

ภาคผนวก ง

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ใบรับรองการสอบเทียบเครื่องมือ



# ROTA METER CALIBRATION RESULT JANUARY 2022

Rotameter ID.	Calibration Date	Regression Result	Coefficient (R <sup>2</sup> )
BKK_FS0577	05 Jan 22	$Y = 0.9899x + 0.9112$	0.9999
BKK_FS0579	05 Jan 22	$Y = 1.007x - 0.0299$	1.0000
BKK_FS0583	05 Jan 22	$Y = 1.0513x + 1.869$	0.9967
BKK_FS0584	05 Jan 22	$Y = 1.0048x - 1.069$	1.0000
BKK_FS0585	05 Jan 22	$Y = 1.0076x - 1.1036$	0.9999
BKK_FS0586	05 Jan 22	$Y = 0.9933x + 3.2655$	1.0000
BKK_FS0587	05 Jan 22	$Y = 1.0401x - 17.457$	0.9996
BKK_FS0588	05 Jan 22	$Y = 1.0154x + 4.8357$	0.9999
BKK_FS0589	05 Jan 22	$Y = 0.9918x + 4.8069$	0.9999
BKK_FS0590	05 Jan 22	$Y = 0.9861x + 10.07$	0.9995
BKK_FS0591	05 Jan 22	$Y = 1.0117x - 92.415$	0.9995
BKK_FS0592	05 Jan 22	$Y = 1.0031x - 69.305$	0.9996
BKK_FS0593	05 Jan 22	$Y = 1.0131x - 98.198$	0.9996
BKK_FS0594	05 Jan 22	$Y = 1.0075x - 7.0829$	0.9999
BKK_FS0595	05 Jan 22	$Y = 1.0249x - 98.162$	0.9999
BKK_FS0596	05 Jan 22	$Y = 0.9843x - 26.806$	0.9991
BKK_FS0597	05 Jan 22	$Y = 1.0203x - 122.14$	0.9999
BKK_FS1004	04 Jan 22	$Y = 0.9651x + 19.648$	0.9989
BKK_FS1005	04 Jan 22	$Y = 1.0096x + 4.6643$	0.9997
BKK_FS1006	04 Jan 22	$Y = 1.2188x - 7.1214$	0.9994
BKK_FS1007	05 Jan 22	$Y = 1.0563x - 1.0912$	1.0000
BKK_FS1008	05 Jan 22	$Y = 0.9689x + 1.9061$	1.0000
BKK_FS1009	05 Jan 22	$Y = 1.0132x + 1.1633$	0.9960
BKK_FS1010	05 Jan 22	$Y = 1.0033x - 0.5758$	0.9999
BKK_FS1014	05 Jan 22	$Y = 1.0021x + 0.3148$	0.9998
BKK_FS1015	05 Jan 22	$Y = 0.9994x + 1.786$	1.0000
BKK_FS1016	05 Jan 22	$Y = 1.0105x - 80.256$	0.9998
BKK_FS1017	05 Jan 22	$Y = 0.9995x + 0.649$	1.0000
BKK_FS1018	05 Jan 22	$Y = 1.0011x + 1.1786$	1.0000
BKK_FS1019	05 Jan 22	$Y = 1.0023x - 68.424$	0.9996
BKK_FS1020	05 Jan 22	$Y = 0.9887x + 2.8844$	0.9999
BKK_FS1021	05 Jan 22	$Y = 0.9659x + 1.4905$	0.9978
BKK_FS1022	05 Jan 22	$Y = 1.022x - 17.957$	0.9997
BKK_FS1023	05 Jan 22	$Y = 1.0094x + 0.0717$	0.9999
BKK_FS1024	05 Jan 22	$Y = 1.0042x + 0.4086$	0.9997
BKK_FS1025	05 Jan 22	$Y = 1.0132x - 88.507$	0.9996
BKK_FS1026	05 Jan 22	$Y = 0.9902x + 0.9554$	1.0000
BKK_FS1027	05 Jan 22	$Y = 1.0086x - 2.279$	1.0000
BKK_FS1028	05 Jan 22	$Y = 1.0105x - 81.055$	0.9997



# ROTA METER CALIBRATION RESULT JANUARY 2022

Rotameter ID.	Calibration Date	Regression Result	Coefficient (R <sup>2</sup> )
BKK_FS1029	05 Jan 22	$Y = 0.9935x + 0.8234$	1.0000
BKK_FS1030	05 Jan 22	$Y = 1.0039x + 0.515$	0.9999
BKK_FS1031	05 Jan 22	$Y = 1.009x - 79.295$	0.9998
BKK_FS1039	04 Jan 22	$Y = 0.9916x + 6.1524$	0.9988
BKK_FS1040	04 Jan 22	$Y = 1.0133x - 10.177$	0.9985
BKK_FS1041	04 Jan 22	$Y = 1.0805x - 1.7381$	0.9998
BKK_FS1042	04 Jan 22	$Y = 1.0061x + 1.3405$	0.9994
BKK_FS1043	04 Jan 22	$Y = 1.0112x - 10.393$	0.9999
BKK_FS1044	04 Jan 22	$Y = 1.0495x - 1.0136$	0.9996
BKK_FS1161	05 Jan 22	$Y = 0.9812x + 15571$	1.0000
BKK_FS1162	05 Jan 22	$Y = 0.9932x + 5.0014$	0.9997
BKK_FS1163	05 Jan 22	$Y = 1.0082x - 82.062$	0.9998
BKK_FS1164	05 Jan 22	$Y = 0.9914x + 0.8427$	0.9997
BKK_FS1165	05 Jan 22	$Y = 0.9893x + 6.5919$	0.9998
BKK_FS1166	05 Jan 22	$Y = 1.0031x - 77.881$	0.9996
RYG_FS0197	04 Jan 22	$Y = 1.0068x + 1.7152$	0.9998
RYG_FS0198	04 Jan 22	$Y = 0.9986x + 18.196$	0.9995
RYG_FS0199	04 Jan 22	$Y = 1.1202x - 3.5782$	0.9999

Review By :

*Wichan Choonharat*  
(Mr. Wichan Choonharat)  
Enviro Field Services Manager

Approved By :

*Mr. Sarayuth Jitranont*  
(Mr. Sarayuth Jitranont)  
Assistant General Manager



# ROTA METER CALIBRATION RESULT APRIL 2022

Rotameter ID.	Calibration Date	Regression Result	Coefficient (R <sup>2</sup> )
BKK_FS0577	01 Apr 22	$Y = 1.0202x + 0.1976$	1.0000
BKK_FS0579	01 Apr 22	$Y = 1.0078x + 0.4789$	0.9998
BKK_FS0583	01 Apr 22	$Y = 1.016x - 0.3922$	1.0000
BKK_FS0584	01 Apr 22	$Y = 1.0036x + 2.2262$	0.9997
BKK_FS0585	01 Apr 22	$Y = 1.0189x - 5.6476$	0.9997
BKK_FS0586	01 Apr 22	$Y = 1.0095x - 1.1524$	0.9995
BKK_FS0587	01 Apr 22	$Y = 1.013x - 3.6619$	0.9996
BKK_FS0588	01 Apr 22	$Y = 1.0154x + 4.8357$	0.9999
BKK_FS0589	01 Apr 22	$Y = 0.9918x + 4.8069$	0.9999
BKK_FS0590	01 Apr 22	$Y = 1.0038x - 0.4857$	0.9996
BKK_FS0591	01 Apr 22	$Y = 0.9705x - 52.174$	0.9986
BKK_FS0592	01 Apr 22	$Y = 0.9646x - 37.642$	0.9985
BKK_FS0593	01 Apr 22	$Y = 0.9767x - 58.445$	0.9988
BKK_FS0594	01 Apr 22	$Y = 0.9902x - 62.87$	0.9999
BKK_FS0595	01 Apr 22	$Y = 1.0249x - 98.162$	0.9999
BKK_FS0596	01 Apr 22	$Y = 0.9843x - 26.806$	0.9991
BKK_FS0597	01 Apr 22	$Y = 0.9802x - 61.653$	0.9978
BKK_FS1004	01 Apr 22	$Y = 0.9696x + 17.69$	0.9990
BKK_FS1005	01 Apr 22	$Y = 1.0065x + 5.6786$	0.9997
BKK_FS1006	01 Apr 22	$Y = 1.2142x - 7.1037$	0.9993
BKK_FS1007	01 Apr 22	$Y = 0.9917x + 1.6592$	1.0000
BKK_FS1008	01 Apr 22	$Y = 1.0132x + 0.7207$	1.0000
BKK_FS1009	01 Apr 22	$Y = 1.0132x + 1.1633$	0.9960
BKK_FS1010	01 Apr 22	$Y = 1.0033x + 0.5758$	0.9999
BKK_FS1011	01 Apr 22	$Y = 1.0234x + 0.1759$	0.9996
BKK_FS1012	01 Apr 22	$Y = 1.0106x - 2.0048$	0.9997
BKK_FS1013	01 Apr 22	$Y = 0.9677x - 35.851$	0.9997
BKK_FS1014	01 Apr 22	$Y = 1.0021x + 0.3148$	0.9998
BKK_FS1015	01 Apr 22	$Y = 0.9994x + 1.786$	1.0000
BKK_FS1016	01 Apr 22	$Y = 1.0105x - 80.256$	0.9998
BKK_FS1017	01 Apr 22	$Y = 0.9995x + 0.649$	1.0000
BKK_FS1018	01 Apr 22	$Y = 1.0011x + 1.1786$	1.0000
BKK_FS1019	01 Apr 22	$Y = 1.0023x - 68.424$	0.9996
BKK_FS1020	01 Apr 22	$Y = 1.0547x - 0.666$	0.9998
BKK_FS1021	01 Apr 22	$Y = 1.018x - 3.3286$	0.9998
BKK_FS1022	01 Apr 22	$Y = 0.9932x - 57.035$	0.9986
BKK_FS1023	01 Apr 22	$Y = 1.0094x + 0.0717$	0.9999
BKK_FS1024	01 Apr 22	$Y = 1.0042x + 0.4086$	0.9997



# ROTA METER CALIBRATION RESULT APRIL 2022

Rotameter ID.	Calibration Date	Regression Result	Coefficient (R <sup>2</sup> )
BKK_FS1025	01 Apr 22	$Y = 1.0132x - 88.507$	0.9996
BKK_FS1026	01 Apr 22	$Y = 1.0018x + 1.0776$	0.9997
BKK_FS1027	01 Apr 22	$Y = 1.0053x + 0.231$	0.9995
BKK_FS1028	01 Apr 22	$Y = 0.9792x - 60.312$	0.9982
BKK_FS1029	01 Apr 22	$Y = 0.9935x + 0.8234$	1.0000
BKK_FS1030	01 Apr 22	$Y = 1.0039x + 0.515$	0.9999
BKK_FS1031	01 Apr 22	$Y = 1.009x - 79.295$	0.9998
BKK_FS1039	01 Apr 22	$Y = 0.9868x + 7.8119$	0.9993
BKK_FS1040	01 Apr 22	$Y = 1.0096x - 7.2905$	0.9990
BKK_FS1041	01 Apr 22	$Y = 1.078x - 2.0503$	0.9999
BKK_FS1042	01 Apr 22	$Y = 1.0054x + 1.6095$	0.9995
BKK_FS1043	01 Apr 22	$Y = 1.0108x - 11.048$	0.9999
BKK_FS1044	01 Apr 22	$Y = 1.0468x - 0.9391$	0.9997
BKK_FS1161	01 Apr 22	$Y = 1.0126x + 0.7738$	0.9999
BKK_FS1162	01 Apr 22	$Y = 0.9994x + 2.6357$	0.9995
BKK_FS1163	01 Apr 22	$Y = 0.977x - 55.03$	0.9987
BKK_FS1164	01 Apr 22	$Y = 0.9914x + 0.8427$	0.9997
BKK_FS1165	01 Apr 22	$Y = 0.9893x + 6.5919$	0.9998
BKK_FS1166	01 Apr 22	$Y = 1.0031x - 77.881$	0.9996
RYG_FS0197	01 Apr 22	$Y = 1.0055x + 1.1914$	0.9998
RYG_FS0198	01 Apr 22	$Y = 0.996x + 23.788$	0.9996
RYG_FS0199	01 Apr 22	$Y = 1.1166x - 3.3942$	0.9998

Review By :

*Wichan Choonharat*  
(Mr. Wichan Choonharat)  
Enviro Field Services Manager

Approved By :

*Mr. Sarayuth Jitranont*  
(Mr. Sarayuth Jitranont)  
Assistant General Manager

## Certificate of System Qualification

GC-OQ

System ID: GC-6  
Organization Name: ALS Laboratory Group (Thailand) Co., Ltd.  
Organization Location: 104 Phattanakan 40, Phattarakon Rd., Suan Luang Bangkok 10250  
Date: October 21, 2021 10:05:40 AM  
EQP Name: Agilent Recommended  
EQP Revision: GC.02.50  
Overall Qualification Status: Pass

REVIEW BY: Suchada T.  
APPROVED BY: Saran M.  
NEXT CAL. DATE: 21 Apr 2023

## 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: 0.0 psi /5 minutes  
Agilent Recommended:  $\geq -2.0$  and  $\leq 0.5$

## Overall Inlet Pressure Decay Test Status

Pass

## Inlet Pressure Accuracy

Name: 7890  
Front SSL

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Setpoint Status: Pass  
Setpoint: 25.0 psi Actual: 24.9 psi  
Inlet Pressure: 25.0 psi  
Accuracy: 0.1 psi  
Agilent Recommended:  $\leq 1.2$

## Overall Inlet Pressure Accuracy Test Status

Pass

## Inlet Pressure Decay

Name: 7890  
Back SSL

Setpoint Status: Pass  
Pressure: 25.0 psi  
Pressure Change: 0.0 psi /5 minutes  
Agilent Recommended:  $\geq -2.0$  and  $\leq 0.5$

## Overall Inlet Pressure Decay Test Status

Pass

## Inlet Pressure Accuracy

Name: 7890  
Back SSL

Setpoint Status: Pass  
Setpoint: 25.0 psi Actual: 24.9 psi  
Inlet Pressure: 25.0 psi  
Accuracy: 0.1 psi  
Agilent Recommended:  $\leq 1.2$

## Overall Inlet Pressure Accuracy Test Status

Pass

## Detector Flow Accuracy

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System ID: GC-6

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Name: 7890  
Front FID

Setpoint Status: Pass  
Flow Type: Fuel  
Setpoint: 30.0 mL/min Measured Flow: 30.5 mL/min  
Accuracy: 0.5 mL/min  
Agilent Recommended:  $\leq 10.0$  % 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: 394.0 mL/min  
Accuracy: 6.0 mL/min  
Agilent Recommended:  $\leq 10.0$  % 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: 24.2 mL/min  
Accuracy: 0.8 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

## Detector Flow Accuracy

Name: 7890  
Back FID

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Setpoint Status: Pass  
Flow Type: Fuel  
Setpoint: 30.0 mL/min Measured Flow: 29.1 mL/min  
Accuracy: 0.9 mL/min  
Agilent Recommended:  $\leq 10.0$  % 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: 397.3 mL/min  
Accuracy: 2.7 mL/min  
Agilent Recommended:  $\leq 10.0$  % 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: 24.4 mL/min  
Accuracy: 0.6 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

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System ID: GC-6

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Setpoint Status: **Pass**  
Zone: Oven  
Setpoint/Actual  
Temperature: 230.0 231.5 °C  
Accuracy: 1.5 °C  
Agilent Recommended:  $\geq -1.0$  % setpoint in K ( -5.0 °C )  
 $\leq 1.0$  % setpoint in K ( 5.0 °C )

Setpoint Status: **Pass**  
Zone: Oven  
Setpoint/Actual  
Temperature: 100.0 100.5 °C  
Accuracy: 0.5 °C  
Agilent Recommended:  $\geq -1.0$  % setpoint in K ( -3.7 °C )  
 $\leq 1.0$  % setpoint in K ( 3.7 °C )

## Overall GC Oven Temperature Accuracy Test Status

Pass

## GC Oven Temperature Stability

Name: 7890  
Setpoint Status: **Pass**  
Setpoint/Average  
Temperature: 100.0 100.4667 °C  
Stability: 0.1 °C  
Agilent Recommended:  $\leq 0.5$

## Overall GC Oven Temperature Stability Test Status

Pass

## Scouting Run

Tested Combination1 Front SSL / Front FID  
Injection Tower  
Name: 7693A

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Setpoint Status: **Completed**  
Injection Volume on Column: 1.0 uL  
Overall Scouting Run Status  
Completed

## Noise and Drift

Tested Combination1 Front SSL / Front FID  
Name: 7890  
Setpoint Status: **Pass**  
Base Signal: 12.7 pA  
ASTM Noise pA 0.06  
Agilent Recommended:  $\leq 0.10$   
Status: **Pass**  
Drift pA/Hr 0.10  
Agilent Recommended:  $\leq 2.50$   
Status: **Pass**

## Overall Noise and Drift Test Status

Pass

## Injection Precision

Tested Combination1 Front SSL / Front FID  
Name: 7693A  
Setpoint Status: **Pass**  
Injection Volume on Column: 1.0 uL  
Area RSD: 0.42 %  
Agilent Recommended:  $\leq 3.00$   
Retention Time RSD: 0.16 %  
 $\leq 1.00$

## Overall Injection Precision Test Status

Pass

## Signal to Noise

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Tested Combination1 Front SSL / Front FID  
Injection Tower  
Name: 7890  
Setpoint Status: **Pass**  
Signal to Noise: 1174861  
Agilent Recommended:  $\geq 300000$

## Overall Signal to Noise Test Status

Pass

## Scouting Run

Tested Combination2 Back SSL / Back FID  
Injection Tower  
Name: 7693A

Setpoint Status: **Completed**  
Injection Volume on Column: 1.0 uL

## Overall Scouting Run Status

Completed

## Noise and Drift

Tested Combination2 Back SSL / Back FID  
Name: 7890  
Setpoint Status: **Pass**  
Base Signal: 10.4 pA  
ASTM Noise pA 0.05  
Agilent Recommended:  $\leq 0.10$   
Status: **Pass**  
Drift pA/Hr 0.00  
 $\leq 2.50$

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## Overall Noise and Drift Test Status

Pass

## Injection Precision

Tested Combination2 Back SSL / Back FID  
Name: 7693A  
Setpoint Status: **Pass**  
Injection Volume on Column: 1.0 uL  
Area RSD: 1.16 %  
Agilent Recommended:  $\leq 3.00$   
Retention Time RSD: 0.12 %  
 $\leq 1.00$

## Overall Injection Precision Test Status

Pass

## Signal to Noise

Tested Combination2 Back SSL / Back FID  
Injection Tower  
Name: 7890

Setpoint Status: **Pass**  
Signal to Noise: 805466  
Agilent Recommended:  $\geq 300000$

## Overall Signal to Noise Test Status

Pass

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## Instrument Details

### Purpose

This section describes the as found system configuration.

### Details

#### System

System ID	GC-6
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
Sampler Identifier	Sampler 2
Inlet	Front
Detector	Front
LTM Included?	No

#### Tested Combination2

Injection Technique	Injection Tower
Sampler Identifier	Sampler 3
Inlet	Back
Detector	Back
LTM Included?	No

#### Sampler 1

Manufacturer	Agilent Technologies
Type	Tray
Name	7693A
Model Number	G4514A
Serial Number	CN15380030
Firmware Revision	A.11.01
Vial Heater	Not installed

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#### Sampler 2

Manufacturer	Agilent Technologies
Type	Injection Tower
Name	7693A
Model Number	G4513A
Serial Number	CN10340103
Firmware Revision	A.10.09
Usage	Sample Injection
Location	Front
Syringe Volume (µL)	10

#### Sampler 3

Manufacturer	Agilent Technologies
Type	Injection Tower
Name	7693A
Model Number	G4513A
Serial Number	CN16280128
Firmware Revision	A.10.09
Usage	Sample Injection
Location	Back
Syringe Volume (µL)	10

#### Mainframe 1

Manufacturer	Agilent Technologies
Name	7890
Model Number	G3440A
Serial Number	CN11461066
Firmware Revision	Version 4.27
Component ID/Asset No.	GC-6
Oven Type	Standard

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#### Inlet 1

Manufacturer	Agilent Technologies
Name	7890
Type	SSL
Location	Front
Carrier Gas	Helium
Control Type	Electronic Pressun Control (EPC)
Purged Inlet	Yes

#### Inlet 2

Manufacturer	Agilent Technologies
Name	7890
Type	SSL
Location	Back
Carrier Gas	Helium
Control Type	Electronic Pressun Control (EPC)
Purged Inlet	Yes

#### Detector 1

Manufacturer	Agilent Technologies
Name	7890
Type	FID
Adapter	Capillary
Control Type	Electronic Pressun Control (EPC)
Location	Front
Makeup Gas	Nitrogen

#### Detector 2

Manufacturer	Agilent Technologies
Name	7890
Type	FID
Adapter	Capillary
Control Type	Electronic Pressun Control (EPC)
Location	Back
Makeup Gas	Nitrogen

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## Electronic Signature

### Purpose

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User Name: suriya.thongkiew  
Hostname: ASBKOW7015System ID: GC-6  
Print Date: October 21, 2021 10:05:46 AM

## QG GC ALS CN11481066 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 20, 2021 12:18:50 PM	Audit	SessionCreated	Session	None
October 20, 2021 12:18:50 PM	Start	Configuration	Session	None
October 20, 2021 12:18:50 PM	Audit	Entitlement	Licensing	User is Nonpaying and does not require an unlock code
October 20, 2021 12:24:57 PM	Audit	ExpLoaded	Session	EQP details for primary technique [GC] - File path: (P:\msd\PackCo\Configurations\02-51\GC-02-51-eng). EQP File Name: [GC-02-51-eng]. EQP Name: [AgilentRecommended]
October 20, 2021 12:25:02 PM	End	Configuration	Session	None
October 20, 2021 12:25:09 PM	Start	Qualification	Session	QG
October 20, 2021 12:25:09 PM	Start	Execution	System Inspection and Basic Safety and Operation - 7890 - Qualitative Test - No setpoints associated	None
October 20, 2021 12:30:25 PM	End	Execution	System Inspection and Basic Safety and Operation - 7890 - Qualitative Test - No setpoints associated	Run Count : 1
October 20, 2021 12:56:29 PM	Start	Execution	Inlet Pressure Decay - Front SSL - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi	None

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Date: October 21, 2021 10:05:40 AM  
System ID: GC-6

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User Name: suriya.thongkiew  
Hostname: ASBKOW7015System ID: GC-6  
Print Date: October 21, 2021 10:05:46 AM

## QG GC ALS CN11481066 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 20, 2021 1:02:16 PM	End	Execution	Inlet Pressure Decay - Front SSL - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi	Run Count : 1
October 20, 2021 1:02:18 PM	Start	Execution	Inlet Pressure Accuracy - Front SSL - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	None
October 20, 2021 1:02:26 PM	End	Execution	Inlet Pressure Accuracy - Front SSL - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	Run Count : 1
October 20, 2021 1:02:29 PM	Start	Execution	Inlet Pressure Decay - Back SSL - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi	None
October 20, 2021 1:04:21 PM	End	Execution	Inlet Pressure Decay - Back SSL - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi	Run Count : 1
October 20, 2021 1:07:53 PM	Start	Execution	Inlet Pressure Accuracy - Back SSL - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	None
October 20, 2021 1:08:11 PM	End	Execution	Inlet Pressure Accuracy - Back SSL - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	Run Count : 1
October 20, 2021 1:08:16 PM	Start	Execution	Detector Flow Accuracy - Front FID - Type: Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	None
October 20, 2021 1:20:23 PM	Audit	Data	Detector Flow Accuracy - Front FID - Type: Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
October 20, 2021 1:20:26 PM	End	Execution	Detector Flow Accuracy - Front FID - Type: Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	Run Count : 1

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Date: October 21, 2021 10:05:40 AM  
System ID: GC-6

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User Name: suriya.thongkiew  
Hostname: ASBKOW7015System ID: GC-6  
Print Date: October 21, 2021 10:05:46 AM

## QG GC ALS CN11481066 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 20, 2021 1:20:29 PM	Start	Execution	Detector Flow Accuracy - Front FID - Type: Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	None
October 20, 2021 1:23:27 PM	Audit	Data	Detector Flow Accuracy - Front FID - Type: Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
October 20, 2021 1:23:29 PM	End	Execution	Detector Flow Accuracy - Front FID - Type: Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
October 20, 2021 1:23:31 PM	Start	Execution	Detector Flow Accuracy - Front FID - Type: Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	None
October 20, 2021 1:27:40 PM	Audit	Data	Detector Flow Accuracy - Front FID - Type: Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
October 20, 2021 1:27:42 PM	End	Execution	Detector Flow Accuracy - Front FID - Type: Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
October 20, 2021 1:27:46 PM	Start	Execution	Detector Flow Accuracy - Back FID - Type: Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	None
October 20, 2021 1:32:10 PM	Audit	Data	Detector Flow Accuracy - Back FID - Type: Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
October 20, 2021 1:32:12 PM	End	Execution	Detector Flow Accuracy - Back FID - Type: Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
October 20, 2021 1:32:14 PM	Start	Execution	Detector Flow Accuracy - Back FID - Type: Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	None
October 20, 2021 1:34:13 PM	Audit	Data	Detector Flow Accuracy - Back FID - Type: Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry

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Date: October 21, 2021 10:05:40 AM  
System ID: GC-6

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User Name: suriya.thongkiew  
Hostname: ASBKOW7015System ID: GC-6  
Print Date: October 21, 2021 10:05:46 AM

## QG GC ALS CN11481066 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 20, 2021 1:34:16 PM	End	Execution	Detector Flow Accuracy - Back FID - Type: Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
October 20, 2021 1:34:46 PM	Start	Execution	Detector Flow Accuracy - Back FID - Type: Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	None
October 20, 2021 1:36:33 PM	Audit	Data	Detector Flow Accuracy - Back FID - Type: Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
October 20, 2021 1:36:36 PM	End	Execution	Detector Flow Accuracy - Back FID - Type: Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
October 20, 2021 1:36:38 PM	Start	Execution	GC Oven Temperature Accuracy - 7890 - Temperature - Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
October 20, 2021 2:04:31 PM	Audit	Data	GC Oven Temperature Accuracy - 7890 - Temperature - Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry
October 20, 2021 2:04:32 PM	End	Execution	GC Oven Temperature Accuracy - 7890 - Temperature - Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Run Count : 1
October 20, 2021 2:04:34 PM	Start	Execution	GC Oven Temperature Accuracy - 7890 - Temperature - Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
October 20, 2021 2:10:47 PM	Audit	Data	GC Oven Temperature Accuracy - 7890 - Temperature - Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry

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Date: October 21, 2021 10:05:40 AM  
System ID: GC-6

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User Name: suriya.thongkiew  
Hostname: ASBKKW7015System ID: GC-6  
Print Date: October 21, 2021 10:05:46 AM

## OQ GC ALS CN11461066 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 20, 2021 2:10:49 PM	End	Execution	GC Oven Temperature Accuracy - 7890 - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Run Count : 1
October 20, 2021 2:10:51 PM	Start	Execution	GC Oven Temperature Stability - 7890 - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	None
October 20, 2021 2:31:39 PM	Audit	Data	GC Oven Temperature Stability - 7890 - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Manual Data Entry
October 20, 2021 2:31:41 PM	End	Execution	GC Oven Temperature Stability - 7890 - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Run Count : 1
October 20, 2021 2:31:44 PM	Start	Execution	GC Scouting Run - Injection Tower, Front SSL, Front FID - Part of System Preparation - No limits associated	None
October 20, 2021 2:43:06 PM	Audit	AcqClosed	Session	None
October 21, 2021 9:18:59 AM	Audit	AcqRestarted	Session	None
October 21, 2021 9:19:02 AM	Audit	SessionRelocated	Session	None
October 21, 2021 9:19:09 AM	Start	Qualification	Session	OQ
October 21, 2021 9:19:09 AM	Start	Execution	GC Scouting Run - Injection Tower, Front SSL, Front FID - Part of System Preparation - No limits associated	None
October 21, 2021 9:19:41 AM	Audit	AcqClosed	Session	None

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Date: October 21, 2021 10:05:40 AM  
System ID: GC-6

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User Name: suriya.thongkiew  
Hostname: ASBKKW7015System ID: GC-6  
Print Date: October 21, 2021 10:05:46 AM

