

ภาคผนวก ง

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ใบรับรองการสอบเทียบเครื่องมือ



Lot No. 2413409-1

## ANALYZER CALIBRATION DATA

Client: Global Power Synergy PCL  
Date: 12 Feb 24  
Location: HRSQ #1  
Test Operator: Kantaphon M.O<sub>2</sub> ANALYZER  
Model: TELEDYNE API 200EH  
Serial No.: 774  
Span (%): 25

	Cylinder Value (%)	Initial Analyzers Calibration Response (%)	Final Analyzers Calibration Response (%)	Difference (Percent of Span)
Zero Gas	0.00	0.01	0.02	0.04
Low-Level Gas	8.00	8.02	8.09	0.04
Span Gas	16.02	16.04	16.06	0.06

NO<sub>x</sub> ANALYZER  
Model: TELEDYNE API 200EH  
Serial No.: 774  
Span (ppm): 100

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.02	0.02	0.00
Low-Level Gas	56.17	56.18	56.16	0.01
Span Gas	82.39	82.40	82.43	0.03

CO ANALYZER  
Model: TELEDYNE API 300EM  
Serial No.: 451  
Span (ppm): 100

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.01	0.02	0.01
Low-Level Gas	54.24	54.25	54.27	0.02
Span Gas	79.48	79.50	79.52	0.02

Calibrated by

(Mr. Kantaphon Maneesampan)

Environmental Field Scientist (2)

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Lot No. 2413409-1

## SYSTEM CALIBRATION BIAS AND DRIFT DATA

Client: Global Power Synergy PCL  
Date: 12 Feb 24  
Location: HRSQ #1  
Test Operator: Kantaphon M.O<sub>2</sub> ANALYZER  
Cylinder Conc. (%): 16.02  
Span (%): 25

	O <sub>2</sub> Analyzer Calibration Response	Initial Values System Calibration Response	System Cal Bias (% of Span)	Final Values System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.01	0.02	0.04	0.03	0.08	0.04
Upscale Gas	16.04	16.05	0.04	16.06	0.08	0.04

NO<sub>x</sub> ANALYZER  
Cylinder Conc. (ppm): 82.39  
Span (ppm): 100

	NO <sub>x</sub> Analyzer Calibration Response	Initial Values System Calibration Response	System Cal Bias (% of Span)	Final Values System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.02	0.02	0.00	0.04	0.02	0.02
Upscale Gas	82.40	82.42	0.02	82.43	0.03	0.01

CO ANALYZER  
Cylinder Conc. (ppm): 79.48  
Span (ppm): 100

	CO Analyzer Calibration Response	Initial Values System Calibration Response	System Cal Bias (% of Span)	Final Values System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.01	0.03	0.02	0.04	0.03	0.01
Upscale Gas	79.50	79.53	0.03	79.54	0.04	0.01

Calibrated by

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## EMISSION TEST RESULT

Client: Global Power Synergy PCL  
Date: 12 Feb 24  
Start Time: 10:40  
Run #: 1  
Location: HRSQ #1  
Test Operator: Kantaphon M.  
Finish Time: 11:00  
Serial No.: 774  
Serial No.: 451  
SO<sub>2</sub> Analyzer Model: -  
NO<sub>x</sub>/O<sub>2</sub> Analyzer Model: TELEDYNE API 200EH  
CO/CO<sub>2</sub> Analyzer Model: TELEDYNE API 300EM

Time (min)	O <sub>2</sub> (%)	CO <sub>2</sub> (%)	NO <sub>x</sub> (ppm)	SO <sub>2</sub> (ppm)	CO (ppm)	Remark
10:40	14.17	3.71	7.71	-	6.91	
10:41	14.16	3.72	7.74	-	6.95	
10:42	14.15	3.72	7.67	-	6.91	
10:43	14.16	3.73	7.61	-	6.90	
10:44	14.16	3.72	7.56	-	6.89	
10:45	14.17	3.72	7.63	-	6.96	
10:46	14.13	3.72	7.62	-	6.92	
10:47	14.16	3.72	7.60	-	6.93	
10:48	14.17	3.72	7.62	-	6.88	
10:49	14.14	3.73	7.50	-	6.90	
10:50	14.15	3.73	7.67	-	7.14	
10:51	14.13	3.73	7.73	-	7.34	
10:52	14.12	3.74	7.79	-	7.31	
10:53	14.14	3.74	7.84	-	7.22	
10:54	14.13	3.74	7.86	-	7.05	
10:55	14.14	3.72	7.78	-	6.93	
10:56	14.16	3.72	7.79	-	6.92	
10:57	14.16	3.71	7.82	-	6.85	
10:58	14.17	3.71	7.78	-	6.92	
10:59	14.16	3.73	7.79	-	6.89	
11:00	14.17	3.72	7.79	-	6.99	
Average	14.15	3.72	7.71	-	6.98	

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## EMISSION TEST RESULT

Client: Global Power Synergy PCL  
Date: 12 Feb 24  
Start Time: 11:01  
Run #: 2  
Location: HRSQ #1  
Test Operator: Kantaphon M.  
Finish Time: 11:21  
Serial No.: -  
Serial No.: 774  
Serial No.: 451  
SO<sub>2</sub> Analyzer Model: -  
NO<sub>x</sub>/O<sub>2</sub> Analyzer Model: TELEDYNE API 200EH  
CO/CO<sub>2</sub> Analyzer Model: TELEDYNE API 300EM

Time (min)	O <sub>2</sub> (%)	CO <sub>2</sub> (%)	NO <sub>x</sub> (ppm)	SO <sub>2</sub> (ppm)	CO (ppm)	Remark
11:01	14.15	3.72	7.86	-	6.94	
11:02	14.14	3.72	7.85	-	6.91	
11:03	14.16	3.72	7.85	-	6.85	
11:04	14.17	3.72	7.86	-	6.94	
11:05	14.16	3.72	7.75	-	6.97	
11:06	14.17	3.71	7.86	-	6.87	
11:07	14.17	3.71	7.83	-	6.89	
11:08	14.15	3.71	7.86	-	6.92	
11:09	14.15	3.71	7.83	-	6.95	
11:10	14.15	3.72	7.80	-	6.93	
11:11	14.13	3.73	7.79	-	7.03	
11:12	14.11	3.74	7.74	-	7.18	
11:13	14.09	3.76	7.95	-	7.22	
11:14	14.07	3.76	7.94	-	7.44	
11:15	14.08	3.78	7.92	-	7.43	
11:16	14.09	3.77	7.86	-	7.29	
11:17	14.14	3.73	7.80	-	7.05	
11:18	14.16	3.72	7.79	-	6.91	
11:19	14.16	3.72	7.70	-	6.93	
11:20	14.17	3.72	7.65	-	6.94	
11:21	14.16	3.72	7.66	-	6.87	
Average	14.14	3.73	7.82	-	7.00	

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## EMISSION TEST RESULT

Client	Global Power Synergy PCL	Run #	3
Date	12 Feb 24	Location	HRSG #1
Start Time	11:22	Test Operator	Kantaphon M.
SO <sub>2</sub> Analyzer Model	TELEDYNE API 200EH	Finish Time	11:42
NO <sub>x</sub> /O <sub>2</sub> Analyzer Model	TELEDYNE API 300EM	Serial No.	774
CO/CO <sub>2</sub> Analyzer Model	TELEDYNE API 300EM	Serial No.	451

Time (min)	O <sub>2</sub> (%)	CO <sub>2</sub> (%)	NO <sub>x</sub> (ppm)	SO <sub>2</sub> (ppm)	CO (ppm)	Remark
11:22	14.16	3.71	7.71	-	6.92	
11:23	14.17	3.72	7.76	-	6.95	
11:24	14.17	3.71	7.77	-	6.96	
11:25	14.16	3.71	7.80	-	7.02	
11:26	14.16	3.71	7.83	-	6.91	
11:27	14.15	3.72	7.86	-	6.80	
11:28	14.16	3.71	7.89	-	6.78	
11:29	14.17	3.71	7.81	-	6.94	
11:30	14.14	3.72	7.73	-	7.02	
11:31	14.14	3.72	7.74	-	7.14	
11:32	14.10	3.75	7.89	-	7.30	
11:33	14.08	3.76	7.92	-	7.34	
11:34	14.05	3.79	8.01	-	7.23	
11:35	14.05	3.79	7.99	-	7.28	
11:36	14.06	3.77	8.03	-	7.34	
11:37	14.10	3.76	7.98	-	7.38	
11:38	14.09	3.76	7.98	-	7.30	
11:39	14.11	3.76	7.92	-	7.12	
11:40	14.14	3.73	7.85	-	7.10	
11:41	14.13	3.73	7.77	-	7.04	
11:42	14.14	3.73	7.73	-	6.87	
Average	14.12	3.74	7.84	-	7.08	

Kantaphon M.

