

ภาคผนวก ง

เอกสารสอบเทียบเครื่องมือที่ใช้ในการวิเคราะห์



right solutions.
right partner.

รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

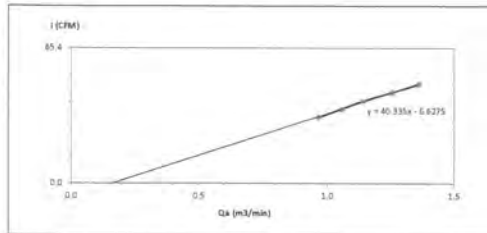
Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Ambient	Particulate Matter (PM-10)	High Volume	RYG_FS0400	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	High Volume	RYG_FS0665	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	High Volume	RYG_FS0667	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	High Volume	RYG_FS0668	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	Digital Balance	RYG_EN0001	1-Mar-23	1-Mar-24	12
Ambient	Total Suspended Particulate	High Volume	RYG_FS0661	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	RYG_FS0661	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	RYG_FS0661	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	RYG_FS0661	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	RYG_FS0661	-	-	On site Calibration
Ambient	Nitrogen Dioxide	NO ₂ Analyzer	RYG_FS0264	1-Jul-23	1-Jan-24	6
Ambient	Nitrogen Dioxide	NO ₂ Analyzer	RYG_FS0272	1-Jul-23	1-Jan-24	6
Ambient	Nitrogen Dioxide	NO ₂ Analyzer	RYG_FS0261	1-Jul-23	1-Jan-24	6
Ambient	Nitrogen Dioxide	NO ₂ Analyzer	RYG_FS0453	1-Jul-23	1-Jan-24	6
Ambient	Sulfur Dioxide	SO ₂ Analyzer	RYG_FS0263	2-Jul-23	2-Jan-24	6
Ambient	Sulfur Dioxide	SO ₂ Analyzer	RYG_FS0271	2-Jul-23	2-Jan-24	6
Ambient	Sulfur Dioxide	SO ₂ Analyzer	RYG_FS0260	2-Jul-23	2-Jan-24	6
Ambient	Sulfur Dioxide	SO ₂ Analyzer	RYG_FS0452	2-Jul-23	2-Jan-24	6
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	RYG_FS0649	20-Jun-23	20-Dec-24	18
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	RYG_FS0648	20-Jun-23	20-Dec-24	18
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	RYG_FS0647	20-Jun-23	20-Dec-24	18
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	RYG_FS0650	20-Jun-23	20-Dec-24	18
Noise	Leq 24 hrs	Sound Calibrator	RYG_FS0213	26-Jan-23	26-Jan-24	12
Noise	Leq 24 hrs	Sound Level Meter	RYG_FS0386	19-Oct-23	19-Oct-24	12
Noise	Leq 24 hrs	Sound Level Meter	RYG_FS0432	25-Jan-23	25-Jan-24	12
Noise	Leq 24 hrs	Sound Level Meter	RYG_FS0495	13-Jan-23	13-Jan-24	12
Noise	Leq 24 hrs	Sound Level Meter	RYG_FS0433	25-Jan-23	25-Jan-24	12
Noise	Noise Annoyance	Sound Calibrator	RYG_FS0213	26-Jan-23	26-Jan-24	12
Noise	Noise Annoyance	Sound Level Meter	RYG_FS0386	19-Oct-23	19-Oct-24	12
Noise	Noise Annoyance	Sound Level Meter	RYG_FS0432	25-Jan-23	25-Jan-24	12
Noise	Noise Annoyance	Sound Level Meter	RYG_FS0495	13-Jan-23	13-Jan-24	12
Noise	Noise Annoyance	Sound Level Meter	RYG_FS0433	25-Jan-23	25-Jan-24	12
Noise	Noise Annoyance	Sound Calibrator	RYG_FS0213	26-Jan-23	26-Jan-24	12
Noise	Noise Annoyance	Sound Level Meter	RYG_FS0434	25-Jan-23	25-Jan-24	12
Noise	Noise Annoyance	Sound Level Meter	RYG_FS0431	25-Jan-23	25-Jan-24	12
Noise	Noise Annoyance	Sound Level Meter	RYG_FS0494	13-Jan-23	13-Jan-24	12
Noise	Noise Annoyance	Sound Level Meter	RYG_FS0023	13-Jan-23	13-Jan-24	12
Water Lab	Arsenic	ICP-MS	BKK_EL0026	12-Jun-23	11-Jun-24	12
Water Lab	Arsenic	Hot Block	BKK_EL0054	22-Sep-23	22-Mar-25	18
Water Lab	Arsenic	Chamber (Cold Room)	BKK_EN0167	30-Jun-22	30-Dec-23	18
Water Lab	Cadmium	ICP-MS	BKK_EL0026	12-Jun-23	11-Jun-24	12
Water Lab	Cadmium	Hot Block	BKK_EL0054	22-Sep-23	22-Mar-25	18
Water Lab	Cadmium	Chamber (Cold Room)	BKK_EN0167	30-Jun-22	30-Dec-23	18
Water Lab	Copper	ICP-MS	BKK_EL0026	12-Jun-23	11-Jun-24	12
Water Lab	Copper	Hot Block	BKK_EL0054	22-Sep-23	22-Mar-25	18
Water Lab	Copper	Chamber (Cold Room)	BKK_EN0167	30-Jun-22	30-Dec-23	18
Water Lab	Hexavalent Chromium	Spectrophotometer	BKK_EN0018	15-Sep-23	15-Sep-24	12
Water Lab	Lead	ICP-MS	BKK_EL0026	12-Jun-23	11-Jun-24	12
Water Lab	Lead	Hot Block	BKK_EL0054	22-Sep-23	22-Mar-25	18
Water Lab	Lead	Chamber (Cold Room)	BKK_EN0167	30-Jun-22	30-Dec-23	18
Water Lab	Manganese	ICP-MS	BKK_EL0026	12-Jun-23	11-Jun-24	12
Water Lab	Manganese	Hot Block	BKK_EL0054	22-Sep-23	22-Mar-25	18
Water Lab	Manganese	Chamber (Cold Room)	BKK_EN0167	30-Jun-22	30-Dec-23	18
Water Lab	Mercury	DUO-CVAFS / CVAAS	BKK_EL0023	24-May-23	24-May-24	12



High Volume Air Sampler Calibration Worksheet

Project Site : WHA Rayong 36 Company Limited Barometric Pressure (mm Hg) : 753
 Calibrate Location : จุดที่ 1 บริเวณ โรงงาน (A1) Temperature (°C) : 32
 Calibrate Date : 17-Dec-23 High Volume ID : RYG PS0468
 Calibration Sheet No. : C-171223-RYG PS0468 High Volume Model : TE-S009X
 Calibrator ID : RYG PS0205 High Volume S/N : 5691
 Calibrator Model : TE-S028A Calibrator Slope : 0.94434
 Calibrator S/N : 1166 Calibrator Intercept : -0.01292

Test No.	Delta H ₂ O (inch)	Qa (m ³ /min)	I : Chart (CFM)	Linear Regression
1	2.8	0.966	32	Slope : 40.3346 Intercept : -6.6275 Correlation Coefficient : 0.9901
2	2.4	1.057	36	
3	2.8	1.141	40	
4	3.4	1.256	44	
5	4.0	1.361	48	



Calibrated by : Satcha P.
 (Mr. Satcha Phitsawang)
 Field Scientist (3)

Approved by : [Signature]
 (Mr. Noppong Juntarupun)
 Enviro Field Coordinator Scientist (3)

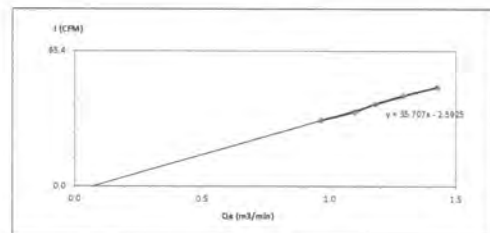
FORM NO: F 06-074 REVISION NO.: ISSUE DATE: 14/03/16



High Volume Air Sampler Calibration Worksheet

Project Site : WHA Rayong 36 Company Limited Barometric Pressure (mm Hg) : 753
 Calibrate Location : จุดที่ 1 บริเวณ โรงงาน (A2) Temperature (°C) : 32
 Calibrate Date : 17-Dec-23 High Volume ID : RYG PS0665
 Calibration Sheet No. : C-171223-RYG PS0665 High Volume Model : TE-S009X
 Calibrator ID : RYG PS0205 High Volume S/N : 6264
 Calibrator Model : TE-S028A Calibrator Slope : 0.94434
 Calibrator S/N : 1166 Calibrator Intercept : -0.01292

Test No.	Delta H ₂ O (inch)	Qa (m ³ /min)	I : Chart (CFM)	Linear Regression
1	2.8	0.966	32	Slope : 35.7073 Intercept : -2.5925 Correlation Coefficient : 0.9901
2	2.6	1.100	36	
3	3.0	1.180	40	
4	3.6	1.292	44	
5	4.4	1.427	48	



Calibrated by : Satcha P.
 (Mr. Satcha Phitsawang)
 Field Scientist (3)

Approved by : [Signature]
 (Mr. Noppong Juntarupun)
 Enviro Field Coordinator Scientist (3)

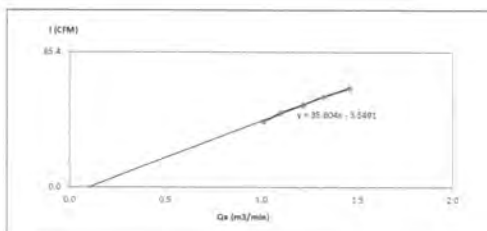
FORM NO: F 06-074 REVISION NO.: ISSUE DATE: 14/03/16



High Volume Air Sampler Calibration Worksheet

Project Site : WHA Rayong 36 Company Limited Barometric Pressure (mm Hg) : 753
 Calibrate Location : จุดที่ 7 บริเวณ โรงงาน (A3) Temperature (°C) : 32
 Calibrate Date : 17-Dec-23 High Volume ID : RYG PS0667
 Calibration Sheet No. : C-171223-RYG PS0667 High Volume Model : TE-S009X
 Calibrator ID : RYG PS0205 High Volume S/N : 6266
 Calibrator Model : TE-S028A Calibrator Slope : 0.94434
 Calibrator S/N : 1166 Calibrator Intercept : -0.01292

Test No.	Delta H ₂ O (inch)	Qa (m ³ /min)	I : Chart (CFM)	Linear Regression
1	2.2	1.013	32	Slope : 35.6042 Intercept : -3.5491 Correlation Coefficient : 0.9979
2	2.6	1.190	36	
3	3.2	1.219	40	
4	3.8	1.327	44	
5	4.6	1.458	48	



Calibrated by : Satcha P.
 (Mr. Satcha Phitsawang)
 Field Scientist (3)

Approved by : [Signature]
 (Mr. Noppong Juntarupun)
 Enviro Field Coordinator Scientist (3)

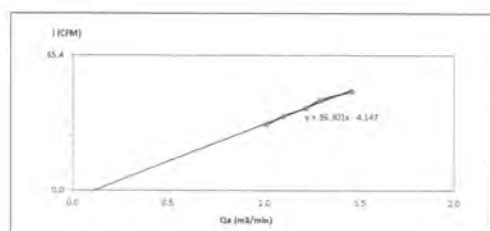
FORM NO: F 06-074 REVISION NO.: ISSUE DATE: 14/03/16



High Volume Air Sampler Calibration Worksheet

Project Site : WHA Rayong 36 Company Limited Barometric Pressure (mm Hg) : 753
 Calibrate Location : จุดที่ 6 บริเวณ โรงงาน (A5) Temperature (°C) : 32
 Calibrate Date : 17-Dec-23 High Volume ID : RYG PS0668
 Calibration Sheet No. : C-171223-RYG PS0668 High Volume Model : TE-S009X
 Calibrator ID : RYG PS0205 High Volume S/N : 6267
 Calibrator Model : TE-S028A Calibrator Slope : 0.94434
 Calibrator S/N : 1166 Calibrator Intercept : -0.01292

Test No.	Delta H ₂ O (inch)	Qa (m ³ /min)	I : Chart (CFM)	Linear Regression
1	2.2	1.013	32	Slope : 36.3010 Intercept : -4.1470 Correlation Coefficient : 0.9917
2	2.6	1.100	36	
3	3.2	1.219	40	
4	3.6	1.292	44	
5	4.6	1.458	48	



Calibrated by : Satcha P.
 (Mr. Satcha Phitsawang)
 Field Scientist (3)

Approved by : [Signature]
 (Mr. Noppong Juntarupun)
 Enviro Field Coordinator Scientist (3)

FORM NO: F 06-074 REVISION NO.: ISSUE DATE: 14/03/16

Sartorius (Thailand) Co., Ltd.
129 Rama 9 Road, Huaykwang, Huaykwang, Bangkok 10310
Tel: +66 2643 8361-6 Fax: +66 2643 8367 e-mail: service.thailand@sartorius.com



SARTORIUS

ASCT-700-TS 17025
CALIBRATION 0438

REVIEW BY *Thatchai*
APPROVED BY *P. Satcha*
NEXT CAL DATE 01/03/24

Certificate of Calibration

Model Number: LA130S-F Certificate No.: 23BCI0110
Description: Analytical Balance Issued Date: Friday, March 03, 2023
Serial Number: 25409664 Reference No.: 204833
ID No.: RYG_EN0001
Manufacturer: Sartorius Page No.: 1 of 2

Customer Name: ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch)
616/10 Moo 5 T.Maenam Khu. A.Pluak Daeng, Rayong 21140, Thailand

Calibrated Place: ALS Laboratory Group (Thailand) Co., Ltd. (Balance Room)
616/10 Moo 5 T.Maenam Khu. A.Pluak Daeng, Rayong 21140, Thailand

Calibrated By: Mr Chonchai Inthana Calibration Procedure No.: This calibration was conducted by
Using in-house calibration procedure number (WI-003)
Based on UKAS LAB 14 : 2019

Metrical data: Capacity: 150 g Readability: 0.0001 g
Ambient Conditions: Temperature: 24.2 °C ± 5.0 °C
Humidity: 60.0 % RH ± 10.0 % RH
Pressure: ±

Reasons for calibration: ☐ New Installation ☐ Service / Repair ☒ Re-calibration / Maintenance ☐ Equipment Condition ☒ Good Operation ☐ Fail

Measurement Method UKAS Publication Ref: Lab 14

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 calibration certificate documents the traceability to National Standards, which realise the unit of measurement according to the International Standard System of Units (SI). Report of Tolerance came from list of Sartorius Metrological Specifications.

Traceability:

Model Number	Description	Traceability	Certificate No.	Due Date
YCS011-522-00	Sartorius weight set 1mg - 5000g E2 YCS011-522-00	SPC-RT	C02212585	14-Sep-2023
MHB-382SD	Humidity/Balometer/Temp. Lutron MHB-382SD	DKSH	C19220444	5-Sep-2023

This certificate relate and apply this equipment only
This certificate may not be reproduced other than in full except with the prior written approval of the Verification Operation Division
Sartorius (Thailand) Co., Ltd.

Chonchai Inthana
Mr Chonchai Inthana (Technical Manager)



SOP FM 33 03 February 2022

Sartorius (Thailand) Co., Ltd.
129 Rama 9 Road, Huaykwang, Huaykwang, Bangkok 10310
Tel: +66 2643 8361-6 Fax: +66 2643 8367 e-mail: service.thailand@sartorius.com

SARTORIUS

Certificate of Calibration

Model Number: LA130S-F Certificate No.: 23BCI0110
Description: Analytical Balance Issued Date: Friday, March 03, 2023
Serial Number: 25409664 Reference No.: 204833
ID No.: RYG_EN0001
Manufacturer: Sartorius Page No.: 2 of 2

Calibration Results : Without Adjustment

Repeatability		Eccentricity (Off-center loading error)	
The reproducibility is the ability of a weighing instrument to display nearly identical results under constant test conditions when the same load within a measurement series is placed repeatedly on the weighing pan in the same manner. The standard deviation is used to express reproducibility quantitatively.		The off-center loading error is yielded by the difference between the result of the load (e.g. 1/3 or 1/4 of maximum capacity) placed in the middle of the weighing pan and between each of four additional measurement points (positions defined according to DIN, R76).	
Nominal Value : (Low Load)	10.0000 100.0001	Nominal value : 50 g	
10 g	10.0000 100.0002	Tolerance: 0.0004 g	
Tolerance	10.0001 100.0001		
0.0001 g	10.0000 100.0000		
	9.9998 100.0002		
Nominal Value : (High Load)	10.0000 100.0001		
100 g	10.0001 100.0001		
Tolerance	10.0000 100.0001		
0.0001 g	9.9999 100.0002		
	9.9998 100.0001		
Standard Deviation	0.00009 0.00006		

Linearity

The linearity, also called linearity error, describes the deviation of the characteristic curve of a weighing instrument from the linear slope.

Tolerance		0.0002 g		
Nominal Value	Conventional Mass Value	Displayed Value	Deviation	Uncertainty
(g)	(g)	(g)	(g)	(g)
0.01	0.0100	0.0100	0.0000	0.00022
0.05	0.0500	0.0500	0.0000	0.00023
0.1	0.1000	0.1000	0.0000	0.00023
0.5	0.5000	0.5000	0.0000	0.00023
1	1.0000	1.0000	0.0000	0.00023
2	2.0000	2.0000	0.0000	0.00023
5	5.0000	5.0000	0.0000	0.00023
10	10.0000	10.0001	0.0001	0.00024
20	20.0000	20.0001	0.0001	0.00023
100	100.0000	100.0002	0.0002	0.00026

End of Report

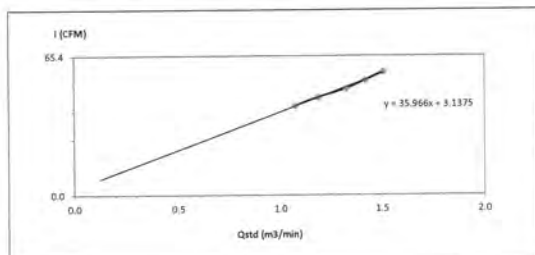
SOP FM 33 03 February 2022



High Volume Air Sampler Calibration Worksheet

Project Site: WHA Rayong 36 Company Limited Barometric Pressure (mm Hg): 753
Calibrate Location: หมู่ที่ 1 ตำบลบึงเกลือ อำเภอบึงสามพัน (A1) Temperature (°C): 32
Calibrate Date: 17-Dec-23 High Volume ID: RYG-FS0661
Calibration Sheet No.: C-171223-RYG-FS0661 High Volume Model: TE-S009X
Calibrator ID: RYG-FS0205 High Volume S/N: 6258
Calibrator Model: TE-S028A Calibrator Slope: 1.50765
Calibrator S/N: 1166 Calibrator Intercept: -0.02043

Test No.	Delta H ₂ O (inch)	Q _{std} (m ³ /min)	I: Chart (CFM)	Linear Regression
1	2.6	1.0727	42	Slope: 35.9659
2	3.2	1.1878	46	Intercept: 3.1375
3	4.0	1.3256	50	Correlation Coefficient: 0.9963
4	4.6	1.4201	54	
5	5.2	1.5086	58	



Calibrated by: *Satcha P.*
(Mr. Satcha Phetsawang)
Field Scientist(3)

Approved by: *Mr. Noppog Juntarupan*
Enviro Field Coordinator Scientist (3)

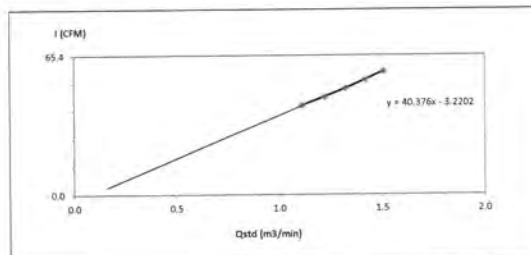
FORM NO. F 06-073 REVISION NO.: ISSUE DATE: 14/03/16



High Volume Air Sampler Calibration Worksheet

Project Site: WHA Rayong 36 Company Limited Barometric Pressure (mm Hg): 753
Calibrate Location: หมู่ที่ 1 ตำบลบึงเกลือ อำเภอบึงสามพัน (A2) Temperature (°C): 32
Calibrate Date: 17-Dec-23 High Volume ID: RYG-FS0662
Calibration Sheet No.: C-171223-RYG-FS0662 High Volume Model: TE-S009X
Calibrator ID: RYG-FS0205 High Volume S/N: 6259
Calibrator Model: TE-S028A Calibrator Slope: 1.50765
Calibrator S/N: 1166 Calibrator Intercept: -0.02043

Test No.	Delta H ₂ O (inch)	Q _{std} (m ³ /min)	I: Chart (CFM)	Linear Regression
1	2.8	1.1124	42	Slope: 40.3764
2	3.4	1.2238	46	Intercept: -3.2202
3	4.0	1.3256	50	Correlation Coefficient: 0.9990
4	4.6	1.4201	54	
5	5.2	1.5086	58	



Calibrated by: *Satcha P.*
(Mr. Satcha Phetsawang)
Field Scientist(3)

Approved by: *Mr. Noppog Juntarupan*
Enviro Field Coordinator Scientist (3)

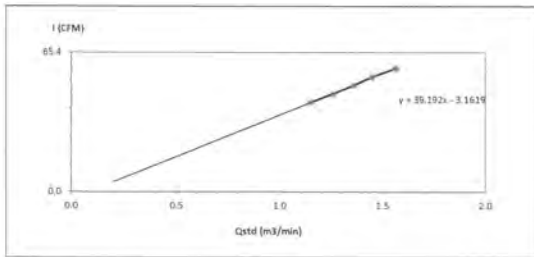
FORM NO. F 06-073 REVISION NO.: ISSUE DATE: 14/03/16



High Volume Air Sampler Calibration Worksheet

Project Site: WHA Rayong 36 Company Limited Barometric Pressure (mm Hg): 753
Calibrate Location: หมู่ที่ 7 บ้านหนองตา อำเภอนายูง (A3) Temperature (°C): 32
Calibrate Date: 17-Dec-23 High Volume ID: RYG_PS0663
Calibration Sheet No.: C-171223-RYG_PS0663 High Volume Model: TE-5009X
Calibrator ID: RYG_PS0205 High Volume S/N: 6260
Calibrator Model: TE-5028A Calibrator Slope: 1.50765
Calibrator S/N: 1166 Calibrator Intercept: -0.02043

Test No.	Delta H ₂ O (inch)	Q _{std} (m ³ /min)	I: Chart (CFM)	Linear Regression
1	3.6	1.1508	42	Slope: 39.1921
2	3.6	1.2586	46	Intercept: -3.1619
3	4.2	1.3579	50	Correlation Coefficient: 0.9995
4	4.8	1.4502	54	
5	5.6	1.5648	58	



Calibrated by: Satcha P.
(Mr. Satcha Phetsawang)
Field Scientist (3)

Approved by: [Signature]
(Mr. Noppong Jantarun)
Enviro Field Coordinator Scientist (3)

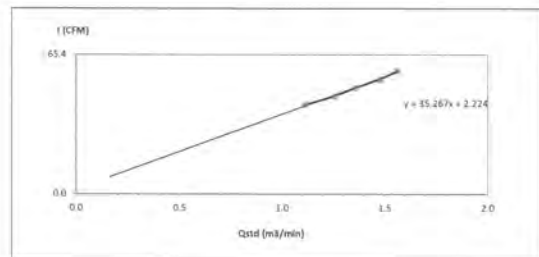
FORM NO. F-06-073 REVISION NO. 1 ISSUE DATE: 14/03/16



High Volume Air Sampler Calibration Worksheet

Project Site: WHA Rayong 36 Company Limited Barometric Pressure (mm Hg): 753
Calibrate Location: หมู่ที่ 6 บ้านหนองตา อำเภอนายูง (A4) Temperature (°C): 32
Calibrate Date: 17-Dec-23 High Volume ID: RYG_PS0664
Calibration Sheet No.: C-171223-RYG_PS0664 High Volume Model: TE-5009X
Calibrator ID: RYG_PS0205 High Volume S/N: 6262
Calibrator Model: TE-5028A Calibrator Slope: 1.50765
Calibrator S/N: 1166 Calibrator Intercept: -0.02043

Test No.	Delta H ₂ O (inch)	Q _{std} (m ³ /min)	I: Chart (CFM)	Linear Regression
1	2.8	1.1124	42	Slope: 35.2675
2	3.6	1.2586	46	Intercept: 2.2240
3	4.2	1.3579	50	Correlation Coefficient: 0.9982
4	5.0	1.4797	54	
5	5.6	1.5648	58	



Calibrated by: Satcha P.
(Mr. Satcha Phetsawang)
Field Scientist (3)

Approved by: [Signature]
(Mr. Noppong Jantarun)
Enviro Field Coordinator Scientist (3)

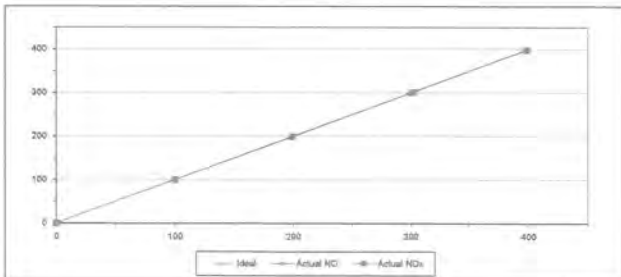
FORM NO. F-06-073 REVISION NO. 1 ISSUE DATE: 14/03/16



MULTIPOINT CALIBRATION REPORT

Calibration Date: 1-Jul-23 Equipment Name: NOx Analyzer
Manufacturer: HORIBA Model: APNA-370
Serial No.: 8G314J3K Equipment ID: RYG_F80264
Calibrator Manufacturer: Teledyne API Model: 700
Serial No.: 947
Std. Gas Concentration (PPM): 55.88 Cylinder No.: GN0027222
Cylinder Pressure (psi): 1800 Certified By: Airgas Inc.
Certified Date: 9-Feb-22 Expired Date: 9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.05	0.05	0.05	0.10	0.10	0.10
1	100.00	99.20	-0.80	-0.80	100.10	0.10	0.10
2	200.00	198.40	-1.60	-0.80	199.10	-0.90	-0.45
3	300.00	298.60	-1.40	-0.47	301.50	1.50	0.50
4	400.00	398.10	-1.90	-0.47	398.00	-2.00	-0.50
AVERAGE (%)				-0.50			-0.05



Calibrated By:

(Mr. Jirawat Sakam)
Field Environmental Scientist (3)

Approved By:

(Mr. Sarayuth Jitrantorn)
Assistant General Manager

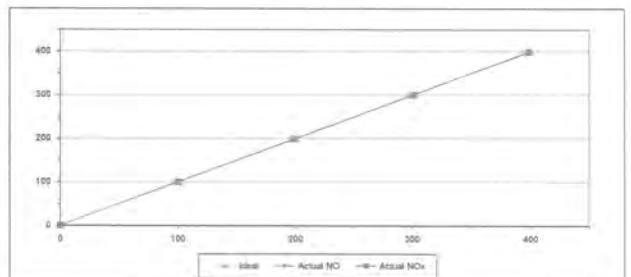
ALS Laboratory Group
FORM NO. F-06-056 REVISION NO. 1 ISSUE DATE: 02/04/12



MULTIPOINT CALIBRATION REPORT

Calibration Date: 1-Jul-23 Equipment Name: NOx Analyzer
Manufacturer: HORIBA Model: APNA-370
Serial No.: 7AV88544 Equipment ID: RYG_F80272
Calibrator Manufacturer: Teledyne API Model: 700
Serial No.: 947
Std. Gas Concentration (PPM): 55.88 Cylinder No.: GN0027222
Cylinder Pressure (psi): 1800 Certified By: Airgas Inc.
Certified Date: 9-Feb-22 Expired Date: 9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.05	0.05	0.05	0.10	0.10	0.10
1	100.00	99.10	-0.90	-0.90	100.10	0.10	0.10
2	200.00	198.80	-1.40	-0.70	199.00	-1.00	-0.50
3	300.00	298.70	-1.30	-0.43	300.50	0.50	0.17
4	400.00	398.00	-2.00	-0.50	398.70	-1.30	-0.33
AVERAGE (%)				-0.50			-0.09



Calibrated By:

(Mr. Jirawat Sakam)
Field Environmental Scientist (3)

Approved By:

(Mr. Sarayuth Jitrantorn)
Assistant General Manager

ALS Laboratory Group
FORM NO. F-06-056 REVISION NO. 1 ISSUE DATE: 02/04/12

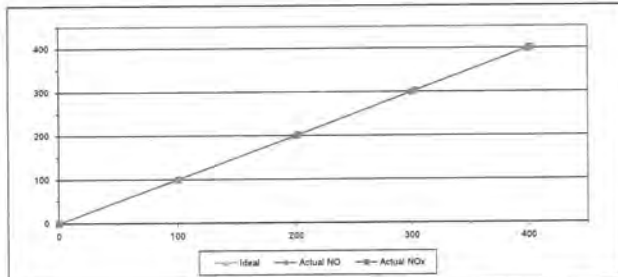


MULTIPOINT CALIBRATION REPORT

Calibration Date: 1-Jul-23
 Manufacturer: HORIBA
 Serial No.: 6EEAW53E
 Calibrator Manufacturer: Teledyne API
 Serial No.: 947
 Std. Gas Concentration (PPM): 55.88
 Cylinder Pressure (psi): 1800
 Certified Date: 9-Feb-22

Equipment Name: NOx Analyzer
 Model: APNA-370
 Equipment ID: RYG_FS0261
 Model: 700
 Cylinder No.: GN0027222
 Certified By: Airgas Inc.
 Expired Date: 9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	98.70	-1.30	-1.30	100.40	0.40	0.40
2	200.00	197.80	-2.20	-1.10	201.50	1.50	0.75
3	300.00	298.10	-1.90	-0.63	302.20	2.20	0.73
4	400.00	396.50	-3.50	-0.88	401.40	1.40	0.35
AVERAGE (%)				-0.66			0.47



Calibrated By

(Mr. Jirawut Sakam)
 Field Environmental Scientist (3)

Approved By

(Mr. Sarayuth Jittrantont)
 Assistant General Manager

ALS Laboratory Group
 FORM NO.: F 05-056 REVISION NO.: ISSUE DATE: 02/04/12

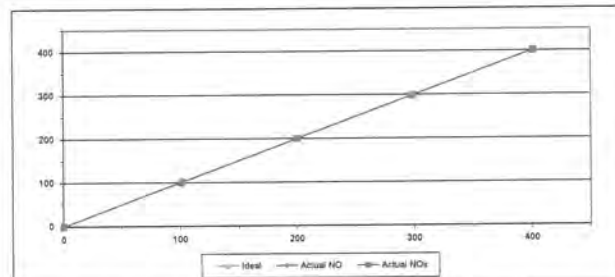


MULTIPOINT CALIBRATION REPORT

Calibration Date: 1-Jul-23
 Manufacturer: HORIBA
 Serial No.: AWXG87CR
 Calibrator Manufacturer: Teledyne API
 Serial No.: 947
 Std. Gas Concentration (PPM): 55.88
 Cylinder Pressure (psi): 1800
 Certified Date: 9-Feb-22

Equipment Name: NOx Analyzer
 Model: APNA-370
 Equipment ID: RYG_FS0453
 Model: 700
 Cylinder No.: GN0027222
 Certified By: Airgas Inc.
 Expired Date: 9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	99.60	-0.40	-0.40	101.40	1.40	1.40
2	200.00	198.60	-1.40	-0.70	199.80	-0.20	-0.10
3	300.00	299.00	-1.00	-0.33	298.50	-1.50	-0.50
4	400.00	402.10	2.10	0.53	401.20	1.20	0.30
AVERAGE (%)				-0.16			0.24



Calibrated By

(Mr. Jirawut Sakam)
 Field Environmental Scientist (3)

Approved By

(Mr. Sarayuth Jittrantont)
 Assistant General Manager

ALS Laboratory Group
 FORM NO.: F 05-056 REVISION NO.: ISSUE DATE: 02/04/12

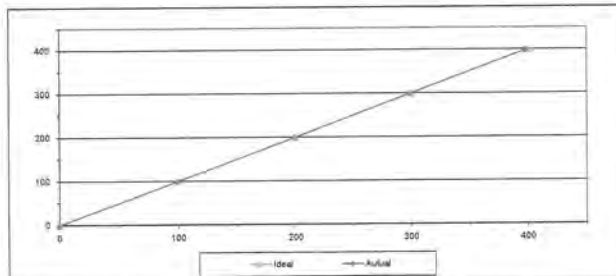


MULTIPOINT CALIBRATION REPORT

Calibration Date: 2-Jul-23
 Manufacturer: HORIBA
 Serial No.: YPRXJ20
 Calibrator Manufacturer: Teledyne API
 Serial No.: 947
 Std. Gas Concentration (PPM): 56.3
 Cylinder Pressure (psi): 1800
 Certified Date: 9-Feb-22

Equipment Name: SO2 Analyzer
 Model: APSA-370
 Equipment ID: RYG_FS0263
 Model: 700
 Cylinder No.: GN0027222
 Certified By: Airgas Inc.
 Expired Date: 9-Feb-30

Point	CALIBRATION RESULTS			
	Ideal	Actual	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	99.80	-0.20	-0.20
2	200.00	199.40	-0.60	-0.30
3	300.00	298.20	-1.80	-0.60
4	400.00	398.00	-2.00	-0.50
AVERAGE (%)				-0.30



Calibrated By

(Mr. Jirawut Sakam)
 Field Environmental Scientist (3)

Approved By

(Mr. Sarayuth Jittrantont)
 Assistant General Manager

ALS Laboratory Group
 FORM NO.: F 05-056 REVISION NO.: ISSUE DATE: 02/04/12

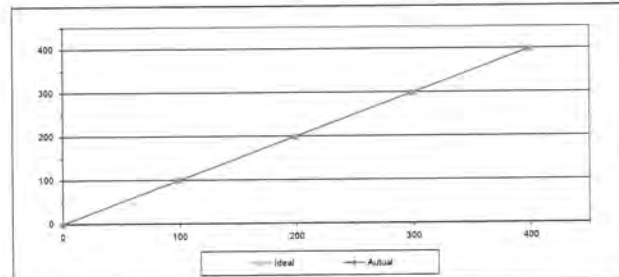


MULTIPOINT CALIBRATION REPORT

Calibration Date: 2-Jul-23
 Manufacturer: HORIBA
 Serial No.: 1062HYKM
 Calibrator Manufacturer: Teledyne API
 Serial No.: 947
 Std. Gas Concentration (PPM): 56.3
 Cylinder Pressure (psi): 1800
 Certified Date: 9-Feb-22

Equipment Name: SO2 Analyzer
 Model: APSA-370
 Equipment ID: RYG_FS0271
 Model: 700
 Cylinder No.: GN0027222
 Certified By: Airgas Inc.
 Expired Date: 9-Feb-30

Point	CALIBRATION RESULTS			
	Ideal	Actual	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	99.50	-0.50	-0.50
2	200.00	198.20	-1.80	-0.90
3	300.00	297.60	-2.40	-0.80
4	400.00	396.00	-4.00	-1.00
AVERAGE (%)				-0.52



Calibrated By

(Mr. Jirawut Sakam)
 Field Environmental Scientist (3)

Approved By

(Mr. Sarayuth Jittrantont)
 Assistant General Manager

ALS Laboratory Group
 FORM NO.: F 05-056 REVISION NO.: ISSUE DATE: 02/04/12

CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM

MANUFACTURER

MODEL/TYPE

SERIAL NUMBER

ID NUMBER

CONDITION AS-RECEIVED

CUSTOMER

Wind Direction Sensor

Novelins

Sensor: WS-02FA

Data logger: 110-WS-250L-D

Sensor: WS0-A5980

Data logger: A5980

RYG_F30649

New item

ALS laboratory group (Thailand) Co., Ltd.

104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang,

Khut Suan Luang, Bangkok 10250 Thailand.

Calibration procedure:

The wind direction sensor was calibrated against
Standard Rotary Encoder model: A3420R75-
D408-P5-S-00 in an open top section of a
type wind tunnel with 900 cm² open cross-section
area. The WS-02FA based on IEC 61400-12-1,
Wind power generation systems - Part 12-1:
Power performance measurements of electricity
producing wind turbines, March 2017 was used as
a calibration guideline.

Traceability:

This certificate provides a traceability of the
measurement to the national standards, and to realization of the international
system of units (SI) through the NMAT (National
Metrology Institute of Thailand) via Certificate
Number: DA-0005-22

Uncertainty of Measurement:

The reported uncertainty of measurement is
based on the standard uncertainty multiplied by a
coverage factor k=2. Which for a normal
distribution corresponds to a coverage probability
of approximately 95%. The standard uncertainty
has been determined in accordance with the GUM
Evaluation of measurement
data - Guide to the expression of uncertainty in
measurement

RECEIVED DATE

MEASUREMENT DATE

ISSUE DATE

16 Jun 2023

20 Jun 2023

20 Jun 2023

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

Temperature

23.0 ± 1.0 °C

Relative Humidity

55.0 ± 15.0 %RH

Atmospheric Pressure

1010 ± 10 hPa

PLACE OF CALIBRATION

Effel-type wind tunnel of Jiranatee Associates Co., Ltd.

CALIBRATION CONDITION

Wind tunnel cross-section area¹

900 cm²

Wind direction frontal area²

129 cm²

Diameter of mounting pipe³

mm

Blockage ratio of test object⁴

0.143 [-]

Preconditioning

24 hours at ambient conditions.

Measurement Condition

The average values during measurement are (24.3)°C, (47.4) %RH and (1010.9) hPa.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

Mr. Sorawit Thachalad

Mr. Jitraporn Lertsomphol



Approved signatory:

Mr. Pannay Booncharoen

Calibration Department Manager

Remarks:

¹ Fully cross-section area of the wind tunnel

² Projected cross-section area of the tested object include mounting pipe

³ Diameter of mounting pipe

⁴ Ratio "a" / "b"

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

Page 2 of 2 Pages

MEASUREMENT RESULTS¹

The wind direction sensor was calibrated against standard rotary encoder by comparison method. During calibration, the measurement was carried out at 45° intervals in clockwise and counterclockwise directions after offset adjustment has been made. The flow speed of wind tunnel (usually 5 m/s) is kept constant while the sensor is rotated around its vertical axis. The results of calibration and associated measurement uncertainties are reported in the table below.

Air speed m/s	D _{ref} Degree (°)	D _{me} Degree (°)	Error Degree (°)	U (k=2) Degree (°)
0.000	0	0	0	1.0
45.000	45	-2	-2	1.0
90.000	87	-3	-3	1.0
135.000	133	-2	-2	1.0
180.000	180	0	0	1.0
225.000	226	1	1	1.0
270.000	272	2	2	1.0
315.000	318	3	3	1.0

Remarks:

¹ Calibration results only count for the tested circumstances and environmental conditions during which calibration took place.

² Direction of standard

Direction of Unit Under Calibration:

End of Certificate of Calibration



CERTIFICATE OF CALIBRATION

Certificate No. CT-025-66
Page 1 of 2

Equipment Name: Data Logger with Temperature sensor

Manufacturer: Novelins

Model: 110-WS-250L-D

Serial No.: A5980

ID No.: RYG_F30649

Customer

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

Address: 104 Phatthanakan 40, Phatthanakan Rd,

Khwaeng Suan Luang, Khut Suan Luang, Bangkok

10250 Thailand.

Received date: 16 Jun 2023

Calibration date: 20 Jun 2023

Issue date: 22 Jun 2023

Reference Used During Calibration

1. Standard Temperature Probe Model: STS-100 A500

Serial No.: 667682-09, Due date: 28 Mar 2024

2. Digital Temperature Indicator Model: DTI-1000-A MH

ii. Serial No.: 671407-00591 Due date: 27 July 2023

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-0038-23, Certificate number: ER-0092-
22

Notes: The certificate is valid only for the item calibrated on date and place of calibration.

Calibrated by:

Mr. Sorawit Thachalad

Mr. Jitraporn Lertsomphol

Mr. Rungnirumpi Phoomnil



Approved Signatory:

Mr. Pannay Booncharoen

Calibration Department Manager

Certificate No. CT-025-66
Page 2 of 2

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 - 40 °C

Function:

This equipment was connected with temperature sensor Model: HMP60 S/N: V1920214.

Dimension: Diameter 12 mm, Length 80 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
70	20.057	20.0	0.1	0.099
70	25.051	24.9	0.2	0.099
70	30.044	29.8	0.2	0.099
70	35.039	34.8	0.2	0.099
70	40.034	39.7	0.3	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 ★





63/14-15,67/35-36, Soi Petchkasem 7/71, Petchkasem Rd,
Walthapa, Bangkok, Bangkok 10600 Thailand.
Tel: (66) 02-8680812#13 Fax: (66) 02-8680860 www.jiranatee.com

CERTIFICATE OF CALIBRATION

Calibration No. : FH-08062023
Page 1 of 1 Pages

Measurement Item: Relative humidity with data logger
Manufacturer: Novalyne
Model/Type: 110-WS-25DL-0
Serial Number: A5980
ID No.: RYG_F50649
Customer: ALS laboratory group (Thailand) Co., Ltd.
104 Phatthanakan Rd, 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:
Unit Under Calibration (UUC) was calibrated by comparison method with standard chilled mirror hygrometer model: 18A0-3 in the humidity generator chamber to determine the errors.

Traceability:
This instrument was calibrated using standard equipment whose accuracy is traceability through National Institute of Standards and Technology to the international system of units (SI) via MCS Calibration, Inc. Certificate number: 20926-001. Due date: Sep 26, 2024.

Measurement Date: Jun 20, 2023
Issued Date: Jun 22, 2023

Measurement Results:
This equipment was connected with indoor air quality probe and Displayed (RPH) on display. Model: HMP60, Serial number: V1920214.

Calibration was performed in the range of 20%RH to 80%RH.

The results of calibration are reported in table below.

Determined (RPH)	Standard (RPH)	UUC (RPH)	Error (RPH)	Uncertainty ±1σ (RPH)
20	20.04	19.3	-0.7	0.52
50	50.25	49.5	-0.8	0.52
80	80.33	80.5	0.2	0.52

Performed by:
☒ Mr. Sorawit Thachalad
☒ Miss Jiraporn Lertsoonthol
☒ Miss Puangwut Phoomthit



Approved Signatory:
Mr. Parinya Booncharoen
Calibration Department Manager

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



JIRANATEE ASSOCIATES CO., LTD.

Jiranatee Associates Co., Ltd.
63/14-15, 67/35-36,
Petchkasem 7/71, Soi Petchkasem, Bangkok,
Bangkok 10600 (Thailand)
Tel: +66(0)2-8680812
Mobile: +66(0)2-8680813
E-mail: nsc-calibration@jiranatee.com
Web site: www.jiranatee.com

Accredited calibration laboratory
ISO/IEC 17025:2017
NSC-TSI-TIS 17025
CALIBRATION 0367

Pressure measurement laboratory
Calibration services department



CERTIFICATE OF CALIBRATION

Certificate No. : CP-009-66

Page 1 of 2 Pages

MEASUREMENT ITEM: Digital barometer
MANUFACTURER: Novalyne
MODEL/TYPE: Sensor: 110-WS-25DP
Data logger: 110-WS-25DL-0
SERIAL NUMBER: Sensor: BP-A5980
Data logger: A5980
ID NUMBER: RYG_F50649
CONDITION AS-RECEIVED: New item.
CUSTOMER: ALS laboratory group (Thailand) Co., Ltd.
104 Phatthanakan Rd, Phatthanakan Rd,
Khwaeng Suan Luang, Khet Suan Luang,
Bangkok 10250 Thailand

RECEIVED DATE: 16 Jun 2023
MEASUREMENT DATE: 20 Jun 2023
ISSUE DATE: 20 Jun 2023

Calibration procedure:
The pressure calibration was done by in-house calibration method as W-CL-003 according to consensus method with digital pressure calibrator based on OGD-R 6.1.

Traceability:
The measurement results are traceable to the international system of units (SI) through the NMAT (National Metrology Institute of Thailand) via Certificate number: MP-0205-22

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

CONDITION OF THIS RESULT OF CALIBRATION:

1. Reference Standard instrument

Instrument	Model	Serial No.	Certificate No.	Due Date
Absolute Pressure Transducer	CPQ2500	41001268	MP-0205-22	02 Dec 2023

2. The UUC was installed in vertical orientation above reference standard instrument and center of UUC was used as the reference level.

3. Calibration conditions:

4. Condition: ☒ Normal ☐ Abnormal
Pressure transmitting medium: Air
At (20°C, 1 bar): 1.18 kg/m³
Humidity: (55±15) %
Temp: (23±3) °C
Press: (1010±10) mbar

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

Calibrated by:
☒ Mr. Sorawit Thachalad
☒ Miss Jiraporn Lertsoonthol



Approved Signatory:
Mr. Parinya Booncharoen
Calibration Department Manager

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



JIRANATEE ASSOCIATES CO., LTD.

Jiranatee Associates Co., Ltd.
63/14-15, 67/35-36,
Petchkasem 7/71, Soi Petchkasem, Bangkok,
Bangkok 10600 (Thailand)
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E-mail: nsc-calibration@jiranatee.com
Web site: www.jiranatee.com

Accredited calibration laboratory
ISO/IEC 17025:2017
NSC-TSI-TIS 17025
CALIBRATION 0367

Pressure measurement laboratory
Calibration services department



CERTIFICATE OF CALIBRATION

Certificate No. : CP-009-66

Page 2 of 2 Pages

MEASUREMENT RESULTS: ☒ Without adjustment ☐ With adjustment
CALIBRATION IN THE RANGE OF: 950 mbar to 1050 mbar

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

STD (mbar)	UUC* (mbar)	Error (mbar)	Uncertainty (k=2) (mbar)
950.33	950.8	0.6	0.84
970.04	970.4	0.4	0.60
989.10	989.8	0.7	0.46
1010.08	1010.1	0.0	0.37
1030.10	1029.8	-0.3	0.50
1050.08	1049.5	-0.6	0.73

Note: UUC* Unit Under Calibration
*To convert the result in report unit to Pa should be multiply by 100

*End of certificate



JIRANATEE ASSOCIATES CO., LTD.

Jiranatee Associates Co., Ltd.
63/14-15, 67/35-36,
Petchkasem 7/71, Soi Petchkasem, Bangkok,
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Tel: +66(0)2-8680812
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E-mail: nsc-calibration@jiranatee.com
Web site: www.jiranatee.com

Accredited calibration laboratory
ISO/IEC 17025:2017
NSC-TSI-TIS 17025
CALIBRATION 0367

An agreed measurement laboratory
Calibration services department

CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM: Cup anemometer
MANUFACTURER: Novalyne
MODEL/TYPE: Sensor: WS-02FA
Data logger: 110-WS-25DL-0
SERIAL NUMBER: Sensor: W50-A5078
Data logger: A5078
ID NUMBER: RYG_F50648
CONDITION AS-RECEIVED: New item.
CUSTOMER: ALS laboratory group (Thailand) Co., Ltd.
104 Phatthanakan Rd, Phatthanakan Rd, Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand

RECEIVED DATE: 16 Jun 2023
MEASUREMENT DATE: 20 Jun 2023
ISSUE DATE: 20 Jun 2023

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:
Temperature: (23.0 ± 3.0) °C
Relative Humidity: (55.0 ± 15.0) %RH
Atmospheric Pressure: (1010 ± 10) mbar

PLACE OF CALIBRATION: 110-type wind tunnel at Jiranatee Associates Co., Ltd.

CALIBRATION CONDITIONS:
Wind tunnel cross-section area: 500 cm²
Win direction frontal area: 100 cm²
Diameter of measuring pipe: 10 mm
Blockage Ratio of test object: 0.113 (-)

Preconditioning: 24 hours at ambient conditions
Measurement Condition: The average values during measurement are (24.2) °C, (44.1) %RH and (1033.8) mbar

TABULATION OF RESULTS:
The table on next page give the tabulated values

Calibrated by:
☒ Mr. Sorawit Thachalad
☒ Miss Jiraporn Lertsoonthol



Approved Signatory:
Mr. Parinya Booncharoen
Calibration Department Manager

Notes:
1. Facility: cross-section area of the wind tunnel.
2. Projected cross-section area of the tested object include mounting pipe.
3. Diameter of measuring pipe.
4. Ratio: A_o/A_t

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

Certificate Number

CD-014-66

Page 2 of 2 Pages

MEASUREMENT RESULTS¹

The cup anemometer, Unit Under Calibration (UUC) was exercised at 10 m/s for 5 minutes prior to calibration being performed. The standard air velocity 0.5 m/s to 5 m/s was calculated by a standard air velocity transducer and above 5 m/s to 30 m/s was calculated by a pitot tube with precision differential pressure meter which was installed 40 mm and 300 mm respectively away from wind tunnel nozzle. UUC was installed in center of the test section. The calibration was carried out under both rising and falling air velocity in the range of 1 m/s to 16 m/s at calibration interval of 1 m/s. The results of calibration and associated measurement uncertainties are reported in the table below.

V_{ref} (m/s)	Temp. wind tunnel (°C)	Temp. room (°C)	V_{UUC} (m/s)	Error (m/s)	U (k=2) (m/s)
1.023	24.20	24.15	0.9	-0.1	0.31
2.026	24.02	24.15	1.9	-0.1	0.31
3.003	24.34	24.15	3.0	0.0	0.31
4.112	24.02	24.15	4.0	-0.1	0.31
5.03	24.28	24.15	5.0	0.0	0.31
5.99	24.12	24.15	6.0	0.0	0.31
7.05	24.22	24.15	7.1	0.0	0.31
8.16	24.20	24.15	8.0	-0.1	0.31
9.09	24.20	24.15	9.0	-0.1	0.31
10.08	24.14	24.15	10.0	-0.1	0.31
11.14	24.18	24.15	11.1	-0.1	0.31
12.15	24.18	24.15	12.2	0.1	0.31
13.15	24.18	24.15	13.2	0.0	0.31
14.24	24.14	24.15	14.0	-0.1	0.31
15.23	24.10	24.15	15.1	-0.1	0.31
16.29	24.10	24.15	16.3	0.0	0.31

Remarks:

¹ Calibration results only count for the tested circumstances and environmental conditions during which calibration took place

² Velocity of standard

³ Velocity of Unit Under Calibration

PHOTO OF CALIBRATION SET-UP



Calibration set-up of the cup anemometer calibration in the wind tunnel of Jiranatee Associates Co., Ltd. The cup anemometer shown may differ from the calibrated one. Remark: The proportion of the set-up is not true to scale due to imaging distortion.



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NSG-TS-75 17025
CALIBRATION 0367

Air speed measurement laboratory
Calibration services department

Certificate Number

CD-014-66

CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM

MANUFACTURER

MODEL/TYPE

SERIAL NUMBER

ID NUMBER

CONDITION AS-RECEIVED

CUSTOMER

RECEIVED DATE

MEASUREMENT DATE

ISSUE DATE

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

Temperature : 23.0 ± 3.0 °C
Relative Humidity : 55.0 ± 15.0 %RH
Atmospheric Pressure : 1010 ± 10 hPa

PLACE OF CALIBRATION

Effel type wind tunnel of Jiranatee Associates Co., Ltd.

CALIBRATION CONDITION

Wind tunnel cross-section area¹ : 800 cm²
Win direction frontal area² : 129 cm²
Diameter of mounting pipe³ : mm
Blockage ratio of test object⁴ : 0.143 (-)

Preconditioning

Measurement Condition

24 hours at ambient conditions.
The average values during measurement are (24.3°C, (48.2) %RH and (1009.3) hPa

TABULATION OF RESULTS:

The table on next page give the measured values

Calibrated by:

☐ Mr. Serawit Thachaid
☐ Miss Jittaporn Lertkomphol



Approved signatory:

Mr. Pinye Booncharoen
Calibration Department Manager

Remarks:

¹ Actual cross-section area of the wind tunnel

² Projected cross-section area of the tested object including mounting pipe

³ Diameter of mounting pipe

⁴ Ratio A_0/A

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Certificate Number

CD-014-66

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MEASUREMENT RESULTS¹

The wind direction sensor was calibrated against standard rotary encoder by comparison method. During calibration, the measurement was carried out at 45 intervals in clockwise and counterclockwise directions after offset adjustment has been made. The flow speed of wind tunnel (usually 3 m/s) is kept constant while the sensor is rotated around its vertical axis. The results of calibration and associated measurement uncertainties are reported in the table below.

Air speed m/s	D°_{ref} Degree (°)	D°_{UUC} Degree (°)	Error Degree (°)	U (k=2) Degree (°)
	0.000	0	0	1.0
	45.000	43	-2	1.0
	90.000	88	-2	1.0
	135.000	133	-2	1.0
	180.000	180	0	1.0
	225.000	226	1	1.0
	270.000	272	2	1.0
	315.000	318	3	1.0

Remarks:

¹ Calibration results only count for the tested circumstances and environmental conditions during which calibration took place

² Direction of standard

³ Direction of Unit Under Calibration

End of Certificate of Calibration



63/14-15, 67/35-36, Soi Petchburi 7/71, Petchburi Rd.
Wathana, Bangkok, Bangkok 10600 Thailand.
Tel: (66) 02-8680812 Fax: (66) 02-8680800 www.jiranatee.com



CERTIFICATE OF CALIBRATION

Certificate No. : CT-024-66
Page 1 of 2

Equipment Name: Data Logger with Temperature sensor

Manufacturer: Navajyo

Model: 110-WS-250L-D

Serial No.: A5978

ID No.: RYG_F50648

Customer

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

Address: 104 Phatthanasak 40, Phatthanasak Rd.,

Khwaeng Suan Luang, Khet Suan Luang, Bangkok

10250 Thailand.

Received date: 16 Jun 2023

Calibration date: 20 Jun 2023

Issue date: 22 Jun 2023

Reference Used During Calibration

1. Standard Temperature Probe Model: STS-100 A500.

Serial No.: 687682-09, Due date: 28 Mar 2024

2. Digital Temperature Indicator Model: DTI 1000-A MR

II, Serial No.: 671407-00591 Due date: 22 July 2023

Calibration Condition

Temperature: (23±3) °C

Relative Humidity: (55±15)%

Calibration Procedure

The temperature calibration was done by in-house calibration method as WI-CL001 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 Thailand (NIMT) Certificate number: TT-0038-23, Certificate number: ER-0052-22

Notes: The certificate is valid only to the item calibrated on date and place of calibration

Calibrated by:

☐ Mr. Serawit Thachaid
☒ Miss Jittaporn Lertkomphol
☐ Miss Ruangsuda Phoomvith



Approved Signatory:

Mr. Pinye Booncharoen
Calibration Department Manager

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Certificate No.: CP-024-66
Page 2 of 2

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

Function:
This equipment was connected with temperature sensor Model: HMP50 5/7i V1920213.
Dimension : Diameter 12 mm. Length 80 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
70	20.057	20.0	-0.1	0.099
70	25.052	24.9	-0.2	0.099
70	30.045	29.8	-0.2	0.14
70	35.039	34.8	-0.2	0.099
70	40.034	39.7	-0.3	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 ★



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CERTIFICATE OF CALIBRATION

Calibration No.: PH-07062023
Page 1 of 1 Pages

Measurement Item: Relative humidity with data logger
Manufacturer: Novelyne
Model/Type: 110 WS-26DL-D
Serial Number: A5978
ID No: RYG P50648
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 (25±0.1)°C, and relative humidity of (50±1.5)%.

Measurement Method:
Unit Under Calibration (UUC) was calibrated by comparison method with standard chilled mirror hygrometer model: 1860-3 in the humidity generator chamber to determine the errors.

Traceability:
This instrument was calibrated using standard equipment whose accuracy is traceability through National Institute of Standards and Technology to the international system of units (SI) via MCS Calibration, Inc. Certificate number 20926-001. Due date: Sep 26, 2024.

Measurement Date: Jun 20, 2023
Issued Date: Jun 22, 2023

Measurement Result:
The equipment was connected with indoor air quality probe and Displayed (RH) on display. Model: HMP50, Serial number: V1920213
Calibration was performed in the range of 20%RH to 80%RH
The results of calibration are reported in table below.

Determined (RH%)	Standard (RH%)	UUC reading (RH%)	Error (RH%)	Uncertainty 2(RH%)
20	20.07	20.7	0.6	0.52
50	50.23	49.1	-1.1	0.61
80	80.30	79.1	-1.2	0.51

Performed by:
☐ Mr. Sorwitt Thachalee
☒ Miss Jiraporn Leisakomol
☐ Miss Ruengrumpal Phoomsil



Approved Signature:
Mr. Parinya Booncharoen
Calibration Department Manager

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Accredited calibration laboratory
ISO/IEC 17025:2017
NSC-TIS-TIS 17025
CALIBRATION 0367



NSC - TIS - TIS 17025
CALIBRATION 0367

Pressure measurement laboratory
Calibration services department

CERTIFICATE OF CALIBRATION

Certificate No.: CP-008-66

Page 1 of 2 Pages

MEASUREMENT ITEM: Digital barometer
MANUFACTURER: Novelyne
MODEL/TYPE: Sensor: 110 WS-25BP
Data logger: 110 WS-25DL-D
SERIAL NUMBER: Sensor: BP A5978
Data logger: A5978
ID NUMBER: RYG P50648
CONDITION AS-RECEIVED: New item
CUSTOMER: ALS laboratory group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd,
Khwaeng Suan Luang, Khet Suan Luang,
Bangkok 10250 Thailand.