## OQ GC ALS CN11461066 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 21, 2021 9:20:08 AM	Audit	AcqRestarted	Session	None
October 21, 2021 9:20:09 AM	Audit	SessionRelocated	Session	None
October 21, 2021 9:20:13 AM	Start	Qualification	Session	OQ
October 21, 2021 9:20:13 AM	Start	Execution	GC Scouting Run - Injection Tower, Front SSL, Front FID - Part of System Preparation - No limits associated	None
October 21, 2021 9:29:45 AM	Audit	Data	GC Scouting Run - Injection Tower, Front SSL, Front FID - Part of System Preparation - No limits associated	Data files Path : C:\Chem32\1\DATA\OQPV20\21OQPV2021_F_2021-10-20\15-49-01\SCOUT_F001.D\FID1A.ch
October 21, 2021 9:30:05 AM	End	Execution	GC Scouting Run - Injection Tower, Front SSL, Front FID - Part of System Preparation - No limits associated	Run Count : 1
October 21, 2021 9:30:08 AM	Start	Execution	Noise and Drift - Front FID - Detector FID - L (Noise) <= 0.10 pA - L (Drift) <= 2.50 pA/hour	None
October 21, 2021 9:30:41 AM	Audit	Data	Noise and Drift - Front FID - Detector FID - L (Noise) <= 0.10 pA - L (Drift) <= 2.50 pA/hour	Data files Path : C:\Chem32\1\DATA\OQPV20\21OQPV2021_F_2021-10-20\15-49-01\SCOUT_F001.D\FID1A.ch
October 21, 2021 9:31:10 AM	End	Execution	Noise and Drift - Front FID - Detector FID - L (Noise) <= 0.10 pA - L (Drift) <= 2.50 pA/hour	Run Count : 1

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Date: October 21, 2021 10:05:40 AM  
System ID: GC-6

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User Name: suriya.thongkiew  
Hostname: ASBKKW7015System ID: GC-6  
Print Date: October 21, 2021 10:05:46 AM

## OQ GC ALS CN11461066 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 21, 2021 9:31:42 AM	Start	Execution	Injection Precision - Injection Tower, Front SSL, Front FID - GC - L (Area) <= 3.00% - L (Ret. Time) <= 1.00%	None
October 21, 2021 9:32:55 AM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID - GC - L (Area) <= 3.00% - L (Ret. Time) <= 1.00%	Data files Path : C:\Chem32\1\DATA\OQPV20\21OQPV2021_F_2021-10-20\16-51-16\INPREC_F002.D\FID1A.ch
October 21, 2021 9:32:55 AM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID - GC - L (Area) <= 3.00% - L (Ret. Time) <= 1.00%	Data files Path : C:\Chem32\1\DATA\OQPV20\21OQPV2021_F_2021-10-20\16-51-16\INPREC_F003.D\FID1A.ch
October 21, 2021 9:32:58 AM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID - GC - L (Area) <= 3.00% - L (Ret. Time) <= 1.00%	Data files Path : C:\Chem32\1\DATA\OQPV20\21OQPV2021_F_2021-10-20\16-51-16\INPREC_F004.D\FID1A.ch
October 21, 2021 9:32:58 AM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID - GC - L (Area) <= 3.00% - L (Ret. Time) <= 1.00%	Data files Path : C:\Chem32\1\DATA\OQPV20\21OQPV2021_F_2021-10-20\16-51-16\INPREC_F005.D\FID1A.ch
October 21, 2021 9:32:58 AM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID - GC - L (Area) <= 3.00% - L (Ret. Time) <= 1.00%	Data files Path : C:\Chem32\1\DATA\OQPV20\21OQPV2021_F_2021-10-20\16-51-16\INPREC_F006.D\FID1A.ch
October 21, 2021 9:32:58 AM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID - GC - L (Area) <= 3.00% - L (Ret. Time) <= 1.00%	Data files Path : C:\Chem32\1\DATA\OQPV20\21OQPV2021_F_2021-10-20\16-51-16\INPREC_F007.D\FID1A.ch

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Date: October 21, 2021 10:05:40 AM  
System ID: GC-6

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User Name: suriya.thongkiew  
Hostname: ASBKKW7015System ID: GC-6  
Print Date: October 21, 2021 10:05:46 AM

## OQ GC ALS CN11461066 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 21, 2021 9:33:07 AM	End	Execution	Injection Precision - Injection Tower, Front SSL, Front FID - GC - L (Area) <= 3.00% - L (Ret. Time) <= 1.00%	Run Count : 1
October 21, 2021 9:33:23 AM	Start	Execution	Signal to Noise - Injection Tower, Front SSL, Front FID - Detector FID - L >= 300000	None
October 21, 2021 9:34:01 AM	Audit	Data	Signal to Noise - Injection Tower, Front SSL, Front FID - Detector FID - L >= 300000	Data files Path : C:\Chem32\1\DATA\OQPV20\21OQPV2021_F_2021-10-20\16-51-16\SIGTONS_F001.D\FID1A.ch
October 21, 2021 9:34:15 AM	End	Execution	Signal to Noise - Injection Tower, Front SSL, Front FID - Detector FID - L >= 300000	Run Count : 1
October 21, 2021 9:34:19 AM	Start	Execution	GC Scouting Run - Injection Tower, Back SSL, Back FID - Part of System Preparation - No limits associated	None
October 21, 2021 9:35:04 AM	Audit	Data	GC Scouting Run - Injection Tower, Back SSL, Back FID - Part of System Preparation - No limits associated	Data files Path : C:\Chem32\1\DATA\OQPV20\21OQPV2021_B_2021-10-20\17-13-45\SCOUT_8001.D\FID1A.ch
October 21, 2021 9:35:27 AM	End	Execution	GC Scouting Run - Injection Tower, Back SSL, Back FID - Part of System Preparation - No limits associated	Run Count : 1
October 21, 2021 9:35:32 AM	Start	Execution	Noise and Drift - Back FID - Detector FID - L (Noise) <= 0.10 pA - L (Drift) <= 2.50 pA/hour	None

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Date: October 21, 2021 10:05:40 AM  
System ID: GC-6

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User Name: suriya.thongkiew

Hostname: ASBKKW7015

System ID: GC-6

Print Date: October 21, 2021 10:05:46 AM

OQ GC ALS CN11461066 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 21, 2021 9:36:06 AM	Audit	Data	Noise and Drift - Back FID - Detector FID - L (Noise) <= 0.10 pA - L (Drift) <= 2.50 pA/Hour	Data files Path : C:\Chem32\1\DATA\OQPV2021\OQPV2021_8 2021-10-20 17-13-45\SIGNSDRF_8001.D\FID028.ch
October 21, 2021 9:36:16 AM	End	Execution	Noise and Drift - Back FID - Detector FID - L (Noise) <= 0.10 pA - L (Drift) <= 2.50 pA/Hour	Run Count : 1
October 21, 2021 9:36:20 AM	Start	Execution	Injection Precision - Injection Tower, Back SSL, Back FID - GC - L (Area) <= 3.00% - L (Ret. Time) <= 1.00%	None
October 21, 2021 9:38:57 AM	Audit	Data	Injection Precision - Injection Tower, Back SSL, Back FID - GC - L (Area) <= 3.00% - L (Ret. Time) <= 1.00%	Data files Path : C:\Chem32\1\DATA\OQPV2021\OQPV2021_8 2021-10-20 17-13-45\INPREC_8002.D\FID028.ch
October 21, 2021 9:38:57 AM	Audit	Data	Injection Precision - Injection Tower, Back SSL, Back FID - GC - L (Area) <= 3.00% - L (Ret. Time) <= 1.00%	Data files Path : C:\Chem32\1\DATA\OQPV2021\OQPV2021_8 2021-10-20 17-13-45\INPREC_8003.D\FID028.ch
October 21, 2021 9:38:57 AM	Audit	Data	Injection Precision - Injection Tower, Back SSL, Back FID - GC - L (Area) <= 3.00% - L (Ret. Time) <= 1.00%	Data files Path : C:\Chem32\1\DATA\OQPV2021\OQPV2021_8 2021-10-20 17-13-45\INPREC_8004.D\FID028.ch
October 21, 2021 9:38:57 AM	Audit	Data	Injection Precision - Injection Tower, Back SSL, Back FID - GC - L (Area) <= 3.00% - L (Ret. Time) <= 1.00%	Data files Path : C:\Chem32\1\DATA\OQPV2021\OQPV2021_8 2021-10-20 17-13-45\INPREC_8005.D\FID028.ch

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Date: October 21, 2021 10:05:40 AM  
System ID: GC-6

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User Name: suriya.thongkiew

Hostname: ASBKKW7015

System ID: GC-6

Print Date: October 21, 2021 10:05:46 AM

OQ GC ALS CN11461066 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 21, 2021 9:38:57 AM	Audit	Data	Injection Precision - Injection Tower, Back SSL, Back FID - GC - L (Area) <= 3.00% - L (Ret. Time) <= 1.00%	Data files Path : C:\Chem32\1\DATA\OQPV20 21\OQPV2021_8 2021-10-20 17-13-45\INPREC_8006.D\FID028.ch
October 21, 2021 9:38:57 AM	Audit	Data	Injection Precision - Injection Tower, Back SSL, Back FID - GC - L (Area) <= 3.00% - L (Ret. Time) <= 1.00%	Data files Path : C:\Chem32\1\DATA\OQPV20 21\OQPV2021_8 2021-10-20 17-13-45\INPREC_8007.D\FID028.ch
October 21, 2021 9:39:08 AM	End	Execution	Injection Precision - Injection Tower, Back SSL, Back FID - GC - L (Area) <= 3.00% - L (Ret. Time) <= 1.00%	Run Count : 1
October 21, 2021 9:39:11 AM	Start	Execution	Signal to Noise - Injection Tower, Back SSL, Back FID - Detector FID - L >= 300000	None
October 21, 2021 9:39:28 AM	Audit	Data	Signal to Noise - Injection Tower, Back SSL, Back FID - Detector FID - L >= 300000	Data files Path : C:\Chem32\1\DATA\OQPV20 21\OQPV2021_8 2021-10-20 17-13-45\IGTONS_8001.D\FID028.ch
October 21, 2021 9:39:39 AM	End	Execution	Signal to Noise - Injection Tower, Back SSL, Back FID - Detector FID - L >= 300000	Run Count : 1
October 21, 2021 9:39:43 AM	End	Qualification	Session	OQ
October 21, 2021 9:39:43 AM	Start	Reporting	Session	None
October 21, 2021 10:04:15 AM	Audit	Reporting	Session	Report Generated: Certificate

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Date: October 21, 2021 10:05:40 AM  
System ID: GC-6

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63/14-15,67/35-36, Soi Petchkasem 7,7/1, Petchkasem Rd,  
Walthapra, Bangkokkai, Bangkok 10600 Thailand.  
Tel: (66) 02-8680812#13 Fax: (66) 02-8680860 www.jiranatee.com

## CERTIFICATE OF CALIBRATION

Certificate No: WS-13072021  
Page 1 of 2 pages

Measurement Item : Cup anemometer with data logger.

Manufacturer : Data logger: Novolynx.  
Cup anemometer: Novolynx.

Model/Type : Data logger: 200-WS-25LB.  
Cup anemometer: WS-02P.

Serial Number : Data logger: A5275.  
Cup anemometer: -.

ID No : Data logger: RY0\_FB0413.  
Cup anemometer: -.

Customer : ALS laboratory group (Thailand co., Ltd.)  
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand.

Test Conditions : Wind tunnel, cross test section area 900 cm<sup>2</sup>  
Anemometer frontal area 100 cm<sup>2</sup>  
Diameter of mounting pipe - mm  
Blockage ratio of test object 0.111 [-]

Test Conditions : Air temperature 24.8 ±0.6 °C  
Air pressure 1007.4 ±0.4 hPa  
Relative air humidity 52.4 ±3.5 %RH

Calibration Procedure : Calibration was carried out base on:  
ISO 61400-12-1 60.1: 2001-Power Performance Measurements of Electricity Producing Wind Turbines;  
MBSNET Anemometer Calibration Procedure - Version 2: 2009.

Traceability : This calibration documents be traceable to national standard, Which realize the unit of measurements according to the international system of units (SI) through National Institute of Metrology Thailand (NIMT).

Measurement Date : Jul 29, 2021.  
Issued Date : Jul 29, 2021.

Calibrated by  
☒ Mr. Somwit Theachad  
☐ Miss Orathai Wiatwattaya



Approved Signatory:   
Mr. Parinya Booncharoen  
Technical Support  
and Calibration Manager



63/14-15,67/35-36, Soi Petchkasem 7,7/1, Petchkasem Rd,  
Walthapra, Bangkokkai, Bangkok 10600 Thailand.  
Tel: (66) 02-8680812#13 Fax: (66) 02-8680860 www.jiranatee.com

Continuation of Certificate of Calibration Number

Certificate No: WS-13072021  
Page 2 of 2 Pages

Result of calibration: ☒ Without adjustment ☐ With adjustment  
Calibration in the range of 1 - 16 m/s at a calibration interval of 1 m/s.  
The results of calibration and associated measurement uncertainties are reported in the table below.

V <sub>an</sub> Reading m/s	V <sub>cup</sub> Reading m/s	Error (m/s)	Uncertainty (%)
2.047	2.0	-0.1	2.4
4.138	4.1	0.0	1.2
6.03	6.1	0.1	0.97
7.99	8.0	0.0	0.84
10.00	10.1	0.1	0.59
12.03	12.2	0.2	0.72
13.99	14.3	0.3	0.47
15.98	16.4	0.4	0.35
15.03	15.3	0.3	0.38
12.99	13.1	0.1	0.59
11.01	11.1	0.1	0.57
9.01	9.0	0.0	0.87
6.99	7.1	0.1	0.81
5.177	5.1	-0.1	0.97
2.972	3.1	0.1	1.6
1.044	0.9	-0.1	5.3

UUC\*: Unit Under Calibration

The reported expanded uncertainty is based on standard uncertainty multiplied by a coverage factor k=2 providing a level of confidence of approximately 95%

### Appendix 1: Instrumentations

NO	Sensor	Manufacturer	Model/Type	Calibration Date	Certificate Report Number	Range
1	Flow static	TESTO INC.	D6312145	July 16, 2020	MW-0035-20	5 - 30 m/s
2	Precision Differential Pressure Meter	Zorglab	DP40600	July 16, 2020	MW-0035-20	3 - 30 m/s
3	Air velocity transducer (hot wire)	TSI INC.	8445-12	July 20, 2020	MW-0035A-20	0 - 5 m/s
4	Temperature	Zorglab	DSR-ThP	March 30, 2021	PH-03032021	-30 - 70 °C
5	Relative humidity	Zorglab	DSR-ThP	March 30, 2021	PH-03032021	0 - 100 %RH
6	Atmospheric pressure	Zorglab	DSR-ThP	March 30, 2021	PH-03032021	500 - 1100 m/s
7	Wind tunnel	ESCOM	MP1300	-	-	0 - 50 Hz

\*\*\*End of certificate of calibration\*\*\*





## CERTIFICATE OF CALIBRATION

Certificate No: WD-13072021  
Page 1 of 2 pages

**Measurement Item** : Wind direction sensor with data logger.  
**Manufacturer** : Data logger: Novallink.  
: Wind direction sensor: Novallink.  
**Model/Type** : Data logger: 200-WS-25LR.  
: Wind direction sensor: WS-02P.  
**Serial Number** : Data logger: A5375.  
: Wind direction sensor: -.  
**ID No** : Data logger: RY0\_F80413.  
: Wind direction sensor: -.  
**Customer** : ALS laboratory group (Thailand) Co.Ltd.  
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand.

### Environmental Condition

The measurement was carried out in an ambient temperature of (23±3)°C, and relative humidity of (40±10)%.

### Measurement Method

The wind direction sensor calibration according to comparison method with reference angle measurement electronic theodolite and line laser is used for axis control. The measurement was taken at 45° intervals in clockwise and counterclockwise directions.

Note: The UUC was warmed up for 1 hour prior to the calibration being performed

### Traceability

The measurement results are traceable to the international system of units (SI) through Certificate No: GC563-07-0045, Certificate No: KWS63/0044.

**Measurement Date** : Jul 29, 2021.  
**Issued Date** : Jul 29, 2021.

**Performed by**  
☒ Mr. Sorawit Thachalad  
☐ Miss Orathai Wiwatwittaya



Approved Signatory:

*Mr. Parinya Booncharoen*  
Technical Support  
and Calibration Manager

THIS CERTIFICATE REPORT MAY NOT BE REPRODUCED EXCEPT IN FULL UNLESS PERMISSION FOR REPRODUCTION HAS BEEN OBTAINED IN WRITING FROM THE LABORATORY.

Continuation of Certificate of Calibration Number

Certificate No: WD-13072021  
Pages 2 of 2 pages

Result of calibration: ☐ Without adjustment ☒ With adjustment.  
Calibration in the range of 0 ~ 360 ° at a calibration interval of 45°.

The results of calibration and associated measurement uncertainties are reported in table below.

NO	Turning Direction	Nominal Angle (°)	Standard Reading (°)	UUC* Reading (°)	Error (°)	Uncertainty a(°)
1	Clockwise	0/360	360	359	-1	3.0
2		45	45	42	-3	3.0
3		90	90	87	-3	3.0
4		135	135	134	-1	3.0
5		180	180	181	1	3.0
6		225	225	226	1	3.0
7		270	270	273	3	3.0
8		315	315	318	3	3.0
9	Counter Clockwise	0/360	360	359	-1	3.0
10		45	45	42	-3	3.0
11		90	90	87	-3	3.0
12		135	135	134	-1	3.0
13		180	180	181	1	3.0
14		225	225	226	1	3.0
15		270	270	273	3	3.0
16		315	315	318	3	3.0

UUC\*: Unit Under Calibration. The reported expanded uncertainty is based on standard uncertainty multiplied by a coverage factor k=2 providing a level of confidence of approximately 95%.

\*\*\*End of Certificate of Calibration\*\*\*



## CERTIFICATE OF CALIBRATION

Certificate No: WD-05012022  
Page 1 of 2 pages

**Measurement Item** : Cup anemometer with data logger.  
**Manufacturer** : Data logger: Novallink.  
: Cup anemometer: Novallink.  
**Model/Type** : Data logger: 200-WS-25LR.  
: Cup anemometer: WS-02P.  
**Serial Number** : Data logger: A5191.  
: Cup anemometer: -.  
**ID No** : Data logger: RY0\_F80328.  
: Cup anemometer: -.  
**Customer** : ALS laboratory group (Thailand) Co. Ltd.  
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand.

**Test Conditions** : Wind tunnel cross test section area: 900 cm<sup>2</sup>  
: Anemometer frontal area: 100 cm<sup>2</sup>  
: Diameter of mounting pipe: - mm  
: Blockage ratio of test object: 0.111 [-]  
**Test Conditions** : Air temperature: 23.9 ±0.6 °C  
: Air pressure: 1014.8 ±0.4 hPa  
: Relative air humidity: 58.9 ±3.5 %RH

**Calibration Procedure** : Calibration was carried out based on:  
ISO 61400-12-1 60.1: 200+Power Performance Measurements of Electricity Producing Wind Turbines.  
MASNET Anemometer Calibration Procedure - Version 2: 2009.

**Traceability** : This calibration documents are traceable to national standard, which realize the unit of measurements according to the international system of units (SI) through National Institute of Metrology Thailand (NIMT).

**Measurement Date** : JAN 28, 2022.  
**Issued Date** : JAN 31, 2022.

**Calibrated by**  
☒ Mr. Sorawit Thachalad  
☐ Miss Orathai Wiwatwittaya



Approved Signatory:

*Mr. Parinya Booncharoen*  
Calibration Department Manager

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Continuation of Certificate of Calibration Number

Certificate No: WD-05012022  
Page 2 of 2 Pages

Result of calibration: ☒ Without adjustment ☐ With adjustment.  
Calibration in the range of 1 ~ 16 m/s at a calibration interval of 1 m/s.

The results of calibration and associated measurement uncertainties are reported in the table below.

V <sub>ref</sub> Reading m/s	V <sub>unc</sub> Reading m/s	Error (m/s)	Uncertainty (%)
2.078	2.0	-0.1	2.4
4.125	4.0	-0.1	1.5
6.00	5.8	-0.2	1.5
8.01	7.9	-0.1	1.0
10.00	9.8	-0.2	0.69
11.99	11.9	-0.1	0.67
14.00	13.6	-0.4	2.8
15.98	15.7	-0.3	1.2
14.99	14.8	-0.2	1.1
13.00	12.8	-0.2	1.5
11.01	10.8	-0.2	1.2
9.02	8.7	-0.3	0.90
7.02	6.7	-0.3	0.94
5.150	5.1	-0.1	1.1
2.976	3.0	0.0	3.0
1.024	0.8	-0.2	4.8

UUC\*: Unit Under Calibration

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

### Appendix 1: Instrumentations

NO	Sensor	Manufacturer	Model/Type	Calibration Date	Certificate Report Number	Range
1	Pitot static	TESTO INC.	D5312145	Aug 07, 2021	MW-0034-21	5 ~ 30 m/s
2	Precision Differential Pressure Meter	Zagab	DPM2500	Aug 07, 2021	MW-0034-21	5 ~ 30 m/s
3	Air velocity transducer (hot wire)	TSI INC.	8445-12	Aug 08, 2021	MW-0035-21	0 ~ 8 m/s
4	Temperature	DSB THP	DSB THP	March 30, 2021	CL-027-64	-30 ~ 70 °C
5	Relative humidity	Zagab	DPM THP	March 30, 2021	RW-03032021	0 ~ 100 %RH
6	Atmospheric pressure	Zagab	DPM THP	March 30, 2021	BP-01032021	500 ~ 1100 hPa
7	Wind tunnel	GSOM	MP3500	-	-	0 ~ 50 Hz

\*\*\*End of certificate of calibration\*\*\*







## CERTIFICATE OF CALIBRATION

Certificate No: WD-05072021  
Page 1 of 2 pages

**Measurement Item** : Wind direction sensor with data logger.  
**Manufacturer** : Data logger: Novalytnx.  
: Wind direction sensor: Novalytnx.  
**Model/Type** : Data logger: 110-WS-25DL-Q.  
: Wind direction sensor: WS-02P.  
**Serial Number** : Data logger: A5789.  
: Wind direction sensor: WSD-011.  
**ID No** : Data logger: \.  
: Wind direction sensor: \.  
**Customer** : ALS laboratory group (Thailand) Co.,Ltd.  
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand.

**Environmental Condition:**  
The measurement was carried out in an ambient temperature of (23±3)°C, and relative humidity of (40±10)%.

**Measurement Method:**  
The wind direction sensor calibration according to comparison method with reference angle measurement electronic theodolite and line laser is used for axis control. The measurement taken at 45° intervals in clockwise and counterclockwise directions.

**Note:** The UUC was warmed up for 1 hour prior to the calibration being performed

**Traceability:**  
The measurement results are traceable to the international system of units (SI) through Certificate No: CS563-07-0045, Certificate No: KWS63/0044.

**Measurement Date** : Jul 14, 2021.  
**Issued Date** : Jul 15, 2021.



Approved Signatory:

Mr. Parinya Booncharoen,  
Technical Support  
and Calibration Manager

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Continuation of Certificate of Calibration Number

Certificate No: WD-05072021  
Pages 2 of 2 pages

**Result of calibration:** ☐ Without adjustment ☒ With adjustment.  
Calibration in the range of 0 - 360 ° at a calibration interval of 45°.  
The results of calibration and associated measurement uncertainties are reported in table below.

NO	Turning Direction	Nominal Angle (°)	Standard Reading (°)	UUC* Reading (°)	Error (°)	Uncertainty ±(°)
1	Clockwise	0/360	0	0	0	3.0
2		45	45	45	0	3.0
3		90	90	90	0	3.0
4		135	135	135	1	3.0
5		180	180	183	3	3.0
6		225	225	228	3	3.0
7		270	270	272	2	3.0
8		315	315	317	2	3.0
9	Counter Clockwise	0/360	0	0	0	3.0
10		45	45	45	0	3.0
11		90	90	90	0	3.0
12		135	135	135	1	3.0
13		180	180	183	3	3.0
14		225	225	228	3	3.0
15		270	270	272	2	3.0
16		315	315	317	2	3.0

UUC\*: Unit Under Calibration The reported expanded uncertainty is based on standard uncertainty multiplied by a coverage factor k=2 providing a level of confidence of approximately 95%.

\*\*\*End of Certificate of Calibration\*\*\*



## CERTIFICATE OF CALIBRATION

Certificate No.: CL-051-64  
Page 1 of 2

**Equipment Name** : Data Logger with Temperature Sensor  
**Manufacturer** : Novalytnx  
**Model** : 110-WS-25  
**Serial No.** : A5789  
**ID No.** :

**Customer**  
**Name** : ALS laboratory group (thailand) Co.,Ltd.  
**Address** : 104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand.

**Reference Used During Calibration**  
1. Standard Temperature Probe Model : STS-100 A500, Serial No. : 667682-09, Due date : 25 Mar 2022  
2. Digital Temperature Indicator Model : DTI-1000-A MK II, Serial No. : 671407-00591 Due date : 04 June 2022

**Calibration Procedure**  
The temperature calibration was done by In-House calibration method as WI-CL-001 according to comparison method with standard digital temperature indicator and standard temperature probe. The temperature scale use was based on ITS-90.

**Received date** : 12 JUL 2021  
**Calibration date** : 13 JUL 2021  
**Issue date** : 13 JUL 2021

**Calibration Condition**  
Temperature : (23±3)°C  
Relative Humidity : (55±15)%

**Traceability**  
The measurement results are traceable to the international system of units (SI) through National Institute of Metrology Thailand (NIMT) Certificate number : TT-0036-21, Certificate number : ER-0032-21.

**Calibrated by**  
☐ Mr. Sorawit Thachalad  
☒ Miss Orathai Wiwatwittaya



Approved Signatory:

Mr. Parinya Booncharoen  
Technical Support  
And Calibration Manager

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Certificate No.: CL-051-64  
Page 2 of 2

**Result of Calibration:** ☒ Without Adjustment ☐ With Adjustment  
**Calibration Range:** 20 °C ~ 40 °C

**Function:**  
This equipment was connected with temperature sensor Model : HMP00 3/N : 34020031  
**Dimension** : Diameter 12mm, Length 80 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
60	20.050	19.7	-0.3	0.13
60	24.877	24.5	-0.4	0.16
60	29.860	29.4	-0.5	0.080
60	34.849	34.3	-0.5	0.080
60	39.815	39.3	-0.6	0.95

UUC\*: Unit Under Calibration  
The reported expanded uncertainty is based on standard uncertainty multiplied by a coverage factor k=2 providing a level of confidence of approximately 95%.

★ End of Certificate ★

## CALIBRATION REPORT

Calibration No.: RH-010/2021  
Page 1 of 1 Pages

**Measurement Item** : Relative humidity with data logger.  
**Manufacturer** : Data logger: Novalynx.  
: Relative humidity sensor: Novalynx.  
**Model/Type** : Data logger: 110-WS-25DL-D.  
: Relative humidity sensor: HMP60.  
**Serial Number** : Data logger: A5789.  
: Relative humidity sensor: S4620631.  
**ID No** : Data logger: -  
: Relative humidity sensor: -  
**Customer** : A.S. laboratory group (Thailand) co., ld.  
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand.

### Environmental Condition:

The measurement was carried out in an ambient temperature of 25±3°C, and relative humidity of (50±15)%.

### Measurement Method:

The Relative humidity with data logger, Unit Under Calibration (UUC) was calibrated by comparison method with the equilibrium of standard salt solution CH<sub>3</sub>COOK: Potassium Acetate, Mg(NO<sub>3</sub>)<sub>2</sub>: Magnesium Nitrate, KCl: Potassium Chloride to determine the errors.

**Measurement Date** : Jul 14, 2021  
**Issued Date** : Jul 14, 2021

### Measurement Results:

The results of calibration are reported in table below.

Standard salt solution	Standard (RH)	UUC(Reading)	Error
CH <sub>3</sub> COOK: Potassium Acetate	22.61	22.8	0.3
Mg(NO <sub>3</sub> ) <sub>2</sub> : Magnesium Nitrate	52.89	53.2	0.3
KCl: Potassium Chloride	84.34	84.9	0.6

**Performed by**  
☒ Mr. Sorawit Thachalad  
☐ Miss Orathai Wiatwitayay



Mr. Parinya Booncharoen,  
Technical Support  
and Calibration Manager

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## CERTIFICATE OF CALIBRATION

Certificate No.: WS-03072021  
Page 1 of 2 pages

**Measurement Item** : Cup anemometer with data logger.  
**Manufacturer** : Data logger: Novalynx.  
: Cup anemometer: Novalynx.  
**Model/Type** : Data logger: 200-WS-25DL.  
: Cup anemometer: WS-02P.  
**Serial Number** : Data logger: A4985.  
: Cup anemometer: -  
**ID No** : Data logger: RYD\_FS0087.  
: Cup anemometer: -  
**Customer** : A.S. laboratory group (Thailand) co., ld.  
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand.



