

ภาคผนวก ง

เอกสารการสอบเทียบเครื่องมือตรวจวิเคราะห์



รายงานเครื่องใช้เป็นการร่วม / ผลรวม

Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Heat Cal	Freq. Calibrate (Months)
Water Lab	Calcium	Q2-CES	RYG_110001	23-Sep-25	23-Nov-24	18
Water Lab	Calcium	Hot Block	RYG_110004	22-Sep-25	22-Nov-24	18
Water Lab	Calcium	Chamber - Clogging Round	RYG_100007	6-Nov-25	6-Jan-25	18
Water Lab	Magnesium	Q2-CES	RYG_110001	23-Sep-25	23-Nov-24	18
Water Lab	Magnesium	Hot Block	RYG_110004	22-Sep-25	22-Nov-24	18
Water Lab	Magnesium	Chamber - Clogging Round	RYG_100007	6-Nov-25	6-Jan-25	18
Water Lab	Sulfur	Q2-CES	RYG_110001	23-Sep-25	23-Nov-24	18
Water Lab	Sulfur	Hot Block	RYG_110004	22-Sep-25	22-Nov-24	18
Water Lab	Sulfur	Chamber - Clogging Round	RYG_100007	6-Nov-25	6-Jan-25	18
Water Lab	Salinity	Q2-CES	RYG_110001	23-Sep-25	23-Nov-24	18
Water Lab	Salinity	Hot Block	RYG_110004	22-Sep-25	22-Nov-24	18
Water Lab	Salinity	Chamber - Clogging Round	RYG_100007	6-Nov-25	6-Jan-25	18
Water Lab	Chlorophyll	Q2-CES	RYG_110001	23-Sep-25	23-Nov-24	18
None	Long 8 hrs	Sound Calibrator	RYG_P30205	28-Feb-25	27-Feb-25	12
None	Long 8 hrs	Sound Level Meter	RYG_P30206	13-Jul-25	13-Jul-25	12
None	Long 8 hrs	Sound Level Meter	RYG_P30207	21-Jan-25	21-Jan-25	12
None	Long 8 hrs	Sound Level Meter	RYG_P30208	25-Jan-25	26-Jan-25	12
None	Long 8 hrs	Sound Level Meter	RYG_P30209	1-Sep-25	1-Sep-25	12
None	Long 8 hrs	Sound Level Meter	RYG_P30210	12-Jan-25	11-Jan-25	12
None	Long 8 hrs	Sound Level Meter	RYG_P30211	5-Jan-25	4-Jan-25	12
None	Long 8 hrs	Sound Level Meter	RYG_P30212	12-Jan-25	11-Jan-25	12
None	Long 8 hrs	Sound Calibrator	RYG_P30213	28-Feb-25	27-Feb-25	12
None	Long 8 hrs	Sound Level Meter	RYG_P30214	19-Sep-25	19-Sep-25	12
None	Long 8 hrs	Sound Level Meter	RYG_P30215	13-Jul-25	13-Jul-25	12
None	Long 8 hrs	Sound Level Meter	RYG_P30216	25-Jan-25	26-Jan-25	12
None	Long 8 hrs	Sound Level Meter	RYG_P30217	30-Aug-24	30-Aug-24	12
None	Long 8 hrs	Sound Level Meter	RYG_P30218	12-Jan-25	11-Jan-25	12
None	Long 8 hrs	Sound Level Meter	RYG_P30219	30-Aug-24	30-Aug-24	12
None	Long 8 hrs	Sound Level Meter	RYG_P30220	12-Jan-25	11-Jan-25	12
None	Long 8 hrs	Sound Level Meter	RYG_P30221	9-Jun-25	9-Jun-25	12
None	Long 8 hrs	Sound Level Meter	RYG_P30222	11-Jan-25	10-Jan-25	12
None	Long 8 hrs	Sound Level Meter	RYG_P30223	19-Feb-25	18-Feb-25	12
Fluorimetric	Fluorimetric	Lab Meter	RYG_P30271	14-Nov-24	13-Nov-24	12
Fluorimetric	Fluorimetric	Lab Meter	RYG_P30224	16-Jan-25	16-Jan-25	12

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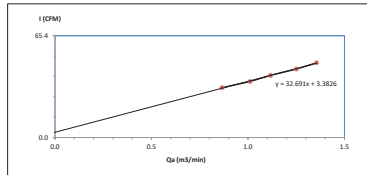
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High Volume Air Sampler Calibration Worksheet

Project Site :	Gulf NC Co., Ltd.	Barometric Pressure (mm Hg) :	756.0
Calibrate Location :	ท่าเรือท่าเรือท่าเรือ	Temperature (°C) :	33.5
Calibrate Date :	1-Nov-24	High Volume ID :	RYG_P30647
CalibrationSheet No.:	C-011124-RYG_P30647	High Volume Model :	TE-50095
Calibrator ID :	RYG_P30205	High Volume S/N :	6266
Calibrator Model :	TE-5028A	Calibrator Slope :	0.95561
Calibrator S/N :	1166	Calibrator Intercept :	-0.02266

Test No.	Delta H ₂ O (inch)	Q _a (m ³ /min)	1 : Chart (CFM)	Linear Regression
1	1.6	0.865	32	Slope: 32.6913
2	2.2	1.011	36	Intercept: 3.3826
3	2.7	1.118	40	Correlation Coefficient: 0.9985
4	3.4	1.251	44	
5	4.0	1.355	48	



Calibrated by : (Mr. Apichart Wilars) RYG-Field Services Scientist(1)
Approved by : (Mr. Supat Salamat) RYG-Field Services Section Head

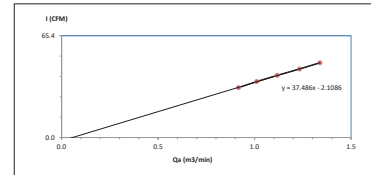
FORM NO. F-06-074 REVISION NO.2 ISSUE DATE: 20/11/23



High Volume Air Sampler Calibration Worksheet

Project Site :	Gulf NC Co., Ltd.	Barometric Pressure (mm Hg) :	756
Calibrate Location :	ท่าเรือท่าเรือท่าเรือ	Temperature (°C) :	33.5
Calibrate Date :	1-Nov-24	High Volume ID :	RYG_P30191
CalibrationSheet No.:	C-011124-RYG_P30191	High Volume Model :	TE-5009X
Calibrator ID :	RYG_P30205	High Volume S/N :	5330
Calibrator Model :	TE-5028A	Calibrator Slope :	0.95561
Calibrator S/N :	1166	Calibrator Intercept :	-0.02266

Test No.	Delta H ₂ O (inch)	Q _a (m ³ /min)	1 : Chart (CFM)	Linear Regression
1	1.8	0.917	32	Slope: 37.4856
2	2.2	1.011	36	Intercept: -2.1086
3	2.7	1.118	40	Correlation Coefficient: 0.9955
4	3.3	1.233	44	
5	3.9	1.339	48	



Calibrated by : (Mr. Apichart Wilars) RYG-Field Services Scientist(1)
Approved by : (Mr. Supat Salamat) RYG-Field Services Section Head

FORM NO. F-06-074 REVISION NO.2 ISSUE DATE: 20/11/23



รายงานเครื่องใช้เป็นการร่วม / ผลรวม

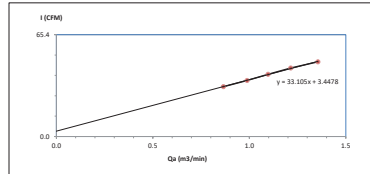
Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Ambient	Particulate Matter (PM 10)	High Volume	RYG_P30645	-	-	On-site Calibration
Ambient	Particulate Matter (PM 10)	High Volume	RYG_P30646	-	-	On-site Calibration
Ambient	Particulate Matter (PM 10)	High Volume	RYG_P30647	-	-	On-site Calibration
Ambient	Particulate Matter (PM 10)	High Volume	RYG_P30648	-	-	On-site Calibration
Ambient	Particulate Matter (PM 10)	High Volume	RYG_P30649	-	-	On-site Calibration
Ambient	Particulate Matter (PM 10)	Digital Balance	RYG_P30650	29-Feb-25	29-Feb-25	12
Ambient	Total Suspended Particulate	High Volume	RYG_P30205	-	-	On-site Calibration
Ambient	Total Suspended Particulate	High Volume	RYG_P30206	-	-	On-site Calibration
Ambient	Total Suspended Particulate	High Volume	RYG_P30207	-	-	On-site Calibration
Ambient	Total Suspended Particulate	High Volume	RYG_P30208	-	-	On-site Calibration
Ambient	Total Suspended Particulate	High Volume	RYG_P30209	-	-	On-site Calibration
Ambient	Total Suspended Particulate	Digital Balance	RYG_P30651	29-Feb-25	29-Feb-25	12
Ambient	Hydrogen Peroxide	RYG_Analyzer	RYG_P30204	2-Jul-25	2-Jul-25	6
Ambient	Hydrogen Peroxide	RYG_Analyzer	RYG_P30205	5-Jul-25	5-Jul-25	6
Ambient	Hydrogen Peroxide	RYG_Analyzer	RYG_P30206	5-Jul-25	5-Jul-25	6
Ambient	Hydrogen Peroxide	RYG_Analyzer	RYG_P30207	2-Jul-25	2-Jul-25	6
Ambient	Hydrogen Peroxide	RYG_Analyzer	RYG_P30208	5-Jul-25	5-Jul-25	6
Ambient	Hydrogen Peroxide	RYG_Analyzer	RYG_P30209	5-Jul-25	5-Jul-25	6
Ambient	Hydrogen Peroxide	RYG_Analyzer	RYG_P30210	6-Jul-25	6-Jul-25	6
Ambient	Hydrogen Peroxide	RYG_Analyzer	RYG_P30211	5-Jul-25	5-Jul-25	6
Ambient	Hydrogen Peroxide	RYG_Analyzer	RYG_P30212	6-Jul-25	6-Jul-25	6
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	RYG_P30215	21-Aug-24	21-Aug-24	18
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	RYG_P30216	18-Sep-24	18-Sep-24	18
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	RYG_P30217	18-Sep-24	18-Sep-24	18
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	RYG_P30218	18-Sep-24	18-Sep-24	18
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	RYG_P30219	18-Sep-24	18-Sep-24	18
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	RYG_P30220	17-Sep-24	17-Sep-24	18
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	RYG_P30221	18-Sep-24	18-Sep-24	18
Stack	Total Suspended Particulate	Flow Rate	RYG_P30222	15-Jul-25	15-Jul-25	6
Stack	Total Suspended Particulate	Flow Rate	RYG_P30223	16-Jul-25	16-Jul-25	6
Stack	Total Suspended Particulate	Digital Balance	RYG_P30224	24-Apr-24	23-Apr-24	12
Stack	Total Suspended Particulate	Digital Balance	RYG_P30225	22-Feb-25	22-Feb-25	12
Stack	Total Suspended Particulate	Digital Balance	RYG_P30226	22-Feb-25	22-Feb-25	12
Stack	Total Suspended Particulate	Digital Balance	RYG_P30227	22-Feb-25	22-Feb-25	12
Stack	Total Suspended Particulate	Digital Balance	RYG_P30228	22-Feb-25	22-Feb-25	12
Stack	Total Suspended Particulate	Digital Balance	RYG_P30229	22-Feb-25	22-Feb-25	12
Stack	Total Suspended Particulate	Digital Balance	RYG_P30230	22-Feb-25	22-Feb-25	12
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Stack	Total Suspended Particulate	Digital Balance	RYG_P30232	22-Feb-25	22-Feb-25	12
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Stack	Total Suspended Particulate	Digital Balance	RYG_P30235	22-Feb-25	22-Feb-25	12
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Stack	Total Suspended Particulate	Digital Balance	RYG_P30243	22-Feb-25	22-Feb-25	12
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Stack	Total Suspended Particulate	Digital Balance	RYG_P30251	22-Feb-25	22-Feb-25	12
Stack	Total Suspended Particulate	Digital Balance	RYG_P30252	22-Feb-25	22-Feb-25	12
Stack	Total Suspended Particulate	Digital Balance	RYG_P30253	22-Feb-25	22-Feb-25	12
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Stack	Total Suspended Particulate	Digital Balance	RYG_P30354	22-Feb-25	22-Feb-25	12
Stack	Total Suspended Particulate	Digital Balance	RYG_P30355	22-Feb-25	22-Feb-25	12
Stack	Total Suspended Particulate	Digital Balance	RYG_P30356	22-Feb-25	22-Feb-25	12
Stack	Total Suspended Particulate	Digital Balance	RYG_P30357	22-Feb-25	22-Feb-25	12
Stack	Total Suspended Particulate	Digital Balance	RYG_P30358	22-Feb-25	22-Feb-25	12
Stack	Total Suspended Particulate	Digital Balance	RYG_P30359	22-Feb-25	22-Feb-25	12
Stack	Total Suspended Particulate	Digital Balance	RYG_P30360	22-Feb-25	22-Feb-25	12
Stack	Total Suspended Particulate	Digital Balance	RYG_P30361	22-Feb-25	22-Feb-25	12
Stack	Total Suspended Particulate	Digital Balance	RYG_P30362	22-Feb-25	22-Feb-25	12
Stack	Total Suspended Particulate	Digital Balance	RYG_P30363	22-Feb-25	22-Feb-25	12
Stack	Total Suspended Particulate	Digital Balance	RYG_P30364	22-Feb-25	22-Feb-25	12
Stack	Total Suspended Particulate	Digital Balance	RYG_P30365	22-Feb-25	22-Feb-25	12
Stack	Total Suspended Particulate	Digital Balance	RYG_P30366	22-Feb-25	22-Feb-25	12
Stack	Total Suspended Particulate	Digital Balance	RYG_P30367	22-Feb-25	22-Feb-25	12
Stack	Total Suspended Particulate	Digital Balance	RYG_P30368	22-Feb-25	22-Feb-25	12
Stack	Total Suspended Particulate	Digital Balance	RYG_P30369	22-Feb-25	22-Feb-25	12
Stack	Total Suspended Particulate	Digital Balance	RYG_P30370	22-Feb-25	22-Feb-25	12
Stack	Total Suspended Particulate	Digital Balance	RYG_P30371	22-Feb-25	22-Feb-25	12
Stack	Total Suspended Particulate	Digital Balance	RYG_P30372	22-Feb-25	22-Feb-25	12
Stack	Total Suspended Partic					



High Volume Air Sampler Calibration Worksheet

Project Site :	Gulf NC Co., Ltd.	Barometric Pressure (mm Hg) :	756.0
Calibrate Location :	สมุทรสาคร	Temperature (°C) :	33.5
Calibrate Date :	1-Nov-24	High Volume ID :	RYG-FS0666
CalibrationSheet No.:	C-011124-RYG-FS0666	High Volume Model :	TE-5009X
Calibrator ID :	RYG-FS0205	High Volume S/N :	6265
Calibrator Model :	TE-5028A	Calibrator Slope :	0.95561
Calibrator S/N :	1166	Calibrator Intercept :	-0.02266

Test No.	Delta H ₂ O (inch)	Q _{as} (m ³ /min)	I: Chart (CFM)	Linear Regression
1	1.6	0.865	32	Slope: 33.1952
2	2.1	0.988	36	Intercept: 1.4478
3	2.6	1.097	40	Correlation Coefficient: 0.9990
4	3.2	1.215	44	
5	4.0	1.355	48	



Calibrated by: [Signature] Approved by: [Signature]
(Mr. Apichart Wilans) (Mr. Supot Salanteth)
RYG-Field Services Scientist(1) RYG-Field Services Section Head

FORM NO. F 06-074 REVISION NO.2 ISSUE DATE: 20/11/23

Sartorius (Thailand) Co., Ltd.
101 Rama 4 Road, Bangkok, Thailand 10110
Tel: +66 2843 8181-4 Fax: +66 2843 8187 e-mail: sartorius.thailand@sartorius.com

SARTORIUS

Certificate of Calibration

Model Number :	LA1305-F	Certificate No :	24BCH0008
Description :	Analytical Balance	Issued Date :	Friday, February 23, 2024
Serial Number :	3040004	Reference No :	229198
ID No. :	RYG_EN0001	Page No. :	2 of 2
Manufacturer :	Sartorius		

Calibration Results : Without Adjustment

Repeatability		Eccentricity (Off-center loading error)	
This repeatability is the ability of a weighing instrument to display steady identical readings under constant test conditions within the same mass within a mass nominal value is placed repeatedly at the weighing place of the same function. The standard deviation is used to represent repeatability quantitatively.		This off-center loading error is plotted by the difference between the readings of the load (LA 1305 or 103 at maximum capacity, placed at the middle of the weighing pan and reference pans of four identical measurement points) positions defined according to DIN 6108, 6176.	
Nominal Value (Low Load)	10.0000 g	Nominal value:	50 g
Tolerance	0.0001 g	Tolerance:	0.0004 g
Standard Deviation	0.00005 g	Difference:	0

Linearity		Linearity	
This linearity, with stated uncertainty, describes the maximum of line (uncertainty) factor of a weighing instrument from the linear range.		This linearity, with stated uncertainty, describes the maximum of line (uncertainty) factor of a weighing instrument from the linear range.	
Nominal Value	0.0002 g	Displayed Value	0.0002 g
Conversion Factor	0.0002 g	Deviation	0.0000 g
Uncertainty	0.0000 g	Uncertainty	0.0000 g
1	0.0000 g	1	0.0000 g
2	0.0000 g	2	0.0000 g
3	0.0000 g	3	0.0000 g
4	0.0000 g	4	0.0000 g
5	0.0000 g	5	0.0000 g
6	0.0000 g	6	0.0000 g
7	0.0000 g	7	0.0000 g
8	0.0000 g	8	0.0000 g
9	0.0000 g	9	0.0000 g
10	0.0000 g	10	0.0000 g

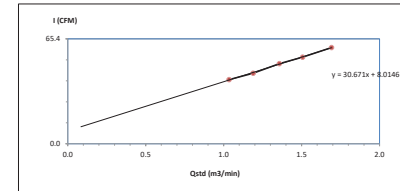
ROP FM 53 03 February 2020



High Volume Air Sampler Calibration Worksheet

Project Site :	Gulf NC Co., Ltd.	Barometric Pressure (mm Hg) :	756.0
Calibrate Location :	สมุทรสาคร	Temperature (°C) :	33.5
Calibrate Date :	1-Nov-24	High Volume ID :	RYG-FS0395
CalibrationSheet No.:	C-011124-RYG-FS0395	High Volume Model :	TE-5170D
Calibrator ID :	RYG-FS0205	High Volume S/N :	5692
Calibrator Model :	TE-5028A	Calibrator Slope :	1.52567
Calibrator S/N :	1166	Calibrator Intercept :	-0.03613

Test No.	Delta H ₂ O (inch)	Q _{as} (m ³ /min)	I: Chart (CFM)	Linear Regression
1	2.4	1.0347	40	Slope: 30.6713
2	3.2	1.1892	44	Intercept: 8.0146
3	4.2	1.3571	50	Correlation Coefficient: 0.9990
4	5.2	1.5060	54	
5	6.6	1.6921	60	



Calibrated by: [Signature] Approved by: [Signature]
(Mr. Apichart Wilans) (Mr. Supot Salanteth)
RYG-Field Services Scientist(1) RYG-Field Services Section Head

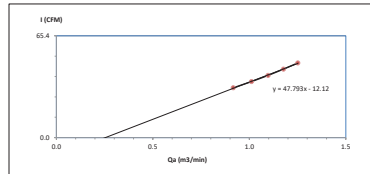
FORM NO. F 06-073 REVISION NO.2 ISSUE DATE: 20/11/23



High Volume Air Sampler Calibration Worksheet

Project Site :	Gulf NC Co., Ltd.	Barometric Pressure (mm Hg) :	756.0
Calibrate Location :	สมุทรสาคร	Temperature (°C) :	33.5
Calibrate Date :	1-Nov-24	High Volume ID :	RYG-FS0189
CalibrationSheet No.:	C-011124-RYG-FS0189	High Volume Model :	TE-5009X
Calibrator ID :	RYG-FS0205	High Volume S/N :	4797
Calibrator Model :	TE-5028A	Calibrator Slope :	0.95561
Calibrator S/N :	1166	Calibrator Intercept :	-0.02266

Test No.	Delta H ₂ O (inch)	Q _{as} (m ³ /min)	I: Chart (CFM)	Linear Regression
1	1.8	0.917	32	Slope: 47.7933
2	2.2	1.011	36	Intercept: -12.1196
3	2.6	1.097	40	Correlation Coefficient: 0.9989
4	3.0	1.177	44	
5	3.4	1.251	48	



Calibrated by: [Signature] Approved by: [Signature]
(Mr. Apichart Wilans) (Mr. Supot Salanteth)
RYG-Field Services Scientist(1) RYG-Field Services Section Head

FORM NO. F 06-074 REVISION NO.2 ISSUE DATE: 20/11/23

Sartorius (Thailand) Co., Ltd.
101 Rama 4 Road, Bangkok, Thailand 10110
Tel: +66 2843 8181-4 Fax: +66 2843 8187 e-mail: sartorius.thailand@sartorius.com

SARTORIUS

Certificate of Calibration

Model Number :	LA1305-F	Certificate No :	24BCH0008
Description :	Analytical Balance	Issued Date :	Friday, February 23, 2024
Serial Number :	3040004	Reference No :	229198
ID No. :	RYG_EN0001	Page No. :	1 of 1
Manufacturer :	Sartorius		

Customer Name :	ALS Laboratory Group (Thailand) Co., Ltd. (Private Room)
Address :	618/10 Moo 8 T. Maenam Khui, A. Pong, Oesna, Rayong 21140, Thailand
Calibrated Place :	ALS Laboratory Group (Thailand) Co., Ltd. (Private Room)
Address :	618/10 Moo 8 T. Maenam Khui, A. Pong, Oesna, Rayong 21140, Thailand

Calibrated By :	Mr. Chanchai Intharak
Calibration Date :	Thursday, February 22, 2024
Calibration Procedure No. :	This calibration was conducted by using an in-house calibration procedure (number: WJG03) based on UKAS LAB 14 : 2019

Metrolological data :	Capacity : 150 g Readability : 0.0001 g	Temperature : 23.0 °C ± 0.5 °C	Humidity : 54.0 % RH ± 10.0 % RH	Pressure : 1013.25 hPa ± 0.1 hPa
Reasons for calibration :	<input type="checkbox"/> New Installation <input type="checkbox"/> Service / Required <input checked="" type="checkbox"/> Periodical Maintenance			
Equipment Condition :	<input checked="" type="checkbox"/> Good Condition <input type="checkbox"/> Not			

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 makes the use of measurements according to the International System of Units (SI). Repeat of Tolerance (same both list of Sartorius Metrolological Specifications).

Model Number	Description	Traceability	Certificate No.	Due Date
MY0011-502-02	Reference weights 10g - 1000g	ISO 9001:2015	M23081979	23-Aug-2028
MHB-38280	Humidity/temperature control	ISO 9001:2015	G19031846	23-Aug-2024

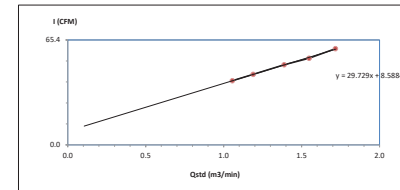
This certificate relates and only apply this equipment only.
This certificate may not be reproduced other than in full except with the prior written approval of the Calibration Operator/Department.
Sartorius (Thailand) Co., Ltd.
ROP FM 53 03 February 2020



High Volume Air Sampler Calibration Worksheet

Project Site :	Gulf NC Co., Ltd.	Barometric Pressure (mm Hg) :	756.0
Calibrate Location :	สมุทรสาคร	Temperature (°C) :	33.5
Calibrate Date :	1-Nov-24	High Volume ID :	RYG-FS0291
CalibrationSheet No.:	C-011124-RYG-FS0291	High Volume Model :	TE-5170D
Calibrator ID :	RYG-FS0205	High Volume S/N :	5333
Calibrator Model :	TE-5028A	Calibrator Slope :	1.52567
Calibrator S/N :	1166	Calibrator Intercept :	-0.03613

Test No.	Delta H ₂ O (inch)	Q _{as} (m ³ /min)	I: Chart (CFM)	Linear Regression
1	2.5	1.0553	40	Slope: 29.7289
2	3.2	1.1892	44	Intercept: 8.5884
3	4.4	1.3862	50	Correlation Coefficient: 0.9990
4	5.5	1.5478	54	
5	6.8	1.7170	60	



Calibrated by: [Signature] Approved by: [Signature]
(Mr. Apichart Wilans) (Mr. Supot Salanteth)
RYG-Field Services Scientist(1) RYG-Field Services Section Head

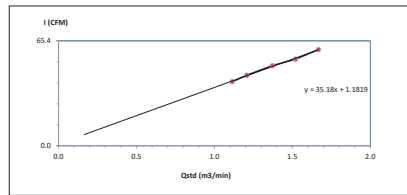
FORM NO. F 06-073 REVISION NO.2 ISSUE DATE: 20/11/23



High Volume Air Sampler Calibration Worksheet

Project Site: Gulf NC Co., Ltd. Barometric Pressure (mm Hg): 756.0
Calibrate Location: โรงเรือนปลูกพืชปลอดสาร Temperature (°C): 33.5
Calibrate Date: 1-Nov-24 High Volume ID: RYG_FSD173
CalibrationSheet No.: C-011124-RYG_FSD173 High Volume Model: TE-51700
Calibrator ID: RYG_FSD205 High Volume S/N: 4799
Calibrator Model: TE-5028A High Volume S/N: 152567
Calibrator S/N: 1166 Calibrator Intercept: -0.03613

Test No.	Delta H ₂ O (inch)	Q _{std} (m ³ /min)	I : Chart (CFM)	Linear Regression
1	2.8	1.1147	40	Slope: 35.1798
2	3.3	1.2071	44	Intercept: 1.1819
3	4.3	1.3728	50	Correlation Coefficient: 0.9980
4	5.3	1.5201	54	
5	6.4	1.6668	60	



Calibrated by: [Signature]
(Mr. Apichart Wilars)
RYG-Field Services Scientist(1)

Approved by: [Signature]
(Mr. Supot Salanteh)
RYG-Field Services Section Head

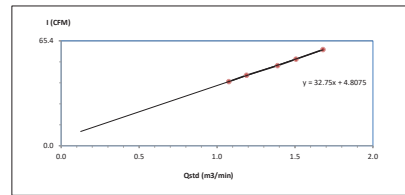
FORM NO. F 06-073 REVISION NO.2 ISSUE DATE: 20/11/23



High Volume Air Sampler Calibration Worksheet

Project Site: Gulf NC Co., Ltd. Barometric Pressure (mm Hg): 756.0
Calibrate Location: โรงเรือนปลูกพืชปลอดสาร Temperature (°C): 33.5
Calibrate Date: 1-Nov-24 High Volume ID: RYG_FSD181
CalibrationSheet No.: C-011124-RYG_FSD181 High Volume Model: TE-51700
Calibrator ID: RYG_FSD205 High Volume S/N: 5334
Calibrator Model: TE-5028A High Volume S/N: 152567
Calibrator S/N: 1166 Calibrator Intercept: -0.03613

Test No.	Delta H ₂ O (inch)	Q _{std} (m ³ /min)	I : Chart (CFM)	Linear Regression
1	2.6	1.0755	40	Slope: 32.7504
2	3.2	1.1892	44	Intercept: 4.8075
3	4.4	1.3882	50	Correlation Coefficient: 0.9996
4	5.2	1.5060	54	
5	6.5	1.6795	60	



Calibrated by: [Signature]
(Mr. Apichart Wilars)
RYG-Field Services Scientist(1)

Approved by: [Signature]
(Mr. Supot Salanteh)
RYG-Field Services Section Head

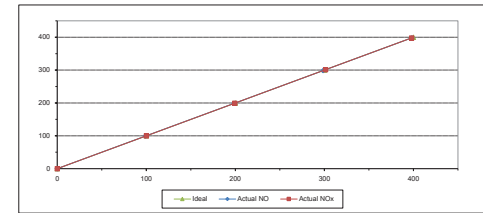
FORM NO. F 06-073 REVISION NO.2 ISSUE DATE: 20/11/23



MULTIPOINT CALIBRATION REPORT

Calibration Date: 2-Jul-24 Equipment Name: NOx Analyzer
Manufacturer: HORIBA Model: APMA-370
Serial No.: 8G814J3K Equipment ID: RYG_F80284
Calibrator Manufacturer: Teledyne API Model: 700
Serial No.: 947
Std. Gas Concentration (PPM): 55.88 Cylinder No.: GN0027222
Cylinder Pressure (psf): 1800 Certified By: Algea Inc.
Certified Date: 9-Feb-22 Expired Date: 9-Feb-30

CALIBRATION RESULTS							
Point	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	198.50	-1.50	-0.75	199.30	-0.70	-0.35
3	300.00	298.60	-1.40	-0.47	301.40	1.40	0.47
4	400.00	398.20	-1.80	-0.45	398.00	-2.00	-0.50
AVERAGE (%)				-0.48			-0.04



Calibrated By: [Signature]
(Mr. Jitwut Sakam)
Field Environmental Scientist (3)

Approved By: [Signature]
(Mr. Sarayuth Jitranont)
Assistant General Manager

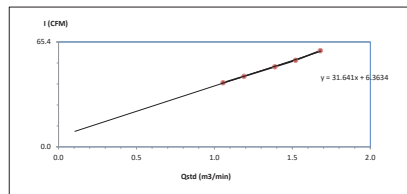
ALS Laboratory Group
FORM NO. F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



High Volume Air Sampler Calibration Worksheet

Project Site: Gulf NC Co., Ltd. Barometric Pressure (mm Hg): 756.0
Calibrate Location: โรงเรือนปลูกพืชปลอดสาร Temperature (°C): 33.5
Calibrate Date: 1-Nov-24 High Volume ID: RYG_FSD394
CalibrationSheet No.: C-011124-RYG_FSD394 High Volume Model: TE-51700
Calibrator ID: RYG_FSD205 High Volume S/N: 5690
Calibrator Model: TE-5028A High Volume S/N: 152567
Calibrator S/N: 1166 Calibrator Intercept: -0.03613

Test No.	Delta H ₂ O (inch)	Q _{std} (m ³ /min)	I : Chart (CFM)	Linear Regression
1	2.5	1.0553	40	Slope: 31.6411
2	3.2	1.1892	44	Intercept: 6.3634
3	4.4	1.3882	50	Correlation Coefficient: 0.9988
4	5.3	1.5201	54	
5	6.5	1.6795	60	



Calibrated by: [Signature]
(Mr. Apichart Wilars)
RYG-Field Services Scientist(1)

Approved by: [Signature]
(Mr. Supot Salanteh)
RYG-Field Services Section Head

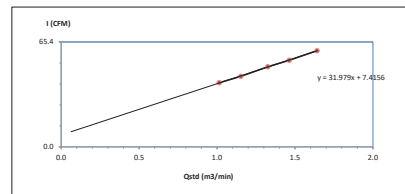
FORM NO. F 06-073 REVISION NO.2 ISSUE DATE: 20/11/23



High Volume Air Sampler Calibration Worksheet

Project Site: Gulf NC Co., Ltd. Barometric Pressure (mm Hg): 756.0
Calibrate Location: โรงเรือนปลูกพืชปลอดสาร Temperature (°C): 33.5
Calibrate Date: 1-Nov-24 High Volume ID: RYG_FSD393
CalibrationSheet No.: C-011124-RYG_FSD393 High Volume Model: TE-51700
Calibrator ID: RYG_FSD205 High Volume S/N: 5682
Calibrator Model: TE-5028A High Volume S/N: 152567
Calibrator S/N: 1166 Calibrator Intercept: -0.03613

Test No.	Delta H ₂ O (inch)	Q _{std} (m ³ /min)	I : Chart (CFM)	Linear Regression
1	2.3	1.0137	40	Slope: 31.9786
2	3.0	1.1526	44	Intercept: 7.4156
3	4.0	1.3253	50	Correlation Coefficient: 0.9996
4	4.9	1.4630	54	
5	6.2	1.6411	60	



Calibrated by: [Signature]
(Mr. Apichart Wilars)
RYG-Field Services Scientist(1)

Approved by: [Signature]
(Mr. Supot Salanteh)
RYG-Field Services Section Head

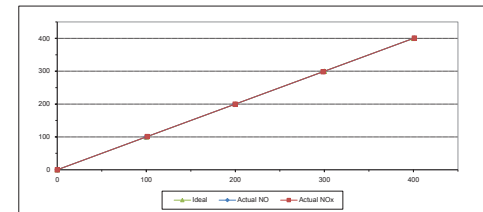
FORM NO. F 06-073 REVISION NO.2 ISSUE DATE: 20/11/23



MULTIPOINT CALIBRATION REPORT

Calibration Date: 2-Jul-24 Equipment Name: NOx Analyzer
Manufacturer: HORIBA Model: APMA-370
Serial No.: AWX087CR Equipment ID: RYG_F80453
Calibrator Manufacturer: Teledyne API Model: 700
Serial No.: 947
Std. Gas Concentration (PPM): 55.88 Cylinder No.: GN0027222
Cylinder Pressure (psf): 1800 Certified By: Algea Inc.
Certified Date: 9-Feb-22 Expired Date: 9-Feb-30

CALIBRATION RESULTS							
Point	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	99.80	-0.40	-0.40	101.10	1.10	1.10
2	200.00	198.60	-1.40	-0.70	199.80	-0.20	-0.10
3	300.00	299.00	-1.00	-0.33	298.60	-1.40	-0.47
4	400.00	401.10	1.10	0.28	401.10	1.10	0.28
AVERAGE (%)				-0.21			0.18



Calibrated By: [Signature]
(Mr. Jitwut Sakam)
Field Environmental Scientist (3)