(Mr. Kantaphon Maneesampan)

Environmental Field Scientist (2)



## ANALYZER CALIBRATION DATA

Client	Global Power Synergy PCL	Location	HRSG #2
Date	12 Feb 24	Test Operator	Sathaporn T.
O <sub>2</sub> ANALYZER Model	TELEDYNE API 200EH	Serial No.	735
Span (%)	25		

	Cylinder Value (%)	Initial Analyzers Calibration Response (%)	Final Analyzers Calibration Response (%)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.01	0.04
Low-Level Gas	8.04	8.05	8.05	0.00
Span Gas	16.00	16.00	16.01	0.04

NO <sub>x</sub> ANALYZER Model	TELEDYNE API 200EH	Serial No.	735
Span (ppm)	100		

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.01	0.01	0.00
Low-Level Gas	54.98	54.95	54.93	0.02
Span Gas	82.51	82.51	82.50	0.01

CO ANALYZER Model	TELEDYNE API 300EM	Serial No.	425
Span (ppm)	100		

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.02	0.02	0.00
Low-Level Gas	54.84	54.83	54.83	0.00
Span Gas	79.74	79.74	79.74	0.00

Calibrated by

Sathaporn T.

(Mr. Sathaporn Thakaw)

Environmental Field Scientist (3)



## SYSTEM CALIBRATION BIAS AND DRIFT DATA

Client	Global Power Synergy PCL	Location	HRSG #2
Date	12 Feb 24	Test Operator	Sathaporn T.

O <sub>2</sub> ANALYZER Cylinder Conc. (%)	16.00	Span (%)	25
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	O <sub>2</sub> Analyzer Calibration Response	Initial Values System Calibration Response	System Cal Bias (% of Span)	Final Values System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.00	0.02	0.08	0.02	0.08	0.00
Upscale Gas	16.00	16.02	0.08	16.02	0.08	0.00

NO <sub>x</sub> ANALYZER Cylinder Conc. (ppm)	82.51	Span (ppm)	100
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	NO <sub>x</sub> Analyzer Calibration Response	Initial Values System Calibration Response	System Cal Bias (% of Span)	Final Values System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.01	0.02	0.01	0.02	0.01	0.00
Upscale Gas	82.51	82.48	0.03	82.48	0.03	0.00

CO ANALYZER Cylinder Conc. (ppm)	79.74	Span (ppm)	100
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	CO Analyzer Calibration Response	Initial Values System Calibration Response	System Cal Bias (% of Span)	Final Values System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.02	0.03	0.01	0.04	0.02	0.01
Upscale Gas	79.74	79.72	0.02	79.72	0.02	0.00

Calibrated by

Sathaporn T.

(Mr. Sathaporn Thakaw)

Environmental Field Scientist (3)



## EMISSION TEST RESULT

Client	Global Power Synergy PCL	Run #	1
Date	12 Feb 24	Location	HRSG #2
Start Time	10:40	Test Operator	Sathaporn T.
SO <sub>2</sub> Analyzer Model	TELEDYNE API 200EH	Finish Time	11:00
NO <sub>x</sub> /O <sub>2</sub> Analyzer Model	TELEDYNE API 300EM	Serial No.	735
CO/CO <sub>2</sub> Analyzer Model	TELEDYNE API 300EM	Serial No.	425

Time (min)	O <sub>2</sub> (%)	CO <sub>2</sub> (%)	NO <sub>x</sub> (ppm)	SO <sub>2</sub> (ppm)	CO (ppm)	Remark
10:40	14.61	3.65	10.44	-	3.24	
10:41	14.62	3.60	10.44	-	3.22	
10:42	14.62	3.61	10.38	-	3.17	
10:43	14.61	3.62	10.38	-	3.16	
10:44	14.62	3.59	10.44	-	3.05	
10:45	14.62	3.64	10.43	-	3.01	
10:46	14.62	3.61	10.42	-	3.01	
10:47	14.62	3.64	10.45	-	2.99	
10:48	14.61	3.62	10.44	-	2.91	
10:49	14.63	3.63	10.41	-	2.78	
10:50	14.62	3.64	10.38	-	2.60	
10:51	14.62	3.63	10.37	-	2.63	
10:52	14.62	3.64	10.39	-	2.74	
10:53	14.62	3.62	10.39	-	2.71	
10:54	14.62	3.62	10.39	-	2.53	
10:55	14.62	3.60	10.41	-	2.54	
10:56	14.62	3.64	10.41	-	2.57	
10:57	14.62	3.62	10.44	-	2.50	
10:58	14.62	3.65	10.40	-	2.35	
10:59	14.63	3.62	10.53	-	2.30	
11:00	14.62	3.62	10.48	-	2.30	
Average	14.62	3.63	10.42	-	2.78	

Sathaporn T.

(Mr. Sathaporn Thakaw)

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## EMISSION TEST RESULT

Client	Global Power Synergy PCL	Run #	HRSG #2
Date	12 Feb 24	Location	Sathaporn.T
Start Time	11:01	Test Operator	11:21
SO <sub>2</sub> Analyzer Model	TELEDYNE API 200EH	Serial No.	735
NO <sub>x</sub> /O <sub>2</sub> Analyzer Model	TELEDYNE API 300EM	Serial No.	425

Time (min)	O <sub>2</sub> (%)	CO <sub>2</sub> (%)	NO <sub>x</sub> (ppm)	SO <sub>2</sub> (ppm)	CO (ppm)	Remark
11:01	14.63	3.63	10.45	-	2.34	
11:02	14.63	3.61	10.46	-	2.31	
11:03	14.62	3.63	10.47	-	2.24	
11:04	14.62	3.63	10.51	-	2.18	
11:05	14.62	3.62	10.51	-	2.17	
11:06	14.62	3.62	10.48	-	2.19	
11:07	14.63	3.63	10.50	-	2.22	
11:08	14.63	3.62	10.53	-	2.02	
11:09	14.63	3.62	10.53	-	2.13	
11:10	14.63	3.63	10.58	-	2.18	
11:11	14.63	3.65	10.57	-	2.07	
11:12	14.63	3.60	10.52	-	1.97	
11:13	14.63	3.62	10.45	-	1.95	
11:14	14.62	3.61	10.45	-	1.91	
11:15	14.63	3.62	10.44	-	1.95	
11:16	14.62	3.63	10.48	-	1.92	
11:17	14.63	3.59	10.48	-	1.85	
11:18	14.63	3.64	10.47	-	1.85	
11:19	14.63	3.67	10.50	-	1.81	
11:20	14.63	3.59	10.51	-	1.83	
11:21	14.63	3.63	10.53	-	1.85	
Average	14.63	3.63	10.49	-	2.03	

Sathaporn.T

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## EMISSION TEST RESULT

Client	Global Power Synergy PCL	Run #	HRSG #2
Date	12 Feb 24	Location	Sathaporn.T
Start Time	11:22	Test Operator	11:42
SO <sub>2</sub> Analyzer Model	TELEDYNE API 200EH	Serial No.	735
NO <sub>x</sub> /O <sub>2</sub> Analyzer Model	TELEDYNE API 300EM	Serial No.	425

Time (min)	O <sub>2</sub> (%)	CO <sub>2</sub> (%)	NO <sub>x</sub> (ppm)	SO <sub>2</sub> (ppm)	CO (ppm)	Remark
11:22	14.63	3.60	10.54	-	1.79	
11:23	14.63	3.62	10.57	-	1.73	
11:24	14.63	3.61	10.56	-	1.85	
11:25	14.63	3.62	10.51	-	1.63	
11:26	14.64	3.62	10.50	-	1.75	
11:27	14.64	3.61	10.53	-	1.75	
11:28	14.64	3.62	10.51	-	1.69	
11:29	14.63	3.60	10.47	-	1.66	
11:30	14.64	3.61	10.52	-	1.58	
11:31	14.64	3.63	10.48	-	1.59	
11:32	14.64	3.62	10.49	-	1.61	
11:33	14.65	3.62	10.54	-	1.56	
11:34	14.64	3.60	10.57	-	1.53	
11:35	14.63	3.62	10.57	-	1.55	
11:36	14.64	3.64	10.54	-	1.52	
11:37	14.64	3.63	10.50	-	1.47	
11:38	14.64	3.62	10.49	-	1.51	
11:39	14.64	3.61	10.54	-	1.49	
11:40	14.63	3.62	10.55	-	1.45	
11:41	14.63	3.61	10.52	-	1.47	
11:42	14.63	3.64	10.49	-	1.39	
Average	14.64	3.62	10.52	-	1.61	