**Test Conditions** : Wind tunnel cross test section area 900 cm<sup>2</sup>  
: Anemometer frontal area 100 cm<sup>2</sup>  
: Diameter of mounting pipe - mm  
: Blockage ratio of test object 0.111 [-]

**Test Conditions** : Air temperature 24.1 ±0.8 °C  
: Air pressure 1000.3 ±0.4 hPa  
: Relative air humidity 60.2 ±3.5 %RH

**Calibration Procedure** : Calibration was carried out base on:  
ISO 9140-12-1 CO.1, C005Power Performance Measurements of Directly Producing Wind Turbines  
MEASNET Anemometer Calibration Procedure - Version 2: 2009.

**Traceability** : This calibration documents the traceable to national standard, which realize the unit of measurement according to the international system of units (SI) through National Institute of Metrology Thailand (NIMT).

**Measurement Date** : Jul 13, 2021.  
**Issued Date** : Jul 14, 2021.

**Calibrated by**  
☒ Mr. Sorawit Thachalad  
☐ Miss Orathai Wiatwitayay



Approved Signatory:   
Mr. Parinya Booncharoen  
Technical Support  
and Calibration Manager

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### Continuation of Certificate of Calibration Number

Certificate No.: WS-03072021  
Page 2 of 2 Pages

**Result of calibration:** ☒ Without adjustment ☐ With adjustment  
Calibration in the range of 1 - 16 m/s at a calibration interval of - m/s.

The results of calibration and associated measurement uncertainties are reported in the table below.

V <sub>REF</sub> Reading m/s	V <sub>UUC</sub> Reading m/s	Error (m/s)	Uncertainty (%)
2.087	2.0	-0.1	2.4
4.150	4.1	-0.1	1.2
6.09	6.0	0.0	1.1
8.01	8.0	0.0	0.73
10.02	10.2	0.2	0.68
11.98	12.3	0.3	0.66
13.97	14.3	0.3	0.65
16.02	16.6	0.6	0.48
14.96	15.5	0.5	0.37
13.03	13.4	0.4	0.66
10.97	11.2	0.2	0.69
9.02	9.1	0.1	0.65
7.02	7.0	0.0	0.81
5.165	5.0	-0.2	0.88
3.018	3.0	0.0	1.5
1.037	0.9	-0.1	4.7

### UUC: Unit Under Calibration

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

### Appendix 1: Instrumentations

NO	Sensor	Manufacturer	Model/Type	Calibration Date	Certificate Report Number	Range
1	Pist static	TESTO INC.	06351145	July 16, 2020	MW-0035-20	5 - 30 m/s
2	Pressure Differential Pressure Meter	Ziegler	DPM500	July 16, 2020	MW-0035-20	5 - 30 m/s
3	Air velocity transducer (hot wire)	TSI INC.	9451-12	July 20, 2020	MW-0035A-20	0 - 5 m/s
4	Temperature	Ziegler	DSR1P	March 30, 2021	EL-027-44	-30 - 70°C
5	Relative humidity	Ziegler	DSR1P	March 30, 2021	RH-03032021	0 - 100 %RH
6	Atmospheric pressure	Ziegler	DSR1P	March 30, 2021	BP-01032021	500 - 1100 hPa
7	Wind tunnel	ESSOM	MP300	-	-	0 - 50 Hz

\*\*\*End of certificate of calibration\*\*\*



## CERTIFICATE OF CALIBRATION

Certificate No.: WD-03072021  
Page 1 of 2 pages

**Measurement Item** : Wind direction sensor with data logger.  
**Manufacturer** : Data logger: Novalynx.  
: Wind direction sensor: Novalynx.  
**Model/Type** : Data logger: 200-WS-25DL.  
: Wind direction sensor: WS-02P.  
**Serial Number** : Data logger: A4985.  
: Wind direction sensor: -  
**ID No** : Data logger: RYD\_FS0087.  
: Wind direction sensor: -  
**Customer** : A.S. laboratory group (Thailand) Co.,LTD.  
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand.

### Environmental Condition:

The measurement was carried out in an ambient temperature of 23±3°C, and relative humidity of (40±10)%.

### Measurement Method:

The wind direction sensor calibration according to comparison method with reference angle measurement electronic theodolite and the laser is used for axis control. The measurement were taken at 45° intervals in clockwise and counterclockwise directions.

Note: The UUC was warmed up for 1 hour prior to the calibration being performed

### Traceability:

The measurement results are traceable to the international system of units (SI) through Certificate No.: OC563-07-0045, Certificate No.: KWS63/0044.

**Measurement Date** : Jul 14, 2021.  
**Issued Date** : Jul 14, 2021.



**Performed by**  
☒ Mr. Sorawit Thachalad  
☐ Miss Orathai Wiatwitayay

Approved Signatory:   
Mr. Parinya Booncharoen,  
Technical Support  
and Calibration Manager

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Continuation of Certificate of Calibration Number

Certificate No: WD-03072021  
Page 2 of 2 pages

Result of calibration: ☐ Without adjustment ☒ With adjustment.  
Calibration in the range of 0 - 360 ° at a calibration interval of 45°.  
The results of calibration and associated measurement uncertainties are reported in table below.

NO	Turning Direction	Nominal Angle (°)	Standard Reading (°)	UUC* Reading (°)	Error (°)	Uncertainty ±(°)
1	Clockwise	0/360	360	359	-1	3.0
2		45	45	42	-3	3.0
3		90	90	87	-3	3.0
4		135	135	132	-3	3.0
5		180	180	178	-2	3.0
6		225	225	227	2	3.0
7		270	270	273	3	3.0
8		315	315	318	3	3.0
9	Counter Clockwise	0/360	360	359	-1	3.0
10		45	45	42	-3	3.0
11		90	90	87	-3	3.0
12		135	135	132	-3	3.0
13		180	180	178	-2	3.0
14		225	225	227	2	3.0
15		270	270	273	3	3.0
16		315	315	318	3	3.0

UUC\*: Unit Under Calibration The reported expanded uncertainty is based on standard uncertainty multiplied by a coverage factor k=2 providing a level of confidence of approximately 95%.

\*\*\*End of Certificate of Calibration\*\*\*



## CERTIFICATE OF CALIBRATION

Certificate No: WS-14072021  
Page 1 of 2 pages

Measurement Item : Cup anemometer with data logger.

Manufacturer : Data logger: Novallink.  
Cup anemometer: Novallink.

Model/Type : Data logger: 200-WS-25LB.  
Cup anemometer: WS-02P.

Serial Number : Data logger: A5376.  
Cup anemometer: -.

ID No : Data logger: RY0\_F50414.  
Cup anemometer: -.

Customer : ALS laboratory group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand.

Test Conditions : Wind tunnel, cross test section area 900 cm<sup>2</sup>  
Anemometer frontal area 100 cm<sup>2</sup>  
Diameter of mounting pipe - mm  
Blockage ratio of test object 0.111 %

Test Conditions : Air temperature 25.2 ±0.8 °C  
Air pressure 1005.6 ±0.4 hPa  
Relative air humidity 61.4 ±3.0 %RH

Calibration Procedure : Calibration was carried out based on:  
JIS S 1400-12-1 Ed.1: 2001-Performance Measurements of Electricity Producing Wind Turbines  
MCSA/CT Anemometer Calibration Procedure - Version 2: 2009.

Traceability : This calibration documents the traceability to national standard, which realize the unit of measurement according to the international system of units (SI) through National Institute of Metrology Thailand (NIMT).

Measurement Date : Jul 29, 2021.  
Issued Date : Jul 29, 2021.

Calibrated by:  
☒ Mr. Sorawit Thachalad  
☐ Miss Orathai Wivattitay



Approved Signatory:   
Mr. Parinya Booncharoen  
Technical Support  
and Calibration Manager

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Continuation of Certificate of Calibration Number

Certificate No: WS-14072021  
Page 2 of 2 Pages

Result of calibration: ☒ Without adjustment ☐ With adjustment  
Calibration in the range of 1 - 16 m/s at a calibration interval of 1 m/s.

The results of calibration and associated measurement uncertainties are reported in the table below.

V <sub>avg</sub> Reading m/s	V <sub>avg</sub> Reading m/s	Error (m/s)	Uncertainty (%)
2.057	1.8	-0.3	3.1
4.135	4.0	-0.1	1.3
6.02	6.0	0.0	2.1
7.99	8.0	0.0	0.74
10.00	10.1	0.1	0.69
11.99	12.0	0.0	0.72
13.98	14.2	0.2	0.48
15.98	16.2	0.2	0.77
14.99	15.2	0.2	0.49
13.00	13.1	0.1	0.52
11.01	11.0	0.0	0.94
9.01	9.0	0.0	0.81
6.99	7.0	0.0	2.0
5.189	5.1	-0.1	0.96
2.987	3.0	0.0	2.0
1.034	0.8	-0.2	6.3

UUC\*: Unit Under Calibration  
The reported expanded uncertainty is based on standard uncertainty multiplied by a coverage factor k=2 providing a level of confidence of approximately 95%.

### Appendix 1: Instrumentations

NO	Sensor	Manufacturer	Model/Type	Calibration Date	Certificate Report Number	Range
1	Pilot static	TESTO INC.	05312145	July 16, 2020	MIR-0035-20	5 - 30 m/s
2	Precision Differential Pressure Meter	Zorgas	DP3500	July 16, 2020	MIR-0035-20	5 - 30 m/s
3	Air velocity transducer (hot wire)	TSI INC.	8443-12	July 20, 2020	MIR-0036A-20	6 - 5 m/s
4	Temperature	Zorgas	DSB-T1P	March 30, 2021	IRV-03032021	-30 - 70 °C
5	Relative humidity	Zorgas	DSB-T1P	March 30, 2021	IRV-03032021	0 - 100 %RH
6	Atmospheric pressure	Zorgas	DSB-T1P	March 30, 2021	IRV-03032021	800 - 1100 hPa
7	Wind tunnel	QSSOM	MF300	-	-	0 - 50 m/s

\*\*\*End of certificate of calibration\*\*\*



## CERTIFICATE OF CALIBRATION

Certificate No: WD-14072021  
Page 1 of 2 pages

Measurement Item : Wind direction sensor with data logger.

Manufacturer : Data logger: Novallink.  
Wind direction sensor: Novallink.

Model/Type : Data logger: 200-WS-25LB.  
Wind direction sensor: WS-02P.

Serial Number : Data logger: A5376.  
Wind direction sensor: -.

ID No : Data logger: RY0\_F50414.  
Wind direction sensor: -.

Customer : ALS laboratory group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand.

Environmental Condition:  
The measurement was carried out in an ambient temperature of (23±3) °C, and relative humidity of (40±10)%.

Measurement Method:  
The wind direction sensor calibration according to comparison method with reference angle measurement electronic theodolite and line laser is used for axis control. The measurement were taken at 45° intervals in clockwise and counterclockwise directions.

Note: The UUC was warmed up for 1 hour prior to the calibration being performed.

Traceability:  
The measurement results are traceable to the international system of units (SI) through Certificate No: CC503-07-0045.  
Certificate No: RW563/0044.

Measurement Date : Jul 29, 2021.  
Issued Date : Jul 29, 2021.

Performed by:  
☒ Mr. Sorawit Thachalad  
☐ Miss Orathai Wivattitay



Approved Signatory:   
Mr. Parinya Booncharoen  
Technical Support  
and Calibration Manager

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Result of calibration: ☐ Without adjustment ☒ With adjustment.

Calibration in the range of 0 ~ 360 ° at a calibration interval of 45°.

The results of calibration and associated measurement uncertainties are reported in table below.

NO	Turning Direction	Nominal Angle (°)	Standard Reading (°)	UUC* Reading (°)	Error (°)	Uncertainty (°)
1	Clockwise	0/360	360	359	-1	3.0
2		45	45	43	-2	3.0
3		90	90	87	-3	3.0
4		135	135	132	-3	3.0
5		180	180	179	-1	3.0
6		225	225	228	3	3.0
7		270	270	273	3	3.0
8		315	315	318	3	3.0
9	Counter Clockwise	0/360	360	359	-1	3.0
10		45	45	43	-2	3.0
11		90	90	87	-3	3.0
12		135	135	132	-3	3.0
13		180	180	179	-1	3.0
14		225	225	228	3	3.0
15		270	270	273	3	3.0
16		315	315	318	3	3.0

UUC\* Limit Under Calibration. The reported expanded uncertainty is based on standard uncertainty multiplied by a coverage factor  $k=2$  providing a level of confidence of approximately 95%.

\*\*\*End of Certificate of Calibration\*\*\*



## Calibration Certificate

**Equipment :** SOUND CALIBRATOR  
**Manufacturer :** RION  
**Model :** NC-74  
**Serial No.:** 34178123  
**ID No.:** RYG\_FS0215

**Condition As Found :** GOOD

**Customer :** ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,  
BANGKOK, 10250 THAILAND.

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

**Received Date :** 05 AUGUST 2021  
**Calibration Date :** 09 AUGUST 2021  
**Date of Issue :** 11 AUGUST 2021

REVIEW BY: *Nathakorn*  
APPROVED BY: *T. Petchurai*  
NEXT CAL DATE: 9/3/22

**Calibrated by :** Nathakorn Pisutpaisan

**Approved by :**

*T. Petchurai*  
( Thanakul Petchurai )

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

QF-TS12-04-04-020664

### Continuation of Calibration Certificate

Cert. No. : ACC21009  
Job No. : VC64AC0058  
Pages : 2 of 3

**Calibration Procedure :** CP-AC-03

#### Calibration Method :

This equipment was calibrated by based on IEC-60942:2003 Standard.

The sound pressure level, frequency and total distortion of the sound calibrator was measured using the reference microphone.

#### Condition of this result of calibration :

##### 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL.BP. 05/0264	10-Feb-22
Digital Multimeter	8846A	1997025	EEL.BP. 06/0264	05-Feb-22
Digital Multimeter	33461A	MY53220116	EEL.BP. 04/0264	10-Feb-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KA	34560495	AA-3003-21	16-Feb-22
Audio Analyzer	AVR-3360A	V744B6069	EF-0010-21	10-Feb-22

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

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

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

### Continuation of Calibration Certificate

Cert. No. : ACC21009  
Job No. : VC64AC0058  
Pages : 3 of 3

#### Result of calibration :

##### 1. Sound pressure level

Specified sound pressure level (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit (dB)
94	94.06	0.06	0.14	0.40

##### 2. Frequency

Specified Frequency (Hz)	Measured value (Hz)	Deviated value (%)	Uncertainty (%)	Tolerance limit (%)
1000	1001.5	0.1	0.1	1.0

##### 3. Total distortion

Measured value (%)	Uncertainty (%)	Tolerance limit (%)
1.67	0.10	3.0


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





**ELECTRICAL AND ELECTRONICS INSTITUTE  
FOUNDATION FOR INDUSTRIAL DEVELOPMENT**  
975 Moo 4, Bangpoo Industrial Estate, Sol 8, Sukhumvit Road km 37,  
Phraek Sa, Mueang Samut Prakan, Samut Prakan 10280  
Tel: +66 2709 4860-8 Fax: +66 2324 0917-8



ISO 9001:2015  
ISO 17025:2017  
CALIBRATION 0119


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Certificate No.: 0224SV21  
Operation No.: CP2021050034

### Certificate of Calibration


Equipment:	Sound Level Meter
Manufacturer:	RION
Model/Type:	NL-42 (Meter), UC-52 (Microphone), NH-24 (Preamplifier)
Serial No.:	00472130 (Meter), 157774 (Microphone), 72464 (Preamplifier)
ID No.:	RYG_FS0303
Customer:	ALS Laboratory Group(Thailand) Co.,Ltd.
Address:	104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan Khet Suan Luang, Bangkok 10250 Thailand
Received Date:	28 May 2021
Calibrated Date:	2 - 9 June 2021
Issued Date:	11 June 2021
Calibrated by:	Ms. Juntaporn Kunhalom

REVIEW BY *[Signature]*  
 APPROVED BY *[Signature]*  
 NEXT CAL DATE 2/6/22

  
 Approved by:  
 (Mr. Sittichai Swakunwong)  
 Group Manager

The reported uncertainty of measurement was based on standard uncertainty multiplied by a coverage factor  $k = 2.00$ , providing a level of confidence of approximately 95%. This certificate may not be reproduced other than in full except with the prior written approval of the Electrical and Electronics Institute, Foundation for Industrial Development.

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**ELECTRICAL AND ELECTRONICS INSTITUTE  
FOUNDATION FOR INDUSTRIAL DEVELOPMENT**

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Certificate No.: 0224SV21

### Calibration Report

Equipment:	Sound Level Meter
Manufacturer:	RION
Model/Type:	NL-42 (Meter), UC-52 (Microphone), NH-24 (Preamplifier)
Serial No.:	00472130 (Meter), 157774 (Microphone), 72464 (Preamplifier)
ID No.:	RYG_FS0303
Ambient Temperature:	( $23 \pm 2$ ) °C
Relative Humidity:	( $50 \pm 15$ ) %
Pressure:	( $101.3 \pm 1.5$ ) kPa
Method of Calibration :-	IEC 61672-3:2013.
Condition of this result of calibration	1. Reference standards instrument :-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Standard microphone	4180	2787490	AA-1001-21	12 January 2022
2) Sine generator	1051	1501442	0151RF20	21 September 2021
3) Arbitrary Function Generator	AFG2021	C010063	0099RF20	17 June 2021
4) Programmable Attenuator	PA5	2913	EF-0017-21	1 April 2022
5) Programmable Attenuator	PA5	2755	EF-0034-20	10 November 2021
6) 6.5 Digit precision multimeter	8846A	5609027	0498EL20	10 August 2021
7) 6.5 Digit precision multimeter	8846A	5610014	0669EL20	27 October 2021
8) Pressure humidity and Temperature Transmitter	PTU301	L1950484	CL1-P210020 0176TE21	22 March 2022 1 April 2022

2. This result of calibration was found accurate as shown or date and place of calibration only.  
 3. This certification is traceable to the international system of unit maintained at :-  
 Reference standards instrument for Acoustic function  
 - National Institute of Metrology (Thailand)  
 Reference standards instrument for Electrical function  
 - National Institute of Metrology (Thailand)  
 - Electrical and Electronics Institute; ONSC Accredited Calibration No.0119


#### Result of Calibration:

Function : 1. Indication at the calibration check frequency

Reference Acoustic Signal (dB)	Measured value (dB)	Deviation (dB)	Acceptance limits (dB)
94.0	94.0	0.0	$\pm 1.0$

Note : Absolute sensitivity was established by the use of the Sound Calibrator RION Type NC-74 S/N : 34615278.

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**ELECTRICAL AND ELECTRONICS INSTITUTE  
FOUNDATION FOR INDUSTRIAL DEVELOPMENT**

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Certificate No.: 0224SV21

### Calibration Report

Function : 2. Self-generated Noise

#### 2.1 Microphone Installed

Measured value (dB)
19.6

#### 2.2 Microphone replaced by the electrical input signal device

Frequency Weighting	Measured value (dB)
A-weighting	15.8
C-weighting	21.5
Z-weighting	27.7

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

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

Frequency (Hz)	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance limits (dB)
125	0.3	0.7	0.3	$\pm 1.5$
1000	0.0	0.0	0.0	$\pm 1.0$
8000	-0.9	-0.9	-1.0	$\pm 5.0$

#### Function : 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 Hz.


Frequency (Hz)	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance limits (dB)
63	0.0	-0.1	0.0	$\pm 2.0$
125	0.0	-0.2	0.0	$\pm 1.5$
250	0.0	-0.1	0.0	$\pm 1.5$
500	0.0	-0.1	0.0	$\pm 1.5$
1000	0.0	0.0	0.0	$\pm 1.0$
2000	0.1	0.0	0.0	$\pm 2.0$
4000	0.0	0.0	0.0	$\pm 3.0$
8000	0.1	0.1	0.0	$\pm 5.0$

#### Function : 5. Frequency and time weighting at 1 kHz

##### 5.1 Frequency weighting at 1 kHz

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

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**ELECTRICAL AND ELECTRONICS INSTITUTE  
FOUNDATION FOR INDUSTRIAL DEVELOPMENT**

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Certificate No.: 0224SV21

### Calibration Report

#### 5.2 Time weighting at 1 kHz

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

#### Function : 6. Long-Term Stability

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

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

#### Function : 7. Level Linearity on the reference level range

##### 7.1 Level Linearity on the reference level range, Upper

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	$\pm 1.1$
99.0	99.0	0.0	$\pm 1.1$
104.0	104.0	0.0	$\pm 1.1$
109.0	109.0	0.0	$\pm 1.1$
114.0	114.0	0.0	$\pm 1.1$
119.0	119.0	0.0	$\pm 1.1$
124.0	124.0	0.0	$\pm 1.1$
129.0	129.0	0.0	$\pm 1.1$
130.0	130.0	0.0	$\pm 1.1$
131.0	131.0	0.0	$\pm 1.1$
132.0	132.0	0.0	$\pm 1.1$
133.0	133.0	0.0	$\pm 1.1$
134.0	134.0	0.0	$\pm 1.1$
135.0	135.0	0.0	$\pm 1.1$
136.0	136.0	0.0	$\pm 1.1$
137.0	137.0	0.0	$\pm 1.1$

##### 7.2 Level Linearity on the reference level range, Lower

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	$\pm 1.1$
89.0	89.0	0.0	$\pm 1.1$
84.0	84.0	0.0	$\pm 1.1$
79.0	79.0	0.0	$\pm 1.1$
74.0	74.0	0.0	$\pm 1.1$
69.0	69.0	0.0	$\pm 1.1$
64.0	64.0	0.0	$\pm 1.1$
59.0	59.0	0.0	$\pm 1.1$

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Certificate No.: 0224SV21

### Calibration Report

#### 7.2 Level Linearity on the reference level range, Lower Cont.)

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
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	33.9	-0.1	±1.1
29.0	29.0	0.0	±1.1
24.0	24.1	0.1	±1.1

#### Function : 8. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	200	121.0	0.0	±1.0
	2	101.9	-0.1	+1.0 ; -2.5
	0.25	99.9	-0.1	+1.5 ; -5.0
Slow	200	111.6	0.0	±1.0
	2	101.0	0.0	+1.0 ; -5.0
	200	121.0	0.0	±1.0
LAE	2	101.0	0.0	+1.0 ; -2.5
	0.25	90.8	-0.2	+1.5 ; -5.0

#### Function : 9. Peak C sound level

Number of cycles in test signal	Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Complete cycle	125.4	121.2	-0.2	±3.0
Positive half cycle	124.4	121.1	-0.3	±2.0
Negative half cycle	124.4	121.1	-0.3	±2.0

#### Function : 10. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limits (dB)
Positive one-half cycle	Negative one-half cycle		
139.5	139.5	0.0	±1.5



Certificate No.: 0224SV21

### Calibration Report

#### Function : 11. High-Level Stability

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

Time Period to Apply Signal (min)	Reference SPL (dB)	Record SPL at Conclusion of Time Period (dB)	Deviated value (dB)	Acceptance limits (dB)
5	129.0	125.0	0.0	±0.3

#### Uncertainty of measurement

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

Remarks: 1. The acceptance limit is for the deviated value.  
2. Acceptance limits was IEC61672-3:2013 Class 2.

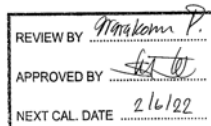
-- End of Report --



Certificate No.: 0225SV21  
Operation No.: CP2021050035

### Certificate of Calibration

Equipment: Sound Level Meter  
Manufacturer: RION  
Model/Type: NL-42 (Meter), UC-52 (Microphone), NH-24 (Preamplifier)  
Serial No.: 00472132 (Meter), 169445 (Microphone), 72466 (Preamplifier)  
ID No.: RYG\_FS0304  
Customer: ALS Laboratory Group(Thailand) Co.,Ltd.  
Address: 104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan  
Khet Suan Luang, Bangkok 10250 Thailand  
Received Date: 28 May 2021  
Calibrated Date: 2 - 9 June 2021  
Issued Date: 11 June 2021  
Calibrated by: Ms. Juntaporn Kunhakom



Approved by:

(Mr. Sittichai Suvannaprasit)  
Group Manager

The reported uncertainty of measurement was based on standard uncertainty multiplied by a coverage factor  $k = 2.00$ , providing a level of confidence of approximately 95%. This certificate may not be reproduced other than in full except with the prior written approval of the Electrical and Electronics Institute, Foundation for Industrial Development.



Certificate No.: 0225SV21

### Calibration Report

Equipment: Sound Level Meter  
Manufacturer: RION  
Model/Type: NL-42 (Meter), UC-52 (Microphone), NH-24 (Preamplifier)  
Serial No.: 00472132 (Meter), 169445 (Microphone), 72466 (Preamplifier)  
ID No.: RYG\_FS0304  
Ambient Temperature: (23 ± 2) °C  
Relative Humidity: (50 ± 15) %  
Pressure: (101.3 ± 1.5) kPa  
Method of Calibration :-  
IEC 61672-3:2013.

#### Condition of this result of calibration

1. Reference standards instrument :-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Standard microphone	4180	2787490	AA-1001-21	12 January 2022
2) Sine generator	1051	1501442	0151RF20	21 September 2021
3) Arbitrary Function Generator	AFG2021	010063	0099RF20	17 June 2021
4) Programmable Attenuator	PA5	2913	EF-0017-21	1 April 2022
5) Programmable Attenuator	PA5	2755	EF-0034-20	10 November 2021
6) 6.5 Digit precision multimeter	8846A	9609027	0498EL20	10 August 2021
7) 6.5 Digit precision multimeter	8846A	9610014	0669EL20	27 October 2021
8) Pressure humidity and Temperature Transmitter	PTU301	L1950484	CL1-P210020	22 March 2022
			0176TE21	1 April 2022

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

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

- Reference standards instrument for Acoustic function  
- National Institute of Metrology (Thailand)
- Reference standards instrument for Electrical function  
- National Institute of Metrology (Thailand)
- Electrical and Electronics Institute; ONSAC Accredited Calibration No.0119

#### Result of Calibration:

Function : 1. Indication at the calibration check frequency

Reference Acoustic Signal (dB)	Measured value (dB)	Deviation (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±1.0

Note : Absolute sensitivity was established by the use of the Sound Calibrator RION Type NC-74 S/N : 34615278.



Certificate No.: 0225SV21

Calibration Report

Function : 2. Self-generated Noise

2.1 Microphone Installed

Measured value (dB)
14.5

2.2 Microphone replaced by the electrical input signal device

Frequency Weighting	Measured value (dB)
A-weighting	10.4
C-weighting	17.5
Z-weighting	23.1

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

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

Frequency (Hz)	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance limits (dB)
125	0.3	0.3	0.3	±1.5
1000	0.1	0.1	0.1	±1.0
8000	-0.9	-0.9	-1.0	±5.0

Function : 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz

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

Function : 5. Frequency and time weighting at 1 kHz

5.1 Frequency weighting at 1 kHz

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



Certificate No.: 0225SV21

Calibration Report

5.2 Time weighting at 1 kHz

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

Function : 6. Long-Term Stability

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

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

Function : 7. Level Linearity on the reference level range

7.1 Level Linearity on the reference level range, Upper

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±1.1
99.0	99.0	0.0	±1.1
104.0	104.0	0.0	±1.1
109.0	109.0	0.0	±1.1
114.0	114.0	0.0	±1.1
119.0	119.0	0.0	±1.1
124.0	124.0	0.0	±1.1
129.0	129.0	0.0	±1.1
130.0	130.0	0.0	±1.1
131.0	131.0	0.0	±1.1
132.0	132.0	0.0	±1.1
133.0	133.0	0.0	±1.1
134.0	134.0	0.0	±1.1
135.0	135.0	0.0	±1.1
136.0	136.0	0.0	±1.1
137.0	137.0	0.0	±1.1

7.2 Level Linearity on the reference level range, Lower

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1



Certificate No.: 0225SV21

Calibration Report

7.2 Level Linearity on the reference level range, Lower Cont.)

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	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	33.9	-0.1	±1.1
29.0	28.8	-0.2	±1.1
24.0	23.9	-0.1	±1.1

Function : 8. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	200	124.0	0.0	±1.0
	2	105.0	0.0	+1.0 ; -2.5
	0.25	99.9	-0.1	+1.5 ; -5.0
Slow	200	115.6	0.0	±1.0
	2	100.0	0.0	+1.0 ; -5.0
	0.25	90.9	-0.1	+1.5 ; -5.0

Function : 9. Peak C sound level

Number of cycles In test signal	Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Complete cycle	125.4	125.4	0.0	±3.0
Positive half cycle	124.4	124.1	-0.3	±2.0
Negative half cycle	124.4	124.1	-0.3	±2.0

Function : 10. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limits (dB)
Positive one-half cycle	Negative one-half cycle		
139.5	139.4	-0.1	±1.5



Certificate No.: 0225SV21

Calibration Report

Function : 11. High-Level Stability

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

Time Period to Apply Signal (min)	Reference SPL (dB)	Record SPL at Conclusion of Time Period (dB)	Deviated value (dB)	Acceptance limits (dB)
5	129.0	129.0	0.0	±0.3

Uncertainty of measurement

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

Remarks: 1. The acceptance limit is for the deviated value.  
2. Acceptance limits was IEC61672-3:2013 Class 2.