Approved By: [Signature]
(Mr. Sarayuth Jitranont)
Assistant General Manager

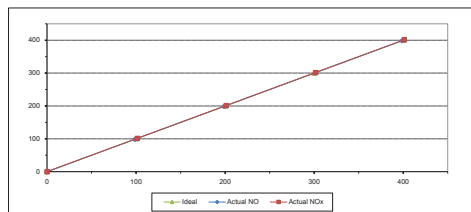
ALS Laboratory Group
FORM NO. F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



MULTIPOINT CALIBRATION REPORT

Calibration Date 3-Jul-24 Equipment Name NOx Analyzer
Manufacturer HORIBA Model APNA-370
Serial No. ALPOV0VY Equipment ID RYG_FB0465
Calibrator Manufacturer Teledyne API Model 700
Serial No. 947
Std. Gas Concentration (PPM) 55.88 Cylinder No. GN0027222
Cylinder Pressure (psi) 1800 Certified By Algas 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	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	98.60	-1.40	-1.40	101.60	1.60	1.60
2	200.00	198.80	-1.20	-0.60	201.30	1.30	0.65
3	300.00	301.00	1.00	0.33	301.80	1.80	0.60
4	400.00	398.50	-1.50	-0.38	401.30	1.30	0.33
AVERAGE (%)				-0.38			0.88



Calibrated By

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

Approved By

(Mr. Sarayuth Jitranont)
Assistant General Manager

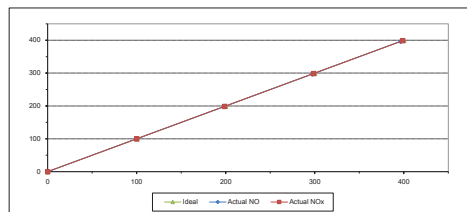
ALS Laboratory Group
FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



MULTIPOINT CALIBRATION REPORT

Calibration Date 2-Jul-24 Equipment Name NOx Analyzer
Manufacturer Teledyne API Model T200
Serial No. 2197 Equipment ID RYG_FB0285
Calibrator Manufacturer Teledyne API Model 700
Serial No. 947
Std. Gas Concentration (PPM) 55.88 Cylinder No. GN0027222
Cylinder Pressure (psi) 1800 Certified By Algas 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	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	99.60	-0.40	-0.40	100.10	0.10	0.10
2	200.00	198.00	-2.00	-1.00	198.70	-1.30	-0.65
3	300.00	297.30	-2.70	-0.90	298.70	-1.30	-0.43
4	400.00	396.40	-3.60	-0.90	398.80	-1.20	-0.30
AVERAGE (%)				-0.82			-0.24



Calibrated By

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

Approved By

(Mr. Sarayuth Jitranont)
Assistant General Manager

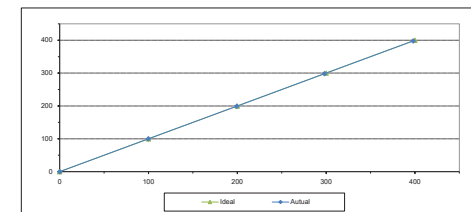
ALS Laboratory Group
FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



MULTIPOINT CALIBRATION REPORT

Calibration Date 4-Jul-24 Equipment Name SO2 Analyzer
Manufacturer HORIBA Model APSA-370
Serial No. YPRCU220 Equipment ID RYG_FB0283
Calibrator Manufacturer Teledyne API Model 700
Serial No. 947
Std. Gas Concentration (PPM) 66.3 Cylinder No. GN0027222
Cylinder Pressure (psi) 1800 Certified By Algas Inc.
Certified Date 9-Feb-22 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 Jitranont)
Assistant General Manager

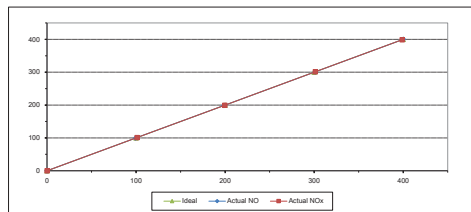
ALS Laboratory Group
FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



MULTIPOINT CALIBRATION REPORT

Calibration Date 3-Jul-24 Equipment Name NOx Analyzer
Manufacturer HORIBA Model APNA-370
Serial No. NV0ERYTH Equipment ID RYG_FB0469
Calibrator Manufacturer Teledyne API Model 700
Serial No. 947
Std. Gas Concentration (PPM) 55.88 Cylinder No. GN0027222
Cylinder Pressure (psi) 1800 Certified By Algas 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	99.50	-0.50	-0.50	101.20	1.20	1.20
2	200.00	198.70	-1.30	-0.65	199.70	-0.30	-0.15
3	300.00	301.10	1.10	0.37	301.40	1.40	0.47
4	400.00	400.30	0.30	0.08	398.80	-1.20	-0.30
AVERAGE (%)				-0.13			0.28



Calibrated By

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

Approved By

(Mr. Sarayuth Jitranont)
Assistant General Manager

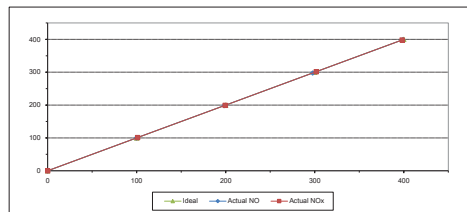
ALS Laboratory Group
FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



MULTIPOINT CALIBRATION REPORT

Calibration Date 2-Jul-24 Equipment Name NOx Analyzer
Manufacturer Teledyne API Model T200
Serial No. 090 Equipment ID BKCF_F00741
Calibrator Manufacturer Teledyne API Model 700
Serial No. 947
Std. Gas Concentration (PPM) 55.88 Cylinder No. GN0027222
Cylinder Pressure (psi) 1800 Certified By Algas 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	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	99.80	-0.20	-0.20	101.10	1.10	1.10
2	200.00	198.30	-1.70	-0.85	199.30	-0.70	-0.35
3	300.00	297.60	-2.40	-0.80	301.70	1.70	0.57
4	400.00	398.70	-1.30	-0.33	398.20	-1.80	-0.45
AVERAGE (%)				-0.41			0.19



Calibrated By

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

Approved By

(Mr. Sarayuth Jitranont)
Assistant General Manager

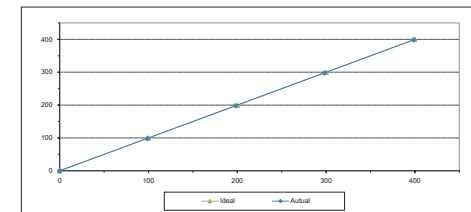
ALS Laboratory Group
FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



MULTIPOINT CALIBRATION REPORT

Calibration Date 5-Jul-24 Equipment Name SO2 Analyzer
Manufacturer HORIBA Model APSA-370
Serial No. 90UDXJ51 Equipment ID RYG_FB0462
Calibrator Manufacturer Teledyne API Model 700
Serial No. 947
Std. Gas Concentration (PPM) 66.3 Cylinder No. GN0027222
Cylinder Pressure (psi) 1800 Certified By Algas Inc.
Certified Date 9-Feb-22 Expired Date 9-Feb-30

Point	CALIBRATION RESULTS			
	Ideal	Actual	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	98.60	-1.40	-1.40
2	200.00	198.00	-2.00	-1.00
3	300.00	298.00	-2.00	-0.67
4	400.00	398.50	-1.50	-0.38
AVERAGE (%)				-0.67



Calibrated By

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

Approved By

(Mr. Sarayuth Jitranont)
Assistant General Manager

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

Page 1 of 3 Pages

CERTIFICATE OF CALIBRATION

MEASUREMENT ITEM
Wind direction sensor
MANUFACTURER
Honeywell
MODEL/TYPE
Sensor WS-DA0-A
SERIAL NUMBER
Data logger: LIO WS-DA0-D
Sensor: WS-DA0-A
Data logger: A0000
RHS: 150727
ID NUMBER
None Item
CONDITION AS RECEIVED
CUSTOMER
ALS Laboratory group (Thailand) Co., Ltd.
100 Phatthanasak Rd., Phatthanasak Rd., Phrasang Suan Luang, Bangkok 10250 Thailand

RECEIVED DATE
12 Sep 2024
MEASUREMENT DATE
18 Sep 2024
ISSUE DATE
01 Oct 2024

ENVIRONMENTAL CONDITIONS
Ambient condition in the laboratory are as follows:
Temperature: 23.0 ± 0.5 °C
Relative humidity: 55.0 ± 5.0 %
Atmospheric pressure: 1013.0 ± 0.5 hPa

PLACE OF CALIBRATION
100 Phatthanasak Rd., Phatthanasak Rd., Phrasang Suan Luang, Bangkok 10250 Thailand

CALIBRATION CONDITION
Wind tunnel sensor calibration
Wind direction (Type: WS-DA0-A)
Uncertainty of calibration: ± 0.5°
Measurement range: 0 to 360°

Preconditioning
Measurement Condition
24 hours at ambient conditions
(Temperature: 23.0 ± 0.5 °C, Relative humidity: 55.0 ± 5.0 %)

TOLERANCE OF RESULTS
The tolerance of results is as follows:
± 0.5°

Calibrated by
Mr. Pongthorn Pongthorn
Calibration Department Manager

Remarks
1. The calibration is valid only for the conditions specified in this certificate.
2. The calibration is valid only for the conditions specified in this certificate.
3. The calibration is valid only for the conditions specified in this certificate.

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

Page 1 of 3 Pages

CERTIFICATE OF CALIBRATION

MEASUREMENT ITEM
Data Logger with Temperature sensor
MANUFACTURER
Honeywell
MODEL/TYPE
LIO WS-DA0-D
SERIAL NUMBER
A0000
ID NUMBER
RHS: 150727
CONDITION AS RECEIVED
CUSTOMER
ALS Laboratory group (Thailand) Co., Ltd.
100 Phatthanasak Rd., Phatthanasak Rd., Phrasang Suan Luang, Bangkok 10250 Thailand

RECEIVED DATE
12 Sep 2024
MEASUREMENT DATE
18 Sep 2024
ISSUE DATE
01 Oct 2024

ENVIRONMENTAL CONDITIONS
Ambient condition in the laboratory are as follows:
Temperature: 23.0 ± 0.5 °C
Relative humidity: 55.0 ± 5.0 %

Calibrated by
Mr. Pongthorn Pongthorn
Calibration Department Manager

Remarks
1. The calibration is valid only for the conditions specified in this certificate.
2. The calibration is valid only for the conditions specified in this certificate.
3. The calibration is valid only for the conditions specified in this certificate.

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Page 1 of 3 Pages

CERTIFICATE OF CALIBRATION

MEASUREMENT ITEM
Relative humidity and data logger
MANUFACTURER
Honeywell
MODEL/TYPE
Data logger: LIO WS-DA0-D
Sensor: RH000
SERIAL NUMBER
Sensor: RH000
RHS: 150727
ID NUMBER
None Item
CONDITION AS RECEIVED
CUSTOMER
ALS Laboratory group (Thailand) Co., Ltd.
100 Phatthanasak Rd., Phatthanasak Rd., Phrasang Suan Luang, Bangkok 10250 Thailand

RECEIVED DATE
12 Sep 2024
MEASUREMENT DATE
18 Sep 2024
ISSUE DATE
01 Oct 2024

ENVIRONMENTAL CONDITIONS
Ambient condition in the laboratory are as follows:
Temperature: 23.0 ± 0.5 °C
Relative humidity: 55.0 ± 5.0 %

Calibrated by
Mr. Pongthorn Pongthorn
Calibration Department Manager

Remarks
1. The calibration is valid only for the conditions specified in this certificate.
2. The calibration is valid only for the conditions specified in this certificate.
3. The calibration is valid only for the conditions specified in this certificate.

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Page 2 of 3 Pages

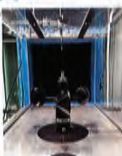
MEASUREMENT RESULTS

The wind direction sensor was calibrated against standard reference sensor by comparison method. During calibration, the measurement was carried out at 10° intervals in elevation and azimuth. The results of calibration and associated measurement uncertainties are reported in the table below.

Air speed m/s	D _{ref} Degree (°)	D _{meas} Degree (°)	Error Degree (°)	U _{ref} Degree (°)
0.0	0.0	0.0	0.0	0.0
0.0	10.0	10.0	0.0	0.0
0.0	20.0	20.0	0.0	0.0
0.0	30.0	30.0	0.0	0.0
0.0	40.0	40.0	0.0	0.0
0.0	50.0	50.0	0.0	0.0
0.0	60.0	60.0	0.0	0.0
0.0	70.0	70.0	0.0	0.0
0.0	80.0	80.0	0.0	0.0
0.0	90.0	90.0	0.0	0.0
0.0	100.0	100.0	0.0	0.0
0.0	110.0	110.0	0.0	0.0
0.0	120.0	120.0	0.0	0.0
0.0	130.0	130.0	0.0	0.0
0.0	140.0	140.0	0.0	0.0
0.0	150.0	150.0	0.0	0.0

Remarks
1. Calibration results only valid for the conditions specified in this certificate.
2. The calibration is valid only for the conditions specified in this certificate.
3. The calibration is valid only for the conditions specified in this certificate.

FIGURE 1: CALIBRATION RESULTS



Calibration results of the Cup anemometer calibration in the wind tunnel of Jiranatee Associates Co., Ltd. The Cup anemometer was calibrated against standard reference sensor by comparison method. During calibration, the measurement was carried out at 10° intervals in elevation and azimuth. The results of calibration and associated measurement uncertainties are reported in the table below.



Page 2 of 3 Pages

MEASUREMENT RESULTS

The wind direction sensor was calibrated against standard reference sensor by comparison method. During calibration, the measurement was carried out at 10° intervals in elevation and azimuth. The results of calibration and associated measurement uncertainties are reported in the table below.

Air speed m/s	D _{ref} Degree (°)	D _{meas} Degree (°)	Error Degree (°)	U _{ref} Degree (°)
0.0	0.0	0.0	0.0	0.0
0.0	10.0	10.0	0.0	0.0
0.0	20.0	20.0	0.0	0.0
0.0	30.0	30.0	0.0	0.0
0.0	40.0	40.0	0.0	0.0
0.0	50.0	50.0	0.0	0.0
0.0	60.0	60.0	0.0	0.0
0.0	70.0	70.0	0.0	0.0
0.0	80.0	80.0	0.0	0.0
0.0	90.0	90.0	0.0	0.0
0.0	100.0	100.0	0.0	0.0
0.0	110.0	110.0	0.0	0.0
0.0	120.0	120.0	0.0	0.0
0.0	130.0	130.0	0.0	0.0
0.0	140.0	140.0	0.0	0.0
0.0	150.0	150.0	0.0	0.0

Remarks
1. Calibration results only valid for the conditions specified in this certificate.
2. The calibration is valid only for the conditions specified in this certificate.
3. The calibration is valid only for the conditions specified in this certificate.



Calibration results of the Cup anemometer calibration in the wind tunnel of Jiranatee Associates Co., Ltd. The Cup anemometer was calibrated against standard reference sensor by comparison method. During calibration, the measurement was carried out at 10° intervals in elevation and azimuth. The results of calibration and associated measurement uncertainties are reported in the table below.

Page 2 of 3 Pages

Continuation of Certificate of Calibration Number CND-000-67

Result of Calibration
Calibration Result: 20 °C to 40 °C
Function: 1. The calibration is valid only for the conditions specified in this certificate.
2. The calibration is valid only for the conditions specified in this certificate.
3. The calibration is valid only for the conditions specified in this certificate.

Measurement Depth (mm)	Standard Reading (°C)	UNC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.000	19.9	0.1	0.1
80	25.000	24.9	0.1	0.1
80	30.000	29.9	0.1	0.1
80	35.000	34.9	0.1	0.1

Remarks
1. The calibration is valid only for the conditions specified in this certificate.
2. The calibration is valid only for the conditions specified in this certificate.
3. The calibration is valid only for the conditions specified in this certificate.



Calibration results of the Cup anemometer calibration in the wind tunnel of Jiranatee Associates Co., Ltd. The Cup anemometer was calibrated against standard reference sensor by comparison method. During calibration, the measurement was carried out at 10° intervals in elevation and azimuth. The results of calibration and associated measurement uncertainties are reported in the table below.

CERTIFICATE OF CALIBRATION
Page 1 of 2 Pages

Certificate No.: COT-172-07

MEASUREMENT ITEM
MANUFACTURER: Newlyn
MODEL/TYPE: 110 WS-250L-D
SERIAL NUMBER: A0509
ID NUMBER: NYL_150724
CONDITION AS RECEIVED: New item
CUSTOMER: A/S laboratory group (Thailand) Co., Ltd.
104 Phatthanasak Rd., Phatthanasak Rd., Bangkok 10150 Thailand.

RECEIVED DATE: 12 Sep 2024
MEASUREMENT DATE: 14 Sep 2024
ISSUE DATE: 01 Oct 2024

ENVIRONMENTAL CONDITIONS
Ambient conditions in the laboratory are as follows:
Temperature: 23.0 ± 1.0 °C
Relative Humidity: 55.0 ± 5.0 %RH

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

TABULATION OF RESULTS
The table on next page give the measured values.

Calibrated by: Mr. Paitoon Boonchiraporn
Approved signature: Mr. Paitoon Boonchiraporn
Calibration Department Manager

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CERTIFICATE OF CALIBRATION
Page 1 of 2 Pages

Certificate No.: COT-041-07

MEASUREMENT ITEM
MANUFACTURER: Newlyn
MODEL/TYPE: 100 WS-250L-D
SERIAL NUMBER: A0509
ID NUMBER: NYL_150724
CUSTOMER: A/S laboratory group (Thailand) Co., Ltd.
104 Phatthanasak Rd., Phatthanasak Rd., Bangkok 10150 Thailand.

RECEIVED DATE: 12 Sep 2024
MEASUREMENT DATE: 14 Sep 2024
ISSUE DATE: 01 Oct 2024

ENVIRONMENTAL CONDITIONS
Ambient conditions in the laboratory are as follows:
Temperature: 23.0 ± 1.0 °C
Relative Humidity: 55.0 ± 5.0 %RH

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

TABULATION OF RESULTS
The table on next page give the measured values.

Calibrated by: Mr. Paitoon Boonchiraporn
Approved signature: Mr. Paitoon Boonchiraporn
Calibration Department Manager

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CERTIFICATE OF CALIBRATION
Page 1 of 2 Pages

Certificate No.: COT-050-07

MEASUREMENT ITEM
MANUFACTURER: Newlyn
MODEL/TYPE: 100 WS-250L-D
SERIAL NUMBER: A0509
ID NUMBER: NYL_150724
CUSTOMER: A/S laboratory group (Thailand) Co., Ltd.
104 Phatthanasak Rd., Phatthanasak Rd., Bangkok 10150 Thailand.

RECEIVED DATE: 12 Sep 2024
MEASUREMENT DATE: 14 Sep 2024
ISSUE DATE: 01 Oct 2024

ENVIRONMENTAL CONDITIONS
Ambient conditions in the laboratory are as follows:
Temperature: 23.0 ± 1.0 °C
Relative Humidity: 55.0 ± 5.0 %RH

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

TABULATION OF RESULTS
The table on next page give the measured values.

Calibrated by: Mr. Paitoon Boonchiraporn
Approved signature: Mr. Paitoon Boonchiraporn
Calibration Department Manager

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Page 2 of 2 Pages

MEASUREMENT RESULTS
The used detection sensor was calibrated against standard sensor by comparison method. During calibration, the measurement was carried out at 45° intervals in clockwise and counter-clockwise directions after adjustment has been made. The free speed of wind tunnel (velocity) is kept constant within the value is relative standard deviation. The results of calibration and associated measurement uncertainties are reported in the table below.

Air speed m/s	U _{ref} m/s	U _{ref} m/s	U _{ref} m/s	U _{ref} m/s	U _{ref} m/s
45.000	42	42	42	42	42
90.000	87	87	87	87	87
135.000	132	132	132	132	132
180.000	180	180	180	180	180
225.000	227	227	227	227	227
270.000	273	273	273	273	273
315.000	319	319	319	319	319
360.000	359	359	359	359	359

Remarks:
* Calibration uncertainty cover for the measured temperature and environmental conditions during calibration.
* Direction of standard.
* Direction of test sensor calibration.

End of Certificate of Calibration



Page 2 of 2 Pages

Continuation of Certificate of Calibration Number COT-172-07

Results of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 °C to 60 °C

Exclusion:
Table 3: This equipment was connected with temperature sensor Model: HANSA 100 WS-250L-D.
Dimension: Diameter 13 mm, Length 80 mm.

Temperature (°C)	Standard Reading (°C)	UAC Reading (°C)	UAC Reading (°C)	UAC Reading (°C)
20	20.001	19.9	19.9	19.9
30	30.004	29.8	29.8	29.8
40	40.000	39.8	39.8	39.8
50	50.000	49.8	49.8	49.8
60	60.000	59.8	59.8	59.8

UAC: Used Under Calibration

End of Certificate of Calibration



Page 2 of 2 Pages

Continuation of Certificate of Calibration Number COT-041-07

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

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Table 1: The results of calibration of relative humidity at 30 °C are reported in table below.
Calibration Range: 20.000 to 80.000

Air Temperature (°C)	Standard Reading (°C)	UAC Reading (°C)	UAC Reading (°C)	UAC Reading (°C)
20.0	20.0	19.8	19.8	19.8
30.0	30.0	29.8	29.8	29.8
40.0	40.0	39.8	39.8	39.8
50.0	50.0	49.8	49.8	49.8
60.0	60.0	59.8	59.8	59.8
70.0	70.0	69.8	69.8	69.8
80.0	80.0	79.8	79.8	79.8

UAC: Used Under Calibration

End of Certificate of Calibration



CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM
MANUFACTURER
MODEL/TYPE

ID NUMBER
CONDITION AS RECEIVED
CUSTOMER

RECEIVED DATE
MEASUREMENT DATE
ISSUE DATE

ENVIRONMENTAL CONDITIONS:
Ambient condition in the laboratory are as follows:
Temperature
Relative Humidity
Atmospheric Pressure

PLACE OF CALIBRATION

CALIBRATION CONDITIONS
(Wind tunnel cross section area)
(Wind direction (span) area)
(Density of measuring gas)
(Backdraft ratio of test object)

Preconditioning
Measurement Condition

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

Calibrated by:
Mr. Sarnat Thirachai
Mr. Mita Thirachai

Remarks:
1. Found low flow area of the wind tunnel.
2. Found low flow area of the wind tunnel.
3. Found low flow area of the wind tunnel.
4. Found low flow area of the wind tunnel.

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

CERTIFICATE OF CALIBRATION

Certificate No. : COT-173-07

Page 1 of 2 Pages

MEASUREMENT ITEM
MANUFACTURER
MODEL/TYPE
SERIAL NUMBER
ID NUMBER
CONDITION AS RECEIVED
CUSTOMER

Data Logger with Temperature sensor
Newstar
1100-W5-250-D
A070
A07025
Used item
A/S Laboratory group (Thailand) Co., Ltd.
104 Phatthanaburi Rd, Phatthanaburi Rd,
Khlong Suan Luang, Khlong Suan Luang,
Bangkok 10250 Thailand.

RECEIVED DATE
MEASUREMENT DATE
ISSUE DATE

12 Sep 2024
13 Sep 2024
03 Oct 2024

ENVIRONMENTAL CONDITIONS:
Ambient condition in the laboratory are as follows:
Temperature
Relative Humidity

23.0 ± 0.5 °C
55.0 ± 5.0 %RH

NOTE: The certificate is valid only in the item calibration and place of calibration.

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

Calibrated by:
Mr. Pongthorn Thongthong
13 Sep 2024
Mr. Pongthorn Thongthong
13 Sep 2024

J NAC
HIRANATEE ASSOCIATES CO., LTD.
Approved signature:
Mr. Pongthorn Thongthong
Calibration Department Manager

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CERTIFICATE OF CALIBRATION

Certificate No. : COT-042-07

Page 1 of 2 Pages

MEASUREMENT ITEM
MANUFACTURER
MODEL/TYPE
SERIAL NUMBER
ID NUMBER
CONDITION AS RECEIVED
CUSTOMER

Relative humidity with data logger
Newstar
Data Logger: 1100-W5-250-D
Sensor: RH070
Data Logger: A070
Sensor: W250250
A070, A07025
New item
A/S Laboratory group (Thailand) Co., Ltd.
104 Phatthanaburi Rd, Phatthanaburi Rd, Khlong Suan Luang,
Khlong Suan Luang, Bangkok 10250 Thailand

RECEIVED DATE
MEASUREMENT DATE
ISSUE DATE

12 Sep 2024
13 Sep 2024
03 Oct 2024

ENVIRONMENTAL CONDITIONS:
Ambient condition in the laboratory are as follows:
Temperature
Relative Humidity

23.0 ± 0.5 °C
55.0 ± 5.0 %RH

NOTE: The certificate is valid only in the item calibration and place of calibration.

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

Calibrated by:
Mr. Pongthorn Thongthong
13 Sep 2024
Mr. Pongthorn Thongthong
13 Sep 2024

J NAC
HIRANATEE ASSOCIATES CO., LTD.
Approved signature:
Mr. Pongthorn Thongthong
Calibration Department Manager

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CERTIFICATE OF CALIBRATION

Certificate No. : COT-050-07

Page 1 of 2 Pages

MEASUREMENT ITEM
MANUFACTURER
MODEL/TYPE
SERIAL NUMBER
ID NUMBER
CONDITION AS RECEIVED
CUSTOMER

Digital barometer
Newstar
Sensor: 110-W5-250-D
Data Logger: 110-W5-250-D
Sensor: A070
Data Logger: A070
A07025
New item
A/S Laboratory group (Thailand) Co., Ltd.
104 Phatthanaburi Rd, Phatthanaburi Rd, Khlong Suan Luang,
Khlong Suan Luang, Bangkok 10250 Thailand

RECEIVED DATE
MEASUREMENT DATE
ISSUE DATE

12 Sep 2024
13 Sep 2024
03 Oct 2024

ENVIRONMENTAL CONDITIONS:
Ambient condition in the laboratory are as follows:
Temperature
Relative Humidity

23.0 ± 0.5 °C
55.0 ± 5.0 %RH

NOTE: The certificate is valid only in the item calibration and place of calibration.

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

Calibrated by:
Mr. Pongthorn Thongthong
13 Sep 2024
Mr. Pongthorn Thongthong
13 Sep 2024

J NAC
HIRANATEE ASSOCIATES CO., LTD.
Approved signature:
Mr. Pongthorn Thongthong
Calibration Department Manager

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Page 2 of 2 Pages

MEASUREMENT RESULTS:

The second decimal point was calibrated against standard value provided by manufacturer method. During calibration, the measurement was carried out at 45°
propagated in the laboratory and counterbalance direction after offset adjustment has been made. The final value of standard (NIST) is used as the
value in the certificate and the result of calibration and associated measurement uncertainty are reported in the table below.

Air speed	U ₉₅	U ₉₅	U ₉₅	U ₉₅	U ₉₅
m/s	Degree (°)	Degree (°)	Degree (°)	Degree (°)	Degree (°)
0.000	0	0	0	0	0
41.000	41	41	41	41	41
90.000	90	90	90	90	90
130.000	130	130	130	130	130
160.000	160	160	160	160	160
220.000	220	220	220	220	220
270.000	270	270	270	270	270
310.000	310	310	310	310	310

Remarks:
* Calibration was performed for the stated measurement and environmental conditions during calibration and place of calibration.
* Uncertainty of standard.
* Uncertainty of Unit Under Calibration.

J NAC
HIRANATEE ASSOCIATES CO., LTD.
Approved signature:
Mr. Pongthorn Thongthong
Calibration Department Manager

Page 2 of 2 Pages

Continuation of Certificate of Calibration Number COT-173-07

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Result: 20 °C to 50 °C

Extension:

Table 1: This equipment was connected with temperature sensor Model: RH070 (N: W250250).
Dimension: Diameter 12 mm, Length 80 mm.

Immersion Depth (mm)	Standard Reading (°C)	UNC Reading (°C)	Error (°C)	Uncertainty (°C)
40	20.017	19.8	-0.2	0.009
50	20.015	19.8	-0.2	0.009
60	20.012	19.8	-0.2	0.009
80	20.010	19.8	-0.2	0.009
90	20.017	19.8	-0.2	0.009

UNC*: Less Under Calibration

End of Certificate of Calibration

J NAC
HIRANATEE ASSOCIATES CO., LTD.
Approved signature:
Mr. Pongthorn Thongthong
Calibration Department Manager

Page 2 of 2 Pages

Continuation of Certificate of Calibration Number COT-042-07

Measurement Results:

The result of calibration and associated measurement uncertainty are reported in the table below.

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Table 1: The results of calibration of relative humidity at 20 °C are reported in table below.

Air Temperature (°C)	Standard Reading (°C)	UNC Reading (°C)	Error (°C)	Uncertainty (°C)
20.0	19.87	19.9	-0.13	0.04
20.1	19.88	19.9	-0.12	0.04
20.2	19.89	19.9	-0.11	0.04

UNC*: Less Under Calibration

End of Certificate of Calibration

J NAC
HIRANATEE ASSOCIATES CO., LTD.
Approved signature:
Mr. Pongthorn Thongthong
Calibration Department Manager



DIGITAL TEMPERATURE CALIBRATION DATA SHEET

Calibration Date :	31 Jul 24	Ambient Temperature (°C)	27
Calibration sheet No. :	C-310724-BKK_FS0527	Relative Humidity (%) :	53
Digital Reference ID :	BKK_FS0527	Reference Temperature ID :	RYG_FS0681
Serial No. :		Serial No. :	20100014918
Model :	XC-572-V	Model :	Digicon-CC-V1-M5
		Next Calibrate :	13 Nov 24

Location	Reference Temperature °C	Digital Temperature °C	Error °C	MPE	Pass / Fail
Stick	0	0	0	±3	Pass
	25	25	0	±3	Pass
	50	50	0	±3	Pass
	100	100	0	±3	Pass
	150	150	0	±3	Pass
Probe	200	200	0	±3	Pass
	250	250	0	±3	Pass
	300	300	0	±3	Pass
	350	350	1	±3	Pass
	400	400	1	±3	Pass
Oven	100	101	1	±3	Pass
	120	121	1	±3	Pass
	140	141	1	±3	Pass
	160	161	1	±3	Pass
	180	181	1	±3	Pass
Filter	120	121	1	±3	Pass
	140	141	1	±3	Pass
	160	161	1	±3	Pass
	180	181	1	±3	Pass
	200	201	1	±3	Pass
Exit	0	0	0	±3	Pass
	10	9	-1	±3	Pass
	20	20	0	±3	Pass
	30	30	0	±3	Pass
	40	40	0	±3	Pass
Meter	0	-1	-1	±3	Pass
	25	24	-1	±3	Pass
	50	48	-2	±3	Pass
	75	74	-1	±3	Pass
	100	99	-1	±3	Pass
AUX	0	0	0	±3	Pass
	25	25	0	±3	Pass
	50	50	0	±3	Pass
	75	75	0	±3	Pass
	100	100	0	±3	Pass

MPE : (Maximum permissible error of measurement) ค่าความคลาดเคลื่อนสูงสุดที่รับได้

Calibrated by : Saksit Phaisanphut Approved by : Nattapong Jengwareewong
(Mr. Saksit Phaisanphut) (Mr. Nattapong Jengwareewong)
RYG Field Services Scientist (4) RYG Field Services Specialist (1)

Form NO. : F-06-027 REVISION NO. : 2 ISSUE DATE: 16/02/23



Type S Pitot Tube Calibration

Date Calibration 31-Jul-24 Due Date 31-Jan-25
Pitot ID BKK_FS0532 Inclinator ID BKK_FS1131
Pitot SN - Vernier ID RYG_FS0539



Parameter	Value	Allowable Range	Check
α1	-2.4	-10° < α1 < +10°	OK
α2	-1.2	-10° < α2 < +10°	OK
β1	-2.0	-5° < β1 < +5°	OK
β2	1.3	-5° < β2 < +5°	OK
γ	0.3	-	-
θ	0.2	-	-
Z = A tan γ	0.005	Z < 0.125"	OK
W = A tan θ	0.003	W < 0.031"	OK
Dt	0.310	0.188" to 0.375"	OK
A/2Dt	1.468	1.05 ≤ A/Dt ≤ 1.5	OK
A	0.91	2.1Dt ≤ A ≤ 3Dt	OK

Certify that pitot tube/porbe meets or exceeds all specifications, criteria and/or applicable design features and is hereby assigned a pitot tube certification fact of 0.84. See 40 CFR Pt. 60, App. A, EPA Method 2.