Sathaporn.T

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## ANALYZER CALIBRATION DATA

Client	Global Power Synergy PCL	Location	HRSG #3
Date	11 Feb 24	Test Operator	Sathaporn.T
O <sub>2</sub> ANALYZER	TELEDYNE API 200EH	Serial No.	735
Span (%)	25		

	Cylinder Value (%)	Initial Analyzers Calibration Response (%)	Final Analyzers Calibration Response (%)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.01	0.04
Low-Level Gas	8.04	8.05	8.05	0.00
Span Gas	16.00	16.00	16.01	0.04

NO <sub>x</sub> ANALYZER	TELEDYNE API 200EH	Serial No.	735
Model			
Span (ppm)	100		

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.01	0.02	0.01
Low-Level Gas	54.96	54.95	54.93	0.02
Span Gas	82.51	82.51	82.48	0.03

CO ANALYZER	TELEDYNE API 300EM	Serial No.	425
Model			
Span (ppm)	100		

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.02	0.02	0.00
Low-Level Gas	54.84	54.83	54.83	0.00
Span Gas	79.74	79.74	79.74	0.00

CO <sub>2</sub> ANALYZER	TELEDYNE API 300EM	Serial No.	425
Model			
Span (%)	25		

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (%)	Final Analyzers Calibration Response (%)	Difference (Percent of Span)
Zero Gas	0.00	0.02	0.03	0.04
Low-Level Gas	8.00	7.99	7.97	0.08
Span Gas	15.02	15.02	15.00	0.08

Calibrated by

Sathaporn.T

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## SYSTEM CALIBRATION BIAS AND DRIFT DATA

Client	Global Power Synergy PCL	Location	HRSG #3
Date	11 Feb 24	Test Operator	Sathaporn.T

O <sub>2</sub> ANALYZER	Cylinder Conc. (%) : 16.00	Span (%) : 25
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	O <sub>2</sub> Analyzer Calibration Response	System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.00	0.02	0.08	0.02	0.08	0.00
Up-scale Gas	16.00	16.02	0.08	16.02	0.08	0.00

NO <sub>x</sub> ANALYZER	Cylinder Conc. (ppm) : 82.51	Span (ppm) : 100
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	NO <sub>x</sub> Analyzer Calibration Response	System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.01	0.02	0.03	0.02	0.02	0.01
Up-scale Gas	82.51	82.48	0.05	82.45	0.06	0.01

CO ANALYZER	Cylinder Conc. (ppm) : 79.74	Span (ppm) : 100
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	CO Analyzer Calibration Response	System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.02	0.03	0.01	0.04	0.02	0.01
Up-scale Gas	79.74	79.72	0.02	79.72	0.02	0.00

CO <sub>2</sub> ANALYZER	Cylinder Conc. (%) : 15.02	Span (%) : 25
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	CO <sub>2</sub> Analyzer Calibration Response	System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.02	0.04	0.05	0.04	0.05	0.00
Up-scale Gas	15.02	15.00	0.08	14.98	0.16	0.08

Calibrated by

Sathaporn.T

(Mr.Sathaporn Thakaeew)

Environmental Field Scientist (3)

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

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## EMISSION TEST RESULT

Client	Global Power Synergy PCL.	Run #	3
Date	11 Feb 24	Location	HRSG #3
Start Time	10:20	Test Operator	Sathaporn.T
SO <sub>2</sub> Analyzer Model	#N/A	Finish Time	10:40
NO <sub>x</sub> /O <sub>2</sub> Analyzer Model	TELEDYNE API 200EH	Serial No.	#N/A
CO/CO <sub>2</sub> Analyzer Model	TELEDYNE API 300EM	Serial No.	735
		Serial No.	425

Time (min)	O <sub>2</sub> (%)	CO <sub>2</sub> (%)	NO <sub>x</sub> (ppm)	SO <sub>2</sub> (ppm)	CO (ppm)	Remark
10:20	13.94	4.01	16.96	-	12.37	
10:21	13.97	4.02	16.53	-	12.28	
10:22	14.06	3.99	16.84	-	12.24	
10:23	14.03	3.98	16.90	-	12.04	
10:24	14.05	3.96	15.98	-	11.60	
10:25	14.04	3.95	17.19	-	11.63	
10:26	14.00	3.99	17.10	-	11.85	
10:27	13.95	4.08	17.08	-	12.19	
10:28	13.89	4.09	17.27	-	12.11	
10:29	13.83	4.05	17.56	-	12.03	
10:30	13.80	4.10	17.73	-	11.92	
10:31	13.78	4.14	17.56	-	11.83	
10:32	13.77	4.13	17.32	-	11.75	
10:33	13.77	4.13	17.37	-	11.73	
10:34	13.76	4.10	17.62	-	11.60	
10:35	13.75	4.11	17.60	-	11.36	
10:36	13.74	4.09	17.99	-	11.21	
10:37	13.74	4.17	17.87	-	11.03	
10:38	13.76	4.12	17.78	-	11.41	
10:39	13.79	4.11	17.85	-	11.75	
10:40	13.83	4.09	18.03	-	11.88	
Average	13.87	4.07	17.45	-	11.80	

Sathaporn.T

(Mr. Sathaporn Thakaeew)

Environmental Field Scientist (3)

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



## EMISSION TEST RESULT

Client	Global Power Synergy PCL.	Run #	3
Date	11 Feb 24	Location	HRSG #3
Start Time	10:41	Test Operator	Sathaporn.T
SO <sub>2</sub> Analyzer Model	#N/A	Finish Time	11:01
NO <sub>x</sub> /O <sub>2</sub> Analyzer Model	TELEDYNE API 200EH	Serial No.	#N/A
CO/CO <sub>2</sub> Analyzer Model	TELEDYNE API 300EM	Serial No.	735
		Serial No.	425

Time (min)	O <sub>2</sub> (%)	CO <sub>2</sub> (%)	NO <sub>x</sub> (ppm)	SO <sub>2</sub> (ppm)	CO (ppm)	Remark
10:41	13.85	4.08	16.16	-	12.04	
10:42	13.86	4.05	16.14	-	12.00	
10:43	13.89	4.04	16.01	-	11.93	
10:44	13.81	4.12	16.07	-	12.11	
10:45	13.75	4.17	16.31	-	11.40	
10:46	13.69	4.16	16.66	-	10.32	
10:47	13.63	4.19	16.86	-	9.63	
10:48	13.59	4.22	16.84	-	9.07	
10:49	13.56	4.26	16.79	-	8.53	
10:50	13.53	4.23	16.94	-	8.11	
10:51	13.52	4.24	16.26	-	7.89	
10:52	13.51	4.24	16.49	-	7.67	
10:53	13.52	4.29	16.35	-	7.76	
10:54	13.54	4.31	16.02	-	7.90	
10:55	13.57	4.22	16.81	-	8.29	
10:56	13.61	4.23	16.59	-	8.68	
10:57	13.67	4.19	16.54	-	9.64	
10:58	13.74	4.11	16.37	-	10.65	
10:59	13.78	4.14	16.08	-	11.30	
11:00	13.74	4.15	17.86	-	10.98	
11:01	13.83	4.22	17.97	-	9.71	
Average	13.68	4.18	16.58	-	9.60	

Sathaporn.T

(Mr. Sathaporn Thakaeew)

Environmental Field Scientist (3)

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



## EMISSION TEST RESULT

Client	Global Power Synergy PCL.	Run #	3
Date	11 Feb 24	Location	HRSG #3
Start Time	11:02	Test Operator	Sathaporn.T
SO <sub>2</sub> Analyzer Model	#N/A	Finish Time	11:22
NO <sub>x</sub> /O <sub>2</sub> Analyzer Model	TELEDYNE API 200EH	Serial No.	#N/A
CO/CO <sub>2</sub> Analyzer Model	TELEDYNE API 300EM	Serial No.	735
		Serial No.	425