-- End of Report --

# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

451-451/1 Sirinthon Rd., Bangbunru, Banglud Bangkok 10700 THAILAND.  
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.com



NSC-TS1-715 17025  
CALIBRATION 0394

Cert. No. : ACL21102  
Pages : 1 of 8

## Calibration Certificate

**Equipment :** SOUND LEVEL METER  
**Manufacturer :** RION  
**Model :** NL-42/ Microphone UC-52 / Pre-amplifier NH-24  
**Serial No.:** 01173611 / 172173 / 74023  
**ID No.:** RYG\_FS0390

**Condition As Found :** GOOD

**Customer :** ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,  
BANGKOK, 10250 THAILAND.

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

**Received Date :** 01 SEPTEMBER 2021  
**Calibration Date :** 13-15 SEPTEMBER 2021  
**Date of Issue :** 16 SEPTEMBER 2021

REVIEW BY *Nathakorn P.*  
APPROVED BY *T. Petchurai*  
NEXT CAL. DATE 13/9/22

**Calibrated by :** Nathakorn Pisutpaisan

**Approved by :**

*T. Petchurai*  
( Thanakul Petchurai )

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

QF-TS12-04-04-020664

# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

## Continuation of Calibration Certificate

Cert. No. : ACL21102  
Job No. : VC64AC0066  
Pages : 2 of 8

**Calibration Procedure :** CP-AC-01

### Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).  
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.  
For tests results of each items were made by observation of each Instruments display and also with SLM's display.

### Condition of this result of calibration :

#### 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL-BP_05/0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL-BP_03/0264	08-Feb-22
Digital Multimeter	8846A	1997025	EEL-BP_06/0264	05-Feb-22
Programmable Attenuator	MAT-10T0	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KAI	34560495	AA-3003-21	16-Feb-22

2. This result of calibration was found accurate as shown on date and place of calibration, for this calibrated item only.

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

- 3.1 National Institute of Metrology (Thailand).
- 3.2 Thailand Institute of Scientific and Technological Research (TISTR).

QF-TS12-04-04-020664

# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

## Continuation of Calibration Certificate

Cert. No. : ACL21102  
Job No. : VC64AC0066  
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	✓	-	0.3	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

QF-TS12-04-04-020664

# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

## Continuation of Calibration Certificate

Cert. No. : ACL21102  
Job No. : VC64AC0066  
Pages : 4 of 8

### Result of calibration :

#### 1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.96)	93.9	0.0	±0.3

#### 2. Self-generated noise

##### 2.1 Normal test

Measured Value (dB)
14.8

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

Frequency Weighting	Measured value (dB)
A-weight	11.6
C-weight	17.8
Flat	22.8

#### 3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.6	0.6	0.6	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-0.3	-0.2	-0.2	± 5.0

QF-TS12-04-04-020664



## Continuation of Calibration Certificate

Cert. No. : ACL21102  
Job No. : VC64AC0066  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL21102  
Job No. : VC64AC0066  
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	27.9	-0.1	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.9	-0.1	± 1.1

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## Continuation of Calibration Certificate

Cert. No. : ACL21102  
Job No. : VC64AC0066  
Pages : 7 of 8

## 8. Level linearity including the level range control

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

## 9. Tone burst response

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

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value ( dB )	Measured Value, L <sub>peak</sub> ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Continuous	133.0	133.0	0.0	-
One	136.4	136.2	-0.2	±3.0

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

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL21102  
Job No. : VC64AC0066  
Pages : 8 of 8

## 11. Overload indication

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

## 12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664



# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

451-451/1 Sirinthorn Rd, Bangbunru, Bangplud Bangkok 10700 THAILAND.  
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Cert. No. : ACL22030  
Pages : 1 of 8

## Calibration Certificate

**Equipment :** SOUND LEVEL METER  
**Manufacturer :** RION  
**Model :** NL-42/ Microphone UC-52 / Preamplifier NH-24  
**Serial No.:** 01122607 / 145551 / 34373  
**ID No.:** RYG\_FS0019

**Condition As Found :** GOOD

**Customer :** ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,  
BANGKOK, 10250 THAILAND.

**Location :** -  
**Ambient Temperature :** ( 23.0 ± 3 ) °C  
**Pressure :** ( 101.3 ± 3 ) kPa  
**Relative Humidity :** ( 50.0 ± 20 ) %  
**Received Date :** 05 JANUARY 2022  
**Calibration Date :** 10-12 JANUARY 2022  
**Date of Issue :** 13 JANUARY 2022



**Calibrated by :** Nathakorn Pisutpaisan

**Approved by :**

*T. Petchur*  
( Thanakul Petchurai )

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

QF-TS12-04-04-020664

# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

## Continuation of Calibration Certificate

Cert. No. : ACL22030  
Job No. : VC65AC0040  
Pages : 2 of 8

**Calibration Procedure :** CP-AC-01

### Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM). The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

For tests results of each items were made by observation of each Instruments display and also with SLM's display.

### Condition of this result of calibration :

#### 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL.BP. 05/0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0264	08-Feb-22
Digital Multimeter	34461A	MY60024273	1-15180725251-1	15-Sep-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KA1	34560495	AA-3003-21	16-Feb-22

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

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

- 3.1 National Institute of Metrology (Thailand).
- 3.2 Thailand Institute of Scientific and Technological Research (TISTR).

QF-TS12-04-04-020664

# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

## Continuation of Calibration Certificate

Cert. No. : ACL22030  
Job No. : VC65AC0040  
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

QF-TS12-04-04-020664

# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

## Continuation of Calibration Certificate

Cert. No. : ACL22030  
Job No. : VC65AC0040  
Pages : 4 of 8

### Result of calibration :

#### 1. Absolute sensitivity

Reference Acoustic Signal ( dB )	Measured Value ( dB )	Deviation ( dB )	Acceptance Limit ( dB )
93.9 (93.96)	93.9	0.0	±0.3

#### 2. Self-generated noise

##### 2.1 Normal test

Measured Value ( dB )
16.5

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

Frequency Weighting	Measured value ( dB )
A - weight	13.1
C - weight	19.4
Flat	24.8

#### 3. Acoustical signal tests of frequency weightings

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

Frequency ( Hz )	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.5	0.5	0.6	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-1.7	-1.7	-1.6	±5.0

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL22030  
Job No. : VC65AC0040  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1kHz.

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

QF-TS12-04-04-020664

T. Bth.

## Continuation of Calibration Certificate

Cert. No. : ACL22030  
Job No. : VC65AC0040  
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	84.1	0.1	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.1	0.1	± 1.1
69.0	69.1	0.1	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.1	0.1	± 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	26.9	-0.1	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.9	-0.1	± 1.1

QF-TS12-04-04-020664

T. Bth.

## Continuation of Calibration Certificate

Cert. No. : ACL22030  
Job No. : VC65AC0040  
Pages : 7 of 8

## 8. Level linearity including the level range control

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

## 9. Tone burst response

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

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value ( dB )	Measured Value, Lepeak ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Continuous	133.0	133.0	0.0	-
One	136.4	136.3	-0.1	±3.0

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

QF-TS12-04-04-020664

T. Bth.

## Continuation of Calibration Certificate

Cert. No. : ACL22030  
Job No. : VC65AC0040  
Pages : 8 of 8

## 11. Overload indication

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

## 12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

T. Bth.



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Cert. No. : ACL22059  
Pages : 1 of 8

## Calibration Certificate

**Equipment :** SOUND LEVEL METER  
**Manufacturer :** RION  
**Model :** NL-42/ Microphone UC-52 / Preamplifier NH-24  
**Serial No.:** 00734220 / 145272 / 34370  
**ID No.:** RYG\_FS0026

**Condition As Found :** GOOD

**Customer :** ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
KHWANG PHATTHANAKAN, KHET SUAN LUANG,  
BANGKOK, 10250 THAILAND.

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

**Received Date :** 14 JANUARY 2022  
**Calibration Date :** 21-24 JANUARY 2022  
**Date of Issue :** 25 JANUARY 2022



**Calibrated by :** Nathakorn Pisutpaisan

**Approved by :**

*T. Petchurai*  
( Thanakul Petchurai )

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

QF-TS12-04-04-020664

# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

## Continuation of Calibration Certificate

Cert. No. : ACL22059  
Job No. : VC65AC0043  
Pages : 2 of 8

**Calibration Procedure :** CP-AC-01

### Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).  
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.  
For tests results of each items were made by observation of each Instruments display and also with SLM's display.

### Condition of this result of calibration :

#### 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL-BP_05/0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL-BP_03/0264	08-Feb-22
Digital Multimeter	34461A	MY60024273	1-15180725251-1	15-Sep-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KAI	34560495	AA-3003-21	16-Feb-22

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

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

- 3.1 National Institute of Metrology (Thailand).
- 3.2 Thailand Institute of Scientific and Technological Research (TISTR).

QF-TS12-04-04-020664

# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

## Continuation of Calibration Certificate

Cert. No. : ACL22059  
Job No. : VC65AC0043  
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

QF-TS12-04-04-020664

# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

## Continuation of Calibration Certificate

Cert. No. : ACL22059  
Job No. : VC65AC0043  
Pages : 4 of 8

### Result of calibration :

#### 1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.96)	95.9	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	11.6
C - weight	17.8
Flat	23.7

#### 3. Acoustical signal tests of frequency weightings

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

Frequency ( Hz )	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.3	0.3	0.3	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-1.6	-1.5	-1.5	±5.0

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22059  
Job No. : VC65AC0043  
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1kHz.

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

QF-TS12-04-04-020664

T. P. L.

Continuation of Calibration Certificate

Cert. No. : ACL22059  
Job No. : VC65AC0043  
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	38.9	-0.1	± 1.1
34.0	33.9	-0.1	± 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	26.1	0.1	± 1.1
25.0	25.0	0.0	± 1.1

QF-TS12-04-04-020664

T. P. L.

Continuation of Calibration Certificate

Cert. No. : ACL22059  
Job No. : VC65AC0043  
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

Time Weighting	Tone burst duration, Tb ( ms )	Cycle	Anticipated Value ( dB )	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.1	0.1	±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
	200	800	128.0	128.0	0.0	±1.0
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value ( dB )	Measured Value, L <sub>peak</sub> ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Continuous	133.0	133.0	0.0	-
One	136.4	136.1	-0.3	±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	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

QF-TS12-04-04-020664

T. P. L.

Continuation of Calibration Certificate

Cert. No. : ACL22059  
Job No. : VC65AC0043  
Pages : 8 of 8

11. Overload indication

Measured value ( dB )		Deviated Value ( dB )	Acceptance Limits ( dB )
Positive one-half cycle	Negative one-half cycle		
89.6	89.7	0.1	±1.5

12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

T. P. L.





Cert. No. : ACL22027  
Pages : 1 of 8

## Calibration Certificate

**Equipment :** SOUND LEVEL METER  
**Manufacturer :** RION  
**Model :** NL-42/ Microphone UC-52 / Preamplifier NH-24  
**Serial No.:** 00900072 / 18846i / 01734  
**ID No.:** RYG\_FS0493

**Condition As Found :** GOOD

**Customer :** ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,  
BANGKOK, 10250 THAILAND.

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

**Received Date :** 05 JANUARY 2022  
**Calibration Date :** 10-12 JANUARY 2022  
**Date of Issue :** 13 JANUARY 2022

**Calibrated by :** Nathakorn Pisutpaisan

**Approved by :**

*T. Petchur*  
( Thanakul Petchur )

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

QF-TS12-04-04-020664

Cert. No. : ACL22027  
Job No. : VC65AC0040  
Pages : 2 of 8

**Calibration Procedure :** CP-AC-01

### Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).  
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.  
For tests results of each items were made by observation of each Instruments display and also with SLM's display.

### Condition of this result of calibration :

#### 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL-BP_05/0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL-BP_03/0264	08-Feb-22
Digital Multimeter	34461A	MY60024273	1-15180725251-1	15-Sep-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KAI	34560495	AA-3003-21	16-Feb-22

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

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

- 3.1 National Institute of Metrology (Thailand).
- 3.2 Thailand Institute of Scientific and Technological Research (TISTR).

QF-TS12-04-04-020664

*T. Petchur*

Cert. No. : ACL22027  
Job No. : VC65AC0040  
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

QF-TS12-04-04-020664

*T. Petchur*

Cert. No. : ACL22027  
Job No. : VC65AC0040  
Pages : 4 of 8

### Result of calibration :

#### 1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.96)	93.9	0.0	±0.3

#### 2. Self-generated noise

##### 2.1 Normal test

Measured Value (dB)
14.8

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

Frequency Weighting	Measured value (dB)
A - weight	9.9
C - weight	16.9
Flat	22.6

#### 3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.4	0.4	0.4	±1.5
1000	0.0	0.0	0.0	±1.0
8000	-1.2	-1.1	-1.1	±5.0

QF-TS12-04-04-020664

*T. Petchur*



## Continuation of Calibration Certificate

Cert. No. : ACL22027  
Job No. : VC65AC0040  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1kHz.

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

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

Frequency Weighting	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

QF-TS12-04-04-020664

T. Petch.

## Continuation of Calibration Certificate

Cert. No. : ACL22027  
Job No. : VC65AC0040  
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	135.1	0.1	± 1.1
134.0	134.1	0.1	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.1	0.1	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.1	0.1	± 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	26.1	0.1	± 1.1
25.0	25.1	0.1	± 1.1

QF-TS12-04-04-020664

T. Petch.

## Continuation of Calibration Certificate

Cert. No. : ACL22027  
Job No. : VC65AC0040  
Pages : 7 of 8

## 8. Level linearity including the level range control

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

## 9. Tone burst response

Time Weighting	Tone burst duration, Tb ( ms )	Cycle	Anticipated Value ( dB )	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	116.9	-0.1	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.8	-0.2	1.5 ; -5.0
	2	8	108.0	107.9	-0.1	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value ( dB )	Measured Value, Lcpeak ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Continuous	133.0	133.0	0.0	-
One	136.4	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

QF-TS12-04-04-020664

T. Petch.

## Continuation of Calibration Certificate

Cert. No. : ACL22027  
Job No. : VC65AC0040  
Pages : 8 of 8

## 11. Overload indication

Measured value ( dB )		Deviated Value ( dB )	Acceptance Limits ( dB )
Positive one-half cycle	Negative one-half cycle		
89.6	89.6	0.0	±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

QF-TS12-04-04-020664

T. Petch.

546, 196993

**CERTIFICATE OF CALIBRATION**

ISSUED BY: Cirrus Research plc

DATE OF ISSUE: 14/03/22

CERTIFICATE NUMBER: 171513

REVIEW BY: *Monika P.*

APPROVED BY: *Stefan*

NEXT CAL. DATE: 4/3/23

Page 1 of 1

Test engineer: Nigel Smith

Electronically signed: *Nigel Smith*

Cirrus Research plc  
Acoustic House  
Bridlington Road  
Hunmanby  
North Yorkshire  
YO14 0PH  
United Kingdom

**doseBadge Reader**

**Instrument**

Manufacturer: Cirrus Research plc

Model Number: RC:110A

Serial Number: 92612

Notes:

**Calibration Procedure**

The tests were carried out in accordance with the requirements of IEC 60942:2003 where applicable.

Date of Calibration: 14 March 2022

**Functionality Results**

Function	Result
Keypad	Pass
Battery Power	Pass
Display	Pass
Communication	Pass
2 way IR link	Pass
Clock	Pass

**Calibration Results**

	Level (dB)	Frequency (Hz)	Distortion (% THD + Noise)
Initial	113.90	1000.4	0.38
Adjusted	114.00	1000.4	0.38
Uncertainty	± 0.11	± 0.14	± 0.10
Tolerances	± 0.60	± 2.00	± 4.00

**Environmental Conditions**

Pressure: 101.30 kPa

Temperature: 21.3 °C

Humidity: 42.5 %

**Notes**

This certificate provides traceability of measurement to the S system of units and/or to units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory. The results within this certificate relate only to the items calibrated. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a coverage probability of approximately 95%.

63/14 15,67/35-36, Soi Petchkasem 7,7/1, Petchkasem Rd,  
Wathapra, Bangkokhyai, Bangkok 10600 Thailand.

TeL: (66) 02-8680812#13 Fax: (66) 02-8680860 www.jiranatee.com

**CERTIFICATE OF CALIBRATION**

Certificate No.: CL-041-65

Page 1 of 2

Equipment Name: Digital thermometer with RTD

Manufacturer: DeltaOHM

Model: HD32.2

Serial No: 20032242

ID No: RYG\_FS0522

Customer

Name: ALS laboratory group (thailand) Co.,Ltd.

Address: 104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand.

Received date: 25 FEB 2022

Calibration date: 7 MAR 2022

Issue date: 10 MAR 2022

Reference Used During Calibration

1. Standard Temperature Probe Model: STS-100 A500, Serial No: 667682-09, Due date: 25 Mar 2022

2. Digital Temperature Indicator Model: DTI-1000-A MK II, Serial No: 671407-00591 Due date: 04 June 2022

Calibration Condition

Temperature: (23±3) °C

Relative Humidity: (55±15)%

Calibration Procedure

The temperature calibration was done by In House calibration method as WI-CL-001 according to comparison method with standard digital temperature indicator and standard temperature probe. The temperature scale use was based on ITS-90.

Traceability

The measurement results are traceable to the international system of units (SI) through National Institute of Metrology (NIMT) Certificate number: TT-0036-21, Certificate number: ER-0032-21

Calibrated by

☒ Mr. Sorawit Thachalad

☐ Miss Orathai Wiwatwittaya

Approved Signatory: *Stefan*

Mr. Parinya Booncharoen

Calibration Department Manager

REVIEW BY: *Monika P.*

APPROVED BY: *Stefan*

NEXT CAL. DATE: 4/3/23

**J NAC**

63/14-15,67/35-36, Soi Petchkasem 7,7/1, Petchkasem Rd,  
Wathapra, Bangkokhyai, Bangkok 10600 Thailand.

TeL: (66) 02-8680812#13 Fax: (66) 02-8680860 www.jiranatee.com

Certificate No.: CL-041-65

Page 2 of 2

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 - 40 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 21001206.  
Dimension: Diameter 14 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
30	20.058	20.0	-0.1	0.099
30	25.049	25.0	0.0	0.099
30	30.045	30.0	0.0	0.099
30	35.020	35.0	0.0	0.099
30	39.999	40.0	0.0	0.099

Table 2: This equipment was connected with temperature probe Model: TP3207.2 S/N: 21001796.  
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
70	20.058	20.2	1.0	0.099
70	25.049	25.0	0.0	0.099
70	30.032	29.7	-0.3	0.099
70	35.011	34.6	-0.4	0.099
70	40.000	39.5	-0.5	0.099

Table 3: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 21001250.  
Dimension: Diameter 8 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.058	20.0	-0.1	0.099
110	25.048	25.0	0.0	0.099
110	30.031	30.0	0.0	0.099
110	35.020	35.0	0.0	0.099
110	40.000	40.0	0.0	0.099

UUC\*: Unit Under Calibration

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

★ End of Certificate ★

**J NAC**

JIRANATE ASSOCIATES CO., LTD.

63/14-15,67/35-36, Soi Petchkasem 7,7/1, Petchkasem Rd,  
Wathapra, Bangkokhyai, Bangkok 10600 Thailand.

TeL: (66) 02-8680812#13 Fax: (66) 02-8680860 www.jiranatee.com

**CERTIFICATE OF CALIBRATION**

Certificate No.: CL-042-65

Page 1 of 2

Equipment Name: Digital thermometer with RTD

Manufacturer: DeltaOHM

Model: HD32.2

Serial No: 20032243

ID No: RYG\_FS0523

Customer

Name: ALS laboratory group (thailand) Co.,Ltd.

Address: 104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand.

Received date: 25 FEB 2022

Calibration date: 7 MAR 2022

Issue date: 10 MAR 2022

Reference Used During Calibration

1. Standard Temperature Probe Model: STS-100 A500, Serial No: 667682-09, Due date: 25 Mar 2022

2. Digital Temperature Indicator Model: DTI-1000-A MK II, Serial No: 671407-00591 Due date: 04 June 2022

Calibration Condition

Temperature: (23±3) °C

Relative Humidity: (55±15)%

Calibration Procedure

The temperature calibration was done by In House calibration method as WI-CL-001 according to comparison method with standard digital temperature indicator and standard temperature probe. The temperature scale use was based on ITS-90.

Traceability

The measurement results are traceable to the international system of units (SI) through National Institute of Metrology (NIMT) Certificate number: TT-0036-21, Certificate number: ER-0032-21

Calibrated by

☒ Mr. Sorawit Thachalad

☐ Miss Orathai Wiwatwittaya

Approved Signatory: *Stefan*

Mr. Parinya Booncharoen

Calibration Department Manager

REVIEW BY: *Monika P.*

APPROVED BY: *Stefan*

NEXT CAL. DATE: 4/3/23

THIS CERTIFICATE REPORT MAY NOT BE REPRODUCED EXCEPT IN FULL UNLESS PERMISSION FOR REPRODUCTION HAS BEEN OBTAINED IN WRITING FROM THE LABORATORY.





Certificate No. : CL-042-65  
Page 2 of 2

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 - 40 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 21001219.  
Dimension: Diameter 14 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
30	20.050	20.0	-0.1	0.099
30	25.047	25.0	0.0	0.099
30	30.034	30.0	0.0	0.099
30	35.021	35.0	0.0	0.099
30	40.005	40.0	0.0	0.099

Table 2: This equipment was connected with temperature probe Model: TP3207.2 S/N: 21001786.  
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
70	20.058	20.2	0.1	0.099
70	25.045	25.1	0.1	0.099
70	30.032	30.0	0.0	0.099
70	35.021	34.9	-0.1	0.099
70	40.001	39.7	-0.3	0.099

Table 3: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 21001243.  
Dimension: Diameter 8 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.059	20.0	-0.1	0.099
110	25.047	25.0	0.0	0.099
110	30.032	30.0	0.0	0.099
110	35.016	35.0	0.0	0.099
110	40.007	40.0	0.0	0.099

UUC\* : Unit Under Calibration

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

★ End of certificate ★



## CERTIFICATE OF CALIBRATION

Certificate No. : CL-043-65  
Page 1 of 2

Equipment Name: Digital thermometer with RTD  
Manufacturer: DeltaOHM  
Model: HD32.2  
Serial No: 20032249  
ID No: RYG\_FS0524

Customer  
Name: ALS laboratory group (thailand) Co.,Ltd.  
Address: 104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand.

Received date: 25 FEB 2022  
Calibration date: 8 MAR 2022  
Issue date: 10 MAR 2022

Reference Used During Calibration  
1. Standard Temperature Probe Model: STS-100 A500,  
Serial No: 667682.09, Due date: 25 Mar 2022  
2. Digital Temperature Indicator Model: DTI-1000.A MK II, Serial No.: 671407-00591 Due date: 04 June 2022

Calibration Condition  
Temperature: (23±3) °C  
Relative Humidity: (55±15)%

Calibration Procedure  
The temperature calibration was done by In-House calibration method as WI-CL-001 according to comparison method with standard digital temperature indicator and standard temperature probe. The temperature scale use was based on ITS-90.

Traceability  
The measurement results are traceable to the international system of units (SI) through National Institute of Metrology (NIMT) Certificate number: TT-0036-21, Certificate number: ER-0032-21

REVIEW BY	<i>Manan P.</i>
APPROVED BY	<i>[Signature]</i>
NEXT CAL DATE	8/3/23

Calibrated by  
☒ Mr. Sorawit Thechealed  
☐ Miss Orathai Wiwatwittaya



Approved Signatory: *[Signature]*  
Mr. Parinya Booncharoen  
Calibration Department Manager

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Certificate No. : CL-043-65  
Page 2 of 2

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 - 40 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 21001215.  
Dimension: Diameter 14 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
30	20.057	20.1	0.0	0.099
30	25.046	25.1	0.1	0.099
30	30.032	30.1	0.1	0.099
30	35.013	35.1	0.1	0.099
30	39.998	40.0	0.0	0.099

Table 2: This equipment was connected with temperature probe Model: TP3207.2 S/N: 21001785.  
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
70	20.057	20.1	0.0	0.099
70	25.046	25.0	0.0	0.099
70	30.035	29.9	-0.1	0.099
70	35.023	34.7	-0.3	0.099
70	40.002	39.6	-0.4	0.099

Table 3: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 21001244.  
Dimension: Diameter 8 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.056	20.0	-0.1	0.099
110	25.046	25.0	0.0	0.099
110	30.032	30.0	0.0	0.099
110	35.015	35.0	0.0	0.099
110	39.992	39.9	-0.1	0.099

UUC\* : Unit Under Calibration

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

★ End of Certificate ★



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 16, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL. 0-2717-3000-27 FAX 0-2719-9484



Cert.No.: 22CH405  
Page: 1 of 3

## Certificate of Calibration

Equipment : pH Meter  
Manufacturer : Mettler Toledo  
Model : Seven Compact S220  
Serial No. : C104059460  
ID No. : RYG\_EN0183  
Condition As-Received: Used Item  
Received Date : 16 March 2022  
Calibration Date : 17 March 2022  
Reference : 2203-0611DSC-4  
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.  
Rayong Branch  
616/10 Moo 5 T.Maenam Khu,  
A.Pluakdaeng, Rayong 21140, Thailand  
Ambient Temperature : (25 ± 2.5) °C  
Relative Humidity : (50 ± 15) %  
Calibration Procedure : In-house method :  
- CP-CH5 by direct measurement with standard voltage calibrator and direct measurement with certified reference material (CRM)  
- CP-CH8 by comparison with standard thermometer

REVIEW BY	<i>N. Banjit</i>
APPROVED BY	<i>[Signature]</i>
NEXT CAL DATE	17/3/23

Calibrated by : Warakorn Lemgagtrakul

Approved by : *[Signature]*  
Approved Signatory

(/ ) Malee Butkruea  
( ) Saitthip Meangmai  
( ) Warakorn Lemgagtrakul

Issue Date : 22 March 2022

The Uncertainties are for a confidence probability of approximately 95%

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Cert.No.: 22CH405  
Page.: 2 of 3

#### Condition of this calibration result

1. Reference Standard Instrument : -

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC116	21E2682	25 Aug 2022
2) Ref. Standard Thermometer	4982054	110RC044	21I1201	26 Oct 2022

This certification is traceable to the International System of Unit maintained at:-  
- Traceable to National Institute of Metrology (Thailand), NIMT

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

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	788995	01 Jan 2024
pH 6.982	CPA chem	761017	02 Aug 2022
pH 10.015	CPA chem	766824	04 Sep 2022

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

#### Calibration Results

Function : mV Measurement

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

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement ( $\pm$ mV)	Coverage factor k
	pH	mV	nV	pH		
pH Meter S/N.: C104059460	4.000	177.48	17.4	4.000	0.058	2.00
	7.000	0.00	-1.1	7.000	0.058	2.00
	10.000	-177.48	-17.5	10.000	0.058	2.00

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Cert.No.: 22CH405  
Page.: 3 of 3

#### Calibration Results

Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH measurement ( $\pm$ )	Coverage factor k
pH Electrode S/N.: 1453404	4.008	4.010	177.7	0.0046	2.00
	6.982	6.988	3.6	0.0084	2.00
	10.015	10.010	-172.9	0.0073	2.05

Function : Temperature Measurement

(\*) Without adjustment

This equipment was connected with Temperature Probe

- Model : InLab Expert Pro-ISM

- Serial No. : 1453404

Dimension of probe:

- Length : 120 mm.

- Diameter : 12 mm.

- Immersion Depth : 100 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement ( $\pm$ °C)	Coverage factor k
25.0	25.002	24.9	-0.102	0.13	2.00

Remark : - UUC\* = Unit Under Calibration

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

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
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53/44 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250  
TEL. 0-2717-3000-24 FAX. 0-2719-9484



### Certificate of Calibration

Certificate No. : 22E986  
Page : 1 of 2

Equipment : pH Meter

Manufacturer: Mettler Toledo

Model : SevenCompact S220

Serial No.: C104059460

ID No.: RYG\_EN0183

Condition As-Received: Used Item

Received Date: 16 March 2022

Calibration Date: 21 March 2022

Reference: 2203-0611DSC

Ambient Temperature: (23  $\pm$  2) °C

Relative Humidity: (50  $\pm$  10) %

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Corporate Services 3: Equipment Calibration and Testing Services.

Submitted by: ALS Laboratory Group (Thailand) Co., Ltd. Rayong Branch

616/10 Moo 5 T.Maenam Khu, A.Pluakdaeng, Rayong  
21140, Thailand

Procedure used: Calibration were conducted using in-house calibration Procedure CP-E17 According to direct measurement method with Multi-Product Calibrator.