Calibrated by : Saksit Phaisanphut Approved by : Nattapong Jengwareewong
(Mr. Saksit Phaisanphut) (Mr. Nattapong Jengwareewong)
RYG Field Services Scientist (4) RYG Field Services Specialist (1)

Form NO. : F-06-124 REVISION NO. : 0 ISSUE DATE: 25/12/23



Calibration Certificate



Certificate No.: G 670280

Standard Reference (Table 1)	Standard	Certificate No.	Vendor	Due date
Oxygen (O ₂) 2.50 % Vol	2412/23	Uncal	Uncal	27-Aug-27
Oxygen (O ₂) 10.04 % Vol	CG-0153-23	Uncal	Uncal	18-Nov-26
Oxygen (O ₂) 21.02 % Vol	CG-0040-23	Uncal	Uncal	18-Feb-27
Carbon monoxide (CO) 80.14 ppm	CG-0040-23	Uncal	Uncal	18-Feb-27
Carbon monoxide (CO) 302 ppm	1916/23	Uncal	Uncal	18-Jun-25
Carbon monoxide (CO) 1000 ppm	2594/23	Uncal	Uncal	10-Sep-25
Nitrogen Dioxide (NO ₂) 30.34 ppm	2703/22	Uncal	Uncal	22-Aug-24
Nitrogen Dioxide (NO ₂) 81.32 ppm	3394/23	Uncal	Uncal	14-Jan-26
Nitrogen Dioxide (NO ₂) 201.8 ppm	1972/23	Uncal	Uncal	17-Jul-25
Nitric Oxide (NO) 30.81 ppm	CG-0014-23	Uncal	Uncal	19-Feb-26
Nitric Oxide (NO) 151.5 ppm	1151/23	Uncal	Uncal	22-Jan-25
Nitric Oxide (NO) 320.5 ppm	1916/23	Uncal	Uncal	17-Jul-25
Sulfur Dioxide (SO ₂) 50.36 ppm	3004/23	Uncal	Uncal	17-Jul-25
Sulfur Dioxide (SO ₂) 100.8 ppm	2007/23	Uncal	Uncal	09-Nov-24
Sulfur Dioxide (SO ₂) 1000.8 ppm	3007/23	Uncal	Uncal	17-Jul-25

Measured span conditions
Temperature : 22.6 °C Humidity : 64.3 %RH Pressure : 1005.6 mbar

Calibration conditions
Gas Temperature : 34 °C Flow rate : 1.200 m/min Gas pressure : 1019.2 mbar

Calibration Results (Before adjustment) (Table 2)

Parameter of Standard	Standard Values	Mean of UMC	Error	Uncertainty (1)
O ₂ (%Vol)	2.50	2.44	-0.06	0.13
O ₂ (%Vol)	10.04	9.92	-0.12	0.20
O ₂ (%Vol)	21.02	21.12	0.10	0.30
CO (ppm)	80.14	80	-0.14	3.0
CO (ppm)	302	301	-1	6.0
CO (ppm)	1000	1000	-1	12
NO ₂ (ppm)	30.34	29.8	-0.54	8.0
NO ₂ (ppm)	81.32	79.9	-1.42	8.0
NO ₂ (ppm)	201.8	191.5	-10.4	12
NO (ppm)	30.81	29	-1.81	6.0
NO (ppm)	151.5	147	-4.5	8.0
NO (ppm)	320.5	308	-12.5	12
SO ₂ (ppm)	50.36	52	1.64	8.0
SO ₂ (ppm)	100.8	101	0.3	8.0
SO ₂ (ppm)	1000.8	1006	-4.8	12

ENTECH Industrial Solution Co., Ltd.
17/121 Soi Phatthanasarak 47, Yotha 46, Phatthanasarak, Bangkok 10210 THAILAND Tel: 0-2719-8888 Call: 09-09090909



Stopwatch Calibration Test Report

Calibration Date : 31 Jul 24 Next Cal. Date : 31 Jan 25
Barometric Pressure (mmHg) : 754 Temperature (°C) : 27.0
Relative Humidity (%) : 53.0

Reference Stopwatch Data Console Control Meter Data
Stopwatch ID No. : RYG_FS0540 Dry Gas Meter No. : BKK_FS0527
Model : F808 Model : XC-572-V
Serial No. : E18061 Serial No. : 1508053
Calibration Date : 4 Jul 24
Certificate No. : E-2407022

Run No.	Time Actual (ms.ms)	Time Reading (ms)	Diff. (ms)	Diff. (min)
1	5:00:03	5:00	3	0.00005
2	5:00:09	5:00	9	0.00013
3	5:00:09	5:00	9	0.00015
4	5:00:11	5:00	11	0.00018
5	5:00:05	5:00	5	0.00008
6	5:00:06	5:00	6	0.00010
7	5:00:06	5:00	6	0.00010
8	5:00:08	5:00	8	0.00013
9	5:00:09	5:00	9	0.00015
10	5:00:07	5:00	7	0.00012
Average			0.00012	
SD			0.00004	

Calibrate by : Saksit Phaisanphut Approved by : Nattapong Jengwareewong
(Mr. Saksit Phaisanphut) (Mr. Nattapong Jengwareewong)
RYG Field Service Scientist (4) RYG Field Service Specialist (1)



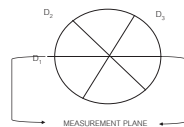
PROBE NOZZLE DIAMETER

CALIBRATION DATA SHEET

Calibration Date :	31 Jul 24	Nozzle Set ID :	BKK_FS0533
Calibration Sheet No. :	C-310724-BKK_FS0533	Vernier Caliper ID :	BKK_FS1123

Nozzle ID #	Nozzle Diameter (cm.)			H - Lo	(D ₁ + D ₂ + D ₃) / 3
	D ₁	D ₂	D ₃		
1	0.316	0.318	0.316	0.002	0.317
2	0.480	0.475	0.474	0.006	0.476
3	0.635	0.635	0.635	0.000	0.635
4	0.791	0.792	0.791	0.001	0.791
5	0.950	0.952	0.951	0.002	0.951
6	1.088	1.080	1.089	0.009	1.086
7	1.270	1.270	1.270	0.000	1.270
8	1.600	1.600	1.598	0.002	1.599

Where :
D₁, D₂, D₃ = Three different nozzle diameters at 60 degrees to each other, each measured the nearest 0.025 mm.
ΔD = Maximum distance between any two diameters, must be ≤ 1.100 mm.
D_{avg} = (D₁ + D₂ + D₃) / 3



Calibrated by : Saksit Phaisanphut Approved by : Nattapong Jengwareewong
(Mr. Saksit Phaisanphut) (Mr. Nattapong Jengwareewong)
Field Scientist (4) Field Specialist (1)



Calibration Certificate



Certificate No.: G 670280
Date of issue : 25-Apr-24

Instrument description	Flare Gas Analyser
Instrument model	Testo 356 New
Control unit serial no.	0350182/1131
Instrument serial no.	0295016/1131
ID no. or control no.	RYG_FS0544
Manufacturer	Testo SE & Co. KGaA
Probe description	-
Probe model	-
Probe serial no.	-
Customer name	ALS LABORATORY GROUP (THAILAND) CO., LTD.
Customer address	104 Phatthanasarak Rd, Phatthanasarak Road, Klongkum, Bangkok 10250 Thailand
Total pages of certificate	3 Pages
Receiving no.	1-24-180
Receiving date	11-Apr-24
Parameter of calibration	Gas Calibrated (Oxygen 2.50, 10.04, 21.02 %Vol, Carbon Monoxide 80.14, 302, 1000 ppm, Nitrogen Dioxide 30.34, 81.32, 201.8 ppm, Nitric Oxide 30.81, 151.5, 320.5 ppm, Sulfur Dioxide 50.36, 100.8, 1000.8 ppm)
Condition of UMC	Used
Ambient condition	All of the Measurement were carried out the calibrated laboratory. Temperature : 23.45 °C Humidity : 50 ± 15 %RH
Calibration place	17/121 Soi Phatthanasarak 47 Yotha 46, Phatthanasarak, Bangkok 10210 THAILAND
Calibration procedure no.	This instrument was calibrated by comparison with Standard gas mixture according to calibration Work Instruction no. WI-CL-28-C
The calibration certificate expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%. This certificate is applicable only to items under test (Environmental condition). This Calibration Certificate may not be reproduced other than as full except with the permission of the issuing laboratory. Calibration certificate without signature and seal not valid and the results release only to the items tested/calibrated. This calibration certificate documents are traceable to national standards, which realize measurement according to the International System of Units (SI).	
Date of calibration	24-Apr-24

Calibrated by : Saksit Phaisanphut Approved by : Nattapong Jengwareewong
(Mr. Saksit Phaisanphut) (Mr. Nattapong Jengwareewong)
Field Scientist (4) Field Specialist (1)

ENTECH Industrial Solution Co., Ltd.
17/121 Soi Phatthanasarak 47 Yotha 46, Phatthanasarak, Bangkok 10210 THAILAND Tel: 0-2719-8888 Call: 09-09090909

Mağazacılık İhtimamı/Teknisiği 51612001

Environmental Field Scientist (4)

FORM NO.: F 05-062 REVISION NO.: 4 ISSUE DATE: 18/01/24
ALS Laboratory Group

[illegible]

FORM NO.: F 05-062 REVISION NO.: 4 ISSUE DATE: 18/01/24
ALS Laboratory Group

Lot No. 2457400-1

FORM NO.: F 06-053 REVISION NO.: 4 ISSUE DATE: 18/01/2014

A.S. Laboratory Group

ANALYZER CALIBRATION DATA

Lot No. 24547401-1

Client : Gulf NC Co., Ltd. Location : Sida HRSG 12
 Date : 04 Nov 24 Test Operator : Saksit P.

NO. ANALYZER : TELEDYNE API 1803 Serial No. : 81
 Model : 25
 Span (%) :

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (%)	Final Analyzers Calibration Response (%)	Difference (Percent of Span)
ZERO Gas	0.00	0.20	0.10	0.40
LOW-Level Gas	8.00	8.20	8.10	0.30
HIGH Gas	16.00	16.22	16.12	0.40

NO. ANALYZER : HORIBA PG-350 Serial No. : TDBARGKP
 Model : 200
 Span (ppm) :

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
ZERO Gas	0.00	0.50	0.30	0.10
LOW-Level Gas	82.30	82.90	82.70	0.15
HIGH Gas	164.40	165.00	164.70	0.15

SO2 ANALYZER : TELEDYNE API 100EH Serial No. : 437
 Model : 200
 Span (ppm) :

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
ZERO Gas	0.00	0.16	0.05	0.06
LOW-Level Gas	79.76	79.69	79.79	0.06
HIGH Gas	159.50	159.76	159.85	0.05

CO ANALYZER : TELEDYNE API 300EM Serial No. : 451
 Model : 200
 Span (ppm) :

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
ZERO Gas	0.00	0.05	0.01	0.01
LOW-Level Gas	79.49	79.43	79.47	0.01
HIGH Gas	407.40	407.39	407.39	0.01


Calibrated by

(Mr. Saksit Phaisanphut)

Environmental Field Scientist (4)

FORM NO.: F-05-053 REVISION NO.: 4 ISSUE DATE: 18/01/24

Client Name Plant Name		Gulf NGL Co., Ltd. Plant No.		Date Location		GDS No. 04 Date: 19/05/11						
Run No. 7		Run No. 8		Run No. 9		Run No. 10						
Time		Time		Time		Time						
Date	Time	Run	MS	MS	MS	Date	Time	Run	MS	MS	MS	
19/05/11	12:00	0.71	7.28	0.80	1.28	1.01	19/05/11	12:00	0.71	8.67	0.80	1.01
19/05/11	12:05	0.71	7.48	0.81	1.28	1.01	19/05/11	12:05	0.71	8.87	0.80	1.01
19/05/11	12:10	0.71	7.68	0.80	1.21	1.01	19/05/11	12:10	0.71	10.67	0.80	1.01
19/05/11	12:15	0.71	7.88	0.81	1.21	1.01	19/05/11	12:15	0.71	10.87	0.80	1.01
19/05/11	12:20	0.71	8.08	0.81	1.07	1.01	19/05/11	12:20	0.71	10.87	0.81	1.01
19/05/11	12:25	0.71	8.28	0.81	1.07	1.01	19/05/11	12:25	0.71	10.87	0.81	1.01
19/05/11	12:30	0.71	8.48	0.81	1.07	1.01	19/05/11	12:30	0.71	10.87	0.81	1.01
19/05/11	12:35	0.71	8.68	0.81	1.07	1.01	19/05/11	12:35	0.71	10.87	0.81	1.01
19/05/11	12:40	0.71	8.88	0.79	1.23	1.01	19/05/11	12:40	0.71	10.87	0.81	1.01
19/05/11	12:45	0.71	9.08	0.79	1.23	1.01	19/05/11	12:45	0.71	10.87	0.81	1.01
19/05/11	12:50	0.71	9.28	0.79	1.23	1.01	19/05/11	12:50	0.71	10.87	0.81	1.01
19/05/11	12:55	0.71	9.48	0.79	1.23	1.01	19/05/11	12:55	0.71	10.87	0.81	1.01
19/05/11	13:00	0.71	9.68	0.79	1.23	1.01	19/05/11	13:00	0.71	10.87	0.81	1.01
19/05/11	13:05	0.71	9.88	0.79	1.23	1.01	19/05/11	13:05	0.71	10.87	0.81	1.01
19/05/11	13:10	0.71	10.08	0.79	1.23	1.01	19/05/11	13:10	0.71	10.87	0.81	1.01
19/05/11	13:15	0.71	10.28	0.79	1.23	1.01	19/05/11	13:15	0.71	10.87	0.81	1.01
19/05/11	13:20	0.71	10.48	0.79	1.23	1.01	19/05/11	13:20	0.71	10.87	0.81	1.01
19/05/11	13:25	0.71	10.68	0.80	1.07	1.01	19/05/11	13:25	0.71	10.87	0.81	1.01
19/05/11	13:30	0.71	10.88	0.80	1.07	1.01	19/05/11	13:30	0.71	10.87	0.81	1.01
19/05/11	13:35	0.71	11.08	0.80	1.07	1.01	19/05/11	13:35	0.71	10.87	0.81	1.01
19/05/11	13:40	0.71	11.28	0.80	1.07	1.01	19/05/11	13:40	0.71	10.87	0.81	1.01
19/05/11	13:45	0.71	11.48	0.80	1.07	1.01	19/05/11	13:45	0.71	10.87	0.81	1.01
19/05/11	13:50	0.71	11.68	0.80	1.07	1.01	19/05/11	13:50	0.71	10.87	0.81	1.01
19/05/11	13:55	0.71	11.88	0.80	1.07	1.01	19/05/11	13:55	0.71	10.87	0.81	1.01
19/05/11	14:00	0.71	12.08	0.80	1.07	1.01	19/05/11	14:00	0.71	10.87	0.81	1.01
19/05/11	14:05	0.71	12.28	0.80	1.07	1.01	19/05/11	14:05	0.71	10.87	0.81	1.01
19/05/11	14:10	0.71	12.48	0.80	1.07	1.01	19/05/11	14:10	0.71	10.87	0.81	1.01



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ANALYZER

nder Con. (%)

16.02

Gulf NC Co., Ltd.

04 Nov 24

Location

Test Operator

shua HRSO 12

Saksit P.

Span (%) : 25

O ₂ Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
	System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	
O ₂ Gas	0.20	0.20	0.05	0.10	0.40
scale Gas	16.22	16.22	0.00	16.12	0.40

ANALYZER (ppm) : 154.40

Span (ppm) : 200

NO _x Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
	System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	
O ₂ Gas	0.50	0.50	0.00	0.30	0.10
scale Gas	105.00	105.00	0.00	102.75	0.15

ANALYZER (ppm) : 159.90

Span (ppm) : 200

SO ₂ Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
	System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	
O ₂ Gas	0.15	0.15	0.00	0.05	0.05
scale Gas	159.75	159.75	0.00	159.85	0.05

ANALYZER (ppm) : 407.40

Span (ppm) : 500

CO Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
	System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	
O ₂ Gas	0.05	0.05	0.00	0.01	0.01
scale Gas	407.35	407.35	0.00	407.35	0.01

Calibrated by

Saksit P.

(Mr.Saksit Phaisanphrui)

Environmental Field Scientist (4)



CEMs Opacity Data



CEMs Opacity Data



CEMs Data

Client Name		Gulf NeCo Ltd		Location		SSEA H990 11									
Plant Name															
Run No: 1				Run No: 2				Run No: 3				Run No: 4			
Date	Time	Flowrate m ³ /hr	Temperature °C	Date	Time	Flowrate m ³ /hr	Temperature °C	Date	Time	Flowrate m ³ /hr	Temperature °C	Date	Time	Flowrate m ³ /hr	Temperature °C
20/04/24	11:30	204.705	506.0	20/04/24	10:00	204.845	506.0	20/04/24	11:10	202.705	506.5	20/04/24	11:20	198.578	504.7
20/04/24	11:35	217.649	506.0	20/04/24	10:05	205.000	506.0	20/04/24	11:20	204.690	506.0	20/04/24	11:25	201.965	504.0
20/04/24	11:40	222.297	506.0	20/04/24	10:10	202.000	506.0	20/04/24	11:25	204.690	506.0	20/04/24	11:30	211.880	506.0
20/04/24	11:45	226.254	506.0	20/04/24	10:15	202.857	506.0	20/04/24	11:30	204.690	506.0	20/04/24	11:35	214.460	506.0
20/04/24	11:50	231.026	506.0	20/04/24	10:20	203.421	506.0	20/04/24	11:35	204.690	506.0	20/04/24	11:40	214.460	506.0
20/04/24	11:55	234.250	506.0	20/04/24	10:25	217.277	506.0	20/04/24	11:40	204.690	506.0	20/04/24	11:45	215.271	506.0
20/04/24	12:00	235.876	505.0	20/04/24	10:30	218.371	506.0	20/04/24	11:45	205.871	507.0	20/04/24	11:50	214.890	506.0
20/04/24	12:05	238.640	505.0	20/04/24	10:35	217.264	506.0	20/04/24	11:50	206.817	506.0	20/04/24	11:55	217.260	506.0
20/04/24	12:10	245.716	506.0	20/04/24	10:40	221.871	506.0	20/04/24	11:55	207.890	506.0	20/04/24	12:00	214.890	506.0
20/04/24	12:15	250.281	506.0	20/04/24	10:45	220.802	506.0	20/04/24	12:00	210.371	506.0	20/04/24	12:05	218.475	506.0
20/04/24	12:20	254.493	506.0	20/04/24	10:50	220.807	506.0	20/04/24	12:05	217.890	506.0	20/04/24	12:10	220.91	506.0
20/04/24	12:25	257.827	506.0	20/04/24	10:55	224.523	506.0	20/04/24	12:10	217.878	506.0	20/04/24	12:15	214.813	506.0
20/04/24	12:30	257.717	506.0	20/04/24	11:00	223.739	506.0	20/04/24	12:15	217.890	506.0	20/04/24	12:20	216.910	506.0
20/04/24	12:35	259.623	506.0	20/04/24	11:05	223.739	506.0	20/04/24	12:20	217.739	506.0	20/04/24	12:25	217.327	506.0
20/04/24	12:40	260.862	506.0	20/04/24	11:10	224.051	506.0	20/04/24	12:25	217.739	506.0	20/04/24	12:30	214.813	506.0
20/04/24	12:45	262.890	506.0	20/04/24	11:15	224.051	506.0	20/04/24	12:30	217.739	506.0	20/04/24	12:35	214.813	506.0
20/04/24	12:50	262.890	506.0	20/04/24	11:20	224.051	506.0	20/04/24	12:35	217.739	506.0	20/04/24	12:40	214.813	506.0
20/04/24	12:55	262.203	506.0	20/04/24	11:25	224.051	506.0	20/04/24	12:40	217.739	506.0	20/04/24	12:45	214.813	506.0
20/04/24	13:00	261.203	506.0	20/04/24	11:30	224.051	506.0	20/04/24	12:45	217.739	506.0	20/04/24	12:50	214.813	506.0
20/04/24	13:05	261.203	506.0	20/04/24	11:35	224.051	506.0	20/04/24	12:50	217.739	506.0	20/04/24	12:55	214.813	506.0
20/04/24	13:10	261.203	506.0	20/04/24	11:40	224.051	506.0	20/04/24	12:55	217.739	506.0	20/04/24	13:00	214.813	506.0
20/04/24	13:15	261.203	506.0	20/04/24	11:45	224.051	506.0	20/04/24	13:00	217.739	506.0	20/04/24	13:05	214.813	506.0
20/04/24	13:20	261.203	506.0	20/04/24	11:50	224.051	506.0	20/04/24	13:05	217.739	506.0	20/04/24	13:10	214.813	506.0
20/04/24	13:25	261.203	506.0	20/04/24	11:55	224.051	506.0	20/04/24	13:10	217.739	506.0	20/04/24	13:15	214.813	506.0
20/04/24	13:30	261.203	506.0	20/04/24	12:00	224.051	506.0	20/04/24	13:15	217.739	506.0	20/04/24	13:20	214.813	506.0
20/04/24	13:35	261.203	506.0	20/04/24	12:05	224.051	506.0	20/04/24	13:20	217.739	506.0	20/04/24	13:25	214.813	506.0
20/04/24	13:40	261.203	506.0	20/04/24	12:10	224.051	506.0	20/04/24	13:25	217.739	506.0	20/04/24	13:30	214.813	506.0
20/04/24	13:45	261.203	506.0	20/04/24	12:15	224.051	506.0	20/04/24	13:30	217.739	506.0	20/04/24	13:35	214.813	506.0
20/04/24	13:50	261.203	506.0	20/04/24	12:20	224.051	506.0	20/04/24	13:35	217.739	506.0	20/04/24	13:40	214.813	506.0
20/04/24	13:55	261.203	506.0	20/04/24	12:25	224.051	506.0	20/04/24	13:40	217.739	506.0	20/04/24	13:45	214.813	506.0
20/04/24	14:00	261.203	506.0	20/04/24	12:30	224.051	506.0	20/04/24	13:45	217.739	506.0	20/04/24	13:50	214.813	506.0
20/04/24	14:05	261.203	506.0	20/04/24	12:35	224.051	506.0	20/04/24	13:50	217.739	506.0	20/04/24	13:55	214.813	506.0
20/04/24	14:10	261.203	506.0	20/04/24	12:40	224.051	506.0	20/04/24	13:55	217.739	506.0	20/04/24	14:00	214.813	506.0
20/04/24	14:15	261.203	506.0	20/04/24	12:45	224.051	506.0	20/04/24	14:00	217.739	506.0	20/04/24	14:05	214.813	506.0
20/04/24	14:20	261.203	506.0	20/04/24	12:50	224.051	506.0	20/04/24	14:05	217.739	506.0	20/04/24	14:10	214.813	506.0
20/04/24	14:25	261.203	506.0	20/04/24	12:55	224.051	506.0	20/04/24	14:10	217.739	506.0	20/04/24	14:15	214.813	506.0
20/04/24	14:30	261.203	506.0	20/04/24	13:00	224.051	506.0	20/04/24	14:15	217.739	506.0	20/04/24	14:20	214.813	506.0
20/04/24	14:35	261.203	506.0	20/04/24	13:05	224.051	506.0	20/04/24	14:20	217.739	506.0	20/04/24	14:25	214.813	506.0
20/04/24	14:40	261.203	506.0	20/04/24	13:10	224.051	506.0	20/04/24	14:25	217.739	506.0	20/04/24	14:30	214.813	506.0
20/04/24	14:45	261.203	506.0	20/04/24	13:15	224.051	506.0	20/04/24	14:30	217.739	506.0	20/04/24	14:35	214.813	506.0
20/04/24	14:50	261.203	506.0	20/04/24	13:20	224.051	506.0	20/04/24	14:35	217.739	506.0	20/04/24	14:40	214.813	506.0
20/04/24	14:55	261.203	506.0	20/04/24	13:25	224.051	506.0	20/04/24	14:40	217.739	506.0	20/04/24	14:45	214.813	506.0
20/04/24	15:00	261.203	506.0	20/04/24	13:30	224.051	506.0	20/04/24	14:45	217.739	506.0	20/04/24	14:50	214.813	506.0
20/04/24	15:05	261.203	506.0	20/04/24	13:35	224.051	506.0	20/04/24	14:50	217.739	506.0	20/04/24	14:55	214.813	506.0
20/04/24	15:10	261.203	506.0	20/04/24	13:40	224.051	506.0	20/04/24	14:55	217.739	506.0	20/04/24	15:00	214.813	506.0
20/04/24	15:15	261.203	506.0	20/04/24	13:45	224.051	506.0	20/04/24	15:00	217.739	506.0	20/04/24	15:05	214.813	506.0
20/04/24	15:20	261.203	506.0	20/04/24	13:50	224.051	506.0	20/04/24	15:05	217.739	506.0	20/04/24	15:10	214.813	506.0
20/04/24	15:25	261.203	506.0	20/04/24	13:55	224.051	506.0	20/04/24	15:10	217.739	506.0	20/04/24	15:15	214.813	506.0
20/04/24	15:30	261.203	506.0	20/04/24	14:00	224.051	506.0	20/04/24	15:15	217.739	506.0	20/04/24	15:20	214.813	506.0
20/04/24	15:35	261.203	506.0	20/04/24	14:05	224.051	506.0	20/04/24	15:20	217.739	506.0	20/04/24	15:25	214.813	506.0
20/04/24	15:40	261.203	506.0	20/04/24	14:10	224.051	506.0	20/04/24	15:25	217.739	506.0	20/04/24	15:30	214.813	506.0
20/04/24	15:45	261.203	506.0	20/04/24	14:15	224.051	506.0	20/04/24	15:30	217.739	506.0	20/04/24	15:35	214.813	506.0
20/04/24	15:50	261.203	506.0	20/04/24	14:20	224.051	506.0	20/04/24	15:35	217.739	506.0	20/04/24	15:40	214.813	506.0
20/04/24	15:55	261.203	506.0	20/04/24	14:25	224.051	506.0	20/04/24	15:40	217.739	506.0	20/04/24	15:45	214.813	506.0
20/04/24	16:00	261.203	506.0	20/04/24	14:30	224.051	506.0	20/04/24	15:45	217.739	506.0	20/04/24	15:50	214.813	506.0
20/04/24	16:05	261.203	506.0	20/04/24	14:35	224.051	506.0	20/04/24	15:50	217.739	506.0	20/04/24	15:55	214.813	506.0
20/04/24	16:10	261.203	506.0	20/04/24	14:40	224.051	506.0	20/04/24	15:55	217.739	506.0	20/04/24	16:00	214.813	506.0
20/04/24	16:15	261.203	506.0	20/04/24	14:45	224.051	506.0	20/04/24	16:00	217.739	506.0	20/04/24	16:05	214.813	506.0
20/04/24	16:20	261.203	506.0	20/04/24	14:50	224.051	506.0	20/04/24	16:05	217.739	506.0	20/04/24	16:10	214.813	506.0
20/04/24	16:25	261.203	506.0	20/04/24	14:55	224.051	506.0	20/04/24	16:10	217.739	506.0	20/04/24	16:15	214.813	506.0
20/04/24	16:30	261.203	506.0	20/04/24	15:00	224.051	506.0	20/04/24	16:15	217.739	506.0	20/04/24	16:20	214.813	506.0
20/04/24	16:35	261.203	506.0	20/04/24	15:05	224.051	506.0	20/04/24	16:20	217.739	506.0	20/04/24	16:25	214.813	506.0
20/04/24	16:40	261.203	506.0	20/04/24	15:10	224.051	506.0	20/04/24	16:25	217.739	506.0	20/04/24	16:30	214.813	506.0
20/04/24	16:45	261.203	506.0	20/04/24	15:15	224.051	506.0	20/04/24	16:30	217.739	506.0	20/04/24	16:35	214.813	506.0
20/04/24	16:50	261.203	506.0	20/04/24	15:20	224.051	506.0	20/04/24	16:35	217.739	506.0	20/04/24	16:40	214.813	506.0
20/04/24	16:55	261.203	506.0	20/04/24	15:25	224.051	506.0	20/04/24	16:40	21					



CEMs Data



Reference Method Data

CEMs Opacity Data

Client Name		Gulf WC Co., Ltd.		Date		4-Nov-24			
Plant Name		GNC		Location		Uda HSRS 12			
Run No.1		Run No.2		Run No.3		Run No.4		Run No.5	
Time	Opacity (%)	Time	Opacity (%)	Time	Opacity (%)	Time	Opacity (%)	Time	Opacity (%)
11:40	6.27	12:40	6.10	13:40	6.19	14:40	6.61	15:40	6.39
11:41	6.05	12:41	5.94	13:41	6.32	14:41	6.25	15:41	6.09
11:42	6.04	12:42	5.92	13:42	6.18	14:42	6.05	15:42	6.31
11:43	6.51	12:43	5.96	13:43	6.17	14:43	5.97	15:43	6.24
11:44	6.18	12:44	5.95	13:44	6.44	14:44	5.96	15:44	6.08
11:45	6.27	12:45	6.00	13:45	6.30	14:45	5.91	15:45	6.19
11:46	6.22	12:46	6.09	13:46	6.41	14:46	6.05	15:46	6.39
11:47	6.04	12:47	5.99	13:47	6.26	14:47	5.95	15:47	6.05
11:48	5.92	12:48	5.97	13:48	6.14	14:48	6.11	15:48	6.37
11:49	6.14	12:49	6.07	13:49	6.42	14:49	6.18	15:49	6.18
11:50	5.97	12:50	6.09	13:50	6.23	14:50	6.03	15:50	6.20
11:51	5.78	12:51	5.93	13:51	6.26	14:51	5.77	15:51	6.59
11:52	6.02	12:52	6.15	13:52	6.38	14:52	6.13	15:52	6.11
11:53	6.01	12:53	5.90	13:53	6.33	14:53	6.10	15:53	6.14
11:54	5.96	12:54	6.01	13:54	6.60	14:54	6.24	15:54	6.30
11:55	5.93	12:55	6.24	13:55	6.85	14:55	6.30	15:55	6.24
11:56	5.95	12:56	5.95	13:56	6.55	14:56	6.56	15:56	6.34
11:57	6.19	12:57	5.64	13:57	6.21	14:57	6.14	15:57	6.59
11:58	6.02	12:58	5.96	13:58	6.21	14:58	6.29	15:58	6.38
11:59	6.07	12:59	6.12	13:59	6.14	14:59	6.25	15:59	6.33
12:00	6.85	13:00	6.18	14:00	6.21	15:00	6.11	16:00	6.40
12:01	6.15	13:01	6.21	14:01	6.08	15:01	6.14	16:01	6.70
12:02	6.47	13:02	6.53	14:02	6.14	15:02	6.12	16:02	6.44
12:03	6.05	13:03	6.30	14:03	6.50	15:03	6.18	16:03	6.35
12:04	6.16	13:04	6.14	14:04	6.31	15:04	6.02	16:04	6.35
12:05	6.15	13:05	5.87	14:05	6.13	15:05	5.86	16:05	6.09
12:06	6.13	13:06	5.95	14:06	6.38	15:06	5.79	16:06	5.92
12:07	6.12	13:07	5.87	14:07	6.25	15:07	6.05	16:07	6.18
12:08	5.91	13:08	5.58	14:08	6.01	15:08	6.33	16:08	6.23
12:09	5.79	13:09	5.89	14:09	6.46	15:09	6.05	16:09	6.18
12:10	5.82	13:10	6.09	14:10	6.21	15:10	6.33	16:10	6.32
12:11	5.82	13:11	6.14	14:11	6.10	15:11	6.06	16:11	6.17
12:12	6.14	13:12	6.12	14:12	6.41	15:12	6.20	16:12	6.26
12:13	6.14	13:13	6.22	14:13	6.33	15:13	6.15	16:13	5.97
12:14	5.73	13:14	5.81	14:14	6.02	15:14	6.19	16:14	6.45
12:15	6.03	13:15	5.58	14:15	5.86	15:15	6.38	16:15	6.14
12:16	5.66	13:16	5.73	14:16	5.93	15:16	6.04	16:16	6.14
12:17	6.01	13:17	5.74	14:17	5.96	15:17	6.06	16:17	6.21
12:18	5.79	13:18	5.58	14:18	5.96	15:18	6.20	16:18	6.36
12:19	5.86	13:19	5.79	14:19	6.07	15:19	6.49	16:19	6.22
12:20	6.49	13:20	6.17	14:20	6.22	15:20	6.22	16:20	6.37
12:21	5.84	13:21	6.07	14:21	6.33	15:21	6.26	16:21	6.43
12:22	5.84	13:22	5.74	14:22	6.28	15:22	6.14	16:22	6.60
12:23	5.87	13:23	5.70	14:23	6.23	15:23	6.25	16:23	6.03
12:24	5.85	13:24	5.82	14:24	6.32	15:24	6.23	16:24	6.25
12:25	5.74	13:25	5.89	14:25	6.30	15:25	6.19	16:25	6.34
12:26	5.83	13:26	5.53	14:26	6.59	15:26	5.96	16:26	6.26
12:27	5.80	13:27	5.59	14:27	6.41	15:27	5.99	16:27	6.25
12:28	5.64	13:28	6.02	14:28	6.05	15:28	6.02	16:28	6.30



EMISSION TEST RESULT

Client	Gulf NC Co., Ltd.	Run #	1
Date	05 Nov 24	Location	Udaa HRSG 11
Start Time	10:40	Test Operator	Saksit P.
SO ₂ Analyzer Model	TELEDYNE API 100EH	Serial No.	437
NO _x /O ₂ Analyzer Model	HORIBA PG-350	Serial No.	TDBARGKP
CO/CO ₂ Analyzer Model	TELEDYNE API 300EM	Serial No.	451

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
10:40	14.58	3.43	9.77	0.65	52.38	
10:41	14.60	3.42	8.29	0.66	52.69	
10:42	14.52	3.39	7.84	0.66	51.45	
10:43	14.63	3.39	7.78	0.68	50.16	
10:44	14.61	3.39	8.06	0.68	49.79	
10:45	14.53	3.41	9.48	0.68	49.91	
10:46	14.52	3.41	9.91	0.68	50.41	
10:47	14.55	3.42	9.33	0.68	50.84	
10:48	14.58	3.41	8.28	0.69	51.05	
10:49	14.58	3.40	7.97	0.70	50.97	
10:50	14.59	3.40	8.45	0.69	50.31	
10:51	14.58	3.40	9.87	0.65	50.22	
10:52	14.58	3.42	9.39	0.66	50.71	
10:53	14.57	3.42	8.69	0.66	51.68	
10:54	14.59	3.41	8.95	0.66	51.27	
10:55	14.41	3.43	9.79	0.68	51.58	
10:56	14.41	3.42	7.90	0.87	50.97	
10:57	14.45	3.40	8.34	0.87	50.00	
10:58	14.47	3.39	8.89	0.92	49.88	
10:59	14.47	3.40	9.66	0.92	49.80	
11:00	14.48	3.41	10.38	0.92	50.17	
Average	14.52	3.40	8.91	0.65	50.79	

Saksit P.

