

ภาคผนวก ง

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เอกสารสอบเทียบเครื่องมือที่ใช้ในการวิเคราะห์



### High Volume Air Sampler Calibration Worksheet

Project Site: WHA Rayong 36 Company Limited  
โครงการสร้างโรงงาน (พื้นที่ 7 ไร่) บ้านดอน  
สามัคคี (AZ)

Calibrate Location: 9-Dec-24

Calibration Sheet No.: C-091224-RYG-FS0173

Calibrator ID: RYG-FS0205

Calibrator Model: TE-5028A

Calibrator S/N: 1166

Barometric Pressure (mm Hg): 755.6

Temperature (°C): 30.5

High Volume ID: RYG-FS0173

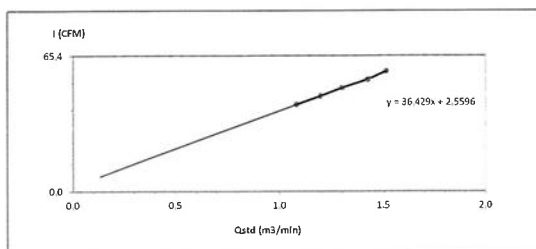
High Volume Model: TE-5170D

High Volume S/N: 4799

Calibrator Slope: 1.52567

Calibrator Intercept: -0.03613

Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>std</sub> (m <sup>3</sup> /min)	I: Chart (CFM)	Linear Regression
1	2.6	1.0803	42	Slope: 36.4287 Intercept: 2.5596 Correlation Coefficient: 0.9989
2	3.2	1.1946	46	
3	3.8	1.2985	50	
4	4.6	1.4251	54	
5	5.2	1.5129	58	



Calibrated by: Satcha P.  
(Mr. Satcha Phetsawaeng)  
RYG-Field Services Scientist (3)

Approved by: Spt S  
(Mr. Supot Salameh)  
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: WHA Rayong 36 Company Limited  
โครงการสร้างโรงงาน (พื้นที่ 7 ไร่) บ้านดอน  
สามัคคี (AZ)

Calibrate Location: 9-Dec-24

Calibration Sheet No.: C-091224-RYG-FS0174

Calibrator ID: RYG-FS0205

Calibrator Model: TE-5028A

Calibrator S/N: 1166

Barometric Pressure (mm Hg): 755.6

Temperature (°C): 30.5

High Volume ID: RYG-FS0174

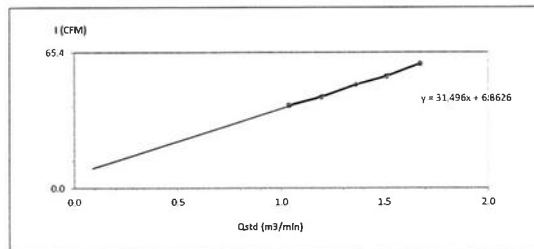
High Volume Model: TE-5170D

High Volume S/N: 4800

Calibrator Slope: 1.52567

Calibrator Intercept: -0.03613

Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>std</sub> (m <sup>3</sup> /min)	I: Chart (CFM)	Linear Regression
1	2.4	1.0394	40	Slope: 31.4959 Intercept: 6.8626 Correlation Coefficient: 0.9983
2	3.2	1.1946	44	
3	4.2	1.3633	50	
4	5.2	1.5129	54	
5	6.4	1.6744	60	



Calibrated by: Satcha P.  
(Mr. Satcha Phetsawaeng)  
RYG-Field Services Scientist (3)

Approved by: Spt S  
(Mr. Supot Salameh)  
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: WHA Rayong 36 Company Limited  
โครงการสร้างโรงงาน (พื้นที่ 1 ไร่) บ้านดอน  
สามัคคี (AZ)

Calibrate Location: 9-Dec-24

Calibration Sheet No.: C-091224-RYG-FS0175

Calibrator ID: RYG-FS0205

Calibrator Model: TE-5028A

Calibrator S/N: 1166

Barometric Pressure (mm Hg): 755.6

Temperature (°C): 30.5

High Volume ID: RYG-FS0175

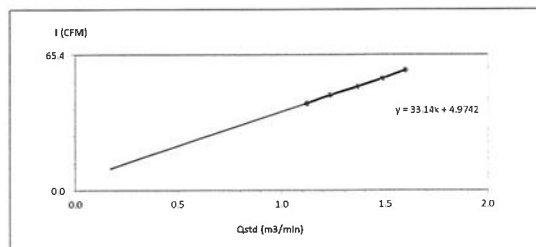
High Volume Model: TE-5170D

High Volume S/N: 4801

Calibrator Slope: 1.52567

Calibrator Intercept: -0.03613

Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>std</sub> (m <sup>3</sup> /min)	I: Chart (CFM)	Linear Regression
1	2.8	1.1198	42	Slope: 33.1400 Intercept: 4.9742 Correlation Coefficient: 0.9996
2	3.4	1.2302	46	
3	4.2	1.3633	50	
4	5.0	1.4842	54	
5	5.8	1.5957	58	



Calibrated by: Satcha P.  
(Mr. Satcha Phetsawaeng)  
RYG-Field Services Scientist (3)

Approved by: Spt S  
(Mr. Supot Salameh)  
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: WHA Rayong 36 Company Limited  
โครงการสร้างโรงงาน (พื้นที่ 1 ไร่) บ้านดอน  
สามัคคี (AZ)

Calibrate Location: 9-Dec-24

Calibration Sheet No.: C-091224-RYG-FS0185

Calibrator ID: RYG-FS0205

Calibrator Model: TE-5028A

Calibrator S/N: 1166

Barometric Pressure (mm Hg): 755.6

Temperature (°C): 30.5

High Volume ID: RYG-FS0185

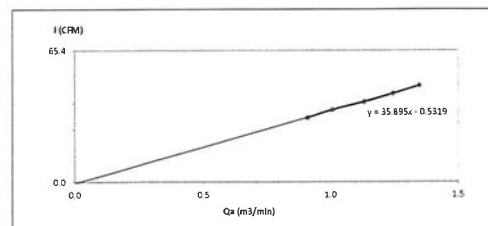
High Volume Model: TE-5009X

High Volume S/N: 4793

Calibrator Slope: 0.95561

Calibrator Intercept: -0.02266

Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>std</sub> (m <sup>3</sup> /min)	I: Chart (CFM)	Linear Regression
1	1.8	0.912	32	Slope: 35.8951 Intercept: -0.5319 Correlation Coefficient: 0.9991
2	2.2	1.086	36	
3	2.0	1.132	40	
4	3.4	1.246	44	
5	4.0	1.349	48	



Calibrated by: Satcha P.  
(Mr. Satcha Phetsawaeng)  
RYG-Field Services Scientist (3)

Approved by: Spt S  
(Mr. Supot Salameh)  
RYG-Field Services Section Head

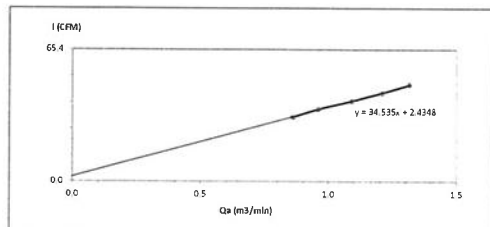
FORM NO: F-06-074 REVISION NO.2 ISSUE DATE: 20/11/23



### High Volume Air Sampler Calibration Worksheet

Project Site : WHA Rayong 36 Company Limited  
Calibrate Location : โรงงานกระดาษ (หมู่ 7 ตำบลนาเกลือ  
Calibrate Date : 9-Dec-24  
CalibrationSheet No. : C-091224-RYG-FS0191  
Calibrator ID : RYG-FS0205  
Calibrator Model : TE-5028A  
Calibrator S/N : 1166  
Barometric Pressure (mm Hg) : 755.6  
Temperature (°C) : 30.5  
High Volume ID : RYG-FS0191  
High Volume Model : TE-5009X  
High Volume S/N : 5130  
Calibrator Slope : 0.95561  
Calibrator Intercept : -0.02266

Test No.	Delta H <sub>2</sub> O (Inch)	Q <sub>a</sub> (m <sup>3</sup> /min)	I : Chart (CFM)	Linear Regression
1	1.6	0.862	32	Slope: 34.5317 Intercept: 2.1340 Correlation Coefficient: 0.9992
2	2.0	0.961	36	
3	2.6	1.092	40	
4	3.2	1.209	44	
5	3.0	1.315	48	



Calibrated by : Satcha P.  
( Mr.Satcha Phetsawaeng )  
RYG-Field Services Scientist (3)

Approved by : Spt S  
( Mr.Supt Salamtch )  
RYG- Field Services Section Head

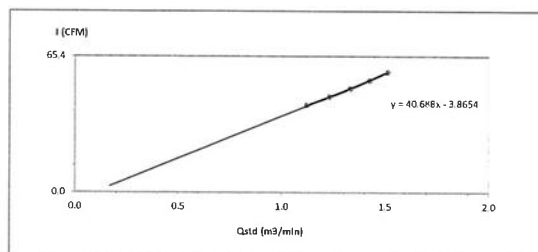
FORM NO. F 06-074 RI VISION NO.2 ISSUE DATE: 20/11/23



### High Volume Air Sampler Calibration Worksheet

Project Site : WHA Rayong 36 Company Limited  
Calibrate Location : โรงงานกระดาษ (หมู่ 6 ตำบลนาเกลือ  
Calibrate Date : 9-Dec-24  
CalibrationSheet No. : C-091224-RYG-FS0396  
Calibrator ID : RYG-FS0205  
Calibrator Model : TE-5028A  
Calibrator S/N : 1166  
Barometric Pressure (mm Hg) : 755.6  
Temperature (°C) : 30.5  
High Volume ID : RYG-FS0396  
High Volume Model : TE-5170D  
High Volume S/N : 5688  
Calibrator Slope : 1.52567  
Calibrator Intercept : -0.03613

Test No.	Delta H <sub>2</sub> O (Inch)	Q <sub>a</sub> (m <sup>3</sup> /min)	I : Chart (CFM)	Linear Regression
1	2.8	1.1198	42	Slope: 40.6883 Intercept: -3.8654 Correlation Coefficient: 0.9990
2	3.4	1.2302	46	
3	4.0	1.3313	50	
4	4.6	1.4251	54	
5	5.2	1.5129	58	



Calibrated by : Satcha P.  
( Mr.Satcha Phetsawaeng )  
RYG-Field Services Scientist (3)

Approved by : Spt S  
( Mr.Supt Salamtch )  
RYG- Field Services Section Head

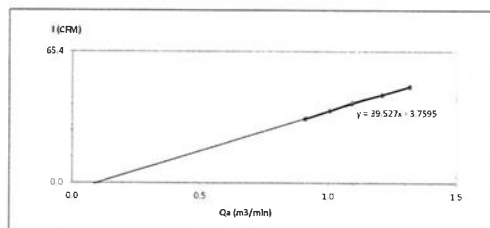
FORM NO. F 06-073 REVISION NO.2 ISSUE DATE: 20/11/23



### High Volume Air Sampler Calibration Worksheet

Project Site : WHA Rayong 36 Company Limited  
Calibrate Location : โรงงานกระดาษ (หมู่ 1 ตำบลนาเกลือ 12  
Calibrate Date : 9-Dec-24  
CalibrationSheet No. : C-091224-RYG-FS0397  
Calibrator ID : RYG-FS0205  
Calibrator Model : TE-5028A  
Calibrator S/N : 1166  
Barometric Pressure (mm Hg) : 755.6  
Temperature (°C) : 30.5  
High Volume ID : RYG-FS0397  
High Volume Model : TE-5009X  
High Volume S/N : 5687  
Calibrator Slope : 0.95561  
Calibrator Intercept : -0.02766

Test No.	Delta H <sub>2</sub> O (Inch)	Q <sub>a</sub> (m <sup>3</sup> /min)	I : Chart (CFM)	Linear Regression
1	1.0	0.912	32	Slope: 39.5268 Intercept: -3.7595 Correlation Coefficient: 0.9994
2	2.2	1.006	36	
3	2.6	1.092	40	
4	3.2	1.209	44	
5	3.8	1.315	48	



Calibrated by : Satcha P.  
( Mr.Satcha Phetsawaeng )  
RYG-Field Services Scientist (3)

Approved by : Spt S  
( Mr.Supt Salamtch )  
RYG- Field Services Section Head

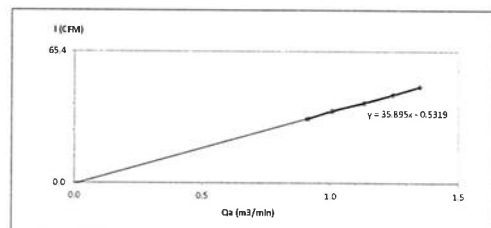
FORM NO. F 06-074 REVISION NO.2 ISSUE DATE: 20/11/23



### High Volume Air Sampler Calibration Worksheet

Project Site : WHA Rayong 36 Company Limited  
Calibrate Location : โรงงานกระดาษ (หมู่ 6 ตำบลนาเกลือ  
Calibrate Date : 9-Dec-24  
CalibrationSheet No. : C-091224-RYG-FS0400  
Calibrator ID : RYG-FS0205  
Calibrator Model : TE-5028A  
Calibrator S/N : 1166  
Barometric Pressure (mm Hg) : 755.6  
Temperature (°C) : 30.5  
High Volume ID : RYG-FS0400  
High Volume Model : TE-5009X  
High Volume S/N : 5691  
Calibrator Slope : 0.95561  
Calibrator Intercept : -0.02766

Test No.	Delta H <sub>2</sub> O (Inch)	Q <sub>a</sub> (m <sup>3</sup> /min)	I : Chart (CFM)	Linear Regression
1	1.0	0.912	32	Slope: 35.8951 Intercept: -0.5319 Correlation Coefficient: 0.9991
2	2.2	1.006	36	
3	2.8	1.132	40	
4	3.4	1.246	44	
5	4.0	1.349	48	



Calibrated by : Satcha P.  
( Mr.Satcha Phetsawaeng )  
RYG-Field Services Scientist (3)

Approved by : Spt S  
( Mr.Supt Salamtch )  
RYG- Field Services Section Head

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



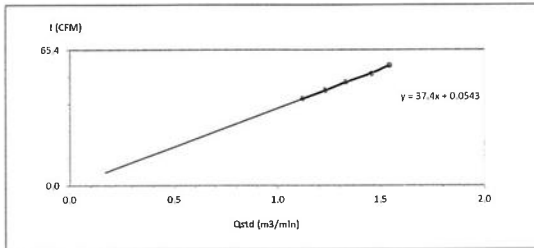


### High Volume Air Sampler Calibration Worksheet

Project Site: WHA Rayong 36 Company Limited  
Calibrate Location: รังนก (หมู่ 1 บ้านนาหวาย) ตำบลนาหวาย (AZ)  
Calibrate Date: 9-Dec-24  
Calibration Sheet No.: C-091224-RYG-PS0181  
Calibrator ID: RYG-PS0205  
Calibrator Model: TE-5028A  
Calibrator S/N: 1166

Barometric Pressure (mm Hg): 755.6  
Temperature (°C): 30.5  
High Volume ID: RYG-PS0181  
High Volume Model: TE-5170D  
High Volume S/N: 5334  
Calibrator Slope: 1.52567  
Calibrator Intercept: -0.03613

Test No.	Delta H <sub>2</sub> O (Inch)	Q <sub>std</sub> (m <sup>3</sup> /min)	I: Chart (CFM)	Linear Regression
1	2.8	1.1198	42	Slope: 37.3997 Intercept: 0.0543 Correlation Coefficient: 0.9989
2	3.4	1.2302	46	
3	4.0	1.3313	50	
4	4.8	1.4549	54	
5	5.4	1.5410	58	



Calibrated by: Satcha P.  
(Mr. Satcha Phetsavaeng)  
RYG-Field Services Scientist (3)

Approved by: Spt S  
(Mr. Supot Salamich)  
RYG-Field Services Section Head

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

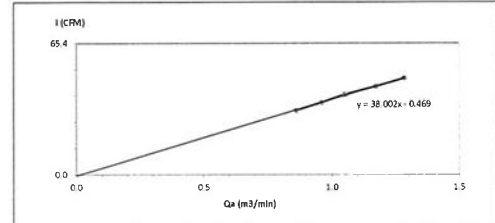


### High Volume Air Sampler Calibration Worksheet

Project Site: WHA Rayong 36 Company Limited  
Calibrate Location: รังนก (หมู่ 1 บ้านนาหวาย) ตำบลนาหวาย (AZ)  
Calibrate Date: 9-Dec-24  
Calibration Sheet No.: C-091224-RYG-PS0192  
Calibrator ID: RYG-PS0205  
Calibrator Model: TE-5028A  
Calibrator S/N: 1166

Barometric Pressure (mm Hg): 755.6  
Temperature (°C): 30.5  
High Volume ID: RYG-PS0192  
High Volume Model: TE-5009X  
High Volume S/N: 5331  
Calibrator Slope: 0.95561  
Calibrator Intercept: -0.02266

Test No.	Delta H <sub>2</sub> O (Inch)	Q <sub>std</sub> (m <sup>3</sup> /min)	I: Chart (CFM)	Linear Regression
1	1.6	0.862	32	Slope: 38.0015 Intercept: -0.4690 Correlation Coefficient: 0.9986
2	2.0	0.961	36	
3	2.4	1.050	40	
4	3.0	1.171	44	
5	3.6	1.201	48	



Calibrated by: Satcha P.  
(Mr. Satcha Phetsavaeng)  
RYG-Field Services Scientist (3)

Approved by: Spt S  
(Mr. Supot Salamich)  
RYG-Field Services Section Head

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

Sartorius (Thailand) Co., Ltd.  
129 Rama 9 Road, Huaykwang, Huaykwang, Bangkok 10310  
Tel: +66 2643 8381-6, e-mail: service.thailand@sartorius.com



SARTORIUS

## Certificate of Calibration

Model Number: LA130S-F  
Description: Analytical Balance  
Serial Number: 25409564  
ID No.: RYG\_EN0001  
Manufacturer: Sartorius

Certificate No.: 24BCI0068  
Issued Date: Friday, February 23, 2024  
Reference No.: 229198

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

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

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

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

Metrological data:  
Capacity: 150 g Readability: 0.0001 g

Ambient Conditions:  
Temperature: 23.6 °C ± 5.0 °C  
Humidity: 54.0 % RH ± 10.0 % RH  
Pressure: ±

Reasons for calibration:  
☐ New Installation ☐ Service / Required ☒ Re-calibration / Maintenance

Equipment Condition: ☒ Good Operate ☐ Fair

Measurement Method: UKAS Publication Ref: Lab 14  
The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM). The calibration certificate documents the traceability to National Standards, which realise the unit of measurement according to the International Standard System of Units (SI). Report of Tolerance came from list of Sartorius Metrological Specifications.

### Traceability:

Model Number	Description	Traceability	Certificate No.	Due Date
YCS011-522-00	Sartorius weight set 1mg - 5000g E2 YCS011-522-00	TCS	M2308197S	23-Aug-2025
MHB-382SD	Humidity/Barometer/Temp. Lutron MHB-382SD	DKSH	C1923184S	23-Aug-2024

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

Mr. Chonchai Inthana (Technical Manager)



SOP FM 33 03 February 2022

Sartorius (Thailand) Co., Ltd.

129 Rama 9 Road, Huaykwang, Huaykwang, Bangkok 10310  
Tel: +66 2643 8381-6 Fax: +66 2643-8387, e-mail: service.thailand@sartorius.com

SARTORIUS

## Certificate of Calibration

Model Number: LA130S-F  
Description: Analytical Balance  
Serial Number: 25409564  
ID No.: RYG\_EN0001  
Manufacturer: Sartorius

Certificate No.: 24BCI0068  
Issued Date: Friday, February 23, 2024  
Reference No.: 229198

Page No.: 2 of 2

### Calibration Results: Without Adjustment

Repeatability	Eccentricity (Off-center loading error)
The reproducibility is the ability of a weighing instrument to display nearly identical readings under constant test conditions when the same load within a measurement series is placed repeatedly on the weighing pan in the same manner. The standard deviation is used to express reproducibility quantitatively.	The off-center loading error is yielded by the difference between the reading of the load, i.e. 1/3 or 1/4 of maximum capacity, placed in the middle of the weighing pan and between each of four additional measurement points (positions defined according to OIML R110).
Nominal Value: (Low Load) 10 g Tolerance 0.0001 g	Nominal value: 50 g Tolerance: 0.0004 g
Nominal Value: (High Load) 100 g Tolerance 0.0001 g	Difference 1: 0.0001 2: -0.0001 3: 0.0001 4: 0.0002 5: 0.0000 6: -
Standard Deviation: 0.00005	

### Linearity

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

Tolerance		0.0002 g		
Nominal Value	Conventional Mass Value	Displayed Value	Deviation	Uncertainty
(g)	(g)	(g)	(g)	(g)
0.01	0.0100	0.0100	0.0000	0.00020
0.05	0.0500	0.0500	0.0000	0.00021
0.1	0.1000	0.1000	0.0000	0.00021
0.5	0.5000	0.5000	0.0000	0.00021
1	1.0000	1.0000	0.0000	0.00021
2	2.0000	2.0000	0.0000	0.00021
5	5.0000	5.0000	0.0000	0.00021
10	10.0000	10.0001	0.0001	0.00024
20	20.0000	20.0001	0.0001	0.00021
100	100.0000	99.9999	-0.0001	0.00024

End of Report

SOP FM 33 03 February 2022

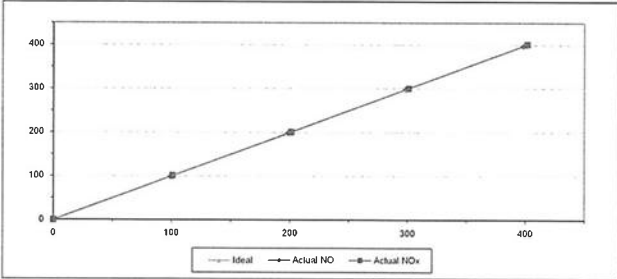




## MULTIPOINT CALIBRATION REPORT

Calibration Date 4-Jan-24 Equipment Name NOx Analyzer  
 Manufacturer Teledyne API Model T200  
 Serial No. 7238 Equipment ID RYG\_FS0533  
 Calibrator Manufacturer Teledyne API Model 700  
 Serial No. 947  
 Std. Gas Concentration (PPM) 55.88 Cylinder No. GN0027222  
 Cylinder Pressure (psi) 1800 Certified By Airgas Inc.  
 Certified Date 9-Feb-22 Expired Date 9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	99.50	-0.50	-0.50	101.10	1.10	1.10
2	200.00	198.70	-1.30	-0.65	201.20	1.20	0.60
3	300.00	298.80	-1.20	-0.40	301.10	1.10	0.37
4	400.00	398.30	-1.70	-0.42	401.80	1.80	0.45
AVERAGE (%)				-0.38			0.52



Calibrated By

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

Approved By

(Mr.Sarayuth Jittranont)  
Assistant General Manager

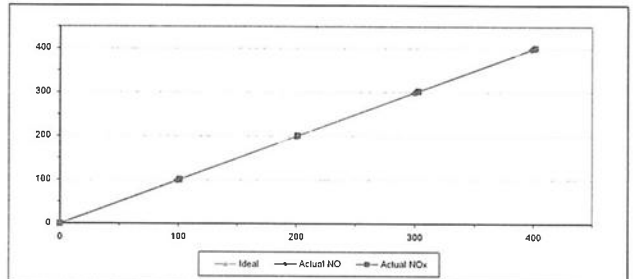
ALS Laboratory Group  
FORM NO. F 05-056 REVISION NO. - ISSUE DATE 02/04/12



## MULTIPOINT CALIBRATION REPORT

Calibration Date 4-Jan-24 Equipment Name NOx Analyzer  
 Manufacturer HORIBA Model APNA-370  
 Serial No. R06K0177 Equipment ID RYG\_FS0483  
 Calibrator Manufacturer Teledyne API Model 700  
 Serial No. 947  
 Std. Gas Concentration (PPM) 55.88 Cylinder No. GN0027222  
 Cylinder Pressure (psi) 1800 Certified By Airgas Inc.  
 Certified Date 9-Feb-22 Expired Date 9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	98.80	-1.20	-1.20	101.10	1.10	1.10
2	200.00	201.30	1.30	0.65	201.20	1.20	0.60
3	300.00	299.40	-0.60	-0.20	302.60	2.60	0.87
4	400.00	398.70	-1.30	-0.33	401.50	1.50	0.38
AVERAGE (%)				-0.20			0.61



Calibrated By

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

Approved By

(Mr.Sarayuth Jittranont)  
Assistant General Manager

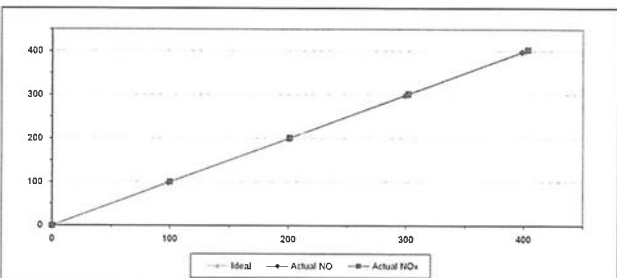
ALS Laboratory Group  
FORM NO. F 05-056 REVISION NO. - ISSUE DATE 02/04/12



## MULTIPOINT CALIBRATION REPORT

Calibration Date 4-Jan-24 Equipment Name NOx Analyzer  
 Manufacturer HORIBA Model APNA-370  
 Serial No. T95HWM41 Equipment ID RYG\_FS0461  
 Calibrator Manufacturer Teledyne API Model 700  
 Serial No. 947  
 Std. Gas Concentration (PPM) 55.88 Cylinder No. GN0027222  
 Cylinder Pressure (psi) 1800 Certified By Airgas Inc.  
 Certified Date 9-Feb-22 Expired Date 9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	98.70	-1.30	-1.30	100.10	0.10	0.10
2	200.00	201.00	1.00	0.50	201.10	1.10	0.55
3	300.00	298.70	-1.30	-0.43	302.10	2.10	0.70
4	400.00	398.40	-1.60	-0.40	403.50	3.50	0.88
AVERAGE (%)				-0.31			0.47



Calibrated By

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

Approved By

(Mr.Sarayuth Jittranont)  
Assistant General Manager

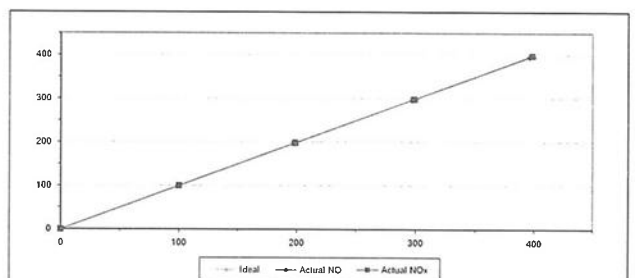
ALS Laboratory Group  
FORM NO. F 05-056 REVISION NO. - ISSUE DATE 02/04/12



## MULTIPOINT CALIBRATION REPORT

Calibration Date 4-Jan-24 Equipment Name NOx Analyzer  
 Manufacturer Teledyne API Model T200  
 Serial No. 2197 Equipment ID RYG\_FS0255  
 Calibrator Manufacturer Teledyne API Model 700  
 Serial No. 947  
 Std. Gas Concentration (PPM) 55.88 Cylinder No. GN0027222  
 Cylinder Pressure (psi) 1800 Certified By Airgas Inc.  
 Certified Date 9-Feb-22 Expired Date 9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	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	198.50	-1.50	-0.75
3	300.00	297.30	-2.70	-0.90	298.70	-1.30	-0.43
4	400.00	396.40	-3.60	-0.90	398.50	-1.50	-0.38
AVERAGE (%)				-0.62			-0.27



Calibrated By

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

Approved By

(Mr.Sarayuth Jittranont)  
Assistant General Manager

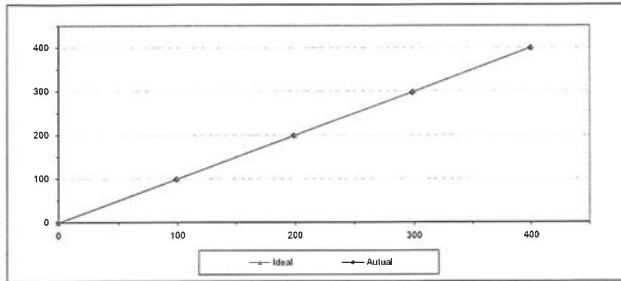
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FORM NO. F 05-056 REVISION NO. - ISSUE DATE 02/04/12



## MULTIPOINT CALIBRATION REPORT

Calibration Date	4-Jan-24	Equipment Name	SO2 Analyzer
Manufacturer	Teledyne API	Model	T100
Serial No.	6060	Equipment ID	RYG_FS0532
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	56.3	Cylinder No.	GN0027222
Cylinder Pressure (psi)	1800	Certified By	Airgas Inc.
Certified Date	9-Feb-22	Expired Date	9-Feb-30

Point	CALIBRATION RESULTS			
	Ideal	Actual	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	98.80	-1.20	-1.20
2	200.00	198.60	-1.40	-0.70
3	300.00	299.30	-1.70	-0.57
4	400.00	399.60	-0.40	-0.10
AVERAGE (%)				-0.49