#### Condition of this result of calibration

1. Reference standards instruments :

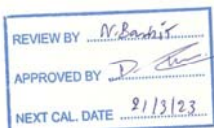
Instrument	Model	Serial No.	Certificate No.	Due Date
1) Multi-Product Calibrator	500A	6440007	21E1444	07 May 2022

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

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

4. This Certification is traceable to the International System of Unit maintained at:-

- National Institute of Metrology (Thailand) (NIMT)



Calibrated by: Pongsagorn Boonyaporn  
Issue Date: 22 March 2022

Approved signatory :  
[x] Phalinee Prabpaipal  
[ ] Nuntawat Khamchai  
[ ] Ponthipha Tamayakul

B 0284414



Cert. No.: 22E986  
Page.: 2 of 2

Result of calibration :- (\*) Without adjustment ( ) After adjustment

Function:	DC voltage measurement	Range:	2000 mV	
	Standard Value (mV)	UUC* Reading (mV)	Error (mV)	Uncertainty ( $\pm$ $\mu$ V)
	-200.0000	-200.0	0.0	72
	-150.0000	-150.0	0.0	69
	-100.0000	-100.0	0.0	65
	-50.0000	-50.0	0.0	62
	0.0000	0.0	0.0	58
	50.0000	50.0	0.0	62
	100.0000	100.0	0.0	65
	150.0000	150.0	0.0	69
	200.0000	200.0	0.0	72

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

\*UUC= Unit Under Calibration.

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## Certificate of Calibration

Equipment: SPECTROPHOTOMETER  
Model: DR6000  
Serial No. (or ID.): 1627845 (RYG\_EN0037)  
Manufacturer: HACH  
Condition: In Condition

Certificate No.: C06210159  
Issued Date: 01 April 2021  
Job No.: KSPR2104738  
Page: 1 of 3

Customer: ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)  
616/10 Moo 5 T.Maenam Klu,  
A.Pluakdaeng, Rayong 21140, Thailand.



Environment Condition: Temperature 25.1 °C ± 0.4 °C  
Humidity 48.8 %RH ± 3.7 %RH

Calibration Place: ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch) ( Wet Chemistry Lab )  
616/10 Moo 5 T.Maenam Klu,  
A.Pluakdaeng, Rayong 21140, Thailand.

Calibration By: Mr. Chutaphon Foithong

Calibration Date: 01 April 2021

The Method used: In house method, SPCC-W124, base on ASTM E 275-08 and ASTM E 387-04

Traceability: This certificate is traceable to the CRM maintained by National Institute of Standards and Technology (NIST) through Sarna Scientific Limited.

The standard for Wavelength Certificate No. 87146 and 87152  
The standard for Photometric Certificate No. 87220 and 87139  
The standard for Stray light Certificate No. 87163 and 87161  
The standard for Spectral resolution Certificate No. 87173

  
(Mr. Chutaphon Foithong)  
Person in charge

  
บริษัท เอสซี อาร์ท จำกัด  
SPC RT Co., Ltd.

  
(Mr. Dumrong Boonsopon)  
Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.  
The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).  
These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of SPC RT Co., Ltd.

บริษัท เอสซี อาร์ท จำกัด  
SPC RT Co., Ltd.  
จ.ฉะเชิงเทรา 1134 ซอยวัดพระบาทนาคี 57 ต.บางพระ อ.บางพระ จ.ฉะเชิงเทรา 11340  
โทร 08003 1134 Sae Wachirathamachul 57 Sukhumvit 10/1 Road, Bangkok, Phraekhong, Bangkok 10360 Thailand

## Calibration Results:

## Without Adjustment

Wavelength Accuracy (nm), The spectral bandwidth of Std at 2 nm and UUC at 2 nm				
Standard Wavelength	Unit Under Calibration	Correction	Uncertainty	
418.61	418.4	0.21	0.13	
536.66	536.7	-0.04	0.13	
637.98	638.3	-0.32	0.14	
748.48	748.7	-0.22	0.14	
807.03	807.4	-0.37	0.14	

Photometric Accuracy (Absorbance)				
Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
420 nm	0.0000	0.000	0.0000	0.0045
	0.5890	0.590	-0.0010	0.0045
	0.7616	0.762	-0.0004	0.0045
	1.0263	1.027	-0.0007	0.0045
440 nm	0.0000	0.000	0.0000	0.0045
	0.5787	0.579	-0.0003	0.0045
	0.7442	0.744	0.0002	0.0045
	1.0039	1.004	-0.0001	0.0045
465 nm	0.0000	0.000	0.0000	0.0045
	0.5292	0.530	-0.0008	0.0045
	0.6865	0.687	-0.0005	0.0045
	0.9534	0.954	-0.0006	0.0045
546.1 nm	0.0000	0.000	0.0000	0.0045
	0.5468	0.546	0.0008	0.0045
	0.6957	0.695	0.0007	0.0045
	0.9991	0.998	0.0011	0.0045
590 nm	0.0000	0.000	0.0000	0.0045
	0.5851	0.584	0.0011	0.0045
	0.7238	0.723	0.0008	0.0045
	1.0957	1.094	0.0017	0.0045
635 nm	0.0000	0.000	0.0000	0.0045
	0.5692	0.568	0.0012	0.0045
	0.6914	0.691	0.0004	0.0045
	1.0881	1.087	0.0011	0.0045

บริษัท เอสซี อาร์ท จำกัด  
SPC RT Co., Ltd.  
จ.ฉะเชิงเทรา 1134 ซอยวัดพระบาทนาคี 57 ต.บางพระ อ.บางพระ จ.ฉะเชิงเทรา 11340  
โทร 08003 1134 Sae Wachirathamachul 57 Sukhumvit 10/1 Road, Bangkok, Phraekhong, Bangkok 10360 Thailand

## Calibration Results:

## Without Adjustment

Photometric Accuracy (Absorbance)				
Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
235 nm	0.0000	0.000	0.0000	0.0080
	0.7307	0.730	0.0007	0.0080
257 nm	0.0000	0.000	0.0000	0.0080
	0.8516	0.850	0.0016	0.0080
313 nm	0.0000	0.000	0.0000	0.0080
	0.2836	0.285	-0.0014	0.0080
350 nm	0.0000	0.000	0.0000	0.0080
	0.6319	0.629	0.0029	0.0080

## Stray light \*

Standard: cut-off	UUC: Wavelength (nm)	UUC: Transmission (%)	Absorbance (A)
260.57 +/- 0.11 nm	260.6	1.5	1.824
392.03 +/- 0.11 nm	392.0	1.5	1.824

The stray light transmission reference is less than 1.0T(%) and absorbance is greater than 2.0 (A)

## Spectral Resolution \*

Nominal Concentration 0.02 % v/v	Peak	Trough	Ratio	SBW
Standard Wavelength (nm)	268.72	266.76	1.39	2.00
UUC: Wavelength (nm)	268.2	266.1		
Std Absorbance (A)	0.4616	0.2797		
Absorbance (A)	0.416	0.300		

\* Calibration Marked \* Not TISI Accredited \* in this Certificate have been included for completeness.

The End of Certificate

บริษัท เอสซี อาร์ท จำกัด  
SPC RT Co., Ltd.  
จ.ฉะเชิงเทรา 1134 ซอยวัดพระบาทนาคี 57 ต.บางพระ อ.บางพระ จ.ฉะเชิงเทรา 11340  
โทร 08003 1134 Sae Wachirathamachul 57 Sukhumvit 10/1 Road, Bangkok, Phraekhong, Bangkok 10360 Thailand

## ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: KSPR2104738

ชนิดเครื่องมือ: SPECTROPHOTOMETER

รุ่น: DR6000

หมายเลขเครื่อง: 1627845

ตรวจสอบ (วัน)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
01 Apr 2021			01 Apr 2021		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
		<i>General</i>			
<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 ( ซองใส่ตัวอย่าง, 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"/>	
		<i>Spectrophotometer</i>			
<input type="checkbox"/>	<input type="checkbox"/>	6. แรตตันไฟฟ้า (Battery Backup) $\geq$ 2.5 VDC	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	7. ตัวหมุนเลือกความยาวคลื่น (Wavelength Control)	<input type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. ความยาวคลื่น (Wavelength Check)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	9. แสงอุลตราไวโอเลต (UV $<$ 3,000 hour)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	10. แสงที่มองเห็น (Visible $<$ 5,000 hour)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	11. ซองจัดหลายตัวอย่าง (Carousel Module)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
		<i>pH Meter and Conductivity Meter</i>			
<input type="checkbox"/>	<input type="checkbox"/>	12. อิเล็กโทรด ( Electrode and Connection Cable )	<input 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. ขาจับอิเล็กโทรด (Stand)	<input type="checkbox"/>	<input type="checkbox"/>	
		<i>Turbidimeter</i>			
<input type="checkbox"/>	<input type="checkbox"/>	16. ค่าความขุ่นที่ต่ำสุด (No Sample)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	17. ระดับการส่องสว่างของแสง ( $\geq$ 2.5 ไม่นเกิน 3.0)	<input type="checkbox"/>	<input type="checkbox"/>	
		<i>Automatic titrator</i>			
<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. ระบบทาสายยางและอุปกรณ์ประกอบ	<input type="checkbox"/>	<input type="checkbox"/>	

เพิ่มเติมข้อแนะนำ:

Mr. Chutaphon Foithong  
Service Engineer

บริษัท เอสซี อาร์ท จำกัด  
SPC RT Co., Ltd.  
จ.ฉะเชิงเทรา 1134 ซอยวัดพระบาทนาคี 57 ต.บางพระ อ.บางพระ จ.ฉะเชิงเทรา 11340  
โทร 08003 1134 Sae Wachirathamachul 57 Sukhumvit 10/1 Road, Bangkok, Phraekhong, Bangkok 10360 Thailand



# Metrological Center

## SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoh, Saraburi 18110, Thailand.  
Saraburi Tel : +66 3627 3096 Fax : +66 3627 3100  
Bangkok Tel : +668 9/05 6851 , +669 8247 2360  
Website : www.scieco.co.th E-Mail : calibrate@scg.co.th

RYG\_EN0184



Certificate No. T220384101 "Substitute for Calibration Certificate Number T220384" Page 1 of 4

### Certificate of Calibration

Equipment : Chamber ( Cold Room )  
Manufacturer : MODULAR  
Model : IREVCOHCOO  
Serial No. : C00351459  
Customer Code : RYG\_EN0184  
ID No. : T1939A5  
Customer : ALS Laboratory Group (Thailand) Co.,Ltd. ( Rayong Branch )  
616/10 Moo 5 T.Maenam Khu,  
A.Pluakdaeng, Rayong 21140  
Customer Location : Laboratory  
Date of Receipt : 18 February 2022  
Calibrated By : Boonchai Suriyawong ( Site Calibration Manager )  
Approved By : [Signature] / Sujjar Nakhnakred (Site Calibration Manager)  
Date of Issue : 18 MAR 2022



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

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

FM-L14 117/01-02-64



# Metrological Center

## SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoh, Saraburi 18110, Thailand.



Certificate No. T220384101

Page 2 of 4

### Calibration Report

Equipment : Chamber ( Cold Room )  
Date of Calibration : 22 February 2022  
Environment : Temperature : 23.2-24.3 °C  
Line Voltage : 221.8-227.2 V  
Relative Humidity : 55 - 65 %RH

#### Condition of this results of calibration :

- This equipment was calibrated by insert 16 standard thermocouples type T into its chamber , the other one standard thermocouples type T use for ambient temperature measurement . The calibration was done in according to WI-T20 ( based on ASTM E145-94 ( Reapproved 2001 ) and AS2853-1986 ).  
All data show below were final values and the initial data from customer request . The temperature scale used was based on ITS - 90 .
- Reference Standard Instrument :  

Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	TYPE T	TN141-TN150	T210743	21 April 2022
TC	TYPE T	TN151-TN160	T210743	21 April 2022
DATA LOGGER	34970A	T150	T210743	21 April 2022
- This certificate is traceable to :  
National Institute of Metrology ( Thailand ) through Metrological Center ( NSC-TISI-TIS 17025 CALIBRATION 0244.)
- Condition of calibrated item : good  
Equipment Description :  

Time Constant	-	Hour	40	Minute At	3	°C
Fresh Air Damper	<input type="checkbox"/> Open	<input type="checkbox"/> Min	<input type="checkbox"/> Medium	<input type="checkbox"/> Max		
	<input type="checkbox"/> Close					
	<input checked="" type="checkbox"/> Not Available					
- Adjustment :  
( X ) without adjustment ( ) after adjustment

Approved By. [Signature]

FM-L15 117/15-05-63



# Metrological Center

## SCI ECO Services Company Limited

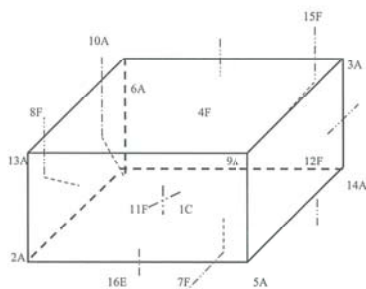
33/2 Moo 3, T.Banpa, A.Kaengkhoh, Saraburi 18110, Thailand.



Certificate No. T220384101

Page 3 of 4

### Calibration Report



C = Centre , F = Centre of Face , A = Corner , E = Centre of Edge

1C = TN141	12F = TN152
2A = TN142	13A = TN153
3A = TN143	14A = TN154
4F = TN144	15F = TN155
5A = TN145	16E = TN156
6A = TN146	
7F = TN147	
8F = TN148	
9A = TN149	
10A = TN150	
11F = TN151	

Approved By. [Signature]

FM-L15 117/15-05-63



# Metrological Center

## SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoh, Saraburi 18110, Thailand.



Certificate No. T220384101

Page 4 of 4

### Calibration Report

#### Measurement Results

Calibration Point	Average Standard Reading at each position (°C)									
	TN141	TN142	TN143	TN144	TN145	TN146	TN147	TN148	TN149	TN150
3.0	2.80	2.96	2.98	2.97	3.16	3.29	2.95	3.14	3.10	3.45
	TN151	TN152	TN153	TN154	TN155	TN156				
	3.04	3.19	3.03	3.34	3.11	3.11				

Chamber ( Cold Room )		Temperature Distribution					
Setting (°C)	Reading (°C)		Average (°C)	Stability (±°C)	Uniformity (°C)	Uncertainty (±°C)	Coverage Factor k
	Min	Max					
3.0	2.7	4.1	3.5	3.11	1.30	1.30	2.05

\* The Acquired uncertainty exclude "uniformity"

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on date and place of test only.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k which for a t-distribution, providing a level of confidence of approximately 95 % .

Approved By. [Signature]

FM-L15 117/15-05-63





Cert.No.: 21TW20  
Page.: 1 of 2

## Certificate of Testing

Equipment : DO Meter  
Manufacturer : YSI  
Model : 5100  
Serial No. : 15L102139  
ID No. : RYG\_EN0140  
Received Date : 29 January 2021  
Test Date : 32 February 2021  
Reference : 2101-0817DSC-1  
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.  
Rayong Branch  
Eastern Seaboard Industrial Estate (Rayong)  
34/77 Moo 4,Building No.B1, Highway 331,  
Km91.5, T.Pluakdaeng, A.Pluakdaeng,  
Rayong 21140 Thailand  
Laboratory Condition : Temperature (  $25 \pm 5$  ) °C  
Humidity (  $50 \pm 20$  ) %  
Test Procedure : n - house method : CP-CH9  
y Comparison Technique with Azide Modification Method  
Calibrated by : Walalak Sirithean  
Approved by :   
( / ) Malee Butkruea  
( ) Salthip Meangmai  
( ) Warakorn Lemgagtrakul  
Issue Date : 3 February 2021



B 0252485



Cert.No.: 21TW20  
Page.: 2 of 2

Result : Dissolved Oxygen Meter Adjustment With Air 100 %  
Dissolved Oxygen Probe No.: 16C100647

Titration Method (Azide Modification Method) (mg/L)	DC Meter Reading (mg/L)	Standard Deviation (mg/L)
8.02	8.02	0.0055

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

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a 1038971



Cert. No.: 21TM271  
Page.: 1 of 2

## Certificate of Calibration

Equipment : DO Meter with Sensor  
Manufacturer : YSI  
Model : 5100  
Serial No. : 15L102139  
ID No. : RYG\_EN0140  
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd. Rayong Branch  
Eastern Seaboard Industrial Estate (Rayong)  
6477 Moo 4 Building No.B1, Highway 331 km. 91.5,  
T. Pluakdaeng, A. Pluakdaeng, Rayong 21140 Thailand  
Location : TPA On Site Calibration Laboratory  
Received Order : 29 January 2021  
Calibrated Date : 3 February 2021  
Ambient Temperature : (  $25 \pm 10$  ) °C  
Relative Humidity : (  $50 \pm 30$  ) %  
AC Line Voltage : (  $220 \pm 22$  ) V  
Calibrated by : Malee Butkruea  
Approved by :   
( ) Pornthippa Tameyakul  
( / ) Suwit Imjai  
Issue Date : 4 February 2021

The Uncertainties are for a confidence probability of approximately 95%

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A 0024028



Equipment : DO Meter with Sensor  
Condition As-Received : Used Item  
Reference : 2101-0817DSC-2

Cert. No.: 21TM271  
Page.: 2 of 2

### Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-OT01 according to comparison with Industrial Platinum Resistance Thermometer (IPRT) into Temperature Bath.

The temperature scale used was based on ITS-90.

### Condition of this result of calibration

#### 1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Digital Thermometer	1523	2188080	201389	20 Nov 2021
2) This certificate is valid only to the item calibrated on date and place of calibration.				
3) This certification is traceable to the International System of Unit maintained at:-				

- National Institute of Metrology Thailand (NIMT)

Result of Calibration :- ( \* ) Without Adjustment

Function : Temperature measurement.

This instrument was connected with temperature sensor, S/N.: 16C100647

Calibration Point ( °C )	Immersion Depth ( mm )	Standard Temperature ( °C )	UUC* Reading ( °C )	Error ( °C )	Uncertainty ( ± °C )	Coverage Factor k
20.00	60	20.008	19.96	-0.048	0.15	2.00

UUC\* : Unit Under Calibration

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

-o0o-

a 1038626



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



## Certificate of Calibration

Cert. No.: 22TM317  
Page: 1 of 3

Equipment : Low Temp. Incubator

Manufacturer : Memmert

Model : IPP750

Serial No. : V818.0084

ID No. : RYG\_EN0154

Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.  
(Rayong Branch)  
616/10 Moo 5 T.Meenam Khu,  
A.Pluakdaeng, Rayong 21140, Thailand

Location : BOD Room

Received Order : 22 April 2022

Calibration Date : 22 April 2022

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 30) %

Calibrated by : Man Pattanapongpaiboon

Approved by :   
Approved Signatory

( ) Pornthippa Tameyakul  
( ) Malee Butkruea  
( ) Suwit Imjai

Issue Date : 3 May 2022

The Uncertainties are for a confidence probability of approximately 95%

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

REVIEW BY   
APPROVED BY   
NEXT CAL. DATE 29/10/23



Equipment : Low Temp. Incubator  
Condition As-Received : Used Item  
Reference : 2204-0146OC-1  
Procedure Used :-

Cert. No.: 22TM317  
Page: 2 of 3

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement  
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	MY44031769	21LM12	02 Sep 2022

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

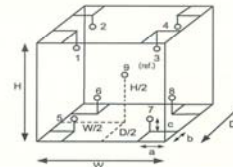
3. This certification is traceable to the International System of Unit.

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Close

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	25	25
REL.Humid. ( % )	54	58
AC Supply ( Volt )	221	223



#### Probe Installation Details :

a =	10	cm	D =	0.60	m
b =	10	cm	W =	1.0	m
c =	10	cm	H =	1.2	m
			Capacity =	0.75	m <sup>3</sup>

#### Dimension of Chamber :

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

A 0040735

a 1106485



Equipment : Low Temp. Incubator  
Condition As-Received : Used Item  
Reference : 2204-0146OC-1  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Close

Cert. No.: 22TM317  
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	0.022	0.20	0.22	0.30	2

Calibration Point ( °C )	Measured Temperature ( °C )								
	1	2	3	4	5	6	7	8	9 (ref.)
20.0	20.209	20.174	20.199	20.110	20.075	20.062	20.027	20.069	20.030

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 %.

-00-



PENTA  
CALIBRATION

PENTA CALIBRATION CO., LTD.  
66/124 The Connect 33 Village Kanchanaphisek Road  
Dokmai Prasert Bangkok 10250  
Tel: +66 (0) 2069-9773  
www.pentalcal.com

## Certificate of Calibration

Represent to Certificate of Calibration PTC/07/22103

Certificate No.:	PTC/07/22103	Page:	1 of 2
Equipment:	Digital Balance	Condition:	Normal
Manufacturer:	Sartorius	Serial No:	26207038
Model:	MSE2245-100-DU	ID No:	RYG_EN0002
Type of Balance:	Single interval		

Customer: ALS Laboratory Group (Thailand) Co., Ltd.  
616/10 Moo 5 T.Maenankoo, A.Pluakdaeng,  
Rayong 21140, Thailand

REVIEW BY   
APPROVED BY   
NEXT CAL. DATE 29/10/23

Environment Condition:	Temperature	23.9 °C	± 0.3 °C
	Humidity	58.1 %RH	± 4.4 %RH
	Air density	1.17	kg/m <sup>3</sup>

Calibration Place: ALS Laboratory Group (Thailand) Co., Ltd.  
616/10 Moo 5 T.Maenankoo, A.Pluakdaeng,  
Rayong 21140, Thailand

The Method used: In house method, PTC-WI-07, base on Euramet cg. 18

Traceability: This certificate is traceable to the SI Units through Thai Calibration Service Co., Ltd.  
, NSC-ONSC Accreditation No.: Calibration 0189

Date Received: March 23, 2022

Calibration Date: March 23, 2022

Issued Date: March 25, 2022

Calibration By: Mr. Rungroje Metakul



( Mr. Kiangsak Kalasri )  
Reviewed by

Approved By :   
( Mr. Keattisak Kerdto )  
Laboratory Manager

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

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

This calibration certificate shall not be reproduced except in full, without written approval from penta calibration co., ltd

a 1106484



Represent to Certificate of Calibration PTC/07/22103

Certificate No.: PTC/07/22103

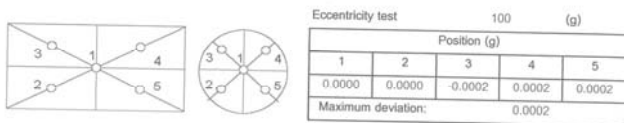
Page: 2 of 2

### Measurement Results:

Without Adjustment :

Function Calibration: Non Adjustment

Eccentric Error: Weight to be 1/3, 1/2 or of Maximum capacity



Repeatability Test : Weight to be  $1/2 \leq L_1 \leq$  Maximum capacity

Determination of the standard deviation of weighing balance., Readability 0.0001 (g)

Nominal test value (g)	Standard Deviation
200	0.00003

Error of indication : from nominal value., Readability 0.0001 (g)

Nominal Value (g)	Conventional Mass (g)	Indication (g)	Correction of Balance (g)	Uncertainty (g)	k
0	0.00000	0.0000	0.0000	0.000086	2.16
0.01	0.01000	0.0100	0.0000	0.00010	2.06
0.1	0.10000	0.1000	0.0000	0.00010	2.06
1	1.00000	1.0000	0.0000	0.00010	2.06
2	2.00000	1.9999	0.0001	0.00010	2.06
5	5.00001	5.0000	0.0000	0.00010	2.06
10	10.00000	10.0000	0.0000	0.00010	2.06
20	20.00003	19.9999	0.0001	0.00011	2.05
50	50.00004	49.9999	0.0001	0.00012	2.00
100	100.00004	100.0001	-0.0001	0.00017	2.00
200	200.00011	200.0000	0.0001	0.00027	2.00

Note: Weight of adjust (g)

The End of Certificate

PTC-FMC-07-02: 2 Feb 2020



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



Cert. No.: 21TM827  
Page: 1 of 3

## Certificate of Calibration

Equipment : Ho. Air Oven

Manufacturer : Memmert

Model : UFE 500

Serial No. : G511.1572

ID No. : RYG\_EN0010

Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)  
616/10 Moo 5 T. Maenam Khu,  
A. Pluakdaeng,  
Rayong 21140 Thailand

Location : Oven Room

Received Order : 5 May 2021

Calibration Date : 5 May 2021

Ambient Temperature : (25 ± 10) °C

Relative Humidity : (50 ± 30) %

Calibrated by : Khit Ruttanaprapachai

Approved by :   
Approved Signatory

( ) Pornthippa Tameyakul  
(/ ) Malee Butkruea  
( ) Suwit Imjai

Issue Date : 14 May 2021

The Uncertainties are for a confidence probability of approximately 95%

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

A 0028099



Equipment : Hot Air Oven  
Condition As-Received : Used Item  
Reference : 2105-0005OC-4

Cert. No.: 21TM827  
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 34972A MY57013823 21LM3 26 Feb 2022

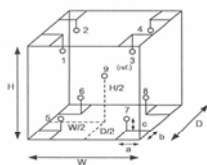
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration :- ( ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Close



Environment during calibration	
	Beginning
Temp. (°C)	28
REL.Humid. (%)	59
AC Supply (Volt)	220
	Finished
Temp. (°C)	29
REL.Humid. (%)	56
AC Supply (Volt)	221

Ref. Std. ID No.: @ Calibration Point	
Position	(104) °C
1	21-17RTD-01
2	21-17RTD-02
3	17RTD-03
4	17RTD-04
5	17RTD-05
6	17RTD-06
7	17RTD-07
8	17RTD-08
9 (ref.)	17RTD-09

Probe Installation Details : Dimension of Chamber :  
a = 5.0 cm D = 0.40 m  
b = 5.0 cm W = 0.56 m  
c = 5.0 cm H = 0.48 m  
Capacity = 0.11 m³



Equipment : Hot Air Oven  
Condition As-Received : Used Item  
Reference : 2105-0005OC-4

Cert. No.: 21TM827  
Page: 3 of 3

Result of Calibration :- ( ) Without Adjustment

Function of UUC\* : Temperature Source

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (± °C)	Coverage Factor k
104.0	104.0	104.0	0.063	0.54	0.70	0.42	2
180.0	180.0	180.0	0.15	0.89	1.3	1.1	2

Calibration Point (°C)	Measured Temperature (°C)								
	1	2	3	4	5	6	7	8	9 (ref.)
104.0	104.243	103.732	103.760	103.742	103.863	103.743	104.311	103.689	103.815
180.0	180.101	180.481	179.401	179.692	179.980	179.943	180.127	179.915	179.709

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 %.

-060-

a 1054287

a 1054286



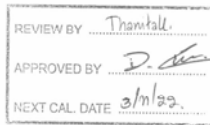
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534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL. 0-2717-3000-27 FAX 0-2719-9484



Cert. No.: 21TM829  
Page: 1 of 3

## Certificate of Calibration

Equipment : Hot Air Oven  
Manufacturer : Memmert  
Model : UM 400  
Serial No. : b495.0899  
ID No. : RYG\_EN0006  
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)  
616/10 Moo 5 T. Maenam Khu,  
A. Phuakdaeng,  
Rayong 21140 Thailand  
Location : Oven Room  
Received Order : 5 May 2021  
Calibration Date : 5 - 6 May 2021  
Ambient Temperature : (26 ± 10) °C  
Relative Humidity : (50 ± 30) %  
Calibrated by : Khit Ruttanaprapachai



Approved by :   
Approved Signatory

( ) Pornthippa Tameyakul  
( ) Malee Butkruea  
( ) Suwit Imjai

Issue Date : 14 May 2021

The Uncertainties are for a confidence probability of approximately 95%

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

A 0028096



Equipment : Hot Air Oven  
Condition As-Received : Used Item  
Reference : 2105-0005OC-1

Cert. No.: 21TM829  
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	34972A	MY57013823	21LM3	26 Feb 2022

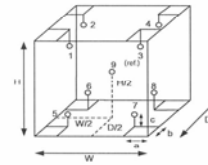
2. This certificate is valid only to the item calibrated on date and place of calibration.

3. This certificate 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 m<sup>3</sup>

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	29	30
REL.Humid. ( % )	56	58
AC Supply ( Volt )	221	222

Position :	Ref. Std. ID No.:
1	21-17RTD-01
2	21-17RTD-02
3	17RTD-03
4	17RTD-04
5	17RTD-05
6	17RTD-06
7	17RTD-07
8	17RTD-08
9 (ref.)	17RTD-09

a 1054310



Equipment : Hot Air Oven  
Condition As-Received : Used Item  
Reference : 2105-0005OC-1  
Result of Calibration :- ( ) Without Adjustment  
Function of UUC\* : Temperature Source

Cert. No.: 21TM829  
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
70.0	70.0	70.0	0.21	1.8	2.0	0.55	2

Calibration Point ( °C )	Measured Temperature ( °C )								
	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
70.0	70.404	70.277	70.607	70.307	68.789	69.257	68.846	69.331	70.495

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 %.

