February 2022

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

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

เอกสารไม่ควบคุม  
A 1095042

เอกสารไม่ควบคุม  
A 0038099



Equipment : Hot Air Oven  
Condition As-Received : Used Item  
Reference : 2210-0575OC-1  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Close

Cert. No.: 22TM1490  
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
104.0	104.0	104.0	0.061	1.3	1.7	0.42	2
140.0	140.0	140.0	0.14	2.3	2.4	1.1	2
180.0	180.0	180.0	0.21	3.5	3.6	1.3	2

Calibration Point ( °C )	Measured Temperature ( °C )								
	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
104.0	103.076	103.876	103.777	104.124	104.667	104.426	104.012	103.928	104.370
140.0	138.199	139.189	138.808	139.550	140.266	139.622	139.293	139.385	140.369
180.0	177.930	179.267	178.543	179.753	181.011	180.093	179.496	179.743	181.278

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

Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.  
Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.  
Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.  
UUC\* : Unit Under Calibration

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

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

-000-



National Institute of Standards and Technology  
National Center for Environmental and Estuarine Science  
National Center for Environmental and Estuarine Science



## Calibration Report

Certificate No.: 2202934-001-01  
Equipment: Electronic Balance  
Model: XS204  
Serial No.: C117030041  
Capacity: 220 g  
Manufacturer: METTLER TOLEDO  
Resolution: 0.0001 g  
ID No.: UAE.WAO.0122564

Date of Calibration: 11 May 2022 Page 4 of 4

Calibration Results: (Continued)

Calibration Range: 0 - 200g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value:

Nominal Value ( g )	Standard Value ( g )	Average Reading ( g )	Correction ( g )	Uncertainty ( ± g )	Coverage Factor
50	50.00000	50.00001	-0.00001	0.00011	2.00
55	55.00000	55.00001	-0.00001	0.00012	2.00
60	60.00000	60.00001	-0.00001	0.00012	2.00
65	65.00000	65.00002	-0.00002	0.00013	2.00
70	70.00000	70.00002	-0.00002	0.00013	2.00
75	75.00000	75.00002	-0.00002	0.00013	2.00
80	80.00000	80.00002	-0.00002	0.00014	2.00
85	85.00000	85.00002	-0.00002	0.00014	2.00
90	90.00000	90.00002	-0.00002	0.00015	2.00
100	100.00000	100.00000	-0.00000	0.00016	2.00
120	120.00000	120.00000	-0.00000	0.00018	2.00
150	150.00000	150.00000	-0.00000	0.00021	2.00
200	200.00000	200.00000	-0.00000	0.00028	2.00

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

End

FCS-612 Revision: 01 Date: 20-04-65

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม





TECHNOLOGY PROMOTION ASSOCIATION (THAI AND JAPAN)  
CORPORATE SERVICES, EQUIPMENT CALIBRATION AND TESTING SERVICES  
301, 4/F, PATTANAKARN 1/153/101, BANGKOK, THAILAND 10260  
TEL: 02-2715-3000 FAX: 02-2715-3001



Cert. No.: 22TM305  
Page: 1 of 3

## Certificate of Calibration

Equipment : BOD Incubator  
Manufacturer : ARCO  
Model : UR-1320  
Serial No. :  
ID No. : UAE.WAO.018/2551  
Submitted by : United Analyst and Engineering Consultant Co., Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong,  
Bangkok 10260  
Location : Lab Floor 2  
Received Order : 7 April 2022  
Calibration Date : 7 April 2022  
Ambient Temperature :  $(26 \pm 10) ^\circ\text{C}$   
Relative Humidity :  $(50 \pm 30) \%$   
Calibrated by : Man Pattanapongpaiboon  
Approved by :  
( ) Pomthipha Tameyekul  
( ) Malee Butkruea  
( ) Suwit Imjai  
Issue Date : 18 April 2022

The Uncertainties are for a confidence probability of approximately 95 %

This certificate is valid for the period of 12 months from the date of calibration.  
Approved by: Man Pattanapongpaiboon, Service Engineer, Calibration Department, TMA

เอกสารไม่ควบคุม  
A 0040246

## ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

ชนิดเครื่องมือ: CONDUCTIVITY METER		รุ่น: Lab955	เลขที่ใบงาน: KSPR2203267		
ตรวจสอบ (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
22 Mar 2022			22 Mar 2022		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
		General			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. ความสมบูรณ์เครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. ความสะอาด (ช่องใส่ตัวอย่าง, ภายใน-นอกเครื่อง)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. สวิตช์ ปิด - เปิด เครื่อง (On-Off Switch)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. ปุ่มกด (Keypad)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. หน้าจอ (Display, Screen Contrast)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
		Spectrophotometer			
<input type="checkbox"/>	<input type="checkbox"/>	6. แบตเตอรี่ไฟฟ้า (Battery Backup) $\geq 2.5$ VDC	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	7. หัวหมุนเลือกความยาวคลื่น (Wavelength Control)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	8. ความยาวคลื่น (Wavelength Check)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	9. แสงยูวี (UV $< 3,000$ hour)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	10. แสงที่มองเห็น (Visible $< 5,000$ hour)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	11. ช่องใส่หลอดตัวอย่าง (Carousel Module)	<input type="checkbox"/>	<input type="checkbox"/>	
		pH Meter and Conductivity Meter			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	12. อิเล็กโทรด (Electrode and Connection Cable)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	13. ระดับสารละลายใน Electrode (Level KCl)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	14. ฝาปิดกันปลาย Electrode (Dust Protection Hood)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	15. ขาตั้งยึดอิเล็กโทรด (Stand)	<input type="checkbox"/>	<input type="checkbox"/>	
		Turbidimeter			
<input type="checkbox"/>	<input type="checkbox"/>	16. ค่าความขุ่นตัวอย่าง (No Sample)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	17. ระดับการส่องสว่างของแสง ( $\geq 2.5$ ไมล์ 3.0)	<input type="checkbox"/>	<input type="checkbox"/>	
		Automatic titrator			
<input type="checkbox"/>	<input type="checkbox"/>	18. สภาพ Piston Burettes	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	19. Function Rinsing and Dosing	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	20. ระบบกลั่นสารผ่านและอุณหภูมิควบคุม	<input type="checkbox"/>	<input type="checkbox"/>	

ข้อแนะนำ : Electrode วัดอุณหภูมิได้  $24.9 ^\circ\text{C}$  โดย Control Waterbath ที่  $25.0 \pm 0.1 ^\circ\text{C}$

Mr. Wasan Nuchnabee  
Service Engineer

เอกสารไม่ควบคุม  
SPCC-FM-R31-02: 23 Nov 202



Equipment : Electronic Balance  
Condition As-Received : Used Item  
Reference : 2204-0542OC-1  
Result of calibration

### 2. Effect of off center loading

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

Position 1	Position 2	Position 3	Position 4	Position 5	Maximum difference between off-center and central loading
(g)	(g)	(g)	(g)	(g)	(g)
-0.0002	-0.0001	0.0000	-0.0002	-0.0002	0.0002

### 3. Departure from nominal value

Applied Weight	Balance Reading	Correction	Measurement Uncertainty	Coverage Factor
(g)	(g)	(g)	( $\pm$ mg)	(k)
Unload	0.00000	0.00000	0.016	2.13
0.05	0.05001	-0.00001	0.016	2.13
0.1	0.10001	-0.00001	0.017	2.11
1	1.00002	-0.00002	0.019	2.05
5	5.00003	-0.00003	0.026	2.00
20	20.00008	-0.00008	0.049	2.00
50	50.00010	-0.00010	0.080	2.00
80	80.00014	-0.00014	0.15	2.00
100	100.0001	-0.0001	0.21	2.00
150	150.0001	-0.0001	0.29	2.00
200	200.0001	-0.0001	0.35	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 %.

-0.000-



Equipment : BOD Incubator  
Condition As-Received : Used Item  
Reference : 2202-0446OC-1  
Result of Calibration : ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Not Available

Calibration Point	UUC* Setting	UUC* Reading	Temperature stability	Temperature uniformity	Overall Variation	Uncertainty	Coverage Factor
( $^{\circ}\text{C}$ )	( $^{\circ}\text{C}$ )	( $^{\circ}\text{C}$ )	( $\pm$ $^{\circ}\text{C}$ )	( $^{\circ}\text{C}$ )	( $^{\circ}\text{C}$ )	( $\pm$ $^{\circ}\text{C}$ )	k
20.0	19.5	19.4	0.30	0.58	1.0	0.55	2

Calibration Point	Measured Temperature ( $^{\circ}\text{C}$ )								
	1	2	3	4	5	6	7	8	9 (ref.)
20.0	20.154	20.013	20.356	19.939	19.534	19.761	19.817	19.824	19.922

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 %.

-0.00-

เอกสารไม่ควบคุม  
A 106342

เอกสารไม่ควบคุม  
A 1096041



## REPORT OF CALIBRATION

Certificate No. : SP22-016

Page 2 of 5

Environment Condition : Ambient Temperature  $25 \pm 5$  °CRelative humidity  $55 \pm 20$  %RH

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

## Certified Reference Materials :

Material	Serial No.	Certificate No.	Due date
Absorbance Standard set	25760	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.

เอกสารไม่ควบคุม

FM-708-02.301.1/11/2021



Equipment : BOD Incubator  
 Condition As-Received : Used Item  
 Reference : 2204-0015OC-2  
 Result of Calibration :- ( \* ) Without Adjustment  
 Function of UUC\* : Temperature Source  
 Fresh air setting : Not Available

Cert. No. : 22TM305  
 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
20.0	20.0	20.0	0.50	0.44	1.1	0.64	2

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

Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor  
 Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.  
 Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.  
 UUC\* : Unit Under Calibration

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

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

-000-

เอกสารไม่ควบคุม

a 1104313



## 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.Tmaswut Rittidach )  
 Technical Manager

Approved by :

( Ms. Chouthicha Sangngern )  
 Quality Manager

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

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

เอกสารไม่ควบคุม

FM-708-02.301.1/11/2021



Equipment : BOD Incubator  
 Condition As-Received : Used Item  
 Reference : 2204-0015OC-2

Cert. No. : 22TM305  
 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	MY41021843	22LM4	10 Jan 2023

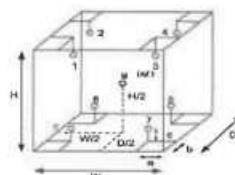
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Not Available



## Probe Installation Details :

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

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	27	27
REL Humid. ( % )	58	59
AC Supply ( Volt )	222	221

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

เอกสารไม่ควบคุม

a 1104314



## CERTIFICATE OF CALIBRATION

Certificate No. : SP22-007

Page 1 of 5

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

Address : 3 Soi Udomsuk 41, Sukhumvit Road, Bungehok, 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 :

(Mr. Tanavut Rintach)

Approved by :

(Ms. Chutichol Sangsri)

Technical Manager

Quality Manager

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

The measurement capability of the laboratory and its traceability to international standards and to the unit of measurement defined in 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

เอกสารไม่ควบคุม



## 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	0.16	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

- NA = 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 TSI accredited

- End of Certificate -

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021



## 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

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021



## 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

DQE Services Co., Ltd. 32 Soi Ladpro-Wanghin 55, Ladpro-Wanghin Rd., Ladpro, Ladpro, Bangkok 10230 Phone : +66 (0)2 538 2054, Email : dqeserviceinfo@gmail.com				
<b>REPORT OF CALIBRATION</b> Certificate No. : SP22-007 Page 5 of 5 Wavelength Accuracy :				
CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor 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  
- NA = Not Available  
- The result expanded uncertainty of measurement U is based on 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 ISO TSI Accredited  
- End of Certificate -

FM-708-02 R01 1/1/2023

เอกสารไม่ควบคุม

DQE Services Co., Ltd. 32 Soi Ladpro-Wanghin 55, Ladpro-Wanghin Rd., Ladpro, Ladpro, Bangkok 10230 Phone : +66 (0)2 538 2054, Email : dqeserviceinfo@gmail.com					
<b>REPORT OF CALIBRATION</b> 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

FM-708-02 R01 1/1/2023

เอกสารไม่ควบคุม

DQE Services Co., Ltd. 32 Soi Ladpro-Wanghin 55, Ladpro-Wanghin Rd., Ladpro, Ladpro, Bangkok 10230 Phone : +66 (0)2 538 2054, Email : dqeserviceinfo@gmail.com					
<b>REPORT OF CALIBRATION</b> 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

FM-708-02 R01 1/1/2023

เอกสารไม่ควบคุม

DQE Services Co., Ltd. 32 Soi Ladpro-Wanghin 55, Ladpro-Wanghin Rd., Ladpro, Ladpro, Bangkok 10230 Phone : +66 (0)2 538 2054, Email : dqeserviceinfo@gmail.com			
<b>REPORT OF CALIBRATION</b> 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 Sarnia 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.			