Calibrated By

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

Approved By

(Mr.Sarayuth Jittrantont)  
Assistant General Manager

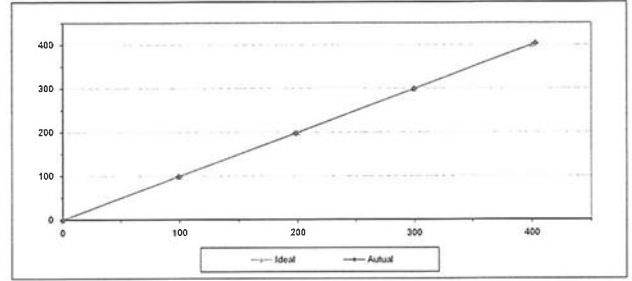
ALS Laboratory Group  
FORM NO. F-06-056 REVISION NO. - ISSUE DATE 02/04/12



## MULTIPOINT CALIBRATION REPORT

Calibration Date	4-Jan-24	Equipment Name	SO2 Analyzer
Manufacturer	HORIBA	Model	APSA-370
Serial No.	XL28Y859	Equipment ID	RYG_FS0462
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	56.3	Cylinder No.	GN0027222
Cylinder Pressure (psi)	1800	Certified By	Airgas Inc.
Certified Date	9-Feb-22	Expired Date	9-Feb-30

Point	CALIBRATION RESULTS			
	Ideal	Actual	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	99.10	-0.90	-0.90
2	200.00	198.10	-1.90	-0.95
3	300.00	299.90	-0.10	-0.03
4	400.00	403.20	3.20	0.80
AVERAGE (%)				-0.20



Calibrated By

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

Approved By

(Mr.Sarayuth Jittrantont)  
Assistant General Manager

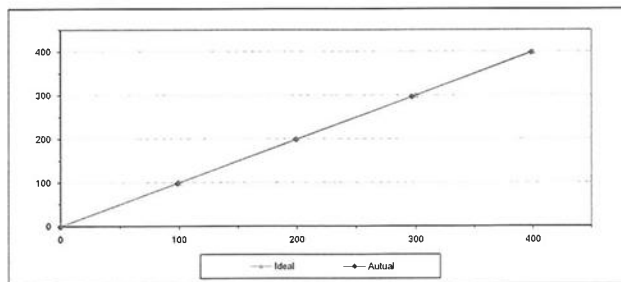
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FORM NO. F-06-056 REVISION NO. - ISSUE DATE 02/04/12



## MULTIPOINT CALIBRATION REPORT

Calibration Date	4-Jan-24	Equipment Name	SO2 Analyzer
Manufacturer	HORIBA	Model	APSA-370
Serial No.	VABF9LSH	Equipment ID	RYG_FS0460
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	56.3	Cylinder No.	GN0027222
Cylinder Pressure (psi)	1800	Certified By	Airgas Inc.
Certified Date	9-Feb-22	Expired Date	9-Feb-30

Point	CALIBRATION RESULTS			
	Ideal	Actual	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	98.70	-1.30	-1.30
2	200.00	198.80	-1.20	-0.60
3	300.00	298.50	-3.50	-1.17
4	400.00	398.30	-1.70	-0.42
AVERAGE (%)				-0.68



Calibrated By

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

Approved By

(Mr.Sarayuth Jittrantont)  
Assistant General Manager

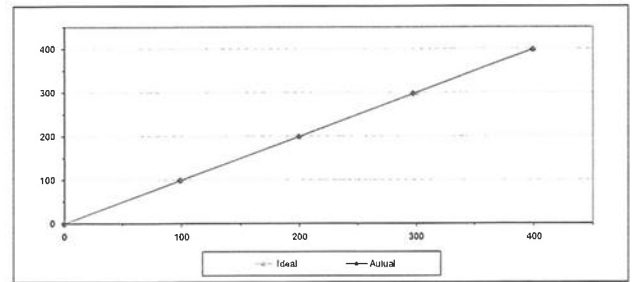
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FORM NO. F-06-056 REVISION NO. - ISSUE DATE 02/04/12



## MULTIPOINT CALIBRATION REPORT

Calibration Date	4-Jan-24	Equipment Name	SO2 Analyzer
Manufacturer	Teledyne API	Model	T100
Serial No.	1772	Equipment ID	RYG_FS0254
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	56.3	Cylinder No.	GN0027222
Cylinder Pressure (psi)	1800	Certified By	Airgas Inc.
Certified Date	9-Feb-22	Expired Date	9-Feb-30

Point	CALIBRATION RESULTS			
	Ideal	Actual	Error	%Error
ZERO	0.00	0.05	0.05	0.05
1	100.00	99.10	-0.90	-0.90
2	200.00	199.60	-0.40	-0.20
3	300.00	297.50	-2.50	-0.83
4	400.00	398.90	-1.10	-0.28
AVERAGE (%)				-0.43



Calibrated By

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

Approved By

(Mr.Sarayuth Jittrantont)  
Assistant General Manager

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







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## CERTIFICATE OF CALIBRATION

Certificate No. CL-006-66  
Page 1 of 2

Equipment Name: Data Logger with Temperature  
Sensor  
Manufacturer: Novolynx  
Model: 110 WS 25DL-D  
Serial No.: A5789  
ID No.: RYG\_FS0531

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

Received date: 16 Jan 2023  
Calibration date: 18 Jan 2023  
Issue date: 20 Jan 2023

Reference Used During Calibration  
1. Standard Temperature Probe Model: STS-100 A500,  
Serial No.: 667682-09, Due date: 23 Mar 2023  
2. Digital Temperature Indicator Model: DTI-1000-A MK  
II, Serial No.: 671407-00591 Due date: 22 July 2023

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

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

Traceability  
The measurement results are traceable to the  
international system of units (SI) through National  
Institute of Metrology (NIMT) Certificate  
number: TT-0034-22, Certificate number: ER-0092-  
22

Calibrated by  
☐ Mr. Sorawit Thachalad  
☒ Miss Jitraporn Lertsomphol

Approved Signatory: *Ms. P. Booncharoen*  
Mr. Pinyo Booncharoen  
Calibration Department Manager

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BEEN OBTAINED IN WRITING FROM THE LABORATORY.



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Certificate No. CL-006-66  
Page 2 of 2

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

Function:  
This equipment was connected with temperature sensor Model: HMP60 S/N: T0210901.

Dimension : Diameter 12 mm. Length 80 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
60	20.067	19.6	-0.3	0.099
60	25.065	24.6	-0.5	0.099
60	30.052	29.5	-0.6	0.099
60	35.047	34.5	-0.5	0.099
60	40.038	39.3	-0.7	0.099

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

★ End of Certificate ★



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## CERTIFICATE OF CALIBRATION

Calibration No. : RH 06012023  
Page 1 of 1 Pages

Measurement Item : Relative humidity with data logger  
Manufacturer : Novolynx  
Model/Type : 110 WS 25DL-D  
Serial Number : A5789  
ID No. : RYG\_FS0531  
Customer : ALS laboratory group (Thailand) Co., Ltd.  
104 Phatthanaikan 40, Phatthanaikan Rd., Khwaeng Suan Luang, Khet Suan Luang, Bangkok  
10250 Thailand.

Environmental Condition:  
The measurement was carried out in an ambient temperature of (26±3)°C, and relative humidity of (60±15)%.

Measurement Method:  
Unit Under Calibration (UUC) was calibrated by comparison method with standard thermo hygrometer in the humidity gener-  
ator chamber to determine the errors.

Traceability:  
This instrument was calibrated using standard equipment whose accuracy is traceability through National Institute of  
Standards and Technology to the international system of units (SI) via MCS Calibration, Inc. Certificate number:  
20314-101, Due date: Mar 14, 2023.

Measurement Date : Jan 18, 2023  
Issued Date : Jan 20, 2023

Measurement Results:  
This equipment was connected with Incoor air quality probe and Displayed (IUI) on display. Model: HMP60, Serial num-  
ber: T0210901.  
Calibration was performed in the range of 20%RH to 80%RH

The results of calibration are reported in table below

Determined (%RH)	Standard (%RH)	UUC (%RH)	Error (%RH)	Uncertainty (%RH)
20	20.03	16.0	-2.0	0.51
50	50.24	47.8	-2.4	0.51
80	80.19	77.3	-2.9	0.51

Performed by  
☐ Mr. Sorawit Thachalad  
☒ Miss Jitraporn Lertsomphol



Approved Signatory: *Ms. P. Booncharoen*  
Mr. Pinyo Booncharoen  
Calibration Department Manager

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HAS BEEN OBTAINED IN WRITING FROM THE LABORATORY



JIRANATEE ASSOCIATES CO., LTD.  
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10250 Thailand.  
Tel: (66) 02-8680812#13 Fax: (66) 02-8680860  
Email: jiranatee@jiranatee.com  
Website: www.jiranatee.com

Accredited calibration laboratory  
ISO/IEC 17025:2017  
MSC 154-TS 17025  
CALIBRATION 0367

Air speed measurement laboratory  
Calibration services department

## CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

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

Cup anemometer  
Novolynx  
Sensor: WS-02FA  
Data logger: 110 WS 25DL-D  
Sensor: WS0 A5590  
Data logger: A5789  
RYG\_FS0531  
New item  
ALS laboratory group (Thailand) Co., Ltd.  
104 Phatthanaikan 40, Phatthanaikan Rd., Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand

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

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:  
Temperature : 23.0 ± 3.0 °C  
Relative Humidity : 55.0 ± 15.0 %RH  
Atmospheric Pressure : 1010 ± 1.0 hPa

PLACE OF CALIBRATION : Diffuse-type wind tunnel of Jiranatee Associates Co., Ltd.

CALIBRATION CONDITIONS  
Wind tunnel cross-section area : 900 cm<sup>2</sup>  
Wind direction frontal area : 100 cm<sup>2</sup>  
Diameter of measuring probe : 12 mm  
Blockage ratio of test object : 0.111 [-]

Preconditioning : 24 hours at ambient conditions.  
Measurement Condition : The average values during measurement are (24.4) °C, (41.8) %RH and (1011.5) hPa.

### TABULATION OF RESULTS

The table on next page give the measurement values

Calibrated by  
☒ Mr. Sorawit Thachalad  
☒ Miss Jitraporn Lertsomphol



Approved signatory: *Ms. P. Booncharoen*  
Mr. Pinyo Booncharoen  
Calibration Department Manager

Remarks:  
1. Wind tunnel cross-section area of the wind tunnel.  
2. Applied cross-section area of the tested object include measuring probe.  
3. Diameter of measuring probe.  
4. Ratio 100%

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Certificate Number

CD-015-66

Page 2 of 2 Pages

MEASUREMENT RESULTS<sup>1</sup>

The cup anemometer, Unit Under Calibration (UUC) was exercised at 10 m/s for 5 minutes prior to calibration being performed. The standard air velocity 0.5 m/s to 5 m/s was calculated by a standard air velocity transducer and above 5 m/s to 30 m/s was calculated by a pitot tube with precision differential pressure meter which was installed 40 mm and 303 mm respectively away from wind tunnel nozzle. UUC was installed at center of the test section. The calibration was carried out under both rising and falling air velocity in the range of 1 m/s to 16 m/s at calibration interval of 1 m/s. The results of calibration and associated measurement uncertainties are reported in the table below.

$V_{ref}$ (m/s)	Temp. wind tunnel (°C)	Temp. room (°C)	$V_{UUC}$ (m/s)	Error (m/s)	$U$ (k=2) (m/s)
1.023	24.30	24.40	0.5	-0.1	0.31
2.025	24.50	24.40	1.5	-0.1	0.31
2.998	24.40	24.40	2.5	-0.1	0.31
4.109	24.34	24.40	4.0	0.1	0.31
5.03	24.32	24.40	4.9	-0.1	0.31
6.01	24.32	24.40	5.9	-0.1	0.31
7.05	24.24	24.40	7.0	0.1	0.31
8.17	24.14	24.40	8.0	-0.2	0.31
9.10	24.20	24.40	9.0	-0.1	0.31
10.68	24.10	24.40	9.9	-0.1	0.31
11.14	24.20	24.40	11.0	-0.1	0.31
12.13	24.10	24.40	12.0	-0.2	0.31
13.10	24.14	24.40	13.0	-0.2	0.31
14.23	24.10	24.40	14.0	-0.2	0.31
15.33	24.10	24.40	15.1	-0.2	0.31
16.29	24.10	24.40	16.1	-0.2	0.32

## Remark:

<sup>1</sup> Calibration results only count for the tested circumstances and environmental condition during which calibration took place.

<sup>2</sup> Velocity of standard

<sup>3</sup> Velocity of Unit Under Calibration

## PHOTO OF CALIBRATION SET UP



Calibration set up of the cup anemometer calibration in the wind tunnel of Jiranatee Associates Co., Ltd. The cup anemometer shown may differ from the calibrated one. Remark: The position of the set up is not true as shown in the photograph.



**J NAC**  
JIRANATEE ASSOCIATES CO., LTD.

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Accredited calibration laboratory  
ISO/IEC 17025:2017  
NAC 10175-17025  
CALIBRATION 0367

Air speed measurement laboratory  
Calibration services department

Certificate Number

CD 015 66

## CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

## MEASUREMENT ITEM

Wind Direction Sensor

## MANUFACTURER

Novatyna

## MODEL/TYPE

Sensor WS 02FA

## SERIAL NUMBER

Data logger: 110-WS-25DL-D

## ID NUMBER

Sensor: WSD-A5980

## CONDITION AS RECEIVED

Data logger: A5980

## CUSTOMER

RYG\_F50649

## RECEIVED DATE

16 Jun 2023

## MEASUREMENT DATE

20 Jun 2023

## ISSUE DATE

20 Jun 2023

## ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follows

Temperature: 23.0 ± 3.0 °C

Relative Humidity: 55.0 ± 1.0 %RH

Atmospheric Pressure: 1010 ± 10 hPa

## PLACE OF CALIBRATION

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

## CALIBRATION CONDITION

Wind tunnel cross-section area<sup>1</sup>: 900 cm<sup>2</sup>Wind direction frontal area<sup>2</sup>: 120 cm<sup>2</sup>Diameter of mounting pipe<sup>3</sup>: 143 mmBlockage ratio of test object<sup>4</sup>: 0.143 (-)

## Preconditioning

24 hours at ambient conditions

## Measurement Condition

The average values during measurement are 124.3°C, (47.4) %RH and 1010.0 hPa

## TABULATION OF RESULTS:

The table on next page give the measured values

## Calibrated by

1) Mr. Sarawit Thacholap

2) Mr. Jiraporn Lertsonghol



## Approved Signatory

Mr. Pannya Booncharoen  
Calibration Department Manager

## Remark:

<sup>1</sup> Inside cross-section area of the wind tunnel

<sup>2</sup> Frontal cross-section area of the tested object inside mounting pipe

<sup>3</sup> Diameter of mounting pipe

<sup>4</sup> Ratio to

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Certificate Number

CD-015-66

Page 2 of 2 Pages

MEASUREMENT RESULTS<sup>1</sup>

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

Air speed m/s	D <sub>100</sub> Degree (°)	D <sub>100</sub> Degree (°)	Error Degree (°)	U (k=2) Degree (°)
	0.000	0	0	1.0
	45.000	43	-2	3.0
	90.000	87	-3	3.0
	135.000	133	-2	1.0
5.02	180.000	180	0	1.0
	225.000	226	1	1.0
	270.000	272	2	1.0
	315.000	318	3	1.0

## Remark:

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

<sup>2</sup> Direction of standard

<sup>3</sup> Direction of Unit Under Calibration

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



**J NAC**  
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Tel: (66) 02-8680812-13 Fax: (66) 02-8680860 www.jiranatee.com



## CERTIFICATE OF CALIBRATION

Certificate No.: CT025-66  
Page 2 of 2

## Equipment Name: Data Logger with Temperature Sensor

## Manufacturer: Novatyna

## Model: 110-WS-25DL-D

## Serial No.: A5980

## ID No.: RYG\_F50649

## Customer

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

## Received date: 16 Jun 2023

## Calibration date: 20 Jun 2023

## Issue date: 22 Jun 2023

## Reference Used During Calibration

1. Standard Temperature Probe Model: STS-100 A500.  
Serial No.: 667822-09, Due date: 28 Mar 2024  
2. Digital Temperature Indicator Model: DTI-1000-A MK II, Serial No.: 671407-00591 Due date: 22 July 2023

## Calibration Condition

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

## Calibration Procedure

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

## Traceability

The measurement results are traceable to the international system of units (SI) through National Institute of Metrology (NIMT), Certificate number: TT-0036-23, Certificate number: ER-0092-22

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

## Calibrated by

1) Mr. Sarawit Thacholap  
2) Miss Jiraporn Lertsonghol  
3) Mr. Ruangsak Poommit



## Approved Signatory:

Mr. Pannya Booncharoen  
Calibration Department Manager

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Certificate No.: C-025/86  
Page 2 of 2

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

#### Function:

This equipment was connected with temperature sensor Model: HMP60 S/N: V1920214.  
Dimension : Diameter 12 mm, Length 80 mm.

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

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

★ End of Certificate ★



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

## CERTIFICATE OF CALIBRATION

Calibration No.: RH-08062023  
Page 1 of 1 Page

Measurement Item : Relative humidity with data logger  
Manufacturer : Novatyns  
Model/Type : 110 WS 25DL-D  
Serial Number : A5980  
ID No : RYG\_F50649  
Customer : ALS laboratory group (Thailand) Co., Ltd.  
104 Phatthanan Rd., Phatthanan Rd., Khwaeng Suan Luang, Khet Suan Luang, Bangkok  
10250 Thailand.

Environmental Condition  
The measurement was carried out in an ambient temperature of (26±3)°C, and relative humidity of (50±15)%

Measurement Method:  
Unit Under Calibration (UUC) was calibrated by comparison method with standard chilled mirror hygrometer model: 16d-3 in the humidity generator chamber to determine the errors.

Traceability  
This instrument was calibrated using standard equipment whose accuracy is traceability through National Institute of Standards and Technology to the international system of units (SI) via MCS Calibration, Inc. Certificate number: 200926-001, Due date: Sep. 26, 2024.

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

#### Measurement Results:

This equipment was connected with indoor air quality probe and Displayed (UFI) on display. Model: HMP60, Serial number: V1920214  
Calibration was performed in the range of 20%RH to 80%RH

The results of calibration are reported in table below.

Determined (%RH)	Standard Reading (%RH)	UUC Reading (%RH)	Error (%RH)	Uncertainty (%RH)
26	26.04	19.3	-0.7	0.62
50	50.25	49.5	-0.8	0.62
80	80.33	80.5	0.2	0.62

Performed by:  
☐ Mr. Sorawit Thachalad  
☒ Miss Jitraporn Lertsomphol  
☐ Miss Ruangruepa Phoommit



Approved Signatory:

Mr. Parinya Booncharoen  
Calibration Department Manager

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



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NSC-TISI-TIS 17025  
CALIBRATION 0367

Pressure measurement laboratory  
Calibration services department



## CERTIFICATE OF CALIBRATION

Certificate No.: CP-003 56

Page 1 of 2 Pages

MEASUREMENT ITEM : Digital barometer  
MANUFACTURER : Novatyns  
MODEL/TYPE : Sensor: 110 WS 258P  
Data logger: 110 WS-25DL-D  
SERIAL NUMBER : Sensor: BP-A5980  
Data logger: A5980  
ID NUMBER : RYG\_F50649  
CONDITION AS-RECEIVED : New item  
CUSTOMER : ALS laboratory group (Thailand) Co., Ltd  
104 Phatthanan Rd., Phatthanan Rd., Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand  
RECEIVED DATE : 16 Jun 2023  
MEASUREMENT DATE : 20 Jun 2023  
ISSUE DATE : 20 Jun 2023

Calibration procedure:  
The pressure calibration was done by in-house calibration method by VSL-003 according to comparison method with digital pressure calibrator based on G10-01.

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

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

#### CONDITION OF THIS RESULT OF CALIBRATION:

- Reference Standard Instrument
- The UUC\* was installed in vertical orientation above reference standard instrument and center of UUC\* was used as the reference level
- Calibration conditions:
- Condition:  
Pressure Transmitter: medium  
Air (20°C, 1 bar)  
Humidity: (55±15)%  
Temperature: (23±3)°C  
Pressure: (1010±10) mbar
- The certificate is valid only to the item calibrated on date and place of calibration

Calibrated by:  
☒ Mr. Sorawit Thachalad  
☒ Miss Jitraporn Lertsomphol



Approved signatory

Mr. Parinya Booncharoen  
Calibration Department Manager

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



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NSC-TISI-TIS 17025  
CALIBRATION 0367

Pressure measurement laboratory  
Calibration services department



## CERTIFICATE OF CALIBRATION

Certificate No.: CP-003 66

Page 2 of 2 Pages

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

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

STD (mbar)	UUC* (mbar)	Error (mbar)	Uncertainty (k=2) (mbar)
950.13	950.8	0.6	0.64
970.04	970.4	0.4	0.60
990.10	990.3	0.2	0.45
1010.05	1010.1	0.0	0.37
1030.10	1029.8	-0.3	0.50
1050.08	1049.5	-0.5	0.73

Note: UUC\* Unit Under Calibration

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

\*End of certificate\*





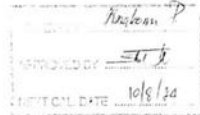


JIRANATEE ASSOCIATES CO., LTD.

Innovative Associates Co., Ltd.  
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Web site : www.jirantee.com

Accredited calibration laboratory  
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CALIBRATION 0367

Air speed measurement laboratory  
Calibration services department



Certificate Number

CL-018-66

## CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

**MEASUREMENT ITEM** : Cup anemometer  
**MANUFACTURER** : Novalys  
**MODEL/TYPE** : Sensor: WS-02F  
Data logger: 200-WS-25L8  
**SERIAL NUMBER** : Sensor :  
Data logger: AS369  
**ID NUMBER** : RYG\_P50411  
**CONDITION AS RECEIVED** : Used item  
**CUSTOMER** : ALS laboratory group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang,  
Khet Suan Luang, Bangkok 10250 Thailand

**RECEIVED DATE** : 27 Jan 2023  
**MEASUREMENT DATE** : 10 Feb 2023  
**ISSUE DATE** : 10 Feb 2023

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

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

### PLACE OF CALIBRATION

1. Wind tunnel of Jirantee Associates Co., Ltd.

### CALIBRATION CONDITIONS

Wind tunnel cross section area  $m^2$  : 900  $cm^2$   
Wind direction frontal area  $m^2$  : 100  $cm^2$   
Diameter of mounting pipe : mm  
Blockage ratio of test object : 0.143 [-]

### Preconditioning

24 hours at ambient conditions

### Measurement Condition

The average values during measurement are  $(23.0 \pm 3.0)$  °C,  $(44.8 \pm 9.4)$  %RH and  $(1010.3 \pm 10.4)$  hPa.

### TABULATION OF RESULTS:

The table on next page give the measured values.

### Calibrated by:

Mr. Somwit Thachakul  
Miss. Jiraporn Jiratanont



Approved signature

Mr. Panyaporn Booncharoen  
Calibration Department Manager

### Remark:

1. Inside cross-section area of the wind tunnel  
2. Inside cross-section area of the test object includes mounting pipe  
3. Diameter of mounting pipe  
4. Ratio of 10

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Certificate Number

CL-018-66

Page 2 of 2 Pages

### MEASUREMENT RESULTS

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

$V_{ref}$ (m/s)	Temp. wind tunnel (°C)	Temp. room (°C)	$V_{meas}$ (m/s)	Error (m/s)	U (k=2) (m/s)
0.503	23.60	23.55	0.8	-0.3	0.15
2.036	23.50	23.55	1.8	-0.2	0.16
3.044	23.50	23.55	2.8	0.2	0.18
4.147	23.58	23.55	3.9	-0.3	0.19
5.00	23.50	23.55	4.9	-0.1	0.18
5.96	23.62	23.55	5.9	0.1	0.18
7.04	23.28	23.55	7.0	-0.1	0.18
8.16	23.56	23.55	8.0	-0.2	0.19
9.20	23.26	23.55	9.0	-0.1	0.18
10.07	23.50	23.55	10.0	-0.1	0.18
11.13	23.10	23.55	11.0	-0.2	0.20
12.11	23.50	23.55	12.1	0.1	0.20
13.21	23.12	23.55	13.1	-0.1	0.22
14.25	23.36	23.55	14.0	-0.2	0.27
15.24	23.10	23.55	15.1	-0.2	0.26
16.29	23.20	23.55	16.0	0.3	0.24

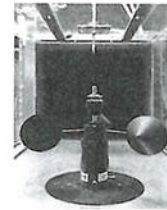
### Remarks:

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

Velocity of standard

Velocity of UHF Under Calibration

### PHOTO OF CALIBRATION SET-UP



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

\*\*\*End of Certificate of Calibration\*\*\*  
JIRANATEE ASSOCIATES CO., LTD.



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CALIBRATION 0367

Air speed measurement laboratory  
Calibration services department

Certificate Number

CL-018-66

## CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

**MEASUREMENT ITEM** : Wind Direction Sensor  
**MANUFACTURER** : Novalys  
**MODEL/TYPE** : Sensor: WS-02F  
Data logger: 200-WS-25L8  
**SERIAL NUMBER** : Sensor :  
Data logger: AS369  
**ID NUMBER** : RYG\_P50411  
**CONDITION AS RECEIVED** : Used item  
**CUSTOMER** : ALS laboratory group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang,  
Khet Suan Luang, Bangkok 10250 Thailand

**RECEIVED DATE** : 27 Jan 2023  
**MEASUREMENT DATE** : 10 Feb 2023  
**ISSUE DATE** : 10 Feb 2023

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

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

### PLACE OF CALIBRATION

1. Wind tunnel of Jirantee Associates Co., Ltd.

### CALIBRATION CONDITION

Wind tunnel cross section area  $m^2$  : 900  $cm^2$   
Wind direction frontal area  $m^2$  : 129  $cm^2$   
Diameter of mounting pipe : mm  
Blockage ratio of test object : 0.143 [-]

### Preconditioning

24 hours at ambient conditions

### Measurement Condition

The average values during measurement are  $(23.0 \pm 3.0)$  °C,  $(44.8 \pm 9.4)$  %RH and  $(1010.3 \pm 10.4)$  hPa.

### TABULATION OF RESULTS:

The table on next page give the measured values.