(Mr. Saksit Phaisanphitout)

Environmental Field Scientist (4)

FORM NO. F 06-002 REVISION NO. 1 ISSUE DATE: 18/01/24

ALS Laboratory Group

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EMISSION TEST RESULT

Client	Gulf NC Co., Ltd.	Run #	3
Date	05 Nov 24	Location	Udaa HRSG 11
Start Time	11:22	Test Operator	Saksit P.
SO ₂ Analyzer Model	TELEDYNE API 100EH	Serial No.	437
NO _x /O ₂ Analyzer Model	HORIBA PG-350	Serial No.	TDBARGKP
CO/CO ₂ Analyzer Model	TELEDYNE API 300EM	Serial No.	451

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
11:22	14.57	3.42	7.31	0.61	52.22	
11:23	14.57	3.40	7.33	0.60	50.37	
11:24	14.59	3.40	7.44	0.60	50.37	
11:25	14.59	3.40	7.61	0.62	48.68	
11:26	14.60	3.40	7.74	0.63	48.85	
11:27	14.60	3.39	7.52	0.62	48.73	
11:28	14.58	3.40	8.22	0.58	48.77	
11:29	14.60	3.42	8.90	0.57	48.91	
11:30	14.60	3.42	8.57	0.56	48.89	
11:31	14.42	3.41	9.14	0.58	49.01	
11:32	14.48	3.41	8.64	0.57	49.49	
11:33	14.48	3.41	7.96	0.58	49.41	
11:34	14.48	3.41	7.88	0.57	49.28	
11:35	14.48	3.42	8.09	0.58	48.85	
11:36	14.49	3.42	8.93	0.58	48.88	
11:37	14.53	3.42	7.90	0.59	48.97	
11:38	14.58	3.41	7.52	0.60	48.79	
11:39	14.53	3.41	8.22	0.60	48.57	
11:40	14.54	3.41	8.73	0.60	48.71	
11:41	14.58	3.41	8.29	0.50	49.37	
11:42	14.58	3.41	8.71	0.51	49.50	
Average	14.53	3.40	8.12	0.58	49.21	

Saksit P.

(Mr. Saksit Phaisanphitout)

Environmental Field Scientist (4)

FORM NO. F 06-002 REVISION NO. 1 ISSUE DATE: 18/01/24

ALS Laboratory Group

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SYSTEM CALIBRATION BIAS AND DRIFT DATA

Client	Gulf NC Co., Ltd.	Location	Udaa HRSG 12
Date	04 Nov 24	Test Operator	Saksit P.
O ₂ ANALYZER			
Cylinder Conc. (%)	16.02	Span (%)	25

	O ₂ Analyzer Calibration Response	Initial Values System Calibration Response	System Cal Bias (% of Span)	Final Values System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.30	0.30	0.00	0.19	0.40	0.40
Upscale Gas	16.22	16.22	0.00	16.12	0.40	0.40

NO _x ANALYZER			
Cylinder Conc. (ppm)	164.40	Span (ppm)	200

	NO _x Analyzer Calibration Response	Initial Values System Calibration Response	System Cal Bias (% of Span)	Final Values System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.50	0.50	0.00	0.30	0.10	0.10
Upscale Gas	165.90	165.90	0.00	164.70	0.15	0.15

SO ₂ ANALYZER			
Cylinder Conc. (ppm)	159.90	Span (ppm)	200

	SO ₂ Analyzer Calibration Response	Initial Values System Calibration Response	System Cal Bias (% of Span)	Final Values System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	-0.15	-0.15	0.00	-0.05	0.05	0.05
Upscale Gas	159.75	159.75	0.00	159.85	0.05	0.05

CO ANALYZER			
Cylinder Conc. (ppm)	407.40	Span (ppm)	500

	CO Analyzer Calibration Response	Initial Values System Calibration Response	System Cal Bias (% of Span)	Final Values System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	-0.05	-0.05	0.00	-0.01	0.01	0.01
Upscale Gas	407.35	407.35	0.00	407.39	0.01	0.01

Calibrated by

Saksit P.

(Mr. Saksit Phaisanphitout)

Environmental Field Scientist (4)

FORM NO. F 06-003 REVISION NO. 4 ISSUE DATE: 18/01/24

ALS Laboratory Group

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SYSTEM CALIBRATION BIAS AND DRIFT DATA

Client	Gulf NC Co., Ltd.	Location	Udaa HRSG 11
Date	05 Nov 24	Test Operator	Saksit P.
O ₂ ANALYZER			
Cylinder Conc. (%)	16.02	Span (%)	25

	O ₂ Analyzer Calibration Response	Initial Values System Calibration Response	System Cal Bias (% of Span)	Final Values System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.30	0.30	0.00	0.19	0.40	0.40
Upscale Gas	16.22	16.22	0.00	16.12	0.40	0.40

NO _x ANALYZER			
Cylinder Conc. (ppm)	164.40	Span (ppm)	200

	NO _x Analyzer Calibration Response	Initial Values System Calibration Response	System Cal Bias (% of Span)	Final Values System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.50	0.50	0.00	0.30	0.10	0.10
Upscale Gas	165.90	165.90	0.00	164.70	0.15	0.15

SO ₂ ANALYZER			
Cylinder Conc. (ppm)	159.90	Span (ppm)	200

	SO ₂ Analyzer Calibration Response	Initial Values System Calibration Response	System Cal Bias (% of Span)	Final Values System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	-0.15	-0.15	0.00	-0.05	0.05	0.05
Upscale Gas	159.75	159.75	0.00	159.85	0.05	0.05

CO ANALYZER			
Cylinder Conc. (ppm)	407.40	Span (ppm)	500

	CO Analyzer Calibration Response	Initial Values System Calibration Response	System Cal Bias (% of Span)	Final Values System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	-0.05	-0.05	0.00	-0.01	0.01	0.01
Upscale Gas	407.35	407.35	0.00	407.39	0.01	0.01

Calibrated by

Saksit P.

(Mr. Saksit Phaisanphitout)

Environmental Field Scientist (4)

FORM NO. F 06-003 REVISION NO. 4 ISSUE DATE: 18/01/24

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EMISSION TEST RESULT

Client	Gulf NC Co., Ltd.	Run #	2
Date	05 Nov 24	Location	Udaa HRSG 11
Start Time	11:01	Test Operator	Saksit P.
SO ₂ Analyzer Model	TELEDYNE API 100EH	Serial No.	437
NO _x /O ₂ Analyzer Model	HORIBA PG-350	Serial No.	TDBARGKP
CO/CO ₂ Analyzer Model	TELEDYNE API 300EM	Serial No.	451

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
11:01	14.47	3.44	10.45	0.62	50.54	
11:02	14.48	3.44	10.38	0.62	50.86	
11:03	14.49	3.43	10.00	0.63	51.46	
11:04	14.50	3.43	9.81	0.63	51.58	
11:05	14.51	3.43	9.53	0.64	51.84	
11:06	14.52	3.43	10.04	0.64	51.74	
11:07	14.53	3.44	10.12	0.65	51.23	
11:08	14.54	3.43	9.76	0.66	51.33	
11:09	14.55	3.43	9.87	0.66	51.44	
11:10	14.55	3.42	10.08	0.66	51.27	
11:11	14.55	3.43	10.08	0.67	51.26	
11:12	14.55	3.43	9.77	0.67	51.29	
11:13	14.38	3.44	10.10	0.67	51.47	
11:14	14.38	3.44	10.25	0.67	51.86	
11:15	14.41	3.44	10.23	0.67	51.86	
11:16	14.42	3.44	10.45	0.68	52.24	
11:17	14.42	3.45	10.42	0.68	52.36	
11:18	14.45	3.45	10.40	0.69	52.48	
11:19	14.47	3.45	10.02	0.69	52.30	
11:20	14.49	3.44	9.74	0.69	52.15	
11:21	14.53	3.43	8.92	0.60	52.40	
Average	14.48	3.43	9.99	0.66	51.84	

Saksit P.

(Mr. Saksit Phaisanphitout)

Environmental Field Scientist (4)

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ANALYZER CALIBRATION DATA

Client	Gulf NC Co., Ltd.	Location	Udaa HRSG 12
Date	04 Nov 24	Test Operator	Saksit P.
O ₂ ANALYZER			
Model	TELEDYNE API T803	Serial No.	81
Span (%)	25		

	Cylinder Value (%)	Initial Analyzers Calibration Response (%)	Final Analyzers Calibration Response (%)	Difference (Percent of Span)
25% O ₂ GAS	0.30	0.29	0.10	0.40
LOW-LEVEL GAS	0.30	0.29	0.10	0.40
SPAN GAS	16.02	16.22	16.12	0.40

NO _x ANALYZER			
Model	HORIBA PG-350	Serial No.	TDBARGKP
Span (ppm)	200		

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.50	0.50	0.30	0.10
LOW-LEVEL GAS	167.30	167.30	167.60	0.15
SPAN GAS	164.40	165.00	164.70	0.15

SO ₂ ANALYZER			
Model	TELEDYNE API 100EH	Serial No.	437
Span (ppm)	200		

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.50	-0.15	0.30	0.05
LOW-LEVEL GAS	159.75	159.75	159.85	0.05
SPAN GAS	159.90	159.90	159.85	0.05

CO ANALYZER			
Model	TELEDYNE API 300EM	Serial No.	451
Span (ppm)	500		

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
25% O ₂ GAS	0.30	-0.05	0.10	0.01
LOW-LEVEL GAS	78.48	78.48	78.47	0.01
SPAN GAS	407.35	407.35	407.39	0.01

Calibrated by

Saksit P.

(Mr. Saksit Phaisanphitout)

Environmental Field Scientist (4)

FORM NO. F 06-002 REVISION NO. 4 ISSUE DATE: 18/01/24

ALS Laboratory Group

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SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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Calibration Certificate

Equipment : SOUND CALIBRATOR
Manufacturer : RION
Model : NC-74
Serial No.: 34178124
ID No.: RYQ_P50216

REVIEW BY: *S.P.S.*

APPROVED BY: *[Signature]*

NEXT CAL DATE: 22-Oct-25

Condition As Found : GOOD

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

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

Received Date : 18 OCTOBER 2024
Calibration Date : 22 OCTOBER 2024
Date of Issue : 24 OCTOBER 2024

Calibrated by : Nathakorn Pisutpaisan

Approved by : *T. Petch.*
(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.

Cert. No. : ACC24055
Job No. : VC68AC0015
Pages : 3 of 3

Result of calibration :

1. Sound pressure level

Specified sound pressure level (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (dB)	Acceptance limit (dB)
94	94.19	0.19	0.14	0.40

2. Frequency

Specified Frequency (Hz)	Measured value (Hz)	Deviated value (%)	Uncertainty (%)	Acceptance limit (%)
1000	1001.3	0.1	0.1	1.0

3. Total distortion

Measured value (%)	Uncertainty (%)	Acceptance limit (%)
1.82	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

T. Petch.

Cert. No. : ACC24266
Job No. : VC67AC0140
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by follow 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 Acoustic chamber and Reference Standard instruments.
For tests results of each item 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-0009-24	05-FEB-25
Waveform Generator	33511B	MY52302742	EF-0007-24	05-FEB-25
Digital Multimeter	33861A	MY53220104	EEL-BP 210267	13-FEB-25
Digital Multimeter	33861A	MY53220076	EEL-BP 200267	13-FEB-25
Digital Multimeter	34461A	MY60024273	EEL-BP 220267	15-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KA1	34560495	AA-3001-24	05-FEB-25

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).

T. Petch.



CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

Customer: AIR LIQUIDE (THAILAND) LTD.
Pail Number: 02000000000000000000
Cylinder Number: 040027197
Laboratory: 124 - Phnom Penh
NGQP Number: 02000000000000000000
Class Code: 02000000000000000000
Reference Number: 180-402340010-1
Cylinder Volume: 349.8 CF
Cylinder Pressure: 2214 PSI
Valve Outlet: 100
Certification Date: Feb 02, 2023

Expiration Date: Feb 02, 2025

A calibration certificate is issued to the customer for the purpose of providing evidence of the accuracy of the product. The certificate is valid for the period of time specified in the certificate. The certificate is valid for the period of time specified in the certificate. The certificate is valid for the period of time specified in the certificate.

Component	Request Concentration	Actual Concentration	Provision Method	Total Relative Uncertainty	Assay Date
ISOGEN	100.00 %	100.00 %	0.1	± 0.14 % (k=2) (Theoretical)	05/02/2023

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
ISOGEN	00000000	00000000	100.00 %	± 0.14 % (k=2) (Theoretical)	05/02/2025

Instrument/Model	Serial No.	Calibration Date
ISOGEN	00000000	05/02/2023

Instrument/Model	Serial No.	Calibration Date
ISOGEN	00000000	05/02/2023

Total Data Available Upon Request
NOVELLONE Weight: 48.8 Kg
Net Weight: 8.2 Kg



Approved for Release

Approved for Release

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

401-401/1 Srinthorn Road, Bangbunmu, Bangkok, 10700 Thailand
Tel: +66 2433 8331 Email: calibration@sithiporn.com

SITHIPORN
associates



Cert. No. : ACC24055
Job No. : VC68AC0015
Pages : 2 of 3

Calibration Procedure : CP-AC-03

Calibration Method :

This equipment was calibrated by follow 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-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	EEL-BP 210267	13-FEB-25
Digital Multimeter	33461A	MY53220076	EEL-BP 200267	15-FEB-25
Digital Multimeter	33461A	MY60024273	EEL-BP 220267	15-FEB-25
Programmable Attenuator	MAT-1070	62100114	EF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KA1	34560495	AA-3001-24	05-FEB-25
Audio Analyzer	AVR-3360A	V744B6069	EF-0009-24	05-FEB-25

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).

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-92 / Pre-amplifier NII-24
Serial No.: 00734218 / 146937 / 34368
ID No.: RYQ_P50001

Condition As Found : GOOD

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

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

Received Date : 09 AUGUST 2024
Calibration Date : 30 AUGUST 2024
Date of Issue : 03 SEPTEMBER 2024

Calibrated by : Nathakorn Pisutpaisan

Approved by : *T. Petch.*
(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.

T. Petch.

Cert. No. : ACL24266
Job No. : VC67AC0140
Page : 4 of 8

Result of calibration 1.

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.94)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal noise

Measured Value (dB)
19.5

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

Frequency (Hz)	Weighting
A-weight	11.6
C-weight	17.6
Flat	23.3

3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 94 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)				Acceptance Limits
	Flat	C-weight	A-weight		
125	0.5	0.6	0.6		±1.5
1000	0.0	0.0	0.0		±1.0
8000	-1.1	-1.1	-1.1		±5.0

T. Petch

Cert. No. : ACL24266
Job No. : VC67AC0140
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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	89.1	0.1	±1.1
84.0	84.1	0.1	±1.1
79.0	79.0	0.0	±1.1
74.0	74.1	0.1	±1.1
69.0	69.1	0.1	±1.1
64.0	64.0	0.0	±1.1
59.0	59.1	0.1	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	34.0	0.0	±1.1
30.0	30.0	0.0	±1.1
29.0	29.1	0.1	±1.1
28.0	28.0	0.0	±1.1
27.0	27.0	0.0	±1.1
26.0	26.1	0.1	±1.1
25.0	25.1	0.1	±1.1

T. Petch

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18. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Leq (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±0.0
One	130.4	130.4	0.0	±0.0

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	±0.0
Positive half cycle	135.4	135.2	-0.2	±0.0
Negative half cycle	135.4	135.2	-0.2	±0.0

11. Overload indication

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

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

T. Petch

Cert. No. : ACL24266
Job No. : VC67AC0140
Page : 3 of 8

Summary of Measurement Result 1.

Parameter	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	0.3	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. Time 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

T. Petch

Cert. No. : ACL24266
Job No. : VC67AC0140
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4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)				Acceptance Limits
	Flat	C-weight	A-weight		
63	-0.1	-0.1	-0.1		±2.0
125	0.0	0.0	-0.1		±1.3
250	0.0	0.0	0.0		±1.5
500	0.0	0.0	-0.1		±1.5
1000	0.0	0.0	0.0		±1.0
2000	0.0	0.0	0.0		±2.0
4000	0.0	0.0	0.0		±3.0
8000	0.0	0.1	0.1		±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	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
Log	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

T. Petch

Cert. No. : ACL24266
Job No. : VC67AC0140
Page : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	94.0	94.0	0.0	±1.1

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	30.0	29.8	-0.2	±1.1

9. Time burst response

Time Weighting	Time 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 ; -3.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	0.25	1	108.0	108.0	0.0	1.5 ; -3.0
	2	8	127.6	127.6	0.0	±1.0
	200	800	128.0	128.1	0.1	±1.0

T. Petch

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by follow on (IEC 61672-3:2013) standard for sound level meter (SLM).
The SLM had tests in Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.
For test results of each item were made by observation of each instrument's 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	33510A	MY48017076	EE-0009-23	07-FEB-24
Waveform Generator	33511B	MY5230242	EE-0010-23	07-FEB-24
Digital Multimeter	33461A	MY5120104	EE-0010-23	07-FEB-24
Digital Multimeter	33461A	MY5120076	EE-0010-23	07-FEB-24
Digital Multimeter	34461A	MY6002473	EE-0011-23	08-FEB-24
Programmable Attenuator	MAT-1070	62100114	EE-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1061-23	14-FEB-24
Measuring Amplifier	NA-42KA1	3450495	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 units maintained at :

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

T. Petchum

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)
18.8

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

Frequency Weighting	Measured value (dB)
A-weight	12.0
C-weight	18.4
Flat	24.2

3. Acoustical signal tests of frequency weightings

Metz free-field acoustic response at a level of 94 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.7	0.8	0.9	±1.5
1000	-0.2	-0.2	-0.2	±1.0
8000	-2.5	-2.5	-2.5	±5.0

T. Petchum

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
128.0	128.0	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	89.1	0.1	±1.1
84.0	84.1	0.1	±1.1
79.0	79.1	0.1	±1.1
74.0	74.1	0.1	±1.1
69.0	69.1	0.1	±1.1
64.0	64.0	0.0	±1.1
59.0	59.1	0.1	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	34.0	0.0	±1.1
29.0	29.0	0.0	±1.1
24.0	24.1	0.1	±1.1
19.0	19.1	0.1	±1.1
14.0	14.1	0.1	±1.1
9.0	9.1	0.1	±1.1
4.0	4.1	0.1	±1.1

T. Petchum

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Pre-amplifier NH-24
Serial No. : 00472126 / 158778 / 88180
ID No. : RYG_FS0301

Condition As Found :

GOOD

Customer :

ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KHUANG PHATTHANAKAN, KHUANG SUAN LUANG,
BANGKOK, 10250 THAILAND.

Location :

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

Received Date : 19 DECEMBER 2023
Calibration Date : 12 JANUARY 2024
Date of Issue : 16 JANUARY 2024

Calibrated by : Natikorn Prapantun

Approved by :

T. Petchum
(Thanakul Petchum)

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.

Summary of Measurement Result :

Parameter	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	0.3	0.25
12. High level stability	0.1	0.1

T. Petchum

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
50	-0.1	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
Long	94.0	94.0	0.0	±0.1

6. Long-term stability

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

T. Petchum

Cert. No. : ACL24027
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11. Overload indication

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

T. Petch

Cert. No. : ACL24006
Job No. : VC67AC0164
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by follow on IEC-61672-3 (2013) Standard for sound level meter (SLM). The SLM has tests to Acoustical and Electrical signal tests of frequency weighting with Acoustic chamber and Reference Standard Instruments. For test results of each item were made by observation of each instrument 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	MY48017075	EP-0009-24	05-FEB-25
Waveform Generator	33511B	MY52303742	EP-0007-24	05-FEB-25
Digital Multimeter	33461A	MY32200184	IEL-HP 210267	13-FEB-25
Digital Multimeter	33461A	MY32200076	IEL-HP 300267	13-FEB-25
Digital Multimeter	34461A	MY60024273	IEL-HP 220267	13-FEB-25
Programmable Attenuator	MAT-1070	62100114	EP-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KAI	34560495	AA-3001-24	05-FEB-25

- This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.
- This certificate is renewable to the international system of unit maintained at :
 - National Institute of Metrology (Thailand).
 - Thailand Institute of Scientific and Technological Research (TISTR).

T. Petch

Cert. No. : ACL24006
Job No. : VC67AC0164
Page : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.94)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
13.4

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

Frequency Weighting	Weighting (dB)
A-weight	0.8
C-weight	16.8
Flat	22.4

3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 94 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Filt	C-weight	A-weight	Acceptance Limits
125	0.3	0.4	0.4	±1.5
1000	0.0	0.0	0.0	±1.0
8000	-1.9	-1.8	-1.8	±5.0

T. Petch

Cert. No. : ACL24027
Job No. : VC67AC0044
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	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	±0.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±0.0
	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
S&H	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	±0.0
One	136.4	135.3	-1.1	±0.0

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	±0.0
Positive half cycle	135.4	135.2	-0.2	±0.0
Negative half cycle	135.4	135.2	-0.2	±0.0

T. Petch

Cert. No. : ACL24006
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-02 / Microphone UC-62 / Pre-amplifier N31-24
Serial No. : 00597169 / 158770 / 14370
ID No. : RYG, P80439

Condition As Found : GOOD

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

Location :
Ambient Temperature : (23.0 ± 1) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (50.0 ± 2.0) %

Received Date : 23 SEPTEMBER 2024
Calibration Date : 09 OCTOBER 2024
Date of Issue : 09 OCTOBER 2024

REVIEW BY : *[Signature]*
APPROVED BY : *[Signature]*
NEXT CAL DATE : 9/10/25

Calibrated by :

Nattakorn Pongpisan

Approved by :

T. Petch
(Thanakul Petchura)

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.

Cert. No. : ACL24006
Job No. : VC67AC0164
Pages : 3 of 8

Summary of Measurement Result :

Parameter	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	0.3	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	0.35
12. High level stability	0.1	0.1

T. Petch

Cert. No. : ACL24306
Job No. : VC07AC0164
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	34.0	0.0	±1.1
30.0	30.0	0.0	±1.1
29.0	29.1	0.1	±1.1
28.0	28.1	0.1	±1.1
27.0	27.1	0.1	±1.1
26.0	26.2	0.2	±1.1
25.0	25.3	0.3	±1.1

T. Petch

Cert. No. : ACL24306
Job No. : VC07AC0164
Pages : 8 of 8

10. Peak C-mund 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	±3.0
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	±2.0
Positive half cycle	135.4	135.3	-0.1	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

T. Petch

Cert. No. : ACL24304
Job No. : VC07AC0164
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by follow 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	BF-0009-24	05-FEB-25
Waveform Generator	33511B	MY32302742	BF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY3320104	EEL-BP 21-02-07	13-FEB-25
Digital Multimeter	33461A	MY3320076	EEL-BP 20-02-07	13-FEB-25
Digital Multimeter	34461A	MY60024273	EEL-BP 22-02-07	13-FEB-25
Programmable Attenuator	MAT-1070	62100114	EF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	13-FEB-25
Measuring Amplifier	NA-42KAI	34560495	AA-3001-24	05-FEB-25

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 inaccable to the international system of unit maintained as :

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

T. Petch

Cert. No. : ACL24306
Job No. : VC07AC0164
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	0.0	0.0	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.0	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±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

T. Petch

Cert. No. : ACL24306
Job No. : VC07AC0164
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)
130	94.0	94.0	0.0	±1.1

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	30.0	30.1	0.1	±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

T. Petch

Cert. No. : ACL24304
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : BION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00873057 / 171591 / 73333
ID No.: RYO_P30381

Condition As Found : GOOD

Customer : AJS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KHUANG PHATTHANAKAN, KHUAT SUAN LUANG,
BANGKOK, 10250 THAILAND.

Location :
Ambient Temperature : (23.0 ± 3) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (50.0 ± 20) %
Received Date : 23 SEPTEMBER 2024
Calibration Date : 09 OCTOBER 2024
Date of Issue : 09 OCTOBER 2024

REVIEW BY : *[Signature]*
APPROVED BY : *[Signature]*
NEXT CAL DATE : 9/10/25

Calibrated by : Nitiakorn Pitsaporn

Approved by : T. Petch
(Thannakul Petchum)

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SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

451-451/1 Sathorn Road, Banglamue, Bangkok, 10700 Thailand
Tel: +66 2433 8331 Email: calibration@sithiporn.com



Cert. No. : ACL2404
Job No. : VC67ACB164
Page : 4 of 8

Result of calibration 1.

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limits (dB)
93.9 (93.94)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
16.7

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

Frequency Weighting (dB)	Weighting (dB)
A-weight	13.4
C-weight	19.3
Flat	25.0

3. Acoustical signal tests of frequency weightings

Mixer free-field acoustic response at a level of 94 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.3	0.4	0.4	±1.5
1000	0.1	0.1	0.1	±1.0
8000	1.1	1.2	1.2	±5.0

T. Petch

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Cert. No. : ACL2404
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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
130.0	130.0	0.0	±1.1
129.0	129.0	0.0	±1.1
128.0	128.0	0.0	±1.1
119.0	119.0	0.0	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.0	0.0	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	34.0	0.0	±1.1
30.0	30.1	0.1	±1.1
29.0	29.0	0.0	±1.1
28.0	28.1	0.1	±1.1
27.0	27.1	0.1	±1.1
26.0	26.2	0.2	±1.1
25.0	25.2	0.2	±1.1

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Cert. No. : ACL2404
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10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lepeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	135.9	-0.5	±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	±3.0
Positive half cycle	135.4	135.2	-0.2	±3.0
Negative half cycle	135.4	135.2	-0.2	±3.0

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.6	89.3	-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

T. Petch

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Cert. No. : ACL2404
Job No. : VC67ACB164
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Summary of Measurement Result 1.

Parameter	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	0.3	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 covered	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

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Cert. No. : ACL2404
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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
83	0.0	0.0	0.0	±2.0
125	0.1	0.1	0.1	±1.5
250	0.1	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	±5.0
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	94.1	0.1	±0.3

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8. Level linearity including the level range covered

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	94.0	94.0	0.0	±1.1

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	30.0	30.1	0.1	±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	134.1	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

T. Petch

Cert. No. : ACL24013
Job No. : VC67AC0044
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by follow on IEC-61672-3 (2013) Standard for sound level meter (SLM).
The SLM had tests to Acoustical and Electrical signal test of frequency weighting with Anechoic chamber and Reference Standard Instruments.
For test results of each item 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	MY44017076	EF-0099-23	07-FEB-24
Waveform Generator	33311B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220049	EEL-00 300266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL-00 300266	13-FEB-24
Digital Multimeter	34461A	MY60004773	EEL-00 318266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	FF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42EAI	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).

T. Petchai

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.94)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
15.1

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

Frequency Weighting	Measured value (dB)
A-weight	13.8
C-weight	20.3
Flat	25.8

3. Acoustical signal tests of frequency weightings

Micro 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	1.5	1.6	1.6	±5.0

T. Petchai

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	89.1	0.1	±1.1
84.0	84.1	0.1	±1.1
79.0	79.0	0.0	±1.1
74.0	74.1	0.1	±1.1
69.0	69.1	0.1	±1.1
64.0	64.0	0.0	±1.1
59.0	59.1	0.1	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	34.1	0.1	±1.1
30.0	30.1	0.1	±1.1
29.0	29.1	0.1	±1.1
28.0	28.1	0.1	±1.1
27.0	27.2	0.2	±1.1
26.0	26.2	0.2	±1.1
25.0	25.3	0.3	±1.1

Cert. No. : ACL24013
Job No. : VC67AC0044
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T. Petchai

Cert. No. : ACL24013
Job No. : VC67AC0044
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42A / Microphone UC-52 / Preamplifier NH-24
Serial No. : 00623391 / 108638 / 26419
ID No. : RYC_P50616

Condition As Found : GOOD

Customer : A.S. LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 46, PHATTHANAKAN ROAD,
KIWAENG PHATTHANAKAN, KHUET SUAN LIANG,
BANGKOK, 10250 THAILAND.

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

Received Date : 19 DECEMBER 2023
Calibration Date : 05-08 JANUARY 2024
Date of Issue : 09 JANUARY 2024

Calibrated by : Nutthakorn Pitsanunai

Approved by : T. Petchai
(Thianakul Petchai)

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other than in full, except with the prior written approval of the head of Calibration Laboratory.

Nutthakorn P
4/1/25

Summary of Measurement Result :

Parameter	Uncertainty	Maximum-permitted
	(dB)	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	0.3	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

Cert. No. : ACL24013
Job No. : VC67AC0044
Pages : 3 of 8

T. Petchai

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	-0.1	±1.5
500	0.0	0.0	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	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

T. Petchai

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Cert. No. : ACL24013
Job No. : VC67AC0044
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	89.8	0.3	±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



Cert.No.: 24CH383
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	23E2802	27 Aug 2024

This certification is traceable to the International System of Unit maintained through:-
- Technology Promotion Association (Thailand-Japan)

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

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	940102	27 Nov 2025
pH 6.986	CPA chem	940104	02 Nov 2024
pH 9.997	CPA chem	940106	02 Nov 2024

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

Calibration Results

Function : mV Measurement

Performing standard curve by Document Process Calibrator at pH (4,7,10)

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (±mV)	Coverage factor k
	pH	mV	mV	pH		
pH Meter S/N.: C202355606	4.00	177.48	177	4.00	0.58	2.00
	7.00	0.00	0	7.00	0.58	2.00
	10.00	-177.48	-178	10.00	0.58	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.: 2015870	4.008	4.01	167	0.0071	2.00
	6.986	6.99	-10	0.010	2.00
	9.997	10.00	-178	0.0062	2.00

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

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Equipment : pH Meter with Sensor
Condition As-Received : Used Item
Reference : 2403-1017DSC-10

Cert. No.: 24LM61
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	AS2847	231222	TPA	10 Oct 2024

2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This certification is traceable to the International System of Unit.
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (°) Without Adjustment

Function : Temperature measurement.

This instrument was connected with temperature sensor, S/N.: 2015780

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty (± °C)	Coverage Factor k
25.0	100	25.002	25.0	-0.002	0.16	2.00
40.0	100	40.003	40.1	0.097	0.16	2.00
60.0	100	60.004	60.1	0.096	0.16	2.00

UUC* : Unit Under Calibration

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

-000-

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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	±1.7

9. Time burst response

Time Weighting	Time 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	127.8	127.6	-0.2	±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 (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
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	133.1	0.1	±3.0
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.3	-0.1	±2.0



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534/4 PATTANAKARN ROAD SOI 18, SUANLIANG, SUANLIANG BANGKOK 10250
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Certificate of Calibration

Cert.No.: 24CH383
Page: 1 of 2

Equipment :

Manufacturer : Mettler Toledo

Model : Seven2GoTM pHmV S2

Serial No. : C202355606

ID No. : RYG_FS0574

Condition As-Received: Used Item

Received Date : 29 March 2024

Calibration Date : 01 April 2024

Reference : 2403-1017DSC-9

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

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

Ambient Temperature : (25 ± 2.5) °C

Relative Humidity : (50 ± 15) %

In-house method : - CP-OH5 by direct measurement with DC voltage

Calibration Procedure : standard and direct measurement with certified reference material (CRM)

Calibrated by : Warakorn Lemgagtrakul

Approved by :

Approved Signatory

() Ponpan Paipin

() Unnophol Harachai

(✓) Sathip Mengmai

Issue Date : 02 April 2024

The Uncertainties are for a confidence probability of approximately 95%

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLIANG, SUANLIANG BANGKOK 10250
TEL. 0-2717-3000-39 FAX. 0-2718-9484



Certificate of Calibration

Cert. No.: 24LM61
Page: 1 of 2

Equipment :

Manufacturer : Mettler Toledo

Model : Seven2GoTM pHmV S2

Serial No. : C202355606

ID No. : RYG_FS0574

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

Rayong Branch

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

Location : TPA On Site Calibration Laboratory

Received Order : 29 March 2024

Calibrated Date : 02 April 2024

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 30) %

AC Line Voltage : (220 ± 22) V

Calibrated by : Warakorn Lemgagtrakul

Approved by :

Approved Signatory

() Ponthippa Tameyajakul

(✓) Ponpan Paipin

() Suwit Imjai

Issue Date : 7 April 2024

The Uncertainties are for a confidence probability of approximately 95%

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Cert. No.: 23C1024
Page: 2 of 2

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

Function:	DC voltage measurement	Range:	2000 mV	Uncertainty
Standard Value	UUC Reading	Error		
(mV)	(mV)	(mV)		(mV)
-200.0000	-198.8	0.1	0.0	0.0
-150.0000	-150.0	0.0	0.0	0.0
-100.0000	-100.0	0.0	0.0	0.0
-50.0000	-50.0	0.0	0.0	0.0
0.0000	0.0	0.0	0.0	0.0
50.0000	50.0	0.0	0.0	0.0
100.0000	100.0	0.0	0.0	0.0
150.0000	150.0	0.0	0.0	0.0
200.0000	198.8	-0.1	0.0	0.0

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.