Time (min)	O <sub>2</sub> (%)	CO <sub>2</sub> (%)	NO <sub>x</sub> (ppm)	SO <sub>2</sub> (ppm)	CO (ppm)	Remark
11:02	13.47	4.26	18.50	-	7.86	
11:03	13.40	4.30	18.94	-	7.00	
11:04	13.40	4.32	19.08	-	6.74	
11:05	13.46	4.29	18.82	-	7.16	
11:06	13.56	4.20	18.61	-	8.37	
11:07	13.69	4.14	18.47	-	9.79	
11:08	13.83	4.12	18.33	-	11.41	
11:09	13.93	4.02	18.09	-	12.19	
11:10	13.95	4.01	17.62	-	12.20	
11:11	13.92	4.01	17.43	-	12.29	
11:12	13.88	4.09	17.45	-	12.30	
11:13	13.84	4.11	17.62	-	12.07	
11:14	13.81	4.08	17.63	-	11.99	
11:15	13.81	4.09	17.83	-	11.95	
11:16	13.83	4.13	17.45	-	12.01	
11:17	13.87	4.06	17.36	-	12.07	
11:18	13.91	4.06	17.54	-	12.14	
11:19	13.94	4.06	17.80	-	12.23	
11:20	13.90	3.99	17.73	-	12.20	
11:21	13.96	4.04	17.48	-	12.14	
11:22	13.91	4.04	17.40	-	12.09	
Average	13.78	4.11	17.95	-	10.87	

Sathaporn.T

(Mr. Sathaporn Thakaeew)

Environmental Field Scientist (3)

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



## ANALYZER CALIBRATION DATA

Client	Global Power Synergy PCL.	Location	HRSG #4
Date	13 Feb 24	Test Operator	Kantaphon M.
O <sub>2</sub> ANALYZER Model	TELEDYNE API 200EH	Serial No.	774
Span (%)	25		

	Cylinder Value (%)	Initial Analyzers Calibration Response (%)	Final Analyzers Calibration Response (%)	Difference (Percent of Span)
Zero Gas	0.00	0.02	0.03	0.04
Low-Level Gas	8.00	8.03	8.04	0.04
Span Gas	16.02	16.03	16.05	0.08

NO <sub>x</sub> ANALYZER Model	TELEDYNE API 200EH	Serial No.	774
Span (ppm)	100		

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.02	0.03	0.01
Low-Level Gas	56.17	56.18	56.20	0.02
Span Gas	82.39	82.40	82.41	0.01

CO ANALYZER Model	TELEDYNE API 300EM	Serial No.	451
Span (ppm)	100		

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.03	0.05	0.02
Low-Level Gas	54.24	54.26	54.27	0.01
Span Gas	79.48	79.50	79.52	0.02

Calibrated by

Kantaphon M

(Mr. Kantaphon Maneesampan)

Environmental Field Scientist (2)

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



Lot No. 2415446-1

## SYSTEM CALIBRATION BIAS AND DRIFT DATA

Client: Global Power Synergy PCL. Location: HRSG #4  
Date: 13 Feb 24 Test Operator: Kantaphon M.O<sub>2</sub> ANALYZER: 16.02 Span (%) : 25  
Cylinder Conc. (%)

	O <sub>2</sub> 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	0.02	0.03	0.04	0.04	0.08	0.04
Upstream Gas	16.03	16.04	0.04	16.05	0.08	0.04

NO<sub>x</sub> ANALYZER: 82.39 Span (ppm) : 100  
Cylinder Conc. (ppm)

	NO <sub>x</sub> 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	0.02	0.03	0.01	0.05	0.03	0.02
Upstream Gas	82.40	82.41	0.01	82.43	0.03	0.02

CO ANALYZER: 79.48 Span (ppm) : 100  
Cylinder Conc. (ppm)

	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	0.03	0.04	0.01	0.04	0.01	0.00
Upstream Gas	79.50	79.52	0.02	79.53	0.03	0.01

Calibrated by

Kantaphon M.

( Mr. Kantaphon Maneesampan )

Environmental Field Scientist (2)

FORM NO. F 06-063 REVISION NO. 4 ISSUE DATE: 18/01/24

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## EMISSION TEST RESULT

Client: Global Power Synergy PCL. Run #  
Date: 13 Feb 24 Location: HRSG #4  
Start Time: 10:30 Test Operator: Kantaphon M.  
SO<sub>2</sub> Analyzer Model: Finish Time: 10:50  
NO<sub>x</sub>/O<sub>2</sub> Analyzer Model: Serial No.:  
CO/CO<sub>2</sub> Analyzer Model: TELEDYNE API 300EM Serial No.: 774  
Serial No.: 451

Time (min)	O <sub>2</sub> (%)	CO <sub>2</sub> (%)	NO <sub>x</sub> (ppm)	SO <sub>2</sub> (ppm)	CO (ppm)	Remark
10:30	14.30	3.93	10.28	--	7.40	
10:31	14.36	3.91	10.32	--	7.48	
10:32	14.31	3.89	10.63	--	7.66	
10:33	14.28	3.89	11.03	--	7.55	
10:34	14.21	3.92	11.11	--	6.40	
10:35	14.17	3.88	11.61	--	5.14	
10:36	14.28	3.91	11.72	--	5.95	
10:37	14.30	3.87	11.64	--	6.75	
10:38	14.45	3.81	11.26	--	7.65	
10:39	14.47	3.79	10.93	--	7.90	
10:40	14.52	3.78	10.71	--	8.26	
10:41	14.52	3.77	10.71	--	8.53	
10:42	14.54	3.77	10.96	--	8.50	
10:43	14.54	3.75	11.14	--	8.48	
10:44	14.56	3.73	11.34	--	8.45	
10:45	14.54	3.74	11.03	--	8.54	
10:46	14.52	3.76	10.20	--	8.57	
10:47	14.52	3.78	9.76	--	8.64	
10:48	14.53	3.76	9.92	--	8.57	
10:49	14.54	3.76	10.09	--	8.46	
10:50	14.52	3.78	9.76	--	8.57	
Average	14.48	3.82	10.78	--	7.79	

Kantaphon M.

( Mr. Kantaphon Maneesampan )

Environmental Field Scientist (2)

FORM NO. F 06-060 REVISION NO. 1 ISSUE DATE: 18/01/24

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## EMISSION TEST RESULT

Client: Global Power Synergy PCL. Run #  
Date: 13 Feb 24 Location: HRSG #4  
Start Time: 10:51 Test Operator: Kantaphon M.  
SO<sub>2</sub> Analyzer Model: Finish Time: 11:11  
NO<sub>x</sub>/O<sub>2</sub> Analyzer Model: Serial No.:  
CO/CO<sub>2</sub> Analyzer Model: TELEDYNE API 300EM Serial No.: 451

Time (min)	O <sub>2</sub> (%)	CO <sub>2</sub> (%)	NO <sub>x</sub> (ppm)	SO <sub>2</sub> (ppm)	CO (ppm)	Remark
10:51	14.54	3.76	9.68	--	8.54	
10:52	14.53	3.77	9.73	--	8.43	
10:53	14.52	3.78	9.75	--	8.45	
10:54	14.53	3.76	9.70	--	8.43	
10:55	14.54	3.75	9.72	--	8.40	
10:56	14.54	3.75	9.73	--	8.37	
10:57	14.54	3.76	9.96	--	8.46	
10:58	14.53	3.77	10.26	--	8.45	
10:59	14.52	3.76	10.26	--	8.38	
11:00	14.57	3.73	10.32	--	8.48	
11:01	14.57	3.73	10.28	--	8.47	
11:02	14.57	3.73	10.04	--	8.49	
11:03	14.59	3.73	9.96	--	8.52	
11:04	14.57	3.74	9.76	--	8.47	
11:05	14.57	3.74	9.70	--	8.46	
11:06	14.57	3.73	9.40	--	8.51	
11:07	14.54	3.76	9.44	--	8.54	
11:08	14.56	3.75	9.55	--	8.53	
11:09	14.55	3.75	9.65	--	8.45	
11:10	14.57	3.75	10.18	--	8.48	
11:11	14.57	3.74	10.52	--	8.53	
Average	14.55	3.75	9.90	--	8.47	

Kantaphon M.