### Calibrated by:

Mr. Somwit Thachakul  
Miss. Jiraporn Jiratanont



Approved signature

Mr. Panyaporn Booncharoen  
Calibration Department Manager

### Remark:

1. Inside cross-section area of the wind tunnel  
2. Inside cross-section area of the test object includes mounting pipe  
3. Diameter of mounting pipe  
4. Ratio of 10

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

Certificate Number

CL-018-66

Page 2 of 2 Pages

### MEASUREMENT RESULTS

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

Air speed m/s	$D'_{ref}$ Degree (°)	$D'_{meas}$ Degree (°)	Error Degree (°)	U (k=2) Degree (°)
0.000	0	0	0	0.58
45.000	41	41	-4	0.58
90.000	87	87	-3	0.59
135.000	135	135	0	0.68
180.000	182	182	2	0.74
225.000	230	230	5	0.68
270.000	275	275	5	0.58
315.000	320	320	5	0.58

### Remarks:

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

Direction of standard

Direction of UHF Under Calibration



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

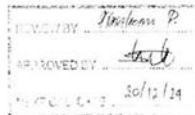


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CALIBRATION 0367

Air speed measurement laboratory  
Calibration services department



Certificate Number

CC 014 66

## CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

**MEASUREMENT ITEM** : Cup anemometer  
**MANUFACTURER** : Novatys  
**MODEL/TYPE** : Sensor: WS-02FA  
Data logger: 110 WS 25DL D  
**SERIAL NUMBER** : Sensor: WSD-A5078  
Data logger: AS078  
**ID NUMBER** : RYG\_F5046  
**CONDITION AS-RECEIVED** : New item  
**CUSTOMER** : ALS laboratory group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang,  
Khet Suan Luang, Bangkok 10250 Thailand

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

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:  
Temperature :  $23.0 \pm 3.0$  °C  
Relative Humidity :  $55.0 \pm 15.0$  %RH  
Atmospheric Pressure :  $1010 \pm 10$  hPa

**PLACE OF CALIBRATION** : Effel-type wind tunnel of Jirantee Associates Co., Ltd.

**CALIBRATION CONDITIONS** : Wind tunnel cross-section area<sup>1</sup> : 900 cm<sup>2</sup>  
Wind direction frontal area<sup>2</sup> : 100 cm<sup>2</sup>  
Diameter of mounting pipe<sup>3</sup> : - mm  
Blockage ratio of test object<sup>4</sup> : 0.113 [-]

**Preconditioning** : 24 hours at ambient conditions  
**Measurement Condition** : The average values during measurement are (24.2) °C, (44.1) %RH and (1011.4) hPa

### TABULATION OF RESULTS

The table on next page give the measured values

Calibrated by:  
Mr. Sorawat Thairakul  
Miss Jiraporn Jantamphol



Approved signature

Mr. Kanyisa Booncharoen  
Calibration Department Manager

**Remarks:**  
1. Available cross-section area of the wind tunnel  
2. Projected cross-section area of the tested object include mounting pipe  
3. Diameter of mounting pipe  
4. Ratio of test object

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Certificate Number

CC 014 66

Page 2 of 2 Pages

### MEASUREMENT RESULTS<sup>5</sup>

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

V <sub>ref</sub> (m/s)	Temp. wind tunnel (°C)	Temp. room (°C)	V <sub>uuc</sub> (m/s)	Error (m/s)	U (k=2) (m/s)
1.023	24.20	24.15	0.9	-0.1	0.31
2.026	24.02	24.15	1.9	-0.1	0.31
3.003	24.34	24.15	3.0	0.0	0.31
4.112	24.02	24.15	4.0	0.1	0.31
5.08	24.28	24.15	5.0	0.0	0.31
5.99	24.12	24.15	6.0	0.0	0.31
7.05	24.22	24.15	7.1	0.1	0.31
8.15	24.20	24.15	8.0	-0.1	0.31
9.02	24.20	24.15	9.0	-0.1	0.31
10.08	24.14	24.15	10.0	-0.1	0.31
11.14	24.18	24.15	11.1	-0.1	0.31
12.13	24.18	24.15	12.2	0.1	0.31
13.19	24.18	24.15	13.2	0.0	0.31
14.24	24.14	24.15	14.3	0.1	0.31
15.23	24.10	24.15	15.1	-0.1	0.31
16.29	24.10	24.15	16.3	0.0	0.31

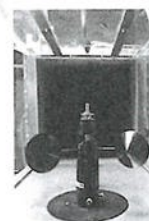
### Remarks:

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

<sup>5</sup> Value of standard

<sup>6</sup> Direction of Unit Under Calibration

### PHOTO OF CALIBRATION SET UP



Calibration set up of the cup anemometer calibration in the wind tunnel of Jirantee Associates Co., Ltd. The cup anemometer shown may differ from the calibrated one. Remarks: The proportion of the test object to the wind tunnel is kept constant



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CALIBRATION 0367

Air speed measurement laboratory  
Calibration services department



Certificate Number

CD 014 66

## CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

**MEASUREMENT ITEM** : Wind Direction Sensor  
**MANUFACTURER** : Novatys  
**MODEL/TYPE** : Sensor: WS-02FA  
Data logger: 110 WS 25DL-D  
**SERIAL NUMBER** : Sensor: WSD-A5078  
Data logger: AS078  
**ID NUMBER** : RYG\_F5046  
**CONDITION AS-RECEIVED** : New item  
**CUSTOMER** : ALS laboratory group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang,  
Khet Suan Luang, Bangkok 10250 Thailand

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

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:  
Temperature :  $23.0 \pm 3.0$  °C  
Relative Humidity :  $55.0 \pm 15.0$  %RH  
Atmospheric Pressure :  $1010 \pm 10$  hPa

**PLACE OF CALIBRATION** : Effel-type wind tunnel of Jirantee Associates Co., Ltd.

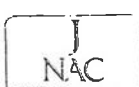
**CALIBRATION CONDITION** : Wind tunnel cross-section area<sup>1</sup> : 900 cm<sup>2</sup>  
Wind direction frontal area<sup>2</sup> : 129 cm<sup>2</sup>  
Diameter of mounting pipe<sup>3</sup> : - mm  
Blockage ratio of test object<sup>4</sup> : 0.143 [-]

**Preconditioning** : 24 hours at ambient conditions  
**Measurement Condition** : The average values during measurement are (24.3) °C, (48.2) %RH and (1009.3) hPa

### TABULATION OF RESULTS

The table on next page give the measured values

Calibrated by:  
Mr. Sorawat Thairakul  
Miss Jiraporn Jantamphol



Approved signature

Mr. Kanyisa Booncharoen  
Calibration Department Manager

**Remarks:**  
1. Available cross-section area of the wind tunnel  
2. Projected cross-section area of the tested object include mounting pipe  
3. Diameter of mounting pipe  
4. Ratio of test object

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

Certificate Number

CD 014 66

Page 2 of 2 Pages

### MEASUREMENT RESULTS<sup>5</sup>

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

Air speed m/s	D <sub>ref</sub> Degree (°)	D <sub>uuc</sub> Degree (°)	Error Degree (°)	U (k=2) Degree (°)
5.00	0.000	0	0	1.0
	45.000	43	-2	1.0
	90.000	84	-6	1.0
	135.000	123	-12	1.0
	180.000	160	0	1.0
	225.000	206	1	1.0
	270.000	272	2	1.0
	315.000	318	3	1.0

### Remarks:

<sup>5</sup> Calibration results only count for the tested circumstances and environmental conditions during which calibration took place

<sup>6</sup> Direction of standard

<sup>7</sup> Direction of Unit Under Calibration

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





63/14-15,67/35-36, Soi Petchkasem 7/71, Petchkasem Rd,  
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## CERTIFICATE OF CALIBRATION

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

Equipment Name: Data Logger with Temperature sensor  
Manufacturer: Novolynx  
Model: 110-WS-25DL-D  
Serial No.: A5978  
ID No.: RYG\_FS0648

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

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

Reference Used During Calibration  
1. Standard Temperature Probe Model: STS 100 A500,  
Serial No.: 667682-05, Due date: 26 Mar 2024  
2. Digital Temperature Indicator Model: DTI-1000-A MK  
II, Serial No.: 671407-00591 Due date: 22 July 2023

Calibration Condition  
Temperature: (23±5) °C  
Relative Humidity: (55±15)%

### Calibration Procedure

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

### Traceability

The measurement results are traceable to the  
international system of units (SI) through National  
Institute of Metrology Thailand (NIMT) Certificate  
number: TT-0038-23, Certificate number: CR 0092-  
22

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

Calibrated by

☐ Mr. Sorawit Thachalee  
☒ Miss Jitraporn Lertsomphol  
☐ Miss Ruangsri Phoommit



Approved Signatory:

Mr. Pannya Booncharoen  
Calibration Department Manager

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

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

### Function:

This equipment was connected with temperature sensor Model: HMP60 S/N: V1920213.

Dimension: Diameter 12 mm, Length 80 mm.

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

UUC\*: Unit Under Calibration

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

★ End of Certificate ★



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## CERTIFICATE OF CALIBRATION

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

Measurement Item: Relative humidity with data logger  
Manufacturer: Novolynx  
Model/Type: 110-WS-25DL-D  
Serial Number: A5978  
ID No.: RYG\_FS0648  
Customer: ALS Laboratory group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd., Khwang Suan Luang, Khet Suan Luang, Bangkok  
10250 Thailand

### Environmental Condition

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

### Measurement Method

Unit Under Calibration (UUC) was calibrated by comparison method with standard chiller mirror hygrometer model 1960  
3 in the humidity generator chamber to determine the errors.

### Traceability

This instrument was calibrated using standard equipment whose accuracy is traceability through National Institute of  
Standards and Technology to the international system of units (SI) via MCS Calibration, Inc. Certificate number: 20V26-  
601, Due date: Sep 29, 2024.

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

### Measurement Results

This equipment was connected with indoor air quality probe and Displayed (URI) on display Model IIMT60, Serial num  
ber: V1920213

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

The results of calibration are reported in table below.

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

Performed by

☐ Mr. Sorawit Thachalee  
☒ Miss Jitraporn Lertsomphol  
☐ Miss Ruangsri Phoommit



Approved Signatory:

Mr. Pannya Booncharoen  
Calibration Department Manager

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

Pressure measurement laboratory  
Calibration services department



NSC-TISI-TIS 17025  
CALIBRATION 0367

## CERTIFICATE OF CALIBRATION

Certificate No.: CP-008-56

Page 1 of 2 Pages

### MEASUREMENT ITEM

### MANUFACTURER

### MODEL/TYPE

### SERIAL NUMBER

### ID NUMBER

### CONDITION AS-RECEIVED

### CUSTOMER

Digital barometer

Novolynx

Sensor: 110-WS-25DP

Data logger: 110-WS-25DL-D

Sensor: BP-A5978

Data logger: A5978

RYG\_FS0648

Novolynx

ALS Laboratory group (Thailand) Co., Ltd.

104 Phatthanakan 40, Phatthanakan Rd.

Khwang Suan Luang, Khet Suan Luang

Bangkok 10250 Thailand

### RECEIVED DATE

### MEASUREMENT DATE

### ISSUE DATE

16 Jun 2023

20 Jun 2023

20 Jun 2023

### Calibration procedure

The pressure calibration was done by In-  
house calibration method as WI-CL-023  
according to comparison method with Digital  
pressure calibrator based on DIX-P 1.

### Traceability

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

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

### CONDITION OF THIS RESULT OF CALIBRATION:

1. Reference Standard Instrument

### Instrument

Absolute Pressure Transducer

Model

CP02500

Serial No.

<100126P

Certificate No.

MP-0205-22

Due Date

02 Dec 2023

2. Calibration effort for calibration sequence C

3. The UUC\* was installed in writing in presentation above reference standard instrument and center of UUC\* was used as the reference level

4. Calibration conditions

5. Condition

Pressure transmitting medium

Normal

Air

At (20°C ± 0.1)

1.19 kg/m<sup>3</sup>

(55-15)%

(23±5) °C

(1010±10) mbar

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

Calibrated by

☒ Mr. Sorawit Thachalee  
☐ Miss Jitraporn Lertsomphol



Approved signatory

Mr. Pannya Booncharoen  
Calibration Department Manager

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0292 MTC No. EEL, BP. KJ/0267

## 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,  
Soi 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\_FS0213)

Standards used : 1. Digital Function Synthesizer NF Electronic DF-193A S/N 132307.

2. Measuring Amplifier Bruel&amp;Kjaer 2636 S/N 1537484.

3. Programmable Attenuator Tamagawa TPA 303A S/N OF 2214.

4. Digital Multimeter Agilent 34401A S/N MY44005560.

5. Pressure Transmitter Vaisala PTB202AD S/N 10650001.

6. Audio Analyzer Keithley 2015-P S/N 4106495.

7. Condenser Microphone B&amp;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

This result is valid only for the items for which the above is stated.  
Adopting the Result Certificate and copies of the results except as full are prohibited unless written permission is obtained from the approval of TISTR.

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Changwat Pathumthani 12120, Thailand  
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Bangkok 10310, Thailand  
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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0292 MTC No. EEL, BP. KJ/0267

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

Nominal Output of Unit Under Test = 94 dB re 20  $\mu$ Pa at 1000 HzAcoustic Output in dB re 20  $\mu$ Pa, Corrected to Reference Conditions: 101.325 kPa, 23.0 °C and 50 %RH.

## 1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC 60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	94.01	0.01	± 0.10	± 0.40 dB

## 2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC 60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	1003.1	3.1	± 1.5	± 1.0%

## 3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC 60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	1.80	± 0.50	± 3.0%

Note: 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was included at level of 0.16 dB from manual.

Calibrated by :  
(Mr. Weerachai Deechaiyae)

Approved by :  
(Mr. Weerachai Deechaiyae)  
Director  
Electrical and Electronic Standards Laboratory  
Industrial Metrology and Testing Service Centre  
Ref: 2011267021900719001

End of Certificate

2 / 2

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SITHIPORN ASSOCIATES

Cert. No.: ACL24074  
Pages: 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24  
Serial No.: 01122607 / 145554 / 34373  
ID No.: RYG\_FS0019

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

Calibrated by : Naitakorn Pisuaisan

Approved by :

( Thanakul Petchurui )

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.

SITHIPORN ASSOCIATES CO., LTD.  
CALIBRATION LABORATORY

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SITHIPORN ASSOCIATES

Cert. No.: ACL24074  
Job No.: VC67AC0054  
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	LI-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL-BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL-BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL-BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAJ	34560495	AA-3002-23	14-FEB-24

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

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

3.1 National Institute of Metrology (Thailand).

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

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**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...*

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**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)
17.0

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	17.0
Flat	22.7

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

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.4	0.4	0.4	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-1.4	-1.4	-1.3	± 5.0

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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
63	0.0	-0.1	0.0	± 2.0
125	0.0	0.1	0.0	± 1.5
250	0.0	0.0	0.0	± 1.5
500	0.0	0.1	0.0	± 1.5
1000	0.0	0.0	0.0	± 1.0
2000	0.0	0.1	0.0	± 2.0
4000	0.0	0.1	0.0	± 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
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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Cert. No. : ACL24074  
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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	104.1	0.1	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.0	0.0	± 1.1
26.0	26.0	0.0	± 1.1
25.0	25.0	0.0	± 1.1

*T. Petch...*



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Cert. No. : ACL24074  
Job No. : VC67AC0054  
Pages : 7 of 8

## 8. Level linearity including the level range control

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

## 9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	108.0	0.0	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.1	0.1	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
	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 <sub>peak</sub> (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	135.7	-0.7	±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	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

*r. Pitch*

# SITHIPORN ASSOCIATES CO., LTD. CALIBRATION LABORATORY

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Tel : 02 2432 8331 Email : calibration@sithiporn.com

SITHIPORN  
associates



Cert. No. : ACL24074  
Job No. : VC67AC0054  
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	89.5	0.0	±1.5

## 12. High level stability

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

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

End of Calibration Certificate

*r. Pitch*



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0232

MTC No. EEL, BP, 171-0167

## CALIBRATION CERTIFICATE

Submitted by : A.I.S 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

Sor 1C, Bangpoo Industrial Estate, Sukhumvit Rd., A.Muang, Samutprakan 10280.

Instrument Calibrated :

Description : Sound Level Meter

Manufacturer : Rion

Model : NI-42

Serial No. : 00296518 (ID: RYG F50431)

Microphone : Type UC-52 No.66239

Preamplifier : Type NI-24 No.34375

Standards used :

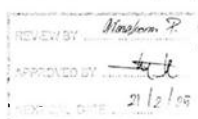
1. Band Pass Filter Wavelec 752A S/N 90010494.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871.
3. Decade Attenuator Audio AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Digital Multimeter Fluke 8520A S/N 4985007.
7. Pistophone Rion NC-72 S/N 00402446.
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Ambient Environment

Temperature : (23 ± 3) °C

Relative Humidity : (50 ± 15) %

Ambient Pressure : (101.325 ± 1.5) kPa



Date of Receipt : 24 Jan 2024

Date of Calibration : 22-28 Feb 2024

1-0

The instrument is calibrated by the standards maintained at the Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

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FORM MTC-002 Rev.4



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0232

MTC No. EEL, BP, 171-0167

9. Power Amplifier Brüel&Kjær 2706 S/N 1517650.

10. Speaker Tannoy Limited, Great Britain British Patent No. 215300.

11. Digital Multimeter Agilent 34401A S/N MY44005560.

12. Programmable Attenuator Tainagawa TPA-303A S/N 2212.

## Calibration Procedure

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2013). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

This instrument has been calibrated against standards maintained at the Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

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

Date of Calibration : 22-28 Feb 2024

2-0

The instrument is calibrated by the standards maintained at the Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

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FORM MTC-002 Rev.4

### 1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Measured value (dB)	Deviation value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
113.96	114.3	113.9	-0.1	1.0	0.30
					N/A

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 125.1 dB

### 2. Self-generated noise

#### 2.1 Normal test

Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
20.2	0.10	N/A

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

Frequency Weighting	Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
A-Weight	14.4	0.10	N/A
C-Weight	19.9	0.10	N/A
Flat	25.3	0.10	N/A

Date of Calibration : 22-28 Feb. 2024

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The results relate only to the items tested and do not extend to other items.

Afterwards the Report/Certificate and a copy of the results report in Thai and English will be provided unless otherwise permitted by the customer or TISTR.

FMBL/MTC.002 Rev.4

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### 3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
125	-0.1	0.2	0.1	1.5
1 000	0.0	0.0	0.0	1.0
8 000	-1.7	-1.7	-1.7	5.0
				0.45
				0.6
				0.7

### 4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
63	-0.1	-0.1	-0.1	2.0
125	-0.1	0.0	0.0	1.5
250	-0.1	0.0	0.0	1.5
500	-0.1	0.0	0.0	1.5
1 000	0.0	0.0	0.0	1.0
2 000	-0.1	0.0	-0.1	2.0
4 000	-0.1	0.0	0.0	3.0
8 000	0.0	0.0	0.0	5.0
				0.20
				0.6
				0.7

Date of Calibration : 22-28 Feb. 2024

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### 5. Long-term stability

Time	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	94.0				
End	94.0	0.0	0.3	0.10	0.1

### 6. Frequency and time weightings at 1 kHz

#### 6.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
A-weight	94.0	0.0	0.2	0.20	0.2
C-weight	94.0	0.0	0.2	0.20	0.2
Flat	94.1	0.1	0.2	0.20	0.2

#### 6.2 Time weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	94.0	0.0	0.1	0.20	0.2
Slow	94.0	0.0	0.1	0.20	0.2
Leq	94.0	0.0	0.1	0.20	0.2

Date of Calibration : 22-28 Feb. 2024

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### 7. Level linearity on the reference level range

Anticipated value (dB)	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
137	137.0	0.0	1.1	0.30	0.3
136	136.0	0.0	1.1	0.30	0.3
135	135.0	0.0	1.1	0.30	0.3
133	133.0	0.0	1.1	0.30	0.3
132	132.0	0.0	1.1	0.30	0.3
131	131.0	0.0	1.1	0.30	0.3
130	130.0	0.0	1.1	0.30	0.3
129	129.0	0.0	1.1	0.30	0.3
124	124.0	0.0	1.1	0.30	0.3
119	119.0	0.0	1.1	0.30	0.3
114	114.0	0.0	1.1	0.30	0.3
109	109.0	0.0	1.1	0.30	0.3
104	104.0	0.0	1.1	0.30	0.3
99	99.0	0.0	1.1	0.30	0.3
94	94.0	0.0	1.1	0.30	0.3
89	89.0	0.0	1.1	0.30	0.3
84	84.0	0.0	1.1	0.30	0.3
79	79.0	0.0	1.1	0.30	0.3
74	74.0	0.0	1.1	0.30	0.3
69	69.0	0.0	1.1	0.30	0.3
64	63.9	-0.1	1.1	0.30	0.3
59	59.0	0.0	1.1	0.30	0.3

Date of Calibration : 22-28 Feb. 2024

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Request No. 21-67/0232

MTC No. ELL, BP, 171-0167

## 7. Level linearity on the reference level range (cont.)

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
54	53.9	-0.1	1.1	0.30	0.3
49	49.0	0.0	1.1	0.30	0.3
44	43.9	-0.1	1.1	0.30	0.3
39	39.0	0.0	1.1	0.30	0.3
34	33.9	-0.1	1.1	0.30	0.3
29	28.9	-0.1	1.1	0.30	0.3
28	27.9	-0.1	1.1	0.30	0.3
27	26.9	-0.1	1.1	0.30	0.3
26	25.9	-0.1	1.1	0.30	0.3
25	24.8	-0.2	1.1	0.30	0.3

## 8. Level linearity including the level range control

At reference sound level on the reference level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
30-130	94.0	94.0	0.0	1.1	0.30	0.3

Date of Calibration : 22-28 Feb. 2024

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The results relate only to the items inspected and calibrated.

All other results are subject to the results of the inspection and calibration of the items inspected and calibrated.

FM/BLMTC-002 Rev.4

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0232

MTC No. EEL, BP, 171-0167

## 8. Level linearity including the level range control

At reference level at 5 dB greater than the under-range on a level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
30-130	25	25.0	0.0	1.1	0.30	0.3

## 9. Tone burst response

Time	Toneburst	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	200	126.0	0.0	±1.0	0.20	0.3
	2	108.9	-0.1	+1.0, -2.5	0.20	0.3
	0.25	100.0	0.0	+1.5, -5.0	0.20	0.3
Slow	200	119.5	-0.1	±1.0	0.20	0.3
	2	100.0	0.0	+1.0, -5.0	0.20	0.3

Date of Calibration : 22-28 Feb. 2024

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0232

MTC No. ELL, BP, 171-0167

## 10. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Complete cycle	125.4	125.5	0.1	3.0	0.20	0.35
Positive half cycle	124.4	124.1	-0.3	2.0	0.20	0.35
Negative half cycle	124.4	124.1	-0.3	2.0	0.20	0.35

## 11. Overload indication

Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Positive one-half cycle	Negative one-half cycle			
135.4	135.4	0.0	1.5	0.55

## 12. High-level stability

Time	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	129.0	0.0	0.3	0.10	0.1
End	129.0				

Calibrated by:   
(Mr. Pannasit Phusinsang)

Approved by:   
(Mr. Pannasit Phusinsang)

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Ref.: 2011267012400347001

End of Certificate

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Pages: 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Pre-amplifier NH-24  
Serial No.: 00597167 / 179118 / 87525  
ID No.: RYG\_FS0437

Condition As Found : GOOD

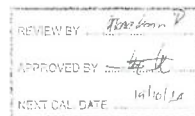
Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,  
BANGKOK, 10250 THAILAND.

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

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

Calibrated by : Naitakorn Pisutpaian

Approved by :   
( Thanakul Petchurai )



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

QF-TS12-04-04-020666



## Continuation of Calibration Certificate

Cert. No. : ACL23320  
Job No. : VC67AC0011  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

## Calibration Method :

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

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

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL_BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL_BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL_BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAI	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).

QF-TS12-04-04-020664

T. Petch...

## Continuation of Calibration Certificate

Cert. No. : ACL23320  
Job No. : VC67AC0011  
Pages : 3 of 8

## Summary of Measurement Result :

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

Note : Pass/Fail evaluation for each parameter.

will be considered together from the acceptance limit and the Maximum-permitted uncertainty of measurement.

QF-TS12-04-04-020664

T. Petch...

## Continuation of Calibration Certificate

Cert. No. : ACL23320  
Job No. : VC67AC0011  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

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

## 2. Self-generated noise

## 2.1 Normal test

Measured Value (dB)
14.6

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

Frequency Weighting	Measured value (dB)
A - weight	11.2
C - weight	17.5
Flat	23.1

## 3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.2	0.2	0.2	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	1.3	1.4	1.4	± 5.0

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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
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
Lsq	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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## 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	$\pm 1.1$
136.0	136.0	0.0	$\pm 1.1$
135.0	135.0	0.0	$\pm 1.1$
134.0	134.0	0.0	$\pm 1.1$
133.0	133.0	0.0	$\pm 1.1$
132.0	132.0	0.0	$\pm 1.1$
131.0	131.0	0.0	$\pm 1.1$
129.0	129.0	0.0	$\pm 1.1$
124.0	124.0	0.0	$\pm 1.1$
119.0	119.0	0.0	$\pm 1.1$
114.0	114.0	0.0	$\pm 1.1$
109.0	109.0	0.0	$\pm 1.1$
104.0	104.0	0.0	$\pm 1.1$
99.0	99.0	0.0	$\pm 1.1$
94.0	94.0	0.0	$\pm 1.1$
89.0	89.0	0.0	$\pm 1.1$
84.0	84.0	0.0	$\pm 1.1$
79.0	79.0	0.0	$\pm 1.1$
74.0	74.0	0.0	$\pm 1.1$
69.0	69.0	0.0	$\pm 1.1$
64.0	63.9	-0.1	$\pm 1.1$
59.0	59.0	0.0	$\pm 1.1$
54.0	53.9	-0.1	$\pm 1.1$
49.0	48.9	-0.1	$\pm 1.1$
44.0	43.9	-0.1	$\pm 1.1$
39.0	38.9	-0.1	$\pm 1.1$
34.0	34.0	0.0	$\pm 1.1$
30.0	29.9	-0.1	$\pm 1.1$
29.0	28.9	-0.1	$\pm 1.1$
28.0	27.9	-0.1	$\pm 1.1$
27.0	26.9	-0.1	$\pm 1.1$
26.0	25.9	-0.1	$\pm 1.1$
25.0	24.9	-0.1	$\pm 1.1$

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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	$\pm 1.1$

## 9. Tone burst response

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

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L <sub>peak</sub> (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.1	0.1	$\pm 3.0$
One	136.4	136.1	-0.3	$\pm 3.0$

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	$\pm 2.0$
Positive half cycle	135.4	135.2	-0.2	$\pm 2.0$
Negative half cycle	135.4	135.2	-0.2	$\pm 2.0$

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## 11. Overload indication

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

## 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	$\pm 0.3$

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

End of Calibration Certificate

QP-TS12-04-04-020664

7. Pethu



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0232

MTC No. EEL, B/L 176/0167

## CALIBRATION CERTIFICATE

Submitted by : A.I.S. Laboratory Group (Thailand) Co., Ltd.

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

Calibrated at : Electrotechnical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre

No. 1C, Bangpoo Industrial Estate, Sukhumvit Rd., A.Muang, Samutprakan 10280.

Instrument Calibrated :

Description : Sound Level Meter

Manufacturer : Rion

Model : NR-42

Serial No. : (09000071) (ID:RYG\_TS0492)

Microphone : UC-52 No.188464

Preamplifier : NH-24 No.01733

Standards used :

- Band Pass Filter Wavelec 752A S/N 90010494.
- Condenser Microphone Brüel&Kjær 4180 S/N 2889871.
- Decade Attenuator Ando AI-205 S/N 00464602.
- Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
- Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
- Digital Multimeter Fluke 8520A S/N 4985007.
- Pistonphone Rion NC-72 S/N 00402446.
- Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 24 Jan. 2024

Date of Calibration : 23 Feb. 2024 - 1 Mar. 2024

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PMR: MTC 007 B014

9. Power Amplifier Brüel&Kjær 2706 S/N 1517650.
10. Speaker Tannoy Limited, Great Britain British Patent No. 215300.
11. Digital Multimeter Agilent 34401A S/N MY44005560.
12. Programmable Attenuator Tamagawa TPA-303A S/N 2212.

#### Calibration Procedure :

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2013). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

This instrument has been calibrated against standards maintained at the Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

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

Date of Calibration : 23 Feb 2024-1 Mar 2024

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The results refer only to the items tested and do not extend to other parts of the instrument.  
Acceptance of the Report Certificate and publication of the results is subject to full and complete compliance with the provisions of the Report.

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#### 1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Measured value (dB)		Deviation value (dB)	Acceptance limit Class 2 (dB)	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
	Before adjust	After adjust				
113.94	113.7	113.9	0.0	1.0	0.30	N/A

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 124.2 dB.

#### 2. Self-generated noise

##### 2.1 Normal test

Measured value (dB)	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
17.3	0.10	N/A

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

Frequency Weighting	Measured value (dB)	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
A-Weight	12.4	0.10	N/A
C-Weight	18.1	0.10	N/A
Flat	23.9	0.10	N/A

Date of Calibration : 23 Feb 2024-1 Mar 2024

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

Frequency (Hz)	Deviation from frequency response (dB)			Acceptance limit class 2 (dB)	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
	A-weight	C-weight	Flat			
125	0.1	0.2	0.2	1.5	0.45	0.6
1 000	-0.1	-0.1	-0.1	1.0	0.45	0.6
8 000	0.3	0.3	0.2	3.0	0.45	0.7

#### 4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)			Acceptance limit class 2 (dB)	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
	A-weight	C-weight	Flat			
63	-0.1	0.0	0.0	2.0	0.20	0.6
125	0.0	0.0	0.0	1.5	0.20	0.6
250	0.0	0.0	0.0	1.5	0.20	0.6
500	0.0	0.0	0.0	1.5	0.20	0.6
1 000	0.0	0.0	0.0	1.0	0.20	0.6
2 000	0.0	0.0	0.0	2.0	0.20	0.6
4 000	0.0	0.0	0.0	3.0	0.20	0.6
8 000	0.0	0.0	0.0	5.0	0.20	0.7

Date of Calibration : 23 Feb 2024-1 Mar 2024

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#### 5. Long-term stability

Time	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (dB)	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
Begin	94.0	0.0	0.3	0.10	0.1
End	94.0				

#### 6. Frequency and time weightings at 1 kHz

##### 6.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (dB)	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
A-weight	94.0	0.0	0.2	0.20	0.2
C-weight	94.0	0.0	0.2	0.20	0.2
Flat	94.0	0.0	0.2	0.20	0.2

##### 6.2 Time weightings at 1 kHz

Frequency Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (dB)	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
Fast	94.0	0.0	0.1	0.20	0.2
Slow	94.0	0.0	0.1	0.20	0.2
Leq	94.0	0.0	0.1	0.20	0.2

Date of Calibration : 23 Feb 2024-1 Mar 2024

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7. Level linearity on the reference level range

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
136	136.0	0.0	1.1	0.30	0.3
135	135.0	0.0	1.1	0.30	0.3
134	134.0	0.0	1.1	0.30	0.3
133	133.0	0.0	1.1	0.30	0.3
132	132.0	0.0	1.1	0.30	0.3
131	131.0	0.0	1.1	0.30	0.3
130	130.0	0.0	1.1	0.30	0.3
129	129.0	0.0	1.1	0.30	0.3
124	124.0	0.0	1.1	0.30	0.3
119	119.0	0.0	1.1	0.30	0.3
114	114.0	0.0	1.1	0.30	0.3
109	109.0	0.0	1.1	0.30	0.3
104	104.0	0.0	1.1	0.30	0.3
99	99.0	0.0	1.1	0.30	0.3
94	94.0	0.0	1.1	0.30	0.3
89	89.0	0.0	1.1	0.30	0.3
84	84.1	0.1	1.1	0.30	0.3
79	79.0	0.0	1.1	0.30	0.3
74	74.0	0.0	1.1	0.30	0.3
69	69.0	0.0	1.1	0.30	0.3

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7. Level linearity on the reference level range (cont.)