-00-

11131422



Cert. No.: 23CH181
Page: 2 of 2

Condition of this calibration result

- Reference Standard Instrument
 - Instrument
 - Serial No.
 - ID No.
 - Cert. No.
 - Due Date
- 1) Document Process Calibrator: 54030040 130RC110 23C2809 27 Aug 2024
2) Ref. Standard Thermometer: 490004 110RC004 23906 26 July 2024
- This calibration is traceable to the International System of Unit maintained through:
- Technology Promotion Association (Thailand-Japan)

2) Certified Reference Material: The measurement results are traceable to SI through CPA chem LR, AND-A001 Industrial Reference Material, Assessed by: AN-1435

Buffer Solution	Manufacturer	Lot No.	Exp. Date
pH 4.009	CPA chem	815086	14 July 2025
pH 6.860	CPA chem	831980	01 Oct 2024
pH 9.197	CPA chem	840100	02 Nov 2024

3) This certificate is valid only for the item calibrated in unit 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	Coverage factor
	pH	mV	mV	(mV)	k
pH Meter	4.000	-177.48	-177.3	-0.056	3.00
ISN: B034291445	7.000	6.007	6.1	0.058	3.00
	10.000	-177.48	-177.5	0.056	3.00

11131422

Sartorius (Thailand) Co., Ltd.
179 Ram 6 Road (Sartorius, Rayong), Rayong 21140
Tel: 039 534 5345, Email: sarthai@th.sartorius.com



SARTORIUS

Certificate of Calibration

REVIEW BY: Ymchul
APPROVED BY: D. S. S.
EFFECTIVE DATE: 01.02.2024

Model Number: MSE224E-100 DU
Description: Analytical Balance
Serial Number: 0020207094
IQ No.: RYD_BH0002
Manufacturer: Sartorius
Page No.: 1 of 2

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

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

Calibrated By: Mr. Chonchai Intakul
Calibration Date: Thursday, February 22, 2024

Calibration Procedure No.: This calibration was conducted by using in-house calibrated procedure number (W-009) based on UKAS LA0-14: 2019

Microbial data:
Capacity: 320 g
Resistivity: 0.0001 M
Temperature: 24.2 °C
Humidity: 97.0 % RH
Pressure: 1010.0 hPa

Reasons for calibration: ☐ New Installation ☐ Service / Repair ☐ Regulatory Requirement ☐ Good Practice ☐ Per

Measurement Method: UKAS Publication Ref: Lab 14
This measurement uncertainty allows 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 consistent with the Guide to the Expression of Uncertainty in Measurement (GUM). The calibration certificate documents the traceability to National Standards, which realize the unit of measurement according to the International System of Units (SI). Report of Test/issue name item list of Sartorius Method/Specification.

Traceability:

Model Number	Description	Traceability	Certificate No.	Exp. Date
YC8011-022-00	Balance weight set, 1mg - 500g (E2) (E1) (E2) (E2)	TCB	M93081075	23-Aug-2025
M80-30250	Humidity/Balance/Temp. Labon RH/20-25	DEPH	C19231845	23-Aug-2024

This certificate is valid and apply this equipment only.
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Sartorius (Thailand) Co., Ltd.

Mr. Chonchai Intakul (Technical Manager)
SARTORIUS
LA0-14: 2019

SGP FM 33, 03 February 2023



TECHNOLOGY PROMOTION ASSOCIATION (THAI AND JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICE
3/41 PATTANAKARN ROAD NO. 10, BANGKONG, BANGKOK 10260
TEL: 02-011-9800-34 FAX: 02-011-9801



Certificate of Calibration

Cert. No.: 23C1024
Page: 1 of 2

Equipment: pH Meter
Manufacturer: Mettler Toledo
Model: SevenCompact
Serial No.: B034291445
ID No.: RYD_BH0152
Condition As-Received: Used (N/A)
Received Date: 08 December 2023
Calibration Date: 14 December 2023
Reference: 2312-0151DSC-3
Ambient Temperature: 23.3 ± 0.2 °C
Relative Humidity: (40 ± 10) %

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

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

Procedure used: Calibration was conducted using company procedure No. SP-014 according to 6108A/ET (g 1)

Condition of this result of calibration

1) Reference Standard Instrument

Instrument	Model	Serial No.	Certificate No.	Exp. Date
1) Multi-Point Calibration	5502A	341880	KE-0041-23	29 Apr 2024

2) This result of calibration was made in accordance with the policy specified by calibration.

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

4) This Certificate is traceable to the International System of Unit maintained through:

- National Institute of Metrology (Thailand-Japan)

REVIEW BY: Mr. Boravit
APPROVED BY: D. S. S.
EFFECTIVE DATE: 11/06/24
1106115

Calibrated by: Nipponpon Promotional
Issue Date: 10 December 2023
Approved Signature: 1) Nipponpon Promotional 2) Nipponpon Promotional 3) Nipponpon Promotional

11081105



TECHNOLOGY PROMOTION ASSOCIATION (THAI AND JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICE
3/41 PATTANAKARN ROAD NO. 10, BANGKONG, BANGKOK 10260
TEL: 02-011-9800-34 FAX: 02-011-9801



Certificate of Calibration

Cert. No.: 23CH181
Page: 1 of 2

Equipment: pH Meter
Manufacturer: Mettler Toledo
Model: SevenCompact
Serial No.: B034291445
ID No.: RYD_BH0152
Condition As-Received: Used Item
Received Date: 08 December 2023
Calibration Date: 15 December 2023
Reference: 2312-0151DSC-3
Submitted by: ALB Laboratory Group (Thailand) Co., Ltd. (Rayong Branch)
616/10 Moo 5, T. Maenam Khu, A. Phraksaeng, Rayong 21140, Thailand

Ambient Temperature: (20 ± 2) °C
Relative Humidity: (50 ± 10) %
Calibration Procedure: In - house method
- CP-C95 by direct measurement with standard voltage calibrator and direct measurement with certified reference material (CRM)
- CP-C95 by comparison with standard measurement

Calibrated by: Watanon Lengmuang

Approved by: Watanon Lengmuang
Approved Signature:

1) Watanon Lengmuang
2) Watanon Lengmuang
3) Watanon Lengmuang
Issue Date: 10 December 2023

The Uncertainty are for a confidence probability of approximately 95 %

This certificate is valid and apply this equipment only.
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Sartorius (Thailand) Co., Ltd.

11081105



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	Uncertainty of pH measurement	Coverage factor
			(mV)	(%)	k
pH Electrode	4.008	4.013	104.1	0.0049	2.00
ISN: 0253469	6.868	6.868	6.7	0.0084	2.00
	9.197	10.005	-104.7	0.0088	2.11

Function: Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe:

- Model: InLabExept Pro-10M
Serial No.: 3225368

- 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 (°C)	Coverage factor k
-20.0	-20.000	24.3	-0.703	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=2, providing a level of confidence of approximately 95 %.

-00-

Cert. No.: 23C1024
Page: 3 of 3

Mr. Chonchai Intakul (Technical Manager)
SARTORIUS
LA0-14: 2019

11131051



Certificate of Calibration

Cert. No.: 24TM632
Page: 1 of 3

Equipment : Hot Air Oven
Manufacturer : Memmert
Model : UFE 500
Serial No. : GS11.1572
ID No. : RYG_EN0010
Submitted by : ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch)
616/10 Moo 5 T. Maenam Khu, A. Pluakdaeng, Rayong 21140 Thailand
Oven Room
Received Order : 21 March 2024
Calibration Date : (25 ± 10) °C
Ambient Temperature : (25 ± 10) °C
Relative Humidity : (25 ± 10) %
Calibrated by : Man Pattanapongpaiboon
Approved by :
() Pornthipga Taneyakul
() Unnopphol Harachai
(X) Suwit Injai
Issue Date : 22 March 2024

The uncertainties are for a confidence probability of approximately 95%
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Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2403-0563OC-1
Function of UUC : Temperature Source
Fresh air setting : Close
Cert. No.: 24TM632
Page: 3 of 3

Calibration Point (°C)	UUC Setting (°C)	UUC Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor
104.0	104.0	104.0	0.051	0.59	0.62	2
180.0	180.0	180.0	0.15	1.3	1.7	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	1	2	3	4	5	6	7	8	9 (ref.)	
104.0	103.921	103.786	103.757	103.759	103.850	103.817	104.213	103.672	103.673	0.42
180.0	179.614	179.270	179.145	179.599	180.001	180.423	180.293	180.629	179.429	1.1

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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Cert.No.: 23TW108
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	1126143784	140RC004	22MM50	20 Sep 2023

2. Standard Material :

Material	Manufacturer	Lot No.	Assay
Sodium Thiosulfate pentahydrate	Merck	AM1763316	100.2%

Result : Dissolved Oxygen Meter Adjustment With Air 100 %

Dissolved Oxygen Probe No.: 15E100454

Titration Method (Azide Modification Method)	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 concern. 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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n 1172155

Sartorius (Thailand) Co., Ltd.
131 Rang 1 Road, Huaywang, Bangna District, Bangkok 10260
Tel: +66 2245 5551-5 Fax: +66 2245 0207, e-mail: sartorius.thailand@merck.com

SARTORIUS

Certificate of Calibration

Model Number : MBR2245-100-DV
Description : Analytical Balance
Serial Number : 9620207038
ID No. : RYG_EN0002
Manufacturer : Sartorius
Certificate No. : 24BC0009
Issued Date : Friday, February 23, 2024
Reference No. : 220106
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 results when identical test conditions exist. The standard error of a measurement series is given as the standard deviation of the series.			The eccentricity loading error is defined as the difference between the results of the load (e.g. 100 g) at different locations placed at the center of the weighing pan and the results of the load (e.g. 100 g) at different locations placed at the periphery of the weighing pan.		
Nominal Value (Low Load)	20.0000 g	199.9999 g	Nominal Value	100 g	
30 g	20.0000 g	200.0000 g	Tolerance	0.0004 g	
Calibration	20.0001 g	200.0000 g			
0.0001 g	20.0000 g	199.9999 g			
	20.0001 g	200.0000 g			
Nominal Value (High Load)	19.9999 g	200.0000 g			
200 g	20.0000 g	200.0000 g			
Tolerance	0.0001 g	199.9999 g			
	19.9999 g	200.0000 g			
	19.9999 g	200.0000 g			
Standard Deviation	0.00007 g	0.00006 g			

Linearity

The linearity is the ability of a weighing instrument to display nearly identical results when identical test conditions exist. The standard error of a measurement series is given as the standard deviation of the series.

Nominal Value (g)	Conversion Mass Value (g)	Displayed Value (g)	Deviation (g)	Uncertainty (g)
0.01	0.0100	0.0100	0.0000	0.0001
0.05	0.0500	0.0500	0.0000	0.0001
0.1	0.1000	0.1000	0.0000	0.0001
0.5	0.5000	0.5000	0.0000	0.0001
1	1.0000	1.0000	0.0000	0.0001
5	5.0000	5.0000	0.0000	0.0001
10	10.0000	10.0000	0.0000	0.0001
20	20.0000	20.0000	0.0000	0.0001
50	50.0000	50.0000	0.0000	0.0001
100	100.0000	100.0000	0.0000	0.0001
200	200.0000	200.0000	0.0000	0.0001

End of Report



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2403-0563OC-1
Procedure Used : Calibration was 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	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY57013711	23LM115	TPA	11 Jul 2024

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

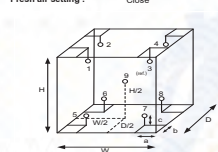
3. This certification is traceable to the International System of Unit.

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

Result of Calibration : (°) Without Adjustment

Function of UUC : Temperature Source

Fresh air setting : 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		
Temp. (°C)	Beginning	Finished
REL Humid. (%)	27	59
AC Supply (Volt)	222	224

Ref. Std. ID No.: @ Calibration Point		
Position	(180 °C)	(104 °C)
1	18-18TC-01	18-18RTD-01
2	18-18TC-02	18-18RTD-02
3	18-18TC-03	18-18RTD-03
4	18-18TC-04	18-18RTD-04
5	18-18TC-05	18-18RTD-05
6	18-18TC-06	23-18RTD-06
7	18-18TC-07	18-18RTD-07
8	18-18TC-08	22-18RTD-08
9 (ref.)	18-18TC-09	18-18RTD-09



Cert.No.: 23TW108
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 : 2307-071308C-1
Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.
Rayong Branch
616/10 Moo 5, T. Maenam Khu, A. Pluakdaeng, Rayong 21140, Thailand
Laboratory Condition : Temperature (25 ± 5) °C
Humidity (80 ± 20) %
Test Procedure : In-house method : CP-CH
by Comparison Technique with Azide Modification Method
Tested by : Walais Sathitip
Approved by :
() Maine Bunnas
(X) Sathitip Meangmat
() Wisakorn Lenggrakul
Issue Date : 28 July 2023

Equipment: DO Meter with Sensor
Condition As-Received: Used Item
Reference: 2307-071305C-2
Procedure Used: Calibration was 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 2168060 221285 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: (°C) Without Adjustment
Function of UUC: Temperature Source
Fresh air setting: Close

This instrument was connected with temperature sensor, SN: 1228476367

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	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 %.

A 1159515

Equipment: Low Temp. Incubator
Condition As-Received: Used Item
Reference: 2411-0002OC-1
Procedure Used: Calibration was conducted using calibration procedure CP-OT02 based on TLAS G-20 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD). The temperature scale used was based on ITS-90.

Condition of this result of calibration:
1. Reference standard instrument:-
Instrument **Serial No.** **Cert. No.** **Traceable** **Due Date**
1) Data Acquisition MY44073361 24LM73 TPA 18 May 2025

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: (°C) Without Adjustment
Function of UUC: Temperature Source
Fresh air setting: Close

Environment during calibration

	Beginning	Finished
Temp. (°C)	24	25
REL Humid. (%)	55	53
AC Supply (Volt)	220	221

Position: **Ref. Std. ID No.:**
1 1RTD-21
2 1RTD-22
3 22-01RTD-03
4 1RTD-24
5 1RTD-25
6 1RTD-26
7 23-01RTD-07
8 1RTD-28
9 (ref.) 23-01RTD-09

Probe Installation Details:
a = 10 cm D = 0.60 m
b = 10 cm W = 1.0 m
c = 10 cm H = 1.2 m
Capacity = 0.72 m³

A 1159515

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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634/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL: 0-2717-3000-29 FAX: 0-2719-9484

Certificate of Calibration **Cert. No.:** 24CG3711
Page: 1 of 2

Equipment: Burette
Capacity: 50 mL
Serial No.: -
ID No.: RYG_EN0216
Manufacturer: Wileg
Made in: Germany
Submitted by: ALS Laboratory Group (Thailand) Co., Ltd. Rayong Branch 616/10 Moo 5, T. Maenam Khu, A. Phukdaeng Rayong 21140, Thailand

Ambient Temperature: (20 ± 2.5) °C
Relative Humidity: (50 ± 10) %
Barometric Pressure: 756 mmHg
Calibration Procedure: ASTM E 542 - 01
Calibrated by: Sa-nguankam Wongsa

Approved by: *S. Srisuda*
Approved Signatory
(✓) Srisuda Khamtha
() Porpan Paipim
() Unnopphol Harachai

Issue Date: 24 September 2024

The Uncertainties are for a confidence probability of approximately 95%
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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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634/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL: 0-2717-3000-29 FAX: 0-2719-9484

Certificate of Calibration **Cert. No.:** 23LM120
Page: 1 of 2

Equipment: DO Meter with Sensor
Manufacturer: YSI
Model: 5000-110V
Serial No.: 15E102796
ID No.: RYG_EN0032
Submitted by: ALS Laboratory Group (Thailand) Co., Ltd. Rayong Branch 616/10 Moo 5 T. Maenam Khu, A. Phukdaeng Rayong 21140 Thailand
Location: TPA On Site Calibration Laboratory

Received Order: 26 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 Hahih
Approved by: *P. Preecha*
Approved Signatory
() Porntippa Tanayakul
() Malee Butrusa
(✓) Suwit Injai

Issue Date: 31 July 2023

The Uncertainties are for a confidence probability of approximately 95%
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A 0053616

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
634/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL: 0-2717-3000-29 FAX: 0-2719-9484

Certificate of Calibration **Cert. No.:** 24TM1663
Page: 1 of 3

Equipment: Low Temp. Incubator
Manufacturer: Memmert
Model: IPP750
Serial No.: V818.0084
ID No.: RYG_EN0154
Submitted by: ALS Laboratory Group (Thailand) Co., Ltd. Rayong Branch 616/10 Moo 5, T. Maenam Khu, A. Phukdaeng Rayong 21140, Thailand
Location: BOD Room

Received Order: 01 November 2024
Calibration Date: 01 November 2024
Ambient Temperature: (26 ± 10) °C
Relative Humidity: (50 ± 30) %
AC Line Voltage: (220 ± 22) V

Calibrated by: Kunchit Maiee
Approved by: *Kunchit*
Approved Signatory
() Porpan Paipim
() Suwit Injai
(✓) Kunchit Promrat

Issue Date: 07 November 2024

The Uncertainties are for a confidence probability of approximately 95%
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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
634/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL: 0-2717-3000-29 FAX: 0-2719-9484

Certificate of Calibration **Cert. No.:** 24TM1663
Page: 3 of 3

Equipment: Low Temp. Incubator
Condition As-Received: Used Item
Reference: 2411-0002OC-1
Result of Calibration: (°C) 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
20.0	20.0	20.0	0.026	0.26	0.53	2

Calibration Point (°C) **Measured Temperature (°C)** **Uncertainty (± °C)**

Point (°C)	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
20.0	20.071	19.915	20.273	20.179	19.977	19.782	20.056	20.026	20.033

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 %.

A 0053616



Certificate of Calibration

Cert. No.: 24TM634
Page: 1 of 3

Equipment : Hot Air Oven
Manufacturer : Memmert
Model : UF 110
Serial No. : B423.0853
ID No. : RYG_EN0213

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

Received Order : 21 March 2024
Calibration Date : 21 - 22 March 2024
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %

Calibrated by : Man Pattanapongpaiboon

Approved by :
() Ponthippa Tameyakul
() Unnopphol Harachai
(x) Suwit Imjai

Issue Date : 23 March 2024

The Uncertainties are for a confidence probability of approximately 95%
This certificate may not be reproduced other than in full, except with the prior written
Approval of the Head of Corporate Services 3: Equipment Calibration and Testing Services.



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2403-0563OC-3
Result of Calibration : () Without Adjustment
Function of UUC : Temperature Source
Fresh air setting : Close

Cert. No.: 24TM634
Page: 3 of 3

Calibration Point (°C)	UUC Setting (°C)	UUC Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
104.0	104.0	104.0	0.065	0.52	0.90	2
180.0	180.0	180.0	0.20	1.2	2.0	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	1	2	3	4	5	6	7	8	9 (ref.)	
104.0	104.169	103.506	103.898	103.712	103.772	103.730	104.289	103.805	103.796	0.42
180.0	180.701	179.238	179.935	179.969	180.127	180.138	180.895	179.313	180.211	1.1

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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Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2403-0563OC-4
Procedure Used : Calibration were conducted using in-house calibration procedure CP-OT04 Based on ASTM E715 according to direct measurement method with Data Acquisition which connected with Industrial Platinum Resistance Thermometer (IPRT).

Cert. No.: 24TM635
Page: 2 of 3

The temperature scale used was based on ITS-90.
Condition of this result of calibration

- Reference standard instrument:-
Instrument : MY57013711 23LM115 TPA 11 Jul 2024
- This certificate is valid only to the item calibrated on date and place of calibration.
- This certificate is traceable to the International System of Unit.

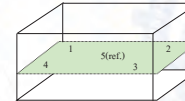
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration : () Without Adjustment

Function of UUC : Temperature Source

Heat transfer medium used : Water

	Environmental		AC Voltage Supply
	(°C)	(%RH)	(Volt)
Beginning of Calibration	25	55	222
Finished of Calibration	25	57	223



Front

Position :	Ref. Std. ID No.:
1	4803988-001
2	4803988-002
3	4803988-003
4	4803988-004
5(ref.)	4803988-005



Equipment : Burette
Received Date : 19 September 2024
Condition As-Received : Used Item
Calibration Date : 24 September 2024
Reference : 2409-0756DSC-3

Cert.No.: 24CG3711
Page: 2 of 2

Condition of this result of calibration

- Reference Standard Instruments :

Instruments	Model	Serial No.	ID. No.	Certificate No.	Traceability	Due date
1) Balance	XP205	B134206712	140RC007	24MM316	TPA	15 July 2025
2) Data Logger	HL-20D	20683159	140EC012	23H2174	TPA	10 Oct 2024
3) Thermometer		1594592	140EC010	24I175	TPA	20 Feb 2025
- This certificate is traceable to SI Unit
- The certificate is valid only to the item calibrated on date and place of calibration.
- 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	10.0259	0.0082	2.00
20	20.0214	0.0085	2.00
30	30.0006	0.0089	2.00
40	40.0003	0.0094	2.00
50	49.9988	0.011	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 %.

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Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2403-0563OC-3
Procedure Used : Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD) and Thermocouple Type T.

Cert. No.: 24TM634
Page: 2 of 3

The temperature scale used was based on ITS-90.
Condition of this result of calibration

- Reference standard instrument:-

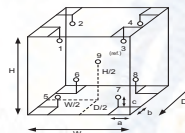
Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY57013711	23LM115	TPA	11 Jul 2024
- This certificate is valid only to the item calibrated on date and place of calibration.
- This certificate is traceable to the International System of Unit.

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

Result of Calibration : () Without Adjustment

Function of UUC : Temperature Source

Fresh air setting : Close



Probe Installation Details : 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		
Temp. (°C)	Beginning	Finished
REL Humid. (%)	59	59
AC Supply (Volt)	224	223

Ref. Std. ID No.: @ Calibration Point		
Position :	(180) °C	(104) °C
1	18-18TC-01	18-18RTD-01
2	18-18TC-02	18-18RTD-02
3	18-18TC-03	18-18RTD-03
4	18-18TC-04	18-18RTD-04
5	18-18TC-05	18-18RTD-05
6	18-18TC-06	23-18RTD-06
7	18-18TC-07	18-18RTD-07
8	18-18TC-08	22-18RTD-08
9 (ref.)	18-18TC-09	18-18RTD-09



Certificate of Calibration

Cert. No.: 24TM635
Page: 1 of 3

Equipment : Water Bath
Manufacturer : Memmert
Model : WN822
Serial No. : L513.0648
ID No. : RYG_EN0081

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 : 21 March 2024
Calibration Date : 21 March 2024
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %

Calibrated by : Man Pattanapongpaiboon

Approved by :
() Ponthippa Tameyakul
() Unnopphol Harachai
(x) Suwit Imjai



Issue Date : 23 March 2024

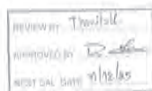
The Uncertainties are for a confidence probability of approximately 95%
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Approval of the Head of Corporate Services 3: Equipment Calibration and Testing Services.


Certificate No. T241120

Page 1 of 4

Certificate of Calibration

Equipment	: Chamber (Cold Room)	 REVIEWED BY: Thirathorn APPROVED BY:  REQUEST DATE: 9/18/15
Manufacturer	: MODULAR	
Model	: JREVC0HCOO	
Serial No.	: C00351459	
Customer Code	: RYG_EN0184	
ID No.	: T1939A5	
Customer	: AFS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)	
	: 616/10 Moo 5 T.Maenam Khu,	
	: A.Pluakdueng, Rayong 21140	



Customer Location	Laboratory
Date of Receipt	5 June 2024
Calibrated By	Sujjar Nakknared (Site Calibration Manager)
Approved By	 Preecha Pibassasethkul (Temperature Calibration Manager)
Date of Issue	11 Jun 2024

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

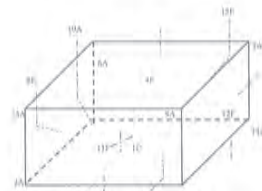
This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding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

99-1114-1016-AM04

Certificate No. T244120

Page 3 of 4

Calibration Report



H = Face, F = Centre of Face, A = Corner, O = Centre of Edge

1C = T8161	11F = T8171
2A = T8162	12F = T8172
3X = T8163	13A = T8173
4F = T8164	14A = T8174
5A = T8165	15F = T8175
6A = T8166	16E = T8176
7F = T8167	
8F = T8168	
9A = T8169	
10A = T8170	

Approved By: _____

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Customer Contact:
HLB Laboratory Group (Thailand) Co., Ltd.
Head Office
104 Phatthanakan 40 Phatthanakan Suburb
Huayeng Phatthanakan District
TAX ID : 010548004699
Chonattagarn.linhom@siglobal.com
27801088

SERVICE REPORT

Customer Purchase Order Number:	Customer Number: 70371013
Service Request:	Service Request Date:
Service Order: 6006878051	Service Confirmation: 6305876103

104 Phatthanakan 48 Phatthanakan B
Khwaeng Phatthanakan Khet Suan



Delivery Site:
ALB Laboratory Group (Thailand) Co
Ltd Head Office

Direct Inquiries to:
Contact Name: CUSTOMER CONTACT CENTER
Contact E-mail: ccc-smt@lgflint.com
Contact Telephone: +863 637 4393
Contact Fax: +863 632 4334

104 Phaschanen 40 Phaschanen 50

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Sub-district, Watana District, Bangkok 10110 Thailand
Attn: Mr. 012 4452 507
TMBKung Thai Bank PLS
Siam Square Bv. 418/1-2 Rama 1 Rd. Pattaya City, BKK 10150
Thailand

03/03/2005

Page 1 of 3

Equipment: Water Bath

Cert. No.: 247M635

Condition As-Received: Used Item

Page : 3 of 3

Reference: 2403-05630C-4

Result of Calibration :- (*) Without Adjustment

Function of UUC*: Temperature Source

Calibration point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Average* Standard Reading (°C)					Uncertainty (± °C)
			Position					
			1	2	3	4	5 (ref.)	
85.0	85.0	85.0	84.428	84.424	84.489	84.507	84.477	0.18

Calibration point (°C)	Uniformity (°C)	Stability (°C)	Coverage Factor <i>k</i>
85.0	0.18	0.11	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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Metrology

SCI ECO Services Company Limited

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



NIST-1610-103-0100
2016-08-01/2017-01-01

Certificate No. T241120
Page 2 of 4

Calibration Report

Equipment	Chamber (Cold Room)		
Date of Calibration	11 June 2024		
Environment	Temperature : 23.1-24.1 °C		
	Line Voltage : 222.3-226.3 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 was for ambient temperature measurement. The calibration was done as according to NIST 7111 based on ASTM E145-94, Calibration 2011 and ASME Y-986 .

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

2. Referenced Standard Instrument

Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	TYPE T	T6101-T8170	T240713	19 April 2025
TC	TYPE B	T6171-T74169	T240713	19 April 2025
DATA LOGGER	34910A	T149	T240713	19 April 2025

3. This certificate is issued to National Institute of Metrology (Thailand) through Metrological Center (NIST-VI-ITS 17025 CALIBRATION)IMPTF.

4. Condition of calibrated item : good

Equipment Description:

Then Constant : ☐ Yes ☒ No HI : ☐ Manual ☐ Auto 1 °C

Fresh Air Bypass : ☐ Open ☐ Min ☐ Medium ☐ Max

☐ Close


☒ Not Available

5. Adjustment : ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 ☐ 11 ☐ 12 ☐ 13 ☐ 14 ☐ 15 ☐ 16 ☐ 17 ☐ 18 ☐ 19 ☐ 20 ☐ 21 ☐ 22 ☐ 23 ☐ 24 ☐ 25 ☐ 26 ☐ 27 ☐ 28 ☐ 29 ☐ 30 ☐ 31 ☐ 32 ☐ 33 ☐ 34 ☐ 35 ☐ 36 ☐ 37 ☐ 38 ☐ 39 ☐ 40 ☐ 41 ☐ 42 ☐ 43 ☐ 44 ☐ 45 ☐ 46 ☐ 47 ☐ 48 ☐ 49 ☐ 50 ☐ 51 ☐ 52 ☐ 53 ☐ 54 ☐ 55 ☐ 56 ☐ 57 ☐ 58 ☐ 59 ☐ 60 ☐ 61 ☐ 62 ☐ 63 ☐ 64 ☐ 65 ☐ 66 ☐ 67 ☐ 68 ☐ 69 ☐ 70 ☐ 71 ☐ 72 ☐ 73 ☐ 74 ☐ 75 ☐ 76 ☐ 77 ☐ 78 ☐ 79 ☐ 80 ☐ 81 ☐ 82 ☐ 83 ☐ 84 ☐ 85 ☐ 86 ☐ 87 ☐ 88 ☐ 89 ☐ 90 ☐ 91 ☐ 92 ☐ 93 ☐ 94 ☐ 95 ☐ 96 ☐ 97 ☐ 98 ☐ 99 ☐ 100


Approved By: _____



1101-11-100-0100



Metrology
SCI ECO Services Company Limited
 33/2 Moo 3, T. Bangs, A. Kaengkhro, Saraburi 18110, Thailand



Certificate No. T241128

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Calibration Report

Measurement Results:

		Average Standard Reading at each position (°C)									
Calibration Point		TN001	TN002	TN003	TN004	TN005	TN006	TN007	TN008	TN009	TN010
3		2.70	2.70	2.77	2.76	2.99	3.38	3.06	3.21	3.08	3.00
		TN011	TN012	TN013	TN014	TN015	TN016				
		3.39	3.01	3.03	3.61	3.62	3.42				


Chamber 1 Cold Room 1			Temperature Distribution				
Setting (°C)	Reading (°C)		Average (°C)	Stability (°C)	Uniformity (°C)	Inhomogeneity (°C)	Coverage Factor #
	Min.	Max.					
3.0	2.9	3.1	3.1	2.07	1.32	1.11	2.00

* The quoted uncertainty excludes 1 inhomogeneity¹

The calibration result apply only to the above calibrated item.

Our result of this test based precisely on reference in this test page of our policy.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k which for a simultaneous measurement is a level of confidence of approximately 95 %.

Approved By: 

SCI ECO SERVICES COMPANY LIMITED

Service Information:

Problem Description:
WU-DU-01-010-001/002

Service Provided:
Corrective (GOW) 11018/001/002
Preventive (D) 001, 002, 003, 004, 005, 006, 007, 008, 009, 010, 011, 012, 013, 014, 015, 016, 017, 018, 019, 020, 021, 022, 023, 024, 025, 026, 027, 028, 029, 030, 031, 032, 033, 034, 035, 036, 037, 038, 039, 040, 041, 042, 043, 044, 045, 046, 047, 048, 049, 050, 051, 052, 053, 054, 055, 056, 057, 058, 059, 060, 061, 062, 063, 064, 065, 066, 067, 068, 069, 070, 071, 072, 073, 074, 075, 076, 077, 078, 079, 080, 081, 082, 083, 084, 085, 086, 087, 088, 089, 090, 091, 092, 093, 094, 095, 096, 097, 098, 099, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 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798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 831, 832, 833, 834, 835, 836, 837, 838, 839, 840, 841, 842, 843, 844, 845, 846, 847, 848, 849, 850, 851, 852, 853, 854, 855, 856, 857, 858, 859, 860, 861, 862, 863, 864, 865, 866, 867, 868, 869, 870, 871, 872, 873, 874, 875, 876, 877, 878, 879, 880, 881, 882, 883, 884, 885, 886, 887, 888, 889, 890, 891, 892, 893, 894, 895, 896, 897, 898, 899, 900, 901, 902, 903, 904, 905, 906, 907, 908, 909, 910, 911, 912, 913, 914, 915, 916, 917, 918, 919, 920, 921, 922, 923, 924, 925, 926, 927, 928, 929, 930, 931, 932, 933, 934, 935, 936, 937, 938, 939, 940, 941, 942, 943, 944, 945, 946, 947, 948, 949, 950, 951, 952, 953, 954, 955, 956, 957, 958, 959, 960, 961, 962, 963, 964, 965, 966, 967, 968, 969, 970, 971, 972, 973, 974, 975, 976, 977, 978, 979, 980, 981, 982, 983, 984, 985, 986, 987, 988, 989, 990, 991, 992, 993, 994, 995, 996, 997, 998, 999, 1000

Service Confirmation Order:
Inspection Code: Scheduled Service
Inspection Code: Scheduled Service
Inspection Code: Scheduled Service
Inspection Code: Scheduled Service

Reported Hours:
8.0

Travel Hours:
5.0

Customer Field Service:
Representative Name:
Special: Unknown

Customer Field Service:
Representative Signature:
Date: 23 Sep 2024

Customer Name:
SUNNY TUNAN (MCHM)

Customer Signature:
Date: 23 Sep 2024

Additional Comments:

Page 2 of 2

Service Instrument:

Model Number	Model Description	Serial Number	System Model	Parent Asset
67540-0100	ICP-05 S100/S115 System			
000104	Applied S100 S100V ICP-05S	14Y1801/0005	ICP-05S S100	SYS-00-0110
000104	S100 S100V ICP-05S	14Y1801/0005	ICP-05S S100	SYS-00-0110

Service Item:

Item	Service Part Y	Description	Qty	Subcontract	Service Date	Service End
1000	EDD	Emergency Operational Qualification	1.00	Agreement Unfulfilled 100 %	23.08.2024	23.08.2024
1010	8810350100	Bottle ICP-05S Woven safe 500ml, 5 pcs	1.00	Agreement Unfulfilled 100 %	23.08.2024	23.08.2024
1020	S100-0001	Collection Bottle without label P1002	1.00	Agreement Unfulfilled 100 %	23.08.2024	23.08.2024

Additional Information:

Page 2 of 2



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-720.
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 (NSC-TIS-TIS T1022 CALIBRATION)

4. Condition of calibrated item : good

Equipment Description :
Time Constant : 2 Hour 20 Minute AL 95 °C

Peak Air Damper : ☐ Open ☐ Min ☐ Medium ☐ Max

☐ Close ☒ Not Available

5. Adjustment :
() without adjustment (X) after adjustment

Approved By: [Signature]

TMA-L13 00030-05-07



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 : Saneek Muskawan (Site Calibration Manager)

Approved By : [Signature] / Sujar Naknakred (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.