( Mr. Kantaphon Maneesampan )

Environmental Field Scientist (2)

FORM NO. F 06-060 REVISION NO. 1 ISSUE DATE: 18/01/24

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## EMISSION TEST RESULT

Client: Global Power Synergy PCL. Run #  
Date: 13 Feb 24 Location: HRSG #4  
Start Time: 11:12 Test Operator: Kantaphon M.  
SO<sub>2</sub> Analyzer Model: Finish Time: 11:32  
NO<sub>x</sub>/O<sub>2</sub> Analyzer Model: Serial No.:  
CO/CO<sub>2</sub> Analyzer Model: TELEDYNE API 300EM Serial No.: 774  
Serial No.: 451

Time (min)	O <sub>2</sub> (%)	CO <sub>2</sub> (%)	NO <sub>x</sub> (ppm)	SO <sub>2</sub> (ppm)	CO (ppm)	Remark
11:12	14.61	3.71	10.80	--	8.49	
11:13	14.56	3.74	10.36	--	8.55	
11:14	14.48	3.78	9.99	--	8.09	
11:15	14.43	3.85	9.70	--	7.86	
11:16	14.48	3.79	9.76	--	7.70	
11:17	14.49	3.78	9.78	--	7.64	
11:18	14.50	3.77	9.81	--	7.72	
11:19	14.52	3.77	9.85	--	7.98	
11:20	14.55	3.76	10.02	--	8.19	
11:21	14.57	3.74	10.30	--	8.31	
11:22	14.55	3.74	10.06	--	8.44	
11:23	14.57	3.73	10.01	--	8.46	
11:24	14.65	3.74	9.96	--	8.45	
11:25	14.58	3.74	10.04	--	8.50	
11:26	14.59	3.73	9.95	--	8.51	
11:27	14.57	3.74	9.55	--	8.37	
11:28	14.45	3.81	9.67	--	7.49	
11:29	14.44	3.83	9.53	--	7.48	
11:30	14.45	3.82	9.75	--	7.54	
11:31	14.51	3.75	9.93	--	7.70	
11:32	14.53	3.76	10.13	--	8.15	
Average	14.52	3.76	9.95	--	8.07	

Kantaphon M.

( Mr. Kantaphon Maneesampan )

Environmental Field Scientist (2)

FORM NO. F 06-060 REVISION NO. 1 ISSUE DATE: 18/01/24

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Lot No. 2413450-1

## ANALYZER CALIBRATION DATA

Client: Global Power Synergy PCL  
Date: 13 Feb 24  
Location: HRSQ #5  
Test Operator: Sathaporn.TO<sub>2</sub> ANALYZER  
Model: TELEDYNE API 200EH  
Span (%): 25  
Serial No.: 735

	Cylinder Value (%)	Initial Analyzers Calibration Response (%)	Final Analyzers Calibration Response (%)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.01	0.04
Low-Level Gas	8.04	8.05	8.05	0.00
Span Gas	16.00	16.00	16.01	0.04

NO<sub>x</sub> ANALYZER  
Model: TELEDYNE API 200EH  
Span (ppm): 100  
Serial No.: 735

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.01	0.01	0.00
Low-Level Gas	54.98	54.95	54.93	0.02
Span Gas	82.51	82.51	82.50	0.01

CO ANALYZER  
Model: TELEDYNE API 300EM  
Span (ppm): 100  
Serial No.: 425

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.02	0.02	0.00
Low-Level Gas	54.84	54.83	54.83	0.00
Span Gas	79.74	79.74	79.74	0.00

Calibrated by

Sathaporn.T

(Mr.Sathaporn Thakaew)  
Environmental Field Scientist (3)FORM NO.: F 06-062 REVISION NO.: 4 ISSUE DATE: 18/01/24  
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Lot No. 2413450-1

## SYSTEM CALIBRATION BIAS AND DRIFT DATA

Client: Global Power Synergy PCL  
Date: 13 Feb 24  
Location: HRSQ #5  
Test Operator: Sathaporn.TO<sub>2</sub> ANALYZER  
Cylinder Conc. (%): 16.00  
Span (%): 25

	O <sub>2</sub> Analyzer Calibration Response	System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.00	0.02	0.08	0.02	0.08	0.00
Up-scale Gas	16.00	16.02	0.08	16.02	0.08	0.00

NO<sub>x</sub> ANALYZER  
Cylinder Conc. (ppm): 82.51  
Span (ppm): 100

	NO <sub>x</sub> Analyzer Calibration Response	System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.01	0.02	0.01	0.03	0.02	0.01
Up-scale Gas	82.51	82.48	0.03	82.48	0.03	0.00

CO ANALYZER  
Cylinder Conc. (ppm): 79.74  
Span (ppm): 100

	CO Analyzer Calibration Response	System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.02	0.03	0.01	0.04	0.02	0.01
Up-scale Gas	79.74	79.72	0.02	79.72	0.02	0.00

Calibrated by

Sathaporn.T

(Mr.Sathaporn Thakaew)  
Environmental Field Scientist (3)FORM NO.: F 06-063 REVISION NO.: 4 ISSUE DATE: 18/01/24  
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## EMISSION TEST RESULT

Client: Global Power Synergy PCL  
Date: 13 Feb 24  
Start Time: 10:20  
SO<sub>2</sub> Analyzer Model: -  
NO<sub>x</sub>/O<sub>2</sub> Analyzer Model: TELEDYNE API 200EH  
CO/CO<sub>2</sub> Analyzer Model: TELEDYNE API 300EM  
Run #: 1  
Location: HRSQ #5  
Test Operator: Sathaporn.T  
Finish Time: 10:40  
Serial No.: 735  
Serial No.: 425

Time (min)	O <sub>2</sub> (%)	CO <sub>2</sub> (%)	NO <sub>x</sub> (ppm)	SO <sub>2</sub> (ppm)	CO (ppm)	Remark
10:20	14.27	3.74	7.29	-	1.03	
10:21	14.26	3.75	7.30	-	0.88	
10:22	14.27	3.77	7.34	-	1.00	
10:23	14.26	3.78	7.37	-	1.09	
10:24	14.27	3.78	7.30	-	1.04	
10:25	14.26	3.74	7.22	-	1.03	
10:26	14.27	3.75	7.21	-	1.14	
10:27	14.27	3.75	7.14	-	1.20	
10:28	14.27	3.77	7.04	-	1.03	
10:29	14.26	3.78	7.04	-	1.01	
10:30	14.27	3.75	7.10	-	1.00	
10:31	14.29	3.78	7.28	-	0.95	
10:32	14.30	3.74	7.56	-	0.94	
10:33	14.31	3.72	7.77	-	0.89	
10:34	14.31	3.72	7.94	-	0.86	
10:35	14.33	3.70	8.06	-	0.79	
10:36	14.33	3.73	8.15	-	0.72	
10:37	14.34	3.74	8.18	-	0.60	
10:38	14.35	3.75	8.09	-	0.74	
10:39	14.37	3.69	7.23	-	0.61	
10:40	14.41	3.68	7.69	-	0.58	
Average	14.30	3.74	7.49	-	0.92	

Sathaporn.T

(Mr.Sathaporn Thakaew)  
Environmental Field Scientist (3)FORM NO.: F 06-060 REVISION NO.: 1 ISSUE DATE: 18/01/24  
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## EMISSION TEST RESULT

Client: Global Power Synergy PCL  
Date: 13 Feb 24  
Start Time: 10:41  
SO<sub>2</sub> Analyzer Model: -  
NO<sub>x</sub>/O<sub>2</sub> Analyzer Model: TELEDYNE API 200EH  
CO/CO<sub>2</sub> Analyzer Model: TELEDYNE API 300EM  
Run #: 2  
Location: HRSQ #5  
Test Operator: Sathaporn.T  
Finish Time: 11:01  
Serial No.: -  
Serial No.: 735  
Serial No.: 425

Time (min)	O <sub>2</sub> (%)	CO <sub>2</sub> (%)	NO <sub>x</sub> (ppm)	SO <sub>2</sub> (ppm)	CO (ppm)	Remark
10:41	14.38	3.68	7.30	-	0.67	
10:42	14.36	3.72	8.63	-	0.69	
10:43	14.35	3.73	8.31	-	0.76	
10:44	14.36	3.73	8.12	-	0.70	
10:45	14.35	3.71	8.07	-	0.69	
10:46	14.39	3.67	8.12	-	0.66	
10:47	14.40	3.71	8.14	-	0.71	
10:48	14.37	3.68	8.95	-	0.72	
10:49	14.38	3.71	8.80	-	0.70	
10:50	14.37	3.71	8.62	-	0.74	
10:51	14.39	3.72	8.94	-	0.69	
10:52	14.39	3.70	8.98	-	0.69	
10:53	14.38	3.74	8.98	-	0.68	
10:54	14.38	3.74	8.01	-	0.56	
10:55	14.37	3.69	8.05	-	0.62	
10:56	14.37	3.70	8.09	-	0.62	
10:57	14.38	3.72	8.12	-	0.71	
10:58	14.37	3.72	8.22	-	0.68	
10:59	14.35	3.70	8.28	-	0.72	
11:00	14.40	3.72	8.67	-	0.65	
11:01	14.40	3.70	8.69	-	0.64	
Average	14.38	3.71	8.22	-	0.68	