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
64	64.0	0.0	1.1	0.30	0.3
59	59.0	0.0	1.1	0.30	0.3
54	53.9	-0.1	1.1	0.30	0.3
49	49.0	0.0	1.1	0.30	0.3
44	44.0	0.0	1.1	0.30	0.3
39	38.9	-0.1	1.1	0.30	0.3
34	33.9	-0.1	1.1	0.30	0.3
29	28.9	-0.1	1.1	0.30	0.3
28	27.9	-0.1	1.1	0.30	0.3
27	26.9	-0.1	1.1	0.30	0.3
26	25.9	-0.1	1.1	0.30	0.3
25	24.8	-0.2	1.1	0.30	0.3

8. Level linearity including the level range control

At reference sound level on the reference level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
30-130	94.0	94.0	0.0	1.1	0.30	0.3

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8. Level linearity including the level range control

At reference level at 5 dB greater than the under-range on a level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
30-130	35.0	35.0	0.0	1.1	0.30	0.3

9. Tone burst response

Time Weighting	Toneburst Duration, 1/s	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	200	126.0	0.0	±1.0	0.20	0.3
	2	108.9	-0.1	+1.0; -2.5	0.20	0.3
	0.25	99.9	-0.1	+1.5; -5.0	0.20	0.3
Slow	200	119.6	0.0	±1.0	0.20	0.3
	2	100.0	0.0	+1.0; -5.0	0.20	0.3
	0.25	90.8	-0.2	+1.5; -5.0	0.20	0.3

Date of Calibration : 23 Feb 2024 - 1 Mar 2024

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10. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Complete cycle	125.4	125.2	-0.2	3.0	0.20	0.35
Positive half cycle	124.4	124.2	-0.2	2.0	0.20	0.35
Negative half cycle	124.4	124.2	-0.2	2.0	0.20	0.35

11. Overload indication

Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Positive one-half cycle	135.0	0.0	1.5	0.20
Negative one-half cycle	135.0	0.0	1.5	0.20

12. High-level stability

Time	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	129.0	0.0	0.3	0.10	0.1
End	129.0	0.0	0.3	0.10	0.1

Calibrated by :

(Mr. Tawitak Jamsuan)

Approved by :

Pran Kiat  
(Mr. Pran Kiat)  
Director

Electrical and Electronic Standards Laboratory  
Industrial Metrology and Testing Service Centre

Date of Calibration : 23 Feb 2024 - 1 Mar 2024

Date of Issue : 1 Mar 2024

Ref: 2011267012400547006

End of Certificate

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This report is only valid for the items tested and is not valid for other items. The results are not valid for other items. The results are not valid for other items.

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Rev. 3, MTC 002 Rev. 4

### CALIBRATION CERTIFICATE

Submitted by : A.I.S 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,  
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., A Muang, Samutprakan 10280.

Instrument Calibrated :  
Description : Sound Level Meter  
Manufacturer : Rion  
Model : NL-42  
Serial No. : 00900072 (ID: RYG JS0493)  
Microphone : UC-52 No. 88465  
Preamplifier : N11-24 No. 01734

Ambient Environment  
Temperature :  $(23 \pm 3) ^\circ\text{C}$   
Relative Humidity :  $(50 \pm 15) \%$   
Ambient Pressure :  $(101.325 \pm 1.5) \text{ kPa}$

#### Standards used :

1. Band Pass Filter Wavelec 752A S/N 90010494.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2849871.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Digital Multimeter Fluke 8520A S/N 4950007.
7. Pistonphone Rion NC-72 S/N 00402446.
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 24 Jan. 2024

Date of Calibration : 23 Feb. 2024 - 1 Mar. 2024

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FM.BLMTC.002 Rev.4

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E-mail : mtc@tistr.or.th

Office : 16 Phatthanakan Road, Chonburi, Bangkok 10250, Thailand  
Tel. (66) 0 2579 1121 ext. 5215, 5225, 5237  
Fax (66) 0 2579 1119  
E-mail : hns@tistr.or.th

9. Power Amplifier Brüel&Kjær 2706 S/N 1517650
10. Speaker Tannoy Limited, Great Britain British Patent No. 215300.
11. Digital Multimeter Agilent 34401A S/N MY44005560.
12. Programmable Attenuator Tamsagawa TPA-303A S/N 2212.

#### Calibration Procedure :

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2013). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

This instrument has been calibrated against standards maintained at the Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

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

Date of Calibration : 23 Feb. 2024 - 1 Mar. 2024

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#### 1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Measured value (dB)	Deviation value (dB)	Acceptance limit Class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
113.91	Before adjust 114.0 After adjust 113.9	0.0	1.0	0.30	N/A

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 123.8 dB.

#### 2. Self-generated noise

##### 2.1 Normal test

Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
17.8	0.10	N/A

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

Frequency Weighting	Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
A-Weight	11.3	0.10	N/A
C-Weight	17.0	0.10	N/A
Flat	23.4	0.10	N/A

Date of Calibration : 23 Feb. 2024 - 1 Mar. 2024

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

Frequency (Hz)	Deviation from frequency response (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
125	A-weight : 0.3 C-weight : 0.4	0.4	1.5	0.6
1 000	-0.2	-0.2	1.0	0.6
8 000	-0.4	-0.5	5.0	0.7

#### 4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
63	A-weight : -0.1 C-weight : 0.0	0.0	2.0	0.6
125	-0.1	0.0	1.5	0.6
250	-0.1	0.0	1.5	0.6
500	0.0	0.0	1.5	0.6
1 000	0.0	0.0	1.0	0.6
2 000	-0.1	0.0	2.0	0.6
4 000	-0.1	0.0	3.0	0.6
8 000	0.0	0.0	5.0	0.7

Date of Calibration : 23 Feb. 2024 - 1 Mar. 2024

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Request No. 21-67/0232

MTC No. EEL, BP, 177/0167

## 5. Long-term stability

Time	Measured value	Deviated value	Acceptance limit	Uncertainty	Maximum-permitted uncertainty of measurement
	(dB)	(dB)	class 2 ( $\pm$ dB)	( $\pm$ dB)	( $\pm$ dB)
Begin	94.0	0.0	0.3	0.10	0.1
End	94.0				

## 6. Frequency and time weightings at 1 kHz

## 6.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured value	Deviated value	Acceptance limit	Uncertainty	Maximum-permitted uncertainty of measurement
	(dB)	(dB)	class 2 ( $\pm$ dB)	( $\pm$ dB)	( $\pm$ dB)
A-weight	94.0	0.0	0.2	0.20	0.2
C-weight	94.0	0.0	0.2	0.20	0.2
Flat	94.0	0.0	0.2	0.20	0.2

## 6.2 Time weightings at 1 kHz

Frequency Weighting	Measured value	Deviated value	Acceptance limit	Uncertainty	Maximum-permitted uncertainty of measurement
	(dB)	(dB)	class 2 ( $\pm$ dB)	( $\pm$ dB)	( $\pm$ dB)
Fast	94.0	0.0	0.1	0.20	0.2
Slow	94.0	0.0	0.1	0.20	0.2
Leq	94.0	0.0	0.1	0.20	0.2

Date of Calibration : 23 Feb 2024-1 Mar 2024

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The results are valid only for the device tested, calibrated or value assigned.  
Approved by the Head of Center and published in the results report. It is prohibited to use the results for other purposes without the approval of TISTR.

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Request No. 21-67/0232

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## 7. Level linearity on the reference level range

Anticipated value	Measured value	Deviated value	Acceptance limit	Uncertainty	Maximum-permitted uncertainty of measurement
(dB)	(dB)	(dB)	class 2 ( $\pm$ dB)	( $\pm$ dB)	( $\pm$ dB)
136	136.0	0.0	1.1	0.30	0.3
135	135.0	0.0	1.1	0.30	0.3
134	134.1	0.1	1.1	0.30	0.3
133	133.0	0.0	1.1	0.30	0.3
132	132.0	0.0	1.1	0.30	0.3
131	131.0	0.0	1.1	0.30	0.3
130	130.0	0.0	1.1	0.30	0.3
129	129.0	0.0	1.1	0.30	0.3
124	124.0	0.0	1.1	0.30	0.3
119	119.0	0.0	1.1	0.30	0.3
114	114.0	0.0	1.1	0.30	0.3
109	109.0	0.0	1.1	0.30	0.3
104	104.0	0.0	1.1	0.30	0.3
99	99.0	0.0	1.1	0.30	0.3
94	94.0	0.0	1.1	0.30	0.3
89	89.0	0.0	1.1	0.30	0.3
84	84.1	0.1	1.1	0.30	0.3
79	79.0	0.0	1.1	0.30	0.3
74	74.0	0.0	1.1	0.30	0.3
69	69.0	0.0	1.1	0.30	0.3

Date of Calibration : 23 Feb 2024-1 Mar 2024

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## 7. Level linearity on the reference level range (cont.)

Anticipated value	Measured value	Deviated value	Acceptance limit	Uncertainty	Maximum-permitted uncertainty of measurement
(dB)	(dB)	(dB)	class 2 ( $\pm$ dB)	( $\pm$ dB)	( $\pm$ dB)
64	64.0	0.0	1.1	0.30	0.3
59	59.0	0.0	1.1	0.30	0.3
54	53.9	-0.1	1.1	0.30	0.3
49	49.0	0.0	1.1	0.30	0.3
44	44.0	0.0	1.1	0.30	0.3
39	38.9	-0.1	1.1	0.30	0.3
34	33.9	-0.1	1.1	0.30	0.3
29	28.9	-0.1	1.1	0.30	0.3
28	27.9	-0.1	1.1	0.30	0.3
27	26.9	-0.1	1.1	0.30	0.3
26	25.9	-0.1	1.1	0.30	0.3
25	24.9	-0.1	1.1	0.30	0.3

## 8. Level linearity including the level range control

At reference sound level on the reference level range

Range	Anticipated value	Measured value	Deviated value	Acceptance limit	Uncertainty	Maximum-permitted uncertainty of measurement
	(dB)	(dB)	(dB)	class 2 ( $\pm$ dB)	( $\pm$ dB)	( $\pm$ dB)
30-130	94.0	94.0	0.0	1.1	0.30	0.3

Date of Calibration : 23 Feb 2024-1 Mar 2024

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## 8. Level linearity including the level range control

At reference level at 5 dB greater than the under-range on a level range

Range	Anticipated value	Measured value	Deviated value	Acceptance limit	Uncertainty	Maximum-permitted uncertainty of measurement
	(dB)	(dB)	(dB)	class 2 ( $\pm$ dB)	( $\pm$ dB)	( $\pm$ dB)
30-130	35.0	35.0	0.0	1.1	0.30	0.3

## 9. Tone burst response

Time Weighting	Toneburst Duration, T <sub>b</sub> (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 ( $\pm$ dB)	Uncertainty ( $\pm$ dB)	Maximum-permitted uncertainty of measurement ( $\pm$ dB)
Fast	200	126.0	0.0	$\pm$ 1.0	0.20	0.3
	2	109.0	0.0	+1.0, -2.5	0.20	0.3
	0.25	99.9	-0.1	+1.5, -5.0	0.20	0.3
Slow	200	119.6	0.0	$\pm$ 1.0	0.20	0.3
	2	100.0	0.0	+1.0, -5.0	0.20	0.3
	0.25	90.9	-0.1	+1.5, -5.0	0.20	0.3

Date of Calibration : 23 Feb 2024-1 Mar 2024

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Request No. 21-67/0232

MTC No. EEL, BP, 177/0167

#### 10. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Complete cycle	125.4	125.2	-0.2	3.0	0.20	0.35
Positive half cycle	124.4	124.1	-0.3	2.0	0.20	0.35
Negative half cycle	124.4	124.1	-0.3	2.0	0.20	0.35

#### 11. Overload indication

Measured value (dB)		Deviated value	Acceptance limit class 2	Uncertainty	Maximum-permitted uncertainty of measurement
Positive one-half cycle	Negative one-half cycle	(dB)	(±dB)	(±dB)	(±dB)
135.5	135.5	0.0	1.5	0.20	0.25

#### 12. High-level stability

Time	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	129.0	0.0	0.3	0.10	0.1
End	129.0				

Calibrated by :

(Mr. Tawikiat Iamsamran)

Approved by :

(Mr. Prasert Kiatpradit)

Electrical and Electronic Standards Laboratory

Date of Calibration : 23 Feb.2024-1 Mar.2024

Date of Issue : 1 Mar. 2024

Ref: 2011267012400347007

End of Certificate

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## SITHIPORN ASSOCIATES CO., LTD. CALIBRATION LABORATORY

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Cert. No. : ACL24008

Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42 / Microphone UC-52 / Preamplifier NI-24  
Serial No.: 01173610 / 143485 / 22619  
ID No.: RYG\_FS0389

Condition As Found : GOOD

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

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

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

Calibrated by : Nathakorn Pisutprasan

Approved by : ( 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.

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Cert. No. : ACL24008  
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 tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.  
For tests results of each items were made by observation of each Instruments display and also with SLM's display.

#### Condition of this result of calibration :

##### 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	3351A	MY53202742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL-BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL-BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL-BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KA1	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).

## SITHIPORN ASSOCIATES CO., LTD. CALIBRATION LABORATORY

451-451/1 Sirthorn Road, Bangbunru, Bangplad, Bangkok, 10700 Thailand  
Tel: +66 2433 8131 Email: calibration@sithiporn.com

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Cert. No. : ACL24008  
Job No. : VC67AC0044  
Pages : 3 of 8

#### 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

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**CALIBRATION LABORATORY**

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Cert. No. : ACL24008  
Job No. : VC67AC0044  
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 )
18.6

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

Frequency Weighting	Measured value ( dB )
A - weight	16.2
C - weight	22.1
Flat	28.0

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

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

Frequency ( Hz )	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.4	0.5	0.5	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	0.5	0.5	0.6	± 5.0

*T. Petin*

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Cert. No. : ACL24008  
Job No. : VC67AC0044  
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	0.0	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

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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 )
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	79.1	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	34.1	0.1	± 1.1
30.0	30.1	0.1	± 1.1
29.0	29.1	0.1	± 1.1
28.0	28.2	0.2	± 1.1
27.0	27.4	0.4	± 1.1
26.0	26.3	0.3	± 1.1
25.0	25.4	0.4	± 1.1

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**8. Level linearity including the level range control**

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

**9. Tone burst response**

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

**10. Peak C sound level**

Number of cycle in test signal	Anticipated Value ( dB )	Measured Value, Lepeak ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Continuous	133.0	133.0	0.0	±3.0
One	136.4	135.7	-0.7	±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. Petin*

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Job No. : VC67AC0044  
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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. Petchur*

**SITHIPORN ASSOCIATES CO., LTD.**  
**CALIBRATION LABORATORY**

451-451/1 Srinthorn Rd., Bangbunru, Bangplud Bangkok, 10700 THAILAND  
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Cert. No. : ACL23322  
Pages : 1 of 8

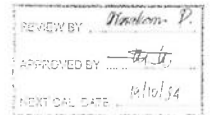
**Calibration Certificate**

**Equipment :** SOUND LEVEL METER  
**Manufacturer :** RION  
**Model :** NL-42/ Microphone UC-52 / Preamplifier NH-24  
**Serial No.:** 00597169 / 180411 / 88181  
**ID No.:** RYG\_1S0439

**Condition As Found :** GOOD

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

**Location :** -  
**Ambient Temperature :** ( 23.0 ± 3 ) °C  
**Pressure :** ( 101.3 ± 3 ) kPa  
**Relative Humidity :** ( 50.0 ± 20 ) %  
**Received Date :** 11 OCTOBER 2023  
**Calibration Date :** 19-20 OCTOBER 2023  
**Date of Issue :** 24 OCTOBER 2023



**Calibrated by :** Nathakorn Pisutpaisan

**Approved by :** *T. Petchur*  
( Thanakul Petchurai )

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

QF-TS12-04-04-020664

**SITHIPORN ASSOCIATES CO., LTD.**  
**CALIBRATION LABORATORY**

**Continuation of Calibration Certificate**

Cert. No. : ACL23322  
Job No. : VC67AC0011  
Pages : 2 of 8

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

**Calibration Method :**

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

For 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	IF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL-BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL-BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL-BP 31/0266	14-FEB-24
Programmable Attenuator	MAJ-1070	62100114	EI-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAI	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).

QF-TS12-04-04-020664

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**SITHIPORN ASSOCIATES CO., LTD.**  
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**Continuation of Calibration Certificate**

Cert. No. : ACL23322  
Job No. : VC67AC0011  
Pages : 3 of 8

**Summary of Measurement Result :**

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

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

QF-TS12-04-04-020664

*T. Petchur*



## Continuation of Calibration Certificate

Cert. No. : ACL23322  
Job No. : VC67AC0011  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

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

## 2. Self-generated noise

## 2.1 Normal test

Measured Value ( dB )
14.6

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

Frequency Weighting	Measured value ( dB )
A - weight	11.6
C - weight	17.7
Flat	23.2

## 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	0.0	0.0	0.0	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	2.0	2.1	2.1	±5.0

Q1-1S12-04-04-020664

T. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL23322  
Job No. : VC67AC0011  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

Frequency Weighting	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

Q1-1S12-04-04-020664

T. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL23322  
Job No. : VC67AC0011  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value ( dB )	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.1	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
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	25.9	-0.1	± 1.1
25.0	25.0	0.0	± 1.1

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## Continuation of Calibration Certificate

Cert. No. : ACL23322  
Job No. : VC67AC0011  
Pages : 7 of 8

## 8. Level linearity including the level range control

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

## 9. Tone burst response

Time Weighting	Tone burst duration, Tb ( ms )	Cycle	Anticipated Value ( dB )	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
SPL	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, Lcpeak ( 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	133.1	0.1	±2.0
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.3	-0.1	±2.0

Q1-1S12-04-04-020664

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## Continuation of Calibration Certificate

Cert. No. : ACL23322  
Job No. : VC67AC0011  
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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	89.7	0.0	±1.5

## 12. High level stability

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

QT-TS12-04-04-020664

T. Petch



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0232

MTC No. EEL BP. 175/0167

## 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, Soi 1/C, Bangpoo Industrial Estate, Sukhumvit Rd., A.Muang, Samutprakan 10280.

Instrument Calibrated :

Ambient Environment

Description : Sound Level Meter

Temperature :  $(23 \pm 3) ^\circ\text{C}$ 

Manufacturer : Rion

Relative Humidity :  $(50 \pm 15) \%$ 

Model : NL-42

Ambient Pressure :  $(101.325 \pm 1.51) \text{ kPa}$ 

Serial No. : 00709746 (ID:RYG, J 80491)

Microphone : UC-52 No 187332

Preamplifier : NH-24 No.01297

Standards used :

1. Band Pass Filter Wavetek 752A S/N 90010494.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871.
3. Decade Attenuator Audio AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Digital Multimeter Fluke 8520A S/N 4985007.
7. Pistonphone Rion NC-72 S/N 00402446.
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 24 Jun. 2024

Date of Calibration : 23 Feb.2024-1 Mar.2024

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This certificate is valid only for the items tested/calibrated at value only.  
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TISTR/MTC.002 Rev.4

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0232

MTC No. EEL BP. 175/0167

9. Power Amplifier Brüel&Kjær 2706 S/N 1517650.
10. Spenker Tannoy Limited, Great Britain British Patent No. 215309.
11. Digital Multimeter Agilent 34401A S/N MY44005560.
12. Programmable Attenuator Tamagawa 1PA-303A S/N 2212.

## Calibration Procedure :

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2013). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

This instrument has been calibrated against standards maintained at the Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

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

Date of Calibration : 23 Feb.2024-1 Mar.2024

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0232

MTC No. EEL BP. 175/0167

## 1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Measured value (dB)		Deviation value (dB)	Acceptance limit Class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	Before adjust	After adjust				
113.93	113.8	113.9	0.0	1.0	0.30	N/A

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 124.2 dB.

## 2. Self-generated noise

## 2.1 Normal test

Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
18.6	0.10	N/A

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

Frequency	Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Weighting			
A-Weight	14.0	0.10	N/A
C-Weight	18.9	0.10	N/A
Flat	24.0	0.10	N/A

Date of Calibration : 23 Feb.2024-1 Mar.2024

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3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
125	0.1	1.5	0.45	0.6
1 000	-0.1	1.0	0.45	0.6
8 000	1.3	5.0	0.45	0.7

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
63	-0.2	2.0	0.20	0.6
125	-0.2	1.5	0.20	0.6
250	-0.1	1.5	0.20	0.6
500	0.0	1.5	0.20	0.6
1 000	0.0	1.0	0.20	0.6
2 000	-0.1	2.0	0.20	0.6
4 000	-0.1	2.0	0.20	0.6
8 000	0.0	5.0	0.20	0.7

Date of Calibration : 23 Feb 2024 - 1 Mar 2024

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5. Long-term stability

Time	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	94.0	0.0	0.3	0.10	0.1
End	94.0				

6. Frequency and time weightings at 1 kHz

6.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
A-weight	94.0	0.0	0.2	0.20	0.2
C-weight	94.0	0.0	0.2	0.20	0.2
Flat	94.0	0.0	0.2	0.20	0.2

6.2 Time weightings at 1 kHz

Frequency Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	94.0	0.0	0.1	0.20	0.2
Slow	94.0	0.0	0.1	0.20	0.2
Leq	94.0	0.0	0.1	0.20	0.2

Date of Calibration : 23 Feb 2024 - 1 Mar 2024

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7. Level linearity on the reference level range

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
136	136.0	0.0	1.1	0.30	0.3
135	135.0	0.0	1.1	0.30	0.3
134	134.0	0.0	1.1	0.30	0.3
133	133.0	0.0	1.1	0.30	0.3
132	132.0	0.0	1.1	0.30	0.3
131	131.0	0.0	1.1	0.30	0.3
130	130.0	0.0	1.1	0.30	0.3
129	129.0	0.0	1.1	0.30	0.3
124	124.0	0.0	1.1	0.30	0.3
119	119.0	0.0	1.1	0.30	0.3
114	114.0	0.0	1.1	0.30	0.3
109	109.0	0.0	1.1	0.30	0.3
104	104.0	0.0	1.1	0.30	0.3
99	99.0	0.0	1.1	0.30	0.3
94	94.0	0.0	1.1	0.30	0.3
89	89.0	0.0	1.1	0.30	0.3
84	84.0	0.0	1.1	0.30	0.3
79	78.9	-0.1	1.1	0.30	0.3
74	74.0	0.0	1.1	0.30	0.3
69	68.9	-0.1	1.1	0.30	0.3

Date of Calibration : 23 Feb 2024 - 1 Mar 2024

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7. Level linearity on the reference level range (cont.)

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
64	63.9	-0.1	1.1	0.30	0.3
59	58.9	-0.1	1.1	0.30	0.3
54	53.9	-0.1	1.1	0.30	0.3
49	48.9	-0.1	1.1	0.30	0.3
44	43.9	-0.1	1.1	0.30	0.3
39	38.9	-0.1	1.1	0.30	0.3
34	33.9	-0.1	1.1	0.30	0.3
29	29.0	0.0	1.1	0.30	0.3
28	28.0	0.0	1.1	0.30	0.3
27	27.0	0.0	1.1	0.30	0.3
26	26.1	0.1	1.1	0.30	0.3
25	25.1	0.1	1.1	0.30	0.3

8. Level linearity including the level range control

At reference sound level on the reference level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
30-130	94.0	94.0	0.0	1.1	0.30	0.3

Date of Calibration : 23 Feb 2024 - 1 Mar 2024

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Request No. 21-67/0232

MTC No. EEL, BP, 175/0167

8. Level linearity including the level range control

At reference level at 5 dB greater than the under-range on a level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
30-130	35.0	35.0	0.0	±1.1	0.30	0.3

9. Tone burst response

Time Weighting	Toneburst Duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	200	126.1	0.1	±1.0	0.20	0.3
	2	109.0	0.0	±1.0; -2.5	0.20	0.3
	0.25	99.9	-0.1	±1.5; -5.0	0.20	0.3
Slow	200	119.6	0.0	±1.0	0.20	0.3
	2	100.0	0.0	±1.0; -5.0	0.20	0.3
	200	120.0	0.0	±1.0	0.20	0.3
SEL	2	100.0	0.0	±1.0; -2.5	0.20	0.3
	0.25	90.9	-0.1	±1.5; -5.0	0.20	0.3

Date of Calibration : 23 Feb.2024-1 Mar.2024

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Request No. 21-67/0232

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10. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Complete cycle	125.4	125.4	0.0	±3.0	0.20	0.35
Positive half cycle	124.4	124.1	-0.3	±2.0	0.20	0.35
Negative half cycle	124.4	124.1	-0.3	±2.0	0.20	0.35

11. Overload indication

Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Positive one-half cycle	135.5	0.0	±1.5	0.20
Negative one-half cycle	135.5	0.0	±1.5	0.20

12. High-level stability

Time	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	129.0	0.0	±0.3	0.10	0.1
End	129.0	0.0	±0.3	0.10	0.1

Calibrated by :

Approved by :

(Mr. Tawikan Jamsanran)

(Mr. Pravee Khunpa)

Electrical and Electronic Standards Laboratory

Date of Calibration : 23 Feb.2024-1 Mar.2024

Industrial Metrology and Testing Service Centre

Date of Issue : 1 Mar. 2024

Ref: 2011267012400347905

End of Certificate

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The results are valid only if the items tested are kept in the same condition as when calibrated. The results are valid only if the items tested are kept in the same condition as when calibrated. The results are valid only if the items tested are kept in the same condition as when calibrated.

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Cert. No. : ACL24034  
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-12A / Microphone UC-52 / Preamplifier NH-24  
Serial No.: 00623393 / 198640 / 26421  
ID No.: RYG\_FS0618

Condition As Found : GOOD

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

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

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

Calibrated by : Nithakorn Pisutpaisan

Approved by :

( Thanakul Peichurai )

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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Cert. No. : ACL24034  
Job No. : VC67AC0052  
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 Anchoic chamber and Reference Standard Instruments.  
For tests results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EELBP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EELBP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EELBP 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-42KA1	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).

( Thanakul Peichurai )

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Cert. No. : ACL24034  
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**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. Pithu*

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Job No. : VC67AC0052  
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)
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

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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
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
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

*7. Pithu*

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Cert. No. : ACL24034  
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
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
30.0	29.9	-0.1	±1.1
29.0	28.9	-0.1	±1.1
28.0	28.0	0.0	±1.1
27.0	27.0	0.0	±1.1
26.0	26.1	0.1	±1.1
25.0	24.9	-0.1	±1.1

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**8. Level linearity including the level range control**

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

**9. Tone burst response**

Time Weighing	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 : -5.0
	2	8	117.0	117.0	0.0	1.0 : -2.5
	200	800	134.0	134.1	0.1	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 : -5.0
	200	800	127.6	127.6	0.0	±1.0
	0.25	1	99.0	98.9	-0.1	1.5 : -5.0
SEL	2	8	108.0	108.0	0.0	1.0 : -2.5
	200	800	128.0	128.1	0.1	±1.0

**10. Peak C sound level**

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lepeak (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	±2.0
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

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Job No. : VC67AC0052  
Pages : 8 of 8

**11. Overload Indication**

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive	Negative	one-half cycle	-0.1
89.7	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. Petchur*

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Cert. No. : ACL24037  
Pages : 1 of 8

**Calibration Certificate**

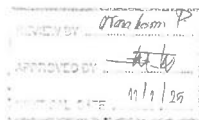
**Equipment :** SOUND LEVEL METER  
**Manufacturer :** RION  
**Model :** NL-42A / Microphone UC-52 / Preamplifier NH-24  
**Serial No.:** 00623396 / 198643 / 26424  
**ID No.:** RYG\_FS0621

**Condition As Found :** GOOD

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

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

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



Calibrated by : Nathakorn Pisutpaisan

Approved by : *T. Petchur*  
( Thanakul Petchurai )

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

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Job No. : VC67AC0052  
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	EI-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EI-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EELBP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EELBP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EELBP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAJ	34560495	AA-3002-23	14-FEB-24

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

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

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

*T. Petchur*



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Job No. : VC67AC0052  
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**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.*

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**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	18.7
Flat	23.6

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

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

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

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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
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	0.1	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
1 eq	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.*

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**7. Level linearity on the reference level range**

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	38.9	-0.1	± 1.1
34.0	33.9	-0.1	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.8	-0.2	± 1.1

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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 <sub>b</sub> (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	128.0	0.0	±1.0

**10. Peak C sound level**

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

*7. Rth*

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Pages : 8 of 8

**11. Overload indication**

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

*7. Rth*



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CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES  
554-4 PATTANAKARN ROAD SRI-THANULANG, SUANLUANG, BANGKOK 10250  
TEL: 0-2511-60829 FAX: 0-2511-60831



Cert.No.: 24CH96  
Page: 1 of 3

**Certificate of Calibration**

**Equipment :** pH Meter  
**Manufacturer :** Mettler Toledo  
**Model :** SevenCompact S220  
**Serial No. :** C104059460  
**ID No. :** RYG\_EN0183  
**Condition As-Received :** Used Item  
**Received Date :** 18 January 2024  
**Calibration Date :** 19 January 2024  
**Reference :** 2401-0579DSC-2  
**Submitted by :** ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch)  
616/10 Moo 5, T.Maenam Khu,  
A.Pluakdaeng, Rayong 21140, Thailand

**Ambient Temperature :** (25 ± 2.5) °C  
**Relative Humidity :** (50 ± 15) %  
**Calibration Procedure :** In-house method :  
- CP-CH5 by direct measurement with standard voltage calibrator and direct measurement with certified reference material (CRM)  
- CP-CH8 by comparison with temperature standard

REVIEW BY *N. Bant*  
APPROVED BY *P. Sathip*  
NEXT CAL DATE 19/01/25

Calibrated by : Warakorn Lemgagrakul

Approved by : *Sathip*  
Approved Signatory

(✓) Sathip Meangmai  
( ) Warakorn Lemgagrakul  
( ) Ponpan Paipim

Issue Date : 24 January 2024  
The Uncertainties are for a confidence probability of approximately 95%

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A 0062854



Cert.No.: 24CH96  
Page: 2 of 3

**Condition of this calibration result**

Reference Standard Instrument	Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator		54030049	130RC116	23E2602	27 Aug 2024
2) Ref. Standard Thermometer		4982054	110RC044	23I9008	26 July 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 Fluke at pH (4.7,10)

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (±mV)	Coverage factor k
	pH	mV	mV	pH		
pH Meter	4.000	177.48	177.4	4.000	0.058	2.00
S/N: C104059460	7.000	0.00	0.0	7.000	0.058	2.00
	10.000	-177.48	-177.5	10.000	0.058	2.00

*Sathip*

A 1198287



Cert.No.: 24CH86  
Page: 3 of 3

#### Calibration Results

Function: pH Measurement

Performing three buffers standard curve by using buffer nominal pH (4.01, 7.00, 10.01)

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: 3225367	4.008 6.986 9.997	4.013 6.983 9.996	176.0 2.2 -174.1	0.0054 0.0084 0.0065	2.07 2.00 2.00

#### Function: Temperature Measurement

(\*) Without adjustment

This equipment was connected with Temperature Probe,

- Model: InLab®Expert Pro-ISM

- Serial No.: 3225367

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
25.0	25.001	25.2	0.199	0.13	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 %.

