

ภาคผนวก จ

ใบรับรองเอกสารการสอบเทียบเครื่องมือตรวจวิเคราะห์



CONSOLE CONTROL UNIT CALIBRATION TEST REPORT

Calibration of Date : 3 Jul 23
Next Cal. Date : 3 Jan 24

Barometric Pressure (mmHg) : 758
Relative Humidity (%) : 63.0
Temperature (°C) : 33.0

Console Control Meter Data

Calibration No. C-030723-BKK_FS1093
Dry Gas Meter ID : BKK_FS1093
Serial No. : 1706090
Model No. : XC-572-V

Reference Dry Gas Meter Data

Reference Dry Gas Meter ID : BKK_FS0629
Serial No. : 1607009
Correction Factor (Y) : 1.0000
Next Calibration Date : 9 Dec 23

ΔH (mm.H ₂ O)	Θ Minutes	Reference Dry Gas Meter Calibration				Console Control ; Drygas Meter						Dry Gas Meter	Orifice
		Vr (Liters)			Tr (°C)	Vm (Liters)			Ti (°C)	To (°C)	Avg.Tm (°C)	Correction	Calibration
		Final	Initial	Total		Final	Initial	Total				Factor (Y)	Factor $\Delta H@$
15	12.30	150.70	0.00	150.70	34.0	455348.2	455200.0	148.20	34.0	34.0	34.0	1.0154	46.5821
25	9.42	150.35	0.00	150.35	35.0	455507.6	455360.0	147.60	35.0	35.0	35.0	1.0162	45.8978
50	6.50	150.27	0.00	150.27	35.0	455662.6	455515.0	147.60	36.0	36.0	36.0	1.0165	43.6115
80	5.10	150.30	0.00	150.30	35.0	455817.2	455670.0	147.20	37.0	37.0	37.0	1.0198	42.8014
120	4.17	150.45	0.00	150.45	35.0	455971.8	455825.0	146.80	37.0	37.0	37.0	1.0196	42.8366
											Avg.	1.0175	44.3459

γ : Ratio of reading of reference to dry gas meter : tolerance for individual values ± 0.02 from average .

$\Delta H@$: Orifice pressure differential that equates to 21.24 lm of air @ 25 C and 760 mm of mercury , mmH₂O ; tolerance for individual values ± 5.08 from average .

Procedure; 40 CFR 60,APP A,METH ,SEC 5.3 & 7

Calibrated by:

(Mr. Worawich Tongpoom)

Field Scientist(2)

Approved by:

(Mr.Samart Roo-ngan)

Field Specialist(1)



DIGITAL TEMPERATURE CALIBRATION DATA SHEET

Calibration Date :	3 Jul 23	Ambient Temperature (°C)	33
Calibration sheet No. :	C-030723-BKK_FS1093	Relative Humidity (%) :	63
Digital Temperature ID :	BKK_FS1093	Reference Temperature ID	BKK_FS1144
Serial No. :	1706090	Serial No. :	201090006013
Model :	XC-572-V	Model :	Digicon-CC-VT-MS
		Next Calibrate :	31 Jan 23

Location	Reference Temperature °C	Digital Temperature °C	Error °C	MPE	Pass / Fail
Stack	0	0	0	±3	Pass
	25	24	-1	±3	Pass
	50	49	-1	±3	Pass
	100	99	-1	±3	Pass
	150	149	-1	±3	Pass
	200	198	-2	±3	Pass
	250	248	-2	±3	Pass
	300	298	-2	±3	Pass
	500	499	-1	±3	Pass
Probe	100	99	-1	±3	Pass
	120	120	0	±3	Pass
	140	139	-1	±3	Pass
Oven	100	100	0	±3	Pass
	120	120	0	±3	Pass
	140	139	-1	±3	Pass
Filter	100	100	0	±3	Pass
	120	120	0	±3	Pass
	140	140	0	±3	Pass
Exit	0	0	0	±3	Pass
	10	9	-1	±3	Pass
	20	19	-1	±3	Pass
Meter	0	0	0	±3	Pass
	25	25	0	±3	Pass
	50	50	0	±3	Pass
AUX	0	-1	-1	±3	Pass
	25	24	-1	±3	Pass
	50	49	-1	±3	Pass

MPE : (Maximum permissible error of measurement) ค่าความผิดพลาดสูงสุดของการวัดที่ยอมรับได้

Calibrated by : 

(Mr.Prasert Surakhan)

Field Scientist (3)

Approved by : 

(Mr.Samart Roo-ngan)

Specialist (1)



Stopwatch Calibration Test Report

Calibration Date : 3 Jul 23

Next Cal. Date : 3 Jan 24

Barometric Pressure (mmHg) : 759

Temperature (°C) : 27.0

Relative Humidity (%) : 58.0

Reference Stopwatch Data

Stopwatch ID No. : E18061

Model : F808

Serial No. : -

Calibration Date : 8 Sep 20

Certificate No. : E-2009018

Console Control Meter Data

Dry Gas Meter No. : BKK_FS1093

Model : XC-572-V

Serial No. : 1706090

Run No.	Time Actual (m:ss.ms)	Time Reading (m:ss)	Diff. (ms)	Diff. (min)
1	5:00:11	5:00	11	0.00018
2	5:00:10	5:00	10	0.00017
3	5:00:11	5:00	11	0.00018
4	5:00:10	5:00	10	0.00017
5	5:00:12	5:00	12	0.00020
6	5:00:12	5:00	12	0.00020
7	5:00:10	5:00	10	0.00017
8	5:00:10	5:00	10	0.00017
9	5:00:08	5:00	8	0.00013
10	5:00:09	5:00	9	0.00015
			Average	0.00017
			SD	0.00002

Calibrate by :

Mr. Prasert Surakhan

Field Scientist (3)

Approved by :

Mr. Samart Roo-ngan

Specialist (1)



Pitot Tube Calibration Data

Pitot Tube Identification Number :	BKK_FS1104	Calibration Date :	3 Jul 23
Lab test duct Number :	258-1-13-01	Standard Pitot ID :	BKK_FS0441
Calibration Sheet No. :	C-030723-BKK_FS1104	Cp Standard :	0.99

Type S Pitot Tube Coefficient Data					
	Type s pitot tube Leg A,B	Standard pitot tube (ΔP , mm.H ₂ O)	Type s pitot tube (ΔP , mm.H ₂ O)	Cp (s) Leg A	Cp (s) Leg B
Test 1	A	12.00	17.00	0.840	-
	B	12.00	17.00	-	0.840
Test 2	A	12.00	17.00	0.840	-
	B	12.00	17.00	-	0.840
Test 3	A	12.00	16.80	0.845	-
	B	12.00	16.80	-	0.845
				\bar{C}_p	0.842
				0.842	0.842

$$Cp(S) = Cp_{(std)} \sqrt{\frac{\Delta P(std)}{\Delta P(s)}}$$

$$\left[\bar{C}_{p(A)} - \bar{C}_{p(B)} \right] \text{ must BE } \leq 0.01$$

$$\text{Average deviation}(A \text{ or } B) = \frac{\sum_i^3 [Cp(s) - Cp(A \text{ or } B)]}{3} \text{ must BE } \leq 0.01$$

Calibrated by : Worawich T.

(Mr. Worawich Tongpoom)

Field Scientist (2)

Approved by : Samart R.

(Mr.Samart Roo-ngan)

Specialist (1)



Pitot Tube Calibration Data

Pitot Tube Identification Number :	BKK_FS1105	Calibration Date :	3 Jul 23
Lab test duct Number :	258-1-13-01	Standard Pitot ID :	BKK_FS0441
Calibration Sheet No. :	C-030723-BKK_FS1105	Cp Standard :	0.99

Type S Pitot Tube Coefficient Data					
	Type s pitot tube Leg A,B	Standard pitot tube (ΔP , mm.H ₂ O)	Type s pitot tube (ΔP , mm.H ₂ O)	Cp (s) Leg A	Cp (s) Leg B
Test 1	A	12.00	16.80	0.845	-
	B	12.00	16.80	-	0.845
Test 2	A	12.00	17.20	0.835	-
	B	12.00	17.20	-	0.835
Test 3	A	12.00	16.80	0.845	-
	B	12.00	16.80	-	0.845
				\bar{Cp}	0.842
				0.842	0.842

$$Cp(S) = Cp_{(std)} \sqrt{\frac{\Delta P(std)}{\Delta P(s)}}$$

$$\left| \bar{Cp}_{(A)} - \bar{Cp}_{(B)} \right| \text{ must BE } \leq 0.01$$

$$\text{Average deviation(A or B)} = \frac{\sum_i [Cp(s) - Cp(A \text{ or } B)]}{3} \text{ must BE } \leq 0.01$$

Calibrated by : Worawich T.

(Mr. Worawich Tongpoom)

Field Scientist (2)

Approved by : Samart P.

(Mr.Samart Roo-ngan)

Specialist (1)



PROBE NOZZLE DIAMETER
CALIBRATION DATA SHEET

Calibration Date : 3 Jul 23	Nozzle Set ID. : BKK_FS1093
Calibration Sheet No. : C-030723-BKK_FS1106	Vernier Caliper ID.: RYG_FS0539

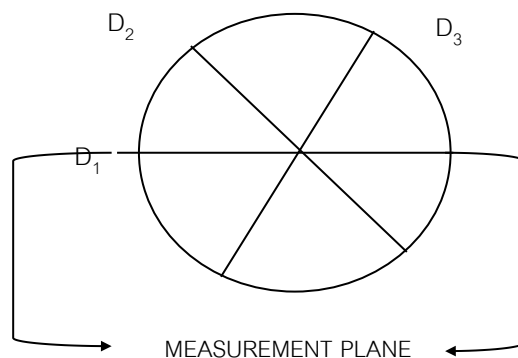
Nozzle ID #	Nozzle Diameter (cm.)			Hi - Lo	$(D_1 + D_2 + D_3) / 3$
	D_1	D_2	D_3	ΔD	D_{avg}
1	0.300	0.300	0.300	0.000	0.300
2	0.450	0.450	0.450	0.000	0.450
3	0.600	0.600	0.600	0.000	0.600
4	0.790	0.790	0.790	0.000	0.790
5	0.950	0.950	0.950	0.000	0.950
6	1.090	1.090	1.090	0.000	1.090
7	1.250	1.250	1.250	0.000	1.250
8	1.600	1.600	1.600	0.000	1.600

Where :

D_1, D_2, D_3 = Three different nozzle diameters at 60 degrees to each other, each measured the nearest 0.025 mm.

ΔD = Maximum distance between any two diameters, must be ≤ 0.100 mm.

D_{avg} = $(D_1 + D_2 + D_3) / 3$



Calibrated by : Worawich T.

(Mr. Worawich Tongpoom)

Field Scientist (2)

Approved by : Samart R.

(Mr. Samart Roo-ngan)

Field Specialist (1)

Sartorius (Thailand) Co., Ltd.

129 Rama 9 Road, Huaykwang, Huaykwang, Bangkok 10310

Tel: +66 2643 8361-6, e-mail: service.thailand@sartorius.com



NSC-TISI-TIS 17025

CALIBRATION 0426

SARTORIUS

Certificate

of Calibration

REVIEW BY	<u>Sinlut P.</u>
APPROVED BY	<u>LL AL</u>
NEXT CAL. DATE	<u>8/2/24</u>

Model Number : MSE224S-100-DUCertificate No. : 23BCI0072Description : Analytical BalanceIssued Date : Monday, February 13, 2023Serial Number : 26207042Reference No. : 203245ID No. : BKK_EN0002Page No. : 1 of 2Manufacturer : SartoriusCustomer Name : ALS Laboratory Group (Thailand)Co., Ltd.104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan, Khet Suan Luang, Bangkok 10250.Calibrated Place : Balance RoomCalibrated By : Mr. Chonchai InthanaCalibration Date : Wednesday, February 08, 2023

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 : 220 g Readability : 0.0001 g

Ambients Conditions:

Temperature : 23.2 °C ± 5.0 °CHumidity : 60.0 % RH ± 10.0 % RHPressure : ±

Reasons for calibration

☐ New Installation ☐ Service / Repaired ☒ Re-calibration/ MaintenanceEquipment Condition: ☒ Good Operate ☐ Fair

Measurement Method UKAS Publication Ref :Lab 14

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

Traceability:

Model Number	Description	Traceability	Certificate No.	Due Date
YCS011-522-00	Sartorius weight set 1mg - 5000g E2, YCS011-522-00	SPC-RT	C02212565	14-Sep-2023
MHB-382SD	Humidity/Barometer/Temp Lutron MHB-382SD	DKSH	C19220444	5-Sep-2023

This certificate relate and apply this equipment only.

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

SOP FM 33 03 February 2022

Mr. Chonchai Inthana (Technical Manager)

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T
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M
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Sartorius (Thailand) Co., Ltd.

129 Rama 9 Road, Huaykwang, Huaykwang, Bangkok 10310

Tel: +66 2643 8361-6 Fax: +66 2643-8367, e-mail: service.thailand@sartorius.com

SARTORIUS

Certificate of Calibration

Model Number : MSE224S-100-DUCertificate No. : 23BCI0072Description : Analytical BalanceIssued Date : Monday, February 13, 2023Serial Number : 26207042Reference No. : 203245ID No. : BKK_EN0002Manufacturer : SartoriusPage No. : 2 of 2

Calibration Results : Without Adjustment

Repeatability

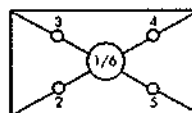
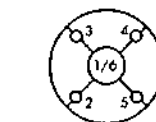
The reproducibility is the ability of a weighing instrument to display nearly identical readouts under constant test conditions when the same load within a measurement series is placed repeatedly on the weighing pan in the same manner. The standard deviation is used to express reproducibility quantitatively.

Nominal Value : (Low Load)	20.0000	200.0000
20 g	20.0000	199.9999
Tolerance	20.0000	200.0000
0.0001 g	20.0000	199.9999
	20.0001	200.0000
Nominal Value : (High Load)	20.0000	200.0000
200 g	20.0000	199.9999
Tolerance	20.0000	199.9999
0.0001 g	20.0000	200.0000
	20.0001	199.9999
Standard Deviation	0.00004	0.00005

Eccentricity (Off-center loading error)

The off-center loading error is yielded by the difference between the readout 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 R76).

Nominal value : 50 g
Tolerance 0.0004 g



	Difference
1	—
2	-0.0001
3	0.0000
4	0.0001
5	0.0000
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 (g)	Conventional Mass Value (g)	Displayed Value (g)	Deviation (g)	Uncertainty (g)
0.01	0.0100	0.0100	0.0000	0.00014
0.1	0.1000	0.1000	0.0000	0.00014
1	1.0000	1.0000	0.0000	0.00014
2	2.0000	2.0000	0.0000	0.00014
5	5.0000	5.0000	0.0000	0.00014
10	10.0000	10.0000	0.0000	0.00014
20	20.0000	20.0000	0.0000	0.00014
50	50.0000	50.0000	0.0000	0.00015
100	100.0000	100.0000	0.0000	0.00019
200	200.0000	199.9999	-0.0001	0.00030

End of Report.



Lot No. 23124733-1

ANALYZER CALIBRATION DATA

Client : Gulf BP Co., Ltd. Location : โรงงาน HRSG 11
Date : 23 Nov 23 Test Operator : Anuvat M.

O₂ ANALYZER

Model : TELEDYNE API T200H Serial No. : 991
Span (%) : 25

	Cylinder Value (%)	Initial Analyzers Calibration Response (%)	Final Analyzers Calibration Response (%)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.11	0.44
Low-Level Gas	7.98	7.89	8.00	0.44
Span Gas	16.02	16.11	16.00	0.44

NO_x ANALYZER

Model : TELEDYNE API T200H Serial No. : 991
Span (ppm) : 100

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.12	0.11	0.01
Low-Level Gas	56.16	56.11	56.00	0.11
Span Gas	79.77	79.78	79.99	0.21

SO₂ ANALYZER

Model : TELEDYNE API T100H Serial No. : 553
Span (ppm) : 100

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.00	0.00
Low-Level Gas	55.55	55.34	55.23	0.11
Span Gas	79.09	79.67	79.00	0.67

CO ANALYZER

Model : TELEDYNE API T300M Serial No. : 924
Span (ppm) : 100

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.11	0.12	0.01
Low-Level Gas	54.22	54.89	54.77	0.12
Span Gas	79.90	78.97	79.24	0.27

Calibrated by

(Mr. Anuvat Mounpair)

Environmental Field Scientist (2)



Lot No. 23124733-1

SYSTEM CALIBRATION BIAS AND DRIFT DATA

Client : Gulf BP Co., Ltd. Location : ห้อง HRSG 11
Date : 23 Nov 23 Test Operator : Anuvat M.

O₂ ANALYZER

Cylinder Conc. (%) : 16.02

Span (%) : 25

	O ₂ Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
		System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	
Zero Gas	0.00	0.11	0.44	0.15	0.60	0.16
Upscale Gas	16.11	15.98	0.52	15.89	0.88	0.36

NO_x ANALYZER

Cylinder Conc. (ppm) : 79.77

Span (ppm) : 100

	NO _x Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
		System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	
Zero Gas	0.12	0.10	0.02	0.12	0.00	0.02
Upscale Gas	79.78	80.00	0.22	80.11	0.33	0.11

SO₂ ANALYZER

Cylinder Conc. (ppm) : 79.90

Span (ppm) : 100

	SO ₂ Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
		System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	
Zero Gas	0.00	0.11	0.11	0.12	0.12	0.01
Upscale Gas	79.67	80.78	1.11	79.89	0.22	0.89

CO ANALYZER

Cylinder Conc. (ppm) : 79.90

Span (ppm) : 100

	CO Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
		System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	
Zero Gas	0.11	0.12	0.01	0.13	0.02	0.01
Upscale Gas	78.97	79.11	0.14	79.33	0.36	0.22

Calibrated by

(Mr. Anuvat Mounpair)

Environmental Field Scientist (2)



EMISSION TEST RESULT

Client	Gulf BP Co., Ltd.	Run #	1
Date	23 Nov 23	Location	ปล่อง HRSG 11
Start Time	14:25	Test Operator	Anuvat M.
SO ₂ Analyzer Model	TELEDYNE API T100H	Finish Time	14:45
NO _x /O ₂ Analyzer Model	TELEDYNE API T200H	Serial No.	553
CO/CO ₂ Analyzer Model	TELEDYNE API T300M	Serial No.	991
		Serial No.	924

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
14:25	14.44	3.58	25.18	0.19	0.66	
14:26	14.46	3.59	25.29	0.18	0.65	
14:27	14.45	3.59	25.50	0.18	0.63	
14:28	14.44	3.59	25.62	0.19	0.63	
14:29	14.43	3.59	25.64	0.19	0.64	
14:30	14.45	3.59	25.55	0.19	0.65	
14:31	14.47	3.60	25.45	0.21	0.61	
14:32	14.45	3.58	25.38	0.19	0.64	
14:33	14.47	3.58	25.41	0.20	0.62	
14:34	14.47	3.58	25.35	0.17	0.61	
14:35	14.46	3.58	25.24	0.19	0.61	
14:36	14.47	3.59	25.15	0.18	0.60	
14:37	14.46	3.58	25.08	0.17	0.62	
14:38	14.43	3.59	25.02	0.18	0.62	
14:39	14.46	3.58	25.08	0.20	0.62	
14:40	14.45	3.58	25.07	0.17	0.62	
14:41	14.44	3.59	25.02	0.17	0.58	
14:42	14.44	3.59	24.95	0.17	0.60	
14:43	14.46	3.59	25.03	0.18	0.60	
14:44	14.45	3.58	25.10	0.18	0.61	
14:45	14.44	3.58	25.10	0.17	0.57	
Average	14.45	3.59	25.25	0.18	0.62	

Anuvat M

(Mr.Anuvat Mounpair)

Environmental Field Scientist (2)



EMISSION TEST RESULT

Client	Gulf BP Co., Ltd.	Run #	2
Date	23 Nov 23	Location	ปล่อง HRSG 11
Start Time	14:46	Test Operator	Anuvat M.
SO ₂ Analyzer Model	TELEDYNE API T100H	Finish Time	15:06
NO _x /O ₂ Analyzer Model	TELEDYNE API T200H	Serial No.	553
CO/CO ₂ Analyzer Model	TELEDYNE API T300M	Serial No.	991
		Serial No.	924

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
14:46	14.46	3.58	25.13	0.18	0.58	
14:47	14.45	3.59	25.22	0.18	0.53	
14:48	14.43	3.59	25.35	0.19	0.58	
14:49	14.44	3.59	25.50	0.17	0.59	
14:50	14.43	3.59	25.60	0.17	0.61	
14:51	14.44	3.59	25.61	0.18	0.64	
14:52	14.47	3.59	25.47	0.18	0.63	
14:53	14.46	3.58	25.10	0.17	0.61	
14:54	14.45	3.58	24.91	0.17	0.63	
14:55	14.44	3.58	24.95	0.18	0.63	
14:56	14.46	3.58	24.97	0.19	0.59	
14:57	14.45	3.58	25.02	0.18	0.54	
14:58	14.46	3.59	24.98	0.18	0.56	
14:59	14.46	3.59	24.92	0.16	0.58	
15:00	14.45	3.59	24.92	0.19	0.59	
15:01	14.44	3.58	24.94	0.18	0.60	
15:02	14.46	3.58	24.92	0.17	0.58	
15:03	14.44	3.59	24.89	0.18	0.59	
15:04	14.45	3.59	24.97	0.18	0.57	
15:05	14.47	3.59	25.02	0.16	0.55	
15:06	14.45	3.58	24.92	0.18	0.59	
Average	14.45	3.59	25.11	0.18	0.59	

Anuvat M

(Mr.Anuvat Mounpair)

Environmental Field Scientist (2)



EMISSION TEST RESULT

Client	Gulf BP Co., Ltd.	Run #	3
Date	23 Nov 23	Location	แปลง HRSG 11
Start Time	15:07	Test Operator	Anuvat M.
SO ₂ Analyzer Model	TELEDYNE API T100H	Finish Time	15:27
NO _x /O ₂ Analyzer Model	TELEDYNE API T200H	Serial No.	553
CO/CO ₂ Analyzer Model	TELEDYNE API T300M	Serial No.	991
		Serial No.	924

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
15:07	14.46	3.58	24.84	0.17	0.61	
15:08	14.43	3.59	24.79	0.18	0.57	
15:09	14.45	3.59	24.84	0.17	0.65	
15:10	14.43	3.60	24.90	0.18	0.65	
15:11	14.44	3.59	25.16	0.18	0.64	
15:12	14.46	3.58	25.24	0.18	0.63	
15:13	14.45	3.58	25.14	0.18	0.60	
15:14	14.43	3.58	25.03	0.19	0.61	
15:15	14.42	3.59	25.06	0.18	0.61	
15:16	14.44	3.59	25.21	0.17	0.63	
15:17	14.42	3.59	25.30	0.18	0.59	
15:18	14.43	3.59	25.30	0.18	0.58	
15:19	14.41	3.59	25.31	0.18	0.59	
15:20	14.42	3.59	25.29	0.18	0.61	
15:21	14.44	3.59	25.13	0.18	0.58	
15:22	14.43	3.60	25.08	0.16	0.60	
15:23	14.44	3.59	25.09	0.19	0.56	
15:24	14.45	3.58	25.06	0.19	0.54	
15:25	14.44	3.59	24.91	0.19	0.57	
15:26	14.44	3.58	24.97	0.17	0.58	
15:27	14.43	3.60	25.11	0.17	0.52	
Average	14.44	3.59	25.08	0.18	0.60	

Anuvat M

(Mr.Anuvat Mounpair)

Environmental Field Scientist (2)



Lot No. 23124735-1

ANALYZER CALIBRATION DATA

Client : Gulf BP Co., Ltd. Location : โรงงาน HRSG 12
Date : 24 Nov 23 Test Operator : Anuvat M.

O₂ ANALYZER

Model : TELEDYNE API T200H Serial No. : 991
Span (%) : 25

	Cylinder Value (%)	Initial Analyzers Calibration Response (%)	Final Analyzers Calibration Response (%)	Difference (Percent of Span)
Zero Gas	0.00	0.11	0.00	0.44
Low-Level Gas	7.98	7.89	7.88	0.04
Span Gas	16.02	16.11	16.00	0.44

NO_x ANALYZER

Model : TELEDYNE API T200H Serial No. : 991
Span (ppm) : 100

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.12	0.11	0.01
Low-Level Gas	56.16	56.11	55.98	0.13
Span Gas	79.77	79.78	80.12	0.34

SO₂ ANALYZER

Model : TELEDYNE API T100H Serial No. : 553
Span (ppm) : 100

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.11	0.11
Low-Level Gas	55.55	55.34	54.88	0.46
Span Gas	79.09	79.67	78.88	0.79

CO ANALYZER

Model : TELEDYNE API T300M Serial No. : 924
Span (ppm) : 100

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.11	0.12	0.01
Low-Level Gas	54.22	54.89	54.13	0.76
Span Gas	79.90	79.87	79.24	0.63

Calibrated by

(Mr. Anuvat Mounpair)

Environmental Field Scientist (2)



Lot No. 23124735-1

SYSTEM CALIBRATION BIAS AND DRIFT DATA

Client : Gulf BP Co., Ltd. Location : โรงงาน HRSG 12
Date : 24 Nov 23 Test Operator : Anuvat M.

O₂ ANALYZER

Cylinder Conc. (%) : 16.02

Span (%) : 25

	O ₂ Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
		System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	
Zero Gas	0.11	0.11	0.00	0.11	0.00	0.00
Upscale Gas	16.11	15.98	0.52	16.00	0.44	0.08

NO_x ANALYZER

Cylinder Conc. (ppm) : 79.77

Span (ppm) : 100

	NO _x Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
		System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	
Zero Gas	0.12	0.10	0.02	0.00	0.12	0.10
Upscale Gas	79.78	80.00	0.22	80.00	0.22	0.00

SO₂ ANALYZER

Cylinder Conc. (ppm) : 79.90

Span (ppm) : 100

	SO ₂ Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
		System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	
Zero Gas	0.00	0.11	0.11	0.12	0.12	0.01
Upscale Gas	79.67	80.00	0.33	80.45	0.78	0.45

CO ANALYZER

Cylinder Conc. (ppm) : 79.90

Span (ppm) : 100

	CO Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
		System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	
Zero Gas	0.11	0.12	0.01	0.13	0.02	0.01
Upscale Gas	79.87	79.11	0.76	79.33	0.54	0.22

Calibrated by

(Mr. Anuvat Mounpair)

Environmental Field Scientist (2)



EMISSION TEST RESULT

Client	Gulf BP Co., Ltd.	Run #	1
Date	24 Nov 23	Location	ปล่อง HRSG 12
Start Time	14:00	Test Operator	Anuvat M.
SO ₂ Analyzer Model	TELEDYNE API T100H	Finish Time	14:20
NO _x /O ₂ Analyzer Model	TELEDYNE API T200H	Serial No.	553
CO/CO ₂ Analyzer Model	TELEDYNE API T300M	Serial No.	991
		Serial No.	924

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
14:00	14.37	3.56	19.70	0.15	1.16	
14:01	14.37	3.55	19.01	0.16	1.17	
14:02	14.39	3.55	18.78	0.14	1.16	
14:03	14.37	3.57	18.84	0.15	1.12	
14:04	14.36	3.58	19.02	0.15	1.16	
14:05	14.36	3.57	19.21	0.16	1.16	
14:06	14.32	3.57	19.27	0.17	1.19	
14:07	14.34	3.58	19.32	0.15	1.20	
14:08	14.31	3.59	19.43	0.15	1.19	
14:09	14.37	3.59	19.44	0.16	1.13	
14:10	14.38	3.55	19.08	0.14	1.10	
14:11	14.38	3.55	18.79	0.17	1.11	
14:12	14.38	3.54	18.78	0.15	1.11	
14:13	14.34	3.55	18.84	0.15	1.10	
14:14	14.34	3.57	18.96	0.15	1.13	
14:15	14.38	3.58	19.03	0.14	1.08	
14:16	14.39	3.57	18.89	0.14	1.07	
14:17	14.36	3.57	18.61	0.14	1.10	
14:18	14.36	3.58	18.59	0.15	1.10	
14:19	14.35	3.58	18.70	0.14	1.12	
14:20	14.36	3.58	18.81	0.15	1.11	
Average	14.36	3.57	19.01	0.15	1.13	

Anuvat M

(Mr.Anuvat Mounpair)

Environmental Field Scientist (2)



EMISSION TEST RESULT

Client	Gulf BP Co., Ltd.	Run #	2
Date	24 Nov 23	Location	ปล่อง HRSG 12
Start Time	14:21	Test Operator	Anuvat M.
SO ₂ Analyzer Model	TELEDYNE API T100H	Finish Time	14:41
NO _x /O ₂ Analyzer Model	TELEDYNE API T200H	Serial No.	553
CO/CO ₂ Analyzer Model	TELEDYNE API T300M	Serial No.	991
		Serial No.	924

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
14:21	14.36	3.57	18.85	0.14	1.07	
14:22	14.29	3.58	18.93	0.16	1.10	
14:23	14.27	3.61	19.53	0.16	1.11	
14:24	14.30	3.61	20.03	0.16	1.11	
14:25	14.31	3.60	19.93	0.15	1.14	
14:26	14.30	3.60	19.73	0.17	1.10	
14:27	14.30	3.60	19.75	0.15	1.10	
14:28	14.32	3.59	19.77	0.15	1.07	
14:29	14.32	3.58	19.71	0.15	1.07	
14:30	14.30	3.59	19.61	0.14	1.08	
14:31	14.28	3.60	19.70	0.16	1.05	
14:32	14.31	3.60	19.95	0.15	1.05	
14:33	14.31	3.59	19.84	0.15	1.07	
14:34	14.32	3.59	19.49	0.15	1.04	
14:35	14.29	3.59	19.32	0.15	1.05	
14:36	14.31	3.60	19.57	0.16	1.01	
14:37	14.31	3.60	19.71	0.16	1.04	
14:38	14.31	3.60	19.59	0.16	1.00	
14:39	14.31	3.60	19.48	0.16	1.03	
14:40	14.32	3.59	19.49	0.16	1.02	
14:41	14.30	3.59	19.52	0.15	1.02	
Average	14.31	3.59	19.60	0.15	1.06	

Anuvat M

(Mr.Anuvat Mounpair)

Environmental Field Scientist (2)



EMISSION TEST RESULT

Client	Gulf BP Co., Ltd.	Run #	3
Date	24 Nov 23	Location	ปล่อง HRSG 12
Start Time	14:42	Test Operator	Anuvat M.
SO ₂ Analyzer Model	TELEDYNE API T100H	Finish Time	15:02
NO _x /O ₂ Analyzer Model	TELEDYNE API T200H	Serial No.	553
CO/CO ₂ Analyzer Model	TELEDYNE API T300M	Serial No.	991
		Serial No.	924

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
14:42	14.28	3.60	19.64	0.15	1.06	
14:43	14.29	3.60	19.77	0.15	1.01	
14:44	14.30	3.59	19.74	0.16	1.03	
14:45	14.31	3.59	19.63	0.15	1.00	
14:46	14.29	3.59	19.65	0.15	1.02	
14:47	14.32	3.60	19.67	0.16	0.99	
14:48	14.31	3.61	19.61	0.15	0.94	
14:49	14.30	3.61	19.64	0.14	1.04	
14:50	14.29	3.61	19.76	0.13	1.02	
14:51	14.31	3.59	19.80	0.14	1.00	
14:52	14.31	3.59	19.68	0.14	1.02	
14:53	14.32	3.60	19.63	0.16	1.03	
14:54	14.31	3.60	19.60	0.13	1.02	
14:55	14.29	3.60	19.60	0.14	1.00	
14:56	14.31	3.60	19.66	0.14	1.06	
14:57	14.30	3.59	19.73	0.14	1.00	
14:58	14.31	3.59	19.72	0.14	1.03	
14:59	14.30	3.61	19.72	0.13	1.01	
15:00	14.31	3.61	19.75	0.14	1.03	
15:01	14.31	3.60	19.77	0.14	0.99	
15:02	14.32	3.59	19.65	0.12	0.97	
Average	14.30	3.60	19.69	0.14	1.01	

Anuvat M

(Mr.Anuvat Mounpair)

Environmental Field Scientist (2)



Lot No. 23124756-1

ANALYZER CALIBRATION DATA

Client : Gulf BP Co., Ltd. Location : โรงงาน HRSG 11
Date : 23 Nov 23 Test Operator : Anuvat M.

O₂ ANALYZER

Model : TELEDYNE API T200H Serial No. : 991
Span (%) : 25

	Cylinder Value (%)	Initial Analyzers Calibration Response (%)	Final Analyzers Calibration Response (%)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.11	0.44
Low-Level Gas	7.98	7.89	8.00	0.44
Span Gas	16.02	16.11	16.00	0.44

NO_x ANALYZER

Model : TELEDYNE API T200H Serial No. : 991
Span (ppm) : 100

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.12	0.11	0.01
Low-Level Gas	56.16	56.11	56.00	0.11
Span Gas	79.77	79.78	79.99	0.21

SO₂ ANALYZER

Model : TELEDYNE API T100H Serial No. : 553
Span (ppm) : 100

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.00	0.00
Low-Level Gas	55.55	55.34	55.23	0.11
Span Gas	79.09	79.67	79.00	0.67

CO ANALYZER

Model : TELEDYNE API T300M Serial No. : 924
Span (ppm) : 100

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.11	0.12	0.01
Low-Level Gas	54.22	54.89	54.77	0.12
Span Gas	79.90	78.97	79.24	0.27

Calibrated by

(Mr. Anuvat Mounpair)

Environmental Field Scientist (2)



Lot No. 23124756-1

SYSTEM CALIBRATION BIAS AND DRIFT DATA

Client : Gulf BP Co., Ltd. Location : ห้อง HRSG 11
Date : 23 Nov 23 Test Operator : Anuvat M.

O₂ ANALYZER

Cylinder Conc. (%) : 16.02

Span (%) : 25

	O ₂ Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
		System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	
Zero Gas	0.00	0.11	0.44	0.15	0.60	0.16
Upscale Gas	16.11	15.98	0.52	15.89	0.88	0.36

NO_x ANALYZER

Cylinder Conc. (ppm) : 79.77

Span (ppm) : 100

	NO _x Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
		System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	
Zero Gas	0.12	0.10	0.02	0.12	0.00	0.02
Upscale Gas	79.78	80.00	0.22	80.11	0.33	0.11

SO₂ ANALYZER

Cylinder Conc. (ppm) : 79.90

Span (ppm) : 100

	SO ₂ Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
		System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	
Zero Gas	0.00	0.11	0.11	0.12	0.12	0.01
Upscale Gas	79.67	80.78	1.11	79.89	0.22	0.89

CO ANALYZER

Cylinder Conc. (ppm) : 79.90

Span (ppm) : 100

	CO Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
		System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	
Zero Gas	0.11	0.12	0.01	0.13	0.02	0.01
Upscale Gas	78.97	79.11	0.14	79.33	0.36	0.22

Calibrated by

(Mr. Anuvat Mounpair)

Environmental Field Scientist (2)



CEMs Data

Client Name Gulf BP Co., Ltd.
Plant Name GBP

Date 23 Nov 23
Location ปล่อง HRSG 11

Run No: 1

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	Load MW
23 Nov 23	13:45	0.22	23.58	0.05	15.04	42.19
23 Nov 23	13:46	0.34	23.74	0.09	15.04	42.18
23 Nov 23	13:47	0.49	24.11	0.11	15.02	42.28
23 Nov 23	13:48	0.62	24.84	0.10	15.00	42.32
23 Nov 23	13:49	0.68	25.00	0.08	15.01	42.03
23 Nov 23	13:50	0.72	24.15	0.08	15.04	41.96
23 Nov 23	13:51	0.73	23.73	0.09	15.05	41.93
23 Nov 23	13:52	0.71	23.68	0.08	15.06	41.94
23 Nov 23	13:53	0.73	23.36	0.07	15.06	41.95
23 Nov 23	13:54	0.71	23.66	0.09	15.04	41.92
23 Nov 23	13:55	0.72	23.62	0.10	15.05	41.91
23 Nov 23	13:56	0.69	23.60	0.08	15.04	41.91
23 Nov 23	13:57	0.69	23.63	0.11	15.04	41.91
23 Nov 23	13:58	0.70	23.64	0.08	15.05	41.98
23 Nov 23	13:59	0.68	23.84	0.09	15.04	41.95
23 Nov 23	14:00	0.66	23.67	0.10	15.05	41.91
23 Nov 23	14:01	0.64	23.60	0.11	15.04	41.91
23 Nov 23	14:02	0.63	23.69	0.12	15.03	41.90
23 Nov 23	14:03	0.62	23.60	0.09	15.04	41.89
23 Nov 23	14:04	0.63	23.99	0.13	15.02	41.93
23 Nov 23	14:05	0.60	24.53	0.11	15.02	41.91
Max		0.73	25.00	0.13	15.06	42.32
Avg		0.63	23.87	0.09	15.04	41.99

Run No: 2

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	Load MW
23 Nov 23	14:06	0.60	24.94	0.15	15.02	41.90
23 Nov 23	14:07	0.60	24.81	0.13	15.02	41.96
23 Nov 23	14:08	0.61	24.80	0.13	15.01	41.96
23 Nov 23	14:09	0.56	25.09	0.14	15.01	41.97
23 Nov 23	14:10	0.39	24.49	0.13	15.02	41.94
23 Nov 23	14:11	0.22	24.35	0.08	15.02	41.92
23 Nov 23	14:12	0.17	24.30	0.05	15.04	41.94
23 Nov 23	14:13	0.19	24.14	0.09	15.04	41.96
23 Nov 23	14:14	0.21	24.12	0.06	15.05	41.99
23 Nov 23	14:15	0.22	23.55	0.07	15.06	41.99
23 Nov 23	14:16	0.22	23.47	0.05	15.06	41.98
23 Nov 23	14:17	0.22	23.51	0.07	15.05	41.94
23 Nov 23	14:18	0.19	23.56	0.06	15.04	41.89
23 Nov 23	14:19	0.24	23.81	0.09	15.04	41.86
23 Nov 23	14:20	0.37	23.69	0.08	15.04	41.94
23 Nov 23	14:21	0.51	23.69	0.08	15.06	41.98
23 Nov 23	14:22	0.61	23.76	0.10	15.06	42.01
23 Nov 23	14:23	0.69	23.86	0.11	15.05	41.95
23 Nov 23	14:24	0.73	24.03	0.07	15.03	41.83
23 Nov 23	14:25	0.75	24.08	0.09	15.04	41.90
23 Nov 23	14:26	0.75	24.32	0.10	15.04	41.96
Max		0.75	25.09	0.15	15.06	42.01
Avg		0.43	24.11	0.09	15.04	41.94

Run No: 3

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	Load MW
23 Nov 23	14:27	0.75	24.21	0.11	15.04	41.97
23 Nov 23	14:28	0.71	24.03	0.10	15.04	41.96
23 Nov 23	14:29	0.72	24.01	0.10	15.04	41.96
23 Nov 23	14:30	0.71	24.00	0.11	15.04	41.94
23 Nov 23	14:31	0.70	23.95	0.11	15.04	41.93
23 Nov 23	14:32	0.66	24.10	0.11	15.05	41.96
23 Nov 23	14:33	0.67	23.72	0.11	15.05	41.98
23 Nov 23	14:34	0.67	23.75	0.13	15.05	41.99
23 Nov 23	14:35	0.63	23.60	0.11	15.05	41.97
23 Nov 23	14:36	0.64	23.55	0.11	15.04	41.95
23 Nov 23	14:37	0.62	23.70	0.10	15.02	41.89
23 Nov 23	14:38	0.62	23.82	0.11	15.04	41.89
23 Nov 23	14:39	0.63	23.86	0.11	15.04	41.93
23 Nov 23	14:40	0.64	23.69	0.08	15.04	41.97
23 Nov 23	14:41	0.58	23.62	0.10	15.04	42.03
23 Nov 23	14:42	0.43	23.57	0.11	15.04	41.95
23 Nov 23	14:43	0.25	23.34	0.06	15.05	41.97
23 Nov 23	14:44	0.25	23.72	0.10	15.03	41.94
23 Nov 23	14:45	0.25	23.68	0.07	15.04	41.91
23 Nov 23	14:46	0.24	23.90	0.10	15.03	41.95
23 Nov 23	14:47	0.20	24.08	0.10	15.03	41.97
Max		0.75	24.21	0.13	15.05	42.03
Avg		0.55	23.80	0.10	15.04	41.95

Run No: 4

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	Load MW
23 Nov 23	14:48	0.22	24.23	0.09	15.03	41.98
23 Nov 23	14:49	0.23	24.20	0.05	15.02	41.96
23 Nov 23	14:50	0.23	24.10	0.08	15.04	42.00
23 Nov 23	14:51	0.22	23.47	0.08	15.05	41.98
23 Nov 23	14:52	0.35	23.51	0.10	15.04	41.98
23 Nov 23	14:53	0.50	23.55	0.07	15.04	42.00
23 Nov 23	14:54	0.61	23.72	0.11	15.03	41.93
23 Nov 23	14:55	0.68	23.71	0.10	15.03	41.91
23 Nov 23	14:56	0.72	23.66	0.08	15.05	41.97
23 Nov 23	14:57	0.71	23.80	0.09	15.04	41.96
23 Nov 23	14:58	0.73	23.60	0.12	15.04	41.96
23 Nov 23	14:59	0.74	23.84	0.11	15.03	41.92
23 Nov 23	15:00	0.73	23.65	0.08	15.04	41.93
23 Nov 23	15:01	0.72	23.67	0.09	15.05	41.95
23 Nov 23	15:02	0.70	23.63	0.11	15.04	41.93
23 Nov 23	15:03	0.69	23.77	0.10	15.05	41.98
23 Nov 23	15:04	0.71	23.56	0.10	15.05	41.98
23 Nov 23	15:05	0.70	23.67	0.10	15.04	41.97
23 Nov 23	15:06	0.69	23.68	0.07	15.04	41.96
23 Nov 23	15:07	0.67	23.62	0.11	15.03	41.89
23 Nov 23	15:08	0.60	23.83	0.14	15.03	41.90
Max		0.74	24.23	0.14	15.05	42.00
Avg		0.58	23.74	0.09	15.04	41.95

Run No: 5

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	Load MW
23 Nov 23	15:09	0.49	23.95	0.11	15.02	41.95
23 Nov 23	15:10	0.49	24.07	0.10	15.04	41.98
23 Nov 23	15:11	0.59	23.94	0.08	15.03	41.98
23 Nov 23	15:12	0.66	23.85	0.11	15.04	41.93
23 Nov 23	15:13	0.67	24.00	0.11	15.03	41.93
23 Nov 23	15:14	0.64	24.19	0.13	15.03	41.95
23 Nov 23	15:15	0.63	24.20	0.14	15.02	41.94
23 Nov 23	15:16	0.62	24.21	0.10	15.03	42.00
23 Nov 23	15:17	0.61	24.15	0.12	15.01	41.97
23 Nov 23	15:18	0.44	23.85	0.10	15.02	41.95
23 Nov 23	15:19	0.26	23.50	0.05	15.02	42.00
23 Nov 23	15:20	0.23	23.62	0.08	15.02	41.98
23 Nov 23	15:21	0.23	24.07	0.07	15.02	41.96
23 Nov 23	15:22	0.22	23.49	0.06	15.04	41.95
23 Nov 23	15:23	0.23	23.53	0.11	15.03	41.94
23 Nov 23	15:24	0.22	23.67	0.05	15.03	41.97
23 Nov 23	15:25	0.22	23.87	0.09	15.02	41.97
23 Nov 23	15:26	0.23	23.96	0.09	15.02	41.96
23 Nov 23	15:27	0.25	23.75	0.08	15.03	41.99
23 Nov 23	15:28	0.36	23.88	0.07	15.04	41.97
23 Nov 23	15:29	0.49	23.70	0.08	15.04	41.94
Max		0.67	24.21	0.14	15.04	42.00
Avg		0.42	23.88	0.09	15.03	41.96

Run No: 6

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	Load MW
23 Nov 23	15:30	0.64	23.84	0.09	15.04	41.91
23 Nov 23	15:31	0.71	23.89	0.12	15.04	41.94
23 Nov 23	15:32	0.76	23.81	0.12	15.03	41.95
23 Nov 23	15:33	0.77	23.74	0.08	15.04	41.96
23 Nov 23	15:34	0.77	23.54	0.10	15.04	41.95
23 Nov 23	15:35	0.73	23.69	0.11	15.04	41.96
23 Nov 23	15:36	0.71	23.42	0.11	15.05	41.97
23 Nov 23	15:37	0.69	23.90	0.14	15.03	41.95
23 Nov 23	15:38	0.67	24.18	0.13	15.02	41.95
23 Nov 23	15:39	0.67	24.35	0.15	15.01	41.95
23 Nov 23	15:40	0.65	24.65	0.11	15.02	41.98
23 Nov 23	15:41	0.65	24.35	0.11	15.03	41.97
23 Nov 23	15:42	0.65	24.45	0.11	15.03	41.97
23 Nov 23	15:43	0.60	24.15	0.12	15.02	41.96
23 Nov 23	15:44	0.47	24.06	0.11	15.01	41.96
23 Nov 23	15:45	0.27	23.97	0.10	15.02	41.97
23 Nov 23	15:46	0.25	23.81	0.07	15.02	41.96
23 Nov 23	15:47	0.25	23.72	0.08	15.04	41.98
23 Nov 23	15:48	0.27	23.59	0.10	15.02	41.95
23 Nov 23	15:49	0.27	23.76	0.08	15.02	41.93
23 Nov 23	15:50	0.24	23.80	0.08	15.03	41.95
Max		0.77	24.65	0.15	15.05	41.98
Avg		0.56	23.94	0.11	15.03	41.96



CEMs Data

Client Name Gulf BP Co., Ltd.
Plant Name GBP

Date 23 Nov 23
Location ปล่อง HRSG 11

Run No: 7 Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	Load MW
23 Nov 23	15:51	0.26	23.81	0.08	15.03	41.94
23 Nov 23	15:52	0.25	23.87	0.08	15.02	41.93
23 Nov 23	15:53	0.28	23.80	0.07	15.03	41.95
23 Nov 23	15:54	0.35	24.02	0.07	15.02	41.95
23 Nov 23	15:55	0.50	24.11	0.09	15.03	41.93
23 Nov 23	15:56	0.64	23.84	0.08	15.04	41.95
23 Nov 23	15:57	0.74	23.78	0.11	15.04	41.95
23 Nov 23	15:58	0.77	23.93	0.12	15.04	41.97
23 Nov 23	15:59	0.74	23.97	0.13	15.04	41.97
23 Nov 23	16:00	0.75	23.72	0.11	15.06	41.96
23 Nov 23	16:01	0.77	23.57	0.10	15.05	41.95
23 Nov 23	16:02	0.74	23.87	0.09	15.04	41.96
23 Nov 23	16:03	0.72	23.68	0.08	15.05	41.95
23 Nov 23	16:04	0.71	23.54	0.09	15.05	41.99
23 Nov 23	16:05	0.68	23.82	0.11	15.04	41.92
23 Nov 23	16:06	0.54	23.78	0.09	15.04	41.94
23 Nov 23	16:07	0.56	23.63	0.12	15.04	41.95
23 Nov 23	16:08	0.64	23.87	0.10	15.03	41.91
23 Nov 23	16:09	0.68	23.81	0.11	15.04	41.94
23 Nov 23	16:10	0.66	23.71	0.11	15.03	41.95
23 Nov 23	16:11	0.64	24.00	0.11	15.03	41.98
Max		0.77	24.11	0.13	15.06	41.99
Avg		0.60	23.81	0.10	15.04	41.95

Run No: 8 Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	Load MW
23 Nov 23	16:12	0.61	23.64	0.10	15.03	41.96
23 Nov 23	16:13	0.48	23.40	0.11	15.02	41.94
23 Nov 23	16:14	0.30	23.72	0.07	15.03	41.95
23 Nov 23	16:15	0.26	23.25	0.08	15.04	41.95
23 Nov 23	16:16	0.27	23.36	0.09	15.04	41.94
23 Nov 23	16:17	0.27	23.31	0.05	15.04	41.98
23 Nov 23	16:18	0.24	23.45	0.09	15.03	41.95
23 Nov 23	16:19	0.22	23.59	0.08	15.03	41.91
23 Nov 23	16:20	0.24	23.45	0.10	15.03	41.92
23 Nov 23	16:21	0.28	23.50	0.07	15.03	41.94
23 Nov 23	16:22	0.27	23.56	0.08	15.03	41.95
23 Nov 23	16:23	0.37	23.86	0.08	15.03	41.97
23 Nov 23	16:24	0.52	23.80	0.07	15.04	41.98
23 Nov 23	16:25	0.66	23.40	0.09	15.05	41.98
23 Nov 23	16:26	0.73	23.56	0.10	15.04	41.99
23 Nov 23	16:27	0.76	23.79	0.11	15.03	41.95
23 Nov 23	16:28	0.76	23.68	0.09	15.04	41.96
23 Nov 23	16:29	0.75	23.65	0.11	15.04	41.96
23 Nov 23	16:30	0.74	23.42	0.11	15.04	41.98
23 Nov 23	16:31	0.72	23.53	0.10	15.03	41.95
23 Nov 23	16:32	0.71	23.69	0.13	15.04	41.97
Max		0.76	23.86	0.13	15.05	41.99
Avg		0.48	23.55	0.09	15.03	41.96