RECEIVED DATE: 16 Jun 2023
MEASUREMENT DATE: 20 Jun 2023
ISSUE DATE: 20 Jun 2023

CONDITION OF THIS RESULT OF CALIBRATION:

- Reference Standard Instrument:
- The UUC* was installed in vertical orientation above reference standard instrument and center of UUC* was used as the reference level.
- Calibration conditions:
- Condition: ☒ Normal ☐ Abnormal
Pressure transmitting medium: Air
At (20°C, 1 bar): 1.59 kg/m³
P_{amb}: (155±1) %
T_{amb}: (22.8±0.1) °C
P_{unc}: (10.0±0.1) mbar
- The certificate is valid only to the item calibrated on date and place of calibration

Calibration procedure:
The pressure calibration was done by in-house calibration method as WI-CL-003 according to comparison method with digital pressure calibrator based on DAQ-6.1

Traceability:
The measurement results are traceable to the international system of units (SI) through the NIMT (National Metrology Institute of Thailand) via Certificate number: MP-0705-22

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

Calibrated by:
☒ Mr. Sorwitt Thachalee
☐ Miss Jiraporn Leisakomol



Approved signature:
Mr. Parinya Booncharoen
Calibration Department Manager

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Pressure measurement laboratory
Calibration services department

CERTIFICATE OF CALIBRATION

Certificate No.: CP-008-66

Page 2 of 2 Pages

MEASUREMENT RESULTS: ☒ Without adjustment ☐ With adjustment
CALIBRATION IN THE RANGE OF: 950 mbar to 1050 mbar

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

STD (mbar)	UUC* (mbar)	Error (mbar)	Uncertainty (k=2) (mbar)
950.11	950.9	0.8	0.97
970.10	970.6	0.5	0.70
990.07	990.3	0.3	0.45
1010.06	1010.0	0.0	0.37
1030.05	1029.8	-0.3	0.49
1040.56	1049.1	0.6	0.96

Note: UUC* Unit Under Calibration
To convert the result in report unit to Pa should be multiply by 100



Approved signature:
Mr. Parinya Booncharoen
Calibration Department Manager



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Accredited calibration laboratory
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MSC-TS-17025
CALIBRATION 0367

Air speed measurement laboratory
Calibration services department

REVIEW BY: *Random P*
APPROVED BY: *tu te*
NEXT CAL DATE: 20/12/24

Certificate Number

CC-013-66

CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM

MANUFACTURER

MODEL/TYPE

SERIAL NUMBER

ID NUMBER

CONDITION AS-RECEIVED

CUSTOMER

RECEIVED DATE

MEASUREMENT DATE

ISSUE DATE

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

Temperature: 23.0 ± 1.0 °C
Relative Humidity: 55.0 ± 15.0 %RH
Atmospheric Pressure: 1010 ± 10 hPa

PLACE OF CALIBRATION

Effel-type wind tunnel of Jirantee Associates Co., Ltd.

CALIBRATION CONDITION

Wind tunnel cross-section area¹ 900 cm²
Wind direction frontal area² 100 cm²
Diameter of mounting pipe³ mm
Blockage ratio of test object⁴ 0.111 [-]

Preconditioning

24 hours at ambient conditions

Measurement Condition

The average values during measurement are (24.4) °C, (45.8) %RH and (1010.2) hPa

TABULATION OF RESULTS:

The table on next page give the measured values

Calibrated by:

① Mr. Sorawit Thachakul
② Miss Intaragarn Urtasakulchai



Approved signature:

Mr. Panyas Booncharoen
Calibration Department Manager

Remark:

¹ Rectangular cross-section area of the wind tunnel
² Rectangular cross-section area of the tested object include mounting pipe
³ Diameter of mounting pipe
⁴ Ratio "a" to "b"

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Certificate Number

CC-013-66

Page 2 of 2 Pages

MEASUREMENT RESULTS¹

The cup anemometer, Unit Under Calibration (UUC) was measure at 10 m/s for 5 minutes prior to calibration being performed. The standard air velocity 0.5 m/s to 5 m/s was calculated by a standard air velocity transducer and above 5 m/s to 30 m/s was calculated by a pitot tube with precision differential pressure meter which was isolated 40 mm and 320 mm respectively away from wind tunnel nozzle. UUC was installed at center of the test section. The calibration was carried out under both rising and falling air velocity in the range of 1 m/s to 16 m/s at calibration interval of 1 m/s. The results of calibration and associated measurement uncertainties are reported in the table below.

V _{ref} [m/s]	Temp. wind tunnel [°C]	Temp. room [°C]	V _{uuc} [m/s]	Error [m/s]	U (k=2) [m/s]
1.024	24.50	24.35	0.9	-0.1	0.31
2.026	24.28	24.35	1.9	-0.1	0.31
3.007	24.40	24.35	3.0	0.0	0.31
4.123	24.36	24.35	4.0	-0.1	0.31
5.02	24.06	24.35	5.0	0.0	0.31
6.01	24.18	24.35	6.0	0.0	0.31
7.06	24.08	24.35	7.0	0.0	0.31
8.16	24.10	24.35	8.2	0.0	0.31
9.15	24.00	24.35	9.1	0.0	0.31
10.08	24.00	24.35	10.1	0.0	0.31
11.13	23.92	24.35	11.2	0.0	0.31
12.13	24.10	24.35	12.1	0.0	0.31
13.19	23.90	24.35	13.2	0.0	0.31
14.28	24.00	24.35	14.3	0.0	0.31
15.33	23.90	24.35	15.3	0.0	0.31
16.30	23.88	24.35	16.3	0.0	0.32

Remark:

¹ Calibration results only count for the tested circumstances and environmental conditions during which calibration took place² Velocity of standard³ Velocity of Unit Under Calibration

PHOTO OF CALIBRATION SET-UP



Calibration set-up of the cup anemometer calibration in the wind tunnel of Jirantee Associates Co., Ltd. The cup anemometer shown may differ from the calibrated one. Remark: The proportion of the set-up is not true to scale due to copyright protection.



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CALIBRATION 0367

Air speed measurement laboratory
Calibration services department

Certificate Number

CD-013-66

CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM

MANUFACTURER

MODEL/TYPE

SERIAL NUMBER

ID NUMBER

CONDITION AS-RECEIVED

CUSTOMER

RECEIVED DATE

MEASUREMENT DATE

ISSUE DATE

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

Temperature: 23.0 ± 1.0 °C
Relative Humidity: 55.0 ± 15.0 %RH
Atmospheric Pressure: 1010 ± 10 hPa

PLACE OF CALIBRATION

Effel-type wind tunnel of Jirantee Associates Co., Ltd.

CALIBRATION CONDITION

Wind tunnel cross-section area¹ 900 cm²
Wind direction frontal area² 129 cm²
Diameter of mounting pipe³ mm
Blockage ratio of test object⁴ 0.143 [-]

Preconditioning

24 hours at ambient conditions

Measurement Condition

The average values during measurement are (24.1) °C, (50.0) %RH and (1007.9) hPa

TABULATION OF RESULTS:

The table on next page give the measured values

Calibrated by:

① Mr. Sorawit Thachakul
② Miss Intaragarn Urtasakulchai



Approved signature:

Mr. Panyas Booncharoen
Calibration Department Manager

Remark:

¹ Rectangular cross-section area of the wind tunnel
² Rectangular cross-section area of the tested object include mounting pipe
³ Diameter of mounting pipe
⁴ Ratio "a" to "b"

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Certificate Number

CD-013-66

Page 2 of 2 Pages

MEASUREMENT RESULTS¹

The wind direction sensor was calibrated against standard rotary encoder by comparison method. During calibration, the measurement was carried out at 45° intervals in clockwise and counter-clockwise directions after offset adjustment has been made. The flow speed of wind tunnel (usually 5 m/s) is kept constant while the sensor is rotated around its vertical axis. The results of calibration and associated measurement uncertainties are reported in the table below.

Air speed m/s	D _{ref} Degree (°)	D _{uuc} Degree (°)	Error Degree (°)	U (k=2) Degree (°)
5.00	0.000	0	0	1.0
	45.000	43	-1	1.0
	90.000	87	-1	1.0
	135.000	132	-1	1.0
	180.000	180	0	1.0
	225.000	227	-1	1.0
	270.000	273	3	1.0
	315.000	318	3	1.0

Remark:

¹ Calibration results only count for the tested circumstances and environmental conditions during which calibration took place² Direction of standard³ Direction of Unit Under Calibration

End of Certificate of Calibration





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CERTIFICATE OF CALIBRATION

Certificate No.: CT-023-66
Page 1 of 2

Equipment Name: Data Logger with Temperature sensor
Manufacturer: Novajym
Model: 110-WS-25DL-D
Serial No.: A5977
ID No.: RYG_F50647

Customer
Name: ALS laboratory group (Thailand) Co., Ltd.
Address: 104 Phatthanasak 40, Phatthanasak Rd.,
Khwang Suan Luang, Khet Suan Luang, Bangkok
10750 Thailand.

Received date: 16 Jun 2023
Calibration date: 20 Jun 2023
Issue date: 22 Jun 2023

Reference Used During Calibration
1. Standard Temperature Probe Model: STS-100 A500.
Serial No.: 667682-09, Due date: 28 Mar 2024
2. Digital Temperature Indicator Model: DTI-1000-A MI
II. Serial No.: 671407-00591 Due date: 22 July 2023

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 Thailand (NIMT) Certificate
number TT-0036-23, Certificate number: ER-0092-
22

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

Calibrated by
☐ Mr. Sorawit Thachalad
☒ Miss Jitraporn Lertsomphol
☐ Miss Ruangrui Poommit



Approved Signatory:
Mr. Panyee Booncharoen
Calibration Department Manager

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Certificate No.: CT-023-66
Page 2 of 2

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

Function:

This equipment was connected with temperature sensor Model: HMP60 S/N: V1920212.

Dimension : Diameter 12 mm. Length 80 mm.

Immersion Depth (mm)	Standard Reading (°C)	Reading (°C)	Error (°C)	Uncertainty (°C)
70	20.057	20.0	0.1	0.099
70	25.052	25.0	0.1	0.099
70	30.045	29.9	-0.2	0.14
70	35.039	34.8	-0.2	0.099
70	40.034	39.7	-0.3	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 ★



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CERTIFICATE OF CALIBRATION

Calibration No.: RI-06062023
Page 1 of 1 Pages

Measurement Item: Relative humidity with data logger
Manufacturer: Novajym
Model/Type: 110-WS-25DL-D
Serial Number: A5977
ID No.: RYG_F50647
Customer: ALS laboratory group (Thailand) Co., Ltd.
104 Phatthanasak 40, Phatthanasak Rd., Khwaeng Suan Luang, Khet Suan Luang, Bangkok
10750 Thailand.

Environmental Condition:

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

Measurement Method:

Unit Under Calibration (UUC) was calibrated by comparison method with standard chilled mirror hygrometer model: 1850-3 in the humidity generator chamber to determine the errors.

Traceability:

This instrument was calibrated using standard equipment whose accuracy is traceability through National Institute of Standards and Technology to the international system of units (SI) via MCS Calibration, Inc. Certificate number: 20920-601, Due date: Sep-26, 2024.

Measurement Date: Jun 20, 2023
Issued Date: Jun 22, 2023

Measurement Results:

This equipment was connected with indoor air quality probe and displayed RH% on display. Model: HMP60, Serial number: V1920212.

Calibration was performed in the range of 20%RH to 80%RH

The results of calibration are reported in table below.

Determined (%RH)	Standard (%RH)	UUC Reading (%RH)	Error (%RH)	Uncertainty (%RH)
20	20.07	20.5	0.4	0.52
50	50.22	49.1	-1.1	0.81
80	80.28	79.2	-1.1	0.81

Performed by
☐ Mr. Sorawit Thachalad
☒ Miss Jitraporn Lertsomphol
☐ Miss Ruangrui Poommit



Approved Signatory:
Mr. Panyee Booncharoen
Calibration Department Manager

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CALIBRATION 0367

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Calibration services department



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CERTIFICATE OF CALIBRATION

Certificate No.: CP-007-60

Page 1 of 2 Pages

MEASUREMENT ITEM:
MANUFACTURER:
MODEL/TYPE:

Digital barometer
Novajym
Sensor: 110-WS-25SP
Data logger: 110-WS-25DL-D

SERIAL NUMBER

Sensor: BP-A5977

ID NUMBER

Data logger: A5977

CONDITION AS RECEIVED

RYG_F50647

CUSTOMER

Novajym
ALS laboratory group (Thailand) Co., Ltd.
104 Phatthanasak 40, Phatthanasak Rd.,
Khwang Suan Luang, Khet Suan Luang,
Bangkok 10750 Thailand.

RECEIVED DATE

16 Jun 2023

MEASUREMENT DATE

20 Jun 2023

ISSUE DATE

20 Jun 2023

CONDITION OF THIS RESULT OF CALIBRATION:

1. Reference Standard Instrument

Instrument: Absolute Pressure Transducer

Model: CPC2500

Serial No.: 41001266

Certificate No.: MP-0305-13

Due Date: 02 Dec 2023

2. Calibration efforts for calibration sequence C

3. Calibration conditions

4. Condition: ☒ Normal ☐ Abnormal

Pressure transmitting medium: Air

Pressure: (100±1) bar

Temperature: (23±3) °C

Humidity: (55±15) %

Power: (110±15) VAC

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

Calibration procedure:
The pressure calibration was done by in-
house calibration method as WI-CL-003
according to comparison method with Digital
pressure calibrator based on OMB-10-1

Traceability:
The measurement results are traceable to
the international system of units (SI) through
the NIMT (National Metrology Institute of
Thailand) via Certificate number MP-0305-13

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

Calibrated by
☒ Mr. Sorawit Thachalad
☐ Miss Jitraporn Lertsomphol



Approved Signatory:
Mr. Panyee Booncharoen
Calibration Department Manager

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



IRANATEE ASSOCIATES CO., LTD.

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Accredited calibration laboratory
ISO/IEC 17025:2017
NSC-TIS-TIS 17025
CALIBRATION 0367

Pressure measurement laboratory
Calibration services department



NSC-TIS-TIS 17025
CALIBRATION 0367

CERTIFICATE OF CALIBRATION

Certificate No.: CP-007-66

Page 2 of 2 Pages

MEASUREMENT RESULTS

Without adjustment ☒ With adjustment ☐

CALIBRATION IN THE RANGE OF : 950 mbar to 1050 mbar

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

STD (mbar)	UUC* (mbar)	Error (mbar)	Uncertainty (k=2) (mbar)
950.12	950.8	0.6	0.83
970.09	970.7	0.6	0.76
990.07	990.4	0.4	0.56
1010.07	1010.2	0.1	0.41
1030.19	1030.0	-0.1	0.39
1050.06	1049.8	-0.2	0.51

Note: UUC* Unit Under Calibration

To convert the result in report unit to Pa should be multiply by 100.

*End of certificate



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CALIBRATION 0367

Air speed measurement laboratory
Calibration services department

VIEWED BY: *Phanbun P*
APPROVED BY: *Phanbun P*
NEXT CAL DATE: 20/12/24

Certificate Number

CC-016-66

CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM

MANUFACTURER

MODEL/TYPE

SERIAL NUMBER

ID NUMBER

CONDITION AS-RECEIVED

CUSTOMER

Cup anemometer

Novallys

Sensor: WS-02FA

Data logger: 11D-WS-250L-D

Sensor: WSD-A5988

Data logger: A5988

RYG_750650

New item

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

RECEIVED DATE

18 Jun 2023

MEASUREMENT DATE

20 Jun 2023

ISSUE DATE

20 Jun 2023

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

Temperature: 23.0 ± 3.0 °C

Relative Humidity: 55.0 ± 15.0 %RH

Atmospheric Pressure: 1050 ± 10 hPa

PLACE OF CALIBRATION

Effel-type wind tunnel of Iranatee Associates Co., Ltd.

CALIBRATION CONDITIONS

Wind tunnel cross-section area¹ 900 cm²

Win direction frontal area² 100 cm²

Diameter of mounting pipe³ 10 mm

Blockage ratio of test object⁴ 0.113 [-]

Preconditioning

24 hours at ambient conditions

Measurement Condition

The average values during measurement are (24.3) °C, (44.7) %RH and (1009.5) hPa

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

Mr. Sorawit Thachulad

Mr. Jiraporn Lertsomphol



Approved signatory

Mr. Parinya Booncharoen
Calibration Department Manager

Remarks:

¹ Nozzle cross-section area of the wind tunnel

² Projected cross-section area of the tested object include mounting pipe

³ Diameter of mounting pipe

⁴ Ratio $\frac{A_o}{A_n}$

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

Certificate Number

CC-016-66

Page 2 of 2 Pages

MEASUREMENT RESULTS¹

The cup anemometer, Unit Under Calibration (UUC) was arrived at 10 m/s for 5 minutes prior to calibration being performed. The standard air velocity 0.5 m/s to 5 m/s was calculated by a standard air velocity transducer and above 5 m/s (in 30 m/s) was calculated by a pitot tube with precision differential pressure meter which was installed 40 mm and 300 mm respectively away from wind tunnel nozzle. UUC was installed at center of the test section. The calibration was carried out under both rising and falling air velocity in the range of 1 m/s to 16 m/s in calibration interval of 1 m/s. The results of calibration and associated measurement uncertainties are reported in the table below.

V _{std} (m/s)	Temp. wind tunnel (°C)	Temp. room (°C)	V _{uuc} (m/s)	Error (m/s)	U (k=2) (m/s)
0.025	24.16	24.30	0.9	-0.1	0.31
0.028	24.00	24.30	1.9	-0.1	0.31
0.011	24.08	24.30	2.9	-0.1	0.31
4.121	24.18	24.30	4.0	-0.1	0.31
5.02	24.00	24.30	4.9	-0.1	0.31
5.99	24.28	24.30	5.9	-0.1	0.31
7.04	23.90	24.30	7.0	0.1	0.31
8.18	24.12	24.30	8.0	-0.2	0.31
9.09	23.90	24.30	9.0	-0.1	0.31
10.09	24.02	24.30	10.0	-0.1	0.31
11.14	23.86	24.30	11.0	-0.2	0.31
12.15	23.90	24.30	12.0	-0.1	0.31
13.19	23.80	24.30	13.0	-0.2	0.31
14.26	23.88	24.30	14.3	-0.2	0.31
15.23	23.90	24.30	15.0	-0.2	0.31
16.31	23.80	24.30	16.1	-0.2	0.31

Remarks:

¹ Calibration results only count for the tested circumstances and environmental conditions during which calibration took place

² Velocity of standard

³ Velocity of Unit Under Calibration

PHOTO OF CALIBRATION SET-UP



Calibration set-up of the cup anemometer calibration in the wind tunnel of Iranatee Associates Co., Ltd. The cup anemometer shown may differ from the calibrated one. Remarks: The proportion of the set-up is not true to scale for better appearance.

*End of Certificate of Calibration



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ISO/IEC 17025:2017
NSC-TIS-TIS 17025
CALIBRATION 0367

Air speed measurement laboratory
Calibration services department

Certificate Number

CC-016-66

CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM

MANUFACTURER

MODEL/TYPE

SERIAL NUMBER

ID NUMBER

CONDITION AS-RECEIVED

CUSTOMER

Wind Direction Sensor

Howeysen

Sensor: WS-02FA

Data logger: 11D-WS-250L-D

Sensor: WSD-A5988

Data logger: A5988

RYG_750650

New item

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

RECEIVED DATE

16 Jun 2023

MEASUREMENT DATE

20 Jun 2023

ISSUE DATE

20 Jun 2023

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

Temperature: 23.0 ± 3.0 °C

Relative Humidity: 55.0 ± 15.0 %RH

Atmospheric Pressure: 1050 ± 10 hPa

PLACE OF CALIBRATION

Effel-type wind tunnel of Iranatee Associates Co., Ltd.

CALIBRATION CONDITION

Wind tunnel cross-section area¹ 900 cm²

Win direction frontal area² 128 cm²

Diameter of mounting pipe³ 10 mm

Blockage ratio of test object⁴ 0.143 [-]

Preconditioning

24 hours at ambient conditions

Measurement Condition

The average values during measurement are (24.3) °C, (51.8) %RH and (1008.5) hPa

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

Mr. Sorawit Thachulad

Mr. Jiraporn Lertsomphol



Approved signatory

Mr. Parinya Booncharoen
Calibration Department Manager

Remarks:

¹ Nozzle cross-section area of the wind tunnel

² Projected cross-section area of the tested object include mounting pipe

³ Diameter of mounting pipe

⁴ Ratio $\frac{A_o}{A_n}$

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Certificate Number

CD-016-86

Page 2 of 2 Pages

MEASUREMENT RESULTS¹

The wind direction sensor was calibrated against standard rotary encoder by comparison method. During calibration, the measurement was carried out at 45 intervals in clockwise and counter-clockwise directions after effort adjustment has been made. The flow speed of wind tunnel (usually 5 m/s) is kept constant while the sensor is rotated around its vertical axis. The results of calibration and associated measurement uncertainties are reported in the table below.

Air speed m/s	D ₁₀₀ Degree (°)	D ₁₀₀ Degree (°)	Error Degree (°)	U (k=2) Degree (°)
	0.000	0	0	1.0
	45.000	42	-3	3.6
	90.000	87	-3	3.0
1.00	135.000	132	-3	1.0
	180.000	179	-1	1.0
	225.000	227	2	1.0
	270.000	271	1	1.0
	315.000	318	3	1.0

Remarks:

¹ Calibration results only count for the tested circumstances and environmental conditions during which calibration took place.

² Deviation of standard

³ Deviation of Unit Under Calibration

End of Certificate of Calibration



63/14-15,67/35-36, Soi Peichkasem 7/71, Peichkasem Rd,
Walthapa, Bangkokkya, Bangkok 10600 Thailand.
Tel: (66) 02-8680812#13 Fax: (66) 02-8680860 www.jiranatee.com



CERTIFICATE OF CALIBRATION

Certificate No.: CT-026-86
Page 1 of 2

Equipment Name: Data Logger with Temperature sensor
Manufacturer: Novatix
Model: 110-WS-25DL-D
Serial No.: A5098
ID No.: RVG_FS0550

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

Received date: 16 Jun 2023
Calibration date: 20 Jun 2023
Issue date: 22 Jun 2023

Reference Used During Calibration
1. Standard Temperature Probe Model: STS-100 A500.
Serial No.: 667982-09. Due date: 28 Mar 2024
2. Digital Temperature Indicator Model: DTI-1000 A MK
II. Serial No.: 671407-00591 Due date: 22 July 2023

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 Thailand (NIMT) Certificate number: IT-0038-23. Certificate number: EH-0092-22

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

Calibrated by
☐ Mr. Soravit Thachalad
☒ Miss Jitraporn Lertsomphol
☐ Miss Ruangsakul Phoomnil



Approved Signatory:
Mr. Panya Booncharoen
Calibration Department Manager

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Certificate No.: CT-026-86
Page 2 of 2

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

Function:

This equipment was connected with temperature sensor Model: HMP60 S/N: V1920215.

Dimension : Diameter 12 mm. Length 80 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
70	20.058	20.0	-0.1	0.099
70	25.053	24.9	-0.2	0.099
70	30.044	29.8	-0.2	0.099
70	35.039	34.6	-0.2	0.099
70	40.034	39.7	-0.3	0.099

UUC*: Unit Under Calibration

This 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 *



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CERTIFICATE OF CALIBRATION

Calibration No.: BH 00062023
Page 1 of 1 Pages

Measurement Item: Relative humidity with data logger
Manufacturer: Novatix
Model/Type: 110-WS-25DL-D
Serial Number: A5098
ID No: RVG_FS0550
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 (25±3)°C and relative humidity of (50±15)%.

Measurement Method:
Unit Under Calibration (UUC) was calibrated by comparison method with standard chilled mirror hygrometer model: 1860-3 in the humidity generator chamber to determine the errors.

Traceability
This instrument was calibrated using standard equipment whose accuracy is traceability through National Institute of Standards and Technology to the international system of units (SI) via NIST Calibration, Inc. Certificate number: 20926-001. Due date: Sep 26, 2024.

Measurement Date: Jun 20, 2023
Issue Date: Jun 22, 2023

Measurement Results:
This equipment was connected with indoor air quality probe and Displayed (RH) on display. Model: HMP60. Serial number: V1920215.
Calibration was performed in the range of 20%RH to 80%RH.

The results of calibration are reported in table below.

Determined (%RH)	Standard (%RH)	UUC (%RH)	Error (%RH)	Uncertainty (%RH)
20	20.03	19.2	-0.9	0.52
50	50.24	49.5	-0.8	0.52
80	80.35	80.5	0.2	0.52

Performed by
☐ Mr. Soravit Thachalad
☒ Miss Jitraporn Lertsomphol
☐ Miss Ruangsakul Phoomnil



Approved Signatory:
Mr. Panya Booncharoen
Calibration Department Manager

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Pressure measurement laboratory
Calibration services department



NSC-TSI-TIS 17025
CALIBRATION 0367

CERTIFICATE OF CALIBRATION

Certificate No.: CP-010-66

Page 1 of 2 Pages

MEASUREMENT ITEM
MANUFACTURER
MODEL/TYPE

Digital barometer
Navalyn
Sensor: 110 WS-258P
Data logger: 110 WS-258D-D
Sensor: BP-A5588
Data logger: A5588
RYG_F50950
New Item

SERIAL NUMBER

ID NUMBER
CONDITION AS-RECEIVED
CUSTOMER

104 Phatthanakan 40, Phatthanakan Rd,
Khuang Suan Luang, Khet Suan Luang,
Bangkok 10250 Thailand.

RECEIVED DATE
MEASUREMENT DATE
ISSUE DATE

16 Jun 2023
20 Jun 2023
20 Jun 2023

Calibration procedure:

The pressure calibration was done by in-house calibration method as W.C.003 according to comparison method with digital pressure calibrator based on DIX 8.6-3

Traceability:

The measurement results are traceable to the international system of units (SI) through the NIMT (National Metrology Institute of Thailand) via Certificate number: MP-0205-22

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

CONDITION OF THIS RESULT OF CALIBRATION:

1. Reference Standard instrument:

Instrument Model Serial No. Certificate No. Due Date

Absolute Pressure Transducer CPG2500 4100126P MP-0205-22 02 Dec 2023

2. Calibration effort for calibration sequence C

3. The UUC* was installed in vertical orientation above reference standard instrument and center of UUC* was used as the reference level.

3. Calibration conditions:

4. Condition

☒ Normal ☐ Abnormal

Pressure transmitting medium:

Air

γ (20°C, 1 bar)

1.19 kg/m³

μ (mPa)

(55±15) %

T_{ref}

(23±3) °C

P_{ref}

(1010±10) mbar

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



Calibrated by:
☒ Mr. Sorawit Thachakul
☐ Miss Jiraporn Lertsomphol

Approved signature:

Mr. Parinya Booncharoen

Mr. Parinya Booncharoen
Calibration Department Manager

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NSC-TSI-TIS 17025
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Pressure measurement laboratory
Calibration services department



NSC-TSI-TIS 17025
CALIBRATION 0367

CERTIFICATE OF CALIBRATION

Certificate No.: CP-010-66

Page 2 of 2 Pages

MEASUREMENT RESULTS

☒ Without adjustment ☐ With adjustment

CALIBRATION IN THE RANGE OF

950 mbar to 1050 mbar

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

STD (mbar)	UUC* (mbar)	Error (mbar)	Uncertainty (k=2) (mbar)
950.08	950.7	0.7	0.85
970.10	970.5	0.4	0.63
990.05	990.4	0.4	0.57
1010.10	1010.2	0.1	0.40
1030.07	1030.0	0.1	0.38
1050.10	1049.8	0.3	0.52

Note: UUC* Unit Under Calibration

To convert the result in report unit to Pa should be multiply by 100

End of certificate



SITHIPORN SITHIPORN ASSOCIATES CO., LTD.
ASSOCIATES CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No.: ACC23009
Job No.: VC66AC0031
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-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL-BP_04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL-BP_03/0265	09-Feb-23
Digital Multimeter	33461A	MY60024273	EEL-BP_05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KA1	34560495	AA-3005-22	22-Feb-23
Audio Analyzer	AVR-3360A	V744B6069	EF-0010-22	07-Feb-23

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).

SITHIPORN ASSOCIATES CO., LTD. CALIBRATION LABORATORY

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



Cert. No.: ACC23009
Pages: 1 of 3

Calibration Certificate

Equipment: SOUND CALIBRATOR
Manufacturer: RION
Model: NC-74
Serial No.: 34178121
ID No.: RYG_FS0213

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: 24 JANUARY 2023
Calibration Date: 26 JANUARY 2023
Date of Issue: 27 JANUARY 2023

Calibrated by: Nathakorn Pirutpasian

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.