-000-

*Signature*

a 1198288



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CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
53/1 PATANAKARN ROAD SOI 18, SUANLUANG, SUKHUMVIT, BANGKOK 10250  
TEL: 0-2711-1208/21 FAX: 0-2719-9481



## Certificate of Calibration

Certificate No.: 24E289  
Page: 1 of 2

Equipment: pH Meter

Manufacturer: Mettler Toledo

Model: SevenCompact S220

Serial No.: C104059460

ID No.: RYG\_EN0183

Condition As-Received: Used Item

Received Date: 18 January 2024

Calibration Date: 23 January 2024

Reference: 2401-05780SC

Ambient Temperature: ( 23 ± 2 ) °C

Relative Humidity: ( 50 ± 10 ) %

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

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

Procedure used: Calibration were conducted using calibration procedure No. CP-E17 According to EURAMET cg-15

#### Condition of this result of calibration

1. Reference standards instruments:

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Multi Product Calibrator	5500A	6315C11	E2U2300035	29 May 2024

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

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

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

-NA Calibration Co., Ltd., ANAB Accredited No. Calibration AC-2658

Calibrated by: Wuthareporn Wongchutikrue

Issue Date: 24 January 2024

Approved Signatory:

[ ] Phalinee Prabpaipal

[x] Nuntawat Khamsai

[ ] Pongtong Boonyaporn

# 0333296



Cert. No.: 24E289  
Page: 2 of 2

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

Function: DC voltage measurement	Range: 2000 mV	Standard Value (mV)	UUC* Reading (mV)	Error (mV)	Uncertainty (± μV)
		-200.0000	-200.0	0.0	66
		-150.0000	-150.0	0.0	65
		-100.0000	-100.0	0.0	63
		-50.0000	-50.0	0.0	61
		0.0000	0.0	0.0	58
		50.0000	50.0	0.0	61
		100.0000	99.9	-0.1	63
		150.0000	149.9	-0.1	65
		200.0000	199.9	-0.1	68

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

UUC\* = Unit Under Calibration.

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## Certificate of Calibration

Equipment: SPECTROPHOTOMETER

Model: DR6000

Serial No. (or ID.): 1627845 (RYG\_EN0037)

Manufacturer: HACH

Condition: In Condition

Certificate No.: C06230441

Issued Date: 19 September 2023

Job No.: WO-00005382

Page: 1 of 3

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

616/10 Moo 5 T.Maenam Khu,

A.Pluakdaeng, Rayong 21140, Thailand.

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

Calibration Place: ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch) (Wet Chemistry)

616/10 Moo 5 T.Maenam Khu,

A.Pluakdaeng, Rayong 21140, Thailand.

Calibration By: Mr.Nattapat Rungrueang

Calibration Date: 18 September 2023

The Method used: In house method, CAL-WI-24, base on ASTM E 275-08 and ASTM E 387-04

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

The standard for Wavelength Certificate No. 111583 and 111584

The standard for Photometric Certificate No. 9114984 and 111588

The standard for Stray light Certificate No. 111586 and 111585

The standard for Spectral resolution Certificate No. 111587

(Mr. Nattapat Rungrueang)

Person in charge

(Mr. Nitinun Shihwan)

Authorized signatory

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

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

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

Unit: Analytical method only  
DKSH Technology Limited  
2531 Sukhumvit Road, Bangkok, Phraechanong, Bangkok 10260  
Phone: +66 2638 1200. Email: info@calibration@dksh.com Website: www.dksh.com/calibration/thailand

Delivering Growth - in Asia and Beyond.

CAL-FM-C06-15 12 Sep 2022



### Calibration Results:

Without Adjustment

Wavelength Accuracy (nm), The spectral bandwidth of Std at 2 nm and UUC at 2 nm				
Standard Wavelength	Unit Under Calibration	Correction	Uncertainty	
418.81	418.3	0.31	0.13	
535.66	535.6	0.06	0.13	
637.96	638.3	-0.32	0.13	
748.48	748.7	-0.22	0.13	
807.03	807.4	-0.37	0.13	
Photometric Accuracy (Absorbance)				
Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
420 nm	0.0000	0.000	0.0000	0.0045
	0.2930	0.289	0.0040	0.0045
	0.5168	0.519	-0.0022	0.0045
	1.0298	1.029	0.0008	0.0045
440 nm	0.0000	0.000	0.0000	0.0045
	0.2867	0.283	0.0037	0.0045
	0.5073	0.509	-0.0017	0.0045
	1.0083	1.007	0.0013	0.0045
465 nm	0.0000	0.000	0.0000	0.0045
	0.2518	0.250	0.0016	0.0045
	0.4595	0.462	-0.0025	0.0045
	0.9334	0.933	0.0004	0.0045
546.1 nm	0.0000	0.000	0.0000	0.0045
	0.2461	0.245	0.0011	0.0045
	0.4652	0.466	-0.0008	0.0045
	0.9468	0.946	0.0008	0.0045
590 nm	0.0000	0.000	0.0000	0.0045
	0.2594	0.259	0.0004	0.0045
	0.5040	0.505	-0.0010	0.0045
	1.0032	1.002	0.0012	0.0045
635 nm	0.0000	0.000	0.0000	0.0045
	0.2579	0.257	0.0009	0.0045
	0.4971	0.497	0.0001	0.0045
	0.9720	0.971	0.0010	0.0045

บริษัท ดีเคเอส อีเซีย จำกัด  
DKSH Technology Limited  
2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260  
2533 Sukhumvit Road, Bangkok, Prachinbong, Bangkok 10260  
Phone: +66 2829 7000 Email: info.dksh@dksh.com Website: www.dksh.com/scientific-thailand

Delivering Growth - In Asia and Beyond.

CAL-FM-C06-15: 12 Sep 2022

### Calibration Results:

Without Adjustment

Photometric Accuracy (Absorbance)				
Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
235 nm	0.0000	0.000	0.0000	0.0080
	0.7355	0.737	-0.0015	0.0080
257 nm	0.0000	0.000	0.0000	0.0080
	0.8574	0.857	0.0004	0.0080
313 nm	0.0000	0.000	0.0000	0.0080
	0.2864	0.290	-0.0036	0.0080
350 nm	0.0000	0.000	0.0000	0.0080
	0.6374	0.637	0.0004	0.0080
Stray light *				
Standard: cut-off	UUC: Wavelength (nm)	UUC: Transmittance (%T)	Absorbance ( A)	
260.62 +/- 0.11 nm	260.6	1.3	1.886	
391.44 +/- 0.11 nm	391.4	1.3	1.886	
Spectral Resolution *				
Nominal Concentration 0.02 % w/v	Peak	Trough	Ratio	SBW
Standard Wavelength ( nm )	268.66	266.69	1.38	2.00
UUC: Wavelength (nm)	268.2	266.1		
Std Absorbance ( A)	0.4566	0.2780		
Absorbance ( A)	0.413	0.300		

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

The End of Certificate

บริษัท ดีเคเอส อีเซีย จำกัด  
DKSH Technology Limited  
2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260  
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Phone: +66 2829 7000 Email: info.dksh@dksh.com Website: www.dksh.com/scientific-thailand

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CAL-FM-C06-15: 12 Sep 2022

### ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: WO-0005382

ชนิดเครื่องมือ: SPECTROPHOTOMETER รุ่น: DR6000 หมายเลขเครื่อง: 1627845

ตรวจสอบ (วัน)	รายการตรวจสอบ		ตรวจสอบ (ส่ง)	หมายเหตุ	
18 Sep 2023			18 Sep 2023		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
<b>General</b>					
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. ความสมบูรณ์เครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. ความสะอาด (ช่องใส่ตัวอย่าง, ภายใน-นอกเครื่อง)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. สวิตช์ ปิด - เปิด เครื่อง (On-Off Switch)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. ปุ่มกด (Keypad)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. หน้าจอ (Display, Screen Contrast)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<b>Spectrophotometer</b>					
<input type="checkbox"/>	<input type="checkbox"/>	6. แบตเตอรี่สำรอง (Battery Backup) >= 2.5 VDC	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	7. ตัวหมุนเลือกความยาวคลื่น (Wavelength Control)	<input type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. ความยาวคลื่น (Wavelength Check)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	*
<input checked="" type="checkbox"/>	<input type="checkbox"/>	9. แหล่งกำเนิดแสง (UV < 3,000 hour)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	9.2 Hours
<input checked="" type="checkbox"/>	<input type="checkbox"/>	10. แหล่งกำเนิดแสง (Visible < 5,000 hour)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	741.5 Hours
<input checked="" type="checkbox"/>	<input type="checkbox"/>	11. ช่องวัดความยาวคลื่น (Carousal Module)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<b>pH Meter and Conductivity Meter</b>					
<input type="checkbox"/>	<input type="checkbox"/>	12. อิเล็กโทรด (Electrode and Connection Cable)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	13. วัสดุสารละลายใน Electrode (Level KCl)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	14. ฝาปิดกันปลาย Electrode (Dust Protection Hood)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	15. รางยึดอิเล็กโทรด (Stand)	<input type="checkbox"/>	<input type="checkbox"/>	
<b>Turbidimeter</b>					
<input type="checkbox"/>	<input type="checkbox"/>	16. ค่าความขุ่นที่ต่ำสุด (No Sample)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	17. ระดับการส่องสว่างของแสง (>= 2.5 ไม่นเกิน 3.0)	<input type="checkbox"/>	<input type="checkbox"/>	
<b>Automatic titrator</b>					
<input type="checkbox"/>	<input type="checkbox"/>	18. สภาพ Piston Burettes	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	19. Function Rinsing and Dosing	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	20. ระบบท่อสามทางและอุปกรณ์ประกอบ	<input type="checkbox"/>	<input type="checkbox"/>	

เงื่อนไขเพิ่มเติม: \*656.1nm=656.1nm

\*485.0nm=485.5nm

Mr.Nattapat Rungrueang  
Service Engineer

บริษัท ดีเคเอส อีเซีย จำกัด  
DKSH Technology Limited  
2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260  
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Phone: +66 2829 7000 Email: info.dksh@dksh.com Website: www.dksh.com/scientific-thailand

Delivering Growth - In Asia and Beyond.

CAL-FM-R31-03: 20 Jul 2022

### Metrological Center

SCI ECO Services Company Limited

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

Saraburi Tel: +66 3627 3095 Fax: +66 3627 3100

Bangkok Tel: +666 9205 6651, +666 8247 2360

Website: www.scieco.co.th E-Mail: calibrate@scg.com

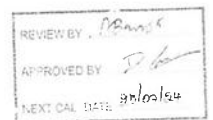


Certificate No. T230116

Page 1 of 4

### Certificate of Calibration

Equipment	: Chamber (Cooling Room)
Manufacturer	: MODULAR
Model	: IREVCOHCOO
Serial No.	: C00351459
Customer Code	: RYG_EN0184
ID No.	: T1939A5
Customer	: A.I.S.Laboratory Group (Thailand) Co.,Ltd. ( Rayong Branch)
	: 616/10 Moo 5 T.Maenam Khu,
	: A.Pluakdaeng, Rayong 21140
Customer Location	: Laboratory
Date of Receipt	: 23 January 2023
Calibrated By	: Atiphong Rongrat ( Technician )
Approved By	: Boonchai Suriyawong (Site Calibration Manager)
Date of Issue	: 07 FEB 2023



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

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

FNH 147 140 04



# Metrological Center

SCI ECO Services Company Limited

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



NSC-TISI-TIS 17025  
CALIBRATION 0244

Certificate No. T230116

Page 2 of 4

## Calibration Report

Equipment : Chamber ( Cooling Room )  
Date of Calibration : 25 January 2023  
Environment : Temperature : 23.4-24.9 °C  
Line Voltage : 221.4-230.2 V  
Relative Humidity : 55 - 65 %RH

### Condition of this results of calibration :

1. 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 E 145-94 ( Reapproved 2001 ) and AS2853-1986 ) .  
All data show below were final values and the initial data from customer request . The temperature scale used was based on ITS - 90 .

### 2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	TYPE T	TN141-TN150	T222123	5 October 2023
TC	TYPE T	TN151-TN160	T222123	5 October 2023
DATA LOGGER	34970A	T150	T222123	5 October 2023

### 3. This certificate is traceable to :

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

### 4. Condition of calibrated item : good

#### Equipment Description :

Time Constant : 1 Hour  
Fresh Air Damper : ☐ Open ☐ Min ☐ Medium ☐ Max  
☐ Close  
☒ Not Available

### 5. Adjustment :

( X ) without adjustment ( ) after adjustment

Approved By:

*[Signature]*

TN141511715-05-03



# Metrological Center

SCI ECO Services Company Limited

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

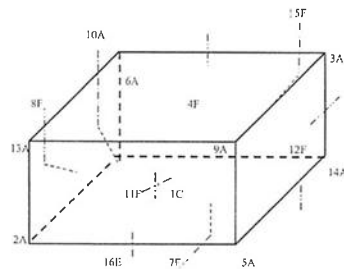


NSC-TISI-TIS 17025  
CALIBRATION 0244

Certificate No. T230116

Page 3 of 4

## Calibration Report



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

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

Approved By:

*[Signature]*

TN141511715-05-03



# Metrological Center

SCI ECO Services Company Limited

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



NSC-TISI-TIS 17025  
CALIBRATION 0244

Certificate No. T230116

Page 4 of 4

## Calibration Report

### Measurement Results

Calibration Point	Average Standard Reading at each position (°C)											
	TN141	TN142	TN143	TN144	TN145	TN146	TN147	TN148	TN149	TN150	TN151	TN152
3.0	3.07	3.16	3.15	3.19	3.45	3.47	3.21	3.35	3.54	3.45	3.24	3.34
	TN153	TN154	TN155	TN156								
	3.28	3.22	3.26	3.21								

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

The calibration result apply only the above calibrated item.

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

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

Approved By:

*[Signature]*

TN141511715-05-03

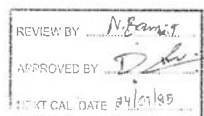


TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES : EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL. 0-2717-3000 FAX 0-2719-9484

Cert. No.: 23TW168  
Page.: 1 of 2

## Certificate of Testing

Equipment : DO Meter  
Manufacturer : YSI  
Model : 5000-115V  
Serial No. : 15E102796  
ID No. : RYG\_EN0032  
Received Date : 21 July 2023  
Test Date : 24 July 2023  
Reference : 2307-0713DSC-1  
Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.  
Rayong Branch  
616/10 Moo 5, T. Maenam, Khu, A. Pluekdaeng,  
Rayong 21140, Thailand  
Laboratory Condition : Temperature ( 25 ± 5 ) °C  
Humidity ( 50 ± 20 ) %  
Test Procedure : In - house method : CP-CH9  
by Comparison Technique with Azide Modification Method  
Tested by : Walalak Sinithean  
Approved by : *[Signature]*  
Approved Signatory  
( ) Maico Bulkrud  
( ) Sathip Meangmai  
( ) Warakom Lemgagrakul  
Issue Date : 26 July 2023



0320211



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

#### Condition of this result of calibration

##### 1. Reference Standard Instruments :

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

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

##### 2. Standard Material :-

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

**Result :** Dissolved Oxygen Meter Adjustment With Air 100 %

Dissolved Oxygen Probe No: 15E100464

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.18	8.17	0.0055

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

-000-

*Saitip*

a 1172155



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CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES  
511 PATTANAKORN ROAD SU-15, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL: 0-2715-3440-29 FAX: 0-2719-9181



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

## Certificate of Calibration

**Equipment :** DO Meter with Sensor  
**Manufacturer :** YSI  
**Model :** 5000-115V  
**Serial No. :** 15E102796  
**ID No. :** RYG\_EN0032  
**Submitted by :** ALS Laboratory Group (Thailand) Co., Ltd.  
Rayong Branch  
616/10 Moo 5 T. Maenam Khu, A. Pluakdaeng  
Rayong 21140 Thailand  
**Location :** TPA On Site Calibration Laboratory  
**Received Order :** 25 July 2023  
**Calibrated Date :** 27 July 2023  
**Ambient Temperature :** (25 ± 10) °C  
**Relative Humidity :** (50 ± 30) %  
**AC Line Voltage :** (220 ± 22) V

**Calibrated by :** Preecha Hahib

**Approved by :** *P. Hahib*  
Approved Signatory

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

**Issue Date :** 31 July 2023

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced or used in any way without the prior written approval of the head of Corporate Services & Equipment Calibration and Testing Services.

A 0053616



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

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

#### Procedure Used :-

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

The temperature scale used was based on ITS-90.

#### Condition of this result of calibration

##### 1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Digital Thermometer	2188080	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 :-** ( \* ) Without Adjustment

**Function :** Temperature measurement.

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

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty (± °C)	Coverage Factor k
20.00	100	20.011	19.91	-0.101	0.15	2.00

UUC\* : Unit Under Calibration

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

-000-

*41*

a 1159515



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES  
511 PATTANAKORN ROAD SU-15, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL: 0-2715-3440-29 FAX: 0-2719-9181



Cert. No.: 23TM962  
Page.: 1 of 3

## Certificate of Calibration

**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. Pluakdaeng, Rayong 21140 Thailand  
**Location :** BOD Room

**Received Order :** 29 May 2023  
**Calibration Date :** 29 May 2023  
**Ambient Temperature :** (26 ± 10) °C  
**Relative Humidity :** (50 ± 30) %

**Calibrated by :** Man Pattanapongpaiboon

**Approved by :** *M. Pattanapongpaiboon*  
Approved Signatory

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

**Issue Date :** 7 June 2023

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced or used in any way without the prior written approval of the head of Corporate Services & Equipment Calibration and Testing Services.

A 0054967





Equipment : Low Temp. Incubator  
Condition As-Received : Used Item  
Reference : 2305-0898OC-2  
Procedure Used :-

Cert. No. : 23TM962  
Page : 2 of 3

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).  
The temperature scale used was based on ITS-90.

#### Condition of this result of calibration

##### 1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34972A	MY57013711	22LM93	02 Jul 2023

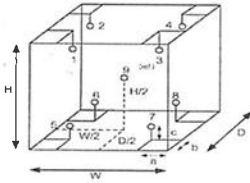
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Close



#### Probe Installation Details :

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

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	23	23
REL.Humid. ( % )	54	56
AC Supply ( Volt )	223	222

Position :	Ref. Std. ID No. :
1	18-18RTD-01
2	18-18RTD-02
3	18-18RTD-03
4	18-18RTD-04
5	18-18RTD-05
6	18-18RTD-10
7	18-18RTD-07
8	22-18RTD-06
9 (ref)	18-18RTD-08

a 1165130



Equipment : Low Temp. Incubator  
Condition As-Received : Used Item  
Reference : 2305-0898OC-2  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Close

Cert. No. : 23TM962  
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
20.0	20.0	20.0	0.019	0.72	1.0	2

Calibration Point ( °C )	Measured Temperature ( °C )									Uncertainty ( ± °C )
	1	2	3	4	5	6	7	8	9 (ref.)	
20.0	19.547	19.780	19.487	19.529	19.408	20.139	20.112	20.406	20.116	0.30

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

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

Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature 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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a 1165129



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES : EQUIPMENT CALIBRATION AND TESTING SERVICES  
53/2 PATTANAKARN ROAD SOI 18, SUKHUMVIT 21, BANGKOK 10110  
TEL : 02-261-1880 FAX : 02-261-9196



Cert.No. : 23CG4276  
Page : 1 of 2

## Certificate of Calibration

Equipment : Burette

Capacity : 50 mL

Serial No. :

ID. No. : RYG\_EN0162

Manufacturer : W/leg

Made in : Germany

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

Ambient Temperature : (20 ± 2.5) °C

Relative Humidity : (50 ± 10) %

Barometric Pressure : 759 mmHg

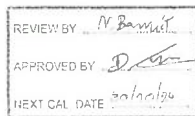
Calibration Procedure : ASTM E 542 - 01

Calibrated by : Srisuda Khamtha

Approved by :   
Approved Signatory

( ) Ponpan Palpim  
( ) Srisuda Khamtha  
(x) Sa-ngueunkam Wongsa

Issue Date : 31 October 2023



Equipment : Burette  
Received Date : 26 October 2023  
Condition As-Received : Used Item  
Calibration Date : 30 October 2023  
Reference : 2310-0815DSC-1

Cert.No. : 23CG4276  
Page : 2 of 2

#### Condition of this result of calibration

##### 1. Reference Standard Instruments :

Instruments	Model	Serial No.	ID. No.	Certificate No.	Traceability	Due date
1) Balance	XP205DR	1126143764	140RC004	23MM538	TPA	15 Sep 2024
2) Thermo-Hygrograph	THDX-CE	00016540	140EC001	23H1275	TPA	09 June 2024
3) Thermometer	-	1594592	140EC010	23I158	TPA	12 Feb 2024

This certification is traceable to SI Unit

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

3. True value is converted to true volume at the standard temperature of 20 °C

#### Calibration result :

Nominal capacity ( mL )	Reading ( mL )	Uncertainty ( ± mL )	k Factor
50	49.9641	0.010	2.00

Remark mL = cm<sup>3</sup>

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

-00-

The Uncertainties are for a confidence probability of approximately 95%

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Approved on the name of the member of the Technology Promotion Association (Thailand-Japan).

A 0060054

a 1187059



NSC-TIS-171233  
CALIBRATION 0426

SARTORIUS

# Certificate of Calibration

REVIEW BY: *Thaniat*  
APPROVED BY: *D. J. J.*  
NEXT CAL. DATE: 02/02/2025

Model Number: MSE224S-100-DU  
Description: Analytical Balance  
Serial Number: 0026207038  
ID No.: RYG\_EN0002  
Manufacturer: Sartorius  
Certificate No.: 24BC10069  
Issued Date: Friday, February 23, 2024  
Reference No.: 229196  
Page No.: 1 of 2

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

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

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

Metrological data:  
Capacity: 220 g Readability: 0.0001 g  
Ambient Conditions:  
Temperature: 24.2 °C ± 5.0 °C  
Humidity: 57.0 % RH ± 10.0 % RH  
Pressure: ±

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

**Measurement Method** UKAS Publication Ref: Lab 14  
The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM). The calibration certificate documents the traceability to National Standards, which realise the unit of measurement according to the International Standard System of Units (SI). Report of Tolerance came from list of Sartorius Metrological Specifications.

## Traceability:

Model Number	Description	Traceability	Certificate No.	Due Date
YCS011-522-00	Sartorius weight set 1mg - 5000g E2 YCS011-522-00	TCS	M2308197S	23-Aug-2025
MHB-382SD	Humidity/Barometer/Temp. Lutron MHB-382SD	DKSH	C19231845	23-Aug-2024

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

Mr. Chonchai Inthana (Technical Manager)



SOP FM 33 03 February 2022

SARTORIUS

# Certificate of Calibration

Model Number: MSE224S-100-DU  
Description: Analytical Balance  
Serial Number: 0026207038  
ID No.: RYG\_EN0002  
Manufacturer: Sartorius  
Certificate No.: 24BC10069  
Issued Date: Friday, February 23, 2024  
Reference No.: 229196  
Page No.: 2 of 2

## Calibration Results : Without Adjustment

Repeatability			Eccentricity (Off-center loading error)		
The reproducibility is the ability of a weighing instrument to display nearly identical readings under constant test conditions when the same load within a measurement series is placed repeatedly on the weighing pan in the same manner. The standard deviation is used to express reproducibility quantitatively.			The off-center loading error is yielded by the difference between the result of the load, 1g, 10g or 100g of maximum capacity, placed in the middle of the weighing pan and between each of four additional measurement points (positions defined according to OIML R76).		
Nominal Value: (Low Load)	20.0000	199.9999	Nominal value:	100	g
20 g	20.0000	200.0000	Tolerance	0.0004	g
Tolerance	0.0001 g	0.0001 g	Difference		
Nominal Value: (High Load)	19.9999	200.0000	1	0.0001	
200 g	20.0000	200.0000	2	-0.0001	
Tolerance	0.0001 g	0.0001 g	3	-0.0001	
Standard Deviation	0.00007	0.00006	4	0.0000	
			5	-0.0001	
			6	-	

## Linearity

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

Tolerance		0.0002 g		
Nominal Value	Conventional Mass Value	Displayed Value	Deviation	Uncertainty
(g)	(g)	(g)	(g)	(g)
0.01	0.0100	0.0100	0.0000	0.00018
0.05	0.0500	0.0500	0.0000	0.00018
0.1	0.1000	0.1000	0.0000	0.00018
0.5	0.5000	0.5000	0.0000	0.00018
1	1.0000	1.0000	0.0000	0.00018
5	5.0000	5.0000	0.0000	0.00018
10	10.0000	10.0000	0.0000	0.00018
20	20.0000	20.0000	0.0000	0.00024
50	50.0000	49.9999	-0.0001	0.00019
100	100.0000	100.0000	0.0000	0.00023
200	200.0000	199.9999	-0.0001	0.00032

End of Report.

SOP FM 33 03 February 2022



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL 0-2717-3000-29 FAX 0-2719-9484



NSC-TIS-171233  
CALIBRATION 0506

## Certificate of Calibration

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

Equipment: Hot Air Oven  
Manufacturer: Memmert  
Model: UFE 500  
Serial No.: G511.1572  
ID No.: RYG\_EN0010  
Submitted by: ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch)  
616/10 Moo 5 T. Maenam Khu, A. Pluakdaeng, Rayong 21140 Thailand  
Location: Oven Room  
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: *Man Pattanapongpaiboon*  
Approved Signatory

REVIEW BY: *Thaniat*  
APPROVED BY: *D. J. J.*  
NEXT CAL. DATE: 21/09/25

( ) Ponthipha Tameyakul  
( ) Unnopphol Harachet  
(x) Suwit Imjai

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  
Procedure Used:-

Cert. No.: 24TM632  
Page: 2 of 3

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD) and Thermocouple Type T.

The temperature scale used was based on ITS-90.

## Condition of this result of calibration

### 1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY57013711	23LM115	TPA	11 Jul 2024

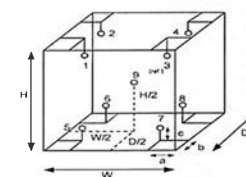
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

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

## Result of Calibration:-

Function of UUC: Temperature Source  
Fresh air setting: Close



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

Environment during calibration		
	Beginning	Finished
Temp. (°C)	27	27
REL.Humid. (%)	57	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



Equipment : Hot Air Oven  
Condition As-Received : Used Item  
Reference : 2403-0563OC-1  
Result of Calibration : ( \* ) Without Adjustment  
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	103.950	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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TEL: 0-2717-3000-29 FAX: 0-2719-9484



Cert.No. : 23CH1088  
Page : 1 of 2

## Certificate of Calibration

Equipment : Conductivity Meter  
Manufacturer : Mettler Toledo  
Model : S230  
Serial No. : B241407147  
ID No. : RYG\_EN0029  
Condition As-Received : Used Item  
Received Date : 01 September 2023  
Calibration Date : 04 September 2023  
Reference : 2309-0010DSC-7  
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd, Rayong Branch  
616/10 Moo 5, T.Maenam Khu,  
A Pluakdaeng, Rayong 21140, Thailand

Ambient Temperature : (25 ± 2.5) °C  
Relative Humidity : (50 ± 15) %  
Calibration Procedure : In-house method.  
- CP-CHS : based on direct measurement by using certified reference material (CRM)

Calibrated by : Warakorn Lemgagrakul

Approved by :   
Approved Signatory

(✓) Sathip Meangmai  
( ) Warakorn Lemgagrakul  
( ) Ponpan Palpm

Issue Date : 7 September 2023

The Uncertainties are for a confidence probability of approximately 95%

This certificate is valid only for the equipment and conditions as stated, and is not valid for other purposes.  
Approval of the head of Corporate Services 3: Equipment Calibration and Testing Services.