Run No: 9 Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	Load MW
23 Nov 23	16:33	0.70	23.52	0.10	15.04	41.95
23 Nov 23	16:34	0.66	23.79	0.10	15.03	41.98
23 Nov 23	16:35	0.66	23.75	0.14	15.03	41.97
23 Nov 23	16:36	0.65	23.75	0.08	15.03	41.93
23 Nov 23	16:37	0.64	23.62	0.08	15.04	41.93
23 Nov 23	16:38	0.46	23.63	0.09	15.04	41.99
23 Nov 23	16:39	0.28	23.34	0.11	15.04	41.97
23 Nov 23	16:40	0.26	23.46	0.08	15.05	42.01
23 Nov 23	16:41	0.28	23.38	0.07	15.03	41.96
23 Nov 23	16:42	0.29	23.40	0.08	15.03	41.95
23 Nov 23	16:43	0.26	23.55	0.10	15.02	41.92
23 Nov 23	16:44	0.25	23.50	0.09	15.03	41.93
23 Nov 23	16:45	0.26	23.46	0.09	15.03	41.93
23 Nov 23	16:46	0.27	23.45	0.10	15.03	41.93
23 Nov 23	16:47	0.28	23.48	0.07	15.02	41.88
23 Nov 23	16:48	0.39	23.34	0.08	15.04	41.93
23 Nov 23	16:49	0.52	23.48	0.08	15.03	41.93
23 Nov 23	16:50	0.65	23.35	0.10	15.04	41.95
23 Nov 23	16:51	0.74	23.61	0.11	15.03	41.93
23 Nov 23	16:52	0.79	23.52	0.11	15.04	41.96
23 Nov 23	16:53	0.77	23.40	0.14	15.02	41.94
Max		0.79	23.79	0.14	15.05	42.01
Avg		0.48	23.51	0.10	15.03	41.95

Run No: 10 Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	Load MW
23 Nov 23	16:54	0.75	23.41	0.11	15.04	41.99
23 Nov 23	16:55	0.74	23.42	0.12	15.03	41.94
23 Nov 23	16:56	0.72	23.50	0.11	15.02	41.95
23 Nov 23	16:57	0.69	23.32	0.13	15.02	41.95
23 Nov 23	16:58	0.69	23.47	0.12	15.02	41.96
23 Nov 23	16:59	0.61	23.50	0.13	15.02	41.90
23 Nov 23	17:00	0.61	23.24	0.10	15.03	41.94
23 Nov 23	17:01	0.63	23.07	0.14	15.02	41.95
23 Nov 23	17:02	0.65	23.21	0.11	15.01	41.97
23 Nov 23	17:03	0.61	22.99	0.09	15.01	41.98
23 Nov 23	17:04	0.45	22.87	0.09	15.00	41.98
23 Nov 23	17:05	0.29	22.88	0.08	15.00	41.94
23 Nov 23	17:06	0.27	23.06	0.08	15.02	41.97
23 Nov 23	17:07	0.29	23.20	0.09	15.01	41.98
23 Nov 23	17:08	0.27	23.32	0.08	15.01	41.93
23 Nov 23	17:09	0.28	23.14	0.08	15.02	41.97
23 Nov 23	17:10	0.25	23.07	0.12	15.01	42.00
23 Nov 23	17:11	0.26	23.23	0.08	15.00	41.96
23 Nov 23	17:12	0.26	23.12	0.10	15.00	41.97
23 Nov 23	17:13	0.28	22.89	0.12	15.00	41.96
23 Nov 23	17:14	0.38	22.98	0.13	15.00	41.97
Max		0.75	23.50	0.14	15.04	42.00
Avg		0.47	23.18	0.11	15.01	41.96

Run No: 11 Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	Load MW
23 Nov 23	17:15	0.52	23.13	0.13	15.00	41.96
23 Nov 23	17:16	0.63	23.08	0.12	15.01	41.97
23 Nov 23	17:17	0.75	23.10	0.12	15.02	41.97
23 Nov 23	17:18	0.76	23.09	0.10	15.01	41.98
23 Nov 23	17:19	0.76	23.18	0.11	15.01	41.98
23 Nov 23	17:20	0.76	23.29	0.09	15.00	41.96
23 Nov 23	17:21	0.72	23.35	0.11	15.01	41.96
23 Nov 23	17:22	0.71	23.25	0.12	15.01	41.97
23 Nov 23	17:23	0.69	23.16	0.11	15.01	41.97
23 Nov 23	17:24	0.67	23.34	0.13	15.00	41.97
23 Nov 23	17:25	0.67	23.12	0.12	15.00	41.95
23 Nov 23	17:26	0.65	23.15	0.10	15.00	41.92
23 Nov 23	17:27	0.62	23.05	0.11	15.01	41.95
23 Nov 23	17:28	0.47	22.85	0.11	14.99	41.94
23 Nov 23	17:29	0.29	22.93	0.11	14.99	41.94
23 Nov 23	17:30	0.28	22.85	0.10	14.99	41.94
23 Nov 23	17:31	0.28	23.01	0.12	14.99	41.95
23 Nov 23	17:32	0.28	22.88	0.10	14.99	41.95
23 Nov 23	17:33	0.27	22.78	0.07	14.99	41.94
23 Nov 23	17:34	0.27	22.84	0.09	14.99	41.95
23 Nov 23	17:35	0.26	22.90	0.10	14.98	41.93
Max		0.76	23.35	0.13	15.02	41.98
Avg		0.54	23.06	0.11	15.00	41.95

Run No: 12 Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	Load MW
23 Nov 23	17:36	0.26	22.85	0.08	14.99	41.93
23 Nov 23	17:37	0.30	22.67	0.09	14.99	41.91
23 Nov 23	17:38	0.39	22.68	0.12	14.99	41.94
23 Nov 23	17:39	0.54	22.87	0.14	14.99	41.95
23 Nov 23	17:40	0.66	22.98	0.14	14.98	41.93
23 Nov 23	17:41	0.77	22.82	0.17	14.99	41.96
23 Nov 23	17:42	0.80	22.81	0.12	14.99	41.94
23 Nov 23	17:43	0.77	22.72	0.14	14.99	41.91
23 Nov 23	17:44	0.75	22.61	0.15	14.99	41.97
23 Nov 23	17:45	0.71	22.94	0.12	14.97	41.94
23 Nov 23	17:46	0.73	22.73	0.12	14.98	41.96
23 Nov 23	17:47	0.70	22.67	0.12	14.97	41.96
23 Nov 23	17:48	0.70	22.79	0.15	14.97	41.96
23 Nov 23	17:49	0.63	22.28	0.13	14.98	41.96
23 Nov 23	17:50	0.55	22.33	0.12	14.96	41.96
23 Nov 23	17:51	0.45	22.30	0.12	14.97	42.10
23 Nov 23	17:52	0.31	22.40	0.12	14.97	42.07
23 Nov 23	17:53	0.28	22.39	0.10	14.97	42.03
23 Nov 23	17:54	0.29	22.52	0.11	14.97	42.12
23 Nov 23	17:55	0.27	22.43	0.06	14.97	42.13
23 Nov 23	17:56	0.24	22.59	0.11	14.98	42.20
Max		0.80	22.98	0.17	14.99	42.20
Avg		0.53	22.64	0.12	14.98	41.99



Reference Method Data

Client Name Gulf BP Co., Ltd.
Plant Name GBP

Date 23 Nov 23
Location ปล่อง HRSG 11

Run No: 1 Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
23 Nov 23	13:45	0.38	25.12	0.56	14.45	3.59
23 Nov 23	13:46	0.37	25.12	0.55	14.47	3.59
23 Nov 23	13:47	0.37	25.09	0.49	14.46	3.58
23 Nov 23	13:48	0.37	25.14	0.55	14.45	3.58
23 Nov 23	13:49	0.38	25.47	0.60	14.42	3.58
23 Nov 23	13:50	0.38	25.86	0.57	14.43	3.61
23 Nov 23	13:51	0.38	25.95	0.58	14.45	3.59
23 Nov 23	13:52	0.38	25.61	0.61	14.47	3.59
23 Nov 23	13:53	0.36	25.18	0.60	14.45	3.58
23 Nov 23	13:54	0.38	24.90	0.63	14.49	3.57
23 Nov 23	13:55	0.37	24.78	0.63	14.47	3.58
23 Nov 23	13:56	0.36	24.80	0.61	14.45	3.58
23 Nov 23	13:57	0.36	24.90	0.60	14.46	3.58
23 Nov 23	13:58	0.36	24.93	0.65	14.48	3.59
23 Nov 23	13:59	0.36	24.98	0.69	14.48	3.59
23 Nov 23	14:00	0.35	25.05	0.68	14.46	3.59
23 Nov 23	14:01	0.37	25.18	0.67	14.45	3.59
23 Nov 23	14:02	0.35	25.15	0.68	14.47	3.58
23 Nov 23	14:03	0.35	25.09	0.68	14.44	3.58
23 Nov 23	14:04	0.34	25.10	0.65	14.46	3.59
23 Nov 23	14:05	0.35	25.11	0.69	14.44	3.58
Max		0.38	25.95	0.69	14.49	3.61
Avg		0.37	25.17	0.62	14.46	3.58

Run No: 2 Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
23 Nov 23	14:06	0.35	25.36	0.71	14.45	3.59
23 Nov 23	14:07	0.35	25.82	0.72	14.43	3.59
23 Nov 23	14:08	0.35	26.22	0.70	14.44	3.61
23 Nov 23	14:09	0.39	26.26	0.69	14.43	3.60
23 Nov 23	14:10	0.41	26.29	0.73	14.42	3.60
23 Nov 23	14:11	0.43	26.39	0.76	14.44	3.59
23 Nov 23	14:12	0.40	26.32	0.73	14.45	3.60
23 Nov 23	14:13	0.40	26.16	0.69	14.46	3.60
23 Nov 23	14:14	0.39	26.02	0.73	14.45	3.59
23 Nov 23	14:15	0.41	25.86	0.67	14.47	3.59
23 Nov 23	14:16	0.38	25.73	0.68	14.48	3.58
23 Nov 23	14:17	0.38	25.38	0.64	14.47	3.57
23 Nov 23	14:18	0.39	25.19	0.65	14.49	3.58
23 Nov 23	14:19	0.39	25.14	0.70	14.45	3.58
23 Nov 23	14:20	0.40	25.19	0.65	14.46	3.58
23 Nov 23	14:21	0.38	25.21	0.65	14.45	3.58
23 Nov 23	14:22	0.39	25.24	0.68	14.49	3.58
23 Nov 23	14:23	0.38	25.15	0.65	14.47	3.57
23 Nov 23	14:24	0.39	25.12	0.64	14.46	3.58
23 Nov 23	14:25	0.38	25.18	0.66	14.44	3.58
23 Nov 23	14:26	0.37	25.29	0.65	14.46	3.59
Max		0.43	26.39	0.76	14.49	3.61
Avg		0.39	25.64	0.68	14.45	3.59

Run No: 3 Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
23 Nov 23	14:27	0.38	25.50	0.63	14.45	3.59
23 Nov 23	14:28	0.38	25.62	0.63	14.44	3.59
23 Nov 23	14:29	0.39	25.64	0.64	14.43	3.59
23 Nov 23	14:30	0.39	25.55	0.65	14.45	3.59
23 Nov 23	14:31	0.41	25.45	0.61	14.47	3.60
23 Nov 23	14:32	0.39	25.38	0.64	14.45	3.58
23 Nov 23	14:33	0.20	25.41	0.62	14.47	3.58
23 Nov 23	14:34	0.17	25.35	0.61	14.47	3.58
23 Nov 23	14:35	0.19	25.24	0.61	14.46	3.58
23 Nov 23	14:36	0.18	25.15	0.60	14.47	3.59
23 Nov 23	14:37	0.17	25.08	0.62	14.46	3.58
23 Nov 23	14:38	0.18	25.02	0.62	14.43	3.59
23 Nov 23	14:39	0.20	25.08	0.62	14.46	3.58
23 Nov 23	14:40	0.17	25.07	0.62	14.45	3.58
23 Nov 23	14:41	0.17	25.02	0.58	14.44	3.59
23 Nov 23	14:42	0.17	24.95	0.60	14.44	3.59
23 Nov 23	14:43	0.18	25.03	0.60	14.46	3.59
23 Nov 23	14:44	0.18	25.10	0.61	14.45	3.58
23 Nov 23	14:45	0.17	25.10	0.57	14.44	3.58
23 Nov 23	14:46	0.18	25.13	0.58	14.46	3.58
23 Nov 23	14:47	0.18	25.22	0.53	14.45	3.59
Max		0.41	25.64	0.65	14.47	3.60
Avg		0.24	25.24	0.61	14.45	3.59

Run No: 4 Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
23 Nov 23	14:48	0.19	25.35	0.58	14.43	3.59
23 Nov 23	14:49	0.17	25.50	0.59	14.44	3.59
23 Nov 23	14:50	0.17	25.60	0.61	14.43	3.59
23 Nov 23	14:51	0.18	25.61	0.64	14.44	3.59
23 Nov 23	14:52	0.18	25.47	0.63	14.47	3.59
23 Nov 23	14:53	0.17	25.10	0.61	14.46	3.58
23 Nov 23	14:54	0.17	24.91	0.63	14.45	3.58
23 Nov 23	14:55	0.18	24.95	0.63	14.44	3.58
23 Nov 23	14:56	0.19	24.97	0.59	14.46	3.58
23 Nov 23	14:57	0.18	25.02	0.54	14.45	3.58
23 Nov 23	14:58	0.18	24.98	0.56	14.46	3.59
23 Nov 23	14:59	0.16	24.92	0.58	14.46	3.59
23 Nov 23	15:00	0.19	24.92	0.59	14.45	3.59
23 Nov 23	15:01	0.18	24.94	0.60	14.44	3.58
23 Nov 23	15:02	0.17	24.92	0.58	14.46	3.58
23 Nov 23	15:03	0.18	24.89	0.59	14.44	3.59
23 Nov 23	15:04	0.18	24.97	0.57	14.45	3.59
23 Nov 23	15:05	0.16	25.02	0.55	14.47	3.59
23 Nov 23	15:06	0.18	24.92	0.59	14.45	3.58
23 Nov 23	15:07	0.17	24.84	0.61	14.46	3.58
23 Nov 23	15:08	0.18	24.79	0.57	14.43	3.59
Max		0.19	25.61	0.64	14.47	3.59
Avg		0.18	25.08	0.59	14.45	3.59

Run No: 5 Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
23 Nov 23	15:09	0.17	24.84	0.65	14.45	3.59
23 Nov 23	15:10	0.18	24.90	0.65	14.43	3.60
23 Nov 23	15:11	0.18	25.16	0.64	14.44	3.59
23 Nov 23	15:12	0.18	25.24	0.63	14.46	3.58
23 Nov 23	15:13	0.18	25.14	0.60	14.45	3.58
23 Nov 23	15:14	0.19	25.03	0.61	14.43	3.58
23 Nov 23	15:15	0.18	25.06	0.61	14.42	3.59
23 Nov 23	15:16	0.17	25.21	0.63	14.44	3.59
23 Nov 23	15:17	0.18	25.30	0.59	14.42	3.59
23 Nov 23	15:18	0.18	25.30	0.58	14.43	3.59
23 Nov 23	15:19	0.18	25.31	0.59	14.41	3.59
23 Nov 23	15:20	0.42	25.29	0.61	14.42	3.59
23 Nov 23	15:21	0.42	25.13	0.58	14.44	3.59
23 Nov 23	15:22	0.40	25.08	0.60	14.43	3.60
23 Nov 23	15:23	0.43	25.09	0.56	14.44	3.59
23 Nov 23	15:24	0.43	25.06	0.54	14.45	3.58
23 Nov 23	15:25	0.43	24.91	0.57	14.44	3.59
23 Nov 23	15:26	0.42	24.97	0.58	14.44	3.58
23 Nov 23	15:27	0.42	25.11	0.52	14.43	3.60
23 Nov 23	15:28	0.41	25.22	0.55	14.46	3.59
23 Nov 23	15:29	0.41	25.17	0.51	14.45	3.58
Max		0.43	25.31	0.65	14.46	3.60
Avg		0.29	25.12	0.59	14.44	3.59

Run No: 6 Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
23 Nov 23	15:30	0.37	25.06	0.54	14.46	3.57
23 Nov 23	15:31	0.36	24.95	0.53	14.43	3.59
23 Nov 23	15:32	0.34	24.86	0.52	14.44	3.59
23 Nov 23	15:33	0.36	24.92	0.53	14.42	3.59
23 Nov 23	15:34	0.37	24.98	0.59	14.45	3.59
23 Nov 23	15:35	0.36	24.88	0.53	14.45	3.58
23 Nov 23	15:36	0.35	24.81	0.51	14.46	3.58
23 Nov 23	15:37	0.37	24.69	0.51	14.45	3.58
23 Nov 23	15:38	0.36	24.70	0.49	14.44	3.58
23 Nov 23	15:39	0.37	24.88	0.52	14.44	3.59
23 Nov 23	15:40	0.36	25.18	0.54	14.42	3.59
23 Nov 23	15:41	0.38	25.44	0.52	14.42	3.59
23 Nov 23	15:42	0.38	25.54	0.51	14.46	3.59
23 Nov 23	15:43	0.36	25.49	0.51	14.44	3.59
23 Nov 23	15:44	0.36	25.36	0.45	14.45	3.59
23 Nov 23	15:45	0.35	25.35	0.51	14.43	3.58
23 Nov 23	15:46	0.36	25.40	0.51	14.43	3.59
23 Nov 23	15:47	0.36	25.35	0.47	14.44	3.59
23 Nov 23	15:48	0.36	25.12	0.48	14.45	3.59
23 Nov 23	15:49	0.36	24.97	0.48	14.44	3.59
23 Nov 23	15:50	0.36	24.96	0.53	14.42	3.58
Max		0.38	25.54	0.59	14.46	3.59
Avg		0.36	25.09	0.51	14.44	3.59



Reference Method Data

Client Name Gulf BP Co., Ltd.
Plant Name GBP

Date 23 Nov 23
Location ปล่อง HRSG 11

Run No: 7

Time Base : 21 min

Run No: 8

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
23 Nov 23	15:51	0.40	25.04	0.53	14.44	3.58
23 Nov 23	15:52	0.42	25.10	0.53	14.45	3.59
23 Nov 23	15:53	0.40	25.07	0.52	14.43	3.58
23 Nov 23	15:54	0.40	25.02	0.49	14.45	3.59
23 Nov 23	15:55	0.39	25.06	0.46	14.43	3.59
23 Nov 23	15:56	0.40	25.13	0.45	14.44	3.59
23 Nov 23	15:57	0.40	25.19	0.44	14.46	3.59
23 Nov 23	15:58	0.40	25.03	0.48	14.42	3.58
23 Nov 23	15:59	0.40	24.89	0.47	14.45	3.58
23 Nov 23	16:00	0.39	24.91	0.49	14.45	3.59
23 Nov 23	16:01	0.38	24.97	0.52	14.46	3.59
23 Nov 23	16:02	0.38	24.90	0.45	14.47	3.58
23 Nov 23	16:03	0.37	24.78	0.48	14.45	3.58
23 Nov 23	16:04	0.38	24.78	0.51	14.46	3.58
23 Nov 23	16:05	0.39	24.70	0.51	14.47	3.58
23 Nov 23	16:06	0.39	24.63	0.52	14.45	3.58
23 Nov 23	16:07	0.38	24.72	0.50	14.47	3.58
23 Nov 23	16:08	0.38	24.75	0.48	14.45	3.58
23 Nov 23	16:09	0.38	24.78	0.48	14.45	3.59
23 Nov 23	16:10	0.39	24.88	0.49	14.46	3.59
23 Nov 23	16:11	0.39	24.87	0.50	14.45	3.60
Max		0.42	25.19	0.53	14.47	3.60
Avg		0.39	24.91	0.49	14.45	3.59

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
23 Nov 23	16:12	0.34	24.86	0.54	14.44	3.59
23 Nov 23	16:13	0.34	24.88	0.52	14.44	3.59
23 Nov 23	16:14	0.34	24.83	0.50	14.44	3.58
23 Nov 23	16:15	0.33	24.80	0.51	14.45	3.59
23 Nov 23	16:16	0.32	24.77	0.44	14.45	3.59
23 Nov 23	16:17	0.33	24.59	0.43	14.45	3.59
23 Nov 23	16:18	0.33	24.51	0.46	14.45	3.59
23 Nov 23	16:19	0.32	24.59	0.50	14.46	3.58
23 Nov 23	16:20	0.33	24.65	0.49	14.45	3.58
23 Nov 23	16:21	0.33	24.68	0.56	14.45	3.59
23 Nov 23	16:22	0.34	24.73	0.50	14.42	3.59
23 Nov 23	16:23	0.33	24.74	0.52	14.45	3.60
23 Nov 23	16:24	0.33	24.81	0.48	14.44	3.59
23 Nov 23	16:25	0.32	24.86	0.48	14.45	3.59
23 Nov 23	16:26	0.33	24.80	0.39	14.45	3.59
23 Nov 23	16:27	0.32	24.64	0.44	14.47	3.59
23 Nov 23	16:28	0.33	24.61	0.46	14.44	3.60
23 Nov 23	16:29	0.33	24.69	0.46	14.46	3.59
23 Nov 23	16:30	0.31	24.69	0.42	14.46	3.58
23 Nov 23	16:31	0.33	24.67	0.44	14.46	3.58
23 Nov 23	16:32	0.34	24.62	0.46	14.46	3.58
Max		0.34	24.88	0.56	14.47	3.60
Avg		0.33	24.72	0.48	14.45	3.59

Run No: 9

Time Base : 21 min

Run No: 10

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
23 Nov 23	16:33	0.32	24.65	0.44	14.45	3.59
23 Nov 23	16:34	0.32	24.65	0.40	14.47	3.59
23 Nov 23	16:35	0.33	24.60	0.36	14.45	3.59
23 Nov 23	16:36	0.32	24.65	0.41	14.47	3.58
23 Nov 23	16:37	0.32	24.81	0.41	14.45	3.57
23 Nov 23	16:38	0.31	24.85	0.40	14.46	3.58
23 Nov 23	16:39	0.32	24.83	0.44	14.46	3.59
23 Nov 23	16:40	0.34	24.73	0.39	14.46	3.58
23 Nov 23	16:41	0.33	24.72	0.42	14.48	3.59
23 Nov 23	16:42	0.33	24.67	0.40	14.45	3.57
23 Nov 23	16:43	0.33	24.59	0.39	14.44	3.58
23 Nov 23	16:44	0.32	24.56	0.39	14.46	3.59
23 Nov 23	16:45	0.31	24.60	0.39	14.43	3.60
23 Nov 23	16:46	0.33	24.61	0.37	14.45	3.59
23 Nov 23	16:47	0.32	24.61	0.38	14.46	3.58
23 Nov 23	16:48	0.33	24.60	0.44	14.46	3.59
23 Nov 23	16:49	0.33	24.56	0.45	14.46	3.59
23 Nov 23	16:50	0.31	24.52	0.41	14.45	3.58
23 Nov 23	16:51	0.32	24.51	0.37	14.46	3.60
23 Nov 23	16:52	0.32	24.49	0.38	14.45	3.59
23 Nov 23	16:53	0.32	24.48	0.39	14.47	3.59
Max		0.34	24.85	0.45	14.48	3.60
Avg		0.32	24.63	0.40	14.46	3.59

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
23 Nov 23	16:54	0.31	24.45	0.42	14.46	3.58
23 Nov 23	16:55	0.29	24.42	0.43	14.45	3.60
23 Nov 23	16:56	0.33	24.45	0.41	14.47	3.59
23 Nov 23	16:57	0.30	24.43	0.35	14.45	3.59
23 Nov 23	16:58	0.31	24.44	0.37	14.46	3.59
23 Nov 23	16:59	0.32	24.48	0.41	14.46	3.59
23 Nov 23	17:00	0.32	24.45	0.41	14.45	3.59
23 Nov 23	17:01	0.30	24.41	0.38	14.46	3.60
23 Nov 23	17:02	0.31	24.27	0.34	14.45	3.59
23 Nov 23	17:03	0.32	24.19	0.34	14.43	3.59
23 Nov 23	17:04	0.30	24.18	0.36	14.43	3.60
23 Nov 23	17:05	0.31	24.13	0.32	14.44	3.60
23 Nov 23	17:06	0.31	24.06	0.40	14.43	3.61
23 Nov 23	17:07	0.31	24.08	0.40	14.45	3.61
23 Nov 23	17:08	0.31	24.15	0.41	14.43	3.60
23 Nov 23	17:09	0.31	24.31	0.41	14.44	3.59
23 Nov 23	17:10	0.31	24.40	0.34	14.44	3.60
23 Nov 23	17:11	0.31	24.32	0.38	14.43	3.60
23 Nov 23	17:12	0.32	24.22	0.37	14.41	3.60
23 Nov 23	17:13	0.32	24.20	0.35	14.44	3.61
23 Nov 23	17:14	0.30	24.14	0.40	14.43	3.61
Max		0.33	24.48	0.43	14.47	3.61
Avg		0.31	24.29	0.38	14.44	3.60

Run No: 11

Time Base : 21 min

Run No: 12

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
23 Nov 23	17:15	0.29	24.04	0.42	14.42	3.60
23 Nov 23	17:16	0.32	24.01	0.44	14.42	3.60
23 Nov 23	17:17	0.31	24.01	0.45	14.40	3.60
23 Nov 23	17:18	0.31	23.98	0.43	14.44	3.61
23 Nov 23	17:19	0.30	24.01	0.42	14.44	3.61
23 Nov 23	17:20	0.32	24.08	0.42	14.42	3.60
23 Nov 23	17:21	0.29	24.19	0.42	14.43	3.60
23 Nov 23	17:22	0.30	24.19	0.47	14.42	3.60
23 Nov 23	17:23	0.31	24.19	0.40	14.43	3.60
23 Nov 23	17:24	0.30	24.14	0.38	14.43	3.60
23 Nov 23	17:25	0.28	24.12	0.39	14.41	3.61
23 Nov 23	17:26	0.29	24.10	0.35	14.41	3.61
23 Nov 23	17:27	0.31	24.10	0.38	14.41	3.60
23 Nov 23	17:28	0.30	24.06	0.40	14.43	3.60
23 Nov 23	17:29	0.30	24.03	0.39	14.42	3.60
23 Nov 23	17:30	0.29	24.00	0.41	14.41	3.61
23 Nov 23	17:31	0.29	24.01	0.41	14.42	3.61
23 Nov 23	17:32	0.30	24.04	0.46	14.42	3.61
23 Nov 23	17:33	0.29	24.03	0.45	14.43	3.61
23 Nov 23	17:34	0.30	23.99	0.44	14.42	3.61
23 Nov 23	17:35	0.30	23.89	0.48	14.41	3.61
Max		0.32	24.19	0.48	14.44	3.61
Avg		0.30	24.06	0.42	14.42	3.61

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
23 Nov 23	17:36	0.28	23.91	0.48	14.41	3.62
23 Nov 23	17:37	0.30	23.95	0.46	14.42	3.61
23 Nov 23	17:38	0.29	23.93	0.48	14.40	3.61
23 Nov 23	17:39	0.29	23.82	0.49	14.42	3.61
23 Nov 23	17:40	0.29	23.75	0.52	14.41	3.62
23 Nov 23	17:41	0.29	23.71	0.48	14.41	3.62
23 Nov 23	17:42	0.30	23.77	0.51	14.39	3.62
23 Nov 23	17:43	0.29	23.81	0.47	14.40	3.62
23 Nov 23	17:44	0.27	23.75	0.43	14.41	3.61
23 Nov 23	17:45	0.28	23.65	0.44	14.41	3.61
23 Nov 23	17:46	0.29	23.63	0.46	14.40	3.62
23 Nov 23	17:47	0.29	23.71	0.46	14.40	3.62
23 Nov 23	17:48	0.28	23.73	0.44	14.42	3.62
23 Nov 23	17:49	0.29	23.70	0.40	14.41	3.61
23 Nov 23	17:50	0.28	23.66	0.41	14.42	3.61
23 Nov 23	17:51	0.28	23.53	0.39	14.41	3.62
23 Nov 23	17:52	0.28	23.44	0.43	14.40	3.62
23 Nov 23	17:53	0.28	23.43	0.39	14.43	3.62
23 Nov 23	17:54	0.28	23.50	0.41	14.42	3.62
23 Nov 23	17:55	0.30	23.59	0.40	14.41	3.62
23 Nov 23	17:56	0.27	23.56	0.38	14.43	3.62
Max		0.30	23.95	0.52	14.43	3.62
Avg		0.29	23.69	0.45	14.41	3.62



Lot No. 23124758-1

ANALYZER CALIBRATION DATA

Client : Gulf BP Co., Ltd. Location : โรงงาน HRSG 12
Date : 24 Nov 23 Test Operator : Anuvat M.

O₂ ANALYZER

Model : TELEDYNE API T200H Serial No. : 991
Span (%) : 25

	Cylinder Value (%)	Initial Analyzers Calibration Response (%)	Final Analyzers Calibration Response (%)	Difference (Percent of Span)
Zero Gas	0.00	0.11	0.00	0.44
Low-Level Gas	7.98	7.89	7.88	0.04
Span Gas	16.02	16.11	16.00	0.44

NO_x ANALYZER

Model : TELEDYNE API T200H Serial No. : 991
Span (ppm) : 100

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.12	0.11	0.01
Low-Level Gas	56.16	56.11	55.98	0.13
Span Gas	79.77	79.78	80.12	0.34

SO₂ ANALYZER

Model : TELEDYNE API T100H Serial No. : 553
Span (ppm) : 100

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.11	0.11
Low-Level Gas	55.55	55.34	54.88	0.46
Span Gas	79.09	79.67	78.88	0.79

CO ANALYZER

Model : TELEDYNE API T300M Serial No. : 924
Span (ppm) : 100

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.11	0.12	0.01
Low-Level Gas	54.22	54.89	54.13	0.76
Span Gas	79.90	79.87	79.24	0.63

Calibrated by

(Mr. Anuvat Mounpair)

Environmental Field Scientist (2)



Lot No. 23124758-1

SYSTEM CALIBRATION BIAS AND DRIFT DATA

Client : Gulf BP Co., Ltd. Location : ห้อง HRSG 12
Date : 24 Nov 23 Test Operator : Anuvat M.

O₂ ANALYZER

Cylinder Conc. (%) : 16.02

Span (%) : 25

	O ₂ Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
		System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	
Zero Gas	0.11	0.11	0.00	0.11	0.00	0.00
Upscale Gas	16.11	15.98	0.52	16.00	0.44	0.08

NO_x ANALYZER

Cylinder Conc. (ppm) : 79.77

Span (ppm) : 100

	NO _x Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
		System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	
Zero Gas	0.12	0.10	0.02	0.00	0.12	0.10
Upscale Gas	79.78	80.00	0.22	80.00	0.22	0.00

SO₂ ANALYZER

Cylinder Conc. (ppm) : 79.90

Span (ppm) : 100

	SO ₂ Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
		System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	
Zero Gas	0.00	0.11	0.11	0.12	0.12	0.01
Upscale Gas	79.67	80.78	1.11	80.45	0.78	0.33

CO ANALYZER

Cylinder Conc. (ppm) : 79.90

Span (ppm) : 100

	CO Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
		System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	
Zero Gas	0.11	0.12	0.01	0.13	0.02	0.01
Upscale Gas	79.87	79.11	0.76	79.33	0.54	0.22

Calibrated by

(Mr. Anuvat Mounpair)

Environmental Field Scientist (2)



CEMs Data

Client Name Gulf BP Co., Ltd.
Plant Name GBP

Date 24 Nov 23
Location ปล่อง HRSG 12

Run No: 1

Time Base : 21 min

Run No: 2

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	Load MW
24 Nov 23	13:05	0.38	17.91	0.00	14.41	42.93
24 Nov 23	13:06	0.10	17.30	0.00	14.42	42.91
24 Nov 23	13:07	0.00	16.23	0.00	14.42	42.94
24 Nov 23	13:08	0.00	16.44	0.00	14.43	43.05
24 Nov 23	13:09	0.00	16.61	0.00	14.42	43.08
24 Nov 23	13:10	0.02	17.01	0.00	14.42	43.08
24 Nov 23	13:11	0.20	17.20	0.00	14.41	43.03
24 Nov 23	13:12	0.35	17.34	0.00	14.42	43.13
24 Nov 23	13:13	0.44	17.57	0.00	14.41	43.12
24 Nov 23	13:14	0.43	17.71	0.00	14.41	43.12
24 Nov 23	13:15	0.28	17.75	0.00	14.43	43.27
24 Nov 23	13:16	0.00	17.29	0.00	14.43	43.49
24 Nov 23	13:17	0.00	16.79	0.00	14.40	43.34
24 Nov 23	13:18	0.00	16.92	0.00	14.45	42.85
24 Nov 23	13:19	0.00	16.51	0.00	14.46	42.18
24 Nov 23	13:20	0.00	16.41	0.00	14.44	42.34
24 Nov 23	13:21	0.02	16.40	0.00	14.46	42.37
24 Nov 23	13:22	0.22	16.74	0.00	14.45	42.97
24 Nov 23	13:23	0.38	17.22	0.00	14.46	42.86
24 Nov 23	13:24	0.44	17.25	0.00	14.49	42.80
24 Nov 23	13:25	0.45	17.14	0.00	14.48	42.86
Max		0.45	17.91	0.00	14.49	43.49
Avg		0.18	17.03	0.00	14.43	42.94

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	Load MW
24 Nov 23	13:26	0.32	17.33	0.00	14.45	42.75
24 Nov 23	13:27	0.02	17.11	0.00	14.45	42.68
24 Nov 23	13:28	0.00	16.41	0.00	14.46	42.73
24 Nov 23	13:29	0.00	16.24	0.00	14.45	42.79
24 Nov 23	13:30	0.00	16.32	0.00	14.46	42.86
24 Nov 23	13:31	0.00	16.51	0.00	14.45	42.86
24 Nov 23	13:32	0.00	16.76	0.00	14.45	42.94
24 Nov 23	13:33	0.09	16.83	0.00	14.47	42.90
24 Nov 23	13:34	0.28	16.94	0.00	14.46	42.88
24 Nov 23	13:35	0.41	17.30	0.00	14.46	42.90
24 Nov 23	13:36	0.45	17.55	0.00	14.45	42.90
24 Nov 23	13:37	0.42	17.81	0.00	14.44	42.76
24 Nov 23	13:38	0.17	17.76	0.00	14.45	42.82
24 Nov 23	13:39	0.00	16.99	0.00	14.47	42.82
24 Nov 23	13:40	0.00	16.61	0.00	14.46	42.88
24 Nov 23	13:41	0.00	16.72	0.00	14.46	42.74
24 Nov 23	13:42	0.00	16.74	0.00	14.47	42.69
24 Nov 23	13:43	0.00	16.64	0.00	14.47	42.71
24 Nov 23	13:44	0.01	16.99	0.00	14.44	43.10
24 Nov 23	13:45	0.18	17.83	0.00	14.39	43.26
24 Nov 23	13:46	0.35	18.37	0.00	14.40	43.05
Max		0.45	18.37	0.00	14.47	43.26
Avg		0.13	17.04	0.00	14.45	42.86

Run No: 3

Time Base : 21 min

Run No: 4

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	Load MW
24 Nov 23	13:47	0.43	18.43	0.00	14.40	42.91
24 Nov 23	13:48	0.43	18.39	0.00	14.43	42.98
24 Nov 23	13:49	0.28	18.07	0.00	14.42	43.08
24 Nov 23	13:50	0.01	17.64	0.00	14.41	43.13
24 Nov 23	13:51	0.00	17.09	0.00	14.40	42.74
24 Nov 23	13:52	0.00	17.00	0.00	14.44	42.64
24 Nov 23	13:53	0.00	16.66	0.00	14.44	42.84
24 Nov 23	13:54	0.00	16.77	0.00	14.44	42.87
24 Nov 23	13:55	0.00	17.18	0.00	14.44	43.03
24 Nov 23	13:56	0.13	17.60	0.00	14.41	43.12
24 Nov 23	13:57	0.31	18.49	0.00	14.40	42.96
24 Nov 23	13:58	0.42	18.33	0.00	14.45	42.79
24 Nov 23	13:59	0.43	17.74	0.00	14.47	42.66
24 Nov 23	14:00	0.39	17.62	0.00	14.46	42.78
24 Nov 23	14:01	0.06	17.38	0.00	14.46	42.80
24 Nov 23	14:02	0.00	16.71	0.00	14.44	42.83
24 Nov 23	14:03	0.00	16.95	0.00	14.44	42.98
24 Nov 23	14:04	0.00	17.04	0.00	14.45	43.02
24 Nov 23	14:05	0.00	17.20	0.00	14.42	42.98
24 Nov 23	14:06	0.00	17.57	0.00	14.43	43.14
24 Nov 23	14:07	0.13	17.74	0.00	14.43	42.92
Max		0.43	18.49	0.00	14.47	43.14
Avg		0.14	17.51	0.00	14.43	42.91

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	Load MW
24 Nov 23	14:08	0.30	17.56	0.00	14.48	42.63
24 Nov 23	14:09	0.39	17.39	0.00	14.47	42.65
24 Nov 23	14:10	0.39	17.54	0.00	14.48	42.83
24 Nov 23	14:11	0.28	17.56	0.00	14.47	43.05
24 Nov 23	14:12	0.01	17.34	0.00	14.44	43.04
24 Nov 23	14:13	0.00	16.75	0.00	14.45	42.88
24 Nov 23	14:14	0.00	16.51	0.00	14.47	42.78
24 Nov 23	14:15	0.00	16.38	0.00	14.47	42.76
24 Nov 23	14:16	0.00	16.58	0.00	14.45	42.82
24 Nov 23	14:17	0.03	16.87	0.00	14.45	42.87
24 Nov 23	14:18	0.21	17.27	0.00	14.46	42.80
24 Nov 23	14:19	0.33	17.27	0.00	14.46	42.91
24 Nov 23	14:20	0.36	17.54	0.00	14.44	43.32
24 Nov 23	14:21	0.29	18.13	0.00	14.37	43.72
24 Nov 23	14:22	0.13	18.91	0.00	14.39	43.42
24 Nov 23	14:23	0.00	18.02	0.00	14.40	43.29
24 Nov 23	14:24	0.00	17.49	0.00	14.42	43.36
24 Nov 23	14:25	0.00	17.50	0.00	14.41	43.34
24 Nov 23	14:26	0.00	17.80	0.00	14.41	43.29
24 Nov 23	14:27	0.00	17.74	0.00	14.42	43.35
24 Nov 23	14:28	0.07	17.83	0.00	14.42	43.43
Max		0.39	18.91	0.00	14.48	43.72
Avg		0.13	17.43	0.00	14.44	43.07

Run No: 5

Time Base : 21 min

Run No: 6

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	Load MW
24 Nov 23	14:29	0.28	18.05	0.00	14.40	43.32
24 Nov 23	14:30	0.36	18.50	0.00	14.40	43.06
24 Nov 23	14:31	0.40	18.60	0.00	14.41	42.96
24 Nov 23	14:32	0.33	18.28	0.00	14.42	43.13
24 Nov 23	14:33	0.05	17.60	0.00	14.42	43.31
24 Nov 23	14:34	0.00	17.40	0.00	14.40	43.28
24 Nov 23	14:35	0.00	17.50	0.00	14.41	43.28
24 Nov 23	14:36	0.00	17.49	0.00	14.42	43.34
24 Nov 23	14:37	0.00	17.59	0.00	14.41	43.33
24 Nov 23	14:38	0.02	17.82	0.00	14.41	43.41
24 Nov 23	14:39	0.19	17.87	0.00	14.41	43.49
24 Nov 23	14:40	0.29	18.06	0.00	14.39	43.39
24 Nov 23	14:41	0.30	18.41	0.00	14.40	43.35
24 Nov 23	14:42	0.28	18.38	0.00	14.42	43.36
24 Nov 23	14:43	0.07	18.01	0.00	14.41	43.44
24 Nov 23	14:44	0.00	17.36	0.00	14.40	43.40
24 Nov 23	14:45	0.00	17.43	0.00	14.41	43.40
24 Nov 23	14:46	0.00	17.35	0.00	14.41	43.45
24 Nov 23	14:47	0.00	17.46	0.00	14.40	43.45
24 Nov 23	14:48	0.02	17.84	0.00	14.40	43.42
24 Nov 23	14:49	0.14	18.03	0.00	14.41	43.39
Max		0.40	18.60	0.00	14.42	43.49
Avg		0.13	17.86	0.00	14.41	43.33

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	Load MW
24 Nov 23	14:50	0.26	18.19	0.00	14.41	43.41
24 Nov 23	14:51	0.30	18.16	0.00	14.41	43.40
24 Nov 23	14:52	0.28	18.33	0.00	14.41	43.42
24 Nov 23	14:53	0.08	18.05	0.00	14.41	43.46
24 Nov 23	14:54	0.00	17.55	0.00	14.40	43.45
24 Nov 23	14:55	0.00	17.49	0.00	14.40	43.45
24 Nov 23	14:56	0.00	17.45	0.00	14.40	43.40
24 Nov 23	14:57	0.00	17.61	0.00	14.40	43.36
24 Nov 23	14:58	0.01	17.86	0.00	14.40	43.25
24 Nov 23	14:59	0.17	18.11	0.00	14.41	43.22
24 Nov 23	15:00	0.23	18.10	0.00	14.42	43.28
24 Nov 23	15:01	0.23	18.12	0.00	14.42	43.35
24 Nov 23	15:02	0.21	18.21	0.00	14.42	43.39
24 Nov 23	15:03	0.01	18.03	0.00	14.41	43.42
24 Nov 23	15:04	0.00	17.57	0.00	14.41	43.38
24 Nov 23	15:05	0.00	17.73	0.00	14.40	43.30
24 Nov 23	15:06	0.00	17.87	0.00	14.41	43.25
24 Nov 23	15:07	0.00	17.93	0.00	14.41	43.21
24 Nov 23	15:08	0.07	18.06	0.00	14.42	43.23
24 Nov 23	15:09	0.22	18.18	0.00	14.42	43.27
24 Nov 23	15:10	0.25	18.10	0.00	14.42	43.38
Max		0.30	18.33	0.00	14.42	43.46
Avg		0.11	17.94	0.00	14.41	43.35



CEMs Data

Client Name Gulf BP Co., Ltd.
Plant Name GBP

Date 24 Nov 23
Location ปล่อง HRSG 12

Run No: 7 Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	Load MW
24 Nov 23	15:11	0.22	18.33	0.00	14.40	43.35
24 Nov 23	15:12	0.07	18.45	0.00	14.40	43.25
24 Nov 23	15:13	0.00	17.73	0.00	14.41	43.18
24 Nov 23	15:14	0.00	17.47	0.00	14.42	43.23
24 Nov 23	15:15	0.00	17.35	0.00	14.42	43.35
24 Nov 23	15:16	0.00	17.51	0.00	14.42	43.42
24 Nov 23	15:17	0.00	17.89	0.00	14.40	43.37
24 Nov 23	15:18	0.08	18.03	0.00	14.41	43.37
24 Nov 23	15:19	0.19	18.12	0.00	14.39	43.24
24 Nov 23	15:20	0.20	18.44	0.00	14.42	43.23
24 Nov 23	15:21	0.20	18.24	0.00	14.42	43.32
24 Nov 23	15:22	0.03	17.90	0.00	14.42	43.42
24 Nov 23	15:23	0.00	17.55	0.00	14.39	43.35
24 Nov 23	15:24	0.00	17.53	0.00	14.41	43.29
24 Nov 23	15:25	0.00	17.42	0.00	14.41	43.31
24 Nov 23	15:26	0.00	17.82	0.00	14.40	43.20
24 Nov 23	15:27	0.01	17.99	0.00	14.42	43.16
24 Nov 23	15:28	0.11	18.03	0.00	14.43	43.26
24 Nov 23	15:29	0.14	17.96	0.00	14.42	43.35
24 Nov 23	15:30	0.16	18.09	0.00	14.42	43.41
24 Nov 23	15:31	0.06	18.16	0.00	14.41	43.41
Max		0.22	18.45	0.00	14.43	43.42
Avg		0.07	17.91	0.00	14.41	43.31

Run No: 8 Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	Load MW
24 Nov 23	15:32	0.00	17.98	0.00	14.40	43.30
24 Nov 23	15:33	0.00	17.51	0.00	14.41	43.33
24 Nov 23	15:34	0.00	17.48	0.00	14.42	43.35
24 Nov 23	15:35	0.00	17.57	0.00	14.42	43.41
24 Nov 23	15:36	0.00	17.92	0.00	14.41	43.38
24 Nov 23	15:37	0.05	18.13	0.00	14.41	43.33
24 Nov 23	15:38	0.16	18.14	0.00	14.42	43.32
24 Nov 23	15:39	0.18	18.08	0.00	14.42	43.44
24 Nov 23	15:40	0.09	18.24	0.00	14.41	43.39
24 Nov 23	15:41	0.00	18.02	0.00	14.41	43.43
24 Nov 23	15:42	0.00	17.40	0.00	14.40	43.43
24 Nov 23	15:43	0.00	17.48	0.00	14.39	43.33
24 Nov 23	15:44	0.00	17.65	0.00	14.40	43.21
24 Nov 23	15:45	0.00	17.81	0.00	14.41	43.16
24 Nov 23	15:46	0.00	17.97	0.00	14.40	42.99
24 Nov 23	15:47	0.09	18.06	0.00	14.41	43.02
24 Nov 23	15:48	0.18	17.81	0.00	14.41	43.06
24 Nov 23	15:49	0.17	18.21	0.00	14.40	43.03
24 Nov 23	15:50	0.07	18.31	0.00	14.43	43.14
24 Nov 23	15:51	0.00	17.50	0.00	14.42	43.24
24 Nov 23	15:52	0.00	17.02	0.00	14.41	43.30
Max		0.18	18.31	0.00	14.43	43.44
Avg		0.05	17.82	0.00	14.41	43.27

Run No: 9 Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	Load MW
24 Nov 23	15:53	0.00	17.33	0.00	14.40	43.30
24 Nov 23	15:54	0.00	17.51	0.00	14.41	43.31
24 Nov 23	15:55	0.00	17.52	0.00	14.41	43.34
24 Nov 23	15:56	0.01	17.82	0.00	14.41	43.41
24 Nov 23	15:57	0.12	18.21	0.00	14.40	43.38
24 Nov 23	15:58	0.16	18.08	0.00	14.41	43.37
24 Nov 23	15:59	0.10	18.25	0.00	14.39	43.20
24 Nov 23	16:00	0.00	18.21	0.00	14.40	43.18
24 Nov 23	16:01	0.00	17.34	0.00	14.42	43.29
24 Nov 23	16:02	0.00	17.06	0.00	14.40	43.34
24 Nov 23	16:03	0.00	17.23	0.00	14.40	43.33
24 Nov 23	16:04	0.00	17.56	0.00	14.40	43.32
24 Nov 23	16:05	0.00	17.63	0.00	14.41	43.37
24 Nov 23	16:06	0.02	17.80	0.00	14.40	43.36
24 Nov 23	16:07	0.12	17.99	0.00	14.40	43.34
24 Nov 23	16:08	0.13	18.10	0.00	14.42	43.38
24 Nov 23	16:09	0.07	18.08	0.00	14.41	43.43
24 Nov 23	16:10	0.00	17.98	0.00	14.40	43.40
24 Nov 23	16:11	0.00	17.35	0.00	14.39	43.30
24 Nov 23	16:12	0.00	17.18	0.00	14.41	43.36
24 Nov 23	16:13	0.00	17.23	0.00	14.41	43.40
Max		0.16	18.25	0.00	14.42	43.43
Avg		0.04	17.69	0.00	14.40	43.34