FM-708-02 R01 1/1/2023

เอกสารไม่ควบคุม



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 R1 (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
	0.30069	0.291	-0.010	3.19	± 0.006
	9.70140	0.678	-0.023	3.34	± 0.012

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

Element	Standard Value of R1 (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	0.296	-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 R1 (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

Continue 4 / 5

INDUSTRIAL METROLOGY AND TESTING SERVICE CENTRE

The results relate only to the items tested/calibrated or value assigned.

Adhering the Report Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the permission of TSC.

PABL/MTC.032 Rev.4

Head Office: 35 Mu 3 Tambon Wang Pa, Amphoe Wang Luang, Changwat Pathumthani 12120, Thailand  
Tel: (66) 0 2577 9100  
Fax: (66) 0 2577 9109  
Email: info@pablmtr.com

Office/Laboratory: 151/15, Bangpakdi Industrial Estate, Sukhumvit Road, Amphoe Bang Pakong, Samut Prakan 10260, Thailand  
Tel: (66) 0 2323 5123  
Fax: (66) 0 2323 5125  
Email: info@pablmtr.com

Office: 151/15, Bangpakdi Industrial Estate, Sukhumvit Road, Bangkok 10260, Thailand  
Tel: (66) 0 2323 5123  
Fax: (66) 0 2323 5125  
Email: info@pablmtr.com



TSC-TSC

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	0.0006	-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	-0.0006	0.0007	-0.0005
	-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	-0.0007	-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	0.000	0.000	0.000	0.000	0.000	0.000
Standard Deviation	0.0005	0.0008	0.0004	0.0007	0.0005	0.0004	0.0005	0.0004

Continue 2 / 5

INDUSTRIAL METROLOGY AND TESTING SERVICE CENTRE

The results relate only to the items tested/calibrated or value assigned.

Adhering the Report Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the permission of TSC.

PABL/MTC.032 Rev.4

Head Office: 35 Mu 3 Tambon Wang Pa, Amphoe Wang Luang, Changwat Pathumthani 12120, Thailand  
Tel: (66) 0 2577 9100  
Fax: (66) 0 2577 9109  
Email: info@pablmtr.com

Office/Laboratory: 151/15, Bangpakdi Industrial Estate, Sukhumvit Road, Amphoe Bang Pakong, Samut Prakan 10260, Thailand  
Tel: (66) 0 2323 5123  
Fax: (66) 0 2323 5125  
Email: info@pablmtr.com

Office: 151/15, Bangpakdi Industrial Estate, Sukhumvit Road, Bangkok 10260, Thailand  
Tel: (66) 0 2323 5123  
Fax: (66) 0 2323 5125  
Email: info@pablmtr.com



TSC-TSC

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	0.0069	0.007	0.0004	5.75	
	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	3.63
	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	0.0647	0.0644	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	0.0886	0.0874	0.089	0.0013	1.42
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	1.22
Mn	0.05	0.0092	0.0092	0.0097	0.0087	0.0085	0.0079	0.0096	0.0085	0.0094	0.0099	0.009	0.0007	7.35
	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	0.0096	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	0.82
Zn	0.05	0.0340	0.0342	0.0380	0.0352	0.0337	0.0351	0.0344	0.0346	0.0349	0.0343	0.035	0.0005	1.47
	0.30	0.1665	0.1653	0.1628	0.1642	0.1637	0.1637	0.1639	0.1632	0.1634	0.1637	0.165	0.0012	0.72
	0.70	0.3456	0.3467	0.3445	0.3430	0.3422	0.3451	0.3437	0.3438	0.3435	0.3438	0.344	0.0013	0.37

Continue 3 / 5

INDUSTRIAL METROLOGY AND TESTING SERVICE CENTRE

The results relate only to the items tested/calibrated or value assigned.

Adhering the Report Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the permission of TSC.

PABL/MTC.032 Rev.4

Head Office: 35 Mu 3 Tambon Wang Pa, Amphoe Wang Luang, Changwat Pathumthani 12120, Thailand  
Tel: (66) 0 2577 9100  
Fax: (66) 0 2577 9109  
Email: info@pablmtr.com

Office/Laboratory: 151/15, Bangpakdi Industrial Estate, Sukhumvit Road, Amphoe Bang Pakong, Samut Prakan 10260, Thailand  
Tel: (66) 0 2323 5123  
Fax: (66) 0 2323 5125  
Email: info@pablmtr.com

Office: 151/15, Bangpakdi Industrial Estate, Sukhumvit Road, Bangkok 10260, Thailand  
Tel: (66) 0 2323 5123  
Fax: (66) 0 2323 5125  
Email: info@pablmtr.com



TSC-TSC

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 Idomsuk41, Sukhumvit Road, Bangkok, Prakanong, Bangkok 10260

## CALIBRATION PROCEDURE : 1. Performance Verification of Atomic Absorption Spectrophotometer

(M-500-02-30)

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

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

Cadmium Lot No. 0106047048, Chromium Lot No. 0106315418, Copper Lot No. 0107480530, Iron Lot No. 0104697566,

Lead Lot No. 0104659473, Manganese Lot No. 11092228A, Nickel Lot No. 0104978044, Zinc Lot No. 010792297

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 288.3 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 50 %

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. Daniel Srithongkum )

Approved by   
For (Mrs. Thippaya Junvee Fortune)  
Director of Analytical Chemistry Laboratory  
Ref. 2025265020400522001  
Calibration Date : 3 February 2022

The results relate only to the items tested/calibrated or value assigned.

Adhering the Report Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the permission of TSC.

PABL/MTC.032 Rev.4

Head Office: 35 Mu 3 Tambon Wang Pa, Amphoe Wang Luang, Changwat Pathumthani 12120, Thailand  
Tel: (66) 0 2577 9100  
Fax: (66) 0 2577 9109  
Email: info@pablmtr.com

Office/Laboratory: 151/15, Bangpakdi Industrial Estate, Sukhumvit Road, Amphoe Bang Pakong, Samut Prakan 10260, Thailand  
Tel: (66) 0 2323 5123  
Fax: (66) 0 2323 5125  
Email: info@pablmtr.com

Office: 151/15, Bangpakdi Industrial Estate, Sukhumvit Road, Bangkok 10260, Thailand  
Tel: (66) 0 2323 5123  
Fax: (66) 0 2323 5125  
Email: info@pablmtr.com



Agilent 5110 and 5100 ICP-OES  
Preventive Maintenance Checklist

System Information

Instrument system name and ID	ICP-OES 5110 v01
Instrument system site and location	UAE Consultant
List system component product numbers	List the serial numbers of each component
1. 01015	1. 001000000
2.	2.
3.	3.
4.	4.
5.	5.
6.	6.
7.	7.
8.	8.
9.	9.
10.	10.

ICP-OES Configuration table	Circle the type or write in the type if other
Nebulizer Type	SeaSpray   OneNeb   other
Spray Chamber	Cyclonic Single Pass   Cyclonic Double Pass   other
Torch	Radial   Dual View   other
Injector Emitter	2.4mm   1.8mm   1.4mm   0.8mm   other
Injector Material	Quartz   Ceramic   other

Issued: 4 March 2021, Revision: A.01

Copyright © 2021  
Page 2 of 8

Agilent Technologies

เอกสารไม่ควบคุม



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 RIA (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 RIA (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	± 0.002
	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: *[Signature]*  
(Mr. Danal Srithongkum)

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

INDUSTRIAL METROLOGY AND TESTING SERVICE CENTRE

Agilent 5110 and 5100 ICP-OES  
Preventive Maintenance Checklist

Agilent Preventive Maintenance provides factory recommended service for your analytical systems to assure reliable operation and the accuracy of your results. Delivered by highly-trained and certified service engineers using genuine Agilent parts and supplies, Agilent Preventive Maintenance provides everything you need to reduce unplanned downtime and keep your systems operating at their peak.

For more information about Agilent Technologies services please visit our web site using the following URL: <http://www.agilent.com/resources/technical/analytical/instrumentation/5100>

Customer Information

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

Service Engineer's Responsibilities

- Only complete/printout pages that relate to the system being serviced.
- Complete empty fields with the relevant information.
- Complete the relevant checkboxes in the checklist using a "X" or tick mark "+" in the checkbox.
- Complete Not Applicable check boxes to indicate services not delivered, as needed.
- Complete the PM service in the order of the tasks listed.
- Complete the Service Review section together with the customer.

Issued: 4 March 2021, Revision: A.01

Copyright © 2021  
Page 1 of 8

Agilent Technologies

เอกสารไม่ควบคุม



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 RIA (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 RIA (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 RIA (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

INDUSTRIAL METROLOGY AND TESTING SERVICE CENTRE

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 IMTSC.

IMTSC.MTC.002 Rev.6

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 IMTSC.

IMTSC.MTC.002 Rev.6



Agilent 5110 and 5100 ICP-OES  
Preventive Maintenance Checklist

ICP-OES Status Results Table

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

Measurement	Standby Mode	Plasma On
Main Voltage	230 VAC	230 VAC
Main Current	8.5 A	8.5 A
Instrument Temperature	25 °C	25 °C
RF Air Flow (sensor speed)	14.0 Hz	14.0 Hz
Plasma Exhaust Temperature	No measurement	25 °C
Water Flow Oscillator	No measurement	2.5 L/min
Water Flow Detector	2.5 L/min	2.5 L/min
Water Inlet Temperature	15 °C	15 °C
Polychromator Temperature	35 °C	35 °C
CCD Temperature	15 °C	15 °C
Thermal Stabilizer	35 °C	35 °C
Argon Supply Pressure	1.4 ± 0.1 kPa	1.4 ± 0.1 kPa
Purge Gas Supply Pressure*1	0.1 ± 0.1 kPa	0.1 ± 0.1 kPa
Option Gas Supply Pressure*1	—	—
Nebulizer Flow	No measurement	0.70 L/min
Nebulizer Back Pressure	No measurement	165 ± 5 kPa
Plasma Gas Flow	No measurement	15.0 L/min
Auxiliary Gas Flow	No measurement	1.20 L/min
RF Power	No measurement	1200 W
RF Supply Current	No measurement	4.2 ± 0.3 A
RF Supply Voltage	No measurement	146 ± 10 V

\*1 If option installed

Issued: 4 March 2021, Revision: A.01

Copyright © 2021  
Page 6 of 8

Agilent Technologies

เอกสารไม่ควบคุม

Agilent 5110 and 5100 ICP-OES  
Preventive Maintenance Checklist

- ☒ Water Flow
- ☒ Gas Flows
- ☒ RF Generator
- ☒ Camera Test
- ☒ Optics Test
- ☒ Nebulizer Test

Instrument Performance Test Results Table

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

	Pre PM Sensitivity Check		Post PM Sensitivity Check	
	Radial	Axial*	Radial	Axial*
Zn 213.857 nm SRBR	4.01 ± 0.5	3.00 ± 0.1	4.01 ± 0.5	3.00 ± 0.1
Mn 207.910 nm SRBR	11.0 ± 1.0	11.0 ± 1.0	11.0 ± 1.0	11.0 ± 1.0
Al 896.152 nm SBR	5.1	15.5	5.1	15.5
K 766.491 nm SBR	5.5	7.5	5.5	7.5

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

Instrument Test Results Table

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

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

Issued: 4 March 2021, Revision: A.01

Copyright © 2021  
Page 6 of 8

Agilent Technologies

เอกสารไม่ควบคุม

Agilent 5110 and 5100 ICP-OES  
Preventive Maintenance Checklist

SPS 3 Auto Sampler

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

SPS 4 Auto Sampler

- ☒ Section NOT Applicable
- ☒ Clean the spill tray, rack location mat, end frames and chassis with a damp soft cloth and diluted mild detergent.
- ☒ Clean the auto sampler cover panels, if cover kit is installed, with domestic window cleaner
- ☒ Check the X-axis and Z-axis drive belts for cracks, splits, damaged teeth, excessive fraying, color changes or degradation from fumes.
- ☒ Check the X-axis, Theta-axis and Z-axis PFC cables for cracks, incorrect positioning, damaged edges or damaged connectors.
- ☒ Pump Tubing Replacement. Replace peristaltic pump tubing. Replace all tubing that goes from the rinse station to the pump and from the pump to the waste/rinse bottles.