QT-TS12-04-04-030664

QT-TS12-04-04-030664

T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACC23009
Job No. : VC66AC0031
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	94.16	0.16	0.14	0.40

2. Frequency

Specified Frequency (Hz)	Measured value (Hz)	Deviated value (%)	Uncertainty (%)	Tolerance limit (%)
1000	1003.2	0.3	0.1	1.0

3. Total distortion

Measured value (%)	Uncertainty (%)	Tolerance limit (%)
1.97	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

QH-TS12-04-04-020664

451-451/1 Srinthorn Rd, Bangbunru, Bangplud Bangkok 10700 THAILAND
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiphorn.com http://www.sithiphorn.comCert. No. : ACL23325
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No. : 01073423 / 169513 / 73684
ID No. : RYG_FSD386

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 : 11 OCTOBER 2023
Calibration Date : 19-20 OCTOBER 2023
Date of Issue : 24 OCTOBER 2023

Calibrated by : Nathakorn Pisutpalaan

Approved by :
(Thanakul Petchum)

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QH-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23325
Job No. : VC67AC0011
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 test 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.	Exp. Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL-BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL-BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL-BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAJ	34560495	AA-3002-23	14-FEB-24

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).

QH-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23325
Job No. : VC67AC0011
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

Note : Pass/Fail evaluation for each parameter, will be considered together from the acceptance limit and the Maximum-permitted uncertainty of measurement.

QH-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23325
Job No. : VC67AC0011
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.98)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
15.4

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	18.8
Flat	24.6

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	0.2	0.2	0.2	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	1.6	1.7	1.6	±5.0

QI-TS12-04-04-020664

P.T.N.

Continuation of Calibration Certificate

Cert. No. : ACL23325
Job No. : VC67AC0011
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	0.0	-0.1	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.0	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

QI-TS12-04-04-020664

P.T.N.

Continuation of Calibration Certificate

Cert. No. : ACL23325
Job No. : VC67AC0011
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	53.9	-0.1	± 1.1
49.0	49.0	0.0	± 1.1
44.0	43.9	-0.1	± 1.1
39.0	38.9	-0.1	± 1.1
34.0	33.9	-0.1	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 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	24.8	-0.2	± 1.1

QI-TS12-04-04-020664

P.T.N.

Continuation of Calibration Certificate

Cert. No. : ACL23325
Job No. : VC67AC0011
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
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 _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
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	±2.0
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

QI-TS12-04-04-020664

P.T.N.

Continuation of Calibration Certificate

Cert. No. : ACL23325
Job No. : VC67AC0011
Pages : 8 of 8

11. Overload indication

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

451-451/1 Sirinthorn Rd., Bangthumru, Bangkok 10700 THAILAND
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACL23078
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No. : 00296515 / 179119 / 87526
ID No. : RYG_FS0432

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 : 24 JANUARY 2023
Calibration Date : 25-26 JANUARY 2023
Date of Issue : 27 JANUARY 2023

Calibrated by : Nuthakorn Pisurpaisan

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. : ACL23078
Job No. : VC66AC0031
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 Aneco 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-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL_BP_03/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL_BP_03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL_BP_05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

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

Continuation of Calibration Certificate

Cert. No. : ACL23078
Job No. : VC66AC0031
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

Continuation of Calibration Certificate

Cert. No. : ACL23078
Job No. : VC66AC0031
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.6

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

Frequency Weighting	Measured value (dB)
A-weight	11.6
C-weight	17.7
Flat	23.4

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	0.0	0.0	0.0	± 1.5
1000	-0.1	-0.1	-0.1	± 1.0
8000	-0.4	-0.3	-0.3	±5.0

QF-TS12-04-04-020664

T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL23078
Job No. : VC66AC0031
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	0.0	±2.0
125	0.0	0.1	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	SIM Display at initial (dB)	SIM 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. : ACL23078
Job No. : VC66AC0031
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	33.9	-0.1	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.0	0.0	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.9	-0.1	± 1.1

QF-TS12-04-04-020664

T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL23078
Job No. : VC66AC0031
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
	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	128.1	0.1	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (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	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

QF-TS12-04-04-020664

T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL23078
Job No. : VC66AC0031
Pages : 8 of 8

11. Overload indication

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

451-451/1 Silinthorn Rd, Bangbunru, Bangplud Bangkok 10700 THAILAND
Tel: 0-2435-8800 Fax: 0-2433-1679 e-mail: cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACL23045
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 00900074 / 188467 / 01736
ID No.: RYG_FS0495

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 : 06 JANUARY 2023
Calibration Date : 13-18 JANUARY 2023
Date of Issue : 19 JANUARY 2023

Calibrated by : Nathakorn Pisulpaisan

Approved by :

T. Petchurai
(Thanakul Petchurai)

This certificate is issued in accordance with the requirements of ISO/JEC 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. : ACL23045
Job No. : VC66AC0024
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-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL_BP_04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL_BP_03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL_BP_05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

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 as :

3.1 National Institute of Metrology (Thailand).

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23045
Job No. : VC66AC0024
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

Continuation of Calibration Certificate

Cert. No. : ACL23045
Job No. : VC66AC0024
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.8

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	16.8
Flat	22.8

3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 64 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	0.1	0.1	0.1	± 1.0
8000	-2.0	-1.9	-1.9	±5.0

QF-TS12-04-04-020664

R. B. L.

Continuation of Calibration Certificate

Cert. No. : ACL23045
Job No. : VC66AC0024
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	-0.1	-0.1	-0.1	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	-0.1	-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

R. B. L.

Continuation of Calibration Certificate

Cert. No. : ACL23045
Job No. : VC66AC0024
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	137.1	0.1	± 1.1
136.0	136.1	0.1	± 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	129.1	0.1	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.1	0.1	± 1.1
114.0	114.1	0.1	± 1.1
109.0	109.1	0.1	± 1.1
104.0	104.1	0.1	± 1.1
99.0	99.1	0.1	± 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	28.9	-0.1	± 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	24.8	-0.2	± 1.1

QF-TS12-04-04-020664

S. D. T.

Continuation of Calibration Certificate

Cert. No. : ACL23045
Job No. : VC66AC0024
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
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 _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.4	0.0	±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

S. D. T.

Continuation of Calibration Certificate

Cert. No. : ACL23045
Job No. : VC66AC0024
Pages : 8 of 8

11. Overload indication

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

12. High level stability

Frequency	SLM Display	SLM Display	Deviated	Acceptance
Weighting	at initial	at final	Value	Limits
	(dB)	(dB)	(dB)	(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

451-451/1 Siinthorn Rd., Bangbunru, Bangkok 10700 THAILAND
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:center@sithiporn.com http://www.sithiporn.comCert. No. : ACL23079
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preampifier NH-24
Serial No. : 00296516 / 180412 / 88182
ID No. : RYG_FS0433

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KHAENG 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 : 24 JANUARY 2023
Calibration Date : 25-26 JANUARY 2023
Date of Issue : 27 JANUARY 2023

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. : ACL23079
Job No. : VC66AC0031
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-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL_BP_04-0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL_BP_03-0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL_BP_05-0265	09-Feb-23
Programmable Attenuator	MA1-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

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

Continuation of Calibration Certificate

Cert. No. : ACL23079
Job No. : VC66AC0031
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

Continuation of Calibration Certificate

Cert. No. : ACL23079
Job No. : VC66AC0031
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limits (dB)
93.9 (93.95)	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	17.5
Flat	23.3

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			Acceptance Limits
	Flat	C-weight	A-weight	
125	0.0	0.1	0.1	± 1.5
1000	-0.1	-0.1	-0.1	± 1.0
8000	0.4	0.5	0.4	±5.0

QF-TS12-04-04-020664

T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL23079
Job No. : VC66AC0031
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

Continuation of Calibration Certificate

Cert. No. : ACL23079
Job No. : VC66AC0031
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	29.8	-0.2	± 1.1
29.0	28.8	-0.2	± 1.1
28.0	27.8	-0.2	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	25.8	-0.2	± 1.1
25.0	24.8	-0.2	± 1.1

QF-TS12-04-04-020664

T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL23079
Job No. : VC66AC0031
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 ; -3.0
	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
	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, Lpeak (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	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

QF-TS12-04-04-020664

T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL23079
Job No. : VC66AC0031
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	89.7	0.2	+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

451-451/1 Sirinthern Rd., Bangbunru, Bangkok 10700 THAILAND
Tel: 0-2435-8800 Fax: 0-2433-1679 e-mail: cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACL23080
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No. : 00296517 / 135220 / 87527
ID No. : RYG_FS0434

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 : 24 JANUARY 2023
Calibration Date : 25-26 JANUARY 2023
Date of Issue : 27 JANUARY 2023

Calibrated by : Nathakorn Pisupaisan

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. : ACL23080
Job No. : VC66AC0031
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-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL_BP_04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL_BP_05/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL_BP_05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

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

Continuation of Calibration Certificate

Cert. No. : ACL23080
Job No. : VC66AC0031
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

Continuation of Calibration Certificate

Cert. No. : ACL23080
Job No. : VC66AC0031
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
17.1

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

Frequency Weighting	Measured value (dB)
A-weight	14.2
C-weight	19.9
Flat	25.5

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	-1.5	-1.4	-1.4	±5.0

QF-TS12-04-04-020664

T. Petch.

Continuation of Calibration Certificate

Cert. No. : ACL23080
Job No. : VC66AC0031
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	0.0	0.0	±2.0
125	0.0	0.1	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. Petch.

Continuation of Calibration Certificate

Cert. No. : ACL23080
Job No. : VC66AC0031
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	29.9	-0.1	±1.1
29.0	28.9	-0.1	±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	24.8	-0.2	±1.1

QF-TS12-04-04-020664

T. Petch.

Continuation of Calibration Certificate

Cert. No. : ACL23080
Job No. : VC66AC0031
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
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	128.1	0.1	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (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	133.1	0.1	-
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. Petch.

Continuation of Calibration Certificate

Cert. No. : ACL23080
Job No. : VC66AC0031
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11. Overload indication

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

QP-TS12-04-04-020664

T. Petchur

451-451/1 Srinthorn Rd., Bangbunru, Bangkok 10700 THAILAND
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACL23081
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone L/C-52 / Preamplifier NH-24
Serial No.: 00296518 / 66239 / 34375
ID No.: RYG_FS0431

Condition As Found : GOOD

Customer : A.L.S. LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KHUWAENG 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 : 24 JANUARY 2023
Calibration Date : 25-26 JANUARY 2023
Date of Issue : 27 JANUARY 2023

Calibrated by : Nithakorn 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.

QP-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23081
Job No. : VC66AC0031
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-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL-BP_04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL-BP_03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL-BP_05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KA1	34560495	AA-3005-22	22-Feb-23

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).

QP-TS12-04-04-020664

T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL23081
Job No. : VC66AC0031
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

QP-TS12-04-04-020664

T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL23081
Job No. : VC66AC0031
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
21.7

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	19.0
Flat	24.7

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	0.0	0.0	0.0	± 1.5
1000	-0.1	-0.1	-0.1	± 1.0
8000	-0.4	-0.3	-0.3	± 5.0

QF-TS12-04-04-020664

T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL23081
Job No. : VC66AC0031
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	0.0	0.0	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.0	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±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. Petch

Continuation of Calibration Certificate

Cert. No. : ACL23081
Job No. : VC66AC0031
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	53.9	-0.1	± 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	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	27.8	-0.2	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.8	-0.2	± 1.1

QF-TS12-04-04-020664

T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL23081
Job No. : VC66AC0031
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
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 _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	135.8	-0.6	±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. Petch

Continuation of Calibration Certificate

Cert. No. : ACL23081
Job No. : VC66AC0031
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	89.5	-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

QP-TS12-04-04-020664

451-451/1 Sirinthorn Rd., Bangumru, Bangplud Bangkok 10700 THAILAND.
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:center@sithiporn.com http://www.sithiporn.comCert. No. : ACL23044
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 00900073 / 188466 / 01735
ID No.: RYG_FS0494

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 : 06 JANUARY 2023
Calibration Date : 13-18 JANUARY 2023
Date of Issue : 19 JANUARY 2023

Calibrated by : Nathakorn Pisutpaisan

Approved by :
(Thanakul Petchurai)

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QP-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23044
Job No. : VC66AC0024
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-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL_BP_04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL_BP_03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL_BP_05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

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).

QP-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23044
Job No. : VC66AC0024
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

QP-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23044
Job No. : VC66AC0024
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.8

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	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	0.1	0.1	0.1	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-0.2	-0.2	-0.1	± 5.0

QF-TS12-04-04-020664

P.L.H.

Continuation of Calibration Certificate

Cert. No. : ACL23044
Job No. : VC66AC0024
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	-0.1	-0.1	0.0	±2.0
125	0.0	0.1	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	0.1	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	94.1	0.1	± 0.3

QF-TS12-04-04-020664

P.L.H.

Continuation of Calibration Certificate

Cert. No. : ACL23044
Job No. : VC66AC0024
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	119.1	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	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 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

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P.L.H.

Continuation of Calibration Certificate

Cert. No. : ACL23044
Job No. : VC66AC0024
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, T _b (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	108.0	0.0	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
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	128.1	0.1	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{Cpeak} (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	132.9	-0.1	-
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

P.L.H.

Continuation of Calibration Certificate

Cert. No. : ACL23044
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11. Overload indication

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

12. High level stability

Frequency	SLM Display	SLM Display	Deviated	Acceptance
Weighting	at initial	at final	Value	Limits
	(dB)	(dB)	(dB)	(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. Petchurai

451-451/1 Sirdinthorn Rd, Bangbunru, Bangplud Bangkok 10700 THAILAND
Tel: 0-2435-8800 Fax: 0-2433-1679 e-mail: cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACL23048
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No. : 01222724 / 143842 / 22771
ID No. : RYG_FS0023

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 : 06 JANUARY 2023
Calibration Date : 13-18 JANUARY 2023
Date of Issue : 19 JANUARY 2023

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. : ACL23048
Job No. : VC66AC0024
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 weightings 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-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL_BP_04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL_BP_03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL_BP_05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

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. Petchurai

Continuation of Calibration Certificate

Cert. No. : ACL23048
Job No. : VC66AC0024
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. Petchurai

Continuation of Calibration Certificate

Cert. No. : ACL23048
Job No. : VC66AC0024
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
15.4

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

Frequency Weighting	Measured value (dB)
A-weight	11.2
C-weight	17.6
Flat	23.4

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	0.2	0.2	0.2	± 1.5
1000	-0.1	-0.1	-0.1	± 1.0
8000	-0.8	-0.8	-0.7	±5.0

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Continuation of Calibration Certificate

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Job No. : VC66AC0024
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	-0.1	-0.1	0.0	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.0	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±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

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P.T.A.

Continuation of Calibration Certificate

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Job No. : VC66AC0024
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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	53.9	-0.1	± 1.1
49.0	48.9	-0.1	± 1.1
44.0	43.9	-0.1	± 1.1
39.0	38.9	-0.1	± 1.1
34.0	33.9	-0.1	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	28.8	-0.2	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	26.8	-0.2	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.8	-0.2	± 1.1

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Continuation of Calibration Certificate

Cert. No. : ACL23048
Job No. : VC66AC0024
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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, T _b (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 _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	135.8	-0.6	±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

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Continuation of Calibration Certificate

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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. R. L. L.

800_310025

7700 Series ICP-MS
Preventive Maintenance Checklist - Standard

Agilent Technologies

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

For more information about Agilent Technologies services please visit our web site using the following URL: <http://www.chem.agilent.com/en-us/products/services/pages/default.aspx>

Customer Information

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

Service Engineer's Responsibilities

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

REVIEW BY: Suphachai P.
APPROVED BY: Suphachai P.
NEXT CAL. DATE: 11/06/2014

Issued: 7-Feb-2014, Revision: 1.2

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7700 Series ICP-MS
Preventive Maintenance Checklist - Standard

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System Information

Instrument system name and ID	7700X ICP-MS
Instrument system site and location	ALS Laboratory Group (Thailand) Co., Ltd.
List system component product numbers	List the serial numbers of each component
1. G3281A	1. 7812091612
2. G3282A	2. 4N 4220700
3. P1X 500	3. 05 021295A SLO
4.	4.
5.	5.
6.	6.
7.	7.

ICP-MS configuration table	Circle the type or write in the type if other
Nebulizer	MicroMist Micro Flow (Micro Mist) other
Spray Chamber	Quartz PFA other
Torch	Quartz Demountable other
Sampling Cone	Si Pt other
Skimmer Cone	Si Pt Ni plated other

Preparation

- Discuss any specific issues with the customer prior to starting.
- Review the instrument logbook.
- Save instrument control settings before starting the procedure.
- Perform general inspection of system for cleanliness.
- Check for proper installation of safety-related parts, assemblies, sensors etc.
- Check for required firmware updates and verify with customers if they would like it installed.
- Begin system vent.

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Inspect and clean system while venting

- Perform a general inspection of the system.
- Look for any obvious external damage or problems.
- Check mechanical pumps for evidence of excessive fluid leaks.
- Inspect vacuum hoses, pump exhaust tubes and power cord for excessive wear.
- Inspect shield plate contacts. Clean if needed.
- Inspect the tape lining on the peristaltic pump clamp; replace the tape if worn (5043-0030).
- Check electronics for dust accumulation; clean if necessary.

Mechanical vacuum pumps

- Drain and replace mechanical pump fluid.
- Verify proper oil recycling function of mechanical pumps; the gas ballast valve must be open.
- Replace the oil mist filter.
- Inspect and clean or replace the inlet filter (P/N 5190-0145 for E2M18, P/N SR03700237 for DS402).
- Verify proper oil recycling function of mechanical pumps; the gas ballast valve must be open when connected to an Edwards E2M18.

Cooling water system

- Drain cooling fluid.
- Remove, clean and reinstall metal mesh filter.
- Re fill Polyclear cooling fluid (G3202-80010).
- Clean the Air filter and the Condenser by compressed air or vacuum cleaner.

Ion lens cleaning

- Remove extraction/insert lenses and clean all lenses.
- Remove ORS cell, plate bias and deflect lens; clean all lenses.
- Replace octopole. Reinstall all lenses and the ORS cell and close analyzer.

Auto Sampler ASX500 Series

- Clean external surfaces of the Autosampler; this will protect the service technician from potential chemical burns.
- Z-Axis Inspection: Inspect the Z-axis PEEK drive cable for kinks or slight bends. Power off the autosampler and manually move the Z-drive up and down using the rotor on the rear of the instrument. Inspect the Z-axis drive cable for kinks or slight bends. If the movement is rough and hard to move then replace Z-axis drive cable (P/N G3286-80331) or Z-axis drive assembly (P/N G3286-80330).

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- ☑ Pump Tubing Replacement
Replace peristaltic pump tubing. Replace all tubing that goes from the rinse station to the pump and from the pump to the waste/rinse bottles.
- ☑ QC Testing
Using customer's racks and the Agilent software move the sample probe to the 4 outermost corners and ensure that the probe is centered in the vial.
- ☑ Final Inspection
Check that all components are tight.

Auto Sampler I-AS

- ☐ Clean external surfaces of the Autosampler, this will protect the service technician from potential chemical burns.
- ☑ Pump Tubing Replacement
Replace peristaltic pump tubing. Replace all tubing that goes from the rinse station to the pump and from the pump to the waste/rinse bottles.
- ☑ QC Testing
Using customer's tray and move the sample probe to the sample vial 1, wash vial and rinse port and ensure that the probe is centered in the vial.

ISIS

- ☑ Replace ISIS valve seal (P/N G3138-65117).
- ☑ Inspect the tape lining on the peristaltic pump clamp; replace the tape if worn (5043-0030).
- ☑ QC test.
Verify the function of valve and Peripump. Make sure that there is no leak from the valve and pump tubing connections.

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Restore Instrument

- ☑ Pump system down.
- ☑ Perform the system post check.
 - ☑ Check quadrupole matching.
 - ☑ Perform octopole matching.
 - ☑ Verify good gas control function by changing the flow and observing the meter readings, perform an automatic offset adjustment for the MPC's.
 - ☑ Verify in Tune (using the customer's last tune) that changes in lens voltage result in the expected sensitivity change.
- ☑ Perform Startup including performance report and an Autotune. Print the Autotune report and attach it to this checklist.
- ☑ Check the instrument status and record the measurements in the status table. (Use "Record Log" in "Maintenance LogBook" with G7200B software, Use Performance report with G7201A/II software)
- ☑ Record the EM and discriminator Voltages in the results table.
- ☑ Run 10 minute stability test with tune solution. Check the result of ESD is below 4%.

Guidance

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

Service Review

- ☑ Attach available reports/printouts of all tests to this documentation.
- ☑ Make an entry in the MassHunter Maintenance Log Book recording the PM activities.
- ☑ Update/reset instrument maintenance counters as appropriate.
- ☑ Affix the PM sticker to the system or instrument logbook based on the customer's request.
- ☑ Complete the Service Engineer Comments section below if there are additional comments.
- ☑ Review the service and any test results with the customer.
- ☑ If the Instrument firmware was updated, record the details of the change in the Service Engineer's Comments box below or if necessary, in the customer's IQ records.

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7700 Series ICP-MS Status Results Table

- ☐ Check this box if you have run a performance report to record the meter readings. Print out the report and attach it to this checklist, instead of completing the table.

Measurement	Standby Mode	Analysis Mode No Gas Mode	Analysis Mode H ₂ Gas @ 4ml/min	Analysis Mode He Gas @ 4ml/min
IP/DK Press	7.65 Pa	2.02 Pa	— Pa	2.02 Pa
TMP Revolution	1.00 %	1.00 %	— %	1.00 %
Analyzer Press	1.54x10 ⁻⁵ Pa	2.95x10 ⁻⁶ Pa	— Pa	4.15x10 ⁻⁶ Pa
Water RP/WC/IP	0	1.50 L/min		
Water Temperature		22.1 °C		
Inlet Temp.	14.4 °C	24.4 °C		
Internal Temp	16.0 °C	46.0 °C		
RF Power		1591 Watts		
RF Reflect		5 Watts		
Plasma Freq		2.75 MHz		
Carrier Gas (BP)		4.41 kPaG		
Ar Gas Tank Press		5.61 kPaG		
Carrier Gas		1.00 L/min		
MU/Dil. Gas		0.10 L/min		
Plasma Gas		15.00 L/min		
Aux Gas		1.54 L/min		
S-C Temperature		2.0 °C		
OP Gas Tank Press (I)	— kPaG	— kPaG		
Optional Gas (I)		— %		

☐ Do not fill in the shaded cells in the table. There are no measurements for these combinations.

Notes:

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7700 Series ICP-MS Test Results Table

Test Description	Expected Test Result	Actual Test Result
Analog HV Voltage	Not applicable	1201 V
Pulse HV Voltage	Not applicable	44.6 V
Discriminator Voltage	Not applicable	4.5 mV

7700 Series ICP-MS Parts List Table

Part Description	Part Number	Product/Model # where used	Quantity Consumed
1L Rough Pump Oil	6040-0834	7700 ICP-MS	2
Oil Mist Filter Kit for E2M18	3102-1056	7700 ICP-MS	1
Oil Mist Filter for DS402	0460342M002	7700 ICP-MS	—
Graphite Gasket for Sample Cone (5pk)	G3280-67009	7700 ICP-MS	1
7700 Octopole	G3280-67045	7700 ICP-MS	1
Polyclear cooling fluid	G3292-80010	G1879B, G3292A	1
Rinse / Drain tubing	G3286-80117	ASX-500	1
Tubing / connection kit for drain	G3286-80118	ASX-500	1
Peristaltic pump tubing set	G3100-65326	I-AS	—
Drain tubing in rinse bottle and drain bottle	G3100-65328	I-AS	—
Robot seal for Valve (ISIS)	G3138-65117	ISIS	1
Additional parts may be required from engineers stock:			
Inlet Filter E2M18	5196-0146	7700 ICP-MS	—
Inlet Filter DS402	SR03700237	7700 ICP-MS	—
Peristaltic pump tape (30m roll)	5043-0030	7700 ICP-MS	—
Polishing Paper Kit (#400) #1200, 5 sheets each	G1833-05404	7700 ICP-MS	—
Cotton Swabs, ultra-fine conical bud shape at both ends (100/pk)	0300-2573	7700 ICP-MS	—
Alumina Powder	8660-0791	7700 ICP-MS	—
Lint-free paper	05950-60051	7700 ICP-MS	—
Z-Axis Drive PEEK Cable (Anti-Kink)	G3286-80331	ASX-500	—
Z-Axis Drive Assembly (PEEK, Anti-Kink)	G3286-80330	ASX-500	—

Issued: 7-Feb-2014, Revision: 1.2

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Page 7 of 8

Agilent Technologies

7700 Series ICP-MS Preventive Maintenance Checklist - Standard

Agilent Technologies

Service Engineer Comments (optional)

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

Other Important Customer Web Links

- How to get information on your product: Literature Library - <http://www.agilent.com/chem/library>
- Need to know more? - www.agilent.com/chem/education
- Need technical support, FAQs? - www.agilent.com/chem/techsupp
- Need supplies? - www.agilent.com/chem/supplies

Service Completion

Service request number: 600 614615 Date service completed: 12 June 2023

Agilent signature: [Signature] Customer signature: [Signature]

Document part number: G3280-90078

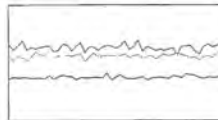
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Page 8 of 8

Tune Report

Operator Name: Supakorn Mali
Acq/Data Batch: C:\Agilent\CPM\11\11UserTune.b
Acq. Date-Time: 6/12/2023 4:05:12 PM
Report Comment: PM 12 June 2023
Instrument Name: G3281A JP12001612

(No Gas)

Sensitivity



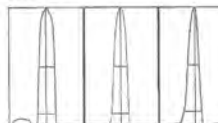
Mass	Range	Count	RSD%	Background
7	10000	6249	4.494	2.100
89	50000	27817	3.328	3.600
205	50000	18665	3.537	8.600

Sampling Period [sec]: 0.311
Integration Time [sec]: 0.1

oxide/doubly charged ratio

Oxide: 156 / 140 1.492 %
Doubly Charged: 70 / 140 1.508 %

Resolution/Axis



Mass	Peak Height	Area	W-50%	W-10%
7	6337.86	7.00	0.64	0.735
89	27581.94	89.00	0.55	0.710
205	19018.73	205.00	0.46	0.726

Integration Time [sec]: 0.1
Acquisition Time [sec]: 22.74
V Axis: Linear

Tune Parameters

Plasma Mode	—	Nebulizer Gas	1.00 L/min	Makeup Gas	0.10 L/min
RF Power	1550 W	Option Gas	—	Auxiliary Gas	0.90 L/min
RF Matching	1.80 V	Nebulizer Pump	0.10 rpm	Plasma Gas	15.0 L/min
Sample Depth	8.0 mm	S/C Temp	2 °C		
Lens Parameters					
Extract 1	0.0 V	Omega Lens	6.4 V	Deflect	11.8 V
Extract 2	-145.0 V	Cell Entrance	-30 V	Pole Bias	-40 V
Omega Bias	-90 V	Cell Exit	-50 V		
Cell Parameters					
Use Gas	No	3rd Gas Flow	—	Energy Discrimination	5.0 V
He Flow	0.0 mL/min	OxP Bias	-8.0 V		

1 of 3

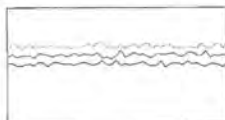
6/12/2023 4:05 PM

Tune Report

H2 Flow: — OctP RF: 190 V
QP Parameters: — Axis Gain: 1.0021 QP Bias: -3.0 V
Mass Gain: 145 Axis Offset: 0.12
Mass Offset: 124
Hardware Settings:
Torch:
Torch H: -0.4 mm Torch V: 0.0 mm
EM:
Discriminator: 4.5 mV Analog HV: 1748 V Pulse HV: 1495 V

Plot

Sensitivity



Mass	Range	Count	RSD%	Background
59	20000	11826	2.752	7.200
89	20000	13367	2.527	5.800
205	50000	25871	2.706	13.300

Sampling Period [sec]: 0.31
Integration Time [sec]: 0.1

oxide/doubly charged ratio

Oxide: 156 / 140 1.165 %
Doubly Charged: 70 / 140 1.585 %

Tune Parameters

Plasma Parameters		Nebulizer Gas	1.00 L/min	Makeup Gas	0.10 L/min
Plasma Mode	—	Option Gas	—	Auxiliary Gas	0.90 L/min
RF Power	1550 W	Nebulizer Pump	0.10 rpm	Plasma Gas	15.0 L/min
RF Matching	1.80 V	S/C Temp	2 °C		
Sample Depth	8.0 mm				
Lens Parameters					
Extract 1	0.0 V	Omega Lens	7.4 V	Deflect	3.6 V
Extract 2	-200.0 V	Cell Entrance	-80 V	Pole Bias	-115 V
Omega Bias	-80 V	Cell Exit	-70 V		
Cell Parameters					
Use Gas	Yes	3rd Gas Flow	—	Energy Discrimination	3.0 V
He Flow	4.5 mL/min	OxP Bias	-21.0 V		
H2 Flow	—	OctP RF	203 V		
QP Parameters					
Mass Gain	145	Axis Gain	1.0021	QP Bias	-18.0 V
Mass Offset	124	Axis Offset	0.12		
Hardware Settings					
Torch					
Torch H	-0.4 mm	Torch V	0.0 mm		

2 of 3

6/12/2023 4:05 PM

Tune Report

EM: Discriminator: 4.5 mV Analog HV: 1748 V Pulse HV: 1495 V

3 of 5

6/12/2023 4:05 PM



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Certificate No. T231676

Page 1 of 6

Certificate of Calibration

Equipment : HEATING BLOCK
Manufacturer : Environmental Express
Model : SC 196
Serial No. : 6974CECW3285
Customer Code : BKK_EL0054
ID No. : T5306A3
Customer : ALS Laboratory Group (Thailand) Co.,Ltd.
104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,
Khet Suan Luang, Bangkok 10250
Customer Location : Acid Digestion Lab
Date of Receipt : 13 September 2023
Calibrated By : Sanej Musikawan (Site Calibration Manager)
Approved By :  / Sujjar Nakhakred (Site Calibration Manager)
Date of Issue : 26 SEP 2023

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-L12 B9-30-05-57



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Certificate No. T231676

Page 2 of 6

Calibration Report

Equipment : HEATING BLOCK
Date of Calibration : 22 September 2023
Environment : Temperature : 21.8-23.1 °C
Line Voltage : 221.6-226.3 V
Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

1. This equipment was calibrated by insert 20 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.

All data show below were final values and the initial data from customer request . The temperature scale used was based on ITS - 90 .