Run No: 10 Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	Load MW
24 Nov 23	16:14	0.00	17.50	0.00	14.41	43.41
24 Nov 23	16:15	0.00	17.60	0.00	14.41	43.45
24 Nov 23	16:16	0.07	17.85	0.00	14.41	43.43
24 Nov 23	16:17	0.13	18.05	0.00	14.42	43.50
24 Nov 23	16:18	0.09	18.17	0.00	14.41	43.25
24 Nov 23	16:19	0.02	18.12	0.00	14.44	42.93
24 Nov 23	16:20	0.00	17.02	0.00	14.46	42.45
24 Nov 23	16:21	0.00	16.33	0.00	14.44	42.18
24 Nov 23	16:22	0.00	16.19	0.00	14.45	42.99
24 Nov 23	16:23	0.00	16.23	0.00	14.46	42.99
24 Nov 23	16:24	0.00	16.51	0.00	14.46	42.99
24 Nov 23	16:25	0.00	16.82	0.00	14.46	42.83
24 Nov 23	16:26	0.05	16.93	0.00	14.46	42.95
24 Nov 23	16:27	0.13	17.09	0.00	14.46	42.90
24 Nov 23	16:28	0.11	17.18	0.00	14.45	42.81
24 Nov 23	16:29	0.04	17.21	0.00	14.47	42.86
24 Nov 23	16:30	0.00	16.62	0.00	14.46	42.83
24 Nov 23	16:31	0.00	16.28	0.00	14.44	42.86
24 Nov 23	16:32	0.00	16.32	0.00	14.45	43.03
24 Nov 23	16:33	0.00	16.48	0.00	14.45	43.05
24 Nov 23	16:34	0.00	16.77	0.00	14.43	43.11
Max		0.13	18.17	0.00	14.47	43.50
Avg		0.03	17.01	0.00	14.44	42.99

Run No: 11 Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	Load MW
24 Nov 23	16:35	0.00	17.24	0.00	14.41	43.21
24 Nov 23	16:36	0.05	17.65	0.00	14.42	43.43
24 Nov 23	16:37	0.15	18.09	0.00	14.39	43.22
24 Nov 23	16:38	0.15	18.11	0.00	14.44	43.09
24 Nov 23	16:39	0.05	17.58	0.00	14.45	43.22
24 Nov 23	16:40	0.00	17.25	0.00	14.45	42.98
24 Nov 23	16:41	0.00	16.30	0.00	14.46	42.92
24 Nov 23	16:42	0.00	16.11	0.00	14.46	43.07
24 Nov 23	16:43	0.00	16.22	0.00	14.46	42.93
24 Nov 23	16:44	0.00	16.11	0.00	14.46	42.89
24 Nov 23	16:45	0.00	16.52	0.00	14.45	42.90
24 Nov 23	16:46	0.03	16.91	0.00	14.44	42.87
24 Nov 23	16:47	0.15	16.84	0.00	14.45	42.86
24 Nov 23	16:48	0.22	16.91	0.00	14.44	42.84
24 Nov 23	16:49	0.20	17.16	0.00	14.45	42.89
24 Nov 23	16:50	0.07	17.20	0.00	14.45	42.85
24 Nov 23	16:51	0.00	16.79	0.00	14.45	42.87
24 Nov 23	16:52	0.00	16.01	0.00	14.45	42.85
24 Nov 23	16:53	0.00	16.24	0.00	14.43	42.81
24 Nov 23	16:54	0.00	16.15	0.00	14.45	42.86
24 Nov 23	16:55	0.00	16.26	0.00	14.43	42.73
Max		0.22	18.11	0.00	14.46	43.43
Avg		0.05	16.84	0.00	14.44	42.97

Run No: 12 Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	Load MW
24 Nov 23	16:56	0.00	16.54	0.00	14.44	42.77
24 Nov 23	16:57	0.02	16.70	0.00	14.44	42.74
24 Nov 23	16:58	0.18	16.94	0.00	14.44	42.73
24 Nov 23	16:59	0.23	17.12	0.00	14.43	42.64
24 Nov 23	17:00	0.20	17.14	0.00	14.44	42.66
24 Nov 23	17:01	0.09	17.08	0.00	14.44	42.77
24 Nov 23	17:02	0.00	16.56	0.00	14.43	42.68
24 Nov 23	17:03	0.00	16.07	0.00	14.44	42.76
24 Nov 23	17:04	0.00	16.18	0.00	14.43	42.75
24 Nov 23	17:05	0.00	16.28	0.00	14.43	42.73
24 Nov 23	17:06	0.00	16.39	0.00	14.44	42.76
24 Nov 23	17:07	0.00	16.42	0.00	14.44	42.67
24 Nov 23	17:08	0.03	16.75	0.00	14.43	42.69
24 Nov 23	17:09	0.19	16.76	0.00	14.44	42.77
24 Nov 23	17:10	0.24	16.91	0.00	14.44	42.79
24 Nov 23	17:11	0.26	16.97	0.00	14.44	42.81
24 Nov 23	17:12	0.09	16.88	0.00	14.43	42.80
24 Nov 23	17:13	0.00	16.26	0.00	14.42	42.76
24 Nov 23	17:14	0.00	15.86	0.00	14.41	42.71
24 Nov 23	17:15	0.00	15.94	0.00	14.42	42.82
24 Nov 23	17:16	0.00	15.92	0.00	14.41	42.79
Max		0.26	17.14	0.00	14.44	42.82
Avg		0.07	16.56	0.00	14.43	42.74



Reference Method Data

Client Name Gulf BP Co., Ltd.
Plant Name GBP

Date 24 Nov 23
Location ปล่อง HRSG 12

Run No: 1 Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
24 Nov 23	13:05	0.17	22.84	1.19	14.27	3.63
24 Nov 23	13:06	0.16	21.76	1.23	14.15	3.70
24 Nov 23	13:07	0.16	19.29	1.29	14.19	3.72
24 Nov 23	13:08	0.15	17.83	1.25	14.29	3.67
24 Nov 23	13:09	0.16	17.12	1.24	14.32	3.62
24 Nov 23	13:10	0.16	17.88	1.26	14.24	3.65
24 Nov 23	13:11	0.18	18.91	1.26	14.31	3.65
24 Nov 23	13:12	0.19	19.24	1.26	14.31	3.64
24 Nov 23	13:13	0.16	18.81	1.24	14.32	3.62
24 Nov 23	13:14	0.17	18.71	1.23	14.33	3.62
24 Nov 23	13:15	0.16	18.68	1.20	14.32	3.61
24 Nov 23	13:16	0.16	18.73	1.22	14.31	3.61
24 Nov 23	13:17	0.16	18.82	1.18	14.31	3.62
24 Nov 23	13:18	0.17	18.86	1.22	14.29	3.63
24 Nov 23	13:19	0.17	18.89	1.21	14.31	3.63
24 Nov 23	13:20	0.16	18.95	1.22	14.30	3.63
24 Nov 23	13:21	0.16	19.03	1.20	14.31	3.63
24 Nov 23	13:22	0.17	19.03	1.25	14.33	3.62
24 Nov 23	13:23	0.17	19.03	1.21	14.31	3.62
24 Nov 23	13:24	0.16	19.13	1.21	14.33	3.64
24 Nov 23	13:25	0.16	18.98	1.20	14.35	3.61
Max		0.19	22.84	1.29	14.35	3.72
Avg		0.16	19.07	1.23	14.30	3.64

Run No: 2 Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
24 Nov 23	13:26	0.15	18.54	1.19	14.34	3.60
24 Nov 23	13:27	0.16	18.35	1.21	14.35	3.60
24 Nov 23	13:28	0.16	18.34	1.19	14.35	3.60
24 Nov 23	13:29	0.16	18.47	1.23	14.36	3.61
24 Nov 23	13:30	0.15	18.55	1.20	14.38	3.60
24 Nov 23	13:31	0.15	18.46	1.15	14.39	3.59
24 Nov 23	13:32	0.16	18.37	1.13	14.35	3.59
24 Nov 23	13:33	0.17	18.44	1.15	14.36	3.61
24 Nov 23	13:34	0.16	18.55	1.15	14.34	3.60
24 Nov 23	13:35	0.16	18.50	1.14	14.34	3.61
24 Nov 23	13:36	0.15	18.45	1.15	14.36	3.61
24 Nov 23	13:37	0.17	18.46	1.13	14.33	3.60
24 Nov 23	13:38	0.17	18.53	1.14	14.34	3.61
24 Nov 23	13:39	0.18	18.58	1.15	14.37	3.60
24 Nov 23	13:40	0.16	18.58	1.13	14.36	3.59
24 Nov 23	13:41	0.17	18.61	1.17	14.33	3.60
24 Nov 23	13:42	0.17	18.74	1.15	14.34	3.61
24 Nov 23	13:43	0.16	18.93	1.12	14.33	3.60
24 Nov 23	13:44	0.16	19.02	1.14	14.34	3.61
24 Nov 23	13:45	0.16	19.06	1.11	14.37	3.61
24 Nov 23	13:46	0.17	18.97	1.13	14.36	3.61
Max		0.18	19.06	1.23	14.39	3.61
Avg		0.16	18.60	1.15	14.35	3.60

Run No: 3 Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
24 Nov 23	13:47	0.15	18.88	1.13	14.35	3.61
24 Nov 23	13:48	0.15	18.86	1.17	14.36	3.60
24 Nov 23	13:49	0.17	18.74	1.12	14.36	3.59
24 Nov 23	13:50	0.15	18.63	1.12	14.36	3.59
24 Nov 23	13:51	0.16	18.80	1.16	14.30	3.60
24 Nov 23	13:52	0.16	19.49	1.14	14.30	3.65
24 Nov 23	13:53	0.16	19.83	1.15	14.30	3.65
24 Nov 23	13:54	0.17	19.77	1.13	14.33	3.64
24 Nov 23	13:55	0.15	19.53	1.12	14.32	3.62
24 Nov 23	13:56	0.15	19.27	1.13	14.32	3.64
24 Nov 23	13:57	0.17	19.29	1.13	14.30	3.64
24 Nov 23	13:58	0.17	19.40	1.11	14.34	3.64
24 Nov 23	13:59	0.17	19.13	1.10	14.35	3.61
24 Nov 23	14:00	0.15	18.94	1.07	14.34	3.60
24 Nov 23	14:01	0.15	18.88	1.08	14.35	3.60
24 Nov 23	14:02	0.16	19.02	1.07	14.33	3.61
24 Nov 23	14:03	0.17	19.51	1.09	14.30	3.64
24 Nov 23	14:04	0.17	19.86	1.19	14.32	3.62
24 Nov 23	14:05	0.15	19.70	1.16	14.37	3.60
24 Nov 23	14:06	0.16	19.01	1.17	14.37	3.59
24 Nov 23	14:07	0.14	18.78	1.16	14.39	3.59
Max		0.17	19.86	1.19	14.39	3.65
Avg		0.16	19.21	1.13	14.34	3.62

Run No: 4 Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
24 Nov 23	14:08	0.15	18.84	1.12	14.37	3.61
24 Nov 23	14:09	0.15	19.02	1.16	14.36	3.61
24 Nov 23	14:10	0.16	19.21	1.15	14.36	3.61
24 Nov 23	14:11	0.17	19.27	1.19	14.32	3.60
24 Nov 23	14:12	0.15	19.32	1.20	14.34	3.61
24 Nov 23	14:13	0.15	19.43	1.19	14.31	3.63
24 Nov 23	14:14	0.16	19.44	1.12	14.37	3.63
24 Nov 23	14:15	0.14	19.08	1.10	14.38	3.59
24 Nov 23	14:16	0.17	18.79	1.11	14.38	3.59
24 Nov 23	14:17	0.15	18.78	1.11	14.38	3.58
24 Nov 23	14:18	0.14	18.84	1.10	14.34	3.59
24 Nov 23	14:19	0.15	18.96	1.13	14.34	3.60
24 Nov 23	14:20	0.14	19.03	1.08	14.38	3.62
24 Nov 23	14:21	0.14	18.89	1.07	14.39	3.60
24 Nov 23	14:22	0.14	18.61	1.10	14.36	3.60
24 Nov 23	14:23	0.15	18.59	1.10	14.36	3.62
24 Nov 23	14:24	0.14	18.70	1.12	14.35	3.62
24 Nov 23	14:25	0.15	18.81	1.11	14.36	3.62
24 Nov 23	14:26	0.14	18.85	1.07	14.36	3.60
24 Nov 23	14:27	0.16	18.93	1.10	14.29	3.61
24 Nov 23	14:28	0.16	19.53	1.11	14.27	3.65
Max		0.17	19.53	1.20	14.39	3.65
Avg		0.15	19.00	1.12	14.35	3.61

Run No: 5 Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
24 Nov 23	14:29	0.16	20.03	1.11	14.30	3.65
24 Nov 23	14:30	0.15	19.93	1.14	14.31	3.64
24 Nov 23	14:31	0.17	19.73	1.10	14.30	3.64
24 Nov 23	14:32	0.15	19.75	1.10	14.30	3.64
24 Nov 23	14:33	0.15	19.77	1.07	14.32	3.63
24 Nov 23	14:34	0.15	19.71	1.07	14.32	3.62
24 Nov 23	14:35	0.14	19.61	1.08	14.30	3.63
24 Nov 23	14:36	0.16	19.70	1.05	14.28	3.64
24 Nov 23	14:37	0.15	19.95	1.05	14.31	3.64
24 Nov 23	14:38	0.15	19.84	1.07	14.31	3.63
24 Nov 23	14:39	0.15	19.49	1.04	14.32	3.63
24 Nov 23	14:40	0.15	19.32	1.05	14.29	3.63
24 Nov 23	14:41	0.16	19.57	1.01	14.31	3.64
24 Nov 23	14:42	0.16	19.71	1.04	14.31	3.64
24 Nov 23	14:43	0.16	19.59	1.00	14.31	3.64
24 Nov 23	14:44	0.16	19.48	1.03	14.31	3.64
24 Nov 23	14:45	0.15	19.49	1.02	14.32	3.63
24 Nov 23	14:46	0.14	19.52	1.02	14.30	3.63
24 Nov 23	14:47	0.15	19.64	1.06	14.28	3.64
24 Nov 23	14:48	0.15	19.77	1.01	14.29	3.64
24 Nov 23	14:49	0.15	19.74	1.03	14.30	3.63
Max		0.17	20.03	1.14	14.32	3.65
Avg		0.15	19.68	1.05	14.31	3.63

Run No: 6 Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
24 Nov 23	14:50	0.15	19.63	0.99	14.31	3.63
24 Nov 23	14:51	0.15	19.65	1.02	14.29	3.63
24 Nov 23	14:52	0.16	19.67	0.99	14.32	3.64
24 Nov 23	14:53	0.15	19.61	0.94	14.31	3.64
24 Nov 23	14:54	0.14	19.64	1.04	14.30	3.65
24 Nov 23	14:55	0.13	19.76	1.02	14.29	3.65
24 Nov 23	14:56	0.14	19.80	1.00	14.31	3.63
24 Nov 23	14:57	0.14	19.68	1.02	14.31	3.63
24 Nov 23	14:58	0.16	19.63	1.03	14.32	3.64
24 Nov 23	14:59	0.13	19.60	1.02	14.31	3.64
24 Nov 23	15:00	0.14	19.60	1.00	14.29	3.64
24 Nov 23	15:01	0.14	19.66	1.05	14.31	3.64
24 Nov 23	15:02	0.14	19.73	1.00	14.30	3.63
24 Nov 23	15:03	0.14	19.72	1.03	14.31	3.63
24 Nov 23	15:04	0.13	19.72	1.01	14.30	3.65
24 Nov 23	15:05	0.14	19.75	1.03	14.31	3.65
24 Nov 23	15:06	0.14	19.77	0.99	14.31	3.64
24 Nov 23	15:07	0.12	19.65	0.97	14.32	3.63
24 Nov 23	15:08	0.13	19.60	0.98	14.32	3.62
24 Nov 23	15:09	0.14	19.65	1.02	14.33	3.63
24 Nov 23	15:10	0.14	19.76	0.97	14.32	3.63
Max		0.16	19.80	1.05	14.33	3.65
Avg		0.14	19.68	1.01	14.31	3.64



Reference Method Data

Client Name Gulf BP Co., Ltd.
Plant Name GBP

Date 24 Nov 23
Location ปล่อง HRSG 12

Run No: 7 Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
24 Nov 23	15:11	0.16	19.90	0.98	14.31	3.63
24 Nov 23	15:12	0.14	20.01	0.99	14.30	3.64
24 Nov 23	15:13	0.14	19.99	0.97	14.30	3.63
24 Nov 23	15:14	0.13	19.90	0.97	14.32	3.63
24 Nov 23	15:15	0.14	19.84	0.95	14.32	3.63
24 Nov 23	15:16	0.14	19.72	0.96	14.33	3.63
24 Nov 23	15:17	0.14	19.64	0.92	14.30	3.63
24 Nov 23	15:18	0.13	19.72	0.94	14.30	3.64
24 Nov 23	15:19	0.14	19.88	0.98	14.30	3.64
24 Nov 23	15:20	0.14	19.88	0.98	14.31	3.64
24 Nov 23	15:21	0.14	19.82	1.12	14.33	3.64
24 Nov 23	15:22	0.15	19.68	1.13	14.32	3.63
24 Nov 23	15:23	0.14	19.69	1.15	14.30	3.63
24 Nov 23	15:24	0.14	19.81	1.15	14.32	3.63
24 Nov 23	15:25	0.13	19.83	1.11	14.29	3.63
24 Nov 23	15:26	0.15	19.89	1.12	14.31	3.64
24 Nov 23	15:27	0.14	19.90	1.11	14.33	3.63
24 Nov 23	15:28	0.14	19.79	1.08	14.33	3.63
24 Nov 23	15:29	0.16	19.64	1.10	14.30	3.63
24 Nov 23	15:30	0.14	19.78	1.11	14.30	3.63
24 Nov 23	15:31	0.15	19.88	1.09	14.32	3.63
Max		0.16	20.01	1.15	14.33	3.64
Avg		0.14	19.82	1.04	14.31	3.63

Run No: 8 Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
24 Nov 23	15:32	0.13	19.87	1.12	14.32	3.64
24 Nov 23	15:33	0.14	19.92	1.12	14.30	3.64
24 Nov 23	15:34	0.14	19.87	1.13	14.33	3.63
24 Nov 23	15:35	0.13	19.78	1.13	14.31	3.62
24 Nov 23	15:36	0.15	19.78	1.09	14.32	3.62
24 Nov 23	15:37	0.13	19.83	1.11	14.32	3.63
24 Nov 23	15:38	0.13	19.91	1.16	14.31	3.64
24 Nov 23	15:39	0.14	20.00	1.13	14.31	3.63
24 Nov 23	15:40	0.14	19.99	1.14	14.32	3.63
24 Nov 23	15:41	0.13	19.92	1.10	14.33	3.63
24 Nov 23	15:42	0.14	19.90	1.12	14.31	3.63
24 Nov 23	15:43	0.14	19.98	1.09	14.31	3.63
24 Nov 23	15:44	0.14	20.01	1.13	14.32	3.64
24 Nov 23	15:45	0.13	19.93	1.08	14.34	3.64
24 Nov 23	15:46	0.16	19.85	1.06	14.32	3.63
24 Nov 23	15:47	0.14	19.87	1.08	14.32	3.63
24 Nov 23	15:48	0.14	19.89	1.08	14.31	3.63
24 Nov 23	15:49	0.13	19.95	1.09	14.30	3.65
24 Nov 23	15:50	0.15	20.02	1.12	14.31	3.65
24 Nov 23	15:51	0.15	20.06	1.16	14.32	3.64
24 Nov 23	15:52	0.14	20.10	1.13	14.32	3.63
Max		0.16	20.10	1.16	14.34	3.65
Avg		0.14	19.93	1.11	14.32	3.63

Run No: 9 Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
24 Nov 23	15:53	0.14	20.09	1.13	14.32	3.64
24 Nov 23	15:54	0.14	19.92	1.10	14.32	3.63
24 Nov 23	15:55	0.15	19.78	1.12	14.31	3.64
24 Nov 23	15:56	0.14	19.88	1.12	14.32	3.63
24 Nov 23	15:57	0.14	19.95	1.04	14.33	3.63
24 Nov 23	15:58	0.15	19.80	1.06	14.32	3.62
24 Nov 23	15:59	0.14	19.83	1.09	14.31	3.63
24 Nov 23	16:00	0.15	19.94	1.10	14.31	3.64
24 Nov 23	16:01	0.13	19.95	1.06	14.32	3.64
24 Nov 23	16:02	0.14	19.87	1.11	14.32	3.63
24 Nov 23	16:03	0.13	19.91	1.12	14.32	3.63
24 Nov 23	16:04	0.15	19.97	1.07	14.33	3.63
24 Nov 23	16:05	0.14	20.00	1.12	14.28	3.63
24 Nov 23	16:06	0.13	20.10	1.08	14.30	3.65
24 Nov 23	16:07	0.15	20.14	1.08	14.33	3.64
24 Nov 23	16:08	0.14	19.93	1.05	14.32	3.63
24 Nov 23	16:09	0.16	19.80	1.06	14.31	3.62
24 Nov 23	16:10	0.14	19.87	1.05	14.31	3.63
24 Nov 23	16:11	0.15	19.94	1.02	14.32	3.64
24 Nov 23	16:12	0.15	19.90	1.04	14.31	3.63
24 Nov 23	16:13	0.14	19.92	1.10	14.31	3.64
Max		0.16	20.14	1.13	14.33	3.65
Avg		0.14	19.93	1.08	14.31	3.63

Run No: 10 Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
24 Nov 23	16:14	0.13	19.99	1.08	14.32	3.64
24 Nov 23	16:15	0.14	19.96	1.07	14.33	3.63
24 Nov 23	16:16	0.15	19.96	1.06	14.29	3.63
24 Nov 23	16:17	0.15	20.01	1.14	14.31	3.64
24 Nov 23	16:18	0.16	20.04	1.08	14.31	3.64
24 Nov 23	16:19	0.14	19.92	1.07	14.32	3.63
24 Nov 23	16:20	0.15	19.91	1.07	14.31	3.62
24 Nov 23	16:21	0.15	19.93	1.08	14.32	3.63
24 Nov 23	16:22	0.14	19.95	1.09	14.32	3.63
24 Nov 23	16:23	0.14	19.96	1.09	14.32	3.64
24 Nov 23	16:24	0.14	20.03	1.06	14.32	3.63
24 Nov 23	16:25	0.15	20.05	1.10	14.35	3.63
24 Nov 23	16:26	0.14	19.84	1.03	14.40	3.62
24 Nov 23	16:27	0.14	19.40	1.07	14.34	3.62
24 Nov 23	16:28	0.13	19.12	1.09	14.36	3.62
24 Nov 23	16:29	0.14	18.95	1.07	14.37	3.61
24 Nov 23	16:30	0.15	18.94	1.08	14.38	3.60
24 Nov 23	16:31	0.14	19.07	1.10	14.35	3.60
24 Nov 23	16:32	0.13	19.08	1.05	14.38	3.60
24 Nov 23	16:33	0.14	19.04	1.03	14.38	3.61
24 Nov 23	16:34	0.13	19.08	1.08	14.36	3.61
Max		0.16	20.05	1.14	14.40	3.64
Avg		0.14	19.63	1.07	14.34	3.62

Run No: 11 Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
24 Nov 23	16:35	0.14	19.16	1.06	14.38	3.62
24 Nov 23	16:36	0.13	19.10	1.08	14.37	3.61
24 Nov 23	16:37	0.12	19.04	1.07	14.38	3.61
24 Nov 23	16:38	0.13	19.11	1.06	14.37	3.61
24 Nov 23	16:39	0.15	19.16	1.09	14.37	3.62
24 Nov 23	16:40	0.15	19.22	1.13	14.37	3.61
24 Nov 23	16:41	0.15	19.42	1.14	14.32	3.62
24 Nov 23	16:42	0.14	19.67	1.16	14.32	3.63
24 Nov 23	16:43	0.15	19.91	1.10	14.30	3.63
24 Nov 23	16:44	0.13	20.09	1.15	14.33	3.64
24 Nov 23	16:45	0.15	19.91	1.10	14.36	3.63
24 Nov 23	16:46	0.15	19.46	1.10	14.36	3.62
24 Nov 23	16:47	0.15	19.32	1.09	14.37	3.62
24 Nov 23	16:48	0.14	19.25	1.09	14.36	3.61
24 Nov 23	16:49	0.14	19.13	1.07	14.37	3.61
24 Nov 23	16:50	0.14	19.05	1.09	14.38	3.61
24 Nov 23	16:51	0.14	19.04	1.08	14.35	3.62
24 Nov 23	16:52	0.14	19.04	1.10	14.35	3.62
24 Nov 23	16:53	0.14	19.04	1.10	14.36	3.61
24 Nov 23	16:54	0.15	19.00	1.07	14.35	3.61
24 Nov 23	16:55	0.15	19.04	1.12	14.37	3.62
Max		0.15	20.09	1.16	14.38	3.64
Avg		0.14	19.29	1.10	14.36	3.62

Run No: 12 Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
24 Nov 23	16:56	0.15	19.07	1.10	14.37	3.62
24 Nov 23	16:57	0.15	19.11	1.09	14.35	3.62
24 Nov 23	16:58	0.16	19.10	1.08	14.36	3.62
24 Nov 23	16:59	0.15	19.07	1.14	14.35	3.62
24 Nov 23	17:00	0.15	19.07	1.12	14.36	3.62
24 Nov 23	17:01	0.17	19.06	1.14	14.34	3.62
24 Nov 23	17:02	0.14	19.07	1.13	14.33	3.63
24 Nov 23	17:03	0.15	19.09	1.11	14.34	3.61
24 Nov 23	17:04	0.14	19.08	1.12	14.36	3.61
24 Nov 23	17:05	0.14	19.12	1.15	14.33	3.63
24 Nov 23	17:06	0.14	19.15	1.08	14.34	3.63
24 Nov 23	17:07	0.15	19.11	1.08	14.34	3.62
24 Nov 23	17:08	0.15	19.04	1.09	14.34	3.62
24 Nov 23	17:09	0.15	19.09	1.11	14.34	3.62
24 Nov 23	17:10	0.13	19.10	1.13	14.32	3.61
24 Nov 23	17:11	0.16	19.07	1.14	14.35	3.61
24 Nov 23	17:12	0.15	19.03	1.19	14.34	3.62
24 Nov 23	17:13	0.15	18.99	1.17	14.36	3.62
24 Nov 23	17:14	0.15	18.99	1.16	14.33	3.62
24 Nov 23	17:15	0.14	18.96	1.15	14.33	3.62
24 Nov 23	17:16	0.17	18.93	1.15	14.35	3.61
Max		0.17	19.15	1.19	14.37	3.63
Avg		0.15	19.06	1.13	14.34	3.62

CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

Customer: AIR LIQUIDE
(THAILAND) LTD
Part Number: E04N199E3HA0002
Cylinder Number: GN0027212
Laboratory: 124 - Plumsteadville - PA
PGVP Number: A12022
Gas Code: CO,NO,NOX,SO2,BALN

Reference Number: 160-402340013-1
Cylinder Volume: 247.2 CF
Cylinder Pressure: 2215 PSIG
Valve Outlet: 660
Certification Date: Feb 11, 2022

Expiration Date: Feb 11, 2030

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are mole/mole basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	80.00 PPM	79.77 PPM	G1	+/- 1.0% NIST Traceable	02/04/2022, 02/11/2022
CARBON MONOXIDE	80.00 PPM	79.90 PPM	G1	+/- 0.6% NIST Traceable	02/04/2022
NITRIC OXIDE	80.00 PPM	79.77 PPM	G1	+/- 1.0% NIST Traceable	02/04/2022, 02/11/2022
SULFUR DIOXIDE	80.00 PPM	79.09 PPM	G1	+/- 0.9% NIST Traceable	02/04/2022, 02/11/2022
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	09010212	KAL004777	98.48 PPM CARBON MONOXIDE/NITROGEN	+/- 0.5%	Oct 16, 2024
NTRM	200610-15	CC733106	98.61 PPM NITRIC OXIDE/NITROGEN	+/- 0.9%	Oct 06, 2026
NTRM	200610-04	CC708044	98.61 PPM NITRIC OXIDE/NITROGEN	+/- 0.9%	Oct 06, 2026
GMIS	124206889139	CC323707	4.097 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.0%	Sep 03, 2024
NTRM	11010419	KAL004813	99.6 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Jul 28, 2023

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet iS50 FTIR AUP2010245 CO	FTIR	Feb 03, 2022
Nicolet iS50 FTIR AUP2010245 NO	FTIR	Feb 10, 2022
Nicolet iS50 FTIR AUP2010245 NO2	FTIR	Jan 27, 2022
Nicolet iS50 FTIR AUP2010245 SO2	FTIR	Jan 20, 2022

Trace Data Available Upon Request

NOTES: Gross Weight: 48.5 Kg
Net Weight: 8.1 Kg



CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E04NI99E3HA0066 Reference Number: 160-402138464-1
Cylinder Number: ND11215 Cylinder Volume: 247.2 CF
Laboratory: 124 - Plumsteadville - PA Cylinder Pressure: 2215 PSIG
PGVP Number: A12021 Valve Outlet: 660
Gas Code: CO,NO,NOX,SO2,BALN Certification Date: Jul 15, 2021

Expiration Date: Jul 15, 2029

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 800/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	55.00 PPM	56.16 PPM	G1	+/- 1.4% NIST Traceable	07/08/2021, 07/15/2021
CARBON MONOXIDE	55.00 PPM	54.22 PPM	G1	+/- 0.5% NIST Traceable	07/08/2021
NITRIC OXIDE	55.00 PPM	56.16 PPM	G1	+/- 1.0% NIST Traceable	07/08/2021, 07/15/2021
SULFUR DIOXIDE	55.00 PPM	55.55 PPM	G1	+/- 1.1% NIST Traceable	07/08/2021, 07/15/2021
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	11010130	KAL004536	97.31 PPM CARBON MONOXIDE/NITROGEN	+/- 0.4%	Oct 04, 2022
PRM	12386	D685025	9.91 PPM AIR/NITROGEN DIOXIDE	2.0%	Feb 20, 2020
NTRM	200610-50	CC733426	98.61 PPM NITRIC OXIDE/NITROGEN	+/- 0.9%	Oct 06, 2026
GMIS	124206889	CC323707	4.028 PPM NITROGEN DIOXIDE/NITROGEN	2.1%	Aug 15, 2021
NTRM	16010224	KAL003838	97.68 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Dec 23, 2021

The SRM, PRM or RGM noted above is only in reference to the GMIS used in the assay and not part of the analysis.

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet iS50 FTIR AUP2010245 CO	FTIR	Jun 24, 2021
Nicolet iS50 FTIR AUP2010245 NO	FTIR	Jul 01, 2021
Nicolet iS50 FTIR AUP2010245 NO2	FTIR	Jun 30, 2021
Nicolet iS50 FTIR AUP2010245 SO2	FTIR	Jul 09, 2021

Triad Data Available Upon Request

NOTES:

Gross Weight: 47.9 Kg
Net Weight: 7.8 Kg



Michael A. Hunter

CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

Customer: AIR LIQUIDE
(THAILAND) LTD
Part Number: E02N192E3HA0000
Cylinder Number: GN0027038
Laboratory: 124 - Plumsteadville - PA
PGVP Number: A12022
Gas Code: O2,BALN
Reference Number: 160-402340009-1
Cylinder Volume: 248.4 CF
Cylinder Pressure: 2214 PSIG
Valve Outlet: 590
Certification Date: Feb 10, 2022

Expiration Date: Feb 10, 2030

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
OXYGEN	8.000 %	7.979 %	G1	+/- 0.5% NIST Traceable	02/10/2022
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	10010635	K022176	9.967 % OXYGEN/NITROGEN	+/- 0.3%	Apr 19, 2022

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
SIEMENS OXYMAT 6 - N1-W5-951 - O2	PARAMAGNETIC	Jan 27, 2022

Triad Data Available Upon Request

NOTES: Gross Weight: 48.3 Kg

Net Weight: 8.1 Kg



[Signature]

Approved for Release

CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

Customer: AIR LIQUIDE
(THAILAND) LTD
Part Number: E02NI84E3HA0001
Cylinder Number: GN0027207
Laboratory: 124 - Plumsteadville - PA
PGVP Number: A12022
Gas Code: O2,BALN
Reference Number: 160-402340010-1
Cylinder Volume: 249.8 CF
Cylinder Pressure: 2214 PSIG
Valve Outlet: 590
Certification Date: Feb 02, 2022

Expiration Date: Feb 02, 2030

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
OXYGEN	15.00 %	16.02 %	G1	+/- 0.4% NIST Traceable	02/02/2022
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	08010230	K005228	23.20 % OXYGEN/NITROGEN	+/- 0.4%	Jun 01, 2022

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
SIEMENS OXYMAT 6 - N1-W5-951 - O2	PARAMAGNETIC	Jan 27, 2022

Triad Data Available Upon Request

NOTES: Gross Weight: 48.8 Kg

Net Weight: 8.2 Kg



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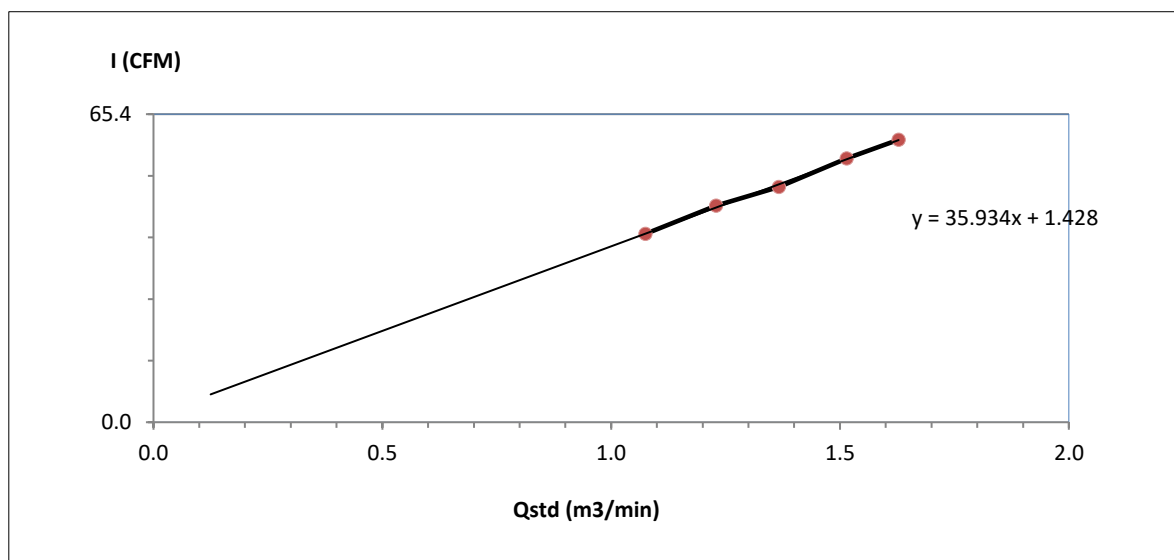
Approved for Release



High Volume Air Sampler Calibration Worksheet

Project Site :	Gulf BP Co., Ltd.	Barometric Pressure (mm Hg) :	758
Calibrate Location :	รพ.สต.บ้านหว้า	Temperature (°C) :	32
Calibrate Date :	20-Nov-23	High Volume ID :	BKK_FS0358
CalibrationSheet No.:	C-201123-BKK_FS0358	High Volume Model :	TE-5009X
Calibrator ID:	BKK_FS0625	High Volume S/N :	5193
Calibrator Model :	TE-5028A	Calibrator Slope :	1.66209
Calibrator S/N :	2585	Calibrator Intercept :	-0.01241

Test No.	Delta H ₂ O (inch)	Q _{std} (m ³ /min)	I : Chart (CFM)	Linear Regression
1	3.2	1.0748	40	Slope : 35.9339 Intercept : 1.4280 Correlation Coefficient : 0.9991
2	4.2	1.2296	46	
3	5.2	1.3668	50	
4	6.4	1.5149	56	
5	7.4	1.6280	60	



Calibrated by 

(Mr. Thananat Anake)
Field Scientist(2)

Approved by : 

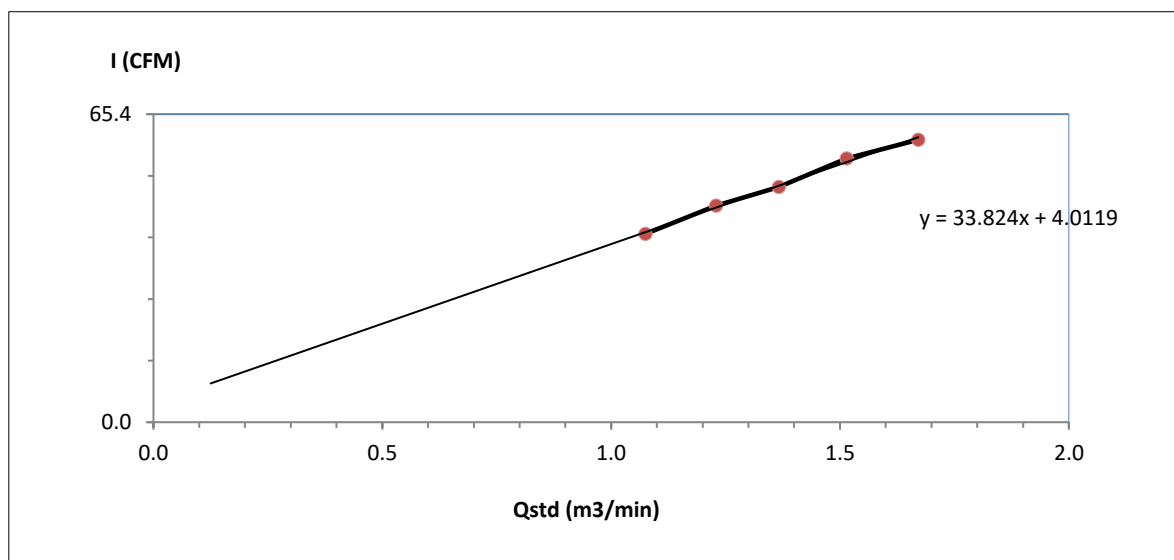
(Mr. Noppong Juntarupan)
Enviro Field Coordinator Scientist (3)



High Volume Air Sampler Calibration Worksheet

Project Site :	Gulf BP Co., Ltd.	Barometric Pressure (mm Hg) :	758
Calibrate Location :	โรงเรียนเจ้าฟ้าสร้าง	Temperature (°C) :	32
Calibrate Date :	20-Nov-23	High Volume ID :	BKK_FS0366
CalibrationSheet No.:	C-201123-BKK_FS0366	High Volume Model :	TE-5009X
Calibrator ID:	BKK_FS0625	High Volume S/N :	4156
Calibrator Model :	TE-5028A	Calibrator Slope :	1.66209
Calibrator S/N :	2585	Calibrator Intercept :	-0.01241

Test No.	Delta H ₂ O (inch)	Q _{std} (m ³ /min)	I : Chart (CFM)	Linear Regression
1	3.2	1.0748	40	Slope : 33.8241 Intercept : 4.0119 Correlation Coefficient : 0.9976
2	4.2	1.2296	46	
3	5.2	1.3668	50	
4	6.4	1.5149	56	
5	7.8	1.6711	60	



Calibrated by 

(Mr. Thananat Anake)
Field Scientist(2)

Approved by : 

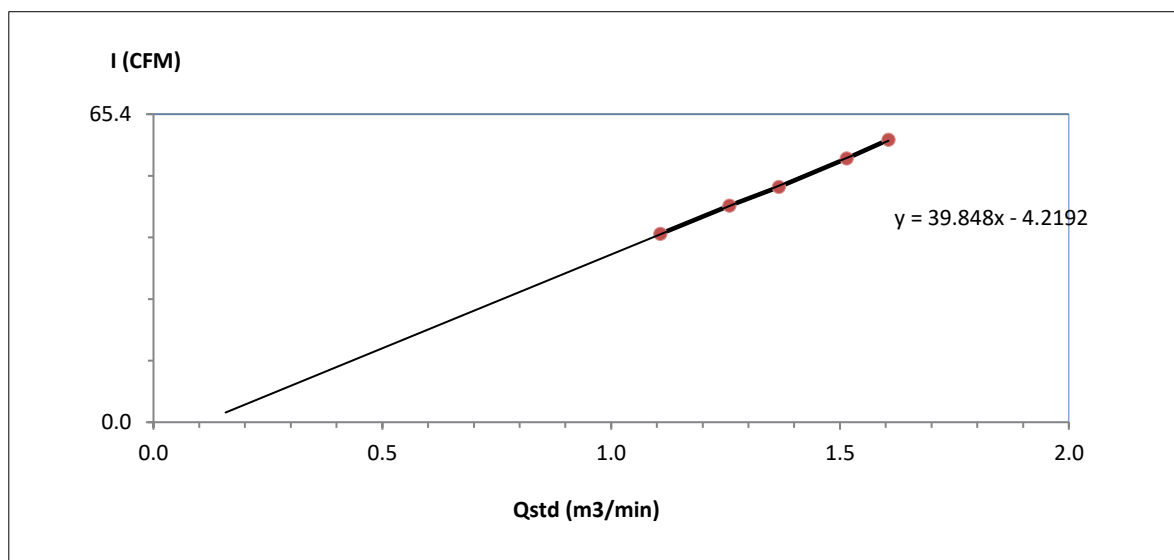
(Mr. Noppong Juntarupan)
Enviro Field Coordinator Scientist (3)



High Volume Air Sampler Calibration Worksheet

Project Site :	Gulf BP Co., Ltd.	Barometric Pressure (mm Hg) :	758
Calibrate Location :	หมู่ที่ 3 ตำบลบ้านเลน	Temperature (°C) :	32
Calibrate Date :	20-Nov-23	High Volume ID :	BKK_FS0359
CalibrationSheet No.:	C-201123-BKK_FS0359	High Volume Model :	TE-5009X
Calibrator ID:	BKK_FS0625	High Volume S/N :	5194
Calibrator Model :	TE-5028A	Calibrator Slope :	1.66209
Calibrator S/N :	2585	Calibrator Intercept :	-0.01241

Test No.	Delta H ₂ O (inch)	Q _{std} (m ³ /min)	I : Chart (CFM)	Linear Regression
1	3.4	1.1075	40	Slope : 39.8475 Intercept : -4.2192 Correlation Coefficient : 0.9997
2	4.4	1.2582	46	
3	5.2	1.3668	50	
4	6.4	1.5149	56	
5	7.2	1.6061	60	



Calibrated by 

(Mr. Thananat Anake)
Field Scientist(2)

Approved by : 

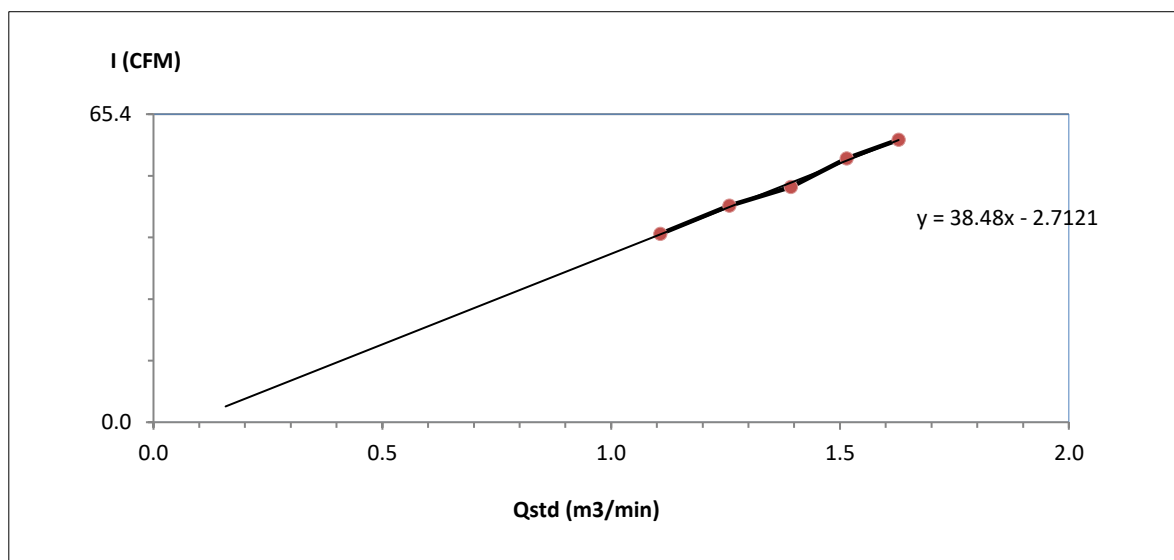
(Mr. Noppong Juntarupan)
Enviro Field Coordinator Scientist (3)



High Volume Air Sampler Calibration Worksheet

Project Site :	Gulf BP Co., Ltd.	Barometric Pressure (mm Hg) :	758
Calibrate Location :	หมู่ที่ 2 ตำบลบ้านหว้า	Temperature (°C) :	32
Calibrate Date :	20-Nov-23	High Volume ID :	BKK_FS1375
CalibrationSheet No.:	C-201123-BKK_FS1375	High Volume Model :	TE-5009X
Calibrator ID:	BKK_FS0625	High Volume S/N :	6256
Calibrator Model :	TE-5028A	Calibrator Slope :	1.66209
Calibrator S/N :	2585	Calibrator Intercept :	-0.01241

Test No.	Delta H ₂ O (inch)	Q _{std} (m ³ /min)	I : Chart (CFM)	Linear Regression
1	3.4	1.1075	40	Slope : 38.4797 Intercept : -2.7121 Correlation Coefficient : 0.9979
2	4.4	1.2582	46	
3	5.4	1.3926	50	
4	6.4	1.5149	56	
5	7.4	1.6280	60	



Calibrated by

(Mr. Thananat Anake)
Field Scientist(2)

Approved by :

(Mr. Noppong Juntarupan)
Enviro Field Coordinator Scientist (3)

Sartorius (Thailand) Co., Ltd.

129 Rama 9 Road, Huaykwang, Bangkok 10310

Tel: +66 2643 8361-6, e-mail: service.thailand@sartorius.com

**SARTORIUS**

Certificate

of Calibration

REVIEW BY	<u>Siriruk P.</u>
APPROVED BY	<u>KL AL</u>
NEXT CAL. DATE	<u>8/2/24</u>

Model Number : XP105DU
Description : Semi-micro Balance
Serial Number : 1123091884
ID No. : BKK_EN0004
Manufacturer : Mettler Toledo

Certificate No. : 23BC10071
Issued Date : Monday, February 13, 2023
Reference No. : 203245
Page No. : 1 of 3

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

Calibrated Place : Balance Room.

Calibrated By : Mr. Chonchai Inthana
Calibration Date : Wednesday, February 08, 2023

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 : 31/120 g Readability : 0.0001 g

Ambients Conditions:

Temperature : 21.0 °C ± 3.0 °C

Humidity : 65.0 % RH ± 5.0 % RH

Pressure : ±

Reasons for calibration

☐ New Installation ☐ Service / Repaired ☒ Re-calibration/ Maintenance

Equipment Condition: ☒ Good Operate ☐ Fair

Measurement Method UKAS Publication Ref :Lab 14

The measurement uncertainty stated is the expended 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 - 1kg E2 s/n 37929119	SPC-RT	C02212565	14-Sep-2023
MHB-382SD	Humidity/Barometer/Temp Lutron MHB-382SD	DKSH	C19220444	5-Sep-2023

This certificate relate and apply this equipment only.

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

Mr.Chonchai Inthana(Technical Manager)

S
T
A
M
P



Certificate of Calibration

Model Number : XP105DU

Description : Semi-micro Balance

Serial Number : 1123091884

ID No. : BKK_EN0004

Manufacturer : Mettler Toledo

Certificate No. : 23BCI0071

Issued Date : Monday, February 13, 2023

Reference No. : 203245

Page No. : 2 of 3

Calibration Results : Without Adjustment

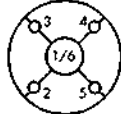
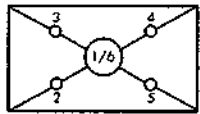
Repeatability

The reproducibility is the ability of a weighing instrument to display nearly identical readouts 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.

Nominal Value : (Low Load)	2.00002	20.00002
2 g	2.00001	20.00001
Tolerance	2.00002	20.00001
N/A g	2.00002	20.00001
Nominal Value : (High Load)	2.00002	20.00000
20 g	2.00002	20.00001
Tolerance	2.00002	20.00000
N/A g	2.00001	20.00000
	2.00001	20.00001
Standard Deviation	0.000005	0.000007

Eccentricity (Off-center loading error)

The off-center loading error is yielded by the difference between the readout 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 R76).