Sathaporn.T

(Mr.Sathaporn Thakaew)  
Environmental Field Scientist (3)FORM NO.: F 06-060 REVISION NO.: 1 ISSUE DATE: 18/01/24  
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## EMISSION TEST RESULT

Client	Global Power Synergy PCL	Run #	3
Date	13 Feb 24	Location	HRSG #6
Start Time	11:02	Test Operator	Sathaporn.T
SO <sub>2</sub> Analyzer Model	TELEDYNE API 200EH	Finish Time	11:22
NO <sub>x</sub> /O <sub>2</sub> Analyzer Model	TELEDYNE API 300EM	Serial No.	735
CO/CO <sub>2</sub> Analyzer Model	TELEDYNE API 300EM	Serial No.	425

Time (min)	O <sub>2</sub> (%)	CO <sub>2</sub> (%)	NO <sub>x</sub> (ppm)	SO <sub>2</sub> (ppm)	CO (ppm)	Remark
11:02	14.41	3.68	7.08	-	0.63	
11:03	14.39	3.72	7.12	-	0.64	
11:04	14.40	3.68	7.09	-	0.62	
11:05	14.40	3.71	7.02	-	0.60	
11:06	14.39	3.72	6.91	-	0.67	
11:07	14.39	3.69	6.79	-	0.68	
11:08	14.39	3.71	6.80	-	0.63	
11:09	14.38	3.70	6.75	-	0.70	
11:10	14.38	3.73	6.76	-	0.71	
11:11	14.38	3.74	6.93	-	0.69	
11:12	14.39	3.70	7.11	-	0.67	
11:13	14.41	3.71	7.25	-	0.62	
11:14	14.43	3.66	7.42	-	0.70	
11:15	14.40	3.72	7.31	-	0.73	
11:16	14.39	3.75	7.09	-	0.77	
11:17	14.39	3.72	6.91	-	0.70	
11:18	14.41	3.71	6.86	-	0.76	
11:19	14.37	3.74	6.78	-	0.78	
11:20	14.37	3.74	6.66	-	0.81	
11:21	14.37	3.72	6.61	-	0.71	
11:22	14.38	3.76	6.71	-	0.67	
Average	14.39	3.71	6.95	-	0.69	

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Environmental Field Scientist (3)



Lot No. 2413451-1

## ANALYZER CALIBRATION DATA

Client	Global Power Synergy PCL	Location	HRSG #6
Date	10 Feb 24	Test Operator	Sathaporn.T
O <sub>2</sub> ANALYZER Model	TELEDYNE API 200EH	Serial No.	735
Model	25		

	Cylinder Value (%)	Initial Analyzers Calibration Response (%)	Final Analyzers Calibration Response (%)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.01	0.04
Low-Level Gas	8.04	8.05	8.05	0.00
Span Gas	16.00	16.00	16.01	0.04

NO <sub>x</sub> ANALYZER Model	TELEDYNE API 200EH	Serial No.	735
Span (ppm)	100		

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.01	0.01	0.00
Low-Level Gas	54.98	54.95	54.93	0.02
Span Gas	82.51	82.51	82.50	0.01

CO ANALYZER Model	TELEDYNE API 300EM	Serial No.	425
Span (ppm)	100		

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.02	0.02	0.00
Low-Level Gas	54.84	54.83	54.83	0.00
Span Gas	79.74	79.74	79.74	0.00

CO <sub>2</sub> ANALYZER Model	TELEDYNE API 300EM	Serial No.	425
Span (%)	25		

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (%)	Final Analyzers Calibration Response (%)	Difference (Percent of Span)
Zero Gas	0.00	0.02	0.02	0.00
Low-Level Gas	8.00	7.99	7.99	0.00
Span Gas	15.02	15.02	15.01	0.04

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Environmental Field Scientist (3)



Lot No. 2413451-1

## SYSTEM CALIBRATION BIAS AND DRIFT DATA

Client	Global Power Synergy PCL	Location	HRSG #6
Date	10 Feb 24	Test Operator	Sathaporn.T

O <sub>2</sub> ANALYZER	Cylinder Conc. (%) : 16.00	Span (%) : 25
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	O <sub>2</sub> Analyzer Calibration Response	Initial Values	Final Values	Drift (% of Span)
		System Calibration Response	System Calibration Response	
		System Cal Bias (% of Span)	System Cal Bias (% of Span)	
Zero Gas	0.00	0.02	0.02	0.00
Up-scale Gas	16.00	16.02	16.02	0.00

NO <sub>x</sub> ANALYZER	Cylinder Conc. (ppm) : 82.51	Span (ppm) : 100
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	NO <sub>x</sub> Analyzer Calibration Response	Initial Values	Final Values	Drift (% of Span)
		System Calibration Response	System Calibration Response	
		System Cal Bias (% of Span)	System Cal Bias (% of Span)	
Zero Gas	0.01	0.02	0.03	0.01
Up-scale Gas	82.51	82.48	82.48	0.03

CO ANALYZER	Cylinder Conc. (ppm) : 79.74	Span (ppm) : 100
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	CO Analyzer Calibration Response	Initial Values	Final Values	Drift (% of Span)
		System Calibration Response	System Calibration Response	
		System Cal Bias (% of Span)	System Cal Bias (% of Span)	
Zero Gas	0.02	0.03	0.04	0.01
Up-scale Gas	79.74	79.72	79.72	0.02

CO <sub>2</sub> ANALYZER	Cylinder Conc. (%) : 15.02	Span (%) : 25
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	CO <sub>2</sub> Analyzer Calibration Response	Initial Values	Final Values	Drift (% of Span)
		System Calibration Response	System Calibration Response	
		System Cal Bias (% of Span)	System Cal Bias (% of Span)	
Zero Gas	0.02	0.04	0.04	0.00
Up-scale Gas	15.02	15.00	15.00	0.00

Calibrated by

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(Mr.Sathaporn Thakaew)

Environmental Field Scientist (3)



## EMISSION TEST RESULT

Client	Global Power Synergy PCL	Run #	1
Date	10 Feb 24	Location	HRSG #6
Start Time	10:20	Test Operator	Sathaporn.T
SO <sub>2</sub> Analyzer Model	#N/A	Finish Time	10:40
NO <sub>x</sub> /O <sub>2</sub> Analyzer Model	TELEDYNE API 200EH	Serial No.	#N/A
CO/CO <sub>2</sub> Analyzer Model	TELEDYNE API 300EM	Serial No.	735
		Serial No.	425

Time (min)	O <sub>2</sub> (%)	CO <sub>2</sub> (%)	NO <sub>x</sub> (ppm)	SO <sub>2</sub> (ppm)	CO (ppm)	Remark
10:20	14.45	3.64	6.42	-	1.94	
10:21	14.46	3.63	6.56	-	2.01	
10:22	14.47	3.67	6.65	-	2.07	
10:23	14.45	3.64	6.62	-	2.03	
10:24	14.44	3.64	6.54	-	2.05	
10:25	14.43	3.65	6.54	-	2.04	
10:26	14.44	3.63	6.61	-	2.09	
10:27	14.44	3.63	6.72	-	2.04	
10:28	14.45	3.58	6.60	-	1.97	
10:29	14.45	3.64	6.61	-	1.97	
10:30	14.44	3.61	6.75	-	2.02	
10:31	14.46	3.65	6.72	-	2.05	
10:32	14.44	3.62	6.70	-	1.94	
10:33	14.46	3.64	6.68	-	1.92	
10:34	14.46	3.61	6.70	-	1.98	
10:35	14.46	3.63	6.71	-	1.96	
10:36	14.45	3.65	6.70	-	1.96	
10:37	14.45	3.66	6.59	-	1.99	
10:38	14.44	3.66	6.52	-	1.95	
10:39	14.47	3.61	6.50	-	1.99	
10:40	14.46	3.65	6.39	-	1.99	
Average	14.45	3.64	6.63	-	2.00	