TMA-L13 00030-05-07



Certificate No T231676

Page 4 of 6

Calibration Report

Measurement Results		Average Standard Reading at each position (°C)											
Calibration Point		TN21	TN22	TN23	TN24	TN25	TN26	TN27	TN28	TN29	TN30	TN31	TN32
R1 Hole1-Hole6	U/L POINT	Max	95.01	95.41	95.20	95.41	95.51	95.17					
		Min	94.57	95.05	94.75	94.02	94.00	94.72					
	Average	94.79	94.18	94.98	95.17	94.26	94.05						
R2 Hole7-Hole12		Max	95.26	95.43	95.19	95.16	95.35	94.97					
		Min	94.94	94.95	94.72	94.71	94.90	94.57					
	Average	95.10	95.19	94.96	94.94	95.13	94.77						
R3 Hole13-Hole18		Max	95.17	95.05	95.22	95.21	95.33	95.21					
		Min	94.99	95.06	94.78	94.82	94.88	94.96					
	Average	95.18	95.30	95.00	95.03	95.11	95.13						
R4 Hole19-Hole24		Max	95.59	94.42	94.52	94.24	94.63	94.67					
		Min	95.21	94.06	94.13	93.88	94.28	94.27					
	Average	95.40	94.24	94.33	94.06	94.45	94.45						
R5 Hole25-Hole30		Max	95.19	95.28	95.97	95.30	95.14	95.63					
		Min	94.63	95.03	95.56	94.95	94.79	94.70					
	Average	94.91	95.20	95.75	95.12	94.96	94.87						
R6 Hole31-Hole36		Max	94.63	94.90	94.77	94.31	94.24	93.87					
		Min	94.24	94.55	94.44	93.98	93.92	93.56					
	Average	94.43	94.72	94.60	94.14	94.08	93.71						
R7 Hole37-Hole42		Max	94.30	94.44	94.04	93.81	93.89	93.33					
		Min	93.56	94.05	93.47	93.48	93.29	93.90					
	Average	94.13	94.24	93.66	93.63	93.64	93.13						
R8 Hole43-Hole48		Max	95.09	95.63	95.28	95.29	95.43	95.87					
		Min	93.37	95.15	94.82	94.84	94.99	94.48					
	Average	95.78	95.39	95.05	95.07	95.22	94.64						

Approved By: [Signature]

TMA-L13 00030-05-07



Certificate No. T231676

Page 3 of 6

Calibration Report

TN23	TN24	TN25	TN26	TN27	TN28
Hole1	Hole2	Hole3	Hole4	Hole5	Hole6
TN29	TN30	TN31	TN32	TN33	TN34
Hole7	Hole8	Hole9	Hole10	Hole11	Hole12
TN35	TN36	TN37	TN38	TN39	TN40
Hole13	Hole14	Hole15	Hole16	Hole17	Hole18
TN41	TN42	TN43	TN44	TN45	TN46
Hole19	Hole20	Hole21	Hole22	Hole23	Hole24
TN47	TN48	TN49	TN50	TN51	TN52
Hole25	Hole26	Hole27	Hole28	Hole29	Hole30
TN53	TN54	TN55	TN56	TN57	TN58
Hole31	Hole32	Hole33	Hole34	Hole35	Hole36
TN59	TN60	TN61	TN62	TN63	TN64
Hole37	Hole38	Hole39	Hole40	Hole41	Hole42
TN65	TN66	TN67	TN68	TN69	TN70
Hole43	Hole44	Hole45	Hole46	Hole47	Hole48
TN71	TN72	TN73	TN74	TN75	TN76
Hole49	Hole50	Hole51	Hole52	Hole53	Hole54
TN77	TN78	TN79	TN80	TN81	TN82
Hole55	Hole56	Hole57	Hole58	Hole59	Hole60
TN83	TN84	TN85	TN86	TN87	TN88
Hole61	Hole62	Hole63	Hole64	Hole65	Hole66
TN89	TN90	TN91	TN92	TN93	TN94
Hole67	Hole68	Hole69	Hole70	Hole71	Hole72
TN95	TN96	TN97	TN98	TN99	TN100
Hole73	Hole74	Hole75	Hole76	Hole77	Hole78
TN101	TN102	TN103	TN104	TN105	TN106
Hole79	Hole80	Hole81	Hole82	Hole83	Hole84

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	100.2, 100.5	100.4	0.20	0.01
107.0	107.0, 107.1	107.1	0.10	0.76

* The quoted uncertainty include "uniformity" item.

The calibration result apply only the above calibrated item.

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

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

Approved By: _____

TM-613 (08/30/65-57)

Calibration Report

Equipment : Chamber (Cooling Room)
Date of Calibration : 6 December 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 according to WI-T20 (based on ASTM E145-04 (Reapproved 2001) and AS2553-1989). 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 Information:
Instrument Model Instrument No. Certificate No. Exp. Date
YC TYPPE T T2101/T2170 T230773 10 April 2024
TC TYPPE T T2171/T2180 T230773 10 April 2024
DATA LOGGER T4970A T140 T230773
- This certificate is issued to:
National Institute of Metrology (Thailand) through Metrological Centre (NSC-TS0-TS1 TS01 CALIBRATION 0284.)
- Condition of calibrated item : good
Equipment Description :
Time Constant : 1 Hour
Frosty Air Danger : ☐ Open ☐ Min. ☐ Medium ☐ Max.
☐ Close
☒ Not Available.
- Adjustment : (X) without adjustment () after adjustment

Approved By: _____

TM-613 (11/15/65)-0001

Calibration Report

Measurement Results

Average Standard Reading at each position (°C)											
Calibration Point	TN101	TN102	TN103	TN104	TN105	TN106	TN107	TN108	TN109	TN110	TN111
3.0	2.83	3.34	2.45	3.46	3.43	3.56	3.25	3.46	3.35	3.30	3.58
	TN112	TN113	TN114	TN115	TN116	TN117	TN118	TN119	TN120	TN121	TN122
	3.23	3.29	3.13	3.41							

Chamber (Cooling Room)			Temperature Distribution					
Setting (°C)	Reading (°C)		Average (°C)	Stability (°C)	Uniformity (°C)	Uncertainty (°C)	Coverage Factor k	Coverage Factor t
	Min, Max	Average						
3.0	2.8, 4.1	3.5	3.36	1.19	2.00	1.00	2.00	2.00

The calibration result apply only the above calibrated item.

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

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

Approved By: _____

TM-613 (11/15/65)-0001

Certificate No. T231676

Page 5 of 6

Calibration Report

Average Standard Reading at each position (°C)											
Calibration Point	TN21	TN22	TN23	TN24	TN25	TN26	TN27	TN28	TN29	TN30	TN31
R1 Hole1-Hole6											
Max	103.23	104.32	103.43	103.25	104.44	103.27					
Min	104.94	103.35	105.15	103.04	104.11	104.96					
Average	105.09	104.13	105.29	105.15	104.28	105.12					
R2 Hole7-Hole12											
Max	103.30	103.12	103.18	103.32	105.12	105.14					
Min	105.11	104.92	104.80	105.00	104.92	104.97					
Average	105.20	103.10	104.97	105.13	105.02	105.06					
R3 Hole13-Hole18											
Max	105.32	105.63	105.02	104.80	104.69	105.19					
Min	105.17	103.37	104.75	104.59	104.59	105.09					
Average	105.27	103.50	104.88	104.69	104.69	105.09					
R4 Hole19-Hole24											
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											
Max	104.92	104.26	103.34	105.78	105.59	105.87					
Min	104.67	105.96	105.08	105.56	105.36	105.68					
Average	104.81	106.11	103.21	105.67	105.48	105.77					
R6 Hole31-Hole36											
Max	104.75	104.86	104.80	105.30	104.30	104.59					
Min	104.54	104.63	104.59	105.00	104.12	104.16					
Average	104.65	104.75	104.69	105.10	104.41	104.38					
R7 Hole37-Hole42											
Max	104.30	104.80	104.85	104.45	104.46	104.45					
Min	104.09	104.72	104.66	104.47	104.63	104.53					
Average	104.19	104.81	104.75	104.57	104.76	104.68					
R8 Hole43-Hole48											
Max	103.71	103.83	103.39	103.61	103.42	103.19					
Min	103.45	103.61	103.14	103.27	103.18	104.04					
Average	103.58	103.73	103.27	103.44	103.30	103.67					

Approved By: _____

TM-613 (08/30/65-57)

Certificate No. T231600

Page 1 of 4

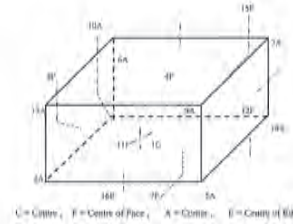
Certificate of Calibration

Equipment : Chamber (Cooling Room)
Manufacturer : KOLITECH
Model : KM 320
Serial No. : TBN-101206/03
Customer Code : BKK-EN0167
ID No. : T2463A3
Customer : ALS Laboratory Group (Thailand) Co., Ltd.
104 Phatthanasarn 40, Phatthanasarn Rd., Klongkum Phatthanasarn,
Khet Suan Luang, Bangkok 10250
Customer Location : Laboratory
Date of Receipt : 29 November 2023
Calibrated By : Atiphong Rongrat (Technician)
Approved By : _____ (Boonchai Suriyayong (Site Calibration Manager))
Date of Issue : 09 JAN 2024

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

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognised 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 Metrology.

Calibration Report



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

1C = TN161	12B = TN172
2A = TN162	13A = TN173
3A = TN163	14A = TN174
4F = TN164	15B = TN175
5A = TN165	16B = TN176
6A = TN166	
7F = TN167	
8F = TN168	
9A = TN169	
10A = TN170	
11F = TN171	

Approved By: _____

TM-613 (11/15/65)-0001

TM-613 (11/15/65)-0001

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-670292 MTC No. EEL. BP. 830267

CALIBRATION CERTIFICATE

Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.
Address : 104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan, Khet Suan Luang, Bangkok, 10250.
Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre,
Site 1C, Bangpoo Industrial Estate, Sukhumvit Rd., Muang, Samutprakan 10280.

Instrument Calibrated : Ambient Environment
Description : Sound Calibrator Temperature : (23 ± 3) °C
Manufacturer : Rion Relative Humidity : (50 ± 15) %
Model : NC-74 Ambient Pressure : (101.325 ± 1.500) kPa
Serial No. : 34178121 (ID:RYG_F80213)

Standards used : 1. Digital Function Synthesizer NF Electronic DP-193A S/N 122037.
2. Measuring Amplifier Bruel&Kjaer 2636 S/N 1537484.
3. Programmable Attenuator Tansgwa TPA-303A S/N OF 2214.
4. Digital Multimeter Agilent 34401A S/N MY4005560.
5. Pressure Transmitter Vishala PTH20AD S/N T0850001.
6. Audio Analyzer Keithley 2015-P S/N4106495.
7. Condenser Microphone B&K 4180 S/N 2889871.

Calibration Procedure: CP-102-04 based on IEC 60942:2003. The sound pressure level generated by sound calibrator under test shall be measured by standard microphone using an insert voltage technique.
This instrument has been calibrated against standards maintained at Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).
The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.
Date of Receipt : 19 Feb. 2024
Date of Calibration : 28 Feb. 2024

The results relate only to the items tested/calibrated or value accepted.
Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the generator of TISTR.

Head Office : 33 Mo 3 Tachin Khong Ha, Amphoe Khong Haeng, Chumphon Subdistrict 10280, Thailand
Tel: 060 0 2577 9000
Fax: 060 0 2577 9009
E-mail: info@tistr.or.th Website: www.tistr.or.th

Office : 104 Phatthanakan Road, Lardkhai, Chatsakul, Bangkok 10000, Thailand
Tel: 060 0 2578 1121-30 ext. 5279, 5275, 5271
Tel: 060 0 2578 8927

Office : 104 Phatthanakan Road, Lardkhai, Chatsakul, Bangkok 10000, Thailand
Tel: 060 0 2578 1121-30 ext. 5279, 5275, 5271
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SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

401-403 Sathorn Road, Bangkok, Bangkok, 10100 Thailand
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SITHIPORN ASSOCIATES
CALIBRATION LABORATORY

401-403 Sathorn Road, Bangkok, Bangkok, 10100 Thailand
Tel: +66 2432 8339 Email: calibration@sithiporn.com

Cert. No. : ACL34228
Page : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Pre-amplifier N01-24
Serial No. : 00734223 / 169439 / 72440
ID No. : RYG_F80029

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTANAKAN 40, PHATTANAKAN ROAD,
KHWAENG PHATTANAKAN, 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 : 10 JULY 2024
Calibration Date : 11 JULY 2024
Date of Issue : 15 JULY 2024

Calibrated by : Nuthakorn Pichaiwan
Approved by : Nuthakorn Pichaiwan
(Nuthakorn Pichaiwan)

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.

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CALIBRATION LABORATORY

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Cert. No. : ACL34228
Job No. : VC67AC0127
Page : 3 of 8

Summary of Measurement Result :

Parameter	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 limits of frequency weightings		
1000 Hz	0.3	0.6
5000 Hz	0.3	0.6
Electrical signal limits 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. Time burst response	0.3	0.3
10. Peak C sound level	0.3	0.35
11. Overload indication	0.2	0.25
12. High level stability	0.1	0.1

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-670292 MTC No. EEL. BP. 830267

Certificate of Calibration
ICS-2100: Anion (ID#659)

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

ICS-2100 S/N: 15010977
AS-HV S/N: 5450A36659

For
ALS Laboratory Group (Thailand) Co., Ltd.

Operator Signature: Nuthakorn Date: Jan 12, 2024
(Mr. Nuthakorn Pichaiwan)
Application Chemist

The results relate only to the items tested/calibrated or value accepted.
Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the generator of TISTR.

Head Office : 33 Mo 3 Tachin Khong Ha, Amphoe Khong Haeng, Chumphon Subdistrict 10280, Thailand
Tel: 060 0 2577 9000
Fax: 060 0 2577 9009
E-mail: info@tistr.or.th Website: www.tistr.or.th

Office : 104 Phatthanakan Road, Lardkhai, Chatsakul, Bangkok 10000, Thailand
Tel: 060 0 2578 1121-30 ext. 5279, 5275, 5271
Tel: 060 0 2578 8927

Office : 104 Phatthanakan Road, Lardkhai, Chatsakul, Bangkok 10000, Thailand
Tel: 060 0 2578 1121-30 ext. 5279, 5275, 5271
Tel: 060 0 2578 8927

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

401-403 Sathorn Road, Bangkok, Bangkok, 10100 Thailand
Tel: +66 2432 8339 Email: calibration@sithiporn.com

SITHIPORN ASSOCIATES
CALIBRATION LABORATORY

401-403 Sathorn Road, Bangkok, Bangkok, 10100 Thailand
Tel: +66 2432 8339 Email: calibration@sithiporn.com

Cert. No. : ACL34228
Job No. : VC67AC0127
Page : 3 of 8

Calibration Procedure : CP-AC-01

Calibration Method :
This equipment was calibrated by follow on IEC 61672-3 (2013) Standard for sound level meter (SLM).
The SLM had tests to Acoustical and Electrical signal limits of frequency weighting with Acoustic 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. Due Date
Waveform Generator 33210A MY48017076 EP-0009-24 05-FEB-25
Waveform Generator 33511B MY32302742 EP-0007-24 05-FEB-25
Digital Multimeter 34461A MY3220104 EIL-IP 21-02-25 13-FEB-25
Digital Multimeter 34461A MY3220076 EIL-IP 20-02-25 15-FEB-25
Digital Multimeter 34461A MY60004273 EIL-IP 22-02-25 15-FEB-25
Programmable Attenuator MAT-1070 62100114 EP-0008-24 05-FEB-25
Condenser Microphone 4180 2977900 AA-1001-24 12-FEB-25
Measuring Amplifier NA-42KA 34560495 AA-3001-24 05-FEB-25

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).

The results relate only to the items tested/calibrated or value accepted.
Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the generator of TISTR.

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Tel: 060 0 2577 9000
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E-mail: info@tistr.or.th Website: www.tistr.or.th

Office : 104 Phatthanakan Road, Lardkhai, Chatsakul, Bangkok 10000, Thailand
Tel: 060 0 2578 1121-30 ext. 5279, 5275, 5271
Tel: 060 0 2578 8927

Office : 104 Phatthanakan Road, Lardkhai, Chatsakul, Bangkok 10000, Thailand
Tel: 060 0 2578 1121-30 ext. 5279, 5275, 5271
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Cert. No. : ACL34228
Job No. : VC67AC0127
Page : 3 of 8

Calibration Procedure : CP-AC-01

Calibration Method :
This equipment was calibrated by follow on IEC 61672-3 (2013) Standard for sound level meter (SLM).
The SLM had tests to Acoustical and Electrical signal limits of frequency weighting with Acoustic 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. Due Date
Waveform Generator 33210A MY48017076 EP-0009-24 05-FEB-25
Waveform Generator 33511B MY32302742 EP-0007-24 05-FEB-25
Digital Multimeter 34461A MY3220104 EIL-IP 21-02-25 13-FEB-25
Digital Multimeter 34461A MY3220076 EIL-IP 20-02-25 15-FEB-25
Digital Multimeter 34461A MY60004273 EIL-IP 22-02-25 15-FEB-25
Programmable Attenuator MAT-1070 62100114 EP-0008-24 05-FEB-25
Condenser Microphone 4180 2977900 AA-1001-24 12-FEB-25
Measuring Amplifier NA-42KA 34560495 AA-3001-24 05-FEB-25

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).
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The results relate only to the items tested/calibrated or value accepted.
Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the generator of TISTR.

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Tel: 060 0 2578 1121-30 ext. 5279, 5275, 5271
Tel: 060 0 2578 8927

Cert. No. : ACL24228
Job No. : VC07AC0127
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	-0.1	±1.5
250	0.0	0.0	-0.1	±1.5
500	0.0	0.0	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.0	0.0	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	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
Imp	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

T. Petchum

Cert. No. : ACL24228
Job No. : VC07AC0127
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	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
SFL	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	135.3	-1.1	±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	±2.0
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±2.0

T. Petchum

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Pre-amplifier NH-24
Serial No. : 01122578 / 143842 / 22771
ID No. : RYQ_J50017

Condition As Found : GOOD

Customer : A.S. LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTANAKARAN 40, PHATTANAKARAN ROAD,
KHWAENG PHATTANAKARAN, KHET SIAM LIANG,
BANGKOK, 10250 THAILAND.

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

Received Date : 11 JANUARY 2024
Calibration Date : 22-24 JANUARY 2024
Date of Issue : 24 JANUARY 2024

Calibrated by : Nathakorn Pousipuan

Approved by : T. Petchum
(Thanikul Petchum)

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.

Cert. No. : ACL24228
Job No. : VC07AC0127
Page : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limits (dB)
93.9 (93.94)	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	Weighting (dB)
A-weight	9.9
C-weight	16.7
Flat	22.4

3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 94 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	-1.7	-1.6	-1.6	±5.0

T. Petchum

Cert. No. : ACL24228
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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
29.0	29.0	0.0	±1.1
24.0	24.0	0.0	±1.1
19.0	19.0	0.0	±1.1
14.0	14.0	0.0	±1.1
9.0	9.0	0.0	±1.1
4.0	4.0	0.0	±1.1

T. Petchum

11. Overload indication

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

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

T. Petchum

Cert. No. : ACL24072
Job No. : VC67AC0054
Pages : 3 of 8

Cert. No. : ACL24072
Job No. : VC67AC0054
Pages : 5 of 8

Cert. No. : ACL24072
Job No. : VC67AC0054
Pages : 7 of 8

Summary of Measurement Result :

Parameter	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

7. Reten

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	0.1	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	Anticipated Value (dB)	Measured Value (dB)	Deviant 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 weightings at 1 kHz

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

6. Long-term stability

Frequency Weighting	SLM Display at Initial (dB)	SLM Display at Final (dB)	Deviant Value (dB)	Acceptance Limits (dB)
A-weight	94.0	94.1	0.1	±0.3

7. Reten

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviant 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)	Deviant 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	0.25	1	108.0	108.0	0.0	1.5 - 5.0
	2	8	108.0	108.0	0.0	±1.0
	200	800	127.6	127.6	0.0	±1.0
SIL	0.25	1	99.0	99.0	-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)	Deviant Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	135.3	-1.1	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviant Value (dB)	Acceptance Limits (dB)
Continuous	133.0	132.9	-0.1	±2.0
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±2.0

7. Reten

Cert. No. : ACL24072
Job No. : VC67AC0054
Pages : 3 of 8

Cert. No. : ACL24072
Job No. : VC67AC0054
Pages : 4 of 8

Cert. No. : ACL24072
Job No. : VC67AC0054
Pages : 6 of 8

Calibration Procedure : CPAC-01

Calibration Method :

This equipment was calibrated by follow an IEC-61672-2 (Q01) 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 item 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	IF-0009-23	07-FEB-24
Waveform Generator	33111B	MY52302742	IF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL-IP 39-0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL-IP 39-0266	13-FEB-24
Digital Multimeter	34461A	MY60034273	EEL-IP 31-0266	14-FEB-24
Programmable Attenuator	MAT-1070	63100114	IF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-43EAF	34560495	AA-1002-23	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 units maintained at :

3.1 National Institute of Metrology (Thailand).

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

7. Reten

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)
16.7

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

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

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

7. Reten

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviant 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
128.0	128.0	0.0	±1.1
119.0	119.1	0.1	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.1	0.1	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	34.0	0.0	±1.1
30.0	30.0	0.0	±1.1
29.0	28.9	-0.1	±1.1
28.0	28.0	0.0	±1.1
27.0	27.0	0.0	±1.1
26.0	26.0	0.0	±1.1
25.0	25.0	0.0	±1.1

7. Reten

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00734225 / 145772 / 34370
ID No.: RYQ, PS0030

Condition As Found : OK000

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PIATTHANAKAN 40, PIATTHANAKAN ROAD,
KHWAENG PIATTHANAKAN, 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 : 19 JANUARY 2024
Calibration Date : 25-26 JANUARY 2024
Date of Issue : 29 JANUARY 2024

Calibrated by : Natsorn Pitsuporn

Approved by : *T. Pitsorn*
(Thankul Pitsorn)

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

Summary of Measurement Result:

Parameter	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

T. Pitsorn

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
63	-0.1	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	0.0	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	±0.3
C-weight	94.0	94.0	0.0	±0.3
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

T. Pitsorn

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89,6	89,6	0,0	±1,5

12. High level stability

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

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

End of Calibration Certificate

T. Pitsorn

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by follow 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	13-0809-23	07-FEB-24
Waveform Generator	33511B	MY52302742	13-0810-23	07-FEB-24
Digital Multimeter	33461A	MY53201014	13-0810-23	13-FEB-24
Digital Multimeter	33461A	MY53200706	13-0810-23	13-FEB-24
Digital Multimeter	34461A	MY60024273	13-0810-23	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	13-0810-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAI	34560495	AA-1002-23	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).

T. Pitsorn

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
21.4

3.2 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	17.6
Flat	23.6

3. Acoustical signal tests of frequency weightings

Main free-field acoustic response at a level of 94 dB

Frequency (Hz)	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	-1.1	-0.9	-0.9	±5.0

T. Pitsorn

Cert. No. : ACL24093
Job No. : VC67AC0058
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

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	0.25	1	108.0	108.0	0.0	1.5 : -5.0
	2	8	127.6	127.6	0.0	±1.0
	200	800	128.0	128.0	0.0	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Leq _{pk} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
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	±2.0
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

T. Petch

Cert. No. : ACL23263
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NI-42 Microphone UC-52 / Preamp/Filter N0124
Serial No. : 01122567 / 143471 / 22605
ID No. : RYG 190016

Condition As Found : GOOD

Customer : A/S LABORATORY GROUP (THAI) AND CO., LTD.
104 PHATHANAKAN 40, PHATHANAKAN ROAD,
KHWAENG PHATHANAKAN, KHEE SUAN LIANG,
BANGKOK, 10250 THAILAND.

Location :
Ambient Temperature : (23.0 ± 3) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (30.0 ± 20) %

Received Date : 23 AUGUST 2023
Calibration Date : 01 SEPTEMBER 2023
Date of Issue : 04 SEPTEMBER 2023



Calibrated by : Nuthakorn Pongpattana

Approved by : T. Petch
(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.

QP-1512-04-04-020664

Cert. No. : ACL23263
Job No. : VC66AC0094
Pages : 3 of 8

Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty (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.

QP-7512-04-04-020664

T. Petch

Cert. No. : ACL24093
Job No. : VC67AC0058
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
127.0	127.0	0.0	±1.1
126.0	126.0	0.0	±1.1
125.0	125.0	0.0	±1.1
124.0	124.0	0.0	±1.1
123.0	123.0	0.0	±1.1
122.0	122.0	0.0	±1.1
121.0	121.0	0.0	±1.1
120.0	120.0	0.0	±1.1
119.0	119.0	0.0	±1.1
118.0	118.0	0.0	±1.1
117.0	117.0	0.0	±1.1
116.0	116.0	0.0	±1.1
115.0	115.0	0.0	±1.1
114.0	114.0	0.0	±1.1
113.0	113.0	0.0	±1.1
112.0	112.0	0.0	±1.1
111.0	111.0	0.0	±1.1
110.0	110.0	0.0	±1.1
109.0	109.0	0.0	±1.1
108.0	108.0	0.0	±1.1
107.0	107.0	0.0	±1.1
106.0	106.0	0.0	±1.1
105.0	105.0	0.0	±1.1
104.0	104.0	0.0	±1.1
103.0	103.0	0.0	±1.1
102.0	102.0	0.0	±1.1
101.0	101.0	0.0	±1.1
100.0	100.0	0.0	±1.1
99.0	99.0	0.0	±1.1
98.0	98.0	0.0	±1.1
97.0	97.0	0.0	±1.1
96.0	96.0	0.0	±1.1
95.0	95.0	0.0	±1.1
94.0	94.0	0.0	±1.1
93.0	93.0	0.0	±1.1
92.0	92.0	0.0	±1.1
91.0	91.0	0.0	±1.1
90.0	90.0	0.0	±1.1
89.0	89.0	0.0	±1.1
88.0	88.0	0.0	±1.1
87.0	87.0	0.0	±1.1
86.0	86.0	0.0	±1.1
85.0	85.0	0.0	±1.1
84.0	84.0	0.0	±1.1
83.0	83.0	0.0	±1.1
82.0	82.0	0.0	±1.1
81.0	81.0	0.0	±1.1
80.0	80.0	0.0	±1.1
79.0	79.0	0.0	±1.1
78.0	78.0	0.0	±1.1
77.0	77.0	0.0	±1.1
76.0	76.0	0.0	±1.1
75.0	75.0	0.0	±1.1

T. Petch

Cert. No. : ACL24093
Job No. : VC67AC0058
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	89.8	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

T. Petch

Cert. No. : ACL23263
Job No. : VC66AC0094
Pages : 2 of 8

Calibration Procedure : CPAC-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 item 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	IF-0009-23	07-FEB-24
Waveform Generator	33511B	MY32302742	IF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY33201004	FEL-0030266	13-FEB-24
Digital Multimeter	33461A	MY33200976	FEL-0030266	13-FEB-24
Digital Multimeter	34461A	MY40024273	FEL-0030266	13-FEB-24
Programmable Attenuator	MAT-1070	62100114	IF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	13-FEB-24
Measuring Amplifier	NA-42KAI	34560495	AA-1002-23	13-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 units maintained at :

3.1 National Institute of Metrology (Thailand).

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

QP-7512-04-04-020664

T. Petch

Cert. No. : ACL23263
Job No. : VC66AC0094
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	0.0	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	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
Imp	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

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Cert. No. : ACL23263
Job No. : VC66AC0094
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	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	±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

QF-TS12-04-04-020864

Cert. No. : ACL24034
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NI-42A / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00623393 / 198640 / 26421
ID No.: RYO_P50618

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAI) AND CO., LTD.
104 PIATTHANAKAN 40, PIATTHANAKAN ROAD,
KHUANG PIATTHANAKAN, KHUANG SUAN LUANG,
BANGKOK, 10250 THAILAND.Location :
Ambient Temperature : (23.0 ± 3) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (50.0 ± 20) %
Received Date : 05 JANUARY 2024
Calibration Date : 12-15 JANUARY 2024
Date of Issue : 16 JANUARY 2024

Calibrated by : Nithiporn Pichumman

Approved by : T. Petchumman
(Thanakul Petchumman)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.Cert. No. : ACL23263
Job No. : VC66AC0094
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	12.0
C-weight	18.3
Flat	24.2

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	0.4	±1.5
1000	-0.1	-0.1	-0.1	±1.0
8000	-2.0	-1.9	-1.9	±5.0

QF-TS12-04-04-020864

Cert. No. : ACL23263
Job No. : VC66AC0094
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	24.9	-0.1	±1.1

QF-TS12-04-04-020864

Cert. No. : ACL23263
Job No. : VC66AC0094
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle	0.2	±1.5
89.7	89.3		

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-TS12-04-04-020864

Summary of Measurement Result :

Parameter	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

T. Pichai

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	0.0	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.1	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	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
Imp	94.0	94.0	0.0	±0.1

5. 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

T. Pichai

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	134.1	0.1	±1.0
Slow	0.25	1	108.0	108.0	0.0	1.5 : -5.0
	2	8	108.0	108.0	0.0	±1.0
	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	±3.0
One	136.4	135.5	-0.9	±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	±5.0
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

T. Pichai

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by follow on IEC-6167-3 (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 item 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	MY48017078	IEF-0009-23	07-FEB-24
Waveform Generator	33511B	MY53202742	IEF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL-BP 300266	13-FEB-24
Digital Multimeter	33461A	MY53220078	EEL-BP 300266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL-BP 310260	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	IEF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAJ	34500495	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).

T. Pichai

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)
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	10.8
C-weight	17.4
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)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.3	0.3	0.3	±1.5
1000	0.1	0.1	0.1	±1.0
8000	-0.3	-0.2	-0.2	±5.0

T. Pichai

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	39.0	0.0	±1.1
34.0	34.0	0.0	±1.1
29.0	28.9	-0.1	±1.1
24.0	24.0	0.0	±1.1
19.0	19.0	0.0	±1.1
14.0	14.0	0.0	±1.1
9.0	9.0	0.0	±1.1
4.0	4.0	0.0	±1.1

T. Pichai

Cert. No. : ACL24013
Job No. : VC67AC0044
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42A / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00023391 / 198638 / 26419
ID No.: RYQ_F50616

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KIWAENG PHATTHANAKAN, KHU SIUAN LIANG,
BANGKOK, 10330 THAILAND.

Location : -
Ambient Temperature : (23.0 ± 3) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (50.0 ± 20) %
Received Date : 19 DECEMBER 2023
Calibration Date : 05-08 JANUARY 2024
Date of Issue : 09 JANUARY 2024

Calibrated by : Nutakorn Pitsutani

Approved by : T. Pitsutani
(Thirakul Pitsutani)

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.

Summary of Measurement Result :

Parameter	Uncertainty	Maximum-permitted
	(dB)	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

Cert. No. : ACL24013
Job No. : VC67AC0044
Pages : 3 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	-0.1	±1.5
500	0.0	0.0	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	94.0	0.0	±0.3
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

Cert. No. : ACL24013
Job No. : VC67AC0044
Pages : 5 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

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by follow on IEC-61673-3 (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 item 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	33310A	MY18017076	EF-0909-23	07-FEB-24
Waveform Generator	33311B	MY12102742	EF-0010-23	07-FEB-24
Digital Multimeter	34461A	MY13220104	EF1-HP 300266	13-FEB-24
Digital Multimeter	34461A	MY13220076	EF1-HP 290266	13-FEB-24
Digital Multimeter	34461A	MY00034273	EF1-HP 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-42KA	34504095	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 :

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

Cert. No. : ACL24013
Job No. : VC67AC0044
Pages : 2 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
15.1

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

Frequency Weighting	Measured value (dB)
A-weight	13.8
C-weight	20.3
Flat	25.8

3. Acoustical signal tests of frequency weightings

Meat 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	1.5	1.6	1.6	±5.0

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Cert. No. : ACL24013
Job No. : VC67AC0044
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	106.0	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	106.0	106.0	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	106.0	106.0	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 ton signal	Anticipated Value (dB)	Measured Value, L _{eqpk} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	135.8	-0.6	±3.0

Number of cycle in ton signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.1	0.1	±2.0
Positive half cycle	133.4	135.2	-0.3	±2.0
Negative half cycle	133.4	135.3	-0.1	±2.0

T. Petchai

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Cert. No. : ACL24036
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42A / Microphone UC-52 / Preamplifier NI-24
Serial No.: 00623195 / 198642 / 20423
ID No.: RYQ_F30620

Condition As Found : GOOD

Customer : AIS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KHUANG PHATTHANAKAN, KHUANG SUAN LUANG,
BANGKOK, 10250 THAILAND.