Nominal value :	20	g
Tolerance	N/A	g
		
		
	Difference	
1	—	
2	-0.00002	
3	-0.00004	
4	0.00002	
5	0.00003	
6	—	

Linearity

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

Tolerance N/A g

Nominal Value (g)	Conventional Mass Value (g)	Displayed Value (g)	Deviation (g)	Uncertainty (g)
0.1	0.10000	0.10000	0.00000	0.000022
0.5	0.50001	0.50000	-0.00001	0.000023
1	1.00000	1.00000	0.00000	0.000024
2	2.00002	2.00001	-0.00001	0.000026
5	5.00002	5.00002	0.00000	0.000030
10	10.00002	10.00002	0.00000	0.000035
15	15.00004	15.00004	0.00000	0.000053
20	20.00000	20.00000	0.00000	0.000053
25	25.00002	25.00002	0.00000	0.000089
30	30.00002	30.00004	0.00002	0.000089

Certificate of Calibration

Model Number : XS105DU
 Description : Semi-micro Balance
 Serial Number : 1123091884
 ID No. : BKK_EN0004
 Manufacturer : Mettler Toledo

Certificate No. : 23BCI0071
 Issued Date : Monday, February 13, 2023
 Reference No. : 203245
 Page No. : 3 of 3

Calibration Results : Without Adjustment

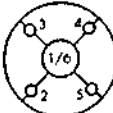
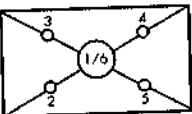
Repeatability

The reproducibility is the ability of a weighing instrument to display nearly identical readouts 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.

Nominal Value : (Low Load)		100.0000
		100.0000
		100.0000
Tolerance		100.0000
		100.0000
		100.0000
Nominal Value : (High Load)		100.0000
		100.0000
		99.9999
Tolerance		100.0000
		100.0000
		100.0000
Standard Deviation		0.00003

Eccentricity (Off-center loading error)

The off-center loading error is yielded by the difference between the readout 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 R76).

Nominal value :	g
Tolerance	N/A g
	
	
	Difference
1	-
2	-
3	-
4	-
5	-
6	-

Linearity

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

Tolerance	N/A	g		
Nominal Value	Conventional Mass Value	Displayed Value	Deviation	Uncertainty
(g)	(g)	(g)	(g)	(g)
50	50.0000	50.0000	0.0000	0.00012
55	55.0000	55.0000	0.0000	0.00015
60	60.0000	60.0000	0.0000	0.00015
65	65.0001	65.0001	0.0000	0.00015
70	70.0000	70.0000	0.0000	0.00015
80	80.0000	80.0000	0.0000	0.00017
90	90.0001	90.0001	0.0000	0.00018
100	100.0000	100.0000	0.0000	0.00018
110	110.0000	110.0000	0.0000	0.00026
120	120.0000	120.0000	0.0000	0.00026

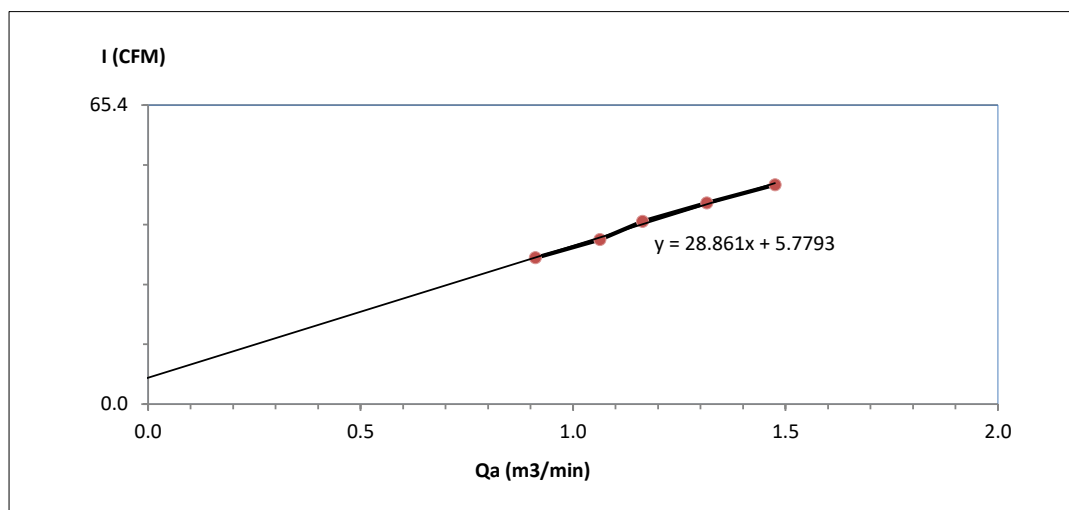
End of Report.





High Volume Air Sampler Calibration Worksheet

Project Site :	Gulf BP Co., Ltd.	Barometric Pressure (mm Hg) :	758
Calibrate Location :	รพ.สต.บ้านหว้า	Temperature (°C) :	32
Calibrate Date :	20-Nov-23	High Volume ID :	BKK_FS1060
CalibrationSheet No.:	C-201123-BKK_FS1060	High Volume Model :	TE-5009X
Calibrator ID:	BKK_FS0625	High Volume S/N :	5503
Calibrator Model :	TE-5028A	Calibrator Slope :	1.04104
Calibrator S/N :	2585	Calibrator Intercept :	-0.00779

Test No.	Delta H ₂ O (inch)	Qa (m ³ /min)	I : Chart (CFM)	Linear Regression
1	2.2	0.912	32	Slope : 28.8611 Intercept : 5.7793 Correlation Coefficient : 0.9974
2	3.0	1.063	36	
3	3.6	1.164	40	
4	4.6	1.315	44	
5	5.8	1.475	48	



Calibrated by 
 (Mr. Thananat Anake)
 Field Scientist(2)

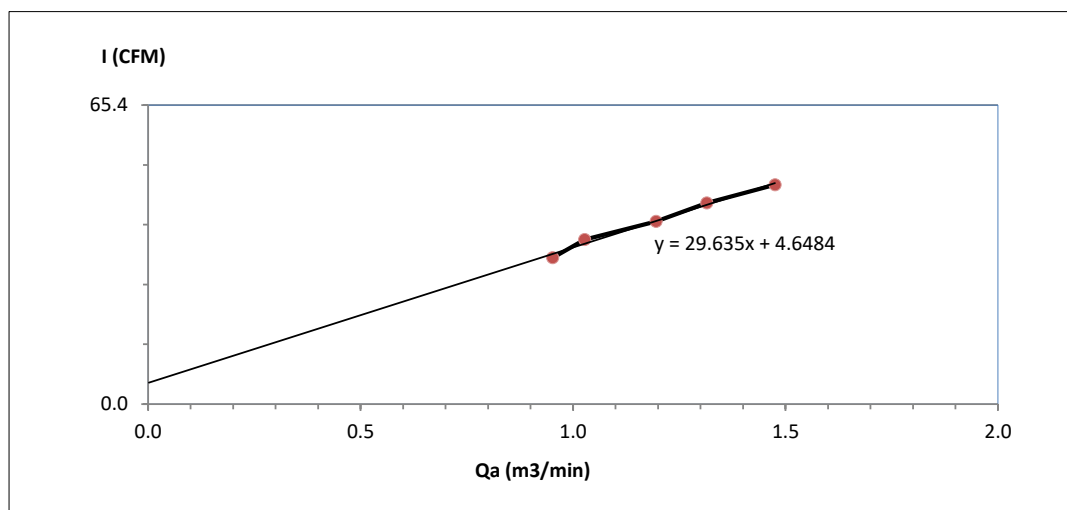
Approved by : 
 (Mr. Noppong Juntarupan)
 Enviro Field Coordinator Scientist (3)



High Volume Air Sampler Calibration Worksheet

Project Site :	Gulf BP Co., Ltd.	Barometric Pressure (mm Hg) :	758
Calibrate Location :	โรงเรียนเจ้าฟ้าสร้าง	Temperature (°C) :	32
Calibrate Date :	20-Nov-23	High Volume ID :	BKK_FS0381
CalibrationSheet No.:	C-201123-BKK_FS0381	High Volume Model :	TE-5009X
Calibrator ID:	BKK_FS0625	High Volume S/N :	4161
Calibrator Model :	TE-5028A	Calibrator Slope :	1.04104
Calibrator S/N :	2585	Calibrator Intercept :	-0.00779

Test No.	Delta H ₂ O (inch)	Qa (m ³ /min)	I : Chart (CFM)	Linear Regression
1	2.4	0.952	32	Slope : 29.6346 Intercept : 4.6484 Correlation Coefficient : 0.9942
2	2.8	1.027	36	
3	3.8	1.196	40	
4	4.6	1.315	44	
5	5.8	1.475	48	



Calibrated by
 (Mr. Thananat Anake)
 Field Scientist(2)

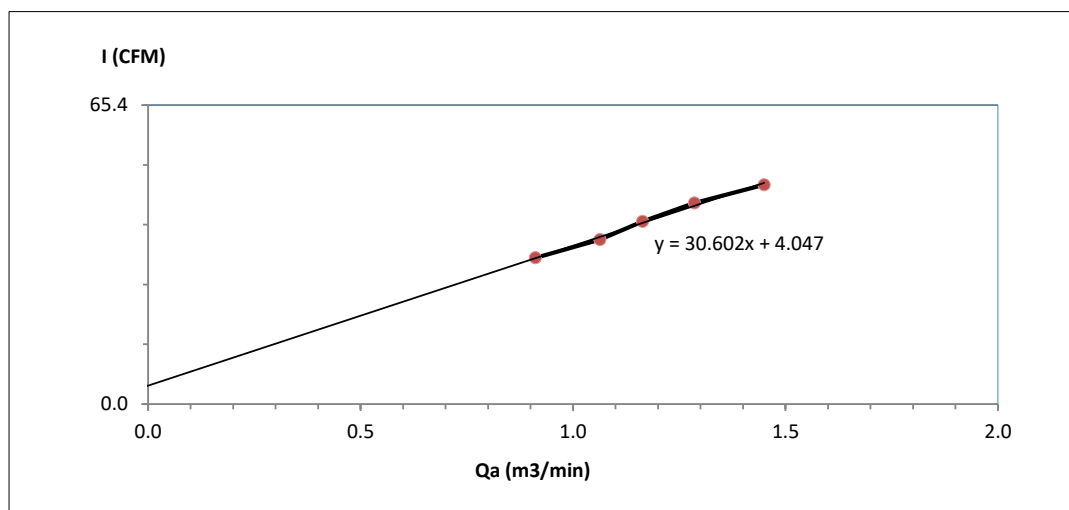
Approved by :
 (Mr. Noppong Juntarupan)
 Enviro Field Coordinator Scientist (3)



High Volume Air Sampler Calibration Worksheet

Project Site :	Gulf BP Co., Ltd.	Barometric Pressure (mm Hg) :	758
Calibrate Location :	หมู่ที่ 3 ตำบลบ้านเลน	Temperature (°C) :	32
Calibrate Date :	20-Nov-23	High Volume ID :	BKK_FS1378
CalibrationSheet No.:	C-201123-BKK_FS1378	High Volume Model :	TE-5009X
Calibrator ID:	BKK_FS0625	High Volume S/N :	6263
Calibrator Model :	TE-5028A	Calibrator Slope :	1.04104
Calibrator S/N :	2585	Calibrator Intercept :	-0.00779

Test No.	Delta H ₂ O (inch)	Qa (m ³ /min)	I : Chart (CFM)	Linear Regression
1	2.2	0.912	32	Slope : 30.6022 Intercept : 4.0470 Correlation Coefficient : 0.9969
2	3.0	1.063	36	
3	3.6	1.164	40	
4	4.4	1.286	44	
5	5.6	1.450	48	



Calibrated by
 (Mr. Thananat Anake)
 Field Scientist(2)

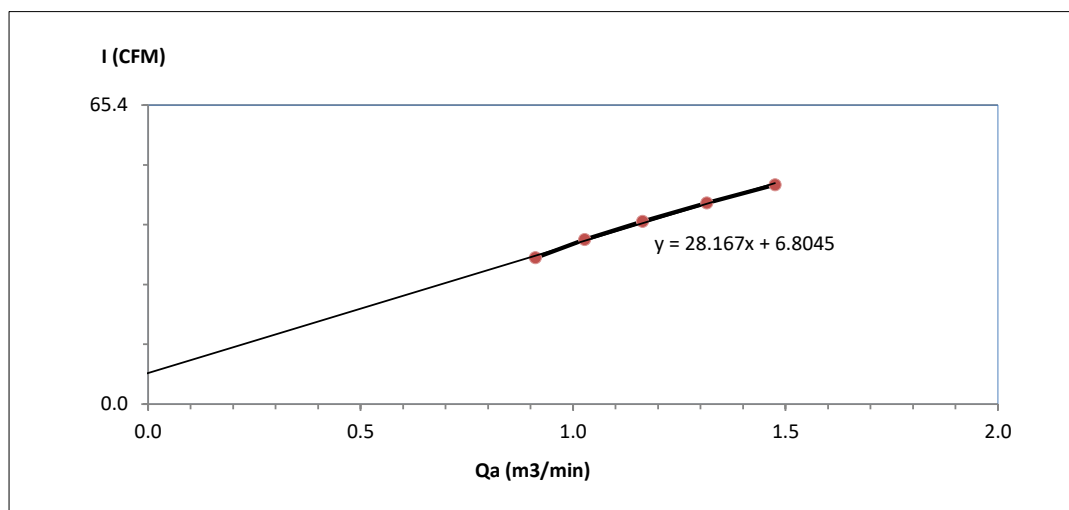
Approved by :
 (Mr. Noppong Juntarupan)
 Enviro Field Coordinator Scientist (3)





High Volume Air Sampler Calibration Worksheet

Project Site :	Gulf BP Co., Ltd.	Barometric Pressure (mm Hg) :	758
Calibrate Location :	หมู่ที่ 2 ตำบลบ้านหว้า	Temperature (°C) :	32
Calibrate Date :	20-Nov-23	High Volume ID :	BKK_FS1377
CalibrationSheet No.:	C-201123-BKK_FS1377	High Volume Model :	TE-5009X
Calibrator ID:	BKK_FS0625	High Volume S/N :	6262
Calibrator Model :	TE-5028A	Calibrator Slope :	1.04104
Calibrator S/N :	2585	Calibrator Intercept :	-0.00779

Test No.	Delta H ₂ O (inch)	Qa (m ³ /min)	I : Chart (CFM)	Linear Regression
1	2.2	0.912	32	Slope : 28.1665 Intercept : 6.8045 Correlation Coefficient : 0.9981
2	2.8	1.027	36	
3	3.6	1.164	40	
4	4.6	1.315	44	
5	5.8	1.475	48	



Calibrated by 
 (Mr. Thananat Anake)
 Field Scientist(2)

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

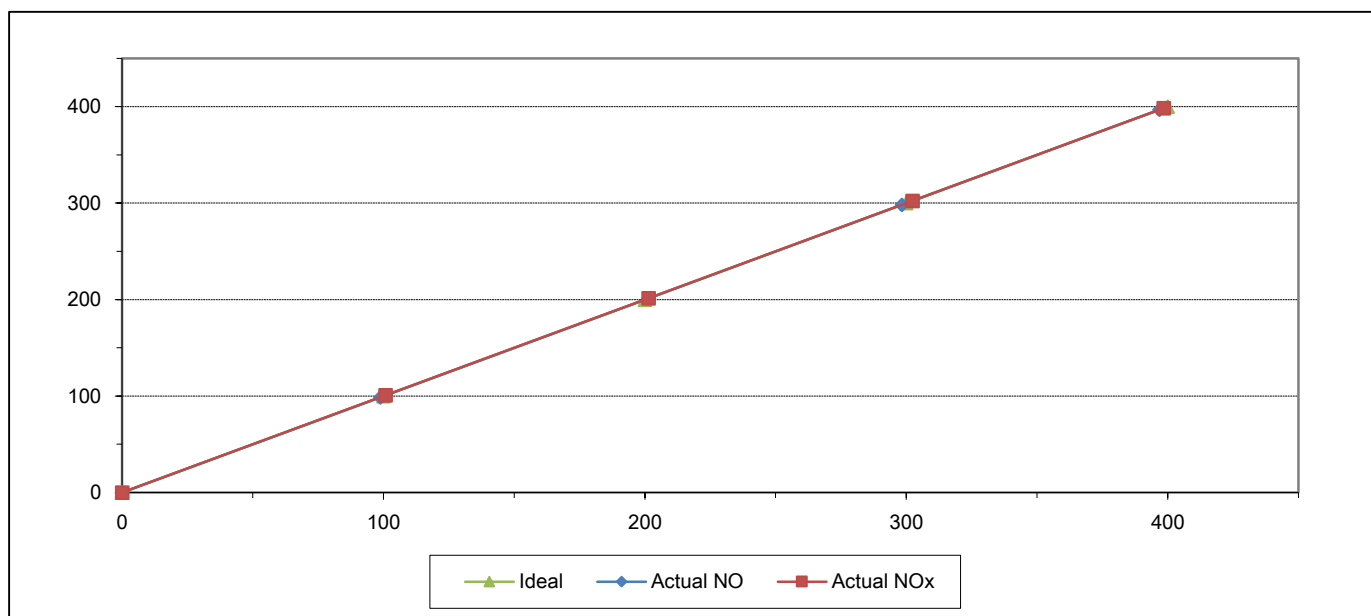


MULTIPOINT CALIBRATION REPORT

Calibration Date 1-Jul-23
Manufacturer HORIBA
Serial No. PPGM9HKH
Calibrator Manufacturer Teledyne API
Serial No. 947
Std. Gas Concentration (PPM) 55.88
Cylinder Pressure (psi) 1800
Certified Date 9-Feb-22

Equipment Name NOx Analyzer
Model APNA-370
Equipment ID BKK_FS1070
Model 700
Cylinder No. GN0027222
Certified By Airgas Inc.
Expired Date 9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	98.80	-1.20	-1.20	100.80	0.80	0.80
2	200.00	201.30	1.30	0.65	201.50	1.50	0.75
3	300.00	298.30	-1.70	-0.57	302.40	2.40	0.80
4	400.00	396.90	-3.10	-0.78	398.50	-1.50	-0.38
AVERAGE (%)				-0.36			0.41



Calibrated By

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

Approved By

(Mr.Sarayuth Jitranont)
Assistant General Manager

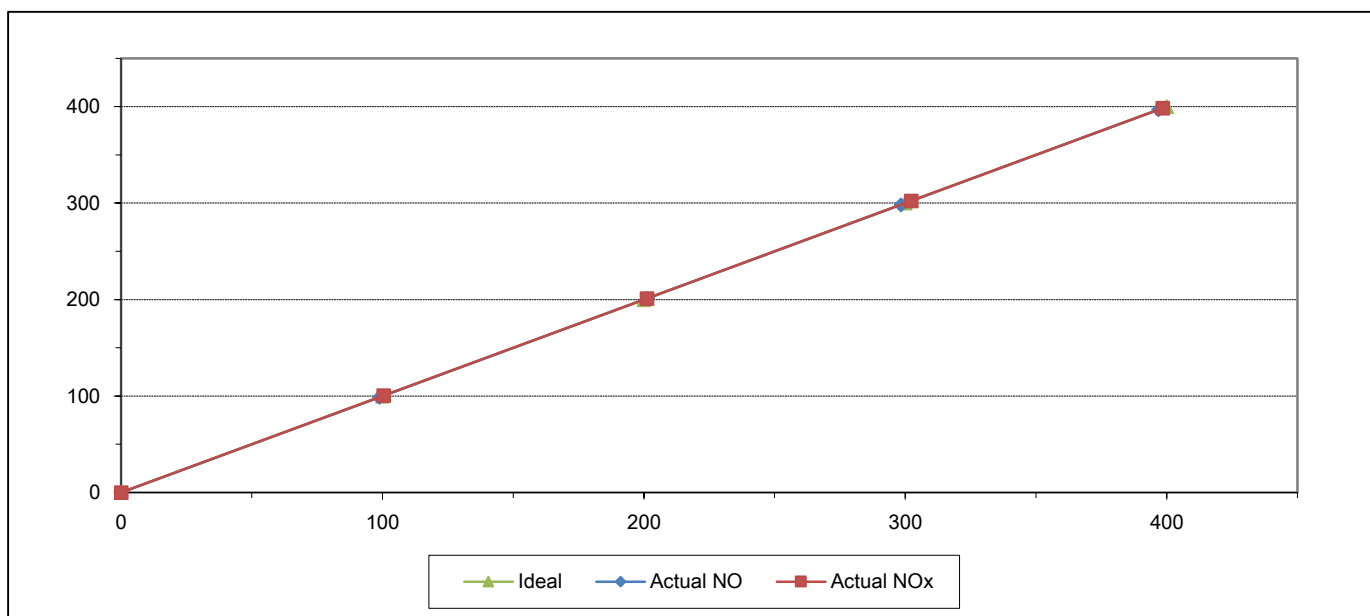


MULTIPOINT CALIBRATION REPORT

Calibration Date 1-Jul-23
Manufacturer HORIBA
Serial No. X9RAXH0D
Calibrator Manufacturer Teledyne API
Serial No. 947
Std. Gas Concentration (PPM) 55.88
Cylinder Pressure (psi) 1800
Certified Date 9-Feb-22

Equipment Name NOx Analyzer
Model APNA-370
Equipment ID BKK_FS0803
Model 700
Cylinder No. GN0027222
Certified By Airgas Inc.
Expired Date 9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	98.80	-1.20	-1.20	100.50	0.50	0.50
2	200.00	201.50	1.50	0.75	201.20	1.20	0.60
3	300.00	298.40	-1.60	-0.53	302.30	2.30	0.77
4	400.00	396.90	-3.10	-0.78	398.50	-1.50	-0.38
AVERAGE (%)				-0.33			0.32



Calibrated By

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

Approved By

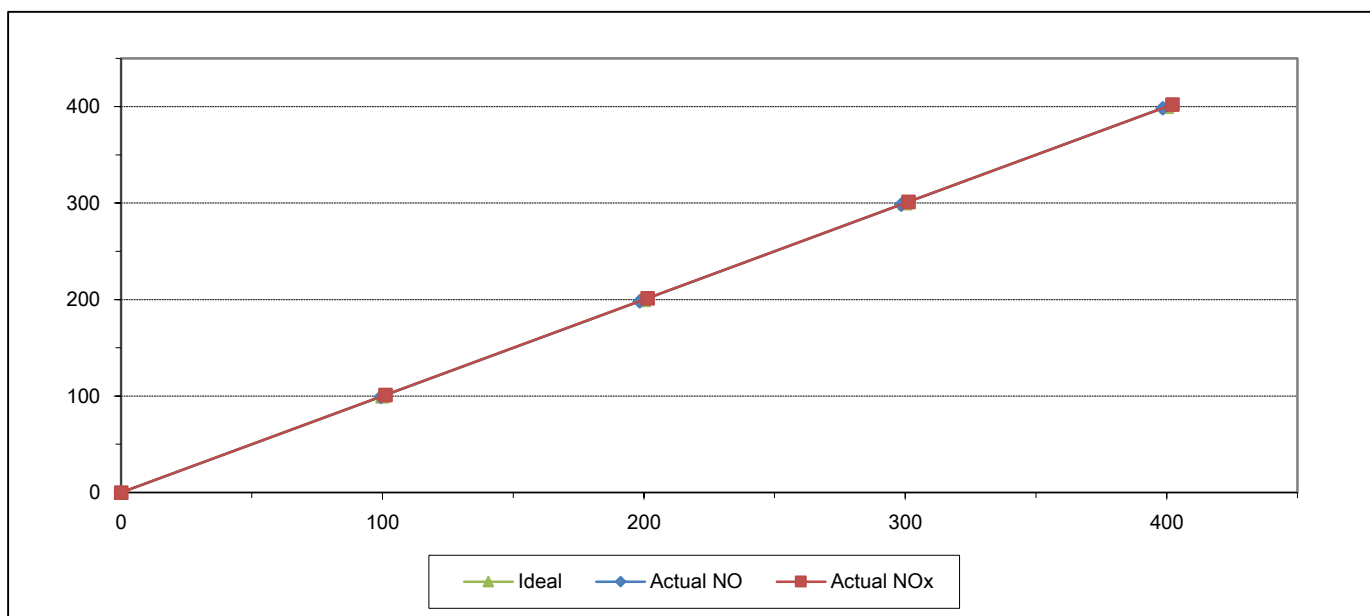
(Mr.Sarayuth Jitranont)
Assistant General Manager



MULTIPOINT CALIBRATION REPORT

Calibration Date	1-Jul-23	Equipment Name	NOx Analyzer
Manufacturer	Teledyne API	Model	T200
Serial No.	6305	Equipment ID	BKK_FS1098
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	99.40	-0.60	-0.60	101.20	1.20	1.20
2	200.00	198.40	-1.60	-0.80	201.40	1.40	0.70
3	300.00	298.50	-1.50	-0.50	301.30	1.30	0.43
4	400.00	398.50	-1.50	-0.38	402.20	2.20	0.55
AVERAGE (%)				-0.43			0.60



Calibrated By

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

Approved By

(Mr.Sarayuth Jitranont)
Assistant General Manager

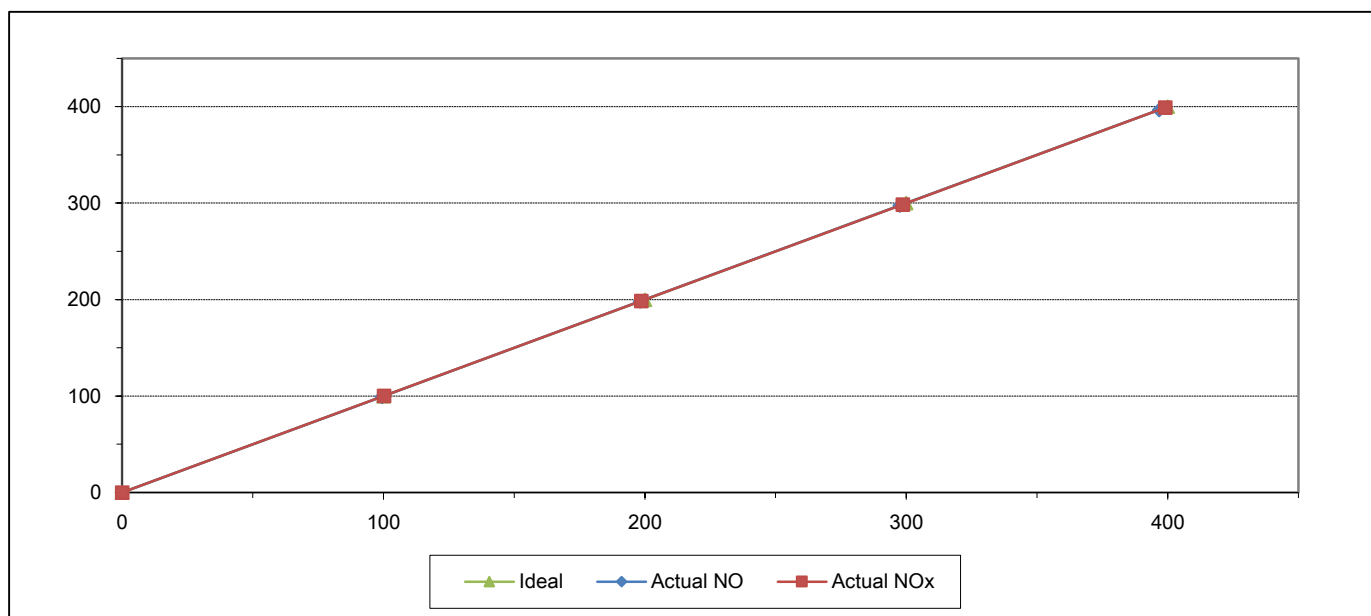


MULTIPOINT CALIBRATION REPORT

Calibration Date 1-Jul-23
Manufacturer HORIBA
Serial No. R0A0GWJC
Calibrator Manufacturer Teledyne API
Serial No. 947
Std. Gas Concentration (PPM) 55.88
Cylinder Pressure (psi) 1800
Certified Date 9-Feb-22

Equipment Name NOx Analyzer
Model APNA-370
Equipment ID BKK_FS0794
Model 700
Cylinder No. GN0027222
Certified By Airgas Inc.
Expired Date 9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	99.40	-0.60	-0.60	100.20	0.20	0.20
2	200.00	198.20	-1.80	-0.90	198.60	-1.40	-0.70
3	300.00	297.50	-2.50	-0.83	298.70	-1.30	-0.43
4	400.00	396.70	-3.30	-0.83	399.10	-0.90	-0.22
AVERAGE (%)				-0.61			-0.21



Calibrated By

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

Approved By

(Mr.Sarayuth Jitranont)
Assistant General Manager

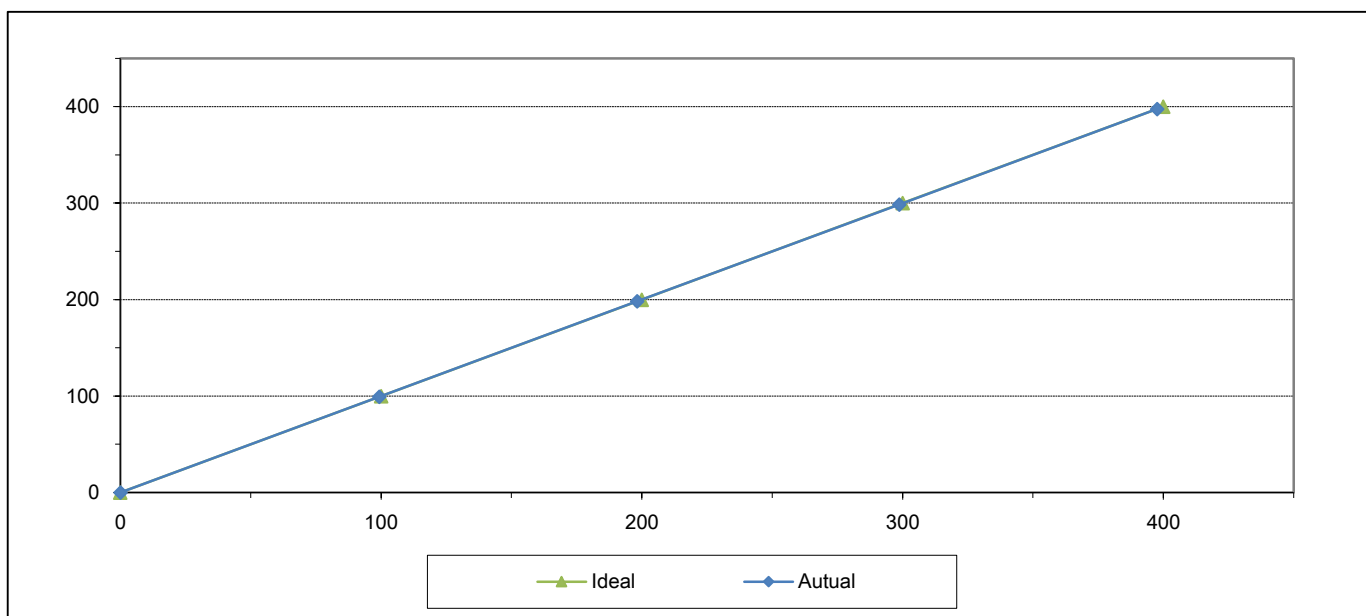


MULTIPOINT CALIBRATION REPORT

Calibration Date 2-Jul-23
Manufacturer HORIBA
Serial No. 70Y1R8R0
Calibrator Manufacturer Teledyne API
Serial No. 947
Std. Gas Concentration (PPM) 56.3
Cylinder Pressure (psi) 1800
Certified Date 9-Feb-22

Equipment Name SO2 Analyzer
Model APSA-370
Equipment ID BKK_FS1069
Model 700
Cylinder No. GN0027222
Certified By Airgas Inc.
Expired Date 9-Feb-30

Point	CALIBRATION RESULTS			
	Ideal	Autual	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	99.30	-0.70	-0.70
2	200.00	198.20	-1.80	-0.90
3	300.00	298.70	-1.30	-0.43
4	400.00	397.70	-2.30	-0.58
AVERAGE (%)				-0.50



Calibrated By

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

Approved By

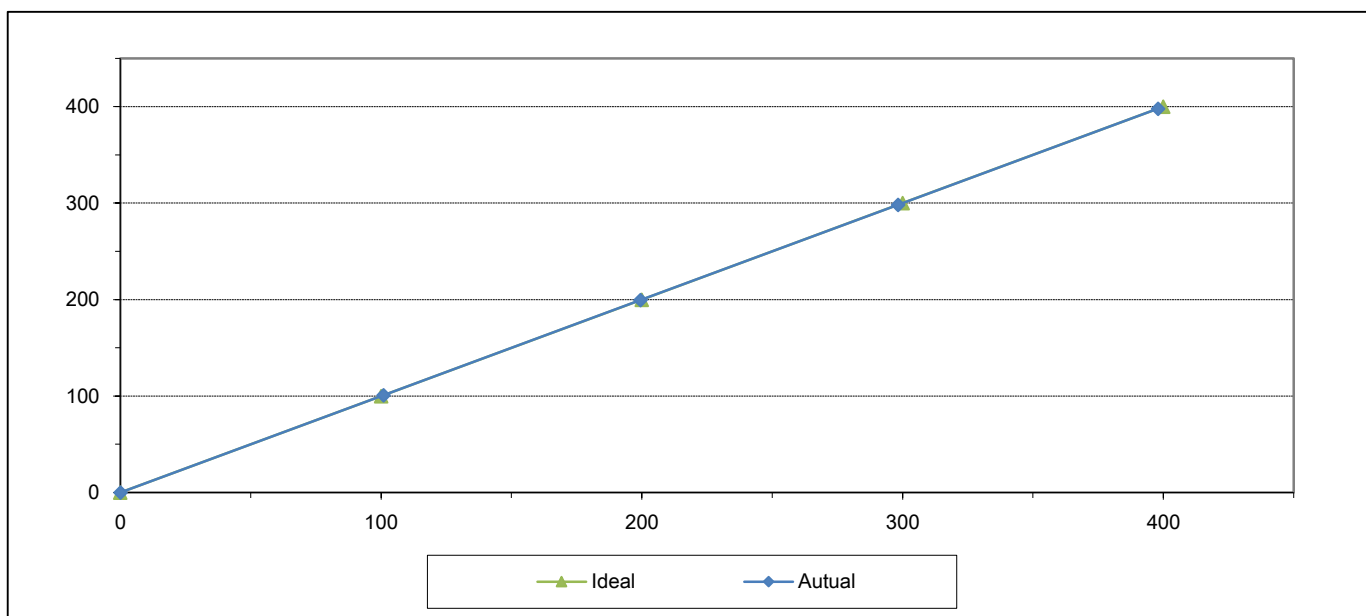
(Mr.Sarayuth Jittranont)
Assistant General Manager



MULTIPOINT CALIBRATION REPORT

Calibration Date	2-Jul-23	Equipment Name	SO2 Analyzer
Manufacturer	HORIBA	Model	APSA-370
Serial No.	2SSLA6G0	Equipment ID	BKK_FS0802
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	Autual	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	101.00	1.00	1.00
2	200.00	199.50	-0.50	-0.25
3	300.00	298.30	-1.70	-0.57
4	400.00	398.00	-2.00	-0.50
AVERAGE (%)				-0.04



Calibrated By

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

Approved By

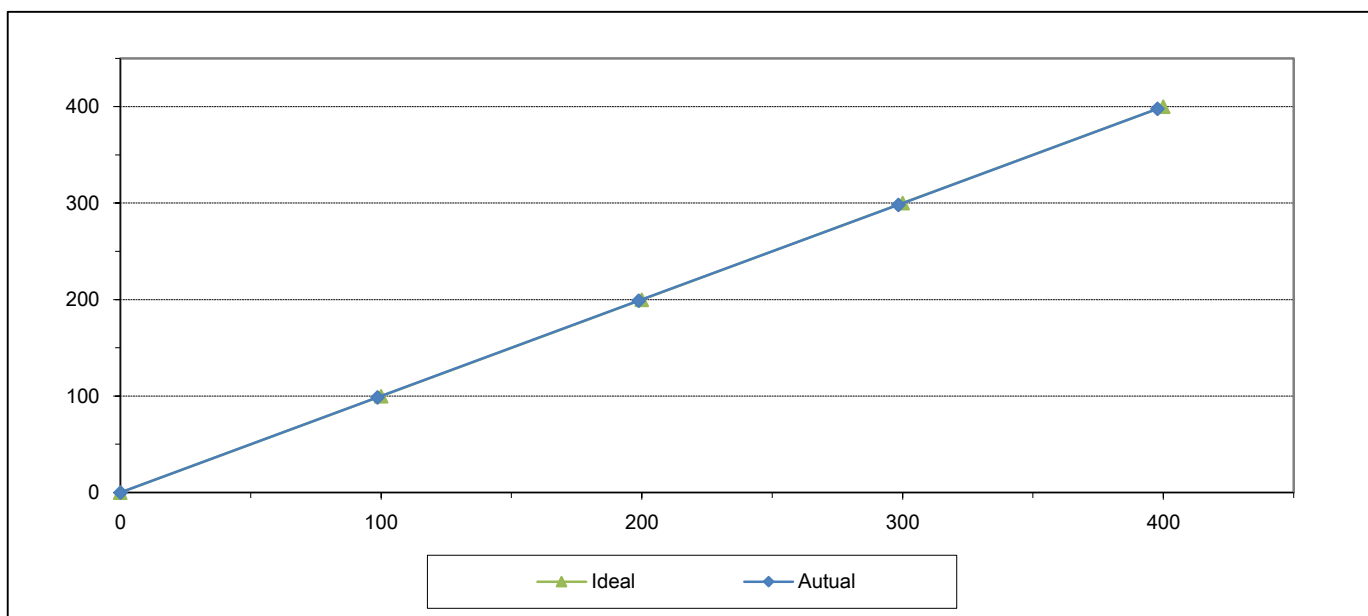
(Mr.Sarayuth Jittranont)
Assistant General Manager



MULTIPOINT CALIBRATION REPORT

Calibration Date	2-Jul-23	Equipment Name	SO2 Analyzer
Manufacturer	Teledyne API	Model	T100
Serial No.	5345	Equipment ID	BKK_FS1097
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	Autual	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	98.60	-1.40	-1.40
2	200.00	198.80	-1.20	-0.60
3	300.00	298.40	-1.60	-0.53
4	400.00	397.80	-2.20	-0.55
AVERAGE (%)				-0.60



Calibrated By

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

Approved By

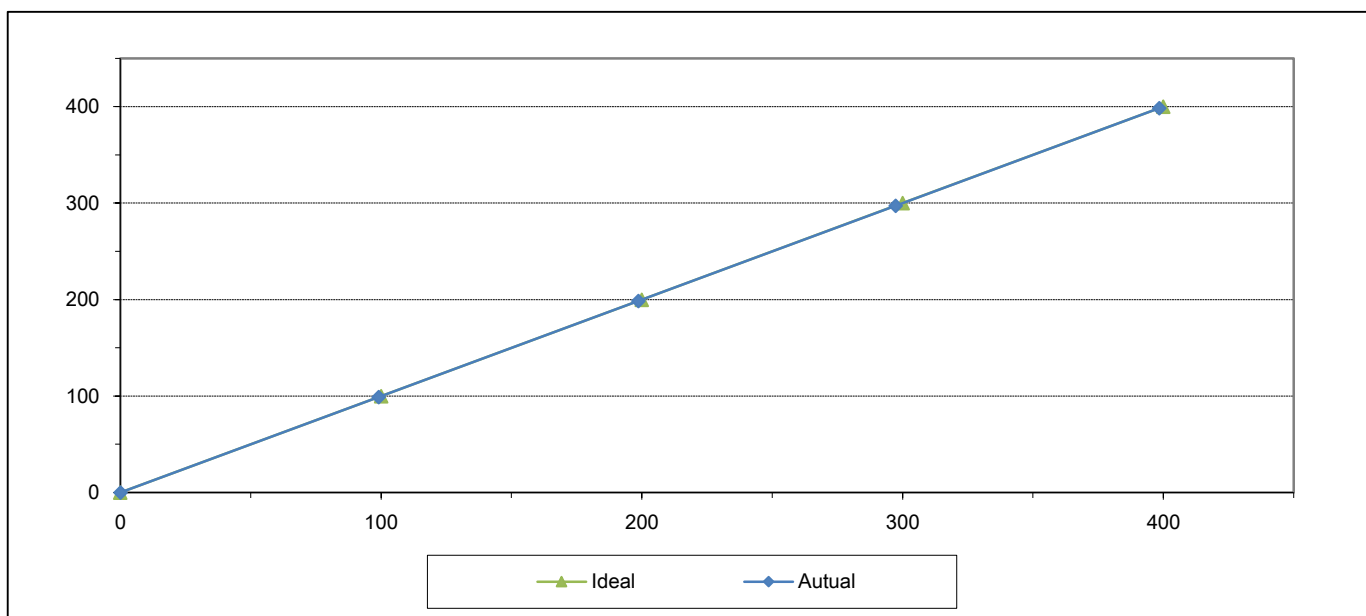
(Mr.Sarayuth Jittranont)
Assistant General Manager



MULTIPOINT CALIBRATION REPORT

Calibration Date	2-Jul-23	Equipment Name	SO2 Analyzer
Manufacturer	HORIBA	Model	APSA-370
Serial No.	2BGDABSF	Equipment ID	BKK_FS0793
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	Autual	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	99.10	-0.90	-0.90
2	200.00	198.70	-1.30	-0.65
3	300.00	297.30	-2.70	-0.90
4	400.00	398.50	-1.50	-0.38
AVERAGE (%)				-0.55



Calibrated By

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

Approved By

(Mr.Sarayuth Jittranont)
Assistant General Manager

Certificate Number
CL-005-65

CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM	: Wind Direction Sensor
MANUFACTURER	: Novalynx
MODEL/TYPE	: Sensor: WS-02F Data logger: 110-WS-25DL-D
SERIAL NUMBER	: Sensor: WSD-015 Data logger: A5907
ID NUMBER	: BKK_FS1212
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	: 09 Nov 2022
MEASUREMENT DATE	: 18 Nov 2022
ISSUE DATE	: 23 Nov 2022

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

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

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

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

Preconditioning	: 24 hours at ambient conditions.
Measurement Condition	: The average values during measurement are (23.4)°C, (47.7) %RH and (1012.3) hPa.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

- ☒ Mr. Sorawit Thachalad
☐ Miss Jitraporn Lertsomphol

Remark:

- ¹ Nozzle cross-section area of the wind tunnel
² Projected cross-section area of the tested object include mounting pipe
³ Diameter of mounting pipe
⁴ Ratio ² to ¹



Approved signatory: *[Signature]*

Mr. Parinya Booncharoen
Calibration Department Manager

MEASUREMENT RESULTS ⁵

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°_{std} Degree (°)	D°_{uuc} Degree (°)	Error Degree (°)	$U (k=2)$ Degree (°)
5.02	0.001	0	0	0.58
	45.001	42	-3	0.58
	90.000	90	0	0.68
	135.000	135	0	0.58
	180.000	181	1	0.68
	225.000	226	1	0.68
	270.001	270	0	0.68
	315.000	315	0	0.68

Remark:

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

⁶ Direction of standard

⁷ Direction of Unit Under Calibration

End of Certificate of Calibration



Jiranatee Associates Co., Ltd.
 63/14-15, 67/35-36
 Petchkasem 7, 7/1, Rd. Wattapra, Bangkokyai,
 Bangkok 10600 (Thailand)
 Tel: +6608680812
 Mobile: +66863999453
 E-mail: jnac-calibration@jiranatee.com
 Web site: www.jiranatee.com

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

Air speed measurement laboratory
 Calibration services department.

Certificate Number

CL-005-65

CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM	: Cup anemometer
MANUFACTURER	: Novalynx
MODEL/TYPE	: Sensor: WS-02F Data logger: 110-WS-25DL-D
SERIAL NUMBER	: Sensor: WSD-015 Data logger: A5907
ID NUMBER	: BKK_FS1212
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	: 09 Nov 2022
MEASUREMENT DATE	: 18 Nov 2022
ISSUE DATE	: 23 Nov 2022

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

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

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

CALIBRATION CONDITIONS	: Wind tunnel cross-section area ¹	900	cm ²
	Win direction frontal area ²	100	cm ²
	Diameter of mounting pipe ³	-	mm
	Blockage ratio of test object ⁴	0.111	[-]

Preconditioning	: 24 hours at ambient conditions.
Measurement Condition	: The average values during measurement are (23.9) °C, (48.8) %RH and (1010.7) hPa.


TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

☒ Mr. Sorawit Thachalad
☐ Miss Jitraporn Lertsomphol

Approved signatory:


 Mr. Parinya Booncharoen
 Calibration Department Manager



Remark:

¹ Nozzle cross-section area of the wind tunnel
² Projected cross-section area of the tested object include mounting pipe
³ Diameter of mounting pipe
⁴ Ratio ² to ¹

MEASUREMENT RESULTS ⁵

The cup anemometer, Unit Under Calibration (UUC) was exercised at 10 m/s for 5 minutes prior to calibration being performed. The standard air velocity 0.5 m/s to 5 m/s was calculated by a standard air velocity transducer and above 5 m/s to 30 m/s was calculated by a pitot tube with precision differential pressure meter which was installed 40 mm and 300 mm respectively away from wind tunnel nozzle. UUC was installed 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_{std}^6 (m/s)	Temp. wind tunnel (°C)	Temp. room (°C)	V_{uuc}^7 (m/s)	Error (m/s)	$U (k=2)$ (m/s)
0.969	24.00	23.85	0.8	-0.2	0.20
2.033	23.76	23.85	1.9	-0.2	0.17
3.061	23.92	23.85	2.9	-0.2	0.19
4.174	23.90	23.85	4.0	-0.2	0.20
5.08	23.82	23.85	5.0	-0.1	0.17
6.01	23.98	23.85	5.9	-0.1	0.20
7.07	23.80	23.85	6.9	-0.2	0.22
8.18	23.98	23.85	8.0	-0.2	0.24
9.10	23.80	23.85	8.9	-0.2	0.20
10.11	23.94	23.85	9.9	-0.2	0.20
11.16	23.60	23.85	11.1	-0.1	0.20
12.14	23.92	23.85	12.0	-0.2	0.22
13.22	23.62	23.85	13.0	-0.2	0.26
14.26	23.80	23.85	14.1	-0.2	0.25
15.25	23.70	23.85	15.1	-0.2	0.25
16.31	23.78	23.85	16.1	-0.2	0.26

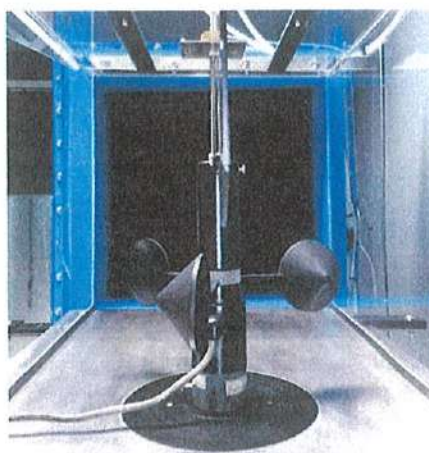
Remark:

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

⁶ Velocity of standard

⁷ Velocity of Unit Under Calibration

PHOTO OF CALIBRATION SET-UP



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

End of Certificate of Calibration





63/14-15,67/35-36, Soi Petchkasem7,7/1, Petchkasem Rd,
Watthapra, Bangkokyai,Bangkok 10600 Thailand.
Tel.: (66) 02-8680812#13 Fax.: (66) 02-8680860 www.jiranatee.com

CERTIFICATE OF CALIBRATION

Calibration No. : RH-05112022

Page 1 of 1 Pages

Measurement Item : Relative humidity with data logger
Manufacturer : Novalynx
Model/Type : 110-WS-25DL-D
Serial Number : A5907
ID No. : BKK_FS1212
Customer : ALS laboratory group (Thailand) Co., Ltd.
: 104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Suan Luang, Khel Suan Luang, Bangkok
10250 Thailand.

Environmental Condition:

The measurement was carried out in an ambient temperature of $(25 \pm 3)^\circ\text{C}$, and relative humidity of $(50 \pm 15)\%$.

Measurement Method:

Unit Under Calibration (UUC) was calibrated by comparison method with standard thermo hygrometer 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: 20314-101. Due date: Mar 14, 2023.

Measurement Date : Nov 18, 2022

Issued Date : Nov 23, 2022

Measurement Results:

This equipment was connected with Indoor air quality probe and Displayed (UR) on display. Model: HMP60, Serial number: U3641224

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 \pm (%RH)
20	20.04	18.3	-1.7	0.52
50	50.28	48.3	-2.0	0.52
80	80.27	78.9	-1.4	0.52

Performed by

- ☒ Mr. Sorawit Thachalad
☐ Miss Jittraporn Lertsomphol



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.

CERTIFICATE OF CALIBRATION

Certificate No.: CL-160-65
Page 1 of 2

Equipment Name: Data Logger with Temperature
Sensor

Manufacturer: Novalynx
Model: 110-WS-25DL-D
Serial No.: A5907
ID No.: BKK_FS1212

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: 09 Nov 2022
Calibration date: 18 Nov 2022
Issue date: 23 Nov 2022

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: $(23 \pm 3)^{\circ}\text{C}$
Relative Humidity: $(55 \pm 15)\%$

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-0034-22, Certificate number: ER-0092-
22

Calibrated by

- ☒ Mr. Sorawit Thachalad
☐ Miss Jittraporn Lertsomphol



Approved Signatory:

Mr. Parinya Booncharoen
Calibration Department Manager

Result of Calibration:- ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20-40 °C

Function:

This equipment was connected with temperature sensor Model: HMP60 S/N: U3641224.