2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	TYPE T	TN21-TN30	T230014	17 January 2024
TC	TYPE T	TN31-TN40	T230014	17 January 2024
DATA LOGGER	34970A	T151	T230014	17 January 2024

3. This certificate is traceable to :

National Institute of Metrology (Thailand) through Metrological Center (NISC-TISI-TIS 17025 CALIBRATION 0244)

4. Condition of calibrated item : good

Equipment Description :

Time Constant : 2 Hour 20 Minute At 95 °C
Fresh Air Damper : ☐ Open ☐ Min ☐ Medium ☐ Max
☐ Close
☒ Not Available

5. Adjustment :

() without adjustment (X) after adjustment

Approved By : 

FM-L13 B08-30-05-57



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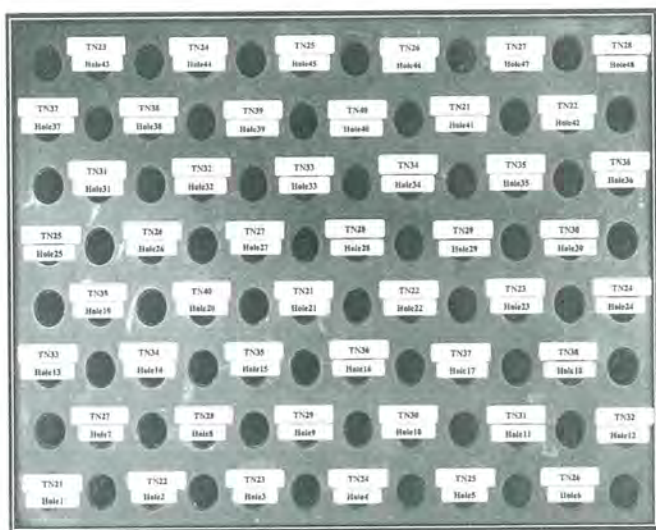
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Page 3 of 6

Calibration Report



FRONT CONTROL

Approved By : 

FM-L13 B08-30-05-57



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Certificate No T231676

Page 4 of 6

Calibration Report

Measurement Results

Calibration Point	Average Standard Reading at each position (°C)					
R1 Hole1-Hole6	TN21	TN22	TN23	TN24	TN25	TN26
CAL POINT	Max	95.01	94.41	95.20	95.41	94.51
	Min	94.57	93.95	94.75	94.92	94.00
	Average	94.79	94.18	94.98	95.17	94.26
R2 Hole7-Hole12	TN27	TN28	TN29	TN30	TN31	TN32
	Max	95.36	95.43	95.19	95.16	95.35
	Min	94.84	94.95	94.72	94.71	94.90
	Average	95.15	95.19	94.96	94.94	95.13
R3 Hole13-Hole18	TN33	TN34	TN35	TN36	TN37	TN38
	Max	95.37	95.50	95.22	95.21	95.33
	Min	94.99	95.09	94.78	94.82	94.88
	Average	95.18	95.30	95.00	95.02	95.11
R4 Hole19-Hole24	TN39	TN40	TN21	TN22	TN23	TN24
	Max	95.59	94.42	94.52	94.24	94.63
	Min	95.21	94.06	94.13	93.88	94.28
	Average	95.40	94.24	94.33	94.06	94.45
R5 Hole25-Hole30	TN25	TN26	TN27	TN28	TN29	TN30
	Max	95.19	95.38	92.93	95.30	95.14
	Min	94.83	95.03	92.56	94.95	94.79
	Average	95.01	95.20	92.75	95.12	94.96
R6 Hole31-Hole36	TN31	TN32	TN33	TN34	TN35	TN36
	Max	94.63	94.90	94.77	94.31	94.24
	Min	94.24	94.55	94.44	93.98	93.92
	Average	94.43	94.72	94.60	94.14	94.08
R7 Hole37-Hole42	TN37	TN38	TN39	TN40	TN21	TN22
	Max	94.30	94.44	94.04	93.81	94.89
	Min	93.95	94.05	93.67	93.48	94.39
	Average	94.13	94.24	93.86	93.65	94.64
R8 Hole43-Hole48	TN23	TN24	TN25	TN26	TN27	TN28
	Max	95.99	95.63	95.28	95.29	95.45
	Min	95.57	95.15	94.82	94.84	94.99
	Average	95.78	95.39	95.05	95.07	95.22

Approved By : 

FM-L13 B08-30-05-57



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Certificate No T231676

Page 5 of 6

Calibration Report

Measurement Results

Calibration Point		Average Standard Reading at each position (°C)					
R1 Hole1-Hole6		TN21	TN22	TN23	TN24	TN25	TN26
CAL POINT	Max	105.23	104.32	105.43	105.25	104.44	105.37
	Min	104.94	103.95	105.15	105.04	104.11	104.96
	Average	105.09	104.13	105.29	105.15	104.28	105.12
R2 Hole7-Hole12		TN27	TN28	TN29	TN30	TN31	TN32
	Max	105.30	105.12	105.18	105.22	105.12	105.16
	Min	105.11	104.92	104.96	105.00	104.82	104.97
	Average	105.20	105.02	105.07	105.11	105.02	105.06
R3 Hole13-Hole18		TN33	TN34	TN35	TN36	TN37	TN38
	Max	105.37	105.63	105.02	104.80	104.69	105.19
	Min	105.17	105.37	104.75	104.59	104.30	105.00
	Average	105.27	105.50	104.88	104.69	104.60	105.09
R4 Hole19-Hole24		TN39	TN40	TN41	TN42	TN43	TN44
	Max	105.31	104.43	106.41	104.71	105.63	105.82
	Min	105.08	104.22	106.15	104.41	105.37	105.56
	Average	105.19	104.33	106.28	104.56	105.50	105.69
R5 Hole25-Hole30		TN45	TN46	TN47	TN48	TN49	TN50
	Max	104.95	106.26	103.34	105.78	105.59	105.67
	Min	104.67	105.96	103.08	105.56	105.36	105.68
	Average	104.81	106.11	103.21	105.67	105.48	105.77
R6 Hole31-Hole36		TN51	TN52	TN53	TN54	TN55	TN56
	Max	104.75	104.86	104.80	105.20	104.50	104.39
	Min	104.54	104.63	104.59	105.00	104.32	104.18
	Average	104.65	104.75	104.69	105.10	104.41	104.28
R7 Hole37-Hole42		TN57	TN58	TN59	TN60	TN61	TN62
	Max	104.30	104.90	104.85	104.65	104.88	104.85
	Min	104.09	104.72	104.66	104.49	104.63	104.52
	Average	104.19	104.81	104.75	104.57	104.76	104.68
R8 Hole43-Hole48		TN63	TN64	TN65	TN66	TN67	TN68
	Max	105.71	105.83	105.39	105.61	105.42	105.19
	Min	105.45	105.61	105.14	105.27	105.18	104.94
	Average	105.58	105.71	105.27	105.44	105.30	105.07

Approved By:

FM-L13 108/30-05-51



Metrological Center

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Certificate No. T231676

Page 6 of 6

Calibration Report

Measurement Results:

HEATING BLOCK			Temperature Distribution	
Setting (°C)	Reading (°C)		Stability (±°C)	Uncertainty (±°C)
	Min, Max	Average		
100.0	100.3, 100.5	100.4	0.26	0.81
107.0	107.0, 107.1	107.1	0.19	0.78

* The quoted 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:

FM-L13 108/30-05-51



Metrological Center

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Bangkok Tel : +668 9205 6851, +668 8247 2360

Website : www.sci-eco.co.th E-Mail : calibrate@sci-eco.co.th



Certificate No. T221644

Page 1 of 4

Certificate of Calibration

Equipment : Chamber (Cold Room)

Manufacturer : KOLDTECH

Model : KM 320

Serial No. : TBN-1012061/05

Customer Code : BKK_EN0167

ID No. : T2463A3

Customer : ALS Laboratory Group (Thailand) Co.,Ltd.

104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,

Khet Suan Luang, Bangkok 10250

Customer Location : Environmental Laboratory

Date of Receipt : 27 June 2022

Calibrated By : Sujjar Naknakred (Site Calibration Manager)

Approved By : / Boonchai Suriyawong (Site Calibration Manager)

Date of Issue : 04 JUL 2022

REVIEW BY	
APPROVED BY	
NEXT CAL DATE	30/12/23

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

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FM-L14 117/01-02-64



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Certificate No. T221644

Page 2 of 4

Calibration Report

Equipment : Chamber (Cold Room)

Date of Calibration : 30 June - 1 July 2022

Environment : Temperature : 18.9-23.7 °C

Line Voltage : 222.9-226.5 V

Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

1. This equipment was calibrated by insert nine 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 (Resapproved 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 .

2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	TYPE T	TN161-TN170	T210009	30 July 2022
TC	TYPE T	TN171-TN180	T210009	30 July 2022
DATA LOGGER	34970A	T149	T210009	30 July 2022

3. This certificate is traceable to :

National Institute of Metrology (Thailand) through Metrological Center (NSC-TISI-TIS 17025 CALIBRATION 0244)

4. Condition of calibrated item : good

Equipment Description :

Time Constant : 3 Hour ± Minute At 3 °C

Fresh Air Dumper ☐ Open ☐ Min ☐ Medium ☐ Max

☐ Close

☒ Not Available

5. Adjustment :

() without adjustment (X) after adjustment

Approved By:

FM-L15 117/03-03-65

Revised March 2004. In your full payment plan, bill every 15 days.

Signature Technician

Place, Date (DD/MM/YYYY)

Signature Customer

Place, Date (DD/MM/YYYY)

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5/24/2023 12:46 Page 1/4

Mercur

Report file:	C:\WinAAS\TMP\2023\May\Pro_032			
Program version:	4.7.10.0	Printed on	5/24/2023	12:46
		Recording started on	5/24/2023	12:35 GMT+7.0
Operator	PSU.OTA			
Laboratory	ALS-BKK			
Code	II_Hg095_2023			

Remarks:
Food water

Method parameters

Method Without enrichment / FBR 30ng/L_PM24052023
Created on 5/24/2023 Time 12:27
Program

Parameters: Mercur Technique: Hg fluorescence

Line	253.7 nm		
Lamp type	Hg-LP		
Integr. mode	Peak height	Integr. time	30 s
PMT	360 V		
AZ time	5 s	Peak smoothing	8/5
Delay	0 s		
	...		
Working mode	w/o enrich	System cleaning	Acid
FBR technique	on	Wash time acid	10 s
Pump speed	3	Soaking time	20 s
Sample load time	10 s	Gas load time	5 NL/h
Reaction time	10 s		
Waiting time AZ	5 s		
Delay	0 s		
Purge time1	28 s		
Purge time2	15 s	Gas wash time2	10 NL/h
Autosampler			
Autosampler	ASS1S/F	Tray type	87/138
Working mode	continuous		

Dilution

American

QC parameters

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

Calibration settings

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

Sample statistics

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

Calibration standards

No.	Name	State	Pos.	Conc. / ng/L	Ints	SD	RSD/%
1	Cal-Zero	(-)	79	0.000	H: 0.000249 A: 0.004274	0.000132 0.001698	53.13 39.72
2	Cal-Std1	(-)	80	30.000	H: 0.001720 A: 0.02172	0.000007 0.000023	0.459 0.107

Hg

Mercur

Calibration function 1

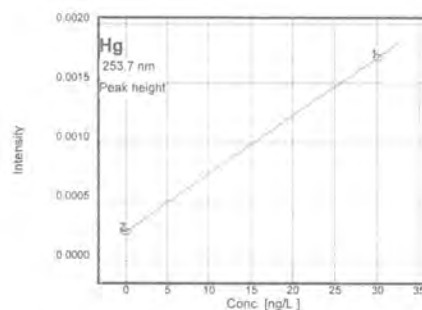
5/24/2023 12:44 Calibration (Peak height)

Ints=k1+k2*conc

k1=0.000249 k2=0.000049

Recal. factor: ---

Slope	0.00005 Ints/(ng/L)	R2-adjusted	1.0000
sd0	1.00000 ng/L		
Lower limit	0 ng/L	Upper limit	33.0 ng/L
Detection limit	---	Deter. limit	---



Measurements and events (sorted by time)

Hg	Without enrichment / FBR 30ng/L PM 24052023	5/24/2023	12:35
ID	Conc.	Ints	BG
Cal-Zero		0.000143	
		0.000397	
		0.000207	
	0ng/L	0.000249	0.0001324
Cal-Std1		0.001720	
		0.001712	
		0.001728	
	30.00ng/L	0.001720	0.000007897
Calibration	Calibration function 01		

Mercur

Peak plots



Hg

Mercur

Mercur

Report file	C:\WNAAS\TMP\2023\May\Pro_033
Program version	4.7.10.0
Operator	PSU,OTA
Laboratory	ALS-BKK
Code	II_Hg095_2023

Remarks:

Food,water:

Method parameters

Method	Enrichment / FER 30ng/L PM_24052023
Created on	5/24/2023 Time: 13:36
Program	---

Parameters Mercur Technique: Hg fluorescence

Line	253.7 nm		
Lamp type	Hg LP		
Integr. mode	Peak height	Integr. time	40 s
PMT	352 V		
AZ time	5 s	Peak smoothing	12/11
Delay	0 s		
Working mode	Enr. w/o reload	System cleaning	Off
FBR technique	off	Wash time acid	10 s
Pump speed	3	Soaking time	20 s
Sample load time	10 s	Gas load time	10 NL/h
Reaction time	10 s		
Waiting time AZ	10 s	Gas AZ wait	10 NL/h
Purge time1	30 s		
Purge time2	15 s	Gas wash time2	5 NL/h
Purge time3	20 s		
Heat time coil 1	20 s	Cool time coil 1	30 s

Mercur

QC parameters

QC type	Conc. check	QC check samp. 2	---
QC check samp. 1	---	Conc.	---
Conc.	---	Error limit	---
Error limit	---	Reaction	flag + continue
Rep. measurement	off	QC std 2 no.	1(30 000 ng/L)
QC std 1 no.	1(30 000 ng/L)	QC std 2 limit	± 50.00%
QC std 1 limit	± 50.00%	Reaction	flag + continue
QC std. act.	flag + continue	Reaction	flag + continue
Expect blank abs.	0.0100± 0.0100	Reaction	flag + continue
QC precision	off	Reaction	off
		QC Recal factor	Off

Calibration settings

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

Sample statistics

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

Calibration standards

No	Name	State	Pos	Conc. / ng/L	Ints	SD	RSD/%
1	Cal-Zero	(-)	##	0.000	H 0.003700 A: 0.02531	0.000081 0.000153	2.192 0.607
2	Cal-Std1	(-)	##	30.000	H 0.01060 A: 0.06589	0.000253 0.002766	2.386 4.135

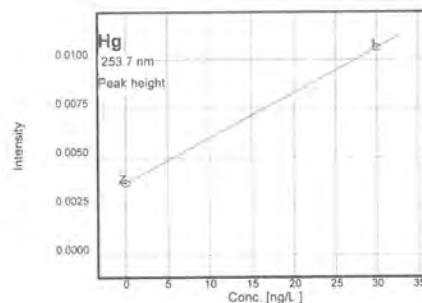
Hg

Mercur

Calibration function 1

5/24/2023 14:00 Calibration (Peak height)

Ints=k1+k2*conc			
k1=0.003700	k2=0.000230	Recal. factor	---
Slope	0.00023 Ints/(ng/L)	R2-adjusted	1.0000
sc0	1.00000 ng/L		
Lower limit	0 ng/L	Upper limit	33.0 ng/L
Detection limit	---	Deter. limit	---



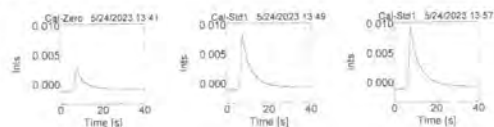
Measurements and events (sorted by time)

Hg	Enrichment / FER 30ng/L PM_24052023					5/24/2023	13:37
ID	Conc.	Ints	BG	SD	RSD/%	Int. type	Time
Cal-Zero		0.003792				PkH	13:41
		0.003666					13:43
		0.003640					13:44
	0ng/L	0.003700		0.000081090	2.192		13:44
Cal-Std1		0.009498				PkH	13:49
		0.008333					13:50
		0.008661					13:52
	30.00ng/L	0.009931		0.0005830	6.528		13:52
Cal-Std1		0.01031				PkH	13:57
		0.01074					13:58
		0.01078					14:00
	30.00ng/L	0.01060		0.0002530	2.386		14:00
Calibration	Calibration function: 01						14:00

Mercur

Peak plots

Hg



Mercur

Mercur

Report file	C:\WinAAS\TMP\2023\May\Pro_034
Program version	4.7.10.0
Operator	PSU,OTA
Laboratory	ALS-BKK
Code	II_Hg095_2023

Remarks:

Food water

Method parameters

Method	Without enrichment / Abs / FBR 100ng/L_PM 24052023
Created on	5/24/2023
Time	14:18
Program	---

Parameters Mercur Technique: Hg absorption

Line	253.7 nm		
Lamp type	Hg-LP		
Integr. mode	Peak height	Integr. time	55 s
PMT	225 V		
AZ time	5 s	Peak smoothing	2/5
Delay	8 s		

Working mode	w/o enrich.	System cleaning	Acid
FBR technique	on	Wash time acid	15 s
Pump speed	4	Soaking time	20 s
Sample load time	8 s	Gas load time	5 NL/h
Reaction time	12 s		
Waiting time AZ	15 s		
Delay	10 s		
Purge time1	50 s		
Purge time2	10 s	Gas wash time2	10 NL/h

Mercur

QC parameters

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

Calibration settings

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

Sample statistics

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

Calibration standards

No.	Name	State	Pos.	Conc. / ng/L	Abs	SD	RSD/%
1	Cal-Zero	(-)	##	0.00	H: 0.000932 A: 0.035928	0.000138 0.006208	14.88 17.28
2	Cal-Std1	(-)	##	100.00	H: 0.004494 A: 0.061286	0.000116 0.001275	2.586 2.062

Hg

Mercur

Calibration function 1

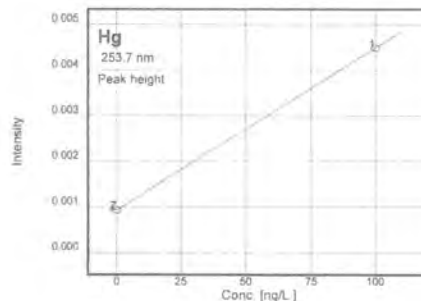
5/24/2023 14:33 Calibration (Peak height)

Abs=k1+k2*conc

k1=0.000932 k2=0.000036

Recal factor: ---

Slope	0.00004 Abs/(ng/L)	R2-adjusted	1.0000
sd	1.00000 ng/L	Character. conc.	122.411 (ng/L/V1%)
Lower limit	0 ng/L	Upper limit	110. ng/L
Detection limit	---	Deter. limit	---



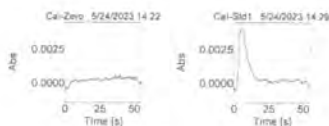
Measurements and events (sorted by time)

Hg ID	Without enrichment / Abs	FBR	100ng/L_PM	24052023	5/24/2023	14:19
Cal-Zero	Conc.	Abs	BG	SD	RSD/%	Int. type
		0.001039				PkH
		0.000775				14:22
		0.000881				14:25
	0ng/L	0.000932		0.00013872	14.88	14:25
Cal-Std1		0.004528				PkH
		0.004364				14:29
		0.004588				14:31
	100.ng/L	0.004494		0.00011623	2.586	14:33
Calibration	Calibration function: 01					14:33

Mercur

Peak plots

Hg



Mercur



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
114 PATTANABURAD ROAD SOI 6, SUAN LUANG, SUAN LUANG, BANGKOK 10250
TEL: 02-2157-9990-29 FAX: 02-214-9884



Cert. No.: 23TM1408
Page: 1 of 4

Certificate of Calibration

Equipment: Autoclave

Manufacturer: TOMY

Model: SX-700

Serial No.: 48134190

ID No.: BKK_ML0041

Submitted by: ALS Laboratory Group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khwaeng Phatthanakan, Khel Suan Luang
Bangkok 10250 Thailand

Location: Media Preparation Room

Received Order: 03 October 2023

Calibration Date: 04 October 2023

Ambient Temperature: (26 ± 10) °C

Relative Humidity: (50 ± 30) %

Calibrated by: Khiti Ruttanaprapachai

Approved by:

() Ponnipha Temeyakul
() Ponnipha Temeyakul
() Suwit Imjar

Approved Signatory

Issue Date: 11 October 2023

() for uncertainties are for a confidence probability of approximately 95%

ALS Laboratory Group, Inc. is an ISO 9001:2015 certified company.
Authorized for use by Corporate Services & Equipment Calibration and Testing Services.

A 0059272



Equipment : Autoclave
Condition As-Received : Used Item
Reference : 2310-0006OC-6
Procedure Used :-

Cert. No.: 23TM1408
Page : 2 of 4

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

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1.) Data Acquisition	MY57013823	23LM66	TPA	25 Mar 2024

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

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

4. This result of calibration covers laboratory autoclaves for the sterilization of goods and material which could be infected with organisms categorized as Hazard Group 1, 2 and 3**
(** = Categorization of pathogens according to hazard and categories of containment, second edition, 1990)

It does not cover autoclaves for use with material infect with organisms in Hazard Group 4, for which complete containment and sterilization of infected condensate is considered to be essential.

This result of calibration does not apply to sterilizers or disinfectors used for medical, dental, pharmaceutical or veterinary purposes which are directly concerned with patient care, or those used for fabrics subjected to sterilization which are required to be dry at the end of cycle.

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

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source



	Environmental		
	(°C)	(%R.H.)	(Volt)
Beginning of Calibration	26	64	221
Finished of Calibration	27	67	222

Position	Description	Ref. Std. ID No.:
1 =	Center of chamber	19-17TC-08
2 =	Temperature sensor	19-17TC-09
3 =	Exhaust port	19-17TC-10

PR

1184533



Equipment : Autoclave
Condition As-Received : Used Item
Reference : 2310-0006OC-6

Cert. No.: 23TM1408
Page : 3 of 4

Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source

Operating parameter Set : Temperature = 108 °C
Sterilization period = 10 minute

UUC* Setting (°C)	UUC* Reading (°C)	Position	Average* Standard Reading (°C)	Stability (± °C)	Pressure Reading (MPa)	Uncertainty (± °C)	Coverage Factor k
108	108	1	108.352	0.12	0.04	0.90	2
		2	108.263				
		3	108.140				

Operating parameter Set : Temperature = 115 °C
Sterilization period = 20 minute

UUC* Setting (°C)	UUC* Reading (°C)	Position	Average* Standard Reading (°C)	Stability (± °C)	Pressure Reading (MPa)	Uncertainty (± °C)	Coverage Factor k
115	115	1	115.376	0.13	0.08	0.90	2
		2	115.297				
		3	115.157				

Operating parameter Set : Temperature = 118 °C
Sterilization period = 10 minute

UUC* Setting (°C)	UUC* Reading (°C)	Position	Average* Standard Reading (°C)	Stability (± °C)	Pressure Reading (MPa)	Uncertainty (± °C)	Coverage Factor k
118	118	1	118.063	0.11	0.09	0.90	2
		2	118.037				
		3	117.954				

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

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

UUC* : Unit Under Calibration

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

PR

1184532



Equipment : Autoclave
Condition As-Received : Used Item
Reference : 2310-0006OC-6
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source

Cert. No.: 23TM1408
Page : 4 of 4

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

UUC* Setting (°C)	UUC* Reading (°C)	Position	Average* Standard Reading (°C)	Stability (± °C)	Pressure Reading (MPa)	Uncertainty (± °C)	Coverage Factor k
121	121	1	121.186	0.17	0.11	0.91	2
		2	121.082				
		3	120.980				

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

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

UUC* : Unit Under Calibration

Note : The reported uncertainty of measurement was excluded stability.

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

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PR

1184531



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
554-4 PATTANAPONG ROAD, SUKHUMVIT 11, SUKHUMVIT, BANGKOK 10110
TEL : 02-271-9890-24 FAX : 02-271-9454



Cert. No.: 23TM1146
Page : 1 of 3

Certificate of Calibration

Equipment : Incubator

Manufacturer : SHEL-LAB

Model : 1915A

Serial No. : 0200599

ID No. : BRK_ML0010

Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khwang Phatthanakan, Khet Suan Luang,
Bangkok 10250 Thailand

Location : Incubation & Micrological Reading

Received Order : 17 July 2023

Calibration Date : 17 July 2023

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 : 24 July 2023

The Uncertainties are for a confidence probability of approximately 95%

(This certificate may only be reproduced without our full consent with the prior written)

Approval of the General Corporate Services : Equipment Calibration and Testing Services

A 0056489



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2307-02850C-1

Cert. No.: 23TM1146
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	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY49001451	23LM27	TPA	25 Feb 2024

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

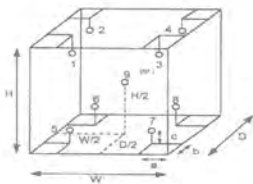
3. This certification is traceable to the International System of Unit.