AVS 4.6.7

- ☒ Section NOT Applicable
- ☒ Replace valve rotor seal
- ☒ Check fittings for signs of leaks
- ☒ Check tubing including autosampler tubing for kinks or excessive wear
- ☒ Check high flow pump for signs of leaks

Instrument Adjustment

- ☒ Check position of Zn peak, adjust if required.
- ☒ Check Argon Ratio, adjust to specified value if required.
- ☒ Perform Detector Calibration.
- ☒ Perform Instrument Calibration.
- ☒ Run Instrument Performance Test and record results in Instrument Performance Test Results Table - Post PM.
- ☒ For systems using ICP Expert version 7.3 and above run the following Instrument tests and record the result in the Instrument Test Results Table
  - ☒ Subsystem Communications Test
  - ☒ Air Flow

Issued: 4 March 2021, Revision: A.01

Copyright © 2021  
Page 4 of 8

Agilent Technologies

เอกสารไม่ควบคุม

Agilent 5110 and 5100 ICP-OES  
Preventive Maintenance Checklist

General Preparation

- ☒ Discuss any specific questions or issues with the customer prior to starting.
- ☒ Review the instrument logbook.
- ☒ Perform general external inspection of system for cleanliness.
- ☒ Check for proper installation of safety-related parts, assemblies, sensors etc.
- ☒ Check for required firmware/software updates and verify with customers if they would like it installed.
- ☒ For HP application systems, if standard sample introduction system was not installed, ask the customer to install it.
- ☒ Run Instrument Performance test and record results in Instrument Performance Test Results Table - Pre PM.

Inspect and clean the system

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

Agilent Water Recirculator

- ☒ Section NOT Applicable
- ☒ Drain cooling fluid and remove any particles from the chiller reservoir
- ☒ Remove, clean, and reinstall water inlet metal mesh filter if present.
- ☒ Re fill with Polyclear Plus cooling fluid.
- ☒ Clean the cooling system Air filter and the condenser.

Issued: 4 March 2021, Revision: A.01

Copyright © 2021  
Page 3 of 8

Agilent Technologies

เอกสารไม่ควบคุม

Resolution Test			Pass
Element Wavelength	Specification	Width	
N (174.213 nm)	≤ 9.40	7.27	
As (188.980 nm)	≤ 8.20	8.23	
C (193.027 nm)	≤ 11.50	8.26	
Mo (202.032 nm)	≤ 8.20	6.42	
Cr (206.156 nm)	≤ 13.40	5.27	
Zn (213.857 nm)	≤ 8.70	6.77	
Pb (220.353 nm)	≤ 9.50	7.12	
Co (228.615 nm)	≤ 17.20	11.88	
Ba (230.424 nm)	≤ 9.40	7.36	
Mn (257.610 nm)	≤ 13.30	9.52	
Mn (280.568 nm)	≤ 20.30	14.30	
Cr (257.716 nm)	≤ 11.00	7.69	
Cu (324.754 nm)	≤ 25.00	19.09	
Cu (327.365 nm)	≤ 14.20	11.32	
Sr (338.071 nm)	≤ 33.50	24.39	
Ba (455.403 nm)	≤ 44.00	33.85	
Sr (460.733 nm)	≤ 36.00	17.38	
Ba (463.408 nm)	≤ 36.00	25.53	
Ba (514.171 nm)	≤ 42.00	24.09	
Ar (675.283 nm)	≤ 74.00	59.49	
K (766.491 nm)	≤ 80.00	65.27	

Page 2 of 4

เอกสารไม่ควบคุม

Report Summary	
Instrument Model	Agilent 5100/5110 VDV ICP-OES
Instrument ID	G8011A/G8015A
Instrument Serial Number	MY18030001
Software Version	7.3.1.9507
Firmware Version	3442
Tested By	Nukoon L.
Test Completed On	12/9/2021 9:14:59 AM
Result Summary	
Subsystem Communications Test	Skipped
Air Flow Test	Skipped
Water Flow Test	Skipped
Gas Flows Test	Skipped
RF Generator Test	Skipped
Camera Test	Skipped
Optics Test	Skipped
Advanced Valve System Test	Skipped
Resolution Test	Pass
Sensitivity Test	Pass
Precision Test	Pass

Page 1 of 4

เอกสารไม่ควบคุม



#### Agilent 5110 and 5100 ICP-OES Preventive Maintenance Checklist

- ☒ Review the service and any test results with the customer.  
☒ If the Instrument firmware was updated, record the details of the change in the Service Engineer's Comments box below or if necessary, in the customer's IQ records.

#### Service Engineer Comments (optional)

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

#### Other Important Customer Web Links

How to get information on your product:

- ☐ Literature Library - <http://www.agilent.com/chem/industrial/ICP-OES/ICP-OES-Products/5110-5100-Products>  
☐ Need to know more! - <http://www.agilent.com/chem/industrial/ICP-OES/ICP-OES-Products/5110-5100-Products>  
☐ Need technical support, FAQs? - <http://www.agilent.com/chem/industrial/ICP-OES/ICP-OES-Products/5110-5100-Products>  
☐ Need supplies? - <http://www.agilent.com/chem/industrial/ICP-OES/ICP-OES-Products/5110-5100-Products>

#### Service Completion

Service request number: 1602547215 Date service completed: 09/12/21  
 Agilent signature: Nukoon L. Customer signature: Apichon Oritong

Document part number: G8014-90075

Issued: 4 March 2021, Revision: A.01

Copyright © 2021  
Page 8 of 8

Agilent Technologies

เอกสารไม่ควบคุม



#### Agilent 5110 and 5100 ICP-OES Preventive Maintenance Checklist

#### ICP-OES Parts List Table

Part description	Part Number	Product / Model # where used	Quantity Consumed
Axial Pre-Optic Window	G8010-88014	G8010A, G8011A, G8014A/G8015A	1
Radial Pre-Optic Window	G8010-88015	AB	1
Polyclear Plus Cooling Fluid	G3282-80012	Agilent Water Recirculator	-
Purge Gas Filter	G8010-80136	AR	1
Air Inlet Filter	G8000-68002	AR	1
High Capacity Air Filter	G8010-80139	Optional	-
Rotor seal for 6-7 port valve for AVS6/7	G8494-60002	G8494A/G8495	-
Rotor seal for 4 port valve for AVS4	G8493-60002	G8493A	-
Rinse solution to rinse station 2.5mm id x 1m	G8410-80123	SPS 4	-
Barb connector 2.5mm-1.5mm ID	G8410-80124	SPS 4	-
PVC waste tubing 8mm od x 5mm id, 2m	G8410-80122	SPS 4	-
Additional Parts may be required from engineers stock:			
X axis drive belt	8410047500	SPS 3	-
Z axis drive belt	8410047400	SPS 3	-
Peristaltic pump tubing, PVC SolvaFlex, 3 bridged,	3710049000	SPS 4	-

#### Restore system

For HF applications, ask the customer to reinstall their sample introduction system.

Leave system in an idle state: on and purging.

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

#### Service Review

- ☒ Affix the PM sticker to the system or instrument logbook based on the customer's request.  
☒ Complete the Service Engineer Comments section below if there are additional comments.

Issued: 4 March 2021, Revision: A.01

Copyright © 2021  
Page 7 of 8

Agilent Technologies

เอกสารไม่ควบคุม

## Resolution Test Pass

Element Wavelength	Specification	Width
N (174.213 nm)	≤ 9.40	7.22
As (188.980 nm)	≤ 8.20	6.15
C (193.027 nm)	≤ 11.50	8.22
Mo (202.032 nm)	≤ 8.20	6.33
Cr (206.158 nm)	≤ 13.40	9.21
Zn (213.857 nm)	≤ 8.70	6.87
Pb (220.353 nm)	≤ 9.50	7.02
Co (228.615 nm)	≤ 17.20	11.81
Ba (230.424 nm)	≤ 9.40	7.46
Mn (257.610 nm)	≤ 13.30	9.49
Mn (259.588 nm)	≤ 20.30	14.19
Cr (267.716 nm)	≤ 11.00	7.90
Cu (324.754 nm)	≤ 25.00	18.92
Cu (327.395 nm)	≤ 14.20	11.32
Sr (338.071 nm)	≤ 33.50	24.29
Ba (455.403 nm)	≤ 44.00	33.68
Sr (460.733 nm)	≤ 36.00	17.04
Ba (493.408 nm)	≤ 36.00	25.56
Ba (614.171 nm)	≤ 42.00	24.75
Ar (675.283 nm)	≤ 74.00	59.18
K (766.491 nm)	≤ 80.00	65.19

Page 2 of 4

เอกสารไม่ควบคุม

## Report Summary

Instrument Model	Agilent 5100/5110 VDV ICP-OES
Instrument ID	G8011A/G8015A
Instrument Serial Number	MY18030001
Software Version	7.3.1.9507
Firmware Version	3442
Tested By	Nukoon L.
Test Completed On	12/9/2021 12:55:49 PM

## Result Summary

Subsystem Communications Test	Skipped
Air Flow Test	Skipped
Water Flow Test	Skipped
Gas Flows Test	Skipped
RF Generator Test	Skipped
Camera Test	Skipped
Optics Test	Pass
Advanced Valve System Test	Skipped
Resolution Test	Pass
Sensitivity Test	Pass
Precision Test	Pass

Optics Test	Radial	Axial
Intensity	5298135	5755042
Wavelength	737.212	737.212

Page 1 of 4

เอกสารไม่ควบคุม

## Precision Test Pass

Radial		
Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 2.50	0.81
Se (196.026 nm)	≤ 2.50	1.21
Zn (213.857 nm)	≤ 1.50	0.39
Pb (220.353 nm)	≤ 2.50	0.41
Mn (257.610 nm)	≤ 1.50	0.45
Al (396.152 nm)	≤ 1.50	0.41
Ba (493.408 nm)	≤ 1.50	0.51
K (766.491 nm)	≤ 1.50	0.36

Axial		
Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 1.50	0.51
Se (196.026 nm)	≤ 1.50	0.73
Zn (206.200 nm)	≤ 1.50	0.30
Zn (213.857 nm)	≤ 1.50	0.37
Cd (214.439 nm)	≤ 1.50	0.36
Pb (220.353 nm)	≤ 1.50	0.26
Mn (257.610 nm)	≤ 1.50	0.53
Cr (267.716 nm)	≤ 1.50	0.30
Cu (324.754 nm)	≤ 1.50	0.54
Al (396.152 nm)	≤ 1.50	0.45
Ba (493.408 nm)	≤ 1.50	0.54
K (766.491 nm)	≤ 1.50	0.56

Page 4 of 4

เอกสารไม่ควบคุม

## Sensitivity Test Pass

Radial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 40.0	SRBR	167.2	1131.3	42.4
Se (196.026 nm)	≥ 41.0	SRBR	119.1	1177.1	84.2
Zn (213.857 nm)	≥ 1421.0	SRBR	4082.3	49908.2	148.6
Pb (220.353 nm)	≥ 46.0	SRBR	191.1	2662.8	172.6
Mn (257.610 nm)	≥ 3518.0	SRBR	11415.2	265002.2	536.8
Al (396.152 nm)	≥ 3.4	SBR	7.8	49838.0	5676.5
Ba (493.408 nm)	≥ 34.0	SBR	118.1	1999041.4	17066.5
K (766.491 nm)	≥ 1.8	SBR	5.3	101078.4	16104.6