-o-o-

a 1054309



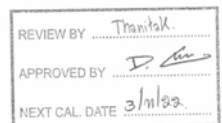
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TEL. 0-2717-3000-27 FAX 0-2719-9484



Cert. No.: 21TM673  
Page: 1 of 3

## Certificate of Calibration

Equipment : Water Bath  
Manufacturer : Memmert  
Model : WMB22  
Serial No. : L513.0648  
ID No. : RYG\_EN0061  
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)  
616/10 Moo 5 T. Maenam Khu,  
A. Phuakdaeng,  
Rayong 21140 Thailand  
Wet Chemistry Lab  
Location :  
Received Order : 5 May 2021  
Calibration Date : 5 May 2021  
Ambient Temperature : (26 ± 10) °C  
Relative Humidity : (50 ± 30) %  
Calibrated by : Tawatchai Pama



Approved by :   
Approved Signatory

( ) Pornthippa Tameyakul  
( ) Malee Butkruea  
( ) Suwit Imjai

Issue Date : 14 May 2021

The Uncertainties are for a confidence probability of approximately 95%

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

A 0028098



Equipment : Water Bath  
Condition As-Received : Used Item  
Reference : 2105-0005OC-3  
Procedure Used :-

Cert. No.: 21TM673  
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	MY44060450	21LM4	06 Mar 2022

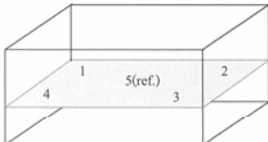
2. This certificate is valid only to the item calibrated on date and place of calibration.

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	22	68	230
Finished of Calibration	20	64	231



Position :	Ref. Std. S/N.:
1	4803988-001
2	4803988-002
3	4803988-003
4	4803988-004
5(ref.)	4803988-005

Front

a 1054289



Equipment : Water Bath  
Condition As-Received : Used Item  
Reference : 2105-0005OC-3  
Result of Calibration :- ( ) Without Adjustment  
Function of UUC\* : Temperature Source

Cert. No.: 21TM673  
Page.: 3 of 3

Calibration point ( °C )	UUC* Setting ( °C )	UUC* Reading ( °C )	Average* Standard Reading ( °C )				
			Position				
			1	2	3	4	5 (ref.)
85.0	85.0	85.0	84.891	84.893	84.880	84.892	84.917

Calibration point ( °C )	Uniformity ( °C )	Stability ( ± °C )	Uncertainty ( ± °C )	Coverage Factor k
85.0	0.089	0.052	0.22	2

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

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

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

UUC\* : Unit Under Calibration

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

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

-o-o-

a 1054288



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TEL. 0-2717-3000-24 F/X. 0-2719-9484



## Certificate of Calibration

Certificate No.: 21T1200  
Page : 1 of 2

Equipment : Digital Thermometer With Sensor  
Manufacturer: Testo  
Model : 106  
Serial No.: 31281494/504  
ID No.: RYG\_FS0467

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Condition As-Received: Used Item  
Received Date: 02 July 2021  
Calibration Date: 07 July 2021  
Reference: 2107-0069DSC  
Ambient Temperature: ( 25 ± 3 ) °C  
Relative Humidity: ( 50 ± 20 ) %

Submitted by: ALS Laboratory Group (Thailand) Co., Ltd. Rayong Branch  
616/10 Moo 5 T.Maenam Khu, A.Pluakdaeng, Rayong  
21140, Thailand

Procedure used: Calibration were conducted using in-house calibration procedure CP-T01 according to comparison with Platinum Resistance Thermometer (PRT) into liquid bath temperature controller.  
The temperature scale used was based on ITS-90.

#### Condition of this result of calibration

##### 1. Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Digital Thermometer	1529-R	B19520	211680	26 Jun 2022
2) Platinum Resistance Thermometer	93i-14-95	261588/1	211680	26 Jun 2022

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

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

-National Institute of Metrology Thailand (NIMT)

REVIEW BY *Tanwasi*  
APPROVED BY *Sut*  
NEXT CAL DATE *7/9/22*

Calibrated by : Yossapon Poijorn  
Issue Date : 09 July 2021

Approved Signatory :  
[ ] Phalinee Prabpaipal  
[ ] Chatchawan Khunpluek  
[x] Wanlop Larpkum

B 0265214



Result of Calibration:- Without Adjustment

Function: Temperature measurement

Dimension of probe : Diameter 3 mm., Length 65 mm. Sheath material : Stainless Steel

Immersion Depth ( mm. )	Standard Temperature ( °C )	UUC* Reading ( °C )	Error ( °C )	Uncertainty of Measurement ( ± °C )
50	25.0029	24.9	-0.1029	0.12
50	30.0018	29.9	-0.1018	0.12
50	40.0035	40.0	-0.0035	0.12

UUC\* : Unit Under Calibration

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%.

-o-o-

Cert. No.: 21T1200  
Page.: 2 of 2

a 1063351



แบบฟอร์มการประเมินเครื่องมือภายหลังทำการสอบเทียบเครื่องมือวิเคราะห์ด้วย

ชื่อเครื่องมือ : GC-MSD

ID No. : BKK\_EN0059(GM7)

S/N : CN14133181/US1415M029

Parameter	Set point	Acceptable	Test Results	Pass	Fail	Remark
Inlet Pressure Accuracy	25 psi	23.8 -26.1	25.3	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Oven Temp. Accuracy	230°C	225 -235	230.6	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Oven Temp. Accuracy	100°C	96.3 -103.7	100.9	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Oven Temp. Stability	100°C	99.5 -100.5	100.9	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
RFA Voltage	1050 m/z	≤ 1100 mV	518	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Signal to Noise Filament 1	-	≥ 1200	1472	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Signal to Noise Filament 2	-	≥ 1200	3400	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
				<input type="checkbox"/>	<input type="checkbox"/>	
				<input type="checkbox"/>	<input type="checkbox"/>	
				<input type="checkbox"/>	<input type="checkbox"/>	
				<input type="checkbox"/>	<input type="checkbox"/>	

ผู้ตรวจสอบ: Nat Somb  
28/12/20  
ว/ด/ป:

ผู้อนุมัติ: Link Anh  
28/12/20  
ว/ด/ป:

Form No. : F12-164 Rev No.: 1 Issue Date : 25/06/2019

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Agilent CrossLab Compliance Services

## Certificate of System Qualification

GC-OQ + GCMS-OQ

System ID: GM-7  
Organization Name: ALS Laboratory Group (Thailand) Co., Ltd.  
Organization Location: 104 Pathanakam 40, Pathanakam rd., Khwang Suan Luang, Khet Suan Luang, Bangkok 10250

Date: December 24, 2020 2:51:10 PM  
EQP Name: AgilentRecommended, AgilentRecommended  
EQP Revision: GC.02.50, GCMS.02.50  
Overall Qualification Status: Pass

REVIEW BY: Nat Somb  
APPROVED BY: KL AL  
NEXT CAL DATE: 28/06/22

### System Inspection and Basic Safety and Operation

Name: 7890  
Setpoint Status: Pass

### Overall System Inspection and Basic Safety and Operation Test Status

Pass

### Inlet Pressure Accuracy

Name: 7890  
Front SSL  
Setpoint Status: Pass  
Setpoint: 25.0 psi Actual: 25.3 psi  
Accuracy: 0.3 psi  
Agilent Recommended: ≤ 1.2

### Overall Inlet Pressure Accuracy Test Status

Pass

### GC Oven Temperature Accuracy

Name: 7890

Date: December 24, 2020 2:51:10 PM  
System ID: GM-7

Page 1 / 13

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Agilent CrossLab Compliance Services

Setpoint Status: Pass  
Zone: Oven  
Temperature: 230.0 Setpoint/Actual: 230.6 °C  
Accuracy: 0.6 °C  
Agilent Recommended: ≥ -1.0 % setpoint in K ( -5.0 °C )  
≤ 1.0 % setpoint in K ( 5.0 °C )

### Data for this setpoint was entered manually.

Reason: Data logging currently not available.

Setpoint Status: Pass  
Zone: Oven  
Temperature: 100.0 Setpoint/Actual: 100.9 °C  
Accuracy: 0.9 °C  
Agilent Recommended: ≥ -1.0 % setpoint in K ( -3.7 °C )  
≤ 1.0 % setpoint in K ( 3.7 °C )

### Data for this setpoint was entered manually.

Reason: Data logging solution currently not available.

### Overall GC Oven Temperature Accuracy Test Status

Pass

### GC Oven Temperature Stability

Name: 7890  
Setpoint Status: Pass  
Setpoint/Average: 100.0 100.9 °C  
Temperature: 100.0 100.9 °C  
Stability: 0.0 °C  
Agilent Recommended: ≤ 0.5

### Data for this setpoint was entered manually.

Reason: Data logging solution currently not available.

Date: December 24, 2020 2:51:10 PM  
System ID: GM-7

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### Overall GC Oven Temperature Stability Test Status

Pass

### Log Amp

Tested Combination1 Front SSL / External SQ  
Name: 5977A  
Setpoint Status: Pass

### Overall Log Amp Test Status

Pass

### RFA

Tested Combination1 Front SSL / External SQ  
Name: 5977A  
Setpoint Status: Pass  
Amu: 1050 m/z Drift After Five Minutes: 15 mV RFA Voltage: 518 mV  
Agilent Recommended: ≥ -100 and ≤ 100 ≤ 1100

### Overall RFA Test Status

Pass

### Tune EI

Tested Combination1 Front SSL / External SQ  
Name: 5977A  
Setpoint Status: Pass  
Filament: 1  
Setpoint Status: Pass  
Filament: 2

### Overall Tune EI Test Status

Pass

Date: December 24, 2020 2:51:10 PM  
System ID: GM-7

Page 3 / 13



## Signal to Noise EI

Tested Combination1	Front	SSL	/ External	SQ
Name:	5977A			
Source:	EI - Extractor	Filement:	1	
Setpoint Status:	Pass			
Signal to Noise:	1472			
Agilent Recommended:	>= 1200			
Source:	EI - Extractor	Filement:	2	
Setpoint Status:	Pass			
Signal to Noise:	3400			
Agilent Recommended:	>= 1200			
Overall Signal to Noise EI Test Status				
Pass				

Date: December 24, 2020 2:51:10 PM  
System ID: GM-7

Page 4 / 13

## Instrument Details

## Purpose

This section describes the as found system configuration.

## Details

System	
System ID	GM-7
Manufacturer	Agilent Technologies
Name	7890
Tested Combination1	
Injection Technique	Manual Injection
Inlet	Front
Detector	External
LTM Included?	No
Sampler 1	
Manufacturer	Agilent Technologies
Type	Manual Injection
Usage	Sample Injection
Syringe Volume (µL)	10
Mainframe 1	
Manufacturer	Agilent Technologies
Name	7890
Model Number	G3442B
Serial Number	CN14133181
Firmware Revision	B.02.03
Oven Type	Standard

Date: December 24, 2020 2:51:10 PM  
System ID: GM-7

Page 5 / 13

## Inlet 1

Manufacturer	Agilent Technologies
Name	7890
Type	SSL
Location	Front
Carrier Gas	Helium
Control Type	Electronic Pressure Control (EPC)
Purged Inlet	Yes

## Detector 1

Manufacturer	Agilent Technologies
Name	Mass Spectrometer
Type	Mass Spectrometer
Location	External

## Mass Spectrometer 1

Manufacturer	Agilent Technologies
Type	SQ
Name	5977A
Serial Number	US1415M209
Firmware Revision	5977 6.00.21
High Vacuum System	Turbo Pump
Scouting Run Standard	OFN Std

## MS EI Source 1

Manufacturer	Agilent Technologies
Source Type	EI - Extractor
Number of filaments	2

Date: December 24, 2020 2:51:10 PM  
System ID: GM-7

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## 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:	Supasak Nimsongthum
Logged On User Name:	supasak.nimsongthum@agilent.com
Signature Creation Date:	December 24, 2020
Reason for Signature:	Executed protocol and published this original version of document

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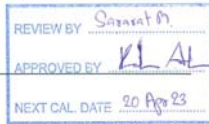
Date: December 24, 2020 2:51:10 PM  
System ID: GM-7

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## Certificate of System Qualification

GC-QQ

System ID: GC-5  
Organization Name: ALS Laboratory Group (Thailand) Co., Ltd.  
Organization Location: 104 Phattanakan 40, Phattanakan Rd., Suan Luang, Bangkok 10250  
Date: October 20, 2021 10:15:57 AM  
EQP Name: AgilentRecommended  
EQP Revision: GC.02.50  
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: 0.3 psi /5 minutes  
Agilent Recommended:  $\geq -2.0$  and  $\leq 0.5$

## Overall Inlet Pressure Decay Test Status

Pass

## Inlet Pressure Accuracy

Name: 7890  
Front SSL

Date: October 20, 2021 10:15:57 AM  
System ID: GC-5

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Setpoint Status: Pass

Setpoint Actual  
Inlet Pressure: 25.0 psi 24.9 psi  
Accuracy: 0.1 psi  
Agilent Recommended:  $\leq 1.2$

## Overall Inlet Pressure Accuracy Test Status

Pass

## Detector Flow Accuracy

Name: 7890  
Front FID  
Setpoint Status: Pass  
Flow Type: Fuel  
Setpoint: 30.0 mL/min Measured Flow: 30.0 mL/min  
Accuracy: 0.0 mL/min  
Agilent Recommended:  $\leq 10.0$  % 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: 390.3 mL/min  
Accuracy: 9.7 mL/min  
Agilent Recommended:  $\leq 10.0$  % 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: 24.5 mL/min  
Accuracy: 0.5 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

Date: October 20, 2021 10:15:57 AM  
System ID: GC-5

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## Overall Detector Flow Accuracy Test Status

Pass

## GC Oven Temperature Accuracy

Name: 7890  
Setpoint Status: Pass  
Zone: Oven  
Setpoint/Actual  
Temperature: 230.0 231.2 °C  
Accuracy: 1.2 °C  
Agilent Recommended:  $\geq -1.0$  % setpoint in K ( -5.0 °C )  
 $\leq 1.0$  % setpoint in K ( 5.0 °C )  
Setpoint Status: Pass  
Zone: Oven  
Setpoint/Actual  
Temperature: 100.0 100.4 °C  
Accuracy: 0.4 °C  
Agilent Recommended:  $\geq -1.0$  % setpoint in K ( -3.7 °C )  
 $\leq 1.0$  % setpoint in K ( 3.7 °C )

## Overall GC Oven Temperature Accuracy Test Status

Pass

## GC Oven Temperature Stability

Name: 7890  
Setpoint Status: Pass  
Setpoint/Average  
Temperature: 100.0 100.4 °C  
Stability: 0.0 °C  
Agilent Recommended:  $\leq 0.5$

## Overall GC Oven Temperature Stability Test Status

Pass

Date: October 20, 2021 10:15:57 AM  
System ID: GC-5

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## Scouting Run

Tested Combination1 Front SSL / Front FID  
Injection Tower  
Name: 7683B  
Setpoint Status: Completed  
Injection Volume on Column: 1.0 µL  
Overall Scouting Run Status  
Completed

## Noise and Drift

Tested Combination1 Front SSL / Front FID  
Name: 7890  
Setpoint Status: Pass  
Base Signal: 20.2 pA  
ASTM Noise pA  
Drift pA/hr  
Agilent Recommended:  $\leq 0.10$  0.05 0.50  
Status: Pass 2.50

## Overall Noise and Drift Test Status

Pass

## Injection Precision

Tested Combination1 Front SSL / Front FID  
Name: 7683B

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Setpoint Status: **Pass**

Injection Volume on Column: 1.0  $\mu$ L

Area RSD: 0.52 % Retention Time RSD: 0.22 %

Agilent Recommended:  $\leq$  3.00  $\leq$  1.00

## Overall Injection Precision Test Status

**Pass**

## Signal to Noise

Tested Combination1	Front	SSL	/ Front	FID
Injection Tower				
Name:	7890			
Setpoint Status:	<b>Pass</b>			
Signal to Noise:	1258310			
Agilent Recommended:	$\geq$ 300000			

## Overall Signal to Noise Test Status

**Pass**

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## Instrument Details

## Purpose

This section describes the as found system configuration.

## Details

## System

System ID	GC-5
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	Front
LTM Included?	No

## Sampler 1

Manufacturer	Agilent Technologies
Type	Injection Tower
Name	7683B
Model Number	G2913A
Serial Number	CN00259643
Firmware Revision	A.11.03
Usage	Sample Injection
Location	Front
Syringe Volume ( $\mu$ L)	10

## Sampler 2

Manufacturer	Agilent Technologies
Type	Tray
Name	7683A
Model Number	G2614A
Serial Number	CN81347892
Firmware Revision	A.02.01

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## Mainframe 1

Manufacturer	Agilent Technologies
Name	7890
Model Number	G3440A
Serial Number	US10813027
Firmware Revision	A.01.12.1
Component ID/Asset No.	GC-5
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	Front
Makeup Gas	Nitrogen

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## 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:	Suriya Thongkaew
Logged On User Name:	suriya.thongkaew@nox.agilent.com
Signature Creation Date:	October 20, 2021
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. Validation depends upon many factors and use of this protocol alone does not assure compliance. Agilent Technologies makes no promises or representations as to its sufficiency for any specific regulatory program.

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User Name: suriya.thongkaew  
Hostname: ASBKXW7529System ID: GC-5  
Print Date: October 20, 2021 10:16:00 AM

OQ GC ALS US10813027 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 19, 2021 10:37:29 AM	Audit	SessionCreated	Session	None
October 19, 2021 10:37:29 AM	Start	Configuration	Session	None
October 19, 2021 10:37:30 AM	Audit	Entitlement	Licensing	Session identifier generated: 0800-0002-0000-1YQP-0M4 G
October 19, 2021 10:45:44 AM	Audit	Entitlement	Licensing	Successfully unlocked session identified by 0800-0002-0000-1YQP-0M4 G with unlock code C2R6-QXES-GOQD-6681-68 3G
October 19, 2021 10:57:00 AM	Audit	EplLoaded	Session	EOP details for primary technique [GC] - File path: [ProtocolPacks\GC\Configurat ions\02_S100_02_51.eop], EOP File Name: [GC_02_51.eop], EOP Name: [AgilentRecommended]
October 19, 2021 10:58:11 AM	End	Configuration	Session	None
October 19, 2021 10:58:14 AM	Start	Qualification	Session	OQ
October 19, 2021 10:58:14 AM	Start	Execution	System Inspection and Basic Safety and Operation - 7890 - Qualitative Test - No septoin associated	None
October 19, 2021 10:59:07 AM	End	Execution	System Inspection and Basic Safety and Operation - 7890 - Qualitative Test - No septoin associated	Run Count : 1

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User Name: suriya.thongkaew  
Hostname: ASBKXW7529System ID: GC-5  
Print Date: October 20, 2021 10:16:00 AM

OQ GC ALS US10813027 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 19, 2021 11:11:55 AM	Start	Execution	Inlet Pressure Decay - Front SSL - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi	None
October 19, 2021 11:28:02 AM	End	Execution	Inlet Pressure Decay - Front SSL - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi	Run Count : 1
October 19, 2021 11:28:08 AM	Start	Execution	Inlet Pressure Accuracy - Front SSL - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	None
October 19, 2021 11:28:15 AM	End	Execution	Inlet Pressure Accuracy - Front SSL - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	Run Count : 1
October 19, 2021 11:28:17 AM	Start	Execution	Detector Flow Accuracy - Front FID - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% septoin	None
October 19, 2021 11:45:30 AM	Audit	Data	Detector Flow Accuracy - Front FID - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% septoin	Manual Data Entry
October 19, 2021 11:45:36 AM	End	Execution	Detector Flow Accuracy - Front FID - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% septoin	Run Count : 1
October 19, 2021 11:45:38 AM	Start	Execution	Detector Flow Accuracy - Front FID - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% septoin	None
October 19, 2021 11:52:52 AM	Audit	Data	Detector Flow Accuracy - Front FID - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% septoin	Manual Data Entry
October 19, 2021 11:52:54 AM	End	Execution	Detector Flow Accuracy - Front FID - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% septoin	Run Count : 1

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User Name: suriya.thongkaew  
Hostname: ASBKXW7529System ID: GC-5  
Print Date: October 20, 2021 10:16:00 AM

OQ GC ALS US10813027 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 19, 2021 11:52:55 AM	Start	Execution	Detector Flow Accuracy - Front FID - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% septoin	None
October 19, 2021 12:03:36 PM	Audit	Data	Detector Flow Accuracy - Front FID - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% septoin	Manual Data Entry
October 19, 2021 12:03:39 PM	End	Execution	Detector Flow Accuracy - Front FID - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% septoin	Run Count : 1
October 19, 2021 12:03:42 PM	Start	Execution	GC Oven Temperature Accuracy - 7890 - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % septoin in K	None
October 19, 2021 12:23:23 PM	Audit	Data	GC Oven Temperature Accuracy - 7890 - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % septoin in K	Manual Data Entry
October 19, 2021 12:23:24 PM	End	Execution	GC Oven Temperature Accuracy - 7890 - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % septoin in K	Run Count : 1
October 19, 2021 12:23:28 PM	Start	Execution	GC Oven Temperature Accuracy - 7890 - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % septoin in K	None
October 19, 2021 12:33:48 PM	Audit	Data	GC Oven Temperature Accuracy - 7890 - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % septoin in K	Manual Data Entry
October 19, 2021 12:33:50 PM	End	Execution	GC Oven Temperature Accuracy - 7890 - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % septoin in K	Run Count : 1

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User Name: suriya.thongkaew  
Hostname: ASBKXW7529System ID: GC-5  
Print Date: October 20, 2021 10:16:00 AM

OQ GC ALS US10813027 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 19, 2021 12:33:53 PM	Start	Execution	GC Oven Temperature Stability - 7890 - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	None
October 19, 2021 12:34:48 PM	Audit	Data	GC Oven Temperature Stability - 7890 - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Manual Data Entry
October 19, 2021 12:54:49 PM	End	Execution	GC Oven Temperature Stability - 7890 - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Run Count : 1
October 19, 2021 12:54:52 PM	Start	Execution	GC Scouting Run - Injection Tower, Front SSL, Front FID - Part of System Preparation - No limits associated	None
October 19, 2021 4:48:40 PM	Audit	AccClosed	Session	None
October 20, 2021 9:34:06 AM	Audit	AccRestarted	Session	None
October 20, 2021 9:34:08 AM	Audit	SessionReloader	Session	None
October 20, 2021 9:34:12 AM	Start	Qualification	Session	OQ
October 20, 2021 9:34:12 AM	Start	Execution	GC Scouting Run - Injection Tower, Front SSL, Front FID - Part of System Preparation - No limits associated	None
October 20, 2021 9:35:51 AM	Audit	Data	GC Scouting Run - Injection Tower, Front SSL, Front FID - Part of System Preparation - No limits associated	Data files Path : C:\Chem32\1\DATA\OQPV20 21\OQPV2021\2021-10-19 17-25-14\SCOUTING001.D\F ID1A.ch

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User Name: suriya.thongkaew  
Hostname: ASBKXW7029System ID: GC-5  
Print Date: October 20, 2021 10:16:00 AM

OQ GC ALS US10813027 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 20, 2021 9:36:24 AM	End	Execution	GC Scouting Run - Injection Tower, Front SSL, Front FID - Part of System Preparation - No limits associated	Run Count : 1
October 20, 2021 9:36:27 AM	Start	Execution	Noise and Drift - Front FID - Detector FID - L (Noise) <= 0.10 pA - L (Drift) <= 2.50 pA/hour	None
October 20, 2021 9:37:19 AM	Audit	Data	Noise and Drift - Front FID - Detector FID - L (Noise) <= 0.10 pA - L (Drift) <= 2.50 pA/hour	Data files Path : C:\Chem32\1\DATA\OQPV20 21\OQPV2021 2021-10-19 17-23-14\NUPREC001.D\FID1 1A.ch
October 20, 2021 9:37:30 AM	End	Execution	Noise and Drift - Front FID - Detector FID - L (Noise) <= 0.10 pA - L (Drift) <= 2.50 pA/hour	Run Count : 1
October 20, 2021 9:37:32 AM	Start	Execution	Injection Precision - Injection Tower, Front SSL, Front FID - GC - L (Area) <= 3.00% - L (Ret. Time) <= 1.00%	None
October 20, 2021 9:37:53 AM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID - GC - L (Area) <= 3.00% - L (Ret. Time) <= 1.00%	Data files Path : C:\Chem32\1\DATA\OQPV20 21\OQPV2021 2021-10-19 17-23-14\NUPREC002.D\FID 1A.ch
October 20, 2021 9:37:53 AM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID - GC - L (Area) <= 3.00% - L (Ret. Time) <= 1.00%	Data files Path : C:\Chem32\1\DATA\OQPV20 21\OQPV2021 2021-10-19 17-23-14\NUPREC003.D\FID 1A.ch

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User Name: suriya.thongkaew  
Hostname: ASBKXW7029System ID: GC-5  
Print Date: October 20, 2021 10:16:00 AM

OQ GC ALS US10813027 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 20, 2021 9:37:53 AM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID - GC - L (Area) <= 3.00% - L (Ret. Time) <= 1.00%	Data files Path : C:\Chem32\1\DATA\OQPV20 21\OQPV2021 2021-10-19 17-23-14\NUPREC004.D\FID 1A.ch
October 20, 2021 9:37:53 AM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID - GC - L (Area) <= 3.00% - L (Ret. Time) <= 1.00%	Data files Path : C:\Chem32\1\DATA\OQPV20 21\OQPV2021 2021-10-19 17-23-14\NUPREC005.D\FID 1A.ch
October 20, 2021 9:37:53 AM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID - GC - L (Area) <= 3.00% - L (Ret. Time) <= 1.00%	Data files Path : C:\Chem32\1\DATA\OQPV20 21\OQPV2021 2021-10-19 17-23-14\NUPREC006.D\FID 1A.ch
October 20, 2021 9:37:53 AM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID - GC - L (Area) <= 3.00% - L (Ret. Time) <= 1.00%	Data files Path : C:\Chem32\1\DATA\OQPV20 21\OQPV2021 2021-10-19 17-23-14\NUPREC007.D\FID 1A.ch
October 20, 2021 9:38:21 AM	End	Execution	Injection Precision - Injection Tower, Front SSL, Front FID - GC - L (Area) <= 3.00% - L (Ret. Time) <= 1.00%	Run Count : 1
October 20, 2021 9:38:28 AM	Start	Execution	Signal to Noise - Injection Tower, Front SSL, Front FID - Detector FID - L - >= 300000	None
October 20, 2021 9:38:42 AM	Audit	Data	Signal to Noise - Injection Tower, Front SSL, Front FID - Detector FID - L - >= 300000	Data files Path : C:\Chem32\1\DATA\OQPV20 21\OQPV2021 2021-10-19 17-23-14\NUPREC008.D\FID 1A.ch
October 20, 2021 9:38:50 AM	End	Execution	Signal to Noise - Injection Tower, Front SSL, Front FID - Detector FID - L - >= 300000	Run Count : 1

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User Name: suriya.thongkaew  
Hostname: ASBKXW7029System ID: GC-5  
Print Date: October 20, 2021 10:16:00 AM

OQ GC ALS US10813027 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 20, 2021 9:38:54 AM	End	Qualification	Session	OQ
October 20, 2021 9:38:54 AM	Start	Reporting	Session	None
October 20, 2021 10:15:14 AM	Audit	Reporting	Session	Report Generated : Certificate

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ภาคผนวก จ

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สำเนาหนังสืออนุญาตขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน





ที่ อก ๐๓๑๐(๑)/ ๑๐๖๕

กรมโรงงานอุตสาหกรรม  
ถนนพระรามที่ ๖ เขตราชเทวี  
กรุงเทพมหานคร ๑๐๔๐๐

๒๘ มกราคม ๒๕๖๕

เรื่อง ต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

เรียน กรรมการผู้จัดการ บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน  
ลงวันที่ ๓๐ กรกฎาคม ๒๕๖๓

- สิ่งที่ส่งมาด้วย ๑. รายชื่อผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๑ แผ่น  
๒. รายชื่อเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๕ แผ่น  
๓. ขอบข่ายสารมลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๓๑ แผ่น

ตามหนังสือที่อ้างถึง บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด ขอต่ออายุ  
หนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ว-๒๐๔ สถานที่ตั้งเลขที่ ๑๐๔  
ซอยพัฒนาการ ๔๐ ถนนพัฒนาการ แขวงพัฒนาการ เขตสวนหลวง กรุงเทพมหานคร  
ต่อกรมโรงงานอุตสาหกรรม นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว ให้บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย)  
จำกัด ต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน โดยมีองค์ประกอบดังนี้

- ก. ผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๖ ราย ตามสิ่งที่ส่งมาด้วย ๑  
ข. เจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๖๒ ราย ตามสิ่งที่ส่งมาด้วย ๒  
ค. ขอบข่ายสารมลพิษที่ได้รับขึ้นทะเบียนให้วิเคราะห์ในน้ำเสีย จำนวน ๕๙ รายการ น้ำได้ดิน  
จำนวน ๑๒๖ รายการ อากาศเสีย ๑๖ รายการ สิ่งปฏิภณหรือวัสดุที่ไม่ใช่แล้ว จำนวน ๓๕ รายการ และดิน  
จำนวน ๑๒๕ รายการ รวมทั้งสิ้นจำนวน ๓๖๑ รายการ ตามสิ่งที่ส่งมาด้วย ๓

หนังสือฉบับนี้จะหมดอายุในวันที่ ๒ กันยายน ๒๕๖๖ หากประสงค์จะต่ออายุหนังสือ  
รับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน ให้ยื่นคำขอต่ออายุพร้อมเอกสารประกอบคำขอ  
ต่อกรมโรงงานอุตสาหกรรม ภายใน ๓๐ วัน ก่อนวันสิ้นอายุของหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์  
เอกชน ซึ่งคำขอต่ออายุดังกล่าวขอรับได้ที่กรมโรงงานอุตสาหกรรม

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

ว.ว.ว.