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

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close



Probe Installation Details :

a = 10 cm
b = 10 cm
c = 10 cm

Dimension of Chamber :

D = 0.50 m
W = 0.75 m
H = 1.2 m
Capacity = 0.45 m³

Environment during calibration		
	Beginning	Finished
Temp. (°C)	24	24
REL Humid. (%)	54	58
AC Supply (Volt)	221	223

Position :	Ref. Std. ID No.:
1	19RTD-2/1
2	19RTD-2/2
3	19RTD-2/3
4	19RTD-2/4
5	19RTD-2/5
6	19RTD-2/6
7	19RTD-2/7
8	19RTD-2/8
9 (ref.)	19RTD-2/9

a 1172189



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2307-02850C-1

Cert. No.: 23TM1146
Page : 3 of 3

Result of Calibration :-

(*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
35.0	35.0	35.0	0.055	0.30	0.44	2

Calibration Point (°C)	Measured Temperature (°C)								Uncertainty (± °C)
	1	2	3	4	5	6	7	8 9 (ref.)	
35.0	34.888	34.933	34.815	34.813	35.004	35.019	35.156	35.141 35.087	0.30

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

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

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

UUC* : Unit Under Calibration

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

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

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a 1172188



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
1) CORPORATE SERVICES 2) EQUIPMENT CALIBRATION AND TESTING SERVICES
114-4 PATTANAKARN ROAD NO. 15, SUAN LUANG MUANGHANG BANGKOK 10300
TEL : 0-2277-8862-3 FAX : 0-2194844



Cert. No.: 22TM1571
Page : 1 of 3

Certificate of Calibration

Equipment : Hot Air Oven

Manufacturer : Binder

Model : ED 240/E2

Serial No. : 00-15533

ID No. : BKK_ML0013

Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khwaeng Phatthanakan, Khel Suan Luang,
Bangkok 10250 Thailand

Location : Media Preparation Room

Received Order : 21 November 2022

Calibration Date : 21 November 2022

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 30) %

Calibrated by : Krisda Malee

Approved by :
Approved Signatory

() Pornthippa Taimeyakul
() Malee Butkrus
() Suwit Injai

Issue Date : 29 November 2022

The Uncertainties are for a confidence probability of approximately 95%

This certificate is only valid for the equipment and conditions specified on this document.
Approved by: Head of Calibration Services 1) Inspection (Customer and Foreign Services)

a 0048150



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2211-06230C-1

Cert. No.: 22TM1571
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 Thermocouple Type T.
The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34970A	MY44067817	22LM121	22 Aug 2023

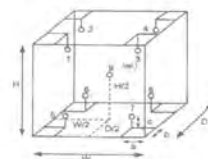
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration :- (*) After Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available



Probe Installation Details :

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

Dimension of Chamber :

D = 0.50 m
W = 0.80 m
H = 0.60 m
Capacity = 0.24 m³

Environment during calibration		
	Beginning	Finished
Temp. (°C)	26	26
REL Humid. (%)	53	55
AC Supply (Volt)	219	220

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

a 1138049



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2211-0623OC-1
Result of Calibration : (*) After Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Not Available

Cert. No.: 22TM1571
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
180	180	180	0.70	1.5	2.9	1.4	2
Measured Temperature (°C)							
Calibration Point (°C)	Position						
	1	2	3	4	5	6	7
180	179.520	180.585	178.655	179.452	178.827	179.938	179.074

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

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

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
134/1 PATTANAKARN ROAD 6th FL SUANLUANG, SUANLUANG DISTRICT BANGKOK 10250
TEL: 0-2917-8800-29 FAX: 0-2917-8804



Cert. No.: 23TM637
Page : 1 of 3

Certificate of Calibration

Equipment : Water Bath

Manufacturer : Memmert

Model : WNE 45

Serial No. : L712,0429

ID No. : BKK_ML0056

Submitted by :

ALS Laboratory Group (Thailand) Co., Ltd
104 Phatthanakari 40, Phatthanakan Rd.,
Khwaeng Phatthanakan, Khet Suan Luang,
Bangkok 10250 Thailand

Location :

Incubator & Microbiological Reading

Received Order :

20 April 2023

Calibration Date :

20 April 2023

Ambient Temperature :

(26 ± 10) °C

Relative Humidity :

(50 ± 30) %

Calibrated by :

Kunchit Promrat

Approved by :

Approved Signatory

() Pornthippa Tameyakul
(✓) Malee Bulkruea
() Suwit Imjai

Issue Date :

24 April 2023

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

This certificate is valid only for the equipment and the conditions stated on this certificate. It is not valid for other equipment or conditions.
It is not valid for the use of the equipment for other than the purpose for which it was calibrated.

A 0053557



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2304-0253OC-1
Procedure Used :-

Cert. No.: 23TM637
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 : MY44073381 : 22LM78/1 : 12 May 2023

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

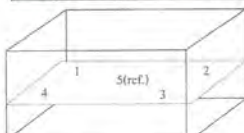
3 This certification is traceable to the International System of Unit.

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Heat transfer medium used : Water

	Environmental		AC Voltage Supply
	(°C)	(%R.H.)	(Volt)
Beginning of Calibration	25	45	223
Finished of Calibration	25	43	223



Front

Position :	Ref. Std. S/N.:
1	4803988-006
2	4803988-007
3	4804539-014
4	4804539-015
5(ref.)	4804539-016

1158265



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2304-0253OC-1
Result of Calibration : (*) Without Adjustment
Function of UUC* : Temperature Source

Cert. No.: 23TM637
Page : 3 of 3

Calibration point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Average* Standard Reading (°C)					Uncertainty (± °C)
			1	2	3	4	5 (ref.)	
44.5	44.5	44.5	44.492	44.493	44.475	44.510	44.491	0.15
45.0	45.0	45.0	44.992	44.992	44.979	45.016	44.986	0.15

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Coverage Factor k
44.5	0.051	0.022	2
45.0	0.080	0.026	2

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

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

Stability : One-half of the greatest maximum difference of measured temperature at any one probe.
UUC* : Unit Under Calibration

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

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

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1158264



Cert.No.: 23TW169
Page.: 1 of 2

Certificate of Testing

Equipment : DO Meter
Manufacturer : YSI
Model : 5000-115V
Serial No. : 15E102796
ID No. : RYG_EN0032
Received Date : 21 July 2023
Test Date : 24 July 2023
Reference : 2307-0713DSC-1
Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.
Rayong Branch
816/10 Moo 5, T. Maenam Khu. A. Puaakdaeng,
Rayong 21140, Thailand
Laboratory Condition : Temperature (25 ± 5) °C
Humidity (50 ± 20) %
Test Procedure : In-house method CP-CH2
by Comparison Technique with Azide Modification Method
Tested by : Walalak Sirthean
Approved by :
Approved Signatory
() Malee Butkrus
(x) Sathip Meangmai
() Warakorn Lengagatrakul
Issue Date : 26 July 2023

R 0320211



Cert.No.: 23TW168
Page.: 2 of 2

Condition of this result of calibration

1. Reference Standard Instruments

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

Instruments	Serial No.	ID No.	Certificate No.	Due Date
1) Burette	-	130BU10	23CG1172	22 Mar 2025
2) Balance	1126143764	140RC004	22MM50	20 Sep 2023

2. Standard Material :-

Material	Manufacturer	Lot No.	Assay
Sodium Thiosulfate pentahydrate	Merk	AM1783316	100.2%

Result : Dissolved Oxygen Meter Adjustment With Air 100 %

Dissolved Oxygen Probe No.: 15E100464

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.18	8.17	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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R 1172155



Cert. No.: 23LM125
Page.: 1 of 2

Certificate of Calibration

Equipment : DO Meter with Sensor
Manufacturer : YSI
Model : 5000-115V
Serial No. : 15E102796
ID No. : RYG_EN0032
Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.
Rayong Branch
816/10 Moo 5 T. Maenam Khu. A. Puaakdaeng
Rayong 21140 Thailand
Location : TPA On Site Calibration Laboratory
Received Order : 25 July 2023
Calibrated Date : 27 July 2023
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
AC Line Voltage : (220 ± 22) V
Calibrated by : Preecha Hiahb
Approved by :
Approved Signatory
() Pornthippa Tameyakul
() Malee Butkrus
(x) Suwit Imjai
Issue Date : 31 July 2023

The Uncertainties are for a confidence probability of approximately 95%

This certification is valid for a maximum of 12 months from the date of issue.
Approved by: Technical of Economic Services, Technology Promotion Association (Thailand-Japan)

A 0053616



Equipment : DO Meter with Sensor
Condition As-Received : Used Item
Reference : 2307-0713DSC-2

Cert. No.: 23LM125
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	Serial No.	Cert. No.	Traceable	Due Date
1) Digital Thermometer	2188060	2211285	TPA	21 Oct 2023

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

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

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

Result of Calibration :- (*) Without Adjustment

Function : Temperature measurement.

This instrument was connected with temperature sensor, S/N.: 1228475367

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty (± °C)	Coverage Factor k
20.00	100	20.011	19.91	-0.101	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-

R 1159515



Equipment: Burette
Received Date: 19 September 2023
Condition As-Received: Used Item
Calibration Date: 25 September 2023
Reference: 2309-0635OSC-31

Cert.No.: 23GG3704
Page: 2 of 2

Condition of this result of calibration

1. Reference Standard Instruments:

Instruments	Model	Serial No.	ID No.	Certificate No.	Traceability	Due date
1) Balance	MS204TS	C226350963	140RC010	TH2068-012	METTLER	29 Sep 2023
2) Thermo-Hygrograph	THDX-CE	00016540	140EC001	23H1275	TPA	09 June 2024
3) Thermometer		1594592	140EC010	231158	TPA	12 Feb 2024

This certification is traceable to SI Unit

2. The certificate is valid only to the item calibrated on date and place of calibration.
3. True value is converted to true volume at the standard temperature of 20 °C

Calibration result:

Nominal capacity (mL)	Reading (mL)	Uncertainty (± mL)	k Factor
10	10.0224	0.0082	2.00
20	20.0064	0.0085	2.00
30	29.9931	0.0089	2.00
40	39.9910	0.0084	2.00
50	49.9808	0.010	2.00

Remark: mL = cm³

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

-000-

1182477



Certificate of Calibration

Equipment: SPECTROPHOTOMETER
Model: DR6000
Serial No. (or ID.): 1627845 (RYG_EN0037)
Manufacturer: HACH
Condition: In Condition

Certificate No.: C06230441
Issued Date: 19 September 2023
Job No.: WO-00005382
Page: 1 of 3

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

Environment Condition: Temperature 23.9 °C ± 0.2
Humidity 65.3 %RH ± 1.4

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

Calibration By: Mr.Nattapet Rungueang

Calibration Date: 18 September 2023

The Method used: In house method, CAL-WI-24, 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 Star Scientific Limited.

The standard for Wavelength Certificate No. 111583 and 111584
The standard for Photometric Certificate No. 9114984 and 111588
The standard for Stray light Certificate No. 111586 and 111585
The standard for Spectral resolution Certificate No. 111587

(Mr. Nattapet Rungueang)
Person in charge

(Mr. Nithun Srinawan)
Authorized signatory

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

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

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

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Phone: +66 2024 7000 Email: info@dksh.com Website: www.dksh.com

Delivering Growth - In Asia and Beyond.

CAL-FM-C06-19: 12 Sep 2022



Certificate No.: C06230441 Page 2 of 3

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
418.81	418.3	0.31	0.13
536.66	536.6	0.06	0.12
637.88	638.3	-0.32	0.12
748.48	748.7	-0.22	0.12
807.03	807.4	-0.37	0.12

Photometric Accuracy (Absorbance)

Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
	0.0000	0.000	0.0000	0.0045
	0.2930	0.285	0.0040	0.0045
420 nm	0.5168	0.519	-0.0022	0.0045
	1.0298	1.028	0.0008	0.0045
	0.0000	0.000	0.0000	0.0045
	0.2887	0.283	0.0037	0.0045
440 nm	0.5073	0.506	-0.0017	0.0045
	1.0083	1.007	0.0013	0.0045
	0.0000	0.000	0.0000	0.0045
	0.2516	0.250	0.0016	0.0045
466 nm	0.4585	0.462	-0.0025	0.0045
	0.9334	0.933	0.0004	0.0045
	0.0000	0.000	0.0000	0.0045
	0.2481	0.245	0.0011	0.0045
548.1 nm	0.4652	0.466	-0.0008	0.0045
	0.9468	0.946	0.0008	0.0045
	0.0000	0.000	0.0000	0.0045
	0.2584	0.259	0.0004	0.0045
590 nm	0.5040	0.505	-0.0010	0.0045
	1.0032	1.002	0.0012	0.0045
	0.0000	0.000	0.0000	0.0045
	0.2579	0.257	0.0008	0.0045
635 nm	0.4971	0.497	0.0001	0.0045
	0.9720	0.971	0.0010	0.0045

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CAL-FM-C06-19: 12 Sep 2022



Certificate No.: C06230441 Page 3 of 3

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
	0.7355	0.737	-0.0015	0.0080
267 nm	0.0000	0.000	0.0000	0.0080
	0.8574	0.857	0.0004	0.0080
313 nm	0.0000	0.000	0.0000	0.0080
	0.2884	0.290	-0.0036	0.0080
350 nm	0.0000	0.000	0.0000	0.0080
	0.6374	0.637	0.0004	0.0080

Stray light *

Standard: cut-off	UUC: Wavelength (nm)	UUC: Transmission (%)	Absorbance (A)
260.62 +/- 0.11 nm	260.8	1.3	1.886
391.44 +/- 0.11 nm	391.4	1.3	1.886

Spectral Resolution *

Nominal Concentration 0.02 % v/v	Peak	Trough	Ratio	SSW
Standard Wavelength (nm)	268.66	269.89	1.38	2.00
UUC: Wavelength (nm)	268.2	268.1		
Std Absorbance (A)	0.4508	0.2780		
Absorbance (A)	0.413	0.300		

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

The End of Certificate

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CAL-FM-C06-19: 12 Sep 2022

Certificate of Calibration

Model Number : MSE224S-100-DU Certificate No. : 23BC10112
Description : Analytical Balance Issued Date : Friday, March 03, 2023
Serial Number : 0026207038 Reference No. : 204833
ID No. : RYG_EN0002
Manufacturer : Sartorius Page No. : 2 of 2

Calibration Results : Without Adjustment

Repeatability			Eccentricity (Off-center loading error)		
The repeatability is the ability of a weighing instrument to display nearly identical readings under constant test conditions when the same load within a measurement range is placed repeatedly on the weighing pan in the same manner. The standard deviation is used to express repeatability quantitatively.			The off-center loading error is created by the difference between the radius of the load, i.e. 1/2 or 1/4 of maximum capacity, placed in the middle of the weighing pan and between each of four additional measurement points (positions defined according to OIML R76)		
Nominal Value : (Low Load)	20.0000 g	199.9999 g	Nominal value	100 g	g
20 g	20.0000	200.0000	Tolerance	0.0004 g	g
Tolerance	20.0000	199.9999			
0.0001 g	20.0000	200.0000			
	20.0000	199.9999			
Nominal Value : (High Load)	20.0000 g	199.9999 g			
200 g	19.9999	200.0000			
Tolerance	20.0000	200.0000			
0.0001 g	20.0000	199.9999			
	20.0000	200.0000			
Standard Deviation	0.00003	0.00004			

Linearity				
The linearity, also called linearity error, describes the deviation of the characteristic curve of a weighing instrument from the linear state.				
Tolerance	0.0002 g			
Nominal Value	Conventional Mass Value	Displayed Value	Deviation	Uncertainty
(g)	(g)	(g)	(g)	(g)
0.01	0.0100	0.0100	0.0000	0.00014
0.05	0.0500	0.0500	0.0000	0.00014
0.1	0.1000	0.1000	0.0000	0.00014
0.5	0.5000	0.5000	0.0000	0.00014
1	1.0000	1.0000	0.0000	0.00014
5	5.0000	5.0000	0.0000	0.00014
10	10.0000	10.0001	0.0001	0.00014
20	20.0000	20.0000	0.0000	0.00014
50	50.0000	50.0000	0.0000	0.00015
100	100.0000	99.9999	-0.0001	0.00019
200	200.0000	200.0000	0.0000	0.00032

SOP FM 33 03 February 2022



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 TATYANAKARN ROAD S/B HUAHANG, MUANG BANGKOK 10200
TEL: 0-2717-3000-21 FAX: 0-2719-9004



Cert. No.: 22TM1492
Page : 1 of 3

Certificate of Calibration

Equipment : Hot Air Oven
Manufacturer : Memmert
Model : UM 400
Serial No. : 0495.0888
ID No. : RYG_EN0006
Submitted by : ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch)
615/10 Moo 5, T. Maenam Khu,
A. Phukdaeng,
Rayong 21140, Thailand
Location : Oven Room
Received Order : 20 October 2022
Calibration Date : 20 October 2022
Ambient Temperature : (25 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Preecha Hahib

Approved by :
() Pongthipa Tameyskul
() Malee Bulkruea
() Suwit Imjai

Issue Date : 2 November 2022

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be organized otherwise in full, except with the prior written
consent of the National Association of Calibration Engineers (NACE)

A 0046905



Equipment : Hot Air Oven Cert. No.: 22TM1492
Condition As-Received : Used Item Page : 2 of 3
Reference : Z210-0378OC-1

Procedure Used :-

Calibration were conducted using calibration procedure CP-0702 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD)
The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34970A	MY44035217	21LM30	23 Dec 2022

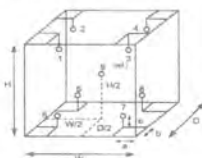
2. This certificate is valid only to the item calibrated on date and place of calibration.

3. This 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 :
L = 5.0 cm
W = 5.0 cm
H = 5.0 cm
Capacity = 0.053 m³

Environment during calibration		
	Beginning	Finished
Temp. (°C)	28	29
REL Humid. (%)	43	47
AC Supply (Volt)	220	221

Position :	Ref. Std. ID No.:
1	18-10RTD-01
2	18-10RTD-02
3	18-10RTD-03
4	18-10RTD-04
5	18-10RTD-05
6	18-10RTD-06
7	18-10RTD-07
8	18-10RTD-08
9 (ref.)	18-10RTD-09



Equipment : Hot Air Oven Cert. No.: 22TM1492
Condition As-Received : Used Item Page : 3 of 3
Reference : Z210-0378OC-1

Result of Calibration :-

Function of UUC* : Temperature Source

Fresh air setting : Close

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (± °C)	Coverage Factor
70.0	70.0	70.0	0.079	0.47	0.77	0.42	2

Measured Temperature (°C)

Position

1 2 3 4 5 6 7 8 9 (ref.)

70.0 70.262 69.995 70.079 70.177 70.564 70.039 70.688 70.149 70.328

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

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

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

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

UUC* : Unit Under Calibration

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

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

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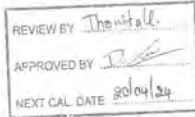
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TEL. 0-2715-3000-21 FAX 0-2715-3044



Cert. No.: 22TM1491
Page : 1 of 3

Certificate of Calibration

Equipment : Water Bath
Manufacturer : Memmert
Model : WNB22
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. Phukdaeng,
Rayong 21140, Thailand
Location : Wet Chemistry Lab
Received Order : 20 October 2022
Calibration Date : 20 October 2022
Ambient Temperature : $(26 \pm 10) ^\circ\text{C}$
Relative Humidity : $(50 \pm 30) \%$
Calibrated by : Preecha Hsieh
Approved by :
() Pornthippa Tameyakul
() Malee Butkruea
() Suwit Imjai



The Uncertainties are for a confidence probability of approximately 95%

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A 0046906



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2210-03760C-4
Procedure Used :-

Cert. No.: 22TM1491
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	MY44035217	21LM30	23 Dec 2022

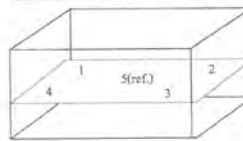
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

	Environmental		AC Voltage Supply
	(°C)	(%R.H.)	(Volt)
Beginning of Calibration	24	53	222
Finished of Calibration	24	50	221



Front

Position :	Ref. Std. S.N.:
1	N37P300726
2	N37P300727
3	N37P300728
4	N37P300729
5(ref.)	N37P300730

a 1132471



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2210-03760C-4
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source

Cert. No.: 22TM1491
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	84.527	84.563	84.628	84.516	84.580

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Uncertainty (± °C)	Coverage Factor k
85.0	0.12	0.081	0.18	2

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

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

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

UUC* : Unit Under Calibration

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

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

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a 1132470



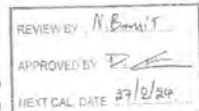
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TEL. 0-2715-3000-21 FAX 0-2715-3044



Cert.No.: 23CH275
Page : 1 of 3

Certificate of Calibration

Equipment : pH Meter
Manufacturer : Mettler Toledo
Model : SevenCompact S320
Serial No. : C104059480
ID No. : RYG_EN0183
Condition As-Received : Used Item
Received Date : 24 February 2023
Calibration Date : 27 February 2023
Reference : 2302-0886DSC-2
Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.
(Rayong Branch)
616/10 Moo 5, T. Maenam Khu, A. Phukdaeng,
Rayong 21140, Thailand



Ambient Temperature : $(25 \pm 2.5) ^\circ\text{C}$
Relative Humidity : $(50 \pm 15) \%$
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

Calibrated by : Waiaak Sirithean

Approved by :
Approved Signatory

() Malee Butkruea
() Sathip Meangmai
() Warakorn Lemgagrakul

Issue Date : 28 February 2023
The Uncertainties are for a confidence probability of approximately 95%

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A 0051538



Cert.No.: 23CH275
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	22E2789	24 Aug 2023
2) Ref. Standard Thermometer	4952054	110RC044	221306	27 Oct 2023

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	820588	09 July 2024
pH 6.867	CPA chem	826589	09 July 2023
pH 10.010	CPA chem	803835	28 Dec 2023

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	mV	pH	mV	pH		
pH Meter S/N: C104059460	4.000	177.48	177.4	4.000	0.058	4.000	0.058	2.00
	7.000	0.00	-0.1	7.000	0.058	7.000	0.058	2.00
	10.000	-177.48	-177.5	10.000	0.058	10.000	0.058	2.00

Sathip

1149925



Cert.No.: 23CH275
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	4.008	179.1	0.0046	2.00
	6.867	6.988	4.7	0.0084	2.00
	10.010	10.013	-172.4	0.0069	2.00

Function: Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe:

- Model: InLabExpert 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	25.001	24.8	-0.201	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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Sathip

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
5349 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250
TEL: 0-2715-3060, 24 FAX: 0-2715-9444



Certificate of Calibration

Certificate No.: 23E753
Page: 1 of 2

Equipment: pH Meter
Manufacturer: Mettler Toledo
Model: SevenCompact S220
Serial No.: C104059460
ID No.: RYG_EH0183
Condition As-Received: Used Item
Received Date: 24 February 2023
Calibration Date: 28 February 2023
Reference: 2302-088EDSC
Ambient Temperature: (23 \pm 2) °C
Relative Humidity: (50 \pm 10) %
Submitted by: ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch)
E1910 Moo 5, T. Maenam Khui, A Phukding, 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 standard instruments

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Multi-Product Calibrator	5000A	5440007	22E1670	18 May 2023

2) This result of calibration was made on request 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: Wuchareepong Wongchulakarn
Issue Date: 02 March 2023

Approved Signatory:
[] Prasinee Prabpai
[x] Nuntawan Khamsa
[] Pansittipha Tameyau

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Cert. No.: 23E753
Page: 2 of 2

Result of calibration: (*) Without adjustment, () After adjustment

Function: DC voltage measurement

Standard Value	UUC* Reading	Error	Uncertainty
(mV)	(mV)	(mV)	(\pm μ V)
-200.0000	-200.0	0.0	72
-150.0000	-150.0	0.0	89
-100.0000	-100.0	0.0	65
-50.0000	-50.0	0.0	62
0.0000	0.0	0.0	56
50.0000	50.0	0.0	62
100.0000	99.9	-0.1	65
150.0000	149.9	-0.1	69
200.0000	199.9	-0.1	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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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
53/4 PATANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK, 10250
TEL. 0-2117-3000-24 FAX. 0-2119-9484



Certificate of Calibration

Certificate No.: 23T1768
Page: 1 of 2

Equipment: Digital Thermometer
Manufacturer: Testo
Model: 106
Serial No.: 83517789/0921
ID No.: RYG_FS0571

Condition As-Received: Used Item
Received Date: 04 October 2023
Calibration Date: 10 October 2023
to 11 October 2023
Reference: 2310-0110DSC
Ambient Temperature: (25 ± 3) °C
Relative Humidity: (50 ± 20) %

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except with the prior written approval of the head of
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. Phusadang,
Rayong 21140, Thailand

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

Condition of this result of calibration

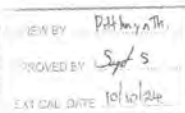
1. Reference standard instrument

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Black Stack Thermometer	1550	8C454	231000	30 May 2024
2) PRT Scanner Module	2562	AD1303	231600	30 May 2024
3) Industrial Platinum Resistance Thermometer	5627-12	571971	231000	30 May 2024

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 through:-

Technology Promotion Association (Thailand-Japan), NIST-ONS Accredited No. Calibration 0008



Calibrated by: Wasirun Sawatdee
Issue Date: 12 October 2023

Approved Signatory:
1) Phalinee Prapachai
1) Chatchawan Khungbuek
1) Watsop Lurklam

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Cert. No.: 23T1768
Page: 2 of 2

Result of Calibration:

Without Adjustment

Function: Temperature measurement
Dimension of probe: Diameter 3 mm, Length 55 mm. Sheath material: Stainless Steel

Immersion Depth (mm)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (± °C)
50	25.0025	24.9	-0.1025	0.12
50	30.0016	29.9	-0.1016	0.12
50	40.0034	40.0	-0.0034	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%.

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RYG_EN0010



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
53/4 PATANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK, 10250
TEL. 0-2117-3000-24 FAX. 0-2119-9484



Cert. No.: 22TM1517
Page: 1 of 3

Certificate of Calibration

Equipment: Hot 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. Phusadang,
Rayong 21140, Thailand

Location: Over Room

Received Order: 20 October 2022

Calibration Date: 20 October 2022

Ambient Temperature: (26 ± 10) °C

Relative Humidity: (50 ± 30) %

Calibrated by: Man Peltanapongpaiboon

Approved by:

() Pornthipa Tameyakul
() Malee Bulkruea
() Suwit Imjai

Issue Date: 2 November 2022

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

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Equipment: Hot Air Oven
Condition As-Received: Used Item
Reference: 2210-03760C-2
Procedure Used:-

Cert. No.: 22TM1517
Page: 2 of 3

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD) 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	MY49023932	22LM97	25 Jul 2023

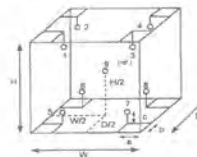
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration:- (°) Without Adjustment

Function of UUC*: Temperature Source

Fresh air setting: Close



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

Environment during calibration		
	Beginning	Finished
Temp. (°C)	25	25
REL. Humid. (%)	54	59
AC Supply (Volt)	223	225

Ref. Std. ID No.: @ Calibration Point		
Position:	(180) °C	(104) °C
1	21-16TC-01	20-16RTD-01
2	21-16TC-02	20-16RTD-02
3	21-16TC-03	20-16RTD-03
4	21-16TC-04	20-16RTD-04
5	21-16TC-05	22-16RTD-05
6	21-16TC-06	20-16RTD-06
7	21-16TC-07	20-16RTD-07
8	21-16TC-08	22-16RTD-08
9 (ref.)	21-16TC-09	22-16RTD-09

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Equipment : Hot Air Oven
 Condition As-Received : Used Item
 Reference : Z210-03760C-2
 Result of Calibration : () Without Adjustment
 Function of UUC* : Temperature Source
 Fresh air setting : Close

Cert. No.: Z2TM1517
 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
104.0	104.0	104.0	0.076	0.52	0.60	0.42	2
180.0	180.0	180.0	0.13	0.88	1.2	1.1	2

Calibration Point (°C)	Measured Temperature (°C)								
	1	2	3	4	5	6	7	8	9 (ref.)
104.0	103.768	103.734	103.723	103.800	104.215	104.131	104.132	103.740	103.747
180.0	179.723	179.359	179.439	179.489	180.361	180.114	180.131	180.243	179.605

Average* : The average of 30 values in each position.
 Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.
 Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location, which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.
 Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.
 UUC* : Unit Under Calibration.
 Note : The reported uncertainty of measurement was included stability and excluded uniformity.
 The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k, providing a level of confidence of approximately 95 %.

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Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhro, Saraburi 18110, Thailand.
 Saraburi Tel : +66 3627 3096 Fax : +66 3627 3100
 Bangkok Tel : +668 9205 8851 ~668 8247 2350
 Website : www.scieco.co.th E-Mail : calibrate@scg.com

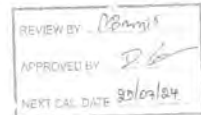


Certificate No. T230116

Page 1 of 4

Certificate of Calibration

Equipment : Chamber (Cooling Room)
 Manufacturer : MODULAR
 Model : IREVOCHCOO
 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.Pjuakdaeng, Rayong 21140
 Customer Location : Laboratory
 Date of Receipt : 23 January 2023
 Calibrated By : Atiphong Rongrat (Technician)
 Approved By : Boonchai Suriyawong (Site Calibration Manager)
 Date of Issue : 07 FEB 2023



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.

TSA1410501-08-04



Metrological Center

SCI ECO Services Company Limited

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



Certificate No. T230116

Page 2 of 4

Calibration Report

Equipment : Chamber (Cooling Room)
 Date of Calibration : 25 January 2023
 Environment : Temperature : 23.4-24.9 °C
 Line Voltage : 221.4-230.2 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 accordance 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	T222123	5 October 2023
TC	TYPE T	TN151-TN160	T222123	5 October 2023
DATA LOGGER	34970A	T150	T222123	5 October 2023
- This certificate is traceable to : National Institute of Metrology (Thailand) through Metrological Center (NSC-TIS-TIS 17025 CALIBRATION 0244).
- Condition of calibrated item : good
 Equipment Description :
 Time Constant : 1 Hour
 Fresh Air Damper : ☐ Open ☐ Min ☐ Medium ☐ Max
☒ Close
☒ Not Available
- Adjustment : (X) without adjustment () after adjustment

Approved By:

33/2100116/100001



Metrological Center

SCI ECO Services Company Limited

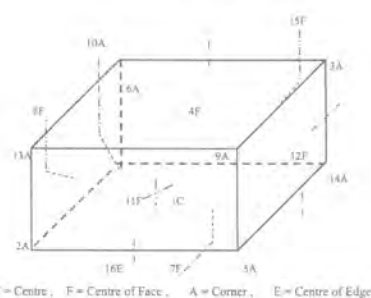
33/2 Moo 3, T.Banpa, A.Kaengkhro, Saraburi 18110, Thailand.