Dimension : Diameter 12 mm. Length 80 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
60	20.00	19.9	-0.1	0.30
60	24.99	24.8	-0.2	0.30
60	30.00	29.7	-0.3	0.30
60	35.01	34.6	-0.4	0.30
60	39.97	39.5	-0.5	0.30

UUC*: Unit Under Calibration

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

✱ End of Certificate ✱



CERTIFICATE OF CALIBRATION

Certificate No.: CL-200-65
Page 1 of 2

Equipment Name: Data Logger with Temperature
Sensor

Manufacturer: Novalynx

Model: 200-WS-25LB

Serial No.: A5262

ID No.: BKK_FS0909

REVIEW BY	<i>Marakorn P.</i>
APPROVED BY	<i>[Signature]</i>
NEXT CAL. DATE	9/6/24

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: 02 Dec 2022

Calibration date: 10 Dec 2022

Issue date: 12 Dec 2022

Reference Used During Calibration

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

Calibration Condition

Temperature: $(23 \pm 3)^{\circ}\text{C}$
Relative Humidity: $(55 \pm 15)\%$

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-0034-22, Certificate number: ER-0092-
22

Calibrated by

- ☒ Mr. Sorawit Thachalad
☐ Miss Jittraporn Lertsomphol



Approved Signatory:

[Signature]
Mr. Parinya Booncharoen
Calibration Department Manager

Result of Calibration:- ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20-40 °C

Function:

This equipment was connected with temperature sensor Model: HMP60 S/N: N0330785.

Dimension : Diameter 12 mm. Length 80 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
60	20.062	19.7	-0.4	0.099
60	25.058	24.7	-0.4	0.099
60	30.049	29.7	-0.3	0.099
60	35.041	34.7	-0.3	0.099
60	40.033	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 ***



CERTIFICATE OF CALIBRATION

Calibration No. : RH-19122022

Page 1 of 1 Pages

Measurement Item : Relative humidity with data logger
Manufacturer : Novalynx
Model/Type : 200-WS-25LB
Serial Number : A5262
ID No. : BKK_PS0909
Customer : ALS laboratory group (Thailand) Co., Ltd.
: 104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Suan Luang, Khet Suan Luang, Bangkok
10250 Thailand.

Environmental Condition:

The measurement was carried out in an ambient temperature of $(25\pm3)^{\circ}\text{C}$, and relative humidity of $(50\pm15)\%$.

Measurement Method:

Unit Under Calibration (UUC) was calibrated by comparison method with standard thermo hygrometer 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: 20314-101. Due date: Mar 14,2023.

Measurement Date : Dec 10, 2022

Issued Date : Dec 12, 2022

Measurement Results:

This equipment was connected with Indoor air quality probe and Displayed (UR) on display. Model: HMP60, Serial number: N0330785.

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 \pm (%RH)
20	19.99	18.0	-2.0	0.56
50	50.26	47.8	-2.5	0.52
80	80.39	77.8	-2.6	0.52

Performed by

- ☒ Mr. Sorawit Thachalad
☐ Miss Jitraporn Lertsomphol



Approved Signatory: 

Mr. Parinya Booncharoen.
Calibration Department Manager



JIRANATEE ASSOCIATES CO.,LTD.

Jiranatee Associates Co.,Ltd.
63/14-15, 67/35-36
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Mobile: +66863999453
E-mail: jnac-calibration@jiranatee.com
Web site: www.jiranatee.com

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

Air speed measurement laboratory
Calibration services department.

Certificate Number

CL-013-65

CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM : Cup anemometer
MANUFACTURER : Novalynx
MODEL/TYPE : Sensor: WS-02F
Data logger: 200-WS-25LB
SERIAL NUMBER : Sensor: -
Data logger: A5262
ID NUMBER : BKK_FS0909
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 : 02 Dec 2022
MEASUREMENT DATE : 09 Dec 2022
ISSUE DATE : 12 Dec 2022

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

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

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

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

Preconditioning : 24 hours at ambient conditions.

Measurement Condition : The average values during measurement are (24.4) °C, (47.7) %RH and (1012.7) hPa.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

☒ Mr. Sorawit Thachalad
☐ Miss Jittraporn Lertsomphol



Approved signatory:

Mr. Parinya Booncharoen
Calibration Department Manager

Remark:

¹ Nozzle cross-section area of the wind tunnel
² Projected cross-section area of the tested object include mounting pipe
³ Diameter of mounting pipe
⁴ Ratio ² to ¹

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

MEASUREMENT RESULTS ⁵

The cup anemometer, Unit Under Calibration (UUC) was exercise at 10 m/s for 5 minutes prior to calibration being performed. The standard air velocity 0.5 m/s to 5 m/s was calculated by a standard air velocity transducer and above 5 m/s to 30 m/s was calculated by a pitot tube with precision differential pressure meter which was installed 40 mm and 300 mm respectively away from wind tunnel nozzle, UUC was installed 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_{std} ⁶ (m/s)	Temp. wind tunnel (°C)	Temp. room (°C)	V_{UUC} ⁷ (m/s)	Error (m/s)	$U (k=2)$ (m/s)
0.985	24.34	24.40	0.7	-0.3	0.15
2.059	24.56	24.40	1.8	-0.3	0.16
3.080	24.38	24.40	2.9	-0.2	0.21
4.214	24.60	24.40	3.9	-0.3	0.19
5.04	24.16	24.40	4.8	-0.2	0.17
6.03	24.50	24.40	5.9	-0.2	0.19
7.08	24.10	24.40	6.9	-0.2	0.18
8.19	24.44	24.40	8.0	-0.2	0.19
9.11	24.10	24.40	9.0	-0.1	0.22
10.11	24.33	24.40	9.8	-0.3	0.20
11.16	24.10	24.40	10.8	-0.3	0.20
12.17	24.24	24.40	11.8	-0.3	0.20
13.22	24.10	24.40	12.9	-0.3	0.23
14.29	24.16	24.40	13.8	-0.5	0.24
15.26	24.10	24.40	14.9	-0.4	0.25
16.32	24.10	24.40	15.9	-0.4	0.29

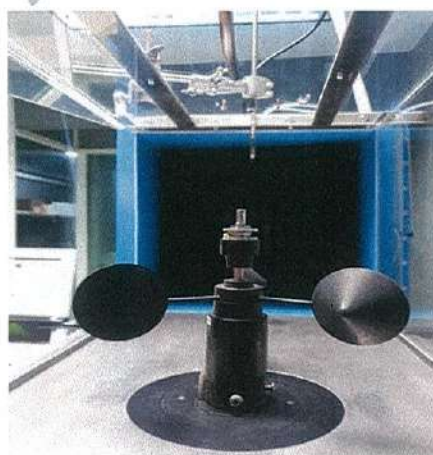
Remark:

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


⁶ Velocity of standard

⁷ Velocity of Unit Under Calibration

PHOTO OF CALIBRATION SET-UP



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

End of Certificate of Calibration

 JIRANATEE ASSOCIATES CO., LTD.



JIRANATEE ASSOCIATES CO.,LTD.

Jiranatee Associates Co.,Ltd.
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Web site: www.jiranatee.com

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

Air speed measurement laboratory
Calibration services department.

Certificate Number

CL-013-65

CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM : Wind Direction Sensor
MANUFACTURER : Novalynx
MODEL/TYPE : Sensor: WS-02F
Data logger: 200-WS-25LB
SERIAL NUMBER : Sensor: -
Data logger: A5262
ID NUMBER : BKK_FS0909
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 : 02 Dec 2022
MEASUREMENT DATE : 12 Dec 2022
ISSUE DATE : 12 Dec 2022

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

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

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

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

Preconditioning : 24 hours at ambient conditions.
Measurement Condition : The average values during measurement are (24.0)°C, (49.5) %RH and (1009.8) hPa.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

- ☒ Mr. Sorawit Thachalad
☐ Miss Jitraporn Lertsomphol



Approved signatory:

Mr. Parinya Booncharoen
Calibration Department Manager

Remark:

- ¹ Nozzle cross-section area of the wind tunnel
² Projected cross-section area of the tested object include mounting pipe
³ Diameter of mounting pipe
⁴ Ratio ² to ¹

MEASUREMENT RESULTS ⁵

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^{std} Degree (°)	D^{UUC} Degree (°)	Error Degree (°)	$U (k=2)$ Degree (°)
5.02	0.001	0	0	0.58
	45.000	42	-3	0.76
	90.000	88	-3	0.76
	135.000	133	-2	0.68
	180.000	181	1	0.74
	225.001	226	1	0.74
	270.000	275	5	0.74
	315.000	320	5	0.76

Remark:

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

⁶ Direction of standard

⁷ Direction of Unit Under Calibration

End of Certificate of Calibration



REVIEW BY	<i>Mmakorn P.</i>
APPROVED BY	<i>[Signature]</i>
NEXT CAL. DATE	17/5/24

Certificate Number

CL-001-65

CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM : Wind Direction Sensor
MANUFACTURER : Novalynx
MODEL/TYPE : Sensor: WS-02F
Data logger: 110-WS-25DL-D
SERIAL NUMBER : Sensor: WSD-011
Data logger: A5908
ID NUMBER : BKK_FS1213
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 : 09 Nov 2022
MEASUREMENT DATE : 17 Nov 2022
ISSUE DATE : 23 Nov 2022

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

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

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

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

Preconditioning : 24 hours at ambient conditions.
Measurement Condition : The average values during measurement are (24.0)°C, (49.7) %RH and (1009.5) hPa.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

- ☒ Mr. Sorawit Thachalad
☐ Miss Jitraporn Lertsomphol



Approved signatory:

[Signature]
Mr. Parinya Booncharoen
Calibration Department Manager

Remark:

- ¹ Nozzle cross-section area of the wind tunnel
² Projected cross-section area of the tested object include mounting pipe
³ Diameter of mounting pipe
⁴ Ratio ² to ¹

MEASUREMENT RESULTS⁵

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'_{std} Degree (°)	D'_{uuc} Degree (°)	Error Degree (°)	$U (k=2)$ Degree (°)
4.99	0.001	0	0	0.58
	45.001	45	0	0.68
	90.000	89	-1	0.74
	135.000	133	-2	0.74
	180.000	177	-3	0.68
	225.000	223	-2	0.74
	270.001	271	1	0.68
	315.001	318	3	0.68

Remark:

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

⁶ Direction of standard

⁷ Direction of Unit Under Calibration

End of Certificate of Calibration



Certificate Number

CL-001-65

CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM	: Cup anemometer
MANUFACTURER	: Novalynx
MODEL/TYPE	: Sensor: WS-02F Data logger: 110-WS-25DL-D
SERIAL NUMBER	: Sensor: WSD-011 Data logger: A5908
ID NUMBER	: BKK_FS1213
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.

Calibration procedure:

The cup anemometer was calibrated against Standard air velocity transducer model: 8455-12 and pitot tube with precision differential pressure meter model: DPM2500 in an close test-section of Eiffel-type wind tunnel with 900 cm² cross test section area. The WI-CL-007 based on IEC 61400-12-1, Wind energy generation systems – Part 12-1: Power performance measurements of electricity producing wind turbines, March 2017 was used as a calibration guideline.

Traceability:

This certificate provides a traceability of The measurement to recognized the national standards, and to realization of the international system of units (SI) through the NIMT (National Metrology Institute of Thailand) via Certificate number: MW-0052-21 and MW-0066-22

Uncertainty of Measurement:

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

RECEIVED DATE	: 09 Nov 2022
MEASUREMENT DATE	: 17 Nov 2022
ISSUE DATE	: 23 Nov 2022

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

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

PLACE OF CALIBRATION	: Eiffel-type wind tunnel of Jiranatee Associates Co., Ltd.
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CALIBRATION CONDITIONS	: Wind tunnel cross-section area ¹	900	cm ²
	Win direction frontal area ²	100	cm ²
	Diameter of mounting pipe ³	-	mm
	Blockage ratio of test object ⁴	0.111	[-]

Preconditioning	: 24 hours at ambient conditions.
Measurement Condition	: The average values during measurement are (23.8) °C, (49.5) %RH and (1012.2) hPa.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

☒ Mr. Sorawit Thachalad
☐ Miss Jitraporn Lertsomphol



Approved signatory:



Mr. Parinya Booncharoen
 Calibration Department Manager

Remark:

- ¹ Nozzle cross-section area of the wind tunnel
² Projected cross-section area of the tested object include mounting pipe
³ Diameter of mounting pipe
⁴ Ratio ² to ¹

MEASUREMENT RESULTS ⁵

The cup anemometer, Unit Under Calibration (UUC) was exercise at 10 m/s for 5 minutes prior to calibration being performed. The standard air velocity 0.5 m/s to 5 m/s was calculated by a standard air velocity transducer and above 5 m/s to 30 m/s was calculated by a pitot tube with precision differential pressure meter which was installed 40 mm and 300 mm respectively away from wind tunnel nozzle, UUC was installed 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.

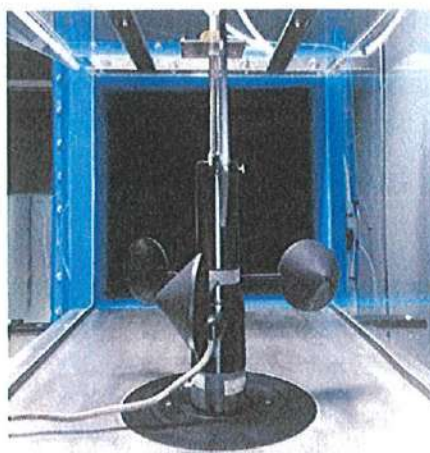
V_{std} ⁶ (m/s)	Temp. wind tunnel (°C)	Temp. room (°C)	V_{uuc} ⁷ (m/s)	Error (m/s)	U (k=2) (m/s)
0.975	24.02	23.75	0.8	-0.2	0.16
2.073	23.54	23.75	1.8	-0.3	0.16
3.068	24.02	23.75	2.8	-0.2	0.21
4.180	23.84	23.75	3.8	-0.3	0.20
5.01	23.92	23.75	4.8	-0.2	0.17
6.00	23.96	23.75	5.8	-0.2	0.18
7.07	23.84	23.75	6.9	-0.2	0.19
8.20	23.86	23.75	7.9	-0.3	0.19
9.11	23.80	23.75	8.9	-0.2	0.22
10.10	23.92	23.75	9.8	-0.3	0.21
11.16	23.82	23.75	10.9	-0.2	0.20
12.14	23.96	23.75	11.9	-0.3	0.21
13.20	23.90	23.75	12.9	-0.3	0.21
14.27	23.94	23.75	14.0	-0.3	0.25
15.19	23.90	23.75	14.9	-0.2	0.22
16.32	23.90	23.75	16.1	-0.3	0.26

Remark:

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

⁶ Velocity of standard

⁷ Velocity of Unit Under Calibration

PHOTO OF CALIBRATION SET-UP

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

CERTIFICATE OF CALIBRATION

Certificate No.: CL-156-65
Page 1 of 2

Equipment Name: Data Logger with Temperature
Sensor

Manufacturer: Novalynx
Model: 110-WS-25DL D
Serial No.: A5908
ID No.: BKK_FS1213

Customer

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

Received date: 09 Nov 2022
Calibration date: 18 Nov2022
Issue date: 23 Nov 2022

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: $(23 \pm 3)^{\circ}\text{C}$
Relative Humidity: $(55 \pm 15)\%$

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-0034-22, Certificate number: ER-0092-
22

Calibrated by

☒ Mr. Sorawit Thachalad
☐ Miss Jitraporn Lertsomphol



Approved Signatory:



Mr. Parinya Booncharoen
Calibration Department Manager

Result of Calibration:- ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20-40 °C

Function:

This equipment was connected with temperature sensor Model: HMP60 S/N: U3641221.

Dimension : Diameter 12 mm. Length 80 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
60	20.00	19.9	-0.1	0.30
60	24.96	24.8	-0.2	0.30
60	30.00	29.8	-0.2	0.30
60	35.00	34.6	-0.4	0.30
60	40.00	39.5	-0.5	0.30

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,
Walthapra, Bangkokyai, Bangkok 10600 Thailand.
Tel.: (66) 02-8680812#13 Fax.: (66) 02-8680860 www.jiranatee.com

CERTIFICATE OF CALIBRATION

Calibration No. : RH-01112022

Page 1 of 1 Pages

Measurement Item : Relative humidity with data logger
Manufacturer : Novalynx
Model/Type : 110-WS-25DL D
Serial Number : A5908
ID No. : BKK_FS1213
Customer : ALS laboratory group (Thailand) Co., Ltd.
: 104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Suan Luang, Khet Suan Luang, Bangkok
10250 Thailand.

Environmental Condition:

The measurement was carried out in an ambient temperature of $(25 \pm 3)^{\circ}\text{C}$, and relative humidity of $(50 \pm 15)\%$.

Measurement Method:

Unit Under Calibration (UUC) was calibrated by comparison method with standard thermo hygrometer 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: 20314-101. Due date: Mar 14, 2023.

Measurement Date : Nov 18, 2022
Issued Date : Nov 23, 2022

Measurement Results:

This equipment was connected with Indoor air quality probe and Displayed (UR) on display. Model: HMP60, Serial number: U3641221

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 \pm (%RH)
20	19.93	17.6	-2.3	0.61
50	50.45	47.7	-2.8	0.57
80	80.30	77.6	-2.7	0.55

Performed by

- ☒ Mr. Sorawit Thachalad
☐ Miss Jitraporn Lertsomphot



Approved Signatory:

Mr. Parinya Booncharoen.
Calibration Department Manager



JIRANATEE ASSOCIATES CO., LTD.

Jiranatee Associates Co., Ltd.
63/14-15, 67/35-36
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Accredited calibration laboratory
ISO/IEC 17025:2017
NSC-TISI-TIS 17025
CALIBRATION 0367

Air speed measurement laboratory
Calibration services department.

REVIEW BY	Karakorn P.
APPROVED BY	At H.
NEXT CAL. DATE	13/8/23 2 24

Certificate Number

CL-022-66

CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM : Cup anemometer
MANUFACTURER : Novalynx
MODEL/TYPE : Sensor: WS-02F
Data logger: 110-WS-25DL-D
SERIAL NUMBER : Sensor: WSD-001
Data logger: A5439
ID NUMBER : BKK_FS0974
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 : 08 Feb 2023
MEASUREMENT DATE : 13 Feb 2023
ISSUE DATE : 13 Feb 2023

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

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

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

CALIBRATION CONDITIONS	: Wind tunnel cross-section area ¹	900	cm ²
	Win direction frontal area ²	100	cm ²
	Diameter of mounting pipe ³	-	mm
	Blockage ratio of test object ⁴	0.111	[-]

Preconditioning : 24 hours at ambient conditions.
Measurement Condition : The average values during measurement are (23.6) °C, (55.3) %RH and (1013.5) hPa.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

- ☒ Mr. Sorawit Thachalad
☐ Miss Jittraporn Lertsomphol



Approved signatory:

Mr. Parinya Booncharoen
Calibration Department Manager

Remark:

- ¹ Nozzle cross-section area of the wind tunnel
² Projected cross-section area of the tested object include mounting pipe
³ Diameter of mounting pipe
⁴ Ratio ² to ¹

MEASUREMENT RESULTS⁵

The cup anemometer, Unit Under Calibration (UUC) was exercise at 10 m/s for 5 minutes prior to calibration being performed. The standard air velocity 0.5 m/s to 5 m/s was calculated by a standard air velocity transducer and above 5 m/s to 30 m/s was calculated by a pitot tube with precision differential pressure meter which was installed 40 mm and 300 mm respectively away from wind tunnel nozzle, UUC was installed 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_{std}^6 (m/s)	Temp. wind tunnel (°C)	Temp. room (°C)	V_{UUC}^7 (m/s)	Error (m/s)	$U (k=2)$ (m/s)
0.985	23.68	23.60	0.9	-0.1	0.15
2.033	23.54	23.60	1.9	-0.1	0.16
3.046	23.68	23.60	3.0	-0.1	0.19
4.144	23.66	23.60	3.9	-0.2	0.21
5.03	23.50	23.60	4.9	-0.1	0.18
5.98	23.50	23.60	5.9	-0.1	0.18
7.05	23.36	23.60	7.0	-0.1	0.18
8.18	23.54	23.60	8.0	-0.2	0.20
9.10	23.30	23.60	8.9	-0.2	0.20
10.10	23.50	23.60	10.0	-0.1	0.19
11.14	23.28	23.60	11.0	-0.1	0.21
12.12	23.40	23.60	11.9	-0.2	0.21
13.19	23.10	23.60	13.0	-0.2	0.26
14.25	23.46	23.60	14.0	-0.2	0.29
15.26	23.10	23.60	15.0	-0.2	0.23
16.31	23.26	23.60	16.1	-0.2	0.24

Remark:

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

⁶ Velocity of standard

⁷ Velocity of Unit Under Calibration

PHOTO OF CALIBRATION SET-UP

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



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

Air speed measurement laboratory
Calibration services department.

Certificate Number

CL-020-66

CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM : Wind Direction Sensor
MANUFACTURER : Novalynx
MODEL/TYPE : Sensor: WS-02F
Data logger: 110-WS-25DL-D
SERIAL NUMBER : Sensor: WSD-001
Data logger: AS439
ID NUMBER : BKK_FS0974
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 : 08 Feb 2023
MEASUREMENT DATE : 13 Feb 2023
ISSUE DATE : 13 Feb 2023

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

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

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

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

Preconditioning : 24 hours at ambient conditions.
Measurement Condition : The average values during measurement are (23.6)°C, (48.9) %RH and (1011.4) hPa.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

- ☒ Mr. Sorawit Thachalad
☐ Miss Jittraporn Lertsomphol



Approved signatory:

Mr. Parinya Booncharoen
Calibration Department Manager

Remark:

- ¹ Nozzle cross-section area of the wind tunnel
² Projected cross-section area of the tested object include mounting pipe
³ Diameter of mounting pipe
⁴ Ratio ² to ¹

MEASUREMENT RESULTS⁵

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^{std} Degree (°)	D^{uuc} Degree (°)	Error Degree (°)	$U (k=2)$ Degree (°)
4.99	0.000	0	0	0.58
	45.000	44	-1	0.74
	90.000	88	-2	0.74
	135.000	133	-2	0.74
	180.000	180	0	0.74
	225.001	225	0	0.74
	270.001	273	3	0.68
	315.000	318	3	0.58

Remark:

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

⁶ Direction of standard

⁷ Direction of Unit Under Calibration



End of Certificate of Calibration



JIRANATEE ASSOCIATES CO.,LTD.

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E-mail: jnac-calibration@jiranatee.com
Web site: www.jiranatee.com

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

Pressure measurement laboratory
Calibration services department.



CERTIFICATE OF CALIBRATION

Certificate No. : CL-005-66

Page 1 of 2 Pages

MEASUREMENT ITEM : Digital barometer
MANUFACTURER : Novalynx
MODEL/TYPE : 110-WS-25BP
SERIAL NUMBER : A5439
ID NUMBER : BKK_FS0974
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 : 08 Feb 2023
MEASUREMENT DATE : 13 Feb 2023
ISSUE DATE : 13 Feb 2023

Calibration procedure:

The pressure calibration was done by In-house calibration method as WI-CL-003 according to comparison method with Digital pressure calibrator based on DKD-R 6-1

Traceability:

The measurement results are traceable to the international system of units (SI) through the NIMT (National Metrology Institute of Thailand) which complies with the requirements of ISO/IEC17025:2017, ANSI/NCSL Z540-1 via Certificate number: MP-0205-22

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

CONDITION OF THIS RESULT OF CALIBRATION:

1. Reference Standard Instrument:

Instrument	Model	Serial No.	Certificate No.	Due Date
Absolute Pressure Transducer	CPG2500	4100126P	MP-0205-22	02 Dec 2023

1. Calibration effort for calibration sequence A

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

3. Calibration conditions:

4. Condition : ☒ Normal ☐ Abnormal
Pressure transmitting medium : Air
 $\rho_F (20^\circ\text{C}, 1 \text{ bar})$: 1.19 kg/m^3
 H_{amb} : $(55 \pm 15) \%$
 t_{amb} : $(23 \pm 3) ^\circ\text{C}$
 p_{amb} : $(1010 \pm 10) \text{ mbar}$

5. 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



JIRANATEE ASSOCIATES CO.,LTD.

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CALIBRATION 0367

Pressure measurement laboratory
Calibration services department.



CERTIFICATE OF CALIBRATION

Certificate No. : CL-005-66

Page 2 of 2 Pages

MEASUREMENT RESULTS : ☒ Without adjustment ☐ With adjustment

CALIBRATION IN THE RANGE OF : 950 – 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	950.9	0.8	0.96
970.13	970.7	0.6	0.78
990.08	990.4	0.3	0.53
1010.09	1010.3	0.2	0.42
1030.03	1030.0	-0.1	0.39
1050.06	1049.8	-0.3	0.48

Note: UUC* Unit Under Calibration

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

End of certificate



SITHIPORN ASSOCIATES CO.,LTD.

CALIBRATION LABORATORY



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

Cert. No. : ACC23006

Pages : 1 of 3

Calibration Certificate

Equipment : SOUND CALIBRATOR
Manufacturer : RION
Model : NC-74
Serial No.: 34178119
ID No.: BKK_FS0632

Condition As Found : GOOD

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

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

Received Date : 06 JANUARY 2023
Calibration Date : 17 JANUARY 2023
Date of Issue : 19 JANUARY 2023

REVIEW BY	Narakorn P.
APPROVED BY	[Signature]
NEXT CAL. DATE	17/1/24

Calibrated by : Nathakorn Pisutpaisan

Approved by :

[Signature]
(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.

Continuation of Calibration Certificate

Cert. No. : ACC23006

Job No. : VC66AC0024

Pages : 2 of 3

Calibration Procedure : CP-AC-03

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL.BP. 04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0265	09-Feb-23
Digital Multimeter	33461A	MY60024273	EEL.BP. 05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23
Audio Analyzer	AVR-3360A	V744B6069	EF-0010-22	07-Feb-23

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

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

3.1 National Institute of Metrology (Thailand).

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

Continuation of Calibration Certificate

Cert. No. : ACC23006

Job No. : VC66AC0024

Pages : 3 of 3

Result of calibration :**1. Sound pressure level**

Specified sound pressure level (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit (dB)
94	93.93	-0.07	0.14	0.40

2. Frequency

Specified Frequency (Hz)	Measured value (Hz)	Deviated value (%)	Uncertainty (%)	Tolerance limit (%)
1000	1001.0	0.1	0.1	1.0

3. Total distortion

Measured value (%)	Uncertainty (%)	Tolerance limit (%)
1.71	0.10	3.0

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

————— **End of Calibration Certificate** —————

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



Cert. No. : ACL23265

Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 01022263 / 136951 / 22311
ID No.: BKK_FS0032

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 \pm 3) °C
Pressure : (101.3 \pm 3) kPa
Relative Humidity : (50.0 \pm 20) %

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

REVIEW BY	<i>Nathakorn P.</i>
APPROVED BY	<i>[Signature]</i>
NEXT CAL. DATE	1/9/24

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchurai
(Thanakul Petchurai)

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

Continuation of Calibration Certificate

Cert. No. : ACL23265

Job No. : VC66AC0094

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 :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
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).

Continuation of Calibration Certificate

Cert. No. : ACL23265
Job No. : VC66AC0094
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.

Continuation of Calibration Certificate

Cert. No. : ACL23265

Job No. : VC66AC0094

Pages : 4 of 8

Result of calibration :**1. Absolute sensitivity**

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
16.7

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

Frequency Weighting	Measured value (dB)
A - weight	11.6
C - weight	17.6
Flat	23.4

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			Acceptance Limits
	Flat	C-weight	A-weight	
125	0.5	0.5	0.5	± 1.5
1000	0.1	0.1	0.1	± 1.0
8000	-1.9	-1.8	-1.8	±5.0

Continuation of Calibration Certificate

Cert. No. : ACL23265

Job No. : VC66AC0094

Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

Continuation of Calibration Certificate

Cert. No. : ACL23265

Job No. : VC66AC0094

Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.9	-0.1	± 1.1

Continuation of Calibration Certificate

Cert. No. : ACL23265

Job No. : VC66AC0094

Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, 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	133.0	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

Continuation of Calibration Certificate

Cert. No. : ACL23265

Job No. : VC66AC0094

Pages : 8 of 8

11. Overload indication

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

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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NSC-TISI-TIS 17025
CALIBRATION 0394

Cert. No. : ACL23194

Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 01022262 / 180410 / 22310
ID No.: BKK_FS0031

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 \pm 3) °C
Pressure : (101.3 \pm 3) kPa
Relative Humidity : (50.0 \pm 20) %

Received Date : 15 JUNE 2023
Calibration Date : 20-22 JUNE 2023
Date of Issue : 23 JUNE 2023

REVIEW BY	<i>Nathakorn P.</i>
APPROVED BY	<i>[Signature]</i>
NEXT CAL. DATE	20/6/24

Calibrated by : Nathakorn Pisutpaisan

Approved by :

[Signature]
(Thanakul Petchurai)

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Continuation of Calibration Certificate

Cert. No. : ACL23194
Job No. : VC66AC0066
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 :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
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).

Continuation of Calibration Certificate

Cert. No. : ACL23194

Job No. : VC66AC0066

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.

Continuation of Calibration Certificate

Cert. No. : ACL23194

Job No. : VC66AC0066

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)
21.4

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

Frequency Weighting	Measured value (dB)
A - weight	19.4
C - weight	26.8
Flat	31.5

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			Acceptance Limits
	Flat	C-weight	A-weight	
125	0.0	0.0	0.0	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-0.9	-0.9	-0.9	±5.0

Continuation of Calibration Certificate

Cert. No. : ACL23194

Job No. : VC66AC0066

Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

Continuation of Calibration Certificate

Cert. No. : ACL23194

Job No. : VC66AC0066

Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.1	0.1	± 1.1
134.0	134.1	0.1	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.1	0.1	± 1.1
114.0	114.1	0.1	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.1	0.1	± 1.1
99.0	99.1	0.1	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.0	0.0	± 1.1
26.0	26.1	0.1	± 1.1
25.0	25.1	0.1	± 1.1

Continuation of Calibration Certificate

Cert. No. : ACL23194

Job No. : VC66AC0066

Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

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

Continuation of Calibration Certificate

Cert. No. : ACL23194

Job No. : VC66AC0066

Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.6	89.6	0.0	±1.5

12. High level stability

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

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

End of Calibration Certificate

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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NSC-TISI-TIS 17025
CALIBRATION 0394

Cert. No. : ACL22287

Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 00658240 / 157780 / 48095
ID No.: BKK_FS0097

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 \pm 3) °C
Pressure : (101.3 \pm 3) kPa
Relative Humidity : (50.0 \pm 20) %

Received Date : 30 NOVEMBER 2022
Calibration Date : 13-16 DECEMBER 2022
Date of Issue : 19 DECEMBER 2022

REVIEW BY	<i>Nathakorn P.</i>
APPROVED BY	<i>[Signature]</i>
NEXT CAL. DATE	13/12/23

Calibrated by : Nathakorn Pisutpaisan

Approved by :

[Signature]
(Thanakul Petchurai)

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Continuation of Calibration Certificate

Cert. No. : ACL22287
Job No. : VC66AC0015
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 :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL.BP. 04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL.BP. 05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

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

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

3.1 National Institute of Metrology (Thailand).

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

Continuation of Calibration Certificate

Cert. No. : ACL22287

Job No. : VC66AC0015

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

Continuation of Calibration Certificate

Cert. No. : ACL22287

Job No. : VC66AC0015

Pages : 4 of 8

Result of calibration :**1. Absolute sensitivity**

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
16.9

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

Frequency Weighting	Measured value (dB)
A - weight	12.6
C - weight	18.4
Flat	24.4

3. Acoustical signal tests of frequency weightings

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

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

Continuation of Calibration Certificate

Cert. No. : ACL22287
Job No. : VC66AC0015
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.1	0.1	± 0.3

Continuation of Calibration Certificate

Cert. No. : ACL22287

Job No. : VC66AC0015

Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.9	-0.1	± 1.1

Continuation of Calibration Certificate

Cert. No. : ACL22287

Job No. : VC66AC0015

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
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.1	0.1	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lcpeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.2	-0.2	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

Continuation of Calibration Certificate

Cert. No. : ACL22287

Job No. : VC66AC0015

Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

SITHIPHORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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



Cert. No. : ACL23255

Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 00658241 / 158767 / 58769
ID No.: BKK_FS0098

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 \pm 3) °C
Pressure : (101.3 \pm 3) kPa
Relative Humidity : (50.0 \pm 20) %

Received Date : 25 JULY 2023
Calibration Date : 14-15 AUGUST 2023
Date of Issue : 22 AUGUST 2023

REVIEW BY	<i>Nathakorn P.</i>
APPROVED BY	<i>[Signature]</i>
NEXT CAL. DATE	14/8/24

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchur.
(Thanakul Petchurai)

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Continuation of Calibration Certificate

Cert. No. : ACL23255

Job No. : VC66AC0089

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 :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
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).

Continuation of Calibration Certificate

Cert. No. : ACL23255

Job No. : VC66AC0089

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.

Continuation of Calibration Certificate

Cert. No. : ACL23255

Job No. : VC66AC0089

Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
15.9

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

Frequency Weighting	Measured value (dB)
A - weight	12.0
C - weight	18.2
Flat	23.9

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			Acceptance Limits
	Flat	C-weight	A-weight	
125	0.4	0.4	0.4	± 1.5
1000	0.0	-0.1	0.0	± 1.0
8000	-1.1	-1.0	-1.0	±5.0

Continuation of Calibration Certificate

Cert. No. : ACL23255

Job No. : VC66AC0089

Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

Continuation of Calibration Certificate

Cert. No. : ACL23255
Job No. : VC66AC0089
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.1	0.1	± 1.1
26.0	26.1	0.1	± 1.1
25.0	25.1	0.1	± 1.1

Continuation of Calibration Certificate

Cert. No. : ACL23255

Job No. : VC66AC0089

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
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, Lcpeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	135.6	-0.8	±3.0

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

Continuation of Calibration Certificate

Cert. No. : ACL23255

Job No. : VC66AC0089

Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.5	89.7	0.2	±1.5

12. High level stability

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

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

End of Calibration Certificate

SITHIPHORN ASSOCIATES CO.,LTD.

CALIBRATION LABORATORY



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

Cert. No. : ACC23014

Pages : 1 of 3

Calibration Certificate

Equipment : SOUND CALIBRATOR
Manufacturer : RION
Model : NC-74
Serial No.: 34178117
ID No.: BKK_FS0630

Condition As Found : GOOD

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

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

Received Date : 22 MAY 2023
Calibration Date : 24 MAY 2023
Date of Issue : 25 MAY 2023

REVIEW BY	<i>Mrakorn P.</i>
APPROVED BY	<i>[Signature]</i>
NEXT CAL. DATE	26/5/24

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchur
(Thanakul Petchurai)

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Continuation of Calibration Certificate

Cert. No. : ACC23014

Job No. : VC66AC0059

Pages : 2 of 3

Calibration Procedure : CP-AC-03

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
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 30/0267	13-FEB-24
Digital Multimeter	33461A	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
Audio Analyzer	AVR-3360A	V744B6069	EF-0012-23	10-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).

Continuation of Calibration Certificate

Cert. No. : ACC23014
Job No. : VC66AC0059
Pages : 3 of 3

Result of calibration :**1. Sound pressure level**

Specified sound pressure level (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit (dB)
94	94.16	0.16	0.14	0.40

2. Frequency

Specified Frequency (Hz)	Measured value (Hz)	Deviated value (%)	Uncertainty (%)	Tolerance limit (%)
1000	1001.7	0.2	0.1	1.0

3. Total distortion

Measured value (%)	Uncertainty (%)	Tolerance limit (%)
1.69	0.10	3.0

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

End of Calibration Certificate

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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



Cert. No. : ACL23004

Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 00858520 / 158771 / 58772
ID No.: BKK_FS0110

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 \pm 3) °C
Pressure : (101.3 \pm 3) kPa
Relative Humidity : (50.0 \pm 20) %

Received Date : 14 DECEMBER 2022
Calibration Date : 03-05 JANUARY 2023
Date of Issue : 06 JANUARY 2023

REVIEW BY	Nathakorn P.
APPROVED BY	[Signature]
NEXT CAL. DATE	3/1/24

Calibrated by :

Nathakorn Pisutpaisan

Approved by :

[Signature]
(Thanakul Petchurai)

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Continuation of Calibration Certificate

Cert. No. : ACL23004

Job No. : VC66AC0021

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 :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL.BP. 04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL.BP. 05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

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

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

3.1 National Institute of Metrology (Thailand).

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

Continuation of Calibration Certificate

Cert. No. : ACL23004
Job No. : VC66AC0021
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

Continuation of Calibration Certificate

Cert. No. : ACL23004

Job No. : VC66AC0021

Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
16.1

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

Frequency Weighting	Measured value (dB)
A - weight	12.5
C - weight	18.8
Flat	24.4

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			Acceptance Limits
	Flat	C-weight	A-weight	
125	0.3	0.3	0.4	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-1.4	-1.4	-1.4	±5.0

Continuation of Calibration Certificate

Cert. No. : ACL23004

Job No. : VC66AC0021

Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

Continuation of Calibration Certificate

Cert. No. : ACL23004
Job No. : VC66AC0021
Pages : 6 of 8

7. Level linearity on the reference level range

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

Continuation of Calibration Certificate

 Cert. No. : ACL23004
 Job No. : VC66AC0021
 Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lcpeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	135.3	-1.1	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

Continuation of Calibration Certificate

Cert. No. : ACL23004
Job No. : VC66AC0021
Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

SITHIPHORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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



Cert. No. : ACL23003

Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 00858519 / 158770 / 58771
ID No.: BKK_FS0109

Condition As Found : GOOD

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

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

Received Date : 14 DECEMBER 2022
Calibration Date : 03-05 JANUARY 2023
Date of Issue : 06 JANUARY 2023



Calibrated by : Nathakorn Pisutpaisan

Approved by :

(*T. Petchur*)
(Thanakul Petchurai)

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Continuation of Calibration Certificate

Cert. No. : ACL23003

Job No. : VC66AC0021

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 :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL.BP. 04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL.BP. 05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

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

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

3.1 National Institute of Metrology (Thailand).

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

Continuation of Calibration Certificate

Cert. No. : ACL23003

Job No. : VC66AC0021

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

Continuation of Calibration Certificate

Cert. No. : ACL23003

Job No. : VC66AC0021

Pages : 4 of 8

Result of calibration :**1. Absolute sensitivity**

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
16.1

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	17.6
Flat	23.4

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			Acceptance Limits
	Flat	C-weight	A-weight	
125	0.3	0.3	0.3	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-1.1	-1.0	-1.0	±5.0

Continuation of Calibration Certificate

Cert. No. : ACL23003

Job No. : VC66AC0021

Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

Continuation of Calibration Certificate

Cert. No. : ACL23003

Job No. : VC66AC0021

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	74.1	0.1	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	28.0	0.0	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.9	-0.1	± 1.1

Continuation of Calibration Certificate

Cert. No. : ACL23003

Job No. : VC66AC0021

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	94.1	0.1	±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, Lcpeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.3	-0.1	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.1	0.1	-
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.3	-0.1	±2.0

Continuation of Calibration Certificate

Cert. No. : ACL23003

Job No. : VC66AC0021

Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

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

_____ **End of Calibration Certificate** _____

SITHIPHORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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



Cert. No. : ACL22302

Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 00858521 / 158765 / 58767
ID No.: BKK_FS0111

Condition As Found : GOOD

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

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

Received Date : 07 DECEMBER 2022
Calibration Date : 16-20 DECEMBER 2022
Date of Issue : 21 DECEMBER 2022

REVIEW BY	<i>Mirakorn P.</i>
APPROVED BY	<i>[Signature]</i>
NEXT CAL. DATE	16/12/23

Calibrated by : Nathakorn Pisutpaisan

Approved by :

[Signature]
(Thanakul Petchurai)

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Continuation of Calibration Certificate

Cert. No. : ACL22302

Job No. : VC66AC0016

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 :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL.BP. 04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL.BP. 05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

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

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

3.1 National Institute of Metrology (Thailand).

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

Continuation of Calibration Certificate

Cert. No. : ACL22302

Job No. : VC66AC0016

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

Continuation of Calibration Certificate

Cert. No. : ACL22302

Job No. : VC66AC0016

Pages : 4 of 8

Result of calibration :**1. Absolute sensitivity**

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.8

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

Frequency Weighting	Measured value (dB)
A - weight	11.6
C - weight	18.1
Flat	23.8

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			Acceptance Limits
	Flat	C-weight	A-weight	
125	0.3	0.3	0.4	± 1.5
1000	0.1	0.0	0.0	± 1.0
8000	-1.9	-1.8	-1.8	±5.0

Continuation of Calibration Certificate

Cert. No. : ACL22302
Job No. : VC66AC0016
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

Continuation of Calibration Certificate

Cert. No. : ACL22302

Job No. : VC66AC0016

Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.1	0.1	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.1	0.1	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.1	0.1	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.9	-0.1	± 1.1

Continuation of Calibration Certificate

Cert. No. : ACL22302

Job No. : VC66AC0016

Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lcpeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	135.4	-1.0	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

Continuation of Calibration Certificate

Cert. No. : ACL22302

Job No. : VC66AC0016

Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

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

————— **End of Calibration Certificate** —————

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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



Cert. No. : ACL22233

Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 00672737 / 158772 / 58773
ID No.: BKK_FS0927

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 \pm 3) °C
Pressure : (101.3 \pm 3) kPa
Relative Humidity : (50.0 \pm 20) %

Received Date : 03 OCTOBER 2022
Calibration Date : 18-19 OCTOBER 2022
Date of Issue : 20 OCTOBER 2022

REVIEW BY	<i>Nathakorn P.</i>
APPROVED BY	<i>Nathakorn P.</i>
NEXT CAL. DATE	18/10/23

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchurai
(Thanakul Petchurai)

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

Continuation of Calibration Certificate

Cert. No. : ACL22233
Job No. : VC65AC0088
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 :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL.BP. 04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL.BP. 05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

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

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

3.1 National Institute of Metrology (Thailand).

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

Continuation of Calibration Certificate

Cert. No. : ACL22233
Job No. : VC65AC0088
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

Continuation of Calibration Certificate

Cert. No. : ACL22233

Job No. : VC65AC0088

Pages : 4 of 8

Result of calibration :**1. Absolute sensitivity**

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
15.5

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	17.1
Flat	22.9

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.3	0.3	0.3	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-0.6	-0.5	-0.6	±5.0

Continuation of Calibration Certificate

Cert. No. : ACL22233
Job No. : VC65AC0088
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

Continuation of Calibration Certificate

Cert. No. : ACL22233

Job No. : VC65AC0088

Pages : 6 of 8

7. Level linearity on the reference level range

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

Continuation of Calibration Certificate

Cert. No. : ACL22233

Job No. : VC65AC0088

Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lcpeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.1	-0.3	±3.0

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

Continuation of Calibration Certificate

Cert. No. : ACL22233
Job No. : VC65AC0088
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

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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



Cert. No. : ACL22245

Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 00572609 / 170133 / 72947
ID No.: BKK_FS0924

Condition As Found : GOOD

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

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

Received Date : 11 OCTOBER 2022
Calibration Date : 25-26 OCTOBER 2022
Date of Issue : 27 OCTOBER 2022

REVIEW BY	Nathakorn P.
APPROVED BY	richan chm
NEXT CAL. DATE	25/10/23

Calibrated by : Nathakorn Pisutpaisan

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.

Continuation of Calibration Certificate

Cert. No. : ACL22245
Job No. : VC65AC0090
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 :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL.BP. 04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL.BP. 05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

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

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

3.1 National Institute of Metrology (Thailand).

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

Continuation of Calibration Certificate

Cert. No. : ACL22245

Job No. : VC65AC0090

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

Continuation of Calibration Certificate

Cert. No. : ACL22245

Job No. : VC65AC0090

Pages : 4 of 8

Result of calibration :**1. Absolute sensitivity**

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
15.1

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	17.6
Flat	23.5

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			Acceptance Limits
	Flat	C-weight	A-weight	
125	0.0	0.1	0.1	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	0.5	0.6	0.6	±5.0

Continuation of Calibration Certificate

Cert. No. : ACL22245
Job No. : VC65AC0090
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

Continuation of Calibration Certificate

Cert. No. : ACL22245

Job No. : VC65AC0090

Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.1	0.1	± 1.1
84.0	84.1	0.1	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.1	0.1	± 1.1
69.0	69.1	0.1	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.1	0.1	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.1	0.1	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.1	0.1	± 1.1
28.0	28.1	0.1	± 1.1
27.0	27.1	0.1	± 1.1
26.0	26.1	0.1	± 1.1
25.0	25.1	0.1	± 1.1

Continuation of Calibration Certificate

Cert. No. : ACL22245
Job No. : VC65AC0090
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lcpeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.0	-0.4	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.1	0.1	-
Positive half cycle	135.4	135.3	-0.1	±2.0
Negative half cycle	135.4	135.3	-0.1	±2.0

Continuation of Calibration Certificate

Cert. No. : ACL22245

Job No. : VC65AC0090

Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

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

————— End of Calibration Certificate —————

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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



Cert. No. : ACL22232

Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 00584982 / 157781 / 48096
ID No.: BKK_FS0925

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 \pm 3) °C
Pressure : (101.3 \pm 3) kPa
Relative Humidity : (50.0 \pm 20) %

Received Date : 03 OCTOBER 2022
Calibration Date : 18-19 OCTOBER 2022
Date of Issue : 20 OCTOBER 2022

REVIEW BY	<i>Nithakorn P.</i>
APPROVED BY	<i>Nichol Chan</i>
NEXT CAL. DATE	18/10/23

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchurai
(Thanakul Petchurai)

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

Continuation of Calibration Certificate

Cert. No. : ACL22232

Job No. : VC65AC0088

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 :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL.BP. 04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL.BP. 05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

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

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

3.1 National Institute of Metrology (Thailand).

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

Continuation of Calibration Certificate

Cert. No. : ACL22232

Job No. : VC65AC0088

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

Continuation of Calibration Certificate

Cert. No. : ACL22232

Job No. : VC65AC0088

Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
17.3

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

Frequency Weighting	Measured value (dB)
A - weight	13.1
C - weight	19.0
Flat	24.7

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			Acceptance Limits
	Flat	C-weight	A-weight	
125	0.3	0.3	0.4	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-0.5	-0.4	-0.4	±5.0

Continuation of Calibration Certificate

Cert. No. : ACL22232
Job No. : VC65AC0088
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.1	0.1	± 0.3

Continuation of Calibration Certificate

Cert. No. : ACL22232

Job No. : VC65AC0088

Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.1	0.1	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.1	0.1	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	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

Continuation of Calibration Certificate

Cert. No. : ACL22232

Job No. : VC65AC0088

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
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, Lcpeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	135.6	-0.8	±3.0

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

Continuation of Calibration Certificate

Cert. No. : ACL22232

Job No. : VC65AC0088

Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.6	89.6	0.0	±1.5

12. High level stability

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

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

End of Calibration Certificate

SITHIPORN ASSOCIATES CO.,LTD.

CALIBRATION LABORATORY



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

Cert. No. : ACC23008

Pages : 1 of 3

Calibration Certificate

Equipment : SOUND CALIBRATOR
Manufacturer : RION
Model : NC-73
Serial No.: 10196929
ID No.: BKK_FS0607

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 \pm 3) °C
Pressure : (101.3 \pm 3) kPa
Relative Humidity : (50.0 \pm 20) %

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

REVIEW BY	<i>Nathakorn P.</i>
APPROVED BY	<i>[Signature]</i>
NEXT CAL. DATE	26/1/24

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchurai
(Thanakul Petchurai)

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

Continuation of Calibration Certificate

Cert. No. : ACC23008

Job No. : VC66AC0031

Pages : 2 of 3

Calibration Procedure : CP-AC-03

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL.BP. 04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0265	09-Feb-23
Digital Multimeter	33461A	MY60024273	EEL.BP. 05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23
Audio Analyzer	AVR-3360A	V744B6069	EF-0010-22	07-Feb-23

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

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

3.1 National Institute of Metrology (Thailand).

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

Continuation of Calibration Certificate

Cert. No. : ACC23008
Job No. : VC66AC0031
Pages : 3 of 3

Result of calibration :**1. Sound pressure level**

Specified sound pressure level (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit (dB)
94	93.7	-0.30	3.91	0.40

2. Frequency

Specified Frequency (Hz)	Measured value (Hz)	Deviated value (%)	Uncertainty (%)	Tolerance limit (%)
1000	978.7	-2.1	0.1	1.0

3. Total distortion

Measured value (%)	Uncertainty (%)	Tolerance limit (%)
1.70	0.10	3.0

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

End of Calibration Certificate

SITHIPHORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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



Cert. No. : ACL23055

Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 00672789 / 170666 / 73129
ID No.: BKK_FS0929

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 \pm 3) °C
Pressure : (101.3 \pm 3) kPa
Relative Humidity : (50.0 \pm 20) %

Received Date : 17 JANUARY 2023
Calibration Date : 19-20 JANUARY 2023
Date of Issue : 23 JANUARY 2023

REVIEW BY	Nathakorn P.
APPROVED BY	[Signature]
NEXT CAL. DATE	19/1/24

Calibrated by : Nathakorn Pisutpaisan

Approved by :

[Signature]
(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.