Axial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 208.0	SRBR	252.9	3214.2	147.0
Se (196.026 nm)	≥ 159.0	SRBR	216.2	3839.7	272.2
Zn (206.200 nm)	≥ 234.0	SRBR	1203.3	14046.1	133.7
Zn (213.857 nm)	≥ 1743.0	SRBR	7866.1	171323.1	472.9
Cd (214.439 nm)	≥ 4227.0	SRBR	7054.9	129539.3	335.4
Pb (220.353 nm)	≥ 320.0	SRBR	531.7	13218.2	566.2
Mn (257.610 nm)	≥ 10625.0	SRBR	30984.7	1314844.0	1807.4
Cr (267.716 nm)	≥ 1048.0	SRBR	4442.1	174420.3	1515.1
Cu (324.754 nm)	≥ 19.0	SBR	50.7	374603.6	7249.0
Al (396.152 nm)	≥ 6.0	SBR	15.7	279915.3	16790.4
Ba (493.408 nm)	≥ 60.0	SBR	208.7	1089996.6	51728.3
K (766.491 nm)	≥ 24.0	SBR	36.9	1983197.5	49746.5

Page 3 of 4

เอกสารไม่ควบคุม

Gas Flows Test				Pass	
Nebulizer Target Flow	Actual Flow	Back Pressure	Auxiliary Target Flow	Actual Flow	Back Pressure
0.70	0.70	203.80	2.00	1.99	108.66
Makeup Target Flow	Actual Flow	Back Pressure	Plasma Target Flow	Actual Flow	Back Pressure
2.00	2.00	113.89	18.00	17.93	24.24

RF Generator Test		Pass
RF Power Supply Test	Passed	
RF Power Supply (V)	141.475	
RF Oscillator Test	Passed	
RF Oscillator Frequency (MHz)	25.874	
Work Coil Current (A)	45.931	
RF Power Supply Current (A)	2.000	

Camera Test				Pass
	Integration Time (ms)	Standard Deviation	Status	
Electronic Offset Test	1000	5.261	Passed	
Dark Current Test	6000	0.734	Passed	
Array Test	5	0.024	Passed	
Linearity Test		0.116	Passed	

Page 2 of 2

เอกสารไม่ควบคุม

Report Summary	
Instrument Model	Agilent 5100/5110 VDV ICP-OES
Instrument ID	G8011A/G8015A
Instrument Serial Number	MY18030001
Software Version	7.3.1.9507
Firmware Version	3442
Tested By	Nukoon L.
Test Completed On	12/9/2021 1:34:10 PM

Result Summary	
Subsystem Communications Test	Pass
Air Flow Test	Pass
Water Flow Test	Pass
Gas Flows Test	Pass
RF Generator Test	Pass
Camera Test	Pass
Optics Test	Skipped
Advanced Valve System Test	Skipped
Resolution Test	Skipped
Sensitivity Test	Skipped
Precision Test	Skipped

Subsystem Communications Test		Pass
Air Flow Test		Pass
30% Air Flow (relative speed)	75% Air Flow (relative speed)	
15.00	18.00	
Water Flow Test		Pass
RF Water Flow (L/min)	Camera Water Flow (L/min)	Water Inlet Temperature (°C)
1.98	1.36	17.16

Page 1 of 2

เอกสารไม่ควบคุม

Precision Test			Pass
Radial			
Element Wavelength	Specification	Measured Value % RSD	
As (188.980 nm)	≤ 2.60	1.38	
Se (196.026 nm)	≤ 2.60	0.91	
Zn (213.857 nm)	≤ 1.50	0.36	
Pb (220.353 nm)	≤ 2.50	0.44	
Mn (257.610 nm)	≤ 1.50	0.43	
Al (396.152 nm)	≤ 1.50	0.38	
Ba (493.408 nm)	≤ 1.50	0.66	
K (766.491 nm)	≤ 1.50	0.36	

Axial		
Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 1.50	0.61
Se (196.026 nm)	≤ 1.50	0.52
Zn (206.200 nm)	≤ 1.50	0.36
Zn (213.857 nm)	≤ 1.50	0.33
Cd (214.439 nm)	≤ 1.50	0.41
Pb (220.353 nm)	≤ 1.50	0.36
Mn (257.610 nm)	≤ 1.50	0.74
Cr (267.716 nm)	≤ 1.50	0.26
Cu (324.754 nm)	≤ 1.50	0.71
Al (396.152 nm)	≤ 1.50	0.44
Ba (493.408 nm)	≤ 1.50	0.73
K (766.491 nm)	≤ 1.50	0.97

Page 4 of 4

เอกสารไม่ควบคุม

Sensitivity Test						Pass
Radial						
Element Wavelength	Specification	Method	Ratio	Standard	Blank	
As (188.980 nm)	≥ 46.0	SRBR	154.8	1242.3	58.5	
Se (196.026 nm)	≥ 41.0	SRBR	117.4	1259.6	97.9	
Zn (213.857 nm)	≥ 1421.0	SRBR	4192.8	52402.6	155.3	
Pb (220.353 nm)	≥ 46.0	SRBR	196.4	2814.2	179.9	
Mn (257.610 nm)	≥ 3518.0	SRBR	11993.6	281210.1	547.6	
Al (396.152 nm)	≥ 3.4	SBR	8.7	55103.6	5662.9	
Ba (493.408 nm)	≥ 34.0	SBR	125.4	2152915.9	17032.2	
K (766.491 nm)	≥ 1.8	SBR	5.7	107906.7	18079.8	

Axial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 208.0	SRBR	297.5	4054.8	170.4
Se (196.026 nm)	≥ 159.0	SRBR	260.2	4794.9	298.5
Zn (206.200 nm)	≥ 234.0	SRBR	1305.9	16162.3	150.3
Zn (213.857 nm)	≥ 1743.0	SRBR	8620.7	200915.8	504.7
Cd (214.439 nm)	≥ 4227.0	SRBR	7958.3	149327.5	350.4
Pb (220.353 nm)	≥ 320.0	SRBR	606.7	15244.5	584.0
Mn (257.610 nm)	≥ 10625.0	SRBR	34460.9	1493082.8	1872.5
Cr (267.716 nm)	≥ 1048.0	SRBR	6018.6	168000.6	1532.6
Cu (324.754 nm)	≥ 19.0	SBR	67.5	423683.7	7248.6
Al (396.152 nm)	≥ 8.0	SBR	18.5	320004.9	16441.4
Ba (493.408 nm)	≥ 60.0	SBR	233.3	11882915.4	50714.5
K (766.491 nm)	≥ 24.0	SBR	44.6	2218974.4	48657.9

Page 3 of 4

เอกสารไม่ควบคุม

Mettler-Toledo (Thailand) Ltd.  
816/4 - 846/5 Laxmi Rd., Bangna Tai Sub-District  
Bangna District, Bangkok 10260  
+66 2723 0362  
MT-TH.Sales.Support@mt.com



## Accuracy Calibration Certificate

### Customer

Company: United Analysts and Engineering Consultant Co., Ltd.  
Address: 3 Soi Udon Suk 41, Sukhumvit Rd., Bang Chak  
City: Phra Khanong  
Zip / Postal: 10250  
State / Province: Bangkok  
Order Number:

### Weighing Device

Manufacturer: Mettler Toledo  
Model: ME4035G1  
Serial No.: 8007910311  
Building: 1/A  
Floor: 2  
Room: Balance Room (276)  
Instrument Type: Weighing Instrument  
Asset Number: UAE.MC.008/2553  
Terminal Model: N/A  
Terminal Serial No.: N/A  
Terminal Asset No.: N/A

Range: 0 to 820 g  
Max. Capacity: 820 g  
Readability: 0.001 g

### Procedure

Calibration Guideline: EURAMET 0g-10 v. 4.0 (11/2015)  
METTLER TOLEDO Work Instruction: CHW0202/08  
This calibration certificate contains measurements for As Found calibration. No As Left calibration was performed because the device was not modified after As Found calibration. Therefore, results for As Left correspond to As Found.  
The sensitivity of the weighing instrument was adjusted before calibration with a built-in weight.  
In accordance with EURAMET 0g-10 (11/2015), the test loads were selected to reflect the specific use of the weighing device or to accommodate specific calibration conditions.

As Found	Start: 22.8 °C	End: 23.0 °C	Start: 49.9 %	End: 50.3 %
----------	----------------	--------------	---------------	-------------

As Found Calibration Date: 07-Apr-2022  
As Left Calibration Date: N/A  
Issue Date: 08-Apr-2022

Calibrator:  
Savit Chanchuan  
Approved Signatory:  
  
☐ Kossakorn Tassanachaiskul  
☐ Sant Jimyon  
☐ Surachet Sukkote

### Result of Calibration:

Calibration Point	Unit Under Calibration Setting	Unit Under Calibration Reading	Temperature Stability	Uncertainty of Measurement
150.0 (°C)	- (°C)	150.6 (°C)	1.3 (°C)	±0.39 (°C)

Calibration Point (°C)	Average Standard Reading (°C)				
	Position				
150.0	1	2	3	4	5
	150.2	150.4	150.4	150.3	150.2
	6	7	8	9	10
	150.4	150.9	151.1	151.1	150.6
	11	12	13	14	15
	150.4	151.0	151.5	151.3	150.5
	16	17	18	19	20
	150.3	150.8	151.2	151.2	150.5
	21	22	23	24	25
	150.2	150.3	150.5	150.4	150.3

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

\*\* End of certificate \*\*

### Condition of this result of calibration

#### Reference Standard Instruments:

Instruments	Model	Serial No.	Certificate No.	Traceable
Thermometer With Sensor	HI935065	03250060101	21T167	Technology Promotion Association (Thailand-Japan)

#### Reference / Procedure:

This equipment was calibration by comparison to the reference standard (Standard platinum resistance thermometer) whose accuracy is traceable to the national standard. The calibration was performed by generating the specified working point of temperature then recorded the temperature reading values against the reference standard according to Hanna Calibration Laboratory work Instruction No. 141.

This temperature scale used was based on ITS-90

All data shown below were as-received values without adjustment.

#### SITE CALIBRATION



## CERTIFICATE OF CALIBRATION

Equipment: COD Test Tube Heater  
Meter Model: HI839800-02  
Manufacturer: Hanna Instruments  
Made in: Romania  
Condition As-Received: Used Product  
Reference: RE220234  
Customer name: United Analysts and Engineering Consultant Co., Ltd.  
3 Soi Udon Suk 41, Sukhumvit Rd., Bangchak,  
Phra Khanong, Bangkok 10260  
Received date: 21 February 2022  
Calibrate date: 1 March 2022  
Issue date: 2 March 2022  
Ambient Temperature: (25 ± 2) °C  
Relative Humidity: (50 ± 15) % RH  
Calibrated Location: Hanna Instruments (Thailand) Ltd.

Calibrated by:   
Mr. Pichit Puthong  
Calibration Engineer

Approved by:   
Mr. Anan Suwanchaisakul  
Authorized Signatory

This certificate was certified only for the instrument we calibrated.  
This result of calibration was found accurate on date and place of calibration only.

\*\* This certificate may not be reproduced other than in full, except with the prior written approval of the head of Hanna Instrument (Thailand) \*\*

## Measurement Uncertainty of the Weighing Instrument in Use

Stated is the expanded uncertainty with  $k=2$  in use. The formula shall be used for the estimation of the uncertainty under consideration of the errors of indication. The value  $R$  represents the net load indication in the unit of measure of the device.