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## EMISSION TEST RESULT

Client	Global Power Synergy PCL.	Run #	HRSG #6
Date	10 Feb 24	Location	Sathaporn.T
Start Time	10:41	Test Operator	11:01
SO <sub>2</sub> Analyzer Model	APIA	Serial No.	735
NO <sub>x</sub> /O <sub>2</sub> Analyzer Model	TELEDYNE API 200EH	Serial No.	425
CO/CO <sub>2</sub> Analyzer Model	TELEDYNE API 300EM		

Time (min)	O <sub>2</sub> (%)	CO <sub>2</sub> (%)	NO <sub>x</sub> (ppm)	SO <sub>2</sub> (ppm)	CO (ppm)	Remark
10:41	14.45	3.63	6.39	-	2.04	
10:42	14.45	3.65	6.39	-	1.99	
10:43	14.46	3.62	6.36	-	1.96	
10:44	14.45	3.64	6.33	-	1.97	
10:45	14.47	3.63	6.30	-	1.97	
10:46	14.49	3.57	6.33	-	2.07	
10:47	14.46	3.63	6.37	-	1.97	
10:48	14.49	3.65	6.45	-	2.03	
10:49	14.50	3.62	6.53	-	2.10	
10:50	14.48	3.63	6.51	-	2.08	
10:51	14.48	3.63	6.54	-	2.02	
10:52	14.48	3.63	6.56	-	1.96	
10:53	14.47	3.65	6.55	-	2.02	
10:54	14.48	3.62	6.52	-	1.96	
10:55	14.50	3.62	6.54	-	2.00	
10:56	14.49	3.63	6.59	-	1.95	
10:57	14.50	3.62	6.59	-	1.93	
10:58	14.49	3.60	6.55	-	1.93	
10:59	14.49	3.63	6.48	-	1.93	
11:00	14.49	3.63	6.44	-	1.93	
11:01	14.47	3.61	6.42	-	2.00	
Average	14.48	3.63	6.40	-	1.99	

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



## EMISSION TEST RESULT

Client	Global Power Synergy PCL.	Run #	3
Date	10 Feb 24	Location	HRSG #6
Start Time	11:02	Test Operator	Sathaporn.T
SO <sub>2</sub> Analyzer Model	APIA	Finish Time	11:22
NO <sub>x</sub> /O <sub>2</sub> Analyzer Model	TELEDYNE API 200EH	Serial No.	735
CO/CO <sub>2</sub> Analyzer Model	TELEDYNE API 300EM	Serial No.	425

Time (min)	O <sub>2</sub> (%)	CO <sub>2</sub> (%)	NO <sub>x</sub> (ppm)	SO <sub>2</sub> (ppm)	CO (ppm)	Remark
11:02	14.47	3.66	6.39	-	1.89	
11:03	14.47	3.87	6.40	-	1.96	
11:04	14.48	3.63	6.46	-	1.97	
11:05	14.49	3.63	6.51	-	2.01	
11:06	14.45	3.62	6.44	-	2.17	
11:07	14.43	3.67	6.34	-	2.03	
11:08	14.49	3.65	6.25	-	2.09	
11:09	14.46	3.63	6.27	-	2.07	
11:10	14.44	3.68	6.20	-	2.13	
11:11	14.44	3.64	6.11	-	2.20	
11:12	14.44	3.66	6.06	-	2.26	
11:13	14.45	3.63	6.08	-	2.24	
11:14	14.46	3.63	6.07	-	2.16	
11:15	14.45	3.66	6.08	-	2.19	
11:16	14.46	3.68	6.13	-	2.11	
11:17	14.45	3.65	6.24	-	2.11	
11:18	14.46	3.64	6.35	-	2.15	
11:19	14.45	3.64	6.43	-	2.05	
11:20	14.45	3.67	6.50	-	2.13	
11:21	14.45	3.64	6.56	-	2.11	
11:22	14.46	3.60	6.62	-	2.12	
Average	14.46	3.65	6.31	-	2.10	

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



Lot No. 2413433-1

## ANALYZER CALIBRATION DATA

Client	Global Power Synergy PCL.	Location	Auxiliary Boiler
Date	14 Feb 24	Test Operator	Sathaporn.T
O <sub>2</sub> ANALYZER Model	TELEDYNE API 200EH	Serial No.	735
Span (%)	25		

	Cylinder Value (%)	Initial Analyzers Calibration Response (%)	Final Analyzers Calibration Response (%)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.01	0.04
Low-Level Gas	8.04	8.05	8.05	0.00
Span Gas	16.00	16.00	16.01	0.04

NO <sub>x</sub> ANALYZER Model	TELEDYNE API 200EH	Serial No.	735
Span (ppm)	100		

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.01	0.02	0.01
Low-Level Gas	54.96	54.95	54.93	0.02
Span Gas	82.51	82.51	82.48	0.03

CO ANALYZER Model	TELEDYNE API 300EM	Serial No.	425
Span (ppm)	100		

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.02	0.02	0.00
Low-Level Gas	54.84	54.83	54.83	0.00
Span Gas	79.74	79.74	79.74	0.00

Calibrated by

Sathaporn.T

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Environmental Field Scientist (3)

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



Lot No. 2413433-1

## SYSTEM CALIBRATION BIAS AND DRIFT DATA

Client	Global Power Synergy PCL.	Location	Auxiliary Boiler
Date	14 Feb 24	Test Operator	Sathaporn.T

O <sub>2</sub> ANALYZER Cylinder Conc. (%)	16.00	Span (%)	25
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	O <sub>2</sub> Analyzer Calibration Response	System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.00	0.02	0.08	0.02	0.08	0.00
Up-scale Gas	16.00	16.02	0.08	16.02	0.08	0.00

NO <sub>x</sub> ANALYZER Cylinder Conc. (ppm)	82.51	Span (ppm)	100
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	NO <sub>x</sub> Analyzer Calibration Response	System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.01	0.02	0.01	0.03	0.02	0.01
Up-scale Gas	82.51	82.48	0.05	82.45	0.06	0.01

CO ANALYZER Cylinder Conc. (ppm)	79.74	Span (ppm)	100
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	CO Analyzer Calibration Response	System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.02	0.03	0.01	0.04	0.02	0.01
Up-scale Gas	79.74	79.72	0.02	79.72	0.02	0.00

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Environmental Field Scientist (3)

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



## EMISSION TEST RESULT

Client	Global Power Synergy PCL.	Run #	3
Date	14 Feb 24	Location	Auxiliary Boiler
Start Time	12:40	Test Operator	Sathaporn.T
SO <sub>2</sub> Analyzer Model	TELEDYNE API 200EH	Finish Time	13:09
NO <sub>x</sub> /O <sub>2</sub> Analyzer Model	TELEDYNE API 300EM	Serial No.	735
CO/CO <sub>2</sub> Analyzer Model	TELEDYNE API 300EM	Serial No.	425

Time (min)	O <sub>2</sub> (%)	CO <sub>2</sub> (%)	NO <sub>x</sub> (ppm)	SO <sub>2</sub> (ppm)	CO (ppm)	Remark
12:40	8.04	7.42	36.53	-	1.43	
12:41	8.05	7.39	36.52	-	1.45	
12:42	8.07	7.37	36.52	-	1.06	
12:43	8.11	7.36	36.35	-	1.04	
12:44	8.11	7.38	36.29	-	1.08	
12:45	8.11	7.40	36.06	-	1.20	
12:46	8.12	7.37	36.03	-	0.97	
12:47	8.08	7.40	36.08	-	0.76	
12:48	8.09	7.36	35.92	-	0.69	
12:49	8.08	7.40	35.94	-	1.08	
12:50	8.10	7.43	36.15	-	1.34	
12:51	8.14	7.38	36.55	-	0.81	
12:52	8.12	7.43	36.66	-	0.67	
12:53	8.10	7.44	36.61	-	0.53	
12:54	8.12	7.33	36.40	-	0.68	
12:55	8.12	7.40	36.62	-	0.68	
12:56	8.11	7.39	36.76	-	0.61	
12:57	8.10	7.37	36.74	-	0.42	
12:58	8.09	7.42	36.56	-	0.69	
12:59	8.08	7.43	36.33	-	0.80	
13:00	8.05	7.44	36.17	-	1.08	
Average	8.09	7.40	36.36	-	0.92	

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## EMISSION TEST RESULT

Client	Global Power Synergy PCL.	Run #	3
Date	14 Feb 24	Location	Auxiliary Boiler
Start Time	13:01	Test Operator	Sathaporn.T
SO <sub>2</sub> Analyzer Model	TELEDYNE API 200EH	Finish Time	13:21
NO <sub>x</sub> /O <sub>2</sub> Analyzer Model	TELEDYNE API 300EM	Serial No.	735
CO/CO <sub>2</sub> Analyzer Model	TELEDYNE API 300EM	Serial No.	425