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

Received Date : 05 JANUARY 2024
Calibration Date : 12-15 JANUARY 2024
Date of Issue : 16 JANUARY 2024



Calibrated by : Nathanon Petchai

Approved by : *T. Petchai*
(Thumkol Petchai)

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T. Petchai

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Cert. No. : ACL24036
Job No. : VC67AC0051
Pages : 3 of 8

Summary of Measurement Result :

Parameter	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

T. Petchai

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Cert. No. : ACL24013
Job No. : VC67AC0044
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
127.0	127.0	0.0	±1.1
126.0	126.0	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
122.0	122.0	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	89.1	0.1	±1.1
84.0	84.1	0.1	±1.1
79.0	79.0	0.0	±1.1
74.0	74.1	0.1	±1.1
69.0	69.1	0.1	±1.1
64.0	64.0	0.0	±1.1
59.0	59.1	0.1	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	34.1	0.1	±1.1
30.0	30.1	0.1	±1.1
29.0	29.1	0.1	±1.1
28.0	28.1	0.1	±1.1
27.0	27.2	0.2	±1.1
26.0	26.2	0.2	±1.1
25.0	25.3	0.3	±1.1

T. Petchai

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Cert. No. : ACL24013
Job No. : VC67AC0044
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	89.8	0.3
		±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

T. Petchai

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Cert. No. : ACL24036
Job No. : VC67AC0051
Pages : 2 of 8

Calibration Procedure : CP-AC01

Calibration Method :

This equipment was calibrated by follow an 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 item 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	EP-0009-23	07-FEB-24
Waveform Generator	33511B	MY53202742	EP-0010-23	07-FEB-24
Digital Multimeter	33461A	MY5320104	EEL-BP 107056	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL-BP 100506	13-FEB-24
Digital Multimeter	34461A	MY6002473	EEL-BP 110206	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EP-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-43KAJ	34560495	AA-3002-23	14-FEB-24

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

T. Petchai

SITHIPORN ASSOCIATES CO., LTD. CALIBRATION LABORATORY

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Cert. No. : ACL24036
Job No. : VC67AC0052
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	0.0	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.0	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	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
1 sec	94.0	94.0	0.0	±0.1

6. Long-term stability

Frequency Weighting	S.M Display at initial (dB)	S.M Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	94.0	0.0	±0.1

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Cert. No. : ACL24036
Job No. : VC67AC0052
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	107.9	-0.1	1.5 / -3.0
	2	8	117.0	117.0	0.0	1.0 / -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	0.25	1	108.0	108.0	0.0	1.5 / -3.0
	2	8	108.0	108.0	0.0	±1.0
	200	800	127.6	127.6	0.0	±1.0
SHL	0.25	1	99.0	98.9	-0.1	1.5 / -3.0
	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 (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	133.1	0.1	±2.0
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.3	-0.1	±2.0

SITHIPORN ASSOCIATES CO., LTD. CALIBRATION LABORATORY

491-493 Srinakharin Road, Bangburu, Bangkok, 10700 Thailand
Tel: +66 2432 8338 Email: calibration@sithiporn.com



Cert. No. : ACL24036
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Pre-amplifier NH-24
Serial No. : 09473127 / 169446 / 73461
ID No. : RVL J50302

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATHANAKAN 40, PHATHANAKAN ROAD,
KHWAENG PHATHANAKAN, KHET SUAN LUANG,
BANGKOK, 10230 THAILAND.

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

Received Date : 04 SEPTEMBER 2024
Calibration Date : 19 SEPTEMBER 2024
Date of Issue : 20 SEPTEMBER 2024

Calibrated by : Nathakorn Pitsupatun

Approved by : *T. Petchu*
(Thunakul Petchurai)

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other than in full, except with the prior written approval of the head of Calibration Laboratory.

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Cert. No. : ACL24036
Job No. : VC67AC0052
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.2

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	16.3
Flat	22.3

3. Acoustical signal tests of frequency weightings

Mean 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	0.4	±1.5
1000	0.0	0.0	0.0	±1.0
8000	0.7	0.8	0.8	±5.0

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491-493 Srinakharin Road, Bangburu, Bangkok, 10700 Thailand
Tel: +66 2432 8338 Email: calibration@sithiporn.com



Cert. No. : ACL24036
Job No. : VC67AC0052
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
128.0	128.0	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	89.1	0.1	±1.1
84.0	84.1	0.1	±1.1
79.0	79.0	0.0	±1.1
74.0	74.1	0.1	±1.1
69.0	69.1	0.1	±1.1
64.0	64.0	0.0	±1.1
59.0	59.1	0.1	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	34.0	0.0	±1.1
30.0	30.0	0.0	±1.1
29.0	29.0	0.0	±1.1
28.0	28.0	0.0	±1.1
27.0	27.0	0.0	±1.1
26.0	26.0	0.0	±1.1
25.0	24.9	-0.1	±1.1

11. Overhaul indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.7	89.7	0.0	±1.5

12. High level stability

Frequency Weighting	S.M Display at initial (dB)	S.M 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

Cert. No. : ACL24283
Job No. : VC67AC0148
Pages : 3 of 8

Summary of Measurement Result :

Parameter	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	0.3	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

T. Petch

Cert. No. : ACL24283
Job No. : VC67AC0148
Pages : 8 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	0.1	0.1	0.0	±1.5
250	0.1	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	0.1	±2.0
4000	0.0	0.1	0.1	±3.0
8000	0.1	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
Long	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	94.1	0.1	±0.3

T. Petch

Cert. No. : ACL24283
Job No. : VC67AC0148
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)
130	94.0	94.0	0.0	±1.1

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	30.0	30.0	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	116.9	-0.1	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	107.9	-0.1	1.5 ; -5.0
	200	800	127.6	127.5	-0.1	±1.0
SIL	0.25	1	99.0	98.8	-0.2	1.5 ; -5.0
	2	8	108.0	107.9	-0.1	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

T. Petch

Cert. No. : ACL24283
Job No. : VC67AC0148
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by follow 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 item 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	MY48017078	EP-0009-24	05-FEB-25
Waveform Generator	33511B	MY52302742	EP-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	UEL-BP 21-0267	13-FEB-25
Digital Multimeter	33461A	MY53220076	UEL-BP 20-0267	15-FEB-25
Digital Multimeter	34461A	MY60024273	UEL-BP 22-0267	15-FEB-25
Programmable Attenuator	MAT-1970	42109114	EP-0008-24	09-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KAI	34560495	AA-3001-24	09-FEB-25

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).

T. Petch

Cert. No. : ACL24283
Job No. : VC67AC0148
Page : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limits (dB)
93.9 (93.94)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
17.5

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

Frequency Weighting	Weighting (dB)
A-weight	12.0
C-weight	18.2
Flat	24.1

3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 94 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.1	0.2	0.2	±1.5
1000	-0.2	-0.2	-0.2	±1.0
8000	-1.2	-1.1	-1.1	±5.0

T. Petch

Cert. No. : ACL24283
Job No. : VC67AC0148
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.1	0.1	±1.1
134.0	134.1	0.1	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.1	0.1	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.1	0.1	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	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	24.9	-0.1	±1.1

T. Petch

Cert. No. : ACL24264
Job No. : VC67AC0140
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Pre-amplifier NF-24
Serial No. : 00472133 / 109445 / 72466
ID No. : RYG_750304

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTANAKAN 40, PHATTANAKAN ROAD,
KHWAENG PHATTANAKAN, 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 : 09 AUGUST 2024
Calibration Date : 30 AUGUST 2024
Date of Issue : 03 SEPTEMBER 2024

Calibrated by : Natthakorn Pichaprasit

Approved by : T. Petcha
(Thanakul Petchai)

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Cert. No. : ACL24264
Job No. : VC67AC0140
Pages : 3 of 8

Summary of Measurement Result :

Parameter	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	0.3	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. Time-hysteresis 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

T. Petcha

Cert. No. : ACL24264
Job No. : VC67AC0140
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	-0.1	±1.5
250	0.0	0.0	-0.1	±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
Imp	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

T. Petcha

Cert. No. : ACL24263
Job No. : VC67AC0140
Pages : 8 of 8

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lepeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
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	±3.0
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±2.0

11. Overload indication

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

T. Petcha

Cert. No. : ACL24264
Job No. : VC67AC0140
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by follow 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 Acoustic chamber and Reference Standard Instruments.

For test results of each item 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	IF-0009-24	05-FEB-25
Waveform Generator	33511B	MY52302742	IF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	EEL-RP 21-0267	13-FEB-25
Digital Multimeter	33461A	MY53220076	EEL-RP 20-0267	15-FEB-25
Digital Multimeter	34461A	MY60024273	EEL-RP 22-0267	15-FEB-25
Programmable Attenuator	MAT-1070	62100114	IF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KAI	34560495	AA-1001-24	05-FEB-25

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).

T. Petcha

Cert. No. : ACL24264
Job No. : VC67AC0140
Page : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviated (dB)	Acceptance Limits (dB)
93.9 (93.94)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
16.6

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

Frequency Weighting	Weighting (dB)
A-weight	11.0
C-weight	18.0
Flat	21.4

3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 94 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.3	0.4	0.4	± 1.5
1000	0.1	0.1	0.1	± 1.0
8000	-0.8	-0.7	-0.8	±5.0

T. Petcha

Cert. No. : ACL24264
Job No. : VC67AC0140
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)
130	94.0	94.0	0.0	±1.1

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	30.0	29.8	-0.2	±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
SIL	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

T. Petch

Cert. No. : ACL24027
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No. : 00472136 / 156778 / R8180
ID No. : RYG_P80101

Condition As Found : GOOD

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

Location :
Ambient Temperature : (23.0 ± 1) °C
Pressure : (101.3 ± 1) kPa
Relative Humidity : (50.0 ± 20) %
Received Date : 19 DECEMBER 2023
Calibration Date : 12 JANUARY 2024
Date of Issue : 16 JANUARY 2024

Calibrated by : Natassak Petchsuan

Approved by : *T. Petch*
(Thakul Petchsuan)

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Natassak Petchsuan
11/1/24

Cert. No. : ACL24027
Job No. : VC67AC0044
Pages : 3 of 8

Summary of Measurement Result :

Parameter	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

T. Petch

Cert. No. : ACL24264
Job No. : VC67AC0140
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	89.1	0.1	±1.1
84.0	84.1	0.1	±1.1
79.0	79.0	0.0	±1.1
74.0	74.1	0.1	±1.1
69.0	69.1	0.1	±1.1
64.0	64.0	0.0	±1.1
59.0	59.1	0.1	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	34.0	0.0	±1.1
30.0	30.0	0.0	±1.1
25.0	25.0	0.0	±1.1
20.0	20.0	0.0	±1.1
15.0	15.0	0.0	±1.1
10.0	10.0	0.0	±1.1
5.0	5.0	0.0	±1.1

T. Petch

Cert. No. : ACL24264
Job No. : VC67AC0140
Pages : 8 of 8

10. Peak C sound level

Number of cycle In test signal	Anticipated Value (dB)	Measured Value, Leq (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	135.6	-0.8	±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	±2.0
Positive half cycle	135.4	135.3	-0.1	±2.0
Negative half cycle	135.4	135.3	-0.1	±2.0

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.5	89.8	0.3	±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

T. Petch

Cert. No. : ACL24027
Job No. : VC67AC0044
Pages : 3 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by follow on IEC-61672-3 (2013) Standard for sound level meter (SLM). The SLM had tests in Acoustical and Electrical signal tests of frequency weighting with Anchoise chamber and Reference Standard Instruments. For test results of each item 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	IF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302342	IF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY5320104	IEL-IP 300266	13-FEB-24
Digital Multimeter	33461A	MY5320076	IEL-IP 300266	13-FEB-24
Digital Multimeter	34461A	MY6002473	IEL-IP 310266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	IF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAI	34500405	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).

T. Petch

CERTIFICATE OF CALIBRATION

Certificate No. : CDT-018-47

Page 1 of 2 Pages

MEASUREMENT ITEM
MANUFACTURER : Hiut Stress Monitor
MODEL/TYPE : Delta CRM
SERIAL NUMBER : HD32.2
ID NUMBER : 15009715
CONDITION AS-RECEIVED : Used item
CUSTOMER : A/S Laboratory group (Thailand) Co., Ltd.
104 Phatthanasak Rd., Phatthanasak Rd.,
Khuang Suan Luang, Khut Suan Luang,
Bangkok 10250 Thailand.

RECEIVED DATE : 11 Jan 2024
MEASUREMENT DATE : 11 Jan 2024
ISSUE DATE : 17 Jan 2024

ENVIRONMENTAL CONDITIONS
Ambient condition in the laboratory are as follow:
Temperature : 23.0 ± 3.0 °C
Relative Humidity : 55.0 ± 15.0 %RH

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

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

Calibration procedure:
The temperature calibration will comply in-house calibration method in accordance to comparison method with 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 (NIM) (Thailand) (NIM) Certificate number: TT-0038-25, Certificate number: TT-0038-25.

Reference Used During Calibration:
1. Standard Temperature Probe Model: ITS-100 A500, Serial No.: 607602-05, Due date: 28 Mar 2024
2. Digital Temperature Indicator Model: DTI-1000-A-MR (L), Serial No.: 671407-0001 Due date: 14 Sep 2024

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.

Calibrated by:
Mr. Nopphat Thachalad
Mr. Nopphat Thachalad
Mr. Nopphat Thachalad

Approved signature:
Mr. Parinya Booncharon
Calibration Department Manager

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

CERTIFICATE OF CALIBRATION

Certificate No. : CDT-015-47

Page 1 of 2 Pages

MEASUREMENT ITEM
MANUFACTURER : Hiut Stress Monitor
MODEL/TYPE : Delta CRM
SERIAL NUMBER : HD32.2
ID NUMBER : 15009715
CONDITION AS-RECEIVED : Used item
CUSTOMER : A/S Laboratory group (Thailand) Co., Ltd.
104 Phatthanasak Rd., Phatthanasak Rd.,
Khuang Suan Luang, Khut Suan Luang,
Bangkok 10250 Thailand.

RECEIVED DATE : 11 Jan 2024
MEASUREMENT DATE : 11 Jan 2024
ISSUE DATE : 17 Jan 2024

ENVIRONMENTAL CONDITIONS
Ambient condition in the laboratory are as follow:
Temperature : 23.0 ± 3.0 °C
Relative Humidity : 55.0 ± 15.0 %RH

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

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

Calibration procedure:
The temperature calibration will comply in-house calibration method in accordance to comparison method with 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 (NIM) (Thailand) (NIM) Certificate number: TT-0038-25, Certificate number: TT-0038-25.

Reference Used During Calibration:
1. Standard Temperature Probe Model: ITS-100 A500, Serial No.: 607602-05, Due date: 28 Mar 2024
2. Digital Temperature Indicator Model: DTI-1000-A-MR (L), Serial No.: 671407-0001 Due date: 14 Sep 2024

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.

Calibrated by:
Mr. Nopphat Thachalad
Mr. Nopphat Thachalad
Mr. Nopphat Thachalad

Approved signature:
Mr. Parinya Booncharon
Calibration Department Manager

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

CERTIFICATE OF CALIBRATION

Certificate No. : CDT-054-47

Page 1 of 2 Pages

MEASUREMENT ITEM
MANUFACTURER : Hiut Stress Monitor
MODEL/TYPE : Delta CRM
SERIAL NUMBER : HD32.2
ID NUMBER : 15009715
CONDITION AS-RECEIVED : Used item
CUSTOMER : A/S Laboratory group (Thailand) Co., Ltd.
104 Phatthanasak Rd., Phatthanasak Rd.,
Khuang Suan Luang, Khut Suan Luang,
Bangkok 10250 Thailand.

RECEIVED DATE : 11 Feb 2024
MEASUREMENT DATE : 15 Feb 2024
ISSUE DATE : 20 Feb 2024

ENVIRONMENTAL CONDITIONS
Ambient condition in the laboratory are as follow:
Temperature : 23.0 ± 3.0 °C
Relative Humidity : 55.0 ± 15.0 %RH

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

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

Calibration procedure:
The temperature calibration will comply in-house calibration method in accordance to comparison method with 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 (NIM) (Thailand) (NIM) Certificate number: TT-0038-25, Certificate number: TT-0038-25.

Reference Used During Calibration:
1. Standard Temperature Probe Model: ITS-100 A500, Serial No.: 607602-05, Due date: 28 Mar 2024
2. Digital Temperature Indicator Model: DTI-1000-A-MR (L), Serial No.: 671407-0001 Due date: 14 Sep 2024

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.

Calibrated by:
Mr. Nopphat Thachalad
Mr. Nopphat Thachalad
Mr. Nopphat Thachalad

Approved signature:
Mr. Parinya Booncharon
Calibration Department Manager

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Continuation of Certificate of Calibration Number CDT-017-47

Page 1 of 2 Pages

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 ~ 40 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 18021466.
Dimension: Diameter 3.3 mm, Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.053	20.1	0.0	0.099
80	25.045	25.1	0.1	0.099
80	30.040	30.1	0.1	0.099
80	35.039	35.1	0.1	0.099
80	40.030	40.0	0.0	0.099

Table 2: This equipment was connected with Globe thermometer probe Model: TP9276.2 S/N: 20019636.
Dimension: Diameter 3.3 mm, Length 205 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.053	20.1	0.1	0.14
110	25.045	25.1	0.1	0.099
110	30.040	30.1	0.1	0.099
110	35.039	35.1	0.1	0.099
110	40.030	40.0	0.0	0.099

Table 3: This equipment was connected with temperature probe Model: TP9207.2 S/N: 15015496.
Dimension: Diameter 14 mm, Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
75	20.053	20.1	0.1	0.099
75	25.045	25.1	0.1	0.099
75	30.040	30.0	0.0	0.099
75	35.039	34.9	-0.1	0.099
75	40.030	39.9	-0.1	0.099

UUC*: Unc Under Calibration
Remark: The reported uncertainty of measurement is 0.14, based on standard uncertainty multiplied by a coverage factor k=2.14 providing a level of confidence of approximately 95%.

End of Certificate of Calibration



Continuation of Certificate of Calibration Number CDT-018-47

Page 2 of 2 Pages

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 ~ 40 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 18021466.
Dimension: Diameter 3.3 mm, Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.053	20.0	0.0	0.099
80	25.045	25.0	0.0	0.099
80	30.040	30.0	0.0	0.099
80	35.039	35.0	0.0	0.099
80	40.030	40.0	0.0	0.099

Table 2: This equipment was connected with Globe thermometer probe Model: TP9276.2 S/N: 18021466.
Dimension: Diameter 3.3 mm, Length 205 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.053	20.0	0.0	0.14
110	25.045	25.0	0.0	0.099
110	30.040	30.1	0.1	0.099
110	35.039	35.1	0.1	0.099
110	40.030	40.1	0.1	0.099

Table 3: This equipment was connected with temperature probe Model: TP9207.2 S/N: 15015496.
Dimension: Diameter 14 mm, Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
75	20.053	20.2	0.1	0.099
75	25.045	25.0	0.0	0.099
75	30.040	30.0	0.0	0.099
75	35.039	34.9	-0.1	0.099
75	40.030	39.9	-0.1	0.099

UUC*: Unc Under Calibration
Remark: The reported uncertainty of measurement is 0.14, based on standard uncertainty multiplied by a coverage factor k=2.14 providing a level of confidence of approximately 95%.

End of Certificate of Calibration



Continuation of Certificate of Calibration Number CDT-015-47

Page 2 of 2 Pages

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 ~ 40 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 17022545.
Dimension: Diameter 3.3 mm, Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.050	20.0	0.0	0.099
80	25.042	25.0	0.0	0.099
80	30.040	30.0	0.0	0.099
80	35.034	35.0	0.0	0.099
80	40.026	40.0	0.0	0.099

Table 2: This equipment was connected with Globe thermometer probe Model: TP9276.2 S/N: 20019636.
Dimension: Diameter 3.3 mm, Length 205 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.050	20.0	0.0	0.099
110	25.042	25.0	0.0	0.099
110	30.040	30.1	0.1	0.099
110	35.034	35.1	0.1	0.099
110	40.026	40.0	0.0	0.099

Table 3: This equipment was connected with temperature probe Model: TP9207.2 S/N: 15015507.
Dimension: Diameter 14 mm, Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
75	20.050	20.2	0.2	0.099
75	25.042	25.0	0.0	0.099
75	30.040	30.0	0.0	0.099
75	35.034	35.0	0.0	0.099
75	40.026	39.9	-0.1	0.099

UUC*: Unc Under Calibration
Remark: The reported uncertainty of measurement is 0.14, based on standard uncertainty multiplied by a coverage factor k=2.14 providing a level of confidence of approximately 95%.

End of Certificate of Calibration



CERTIFICATE OF CALIBRATION

Certificate No. : COT-016-67

Page 1 of 2 Pages

MEASUREMENT ITEM
MANUFACTURER
MODEL/TYPE
SERIAL NUMBER
ID NUMBER
CONDITION AS RECEIVED
CUSTOMER

Huan Stress Monitor
(Data DMM)
H032.2
15008716
HPL 150217
Used Item
ALS laboratory group (Thailand) Co., Ltd.
104 Phatthanasak 40, Phatthanasak Rd.,
Khwaeng Suan Luang, Khut Suan Luang,
Bangkok 10250 Thailand.

Calibration procedure:
The temperature calibration will comply by
in-house calibration method up to 10°C (0.1)
according to correction method with standard
digital temperature probe, and standard
temperature probe. The temperature scale use
was based on ITS-90.

Traceability:
The equipment/units are traceable to the
International System of units (SI) through
National Institute of Standards and Technology (NIST)
Certificate number: 17-0008-23, Certificate
number: 17-0101-23

Reference Used During Calibration:
1. Standard Temperature Probe
Model: STS-100 A500, Serial No.: 807092-05,
Due date: 28 Mar 2024
2. Digital Temperature Indicator
Model: DTI-1000-A-MK II, Serial No.: 873407-
0001 Due date: 14 Sep 2024

RECEIVED DATE
MEASUREMENT DATE
ISSUE DATE

11 Jan 2024
11 Jan 2024
17 Jan 2024

ENVIRONMENTAL CONDITIONS:
Ambient condition in the laboratory are as follow:
Temperature
Relative Humidity

23.0 ± 3.0 °C
55.0 ± 15.0 %RH

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

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

Handwritten signature and date: 16/1/24

Calibrated by:
Mr. Supachai Thachalad
Mr. Mitha Jiraporn Lertsoonthol
Mr. Mitha Jiraporn Lertsoonthol

Approved signature:
Mr. Patsara Booncharoen
Calibration Department Manager

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IN WRITING FROM THE LABORATORY

CERTIFICATE OF CALIBRATION

Certificate No. : COT-055-67

Page 1 of 2 Pages

MEASUREMENT ITEM
MANUFACTURER
MODEL/TYPE
SERIAL NUMBER
ID NUMBER
CONDITION AS RECEIVED
CUSTOMER

Huan Stress Monitor
(Data DMM)
H032.2
15008714
HPL 150217
Used Item
ALS laboratory group (Thailand) Co., Ltd.
104 Phatthanasak 40, Phatthanasak Rd.,
Khwaeng Suan Luang, Khut Suan Luang,
Bangkok 10250 Thailand.

Calibration procedure:
The temperature calibration will comply by
in-house calibration method up to 10°C (0.1)
according to correction method with standard
digital temperature probe, and standard
temperature probe. The temperature scale use
was based on ITS-90.

Traceability:
The equipment/units are traceable to the
International System of units (SI) through
National Institute of Standards and Technology (NIST)
Certificate number: 17-0008-23, Certificate
number: 17-0101-23

Reference Used During Calibration:
1. Standard Temperature Probe
Model: STS-100 A500, Serial No.: 807092-05,
Due date: 28 Mar 2024
2. Digital Temperature Indicator
Model: DTI-1000-A-MK II, Serial No.: 873407-
0001 Due date: 14 Sep 2024

RECEIVED DATE
MEASUREMENT DATE
ISSUE DATE

11 Jan 2024
11 Feb 2024
10 Feb 2024

ENVIRONMENTAL CONDITIONS:
Ambient condition in the laboratory are as follow:
Temperature
Relative Humidity

23.0 ± 3.0 °C
55.0 ± 15.0 %RH

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

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

Handwritten signature and date: 14/1/24

Calibrated by:
Mr. Supachai Thachalad
Mr. Mitha Jiraporn Lertsoonthol
Mr. Mitha Jiraporn Lertsoonthol

Approved signature:
Mr. Patsara Booncharoen
Calibration Department Manager

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

CERTIFICATE OF CALIBRATION

Certificate No. : COT-010-67

Page 1 of 2 Pages

MEASUREMENT ITEM
MANUFACTURER
MODEL/TYPE
SERIAL NUMBER
ID NUMBER
CONDITION AS RECEIVED
CUSTOMER

Huan Stress Monitor
(Data DMM)
H032.2
15008711
HPL 150217
Used Item
ALS laboratory group (Thailand) Co., Ltd.
104 Phatthanasak 40, Phatthanasak Rd.,
Khwaeng Suan Luang, Khut Suan Luang,
Bangkok 10250 Thailand.

Calibration procedure:
The temperature calibration will comply by
in-house calibration method up to 10°C (0.1)
according to correction method with standard
digital temperature probe, and standard
temperature probe. The temperature scale use
was based on ITS-90.

Traceability:
The equipment/units are traceable to the
International System of units (SI) through
National Institute of Standards and Technology (NIST)
Certificate number: 17-0008-23, Certificate
number: 17-0101-23

Reference Used During Calibration:
1. Standard Temperature Probe
Model: STS-100 A500, Serial No.: 807092-05,
Due date: 28 Mar 2024
2. Digital Temperature Indicator
Model: DTI-1000-A-MK II, Serial No.: 873407-
0001 Due date: 14 Sep 2024

RECEIVED DATE
MEASUREMENT DATE
ISSUE DATE

09 Jan 2024
08 Jan 2024
09 Jan 2024

ENVIRONMENTAL CONDITIONS:
Ambient condition in the laboratory are as follow:
Temperature
Relative Humidity

23.0 ± 3.0 °C
55.0 ± 15.0 %RH

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

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

Handwritten signature and date: 7/1/24

Calibrated by:
Mr. Supachai Thachalad
Mr. Mitha Jiraporn Lertsoonthol
Mr. Mitha Jiraporn Lertsoonthol

Approved signature:
Mr. Patsara Booncharoen
Calibration Department Manager

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

Continuation of Certificate of Calibration Number COT-054-67

Page 2 of 2 Pages

Result of Calibration: ☐ Without Adjustment ☐ With Adjustment

Calibration Range: 20 ~ 40 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3001.2 S/N: 1800987.
Dimension: Diameter 3.3 mm, Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	USC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.064	20.1	0.0	0.009
80	25.053	25.1	0.0	0.009
80	30.043	30.1	0.0	0.009
80	35.033	35.1	0.0	0.009
80	40.023	40.1	0.0	0.009

Table 2: This equipment was connected with globe thermometer probe Model: TP9276.3 S/N: 13015867.
Dimension: Diameter 3.3 mm, Length 205 mm.

Immersion Depth (mm)	Standard Reading (°C)	USC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.064	20.1	0.0	0.009
110	25.053	25.1	0.0	0.009
110	30.043	30.1	0.0	0.009
110	35.033	35.1	0.0	0.009
110	40.023	40.1	0.0	0.009

Table 3: This equipment was connected with temperature probe Model: TP9207.2 S/N: 15015489.
Dimension: Diameter 14 mm, Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	USC Reading (°C)	Error (°C)	Uncertainty (°C)
75	20.064	20.1	0.0	0.009
75	25.053	25.1	0.0	0.009
75	30.043	30.1	0.0	0.009
75	35.033	35.1	0.0	0.009
75	40.023	40.1	0.0	0.009

USC* (Unc) Under Calibration
Report: The reported uncertainty of measurement is 0.16, based on standard uncertainty multiplied by a coverage factor k=2.21
providing a level of confidence of approximately 95%.

Handwritten signature and date: 16/1/24

Continuation of Certificate of Calibration Number COT-016-67

Page 2 of 2 Pages

Result of Calibration: ☐ Without Adjustment ☐ With Adjustment

Calibration Range: 20 ~ 40 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3001.2 S/N: 1800987.
Dimension: Diameter 3.3 mm, Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	USC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.064	20.1	0.0	0.009
80	25.043	25.1	0.0	0.009
80	30.043	30.1	0.0	0.009
80	35.033	35.0	0.0	0.009
80	40.023	40.0	0.0	0.009

Table 2: This equipment was connected with globe thermometer probe Model: TP9276.3 S/N: 13015867.
Dimension: Diameter 3.3 mm, Length 205 mm.

Immersion Depth (mm)	Standard Reading (°C)	USC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.064	20.1	0.0	0.009
110	25.043	25.1	0.0	0.009
110	30.043	30.1	0.0	0.009
110	35.033	35.0	0.0	0.009
110	40.023	40.0	0.0	0.009

Table 3: This equipment was connected with temperature probe Model: TP9207.2 S/N: 15015489.
Dimension: Diameter 14 mm, Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	USC Reading (°C)	Error (°C)	Uncertainty (°C)
75	20.043	20.1	0.0	0.009
75	25.043	25.1	0.0	0.009
75	30.043	30.1	0.0	0.009
75	35.034	35.0	-0.1	0.009
75	40.026	39.9	-0.1	0.009

USC* (Unc) Under Calibration

Handwritten signature and date: 16/1/24

Continuation of Certificate of Calibration Number COT-055-67

Page 2 of 2 Pages

Result of Calibration: ☐ Without Adjustment ☐ With Adjustment

Calibration Range: 20 ~ 40 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3001.2 S/N: 1800987.
Dimension: Diameter 3.3 mm, Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	USC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.063	20.4	0.3	0.009
80	25.054	25.4	0.3	0.009
80	30.043	30.4	0.4	0.009
80	35.036	35.4	0.4	0.009
80	40.028	40.4	0.4	0.009

Table 2: This equipment was connected with globe thermometer probe Model: TP9276.3 S/N: 13015867.
Dimension: Diameter 3.3 mm, Length 205 mm.

Immersion Depth (mm)	Standard Reading (°C)	USC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.064	20.1	0.2	0.009
110	25.054	25.2	0.2	0.009
110	30.043	30.3	0.3	0.009
110	35.037	35.3	0.3	0.009
110	40.028	40.3	0.3	0.009

Table 3: This equipment was connected with temperature probe Model: TP9207.2 S/N: 15015489.
Dimension: Diameter 14 mm, Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	USC Reading (°C)	Error (°C)	Uncertainty (°C)
75	20.064	20.5	0.4	0.009
75	25.054	25.4	0.3	0.009
75	30.043	30.4	0.4	0.009
75	35.036	35.3	0.3	0.009
75	40.028	40.2	0.2	0.009

USC* (Unc) Under Calibration

Handwritten signature and date: 16/1/24

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
5344 PATTANAKARN ROAD 18, SUANLUANG, SUANLUANG, BANGKOK 10250
TEL : 0-2317-9999-24 FAX : 0-2317-9984

Certificate of Calibration Certificate No.: 24PH143
Page: 1 of 2

Equipment: Lux Meter
Manufacturer: Teraoka
Model: TM-201L
Serial No.: 190702480
ID No.: RYO_F50471
Condition As-Received: Used Item
Received Date: 12 March 2024
Calibration Date: 14 March 2024
Reference: 2403-0300W9G
Ambient Temperature: (20 ± 2) °C
Relative Humidity: (50 ± 15) %
Submitted by: ALS Laboratory Group (Thailand) Co., Ltd.
104 Phattharanon 40, Phattharanon Rd.,
Klongkum Phattharanon, Khwa Suai Luang,
Bangkok 10250 Thailand
Procedure used: Calibration was conducted using calibration procedure No. GPRF01 based on inverse square law technique

Calibration of this result of calibration
1. Reference standards instruments:
Instrument Model Serial No. Certificate No. Due Date
1) Photometry & Radiometer Lighthouse 9.0 In 11080003 CL-0084-02 20 Jan 2025
2) Luminous Intensity standard lamp CL FEL-41 P-1563 TP-1030-23 08 Jun 2024
2. This result of calibration was made on request at the point specified by customer.
3. Test Equipment: Programmable Voltage/Current Source (Model : CLISA, SN : 1932194)
4. Test Equipment: Radiance Meter (Model : 11002, SN : 080129)
5. The certificate is valid only to the item calibrated on date and place of calibration.
6. This Certificate is traceable to the International System of Unit maintained through:
- National Institute of Metrology Thailand (NIMT)
- National Institute of Metrology (Thailand), NIMT-ONDC Accredited No. Calibration 0144

Calibrated by: Nival Niss
Issue Date: 18 March 2024
Approved Signatory: [Signature]
[Signature]
[Signature]
[Signature]

0337449

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
5344 PATTANAKARN ROAD 18, SUANLUANG, SUANLUANG, BANGKOK 10250
TEL : 0-2317-9999-24 FAX : 0-2317-9984

Certificate of Calibration Certificate No.: 24PH141
Page: 1 of 2

This Certificate was issued to replace to the Certificate No. 24PH142

Equipment: Lux Meter
Manufacturer: Dada CHS
Model: H02102.2
Serial No.: 1802232
ID No.: RYO_F50200
Condition As-Received: Used Item
Received Date: 11 January 2024
Calibration Date: 16 January 2024
Reference: 2401-0300W9G
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (80 ± 15) %
Submitted by: ALS Laboratory Group (Thailand) Co., Ltd.
104 Phattharanon 40, Phattharanon Rd.,
Klongkum Phattharanon, Khwa Suai Luang,
Bangkok 10250 Thailand
Procedure used: Calibration was conducted using calibration procedure No. GPRF01 based on inverse square law technique

Calibration of this result of calibration
1. Reference standards instruments:
Instrument Model Serial No. Certificate No. Due Date
1) Photometry & Radiometer Lighthouse 9.0 In 11080003 CL-0084-02 20 Jan 2025
2) High-accuracy Intensity Standard CL-FEL-41 P-1573 TP-1030-23 14 Feb 2024
2. This result of calibration was made on request at the point specified by customer.
3. Test Equipment: Programmable Voltage/Current Source (Model : CLISA, SN : 1932194)
4. Test Equipment: Radiance Meter (Model : 11002, SN : 080129)
5. The certificate is valid only to the item calibrated on date and place of calibration.
6. This Certificate is traceable to the International System of Unit maintained through:
- National Institute of Metrology Thailand (NIMT)
- National Institute of Metrology (Thailand), NIMT-ONDC Accredited No. Calibration 0144

Calibrated by: Nival Niss
Issue Date: 28 November 2024
Approved Signatory: [Signature]
[Signature]
[Signature]
[Signature]

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Continuation of Certificate of Calibration Number CDF-010-07 Page 2 of 2 Pages

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment
Calibration Range: 20 ~ 40 °C
Function: Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 15093306.
Dimension: Diameter 3.3 mm, Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.059	20.2	0.1	0.099
80	25.051	25.2	0.1	0.099
80	30.047	30.2	0.1	0.099
80	35.039	35.2	0.2	0.099
80	40.035	40.2	0.2	0.099

Table 2: This equipment was connected with Globe thermometer probe Model: TP3275.2 S/N: 17015133.
Dimension: Diameter 3.3 mm, Length 200 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.059	20.2	0.1	0.099
110	25.052	25.2	0.1	0.099
110	30.047	30.2	0.2	0.099
110	35.039	35.2	0.2	0.099
110	40.035	40.2	0.2	0.099

Table 3: This equipment was connected with temperature probe Model: TP3207.2 S/N: 17003390.
Dimension: Diameter 14 mm, Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
75	20.059	20.2	0.1	0.099
75	25.052	25.1	0.0	0.099
75	30.047	29.9	-0.1	0.099
75	35.040	34.8	-0.2	0.099
75	40.036	39.7	-0.3	0.099

UUC* = Unit Under Calibration

End of Certificate of Calibration

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Continuation of Certificate of Calibration Number CDF-010-07 Page 2 of 2 Pages

Result of calibration: (*) Without adjustment () After adjustment
Function: Illuminance Measurement
Standard Value UUC Reading Error Uncertainty
(lx) (lx) (lx) (lx)
0 0.0 0.0 0.0
20 20.1 0.1 0.26
50 50.0 0.0 0.85
100 100.0 0.0 1.3
150 150.0 0.0 2.0
190 190.0 0.0 2.6

Function: Illuminance Measurement
Standard Value UUC Reading Error Uncertainty
(lx) (lx) (lx) (lx)
200 199 -1 2.6
500 499 -1 6.5
1000 1000 0 13
1500 1501 1 20
1900 1901 1 25

Function: Illuminance Measurement
Standard Value UUC Reading Error Uncertainty
(lx) (lx) (lx) (lx)
2000 1990 -10 26
3000 3000 0 39
4000 4000 0 52
5000 5000 0 66

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.