(นายศิระ จันทร์เจ็ด)

นักวิทยาศาสตร์ชำนาญการพิเศษ รักษาการแทน  
ผู้อำนวยการกองวิจัยและเฝ้าระวังมลพิษโรงงาน  
ปฏิบัติราชการแทนอธิบดีกรมโรงงานอุตสาหกรรม

กองวิจัยและเฝ้าระวังมลพิษโรงงาน

กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ

โทร. ๐ ๒๒๐๒ ๔๑๔๖ ๐ ๒๒๐๒ ๔๐๐๒

โทรสาร ๐ ๒๓๔๔ ๓๒๐๘ ๐ ๒๓๔๔ ๓๔๑๕

เอกสารแนบท้ายหนังสือรับต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด

เลขทะเบียน ว-๒๐๔

ที่ อก ๐๓๑๐(๑)/

ลงวันที่ ๒๘ มกราคม ๒๕๖๕

ก. ผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๖ ราย

- ๑) นางสาวยุพาพร จันทร์เปล่ง  
๒) นางสาวชัชชัย โกมารกุล ณ นคร  
๓) นายศรายุทธ จิตรานนท์  
๔) นางสาวกนกกร เอนก  
๕) นายสุริยา สอนแก้ว  
๖) นายวิชาญ ชูณหิรัศ

ทะเบียนเลขที่ ว-๒๐๔-ค-๔๗๐๐

ทะเบียนเลขที่ ว-๒๐๔-ค-๔๗๐๑

ทะเบียนเลขที่ ว-๒๐๔-ค-๔๗๐๒

ทะเบียนเลขที่ ว-๒๐๔-ค-๔๗๐๓

ทะเบียนเลขที่ ว-๒๐๔-ค-๖๑๑๒

ทะเบียนเลขที่ ว-๒๐๔-ค-๖๑๑๓

ว.ว.ว.

(นายศิระ จันทร์เจ็ด)

นักวิทยาศาสตร์ชำนาญการพิเศษ รักษาการแทน

ผู้อำนวยการกองวิจัยและเฝ้าระวังมลพิษโรงงาน

ปฏิบัติราชการแทนอธิบดีกรมโรงงานอุตสาหกรรม

เอกสารแนบท้ายหนังสือรับต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

บริษัท เอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด

เลขทะเบียน ว-๒๐๔

ที่ ออก ๐๓๑๐(๑)/ ๑๐๖๙

ลงวันที่ ๒๘ มกราคม ๒๕๖๕

ข. เจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๖๒ ราย

- ๑) นางสาวจินดา โชกุลธรรม
- ๒) นางสาวสาวตรี น้อยเสงี่ยม
- ๓) นางสาวชนัญญาญจน์ อัมมขม
- ๔) นางสาวนรินทร์ สายเส็ง
- ๕) นางสาวนันทวี สมบูรณ์
- ๖) นางสาวศรีณยา เกลิมธำรงค์
- ๗) นางสาวสรารักษ์ มงคลจิรวุฒิ
- ๘) นางสาวศิริลักษณ์ พึ่งแพง
- ๙) นายนพพงศ์ จันทร์พันธุ์
- ๑๐) นายเศรษฐ์ โกมลย์
- ๑๑) นายธันวา จรียา
- ๑๒) นางสาวเกศรินทร์ แก้วมัน
- ๑๓) นางสาวสุวิมล ชัยเรืองวุฒิ
- ๑๔) นางสาวสุชาดา ธรรมถาวร
- ๑๕) นางสาวเนมิกา ชัยเดชธนกุล
- ๑๖) นางสาวศศิธร หมูสวัสดิ์
- ๑๗) นางสาวเสาวลักษณ์ ภูณาทำพร
- ๑๘) นายอภิสิทธิ์ สิงหา
- ๑๙) นายศักดิ์สิทธิ์ ไพศาลพิสุทธิ
- ๒๐) ว่าที่ร้อยตรีหญิง พรรณิภา ขำเจริญ
- ๒๑) นางจิตตา คำแก้ว
- ๒๒) นางสาวอรวรรณ รักยง
- ๒๓) นางสาวนพรัตน์ แยมกรานต์
- ๒๔) นายจุลเดช วารินทร์
- ๒๕) นางสาวตายุรัตน์ ร้องคำ
- ๒๖) นายนคร สุขเจริญ
- ๒๗) นายบัญชา นามเขตต์
- ๒๘) นายพรมณ์ ศรีปัตเนตร
- ๒๙) นายอุทิศ อุ่นลิ้ม
- ๓๐) ว่าที่ร้อยตรี เกลิมเกียรติ อมรศรีเสริม
- ๓๑) นางสาววริยา สร้างนา
- ๓๒) นายอนุพงศ์ รตินศรีประเสริฐ
- ๓๓) นางสาวจุฑารัตน์ โอนสันเทียะ
- ๓๔) นางสาวจารุวรรณ พิมพ์อภิลักขิตยา

- ทะเบียนเลขที่ ว-๒๐๔-จ-๔๗๐๘  
ทะเบียนเลขที่ ว-๒๐๔-จ-๔๗๐๙  
ทะเบียนเลขที่ ว-๒๐๔-จ-๔๗๑๐  
ทะเบียนเลขที่ ว-๒๐๔-จ-๔๗๑๕  
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ทะเบียนเลขที่ ว-๒๐๔-จ-๕๔๐๘  
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ทะเบียนเลขที่ ว-๒๐๔-จ-๖๒๕๒  
ทะเบียนเลขที่ ว-๒๐๔-จ-๗๗๐๖

(นายศิระ จันทร์เจิด)

๓๕) นางสาวปรังค์ทิพย์...

นักวิทยาศาสตร์ชำนาญการพิเศษ รักษาการแทน  
ผู้อำนวยการกองวิจัยและเตือนภัยมลพิษโรงงาน  
ปตท.ปิโตรเคมีและปิโตรเลียม

- ๒ -

- ๓๕) นางสาวปรังค์ทิพย์ กิจไพศาลศักดิ์
- ๓๖) นางสาวเดือนใจ ทางกลาง
- ๓๗) นางสาวจิราพร ศิริเวช
- ๓๘) นายวรารักษ์ ผูกกริช
- ๓๙) นายทง วีริยะสทกิจ
- ๔๐) นายณิต เจนจบ
- ๔๑) นายคณิศร ขำเพชร
- ๔๒) นายอรรคพล นิยมวิทยาพันธ์
- ๔๓) นายภูวิช พรหมสะอาด
- ๔๔) นายธนเดช โกคาพิพัฒน์
- ๔๕) นายขวฤทธิ์ วงษ์จันทร์
- ๔๖) นายอาทิตย์ ศรีเสน
- ๔๗) นายเจดตินทร์ คงศักดิ์ไทย
- ๔๘) นายจรัส บุญย้ง
- ๔๙) นายธนาภิตี เอนก
- ๕๐) นายอภิวัฒน์ ทุมหนู
- ๕๑) นางสาวสุภาขวัญ มาก
- ๕๒) นางสาวทัตพร ขวาลสมบูรณ์
- ๕๓) นางสาวอติมา บุญเพ็ง
- ๕๔) นางสาวกนกอร เข้มเพ็ชร
- ๕๕) นางสาวพัชรียา หงษ์สมดี
- ๕๖) นางสาวภาวนิดา สุรวงศ์ตระกูล
- ๕๗) นางสาวภาณุมาศ นามวัฒน์
- ๕๘) นางสาวอุไรรัตน์ ทังสร้างแป้น
- ๕๙) นายธีรวัฒน์ ปวงสุข
- ๖๐) นายอิทธิพล ยะโส
- ๖๑) นายประพจน์ วรรณชูชัย
- ๖๒) นายชยธร พวงทิพย์
- ๖๓) นางสาวกนกวรรณ จันทบาล
- ๖๔) นางสาวเกษร หลักบุญ
- ๖๕) นายสิทธิโชค ธงเงิน
- ๖๖) นางศิวารรณ ใจบุญ
- ๖๗) นางสาวพรรณธิดา ทุมคง
- ๖๘) นางสาวศรณีย์ ยิ่งดี
- ๖๙) นายฉวีกร ศรีวิริยะ
- ๗๐) นายสุวิชา ทองอ่อน
- ๗๑) นายวิญญู บุญตะนัย

- ทะเบียนเลขที่ ว-๒๐๔-จ-๗๗๐๙  
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ทะเบียนเลขที่ ว-๒๐๔-จ-๗๗๑๙

(นายศิระ จันทร์เจิด)

๗๒) นายสมบูรณ์...

นักวิทยาศาสตร์ชำนาญการพิเศษ รักษาการแทน  
ผู้อำนวยการกองวิจัยและเตือนภัยมลพิษโรงงาน  
ปตท.ปิโตรเคมีและปิโตรเลียม

๗๒) นายสมบุรณ์ บุตรจันทร์  
๗๓) นายวิรัตน์ ไชยชนะ  
๗๔) นายอนุเบศร์ เพิ่มพูน  
๗๕) นายจิรณัฐ ขวาละออ  
๗๖) นายสมโภช วันสา  
๗๗) นายอัสรี นามบุรี  
๗๘) นายณัฐนันท์ ปานประเสริฐ  
๗๙) นายอัครเศรฐ จอสาว  
๘๐) นายประเสริฐ สุระขันธ  
๘๑) นายภูกุล จันทรเนียม  
๘๒) นายพิรพงษ์ ทองคุณปรีดา  
๘๓) นายอนุพล ทองนุช  
๘๔) นายอนุวัฒน์ ม่วงแพ  
๘๕) นายเจตศรวาณ ปิตตะมะ  
๘๖) นายกฤษณะ สายวรรณ  
๘๗) นายพิชัย บุญยงค์  
๘๘) นายภาณุพงศ์ โอเมวงค์  
๘๙) นายสามารถ คุ่มปลี  
๙๐) นายสัณชัย โกศรนาม  
๙๑) นายณัฐวุฒิ ศรีประเสริฐ  
๙๒) นายชลธิช นาคพนม  
๙๓) นายพงศธร ชัยทิพย์  
๙๔) ว่าที่ร้อยตรี ภาณุพงศ์ แสนศรี  
๙๕) นายสิทธิโชค หาสิดา  
๙๖) นายธนากร อินสุตา  
๙๗) นางสาววรรณิษา ขาติวันชัย  
๙๘) นางสาวพิมพ์ตะวัน มินากุล  
๙๙) นางสาวเพชรรัตน์ สิงห์สมบูรณ์  
๑๐๐) นางสาวชญาณีน พรหมจันทร์  
๑๐๑) นายกิตติ ทวีราช  
๑๐๒) นายจักริน หมั่นวิชา  
๑๐๓) นายฉัตรชัย สุขเปี้ย  
๑๐๔) นายณรรณห์ ด๊ะทองคำ  
๑๐๕) นายศุภพล สนนอก  
๑๐๖) นายทักษ์ดนัย อุบลศรี  
๑๐๗) นายธนศร นามะกุลณา  
๑๐๘) นายธิตพงษ์ บัวแดง

ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๕๑๔  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๕๑๕  
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(นายศิระ จันทรเจ็ด)

นักวิทยาศาสตร์ชำนาญการพิเศษ วิชาการการแพทย์  
ผู้อำนวยการกองวิจัยและเตือนภัยมลพิษโรงงาน  
เปิดพิจารณาและลงนาม

๑๐๙) นายณนทชัย...

๑๐๙) นายณนทชัย อุบลัมภ์  
๑๑๐) นายณัฐพล คุณสุทธิ  
๑๑๑) นายณันท์วัฒน์ สาริน  
๑๑๒) นายปิยะนัฐ พลมะศรี  
๑๑๓) นายพงศ์สิริ โสมเขียว  
๑๑๔) นายพีรพัฒน์ กำคำ  
๑๑๕) นายภาณุพงศ์ มานิตย์  
๑๑๖) นายมงคล ผลาพิชัย  
๑๑๗) นายมนินทร พูลศิริ  
๑๑๘) นายสิรินันท์ ทองอิน  
๑๑๙) นายอนเนชา หันสมัย  
๑๒๐) นายอดิศักดิ์ ผมไผ  
๑๒๑) นายอนันตชัย วิสสม  
๑๒๒) นายณัฐดนัย เจือละออง  
๑๒๓) นายวรารุช ดีนิก  
๑๒๔) นายแสงตะวัน นตะสัด  
๑๒๕) นายยุทธพงศ์ รัตนะ  
๑๒๖) นายชัยณวุฒิ ไชยชนะ  
๑๒๗) นายวิศรุต ศรีธรรมมา  
๑๒๘) นายณนทกร เมื่อกผ่อง  
๑๒๙) นายกำชัย สุทธะ  
๑๓๐) นางสาวณัฐภรณ์ รักทะเล  
๑๓๑) นางสาวประภาภรณ์ บุตรพรม  
๑๓๒) นางสาวนิลาวัลย์ นามพรม  
๑๓๓) นางสาวพัชรินทร์ แสนสร้อย  
๑๓๔) นายไพโรจน์ เปี่ยมพิมาย  
๑๓๕) นางสาวศุภมาศ ทองมาก  
๑๓๖) นางสาวลลิตา จิตรสว่าง  
๑๓๗) นางสาวไมพร เลิกภูเขียว  
๑๓๘) นางสาวกฤติมาพร คำมีแก่น  
๑๓๙) นางสาวสกุลรัตน์ ภาณุภูมิ  
๑๔๐) นางสาวกาญจนา คงคุณ  
๑๔๑) นางสาวไพรินทร์ ศรีรูปี  
๑๔๒) นางสาวทิพนพร ฝอยปัญญา  
๑๔๓) นางสาวสาธิตา ปานทอง  
๑๔๔) นางสาวอริสา ทองนวล  
๑๔๕) นางสาวอริยา คำคล่อง

ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๕๔๔  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๕๔๕  
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ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๖๒๗  
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ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๖๓๐  
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ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๖๓๓  
ทะเบียนเลขที่ ๖-๒๐๔-จ-๗๖๓๔

(นายศิระ จันทรเจ็ด)

นักวิทยาศาสตร์ชำนาญการพิเศษ วิชาการการแพทย์  
ผู้อำนวยการกองวิจัยและเตือนภัยมลพิษโรงงาน  
เปิดพิจารณาและลงนาม

๑๔๖) นางสาวสุดาภรณ์...



๑๔๖) นางสาวชุตารณ สุนทรสนาน	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๓๕
๑๔๗) นางสาวสุดารัตน์ นนทประสาธ	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๓๖
๑๔๘) นางสาวรัชนิกร เนียมกลาง	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๓๗
๑๔๙) นางสาวกัญญารัตน์ ศรีนิลหา	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๓๘
๑๕๐) นางสาวอัญชลี คำจันทร์	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๓๙
๑๕๑) นายบุญฤทธิ์ เอี่ยมเทศ	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๔๐
๑๕๒) นายศิริวัฒน์ พานิชย์	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๔๑
๑๕๓) นางสาวศุภรดา ปันมยุรา	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๔๒
๑๕๔) นางสาวพาดิ คุณนนาน	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๔๓
๑๕๕) นางสาวจิราเจต พองดา	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๔๔
๑๕๖) นางสาวกนกภรณ์ อูระ	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๔๕
๑๕๗) นางสาวอารยา มีชัย	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๔๖
๑๕๘) นางสาวจิตสุภา ประเทืองสุข	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๔๗
๑๕๙) นางสาวอริสา วิริยขันติธรรม	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๔๘
๑๖๐) นางสาววิษุตา นาคผจญ	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๔๙
๑๖๑) นางสาวพนิดา ยอดอินทร์	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๕๐
๑๖๒) นางสาวนันทิยา จันทะสุน	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๕๑



(นายศิริระ จันทรเจต)

นักวิทยาศาสตร์ชำนาญการพิเศษ วิชาการการแพทย์  
ผู้อำนวยการกองวิจัยและเตือนภัยมลพิษโรงงาน  
ปฏิบัติราชการแทนอธิบดีกรมโรงงานอุตสาหกรรม

เอกสารแนบท้ายหนังสือรับต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

บริษัท เอแอลเอส แลบลอราทอรี กรุ๊ป (ประเทศไทย) จำกัด

เลขทะเบียน ว-๒๐๔

ที่ อก ๐๓๑๐(๑)/ ๑๐๖๕

ลงวันที่ ๒๘ มกราคม ๒๕๖๕

ขอขยายสารมลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๓๖๑ รายการ

น้ำเสีย จำนวน 59 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Aldicarb	High-Performance Liquid Chromatographic Method <sup>[4]</sup>
2	Aldicarb Sulfone	High-Performance Liquid Chromatographic Method <sup>[4]</sup>
3	Aldicarb Sulfoxide	High-Performance Liquid Chromatographic Method <sup>[4]</sup>
4	Aldrin	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>
5	Arsenic	1) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[4]</sup>
6	Barium	1) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[4]</sup>
7	α-BHC	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>
8	β-BHC	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>
9	δ-BHC	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>
10	γ-BHC	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>
11	Biochemical Oxygen Demand	1) 5-Day BOD Test, Azide Modification Method <sup>[4]</sup> 2) 5-Day BOD Test, Membrane Electrode Method <sup>[4]</sup>
12	Carbaryl	High-Performance Liquid Chromatographic Method <sup>[4]</sup>
13	Carbofuran	High-Performance Liquid Chromatographic Method <sup>[4]</sup>
14	Cadmium	1) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[4]</sup>
15	Chemical Oxygen Demand	1) Closed Reflux, Colorimetric Method <sup>[4]</sup> 2) Closed Reflux, Titrimetric Method <sup>[4]</sup>
16	Chlordane	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>
17	Chromium	1) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup> 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[4]</sup>
18	Color	ADMI Weighted-Ordinate Spectrophotometric Method




(นางริภาณูจน์ ฉัตรสกุลวิไล)

19 Copper...

ผู้อำนวยการกลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษ  
และทะเบียนห้องปฏิบัติการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
19	Copper	1) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[4]</sup>
20	Cyanide	Distillation, Colorimetric Method <sup>[4]</sup>
21	2,4'-DDD	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>
22	4,4'-DDD	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>
23	2,4'-DDE	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>
24	4,4'-DDE	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>
25	2,4'-DDT	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>
26	4,4'-DDT	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>
27	Dieldrin	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>
28	Endosulfan Sulfate	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>
29	Endosulfan I	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>
30	Endosulfan II	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>
31	Endrin	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>
32	Endrin Aldehyde	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>
33	Formaldehyde	Distillation, Colorimetric Method <sup>[3]</sup>
34	Free Chlorine	1) DPD Ferrous Titrimetric Method <sup>[4]</sup> 2) Iodometric Method <sup>[4]</sup>
35	Heptachlor	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>
36	Heptachlor epoxide	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>
37	Hexavalent Chromium	Filtration, Colorimetric Method <sup>[4]</sup>
38	3-Hydroxycarbofuran	High-Performance Liquid Chromatographic Method <sup>[4]</sup>
39	Lead	1) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[4]</sup>
40	Manganese	1) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[4]</sup>
41	Mercury	1) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>[4]</sup> 2) Digestion, Inductively Coupled Plasma/Mass spectrometric Method <sup>[4]</sup>
42	Methiocarb	High-Performance Liquid Chromatographic Method <sup>[4]</sup>
43	Methoxychlor	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>


  
 (นางริกาญจน์ จิตกรกุลวิไล)  
 ผู้อำนวยการกลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษ  
 ...

44 Methomyl...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
44	Methomyl	High-Performance Liquid Chromatographic Method <sup>[4]</sup>
45	Nickel	1) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[4]</sup>
46	Oil & Grease	1) Liquid-Liquid, Partition-Gravimetric Method <sup>[4]</sup> 2) Soxhlet Extraction Method <sup>[4]</sup>
47	Oxamyl	High-Performance Liquid Chromatographic Method <sup>[4]</sup>
48	Propoxur	High-Performance Liquid Chromatographic Method <sup>[4]</sup>
49	pH	Electrometric Method <sup>[4]</sup>
50	Phenols	1) Distillation, Chloroform Extraction Method <sup>[4]</sup> 2) Distillation, Direct Photometric Method <sup>[4]</sup>
51	Selenium	1) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[4]</sup>
52	Sulfide	Iodometric Method <sup>[4]</sup>
53	Temperature	Laboratory and Field Methods <sup>[4]</sup>
54	Total Dissolved Solids	Dried at 180 °C <sup>[4]</sup>
55	Total Kjeldahl Nitrogen	Semi-Micro Kjeldahl Method <sup>[4]</sup>
56	Total Suspended Solids	Dried at 103-105 °C <sup>[4]</sup>
57	Toxaphene	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>
58	Trivalent Chromium	1) Digestion, Inductively Coupled Plasma Method; Colorimetric Method; Calculation <sup>[4]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method; Colorimetric Method; Calculation <sup>[4]</sup>
59	Zinc	1) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup> 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[4]</sup>

น้ำได้ดิน จำนวน 126 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Acenaphthene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
2	Acetone	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>

  
 (นางริกาญจน์ จิตกรกุลวิไล)  
 ผู้อำนวยการกลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษ  
 และทะเบียนห้องปฏิบัติการ

3 Aldrin...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
3	Aldrin	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
4	Anthracene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
5	Antimony	1) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[4]</sup>
6	Arsenic	1) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[4]</sup>
7	Atrazine	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
8	Barium	1) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[4]</sup>
9	Benz(a)anthracene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
10	Benzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
11	Benzo(b)fluoranthene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
12	Benzo(k)fluoranthene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
13	Benzoic Acid	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
14	Benzo(a)pyrene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
15	Benzo(g,h,i)perylene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
16	Beryllium	1) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[4]</sup>
17	Bis(2-chloroethyl)ether	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>

วิมล

18 Bis(2-ethylhexyl)phthalate...

(นางริกาญจน์ ฉัตรสกุลวิไล)

ผู้อำนวยการกลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษ  
กรมควบคุมมลพิษ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
18	Bis(2-ethylhexyl)phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
19	Bromodichloromethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
20	Bromoform	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
21	Butanol	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup> Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
22	Butyl Benzyl Phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
23	Cadmium	1) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[4]</sup>
24	Carbazole	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
25	Carbon Disulfide	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
26	Carbon tetrachloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
27	Chlordane	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
28	p-Chloroaniline	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
29	Chlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
30	Chlorodibromomethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
31	Chloroform	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
32	2-Chlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
33	Chromium	1) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[4]</sup>

วิมล

34 Chromium (III)...

(นางริกาญจน์ ฉัตรสกุลวิไล)

ผู้อำนวยการกลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษ  
กรมควบคุมมลพิษ



ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
34	Chromium (III)	1) Digestion, Inductively Coupled Plasma Method; Colorimetric Method; Calculation <sup>[4]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method; Colorimetric Method; Calculation <sup>[4]</sup>
35	Chromium (VI)	Colorimetric Method <sup>[4]</sup>
36	Chrysene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
37	Cyanide	Distillation, Colorimetric Method <sup>[4]</sup>
38	2,4-D	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
39	DDD	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
40	DDE	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
41	DDT	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
42	Dibenz(a,h)anthracene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
43	Di-n-Butyl Phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
44	1,2-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
45	1,3-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
46	1,4-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
47	3,3-Dichlorobenzidine	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
48	1,1-Dichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
49	1,2-Dichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
50	1,1-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>

วิธีวิเคราะห์

51 cis-1,2-Dichloroethylene...

(นางริกาญจน์ ฉัตรสกุลวิไล)

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และประเมินผลกระทบต่อสุขภาพ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
51	cis-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
52	trans-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
53	2,4-Dichlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
54	1,2-Dichloropropane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
55	1,3-Dichloropropane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
56	1,3-Dichloropropene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
57	Dieldrin	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
58	Diethyl Phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
59	2,4-Dimethylphenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
60	2,4-Dinitrophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
61	2,4-Dinitrotoluene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
62	2,6-Dinitrotoluene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
63	Di-n-Octyl Phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
64	Endosulfan	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
65	Endrin	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
66	Ethylbenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
67	Fluoranthene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>

วิธีวิเคราะห์

68 Fluorene...

(นางริกาญจน์ ฉัตรสกุลวิไล)

ผู้อำนวยการกลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษ  
และประเมินผลกระทบต่อสุขภาพ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
68	Fluorene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
69	Heptachlor	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
70	Heptachlor epoxide	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
71	Hexachlorobenzene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
72	Hexachloro-1,3-butadiene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
73	n-Hexane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
74	$\alpha$ -HCH	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
75	$\beta$ -HCH	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
76	$\gamma$ -HCH	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
77	Hexachlorocyclopentadiene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
78	Hexachloroethane	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
79	Indeno(1,2,3-cd)pyrene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
80	Isophorone	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
81	Lead	1) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[4]</sup>
82	Manganese	1) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[4]</sup>
83	Mercury	1) Cold Vapor Atomic Absorption Spectrometric Method <sup>[4]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[4]</sup>

วิธีวิเคราะห์

84 Methanol...

(นางริกาญจน์ อัครสกุลวิไล)

ผู้อำนวยการกลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษ

กระทรวงทรัพยากรธรรมชาติและสิ่งแวดล้อม

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
84	Methanol	1) Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
85	Methoxychlor	2) Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
86	Methyl Bromide	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
87	Methylene Chloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
88	2-Methylphenol	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
89	2-Methylnaphthalene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
90	Methyl tert-Butyl Ether	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
91	Naphthalene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
92	Nickel	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
93	Nitrobenzene	1) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[4]</sup>
94	N-Nitrosodiphenylamine	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
95	N-Nitrosodi-n-Propylamine	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
96	Polychlorinated Biphenyls - PCB 1016 - PCB 1221 - PCB 1232 - PCB 1242 - PCB 1248 - PCB 1254 - PCB 1260	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>

วิธีวิเคราะห์

97 Pentachlorophenol...

(นางริกาญจน์ อัครสกุลวิไล)

ผู้อำนวยการกลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษ

กระทรวงทรัพยากรธรรมชาติและสิ่งแวดล้อม

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
97	Pentachlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
98	pH	Electrometric Method <sup>[4]</sup>
99	Phenanthrene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
100	Phenol	1) Distillation, Direct Photometric Method <sup>[4]</sup> 2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
101	Pyrene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
102	Selenium	1) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[4]</sup>
103	Silver	1) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[4]</sup>
104	Styrene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
105	1,1,2,2-Tetrachloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
106	Tetrachloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
107	Toluene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
108	Toxaphene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
109	TPH (C <sub>5</sub> -C <sub>8</sub> )	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[13,24]</sup>
110	TPH (C <sub>8</sub> -C <sub>16</sub> )	Solvent Extraction, Gas Chromatographic Method <sup>[9,21]</sup>
111	TPH (C <sub>16</sub> -C <sub>35</sub> )	Solvent Extraction, Gas Chromatographic Method <sup>[9,21]</sup>
112	1,2,4-Trichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
113	1,1,1-Trichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>

วิทย์พงษ์

114 1,1,2-Trichloroethane...