Continuation of Calibration Certificate

Cert. No. : ACL23055

Job No. : VC66AC0026

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 :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL.BP. 04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL.BP. 05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

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

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

3.1 National Institute of Metrology (Thailand).

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

Continuation of Calibration Certificate

Cert. No. : ACL23055
Job No. : VC66AC0026
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

Continuation of Calibration Certificate

Cert. No. : ACL23055

Job No. : VC66AC0026

Pages : 4 of 8

Result of calibration :**1. Absolute sensitivity**

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.4

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

Frequency Weighting	Measured value (dB)
A - weight	11.6
C - weight	17.7
Flat	23.5

3. Acoustical signal tests of frequency weightings

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

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

Continuation of Calibration Certificate

 Cert. No. : ACL23055
 Job No. : VC66AC0026
 Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz
5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.1	0.1	± 0.3

Continuation of Calibration Certificate

Cert. No. : ACL23055

Job No. : VC66AC0026

Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.1	0.1	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.1	0.1	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	25.0	0.0	± 1.1

Continuation of Calibration Certificate

Cert. No. : ACL23055
Job No. : VC66AC0026
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	116.9	-0.1	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	107.9	-0.1	1.5 ; -5.0
	200	800	127.6	127.5	-0.1	±1.0
SEL	0.25	1	99.0	98.8	-0.2	1.5 ; -5.0
	2	8	108.0	107.9	-0.1	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lcpeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	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	-
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±2.0

Continuation of Calibration Certificate

Cert. No. : ACL23055

Job No. : VC66AC0026

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** —————

SITHIPHORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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



NSC-TISI-TIS 17025
CALIBRATION 0394

Cert. No. : ACL23336

Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00572609 / 170133 / 72947
ID No.: BKK_FS0924

Condition As Found : GOOD

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

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

Received Date : 20 OCTOBER 2023
Calibration Date : 01-02 NOVEMBER 2023
Date of Issue : 03 NOVEMBER 2023

REVIEW BY	Nathakorn P.
APPROVED BY	[Signature]
NEXT CAL. DATE	1/11/24

Calibrated by : Nathakorn Pisutpaisan

Approved by :

[Signature]
(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.

Continuation of Calibration Certificate

Cert. No. : ACL23336

Job No. : VC67AC0014

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 :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
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).

Continuation of Calibration Certificate

Cert. No. : ACL23336

Job No. : VC67AC0014

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.

Continuation of Calibration Certificate

Cert. No. : ACL23336

Job No. : VC67AC0014

Pages : 4 of 8

Result of calibration :**1. Absolute sensitivity**

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
15.1

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	23.5

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			Acceptance Limits
	Flat	C-weight	A-weight	
125	0.0	0.1	0.1	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	0.9	0.9	0.9	±5.0

Continuation of Calibration Certificate

Cert. No. : ACL23336

Job No. : VC67AC0014

Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

Continuation of Calibration Certificate

Cert. No. : ACL23336
Job No. : VC67AC0014
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.0	0.0	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.9	-0.1	± 1.1

Continuation of Calibration Certificate

Cert. No. : ACL23336
 Job No. : VC67AC0014
 Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{cpeak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	136.1	-0.3	±3.0

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

Continuation of Calibration Certificate

Cert. No. : ACL23336

Job No. : VC67AC0014

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	89.4	-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

SITHIPHORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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



Cert. No. : ACL23007

Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 00858527 / 158778 / 58779
ID No.: BKK_FS0117

Condition As Found : GOOD

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

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

Received Date : 14 DECEMBER 2022
Calibration Date : 03-05 JANUARY 2023
Date of Issue : 06 JANUARY 2023

REVIEW BY	<i>Manakorn P.</i>
APPROVED BY	<i>[Signature]</i>
NEXT CAL. DATE	3/1/24

Calibrated by : Nathakorn Pisutpaisan

Approved by :

[Signature]
(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.

Continuation of Calibration Certificate

Cert. No. : ACL23007
Job No. : VC66AC0021
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 :**

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL.BP. 04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL.BP. 05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

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

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

3.1 National Institute of Metrology (Thailand).

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

Continuation of Calibration Certificate

Cert. No. : ACL23007
 Job No. : VC66AC0021
 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

Continuation of Calibration Certificate

Cert. No. : ACL23007

Job No. : VC66AC0021

Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
17.1

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

Frequency Weighting	Measured value (dB)
A - weight	15.8
C - weight	22.0
Flat	27.6

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)			Acceptance Limits
	Flat	C-weight	A-weight	
125	1.1	1.1	1.1	± 1.5
1000	0.2	0.2	0.2	± 1.0
8000	-1.6	-1.5	-1.5	±5.0

Continuation of Calibration Certificate

Cert. No. : ACL23007

Job No. : VC66AC0021

Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	0.0	0.0	±2.0
125	0.0	0.1	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.1	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	0.1	±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	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	0.0	-
C - weight	94.0	0.0	± 0.2
Flat	94.0	0.0	± 0.2

5.2 Time weighting at 1 kHz

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

6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.1	0.1	± 0.3

Continuation of Calibration Certificate

Cert. No. : ACL23007
Job No. : VC66AC0021
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.1	0.1	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.1	0.1	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	25.0	0.0	± 1.1

Continuation of Calibration Certificate

Cert. No. : ACL23007
Job No. : VC66AC0021
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
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.1	0.1	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lcpeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	135.6	-0.8	±3.0

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

Continuation of Calibration Certificate

Cert. No. : ACL23007

Job No. : VC66AC0021

Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

SITHIPHORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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



Cert. No. : ACL23005

Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 00858525 / 170383 / 72889
ID No.: BKK_FS0115

Condition As Found : GOOD

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

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

Received Date : 14 DECEMBER 2022
Calibration Date : 03-05 JANUARY 2023
Date of Issue : 06 JANUARY 2023

REVIEW BY	<i>Nathakorn P.</i>
APPROVED BY	<i>[Signature]</i>
NEXT CAL. DATE	3/1/24

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchurai
(Thanakul Petchurai)

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

Continuation of Calibration Certificate

Cert. No. : ACL23005

Job No. : VC66AC0021

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 :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL.BP. 04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL.BP. 05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

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

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

3.1 National Institute of Metrology (Thailand).

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

Continuation of Calibration Certificate

Cert. No. : ACL23005
Job No. : VC66AC0021
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

Continuation of Calibration Certificate

Cert. No. : ACL23005

Job No. : VC66AC0021

Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
15.5

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

Frequency Weighting	Measured value (dB)
A - weight	14.2
C - weight	20.4
Flat	25.9

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			Acceptance Limits
	Flat	C-weight	A-weight	
125	0.2	0.3	0.3	± 1.5
1000	-0.1	-0.1	-0.1	± 1.0
8000	-1.7	-1.6	-1.6	±5.0

Continuation of Calibration Certificate

Cert. No. : ACL23005

Job No. : VC66AC0021

Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

Continuation of Calibration Certificate

Cert. No. : ACL23005

Job No. : VC66AC0021

Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.1	0.1	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.1	0.1	± 1.1
69.0	69.0	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

Continuation of Calibration Certificate

Cert. No. : ACL23005
 Job No. : VC66AC0021
 Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.4	0.0	±3.0

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

Continuation of Calibration Certificate

Cert. No. : ACL23005

Job No. : VC66AC0021

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

CERTIFICATE OF CALIBRATION

Certificate No. : CDT-030-66
Page 1 of 2

Equipment Name: Heat Stress Monitor
Manufacturer.: Delta OHM
Model: HD32.2
Serial No: 15006318
ID No: BKK_FS0668

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: 11 Jul 2023
Calibration date: 18 Jul 2023
Issue date: 18 Jul 2023

Reference Used During Calibration

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

Calibration Condition

Temperature: $(23 \pm 3)^{\circ}\text{C}$
Relative Humidity: $(55 \pm 15)\%$

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: ER-0092-
22

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

REVIEW BY *Margkorn P.*

APPROVED BY *[Signature]*

NEXT CAL. DATE *18/7/24*

Calibrated by

- ☐ Mr. Sorawit Thachalad
☒ Miss Jitraporn Lertsomphol
☐ Miss Ruangrumpai Phoommit



Approved Signatory:

[Signature]
Mr. Parinya Booncharoen
Calibration Department Manager

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 – 40 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 15017685.
Dimension: Diameter 14 mm. Length 170 mm.

<u>Immersion</u> <u>Depth</u> (mm)	<u>Standard</u> <u>Reading</u> (°C)	<u>UUC</u> <u>Reading</u> (°C)	<u>Error</u> (°C)	<u>Uncertainty</u> (°C)
80	20.060	20.0	-0.1	0.099
80	25.054	25.0	-0.1	0.099
80	30.050	30.0	0.0	0.099
80	35.043	35.0	0.0	0.099
80	40.036	40.0	0.0	0.099

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 15015968.
Dimension: Diameter 3.3 mm. Length 205 mm.

<u>Immersion</u> <u>Depth</u> (mm)	<u>Standard</u> <u>Reading</u> (°C)	<u>UUC</u> <u>Reading</u> (°C)	<u>Error</u> (°C)	<u>Uncertainty</u> (°C)
110	20.060	20.0	-0.1	0.099
110	25.055	25.0	-0.1	0.099
110	30.050	30.0	-0.1	0.099
110	35.043	35.0	0.0	0.099
110	40.036	40.0	0.0	0.099

Table 3: This equipment was connected with temperature probe Model: TP3207.2 S/N: 15015495.
Dimension: Diameter 14 mm. Length 150 mm.

<u>Immersion</u> <u>Depth</u> (mm)	<u>Standard</u> <u>Reading</u> (°C)	<u>UUC</u> <u>Reading</u> (°C)	<u>Error</u> (°C)	<u>Uncertainty</u> (°C)
75	20.060	20.4	0.3	0.099
75	25.055	25.2	0.1	0.099
75	30.050	30.1	0.1	0.099
75	35.043	35.0	0.0	0.099
75	40.036	39.9	-0.1	0.099

UUC* : Unit Under Calibration

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

*** End of Certificate ***



CERTIFICATE OF CALIBRATION

Certificate No. : CL-040-66
Page 1 of 2

Equipment Name: Heat Stress Monitor
Manufacturer.: Delta OHM
Model: HD32.2
Serial No: 15006710
ID No: BKK_FS0672

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: 15 Feb 2023

Calibration date: 22 Feb 2023

Issue date: 23 Feb 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: $(23 \pm 3)^\circ\text{C}$
Relative Humidity: $(55 \pm 15)\%$

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-0034-22, Certificate number: ER-0092-22

REVIEW BY	<i>Parinya P</i>
APPROVED BY	<i>[Signature]</i>
NEXT CAL. DATE	22/2/24

Calibrated by

- ☐ Mr. Sorawit Thachalad
☒ Miss Jitraporn Lertsomphol



Approved Signatory:

[Signature]
Mr. Parinya Booncharoen
Calibration Department Manager

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 – 40 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 15015852.
Dimension: Diameter 14 mm. Length 170 mm.

<u>Immersion</u> <u>Depth</u> (mm)	<u>Standard</u> <u>Reading</u> (°C)	<u>UUC</u> <u>Reading</u> (°C)	<u>Error</u> (°C)	<u>Uncertainty</u> (°C)
60	20.065	20.0	-0.1	0.099
60	25.060	25.0	-0.1	0.099
60	30.053	30.0	-0.1	0.099
60	35.047	35.0	0.0	0.099
60	40.044	40.0	0.0	0.099

Table 2: This equipment was connected with temperature probe Model: TP3207.2 S/N: 14036714.
Dimension: Diameter 14 mm. Length 150 mm.

<u>Immersion</u> <u>Depth</u> (mm)	<u>Standard</u> <u>Reading</u> (°C)	<u>UUC</u> <u>Reading</u> (°C)	<u>Error</u> (°C)	<u>Uncertainty</u> (°C)
70	20.065	20.1	0.0	0.099
70	25.061	24.9	-0.2	0.099
70	30.053	29.8	-0.3	0.099
70	35.047	34.7	-0.3	0.099
70	40.043	39.6	-0.4	0.099

Table 3: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 15021832.
Dimension: Diameter 8 mm. Length 170 mm.

<u>Immersion</u> <u>Depth</u> (mm)	<u>Standard</u> <u>Reading</u> (°C)	<u>UUC</u> <u>Reading</u> (°C)	<u>Error</u> (°C)	<u>Uncertainty</u> (°C)
110	20.065	20.1	0.0	0.099
110	25.060	25.1	0.0	0.099
110	30.053	30.1	0.0	0.099
110	35.047	35.1	0.1	0.099
110	40.043	40.1	0.1	0.099

UUC* : Unit Under Calibration

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

✱ End of Certificate ✱



CERTIFICATE OF CALIBRATION

Certificate No. : CDT-028-66
Page 1 of 2

Equipment Name: Heat Stress Monitor
Manufacturer.: Delta OHM
Model: HD32.2
Serial No: 15002056
ID No: BKK_FS0658

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: 11 Jul 2023
Calibration date: 17 Jul 2023
Issue date: 18 Jul 2023

Reference Used During Calibration

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

Calibration Condition

Temperature: $(23 \pm 3)^{\circ}\text{C}$
Relative Humidity: $(55 \pm 15)\%$

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: ER-0092-
22

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

REVIEW BY *Narakhorn P.*

APPROVED BY *[Signature]*

NEXT CAL. DATE *17/7/24*

Calibrated by

- ☐ Mr. Sorawit Thachalad
☒ Miss Jittraporn Lertsomphol
☐ Miss Ruangrumpai Phoommit



Approved Signatory: *[Signature]*

Mr. Parihya Booncharoen
Calibration Department Manager

Certificate No. : CDT-028-66
Page 2 of 2

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 – 40 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 15008697.
Dimension: Diameter 14 mm. Length 170 mm.

<u>Immersion</u> <u>Depth</u> (mm)	<u>Standard</u> <u>Reading</u> (°C)	<u>UUC</u> <u>Reading</u> (°C)	<u>Error</u> (°C)	<u>Uncertainty</u> (°C)
80	20.054	19.9	-0.2	0.099
80	25.052	24.9	-0.2	0.099
80	30.045	29.9	-0.1	0.099
80	35.038	34.9	-0.1	0.099
80	40.031	39.9	-0.1	0.099

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 18009534.
Dimension: Diameter 3.3 mm. Length 205 mm.

<u>Immersion</u> <u>Depth</u> (mm)	<u>Standard</u> <u>Reading</u> (°C)	<u>UUC</u> <u>Reading</u> (°C)	<u>Error</u> (°C)	<u>Uncertainty</u> (°C)
110	20.055	19.9	-0.2	0.099
110	25.051	24.9	-0.2	0.099
110	30.046	29.9	-0.1	0.099
110	35.038	34.9	-0.1	0.099
110	40.031	39.9	-0.1	0.099

Table 3: This equipment was connected with temperature probe Model: TP3207.2 S/N: 15003274.
Dimension: Diameter 14 mm. Length 150 mm.

<u>Immersion</u> <u>Depth</u> (mm)	<u>Standard</u> <u>Reading</u> (°C)	<u>UUC</u> <u>Reading</u> (°C)	<u>Error</u> (°C)	<u>Uncertainty</u> (°C)
75	20.055	20.1	0.0	0.099
75	25.052	25.0	-0.1	0.099
75	30.046	29.9	-0.1	0.099
75	35.038	34.8	-0.2	0.099
75	40.031	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 ***



CERTIFICATE OF CALIBRATION

Certificate No. : CDT-032-66
Page 1 of 2

Equipment Name: Heat Stress Monitor
Manufacturer.: Delta OHM
Model: HD32.2
Serial No: 15006704
ID No: BKK_FS0670

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: 11 Jul 2023
Calibration date: 18 Jul 2023
Issue date: 18 Jul 2023

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

Calibration Condition
Temperature: $(23 \pm 3)^{\circ}\text{C}$
Relative Humidity: $(55 \pm 15)\%$

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: ER-0092-
22

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

REVIEW BY *Mr. Parinya P.*
APPROVED BY *[Signature]*
NEXT CAL. DATE *18/7/24*

Calibrated by

- ☐ Mr. Sorawit Thachalad
☒ Miss Jitraporn Lertsomphol
☐ Miss Ruangrumpai Phoommit



Approved Signatory:

[Signature]
Mr. Parinya Booncharoen
Calibration Department Manager

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 – 40 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 15017681.
Dimension: Diameter 14 mm. Length 170 mm.

<u>Immersion</u> <u>Depth</u> (mm)	<u>Standard</u> <u>Reading</u> (°C)	<u>UUC</u> <u>Reading</u> (°C)	<u>Error</u> (°C)	<u>Uncertainty</u> (°C)
80	20.039	20.1	0.1	0.099
80	25.056	25.1	0.0	0.099
80	30.051	30.1	0.0	0.099
80	35.046	35.1	0.1	0.099
80	40.040	40.1	0.1	0.099

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 15021838.
Dimension: Diameter 3.3 mm. Length 205 mm.

<u>Immersion</u> <u>Depth</u> (mm)	<u>Standard</u> <u>Reading</u> (°C)	<u>UUC</u> <u>Reading</u> (°C)	<u>Error</u> (°C)	<u>Uncertainty</u> (°C)
110	20.039	20.1	0.1	0.099
110	25.057	25.1	0.0	0.099
110	30.051	30.1	0.0	0.099
110	35.046	35.1	0.1	0.099
110	40.040	40.1	0.1	0.099

Table 3: This equipment was connected with temperature probe Model: TP3207.2 S/N: 15015488.
Dimension: Diameter 14 mm. Length 150 mm.

<u>Immersion</u> <u>Depth</u> (mm)	<u>Standard</u> <u>Reading</u> (°C)	<u>UUC</u> <u>Reading</u> (°C)	<u>Error</u> (°C)	<u>Uncertainty</u> (°C)
75	20.039	20.2	0.2	0.099
75	25.057	25.1	0.0	0.099
75	30.051	30.0	-0.1	0.099
75	35.046	35.0	0.0	0.099
75	40.040	39.9	-0.1	0.099

UUC* : Unit Under Calibration

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

*** End of Certificate ***



CERTIFICATE OF CALIBRATION

Certificate No. : CL-033-66
Page 1 of 2

Equipment Name: Heat Stress Monitor
Manufacturer.: Delta OHM
Model: HD32.2
Serial No: 15006309
ID No: BKK_FS0667

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: 07 Feb 2023
Calibration date: 13 Feb 2023
Issue date: 14 Feb 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: $(23 \pm 3)^{\circ}\text{C}$
Relative Humidity: $(55 \pm 15)\%$

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-0034-22, Certificate number: ER-0092-
22

REVIEW BY	<i>Manatoom P</i>
APPROVED BY	<i>[Signature]</i>
NEXT CAL. DATE	13/2/24

Calibrated by

- ☐ Mr. Sorawit Thachalad
☒ Miss Jittraporn Lertsomphol



Approved Signatory:

[Signature]
Mr. Parinya Booncharoen
Calibration Department Manager

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 – 40 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 15017683.
Dimension: Diameter 14 mm. Length 170 mm.

<u>Immersion</u> <u>Depth</u> (mm)	<u>Standard</u> <u>Reading</u> (°C)	<u>UUC</u> <u>Reading</u> (°C)	<u>Error</u> (°C)	<u>Uncertainty</u> (°C)
60	20.049	20.2	0.2	0.099
60	25.056	25.2	0.1	0.099
60	30.051	30.2	0.1	0.099
60	35.045	35.2	0.2	0.099
60	40.041	40.2	0.2	0.099

Table 2: This equipment was connected with temperature probe Model: TP3207.2 S/N: 15015506.
Dimension: Diameter 14 mm. Length 150 mm.

<u>Immersion</u> <u>Depth</u> (mm)	<u>Standard</u> <u>Reading</u> (°C)	<u>UUC</u> <u>Reading</u> (°C)	<u>Error</u> (°C)	<u>Uncertainty</u> (°C)
70	20.049	20.1	0.1	0.099
70	25.056	25.0	-0.1	0.099
70	30.051	29.8	-0.2	0.14
70	35.045	34.7	-0.3	0.099
70	40.041	39.6	-0.4	0.099

Table 3: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 15009822.
Dimension: Diameter 8 mm. Length 170 mm.

<u>Immersion</u> <u>Depth</u> (mm)	<u>Standard</u> <u>Reading</u> (°C)	<u>UUC</u> <u>Reading</u> (°C)	<u>Error</u> (°C)	<u>Uncertainty</u> (°C)
110	20.049	20.0	0.0	0.099
110	25.056	25.0	-0.1	0.099
110	30.051	30.0	-0.1	0.099
110	35.045	35.0	0.0	0.099
110	40.042	40.0	0.0	0.099

UUC* : Unit Under Calibration

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

*** End of Certificate ***



CERTIFICATE OF CALIBRATION

Certificate No. : CDT-028-66
Page 1 of 2

Equipment Name: Heat Stress Monitor
Manufacturer.: Delta OHM
Model: HD32.2
Serial No: 15002056
ID No: BKK_FS0658

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: 11 Jul 2023
Calibration date: 17 Jul 2023
Issue date: 18 Jul 2023

Reference Used During Calibration

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

Calibration Condition

Temperature: $(23 \pm 3)^{\circ}\text{C}$
Relative Humidity: $(55 \pm 15)\%$

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: ER-0092-
22

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

REVIEW BY *Narakorn P.*

APPROVED BY *[Signature]*

NEXT CAL. DATE *17/7/24*

Calibrated by

- ☐ Mr. Sorawit Thachalad
☒ Miss Jittraporn Lertsomphol
☐ Miss Ruangrumpai Phoommit



Approved Signatory: *[Signature]*

Mr. Parihya Booncharoen
Calibration Department Manager

Certificate No. : CDT-028-66
Page 2 of 2

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 – 40 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 15008697.
Dimension: Diameter 14 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.054	19.9	-0.2	0.099
80	25.052	24.9	-0.2	0.099
80	30.045	29.9	-0.1	0.099
80	35.038	34.9	-0.1	0.099
80	40.031	39.9	-0.1	0.099

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 18009534.
Dimension: Diameter 3.3 mm. Length 205 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.055	19.9	-0.2	0.099
110	25.051	24.9	-0.2	0.099
110	30.046	29.9	-0.1	0.099
110	35.038	34.9	-0.1	0.099
110	40.031	39.9	-0.1	0.099

Table 3: This equipment was connected with temperature probe Model: TP3207.2 S/N: 15003274.
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
75	20.055	20.1	0.0	0.099
75	25.052	25.0	-0.1	0.099
75	30.046	29.9	-0.1	0.099
75	35.038	34.8	-0.2	0.099
75	40.031	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 ***



CERTIFICATE OF CALIBRATION

Certificate No. : CT-004-66
Page 1 of 2

Equipment Name: Heat Stress Monitor
Manufacturer.: Delta OHM
Model: HD32.2
Serial No: 13032503
ID No: BKK_FS0651

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: 22 May 2023

Calibration date: 31 May 2023

Issue date: 01 Jun 2023

Reference Used During Calibration

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

Calibration Condition

Temperature: $(23 \pm 3)^\circ\text{C}$
Relative Humidity: $(55 \pm 15)\%$

REVIEW BY	<i>Narakorn P.</i>
APPROVED BY	<i>[Signature]</i>
NEXT CAL. DATE	31/5/24

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: ER-0092-22

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

Calibrated by

- ☐ Mr. Sorawit Thachalad
☒ Miss Jittraporn Lertsomphol



Approved Signatory:

[Signature]
Mr. Parinya Booncharoen
Calibration Department Manager

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 – 40 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 16008223.
Dimension: Diameter 14 mm. Length 170 mm.

<u>Immersion</u> <u>Depth</u> (mm)	<u>Standard</u> <u>Reading</u> (°C)	<u>UUC</u> <u>Reading</u> (°C)	<u>Error</u> (°C)	<u>Uncertainty</u> (°C)
80	20.001	19.9	-0.1	0.099
80	25.006	24.9	-0.1	0.099
80	29.999	29.9	-0.1	0.099
80	35.000	34.9	-0.1	0.099
80	40.002	39.9	-0.1	0.099

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 16008189.
Dimension: Diameter 3.3 mm. Length 205 mm.

<u>Immersion</u> <u>Depth</u> (mm)	<u>Standard</u> <u>Reading</u> (°C)	<u>UUC</u> <u>Reading</u> (°C)	<u>Error</u> (°C)	<u>Uncertainty</u> (°C)
110	20.001	20.0	0.0	0.099
110	25.006	25.0	0.0	0.099
110	29.999	30.0	0.0	0.099
110	35.000	35.0	0.0	0.099
110	40.002	40.0	0.0	0.099

Table 3: This equipment was connected with temperature probe Model: TP3207.2 S/N: 16010553.
Dimension: Diameter 14 mm. Length 150 mm.

<u>Immersion</u> <u>Depth</u> (mm)	<u>Standard</u> <u>Reading</u> (°C)	<u>UUC</u> <u>Reading</u> (°C)	<u>Error</u> (°C)	<u>Uncertainty</u> (°C)
75	20.002	20.1	0.1	0.099
75	25.006	25.0	0.0	0.099
75	29.999	29.9	-0.1	0.099
75	35.000	34.9	-0.1	0.099
75	40.002	39.8	-0.2	0.099

UUC* : Unit Under Calibration

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

✱ End of Certificate ✱



CERTIFICATE OF CALIBRATION

Certificate No. : CDT-018-66
Page 1 of 2

Equipment Name: Heat Stress Monitor
Manufacturer.: Delta OHM
Model: HD32.2
Serial No: 13024807
ID No: BKK_FS0644

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: 22 Jun 2023

Calibration date: 7 Jul 2023

Issue date: 7 Jul 2023

Reference Used During Calibration

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

Calibration Condition

Temperature: $(23 \pm 3)^{\circ}\text{C}$
Relative Humidity: $(55 \pm 15)\%$

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: ER-0092-
22

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

REVIEW BY	<i>Ormakom P.</i>
APPROVED BY	<i>Wichan</i>
NEXT CAL. DATE	<i>4/4/24</i>

Calibrated by

- ☐ Mr. Sorawit Thachalad
☐ Miss Jittraporn Lertsomphol
☒ Miss Ruangrumpai Phoommit

Approved Signatory:

Parinya
Mr. Parinya Booncharoen
Calibration Department Manager



Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 – 40 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 13030283.
Dimension: Diameter 14 mm. Length 170 mm.

<u>Immersion</u> <u>Depth</u> (mm)	<u>Standard</u> <u>Reading</u> (°C)	<u>UUC</u> <u>Reading</u> (°C)	<u>Error</u> (°C)	<u>Uncertainty</u> (°C)
80	20.039	20.1	0.1	0.099
80	25.050	25.1	0.0	0.099
80	30.048	30.1	0.1	0.099
80	35.043	35.1	0.1	0.099
80	40.037	40.1	0.1	0.099

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 13030457.
Dimension: Diameter 3.3 mm. Length 205 mm.

<u>Immersion</u> <u>Depth</u> (mm)	<u>Standard</u> <u>Reading</u> (°C)	<u>UUC</u> <u>Reading</u> (°C)	<u>Error</u> (°C)	<u>Uncertainty</u> (°C)
110	20.040	20.7	0.7	0.099
110	25.050	25.7	0.6	0.099
110	30.048	30.7	0.7	0.099
110	35.043	35.7	0.7	0.099
110	40.037	40.7	0.7	0.099

Table 3: This equipment was connected with temperature probe Model: TP3207.2 S/N: 13013675.
Dimension: Diameter 14 mm. Length 150 mm.

<u>Immersion</u> <u>Depth</u> (mm)	<u>Standard</u> <u>Reading</u> (°C)	<u>UUC</u> <u>Reading</u> (°C)	<u>Error</u> (°C)	<u>Uncertainty</u> (°C)
75	20.040	20.1	0.1	0.099
75	25.050	25.0	0.0	0.099
75	30.048	29.8	-0.2	0.099
75	35.043	34.8	-0.2	0.099
75	40.037	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 ***





TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
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TEL. 0-2717-3000-24 FAX. 0-2719-9484



Certificate of Calibration

Certificate No. : 22PH476
Page : 1 of 2

Equipment : Lux Meter
Manufacturer: PEAKMETER
Model : PM6612L
Serial No.: H12A-K20118
ID No.: BKK_FS1146
Condition As-Received: Used Item
Received Date: 12 September 2022
Calibration Date: 13 September 2022

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except with the prior written approval of the head of
Corporate Services 3: Equipment Calibration and Testing Services.

Reference: 2209-0405WSC
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 15) %

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

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

Procedure used: Calibration were conducted using In-house calibration procedure CP-PH01 by measuring against
luminous-intensity standard lamp (source-based method) According to the inverse square law measurement
method.

Condition of this result of calibration

1.Reference standards instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1) Photometry & Encorder	LMguide 9,6 m	120RC003	DL-0064-22	20 Jul 2025
2) High-accuracy Irradiance Standard	OL-FEL-U	F-1471	TP-1037-21	18 Oct 2022

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

3.Test Equipment : Programmable Voltage/Current Source (Model : OL83A, S/N : 09220284).

4.Test Equipment : Illuminance Meter (Model : 51002, S/N : 080129).

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

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

-National Institute of Metrology Thailand (NIMT)

REVIEW BY	<i>Naragorn P.</i>
APPROVED BY	<i>[Signature]</i>
NEXT CAL. DATE	13/9/23

Calibrated by : Nivat Nitas
Issue Date : 14 September 2022

Approved Signatory :

- [Signature]*
☐ Phalinee Prabpaipal
☐ Chatchawan Khunpiluek
☒ Nuntawat Khamchai

B 0297390



Cert. No.: 22PH476

Page.: 2 of 2

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

Function : Illuminance Measurement **Range :** Autorange

<u>Standard Value</u>	<u>Before Adjust</u>	<u>After Adjust</u>		
(lx)	UUC* Reading	UUC* Reading	Error	Uncertainty
	(lx)	(lx)	(lx)	(± lx)
0	0.00	0.00	0.00	0.060
15	-	15.06	0.06	0.22
100	-	100.8	0.8	1.5
500	-	501	1	7.3
1000	956	1001	1	15
2000	-	2020	20	30
3000	-	3010	10	45
4000	-	4020	20	60
5000	4800	5030	30	75

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 %

Before adjustment light source factor setting mode : $L_0 = 1.000$

After adjustment light source factor setting mode : $L_0 = 1.047$

UUC* = Unit Under Calibration.

-o0o-



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TEL. 0-2717-3000-24 FAX. 0-2719-9484



Certificate of Calibration

Certificate No. : 23PH627

Page : 1 of 2

Equipment : Lux Meter

Manufacturer: Exttech

Model : 407026

Serial No.: A.060289

ID No.: BKK_FS1219

Condition As-Received: Used Item

Received Date: 27 November 2023

Calibration Date: 28 November 2023

Reference: 2311-0889WSC

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

Ambient Temperature: (23 \pm 2) °C

Relative Humidity: (50 \pm 15) %

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

Procedure used: Calibration were conducted using calibration procedure No. CP-PH01 based on inverse square law technique.

Condition of this result of calibration

1.Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Photometry & Encorder	LMguide 9,6 m	120RC003	DL-0064-22	20 Jul 2025
2) High-accuracy Irradiance Standard	OL-FEL-U	F-1473	TP-1028-23	14 Feb 2024

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

3.Test Equipment : Programmable Voltage/Current Source (Model : OL83A, S/N : 16221394).

4.Test Equipment : Illuminance Meter (Model : 51002, S/N : 080129).

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

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

-National Institute of Metrology Thailand (NIMT)

-National Institute of Metrology (Thailand), NSC-ONSC Accredited No. Calibration 0144

REVIEW BY	<i>Nantawat P.</i>
APPROVED BY	<i>[Signature]</i>
NEXT CAL. DATE	27/11/24

Calibrated by : Nivat Nitas

Issue Date : 30 November 2023

Approved Signatory :

☐ Phalinee Prabpaipal

☐ Chatchawan Khunpiluek

☒ Nuntawat Khamchai

B 0330104



Cert. No.: 23PH627

Page.: 2 of 2

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

Function : Illuminance Measurement		Range :	2000	lx
<u>Standard Value</u>	<u>UUC* Reading</u>	<u>Error</u>	<u>Uncertainty</u>	
(lx)	(lx)	(lx)	(± lx)	
0	0	0	-	
15	14	-1	0.61	
100	101	1	1.4	
500	502	2	6.5	
1000	988	-12	13	
1500	1472	-28	20	
1900	1858	-42	25	

Function : Illuminance Measurement		Range :	20000	lx
<u>Standard Value</u>	<u>UUC* Reading</u>	<u>Error</u>	<u>Uncertainty</u>	
(lx)	(lx)	(lx)	(± lx)	
2000	2020	20	26	
3000	3020	20	39	
4000	4000	0	52	
5000	4950	-50	65	

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 %

Light source factor setting mode : L

UUC* = Unit Under Calibration.

-o0o-



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Cert.No.: 23CH302

Page.: 1 of 2

Certificate of Calibration

Equipment :	pH Meter
Manufacturer :	Mettler Toledo
Model :	S2-Field Kit
Serial No. :	B727332415
ID No. :	BKK_LG0012
Condition As-Received:	Used Item
Received Date :	03 March 2023
Calibration Date :	08 March 2023
Reference :	2303-0113DSC-1
Submitted by :	ALS Laboratory Group (Thailand) Co.,Ltd. 104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan, Khet Suan Luang, Bangkok 10250 Thailand
Ambient Temperature :	(25 ± 2.5) °C
Relative Humidity :	(50 ± 15) %
Calibration Procedure :	In - house method : - CP-CH5 by direct measurement with standard voltage calibrator and direct measurement with certified reference material (CRM)



Calibrated by : Walalak Sirithean

Approved by :

Malee
Approved Signatory

- (☒) Malee Butkruea
() Saithip Meangmai
() Warakorn Lernagtrakul

Issue Date : 10 March 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 0051922



Cert. No.: 23CH302

Page.: 2 of 2

Condition of this calibration result

1. Reference Standard Instrument : -

<u>Instrument</u>	<u>Serial No.</u>	<u>ID No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
1) Document Process Calibrator	54030049	130RC116	22E2769	24 Aug 2023

This certification is traceable to the International System of Unit maintained at:-

- Traceable to National Institute of Metrology (Thailand), NIMT

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

<u>Buffer Solution</u>	<u>Manufacturer</u>	<u>Lot No.</u>	<u>Exp. date</u>
pH 4.008	CPA chem	826588	09 July 2024
pH 6.987	CPA chem	826589	09 July 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 (±mV)	Coverage factor <i>k</i>
	pH	mV	mV	pH		
pH Meter S/N.: B727332415	4.00	177.48	177	4.00	0.58	2.00
	7.00	0.00	0	7.00	0.58	2.00
	10.00	-177.48	-178	10.00	0.58	2.00

Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH measurement (±)	Coverage factor <i>k</i>
pH Electrode S/N.: 2244445	4.008	4.01	188	0.0079	2.00
	6.987	6.99	13	0.011	2.00
	10.010	10.01	-165	0.0096	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 %.

-o0o-

Malu



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



Cert. No.: 23LM38

Page.: 1 of 2

Certificate of Calibration

Equipment : pH Meter with Sensor

Manufacturer : Mettler Toledo

Model : S2-Field Kit

Serial No. : B727332415

ID No. : BKK_LG0012

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

Location : TPA On Site Calibration Laboratory

Received Order : 3 March 2023

Calibrated Date : 14 March 2023

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 30) %

AC Line Voltage : (220 ± 22) V

Calibrated by : Warakorn Lernagatrakul

Approved by :

Malee

Approved Signatory

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

Issue Date : 16 March 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 0052561



Equipment : pH Meter with Sensor
Condition As-Received : Used Item
Reference : 2303-0113DSC-2
Procedure Used :-

Cert. No.: 23LM38

Page.: 2 of 2

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:-

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
1) Digital Thermometer	1523	2188080	221285	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.

Result of Calibration :- (*) Without Adjustment

Function : Temperature measurement.

This instrument was connected with temperature sensor, S/N.: 2244445

<u>Calibration Point</u> (°C)	<u>Immersion Depth</u> (mm)	<u>Standard Temperature</u> (°C)	<u>UUC* Reading</u> (°C)	<u>Error</u> (°C)	<u>Uncertainty</u> (± °C)	<u>Coverage Factor</u> <i>k</i>
20.0	100	20.002	20.2	0.198	0.16	2.00
25.0	100	25.001	25.3	0.299	0.16	2.00
30.0	100	30.002	30.3	0.298	0.16	2.00
35.0	100	35.004	35.3	0.296	0.16	2.00
40.0	100	40.003	40.4	0.397	0.16	2.00
45.0	100	45.003	45.4	0.397	0.16	2.00
50.0	100	50.003	50.4	0.397	0.16	2.00

UUC* : Unit Under Calibration

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

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



Cert.No.: 22CH1222

Page.: 1 of 2

Certificate of Calibration

Equipment :	pH Meter
Manufacturer :	Mettler Toledo
Model :	Seven Compact S220
Serial No. :	B520948426
ID No. :	BKK_EN0072
Condition As-Received:	Used Item
Received Date :	09 September 2022
Calibration Date :	12 September 2022
Reference :	2209-0312DSC-1
Submitted by :	ALS Laboratory Group (Thailand) Co.,Ltd. 104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan, Khet Suan Luang, Bangkok 10250 Thailand
Ambient Temperature :	(25 ± 2.5) °C
Relative Humidity :	(50 ± 15) %
Calibration Procedure :	In - house method : - CP-CH5 by direct measurement with standard voltage calibrator and direct measurement with certified reference material (CRM)

REVIEW BY	<u>Sinluk P.</u>
APPROVED BY	<u>KL AL</u>
NEXT CAL. DATE	<u>12/03/24</u>

Calibrated by : Warakorn Lerngagtrakul

Approved by :

Malee

Approved Signatory

- (☒) Malee Butkruea
(☐) Saithip Meangmai
(☐) Warakorn Lerngagtrakul

Issue Date : 15 September 2022

The Uncertainties are for a confidence probability of approximately 95%

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



Cert. No.: 22CH1222

Page.: 2 of 2

Condition of this calibration result

1. Reference Standard Instrument : -

<u>Instrument</u>	<u>Serial No.</u>	<u>ID No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
1) Document Process Calibrator	54030049	130RC116	22E2769	24 Aug 2023

This certification is traceable to the International System of Unit maintained at:-

- Traceable to National Institute of Metrology (Thailand), NIMT

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

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

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

Calibration Results**Function : mV Measurement****Performing standard curve by Fluke at pH (4,7,10)**

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (\pm mV)	Coverage factor <i>k</i>
	pH	mV	mV	pH		
pH Meter S/N.: B520948426	4.000	177.48	177.4	4.000	0.058	2.00
	7.000	0.00	0.0	7.000	0.058	2.00
	10.000	-177.48	-177.5	10.000	0.058	2.00

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH measurement (\pm)	Coverage factor <i>k</i>
pH Electrode S/N.: PCE-86-EX1001	4.008	3.999	153.9	0.0055	2.09
	6.985	7.017	-13.7	0.0084	2.00
	10.008	9.996	-179.0	0.0078	2.06

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

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a 1126274



Metrological Center

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. T231303

Page 1 of 3

Certificate of Calibration

Equipment : Liquid Bath (Water)

Manufacturer : MEMMERT

Model : WNB29

Serial No. : L611.0135

Customer Code : BKK_EN0148

ID No. : T6455A4

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

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

Customer Location : ORGANIC PREPARATION LAB

Date of Receipt : 27 June 2023

Calibrated By : Sujjar Naknakred (Site Calibration Manager)

Approved By : Boonchai Suriyawong / Boonchai Suriyawong (Site Calibration Manager)

Date of Issue : 11 JUL 2023

REVIEW BY	<u>Siriluk P.</u>
APPROVED BY	<u>KL AL</u>
NEXT CAL. DATE	<u>04/01/25</u>

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.

Certificate No. T231303

Page 2 of 3

Calibration Report

Equipment : Liquid Bath (Water)
Date of Calibration : 4 July 2023
Environment : Temperature : 22.2-22.5 °C
Line Voltage : 221.6-224.8 V
Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

1. This equipment was calibrated by insert five resistance thermometer detectors into its water bath , the other one thermocouple type T use for ambient temperature measurement . The calibration was done in according to WI-T36 (based on ASTM E715-80 (Reapproved 2001)).

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
RTD	100 OHM	M18 (CH1,CH6-CH7,CH9-CH10)	T230545	10 April 2024
DATA LOGGER	34970A	T149	T230545	10 April 2024

3. This certificate is traceable to :

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

4. Condition of calibrated item : good

Equipment Description :

Time Constant 3 Hour 45 Minute At 60 °C

5. Adjustment :

(X) without adjustment

() after adjustment

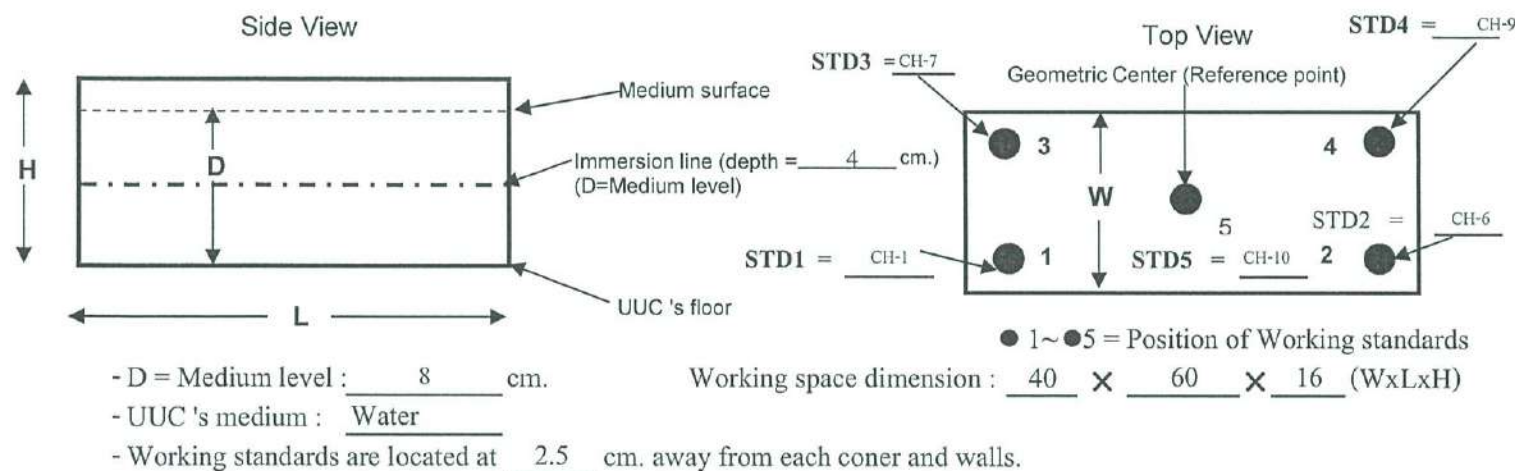
Approved By. _____



Certificate No. T231303

Page 3 of 3

Calibration Report



Measurement Results:

Calibration Point	Average Standard Reading at each position (°C)				
	CH-1	CH-6	CH-7	CH-9	CH-10
60	60.03	60.06	60.24	60.11	60.18
85	84.79	84.83	85.42	85.05	85.20
95	93.71	93.83	94.62	94.15	94.42

Liquid Bath (Water)			Temperature Distribution				
Setting (°C)	Reading (°C)		Average (°C)	Stability (±°C)	Uniformity (±°C)	Uncertainty (±°C)	Coverage Factor <i>k</i>
	Min , Max	Average					
61.0	60.9 , 61.1	61.0	60.12	0.13	0.19	0.29	2.04
86.0	85.8 , 86.2	86.0	85.06	0.19	0.47	0.44	2.17
95.0	94.6 , 95	94.9	94.15	0.32	0.65	0.55	2.13

* 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. 



Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhohi, 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. T222502

Page 1 of 4

Certificate of Calibration

Equipment : Chamber (Oven)

Manufacturer : Memmert

Model : UF 450

Serial No. : B7170531

Customer Code : BKK_EN0273

ID No. : T8042A4

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

104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,

Khet Suan Luang, Bangkok 10250

Customer Location : Oven Room

Date of Receipt : 23 November 2022

Calibrated By : Sujjar Naknakred (Site Calibration Manager)

Approved By : [Signature] /Boonchai Suriyawong (Site Calibration Manager)

Date of Issue : 09 DEC 2022

REVIEW BY	<u>Sinluk P.</u>
APPROVED BY	<u>KL AL</u>
NEXT CAL. DATE	<u>29/05/24</u>

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.

Certificate No. T222502

Page 2 of 4

Calibration Report

Equipment : Chamber (Oven)
Date of Calibration : 29 November 2022
Environment : Temperature : 29.1-29.6 °C
Line Voltage : 221.3-223.2 V
Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

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

2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
RTD	100 ohm	27-(CH1-10)	T210004	30 December 2022
TC	TYPE T	TN261-TN270	T210010	30 December 2022
DATA LOGGER	34970A	T149	T210004	30 December 2022

3. This certificate is traceable to :

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

4. Condition of calibrated item : good

Equipment Description :

Time Constant 1 Hour 49 Minute At 104 °C
Fresh Air Damper ☒ Open ☐ Min ☐ Medium ☒ Max
☐ Close
☐ Not Available

5. Adjustment :

() without adjustment

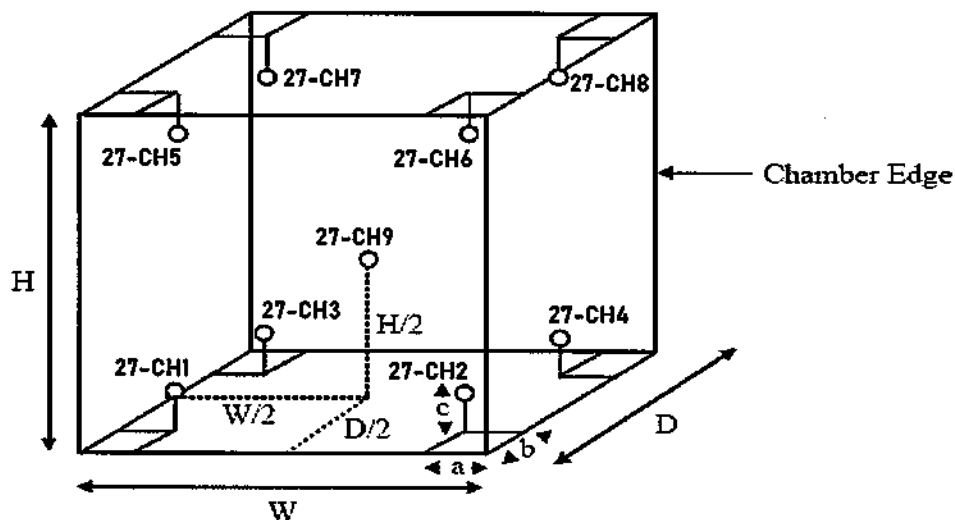
(X) after adjustment

Approved By. Bm Gm

Certificate No. T222502

Page 3 of 4

Calibration Report



Remark :

Internal Dimensions of Chamber : W (Width) = 104 cm. , H (Height) = 72 cm. and D (Depth) = 60 cm.
 Size of Installed Standard sensor number 27-CH1 to number 27-CH8 : a = 5 cm. ,b = 5 cm. and c = 5 cm.
 Size of Installed Standard sensor number 27-CH9 : W/2 = 104 cm./2 , H/2 = 72 cm./2 and D/2 = 60cm./2

Measurement Results

Average Standard Reading at each position (°C)									
Calibration Point	27-CH1	27-CH2	27-CH3	27-CH4	27-CH5	27-CH6	27-CH7	27-CH8	27-CH9
104	104.07	103.60	103.45	104.02	104.47	103.57	104.59	103.78	104.18


Chamber (Oven)			Temperature Distribution				
Setting (°C)	Reading (°C)		Average (°C)	Stability (± °C)	Uniformity (°C)	Uncertainty (± °C)	Coverage Factor k
	Min , Max	Average					
104.0	-	104.0	103.97	0.07	0.70	0.42	2.00

* 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.