Certificate No. T230116

Page 3 of 4

Calibration Report



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

Approved By:

33/2100116/100001



Certificate No. T230116

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	TN151	TN152	TN153	TN154
3.0	3.03	3.16	3.15	3.19	3.45	3.47	3.21	3.35	3.54	3.45	3.24	3.34	3.28	3.22
	TN155	TN156	TN157	TN158	TN159	TN160	TN161	TN162	TN163	TN164	TN165	TN166	TN167	TN168
	3.28	3.22	3.28	3.21	3.21	3.21	3.21	3.21	3.21	3.21	3.21	3.21	3.21	3.21

Chamber (Cooling Room)			Temperature Distribution				
Setting (°C)	Reading (°C)		Stability (±°C)	Uniformity (°C)	Uncertainty (±°C)	Coverage Factor K	
	Min	Max					
3.0	2.8	4.1	3.5	1.20	1.20	1.90	2.07

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:

(00-115111)1500-03

BKK_EL0037



Agilent CrossLab Start Up Services

Agilent 5100 5110 ICP-OES Preventive Maintenance

REVIEW BY	
APPROVED BY	
TEST CAL DATE	01/05/20

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

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

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

Revision A.02, Issued 21 January 2022
Document Number: G8014-90075
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Page 1 of 1



Agilent 5100, 5110 Preventive Maintenance Checklist



Introduction

Customer Information

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

Revision A.02, Issued 21 January 2022
Document Number: G8014-90075
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Agilent 5100, 5110 Preventive Maintenance Checklist



Important Customer Web Links

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

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Document Number: G8014-90075
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Service Engineer's Responsibilities

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

Instrument Maintenance

System Information

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

Instrument System Name and ID	G8014A ; M916010005
Instrument System Site and Location	ALS C Block

List System Component Product Numbers	List the Serial Numbers of each Component
1. G8014A	M916010005
2. G9418A	AU15440964
3. G9412	6005-00189
4. G9485	AU16040115
5.	
6.	
7.	
8.	
9.	

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

Preparation

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

Preventive Maintenance Procedures

Record Pre-PM instrument performance

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

Clean and inspect ICP-OES system

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

Agilent Water Recirculator

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

SPS 3 Auto Sampler

☒ Service not applicable

- ☐ Power cycle the autosampler and verify successful initialization.
- ☐ Inspect X and Z axis belts for wear. Replace is necessary.
- ☐ Clean X and Z axis slide shafts.
- ☐ Using customer's racks and the Agilent software move the sample probe to the 4 outermost corners and rinse port, ensure that the probe is approximately centered in the vial.

SPS 4 Auto sampler

☐ Service not applicable

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

AVS 4, 6, 7 Advanced Valve System

☐ Service not applicable

- ☒ Replace valve rotor seal - *Inspect*
- ☒ Check fittings for signs of leaks
- ☒ Check tubing including autosampler tubing for kinks or excessive wear
- ☒ Check high flow pump for signs of leaks

ICP-OES adjustment

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

Record Post-PM instrument performance

- ☒ Run Instrument Performance test.
- ☒ Record results in Instrument Performance Test Results Table - Post PM.
- ☒ For systems using ICP Expert version 7.3 and above, run the following instrument tests:

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

- ☒ Record the result in the Instrument Test Results Table

Restore Instrument

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

Service Review

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

Test Results

Instrument Performance Test Results Table

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

	Pre PM Sensitivity Check		Post PM Sensitivity Check	
	Radial	Axial*	Radial	Axial*
Zn 213.857 nm SBR	23603.9	146365.1	79,349.9	164,399.5
Mn 257.610 nm SBR	153635.9	620,660.3	159,450.0	213,496.1
Al 396.152 nm SBR	29893.5	200,141.7	29,995.9	196,609.0
K 766.491 nm SBR	99616.9	3151,217.8	99,999.4	2,963,154.9

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

Instrument Test Results Table

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

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

ICP-OES Status Results Table

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

Measurement	Standby Mode	Plasma On
Mains Voltage	219.378 VAC	216.155 VAC
Mains Current	0.257 A	0.116 A
Instrument Temperature	24.4 °C	24.5 °C
RF Air Flow (sensor speed)	16.0 Hz	20.0 Hz
Plasma Exhaust Temperature	No measurement	49.3 °C
Water Flow Oscillator	No measurement	1.20 L/min
Water Flow Detector	1.12 L/min	1.09 L/min
Water Inlet Temperature	23.0 °C	23.5 °C
Polyturmator Temperature	35.0 °C	35.0 °C
CCO Temperature	-40.0 °C	-40.0 °C
Thermal Stabilizer	34.8 °C	35.0 °C
Argon Supply Pressure	619.75 kPa	541.42 kPa
Purge Gas Supply Pressure*1	609.55 kPa	567.77 kPa
Option Gas Supply Pressure*1	— kPa	— kPa
Nebulizer Flow	No measurement	0.70 L/min
Nebulizer Back Pressure	No measurement	255.26 kPa
Plasma Gas Flow	No measurement	11.98 L/min
Auxiliary Gas Flow	No measurement	1.0 L/min
RF Power	No measurement	1199.9 W
RF Supply Current	No measurement	5.22 A
RF Supply Voltage	No measurement	194.432 V

*1 If option installed

Consumed PM Parts

Part Description	Part Number	Product or Model# where used	Quantity consumed
Axial Pre-Optic Window	G8010-68014	G8010A, G8011A, G8014A/G8015A	1
Radial Pre-Optic Window	G8010-68015	All	1
Agilent Cool Clear Coolant Fluid	5799-0037	Agilent Water Recirculator	—
Purge Gas Filter	G8010-60136	All	1
Air Inlet Filter	G8000-68002	All	1
High Capacity Air Filter	G8010-60186	Optional	—
Rotor seal for 5-7 port valve for AV56/7	G8494-60002	G3494A/G3495	—
Rotor seal for 4 port valve for AV54	G8493-60002	G3493A	—
Rinse solution to rinse station 2 5mm id x 1m	G8410-80123	SPS 4	1
Barb connector 2 5mm i.d. 5mm i.d.	G8410-80124	SPS 4	1
PVC waste tubing 8mm od x 5mm id 2m	G8410-80122	SPS 4	1
Additional Parts may be required from engineer's stock:			
X axis drive belt	5410047500	SPS 3	—
Z axis drive belt	5410047400	SPS 3	—
Pneumatic pump tubing PVC SolveFlex 3 bridged	3710049000	SPS 4	—

Consumed Parts Reference

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

☐ Section Not Applicable

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

Service Engineer Comments (optional)

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

- During PM found water tubing in instrument broken then water leaking inside instrument.
- Replace all water tube inside instrument, after replace found water flow sensor water leak also.
- Replace water module and continue pm without deviation.

Service Verification

Service Request Number: 6605835474 Date Service Completed: 2 - May - 2023

Service Engineer Name: Burin Nannvijit Customer Name: Thirawat Banteng

Service Engineer Signature: Burin Nannvijit Customer Signature: Thirawat B.

Total number of pages in this document: 1

 REVIEW BY: P. Sanyam
 APPROVED BY: Sanyam N.
 NEXT CAL DATE: 30.11.23

Performance Verification Certificate

for Mercury Analyzer

Product ID: Quicktrace M-8000, Teledyne Leeman Labs

Equipment ID: BKK_EL0128 Mercury Analyzer
S/N: US22133002BKK_EL0129 Autosampler
S/N: 052222A560Customer Name: ALS Laboratory Group (Thailand) Co., Ltd.
Address: 104 Soi Pattana 40, Pattana Rd. Suan Luang, Suan Luang
Bangkok 10250 Thailand

Date of Qualified: November 30, 2022

Next Due date: November 30, 2023

This certifies for products which was performed in acceptable criteria specifications

Autosampler & Sample Introduction	PASSED
Analyzer	PASSED
Gas Liquid Separator & Dryer	PASSED
CVFS Detector	PASSED
Electronics/Mechanical	PASSED
Data station/PC	PASSED
Analytical test	PASSED

Provided by

 Scientist Instrument Co., Ltd.
 113 Soi Ekachai 44, Ekachai Road
 Khlong Bang Phe, Bangkok
 Bangkok 10150 Thailand

Certified by: Sanyam N.

Thunraphol Sakdayos
Service Engineer



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARAJI ROAD S/O 19 SUANLUANG SUANLUANG BANGKOK 10254
TEL: 0-2 (13-3000)-27 FAX: 0-2 (19-9434)



Cert.No.: 22CH1222
Page: 1 of 2

Certificate of Calibration

Equipment: pH Meter
Manufacturer: Mettler Toledo
Model: Seven Compact S220
Serial No.: B520948426
ID No.: BKK_EN0072
Condition As-Received: Used Item
Received Date: 09 September 2022
Calibration Date: 12 September 2022
Reference: 2209-0312DSC-1
Submitted by: ALS Laboratory Group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khwaeng Phatthanakan, Khet Suan Luang,
Bangkok 10250 Thailand
Ambient Temperature: (25 ± 2.5) °C
Relative Humidity: (50 ± 15) %
Calibration Procedure: In-house method
- CP-CHS by direct measurement with standard
voltage calibrator and direct measurement
with certified reference material (CRM)

Calibrated by: Warakorn Lemngagrakul

Approved by:
Approved Signatory

(/) Maloo Butkrua
() Sathip Meangmai
() Warakorn Lemngagrakul

Issue Date: 15 September 2022

The Uncertainties are for a confidence probability of approximately 95 %

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



Cert. No.: 22CH1222
Page: 2 of 2

Condition of this calibration result

1. Reference Standard Instrument
- | Instrument | Serial No. | ID No. | Cert. No. | Due Date |
|--------------------------------|------------|----------|-----------|-------------|
| 1) Document Process Calibrator | 54030049 | 130RC116 | 22E2769 | 24 Aug 2023 |
- 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-1635

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	823320	20 June 2024
pH 6.985	CPA chem	794122	14 Feb 2023
pH 10.008	CPA chem	823323	20 June 2023

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 (±mV)	Coverage factor k
	pH	mV	mV	mV	pH		
pH Meter	4.000	177.48	177.4	4.000	0.058	2.00	
S/N: B520948426	7.000	0.00	0.0	7.000	0.058	2.00	
	10.000	-177.48	-177.5	10.000	0.058	2.00	

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 (±)	Coverage factor k
pH Electrode S/N: PCE-66-EX1001	4.008	3.999	153.9	0.0055	2.09
	6.985	7.017	-13.7	0.0084	2.00
	10.008	9.996	-179.0	0.0078	2.06

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-

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ภาคผนวก จ

สำเนาหนังสือรับรองห้องปฏิบัติการวิเคราะห์เอกชน

ที่ อก ๐๓๑๐(๑)/ ๑๐๖๕



กรมโรงงานอุตสาหกรรม
ถนนพระรามที่ ๖ เขตราชเทวี
กรุงเทพมหานคร ๑๐๕๐๐

๒๔ มกราคม ๒๕๖๕

เรื่อง คัดสรรผู้สมัครรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน
เรียน กรรมการผู้จัดการ บริษัท แอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด
อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารเคมีของห้องปฏิบัติการวิเคราะห์เอกชน
ลงวันที่ ๓๐ กรกฎาคม ๒๕๖๓

สิ่งที่ส่งมาด้วย ๑. รายชื่อผู้ควบคุมห้องปฏิบัติการวิเคราะห์ จำนวน ๕ แผ่น
๒. รายชื่อเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๕ แผ่น
๓. ขอบข่ายสารเคมีที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๓๑ แผ่น

ตามหนังสือที่อ้างถึง บริษัท แอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด ขอต่ออายุ
หนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ๖-๒๐๔ สถานที่ตั้งเลขที่ ๓๐๔
ซอยพัฒนาการ ๔๐ ถนนพัฒนาการ แขวงพัฒนาการ เขตสวนหลวง กรุงเทพมหานคร
พร้อมโรงงานอุตสาหกรรม นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว ให้บริษัท แอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย)
จำกัด คัดสรรผู้สมัครรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน โดยมีองค์ประกอบดังนี้
ก. ผู้ควบคุมห้องปฏิบัติการวิเคราะห์ จำนวน ๖ ราย ตามสิ่งที่ส่งมาด้วย ๑
ข. เจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๒๒ ราย ตามสิ่งที่ส่งมาด้วย ๒
ค. ขอบข่ายสารเคมีที่ได้รับขึ้นทะเบียนวิเคราะห์ในบัญชี จำนวน ๕๓ รายการ นำไปติด
จำนวน ๑๒๒ รายการ ยากัดเสีย ๑๒ รายการ สิ่งปฏิกูลหรือวัสดุที่ไม่ใช้แล้ว จำนวน ๑๔ รายการ และดิน
จำนวน ๑๒๕ รายการ รวมทั้งสิ้นจำนวน ๓๒๖ รายการ ตามสิ่งที่ส่งมาด้วย ๓

หนังสือฉบับนี้จะมีผลตั้งแต่วันที่ ๒ กันยายน ๒๕๖๕ หากประสงค์จะต่ออายุหนังสือ
รับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน ให้ยื่นคำขอต่ออายุพร้อมเอกสารประกอบคำขอ
ต่อกรมโรงงานอุตสาหกรรม ภายใน ๓๐ วัน ก่อนวันสิ้นอายุของหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์
เอกชน ซึ่งคำขอต่ออายุดังกล่าวขอรับได้ที่กรมโรงงานอุตสาหกรรม

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

(นายศิระ จันทร์นิล)
อธิบดีกรมโรงงานอุตสาหกรรม
ผู้อำนวยการกองส่งเสริมและสนับสนุน
ผู้ชำนาญการกองส่งเสริมและสนับสนุน
ผู้ชำนาญการกองส่งเสริมและสนับสนุน

กองวิจัยและเฝ้าระวังมลพิษโรงงาน

กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบและทะเบียนห้องปฏิบัติการ

โทร. ๐ ๒๒๒๖ ๔๑๔๖ ๐ ๒๒๒๖ ๔๐๐๖

โทรสาร ๐ ๒๒๕๔ ๒๒๐๒ ๐ ๒๒๕๔ ๒๒๕๕

เอกสารแนบท้ายหนังสือรับต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน
บริษัท แอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด
ที่ อก ๐๓๑๐(๑)/ ลงวันที่ ๒๔ มกราคม ๒๕๖๕

เลขทะเบียน ๖-๒๐๔

ก. ผู้ควบคุมห้องปฏิบัติการวิเคราะห์ จำนวน ๖ ราย

๑) นางสาวสุพาพร จันทร์ปลั่ง	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๐๐
๒) นางสาวชัชวาลย์ ไกรกรกุล ณ นคร	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๐๑
๓) นายศราวุธ จิตราชนนท์	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๐๒
๔) นางสาวกนกกร เอนก	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๐๓
๕) นายสุริยา สอนแก้ว	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๐๔
๖) นายวิชาญ จันทะวี	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๐๕

(นายศิระ จันทร์นิล)

อธิบดีกรมโรงงานอุตสาหกรรม
ผู้อำนวยการกองส่งเสริมและสนับสนุน
ผู้ชำนาญการกองส่งเสริมและสนับสนุน
ผู้ชำนาญการกองส่งเสริมและสนับสนุน

เอกสารแนบท้ายหนังสือรับต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน
บริษัท แอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด
ที่ อก ๐๓๑๐(๑)/ ๑๐๖๕ ลงวันที่ ๒๔ มกราคม ๒๕๖๕ เลขทะเบียน ๖-๒๐๔

ข. เจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๒๒ ราย

๑) นางสาวจินดา ไชยสุธรรม	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๐๖
๒) นางสาวสวดี น้อยเสียม	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๐๗
๓) นางสาวณัฐกัญญา อิมขม	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๐๘
๔) นางสาววันวิมล สายแสง	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๐๙
๕) นางสาวนิภากร สมบูรณ์	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๑๐
๖) นางสาวศรียา แฉะอึ้ง	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๑๑
๗) นางสาวสวดี มงคลจิราวุธ	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๑๒
๘) นางสาวสิริลักษณ์ พึ่งพาน	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๑๓
๙) นายพนมกร จันทร์พันธ์	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๑๔
๑๐) นายเกรียงไกร ไชยกุล	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๑๕
๑๑) นายอัมรินทร์ จิรายุ	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๑๖
๑๒) นางสาวกมลรัตน์ แก้วมัน	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๑๗
๑๓) นางสาวสุวิมล ชัยเรืองวุฒิ	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๑๘
๑๔) นางสาวสุภาวดี สรรเสริญ	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๑๙
๑๕) นางสาวเมตตา ชัยเชษฐกุล	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๒๐
๑๖) นางสาวศศิธร หนูสวัสดิ์	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๒๑
๑๗) นางสาวสวดีทิพย์ ภูมาอำพร	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๒๒
๑๘) นายอภิสิทธิ์ สิงหา	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๒๓
๑๙) นายศักดิ์สิทธิ์ โพธิ์กลางพิสุทธิ	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๒๔
๒๐) ว่าที่ร้อยตรีหญิง พรรณีภา ชัยเจริญ	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๒๕
๒๑) นางจิตรา คำแก้ว	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๒๖
๒๒) นางสาวอรรณพ รักษ์	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๒๗
๒๓) นางสาวนันทิมา นันทิมา	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๒๘
๒๔) นายอุบลเดช วารินทร์	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๒๙
๒๕) นางสาวศุภาวดี ร้อยคำ	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๓๐
๒๖) นายอนุช ฤทธิชัย	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๓๑
๒๗) นายบุญชา นามะเขตต์	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๓๒
๒๘) นายพนม ศรีปิตนเศรษฐ์	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๓๓
๒๙) นายอุทัย ดูนิม	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๓๔
๓๐) ว่าที่ร้อยตรี เฉลิมเกียรติ อมวศรีเสริม	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๓๕
๓๑) นางสาววิภา สว่างนา	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๓๖
๓๒) นายอุทัย รัตนศรีประเสริฐ	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๓๗
๓๓) นางสาวจุฑามาศ โอบนสินชัย	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๓๘
๓๔) นางสาวจรรยาพร พันธ์พิศุทธิ	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๓๙

(นายศิระ จันทร์นิล)

อธิบดีกรมโรงงานอุตสาหกรรม
ผู้อำนวยการกองส่งเสริมและสนับสนุน
ผู้ชำนาญการกองส่งเสริมและสนับสนุน
ผู้ชำนาญการกองส่งเสริมและสนับสนุน

๓๕) นางสาวปรางค์ทิพย์...

- ๒ -

๓๕) นางสาวปรางค์ทิพย์ กิจไพศาลศักดิ์	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๔๐
๓๖) นางสาวเดือนใจ ทาเกล	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๔๑
๓๗) นางสาวจิราพร ศิริราช	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๔๒
๓๘) นายวรกร สุทธิรักษ์	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๔๓
๓๙) นายพนม วิริยะสถิต	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๔๔
๔๐) นายณัฐ เจนบุ	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๔๕
๔๑) นายณิศ จันทะ	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๔๖
๔๒) นายอรรถพล นิเวศวิทยาพันธ์	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๔๗
๔๓) นายภูวรินทร์ พรหมเสนา	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๔๘
๔๔) นายณเดช โภคาพิพัฒน์	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๔๙
๔๕) นายชวฤทธิ์ วงษ์จันทร์	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๕๐
๔๖) นายอาทิตย์ ศรีเสน	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๕๑
๔๗) นายเจตนาถ คงศักดิ์ไทย	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๕๒
๔๘) นายธีรพัฒน์ บุญ	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๕๓
๔๙) นายอนันต์ เชน	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๕๔
๕๐) นายอภิวัฒน์ ภูมัญ	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๕๕
๕๑) นางสาวสุภาวดี ภูมัญ	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๕๖
๕๒) นางสาวกมลพร ขวัญบุญ	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๕๗
๕๓) นางสาววิภา บุญ	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๕๘
๕๔) นางสาวกนกกร เข้มแข็ง	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๕๙
๕๕) นางสาวทิพย์ พันธ์นิล	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๖๐
๕๖) นางสาวกนกพร สุวรรณศรี	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๖๑
๕๗) นางสาวกนกพร นามะเขตต์	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๖๒
๕๘) นางสาวอุไรรัตน์ พันธ์สร้าง	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๖๓
๕๙) นายธีรวัฒน์ ปวงสุข	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๖๔
๖๐) นายธีรวัฒน์ ยะ	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๖๕
๖๑) นายประพนธ์ วรรณสุข	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๖๖
๖๒) นายชยธร พงษ์พิ	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๖๗
๖๓) นางสาวกนกพร นามะเขตต์	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๖๘
๖๔) นางสาวกนกพร นามะเขตต์	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๖๙
๖๕) นายสิทธิโชค ธงวัน	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๗๐
๖๖) นางสาวกนกพร นามะเขตต์	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๗๑
๖๗) นางสาวกนกพร นามะเขตต์	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๗๒
๖๘) นางสาวกนกพร นามะเขตต์	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๗๓
๖๙) นางสาวกนกพร นามะเขตต์	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๗๔
๗๐) นายสุริยา ทองอ่อน	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๗๕
๗๑) นายวิชาญ บุญ	ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๗๖

(นายศิระ จันทร์นิล)

อธิบดีกรมโรงงานอุตสาหกรรม
ผู้อำนวยการกองส่งเสริมและสนับสนุน
ผู้ชำนาญการกองส่งเสริมและสนับสนุน
ผู้ชำนาญการกองส่งเสริมและสนับสนุน

๓๖) นายณัฐบุณย์...

- ๓๓๖) นายสมบุญ บุตรจันทร์
๓๓๗) นายวิวัฒน์ ไชยชนะ
๓๓๘) นายณัฐวัฒน์ เต็มขุน
๓๓๙) นายจิรวัฒน์ ขาวทอง
๓๔๐) นายสมโภช วิมล
๓๔๑) นายอัคริ บานบุรี
๓๔๒) นายณัฐวัฒน์ ปานประเสริฐ
๓๔๓) นายอัคริพร อ้อสาว
๓๔๔) นายประเสริฐ สุระชัย
๓๔๕) นายบุญ วัฒนวิกรม
๓๔๖) นายพิรพงษ์ ทองคุณปริศา
๓๔๗) นายณัฐพล ทองสุข
๓๔๘) นายอนุวัฒน์ ม่วงแพ
๓๔๙) นายเจษฎา วัฒนวิกรม
๓๕๐) นายณัฐพล สายวรรณ
๓๕๑) นายพิชัย บุญยงค์
๓๕๒) นายณัฐวัฒน์ วัฒนวิกรม
๓๕๓) นายสมานต์ วัฒนวิกรม
๓๕๔) นายณัฐวัฒน์ วัฒนวิกรม
๓๕๕) นายณัฐวัฒน์ วัฒนวิกรม
๓๕๖) นายณัฐวัฒน์ วัฒนวิกรม
๓๕๗) นายณัฐวัฒน์ วัฒนวิกรม
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๓๖๙) นายณัฐวัฒน์ วัฒนวิกรม
๓๗๐) นายณัฐวัฒน์ วัฒนวิกรม

(นายคิระ จันทร์เกิด)
ผู้อำนวยการสำนักงานทรัพยากรธรรมชาติและสิ่งแวดล้อม
จังหวัดนนทบุรี
๓๗๐) นายณัฐวัฒน์ วัฒนวิกรม

- ๓๗๑) นายณัฐวัฒน์ วัฒนวิกรม
๓๗๒) นายณัฐวัฒน์ วัฒนวิกรม
๓๗๓) นายณัฐวัฒน์ วัฒนวิกรม
๓๗๔) นายณัฐวัฒน์ วัฒนวิกรม
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๓๗๗) นายณัฐวัฒน์ วัฒนวิกรม
๓๗๘) นายณัฐวัฒน์ วัฒนวิกรม
๓๗๙) นายณัฐวัฒน์ วัฒนวิกรม
๓๘๐) นายณัฐวัฒน์ วัฒนวิกรม
๓๘๑) นายณัฐวัฒน์ วัฒนวิกรม
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๓๙๖) นายณัฐวัฒน์ วัฒนวิกรม
๓๙๗) นายณัฐวัฒน์ วัฒนวิกรม
๓๙๘) นายณัฐวัฒน์ วัฒนวิกรม
๓๙๙) นายณัฐวัฒน์ วัฒนวิกรม
๔๐๐) นายณัฐวัฒน์ วัฒนวิกรม

(นายคิระ จันทร์เกิด)
ผู้อำนวยการสำนักงานทรัพยากรธรรมชาติและสิ่งแวดล้อม
จังหวัดนนทบุรี
๔๐๐) นายณัฐวัฒน์ วัฒนวิกรม

- ๓๗๑) นายณัฐวัฒน์ วัฒนวิกรม
๓๗๒) นายณัฐวัฒน์ วัฒนวิกรม
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๓๙๙) นายณัฐวัฒน์ วัฒนวิกรม
๔๐๐) นายณัฐวัฒน์ วัฒนวิกรม

(นายคิระ จันทร์เกิด)
ผู้อำนวยการสำนักงานทรัพยากรธรรมชาติและสิ่งแวดล้อม
จังหวัดนนทบุรี
๔๐๐) นายณัฐวัฒน์ วัฒนวิกรม

เอกสารแนบท้ายหนังสือรับข้อบัญญัติของประธานสภาจังหวัดนนทบุรี
ปริญญ์ เอเธนส์ แลนด์ทอว์ กรุ๊ป (ประเทศไทย) จำกัด
ที่ ๓๓ ๓๓๓(๑) ๑๐๖๕ ลงวันที่ ๒๔ มกราคม ๒๕๖๕

ขอขยายสารเคมีที่ได้รับความเสียหายจากกรณีโรงงานอุตสาหกรรม จำนวน ๓๖๑ รายการ
น้ำเสีย จำนวน 52 รายการ

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

(นายณัฐวัฒน์ วัฒนวิกรม)
ผู้อำนวยการสำนักงานทรัพยากรธรรมชาติและสิ่งแวดล้อม
จังหวัดนนทบุรี

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

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44 Methomyl...

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

น้ำดื่ม จำนวน 126 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Acenaphthene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
2	Acetone	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾

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3 Aldrin...

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

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
18 Bis(2-ethylhexyl)phthalate...

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

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34 Chromium (III)...

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


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
51 cis-1,2-Dichloroethylene...

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


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
68 Fluorene...

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


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
84 Methanol...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
84	Methanol	1) Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾ 2) Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
85	Methoxychlor	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
86	Methyl Bromide	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
87	Methylene Chloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
88	2-Methylphenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
89	2-Methylnaphthalene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
90	Methyl tert-Butyl Ether	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
91	Naphthalene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
92	Nickel	1) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ⁽⁴⁾
93	Nitrobenzene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
94	N-Nitrosodiphenylamine	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
95	N-Nitrosodi-n-Propylamine	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
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 ⁽⁴⁾


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97 Pentachlorophenol...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
97	Pentachlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
98	pH	Electrometric Method ⁽⁴⁾
99	Phenanthrene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
100	Phenol	1) Distillation, Direct Photometric Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
101	Pyrene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
102	Selenium	1) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ⁽⁴⁾
103	Silver	1) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ⁽⁴⁾
104	Styrene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
105	1,1,2,2-Tetrachloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
106	Tetrachloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
107	Toluene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
108	Toxaphene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
109	TPH (C ₇ -C ₉)	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(1,2,4)
110	TPH (C ₁₀ -C ₁₉)	Solvent Extraction, Gas Chromatographic Method ^(9,21)
111	TPH (C ₁₀ -C ₁₉)	Solvent Extraction, Gas Chromatographic Method ^(9,21)
112	1,2,4-Trichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
113	1,1,1-Trichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾



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 กระทรวงพาณิชย์

114 1,1,2-Trichloroethane...

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


จากหนังสือ (ปัจจัยธรรมชาติ) จำนวน 16 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Antimony	Isokinetic, Digestion, Inductively Coupled Plasma Method ⁽³⁾
2	Arsenic	Isokinetic, Digestion, Inductively Coupled Plasma Method ⁽³⁾


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3 Carbon Monoxide...


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


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สิ่งปฏิกูล...