Temperature coefficient for the evaluation of the measurement uncertainty in use:  $3.0 \cdot 10^{-4} / K$   
Temperature range on site for the evaluation of the measurement uncertainty in use:  $3 K$

### Uncertainty of Uncertainty Equation

Range	Min	Max	As Found	As Left
1	0.001 g	620 g	$U = 1.2 \text{ mg} + 0.0185 \text{ mg/g} \cdot R$	N/A

To optimize the stability of the measurement, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

### Absolute and Relative Measurement Uncertainty in Use for Various Net Indications (Examples)

Net Indication	As Found	As Left
0.002 g	1.2 mg	1.5%
0.620 g	1.2 mg	0.20%
0.300 g	1.3 mg	0.021%
62.000 g	2.4 mg	0.0038%
620.000 g	1.2 mg	0.0021%



## Test Equipment

All weights used for metrological testing are traceable to national or international standards. The weights were calibrated and certified by an accredited calibration laboratory.

### Weight Set 1: OIML F1

Weight Set No.: W555  
Certificate Number: CCM-0137-01-C  
Date of Issue: 06-Jul-2021  
Calibration Due Date: 07-Jul-2022

### Weight Set 2: OIML E2

Weight Set No.: W580  
Certificate Number: C2055E1E31  
Date of Issue: 23-Feb-2022  
Calibration Due Date: 14-Aug-2023

### Thermo Hygrometer

Equipment No.: IN161  
Certificate Number: 21H1220  
Date of Issue: 14-Jun-2021  
Calibration Due Date: 01-Jun-2022

## Remarks

FACT adjustment functionality accepted

Equipment condition: Good

Next calibration according to customer's procedure

Calibration data not visible by calibration laboratory

End of Accredited Section

The information below and any attachments to this calibration certificate are not part of the accredited calibration.

## Error of Indication

As Found	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.000 g	0.002 g	0.000 g	1.0 mg	2
2	0.500 g	0.500 g	0.000 g	1.2 mg	2
3	1.000 g	1.002 g	0.000 g	1.2 mg	2
4	10.000 g	10.000 g	0.000 g	1.2 mg	2
5	100.000 g	100.010 g	0.000 g	1.3 mg	2
6	150.000 g	150.021 g	0.000 g	1.5 mg	2
7	200.000 g	200.021 g	0.001 g	1.6 mg	2
8	300.001 g	300.021 g	0.000 g	2.0 mg	2
9	400.021 g	400.021 g	0.000 g	2.5 mg	2
10	500.021 g	500.022 g	0.001 g	2.9 mg	2
11	600.021 g	600.021 g	0.000 g	3.4 mg	2



The uncertainty stated is the expanded uncertainty as calibration obtained by multiplying the standard combined uncertainty by the coverage factor  $k$ , which can be larger than 2 according to EN ISO 91:18. The value of the measured lies within the assigned range of values with a probability of approximately 95%.

The user is responsible for maintaining environmental conditions and the settings of the weighing instrument when it was calibrated.

## Measurement Results

### Repeatability

Test Load: 200 g

Position	As Found	As Left	As Found
1	200.001 g	N/A	200.001 g
2	200.001 g	N/A	200.001 g
3	200.001 g	N/A	200.001 g
4	200.001 g	N/A	200.001 g
5	200.001 g	N/A	200.001 g
6	200.000 g	N/A	200.000 g
7	200.001 g	N/A	200.001 g
8	200.001 g	N/A	200.001 g
9	200.000 g	N/A	200.000 g
10	200.001 g	N/A	200.001 g
Standard Deviation	0.0004 g	N/A	0.0004 g

### Eccentricity

Test Load: 200 g

Position	As Found	As Left
1	200.001 g	N/A
2	200.001 g	N/A
3	200.002 g	N/A
4	200.002 g	N/A
5	200.000 g	N/A
Maximum Deviation	0.001 g	N/A



The "1d" in the graph represents the repeatability of the comparison in which the test was performed.





Equipment : Autoclave  
Condition As-Received : Used Item  
Reference : 2207-02450C-7  
Result of Calibration : ( \* ) Without Adjustment

Cert. No.: 22TM1121  
Page.: 3 of 3

Cert. No.: 22TM572  
Page.: 1 of 3

## Certificate of Calibration

Equipment : Incubator  
Manufacturer : Memmert  
Model : IPP 260  
Serial No. : VS16.0066  
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 : 3 May 2022  
Calibration Date : 5 May 2022  
Ambient Temperature : ( 26 ± 10 ) °C  
Relative Humidity : ( 50 ± 30 ) %  
Calibrated by : Preecha Hahib

Approved by :   
( ) Pormthipa Tameyskul  
(✓) Mailee Bulkrusa  
( ) Suwit Imjai

Issue Date : 11 May 2022

The Uncertainties are for a confidence probability of approximately 95%

This certificate is valid only for the equipment and conditions specified herein.  
Approved for Internal Use Only. (Not for External Use) (Not for Calibration)

เอกสารไม่ควบคุม

UUC* Setting ( °C )	UUC* Reading ( °C )	Position	Average* Standard Reading ( °C )	Stability ( ± °C )	Pressure Reading ( MPa )	Uncertainty ( ± °C )	Coverage Factor k
116	116	1	116.523	0.14	0.06	0.90	2
		2	116.566				
		3	116.440				

Operating parameter Set : Temperature = 121 °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
122	122	1	122.503	0.10	0.12	0.91	2
		2	122.637				
		3	122.558				

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 %.

-000-

เอกสารไม่ควบคุม



Equipment : Autoclave  
Condition As-Received : Used Item  
Reference : 2207-02450C-7  
Procedure Used :-

Cert. No.: 22TM1121  
Page.: 2 of 3

Calibration were conducted using in-house calibration procedure CP-0703 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\*\*

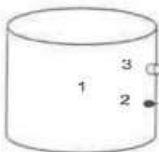
(\*\* = Categorization of pathogens according to hazard and categories of containment, second edition, 1990 )

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	29	48	220
Finished of Calibration	32	48	220

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



Cert. No.: 22TM1121  
Page.: 1 of 3

## Certificate of Calibration

Equipment : Autoclave  
Manufacturer : ALP  
Model : CL-40L  
Serial No. : 807298  
ID No. : UAE.MIC.019/2560  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong,  
Bangkok 10260  
Location : 301 Room  
Received Order : 11 July 2022  
Calibration Date : 11 July 2022  
Ambient Temperature : ( 26 ± 10 ) °C  
Relative Humidity : ( 50 ± 30 ) %  
Calibrated by : Preecha Hahib

Approved by :   
( ) Pormthipa Tameyskul  
(✓) Mailee Bulkrusa  
( ) Suwit Imjai

Issue Date : 18 July 2022

The Uncertainties are for a confidence probability of approximately 95%

This certificate is valid only for the equipment and conditions specified herein.  
Approved for Internal Use Only. (Not for External Use) (Not for Calibration)

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม



Equipment : Waier Bath  
Condition As-Received : Used Item  
Reference : 2202-0444OC-5  
Procedure Used :-

Cert. No.: 22TM332  
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 MY44087817 21LM10 20 Jul 2022

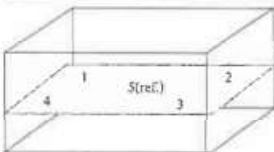
2. This certificate is valid only to the item calibrated on date and place of calibration.

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	56	230



Front

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

เอกสารไมควบคุม

a 1096053



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3. EQUIPMENT CALIBRATION AND TESTING SERVICES  
114 PATTANAKARN ROAD SOI 12, KHAO YAI, BANGKOK 10110  
TEL: 02-551-8421 FAX: 02-551-8421



## Certificate of Calibration

Cert. No.: 22TM332  
Page.: 1 of 3

Equipment : Waier Bath  
Manufacturer : Mammert  
Model : WNE 14  
Serial No. : L418.0614  
ID No. : UAE.MIC.020/2561  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong,  
Bangkok 10260  
Microbiology Laboratory  
Location :  
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 :   
( ) Ponthippa Tameyakul  
( / ) Malee Butkuea

Issue Date : 22 February 2022

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

This calibration was performed in accordance with the ISO 17025:2017 requirements.  
Approved by Bureau of Engineering Services 3. Equipment Calibration and Testing Services

เอกสารไมควบคุม

A 0039095



Equipment : Incubator  
Condition As-Received : Used Item  
Reference : 2205-0033OC-3  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Not Available

Cert. No.: 22TM572  
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	25.0	0.021	0.16	0.33	0.30	2
36.0	36.0	36.0	0.077	0.96	1.8	0.33	2

Calibration Point ( °C )	Measured Temperature ( °C )								
	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
25.0	25.221	25.146	25.127	25.113	24.988	24.986	24.933	25.017	25.047
36.0	35.637	35.236	36.130	36.515	36.928	36.845	36.630	36.761	36.113

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

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

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

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

UUC\* : Unit Under Calibration

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

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

-000-

เอกสารไมควบคุม



Equipment : Incubator  
Condition As-Received : Used Item  
Reference : 2205-0033OC-3  
Procedure Used :-

Cert. No.: 22TM672  
Page.: 2 of 3

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 MY44087817 21LM10 20 Jul 2022

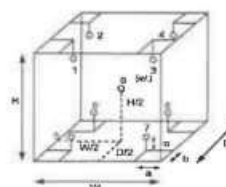
2. This certificate is valid only to the item calibrated on date and place of calibration.

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 : Dimension of Chamber :  
a = 5.0 cm D = 0.50 m  
b = 5.0 cm W = 0.60 m  
c = 5.0 cm H = 0.80 m  
Capacity = 0.24 m<sup>3</sup>

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	25	23
REL.Humid. ( % )	62	57
AC Supply ( Volt )	221	221

Position :	Ref. Std. ID No.:
1	19-15RTD-01
2	19-15RTD-02
3	19-15RTD-03
4	19-15RTD-04
5	19-15RTD-05
6	21-15RTD-06
7	19-15RTD-07
8	19-15RTD-08
9 (ref.)	19-15RTD-09

เอกสารไมควบคุม



Equipment : Water Bath  
Condition As-Received : Used Item  
Reference : 2202-0444OC-6  
Result of Calibration : ( ° ) Without Adjustment  
Function of UUC\* : Temperature Source

Cert. No.: 22TM332  
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	44.548	44.517	44.513	44.537	44.578
50.0	50.0	50.0	50.089	50.061	50.036	50.061	50.092

Calibration point ( °C )	Uniformity ( °C )	Stability ( ± °C )	Uncertainty ( ± °C )	Coverage Factor k
44.5	0.10	0.043	0.15	2
50.0	0.11	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 temperatures 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 %.

-080-

ภาคผนวก จ

---

ใบอนุญาตขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชนจากกรมโรงงาน







ลำดับ	สารเคมี	วิธีการตรวจ
36	Oil & Grease	1) Liquid-Liquid, Partition-Gravimetric Method <sup>6</sup> 2) Soxhlet Extraction Method <sup>12</sup>
37	pH	Electrometric Method <sup>6</sup>
38	Phenols	1) Distillation, Chloroform Extraction Method <sup>13</sup> 2) Distillation, Direct Photometric Method <sup>14</sup>
39	Selenium	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method <sup>15</sup> 2) Digestion, Inductively Coupled Plasma Method <sup>16</sup>
40	Sulfide	1) Iodometric Method <sup>6</sup> 2) Methylene Blue Method <sup>17</sup> Laboratory and Field Methods <sup>18</sup>
41	Temperature	Dried at 180 °C <sup>19</sup>
42	Total Dissolved Solids	Semi-Micro-Kjeldahl Method <sup>15</sup>
43	Total Kjeldahl Nitrogen	Dried at 103-105 °C <sup>17</sup>
44	Total Suspended Solids	1) Digestion, Direct Air-Acetylene Flame Method, Colorimetric Method, Calculation <sup>16</sup> 2) Digestion, Inductively Coupled Plasma Method, Colorimetric Method, Calculation <sup>16</sup>
45	Trivalent Chromium	1) Digestion, Direct Air-Acetylene Flame Method <sup>21</sup> 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method <sup>6</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>16</sup>

หน้า 15 จาก 126 หน้า

ลำดับ	สารเคมี	วิธีการตรวจ
1	Acenaphthene	1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>1</sup> 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>21</sup>
2	Acetone	Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>21</sup>
3	Aldrin	1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>6</sup> 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>21, 22</sup>