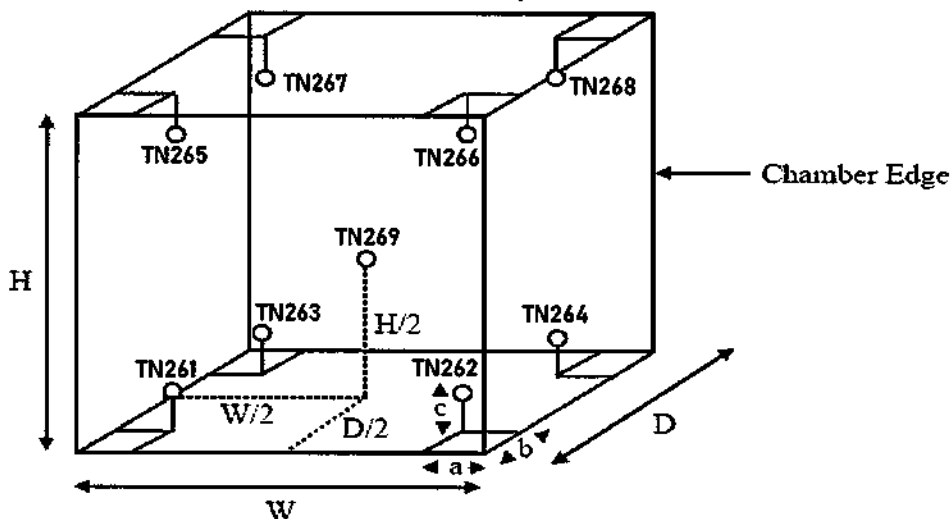
The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor *k* which for a t-distribution, providing a level of confidence of approximately 95 % .

Approved By. 

Certificate No. T222502

Page 4 of 4

Calibration Report



Remark :

Internal Dimensions of Chamber : W (Width) = 104 cm. , H (Height) = 72 cm. and D (Depth) = 60 cm.

Size of Installed Standard sensor number TN261 to number TN268 : a = 5 cm. , b = 5 cm. and c = 5 cm.

Size of Installed Standard sensor number TN269 : W/2 = 104 cm./2 , H/2 = 72 cm./2 and D/2 = 60cm./2

Measurement Results

Calibration Point	Average Standard Reading at each position (°C)								
	TN261	TN262	TN263	TN264	TN265	TN266	TN267	TN268	TN269
180	179.14	179.17	179.65	179.26	180.41	179.64	181.18	180.99	180.36

Chamber (Oven)			Temperature Distribution				
Setting (°C)	Reading (°C)		Average (°C)	Stability (± °C)	Uniformity (°C)	Uncertainty (± °C)	Coverage Factor <i>k</i>
	Min , Max	Average					
180.0	-	180.0	179.98	0.38	1.78	1.10	2.00

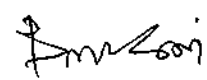
* The quoted uncertainty exclude "uniformity"

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. 



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3 : EQUIPMENT CALIBRATION AND TESTING SERVICES

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

Cert.No.: 22TW178

Page.: 1 of 2

Certificate of Testing

Equipment : DO Meter
Manufacturer : YSI
Model : 5100
Serial No. : 15L103204
ID No. : BKK_EN0205
Received Date : 02 August 2022
Test Date : 03 August 2022
Reference : 2208-0060DSC-1

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

Approved by :

Malee

Approved Signatory

- (☒) Malee Butkruea
(☐) Saithip Meangmai
(☐) Warakorn Lergagtrakul

Issue Date : 4 August 2022

REVIEW BY	<i>Siriluk P.</i>
APPROVED BY	<i>KL AL</i>
NEXT CAL. DATE	<i>03/02/24</i>



Cert.No.: 22TW178

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).

<u>Instruments</u>	<u>Serial No.</u>	<u>ID No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1) Burette	-	130BU10	21CG1389	25 Mar 2023
2) Balance	1126143764	140RC004	21MM430	21 Sep 2022

2. Standard Material :-

<u>Material</u>	<u>Manufacturer</u>	<u>Lot.No.</u>	<u>Assay</u>
Sodium Thiosulfate pentahydrate	Merck	AM1763316	100.2%

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

Dissolved Oxygen Probe No.: 17A100064

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.06	8.07	0.0045

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

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



Cert. No.: 22LM107

Page.: 1 of 2

Certificate of Calibration

Equipment : DO Meter with Sensor

Manufacturer : YSI

Model : 5100

Serial No. : 15L103204

ID No. : BKK_EN0205

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

Location : TPA On Site Calibration Laboratory

Received Order : 2 August 2022

Calibrated Date : 4 August 2022

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 30) %

AC Line Voltage : (220 ± 22) V

Calibrated by : Man Pattanapongpaiboon

Approved by : Malee Butkruea
Approved Signatory

() Pornthippa Tameyakul
☒ Malee Butkruea
() Suwit Imjai

Issue Date : 9 August 2022

The Uncertainties are for a confidence probability of approximately 95%

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

A 0044131



Equipment : DO Meter with Sensor
Condition As-Received : Used Item
Reference : 2208-0060DSC-2

Cert. No.: 22LM107

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:-

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
1) Digital Thermometer	1502A	A52847	21I1144	20 Oct 2022

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

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

Result of Calibration :- (*) Without Adjustment

Function : Temperature measurement.

This instrument was connected with temperature sensor, S/N.: 18C100772

<u>Calibration Point</u> (°C)	<u>Immersion Depth</u> (mm)	<u>Standard Temperature</u> (°C)	<u>UUC* Reading</u> (°C)	<u>Error</u> (°C)	<u>Uncertainty</u> (± °C)	<u>Coverage Factor</u> <i>k</i>
20.00	60	20.002	19.93	-0.072	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 %.

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a 1120698



Metrological Center

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. T231342

Page 1 of 4

Certificate of Calibration

Equipment : Chamber (Incubator)

Manufacturer : MEMMERT

Model : ICP 750

Serial No. : F818.0033

Customer Code : BKK_EN0272

ID No. : T8041A4

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

104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,

Khet Suan Luang, Bangkok 10250

Customer Location : Wet Chemistry Lab 2

Date of Receipt : 3 July 2023

Calibrated By : Sujjar Naknakred (Site Calibration Manager)

Approved By : Boonchai / Boonchai Suriyawong (Assistant Calibration Manager)

Date of Issue : 11 JUL 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.

Certificate No. T231342

Page 2 of 4

Calibration Report

Equipment : Chamber (Incubator)
Date of Calibration : 5-6 July 2023 (Finished Time 4:30 PM)
Environment : Temperature 26.9-30.3 °C
Line Voltage 221.7-225.5 V

Condition of this results of test. :

1. This instrument was calibrated by insert 12 standard resistance thermometer into its chamber and test according to WI-T20 (based on ASTM E145-94 (Reapproved 2001) and AS2853-1986.)

All data show below were final values and the initial data may be obtained upon request.

The temperature scale used was based on ITS - 90.

2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
RTD	100 ohm	27-(CH1-10)	T230543	10 April 2024
RTD	100 ohm	28-(CH1-10)	T230543	10 April 2024
DATA LOGGER	34970A	T149	T230543	10 April 2024

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

UUC Description :

Time Constant 6 Hour 35 Minute At 20 °C
Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max
☐ Close
☒ Not Available

5. Result of test :

() without adjustment

(X) after adjustment

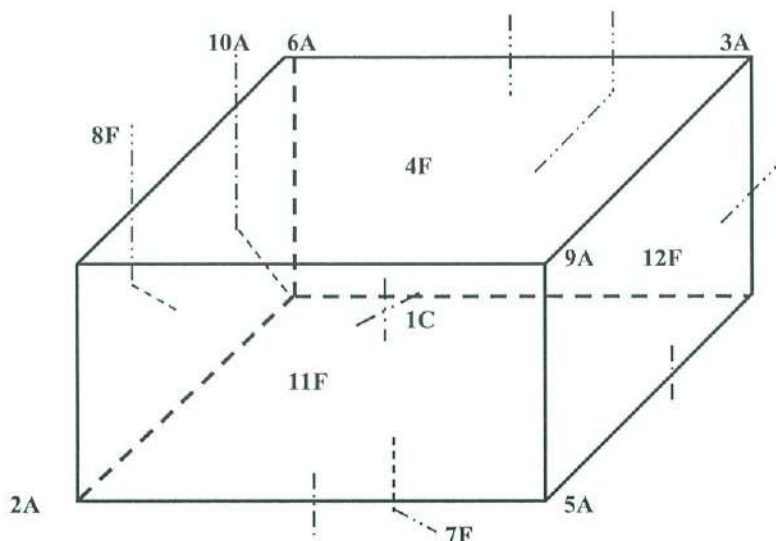
Approved By _____



Certificate No T231342

Calibration Report

Page 3 of 4



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

1C	=	27-CH1
2A	=	27-CH2
3A	=	27-CH3
4F	=	27-CH4
5A	=	27-CH5
6A	=	27-CH6
7F	=	27-CH7
8F	=	27-CH8
9A	=	27-CH9
10A	=	27-CH10

11F	=	28-CH1
12F	=	28-CH2

Approved By. 

Certificate No. T231342

Calibration Report

Page 4 of 4

Measurement Results

Calibration Point	Average Standard Reading at each position (°C)									
	27-CH1	27-CH2	27-CH3	27-CH4	27-CH5	27-CH6	27-CH7	27-CH8	27-CH9	27-CH10
20.0	19.82	19.80	20.32	19.78	19.77	19.65	20.11	19.69	19.78	20.18
	28-CH1	28-CH2								
	20.02	19.81								

Chamber (Incubator)			Temperature Distribution				
Setting (°C)	Reading (°C)		Average (°C)	Stability (±°C)	Uniformity (°C)	Uncertainty (±°C)	Coverage Factor k
	Min , Max	Average					
20.0	19.9 , 20.1	20.0	19.98	0.06	0.61	0.38	2.00

* 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. 

HACH COMPANY

C/O AB Sciex (Thailand) Limited, Building D Room No. D3 11, 3rd Floor, No. 735/4, Srinakarin Road, Pattanakarn, Suanluang, Bangkok
 | Phone +66 (02) 026-3529 Ext. 0 | Fax +66(02) 026-3572 | www.sea.hach.com

LABX 2300073

Test Report

Customers	:	ALS Laboratory Group (Thailand) Co., Ltd.			
Equipment	:	Chlorine Meter	Manufacturer	:	HACH
Controller Model	:	DR300	Sensor Model	:	-
Controller Serial No.	:	20110B004053	Sensor Serial No.	:	BKK LG0043
Date of test	:	19/01/2023	Period	:	1 Year
Environment temperature	:	25.0 °C	Humidity	:	60.0 %RH

ResultsInstrument Checked

Item	Characteristic	Before	After	Remark
1	Visual Inspect	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail	
2	Power Supply (4.5 – 6.0 VDC)	6.0 VDC	6.0 VDC	
3	Display Check	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail	
4	Keyboard Check	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail	
5	Function System Program	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail	

Warning and Error Checked

Item	Event	Before	After
6	Error list	<input checked="" type="checkbox"/> None <input type="checkbox"/> Appear _____	<input checked="" type="checkbox"/> None <input type="checkbox"/> Appear _____

Check with Standard

Item	Characteristic	Before	After	Remark
	DPD-CHLORINE-LR			
7	Blank (0.00 mg/l)	0.00 mg/l	0.00 mg/l	
8	Standard Cl2 No. 1 (0.23 ± 0.09 mg/l)	0.22 mg/l	0.23 mg/l	
9	Standard Cl2 No. 2 (0.89 ± 0.10 mg/l)	0.87 mg/l	0.88 mg/l	
10	Standard Cl2 No. 3 (1.64 ± 0.14 mg/l)	1.63 mg/l	1.64 mg/l	
	DPD-CHLORINE-HR			
11	Blank (0.0 mg/l)	0.0 mg/l	0.0 mg/l	
12	Standard Cl2 No. 1 (2.2 ± 0.2 mg/l)	2.2 mg/l	2.2 mg/l	
13	Standard Cl2 No. 2 (3.9 ± 0.3 mg/l)	3.9 mg/l	3.9 mg/l	
14	Standard Cl2 No. 3 (6.9 ± 0.6 mg/l)	6.9 mg/l	6.9 mg/l	

REVIEW BY Chayathorn P.

APPROVED BY Amakorn P.

NEXT CAL. DATE 19/01/24



HACH COMPANY

C/O AB Sciex (Thailand) Limited, Building D Room No. D3 11, 3rd Floor, No. 735/4, Srinakarin Road, Pattanakarn, Suanluang, Bangkok
| Phone +66 (02) 026-3529 Ext. 0 | Fax +66(02) 026-3572 | www.sea.hach.com

LABX 2300073

Summary of checked

- ☒ The instrument can work normally and efficiently. (เครื่องมือวัดสามารถทำงานได้ปกติและมีประสิทธิภาพ)
☐ The instrument can work but it's requiring to maintenance. (เครื่องมือวัดสามารถทำงานได้แต่ต้องบำรุงรักษา)
☐ The instrument could not work it's requiring to repair. (เครื่องมือวัดไม่สามารถทำงานได้และต้องการซ่อมบำรุง)

Remark:

Standard Equipment Used

Equipment	Equipment I.D.	
Standard Chlorine DPD-CHLORINE-LR	Lot No. A2131	Exp date : May-24
Standard Chlorine DPD-CHLORINE-HR	Lot No. A1019	Exp date : Jan-23
Digital multi meter	S/N : 97270010	Due date : 23-Jun-23
Thermo hygrometer	S/N : 41413945	Due date : 17-Aug-23

Test By :

WILAILAK S.

(Miss Wilailak Sawangpun)

Service Engineer

Approved by :



Position

S. Suanun

(Mr. Suanun Sartyangkool)

Assistant Service Division Manager





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



Cert.No.: 22CG3154

Page.: 1 of 2

Certificate of Calibration

Equipment :	Burette
Capacity :	50 mL
Serial No. :	-
ID. No. :	BKK_EN0171
Manufacturer :	Witeg
Made in :	Germany
Submitted by :	ALS Laboratory Group (Thailand) Co.,Ltd. 104 Phatthanakan 40, Phatthanakan Rd. Khwaeng Phatthanakan, Khet Suan Luang Bangkok 10250 Thailand
Ambient Temperature :	(20 ± 2.5) °C
Relative Humidity :	(50 ± 10) %
Barometric Pressure :	759 mmHg
Calibration Procedure :	ASTM E 542 - 01
Calibrated by :	Panward Pramklam

REVIEW BY	<u>Sinluk P.</u>
APPROVED BY	<u>KLAL</u>
NEXT CAL. DATE	<u>29/03/2024</u>

Approved by :

Approved Signatory

- () Pornthippa Tameyakul
() Malee Butkruea
(☒) Ponpan Paipim
() Srisuda Khamtha

Issue Date :

31 August 2022

The Uncertainties are for a confidence probability of approximately 95%

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

A 0044607



Equipment : Burette
Received Date : 26 August 2022
Condition As-Received : Used Item
Calibration Date : 30 August 2022
Reference : 2208-0918DSC-2

Cert.No.: 22CG3154

Page.: 2 of 2

Condition of this result of calibration

1. Reference Standard Instruments :

<u>Instruments</u>	<u>Model</u>	<u>Serial No.</u>	<u>ID. No.</u>	<u>Certificate No.</u>	<u>Traceability</u>	<u>Due date</u>
1) Balance	AE200S	N03679	140RC001	21MM429	NIMT	22 Sep 2022
2) Thermo-Hygrograph	THDX-CE	00016540	140EC001	22H1243	NIST,NIMT	09 June 2023
3) Thermometer	-	1594592	140EC010	22I181	NIMT	10 Feb 2023

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 (\pm mL)	k Factor
50	49.9959	0.010	2.00

Remark mL = cm³

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

-o0o-

a 1123908



Metrological Center

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.co.th



Certificate No. T221644

Page 1 of 4

Certificate of Calibration

Equipment : Chamber (Cold Room)

Manufacturer : KOLDTECH

Model : KM 320

Serial No. : TBN-1012061/05

Customer Code : BKK_EN0167

ID No. : T2463A3

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

104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,

Khet Suan Luang, Bangkok 10250

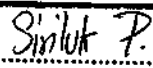
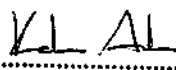
Customer Location : Environmental Laboratory

Date of Receipt : 27 June 2022

Calibrated By : Sujjar Naknakred (Site Calibration Manager)

Approved By :  / Boonchai Suriyawong (Site Calibration Manager)

Date of Issue : 04 JUL 2022

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

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

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.

Certificate No. T221644

Page 2 of 4

Calibration Report

Equipment : Chamber (Cold Room)
Date of Calibration : 30 June - 1 July 2022
Environment : Temperature : 18.9-23.7 °C
Line Voltage : 222.9-226.5 V
Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

1. This equipment was calibrated by insert nine standard thermocouples type T into its chamber , the other one standard thermocouples type T use for ambient temperature measurement . The calibration was done in according to WI-T20 (based on ASTM E145-94 (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	T210009	30 July 2022
TC	TYPE T	TN171-TN180	T210009	30 July 2022
DATA LOGGER	34970A	T149	T210009	30 July 2022

3. This certificate is traceable to :

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

4. Condition of calibrated item : good

Equipment Description :

Time Constant 3 Hour - Minute At 3 °C
Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max
☐ Close
☒ Not Available

5. Adjustment :

() without adjustment

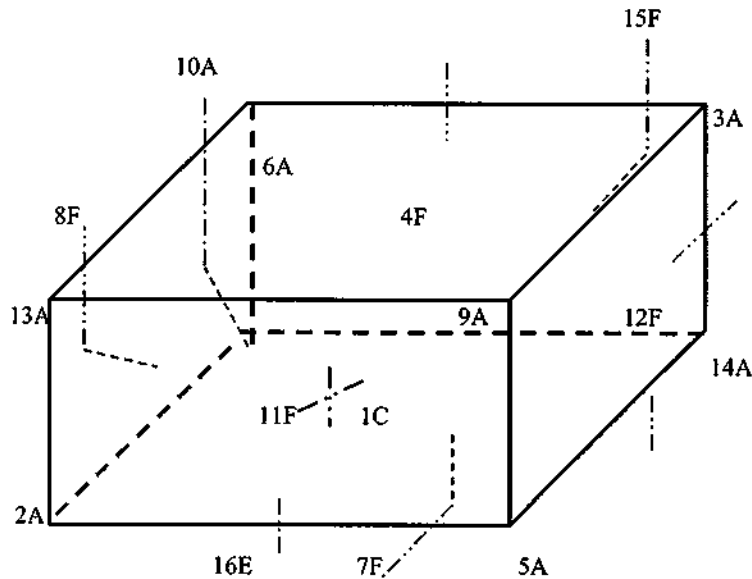
(X) after adjustment

Approved By. 

Certificate No. T221644

Page 3 of 4

Calibration Report



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

1C	=	TN161
2A	=	TN162
3A	=	TN163
4F	=	TN164
5A	=	TN165
6A	=	TN166
7F	=	TN167
8F	=	TN168
9A	=	TN169
10A	=	TN170

11F	=	TN171
12F	=	TN172
13A	=	TN173
14A	=	TN174
15F	=	TN175
16E	=	TN176

Approved By. 

Certificate No. T221644

Page 4 of 4

Calibration Report

Measurement Results:

Average Standard Reading at each position (°C)										
Calibration Point	TN161	TN162	TN163	TN164	TN165	TN166	TN167	TN168	TN169	TN170
3	2.71	2.82	2.75	2.89	2.95	3.68	3.02	2.96	3.03	2.85
	TN171	TN172	TN173	TN174	TN175	TN176				
	2.97	3.02	2.89	3.04	2.97	3.33				

Chamber (Cold Room)			Temperature Distribution				
Setting (°C)	Reading (°C)		Average (°C)	Stability (± °C)	Uniformity (°C)	Uncertainty (± °C)	Coverage
	Min , Max	Average					Factor <i>k</i>
3.0	2.9 , 4.0	3.2	2.99	1.05	1.30	1.66	2.00

* 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 



Agilent Technologies

Agilent Technologies (Thailand) Limited
U CHU LIANG BLDG. 22/F UNIT A,D
968 RAMA 4 ROAD, SILOM, BANGRAK
Bangkok 10500 Thailand

Tel: +662 637 6363
Fax: +662 632 4334
Email: ccc-smt@agilent.com
Website: www.agilent.com/chem

Customer Contact:

ALS Laboratory Group (Thailand) Co
Ltd
Head Office
104 Phatthanakan 40 Phatthanakan Rd
Khwaeng Phatthanakan Khet Suan
TAX ID : 0105540004859
Chanattagarn.lmchom@alsglobal.com
27603068

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:	Customer Number: 70371013
Service Request:	Service Request Date:
Service Order: 6006033911	Service Confirmation: 6904800024

REVIEW BY	Thitima B.
APPROVED BY	Samut M.
NEXT CAL DATE	14 Sep 2024

Direct Inquiries to:

Contact Name:	Customer Contact Center
Contact E-mail:	ccc-smt@agilent.com
Contact Telephone:	+662 637 6363
Contact Fax:	+662 632 4334

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Bangkok 10500 Thailand
Tax ID : 0105542068218

Citibank N.A. Bangkok Branch
399 Interchange 21 Building, Sukhumvit Road, Klongtoey Nau
Sub-district, Wattana District, Bangkok 10110 Thailand
Acc. No: 012-4452-007 ,
THB:Krung Thai Bank PCL
Siam Square Br.,416/1-2 Rama I Rd.,Pathumwan, BKK 10330
Thailand

ORIGINAL

Service Confirmation Number: 8904800024

Service Confirmation Date: 20.03.2023

Service Instrument:

Model Number	Model Description	Serial Number	System Handle	Parent Asset
SYS-IO-5100	ICP-OES 5100/5110 System			
G8010A	Agilent 5100 SVDV ICP-OES Spectrometer	MY16010005	ICP OES 5100	SYS-IO-5100
G8410A	SPS 4 Autosampler	AU15440764	ICP OES 5100	SYS-IO-5100

Service Items:

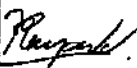

Item	Service/Part #	Description	Qty	Entitlement	Service Start	Service End
1000	EOQ	Enterprise Operational Qualification	1.00	Agreement Entitlement - 100 % covered	20.03.2023	20.03.2023

Additional Information:

Service Confirmation Number: 8904800024

Service Confirmation Date: 20.03.2023

Service Information:

Problem Description: WU-S-QQ-ID-5100-5001143313		
Service Provided: Complete OQHW 5100ICPOES Equipment ID: BKK_EL0037, all tests passed		
Service Overview Code: Reason Code: Scheduled Service Diagnosis Code: Scheduled Service Resolution Code: Scheduled Service		
Reported Hours: 4.0	Travel Hours: 2.0	
Customer Field Service Representative Name: Kanyakorn Sukpathrajarern	Customer Field Service Representative Signature: 	Date: 20 Mar 2023
Customer Name: Thitima Boonpeng	Customer Signature: 	Date: 20 Mar 2023
Additional Comments:		



Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 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 : Sanee Musikawan (Site Calibration Manager)

Approved By :  / Sujjar Naknakred (Site Calibration Manager)

Date of Issue : 26 SEP 2023

REVIEW BY	Tattaporn C.
APPROVED BY	Sauwita N.
NEXT CAL. DATE	22/03/25

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.

Certificate No. T231676

Page 2 of 6

Calibration Report

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

Condition of this results of calibration :

1. This equipment was calibrated by insert 20 standard thermocouples type T into its chamber , the other one standard thermocouples type T use for ambient temperature measurement . The calibration was done in according to WI-T20.

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

2. Reference Standard Instrument :

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

3. This certificate is traceable to :

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

4. Condition of calibrated item : good

Equipment Description :

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

5. Adjustment :

() without adjustment

(X) after adjustment

Approved By _____





Metrological Center

SCI ECO Services Company Limited

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

Telephone : +66 2 586 5792-4 Fax : +66 2 586 5109

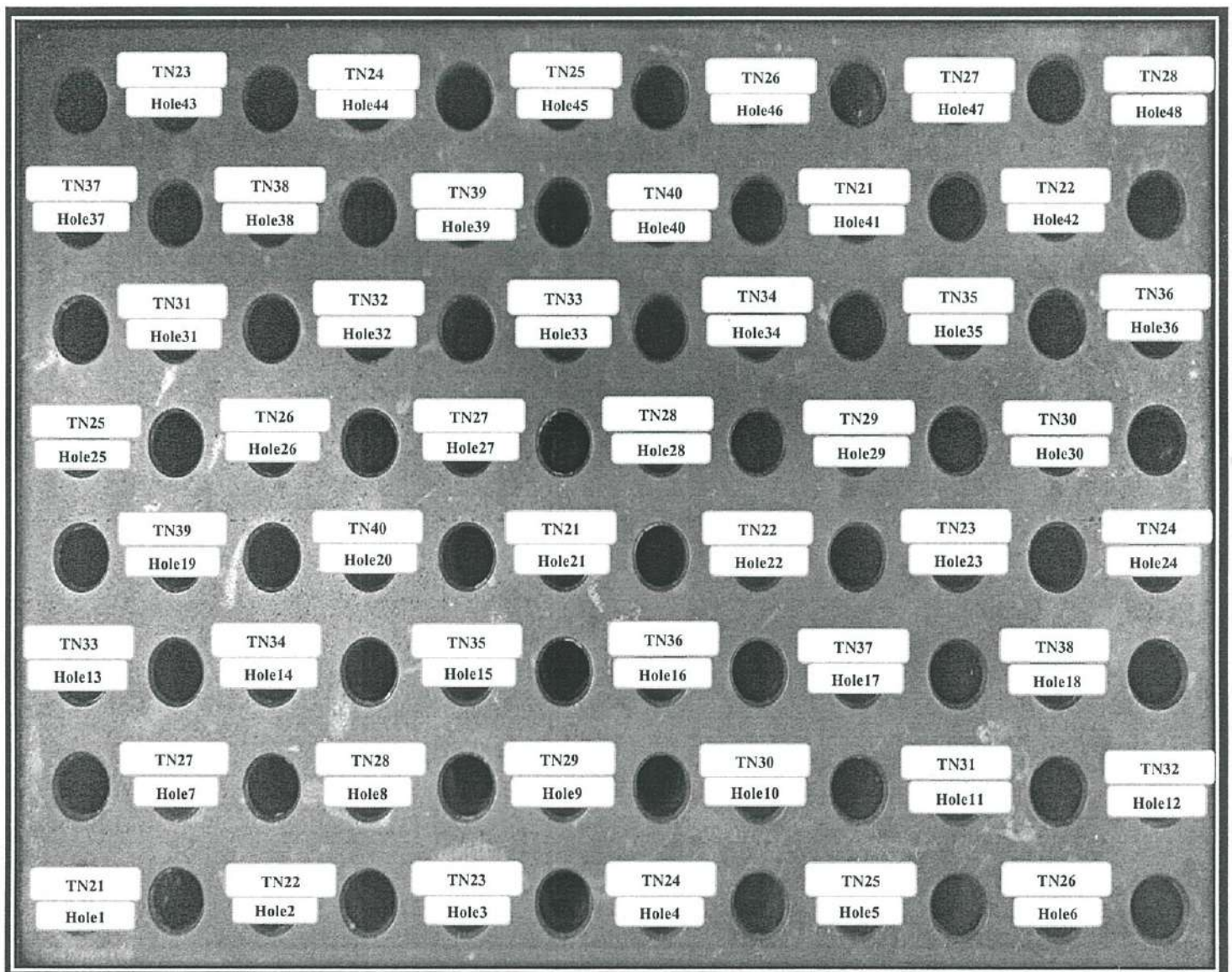
Website : www.scieco.co.th

E-Mail : calibrate@scg.co.th

Certificate No. T231676

Page 3 of 6

Calibration Report



FRONT CONTROL

Approved By. _____

Certificate No T231676

Page 4 of 6

Calibration Report

Measurement Results

Calibration Point		Average Standard Reading at each position (° C)					
R1 Hole1-Hole6		TN21	TN22	TN23	TN24	TN25	TN26
CAL POINT	Max	95.01	94.41	95.20	95.41	94.51	95.17
95	Min	94.57	93.95	94.75	94.92	94.00	94.72
	Average	94.79	94.18	94.98	95.17	94.26	94.95
R2 Hole7-Hole12		TN27	TN28	TN29	TN30	TN31	TN32
	Max	95.36	95.43	95.19	95.16	95.35	94.97
	Min	94.94	94.95	94.72	94.71	94.90	94.57
	Average	95.15	95.19	94.96	94.94	95.13	94.77
R3 Hole13-Hole18		TN33	TN34	TN35	TN36	TN37	TN38
	Max	95.37	95.50	95.22	95.21	95.33	95.31
	Min	94.99	95.09	94.78	94.82	94.88	94.96
	Average	95.18	95.30	95.00	95.02	95.11	95.13
R4 Hole19-Hole24		TN39	TN40	TN21	TN22	TN23	TN24
	Max	95.59	94.42	94.52	94.24	94.63	94.67
	Min	95.21	94.06	94.13	93.88	94.28	94.27
	Average	95.40	94.24	94.33	94.06	94.45	94.47
R5 Hole25-Hole30		TN25	TN26	TN27	TN28	TN29	TN30
	Max	95.19	95.38	92.93	95.30	95.14	95.03
	Min	94.83	95.03	92.56	94.95	94.79	94.70
	Average	95.01	95.20	92.75	95.12	94.96	94.87
R6 Hole31-Hole36		TN31	TN32	TN33	TN34	TN35	TN36
	Max	94.63	94.90	94.77	94.31	94.24	93.87
	Min	94.24	94.55	94.44	93.98	93.92	93.56
	Average	94.43	94.72	94.60	94.14	94.08	93.71
R7 Hole37-Hole42		TN37	TN38	TN39	TN40	TN21	TN22
	Max	94.30	94.44	94.04	93.81	94.89	95.35
	Min	93.95	94.05	93.67	93.48	94.39	94.90
	Average	94.13	94.24	93.86	93.65	94.64	95.12
R8 Hole43-Hole48		TN23	TN24	TN25	TN26	TN27	TN28
	Max	95.99	95.63	95.28	95.29	95.45	94.87
	Min	95.57	95.15	94.82	94.84	94.99	94.48
	Average	95.78	95.39	95.05	95.07	95.22	94.68

Approved By. _____



Certificate No T231676

Page 5 of 6

Calibration Report

Measurement Results

Calibration Point		Average Standard Reading at each position (° C)					
R1 Hole1-Hole6		TN21	TN22	TN23	TN24	TN25	TN26
CAL POINT	Max	105.23	104.32	105.43	105.25	104.44	105.27
105	Min	104.94	103.95	105.15	105.04	104.11	104.96
	Average	105.09	104.13	105.29	105.15	104.28	105.12
R2 Hole7-Hole12		TN27	TN28	TN29	TN30	TN31	TN32
	Max	105.30	105.12	105.18	105.22	105.12	105.16
	Min	105.11	104.92	104.96	105.00	104.92	104.97
	Average	105.20	105.02	105.07	105.11	105.02	105.06
R3 Hole13-Hole18		TN33	TN34	TN35	TN36	TN37	TN38
	Max	105.37	105.63	105.02	104.80	104.69	105.19
	Min	105.17	105.37	104.75	104.59	104.50	105.00
	Average	105.27	105.50	104.88	104.69	104.60	105.09
R4 Hole19-Hole24		TN39	TN40	TN21	TN22	TN23	TN24
	Max	105.31	104.43	106.41	104.71	105.63	105.82
	Min	105.08	104.22	106.15	104.41	105.37	105.56
	Average	105.19	104.33	106.28	104.56	105.50	105.69
R5 Hole25-Hole30		TN25	TN26	TN27	TN28	TN29	TN30
	Max	104.95	106.26	103.34	105.78	105.59	105.87
	Min	104.67	105.96	103.08	105.56	105.36	105.68
	Average	104.81	106.11	103.21	105.67	105.48	105.77
R6 Hole31-Hole36		TN31	TN32	TN33	TN34	TN35	TN36
	Max	104.75	104.86	104.80	105.20	104.50	104.39
	Min	104.54	104.63	104.59	105.00	104.32	104.18
	Average	104.65	104.75	104.69	105.10	104.41	104.28
R7 Hole37-Hole42		TN37	TN38	TN39	TN40	TN21	TN22
	Max	104.30	104.90	104.85	104.65	104.88	104.85
	Min	104.09	104.72	104.66	104.49	104.63	104.52
	Average	104.19	104.81	104.75	104.57	104.76	104.68
R8 Hole43-Hole48		TN23	TN24	TN25	TN26	TN27	TN28
	Max	105.71	105.85	105.39	105.61	105.42	105.19
	Min	105.45	105.61	105.14	105.27	105.18	104.94
	Average	105.58	105.73	105.27	105.44	105.30	105.07

Approved By. _____



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. _____

REVIEW BY

Mont Somb

APPROVED BY

KL AL

NEXT CAL. DATE

21/12/23

Certificate of System Qualification

GC-OQ + GCMS-OQ

System ID: GM-7
Organization Name: ALS Laboratory Group (Thailand) Co., Ltd.
Organization Location: 104 Patthanakarn 40, Patthanakarn rd., Khwang Suan Luang, Khet Suan Luang, Bangkok 10250
Date: June 21, 2022 2:04:12 PM
EQP Name: AgilentRecommended , AgilentRecommended
EQP Revision: GC.02.50, GCMS.02.50
Overall Qualification Status: Pass

System Inspection and Basic Safety and Operation

Name: 7890

Setpoint Status: Pass

Overall System Inspection and Basic Safety and Operation Test Status

Pass

Inlet Pressure Accuracy

Name: 7890

Front SSL

Setpoint Status: Pass

	Setpoint	Actual
Inlet Pressure:	25.0 psi	25.0 psi
Accuracy:		0.0 psi
Agilent Recommended:	<=	1.2

Overall Inlet Pressure Accuracy Test Status

Pass

GC Oven Temperature Accuracy

Name: 7890

Date: June 21, 2022 2:04:12 PM
System ID: GM-7

Setpoint Status:

Pass

Zone:

Oven

Setpoint/Actual

Temperature:

230.0 230.0 °C

Accuracy:

0.0 °C

Agilent Recommended:

>=	-1.0	% setpoint in K	(-5.0	°C)
<=	1.0	% setpoint in K	(5.0	°C)

Setpoint Status:

Pass

Zone:

Oven

Setpoint/Actual

Temperature:

100.0 100.4 °C

Accuracy:

0.4 °C

Agilent Recommended:

>=	-1.0	% setpoint in K	(-3.7	°C)
<=	1.0	% setpoint in K	(3.7	°C)

Overall GC Oven Temperature Accuracy Test Status

Pass

GC Oven Temperature Stability

Name:

7890

Setpoint Status:

Pass

Setpoint/Average

Temperature:

100.0 100.0333 °C

Stability:

0.1 °C

Agilent Recommended:

<= 0.5

Overall GC Oven Temperature Stability Test Status

Pass

Log Amp

Tested Combination1

Front

SSL

/ External

SQ

Name:

5977A

Setpoint Status:

Pass

Date:

June 21, 2022 2:04:12 PM

System ID:

GM-7

Overall Log Amp Test Status

Pass

RFPA

Tested Combination1

Front

SSL

/ External

SQ

Name:

5977A

Setpoint Status:

Pass

Amu:

1050

m/z

Drift After Five Minutes:

22

mV

RFPA Voltage:

568

mV

Agilent Recommended:

>=

-100

and

<=

100

<=

1100

Overall RFPA Test Status

Pass

Tune EI

Tested Combination1

Front

SSL

/ External

SQ

Name:

5977A

Setpoint Status:

Pass

Filament:

1

Setpoint Status:

Pass

Filament:

2

Overall Tune EI Test Status

Pass

Signal to Noise EI

Tested Combination1

Front

SSL

/ External

SQ

Name:

5977A

Date:

June 21, 2022 2:04:12 PM

System ID:

GM-7

Source: Filament:

Setpoint Status:

Signal to Noise:

Agilent Recommended:

Source: Filament:

Setpoint Status:

Signal to Noise:

Agilent Recommended:

This test's 0 comment(s) and 1 deviation(s) are available in the Attachments section.

Overall Signal to Noise EI Test Status

Instrument Details

Purpose

This section describes the as found system configuration.

Details

System

System ID	GM-7
Manufacturer	Agilent Technologies
Name	7890

Tested Combination1

Injection Technique	Manual Injection
Inlet	Front
Detector	External
LTM Included?	No

Sampler 1

Manufacturer	Agilent Technologies
Type	Manual Injection
Usage	Sample Injection
Syringe Volume (µL)	10

Mainframe 1

Manufacturer	Agilent Technologies
Name	7890
Model Number	G3442B
Serial Number	CN14133181
Firmware Revision	B.02.03
Oven Type	Standard

Inlet 1

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

Detector 1

Manufacturer	Agilent Technologies
Name	Mass Spectrometer
Type	Mass Spectrometer
Location	External

Mass Spectrometer 1

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

MS EI Source 1

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

Electronic Signature

Purpose

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

Details

Full Name of Signer:	Supasak Nimsongtham
Logged On User Name:	supasak.nimsongtham@agilent.com
Signature Creation Date:	June 21, 2022
Reason for Signature:	Executed protocol and published this original version of document

Regulatory Disclaimer

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

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Date:	June 21, 2022 2:04:12 PM
System ID:	GM-7

User Name: supasak.nimsongtham
 Hostname: 5CG1115HKC

System Id: GM-7
 Print Date: June 21, 2022 2:04:17 PM

ALS-GM7-2022 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
June 21, 2022 10:25:05 AM	Audit	SessionCreated	Session	None
June 21, 2022 10:25:05 AM	Start	Configuration	Session	None
June 21, 2022 10:25:05 AM	Audit	Entitlement	Licensing	User is FieldEngineer and does not require an unlock code
June 21, 2022 10:25:26 AM	Audit	EqpLoaded	Session	EQP details for primary technique [Gc] - File path: [ProtocolPacks/Gc/Configurations/02.50/Gc.02.50.eqp], EQP File Name: [Gc.02.50.eqp], EQP Name: [AgilentRecommended] EQP details for hyphenated technique [GcMs] - File path: [ProtocolPacks/GcMs/Configurations/02.50/GcMs.02.50.eqp], EQP File Name: [GcMs.02.50.eqp], EQP Name: [AgilentRecommended]
June 21, 2022 10:25:39 AM	End	Configuration	Session	None
June 21, 2022 10:25:43 AM	Start	Qualification	Session	OQ
June 21, 2022 10:25:43 AM	Start	Execution	System Inspection and Basic Safety and Operation - 7890: - Qualitative Test - No setpoints associated	None
June 21, 2022 10:25:54 AM	End	Execution	System Inspection and Basic Safety and Operation - 7890: - Qualitative Test - No setpoints associated	Run Count : 1

User Name: supasak.nimsongtham
 Hostname: 5CG1115HKC

System Id: GM-7
 Print Date: June 21, 2022 2:04:17 PM

ALS-GM7-2022 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
June 21, 2022 10:26:00 AM	Start	Execution	Inlet Pressure Accuracy - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	None
June 21, 2022 10:26:10 AM	End	Execution	Inlet Pressure Accuracy - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	Run Count : 1
June 21, 2022 10:26:12 AM	Start	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
June 21, 2022 10:34:09 AM	Audit	Data	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry
June 21, 2022 10:34:10 AM	End	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Run Count : 1
June 21, 2022 10:34:11 AM	Start	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
June 21, 2022 10:38:42 AM	Audit	Data	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry
June 21, 2022 10:38:44 AM	End	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Run Count : 1
June 21, 2022 10:38:46 AM	Start	Execution	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	None

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Date: June 21, 2022 2:04:12 PM
 System ID: GM-7

User Name: supasak.nimsongtham
 Hostname: 5CG1115HKC

System Id: GM-7
 Print Date: June 21, 2022 2:04:17 PM

ALS-GM7-2022 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
June 21, 2022 11:01:00 AM	Audit	AceClosed	Session	None
June 21, 2022 11:01:47 AM	Audit	AceRestarted	Session	None
June 21, 2022 11:01:48 AM	Audit	SessionReloaded	Session	None
June 21, 2022 11:01:51 AM	Start	Qualification	Session	QQ
June 21, 2022 11:01:51 AM	Start	Execution	GC Oven Temperature Stability	None
			- 7890: - Temperature : Oven -	
			S: 100.0°C - L: <= 0.5°C	
June 21, 2022 11:03:14 AM	Audit	Data	DataManager	DataManager was in a data verification state but the user chose to start over.
June 21, 2022 11:04:19 AM	Audit	Data	GC Oven Temperature Stability	Manual Data Entry
			- 7890: - Temperature : Oven -	
			S: 100.0°C - L: <= 0.5°C	
June 21, 2022 11:04:22 AM	End	Execution	GC Oven Temperature Stability	Run Count : 1
			- 7890: - Temperature : Oven -	
			S: 100.0°C - L: <= 0.5°C	
June 21, 2022 11:04:24 AM	Start	Execution	Log Amp - 5977A SQ: - Source:	None
			EI - Extractor	
June 21, 2022 11:04:34 AM	End	Execution	Log Amp - 5977A SQ: - Source:	Run Count : 1
			EI - Extractor	
June 21, 2022 11:04:37 AM	Start	Execution	RFP A - 5977A SQ: - Source: EI	None
			- Extractor	
June 21, 2022 11:07:49 AM	End	Execution	RFP A - 5977A SQ: - Source: EI	Run Count : 1
			- Extractor	
June 21, 2022 11:07:52 AM	Start	Execution	Tune EI - 5977A SQ: - Source: -	None
			EI - Extractor Filament 1	
			(Qualitative - No setpoints associated)	

User Name: supasak.nimsongtham
 Hostname: SCG1115HKC

System Id: GM-7
 Print Date: June 21, 2022 2:04:17 PM

ALS-GM7-2022 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
June 21, 2022 11:08:35 AM	End	Execution	Tune EI - 5977A SQ: - Source: - Run Count : 1 EI - Extractor Filament 1 (Qualitative - No setpoints associated)	
June 21, 2022 11:14:59 AM	Start	Execution	Tune EI - 5977A SQ: - Source: - None EI - Extractor Filament 2 (Qualitative - No setpoints associated)	
June 21, 2022 11:16:48 AM	End	Execution	Tune EI - 5977A SQ: - Source: - Run Count : 1 EI - Extractor Filament 2 (Qualitative - No setpoints associated)	
June 21, 2022 11:16:49 AM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	None
June 21, 2022 11:17:05 AM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	None
June 21, 2022 11:17:10 AM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	None
June 21, 2022 11:26:09 AM	Audit	AceClosed	Session	None
June 21, 2022 12:36:20 PM	Audit	AceRestarted	Session	None
June 21, 2022 12:36:22 PM	Audit	SessionReloaded	Session	None
June 21, 2022 12:36:26 PM	Start	Qualification	Session	OQ
June 21, 2022 12:36:26 PM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	None

User Name: supasak.nimsongtham
 Hostname: SCG1115HKC

System Id: GM-7
 Print Date: June 21, 2022 2:04:17 PM

ALS-GM7-2022 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
June 21, 2022 12:37:07 PM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	None
June 21, 2022 12:37:08 PM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	None
June 21, 2022 12:38:54 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	Data files Path : H:\ALSGM7_2022\SNF1_001.D
June 21, 2022 12:39:24 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	Data files Path : H:\ALSGM7_2022\SNF1_001.D
June 21, 2022 12:40:09 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	Data files Path : H:\ALSGM7_2022\SNF1_001.D
June 21, 2022 12:42:04 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	Data files Path : H:\ALSGM7_2022\SNF1_001.D
June 21, 2022 12:42:17 PM	Audit	AceClosed	Session	None
June 21, 2022 12:33:31 PM	Audit	AceRestarted	Session	None
June 21, 2022 12:33:33 PM	Audit	SessionReloaded	Session	None
June 21, 2022 12:33:37 PM	Start	Qualification	Session	OQ
June 21, 2022 12:33:37 PM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	None

User Name: supasak.nimsongtham
 Hostname: 5CG1115HKC

System Id: GM-7
 Print Date: June 21, 2022 2:04:17 PM

ALS-GM7-2022 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
June 21, 2022 12:34:44 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	Data files Path : E:\ALSGM7_2022\SNF1_001.D
June 21, 2022 12:36:26 PM	End	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	Run Count : 1
June 21, 2022 12:37:11 PM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	None
June 21, 2022 12:38:15 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	Data files Path : E:\ALSGM7_2022\SNF2_001.D
June 21, 2022 12:38:30 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	Data files Path : E:\ALSGM7_2022\SNF2_001.D
June 21, 2022 12:38:45 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	Data files Path : E:\ALSGM7_2022\SNF2_001.D
June 21, 2022 12:39:00 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	Data files Path : E:\ALSGM7_2022\SNF2_001.D
June 21, 2022 12:39:14 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	Data files Path : E:\ALSGM7_2022\SNF2_001.D

User Name: supasak.nimsongtham
 Hostname: 5CG1115HKC

System Id: GM-7
 Print Date: June 21, 2022 2:04:17 PM

ALS-GM7-2022 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
June 21, 2022 12:39:45 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	Data files Path : E:\ALSGM7_2022\SNF2_001.D
June 21, 2022 12:40:16 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	Data files Path : E:\ALSGM7_2022\SNF2_001.D
June 21, 2022 12:40:40 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	Data files Path : E:\ALSGM7_2022\SNF2_001.D
June 21, 2022 12:41:09 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	Data files Path : E:\ALSGM7_2022\SNF2_001.D
June 21, 2022 12:41:29 PM	End	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	Run Count : 1
June 21, 2022 12:42:30 PM	Audit	TestUnlocked	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	Deviation filed for Run Count : 1
June 21, 2022 12:42:30 PM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	None
June 21, 2022 12:42:35 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	Data files Path : E:\ALSGM7_2022\SNF2_001.D

User Name: supasak.nimsongtham
Hostname: 5CG1115HKC

System Id: GM-7
Print Date: June 21, 2022 2:04:17 PM

ALS-GM7-2022 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
June 21, 2022 12:42:45 PM	End	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	Run Count : 2
June 21, 2022 12:42:50 PM	End	Qualification	Session	OQ
June 21, 2022 12:42:50 PM	Start	Reporting	Session	None
June 21, 2022 12:45:17 PM	Audit	AceClosed	Session	None
June 21, 2022 1:57:47 PM	Audit	AceRestarted	Session	None
June 21, 2022 1:57:50 PM	Audit	SessionReloaded	Session	None
June 21, 2022 1:57:56 PM	Start	Qualification	Session	OQ
June 21, 2022 2:02:42 PM	Audit	Reporting	Session	Report Generated : Certificate



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



Cert.No.: 23CH756/1

Page.: 1 of 2

Certificate of Calibration

This Certificate was issued to replace to the Certificate No.CH756

Equipment : Conductivity Meter

Manufacturer : Mettler Toledo

Model : Seven2Go S2

Serial No. : C307698815

ID No. : BKK_LG0072

Condition As-Received: Used Item

Received Date : 14 June 2023

Calibration Date : 15 June 2023

Reference : 2306-0430DSC-1

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

Ambient Temperature : $(25 \pm 2.5) ^\circ\text{C}$

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

Calibration Procedure: In -house method :
- CP-CH6 : based on direct measurement by
using certified reference material (CRM)

Calibrated by : Walalak Sirithean

Approved by :


Approved Signatory

- (☒) Malee Butkruea
(☐) Saithip Meangmai
(☐) Warakorn Lerngagtrakul

Issue Date : 28 June 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 0055680



Cert.No.: 23CH756/1

Page.: 2 of 2

Condition of this result of calibration

1. Reference Standard Instrument :-

<u>Instrument</u>	<u>Serial No.</u>	<u>ID No.</u>	<u>Certificate No.</u>	<u>Due date</u>
1) Thermometer	1963878	130RC095	2211140	12 Sep 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 :-

- 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

<u>Conductivity Solution</u>	<u>Manufacturer</u>	<u>Lot No.</u>	<u>Exp. date</u>
1413.0 $\mu\text{S/cm}$	CPA Chem	826595	09 July 2023

- Control Conductivity calibration solution temperature by Water bath (25 ± 0.1) $^{\circ}\text{C}$

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

Calibration results

Function : Conductivity Measurement

(*) After Adjustment at 1413.0 $\mu\text{S/cm}$

Conductivity Electrode Serial No.: 5822439456

Standard Conductivity Solution	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement (\pm)	Coverage factor k
1413.0 $\mu\text{S/cm}$	1481 $\mu\text{S/cm}$	1413 $\mu\text{S/cm}$	9.2 $\mu\text{S/cm}$	2.00

Remark - UUC* = Unit Under Calibration

- Cell constant = 0.554 cm^{-1}

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-

Malu.