A 005059



Cert.No. : 23CH1088  
Page : 2 of 2

### Condition of this result of calibration

#### 1. Reference Standard Instrument >

Instrument	Serial No.	ID No.	Certificate No.	Due date
1) Thermometer	9549224	130RC003	23I435	10 Apr 2024

- This Certification is traceable to SI Through Technology Promotion Association (Thailand - Japan)

#### 2. Certified Reference Materials >

- Conductivity calibration solution, CPA chem Ltd., The measurement results are traceable to SI through CPA chem Ltd., ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

Conductivity Solution	Manufacturer	Lot No.	Exp. date
84 000 µS/cm	CPA Chem	885120	28 Mar 2024
1413.0 µS/cm	CPA Chem	913596	14 July 2024
12 880 mS/cm	CPA Chem	885123	28 Mar 2024

- Control Conductivity calibration solution temperature by Water bath (25.0 ± 0.1) °C

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

#### Calibration results

Function : Conductivity Measurement

( \* ) After Adjustment at 1413.0 µS/cm

Conductivity Electrode Serial No. : 5823251000

Standard Conductivity Solution	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement (±)	Coverage factor k
84 000 µS/cm	83.8 µS/cm	85.3 µS/cm	0.62 µS/cm	2.00
1413.0 µS/cm	1388 µS/cm	1413 µS/cm	9.2 µS/cm	2.00
12 880 mS/cm	12.41 mS/cm	12.63 mS/cm	0.086 mS/cm	2.00

Remark : - UUC\* = Unit Under Calibration  
- Cell constant = 0.545371 cm<sup>-1</sup>

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

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a 1178950



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TEL: 0-2717-3000-29 FAX: 0-2719-9484



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

## Certificate of Calibration

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 Pluakdaeng,  
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 Pailanapongpalboom

Approved by :   
Approved Signatory

( ) Ponnthippa Tameyakul  
( ) Unnopphol Harachai  
(✓) Suwit Imjai

Issue Date : 23 March 2024

The Uncertainties are for a confidence probability of approximately 95%

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



Equipment : Water Bath  
 Condition As-Received : Used Item  
 Reference : 2403-0563QC-4  
**Result of Calibration :** ( ) Without Adjustment  
 Function of UUC\* : Temperature Source

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

Calibration point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Average* Standard Reading (°C)					Uncertainty (± °C)
			1	2	3	4	5 (ref.)	
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 k
85.0	0.19	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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 TEL 0-2717-3090-24 FAX 0-2719-9184



## Certificate of Calibration

Certificate No.: 23T1767  
 Page: 1 of 2

Equipment : Digital Thermometer With Sensor

Manufacturers : Tosio

Model : 106

Serial No.: 51162978/611

ID No.: RYG\_FS0418

Condition As-Received: Used Item

Received Date: 04 October 2023

Calibration Date: 10 October 2023

Reference: 2310-0110DSC

Ambient Temperature: ( 25 ± 3 ) °C

Relative Humidity: ( 50 ± 20 ) %

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

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

### Condition of this result of calibration

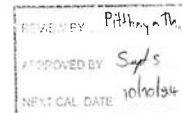
#### 1 Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Black Stack Thermometer	1560	0C45C	231600	30 May 2024
2) PRT Scanner Module	2562	A01303	231600	30 May 2024
3) Industrial Platinum Resistance Thermometer	5627-12	571971	231600	30 May 2024

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

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

- Technology Promotion Association (Thailand-Japan), NSC-ONSAC Accredited No. Calibration 0008



Calibrated by : Wasinee Sawadee  
 Issue Date : 12 October 2023

Approved Signatory :

Phalinee Prabpa :st  
 Chatchawan Khunpiuek  
 Wanlop Larpkern

B 0326170



Cert. No.: 23T1767  
 Page : 2 of 2

### Result of Calibration :

Without Adjustment  
 Function: Temperature measurement  
 Dimension of probe : Diameter 3 mm , Length 56 mm. Sheath material : Stainless Steel

Immersion Depth (mm)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (± °C)
50	25.0030	24.9	-0.1030	0.12
50	30.0038	29.9	-0.1038	0.12
50	40.0040	39.9	-0.1040	0.12

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

-00-



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
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Cert.No.: 23CH830  
 Page: 1 of 3

## Certificate of Calibration

Equipment : pH Meter

Manufacturer : Mettler Toledo

Model : Seven2Go S2

Serial No.: C221115514

ID No.: RYG\_FS0596

Condition As-Received: Used Item

Received Date: 30 June 2023

Calibration Date: 03 July 2023

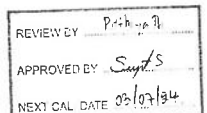
Reference : 2306-0964DSC-6

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

Ambient Temperature : (25 ± 2.5) °C

Relative Humidity : (50 ± 15) %

Calibration Procedure :



In - house method :  
 - CP-CH5 by direct measurement with standard voltage calibrator and direct measurement with certified reference material (CRM)  
 - CP-CH8 by comparison with standard thermometer

Calibrated by : Warakorn Lerngagtrakul

Approved by :

Approved Signatory

( / ) Malee Bulkruea

( ) Sathip Meangmai

( ) Warakorn Lerngagtrakul

Issue Date : 6 July 2023

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.

a 1184741

A 0055863



Cert.No.: 23CH830  
Page: 2 of 3

#### Condition of this calibration result

##### 1. Reference Standard Instrument :-

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC116	22E2769	24 Aug 2023
2) Ref. Standard Thermometer	4982054	110RC044	221306	27 Oct 2023

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

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

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.006	CPA chem	863832	28 Dec 2024
pH 6.866	CPA chem	863833	28 Dec 2023
pH 10.010	CPA chem	863835	28 Dec 2023

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

#### Calibration Results

##### Function : mV Measurement

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

Unit Under Calibration	Nominal Value		Standard Voltage Input		Actual Reading	Uncertainty of Measurement ( $\pm$ mV)	Coverage factor k
	pH	mV	mV	pH			
pH Meter	4.00	177.48	178	4.00	0.58	2.00	
S/N: C221115514	7.00	0.00	0	7.00	0.58	2.00	
	10.00	-177.48	-178	10.00	0.58	2.00	

Male

a 1169603



Cert.No.: 23CH830  
Page: 3 of 3

#### Calibration Results

##### Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH measurement ( $\pm$ )	Coverage factor k
pH Electrode	4.008	4.01	182	0.0085	2.05
S/N: 2465853	6.986	6.99	10	0.0099	2.00
	10.010	10.01	-169	0.0095	2.00

##### Function : Temperature Measurement

##### (\* ) Without adjustment

This equipment was connected with Temperature Probe;

- Model : InLab8Expert Go-ISM

- Serial No. : 2465853

Dimension of probe;

- Length : 120 mm

- Diameter : 12 mm

- Immersion Depth : 100 mm

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement ( $\pm$ °C)	Coverage factor k
25.0	25.003	25.2	0.197	0.13	2.00
30.0	30.002	30.2	0.198	0.13	2.00

Remark : - UUC\* = Unit Under Calibration

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

-00-

Male

a 1169602



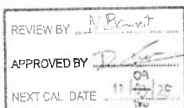
## Certificate of Calibration

Represent to Certificate of Calibration No. C29240007

Equipment:	Block Digestion Unit	Certificate No.:	C29240011
Model:	KT-20s	Issued Date:	22 March 2024
Serial No. (or ID):	5720210009/5770200073	Job No.:	WO-00020429
Manufacturer:	Gerhardt	Page:	1 of 4
Condition:	In Condition	Digestion Block:	20 holes

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

Environment Condition:	Temperature:	25 °C	$\pm$ 0.7 °C
	Humidity:	54 %RH	$\pm$ 4.1 %RH
	Voltage:	225 VAC	$\pm$ 1.7 VAC



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

Calibration By: Mr. Thanathorn Punook

Calibration Date: 11 March 2024

The Method used: In house method, base on by comparison with standard

Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through N.M. Technical Center Laboratory (NTL)  
Certificate No.: TC22/0080

Mr. Thanathorn Punook

Person in charge

Mr. Udon Srichana

Authorized signatory

This certificate is issued in the units of measurement according to the International System of Units (SI). It provides traceability of measurement to the International System of Units (SI) through the use of certified reference materials (CRM) and standard reference materials (SRM) which are calibrated against the SI units. The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by a coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM). These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The results shall not be reproduced except in full without approval of DKSH Technology Limited.

DKSH Technology Limited  
2503 Sukhumvit Road, Bangkok 10110, Thailand  
Phone: +66 2251 2502 Email: info@dksh.com Website: www.dksh.com

Delivering Growth in Asia and Beyond

CAL-FM-C2-07 20 Jul 2022



Certificate No.: C29240011 Page: 2 of 4

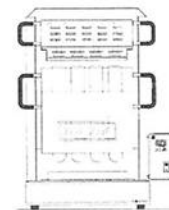
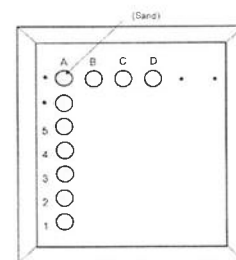


Fig. 1 Front view



Location of standard

Fig. 2 Digestion block

#### Definitions

Indicating Temperature: The average reading of indicating device which forms the integral part of the Digestion block.

Measured Temperature: The average reading of working standard at any positions of digestion.

DKSH Technology Limited  
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Phone: +66 2251 2502 Email: info@dksh.com Website: www.dksh.com

Delivering Growth in Asia and Beyond

CAL-FM-C2-01 20 Jul 2022



Calibration Results:  
Pre Calibration

Locations	Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature (°C)	Correction of UUC (°C)	Uncertainty (± °C)
A1	380	380	380	401.5	21.5	1.5
A2				401.2	21.2	1.5
A3				399.1	19.1	1.5
A4				397.8	17.8	1.5
A5				395.1	15.1	1.5
B1				396.6	16.6	1.5
B2				396.1	16.1	1.5
B3				392.9	12.9	1.5
B4				391.6	11.6	1.5
B5				390.7	10.7	1.5
C1				395.3	15.3	1.5
C2				395.6	15.6	1.5
C3				392.6	12.6	1.5
C4				391.7	11.7	1.5
C5				390.3	10.3	1.5
D1				397.6	17.6	1.5
D2				396.6	16.6	1.5
D3				395.0	15.0	1.5
D4				394.2	14.2	1.5
D5				393.6	13.6	1.5

Calibration Results:  
Without adjustment

Locations	Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature (°C)	Correction of UUC (°C)	Uncertainty (± °C)
A1	380	365	365	382.5	17.5	1.5
A2				382.4	17.4	1.5
A3				382.1	17.1	1.5
A4				379.7	14.7	1.5
A5				378.3	13.3	1.5
B1				380.1	15.1	1.5
B2				380.1	15.1	1.5
B3				376.5	13.5	1.5
B4				376.3	13.3	1.5
B5				379.1	14.1	1.5
C1				380.1	15.1	1.5
C2				380.1	15.1	1.5
C3				378.9	13.9	1.5
C4				376.2	13.2	1.5
C5				377.3	12.3	1.5
D1				380.5	15.5	1.5
D2				380.6	15.6	1.5
D3				376.1	13.1	1.5
D4				376.7	13.7	1.5
D5				377.7	12.7	1.5

The End of Certificate

ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

เลขที่ใบงาน WO-00020429

ชนิดเครื่องมือ Block Digestion Unit รุ่น KT-20s  
หมายเลขเครื่อง 5720210009/5770200073

ตรวจสอบ (วัน)		รายการตรวจเช็ค		ตรวจสอบ (ส่ง)		หมายเหตุ
ปกติ	ไม่ปกติ			ปกติ	ไม่ปกติ	
		General				
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1.	สายไฟ	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2.	การทำงานของ Main Switch	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3.	การทำงานของ Selector Key	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4.	การแสดงผล Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5.	สภาพ Hole	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	6.	สภาพฝาปิด	<input checked="" type="checkbox"/>	<input type="checkbox"/>	ไม่มี
<input checked="" type="checkbox"/>	<input type="checkbox"/>	7.	สภาพตัวเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8.	สภาวะแวดล้อม ณ สถานที่ตั้งเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

ชื่อเจ้าหน้าที่

Mr. Thanathorn Phunook  
Service Engineer



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES J: EQUIPMENT CALIBRATION AND TESTING SERVICES  
5344 PATTANAKARN ROAD 5th, SUANLUANG, SUANLUANG, BANGKOK, 10250  
TEL: 0-2713-3096-24 FAX: 0-2719-9484



Certificate of Calibration

Certificate No : 23E3924  
Page : 1 of 2

Equipment : pH Meter  
Manufacturer : Mettler Toledo  
Model : SevenExcellence  
Serial No : 8834291445  
ID No : RYG\_EN0152

Condition As-Received: Used Item  
Received Date : 08 December 2023  
Calibration Date : 14 December 2023

Reference : 2312-0151DSC  
Ambient Temperature : ( 23 ± 2 ) °C  
Relative Humidity : ( 50 ± 10 ) %

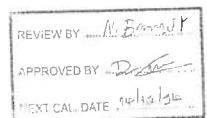
Submitted by : ALS Laboratory Group (Thailand) Co., Ltd. Rayong Branch  
616/10 Moo 5, T Maenam Kru, A Phukdaeng,  
Rayong 21140, Thailand

Procedure used : Calibration were conducted using calibration procedure No. CP-E17 according to EURAMET cg-15

Condition of this result of calibration

1. Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Multi Product Calibrator	5502A	2435802	EE-0041-23	26 Apr 2024
2. This result of calibration was made on requested at the point specified by customer.				
3. The certificate is valid only to the item calibrated on date and place of calibration.				
4. This Certification is traceable to the International System of Unit maintained through - National Institute of Metrology Thailand (NIMT)				



Calibrated by : Napachanok Prasomsophon  
Issue Date : 15 December 2023

Approved Signatory :  
[ ] Phalinnee Prabpalit  
[x] Nuntawat Khanchai  
[ ] Pongsagorn Boonyaporn



Cert. No.: 23E3924  
Page.: 2 of 2

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

Function: DC voltage measurement	Range: 2000 mV		
Standard Value	UUC* Reading	Error	Uncertainty
( mV )	( mV )	( mV )	( ± μV )
-200.0000	-199.9	0.1	68
-150.0000	-150.0	0.0	65
-100.0000	-100.0	0.0	63
-50.0000	-50.0	0.0	61
0.0000	0.0	0.0	58
50.0000	50.0	0.0	61
100.0000	100.0	0.0	63
150.0000	150.0	0.0	65
200.0000	199.9	-0.1	68

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

UUC\*= Unit Under Calibration.

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
53/2 PATTANA KAMPA ROAD SOI 12, SUKHUMVIT ROAD, BANGKOK 10250  
TEL: 0 271 8 991 38 FAX: 0 271 8 991 35



Cert.No.: 23CH1574  
Page.: 1 of 3

## Certificate of Calibration

Equipment : pH Meter  
Manufacturer : Mettler Toledo  
Model : SevenExcellence  
Serial No. : B834291445  
ID No. : RYG\_EN0152  
Condition As-Received: Used Item  
Received Date : 08 December 2023  
Calibration Date : 15 December 2023  
Reference : 2312-0161DSC-3  
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd. Rayong Branch  
616/10 Moo 5, T.Maenam Khu, A.Pluakdaeng,  
Rayong 21140, Thailand  
Ambient Temperature : (25 ± 2.5) °C  
Relative Humidity : (50 ± 15) %  
Calibration Procedure : In-house method :  
- CP-CH5 by direct measurement with standard  
voltage calibrator and direct measurement with  
certified reference material (CRM)  
- CP-CH8 by comparison with standard thermometer

Calibrated by : Warakorn Lemgagrakul

Approved by :   
Approved Signatory

( ) Sathip Meangmai  
( ) Warakorn Lemgagrakul  
(x) Ponpan Paipim

Issue Date : 19 December 2023

The Uncertainties are for a confidence probability of approximately 95%

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

A 0061696



Cert.No.: 23CH1574  
Page.: 2 of 3

### Condition of this calibration result

#### 1. Reference Standard Instrument :-

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC116	23E2802	27 Aug 2024
2) Ref. Standard Thermometer	4982054	110RC044	23I908	26 July 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	913598	14 July 2025
pH 6.986	CPA chem	931959	01 Oct 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 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	0.058	2.00
S/N : B834291445	7.000	0.00	-0.1	0.058	2.00
	10.000	-177.48	-177.5	0.058	2.00

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Cert.No.: 23CH1574  
Page.: 3 of 3

### Calibration Results

Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading ( mV )	Uncertainty of pH measurement ( ± )	Coverage factor k
pH Electrode	4.008	4.013	184.1	0.0045	2.00
S/N : 3225368	6.986	6.998	8.7	0.0084	2.00
	9.997	10.002	-164.7	0.0088	2.11

### Function : Temperature Measurement

(\*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : InLab®Expert Pro-ISM

- 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
25.0	25.003	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  $k$ , providing a level of confidence of approximately 95 %

-000-

a 1193851



Bara Scientific Co., Ltd.  
9/8 U Chu Liang Building Floor 7 Rama 4 Road  
Siam Bangkok Bangkok Thailand 10500  
Tel: 02-6324300 Fax: 02-6375496-7  
www.barscientific.com



## Certificate of Calibration

Certificate No. BSCC-UV-367/23  
Equipment UVVis Spectrophotometer  
Model UV-1800  
Manufacturer Shimadzu  
Serial No. A1145490853CD  
ID No. BKK\_EN0018  
Date of receipt 15 September 2023  
Date of calibration 15 September 2023  
Date of issue 22 September 2023

Number of Page(s) 1 of 3

REVIEW BY *Sirak P.*  
APPROVED BY *L.L.A.L.*  
NEXT CAL DATE 15/09/2024

Customer name ALS Laboratory Group (Thailand) Co., Ltd  
Address 104 Soi Phatthanakan 40 Phatthanakan Road, Phatthanakan, Suan Luang, Bangkok 10250

Temperature (23.4 - 24.7) °C (On site)  
Humidity (55.5 - 61.2) %RH (On site)

Equipment condition Good Operation

Calibration Location Organic Prep

Calibration Procedure In-house method: WI-UV-702-01 based on ASTM E275-01

Traceability Wavelength Accuracy is traceable to certificate No. 95917 and 95918  
Photometric Accuracy is traceable to certificate No. 95937 and 95924  
Stray Light is traceable to certificate No. 95908  
The above certificate are traceable to SI unit through Sarna Scientific Ltd (UKAS accredited calibration laboratory NO. 0659)

Calibrated by Mr Wanchana Janley

Approved by

Mr Kanchit Choochit  
Technical Manager

This document is valid exclusively for the calibration equipment mentioned in this report. Calibration is performed under the conditions of the report. Calibration and validity of the results are not valid for other equipment. The above certificate are traceable to SI unit through Sarna Scientific Ltd (UKAS accredited calibration laboratory NO. 0659)



Bara Scientific Co., Ltd.  
9/8 U Chu Liang Building Floor 7 Rama 4 Road  
Siam Bangkok Bangkok Thailand 10500  
Tel: 02-6324300 Fax: 02-6375496-7  
www.barscientific.com



## Certificate of Calibration

Certificate No. BSCC-UV-367/23

Number of Page(s) 2 of 3

Calibration Results:

### 1. Wavelength Accuracy

Certified Wavelength (nm)	UUC (nm)	Error (nm)	Uncertainty (±nm)
241.70	241.67	-0.03	0.18
334.02	334.03	0.01	0.18
418.53	418.59	0.06	0.18
572.99	573.14	0.15	0.18
879.41	879.21	-0.20	0.18

### 2. Photometric Accuracy (UV)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty (±A)
235	0.0000	0.0000	0.0000	0.0075
	0.7567	0.7460	-0.0007	0.0075
257	0.0000	0.0000	0.0000	0.0075
	0.8662	0.8616	-0.0046	0.0075
313	0.0000	0.0000	0.0000	0.0075
	0.2904	0.2908	0.0004	0.0075
350	0.0000	0.0001	0.0001	0.0075
	0.6429	0.6415	-0.0014	0.0075

\*CNR = Customer not request

This document is valid exclusively for the calibration equipment mentioned in this report. Calibration is performed under the conditions of the report. Calibration and validity of the results are not valid for other equipment. The above certificate are traceable to SI unit through Sarna Scientific Ltd (UKAS accredited calibration laboratory NO. 0659)

FM-UV-702-02 Rev 01 (23/01/23)

BKK\_EL0043



Bara Scientific Co., Ltd.  
9/8 U Chu Liang Building Floor 7 Rama 4 Road  
Siam Bangkok Bangkok Thailand 10500  
Tel: 02-6324300 Fax: 02-6375496-7  
www.barscientific.com



## Certificate of Calibration

Certificate No. BSCC-UV-367/23

Number of Page(s) 3 of 3

Calibration Results:

### 3. Photometric Accuracy (Visible)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty (±A)
420.0	0.0000	0.0000	0.0000	0.0042
	0.5783	0.5793	0.0010	0.0042
	0.7078	0.7024	-0.0004	0.0042
	1.0206	1.0216	0.0010	0.0042
440.0	0.0000	0.0000	0.0000	0.0042
	0.5627	0.5625	-0.0002	0.0042
	0.7459	0.7462	0.0003	0.0042
	0.9985	0.9989	0.0004	0.0042
465.0	0.0000	0.0000	0.0000	0.0042
	0.5227	0.5229	0.0002	0.0042
	0.6869	0.6873	0.0004	0.0042
	0.9497	0.9498	0.0001	0.0042
546.1	0.0000	0.0000	0.0000	0.0042
	0.5211	0.5211	0.0000	0.0042
	0.6973	0.6960	-0.0013	0.0042
	0.9958	0.9944	-0.0015	0.0042
590.0	0.0000	0.0000	0.0000	0.0042
	0.5544	0.5551	0.0006	0.0042
	0.7257	0.7246	-0.0011	0.0042
	1.0942	1.0925	-0.0017	0.0042
635.0	0.0000	0.0000	0.0000	0.0042
	0.5616	0.5612	-0.0004	0.0042
	0.9927	0.9909	-0.0018	0.0042
	1.0881	1.0866	-0.0015	0.0042

\*CNR = Customer not request

### 4. Stray Light

Standard cut-off wavelength (nm)	Unit Under Calibration(UUC) Wavelength (nm)	Transmission (%)	Absorbance (A)
200 BS40 11nm	200.55	0.9770	2.0104

The Stray light transmission reference is less than 1.0% and Stray light absorbance reference is greater than 2.00A

\*Stray Light not NSC-ONSC Accredited

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

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

This document is valid exclusively for the calibration equipment mentioned in this report. Calibration is performed under the conditions of the report. Calibration and validity of the results are not valid for other equipment. The above certificate are traceable to SI unit through Sarna Scientific Ltd (UKAS accredited calibration laboratory NO. 0659)

FM-UV-702-02 Rev 01 (23/01/23)

## Agilent Technologies

Agilent Technologies (Thailand) Limited  
9/8 U Chu Liang Building Floor 7 Rama 4 Road  
Siam Bangkok Bangkok Thailand 10500  
Tel: 02-6324300 Fax: 02-6375496-7  
www.agilent.com/thailand

Tel: +662 637 6361  
Fax: +662 632 4334  
Email: ccc-si@agilent.com  
Web: www.agilent.com/thailand

### Customer Contact:

ALS Laboratory Group (Thailand) Co., Ltd.  
Head Office  
104 Phatthanakan 40 Phatthanakan Rd  
Khwaeng Phatthanakan, Khet Suan  
TAX ID: 0105540004859  
bounced-melchom.chanattagarn@agilent.com  
227156760519

### Invoice To:

ALS Laboratory Group (Thailand) Co., Ltd.  
Head Office  
104 Phatthanakan 40 Phatthanakan Rd  
Khwaeng Phatthanakan, Khet Suan

### Delivery Site:

ALS Laboratory Group (Thailand) Co., Ltd.  
Head Office  
104 Phatthanakan 40 Phatthanakan Rd  
Khwaeng Phatthanakan, Khet Suan

Location:  
Room  
Bldg  
Lab  
Dept

### SERVICE REPORT

Customer Purchase Order Number: 70371013  
Customer Number: 70371013  
Service Request: Service Request Date:  
Service Order: 6006089207  
Service Confirmation: 6904837529

REVIEW BY *Pichakorn K.*  
APPROVED BY *Sirak P.*  
NEXT CAL DATE 04/10/2024

### Direct Inquiries to:

Contact Name: Customer Contact Center  
Contact Email: ccc-si@agilent.com  
Contact Telephone: +662 637 6363  
Contact Fax: +662 632 4334

### Agilent Technologies (Thailand) Limited Head Office

9/8 U Chu Liang Building Floor 7 Rama 4 Road  
Siam Bangkok Bangkok Thailand 10500  
Tel: 02-6324300 Fax: 02-6375496-7

District N.A. Bangkok Branch  
399 Interchange 21 Building Sukhumvit Road Klongkum New  
Sub-district: Wattana District, Bangkok 10110 Thailand  
Acc. No. 012-4452-007  
1118 Young Thai Bank PCL  
Siam Square Bv. 416/12 Rama 4 Rd. Pathumwan BKK 10330  
Thailand

Page 1 of 3



Service Instrument:

Model Number	Model Description	Serial Number	System Handle	Parent Asset
SYS-IM-7900	ICPMS 7900 System			
G8416A	SPS 4 Autosampler	AU15430722	ICP MS 7900	SYS-IM-7900
G8411A	ISIS 3 for Agilent 7900/7900/8900	JP15510227	ICP MS 7900	SYS-IM-7900
G3297A	PSC 610BT Chiller	2U15A1949	ICP MS 7900	SYS-IM-7900
G8403A	Agilent 7900 ICP-MS	JP15471165	ICP MS 7900	SYS-IM-7900

Service Items:

Item	Service/Part #	Description	Qty	Entitlement	Service Start	Service End
1000	EQO	Enterprise Operational Qualification	1.00	Agreement Entitlement - 100 % covered	06/04/2023	06/04/2023
1010	S185-5850	ICP-MS Checkout Solutions	1.00	Agreement Entitlement - 100 % covered		

Additional Information:


Service Information:

Problem Description:  
WU-S-DG-ICP MS 7900-5801143313

Service Provided:  
Test 00 control of instrument ICPMS = BKK\_EL0043 After done all instrument test all Pass.

Service Overview Code:  
Reason Code: Scheduled Service  
Diagnosis Code: Scheduled Service  
Resolution Code: Scheduled Service

Reported Hours: 6.0  
Travel Hours: 1.0

Customer Field Service Representative Name: Panthep Kurasathain  
Customer Name: Anchalee Khamjan  
Customer Signature:   
Date: 06 Apr 2023

Additional Comments:



Metrological Center

SCI ECO Services Company Limited

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


Telephone : +66 2 586 5792-4 Fax : +66 2 586 5109

Website : www.scieco.co.th E-Mail : calibrate@scg.co.th

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 Musikanwan ( Site Calibration Manager )  
Approved By :  / Sujjar Nakkared ( 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.



Metrological Center

SCI ECO Services Company Limited

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

Telephone : +66 2 586 5792-4 Fax : +66 2 586 5109

Website : www.scieco.co.th E-Mail : calibrate@scg.co.th

Certificate No. T231676

Page 2 of 6

Calibration Report

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

Condition of this results of calibration :

1. This equipment was calibrated by insert 20 standard thermocouples type T into its chamber , the other one standard thermocouples type T use for ambient temperature measurement . The calibration was done in according to WI-T20.