4 Anthracene...

ลำดับ	สารเคมี	วิธีการตรวจ
4	Anthracene	1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>7</sup> 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>15</sup>
5	Antimony	Digestion, Inductively Coupled Plasma Method <sup>21</sup>
6	Arsenic	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method <sup>15</sup> 2) Digestion, Inductively Coupled Plasma Method <sup>16</sup>
7	Atrazine	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>24</sup>
8	Barium	1) Digestion, Electrothermal Atomic Absorption Spectrometric Method <sup>11</sup> 2) Digestion, Inductively Coupled Plasma Method <sup>14</sup>
9	Benz[a]anthracene	1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>1</sup> 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>21</sup>
10	Benzene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>21</sup>
11	Benzofluoranthene	1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>21</sup> 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>11</sup>
12	Benzofluoranthene	1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>16</sup> 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>21</sup>
13	Benzoic acid	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>11</sup>
14	Benzo[a]pyrene	1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>21</sup> 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>21, 22</sup>

15 Benzo[b]pyrene...

ลำดับ	สารเคมี	วิธีการตรวจ
15	Benzo[ghi]perylene	1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>1</sup> 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>21</sup>
16	Beryllium	Digestion, Inductively Coupled Plasma Method <sup>21</sup>
17	Bis(2-chloroethyl)ether	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>16</sup>
18	Bis(2-ethylhexyl)phthalate	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>16</sup>
19	Bromodichloromethane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>21</sup>
20	Bromoform	Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>21</sup>
21	Butanol	Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>1</sup>
22	Butyl benzoate	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>16</sup>
23	Cadmium	1) Digestion, Direct Air-Acetylene Flame Method <sup>6</sup> 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method <sup>15</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>20</sup>
24	Carbazole	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>21</sup>
25	Carbon disulfide	Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>16</sup>
26	Carbon tetrachloride	Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>1</sup>
27	Chlordane	1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>1</sup> 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>21</sup>
28	p-CHloroaniline	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>16</sup>
29	Chlorobenzene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>21, 22</sup>

30 Chlorodibromomethane...

ลำดับ	สารเคมี	วิธีการตรวจ
30	Chlorodibromomethane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>26</sup>
31	Chloroform	Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>21</sup>
32	2-Chlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>16</sup>
33	Chromium	1) Digestion, Direct Air-Acetylene Flame Method <sup>10</sup> 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method <sup>15</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>11</sup>
34	Chromium (III)	1) Digestion, Direct Air-Acetylene Flame Method, Colorimetric Method, Calculation <sup>16</sup> 2) Digestion, Inductively Coupled Plasma Method, Colorimetric Method, Calculation <sup>16</sup>
35	Chromium (VI)	1) Colorimetric Method <sup>16</sup> 2) Extraction, Air-Acetylene Flame Method <sup>1</sup>
36	Chrysene	1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>1</sup> 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>21</sup>
37	Cyanine	Distillation, Colorimetric Method <sup>16</sup>
38	2,4-D	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>11</sup>
39	DDD	1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>1</sup> 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>21</sup>
40	DOE	1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>1</sup> 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>21</sup>
41	DDT	1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>1</sup> 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>21, 22</sup>

42 Dibenz[a,h]anthracene...

ลำดับ	สารเคมี	วิธีวิเคราะห์
42	Dibenz[a,h]anthracene	1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>75</sup> 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>76</sup>
43	Di-n-butyl phthalate	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>77</sup>
44	1,2-Dichlorobenzene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>78</sup>
45	1,3-Dichlorobenzene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>79</sup>
46	1,4-Dichlorobenzene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>80</sup>
47	3,3'-Dichlorobenzidine	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>81</sup>
48	1,1-Dichloroethane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>82</sup>
49	1,2-Dichloroethane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>83</sup>
50	1,1-Dichloroethylene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>84</sup>
51	cis-1,2-Dichloroethylene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>85</sup>
52	trans-1,2-Dichloroethylene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>86</sup>
53	2,4-Dichlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>87</sup>
54	1,2-Dichloropropane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>88</sup>
55	1,3-Dichloropropane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>89</sup>
56	1,3-Dichloropropene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>90</sup>
57	Dieldrin	1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>91</sup> 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>92, 93</sup>

58 Diethyl phthalate...

ลำดับ	สารเคมี	วิธีวิเคราะห์
58	Diethyl phthalate	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>94</sup>
59	2,4-Dimethylphenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>95</sup>
60	2,4-Dinitrophenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>96</sup>
61	2,4-Dinitrotoluene	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>97</sup>
62	2,6-Dinitrotoluene	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>98</sup>
63	Di-n-Octyl phthalate	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>99</sup>
64	Endosulfen	1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>100</sup> 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>101</sup>
65	Endrin	1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>102</sup> 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>103</sup>
66	Ethylbenzene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>104</sup>
67	Fluoranthene	1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>105</sup> 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>106</sup>
68	Fluorene	1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>107</sup> 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>108</sup>
69	Heptachlor	1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>109</sup> 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>110, 111</sup>

70 heptachlor epoxide...

ลำดับ	สารเคมี	วิธีวิเคราะห์
70	Heptachlor epoxide	1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>112</sup> 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>113</sup>
71	Hexachlorobenzene	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>114</sup>
72	Hexachloro-1,3-butadiene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>115</sup>
73	n-Hexane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>116</sup>
74	α-HCH	1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>117</sup> 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>118</sup>
75	β-HCH	1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>119</sup> 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>120</sup>
76	γ-HCH	1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>121</sup> 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>122</sup>
77	Hexachlorocyclopentadiene	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>123</sup>
78	Hexachloroethane	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>124</sup>
79	Indeno[1,2,3-cd]pyrene	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>125</sup>
80	Isophorone	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>126</sup>
81	Lead	1) Digestion, Direct Air-Acetylene Flame Method <sup>127</sup> 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method <sup>128</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>129, 130</sup>

82 Manganese...

ลำดับ	สารเคมี	วิธีวิเคราะห์
82	Manganese	1) Digestion, Direct Air-Acetylene Flame Method <sup>131</sup> 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method <sup>132</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>133</sup>
83	Mercury	Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>134</sup>
84	Methanol	Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>135</sup>
85	Methoxychlor	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>136</sup>
86	Methyl bromide	Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>137</sup>
87	Methylene chloride	Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>138</sup>
88	2-Methylphenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>139</sup>
89	2-Methylnaphthalene	1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>140</sup> 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>141</sup>
90	Methyl tert-butyl ether	Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>142</sup>
91	Naphthalene	1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>143</sup> 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>144</sup>
92	Nickel	1) Digestion, Direct Air-Acetylene Flame Method <sup>145</sup> 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method <sup>146</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>147</sup>
93	Nitrobenzene	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>148</sup>
94	N-Nitrosodiphenylamine	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>149</sup>
95	N-Nitrosodipropylamine	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>150, 151</sup>

96 Polychlorinated Biphenyls...

ลำดับ	สารเคมี	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 <sup>21</sup> 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>21</sup>
97	Pentachlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>21</sup>
98	pH	Electrometric Method <sup>21</sup>
99	Phenanthrene	1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>21</sup> 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>21</sup>
100	Phenol	1) Distillation, Chloroform Extraction Method <sup>21</sup> 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>21</sup>
101	Pyrene	1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>21</sup> 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>21</sup>
102	Selenium	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method <sup>21</sup> 2) Digestion, Inductively Coupled Plasma Method <sup>21</sup>
103	Silver	Digestion, Inductively Coupled Plasma Method <sup>21</sup>
104	Styrene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>21</sup>
105	1,1,2,2-Tetrachloroethane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>21</sup>
106	Tetrachloroethylene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>21</sup>
107	Toluene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>21</sup>

108 Toxaphene...

ลำดับ	สารเคมี	วิธีวิเคราะห์
108	Toxaphene	1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>21</sup> 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>21</sup>
109	TPH (C <sub>1</sub> - C <sub>6</sub> )	1) Purge and Trap, Gas Chromatographic Method <sup>21,22</sup> 2) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>21,22</sup>
110	TPH (C <sub>10</sub> - C <sub>20</sub> )	Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method <sup>22</sup>
111	TPH (C <sub>20</sub> - C <sub>30</sub> )	Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method <sup>22</sup>
112	1,2,4-Trichlorobenzene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>21</sup>
113	1,1,1-Trichloroethane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>21</sup>
114	1,1,2-Trichloroethane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>21</sup>
115	Trichloroethylene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>21</sup>
116	2,4,5-Trichlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>21</sup>
117	2,4,6-Trichlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>21</sup>
118	1,3,5-Trimethylbenzene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>21</sup>
119	Vanadium	Digestion, Inductively Coupled Plasma Method <sup>21</sup>
120	Vinyl acetate	Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>21</sup>
121	Vinyl chloride	Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>21</sup>
122	m-Xylene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>21</sup>
123	o-Xylene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>21</sup>

124 p-Xylene...

ลำดับ	สารเคมี	วิธีวิเคราะห์
124	p-Xylene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>21</sup>
125	Xylene (Total)	Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>21</sup>
126	Zinc	1) Digestion, Direct Air-Acetylene Flame Method <sup>21</sup> 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method <sup>21</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>21</sup>

ธาตุเคมี (ไม่ใช่อโลหะ) จำนวน 25 ชนิด

ลำดับ	สารเคมี	วิธีวิเคราะห์
1	Antimony	Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>21</sup>
2	Arsenic	1) Isokinetic Sampling, Digestion, Hydride Generation/Atomic Absorption Spectrometric Method <sup>21</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>21</sup>
3	Cadmium	1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method <sup>21</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>21</sup>
4	Carbon Monoxide	Instrumental Analyzer Method <sup>21</sup>
5	Chlorine	Isokinetic Sampling, Ion Chromatographic Method <sup>21</sup>
6	Chromium	1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method <sup>21</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>21</sup>
7	Cobalt	Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>21</sup>
8	Copper	1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method <sup>21</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>21</sup>
9	Cresol	Absorption Sampling, Gas Chromatographic Method <sup>21</sup>

10 Dioxins/Furans...

ลำดับ	สารเคมี	วิธีวิเคราะห์
10	Dioxins/Furans	Isokinetic Sampling <sup>21</sup>
11	Hydrogen Chloride	Isokinetic Sampling, Ion Chromatographic Method <sup>21</sup>
12	Hydrogen Fluoride	Isokinetic Sampling, Ion Chromatographic Method <sup>21</sup>
13	Hydrogen Sulfide	Absorption Sampling, Iodometric Method <sup>21</sup>
14	Lead	1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method <sup>21</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>21</sup>
15	Manganese	1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method <sup>21</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>21</sup>
16	Mercury	Isokinetic Sampling, Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>21</sup>
17	Nickel	1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method <sup>21</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>21</sup>
18	Opacity	Ringelmann's Method <sup>21</sup>
19	Oxides of Nitrogen	1) Absorption Sampling, Phenoldisulfonic acid Method <sup>21</sup> 2) Instrumental Analyzer Method <sup>21</sup>
20	Selenium	1) Isokinetic Sampling, Digestion, Hydride Generation/Atomic Absorption Spectrometric Method <sup>21</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>21</sup>
21	Sulfur Dioxide	1) Absorption Sampling, Barium-Thoron Titrimetric Method <sup>21</sup> 2) Instrumental Analyzer Method <sup>21</sup>
22	Sulfuric Acid	Isokinetic Sampling, Barium-Thoron Titrimetric Method <sup>21</sup>
23	Total Suspended Particulate	Isokinetic Sampling, Gravimetric Method <sup>21</sup>
24	Vanadium	Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>21</sup>
25	Xylene	1) Bag Sampling, Gas Chromatographic Method <sup>21</sup> 2) Adsorption Sampling, Gas Chromatographic Method <sup>21</sup>

สิ่งปนเปื้อน...