(นางริกาญจน์ ฉัตรสกุลวิไล)  
ผู้อำนวยการกลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษ  
และทะเบียนห้องปฏิบัติการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
114	1,1,2-Trichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
115	Trichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
116	2,4,5-Trichlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
117	2,4,6-Trichlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
118	1,3,5-Trimethylbenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
119	Vanadium	1) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[4]</sup>
120	Vinyl Acetate	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
121	Vinyl Chloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
122	m-Xylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
123	o-Xylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
124	p-Xylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
125	Xylene (Total)	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
126	Zinc	1) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[4]</sup>

อากาศเสีย (ปล่อยระบาย) จำนวน 16 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Antimony	Isokinetic, Digestion, Inductively Coupled Plasma Method <sup>[5]</sup>
2	Arsenic	Isokinetic, Digestion, Inductively Coupled Plasma Method <sup>[5]</sup>


วิทย์พงษ์

3 Carbon Monoxide...

(นางริกาญจน์ ฉัตรสกุลวิไล)  
ผู้อำนวยการกลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษ  
และทะเบียนห้องปฏิบัติการ




ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
3	Carbon Monoxide	1) Sampling Bag Non-Dispersive Infrared Method <sup>[5]</sup> 2) Non-Dispersive Infrared Method <sup>[5]</sup> 3) Instrumental Analyzer Method <sup>[5]</sup>
4	Chlorine	1) Absorption Sampling, Ion Chromatographic Method <sup>[5]</sup> 2) Isokinetic Sampling, Ion Chromatographic Method <sup>[5]</sup>
5	Copper	Isokinetic, Digestion, Inductively Coupled Plasma Method <sup>[5]</sup>
6	Dioxins	Isokinetic Sampling, Analysis by ISO/IEC 17025 Accredited Laboratory or Analysis by Department of Industrial Works Registered Laboratory (Dioxins/Furans Analysis Approved) <sup>[5]</sup>
7	Hydrogen Chloride	1) Absorption Sampling, Ion Chromatographic Method <sup>[5]</sup> 2) Isokinetic Sampling, Ion Chromatographic Method <sup>[5]</sup>
8	Hydrogen Sulfide	Absorption Sampling, Iodometric Method <sup>[5]</sup>
9	Lead	Isokinetic, Digestion, Inductively Coupled Plasma Method <sup>[5]</sup>
10	Mercury	1) Isokinetic Sampling, Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>[5]</sup> 2) Isokinetic, Digestion, Inductively Coupled Plasma Method <sup>[5]</sup>
11	Opacity	Ringelmann's Method <sup>[2]</sup>
12	Oxides of Nitrogen	1) Absorption Sampling, Phenoldisulfonic Acid Method <sup>[5]</sup> 2) Chemiluminescence Method <sup>[5]</sup> 3) Instrumental Analyzer Method <sup>[5]</sup>
13	Sulfur Dioxide	1) Absorption Sampling, Barium-Thorin Titrimetric Method <sup>[5]</sup> 2) UV Fluorescence Method <sup>[5]</sup> 3) Instrumental Analyzer Method <sup>[5]</sup>
14	Sulfuric Acid	Isokinetic Sampling, Barium-Thorin Titrimetric Method <sup>[5]</sup>
15	Total Suspended Particulate	Isokinetic Sampling, Gravimetric Method <sup>[5]</sup>
16	Xylene	Adsorption Sampling, Gas Chromatographic Method <sup>[5]</sup>

  
 (นางริกาญจน์ ฉัตรสกุลวิไล)  
 ผู้อำนวยการกลุ่มมาตรฐานวิธีการวิเคราะห์หัตถ์ทดสอบพิษ  
 กรมควบคุมมลพิษ

สิ่งปฏิกูล...

สิ่งปฏิกูลหรือวัสดุที่ไม่ใช้แล้ว จำนวน 35 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Aldrin	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[1,9,25]</sup> 2) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,22]</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>[22,31]</sup>
2	Antimony	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,6,15]</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[1,6,16]</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>[7,15]</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[7,16]</sup>
3	Arsenic	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,6,15]</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[1,6,16]</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>[7,15]</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[7,16]</sup>
4	Barium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,6,15]</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[1,6,16]</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>[7,15]</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[7,16]</sup>
5	Beryllium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,6,15]</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[1,6,16]</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>[7,15]</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[7,16]</sup>

  
 (นางริกาญจน์ ฉัตรสกุลวิไล)  
 ผู้อำนวยการกลุ่มมาตรฐานวิธีการวิเคราะห์หัตถ์ทดสอบมลพิษ  
 และทะเบียนห้องปฏิบัติการ

6 Cadmium...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
6	Cadmium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,6,15]</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[1,6,16]</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>[7,15]</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[7,16]</sup>
7	Chlordane	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[1,19,25]</sup> 2) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,22]</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>[22,31]</sup>
8	Chromium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,6,15]</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[1,6,16]</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>[7,15]</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[7,16]</sup>
9	Chromium (III)	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method; Waste Extraction, Colorimetric Method; Calculation Method <sup>[1,6,15,17]</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method; Waste Extraction, Colorimetric Method; Calculation Method <sup>[1,6,16,17]</sup> 3) Digestion, Inductively Coupled Plasma Method; Alkaline Digestion, Colorimetric Method; Calculation Method <sup>[7,8,15,17]</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method; Alkaline Digestion, Colorimetric Method; Calculation Method <sup>[7,8, 16,17]</sup>
10	Chromium (VI)	1) Waste Extraction, Colorimetric Method <sup>[1,6,17]</sup> 2) Alkaline Digestion, Colorimetric Method <sup>[8,17]</sup>

วิมล

(นางริกาญจน์ ฉัตรสกุลวิไล)

ผู้อำนวยการกลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษ  
กรมควบคุมมลพิษ

11 Cobalt...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
11	Cobalt	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,6,15]</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[1,6,16]</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>[7,15]</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[7,16]</sup>
12	Copper	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,6,15]</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[1,6,16]</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>[7,15]</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[7,16]</sup>
13	2,4-D	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[1,9,25]</sup> 2) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,22]</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>[22,31]</sup>
14	DDD	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[1,9,25]</sup> 2) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,22]</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>[22,31]</sup>
15	DDE	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[1,9,25]</sup> 2) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,22]</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>[22,31]</sup>
16	DDT	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[1,9,25]</sup>

วิมล

(นางริกาญจน์ ฉัตรสกุลวิไล)

ผู้อำนวยการกลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษ  
กรมควบคุมมลพิษ

2) Soxhlet...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
17	Dieldrin	2) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,22]</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>[22,31]</sup> 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[1,9,25]</sup>
18	Endrin	2) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,22]</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>[22,31]</sup> 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[1,9,25]</sup>
19	Heptachlor	2) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,22]</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>[22,31]</sup> 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[1,9,25]</sup>
20	Lead	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,6,15]</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[1,6,16]</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>[7,15]</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[7,16]</sup>
21	Lindane	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[1,9,25]</sup> 2) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,22]</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>[22,31]</sup>
22	Mercury	1) Waste Extraction, Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>[1,6,18]</sup>

วิธีวิเคราะห์

2) Waste Extraction...

(นางริกาญจน์ ฉัตรสกุลวิไล)

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ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
23	Methoxychlor	2) Waste Extraction, Thermal Decomposition Amalgamation and Atomic Absorption Spectrometric Method <sup>[1,6,19]</sup> 3) Waste Extraction, Digestion, Cold-Vapor Atomic Fluorescence Spectrometric Method <sup>[1,6,20]</sup> 4) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>[18]</sup> 5) Thermal Decomposition Amalgamation and Atomic Absorption Spectrometric Method <sup>[19]</sup> 6) Digestion, Cold-Vapor Atomic Fluorescence Spectrometric Method <sup>[20]</sup>
24	Mirex	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[1,9,25]</sup> 2) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,22]</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>[22,31]</sup>
25	Molybdenum	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,6,15]</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[1,6,16]</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>[7,15]</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[7,16]</sup>
26	Nickel	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,6,15]</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[1,6,16]</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>[7,15]</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[7,16]</sup>

วิธีวิเคราะห์


27 Polychlorinated...

(นางริกาญจน์ ฉัตรสกุลวิไล)

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


ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
27	Polychlorinated biphenyls (PCBs) - Aroclor 1016 - Aroclor 1221 - Aroclor 1232 - Aroclor 1242 - Aroclor 1248 - Aroclor 1254 - Aroclor 1260 - 2-Chlorobiphenyl - 2,3-Dichlorobiphenyl - 2,2',5'-Trichlorobiphenyl - 2,4',5'-Trichlorobiphenyl - 2,2',3,5'-Tetrachlorobiphenyl - 2,2',5,5'-Tetrachlorobiphenyl - 2,3',4,4'-Tetrachlorobiphenyl - 2,2',3,4,5'-Pentachlorobiphenyl - 2,2',4,5,5'-Pentachlorobiphenyl - 2,3,3',4,6-Pentachlorobiphenyl - 2,2',3,4,4',5'-Hexachlorobiphenyl - 2,2',3,4,5,5'-Hexachlorobiphenyl - 2,2',3,5,5',6-Hexachlorobiphenyl - 2,2',4,4',5,5'-Hexachlorobiphenyl - 2,2',3,3',4,4',5-Heptachlorobiphenyl - 2,2',3,4,4',5,5'-Heptachlorobiphenyl - 2,2',3,4,4',5,6-Heptachlorobiphenyl - 2,2',3,4',5,5',6-Heptachlorobiphenyl - 2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[1,9,23]</sup> 2) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,23]</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>[22,31]</sup>

  
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28 Pentachlorophenol...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
28	Pentachlorophenol	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[1,9,25]</sup> 2) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,22]</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>[22,31]</sup>
29	pH	Electrometric Method <sup>[29,30]</sup>
30	Selenium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,6,15]</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[1,6,16]</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>[7,15]</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[7,16]</sup>
31	Silver	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,6,15]</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[1,6,16]</sup>
32	Thallium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,6,15]</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[1,6,16]</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>[7,15]</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[7,16]</sup>
33	Toxaphene	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[1,9,25]</sup> 2) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,22]</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>[22,31]</sup>
34	Vanadium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,6,15]</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[1,6,16]</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>[7,15]</sup>

  
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4) Digestion...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
35	Zinc	4) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[7,16]</sup> 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,6,15]</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[1,6,16]</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>[7,15]</sup> 4) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[7,16]</sup>

ดิน จำนวน 125 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Acenaphthene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
2	Acetone	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>
3	Aldrin	1) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,22]</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
4	Anthracene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
5	Antimony	1) Digestion, Inductively Coupled Plasma Method <sup>[7,15]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[7,16]</sup>
6	Arsenic	1) Digestion, Inductively Coupled Plasma Method <sup>[7,15]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[7,16]</sup>
7	Atrazine	1) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,22]</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
8	Barium	1) Digestion, Inductively Coupled Plasma Method <sup>[7,15]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[7,16]</sup>

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9 Benz(a)anthracene...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
9	Benz(a)anthracene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
10	Benzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>
11	Benzo(b)fluoranthene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
12	Benzo(k)fluoranthene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
13	Benzoic acid	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
14	Benzo(a)pyrene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
15	Benzo(g,h,i)perylene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
16	Beryllium	1) Digestion, Inductively Coupled Plasma Method <sup>[7,15]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[7,16]</sup>
17	Bis(2-chloroethyl)ether	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
18	Bis(2-ethylhexyl)phthalate	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
19	Bromodichloromethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>
20	Bromoform	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>
21	Butanol	Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method <sup>[12,24]</sup>
22	Butyl Benzyl Phthalate	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
23	Cadmium	1) Digestion, Inductively Coupled Plasma Method <sup>[7,15]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[7,16]</sup>
24	Carbazole	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
25	Carbon Disulfide	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>

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26 Carbon tetrachloride...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
26	Carbon tetrachloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>
27	Chlordane	1) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,22]</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
28	p-Chloroaniline	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
29	Chlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>
30	Chlorodibromomethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>
31	Chloroform	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>
32	2-Chlorophenol	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
33	Chromium	1) Digestion, Inductively Coupled Plasma Method <sup>[7,15]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[7,16]</sup>
34	Chromium (III)	1) Digestion, Inductively Coupled Plasma Method; Alkaline Digestion, Colorimetric Method; Calculation Method <sup>[7,8,15,17]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method; Alkaline Digestion, Colorimetric Method; Calculation Method <sup>[7,8,16,17]</sup>
35	Chromium (VI)	Alkaline Digestion, Colorimetric Method <sup>[8,17]</sup>
36	Chrysene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
37	Cyanide	Extraction, Distillation, Colorimetric Method <sup>[26,27,28]</sup>
38	2,4-D	1) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,22]</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
39	DDD	1) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,22]</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>

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40 DDE...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
40	DDE	1) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,22]</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
41	DDT	1) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,22]</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
42	Dibenz(a,h)anthracene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
43	Di-n-Butyl Phthalate	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
44	1,2-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>
45	1,3-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>
46	1,4-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>
47	3,3-Dichlorobenzidine	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
48	1,1-Dichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>
49	1,2-Dichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>
50	1,1-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>
51	cis-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>
52	trans-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>
53	2,4-Dichlorophenol	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
54	1,2-Dichloropropane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>
55	1,3-Dichloropropane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>
56	1,3-Dichloropropene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>

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57 Dieldrin...



ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
57	Dieldrin	1) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,22]</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[25,31]</sup>
58	Diethyl Phthalate	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[25,31]</sup>
59	2,4-Dimethylphenol	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[25,31]</sup>
60	2,4-Dinitrophenol	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[25,31]</sup>
61	2,4-Dinitrotoluene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[25,31]</sup>
62	2,6-Dinitrotoluene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[25,31]</sup>
63	Di-n-Octyl Phthalate	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[25,31]</sup>
64	Endosulfan	1) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,22]</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[25,31]</sup>
65	Endrin	1) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,22]</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[25,31]</sup>
66	Ethylbenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[14,24]</sup>
67	Fluoranthene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[25,31]</sup>
68	Fluorene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[25,31]</sup>
69	Heptachlor	1) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,22]</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[25,31]</sup>
70	Heptachlor Epoxide	1) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,22]</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[25,31]</sup>

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ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
71	Hexachlorobenzene	1) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,22]</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[25,31]</sup>
72	Hexachloro-1,3-butadiene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[14,24]</sup>
73	n-Hexane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[14,24]</sup>
74	$\alpha$ -HCH	1) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,22]</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[25,31]</sup>
75	$\beta$ -HCH	1) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,22]</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[25,31]</sup>
76	$\gamma$ -HCH	1) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,22]</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[25,31]</sup>
77	Hexachlorocyclopentadiene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[25,31]</sup>
78	Hexachloroethane	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[25,31]</sup>
79	Indeno(1,2,3-cd)pyrene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[25,31]</sup>
80	Isophorone	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[25,31]</sup>
81	Lead	1) Digestion, Inductively Coupled Plasma Method <sup>[7,15]</sup> 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[7,16]</sup>
82	Manganese	1) Digestion, Inductively Coupled Plasma Method <sup>[7,15]</sup> 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[7,16]</sup>
83	Mercury	1) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>[18]</sup>

(นางริกาญจน์ อัครสกุลวิไล)  
ผู้อำนวยการศูนย์มาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษ  
และระบบห้องปฏิบัติการ

2) Thermal...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
84	Methanol	2) Thermal Decomposition, Amalgamation, and Atomic Absorption Spectrophotometry <sup>[19]</sup> 3) Digestion, Cold-Vapor Atomic Fluorescence Spectrometric Method <sup>[20]</sup> Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method <sup>[12,24]</sup>
85	Methoxychlor	1) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,22]</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
86	Methyl Bromide	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>
87	Methylene Chloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>
88	2-methylphenol	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
89	2-Methylnaphthalene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
90	Methyl tert-Butyl Ether	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>
91	Naphthalene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
92	Nickel	1) Digestion, Inductively Coupled Plasma Method <sup>[7,15]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[7,16]</sup>
93	Nitrobenzene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
94	N-Nitrosodiphenylamine	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
95	N-Nitrosodi-n-propylamine	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
96	Polychlorinated biphenyls (PCBs) - Aroclor 1016 - Aroclor 1221 - Aroclor 1232	1) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,23]</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>[23,32]</sup>

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
	- Aroclor 1242 - Aroclor 1248 - Aroclor 1254 - Aroclor 1260 - 2-Chlorobiphenyl - 2,2',3,5'-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',3,4,5,5'-Hexachlorobiphenyl - 2,2',3,5,5',6-Hexachlorobiphenyl - 2,2',4,4',5,5'-Hexachlorobiphenyl - 2,2',3,3',4,4',5-Heptachlorobiphenyl - 2,2',3,4,4',5,5'-Heptachlorobiphenyl - 2,2',3,4,4',5,6-Heptachlorobiphenyl - 2,2',3,4',5,5',6-Heptachlorobiphenyl - 2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl	
97	Pentachlorophenol	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
98	Phenanthrene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
99	Phenol	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
100	Pyrene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
101	Selenium	1) Digestion, Inductively Coupled Plasma Method <sup>[7,15]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[7,16]</sup>
102	Silver	1) Digestion, Inductively Coupled Plasma Method <sup>[7,15]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[7,16]</sup>
103	Styrene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>
104	1,1,2,2-Tetrachloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>
105	Tetrachloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>
106	Toluene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>
107	Toxaphene	1) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,22]</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
108	TPH (C <sub>5</sub> -C <sub>8</sub> )	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>
109	TPH (C <sub>8</sub> -C <sub>16</sub> )	1) Solvent Extraction, Gas Chromatographic Method <sup>[11,21]</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>[21,31]</sup>
110	TPH (C <sub>16</sub> -C <sub>35</sub> )	1) Solvent Extraction, Gas Chromatographic Method <sup>[11,21]</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>[21,31]</sup>
111	1,2,4-Trichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>
112	1,1,1-Trichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>
113	1,1,2-Trichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>
114	Trichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>
115	2,4,5-Trichlorophenol	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>

วิมล

116 2,4,6-Trichlorophenol...

(นางริกาญจน์ ฉัตรสกุลวิไล)

ผู้อำนวยการกลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
116	2,4,6-Trichlorophenol	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
117	1,3,5-Trimethylbenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>
118	Vanadium	1) Digestion, Inductively Coupled Plasma Method <sup>[7,15]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[7,16]</sup>
119	Vinyl Acetate	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>
120	Vinyl Chloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>
121	m-Xylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>
122	o-Xylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>
123	p-Xylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>
124	Xylene (Total)	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>
125	Zinc	1) Digestion, Inductively Coupled Plasma Method <sup>[7,15]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[7,16]</sup>

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(นางริกาญจน์ ฉัตรสกุลวิไล)

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ผู้อำนวยการกลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษ  
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(นางริกาญจน์ ฉัตรสกุลวิไล)  
ผู้อำนวยการกลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษ  
และทะเบียนห้องปฏิบัติการ



ที่ อก ๐๓๑๐(๓)/ ๖๔๗๐

กรมโรงงานอุตสาหกรรม  
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท  
เขตราชเทวี กรุงเทพฯ ๑๐๔๐๐

๒๘ มิถุนายน ๒๕๖๔

เรื่อง ขันทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

เรียน กรรมการผู้จัดการ บริษัท เอแอลเอส แลบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน  
ลงวันที่ ๒๙ เมษายน ๒๕๖๔

สิ่งที่ส่งมาด้วย เอกสารแนบท้ายหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน  
บริษัท เอแอลเอส แลบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด จำนวน ๒ แผ่น

ตามหนังสือที่อ้างถึง บริษัท เอแอลเอส แลบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด ขอขึ้นทะเบียน  
ห้องปฏิบัติการวิเคราะห์เอกชน พร้อมรายชื่อผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ เจ้าหน้าที่ประจำ  
ห้องปฏิบัติการวิเคราะห์ และรายการสารมลพิษที่จะทำการวิเคราะห์ ต่อกรมโรงงานอุตสาหกรรม นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว ให้บริษัท เอแอลเอส แลบอราทอรี กรุ๊ป  
(ประเทศไทย) จำกัด ขันทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน มีเลขทะเบียน ว-๓๒๓ สถานที่ตั้งเลขที่  
๖๑๖/๑๐ หมู่ที่ ๕ ตำบลแม่น้ำคู อำเภอบลวกแดง จังหวัดระยอง โดยมีองค์ประกอบดังนี้

ก. ผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์

๑) นายเดช ช่างชน	ทะเบียนเลขที่	ว-๓๒๓-ค-๙๔๔๒
๒) นางวิลาวัลย์ บริรักษ์	ทะเบียนเลขที่	ว-๓๒๓-ค-๙๔๔๓
๓) นายสุพจน์ สลามเต๊ะ	ทะเบียนเลขที่	ว-๓๒๓-ค-๙๔๔๔

ข. เจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์

๑) นางสาวนฤมล บรรจงกิจ	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๔๕
๒) นางพจนา สีดา	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๔๖
๓) นางสาวธนิดา กุลสุริวงศ์	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๔๗
๔) นายพิทยา ทองแดง	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๔๘
๕) นางชลธิชา สิบงกช	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๔๙
๖) ว่าที่ ร.ต.รมชัย ม่วงมา	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๕๐
๗) นายวราวุฒิ พับพา	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๕๑
๘) นายศักดิ์นรินทร์ จรัสกาย	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๕๒
๙) นายสุรศักดิ์ สาชิน	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๕๓
๑๐) นางสาวเพชรคุณ ภวภูตานนท์	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๕๔
๑๑) นายสถาพร ถาแก้ว	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๕๕
๑๒) นายสุทธิดำรงค์ โชคปิตินันท์	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๕๖

๑๓) นายวัลลภ...

-๒-

๑๓) นายวัลลภ หันไชยเนาว์	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๕๗
๑๔) นางสาววนาลี เจริญตระกูล	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๕๘
๑๕) นางสาววนิดา ผดุงจิตต์	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๕๙
๑๖) นายธนสิทธิ์ วงศ์ไชย	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๖๐
๑๗) นายชัยนุสรณ์ เลิศนันทกุลชัย	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๖๑
๑๘) นายสัจจา เพ็ชรแสง	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๖๒
๑๙) นายกันตภณ มณีสัมพันธ์	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๖๓
๒๐) นางสาวจันทนีย์ โกเมนชนะ	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๖๔
๒๑) นายธารินทร์ อีอกจินดา	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๖๕
๒๒) นายศุภณัฐ พิสัยพันธ์	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๖๖
๒๓) นายศุภชัย วงศ์สุริยฉาย	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๖๗
๒๔) นายปฐมพงศ์ กรสวีสดี	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๖๘
๒๕) นายไสว ต้นโพธิ์	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๖๙
๒๖) นางสาวกิตติยา สัญญาอริยาภรณ์	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๗๐
๒๗) นางสาวเจษฎาพร ศรีบุญเรือง	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๗๑
๒๘) นางสาวมธุรินทร์ สิงห์เงา	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๗๒
๒๙) นางสาวธิดารัตน์ ศิริมงคลโร	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๗๓
๓๐) นายพิพัฒน์ นิกัทรเศรษฐ์	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๗๔
๓๑) นายศิริวิทย์ เรืองสม	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๗๕
๓๒) นายปารเมศ สัตยาคุณ	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๗๖
๓๓) นายณนุภาพ ธรรมสะโร	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๗๗
๓๔) นางสาวศุภรัตน์ โสจันทร์	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๗๘
๓๕) นายพชรกร อินทรเสนา	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๗๙
๓๖) นายทิวากร เชื้อมาก	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๘๐
๓๗) นายอนุรักษ ทองขจรศักดิ์	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๘๑
๓๘) นายอภิชาติ วิลาส	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๘๒
๓๙) นายจรัสระวี ศรีรักษา	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๘๓
๔๐) นายประสานมิตร เชื้อนเพชร	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๘๔
๔๑) นายภาณุวัฒน์ วังบง	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๘๕
๔๒) นายสันติ ชัยชนะ	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๘๖
๔๓) นายสิทธิชัย แก้วเกตุ	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๘๗
๔๔) นายทินกร กุลชาติ	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๘๘


ค. ขอบข่ายสารมลพิษที่ได้รับขึ้นทะเบียนให้วิเคราะห์ในน้ำเสีย จำนวน ๑๔ รายการ  
อากาศเสีย (ปล่อยระบาย) จำนวน ๗ รายการ และน้ำใต้ดิน จำนวน ๓ รายการ รวมทั้งสิ้นจำนวน ๒๔ รายการ  
ตามสิ่งที่ส่งมาด้วย



หนังสือฉบับนี้มีอายุ ๓ ปี นับจากวันที่กรมโรงงานอุตสาหกรรมออกหนังสือ หากประสงค์  
จะต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน ให้ยื่นคำขอต่ออายุพร้อมเอกสารประกอบ  
คำขอต่อกรมโรงงานอุตสาหกรรมภายใน ๓๐ วัน ก่อนวันสิ้นอายุของหนังสือรับขึ้นทะเบียนห้องปฏิบัติการ  
วิเคราะห์เอกชน ซึ่งคำขอต่ออายุดังกล่าวขอรับได้ที่กรมโรงงานอุตสาหกรรม

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

  
(นางจินดา เศษศรีนทร์)  
ผู้อำนวยการกองวิจัยและเตือนภัยมลพิษโรงงาน  
ปฏิบัติราชการแทนอธิบดีกรมโรงงานอุตสาหกรรม

๒๘ มิ.ย. ๒๕๖๔

กองวิจัยและเตือนภัยมลพิษโรงงาน  
ศูนย์วิจัยและเตือนภัยมลพิษโรงงานภาคตะวันออก  
โทร. ๐ ๓๘๐๕ ๗๒๖๑-๓  
ไปรษณีย์อิเล็กทรอนิกส์ [airw@diw.mail.go.th](mailto:airw@diw.mail.go.th)

เอกสารแนบท้ายหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

บริษัท เอนแอลเอส แลบลอราทอรี กรุ๊ป (ประเทศไทย) จำกัด เลขทะเบียน ว-๓๒๓

ที่ ออก ๐๓๑๐(๓)/

๒๔๗๐

ลงวันที่

๒๘ มิถุนายน ๒๕๖๔

ขอขยายสารมลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๒๔ รายการ

น้ำเสีย จำนวน 14 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Biochemical Oxygen Demand	1) 5-Day BOD Test, Membrane Electrode Method <sup>[2]</sup> 2) 5-Day BOD Test, Azide Modification Method <sup>[2]</sup>
2	Chemical Oxygen Demand	1) Open Reflux, Titrimetric Method <sup>[2]</sup> 2) Closed Reflux, Colorimetric Method <sup>[2]</sup> 3) Closed Reflux, Titrimetric Method <sup>[2]</sup>
3	Color	ADMI Weighted – Ordinate Spectrophotometric Method <sup>[2]</sup>
4	Cyanide	Distillation, Colorimetric Method <sup>[2]</sup>
5	Formaldehyde	Distillation, Colorimetric Method <sup>[1]</sup>
6	Free Chlorine	DPD-Ferrous Titrimetric Method <sup>[2]</sup>
7	Oil and Grease	Liquid-Liquid Partition-Gravimetric Method <sup>[2]</sup>
8	pH	Electrometric Method <sup>[2]</sup>
9	Phenols	1) Distillation, Chloroform Extraction Method <sup>[2]</sup> 2) Distillation, Direct Photometric Method <sup>[2]</sup>
10	Sulfide	ZnS Precipitation, Iodometric Method <sup>[2]</sup>
11	Temperature	Laboratory and Field Method <sup>[2]</sup>
12	Total Dissolved Solids	Dried at 180 °C <sup>[2]</sup>
13	Total Kjeldahl Nitrogen	Semi-Micro Kjeldahl Method <sup>[2]</sup>
14	Total Suspended Solids	Dried at 103-105 °C <sup>[2]</sup>

อากาศเสีย (ปล่องระบาย) จำนวน 7 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Carbon Monoxide	1) Sampling Bag, Non-Dispersive Infrared Method <sup>[5]</sup> 2) Instrumental Analyzer Method <sup>[8]</sup>
2	Hydrogen Sulfide	Absorption Sampling, Iodometric Method <sup>[5]</sup>
3	Opacity	Ringelmann's Method <sup>[3,4]</sup>
4	Oxide of Nitrogen	1) Absorption Sampling, Phenoldisulfonic Acid Method <sup>[6]</sup> 2) Instrumental Analyzer Method <sup>[9]</sup>
5	Sulfur Dioxide	1) Absorption Sampling, Barium-Thorin Titrimetric Method <sup>[5]</sup> 2) Instrumental Analyzer Method <sup>[10]</sup>



(นางสาววิชุดา สัมฤทธิ์ผล)

ผู้อำนวยการ

ศูนย์วิจัยและเตือนภัยมลพิษโรงงานภาคตะวันออก

Sulfuric Acid...



ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
6	Sulfuric Acid	Isokinetic Sampling, Barium – Thorin Titrimetric Method <sup>[6]</sup>
7	Total Suspended Particulate	Isokinetic Sampling, Gravimetric Method <sup>[7]</sup>

**น้ำใต้ดิน จำนวน 3 รายการ**

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Cyanide	Distillation, Colorimetric Method <sup>[2]</sup>
2	pH	Electrometric Method <sup>[2]</sup>
3	Phenols	Distillation, Direct Photometric Method <sup>[2]</sup>

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ผู้อำนวยการ

ศูนย์วิจัยและเตือนภัยมลพิษโรงงานภาคตะวันออก



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