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

2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	TYPE T	T\21-TN30	T230014	17 January 2024
TC	TYPE T	T\31-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-IISF-IIS 17025 CALIBRATION 0244 )

4. Condition of calibrated item : good

Equipment Description :

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

5. Adjustment :

( ) without adjustment ( X ) after adjustment

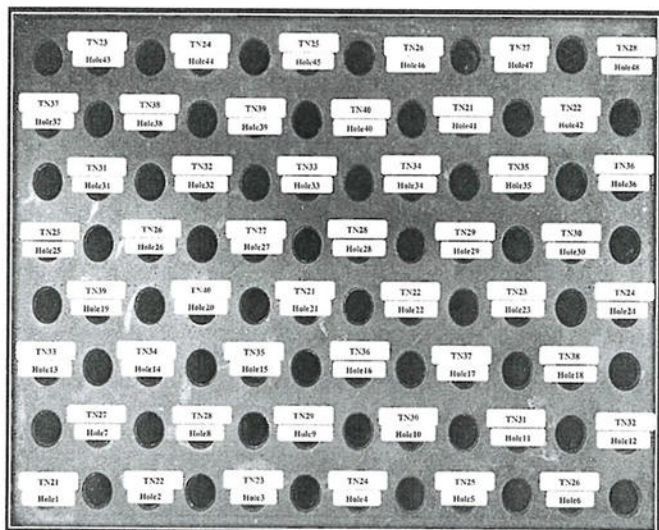
Approved By: 



Certificate No. T231676

Page 3 of 6

### Calibration Report



FRONT CONTROL

Approved By. \_\_\_\_\_

FM-L13 108-30-05-57



Certificate No T231676

Page 4 of 6

### Calibration Report

#### Measurement Results

Calibration Point	Average Standard Reading at each position (°C)					
	R1 Hole1-Hole6	TN21	TN22	TN23	TN24	TN25
CAL POINT	Max	95.01	94.41	95.20	95.41	94.51
	Min	94.57	93.95	94.75	94.02	94.00
	Average	94.79	94.18	94.98	95.17	94.26
R2 Hole7-Hole12	TN27	TN28	TN29	TN30	TN31	TN32
	Max	95.36	95.43	95.19	95.16	95.35
	Min	94.94	94.95	94.72	94.71	94.90
	Average	95.15	95.19	94.96	94.94	95.13
R3 Hole13-Hole18	TN33	TN34	TN35	TN36	TN37	TN38
	Max	95.37	95.50	95.22	95.21	95.33
	Min	94.99	95.09	94.78	94.82	94.88
	Average	95.18	95.30	95.00	95.02	95.11
R4 Hole19-Hole24	TN39	TN40	TN21	TN22	TN23	TN24
	Max	95.59	94.42	94.52	94.24	94.63
	Min	95.21	94.06	94.13	93.88	94.28
	Average	95.40	94.24	94.33	94.06	94.45
R5 Hole25-Hole30	TN25	TN26	TN27	TN28	TN29	TN30
	Max	95.19	95.38	92.95	95.30	95.14
	Min	94.83	95.03	92.56	94.95	94.79
	Average	95.01	95.20	92.75	95.12	94.96
R6 Hole31-Hole36	TN31	TN32	TN33	TN34	TN35	TN36
	Max	94.63	94.90	94.77	94.31	94.24
	Min	94.24	94.55	94.44	93.98	93.92
	Average	94.43	94.72	94.60	94.14	94.08
R7 Hole37-Hole42	TN37	TN38	TN39	TN40	TN21	TN22
	Max	94.30	94.44	94.04	93.81	94.00
	Min	93.95	94.05	93.67	93.48	94.39
	Average	94.13	94.24	93.86	93.65	94.64
R8 Hole43-Hole48	TN23	TN24	TN25	TN26	TN27	TN28
	Max	95.99	95.63	95.28	95.29	95.45
	Min	95.57	95.15	94.82	94.84	94.99
	Average	95.78	95.39	95.05	95.07	95.22

Approved By. \_\_\_\_\_

FM-L13 108-30-05-57



Certificate No T231676

Page 5 of 6

### Calibration Report

#### Measurement Results

Calibration Point	Average Standard Reading at each position (°C)					
	R1 Hole1-Hole6	TN21	TN22	TN23	TN24	TN25
CAL POINT	Max	105.23	104.32	105.43	105.25	104.44
	Min	104.94	103.95	105.15	105.04	104.11
	Average	105.09	104.13	105.29	105.15	104.28
R2 Hole7-Hole12	TN27	TN28	TN29	TN30	TN31	TN32
	Max	105.50	105.12	105.18	105.22	105.12
	Min	105.11	104.92	104.96	105.00	104.92
	Average	105.20	105.02	105.07	105.11	105.02
R3 Hole13-Hole18	TN33	TN34	TN35	TN36	TN37	TN38
	Max	105.57	105.63	105.02	104.80	104.69
	Min	105.17	105.37	104.75	104.59	104.50
	Average	105.27	105.50	104.88	104.69	104.60
R4 Hole19-Hole24	TN39	TN40	TN21	TN22	TN23	TN24
	Max	105.31	104.43	106.41	104.71	105.63
	Min	105.08	104.22	106.15	104.41	105.37
	Average	105.19	104.33	106.28	104.56	105.50
R5 Hole25-Hole30	TN25	TN26	TN27	TN28	TN29	TN30
	Max	104.95	106.26	103.34	105.78	105.59
	Min	104.67	105.96	103.08	105.56	105.68
	Average	104.81	106.11	103.21	105.67	105.48
R6 Hole31-Hole36	TN31	TN32	TN33	TN34	TN35	TN36
	Max	104.75	104.86	104.80	105.20	104.50
	Min	104.54	104.63	104.59	105.00	104.32
	Average	104.65	104.75	104.69	105.10	104.41
R7 Hole37-Hole42	TN37	TN38	TN39	TN40	TN21	TN22
	Max	104.30	104.90	104.85	104.65	104.88
	Min	104.09	104.72	104.66	104.49	104.63
	Average	104.19	104.81	104.75	104.57	104.76
R8 Hole43-Hole48	TN23	TN24	TN25	TN26	TN27	TN28
	Max	105.71	105.85	105.39	105.61	105.42
	Min	105.45	105.61	105.14	105.27	105.18
	Average	105.58	105.73	105.27	105.44	105.30

Approved By. \_\_\_\_\_

FM-L13 108-30-05-57



Certificate No. T231676

Page 6 of 6

### Calibration Report

#### Measurement Results:

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

\* The quoted uncertainty exclude " uniformity "

The calibration result apply only the above calibrated item

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

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

Approved By. \_\_\_\_\_

FM-L13 108-30-05-57



## Metrology

SCI ECO Services Company Limited

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

Saraburi Tel : +66 3627 3096 Fax : +66 3627 3100

Bangkok Tel : +668 9205 6851 , +669 8247 2360

Website : www.scieco.co.th E-Mail : calibrate@scg.com

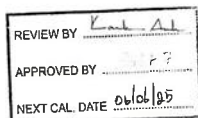


Certificate No. T232160

Page 1 of 4

### Certificate of Calibration

Equipment : Chamber ( Cooling Room )  
Manufacturer : KOLDTECH  
Model : KM 320  
Serial No. : TBN-1012061/05  
Customer Code : BKK\_EN0167  
ID No. : T2463A3  
Customer : ALS Laboratory Group (Thailand) Co.,Ltd.  
104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,  
Khet Suan Luang, Bangkok 10250  
Customer Location : Laboratory  
Date of Receipt : 29 November 2023  
Calibrated By : Atiphong Rongrat ( Technician )  
Approved By : [Signature] / Boonchai Suriyawong (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 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 Metrology.

FM-L14 I19/18-08-66



## Metrology

SCI ECO Services Company Limited

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



Certificate No. T232160

Page 2 of 4

### 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 :

1. 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 W1-T20 ( based on ASTM E145-94 ( Reapproved 2001 ) and AS2853-1986 ). All data show below were final values and the initial data from customer request . The temperature scale used was based on ITS - 90 .

#### 2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	TYPE T	TN161-TN170	T230773	10 April 2024
TC	TYPE T	TN171-TN180	T230773	10 April 2024
DATA LOGGER	34970A	T149	T230773	10 April 2024

#### 3. This certificate is traceable to :

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

#### 4. Condition of calibrated item : good

##### Equipment Description :

Time Constant : 1 Hour 30 Minute At 3 °C  
Fresh Air Damper : ☐ Open ☐ Min ☐ Medium ☐ Max  
☐ Close  
☒ Not Available

#### 5. Adjustment :

( X ) without adjustment ( ) after adjustment

Approved By: [Signature]

FM-L15 I18/18-08-66



## Metrology

SCI ECO Services Company Limited

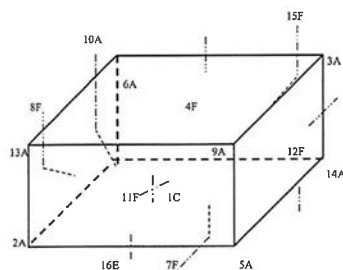
33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110, Thailand.



Certificate No. T232160

Page 3 of 4

### Calibration Report



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

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

Approved By: [Signature]

FM-L15 I18/18-08-66



## Metrology

SCI ECO Services Company Limited

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



Certificate No. T232160

Page 4 of 4

### Calibration Report

#### Measurement Results

Calibration Point	Average Standard Reading at each position (°C)											
	TN161	TN162	TN163	TN164	TN165	TN166	TN167	TN168	TN169	TN170	TN171	TN172
3.0	2.83	3.34	2.95	3.46	3.45	3.76	3.25	3.46	3.39	3.50	3.58	3.42
	TN173	TN174	TN175	TN176								
	3.33	3.39	3.15	3.43								

Chamber ( Cooling Room )		Temperature Distribution				
Setting (°C)	Reading (°C)		Average (°C)	Stability (±°C)	Uniformity (°C)	Uncertainty (±°C)
	Min	Max				
3.0	2.8	4.1	3.5	3.36	1.10	2.00
						1.90
						2.09

The calibration result apply only the above calibrated item.

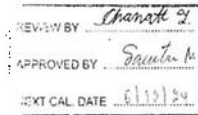
The result of test was found accurate as shown on date and place of test only.

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

Approved By: [Signature]

FM-L15 I18/18-08-66





## Performance Verification Certificate for Mercury Analyzer

**PRODUCT ID** Quicktrace M-8000 , Teledyne Leeman Labs  
**Equipment ID** BKK\_EL0128 Mercury Analyzer  
 S/N: US22133002  
 BKK\_EL0129 Autosampler  
 S/N: 052222A560  
**Customer Name** ALS Laboratory Group (Thailand) Co., Ltd.  
**Address** 104 Soi Pattana 40, Pattana Rd, Suan Luang, Suan Luang  
 Bangkok 10250 Thailand

**Date of Qualified** December 6, 2023  
**Next Due date** December 6, 2024

This certifies for products which was performed in acceptable criteria specifications

<b>Autosampler &amp; Sample Introduction</b>	<b>PASSED</b>
<b>Analyzer</b>	<b>PASSED</b>
<b>Gas Liquid Separator &amp; Dryer</b>	<b>PASSED</b>
<b>CVAFS Detector</b>	<b>PASSED</b>
<b>Electronics/Mechanical</b>	<b>PASSED</b>
<b>Data station/PC</b>	<b>PASSED</b>
<b>Analytical test</b>	<b>PASSED</b>

**Provided by**

Scientist Instrument Co., Ltd.  
 113 Soi 1 Kachai 44, Kachai Road  
 Khlong Bang Phran, Banghoo  
 Bangkok 10150 Thailand

**Certified by**   
 Thumraphol Sakdayos  
 Service Engineer



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
 CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES  
 514 PATTANA VARN ROAD SOI 18 SUAN LUANG SUAN LUANG BANGKOK 10250  
 TEL: 0 2747 000 29 FAX: 0 2719 6164



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

## Certificate of Calibration

**Equipment:** Autoclave  
**Manufacturer:** TOMY  
**Model:** SX-700  
**Serial No.:** 48134180  
**ID No.:** BKK\_ML0041

**Submitted by:** ALS Laboratory Group (Thailand) Co., Ltd.  
 104 Phatthanakan 40, Phatthanakan Rd,  
 Khwaeng Phatthanakan, Khet Suan Luang,  
 Bangkok 10250 Thailand  
**Location:** Media Preparation Room

**Received Order:** 03 October 2023  
**Calibration Date:** 04 October 2023  
**Ambient Temperature:** (26 ± 10) °C  
**Relative Humidity:** (50 ± 30) %

**Calibrated by:** Khil Rutanaprapachai

**Approved by:**   
 Approved Signatory

( ) Pomythippa Tameyukul  
 (✓) Ponpan Paisim  
 ( ) Suwit Imjai

**Issue Date:** 11 October 2023

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced without the permission of the issuer.  
 Approval of the head of Corporate Services - Equipment Calibration and Testing Services

A 0053272



**Equipment:** Autoclave  
**Condition As-Received:** Used Item  
**Reference:** 2310-0006OC-6  
**Cert. No.:** 23TM1408  
**Page:** 2 of 4

**Procedure Used :-**

Calibration was conducted using in-house calibration procedure CP-OT03 according to direct measurement method with Data Acquisition which connected with Thermocouple Type T

The temperature scale used was based on ITS-90.

**Condition of this result of calibration**

1. Reference standard instrument:-

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

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

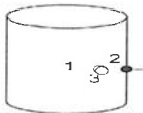
3. This certification is traceable to the International System of Unit.

4. This result of calibration covers laboratory autoclaves for the sterilization of goods and material which could be infected with organisms categorized as Hazard Group 1, 2 and 3\*\*  
 (\*\* = Categorization of pathogens according to hazard and categories of containment, second edition, 1996 )  
 It does not cover autoclaves for use with material infect with organisms in Hazard Group 4, for which complete containment and sterilization of infected condensate is considered to be essential.  
 This result of calibration does not apply to sterilizers or disinfectors used for medical, dental, pharmaceutical or veterinary purposes which are directly concerned with patient care, or those used for fabrics subjected to sterilization which are required to be dry at the end of cycle.

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

**Result of Calibration :-** ( \* ) Without Adjustment

**Function of UUC\* :** Temperature Source



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

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

a 1184533



**Equipment:** Autoclave  
**Condition As-Received:** Used Item  
**Reference:** 2310-0006OC-6  
**Cert. No.:** 23TM1408  
**Page:** 3 of 4

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

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

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

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

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

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

UUC* Setting ( °C )	UUC* Reading ( °C )	Position	Average* Standard Reading ( °C )	Stability ( ± °C )	Pressure Reading ( MPa )	Uncertainty ( ± °C )	Coverage Factor k
118	118	1	118.083	0.11	0.09	0.90	2
		2	118.037				
		3	117.954				

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

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

**UUC\* :** Unit Under Calibration

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

a 1184532



Equipment : Autoclave  
Condition As-Received : Used Item  
Reference : 2310-006OC-6  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source

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

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

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

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

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

UUC\* : Unit Under Calibration

Note : The reported uncertainty of measurement was excluded stability.

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

-o0o-

a 1184531



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES  
23/44 PATTANAPONG ROAD SOI 19, SUANLUANG 2, SUANLUANG BANGKOK 10250  
TEL: 0-2713-5005-29 FAX: 0-2710-3484



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

## Certificate of Calibration

Equipment : Incubator

Manufacturer : SHEL-LAB

Model : 1915A

Serial No. : 0200599

ID No. : BKK\_ML0010

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

Location : Incubation & Micrological Reading

Received Order : 17 July 2023

Calibration Date : 17 July 2023

Ambient Temperature : ( 26 ± 10 ) °C

Relative Humidity : ( 50 ± 30 ) %

Calibrated by : Man Pattanapongpaiboon

Approved by :   
Approved Signatory

( ) Ponthippha Tameyakul  
( / ) Malee Bulkruea  
( ) Suwit Imjai

Issue Date : 24 July 2023

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the Issuing Services. Judgment, Calibration and Testing Services

A 0056489



Equipment : Incubator  
Condition As-Received : Used Item  
Reference : 2307-0285OC-1

Cert. No.: 23TM1146  
Page : 2 of 3

Procedure Used :-

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector ( RTD ).

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

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

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

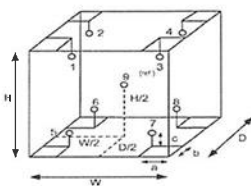
3. This certification is traceable to the International System of Unit.

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

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Close



Probe Installation Details :

Dimension of Chamber :  
a = 10 cm D = 0.50 m  
b = 10 cm W = 0.75 m  
c = 10 cm H = 1.2 m  
Capacity = 0.45 m<sup>3</sup>

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	24	24
REL Humid. ( % )	54	56
AC Supply ( Volt )	221	223

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

Malee

a 1172189



Equipment : Incubator  
Condition As-Received : Used Item  
Reference : 2307-0285OC-1  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Close

Cert. No.: 23TM1146  
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
35.0	35.0	35.0	0.055	0.30	0.44	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	1	2	3	4	5	6	7	8	9 (ref.)	
35.0	34.888	34.933	34.815	34.813	35.064	35.019	35.156	35.141	35.087	0.30

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

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

Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature 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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Malee

a 1172188



## Certificate of Calibration

Cert. No.: 24TM667  
Page : 1 of 3

Equipment : Hot Air Oven  
Manufacturer : Binder  
Model : ED 240/E2  
Serial No. : 00-15533  
ID No. : BKK\_ML0013

Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.  
104 Phatthanakan 40, Phatthanakan Rd.,  
Khwaeng Phatthanakan, Khet Suan Luang,  
Bangkok 10250 Thailand  
Location : Media Preparation Room

Received Order : 23 April 2024  
Calibration Date : 23 April 2024  
Ambient Temperature :  $(26 \pm 10) ^\circ\text{C}$   
Relative Humidity :  $(50 \pm 30) \%$

Calibrated by : Tawatthal Pama

Approved by :

( ) Ponpan Paipim  
(✓) Suwit Imjai  
( ) Kunchit Promprat

Issue Date : 26 April 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.



Equipment : Hot Air Oven  
Condition As-Received : Used Item  
Reference : 2404-0439OC-8  
Procedure Used :-

Cert. No.: 24TM667  
Page : 2 of 3

Calibration were conducted using calibration procedure CP-OT02 based on TLAS G-20 according to direct measurement method with Data Acquisition which connected with Thermocouple Type T.  
The temperature scale used was based on ITS-90.

### Condition of this result of calibration

#### 1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1 ) Data Acquisition	MY49001451	24LM44	TPA	17 Mar 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)

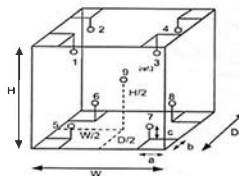
### Result of Calibration :-

Function of UUC\* : ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Close

Environment during calibration		
	Beginning	Finished
Temp. ( ° C )	24	23
REL Humid. ( % )	65	65
AC Supply ( Volt )	223	222



#### Probe Installation Details :

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

#### Dimension of Chamber :

D = 0.50 m  
W = 0.80 m  
H = 0.60 m  
Capacity = 0.24 m<sup>3</sup>

Position :	Ref. Std. ID No.:
1	24-19TC-01
2	24-19TC-02
3	24-19TC-03
4	24-19TC-04
5	24-19TC-05
6	24-19TC-06
7	24-19TC-07
8	24-19TC-08
9 (ref.)	24-19TC-09



Equipment : Hot Air Oven  
Condition As-Received : Used Item  
Reference : 2404-0439OC-8  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Close

Cert. No.: 24TM667  
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
180	180	180	0.64	2.7	3.7	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	1	2	3	4	5	6	7	8	9 (ref.)	
180	181.009	181.511	180.922	181.359	181.217	183.659	181.664	181.986	181.474	1.5

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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## Certificate of Calibration

Cert. No.: 24TM469  
Page : 1 of 3

Equipment : Water Bath  
Manufacturer : Memmert  
Model : WNE 45  
Serial No. : L712.0429  
ID No. : BKK\_ML0056

Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.  
104 Phatthanakan 40, Phatthanakan Rd.,  
Khwaeng Phatthanakan, Khet Suan Luang,  
Bangkok 10250 Thailand  
Location : Incubation \$ Microbiological Reading

Received Order : 01 March 2024  
Calibration Date : 01 March 2024  
Ambient Temperature :  $(26 \pm 10) ^\circ\text{C}$   
Relative Humidity :  $(50 \pm 30) \%$

Calibrated by : Krisda Malee

Approved by :

( ) Ponthipha Tameyakul  
( ) Unnopphol Harachai  
(✓) Suwit Imjai

Issue Date : 4 March 2024

REVIEW BY: *Sithchok T*  
APPROVED BY: *[Signature]*  
NEXT CAL. DATE: 01/03/25

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





Equipment : Water Bath  
Condition As-Received : Used Item  
Reference : 2403-0001OC-1  
Page : 2 of 3

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 ).

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	MYS7013711	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.

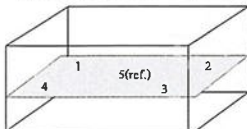
Remark : TPA : Technology Promotion Association ( Thailand - Japan )

Result of Calibration :- ( ° ) Without Adjustment

Function of UUC\* : Temperature Source

Heat transfer medium used : Water

	Environmental		AC Voltage Supply
	( °C )	( %R.H. )	( Volt )
Beginning of Calibration	24	55	221
Finished of Calibration	23	56	220



Front

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



Equipment : Water Bath  
Condition As-Received : Used Item  
Reference : 2403-0001OC-1  
Page : 3 of 3  
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.)	
44.5	44.5	44.5	44.469	44.462	44.492	44.510	44.496	0.15
45.0	45.0	45.0	44.975	44.974	45.007	45.023	44.999	0.15

Calibration point ( °C )	Uniformity ( °C )	Stability ( ± °C )	Coverage Factor k
44.5	0.087	0.029	2
45.0	0.069	0.031	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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ภาคผนวก จ

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สำเนาหนังสือรับรองห้องปฏิบัติการวิเคราะห์เอกชน



ที่ อก ๐๓๑๐(๑)/ ๑ ๖ ๑ ๖ ๘

กรมโรงงานอุตสาหกรรม  
ณกระทรวงที่ ๖ แขวงทุ่งพญาไท  
เขตราชเทวี กรุงเทพฯ ๑๐๕๐๐

๒ ๐ พฤศจิกายน ๒๕๖๖

เรื่อง ต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

เรียน กรรมการผู้จัดการ บริษัท เอลแอล แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด

อ้างถึง ค่าขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารเคมีของห้องปฏิบัติการวิเคราะห์เอกชน  
ลงวันที่ ๔ สิงหาคม ๒๕๖๖

สิ่งที่ส่งมาด้วย ๑. รายชื่อผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๑ แผ่น

๒. รายชื่อเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๕ แผ่น

๓. ขอบข่ายสารเคมีที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๓๑ แผ่น

ตามหนังสือที่อ้างถึง บริษัท เอลแอล แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด ขอต่ออายุหนังสือ  
รับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ๖-๒๐๔-๙๑๔ สถานที่ตั้งเลขที่ ๑๐๔ ซอยพัฒนาการ ๔๐  
ถนนพัฒนาการ แขวงพัฒนาการ เขตสวนหลวง กรุงเทพมหานคร ดอกรมโรงงานอุตสาหกรรม นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว เห็นว่า บริษัท เอลแอล แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด  
ต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน โดยมีองค์ประกอบดังนี้

ก. ผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๖ ราย ตามสิ่งที่ส่งมาด้วย ๑

ข. เจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ ๘๘๑ ราย ตามสิ่งที่ส่งมาด้วย ๒

ค. ขอบข่ายสารเคมีที่ได้รับขึ้นทะเบียนให้วิเคราะห์ในน้ำเสีย น้ำใต้ดิน อากาศเสีย สิ่งปฏิกูล  
หรือวัสดุที่ไม่ใช่แล้ว และดิน ตามสิ่งที่ส่งมาด้วย ๓

หนังสือฉบับนี้จะหมดอายุในวันที่ ๒ กันยายน ๒๕๖๙ หากประสงค์จะต่ออายุหนังสือ  
รับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน ให้ยื่นคำขอต่ออายุพร้อมเอกสารประกอบคำขอต่อ  
กรมโรงงานอุตสาหกรรม ภายใน ๓๐ วัน ก่อนวันสิ้นอายุของหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน  
ทั้งนี้ สามารถยื่นคำขอผ่านระบบอิเล็กทรอนิกส์ได้ทั้งนี้เว็บไซต์กรมโรงงานอุตสาหกรรม

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

(นายศิริ จันทะโร)  
นักวิทยาศาสตร์ชำนาญการ วิชาการตามแบบ  
ผู้อำนวยการกองวิจัยและพัฒนาด้านผลิตภัณฑ์งาน  
ปฏิบัติการและการสนับสนุนกรมโรงงานอุตสาหกรรม

กองวิจัยและพัฒนาด้านผลิตภัณฑ์งาน

กลุ่มมาตรฐานวิชาการวิเคราะห์ทดสอบผลิตภัณฑ์และทะเบียนห้องปฏิบัติการ

โทร. ๐ ๒๕๓๐ ๖๓๑๒ ต่อ ๒๑๐๓-๕

โทรสาร ๐ ๒๕๓๐ ๖๓๑๒ ต่อ ๒๑๑๔-๕

ไปรษณีย์อิเล็กทรอนิกส์ sarabangadlw@mail.go.th



"อุตสาหกรรมก้าวหน้า ประเทศไทยก้าวหน้า ร่วมกันพัฒนา อุตสาหกรรมสีเขียว"



สิ่งที่ส่งมาด้วย ๑

เอกสารแนบท้ายหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

บริษัท เอลแอล แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด เลขทะเบียน ๖-๒๐๔

ที่ อก ๐๓๑๐(๑)/ ๑ ๖ ๑ ๖ ๘ ลงวันที่ ๒ ๐ พฤศจิกายน ๒๕๖๖

ก. ผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๖ ราย

๑) นางสาวบุพผา จันทะโร

๒) นางสาวชัญญิ์ ไกรกรกุล ณ นคร

๓) นายศรายุทธ จิตราชนนท์

๔) นางสาวกนกกร เอนา

๕) นายสุริยา สอนแก้ว

๖) นายวิชาญ ชุนนหวัต

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๐๑

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๐๒

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๐๓

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๐๔

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๐๕

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๐๖

3/11/1

สิ่งที่ส่งมาด้วย ๒

เอกสารแนบท้ายหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

บริษัท เอลแอล แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด เลขทะเบียน ๖-๒๐๔

ที่ อก ๐๓๑๐(๑)/ ๑ ๖ ๑ ๖ ๘ ลงวันที่ ๒ ๐ พฤศจิกายน ๒๕๖๖

ข. เจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๘๘๑ ราย

๑) นายเกษมสันต์ กิตติคุณนิษฐ์

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๐๑

๒) นายภัทรพล สว่างใจธรรม

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๐๒

๓) นายธนธิป เกื้อกัญญา

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๐๓

๔) นายศิริโชค พงษ์ประสม

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๐๔

๕) นายณัฐวุฒิ ตัวมทอง

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๐๕

๖) นางสาวจินดา ไชยธรรม

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๐๖

๗) นางสาวสิริ น้อยเสงี่ยม

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๐๗

๘) นางสาวชนัญญาญจน์ อิมม

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๐๘

๙) นางสาวนันทพร สายสิง

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๐๙

๑๐) นางสาวนันทิ สมบูรณ์

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๑๐

๑๑) นางสาวศรียา เลิศมั่งคั่ง

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๑๑

๑๒) นางสาวอัญญา มงคลจิตรวิ

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๑๒

๑๓) นางสาวศิริลักษณ์ บุญนาค

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๑๓

๑๔) นายพพงษ์ จันทะโร

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๑๔

๑๕) นายบรรณเศรษฐ์ โกมลย์

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๑๕

๑๖) นายธนวิ จริยา

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๑๖

๑๗) นางสาวเกศรินทร์ แก้วมณี

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๑๗

๑๘) นางสาวสุวิมล ชัยเรืองวิ

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๑๘

๑๙) นางสาวสุชาดา ธรรมถาวร

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๑๙

๒๐) นางสาวเมก้า ชัยเดชอนกุล

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๒๐

๒๑) นางสาวศศิธร หนูสวัสดิ์

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๒๑

๒๒) นางสาววราลักษณ์ ภูมิกัญญา

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๒๒

๒๓) นายอภิสิทธิ์ สิงหา

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๒๓

๒๔) นายศักดิ์สิทธิ์ โพธิ์สวัสดิ์

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๒๔

๒๕) ว่าที่ร้อยตรีหญิง พรรณีภา ช่างเจริญ

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๒๕

๒๖) นางจิลดา คำแก้ว

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๒๖

๒๗) นางสาวจรรณกร วิทยง

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๒๗

๒๘) นางสาวพนรัตน์ อัมมกรานนท์

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๒๘

๒๙) นายจุลเดช วารินทร์

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๒๙

๓๐) นางสาวศุภรัตน์ รุ่งเรือง

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๓๐

๓๑) นายพนม ศรีปัดเบตร

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๓๑

๓๒) นายสุทธิ ภูมิลิม

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๓๒

๓๓) ว่าที่ร้อยตรี เลิศมั่งคั่ง ภูมิศรีธรรม

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๓๓

๓๔) นางสาววราญา สว่างมา

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๓๔

๓๕) นายอนุพงษ์ วัฒนศิริประเสริฐ

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๓๕

3/11/1

๓๖) นางสาวจุฑารัตน์

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๓๖) นางสาวจุฑารัตน์ อินสันเทียะ

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๓๖

๓๗) นางสาวจรรณกร พิมพ์กิจฤติยา

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๓๗

๓๘) นางสาวปรางค์ทิพย์ กิจไพศาลศักดิ์

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๓๘

๓๙) นางสาวเดือนใจ ทางกลาง

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๓๙

๔๐) นางสาวจิราพร ศิริเว

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๔๐

๔๑) นายวรกร ผู้กริช

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๔๑

๔๒) นายทอง รื่นยะสกลกิจ

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๔๒

๔๓) นายณิศ เจริญ

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๔๓

๔๔) นายณิศกร ช่างเพชร

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๔๔

๔๕) นายภูษิต พรหมสะอาด

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๔๕

๔๖) นายเจตนาท ภาณุทิพย์

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๔๖

๔๗) นายชฎพร วังจันทร์

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๔๗

๔๘) นายอาทิตย์ ศรีเสน

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๔๘

๔๙) นายเจตนาท ศรีศักดิ์ไทย

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๔๙

๕๐) นายจรัส บุญอึ้ง

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๕๐

๕๑) นายอนาณัติ เอนก

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๕๑

๕๒) นายเจตนาท ศรีบุญ

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๕๒

๕๓) นางสาวสุภาวัญ มาก

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๕๓

๕๔) นางสาวทิพร ขาวละมบูรณ์

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๕๔

๕๕) นางสาววิมล บุญเพ็ง

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๕๕

๕๖) นางสาวกานดา นามวัฒน์

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๕๖

๕๗) นางสาวอุไรรัตน์ ทุ่งสร้างแป้น

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๕๗

๕๘) นายธีรวัฒน์ บังสุสุข

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๕๘

๕๙) นายอิทธิพล ไขสอ

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๕๙

๖๐) นายประจักษ์ วรรณสุขชัย

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๖๐

๖๑) นายเชษฐ พงษ์ทิพย์

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๖๑

๖๒) นางสาวกนกวรรณ จันทร์บาล

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๖๒

๖๓) นายสิทธิโชค ธงเงิน

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๖๓

๖๔) นางสาววิมล ไขบุญ

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๖๔

๖๕) นางสาวพรรณิศา พุ่มคง

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๖๕

๖๖) นายณัฏฐ์ ศรีวิริยะ

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๖๖

๖๗) นายสุวิทย์ ทองอ่อน

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๖๗

๖๘) นายวิมล บุญอึ้ง

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๖๘

๖๙) นายสมบุญ บุตรจันทร์

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๖๙

๗๐) นายวิวัฒน์ ไชยธรรมา

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๗๐

๗๑) นายณัฏฐ์ เพิ่มพูน

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๗๑

๗๒) นายจิณณ์ ขาวละมอ

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๗๒

๗๓) นายอัษฎ์ นามบุรี

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๗๓

๗๔) นายอัษฎ์ เวช

ทะเบียนเลขที่ ๖-๒๐๔-๙-๐๐๗๔

3/11/1

๗๕) นายประเสริฐ



เอกสารแนบท้ายหนังสือรับต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน  
บริษัท เอลแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด เลขทะเบียน ว-๒๐๔  
ที่ อก ๐๓๓๐(๑)/ ๑๖๑๖๘ ลงวันที่ ๒๐ พฤศจิกายน ๒๕๖๖

ค. ขอบข่ายสารมลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๓๙๔ รายการ  
มีเสีย จำนวน 60 รายการ

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

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
19	Copper	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
20	Cyanide	Distillation, Colorimetric Method <sup>(4)</sup>
21	2,4'-DDD	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
22	4,4'-DDD	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
23	2,4'-DDE	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
24	4,4'-DDE	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
25	2,4'-DDT	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
26	4,4'-DDT	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
27	Dieldrin	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
28	Endosulfan Sulfate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
29	Endosulfan I	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
30	Endosulfan II	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
31	Endrin	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
32	Endrin Aldehyde	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
33	Formaldehyde	Distillation, Colorimetric Method <sup>(2)</sup>
34	Free Chlorine	1) DPD Ferrous Titrimetric Method <sup>(4)</sup> 2) DPD Colorimetric Method <sup>(4)</sup>
35	Heptachlor	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
36	Heptachlor Epoxide	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
37	Hexavalent Chromium	Colorimetric Method <sup>(4)</sup>
38	3-Hydroxycarbofuran	High-Performance Liquid Chromatographic Method <sup>(4)</sup>
39	Lead	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>

40 Manganese...

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

น้ำไดคติน...