ระเบียบกระทรวงมหาดไทยว่าด้วยการ 35 ราชกิจ

ลำดับ	สารเคมี	วิธีการตรวจ
1	Aldrin	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method <sup>2,3,21</sup> 2) Ultrasonic Extraction, Gas Chromatographic Method <sup>2,3,22</sup>
2	Arsimony	Digestion, Inductively Coupled Plasma Method <sup>2,3,15</sup>
3	Arsenic	1) Waste Extraction, Digestion, Hydride Generation/Atomic Absorption Spectrometric Method <sup>2,3,18</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>2,3,13</sup> 3) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method <sup>2,3,13</sup> 4) Digestion, Inductively Coupled Plasma Method <sup>2,3,13</sup>
4	Barium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>2,3,13</sup> 2) Digestion, Inductively Coupled Plasma Method <sup>2,3,13</sup>
5	Beryllium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>2,3,13</sup> 2) Digestion, Inductively Coupled Plasma Method <sup>2,3,13</sup>
6	Cadmium	1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method <sup>2,3,14</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>2,3,13</sup> 3) Digestion, Flame Atomic Absorption Spectrometric Method <sup>2,3,13</sup> 4) Digestion, Inductively Coupled Plasma Method <sup>2,3,13</sup>
7	Chlordane	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method <sup>2,3,23</sup> 2) Ultrasonic Extraction, Gas Chromatographic Method <sup>2,3,23</sup>
8	Chromium	1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method <sup>2,3,14</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>2,3,13</sup> ๒. ๖๖๓

3) Digestion...

ลำดับ	สารเคมี	วิธีการตรวจ
9	Chromium (II)	3) Digestion, Flame Atomic Absorption Spectrometric Method <sup>2,3,14</sup> 4) Digestion, Inductively Coupled Plasma Method <sup>2,3,13</sup> 1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method, Waste Extraction, Colorimetric Method; Calculation <sup>2,3,13,14</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method, Waste Extraction, Colorimetric Method; Calculation <sup>2,3,13,14</sup> 3) Digestion, Flame Atomic Absorption Spectrometric Method; Alkaline Digestion, Colorimetric Method; Calculation <sup>2,3,13,14</sup> 4) Digestion, Inductively Coupled Plasma Method; Alkaline Digestion, Colorimetric Method; Calculation <sup>2,3,13,14</sup>
10	Chromium (VI)	1) Waste Extraction, Colorimetric Method <sup>2,3,13</sup> 2) Alkaline Digestion, Colorimetric Method <sup>2,3,13</sup>
11	Cobalt	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>2,3,13</sup> 2) Digestion, Inductively Coupled Plasma Method <sup>2,3,13</sup>
12	Copper	1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method <sup>2,3,14</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>2,3,13</sup> 3) Digestion, Flame Atomic Absorption Spectrometric Method <sup>2,3,14</sup> 4) Digestion, Inductively Coupled Plasma Method <sup>2,3,13</sup>
13	2,4-D	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method <sup>2,3,23</sup> 2) Ultrasonic Extraction, Gas Chromatographic Method <sup>2,3,23</sup>
14	DDE	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method <sup>2,3,23</sup> 2) Ultrasonic Extraction, Gas Chromatographic Method <sup>2,3,23</sup>

15 DDE...

ลำดับ	สารเคมี	วิธีการตรวจ
15	DDE	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method <sup>2,3,23</sup> 2) Ultrasonic Extraction, Gas Chromatographic Method <sup>2,3,23</sup>
16	DDT	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method <sup>2,3,23</sup> 2) Ultrasonic Extraction, Gas Chromatographic Method <sup>2,3,23</sup>
17	Dieldrin	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method <sup>2,3,23</sup> 2) Ultrasonic Extraction, Gas Chromatographic Method <sup>2,3,23</sup>
18	Endrin	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method <sup>2,3,23</sup> 2) Ultrasonic Extraction, Gas Chromatographic Method <sup>2,3,23</sup>
19	Heptachlor	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method <sup>2,3,23</sup> 2) Ultrasonic Extraction, Gas Chromatographic Method <sup>2,3,23</sup>
20	Lead	1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method <sup>2,3,14</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>2,3,13</sup> 3) Digestion, Flame Atomic Absorption Spectrometric Method <sup>2,3,14</sup> 4) Digestion, Inductively Coupled Plasma Method <sup>2,3,13</sup>
21	Lindane	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method <sup>2,3,23</sup> 2) Ultrasonic Extraction, Gas Chromatographic Method <sup>2,3,23</sup>
22	Mercury	1) Waste Extraction, Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>2,3,17</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>2,3,13</sup> ๒. ๖๖๓

3) Digestion...

ลำดับ	สารเคมี	วิธีการตรวจ
23	Methoxychlor	3) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>2,3,17</sup> 4) Digestion, Inductively Coupled Plasma Method <sup>2,3,13</sup> 5) Thermal Decomposition Amalgamation and Atomic Absorption Spectrometric Method <sup>2,3,17</sup>
24	Molybdenum	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>2,3,13</sup> 2) Digestion, Inductively Coupled Plasma Method <sup>2,3,13</sup>
25	Nickel	1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method <sup>2,3,14</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>2,3,13</sup> 3) Digestion, Flame Atomic Absorption Spectrometric Method <sup>2,3,14</sup> 4) Digestion, Inductively Coupled Plasma Method <sup>2,3,13</sup>
26	Polychlorinated Biphenyls - Aroclor 1016 - Aroclor 1221 - Aroclor 1232 - 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 <sup>2,3,23</sup> 2) Ultrasonic Extraction, Gas Chromatographic Method <sup>2,3,23</sup> ๒. ๖๖๓

2,2,4,5,5'...

ลำดับ	สารเคมี	วิธีวิเคราะห์
27	- 2,2',4,5,5'-Pentachlorobiphenyl - 2,3,3',4,4',5'-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',5,5',6'-Heptachlorobiphenyl - 2,2',3,3',4,4',5,5',6'-Nonachlorobiphenyl Pentachlorophenol	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1),(2)</sup> 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(3),(4)</sup> Electrode Method <sup>(5),(6)</sup>
28	pH	
29	Selenium	1) Waste Extraction, Digestion, Hydride Generation/Atomic Absorption Spectrometric Method <sup>(1),(4)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(2),(3),(7)</sup> 3) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method <sup>(7),(8)</sup> 4) Digestion, Inductively Coupled Plasma Method <sup>(1),(5),(9),(10)</sup>

30 Silver...

ลำดับ	สารเคมี	วิธีวิเคราะห์
30	Silver	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1),(11)</sup>
31	Thallium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(2),(12)</sup>
32	Toxaphene	2) Digestion, Inductively Coupled Plasma Method <sup>(1),(13)</sup> 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(1),(14)</sup> 2) Ultrasonic Extraction, Gas Chromatographic Method <sup>(1),(15)</sup>
33	Trichloroethylene	1) Waste Extraction, Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(1),(16),(17)</sup> 2) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(1),(18)</sup>
34	Vanadium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(2),(19)</sup>
35	Zinc	1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method <sup>(1),(20)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(2),(21)</sup> 3) Digestion, Flame Atomic Absorption Spectrometric Method <sup>(1),(22)</sup> 4) Digestion, Inductively Coupled Plasma Method <sup>(1),(23)</sup>

## สิ่งอื่นรวม 125 รายการ

ลำดับ	สารเคมี	วิธีวิเคราะห์
1	Acenaphthene	1) Ultrasonic Extraction, Gas Chromatographic Method <sup>(1),(24)</sup>
2	Acetone	2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1),(25)</sup> Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(2),(26),(27),(28)</sup>

3 Aldin...

ลำดับ	สารเคมี	วิธีวิเคราะห์
3	Aldrin	1) Ultrasonic Extraction, Gas Chromatographic Method <sup>(1),(29)</sup> 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(3),(30)</sup>
4	Anthracene	1) Ultrasonic Extraction, Gas Chromatographic Method <sup>(1),(31)</sup> 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1),(32)</sup>
5	Antimony	Digestion, Inductively Coupled Plasma Method <sup>(1),(33)</sup>
6	Arsenic	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method <sup>(1),(34)</sup> 2) Digestion, Inductively Coupled Plasma Method <sup>(2),(35)</sup>
7	Atrazine	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(2),(36),(37)</sup>
8	Barium	Digestion, Inductively Coupled Plasma Method <sup>(1),(38)</sup>
9	Benz[a]anthracene	1) Ultrasonic Extraction, Gas Chromatographic Method <sup>(1),(39)</sup> 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1),(40)</sup>
10	Benzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(1),(41)</sup>
11	Benzobifluoranthene	1) Ultrasonic Extraction, Gas Chromatographic Method <sup>(1),(42)</sup> 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1),(43)</sup>
12	Benzobifluoranthene	1) Ultrasonic Extraction, Gas Chromatographic Method <sup>(1),(44)</sup> 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1),(45)</sup>
13	Benzoic acid	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1),(46)</sup>
14	Benzo[a]pyrene	1) Ultrasonic Extraction, Gas Chromatographic Method <sup>(1),(47)</sup> 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1),(48),(49)</sup>

15 Benz[ghi]perylene...

ลำดับ	สารเคมี	วิธีวิเคราะห์
15	Benz[ghi]perylene	1) Ultrasonic Extraction, Gas Chromatographic Method <sup>(1),(50)</sup> 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1),(51)</sup>
16	Beryllium	Digestion, Inductively Coupled Plasma Method <sup>(1),(52)</sup>
17	Bis(2-chloroethyl)ether	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1),(53)</sup>
18	Bis(2-ethylhexyl)phthalate	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1),(54)</sup>
19	Bromodichloromethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(1),(55)</sup>
20	Bromoforn	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(1),(56)</sup>
21	Butanol	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(1),(57)</sup>
22	Butyl benzyl phthalate	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1),(58)</sup>
23	Cadmium	1) Digestion, Flame Atomic Absorption Spectrometric Method <sup>(1),(59)</sup> 2) Digestion, Inductively Coupled Plasma Method <sup>(1),(60)</sup>
24	Carbazole	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1),(61)</sup>
25	Carbon dioxide	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(1),(62)</sup>
26	Carbon tetrachloride	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(1),(63)</sup>
27	Chlordane	1) Ultrasonic Extraction, Gas Chromatographic Method <sup>(1),(64)</sup> 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1),(65)</sup>
28	p-Chloroaniline	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1),(66)</sup>
29	Chlorobenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(1),(67)</sup>
30	Chlorodibromomethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(1),(68),(69),(70)</sup>

31 Chloroform...

ลำดับ	สารเคมี	วิธีวิเคราะห์
31	Chloroform	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>1,281</sup>
32	2-Chlorophenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>19,282</sup>
33	Chromium	1) Digestion, Flame Atomic Absorption Spectrometric Method <sup>1,283</sup> 2) Digestion, Inductively Coupled Plasma Method <sup>1,132</sup>
34	Chromium (III)	1) Digestion, Flame Atomic Absorption Spectrometric Method; Alkaline Digestion, Colorimetric Method, Calculation <sup>7,284,144</sup> 2) Digestion, Inductively Coupled Plasma Method; Alkaline Digestion, Colorimetric Method, Calculation <sup>7A,145</sup>
35	Chromium (VI)	Alkaline Digestion, Colorimetric Method <sup>146</sup>
36	Chrysene	1) Ultrasonic Extraction, Gas Chromatographic Method <sup>19,249</sup> 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>19,285</sup>
37	Cyanide	Extraction, Distillation, Colorimetric Method <sup>19,248</sup>
38	2,4-D	Ultrasonic Extraction, Gas Chromatographic Method <sup>191</sup>
39	DDD	1) Ultrasonic Extraction, Gas Chromatographic Method <sup>19,251</sup> 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>19,286</sup>
40	DDE	1) Ultrasonic Extraction, Gas Chromatographic Method <sup>19,251</sup> 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>19,286</sup>
41	DDT	1) Ultrasonic Extraction, Gas Chromatographic Method <sup>1,297</sup> 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>1,286</sup>
42	Dibenz[a,h]anthracene	1) Ultrasonic Extraction, Gas Chromatographic Method <sup>19,249</sup> 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>19,249,147,148</sup>

43 Di-n-butyl phthalate...

ลำดับ	สารเคมี	วิธีวิเคราะห์
43	Di-n-butyl phthalate	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>19,288</sup>
44	1,2-Dichlorobenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>19,248</sup>
45	1,3-Dichlorobenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>19,248</sup>
46	1,4-Dichlorobenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>19,251</sup>
47	3,3'-Dichlorobenzidine	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>19,248</sup>
48	1,1-Dichloroethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>19,249</sup>
49	1,2-Dichloroethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>19,249</sup>
50	1,1-Dichloroethylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>19,249</sup>
51	cis-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>19,249</sup>
52	trans-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>19,249</sup>
53	2,4-Dinitrophenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>19,286</sup>
54	1,2-Dichloropropane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>19,249</sup>
55	1,3-Dichloropropane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>19,249</sup>
56	1,3-Dichloropropene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>19,285</sup>
57	Dieldrin	1) Ultrasonic Extraction, Gas Chromatographic Method <sup>19,279</sup> 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>19,280</sup>
58	Diethyl phthalate	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>19,249</sup>
59	2,4-Dimethylphenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>19,249,147,148</sup>

59 2,4-Dinitrophenol...