สิ่งปฏิกูลหรือวัสดุที่ไม่ใช้แล้ว จำนวน 35 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Aldrin	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1,3,21) 2) Soxhlet Extraction, Gas Chromatographic Method ^(16,22) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(22,31)
2	Antimony	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,4,13) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,4,14) 3) Digestion, Inductively Coupled Plasma Method ^(7,15) 4) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^(7,16)
3	Arsenic	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,4,15) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,4,16) 3) Digestion, Inductively Coupled Plasma Method ^(7,17) 4) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^(7,18)
4	Barium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,4,19) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,4,19) 3) Digestion, Inductively Coupled Plasma Method ^(7,19) 4) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^(7,18)
5	Beryllium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,4,20) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,4,19) 3) Digestion, Inductively Coupled Plasma Method ^(7,21) 4) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^(7,18)


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6 Cadmium...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
6	Cadmium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1.4.15) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1.4.16) 3) Digestion, Inductively Coupled Plasma Method ^(7.15) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7.16)
7	Chlordane	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1.9.23) 2) Soxhlet Extraction, Gas Chromatographic Method ^(10.22) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(22.31)
8	Chromium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1.4.15) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1.4.16) 3) Digestion, Inductively Coupled Plasma Method ^(7.15) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7.16)
9	Chromium (III)	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method; Waste Extraction, Colorimetric Method; Calculation Method ^(1.4.15,17) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method; Waste Extraction, Colorimetric Method; Calculation Method ^(1.4.16,17) 3) Digestion, Inductively Coupled Plasma Method; Alkaline Digestion, Colorimetric Method; Calculation Method ^(7.15,17) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method; Alkaline Digestion, Colorimetric Method; Calculation Method ^(7.16,17)
10	Chromium (VI)	1) Waste Extraction, Colorimetric Method ^(1.4.17) 2) Alkaline Digestion, Colorimetric Method ^(1.17)

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กรมส่งเสริมการค้าระหว่างประเทศ

11 Cobalt...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
11	Cobalt	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1.4.15) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1.4.16) 3) Digestion, Inductively Coupled Plasma Method ^(7.15) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7.16)
12	Copper	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1.4.15) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1.4.16) 3) Digestion, Inductively Coupled Plasma Method ^(7.15) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7.16)
13	2,4-D	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1.9.23) 2) Soxhlet Extraction, Gas Chromatographic Method ^(10.22) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(22.31)
14	DDO	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1.9.23) 2) Soxhlet Extraction, Gas Chromatographic Method ^(10.22) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(22.31)
15	DOE	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1.9.23) 2) Soxhlet Extraction, Gas Chromatographic Method ^(10.22) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(22.31)
16	DOT	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1.9.23)

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2) Soxhlet...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
17	Dieldrin	2) Soxhlet Extraction, Gas Chromatographic Method ^(10.22) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(22.31) 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1.9.23) 2) Soxhlet Extraction, Gas Chromatographic Method ^(10.22) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(22.31)
18	Endrin	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1.9.23) 2) Soxhlet Extraction, Gas Chromatographic Method ^(10.22) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(22.31)
19	Heptachlor	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1.9.23) 2) Soxhlet Extraction, Gas Chromatographic Method ^(10.22) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(22.31)
20	Lead	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1.4.15) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1.4.16) 3) Digestion, Inductively Coupled Plasma Method ^(7.15) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7.16)
21	Lindane	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1.9.23) 2) Soxhlet Extraction, Gas Chromatographic Method ^(10.22) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(22.31)
22	Mercury	1) Waste Extraction, Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ^(1.4.18)

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2) Waste Extraction...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
23	Methoxychlor	2) Waste Extraction, Thermal Decomposition Amalgamation and Atomic Absorption Spectrometric Method ^(1.4.19) 3) Waste Extraction, Digestion, Cold-Vapor Atomic Fluorescence Spectrometric Method ^(1.4.20) 4) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ^(1.18) 5) Thermal Decomposition Amalgamation and Atomic Absorption Spectrometric Method ^(1.19) 6) Digestion, Cold-Vapor Atomic Fluorescence Spectrometric Method ⁽²⁶⁾
24	Mirex	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1.9.23) 2) Soxhlet Extraction, Gas Chromatographic Method ^(10.22) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(22.31)
25	Molybdenum	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1.4.15) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1.4.16) 3) Digestion, Inductively Coupled Plasma Method ^(7.15) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7.16)
26	Nickel	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1.4.15) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1.4.16) 3) Digestion, Inductively Coupled Plasma Method ^(7.15) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7.16)

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
27 Polychlorinated...

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 ^(1,5,23) 2) Soxhlet Extraction, Gas Chromatographic Method ^(10,23) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(10,23)


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28 Pentachlorophenol...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
28	Pentachlorophenol	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1,9,23) 2) Soxhlet Extraction, Gas Chromatographic Method ^(10,23) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(10,23)
29	pH	Electrometric Method ^(23,23)
30	Selenium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,4,13) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,4,16) 3) Digestion, Inductively Coupled Plasma Method ^(7,13) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7,16)
31	Silver	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,4,13) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,4,16)
32	Thallium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,4,13) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,4,16) 3) Digestion, Inductively Coupled Plasma Method ^(7,13) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7,16)
33	Toxaphene	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1,9,23) 2) Soxhlet Extraction, Gas Chromatographic Method ^(10,23) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(10,23)
34	Vanadium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,4,13) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,4,16) 3) Digestion, Inductively Coupled Plasma Method ^(7,13)


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4) Digestion...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
35	Zinc	4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7,16) 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,4,13) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,4,16) 3) Digestion, Inductively Coupled Plasma Method ^(7,13) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7,16)


สืบ จำนวน 125 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Acenaphthene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(23,31)
2	Acetone	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(14,20)
3	Aldrin	1) Soxhlet Extraction, Gas Chromatographic Method ^(10,23) 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(23,31)
4	Anthracene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(23,31)
5	Antimony	1) Digestion, Inductively Coupled Plasma Method ^(7,13) 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7,16)
6	Arsenic	1) Digestion, Inductively Coupled Plasma Method ^(7,13) 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7,16)
7	Atrazine	1) Soxhlet Extraction, Gas Chromatographic Method ^(10,23) 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(23,31)
8	Barium	1) Digestion, Inductively Coupled Plasma Method ^(7,13) 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7,16)


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9 Benz(a)anthracene...

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


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26 Carbon tetrachloride...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
26	Carbon tetrachloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14,24)
27	Chlordane	1) Soxhlet Extraction, Gas Chromatographic/ Method ^(10,22) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
28	p-Chloroaniline	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
29	Chlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14,24)
30	Chlorodibromomethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14,24)
31	Chloroform	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14,24)
32	2-Chlorophenol	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
33	Chromium	1) Digestion, Inductively Coupled Plasma Method ^(7,15) 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^(7,14)
34	Chromium (III)	1) Digestion, Inductively Coupled Plasma Method, Alkaline Digestion, Colorimetric Method, Calculation Method ^(7,6,15,17) 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method, Alkaline Digestion, Colorimetric Method, Calculation Method ^(7,6,14,17)
35	Chromium (VI)	Alkaline Digestion, Colorimetric Method ^(6,17)
36	Chrysene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
37	Cyanide	Extraction, Distillation, Colorimetric Method ^(24,27,28)
38	2,4-D	1) Soxhlet Extraction, Gas Chromatographic/ Method ^(10,22) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
39	DDO	1) Soxhlet Extraction, Gas Chromatographic/ Method ^(10,22) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)

สำนักงานสิ่งแวดล้อม
(นางวิภาดา ชัยมงคลกิจ)

40 DDE...

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

สำนักงานสิ่งแวดล้อม
(นางวิภาดา ชัยมงคลกิจ)

57 Dieldrin...

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

สำนักงานสิ่งแวดล้อม
(นางวิภาดา ชัยมงคลกิจ)

71 Hexachlorobenzene

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

สำนักงานสิ่งแวดล้อม
(นางวิภาดา ชัยมงคลกิจ)

2) Thermal...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
84	Methanol	2) Thermal Decomposition, Amalgamation, and Atomic Absorption Spectrophotometry ⁽¹⁾⁽⁸⁾ 3) Digestion, Cold-Vapor Atomic Fluorescence Spectrometric Method ⁽²⁾⁽²⁰⁾ Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method ⁽¹⁾⁽²⁾⁽²⁰⁾
85	Methoxychlor	1) Soxhlet Extraction, Gas Chromatographic Method ⁽¹⁾⁽²⁾⁽²¹⁾ 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽²⁾⁽³⁾⁽³¹⁾
86	Methyl Bromide	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ⁽¹⁾⁽²⁾⁽²⁰⁾
87	Methylene Chloride	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ⁽¹⁾⁽²⁾⁽²⁰⁾
88	2-methylphenol	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽²⁾⁽³⁾⁽³¹⁾
89	2-Methylnaphthalene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽²⁾⁽³⁾⁽³¹⁾
90	Methyl tert-Butyl Ether	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ⁽¹⁾⁽²⁾⁽²⁰⁾
91	Naphthalene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽²⁾⁽³⁾⁽³¹⁾
92	Nickel	1) Digestion, Inductively Coupled Plasma Method ⁽⁷⁾⁽¹⁾⁽³⁾ 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ⁽⁷⁾⁽¹⁾⁽⁶⁾
93	Nitrobenzene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽²⁾⁽³⁾⁽³¹⁾
94	N-Nitrosodiphenylamine	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽²⁾⁽³⁾⁽³¹⁾
95	N-Nitrosodi-n-propylamine	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽²⁾⁽³⁾⁽³¹⁾
96	Polychlorinated biphenyls (PCBs) - Aroclor 1016 - Aroclor 1221 - Aroclor 1232	1) Soxhlet Extraction, Gas Chromatographic Method ⁽¹⁾⁽²⁾⁽²¹⁾ 2) Automated Soxhlet Extraction, Gas Chromatographic Method ⁽²⁾⁽³⁾⁽³¹⁾

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- Aroclor 1242...

ลำดับที่	สารเคมี	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 ⁽²⁾⁽³⁾⁽³¹⁾
98	Phenanthrene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽²⁾⁽³⁾⁽³¹⁾
99	Phenol	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽²⁾⁽³⁾⁽³¹⁾
100	Pyrene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽²⁾⁽³⁾⁽³¹⁾

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101 Selenium...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
101	Selenium	1) Digestion, Inductively Coupled Plasma Method ⁽⁷⁾⁽¹⁾⁽³⁾ 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ⁽⁷⁾⁽¹⁾⁽⁶⁾
102	Silver	1) Digestion, Inductively Coupled Plasma Method ⁽⁷⁾⁽¹⁾⁽³⁾ 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ⁽⁷⁾⁽¹⁾⁽⁶⁾
103	Styrene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ⁽¹⁾⁽²⁾⁽²⁰⁾
104	1,1,2,2-Tetrachloroethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ⁽¹⁾⁽²⁾⁽²⁰⁾
105	Tetrachloroethylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ⁽¹⁾⁽²⁾⁽²⁰⁾
106	Toluene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ⁽¹⁾⁽²⁾⁽²⁰⁾
107	Tosaphene	1) Soxhlet Extraction, Gas Chromatographic Method ⁽¹⁾⁽²⁾⁽²¹⁾ 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽²⁾⁽³⁾⁽³¹⁾
108	TPH (C ₈ -C ₆)	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ⁽¹⁾⁽²⁾⁽²⁰⁾
109	TPH (C ₈ -C ₁₆)	1) Solvent Extraction, Gas Chromatographic Method ⁽¹⁾⁽²⁾⁽²¹⁾ 2) Automated Soxhlet Extraction, Gas Chromatographic Method ⁽²⁾⁽³⁾⁽³¹⁾
110	TPH (C ₁₈ -C ₃₀)	1) Solvent Extraction, Gas Chromatographic Method ⁽¹⁾⁽²⁾⁽²¹⁾ 2) Automated Soxhlet Extraction, Gas Chromatographic Method ⁽²⁾⁽³⁾⁽³¹⁾
111	1,2,4-Trichlorobenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ⁽¹⁾⁽²⁾⁽²⁰⁾
112	1,1,1-Trichloroethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ⁽¹⁾⁽²⁾⁽²⁰⁾
113	1,1,2-Trichloroethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ⁽¹⁾⁽²⁾⁽²⁰⁾
114	Trichloroethylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ⁽¹⁾⁽²⁾⁽²⁰⁾
115	2,4,5-Trichlorophenol	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽²⁾⁽³⁾⁽³¹⁾

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116 2,4,6-Trichlorophenol...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
116	2,4,6-Trichlorophenol	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽²⁾⁽³⁾⁽³¹⁾
117	1,3,5-Trimethylbenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ⁽¹⁾⁽²⁾⁽²⁰⁾
118	Vanadium	1) Digestion, Inductively Coupled Plasma Method ⁽⁷⁾⁽¹⁾⁽³⁾ 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ⁽⁷⁾⁽¹⁾⁽⁶⁾
119	Vinyl Acetate	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ⁽¹⁾⁽²⁾⁽²⁰⁾
120	Vinyl Chloride	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ⁽¹⁾⁽²⁾⁽²⁰⁾
121	m-Xylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ⁽¹⁾⁽²⁾⁽²⁰⁾
122	o-Xylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ⁽¹⁾⁽²⁾⁽²⁰⁾
123	p-Xylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ⁽¹⁾⁽²⁾⁽²⁰⁾
124	Xylene (Total)	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ⁽¹⁾⁽²⁾⁽²⁰⁾
125	Zinc	1) Digestion, Inductively Coupled Plasma Method ⁽⁷⁾⁽¹⁾⁽³⁾ 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ⁽⁷⁾⁽¹⁾⁽⁶⁾

เอกสารอ้างอิง

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กรมโรงงานอุตสาหกรรม

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กรมโรงงานอุตสาหกรรม

กลุ่มมาตรฐานวิธีการวิเคราะห์ทางเคมีและทางกายภาพและทางชีววิทยา กรมโรงงานอุตสาหกรรม โทร. ๐ ๒๒๒๒ ๙๐๐๐, ๙๑๐๐



ที่ BR ๐๐๐๐๐/๒๐๒๓

กรมโรงงานอุตสาหกรรม
ถนนพระยาพิชัย ๒ แขวงทุ่งพญาไท
เขตราชเทวี กรุงเทพมหานคร ๑๐๖๐๐

๐๒ มีนาคม ๒๐๒๓

เรื่อง เปลี่ยนแปลงชุดรายการของห้องปฏิบัติการวิเคราะห์

เรียน การจัดการผู้จัดการ บริษัท เมลลอบอนด์ เมลลอบอนด์ จำกัด (ประเทศไทย) จำกัด

อ้างถึง คำขอขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์ทางเคมีและทางกายภาพ และนิติทางเคมีของห้องปฏิบัติการวิเคราะห์ทางเคมีและทางกายภาพ กรมโรงงานอุตสาหกรรม

ตามที่ บริษัท เมลลอบอนด์ เมลลอบอนด์ จำกัด (ประเทศไทย) จำกัด ได้ขอขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์ทางเคมีและทางกายภาพ และนิติทางเคมีของห้องปฏิบัติการวิเคราะห์ทางเคมีและทางกายภาพ กรมโรงงานอุตสาหกรรม

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว มีความเห็นดังนี้

๑. ให้ยกเลิกจำนวนที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๔ รายการ

- | | |
|--------------------------|-----------------------------|
| ๑) นานโซลาร์ โซลาร์เซลล์ | ทะเบียนเลขที่ ๖ ๒๐๑๔-๖ ๒๐๑๕ |
| ๒) นานโซลาร์ นานโซลาร์ | ทะเบียนเลขที่ ๖ ๒๐๑๔-๖ ๒๐๑๕ |
| ๓) นานโซลาร์ นานโซลาร์ | ทะเบียนเลขที่ ๖ ๒๐๑๔-๖ ๒๐๑๕ |
| ๔) นานโซลาร์ นานโซลาร์ | ทะเบียนเลขที่ ๖ ๒๐๑๔-๖ ๒๐๑๕ |
| ๕) นานโซลาร์ นานโซลาร์ | ทะเบียนเลขที่ ๖ ๒๐๑๔-๖ ๒๐๑๕ |
| ๖) นานโซลาร์ นานโซลาร์ | ทะเบียนเลขที่ ๖ ๒๐๑๔-๖ ๒๐๑๕ |
| ๗) นานโซลาร์ นานโซลาร์ | ทะเบียนเลขที่ ๖ ๒๐๑๔-๖ ๒๐๑๕ |
| ๘) นานโซลาร์ นานโซลาร์ | ทะเบียนเลขที่ ๖ ๒๐๑๔-๖ ๒๐๑๕ |
| ๙) นานโซลาร์ นานโซลาร์ | ทะเบียนเลขที่ ๖ ๒๐๑๔-๖ ๒๐๑๕ |
| ๑๐) นานโซลาร์ นานโซลาร์ | ทะเบียนเลขที่ ๖ ๒๐๑๔-๖ ๒๐๑๕ |
| ๑๑) นานโซลาร์ นานโซลาร์ | ทะเบียนเลขที่ ๖ ๒๐๑๔-๖ ๒๐๑๕ |
| ๑๒) นานโซลาร์ นานโซลาร์ | ทะเบียนเลขที่ ๖ ๒๐๑๔-๖ ๒๐๑๕ |
| ๑๓) นานโซลาร์ นานโซลาร์ | ทะเบียนเลขที่ ๖ ๒๐๑๔-๖ ๒๐๑๕ |
| ๑๔) นานโซลาร์ นานโซลาร์ | ทะเบียนเลขที่ ๖ ๒๐๑๔-๖ ๒๐๑๕ |
| ๑๕) นานโซลาร์ นานโซลาร์ | ทะเบียนเลขที่ ๖ ๒๐๑๔-๖ ๒๐๑๕ |
| ๑๖) นานโซลาร์ นานโซลาร์ | ทะเบียนเลขที่ ๖ ๒๐๑๔-๖ ๒๐๑๕ |
| ๑๗) นานโซลาร์ นานโซลาร์ | ทะเบียนเลขที่ ๖ ๒๐๑๔-๖ ๒๐๑๕ |
| ๑๘) นานโซลาร์ นานโซลาร์ | ทะเบียนเลขที่ ๖ ๒๐๑๔-๖ ๒๐๑๕ |
| ๑๙) นานโซลาร์ นานโซลาร์ | ทะเบียนเลขที่ ๖ ๒๐๑๔-๖ ๒๐๑๕ |

๔. ให้ยกเลิกจำนวนที่

๒. ให้ยกเลิกจำนวนที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๕ รายการ

- | | |
|--------------------------|-----------------------------|
| ๑) นานโซลาร์ โซลาร์เซลล์ | ทะเบียนเลขที่ ๖ ๒๐๑๔-๖ ๒๐๑๕ |
| ๒) นานโซลาร์ โซลาร์เซลล์ | ทะเบียนเลขที่ ๖ ๒๐๑๔-๖ ๒๐๑๕ |
| ๓) นานโซลาร์ โซลาร์เซลล์ | ทะเบียนเลขที่ ๖ ๒๐๑๔-๖ ๒๐๑๕ |
| ๔) นานโซลาร์ โซลาร์เซลล์ | ทะเบียนเลขที่ ๖ ๒๐๑๔-๖ ๒๐๑๕ |
| ๕) นานโซลาร์ โซลาร์เซลล์ | ทะเบียนเลขที่ ๖ ๒๐๑๔-๖ ๒๐๑๕ |

ดังนั้น ขอให้ยกเลิกจำนวนที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๕ รายการ

ที่ BR ๐๐๐๐๐/๒๐๒๓ ลงวันที่ ๒๑ มีนาคม ๒๐๒๓ ที่ลงวันที่ ๒ มีนาคม ๒๐๒๓ ทั้งนี้ สามารถดำเนินการ

ได้ตามระบบอิเล็กทรอนิกส์ได้ทั้งนี้โปรดแจ้งกรมโรงงานอุตสาหกรรม ตาม QR Code ที่แนบมาด้วย

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

(นางริศกัญญา ธิตกรกุลวิไล)

ผู้อำนวยการศูนย์มาตรฐานวิธีวิเคราะห์ทางเคมีและทางกายภาพ
กรมโรงงานอุตสาหกรรม

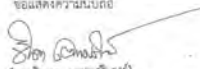
กลุ่มมาตรฐานวิธีการวิเคราะห์ทางเคมีและทางกายภาพและทางชีววิทยา กรมโรงงานอุตสาหกรรม โทร. ๐ ๒๒๒๒ ๙๐๐๐, ๙๑๐๐
โทรสาร ๐ ๒๒๒๒ ๙๐๐๐ FAX ๒๒๒๒ ๙๐๐๐
ไปรษณีย์อิเล็กทรอนิกส์ sdg@ma.doe.go.th



สามารถที่จะส่งมาด้วย

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

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

(นางฉวีลา เศรษฐ์ศิริกุล)
ผู้อำนวยการกองวิเคราะห์และควบคุมมลพิษ
ปฎิบัติราชการแทนอธิบดีกรมโรงงานอุตสาหกรรม
๒๕ มิ.ย. ๒๕๖๕

กองวิจัยและเคมดินกับมลพิษโรงงาน
ศูนย์วิจัยและเคมดินกับมลพิษโรงงานภาคตะวันออก
โทร. ๐ ๒๖๐๕ ๙๐๖๑-๓
ไปรษณีย์อิเล็กทรอนิกส์: envs@mgr.go.th

เอกสารแนบท้ายหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน
บริษัท เอนแอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด เลขทะเบียน ๖-๓๒๓
ที่ ๑๓ ๐๓๑๐(๑)/ ๒๕๗๐ ลงวันที่ ๒๕ มิถุนายน ๒๕๖๕

ขอขยายสารมลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๒๔ รายการ
เป็นเสีย จำนวน 14 รายการ

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

เอกสารเสีย (เปลี่ยนรายการ) จำนวน 7 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Carbon Monoxide	1) Sampling Bag, Non-Dispersive Infrared Method ⁽²⁾ 2) Instrumental Analyzer Method ⁽²⁾
2	Hydrogen Sulfide	Absorption Sampling, Iodometric Method ⁽²⁾
3	Opacity	Ringelmann's Method ⁽²⁾
4	Oxide of Nitrogen	1) Absorption Sampling, Phenolsulfonic Acid Method ⁽²⁾ 2) Instrumental Analyzer Method ⁽²⁾
5	Sulfur Dioxide	1) Absorption Sampling, Barium-Thoron Titrimetric Method ⁽²⁾ 2) Instrumental Analyzer Method ⁽²⁾

วิศ. นิตยา
(นางสาววิภาดา สัมฤทธิ์ชัย)
ผู้อำนวยการ
ศูนย์วิจัยและเคมดินกับมลพิษโรงงานภาคตะวันออก Sulfuric Acid...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
6	Sulfuric Acid	Isokinetic Sampling, Barium - Thoron Titrimetric Method ⁽²⁾
7	Total Suspended Particulate	Isokinetic Sampling, Gravimetric Method ⁽²⁾

หนังสือรับขึ้นทะเบียน จำนวน 3 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Cyanide	Distillation, Colorimetric Method ⁽²⁾
2	pH	Electrometric Method ⁽²⁾
3	Phenols	Distillation, Direct Photometric Method ⁽²⁾

เอกสารอ้างอิง

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7. United States Environmental Protection. Standards of Performance for New Stationary Sources. 40 CFR 60, Appendix A, 2020.
8. United States Environmental Protection Agency. Determination of Carbon Monoxide Emissions from Stationary Sources; Instrumental Analyzer Procedure. 40 CFR 60, Appendix A Method 10, 2017.
9. United States Environmental Protection Agency. Determination of Oxide of Nitrogen Emissions from Stationary Sources; Instrumental Analyzer Procedure. 40 CFR 60, Appendix A Method 7E, 2019.
10. United States Environmental Protection Agency. Determination of Sulfur Dioxide Emissions from Stationary Sources; Instrumental Analyzer Procedure. 40 CFR 60, Appendix A Method 6C, 2017.

วิศ. นิตยา
(นางสาววิภาดา สัมฤทธิ์ชัย)
ผู้อำนวยการ

ศูนย์วิจัยและเคมดินกับมลพิษโรงงานภาคตะวันออก

ศูนย์วิจัยและเคมดินกับมลพิษโรงงานภาคตะวันออก กองวิจัยและเคมดินกับมลพิษโรงงาน กรมโรงงานอุตสาหกรรม โทร ๐ ๒๖๐๕ ๙๐๖๑-๓

สำเนา

ที่ ๑๓ ๐๓๑๐/ ๒๕๖๕

กรมโรงงานอุตสาหกรรม
แผนกทะเบียนที่ ๒ แขวงทุ่งพญาไท
เขตราชเทวี กรุงเทพฯ ๑๐๖๐๐

๒๕ มิ.ย. ๒๕๖๕

เรื่อง เปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์

เรียน กรรมการผู้จัดการ บริษัท เอนแอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด

อ้างถึง คำขอเปลี่ยนบุคลากรของห้องปฏิบัติการวิเคราะห์เอกชน ลงวันที่ ๑๔ มีนาคม ๒๕๖๕

ตามที่หนังสืออ้างถึง บริษัท เอนแอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด ขอแจ้งปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ๖-๓๒๓ สดวันที่ ๒๒๖/๑๐ หมู่ที่ ๕ ตำบลแม่ไม้คู่ อำเภอเลวและจังหวัดระยอง ขอเปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์ ความละเอียดแจ้งดังนี้

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว มีความเห็นดังนี้

ก. ให้อนุญาตเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๕ ราย

- | | | |
|---|---------------|--------------|
| ๑) นางสาวเจษฎาพร ศรีบุญเรือง | ทะเบียนเลขที่ | ๖-๓๒๓-๖-๑๔๓๓ |
| ๒) นางสาวสุรินทร์ สิงห์นา | ทะเบียนเลขที่ | ๖-๓๒๓-๖-๑๔๓๓ |
| ๓) นางสาวนิตยา นฤจิตต์ | ทะเบียนเลขที่ | ๖-๓๒๓-๖-๑๔๓๓ |
| ๔) นายศุภณัฐ พิธีพันธ์ | ทะเบียนเลขที่ | ๖-๓๒๓-๖-๑๔๓๓ |
| ๕) นายสิทธิชัย แก้วเทศ | ทะเบียนเลขที่ | ๖-๓๒๓-๖-๑๔๓๓ |
| ข. ให้เพิ่มเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๒ ราย | | |
| ๑) นายณัฐพงษ์ เพ็ชรนา | ทะเบียนเลขที่ | ๖-๓๒๓-๖-๑๔๓๓ |
| ๒) นางสาวกัญญารัตน์ วัคคิ | ทะเบียนเลขที่ | ๖-๓๒๓-๖-๑๔๓๓ |
| ๓) นางสาวจุฑาทิพย์ สีทองกลาง | ทะเบียนเลขที่ | ๖-๓๒๓-๖-๑๔๓๓ |
| ๔) นางสาวจิตติมา ประเสริฐสุข | ทะเบียนเลขที่ | ๖-๓๒๓-๖-๑๔๓๓ |
| ๕) นายธรรมวิทย์ คุ้มสุภา | ทะเบียนเลขที่ | ๖-๓๒๓-๖-๑๔๓๓ |
| ๖) นายณัฐวุฒิ ธนพรพรหม | ทะเบียนเลขที่ | ๖-๓๒๓-๖-๑๔๓๓ |
| ๗) นายจิตรกร สิมะลา | ทะเบียนเลขที่ | ๖-๓๒๓-๖-๑๔๓๓ |
| ๘) นายสิทธิวิทย์ สุวรรณรัตน์ | ทะเบียนเลขที่ | ๖-๓๒๓-๖-๑๔๓๓ |
| ๙) นายสิทธิวัฒน์ เสนาธิ์ | ทะเบียนเลขที่ | ๖-๓๒๓-๖-๑๔๓๓ |
| ๑๐) นายสุรวิทย์ เสนา | ทะเบียนเลขที่ | ๖-๓๒๓-๖-๑๔๓๓ |
| ๑๑) นายสุรวิทย์ เสนา | ทะเบียนเลขที่ | ๖-๓๒๓-๖-๑๔๓๓ |
| ๑๒) นายณัฐศักดิ์ ะวีร์บุญ | ทะเบียนเลขที่ | ๖-๓๒๓-๖-๑๔๓๓ |

๕ มิ.ย.

อนึ่ง หนังสือฉบับนี้จะหมดอายุพร้อมหนังสือรับขึ้นทะเบียนก่อนปฏิบัติภารกิจประจำที่เอกชน
ที่ ๒๓ ๐๓๑๐(๒)๖๕๓๐๐ ลงวันที่ ๒๘ มิถุนายน ๒๕๖๕ คือในวันที่ ๒๘ มิถุนายน ๒๕๖๕ ทั้งนี้ สามารถยื่นคำขอผ่าน
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