Certificate of Calibration

Equipment:	CONDUCTIVITY METER		Certificate No.:	C24230001
Model:	ORION STAR A215		Issued Date:	5 January 2023
Serial No. (or ID.):	X58031		Job No.:	KSPR2216356
Manufacturer:	Thermo Scientific		Page:	1 of 2
Electrode Serial No.	YV1-18416	Model :	ORION 013005MD	Brand : Thermo Scientific
Condition:	In Condition			

Customer: ALS Laboratory Group (Thailand) Co., Ltd.
104 Soi Pattanakarn 40, Pattanakarn Rd.,
Suan Luang, Bangkok 10250 Thailand

Environment Condition:

Temperature	21.6	°C	±	0.2	°C
Humidity	58.0	%RH	±	2.0	%RH

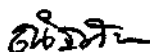
Calibration Place: ALS Laboratory Group (Thailand) Co., Ltd. (Wet Chemistry Lab 2)
104 Soi Pattanakarn 40, Pattanakarn Rd.,
Suan Luang, Bangkok 10250 Thailand

Calibration By: Mr.Nattapat Rungrueang

Calibration Date: 3 January 2023

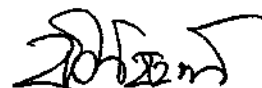
The Method used: In house method, CAL-WI-49, base on ASTM D 1125-14 and D 5391-14

Traceability: This certificate is traceable to the SI Units maintained by CRM of NIST(SRM) through CPA chem Co., Ltd. (ISO/IEC 17034) Certificate No. 838317, 838313, 838315



(Mr. Nattapat Rungrueang)

Person in charge



(Mr. Nitinun Srihawan)

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.

บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด

DKSH Technology Limited

2533 ถนนสุขุมวิท แขวงคลองตันเหนือ เขตวัฒนา กรุงเทพมหานคร 10260

2533 Sukhumvit Road, Bangkok, Phraekhanong, Bangkok 10260

Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

Calibration Results:
Before Adjustment

Standard Conductivity Solution	Unit Under Calibration Reading	Correction	Coverage Factor (k)	Uncertainty (±)
84.000 $\mu\text{S/cm}$	102.4 $\mu\text{S/cm}$	-18.400 $\mu\text{S/cm}$	2.00	0.69 $\mu\text{S/cm}$
1413.0 $\mu\text{S/cm}$	1689 $\mu\text{S/cm}$	-276.0 $\mu\text{S/cm}$	2.00	11 $\mu\text{S/cm}$
12.881 mS/cm	15.42 mS/cm	-2.5390 mS/cm	2.00	0.098 mS/cm

After Adjustment ; at 84.0 $\mu\text{S/cm}$, 1413 $\mu\text{S/cm}$, 12.88 mS/cm

Standard Conductivity Solution	Unit Under Calibration Reading	Correction	Coverage Factor (k)	Uncertainty (±)
84.000 $\mu\text{S/cm}$	84.09 $\mu\text{S/cm}$	-0.090 $\mu\text{S/cm}$	2.00	0.68 $\mu\text{S/cm}$
1413.0 $\mu\text{S/cm}$	1413 $\mu\text{S/cm}$	0.0 $\mu\text{S/cm}$	2.00	11 $\mu\text{S/cm}$
12.881 mS/cm	12.89 mS/cm	-0.0090 mS/cm	2.00	0.098 mS/cm

The End of Certificate

ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: KSPR2216356

ชนิดเครื่องมือ: CONDUCTIVITY METER

รุ่น: ORION STAR A215

หมายเลขเครื่อง: X58031

ตรวจสอบ (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
03 Jan 2023			03 Jan 2023		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
		General			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. ความสมบูรณ์เครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. ความสะอาด (ช่องใส่ตัวอย่าง, ภายใน-นอกเครื่อง)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. สวิทช์ ปิด – เปิด เครื่อง (On-Off Swicth)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. ปุ่มกด (Keypad)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. หน้าจอ (Display, Screen Contrast)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
		Spectrophotometer			
<input type="checkbox"/>	<input type="checkbox"/>	6. แรงดันไฟฟ้า (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 type="checkbox"/>	<input type="checkbox"/>	8. ความยาวคลื่น (Wavelength Check)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	9. แหล่งกำเนิดแสง (UV < 3,000 hour)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	10. แหล่งกำเนิดแสง (Visible < 5,000 hour)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	11. ช่องวัดหลายตัวอย่าง (Carousel Module)	<input type="checkbox"/>	<input type="checkbox"/>	
		pH Meter and Conductivity Meter			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	12. อิเล็กโทรด (Electrode and Connection Cable)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	13. ระดับสารละลายใน Electrode (Level KCl)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	14. ฝาปิดกันปลาย Electrode (Dust Protection Hood)	<input type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	15. ขาจับอิเล็กโทรด (Stand)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
		Turbidimeter			
<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"/>	
		Automatic titrator			
<input type="checkbox"/>	<input type="checkbox"/>	18. สภาพ Piston Burettes	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	19. Function Rinsing and Dosing	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	20. ระบบท่อสายยางและอุปกรณ์ประกอบ	<input type="checkbox"/>	<input type="checkbox"/>	

ข้อเสนอแนะ :

Mr.Nattapat Rungreang

Service Engineer



Certificate of Calibration

Equipment:	CONDUCTIVITY METER		Certificate No.:	C24230001
Model:	ORION STAR A215		Issued Date:	5 January 2023
Serial No. (or ID.):	X58031		Job No.:	KSPR2216356
Manufacturer:	Thermo Scientific		Page:	1 of 2
Electrode Serial No.	YV1-18416	Model :	ORION 013005MD	Brand : Thermo Scientific
Condition:	In Condition			

Customer: ALS Laboratory Group (Thailand) Co., Ltd.
104 Soi Pattanakarn 40, Pattanakarn Rd.,
Suan Luang, Bangkok 10250 Thailand

REVIEW BY
APPROVED BY <u>KL AL</u>
NEXT CAL. DATE

Environment Condition:

Temperature	21.6	°C	±	0.2	°C
Humidity	58.0	%RH	±	2.0	%RH

Calibration Place: ALS Laboratory Group (Thailand) Co., Ltd. (Wet Chemistry Lab 2)
104 Soi Pattanakarn 40, Pattanakarn Rd.,
Suan Luang, Bangkok 10250 Thailand

Calibration By: Mr.Nattapat Rungrueang


Calibration Date: 3 January 2023

The Method used: In house method, CAL-WI-49, base on ASTM D 1125-14 and D 5391-14

Traceability: This certificate is traceable to the SI Units maintained by CRM of NIST(SRM) through CPA chem Co., Ltd. (ISO/IEC 17034) Certificate No. 838317, 838313, 838315


(Mr. Nattapat Rungrueang)

Person in charge


(Mr. Nitinun Srihawan)
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).

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บริษัท ดีเคเอส อีเซีย จำกัด

DKSH Technology Limited

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The End of Certificate

ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: KSPR2216356

ชนิดเครื่องมือ: CONDUCTIVITY METER

รุ่น: ORION STAR A215

หมายเลขเครื่อง: X58031

ตรวจสอบ (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
03 Jan 2023			03 Jan 2023		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
		General			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. ความสมบูรณ์เครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. ความสะอาด (ช่องใส่ตัวอย่าง, ภายใน-นอกเครื่อง)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. สวิทช์ ปิด – เปิด เครื่อง (On-Off Swicth)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
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<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. หน้าจอ (Display, Screen Contrast)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
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<input type="checkbox"/>	<input type="checkbox"/>	20. ระบบท่อสายยางและอุปกรณ์ประกอบ	<input type="checkbox"/>	<input type="checkbox"/>	

ข้อแนะนำ :

Mr.Nattapat Rungrueang
Service Engineer

ภาคผนวก จ

สำเนาหนังสืออนุญาตขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

ที่ อก ๐๓๑๐(๑)/ ๑๐๖๙



กรมโรงงานอุตสาหกรรม
ถนนพระรามที่ ๖ เขตราชเทวี
กรุงเทพมหานคร ๑๐๔๐๐

๒๘ มกราคม ๒๕๖๕

เรื่อง ต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

เรียน กรรมการผู้จัดการ บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน
ลงวันที่ ๓๐ กรกฎาคม ๒๕๖๓

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

ตามหนังสือที่อ้างถึง บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด ขอต่ออายุ
หนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ว-๒๐๕ สถานที่ตั้งเลขที่ ๑๐๔
ซอยพัฒนาการ ๔๐ ถนนพัฒนาการ แขวงพัฒนาการ เขตสวนหลวง กรุงเทพมหานคร
ต่อกรมโรงงานอุตสาหกรรม นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว ให้บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย)
จำกัด ต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน โดยมีองค์ประกอบดังนี้

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

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

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

(นายศิริะ จันทรเจต)

นักวิทยาศาสตร์ชำนาญการพิเศษ รักษาราชการแทน

ผู้อำนวยการกองวิจัยและเตือนภัยมลพิษโรงงาน

ปฏิบัติราชการแทนอธิบดีกรมโรงงานอุตสาหกรรม

กองวิจัยและเตือนภัยมลพิษโรงงาน

กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ

โทร. ๐ ๒๒๐๒ ๔๑๔๖ ๐ ๒๒๐๒ ๔๐๐๒

โทรสาร ๐ ๒๓๕๔ ๓๒๐๘ ๐ ๒๓๕๔ ๓๔๑๕

เอกสารแนบท้ายหนังสือรับต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด

เลขทะเบียน ว-๒๐๔

ที่ อก ๐๓๑๐(๑)/

ลงวันที่ ๒๘ มกราคม ๒๕๖๕

ก. ผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๖ ราย

๑) นางสาวยุพาพร จันทร์เปล่ง

ทะเบียนเลขที่ ว-๒๐๔-ค-๔๗๐๐

๒) นางสาวชนัญ โกลมารกุล ณ นคร

ทะเบียนเลขที่ ว-๒๐๔-ค-๔๗๐๑

๓) นายศรายุทธ จิตรานนท์

ทะเบียนเลขที่ ว-๒๐๔-ค-๔๗๐๒

๔) นางสาวกนกกร เอนก

ทะเบียนเลขที่ ว-๒๐๔-ค-๖๑๑๑

๕) นายสุริยา สอนแก้ว

ทะเบียนเลขที่ ว-๒๐๔-ค-๖๑๑๒

๖) นายวิชาญ ชูณหรัถ

ทะเบียนเลขที่ ว-๒๐๔-ค-๖๑๑๓



(นายศิริระ จันทรเลิศ)

นักวิทยาศาสตร์ชำนาญการพิเศษ วิชาการราชการแทน

ผู้อำนวยการกองวิจัยและพัฒนามลพิษโรงงาน

ปฏิบัติราชการแทนอธิบดีกรมโรงงานอุตสาหกรรม

เอกสารแนบท้ายหนังสือรับต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด

เลขทะเบียน ว-๒๐๔

ที่ อก ๐๓๑๐(๑)/ ๑๐๖๙

ลงวันที่ ๒๘ มกราคม ๒๕๖๕

ข. เจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๖๒ ราย

๑) นางสาวจินดา ไชจุลธรรม	ทะเบียนเลขที่ ว-๒๐๔-จ-๔๗๐๘
๒) นางสาวสาวิตรี น้อยเสงี่ยม	ทะเบียนเลขที่ ว-๒๐๔-จ-๔๗๐๙
๓) นางสาวชนัญญาญจน์ อัมขม	ทะเบียนเลขที่ ว-๒๐๔-จ-๔๗๑๐
๔) นางสาวนรินทร์ สายเส็ง	ทะเบียนเลขที่ ว-๒๐๔-จ-๔๗๑๕
๕) นางสาวนันทวดี สมบูรณ์	ทะเบียนเลขที่ ว-๒๐๔-จ-๔๗๑๖
๖) นางสาวศรียา เฉลิมธำรงค์	ทะเบียนเลขที่ ว-๒๐๔-จ-๔๗๑๗
๗) นางสาวสรารัตน์ มงคลจิรวุฒิ	ทะเบียนเลขที่ ว-๒๐๔-จ-๔๗๑๙
๘) นางสาวศิริลักษณ์ พึ่งแพง	ทะเบียนเลขที่ ว-๒๐๔-จ-๔๗๒๐
๙) นายณพพงศ์ จันทรพันธุ์	ทะเบียนเลขที่ ว-๒๐๔-จ-๕๔๐๘
๑๐) นายนรเศรษฐ์ โกมลาลัย	ทะเบียนเลขที่ ว-๒๐๔-จ-๕๔๑๑
๑๑) นายธินว จริยา	ทะเบียนเลขที่ ว-๒๐๔-จ-๕๔๑๔
๑๒) นางสาวเกศรินทร์ แก้วมัน	ทะเบียนเลขที่ ว-๒๐๔-จ-๕๔๑๖
๑๓) นางสาวสุวิมล ชัยเรืองวุฒิ	ทะเบียนเลขที่ ว-๒๐๔-จ-๕๔๑๗
๑๔) นางสาวสุชาดา ธรรมถาวร	ทะเบียนเลขที่ ว-๒๐๔-จ-๕๔๒๑
๑๕) นางสาวเปมิกา ชัยเดชธนกุล	ทะเบียนเลขที่ ว-๒๐๔-จ-๕๔๒๓
๑๖) นางสาวศศิธร หมูสวัสดิ์	ทะเบียนเลขที่ ว-๒๐๔-จ-๕๔๒๔
๑๗) นางสาวเสาวลักษณ์ ภู่นภาอำพร	ทะเบียนเลขที่ ว-๒๐๔-จ-๕๔๒๕
๑๘) นายอภิสิทธิ์ สิงหา	ทะเบียนเลขที่ ว-๒๐๔-จ-๕๔๒๖
๑๙) นายศักดิ์สิทธิ์ ไพศาลพิสุทธิ์	ทะเบียนเลขที่ ว-๒๐๔-จ-๕๔๒๗
๒๐) ว่าที่ร้อยตรีหญิง พรรณิภา ขำเจริญ	ทะเบียนเลขที่ ว-๒๐๔-จ-๕๔๒๘
๒๑) นางจิตดา คำภูแก้ว	ทะเบียนเลขที่ ว-๒๐๔-จ-๕๔๓๑
๒๒) นางสาวอรรวรรณ รักษย	ทะเบียนเลขที่ ว-๒๐๔-จ-๖๑๑๕
๒๓) นางสาวนพรัตน์ แยมกรานต์	ทะเบียนเลขที่ ว-๒๐๔-จ-๖๑๑๙
๒๔) นายจุลเดช วารินทร์	ทะเบียนเลขที่ ว-๒๐๔-จ-๖๑๒๐
๒๕) นางสาวดาญรัตน์ ร้องคำ	ทะเบียนเลขที่ ว-๒๐๔-จ-๖๑๒๑
๒๖) นายนคร สุขเจริญ	ทะเบียนเลขที่ ว-๒๐๔-จ-๖๑๒๒
๒๗) นายบัญชา นามเขตต์	ทะเบียนเลขที่ ว-๒๐๔-จ-๖๑๒๓
๒๘) นายพรมมี ศรีปัดเนตร	ทะเบียนเลขที่ ว-๒๐๔-จ-๖๑๒๕
๒๙) นายอุทิศ อุ่นสิม	ทะเบียนเลขที่ ว-๒๐๔-จ-๖๑๒๖
๓๐) ว่าที่ร้อยตรี เฉลิมเกียรติ อมรศรีเสริม	ทะเบียนเลขที่ ว-๒๐๔-จ-๖๑๒๘
๓๑) นางสาววริยา สร้างนา	ทะเบียนเลขที่ ว-๒๐๔-จ-๖๑๒๙
๓๒) นายอนุพงศ์ รัตนศรีประเสริฐ	ทะเบียนเลขที่ ว-๒๐๔-จ-๖๑๓๐
๓๓) นางสาวจุฑารัตน์ โอนสันเทียะ	ทะเบียนเลขที่ ว-๒๐๔-จ-๖๑๔๒
๓๔) นางสาวจารุวรรณ พิมพ์อภิกฤติยา	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๐๗๖

(นายศิริะ จันทร์เจ็ด)

๓๕) นางสาวปรางค์ทิพย์...

มหาวิทยาลัยราชภัฏวชิราวุฒิพิเศษ รัชการาชการพิเศษ

ผู้อำนวยการกองวิจัยและเตือนภัยมลพิษโรงงาน

วิทยาลัยราชภัฏวชิราวุฒิพิเศษ รัชการาชการพิเศษ

๓๕) นางสาวปรางค์ทิพย์ กิจไพศาลศักดิ์	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๐๗๙
๓๖) นางสาวเตือนใจ ทางกลาง	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๐๘๐
๓๗) นางสาวจิราพร ศิริเวช	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๐๘๑
๓๘) นายวรกร ผูกרך	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๐๘๓
๓๙) นายทอง วิริยะสหกิจ	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๐๘๔
๔๐) นายธนิศ เจนจบ	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๐๘๕
๔๑) นายคณิศร ขำเพชร	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๐๘๖
๔๒) นายอรรคพล นิยมวิทยาพันธ์	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๐๘๗
๔๓) นายภูวิช พรหมสะอาด	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๐๘๘
๔๔) นายธนเดช โภคาพิพัฒน์	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๐๘๙
๔๕) นายชวฤทธิ์ วงษ์จันทร์	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๐๙๐
๔๖) นายอาทิตย์ ศรีแสน	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๐๙๑
๔๗) นายเจษดินทร์ คงศักดิ์ไทย	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๐๙๒
๔๘) นายจรัส บุญยั้ง	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๐๙๕
๔๙) นายธนาณัติ เอนก	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๐๙๖
๕๐) นายอภิวัฒน์ ทุมหนู	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๐๙๗
๕๑) นางสาวสุภาขวัญ มาก	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๐๙๘
๕๒) นางสาวหัตพร ขวาลสมบูรณ์	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๑๐๐
๕๓) นางสาวธิดิมา บุญเพ็ง	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๑๐๑
๕๔) นางสาวกนกอร เข้มเพ็ชร	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๑๐๒
๕๕) นางสาวพัชรียา หงษ์สมดี	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๑๐๓
๕๖) นางสาวภาวนิดา สุรวงศ์ตระกูล	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๑๐๔
๕๗) นางสาวภาณุมาศ นามวัฒน์	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๑๐๕
๕๘) นางสาวอุไรรัตน์ ทิงสร้างแป้น	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๑๐๖
๕๙) นายธีรวัฒน์ ปวงสุข	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๑๐๗
๖๐) นายอิทธิพล ยะโส	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๑๐๘
๖๑) นายประพจน์ วรรณชูชัย	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๑๐๙
๖๒) นายชยธร พวงทิพย์	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๑๑๐
๖๓) นางสาวกนกวรรณ จันทบาล	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๑๑๑
๖๔) นางสาวเกษร หลักบุญ	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๑๑๒
๖๕) นายสิทธิโชค ธงเงิน	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๑๑๓
๖๖) นางศิวารรณ ใจบุญ	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๕๐๕
๖๗) นางสาวพรรณธิดา พุ่มคง	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๕๐๘
๖๘) นางสาวศรณีย์ ยิ่งดี	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๕๐๙
๖๙) นายนวกัทร ศรีวิริยะ	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๕๑๐
๗๐) นายสุวิชา ทองอ่อน	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๕๑๑
๗๑) นายวิญญู บุญตะนัย	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๕๑๓

(นายศิระ จันทรเจ็ด)

นักวิทยาศาสตร์ชำนาญการพิเศษ วิชาการการแพฐ

ผู้อำนวยการกองวิจัยและเตือนภัยมลพิษโรงงาน

๗๒) นายสมบูรณ์...

๗๒) นายสมบุรณ์ บุตรจันทร์	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๕๑๔
๗๓) นายวิรัตน์ ไชยชนะรา	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๕๑๕
๗๔) นายณฤเบศน์ เพิ่มพูน	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๕๑๖
๗๕) นายจิรณัฐ ขาวละออ	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๕๑๗
๗๖) นายสมโภช วันสา	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๕๑๘
๗๗) นายอัสรี นามบุรี	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๕๑๙
๗๘) นายณัฐนันท์ ปานประเสริฐ	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๕๒๐
๗๙) นายอัครเวศ จ่อสาว	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๕๒๑
๘๐) นายประเสริฐ สุระขันธ	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๕๒๒
๘๑) นายณกุล จันทร์เนียม	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๕๒๓
๘๒) นายพิรพงษ์ ทองคุณปรีดา	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๕๒๔
๘๓) นายณฤพล ทองนุช	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๕๒๕
๘๔) นายอนุวัฒน์ ม่วงแพร่	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๕๒๖
๘๕) นายเจตศราวุฒิ ปิตตะมะ	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๕๒๗
๘๖) นายกฤษณะ สายวรรณ	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๕๒๘
๘๗) นายพิชัย บุญยงค์	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๕๒๙
๘๘) นายภาณุพงศ์ โหมวงศ์	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๕๓๐
๘๙) นายสามารถ คุ่มปลี	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๕๓๑
๙๐) นายสัญญาชัย โกศรีนาม	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๕๓๒
๙๑) นายณัฐวุฒิ ศรีประเสริฐ	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๕๓๓
๙๒) นายชวัลรัช นาคพนม	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๕๓๔
๙๓) นายพงศธร ชัยทิพย์	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๕๓๕
๙๔) ว่าที่ร้อยตรี ภาณุพงศ์ แสนศรี	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๕๓๖
๙๕) นายสิทธิโชค ทาสีดา	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๕๓๗
๙๖) นายธนากร อินสุตา	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๕๓๘
๙๗) นางสาววรรณิษา ขาติวันชัย	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๕๓๙
๙๘) นางสาวพิมพ์ตะวัน มินากุล	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๕๔๐
๙๙) นางสาวเพชรรัตน์ สิงห์สมบูรณ์	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๕๔๑
๑๐๐) นางสาวชญานิษฐ์ พรหมจันทร์	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๕๔๒
๑๐๑) นายเกียรติ ทวีราช	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๕๔๓
๑๐๒) นายจักริน วัฒนวิสา	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๕๔๔
๑๐๓) นายฉัตรชัย สุขเปี้ย	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๕๔๕
๑๐๔) นายณรนนท์ ต๊ะทองคำ	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๕๔๖
๑๐๕) นายตุลพล สมนอก	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๕๔๗
๑๐๖) นายทักษ์ดนัย อุบลศรี	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๕๔๘
๑๐๗) นายธนศร นามะภูณนา	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๕๔๙
๑๐๘) นายธิตีพงศ์ บัวแดง	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๕๕๐

(นายธีระ จันทร์เฑียร)

นักวิทยาศาสตร์ชำนาญการพิเศษ รักษาการแทน

ผู้อำนวยการกองวิจัยและพัฒนากายภาพ

บริการทางการแพทย์และสุขภาพ

๑๐๙) นายณนทชัย...

๑๐๙) นายพนนทชัย อุปถัมภ์	ทะเบียนเลขที่ ว-๒๐๔-จ-๘๕๕๔
๑๑๐) นายนิรุฒ พลสุทธิ	ทะเบียนเลขที่ ว-๒๐๔-จ-๘๕๕๕
๑๑๑) นายนิพนธ์วัฒน์ สาริน	ทะเบียนเลขที่ ว-๒๐๔-จ-๘๕๕๖
๑๑๒) นายปิยะนัฐ พลมะศรี	ทะเบียนเลขที่ ว-๒๐๔-จ-๘๕๕๗
๑๑๓) นายพงศ์สิริ โสมเขียว	ทะเบียนเลขที่ ว-๒๐๔-จ-๘๕๕๘
๑๑๔) นายพีรพัฒน์ กำคำ	ทะเบียนเลขที่ ว-๒๐๔-จ-๘๕๕๙
๑๑๕) นายภาณุพงศ์ มานิตย์	ทะเบียนเลขที่ ว-๒๐๔-จ-๘๖๐๐
๑๑๖) นายมงคล ผลาทิพย์	ทะเบียนเลขที่ ว-๒๐๔-จ-๘๖๐๑
๑๑๗) นายมนินทร์ พูลศิริ	ทะเบียนเลขที่ ว-๒๐๔-จ-๘๖๐๒
๑๑๘) นายสิรินันท์ ทองอิน	ทะเบียนเลขที่ ว-๒๐๔-จ-๘๖๐๓
๑๑๙) นายอเนชา ทันสมัย	ทะเบียนเลขที่ ว-๒๐๔-จ-๘๖๐๔
๑๒๐) นายอดิศักดิ์ ผมไผ	ทะเบียนเลขที่ ว-๒๐๔-จ-๘๖๐๕
๑๒๑) นายอนันตชัย วิสุม	ทะเบียนเลขที่ ว-๒๐๔-จ-๘๖๐๖
๑๒๒) นายณัฐดนัย เจือละออง	ทะเบียนเลขที่ ว-๒๐๔-จ-๘๖๐๗
๑๒๓) นายวรวิธ ดินัก	ทะเบียนเลขที่ ว-๒๐๔-จ-๘๖๐๘
๑๒๔) นายแสงตะวัน นະตะສັດ	ทะเบียนเลขที่ ว-๒๐๔-จ-๘๖๐๙
๑๒๕) นายยุทธพงศ์ รัตนะ	ทะเบียนเลขที่ ว-๒๐๔-จ-๘๖๑๐
๑๒๖) นายชัยณวุฒิ ไชยชนะนิจ	ทะเบียนเลขที่ ว-๒๐๔-จ-๘๖๑๑
๑๒๗) นายวิศรุต ศรีธรรมมา	ทะเบียนเลขที่ ว-๒๐๔-จ-๘๖๑๒
๑๒๘) นายพนนทกร เผือกผ่อง	ทะเบียนเลขที่ ว-๒๐๔-จ-๘๖๑๓
๑๒๙) นายกำชัย สุทธะ	ทะเบียนเลขที่ ว-๒๐๔-จ-๘๖๑๔
๑๓๐) นางสาวณัฐภรณ์ รักทะเล	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๑๙
๑๓๑) นางสาวประภาภรณ์ บุตรพรม	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๒๐
๑๓๒) นางสาวนิลาวัลย์ นามพรม	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๒๑
๑๓๓) นางสาวพัชรินทร์ แสนสร้อย	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๒๒
๑๓๔) นายไพโรจน์ เบรัมย์พิมาย	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๒๓
๑๓๕) นางสาวศุภมาศ ทองมาก	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๒๔
๑๓๖) นางสาวลลิตา จิตรสว่าง	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๒๕
๑๓๗) นางสาวชไมพร เสิกภูเขียว	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๒๖
๑๓๘) นางสาวกฤติมาพร คำมีแก่น	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๒๗
๑๓๙) นางสาวสกุลรัตน์ ภาควุฒิ	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๒๘
๑๔๐) นางสาวกาญจนา คงคุณ	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๒๙
๑๔๑) นางสาวไพรินทร์ ศรีรูปี	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๓๐
๑๔๒) นางสาวทิพนันทร ผุยปัญญา	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๓๑
๑๔๓) นางสาวสาธิตา ปานทอง	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๓๒
๑๔๔) นางสาวอริสา ทองนวล	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๓๓
๑๔๕) นางสาวอรยา คำคล่อง	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๓๔

(นายศิระ จันทร์เจิด)

นักวิทยาศาสตร์ชำนาญการพิเศษ รักษาการแทน

ผู้อำนวยการกองวิจัยและพัฒนากยผลพืชโรงงาน

๑๔๖) นางสาวชุตติภรณ์...

๑๔๖) นางสาวชุตากรณ์ สุนทรสนาน	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๓๕
๑๔๗) นางสาวสุตารัตน์ นนทประสาท	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๓๖
๑๔๘) นางสาวรัชนิกร เนียมกลาง	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๓๗
๑๔๙) นางสาวกัญญารัตน์ ศรีนิลทา	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๓๘
๑๕๐) นางสาวอัญชลี คำจันทร์	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๓๙
๑๕๑) นายบุญฤทธิ์ เอี่ยมเทศ	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๔๐
๑๕๒) นายศิริวัฒน์ พานิชย์	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๔๑
๑๕๓) นางสาวศุภรดา ปันมยุรา	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๔๒
๑๕๔) นางสาวพาฤดี คุณน่าน	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๔๓
๑๕๕) นางสาวจิราเจต ฟองดา	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๔๔
๑๕๖) นางสาวกนกภรณ์ อุระ	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๔๕
๑๕๗) นางสาวอารยา มีชัย	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๔๖
๑๕๘) นางสาวจิตสุภา ประเทืองสุข	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๔๗
๑๕๙) นางสาวอริสา วิริยขันติธรรม	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๔๘
๑๖๐) นางสาววิษชุดา นาคผจญ	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๔๙
๑๖๑) นางสาวพนิดา ยอดอินทร์	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๕๐
๑๖๒) นางสาวนันทิยา จันทะลุน	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๕๑



(นายศิริระ จันทรเจ็ด)

นักวิทยาศาสตร์ชำนาญการพิเศษ รักษาการแทน

ผู้อำนวยการกองวิจัยและพัฒนากิจการโรงงาน

ปฏิบัติการงานทอผ้าไหมและเครื่องทอผ้าไหม

เอกสารแนบท้ายหนังสือรับต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด

เลขทะเบียน ว-๒๐๔

ที่ อก ๐๓๑๐(๑)/ ๑๐๖๕

ลงวันที่ ๒๘ มกราคม ๒๕๖๕

ขอขยายสารมลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๓๖๑ รายการ

น้ำเสีย จำนวน 59 รายการ

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

(นางริกาญจน์ จิตรสกุลไชย)

ผู้อำนวยการกลุ่มมาตรฐานวิชาการวิเคราะห์ทดสอบมลพิษ

และทะเบียนห้องปฏิบัติการ

19 Copper...

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

วิมล

44 Methomyl...

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

น้ำใต้ดิน จำนวน 126 รายการ

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

วิภาว

3 Aldrin...

(นางริกาญจน์ ฉัตรสกุลวิไล)

ผู้อำนวยการกลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษ
และทะเบียนห้องปฏิบัติการ

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


วิฑูรย์

18 Bis(2-ethylhexyl)phthalate...

(นางริกาญจน์ ฉัตรสกุลวิไล)

ผู้อำนวยการกลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษ
และหน่วยงานที่เกี่ยวข้อง

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



34 Chromium (III)...

(นางวิภาดา จิตกรกุลวิไล)

ผู้อำนวยการกลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษ

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

วิมล

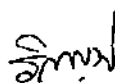
(นางริกาญจน์ ฉัตรสกุลใจ)

ผู้อำนวยการกลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษ

กองควบคุมและปฏิบัติการ

51 cis-1,2-Dichloroethylene...

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



(นางริกาญจน์ ถัตรสกุลวิไล)

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และทะเบียนห้องปฏิบัติการ

68 Fluorene...

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

วิมล

84 Methanol...

(นางริกาญจน์ ฉัตรสกุลวิไล)

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กรมควบคุมมลพิษ

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

วิมล

97 Pentachlorophenol...

(นางริกาญจน์ ฉัตรสกุลวิไล)

ผู้อำนวยการศูนย์มาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษ

และทะเบียนห้องปฏิบัติการ

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

วิมล

114 1,1,2-Trichloroethane...

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

อากาศเสีย (ปล่อยระบาย) จำนวน 16 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Antimony	Isokinetic, Digestion, Inductively Coupled Plasma Method ^[5]
2	Arsenic	Isokinetic, Digestion, Inductively Coupled Plasma Method ^[5]

วิมล

3 Carbon Monoxide...

(นางริภาณูจน์ ฉัตรสกุลวิไล)

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กรมควบคุมมลพิษ

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

วิมล

สิ่งปลูก...

(นางริกาญจน์ ฉัตรสกุลวิไล)

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สิ่งปฏิกูลหรือวัสดุที่ไม่ใช้แล้ว จำนวน 35 รายการ

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



(นางริกาญจน์ ดัตรสกุลใจ)

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และทะเบียนห้องปฏิบัติการ

6 Cadmium...

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



(นางริกาญจน์ ฉัตรสกุลวิไล)

11 Cobalt...

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.....เรียนหนังสือภาคีการ

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

จิรพร

2) Soxhlet...

(นางริภาญจน์ ฉัตรสกุลวิไล)

ผู้อำนวยการศูนย์มาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษ

และคณะผู้รับผิดชอบปฏิบัติการ

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

วิมล

2) Waste Extraction...

(นางริกาญจน์ ฉัตรสกุลวิไล)

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

วิภาดา

27 Polychlorinated...

(นางริกาญจน์ ฉัตรสกุลวิไล)

ผู้อำนวยการกลุ่มมาตรฐานวิชาการวิเคราะห์ทดสอบมลพิษ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
27	<p>Polychlorinated biphenyls (PCBs)</p> <ul style="list-style-type: none"> - Aroclor 1016 - Aroclor 1221 - Aroclor 1232 - Aroclor 1242 - Aroclor 1248 - Aroclor 1254 - Aroclor 1260 - 2-Chlorobiphenyl - 2,3-Dichlorobiphenyl - 2,2',5-Trichlorobiphenyl - 2,4',5-Trichlorobiphenyl - 2,2',3,5'-Tetrachlorobiphenyl - 2,2',5,5'-Tetrachlorobiphenyl - 2,3',4,4'-Tetrachlorobiphenyl - 2,2',3,4,5'-Pentachlorobiphenyl - 2,2',4,5,5'-Pentachlorobiphenyl - 2,3,3',4',6-Pentachlorobiphenyl - 2,2',3,4,4',5'-Hexachlorobiphenyl - 2,2',3,4,5,5'-Hexachlorobiphenyl - 2,2',3,5,5',6-Hexachlorobiphenyl - 2,2',4,4',5,5'-Hexachlorobiphenyl - 2,2',3,3',4,4',5-Heptachlorobiphenyl - 2,2',3,4,4',5,5'-Heptachlorobiphenyl - 2,2',3,4,4',5',6-Heptachlorobiphenyl - 2,2',3,4',5,5',6-Heptachlorobiphenyl - 2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl 	<p>1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method^[1,9,23]</p> <p>2) Soxhlet Extraction, Gas Chromatographic Method^[10,23]</p> <p>3) Automated Soxhlet Extraction, Gas Chromatographic Method^[22,31]</p>

วิมล

(นางริกาญจน์ ฉัตรสกุลวิไล)

ผู้อำนวยการกลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษ

28 Pentachlorophenol...

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

Signature

(นางริกาญจน์ ฉัตรสกุลวิไล)

ผู้อำนวยการศูนย์มาตรฐานวิธีการวิเคราะห์หกลมลพิษ

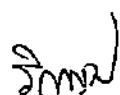
4) Digestion...

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

ดิน จำนวน 125 รายการ

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

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



(นางริกาญจน์ ฉัตรสกุลวิไล)

ผู้อำนวยการกลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษ

26 Carbon tetrachloride...

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

Signature

(นางริภาณูจน์ จิตรสกุลวิไล)

ผู้อำนวยการกลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษ

40 DDE...

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

วิมล

(นางริกาญจน์ อัครสกุลใจ)

57 Dieldrin...

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

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

วิมล

(นางริกาญจน์ ฉัตรสกุลวิไล)

ผู้อำนวยการศูนย์มาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษ

กองควบคุมมลพิษ

2) Thermal...

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

วิฑูรย์

(นางวิภาณูจน์ ฉัตรสกุลวิไล)

- Aroclor 1242...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
	<ul style="list-style-type: none"> - Aroclor 1242 - Aroclor 1248 - Aroclor 1254 - Aroclor 1260 - 2-Chlorobiphenyl - 2,2',3,5'-Tetrachlorobiphenyl - 2,2',5,5'-Tetrachlorobiphenyl - 2,3',4,4'-Tetrachlorobiphenyl - 2,2',3,4,5'-Pentachlorobiphenyl - 2,2',4,5,5'-Pentachlorobiphenyl - 2,3,3',4',6-Pentachlorobiphenyl - 2,2',3,4,4',5'-Hexachlorobiphenyl - 2,2',3,4,5,5'-Hexachlorobiphenyl - 2,2',3,5,5',6-Hexachlorobiphenyl - 2,2',4,4',5,5'-Hexachlorobiphenyl - 2,2',3,3',4,4',5'-Heptachlorobiphenyl - 2,2',3,4,4',5,5'-Heptachlorobiphenyl - 2,2',3,4,4',5',6-Heptachlorobiphenyl - 2,2',3,4',5,5',6-Heptachlorobiphenyl - 2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl 	
97	Pentachlorophenol	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^[25,31]
98	Phenanthrene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^[25,31]
99	Phenol	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^[25,31]
100	Pyrene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^[25,31]

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
101	Selenium	1) Digestion, Inductively Coupled Plasma Method ^[7,15] 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^[7,16]
102	Silver	1) Digestion, Inductively Coupled Plasma Method ^[7,15] 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^[7,16]
103	Styrene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^[14,24]
104	1,1,2,2-Tetrachloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^[14,24]
105	Tetrachloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^[14,24]
106	Toluene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^[14,24]
107	Toxaphene	1) Soxhlet Extraction, Gas Chromatographic Method ^[10,22] 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^[25,31]
108	TPH (C ₅ -C ₆)	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^[14,24]
109	TPH (C ₈ - C ₁₆)	1) Solvent Extraction, Gas Chromatographic Method ^[11,21] 2) Automated Soxhlet Extraction, Gas Chromatographic Method ^[21,31]
110	TPH (C ₁₆ - C ₃₅)	1) Solvent Extraction, Gas Chromatographic Method ^[11,21] 2) Automated Soxhlet Extraction, Gas Chromatographic Method ^[21,31]
111	1,2,4-Trichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^[14,24]
112	1,1,1-Trichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^[14,24]
113	1,1,2-Trichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^[14,24]
114	Trichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^[14,24]
115	2,4,5-Trichlorophenol	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^[25,31]

วิมล

116 2,4,6-Trichlorophenol...

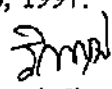
(นางวิภาดาญ์ ฉัตรสุภาวิไล)

ผู้อำนวยการศูนย์มาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษ

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

เอกสารอ้างอิง

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 (นางริกาญจน์ อัครสกุลวิไล)

ผู้อำนวยการกลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษ

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(นางริกาญจน์ จิตรสกุลไชย)

ผู้อำนวยการกลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษ
และทะเบียนห้องปฏิบัติการ



ที่ อก ๐๓๑๐(๑)/ ๕ ๓ ๗ ๙

กรมโรงงานอุตสาหกรรม
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท
เขตราชเทวี กรุงเทพฯ ๑๐๔๐๐

๐ ๙ มีนาคม ๒๕๖๖

เรื่อง เปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์

เรียน กรรมการผู้จัดการ บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน
ลงวันที่ ๔ กุมภาพันธ์ ๒๕๖๖

ตามหนังสือที่อ้างถึง บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด ห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ว-๒๐๔ สถานที่ตั้งเลขที่ ๑๐๔ ซอยพัฒนาการ ๔๐ ถนนพัฒนาการ แขวงพัฒนาการ เขตสวนหลวง กรุงเทพมหานคร ขอเปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์ ความละเอียดแจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว มีความเห็นดังนี้

๑. ให้ยกเลิกเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๙ ราย

- | | |
|---------------------------------|----------------------------|
| ๑) นายนคร สุขเจริญ | ทะเบียนเลขที่ ว-๒๐๔-จ-๖๑๒๒ |
| ๒) นายบัญชา นามเขตต์ | ทะเบียนเลขที่ ว-๒๐๔-จ-๖๑๒๓ |
| ๓) นายอรรคพล นิยมวิทย์พันธ์ | ทะเบียนเลขที่ ว-๒๐๔-จ-๗๐๘๗ |
| ๔) นางสาวพัชรียา หงษ์สมดี | ทะเบียนเลขที่ ว-๒๐๔-จ-๗๑๐๓ |
| ๕) นางสาวภาณิดา สุรวงศ์ตระกูล | ทะเบียนเลขที่ ว-๒๐๔-จ-๗๑๐๔ |
| ๖) นางสาวศรณีย์ ยิ่งดี | ทะเบียนเลขที่ ว-๒๐๔-จ-๗๕๐๙ |
| ๗) นายสมโภช วันสา | ทะเบียนเลขที่ ว-๒๐๔-จ-๗๕๑๙ |
| ๘) นายณัฐนันท์ ปานประเสริฐ | ทะเบียนเลขที่ ว-๒๐๔-จ-๗๘๑๙ |
| ๙) ว่าที่ร้อยตรีภาณุพงศ์ แสนศรี | ทะเบียนเลขที่ ว-๒๐๔-จ-๗๘๓๖ |
| ๑๐) นายมนินทร์ พูลศิริ | ทะเบียนเลขที่ ว-๒๐๔-จ-๘๖๐๒ |
| ๑๑) นายณัฐดนัย เจือละออง | ทะเบียนเลขที่ ว-๒๐๔-จ-๘๖๐๗ |
| ๑๒) นางสาวกาญจนา คงคุณ | ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๒๙ |
| ๑๓) นางสาวรัชนิกร เนียมกลาง | ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๓๗ |
| ๑๔) นางสาวกัญญารัตน์ ศรีนิลทา | ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๓๘ |
| ๑๕) นายศิริวัฒน์ พานิชย์ | ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๔๑ |
| ๑๖) นางสาวกนกภรณ์ อูระ | ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๔๕ |
| ๑๗) นางสาวจิตสุภา ประเทืองสุข | ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๔๗ |
| ๑๘) นางสาวอริสา วิริยขันติธรรม | ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๔๘ |
| ๑๙) นางสาวพนิดา ยอดอินทร์ | ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๕๐ |

๒. ให้เพิ่มเจ้าหน้าที่...

๒. ให้เพิ่มเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๕ ราย

- | | |
|--------------------------------|----------------------------|
| ๑) นายกาจบัณฑิต กิตติศุภวณิชย์ | ทะเบียนเลขที่ ว-๒๐๔-จ-๐๐๐๑ |
| ๒) นายภัทรพล สว่างใจธรรม์ | ทะเบียนเลขที่ ว-๒๐๔-จ-๐๐๐๒ |
| ๓) นายนราธิป เทือกชัยคำ | ทะเบียนเลขที่ ว-๒๐๔-จ-๐๐๐๓ |
| ๔) นายศิริโชค พงษ์ประสม | ทะเบียนเลขที่ ว-๒๐๔-จ-๐๐๐๔ |
| ๕) นายณัฐวุฒิ ดั่งแพง | ทะเบียนเลขที่ ว-๒๐๔-จ-๐๐๐๕ |

อนึ่ง หนังสือฉบับนี้จะหมดอายุพร้อมหนังสือต่ออายุรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน ที่ อก ๐๓๑๐(๑)/๑๐๖๔ ลงวันที่ ๒๘ มกราคม ๒๕๖๔ คือในวันที่ ๒ กันยายน ๒๕๖๖ ทั้งนี้ สามารถยื่นคำขอผ่านระบบอิเล็กทรอนิกส์ได้ที่หน้าเว็บไซต์กรมโรงงานอุตสาหกรรม ตาม QR Code ทำหนังสือฉบับนี้

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ



(นางริกาญจน์ นัตตรสกุลวิไล)

นักวิทยาศาสตร์ชำนาญการพิเศษ รักษาการแทน

ผู้อำนวยการกองวิจัยและเตือนภัยมลพิษโรงงาน

ปฏิบัติราชการแทนอธิบดีกรมโรงงานอุตสาหกรรม

กองวิจัยและเตือนภัยมลพิษโรงงาน

กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ

โทร. ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๐๓-๕

โทรสาร ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๙๙

ไปรษณีย์อิเล็กทรอนิกส์ saraban@diw.mail.go.th



ที่ อก ๐๓๑๐(๑)/ ๖ ๑ ๒ ๕



กรมโรงงานอุตสาหกรรม
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท
เขตราชเทวี กรุงเทพฯ ๑๐๔๐๐

๒ ๓ มีนาคม ๒๕๖๖

เรื่อง เปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์

เรียน กรรมการผู้จัดการ บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน
ลงวันที่ ๑๐ มีนาคม ๒๕๖๖

ตามหนังสือที่อ้างถึง บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด
ห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ว-๒๐๔ สถานที่ตั้งเลขที่ ๑๐๔ ซอยพัฒนาการ ๔๐
ถนนพัฒนาการ แขวงพัฒนาการ เขตสวนหลวง กรุงเทพมหานคร ขอเปลี่ยนแปลงบุคลากรของห้องปฏิบัติการ
วิเคราะห์ ความละเอียดแจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว ให้เปลี่ยนแปลงชื่อเจ้าหน้าที่ประจำห้องปฏิบัติการ
วิเคราะห์ จากเดิม นางสาวสรารค์มี มงคลจิรุติ ทะเบียนเลขที่ ว-๒๐๔-จ-๔๗๑๙ เป็น นางสาวธัญญธร มงคลจิรุติ
ทะเบียนเลขที่ ว-๒๐๔-จ-๔๗๑๙

ทั้งนี้ หากท่านมีความประสงค์จะยื่นคำขอใดๆ สามารถยื่นคำขอผ่านระบบอิเล็กทรอนิกส์
ได้ที่หน้าเว็บไซต์กรมโรงงานอุตสาหกรรม ตาม QR Code ท้ายหนังสือฉบับนี้

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

✓ (นายประสม ดำรงพงษ์)

ผู้อำนวยการกองวิจัยและเตือนภัยมลพิษโรงงาน
ปฏิบัติราชการแทนอธิบดีกรมโรงงานอุตสาหกรรม

กองวิจัยและเตือนภัยมลพิษโรงงาน

กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ

โทร. ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๐๓-๕

โทรสาร ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๙๙

ไปรษณีย์อิเล็กทรอนิกส์ saraban@diw.mail.go.th



ยื่นคำขอผ่านระบบอิเล็กทรอนิกส์

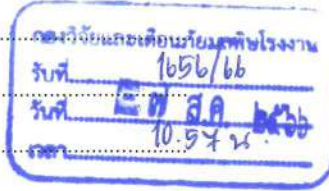


คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน

วันที่ 4 เดือน สิงหาคม พ.ศ. 2566

ข้าพเจ้า () ผู้รับใบอนุญาตประกอบกิจการโรงงาน

(✓) บริษัท/ห้างหุ้นส่วนจำกัด เอแอลเอส แลбораторี กรุป (ประเทศไทย) จำกัด



ตั้งอยู่ที่เลขที่ 104 หมู่ที่ - ตรอก/ซอย พัฒนาการ 40

ถนน พัฒนาการ ตำบล/แขวง พัฒนาการ

อำเภอ/เขต สวนหลวง จังหวัด กรุงเทพมหานคร รหัสไปรษณีย์ 10250

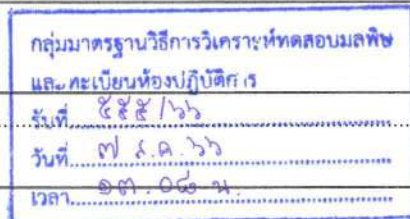
โทรศัพท์ 02 760-3040 โทรสาร 0 2 760-3197

ได้รับทราบระเบียบกรมโรงงานอุตสาหกรรมว่าด้วยการขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน พ.ศ. 2560 โดยตลอดแล้วและยินยอม

ปฏิบัติตามระเบียบฯทุกประการ และได้แนบเอกสารต่างๆ ตามรายการเอกสารประกอบการพิจารณา (แบบ ปอ.1-1) มาพร้อมนี้

รายการขอดำเนินการ

การดำเนินการ	รายละเอียด (รายการ)				
	น้ำเสีย/น้ำทิ้ง	น้ำใต้ดิน	อากาศเสีย	สิ่งปฏิกูลหรือวัสดุที่ไม่ใช้แล้ว	ดิน
[] ขอขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน					
[✓] ต่ออายุห้องปฏิบัติการวิเคราะห์เอกชน	59	126	16	35	125
[✓] เปลี่ยนแปลงสารมลพิษที่วิเคราะห์ (✓) เพิ่มสารมลพิษ () ยกเลิกสารมลพิษ	-	-	12	-	-
[✓] เปลี่ยนแปลงบุคลากร (✓) เพิ่มบุคลากร (✓) ยกเลิกบุคลากร	จำนวน 38 ราย (รายละเอียดตาม แบบ ปว.1) จำนวน 2 ราย (รายละเอียดตาม แบบ ปว.1)				
[] ยกเลิกห้องปฏิบัติการวิเคราะห์เอกชน					
[] อื่นๆ โปรดระบุ.....					



จึงเรียนมาเพื่อโปรดพิจารณา

กวกท.
.....
เพื่อโปรดพิจารณา

ลงชื่อ

(นางทัศนีย์ เลขากุลพร)

ผู้มีอำนาจลงนามแทนนิติบุคคล
ประทับตรา (ถ้ามี)

.....
(นายประสม คำรงพงษ์)
ผู้อำนวยการกองวิจัยและเฝ้าระวังมลพิษโรงงาน

ALS Laboratory Group
(Thailand) Co., Ltd.