ลำดับ	สารเคมี	วิธีวิเคราะห์
60	2,4-Dinitrophenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>19,286</sup>
61	2,4-Dinitrotoluene	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>19,249</sup>
62	2,6-Dinitrotoluene	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>19,249</sup>
63	Di-n-Octyl phthalate	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>19,249</sup>
64	Endosulfan	1) Ultrasonic Extraction, Gas Chromatographic Method <sup>19,279</sup> 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>19,280</sup>
65	Endrin	1) Ultrasonic Extraction, Gas Chromatographic Method <sup>19,249</sup> 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>19,249</sup>
66	Ethylbenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>19,251</sup>
67	Fluoranthene	1) Ultrasonic Extraction, Gas Chromatographic Method <sup>19,249</sup> 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>19,249</sup>
68	Fluorene	1) Ultrasonic Extraction, Gas Chromatographic Method <sup>19,249</sup> 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>19,249</sup>
69	Heptachlor	1) Ultrasonic Extraction, Gas Chromatographic Method <sup>19,249</sup> 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>19,249</sup>
70	Heptachlor epoxide	1) Ultrasonic Extraction, Gas Chromatographic Method <sup>19,249</sup> 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>19,249,147,148</sup>

71 Hexachlorobenzene...

ลำดับ	สารเคมี	วิธีวิเคราะห์
71	Hexachlorobenzene	1) Ultrasonic Extraction, Gas Chromatographic Method <sup>19,249</sup> 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>19,249</sup>
72	Hexachloro-1,3-butadiene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>19,249</sup>
73	n-Hexane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>19,251</sup>
74	α-HCH	1) Ultrasonic Extraction, Gas Chromatographic Method <sup>19,249</sup> 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>19,249</sup>
75	β-HCH	1) Ultrasonic Extraction, Gas Chromatographic Method <sup>19,249</sup> 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>19,249</sup>
76	γ-HCH	1) Ultrasonic Extraction, Gas Chromatographic Method <sup>19,249</sup> 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>19,249</sup>
77	Hexachlorocyclopentadiene	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>19,249</sup>
78	Hexachloroethane	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>19,249</sup>
79	Indeno[1,2,3-cd]pyrene	1) Ultrasonic Extraction, Gas Chromatographic Method <sup>19,249</sup> 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>19,249</sup>
80	Iopronone	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>19,249</sup>
81	Lead	1) Digestion, Flame Atomic Absorption Spectrometric Method <sup>1,291</sup> 2) Digestion, Inductively Coupled Plasma Method <sup>1,141</sup>
82	Manganese	1) Digestion, Flame Atomic Absorption Spectrometric Method <sup>1,291</sup> 2) Digestion, Inductively Coupled Plasma Method <sup>1,141</sup>

83 Mercury...



ลำดับ	สารเคมี	วิธีการตรวจ
83	Mercury	1) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>(14)</sup> 2) Digestion, Inductively Coupled Plasma Method <sup>(122)</sup> 3) Thermal Decomposition Amalgamation and Atomic Absorption Spectrometric Method <sup>(15)</sup>
84	Methanol	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(123)</sup>
85	Methoxychlor	1) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(123)</sup> 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(123)</sup>
86	Methyl bromide	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(123)</sup>
87	Methylene chloride	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(123)</sup>
88	2-Methylphenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(124)</sup>
89	2-Methylnaphthalene	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(124)</sup>
90	Methyl tert-butyl ether	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(123)</sup>
91	Naphthalene	1) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(124)</sup> 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(124)</sup>
92	Nickel	1) Digestion, Flame Atomic Absorption Spectrometric Method <sup>(124)</sup> 2) Digestion, Inductively Coupled Plasma Method <sup>(124)</sup>
93	Nitrobenzene	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(125)</sup>
94	N-Nitrosodiphenylamine	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(126)</sup>
95	N-Nitrosodipropylamine	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(126)</sup>

96 Polychlorinated Biphenyls...

ลำดับ	สารเคมี	วิธีการตรวจ
96	Polychlorinated Biphenyls - Aroclor 1016 - Aroclor 1221 - Aroclor 1232 - Aroclor 1242 - Aroclor 1248 - Aroclor 1254 - Aroclor 1260 Polychlorinated Biphenyls - 2-Chlorobiphenyl - 2,3-Dichlorobiphenyl - 2,2',5-Trichlorobiphenyl - 2,4',5-Trichlorobiphenyl - 2,2',3,3'-Tetrachlorobiphenyl - 2,2',5,5'-Tetrachlorobiphenyl - 2,3,4,4'-Tetrachlorobiphenyl - 2,2',3,4,5'-Pentachlorobiphenyl - 2,2',4,5,5'-Pentachlorobiphenyl - 2,3,3',4,6-Pentachlorobiphenyl - 2,2',3,4,4',5'-Hexachlorobiphenyl - 2,2',3,4,4',5'-Hexachlorobiphenyl - 2,2',3,4,4',5'-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',5,5',6'-Octachlorobiphenyl	1) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(127)</sup> 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(128)</sup> Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(129)</sup>

- 2,2',3,4,5,5',6'-

ลำดับ	สารเคมี	วิธีการตรวจ
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 <sup>(129)</sup>
98	Phenanthrene	1) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(130)</sup> 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(130)</sup>
99	Phenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(130)</sup>
100	Pyrene	1) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(130)</sup> 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(130)</sup>
101	Selenium	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method <sup>(131)</sup> 2) Digestion, Inductively Coupled Plasma Method <sup>(131)</sup>
102	Silver	Digestion, Inductively Coupled Plasma Method <sup>(131)</sup>
103	Styrene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(132)</sup>
104	1,1,2,2-Tetrachloroethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(132)</sup>
105	Tetrachloroethylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(132)</sup>
106	Toluene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(132)</sup>
107	Triaphene	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(132)</sup>
108	TPH (C <sub>10</sub> -C <sub>14</sub> )	1) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(133)</sup> 2) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(133)</sup>
109	TPH (C <sub>10</sub> -C <sub>14</sub> )	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(133)</sup>
110	TPH (C <sub>10</sub> -C <sub>14</sub> )	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(133)</sup>
111	1,2,4-Trichlorobenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(133)</sup>

112 1,1,1-Trichloroethane...

ลำดับ	สารเคมี	วิธีการตรวจ
112	1,1,1-Trichloroethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(133)</sup>
113	1,1,2-Trichloroethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(133)</sup>
114	Trichloroethylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(133)</sup>
115	2,4,5-Trichlorophenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(134)</sup>
116	2,4,6-Trichlorophenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(134)</sup>
117	1,3,5-Trinitrobenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(134)</sup>
118	Vanadium	Digestion, Inductively Coupled Plasma Method <sup>(135)</sup>
119	Vinyl acetate	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(135)</sup>
120	Vinyl chloride	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(135)</sup>
121	m-Xylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(135)</sup>
122	o-Xylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(135)</sup>
123	p-Xylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(135)</sup>
124	Xylene (Total)	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(135)</sup>
125	Zinc	1) Digestion, Flame Atomic Absorption Spectrometric Method <sup>(136)</sup> 2) Digestion, Inductively Coupled Plasma Method <sup>(136)</sup>

## หมายเหตุ:

- กระทรวงอุตสาหกรรม, ประกาศกระทรวงอุตสาหกรรม, พ.ศ. 2549, เรื่อง กำหนดค่าปริมาณมาตรฐานที่เก็บไว้ในภาชนะบรรจุสารเคมีอันตราย, 25 ธันวาคม 2549, หน้า 123 ของหนังสือ 125 4.
- กระทรวงอุตสาหกรรม, ประกาศกระทรวงอุตสาหกรรม, พ.ศ. 2548, เรื่อง การกำหนดค่าปริมาณมาตรฐานที่เก็บไว้ในภาชนะบรรจุสารเคมีอันตราย, 25 มกราคม 2549, หน้า 123 ของหนังสือ 114 4.

3. แผนกวิศวกรรมสิ่งแวดล้อมแห่งประเทศไทย, คู่มือวิเคราะห์น้ำเสีย, พิมพ์ครั้งที่ 4, กรุงเทพมหานคร: กรมการสิ่งแวดล้อม, 2567.
4. APHA, AWWA, WEF. Standard Methods for the Examination of Water and Wastewater, 23<sup>rd</sup> ed. Washington, DC: APHA, 2017.
5. United States Environmental Protection Agency. Standards of Performance for New Stationary Sources, 40 CFR 60, Appendix A, 2019.
6. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. SW-846, 1997.
7. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. Acid Digestion of Sediments, Sludges, and Soils. SW-846 Method 3050B, 1996.
8. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. Alkaline Digestion for Hexavalent Chromium. SW-846 Method 3060A, 1996.
9. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. Separatory Funnel Liquid-Liquid Extraction. SW-846 Method 3510C, 1996.
10. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. Ultrasonic Extraction. SW-846 Method 3550C, 2007.
11. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. Purge and Trap for Aqueous Samples. SW-846 Method 5030C, 2003.
12. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. Closed System Purge and Trap and Extraction for Volatile Organics in Soil and Waste Sample. SW-846 Method 5035A, 2000.
13. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. Inductively Coupled Plasma-Optical Emission Spectrometry. SW-846 Method 6010D, 2014.
14. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. Flame Atomic Absorption Spectrophotometry. SW-846 Method 7000B, 2007.
15. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. Arsenic (Atomic Absorption, Gaseous Hydride). SW-846 Method 7061A, 1992.

16. United States...

16. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. Chromium, Hexavalent (Colorimetric). SW-846 Method 7196A, 1992.
17. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. Mercury in Liquid Waste (Manual Cold Vapor Technique). SW-846 Method 7470A, 1994.
18. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. Mercury in Solid or Semisolid Waste (Manual Cold-Vapor Technique). SW-846 Method 7471B, 1995.
19. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. Mercury in Solids and Solutions by Thermal Decomposition, Amalgamation, and Atomic Absorption Spectrophotometry. SW-846 Method 7473, 2007.
20. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. Selenium (Atomic Absorption, Borohydride Reduction). SW-846 Method 7742, 1999.
21. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. Nonhalogenated Organics Using GC/FID. SW-846 Method 8015D, 2003.
22. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. Organochlorine Pesticides by Gas Chromatography. SW-846 Method 8081B, 2007.
23. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. Polychlorinated Biphenyls (PCBs) by Gas Chromatography. SW-846 Method 8082A, 2007.
24. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. Polynuclear Aromatic Hydrocarbons. SW-846 Method 8100, 1980.
25. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry. SW-846 Method 8260D, 2018.
26. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry. SW-846 Method 8270E, 2018.
27. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. Chlorinated Herbicides by GC Using Methylation or Pentafluorobenzoylation Derivatization. SW-846 Method 8151A, 1996.

28. United States...

28. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. Total and Amenable Cyanide : Distillation. SW-846 Method 9010C, 2004.
29. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. Cyanide Extraction Procedure for Solids and Oils. SW-846 Method 9013A, 2014.
30. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. Cyanide in Waters and Extracts using Titrimetric and Manual Spectrophotometric Procedures. SW-846 Method 9014, 2014.
31. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. pH Electrometric Measurement. SW-846 Method 9040C, 2004.
32. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. Soil and Waste pH. SW-846 Method 9045D, 2006.