น้ำไดคติน จำนวน 126 รายการ

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

18 Bis(2-ethylhexyl)phthalate...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
18	Bis(2-ethylhexyl)phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
19	Bromodichloromethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
20	Bromoform	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
21	Butanol	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
22	Butyl benzyl phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
23	Cadmium	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
24	Carbazole	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
25	Carbon disulfide	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
26	Carbon tetrachloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
27	Chlordane	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
28	p-Chloroaniline	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
29	Chlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
30	Chlorodibromomethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
31	Chloroform	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
32	2-Chlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
33	Chromium	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
34	Chromium (III)	1) Digestion, Inductively Coupled Plasma Method; Colorimetric Method; Calculation <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method; Colorimetric Method; Calculation <sup>(4)</sup>
35	Chromium (VI)	Colorimetric Method <sup>(4)</sup>

36 Chrysene...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
36	Chrysene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
37	Cyanide	Distillation, Colorimetric Method <sup>(4)</sup>
38	2,4-D	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
39	DDD	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
40	DDE	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
41	DDT	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
42	Dibenz(a,h)anthracene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
43	Di-n-Butyl Phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
44	1,2-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
45	1,3-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
46	1,4-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
47	3,3-Dichlorobenzidine	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
48	1,1-Dichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
49	1,2-Dichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
50	1,1-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
51	dis-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
52	trans-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
53	2,4-Dichlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
54	1,2-Dichloropropane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
55	1,3-Dichloropropane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>

56 1,3-Dichloropropene...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
56	1,3-Dichloropropene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
57	Dieldrin	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
58	Diethyl Phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
59	2,4-Dimethylphenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
60	2,4-Dinitrophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
61	2,4-Dinitrotoluene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
62	2,6-Dinitrotoluene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
63	Di-n-octyl phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
64	Endosulfan	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
65	Endrin	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
66	Ethylbenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
67	Fluoranthene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
68	Fluorene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
69	Heptachlor	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
70	Heptachlor epoxide	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
71	Hexachlorobenzene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
72	Hexachloro-1,3-butadiene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
73	n-Hexane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
74	α-HCH	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
75	β-HCH	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>

76 γ-HCH...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
76	γ-HCH	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
77	Hexachlorocyclopentadiene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
78	Hexachloroethane	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
79	Indeno(1,2,3-cd)pyrene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
80	Isophorone	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
81	Lead	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
82	Manganese	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
83	Mercury	1) Digestion, Cold Vapor Atomic Absorption Spectrometric Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
84	Methanol	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
85	Methoxychlor	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
86	Methyl bromide	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
87	Methylene chloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
88	2-Methylphenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
89	2-Methylnaphthalene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
90	Methyl tert-butyl Ether	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
91	Naphthalene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
92	Nickel	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
93	Nitrobenzene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>

94 N-Nitrosodiphenylamine...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
94	N-Nitrosodiphenylamine	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
95	N-Nitrosodi-n-Propylamine	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
96	Polychlorinated Biphenyls - PCB 1016 - PCB 1221 - PCB 1232 - PCB 1242 - PCB 1248 - PCB 1254 - PCB 1260	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
97	Pentachlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
98	pH	Electrometric Method <sup>(4)</sup>
99	Phenanthrene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
100	Phenol	1) Distillation, Chloroform Extraction Method <sup>(4)</sup> 2) Distillation, Direct Photometric Method <sup>(4)</sup> 3) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
101	Pyrene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
102	Selenium	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
103	Silver	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
104	Styrene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
105	1,1,2,2-Tetrachloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
106	Tetrachloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
107	Toluene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
108	Toxaphene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
109	TPH (C <sub>5</sub> -C <sub>6</sub> )	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4) &amp; 25</sup>

110 TPH (C<sub>5</sub>-C<sub>12</sub>)...



ลำดับที่	สารมลพิษ	วิธีการตรวจ
110	TPH (C <sub>9</sub> -C <sub>16</sub> )	Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method <sup>9,22</sup>
111	TPH (C <sub>9</sub> -C <sub>30</sub> )	Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method <sup>9,22</sup>
112	1,2,4-Trichlorobenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>41</sup>
113	1,1,1-Trichloroethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>41</sup>
114	1,1,2-Trichloroethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>41</sup>
115	Trichloroethylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>41</sup>
116	2,4,5-Trichlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>41</sup>
117	2,4,6-Trichlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>41</sup>
118	1,3,5-Trimethylbenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>41</sup>
119	Vanadium	1) Digestion, Inductively Coupled Plasma Method <sup>42</sup> 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>41</sup>
120	Vinyl acetate	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>41</sup>
121	Vinyl chloride	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>41</sup>
122	m-Xylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>41</sup>
123	o-Xylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>41</sup>
124	p-Xylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>41</sup>
125	Xylene (Total)	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>41</sup>
126	Zinc	1) Digestion, Inductively Coupled Plasma Method <sup>42</sup> 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>41</sup>

อากาศเสีย...

## อากาศเสีย (ปล่อยรบบาย) จำนวน 28 รายการ

ลำดับที่	สารมลพิษ	วิธีการตรวจ
1	Antimony	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>51</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>51</sup>
2	Arsenic	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>51</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>51</sup>
3	Beryllium	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>51</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>51</sup>
4	Cadmium	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>51</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>51</sup>
5	Carbon Monoxide	1) Instrumental Analyzer Method <sup>51</sup> 2) Sampling Bag Non-Dispersive Infrared Method <sup>51</sup>
6	Chlorine	1) Absorption Sampling, Ion Chromatographic Method <sup>51</sup> 2) Isokinetic Sampling, Ion Chromatographic Method <sup>51</sup>
7	Chromium	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>51</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>51</sup>
8	Cobalt	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>51</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>51</sup>
9	Copper	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>51</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>51</sup>
10	Cresol	Absorption Sampling, Gas Chromatographic Method <sup>51</sup>
11	Dioxins	Isokinetic Sampling <sup>51</sup>
12	Hydrogen Chloride	1) Absorption Sampling, Ion Chromatographic Method <sup>51</sup> 2) Isokinetic Sampling, Ion Chromatographic Method <sup>51</sup>
13	Hydrogen Fluoride	1) Absorption Sampling, Ion Chromatographic Method <sup>51</sup> 2) Isokinetic Sampling, Ion Chromatographic Method <sup>51</sup>
14	Hydrogen Sulfide	Absorption Sampling, Iodometric Method <sup>51</sup>

15 Lead...

ลำดับที่	สารมลพิษ	วิธีการตรวจ
15	Lead	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>51</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>51</sup>
16	Manganese	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>51</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>51</sup>
17	Mercury	1) Isokinetic Sampling, Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>51</sup> 2) Isokinetic Sampling, Digestion, Cold-Vapor Atomic Fluorescence Spectrometric Method <sup>51</sup>
18	Nickel	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>51</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>51</sup>
19	Opacity	Ringelmann's Method <sup>51</sup>
20	Oxides of Nitrogen	1) Absorption Sampling, Phenoldisulfonic Acid Method <sup>51</sup> 2) Absorption Sampling, Alkaline Permanganate/Colorimetric Method <sup>51</sup> 3) Instrumental Analyzer Method <sup>51</sup>
21	Selenium	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>51</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>51</sup>
22	Sulfur Dioxide	1) Absorption Sampling, Barium-Thorin Titrimetric Method <sup>51</sup> 2) Instrumental Analyzer Method <sup>51</sup>
23	Sulfuric Acid	Isokinetic Sampling, Barium-Thorin Titrimetric Method <sup>51</sup>
24	Tellurium	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>51</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>51</sup>
25	Tin	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>51</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>51</sup>
26	Total Suspended Particulate	1) Isokinetic Sampling, Gravimetric Method <sup>51</sup> 2) Paired Train, Isokinetic Sampling, Gravimetric Method <sup>51</sup>

27 Vanadium...

ลำดับที่	สารมลพิษ	วิธีการตรวจ
27	Vanadium	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>51</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>51</sup>
28	Xylene	Absorption Sampling, Gas Chromatographic Method <sup>51</sup>

## สิ่งปฏิกูลหรือวัสดุที่ไม่ใช้แล้ว จำนวน 35 รายการ

ลำดับที่	สารมลพิษ	วิธีการตรวจ
1	Aldrin	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>11,9,24</sup> 2) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>10,26</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>11,26</sup>
2	Antimony	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>11,6,16</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>11,6,17</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>11,16</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>11,17</sup>
3	Arsenic	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>11,6,16</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>11,6,17</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>11,16</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>11,17</sup>
4	Barium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>11,6,16</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>11,6,17</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>11,16</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>11,17</sup>

5 Beryllium...

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ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
5	Beryllium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1.6.16)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1.6.17)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7.16)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7.17)</sup>
6	Cadmium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1.6.16)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1.6.17)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7.16)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7.17)</sup>
7	Chlordane	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1.9.24)</sup> 2) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10.26)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11.26)</sup>
8	Chromium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1.6.16)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1.6.17)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7.16)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7.17)</sup>
9	Chromium (III)	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method; Waste Extraction, Colorimetric Method; Calculation Method <sup>(1.6.16,19)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method; Waste Extraction, Colorimetric Method; Calculation Method <sup>(1.6.17,19)</sup> 3) Digestion, Inductively Coupled Plasma Method; Alkaline Digestion, Colorimetric Method; Calculation Method <sup>(7.16,19)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method; Alkaline Digestion, Colorimetric Method; Calculation Method <sup>(7.17,19)</sup>

10 Chromium (VI)...

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ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
10	Chromium (VI)	1) Waste Extraction, Colorimetric Method <sup>(1.6.19)</sup> 2) Alkaline Digestion, Colorimetric Method <sup>(8.19)</sup>
11	Cobalt	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1.6.16)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1.6.17)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7.16)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7.17)</sup>
12	Copper	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1.6.16)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1.6.17)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7.16)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7.17)</sup>
13	2,4-D	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1.9.24)</sup> 2) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10.26)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11.26)</sup>
14	DDD	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1.9.24)</sup> 2) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10.26)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11.26)</sup>
15	DDE	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1.9.24)</sup> 2) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10.26)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11.26)</sup>
16	DDT	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1.9.24)</sup>

2) Soxhlet...

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ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
17	Dieldrin	2) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10.26)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11.26)</sup>
18	Endrin	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1.9.24)</sup> 2) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10.26)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11.26)</sup>
19	Heptachlor	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1.9.24)</sup> 2) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10.26)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11.26)</sup>
20	Lead	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1.6.16)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1.6.17)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7.16)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7.17)</sup>
21	Lindane	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1.9.24)</sup> 2) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10.26)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11.26)</sup>

22 Mercury...

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ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
22	Mercury	1) Waste Extraction, Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>(1.6.20)</sup> 2) Waste Extraction, Digestion, Cold-Vapor Atomic Fluorescence Spectrometric Method <sup>(1.6.21)</sup> 3) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>(7.20)</sup> 4) Digestion, Cold-Vapor Atomic Fluorescence Spectrometric Method <sup>(7.21)</sup> 5) Thermal Decomposition Amalgamation and Atomic Absorption Spectrometric Method <sup>(2.2)</sup>
23	Methoxychlor	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1.9.24)</sup> 2) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10.26)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11.26)</sup>
24	Mirex	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1.9.24)</sup> 2) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10.26)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11.26)</sup>
25	Molybdenum	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1.6.16)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1.6.17)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7.16)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7.17)</sup>
26	Nickel	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1.6.16)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1.6.17)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7.16)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7.17)</sup>
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 <sup>(1.9.24)</sup> 2) Soxhlet Extraction, Gas Chromatographic Method <sup>(10.26)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>(11.26)</sup>

- 2-Chlorobiphenyl...

ลำดับที่	สารเคมี	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'-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 <sup>(1,9,26)</sup> 2) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,26)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11,26)</sup> Electrometric Method <sup>(23,24)</sup> 4) Digestion, Inductively Coupled Plasma Method <sup>(1,6,16)</sup> 5) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,6,17)</sup> 6) Digestion, Inductively Coupled Plasma Method <sup>(7,16)</sup> 7) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,17)</sup>
29	pH	
30	Selenium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,6,16)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,6,17)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7,16)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,17)</sup>

31 Silver...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
31	Silver	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,6,16)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,6,17)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7,16)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,17)</sup>
32	Thallium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,6,16)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,6,17)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7,16)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,17)</sup>
33	Toxaphene	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1,9,26)</sup> 2) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,26)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11,26)</sup>
34	Vanadium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,6,16)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,6,17)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7,16)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,17)</sup>
35	Zinc	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,6,16)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,6,17)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7,16)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,17)</sup>

ดิน...

## ดิน จำนวน 125 รายการ

ลำดับที่	สารเคมี	วิธีวิเคราะห์
1	Acenaphthene	1) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11,26)</sup>
2	Acetone	1) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(15,23)</sup> 2) Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method <sup>(13)</sup>
3	Aldrin	1) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11,26)</sup>
4	Anthracene	1) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11,26)</sup>
5	Antimony	1) Digestion, Inductively Coupled Plasma Method <sup>(7,16)</sup> 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,17)</sup>
6	Arsenic	1) Digestion, Inductively Coupled Plasma Method <sup>(7,16)</sup> 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,17)</sup>
7	Atrazine	1) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11,26)</sup>
8	Barium	1) Digestion, Inductively Coupled Plasma Method <sup>(7,16)</sup> 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,17)</sup>
9	Benz(a)anthracene	1) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11,26)</sup>
10	Benzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(15,23)</sup>

11 Benzo(b)fluoranthene

ลำดับที่	สารเคมี	วิธีวิเคราะห์
11	Benzo(b)fluoranthene	1) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11,26)</sup>
12	Benzo(k)fluoranthene	1) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11,26)</sup>
13	Benzoic acid	1) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11,26)</sup>
14	Benzo(a)pyrene	1) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11,26)</sup>
15	Benzo(g,h,i)perylene	1) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11,26)</sup>
16	Beryllium	1) Digestion, Inductively Coupled Plasma Method <sup>(7,16)</sup> 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,17)</sup>
17	Bis(2-chloroethyl)ether	1) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11,26)</sup>
18	Bis(2-ethylhexyl)phthalate	1) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11,26)</sup>
19	Bromodichloromethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(15,23)</sup>
20	Bromoform	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(15,23)</sup>
21	Butanol	Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method <sup>(13,23)</sup>
22	Butyl Benzyl Phthalate	1) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11,26)</sup>

23 Cadmium...



ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
23	Cadmium	1) Digestion, Inductively Coupled Plasma Method <sup>(7,10)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7,17)</sup>
24	Carbazole	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
25	Carbon Disulfide	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,25)</sup>
26	Carbon tetrachloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,25)</sup>
27	Chlordane	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
28	p-Chloroaniline	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
29	Chlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,25)</sup>
30	Chlorodibromomethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,25)</sup>
31	Chloroform	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,25)</sup>
32	2-Chlorophenol	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
33	Chromium	1) Digestion, Inductively Coupled Plasma Method <sup>(7,10)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7,17)</sup>
34	Chromium (III)	1) Digestion, Inductively Coupled Plasma Method; Alkaline Digestion, Colorimetric Method; Calculation Method <sup>(7,8,16,19)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method; Alkaline Digestion, Colorimetric Method; Calculation Method <sup>(7,8,17,19)</sup>
35	Chromium (VI)	Alkaline Digestion, Colorimetric Method <sup>(8,19)</sup>

36 Chrysene...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
36	Chrysene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
37	Cyanide	Extraction, Distillation, Colorimetric Method <sup>(27,28,29)</sup>
38	2,4-D	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
39	DDD	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
40	DDE	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
41	DDT	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
42	Dibenz(a,h)anthracene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
43	Di-n-Butyl Phthalate	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
44	1,2-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,25)</sup>
45	1,3-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,25)</sup>
46	1,4-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,25)</sup>
47	3,3-Dichlorobenzidine	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
48	1,1-Dichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,25)</sup>

49 1,2-Dichloroethane...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
49	1,2-Dichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,25)</sup>
50	1,1-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,25)</sup>
51	cis-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,25)</sup>
52	trans-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,25)</sup>
53	2,4-Dichlorophenol	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
54	1,2-Dichloropropane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,25)</sup>
55	1,3-Dichloropropane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,25)</sup>
56	1,3-Dichloropropene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,25)</sup>
57	Dieldrin	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
58	Diethyl Phthalate	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
59	2,4-Dimethylphenol	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
60	2,4-Dinitrophenol	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
61	2,4-Dinitrotoluene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
62	2,6-Dinitrotoluene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>

63 Di-n-Octyl Phthalate...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
63	Di-n-Octyl Phthalate	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
64	Endosulfan	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
65	Endrin	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
66	Ethylbenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,25)</sup>
67	Fluoranthene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
68	Fluorene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
69	Heptachlor	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
70	Heptachlor epoxide	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
71	Hexachlorobenzene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
72	Hexachloro-1,3-butadiene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,25)</sup>
73	n-Hexane	1) Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,25)</sup> 2) Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method <sup>(13)</sup>

73 n-Hexane...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
74	$\alpha$ -HCH	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,24)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,24)</sup>
75	$\beta$ -HCH	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,24)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,24)</sup>
76	$\gamma$ -HCH	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,24)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,24)</sup>
77	Hexachlorocyclopentadiene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,24)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,24)</sup>
78	Hexachloroethane	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,24)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,24)</sup>
79	Indeno(1,2,3-cd)pyrene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,24)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,24)</sup>
80	Isophorone	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,24)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,24)</sup>
81	Lead	1) Digestion, Inductively Coupled Plasma Method <sup>(7,16)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7,17)</sup>
82	Manganese	1) Digestion, Inductively Coupled Plasma Method <sup>(7,16)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7,17)</sup>
83	Mercury	1) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>(20)</sup> 2) Thermal Decomposition, Amalgamation, and Atomic Absorption Spectrophotometry <sup>(21)</sup> 3) Digestion, Cold-Vapor Atomic Fluorescence Spectrometric Method <sup>(20)</sup>

84 Methanol...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
84	Methanol	1) Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,25)</sup> 2) Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,25)</sup>
85	Methoxychlor	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,24)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,24)</sup>
86	Methyl Bromide	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,25)</sup>
87	Methylene Chloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,25)</sup>
88	2-methylphenol	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,24)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,24)</sup>
89	2-Methylnaphthalene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,24)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,24)</sup>
90	Methyl tert-Butyl Ether	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,25)</sup>
91	Naphthalene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,24)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,24)</sup>
92	Nickel	1) Digestion, Inductively Coupled Plasma Method <sup>(7,16)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7,17)</sup>
93	Nitrobenzene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,24)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,24)</sup>
94	N-Nitrosodiphenylamine	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,24)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,24)</sup>
95	N-Nitrosodi-n-propylamine	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,24)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,24)</sup>

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 - Hexachlorobiphenyl - 2,2',4,4',5,5'-Hexachlorobiphenyl - 2,2',3,3',4,4',5'-Heptachlorobiphenyl - 2,2',3,4,4',5,5'-Heptachlorobiphenyl - 2,2',3,4,4',5,6'-Heptachlorobiphenyl - 2,2',3,4',5,5',6'-Heptachlorobiphenyl - 2,2',3,3',4,4',5,5',6'-Nonachlorobiphenyl	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,24)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,24)</sup>
97	Pentachlorophenol	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,24)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,24)</sup>
98	Phenanthrene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,24)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,24)</sup>

99 Phenol...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
99	Phenol	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,24)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,24)</sup>
100	Pyrene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,24)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,24)</sup>
101	Selenium	1) Digestion, Inductively Coupled Plasma Method <sup>(7,16)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7,17)</sup>
102	Silver	1) Digestion, Inductively Coupled Plasma Method <sup>(7,16)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7,17)</sup>
103	Styrene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,25)</sup>
104	1,1,2,2-Tetrachloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,25)</sup>
105	Tetrachloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,25)</sup>
106	Toluene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,25)</sup>
107	Toxaphene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,24)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,24)</sup>
108	TPH (C <sub>9</sub> -C <sub>9</sub> )	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,25)</sup>
109	TPH (C <sub>10</sub> -C <sub>16</sub> )	1) Automate Extraction, Gas Chromatographic Method <sup>(12,22)</sup> 2) Solvent Extraction, Gas Chromatographic Method <sup>(12,22)</sup> 3) Ultrasonic Extraction, Gas Chromatographic Method <sup>(22,23)</sup>
110	TPH (C <sub>18</sub> -C <sub>35</sub> )	1) Automate Extraction, Gas Chromatographic Method <sup>(12,22)</sup> 2) Solvent Extraction, Gas Chromatographic Method <sup>(12,22)</sup> 3) Ultrasonic Extraction, Gas Chromatographic Method <sup>(22,23)</sup>
111	1,2,4-Trichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,25)</sup>
112	1,1,1-Trichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,25)</sup>
113	1,1,2-Trichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,25)</sup>
114	Trichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,25)</sup>

115 2,4,5-Trichlorophenol...





๕๑) นายพิชกร...

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๕๒) นายทิวากร เสือมาก  
๕๓) นายอนุวัตร หงษ์ขจรศักดิ์  
๕๔) นายอภิชาติ วิไล  
๕๕) นายเจริญศักดิ์ ศรีรักษา  
๕๖) นายประจักษ์ อธิธรรม  
๕๗) นายภาณุวัฒน์ วัชร  
๕๘) นายสันติ ชัยชนะ  
๕๙) นายทิวากร กุศลชาติ  
๖๐) นายชัชวาลย์ สอนทอง  
๖๑) นายชัชวาลย์ สอนทอง  
๖๒) นายชัชวาลย์ สอนทอง  
๖๓) นายชัชวาลย์ สอนทอง  
๖๔) นายชัชวาลย์ สอนทอง  
๖๕) นายชัชวาลย์ สอนทอง  
๖๖) นายชัชวาลย์ สอนทอง  
๖๗) นายชัชวาลย์ สอนทอง  
๖๘) นายชัชวาลย์ สอนทอง  
๖๙) นายชัชวาลย์ สอนทอง  
๗๐) นายชัชวาลย์ สอนทอง

หนังสือฉบับนี้จะมีผลใช้บังคับตั้งแต่วันที่ ๑๕ มิถุนายน ๒๕๖๕ หากประสงค์จะขออุทธรณ์หรือ  
ยื่นคำร้องขอเพิกถอนหรือขอเปลี่ยนแปลงการปกครองหรือขอเปลี่ยนแปลงการบริหาร  
ปกครองภายใน ๖๐ วัน นับแต่วันที่มีผลใช้บังคับหนังสือฉบับนี้

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

(นายพรกร เจริญชัย)  
นายก อบจ. อุดรธานี  
ตำแหน่งนายก อบจ. อุดรธานี

ศูนย์รับและเรียนการสอนของโรงเรียนเกษตรวิสัย  
โทร. ๐ ๓๖๓๓ ๖๐๕๕ ต่อ ๕๐๐๐-๕  
ไปรษณีย์อิเล็กทรอนิกส์: [prgrk@phw.ac.th](mailto:prgrk@phw.ac.th)

Green Industry  
"อุตสาหกรรมก้าวไกล ประเทศไทยก้าวหน้า ร่วมกันพัฒนา อุดรธานีสีเขียว"

เอกสารแนบท้ายหนังสือเปลี่ยนแปลงสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน  
บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด เลขทะเบียน ๖-๓๓๓  
ที่ ๑๓๒๐/ ๗ ๕๓ ๘ ลงวันที่ ๐๔ สิงหาคม ๒๕๖๕

ขอรับสารมลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๒๕ รายการ

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

น้ำใช้ดื่ม จำนวน 3 รายการ

ลำดับ ที่	สารมลพิษ	วิธีวิเคราะห์
1	Cyanide	Distillation, Colorimetric Method <sup>(1)</sup>
2	pH	Electrometric Method <sup>(1)</sup>
3	Phenols	Distillation, Direct Photometric Method <sup>(1)</sup>

อากาศเสีย...

อากาศเสีย (ปล่อยระบอบ) จำนวน 7 รายการ

ลำดับ ที่	สารมลพิษ	วิธีวิเคราะห์
1	Carbon Monoxide	1) Sampling Bag, Non-Dispersive Infrared Method <sup>(1)</sup> 2) Instrumental Analyzer Method <sup>(2)</sup>
2	Hydrogen Sulfide	Absorption Sampling, Iodometric Method <sup>(1)</sup>
3	Opacity	Ringelmanns Method <sup>(1,2)</sup>
4	Oxide of Nitrogen	1) Absorption Sampling, Phenoldisulfonic Acid Method <sup>(1)</sup> 2) Instrumental Analyzer Method <sup>(1,2)</sup>
5	Sulfur Dioxide	1) Absorption Sampling, Barium-Thorin Titrimetric Acid Method <sup>(1)</sup> 2) Instrumental Analyzer Method <sup>(1,2)</sup>
6	Sulfuric Acid	Isokinetic Sampling, Barium - Titrimetric Method <sup>(1)</sup>
7	Total Suspended Particulate	Isokinetic Sampling, Gravimetric Method <sup>(1)</sup>

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ที่ อก ๐๓๒๐/ ๑๐๐๙๙



กรมโรงงานอุตสาหกรรม  
ถนนพหลโยธิน แขวงทุ่งพญาไท  
พระราชพิธี กรุงเทพฯ ๑๐๕๐๐

๐๕ ตุลาคม ๒๕๖๗

เรื่อง แก้อภัยข้อผิดพลาดที่ห้องปฏิบัติการวิเคราะห์เอกชน

เรียน กรรมการผู้จัดการ บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด

อ้างถึง หนังสือ บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด เลขที่ Env 2024/005  
ลงวันที่ ๓๐ สิงหาคม ๒๕๖๗

ตามที่หนังสือที่อ้างถึง บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด ห้องปฏิบัติการ  
วิเคราะห์เอกชน เลขทะเบียน ๖-๓๒๓ สถานที่ตั้งเลขที่ ๖๑๖/๑๐ หมู่ที่ ๕ ตำบลแม่ป่าดู่ อำเภอปลวกแดง  
จังหวัดระยอง ขอแก้ไขข้อผิดพลาดที่ห้องปฏิบัติการวิเคราะห์เอกชน เนื่องจากมีความคลาดเคลื่อน ความละเอียด  
แจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรม ได้รับทราบและดำเนินการแก้ไขข้อผิดพลาดที่ห้องปฏิบัติการ  
วิเคราะห์เอกชน จำนวน ๕ ราย ตามที่แจ้งเรียบร้อยแล้ว เป็นดังนี้

ลำดับที่ ๒๗ นางสาวนา สิตา

ลำดับที่ ๒๘ นางสาวอนิศา กุลสุริวงศ์


ลำดับที่ ๓๐ นางชอริษา สุขเกษ

ลำดับที่ ๓๖ นายสุทธิศักดิ์ โชคประดิษฐ์

ลำดับที่ ๔๒ นายกันตภณ มณีสัมพันธ์


จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

  
(นายพิเชต ก.สันครอง)  
นายพิเชต ก.สันครอง  
ผู้อำนวยการโรงงานอุตสาหกรรม

ศูนย์วิจัยและพัฒนาย้อมสีของโรงงานฯจะรับออก  
โทร. ๐ ๓๓๑๓ ๖๐๕๔ ต่อ ๕๐๐๓๒  
แฟกซ์ ๐๓๓๑๓ ๖๐๕๔ ต่อ ๕๐๐๓๒

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 "อุตสาหกรรมก้าวไกล ประเทศไทยก้าวหน้า ร่วมกันพัฒนาอุตสาหกรรมสีเขียว"







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