1206570

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Cert. No.: 24PH141
Page: 2 of 2

Result of calibration: (*) Without adjustment () After adjustment
Function: Illuminance Measurement
Standard Value UUC Reading Error Uncertainty
(lx) (lx) (lx) (lx)
0 0.00 0.00 0.00
15 14.87 -0.13 0.20
100 98.81 -1.19 1.3
500 492.8 -7.2 8.8
1000 992.1 -7.9 13
2000 2011 11 26
3000 3049 49 39
4000 4098 98 52
5000 5153 153 66

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 %

Calibration with probe sensor s/n. 22038597
UUC* = Unit Under Calibration.

1206570

ภาคผนวก จ

สำเนาหนังสืออนุญาตขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

(๓๓๔) นายอนันต์ชัย

๑๕๗) นางสาวอาน

Four

น้ำเสีย จำนวน 60 รายการ

19 Copper.

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/ Mass Spectrometric Method ⁽⁴⁾
22	4,4'-DDD	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
23	2,4'-DDE	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
24	4,4'-DDE	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
25	2,4'-DDT	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
26	4,4'-DDT	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
27	Dieldrin	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
28	Endosulfan Sulfate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
29	Endosulfan I	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
30	Endosulfan II	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
31	Endrin	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
32	Endrin Aldehyde	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
33	Formaldehyde	Distillation, Colorimetric Method ⁽³⁾
34	Free Chlorine	1) DPD Ferrous Titrimetric Method ⁽³⁾ 2) DPD Colorimetric Method ⁽⁴⁾
35	Heptachlor	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
36	Heptachlor Epoxide	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
37	Hexavalent Chromium	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...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
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/ Mass Spectrometric Method ⁽⁴⁾
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 ⁽³⁾
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	Semi-Micro Kjeldahl Method ⁽⁴⁾
56	Total Phosphorous	Digestion, Colorimetric Method ⁽⁴⁾
57	Total Suspended Solids	Dried from 103-105 °C ⁽⁴⁾
58	Toxaphene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
59	Trivalent Chromium	1) Digestion, Inductively Coupled Plasma Method; Colorimetric Method; Calculation ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method; Colorimetric Method; Calculation ⁽⁴⁾
60	Zinc	1) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ⁽⁴⁾

น้ำใต้ดิน...

น้ำใต้ดิน 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⁾
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	Benz(a)anthracene	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	Benzoic 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-chloroethyl)ether	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾

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	Liquid-Liquid Extraction, 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⁾
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...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
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	DDD	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⁾
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...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
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⁾
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...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
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) Digestion, Cold Vapor Atomic Absorption Spectrometric Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ⁽⁴⁾
84	Methanol	Purge and Trap, 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...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
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⁾
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, Chloroform Extraction Method ⁽⁴⁾ 2) Distillation, Direct Photometric Method ⁽⁴⁾ 3) 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 ₉ -C ₁₄)	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(4,25)

110 TPH (C₁₀-C₁₉)...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
110	TPH (C ₁₀ -C ₁₆)	Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(9,22)
111	TPH (C ₁₁ -C ₁₅)	Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(9,22)
112	1,2,4-Trichlorobenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
113	1,1,1-Trichloroethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
114	1,1,2-Trichloroethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
115	Trichloroethylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
116	2,4,5-Trichlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
117	2,4,6-Trichlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
118	1,3,5-Trimethylbenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
119	Vanadium	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⁾

จากผลเสีย

จากผลเสีย (ปล่อยรวม) จำนวน 28 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Antimony	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽⁵⁾ 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ⁽⁵⁾
2	Arsenic	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽⁵⁾ 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ⁽⁵⁾
3	Beryllium	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽⁵⁾ 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ⁽⁵⁾
4	Cadmium	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽⁵⁾ 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ⁽⁵⁾
5	Carbon Monoxide	1) Instrumental Analyzer Method ⁽⁵⁾ 2) Sampling Bag Non-Dispersive Infrared Method ⁽⁵⁾
6	Chlorine	1) Adsorption Sampling, Ion Chromatographic Method ⁽⁵⁾ 2) Isokinetic Sampling, Ion Chromatographic Method ⁽⁵⁾
7	Chromium	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽⁵⁾ 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ⁽⁵⁾
8	Cobalt	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽⁵⁾ 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ⁽⁵⁾
9	Copper	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽⁵⁾ 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ⁽⁵⁾
10	Cresol	Adsorption Sampling, Gas Chromatographic Method ⁽⁵⁾
11	Dioxins	Isokinetic Sampling ⁽⁵⁾
12	Hydrogen Chloride	1) Adsorption Sampling, Ion Chromatographic Method ⁽⁵⁾ 2) Isokinetic Sampling, Ion Chromatographic Method ⁽⁵⁾
13	Hydrogen Fluoride	1) Adsorption Sampling, Ion Chromatographic Method ⁽⁵⁾ 2) Isokinetic Sampling, Ion Chromatographic Method ⁽⁵⁾
14	Hydrogen Sulfide	Absorption Sampling, Iodometric Method ⁽⁵⁾

15 Lead...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
15	Lead	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽⁵⁾ 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ⁽⁵⁾
16	Manganese	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽⁵⁾ 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ⁽⁵⁾
17	Mercury	1) Isokinetic Sampling, Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ⁽⁵⁾ 2) Isokinetic Sampling, Digestion, Cold-Vapor Atomic Fluorescence Spectrometric Method ⁽⁵⁾
18	Nickel	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽⁵⁾ 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ⁽⁵⁾
19	Opacity	Ringelmann's Method ⁽⁵⁾
20	Oxides of Nitrogen	1) Absorption Sampling, Phenoldisulfonic Acid Method ⁽⁵⁾ 2) Absorption Sampling, Alkaline Permanganate/Colorimetric Method ⁽⁵⁾ 3) Instrumental Analyzer Method ⁽⁵⁾
21	Selenium	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽⁵⁾ 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ⁽⁵⁾
22	Sulfur Dioxide	1) Absorption Sampling, Barium-Thorin Titrimetric Method ⁽⁵⁾ 2) Instrumental Analyzer Method ⁽⁵⁾
23	Sulfuric Acid	Isokinetic Sampling, Barium-Thorin Titrimetric Method ⁽⁵⁾
24	Tellurium	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽⁵⁾ 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ⁽⁵⁾
25	Tin	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽⁵⁾ 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ⁽⁵⁾
26	Total Suspended Particulate	1) Isokinetic Sampling, Gravimetric Method ⁽⁵⁾ 2) Paired Train, Isokinetic Sampling, Gravimetric Method ⁽⁵⁾

27 Vanadium...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
27	Vanadium	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽⁵⁾ 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ⁽⁵⁾
28	Xylene	Adsorption Sampling, Gas Chromatographic Method ⁽⁵⁾

สิ่งปกคลุมหรือวัสดุที่ไม่ใช่พื้นผิว จำนวน 35 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Aldrin	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1,9,26) 2) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(9,26) 3) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1,26)
2	Antimony	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,16) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,17) 3) Digestion, Inductively Coupled Plasma Method ^(7,16) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7,17)
3	Arsenic	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,16) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,17) 3) Digestion, Inductively Coupled Plasma Method ^(7,16) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7,17)
4	Barium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,16) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,17) 3) Digestion, Inductively Coupled Plasma Method ^(7,16) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7,17)

5 Beryllium...

ลำดับที่	สารพิษ	วิธีการหา
5	Beryllium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,4,16) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,4,17) 3) Digestion, Inductively Coupled Plasma Method ^(7,18) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7,17)
6	Cadmium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,6,16) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,4,17) 3) Digestion, Inductively Coupled Plasma Method ^(7,16) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7,17)
7	Chlordane	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1,9,28) 2) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(9,28) 3) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1,26)
8	Chromium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,6,16) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,4,17) 3) Digestion, Inductively Coupled Plasma Method ^(7,16) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7,17)
9	Chromium (III)	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method; Waste Extraction, Colorimetric Method; Calculation Method ^(1,6,16,17) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method; Waste Extraction, Colorimetric Method; Calculation Method ^(1,4,17,19) 3) Digestion, Inductively Coupled Plasma Method; Alkaline Digestion, Colorimetric Method; Calculation Method ^(7,16,19) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method; Alkaline Digestion, Colorimetric Method, Calculation Method ^(7,8,17,19)

10 Chromium (VI)...

ลำดับที่	สารมลพิษ	วิธีการตรวจ
10	Chromium (VI)	1) Waste Extraction, Colorimetric Method ^(1,6,19) 2) Alkaline Digestion, Colorimetric Method ^(8,40)
11	Cobalt	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,6,16) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,6,17) 3) Digestion, Inductively Coupled Plasma Method ^(7,11) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,17)
12	Copper	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,6,18) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,6,17) 3) Digestion, Inductively Coupled Plasma Method ^(7,14) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7,17)
13	2,4-D	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1,9,26) 2) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28) 3) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(11,29)
14	DDD	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1,9,26) 2) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28) 3) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(11,29)
15	DDE	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1,9,26) 2) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,28) 3) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(11,29)
16	DDT	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1,9,26)

2) Soxhlet...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
17	Dieldrin	2) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,26) 3) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,26)
18	Endrin	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1,9,26) 2) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(9,26) 3) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,26)
19	Heptachlor	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1,9,26) 2) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(9,26) 3) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,26)
20	Lead	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,6,16) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,6,17) 3) Digestion, Inductively Coupled Plasma Method ^(7,16) 4) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^(7,17)
21	Lindane	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(9,26) 2) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(9,26) 3) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,26)

22 Mercury..

ลำดับที่	สารพิษ	วิธีการหา
22	Mercury	1) Waste Extraction, Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ^(8,6,20) 2) Waste Extraction, Digestion, Cold-Vapor Atomic Fluorescence Spectrometric Method ^(1,6,30) 3) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ⁽²⁰⁾ 4) Digestion, Cold-Vapor Atomic Fluorescence Spectrometric Method ⁽³⁰⁾ 5) Thermal Decomposition Amalgamation and Atomic Absorption Spectrometric Method ⁽²¹⁾
23	Methoxychlor	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(9,28) 2) Soxhlet Extraction, Gas Chromatographic / Mass Spectrometric Method ^(9,28) 3) Automated Soxhlet Extraction, Gas Chromatographic / Mass Spectrometric Method ^(1,26)
24	Mirex	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(9,28) 2) Soxhlet Extraction, Gas Chromatographic / Mass Spectrometric Method ^(9,28) 3) Automated Soxhlet Extraction, Gas Chromatographic / Mass Spectrometric Method ^(1,26)
25	Molybdenum	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,4,14) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,4,17) 3) Digestion, Inductively Coupled Plasma Method ^(7,14) 4) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^(7,17)
26	Nickel	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,4,14) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,4,17) 3) Digestion, Inductively Coupled Plasma Method ^(7,14) 4) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^(7,17)
27	Polychlorinated biphenyls (PCBs) - Aroclor 1016 - Aroclor 1221 - Aroclor 1232 - Aroclor 1242 - Aroclor 1248 - Aroclor 1254 - Aroclor 1260	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1,9,24) 2) Soxhlet Extraction, Gas Chromatographic Method ^(10,29) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(1,26)

- 2-ChlorobiphenylL...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
28	- 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 Pentachlorophenol	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1,9,24) 2) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) 3) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(11,26) Electrometric Method ^(25,25) 4) Digestion, Inductively Coupled Plasma Method ^(1,6,16) 5) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,6,17) 6) Digestion, Inductively Coupled Plasma Method ^(7,16) 7) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7,17)
29	pH	
30	Selenium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,6,16) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,6,17) 3) Digestion, Inductively Coupled Plasma Method ^(7,16) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7,17)

31 Silver...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
31	Silver	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,6,16) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,6,17) 3) Digestion, Inductively Coupled Plasma Method ^(7,16) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7,17)
32	Thallium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,6,16) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,6,17) 3) Digestion, Inductively Coupled Plasma Method ^(7,16) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7,17)
33	Toxaphene	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1,9,24) 2) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) 3) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(11,26)
34	Vanadium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,6,16) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,6,17) 3) Digestion, Inductively Coupled Plasma Method ^(7,16) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7,17)
35	Zinc	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,6,16) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,6,17) 3) Digestion, Inductively Coupled Plasma Method ^(7,16) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7,17)

31...

สืบ จำนวน 125 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Acenaphthene	1) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(11,26)
2	Acetone	1) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(15,25) 2) Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method ^(13,23)
3	Aldrin	1) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(11,26)
4	Anthracene	1) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(11,26)
5	Antimony	1) Digestion, Inductively Coupled Plasma Method ^(7,16) 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7,17)
6	Arsenic	1) Digestion, Inductively Coupled Plasma Method ^(7,16) 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7,17)
7	Atrazine	1) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(11,26)
8	Barium	1) Digestion, Inductively Coupled Plasma Method ^(7,16) 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7,17)
9	Benz(a)anthracene	1) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(11,26)
10	Benzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(15,25)

11 Benzol(b)fluoranthene

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
11	Benzol(b)fluoranthene	1) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(11,26)
12	Benzol(k)fluoranthene	1) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(11,26)
13	Benzoic acid	1) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(11,26)
14	Benzo(a)pyrene	1) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(11,26)
15	Benzo(g,h,i)perylene	1) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(11,26)
16	Beryllium	1) Digestion, Inductively Coupled Plasma Method ^(7,16) 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7,17)
17	Bis(2-chloroethyl)ether	1) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(11,26)
18	Bis(2-ethylhexyl)phthalate	1) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(11,26)
19	Bromodichloromethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(15,25)
20	Bromoform	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(15,25)
21	Butanol	Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method ^(13,23)
22	Butyl Benzyl Phthalate	1) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(11,26)

23 Cadmium...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
23	Cadmium	1) Digestion, Inductively Coupled Plasma Method ^(7,14) 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^(7,17)
24	Carbazole	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,26) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,26)
25	Carbon Disulfide	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(15,23)
26	Carbon tetrachloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(15,23)
27	Chlordane	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,26) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,26)
28	p-Chloroaniline	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,26) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,26)
29	Chlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(15,23)
30	Chlorodibromomethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(15,23)
31	Chloroform	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(15,23)
32	2-Chlorophenol	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,26) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,26)
33	Chromium	1) Digestion, Inductively Coupled Plasma Method ^(7,14) 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^(7,17)
34	Chromium (III)	1) Digestion, Inductively Coupled Plasma Method; Alkaline Digestion, Colorimetric Method; Calculation Method ^(7,8,16,19) 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method; Alkaline Digestion, Colorimetric Method; Calculation Method ^(7,8,17,19)
35	Chromium (VI)	Alkaline Digestion, Colorimetric Method ^(8,19)

36 Chrysene...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
36	Chrysene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,26) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,26)
37	Cyanide	Extraction, Distillation, Colorimetric Method ^(27,28,29)
38	2,4-D	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,26) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,26)
39	DDD	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,26) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,26)
40	DDE	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,26) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,26)
41	DDT	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,26) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,26)
42	Dibenz(a,h)anthracene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,26) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,26)
43	Di-n-Butyl Phthalate	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,26) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,26)
44	1,2-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(15,23)
45	1,3-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(15,23)
46	1,4-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(15,23)
47	3,3-Dichlorobenzidine	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,26) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,26)
48	1,1-Dichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(15,23)

49 1,2-Dichloroethane...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
49	1,2-Dichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(15,23)
50	1,1-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(15,23)
51	cis-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(15,23)
52	trans-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(15,23)
53	2,4-Dichlorophenol	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,26) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,26)
54	1,2-Dichloropropane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(15,23)
55	1,3-Dichloropropane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(15,23)
56	1,3-Dichloropropene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(15,23)
57	Dieldrin	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,26) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,26)
58	Diethyl Phthalate	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,26) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,26)
59	2,4-Dimethylphenol	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,26) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,26)
60	2,4-Dinitrophenol	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,26) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,26)
61	2,4-Dinitrotoluene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,26) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,26)
62	2,6-Dinitrotoluene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,26) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,26)

63 Di-n-Octyl Phthalate...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
63	Di-n-Octyl Phthalate	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,26) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,26)
64	Endosulfan	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,26) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,26)
65	Endrin	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,26) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,26)
66	Ethylbenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(15,23)
67	Fluoranthene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,26) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,26)
68	Fluorene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,26) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,26)
69	Heptachlor	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,26) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,26)
70	Heptachlor epoxide	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,26) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,26)
71	Hexachlorobenzene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,26) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,26)
72	Hexachloro-1,3-butadiene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(15,23)
73	n-Hexane	1) Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(15,23) 2) Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method ⁽¹³⁾

73 n-Hexane...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
74	α -HCH	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,26) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,26)
75	β -HCH	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,26) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,26)
76	γ -HCH	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,26) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,26)
77	Hexachlorocyclopentadiene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,26) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,26)
78	Hexachloroethane	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,26) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,26)
79	Indeno(1,2,3-cd)pyrene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,26) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,26)
80	Isophorone	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,26) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,26)
81	Lead	1) Digestion, Inductively Coupled Plasma Method ^(7,16) 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^(7,17)
82	Manganese	1) Digestion, Inductively Coupled Plasma Method ^(7,16) 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^(7,17)
83	Mercury	1) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ⁽²⁰⁾ 2) Thermal Decomposition, Amalgamation, and Atomic Absorption Spectrophotometry ⁽²¹⁾ 3) Digestion, Cold-Vapor Atomic Fluorescence Spectrometric Method ⁽²⁰⁾

85 Methanol...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
84	Methanol	1) Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(11,23) 2) Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method ^(11,23)
85	Methoxychlor	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,26) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,26)
86	Methyl Bromide	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(11,23)
87	Methylene Chloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(11,23)
88	2-methylphenol	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,26) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,26)
89	2-Methylnaphthalene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,26) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,26)
90	Methyl tert-Butyl Ether	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(11,23)
91	Naphthalene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,26) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,26)
92	Nickel	1) Digestion, Inductively Coupled Plasma Method ^(7,16) 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^(7,17)
93	Nitrobenzene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,26) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,26)
94	N-Nitrosodiphenylamine	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,26) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,26)
95	N-Nitrosodi-n-propylamine	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,26) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,26)

96 Polychlorinated biphenyls (PCBs)

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
96	Polychlorinated biphenyls (PCBs) - Aroclor 1016 - Aroclor 1221 - Aroclor 1232 - 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',5,5',6'-Heptachlorobiphenyl - 2,2',3,3',4,4',5,5',6'-Nonachlorobiphenyl	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,26) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,26)
97	Pentachlorophenol	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,26) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,26)
98	Phenanthrene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,26) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,26)

99 Phenol...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
99	Phenol	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,26) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,26)
100	Pyrene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,26) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,26)
101	Selenium	1) Digestion, Inductively Coupled Plasma Method ^(7,16) 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^(7,17)
102	Silver	1) Digestion, Inductively Coupled Plasma Method ^(7,16) 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^(7,17)
103	Styrene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(11,23)
104	1,1,2,2-Tetrachloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(11,23)
105	Tetrachloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(11,23)
106	Toluene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(11,23)
107	Toxaphene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,26) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,26)
108	TPH (C ₅ -C ₈)	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(11,23)
109	TPH (C ₈ -C ₁₅)	1) Automate Extraction, Gas Chromatographic Method ^(11,22) 2) Solvent Extraction, Gas Chromatographic Method ^(12,22) 3) Ultrasonic Extraction, Gas Chromatographic Method ^(22,3)
110	TPH (C ₁₅ -C ₃₅)	1) Automate Extraction, Gas Chromatographic Method ^(11,22) 2) Solvent Extraction, Gas Chromatographic Method ^(12,22) 3) Ultrasonic Extraction, Gas Chromatographic Method ^(22,3)
111	1,2,4-Trichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(11,23)
112	1,1,1-Trichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(11,23)
113	1,1,2-Trichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(11,23)
114	Trichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(11,23)

115 2,4,5-Trichlorophenol...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
115	2,4,5-Trichlorophenol	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(16,20) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,20)
116	2,4,6-Trichlorophenol	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,20) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,24)
117	1,3,5-Trimethylbenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(15,23)
118	Vanadium	1) Digestion, Inductively Coupled Plasma Method ^(7,88) 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^(7,17)
119	Vinyl Acetate	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(15,23)
120	Vinyl Chloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(15,23)
121	m-Xylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(15,23)
122	o-Xylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(15,23)
123	p-Xylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(15,23)
124	Xylene (Total)	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(15,23)
125	Zinc	1) Digestion, Inductively Coupled Plasma Method ^(7,14) 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^(7,17)

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ମି. ପ୍ରମୋଦଚନ୍ଦ୍ର/ ୧୧୭୭

กรมโรงงานอุตสาหกรรม
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท
เขตราชเทวี กรุงเทพฯ ๑๐๔๐๐

២៥ មេសា ២៥៦៧

เรื่อง เปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์

เรียน กรรมการผู้จัดการ บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน
ลงวันที่ ๒๕ มีนาคม ๒๕๖๗

ความท้าทายที่อ้างถึง บริษัท แอแอลเอส แล็บอราทอรี กรุ๊ป (ประเทศไทย) จำกัด หวังปฏิบัติการ
วิเคราะห์เอกชน เลขทะเบียน ๖-๒๐๐๔ สังกัดที่ตั้งเลขที่ ๑๐๔ ซอยพัฒนาการ ๔๐ ถนนพัฒนาการ แขวงพัฒนาการ
เขตสวนหลวง กรุงเทพมหานคร ขอเปลี่ยนแปลงบุคลากร ความละเอียดแจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว มีความเห็นดังนี้

- | | |
|---|----------------------------|
| ๓. ให้ยกเลิกเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๓ ราย | |
| ๑) นางสาวพรรณธิดา หุ่นงั้น | ทะเบียนเลขที่ ๖-๒๐๔-๖-๐๐๖๕ |
| ๒) นายก๊วย สุทธะ | ทะเบียนเลขที่ ๖-๒๐๔-๖-๐๑๒๑ |
| ๓) นางสาวศุภรดา ปิ่นมธุรา | ทะเบียนเลขที่ ๖-๒๐๔-๖-๐๑๓๘ |
| ๔. ให้เพิ่มเจ้าหน้าที่ห้องปฏิบัติการวิเคราะห์เภสัชกร จำนวน ๑๒ ราย | |
| ๑) นางสาวฐิติตา กลิ่นเขียว | ทะเบียนเลขที่ ๖-๒๐๔-๖-๐๑๑๒ |
| ๒) นางสาวกาญจน์ภัทรา สายคำ | ทะเบียนเลขที่ ๖-๒๐๔-๖-๐๑๔๗ |
| ๓) นางสาวณัฏฐิณี กัทธวงค์ | ทะเบียนเลขที่ ๖-๒๐๔-๖-๐๑๔๔ |
| ๔) นายธนากร วาจาเคน | ทะเบียนเลขที่ ๖-๒๐๔-๖-๐๑๔๕ |
| ๕) นายฤทธพล ปัญญาวงศ์ | ทะเบียนเลขที่ ๖-๒๐๔-๖-๐๑๔๖ |
| ๖) นายสมชาย หารธา | ทะเบียนเลขที่ ๖-๒๐๔-๖-๐๑๔๗ |
| ๗) นายวิจิตรพงศ์ ผ่องแสงสวน | ทะเบียนเลขที่ ๖-๒๐๔-๖-๐๑๔๘ |
| ๘) นายณัฐพงศ์ โสภา | ทะเบียนเลขที่ ๖-๒๐๔-๖-๐๑๔๙ |
| ๙) นายกัณธิ์กร ปานเพ็ง | ทะเบียนเลขที่ ๖-๒๐๔-๖-๐๑๕๐ |
| ๑๐) นายณัฐพล ชุ่มเงิน | ทะเบียนเลขที่ ๖-๒๐๔-๖-๐๑๕๑ |
| ๑๑) นายธนา สุภาพันธุ์ | ทะเบียนเลขที่ ๖-๒๐๔-๖-๐๑๕๒ |
| ๑๒) นายวรรณ แก้วพวงษา | ทะเบียนเลขที่ ๖-๒๐๔-๖-๐๑๕๓ |

อนึ่ง หนังสือฉบับนี้

(๕) นายพชรกร

(๕๒) นายพรกร เจ็งเจริญ
(๕๓) นายวิภากร เขื่อนมาก
(๕๔) นายอนุรักษ์ ทองขจรศักดิ์
(๕๕) นายอภิชาติ วิลาศ
(๕๖) นายจรัสศรี ศรีรักษา
(๕๗) นายประสาธน์ เจริญเพชร
(๕๘) นายภาณุวัฒน์ วัชร
(๖๐) นายสันติ ชัยชนะ
(๖๑) นายทินกร กุลชาติ

ทะเบียนเลขที่ ว-๑๒๓-จ-๐๐๕๔
ทะเบียนเลขที่ ว-๑๒๓-จ-๐๐๕๕
ทะเบียนเลขที่ ว-๑๒๓-จ-๐๐๕๖
ทะเบียนเลขที่ ว-๑๒๓-จ-๐๐๕๗
ทะเบียนเลขที่ ว-๑๒๓-จ-๐๐๕๘
ทะเบียนเลขที่ ว-๑๒๓-จ-๐๐๕๙
ทะเบียนเลขที่ ว-๑๒๓-จ-๐๐๖๐
ทะเบียนเลขที่ ว-๑๒๓-จ-๐๐๖๑
ทะเบียนเลขที่ ว-๑๒๓-จ-๐๐๖๒

ค. ขอบข่ายชนิดสารมลพิษที่ได้รับขึ้นทะเบียนให้วิเคราะห์ในน้ำเสีย น้ำใต้ดิน อากาศเสีย ตามสิ่งที่ส่งมาด้วย

หนังสือฉบับนี้จะหมดอายุในวันที่ ๒๘ มิถุนายน ๒๕๖๓ หากประสงค์จะต่ออายุหนังสือ รับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน ให้ยื่นคำขอต่ออายุพร้อมเอกสารประกอบคำขอต่อกรมโรงงานอุตสาหกรรมภายใน ๖๐ วัน ก่อนวันสิ้นอายุของหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ


(นายพรศร กัณกรสง)
รองเลขาธิการ
สำนักงานโรงงานอุตสาหกรรม

ศูนย์วิจัยและเคมียกย่องพิษโรงงานภาคตะวันออก
โทร. ๐ ๓๓๓๓ ๖๐๕๙ ต่อ ๕๐๐๑-๒
ไปรษณีย์อิเล็กทรอนิกส์ eww@dw.mae.go.th



"อุตสาหกรรมก้าวไกล ประเทศไทยก้าวทันฯ ร่วมกันพัฒนา อุตสาหกรรมสีเขียว"



เอกสารแนบท้ายหนังสือเปลี่ยนแปลงสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน
บริษัท เอแอลเอส แลบลอจิสติกส์ จำกัด เลขทะเบียน ว-๑๒๓
ที่ กก ๐๓๒๐/ ๗๕๓๘ ลงวันที่ ๐๔ สิงหาคม ๒๕๖๗

ขอขยายสารมลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๒๔ รายการ
น้ำเสีย จำนวน ๑๔ รายการ

ลำดับ ที่	สารมลพิษ	วิธีวิเคราะห์
1	Biochemical Oxygen Demand	1) 5-Day BOD Test, Membrane Electrode Method ^[2] 2) 5-Day BOD Test, Azide Modification Method ^[2]
2	Chemical Oxygen Demand	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	Field Method ^[2]
12	Total Dissolved Solids	Dried at 180 °C ^[2]
13	Total Kjeldahl Nitrogen	Semi-Macro Kjeldahl Method ^[2]
14	Total Suspended Solids	Dried at 103-105 °C ^[2]

น้ำใต้ดิน จำนวน ๓ รายการ

ลำดับ ที่	สารมลพิษ	วิธีวิเคราะห์
1	Cyanide	Distillation, Colorimetric Method ^[2]
2	pH	Electrometric Method ^[2]
3	Phenols	Distillation, Direct Photometric Method ^[2]

อากาศเสีย...

อากาศเสีย (ปล่อยระบาย) จำนวน 7 รายการ

ลำดับ ที่	สารมลพิษ	วิธีวิเคราะห์
1	Carbon Monoxide	1) Sampling Bag, Non-Dispersive Infrared Method ^[3] 2) Instrumental Analyzer Method ^[2]
2	Hydrogen Sulfide	Absorption Sampling, Iodometric Method ^[2]
3	Opacity	Ringelmann's Method ^[4]
4	Oxide of Nitrogen	1) Absorption Sampling, Phenoldisulfonic Acid Method ^[4] 2) Instrumental Analyzer Method ^[10]
5	Sulfur Dioxide	1) Absorption Sampling, Barium-Thorin Titrimetric Acid Method ^[9] 2) Instrumental Analyzer Method ^[11]
6	Sulfuric Acid	Isokinetic Sampling, Barium-Titrimetric Method ^[6]
7	Total Suspended Particulate	Isokinetic Sampling, Gravimetric Method ^[7]

เอกสารอ้างอิง

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4. กระทรวงอุตสาหกรรม, ประกาศกระทรวงอุตสาหกรรม, พ.ศ. 2549, เรื่อง กำหนดค่าปริมาณเพิ่มค่าวันต่อปีในอากาศที่ระบายออกจากปล่องของหม้อน้ำของโรงงาน, ราชกิจจานุเบกษา, 4 ธันวาคม 2549, เล่มที่ 123 ตอนพิเศษ 1254
5. United States Environmental Protection Agency, Standards of Performance for New Stationary Sources, 40 CFR 60, Appendix A, 2017.
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9. United States Environmental Protection Agency, Determination of Carbon Monoxide Emission from Stationary Sources; Instrumental Analyzer Procedure, 40 CFR 60, Appendix A Method 10, 2017.
10. United States Environmental Protection Agency, Determination of Oxide of Nitrogen Emission from Stationary Sources; Instrumental Analyzer Procedure, 40 CFR 60, Appendix A Method 7E, 2023.
11. United States Environmental Protection Agency, Determination of Sulfur dioxide Emission from Stationary Sources; Instrumental Analyzer Procedure, 40 CFR 60, Appendix A Method 6C, 2017.



๐๙ ตุลาคม ๒๕๖๗

เรื่อง แก้ไขรายชื่อเจ้าหน้าที่ห้องปฏิบัติการวิเคราะห์เอกชน

เรียน กรรมการผู้จัดการ บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด

อ้างถึง หนังสือ บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด เลขที่ Env.2024/005
ลงวันที่ ๓๐ สิงหาคม ๒๕๖๗

ตามหนังสือที่อ้างถึง บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด ห้องปฏิบัติการ
วิเคราะห์เอกชน เลขทะเบียน ว-๓๒๓ สถานที่ตั้งเลขที่ ๖๑๖/๑๐ หมู่ที่ ๕ ตำบลแม่ไม้กู่ อำเภอปลวกแดง
จังหวัดระยอง ขอแก้ไขเจ้าหน้าที่ห้องปฏิบัติการวิเคราะห์เอกชน เนื่องจากมีความคลาดเคลื่อน ความละเอียด
แจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรม ได้รับทราบและดำเนินการแก้ไขรายชื่อเจ้าหน้าที่ห้องปฏิบัติการ
วิเคราะห์เอกชน จำนวน ๕ ราย ตามที่แจ้งเรียบร้อยแล้ว เป็นดังนี้

ลำดับที่ ๒๗ นางพจนา สีดา

ลำดับที่ ๒๘ นางสาวธนิศา กุลสุริวงศ์

ลำดับที่ ๓๐ นางชลธิชา สิบงกช

ลำดับที่ ๓๖ นายสุทธิศักดิ์ โชคปิณฑินท์

ลำดับที่ ๔๖ นายกันตณณ มณีสัมพันธ์

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ


(นายพรยศ กลิ่นกรอง)
รองอธิบดี ปฏิบัติราชการแทน
อธิบดีกรมโรงงานอุตสาหกรรม

ศูนย์วิจัยและเตือนภัยมลพิษโรงงานภาคตะวันออก
โทร. ๐ ๓๓๓๓ ๖๐๕๔ ต่อ ๕๐๐๑-๒
ไปรษณีย์อิเล็กทรอนิกส์ eirw@dlw.mail.go.th

 Green Industry “อุตสาหกรรมก้าวไกล ประเทศไทยก้าวหน้า ร่วมกันพัฒนา อุตสาหกรรมสีเขียว”





บริษัท เอแอลเอส แลборาทอรี กรุ๊ป (ประเทศไทย) จำกัด (สำนักงานใหญ่)

104 ซอยพัฒนาการ 40 ถนนพัฒนาการ

แขวงพัฒนาการ เขตสวนหลวง กรุงเทพฯ 10250

ติดต่อเรา