Time (min)	O <sub>2</sub> (%)	CO <sub>2</sub> (%)	NO <sub>x</sub> (ppm)	SO <sub>2</sub> (ppm)	CO (ppm)	Remark
13:01	8.07	7.39	36.12	-	1.13	
13:02	8.07	7.37	36.28	-	0.96	
13:03	8.06	7.38	36.58	-	1.10	
13:04	8.09	7.42	36.84	-	0.97	
13:05	8.07	7.43	36.97	-	1.28	
13:06	8.09	7.39	37.02	-	1.27	
13:07	8.09	7.41	37.06	-	0.99	
13:08	8.08	7.41	37.05	-	1.25	
13:09	8.08	7.35	37.20	-	1.18	
13:10	8.07	7.44	37.48	-	1.16	
13:11	8.06	7.38	37.51	-	1.38	
13:12	8.07	7.38	37.29	-	1.01	
13:13	8.07	7.35	37.08	-	0.94	
13:14	8.06	7.37	36.99	-	0.98	
13:15	8.05	7.46	36.92	-	1.36	
13:16	8.03	7.42	36.69	-	1.44	
13:17	8.06	7.44	36.56	-	1.30	
13:18	8.07	7.39	36.58	-	1.18	
13:19	8.05	7.41	36.62	-	0.88	
13:20	8.08	7.39	36.65	-	0.82	
13:21	8.08	7.36	36.72	-	1.07	
Average	8.01	7.40	36.87	-	1.13	

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## EMISSION TEST RESULT

Client	Global Power Synergy PCL.	Run #	3
Date	14 Feb 24	Location	Auxiliary Boiler
Start Time	13:22	Test Operator	Sathaporn.T
SO <sub>2</sub> Analyzer Model	TELEDYNE API 200EH	Finish Time	13:42
NO <sub>x</sub> /O <sub>2</sub> Analyzer Model	TELEDYNE API 300EM	Serial No.	735
CO/CO <sub>2</sub> Analyzer Model	TELEDYNE API 300EM	Serial No.	425

Time (min)	O <sub>2</sub> (%)	CO <sub>2</sub> (%)	NO <sub>x</sub> (ppm)	SO <sub>2</sub> (ppm)	CO (ppm)	Remark
13:22	8.10	7.38	36.88	-	1.01	
13:23	8.12	7.32	37.06	-	1.08	
13:24	8.08	7.36	37.10	-	0.88	
13:26	8.06	7.41	36.79	-	1.02	
13:29	8.05	7.42	36.60	-	0.98	
13:27	8.09	7.38	36.73	-	1.01	
13:28	8.07	7.42	36.98	-	1.17	
13:29	8.10	7.37	37.08	-	0.97	
13:30	8.09	7.36	37.07	-	1.02	
13:31	8.08	7.38	37.14	-	1.14	
13:32	8.05	7.42	37.16	-	0.92	
13:33	8.06	7.39	37.15	-	1.00	
13:34	8.08	7.40	37.32	-	0.73	
13:35	8.09	7.40	37.37	-	0.91	
13:36	8.09	7.42	37.40	-	0.91	
13:37	8.06	7.36	37.34	-	1.04	
13:38	8.07	7.35	37.36	-	1.14	
13:39	8.08	7.40	37.44	-	0.99	
13:40	8.09	7.36	37.64	-	0.95	
13:41	8.05	7.34	37.61	-	1.02	
13:42	8.06	7.35	37.52	-	1.05	
Average	8.08	7.39	37.18	-	0.99	

Sathaporn.T

(Mr.Sathaporn Thakaw)

Environmental Field Scientist (3)

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

ALS Laboratory Group

Page 5 of 5.



## CONSOLE CONTROL UNIT CALIBRATION TEST REPORT

Barometric Pressure (mm-Hg) : 754.7  
Relative Humidity (%) : 55.0  
Temperature (C°) : 27.2

Reference Dry Gas Meter Data  
Reference Dry Gas Meter ID : BKH-FS1122  
Serial No. : A2003240  
Correction Factor (Y) : 0.9824  
Next Calibration Date : 7-Nov-24

Console Control Meter Data  
Calibration No. : C-090124-RYG-FS0315  
Dry Gas Meter ID : RYG-FS0315  
Serial No. : 1706091  
Model No. : XC-572-V

ΔH (mm-H <sub>2</sub> O)	θ (mm-H <sub>2</sub> O)	Reference Dry Gas Meter Calibration				Console Control Dry Gas Meter				Dry Gas Meter Calibration	
		V <sub>r</sub> (Liters)		T <sub>r</sub> (°C)		V <sub>c</sub> (Liters)		T <sub>c</sub> (°C)		Factor	ΔAvg
15	12.80	Final	Initial	Final	Initial	Final	Initial	Final	Initial		
25	9.78	150.00	0.00	150.00	0.00	1900727.4	1900577.0	150.40	26.0	0.9764	49.8042
50	6.86	150.00	0.00	150.00	0.00	1900698.2	1900748.0	150.20	26.0	0.9767	48.4027
80	5.38	150.00	0.00	150.00	0.00	1900707.8	1900698.0	149.80	27.0	0.9822	47.8064
120	4.40	150.00	0.00	150.00	0.00	1900722.8	1900707.0	149.60	27.0	0.9794	46.7779
		150.00	0.00	150.00	0.00	1900735.6	1900727.0	149.80	26.0	0.9824	46.7715
									Avg	0.9828	47.9243

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

ΔAvg : Orifice pressure differential that equates to 21.34 in of air @ 25°C and 760 mm of mercury ; mm-H<sub>2</sub>O : tolerance for individual values ± 5.08 from average

Procedure: 40 CFR 60 APP A METH. SEC 5.3 & 7

Calibrated by : Sankit Phansavath

(Mr. Sankit Phansavath)  
RYG Field Service Scientist(4)

Approved by :

Nattaporn Jangmanee

(Mr. Nattaporn Jangmanee)  
RYG Field Service Specialist(1)

FORM NO. F 06-002 REVISION NO. 2 ISSUE DATE: 30-Jun-22



### Stopwatch Calibration Test Report

Calibration Date : 9 Jan 24      Next Cal. Date : 9 Jul 24  
Barometric Pressure (mmHg) : 754.7      Temperature (°C) : 27.2  
Relative Humidity (%) : 55.0

#### 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. : RYG\_FS0315  
Model : XC-572-V  
Serial No. : 1706091

Run No.	Time Actual (m:ss.ms)	Time Reading (m:ss)	Diff. (ms)	Diff. (min)
1	5:00.03	5:00	3	0.00005
2	5:00.09	5:00	9	0.00013
3	5:00.09	5:00	9	0.00015
4	5:00.11	5:00	11	0.00018
5	5:00.05	5:00	5	0.00008
6	5:00.06	5:00	6	0.00010
7	5:00.06	5:00	6	0.00010
8	5:00.08	5:00	8	0.00013
9	5:00.09	5:00	9	0.00015
10	5:00.07	5:00	7	0.00012
Average			0.00012	
SD			0.00004	

Calibrated by : Saksit Phaisanphisit  
Mr. Saksit Phaisanphisit  
RYG Field Service Scientist (4)

Approved by : Nattapol Jengwareewong  
Mr. Nattapol Jengwareewong  
RYG Field Service Specialist (1)



### DIGITAL TEMPERATURE CALIBRATION DATA SHEET

Calibration Date : 9 Jan 24		Ambient Temperature (°C) 27.2			
Calibration sheet No. : C-090124-RYG_FS0315		Relative Humidity (%) : 55			
Digital Temperature ID RYG_FS0315		Reference Temperature ID RYG_FS0681			
Serial No. : 1706091		Serial No. : 201090014918			
Model : XC-572-V		Model : Digicon-CC-VT-MS			
Next Calibrate :		13 Nov 24			
Location	Reference Temperature °C	Digital Temperature °C	Error °C	MPE	Pass / Fail
Stack	0	-1	-1	±3	Pass
	25	24	0	±3	Pass
	50	50	0	±3	Pass
	100	101	1	±3	Pass
	150	151	1	±3	Pass
	200	200	0	±3	Pass
	250	250	0	±3	Pass
	300	301	1	±3	Pass
	500	502	2	±3	Pass
	1000	1002	2	±3	Pass
Probe	120	121	1	±3	Pass
	140	141	1	±3	Pass
	100	101	1	±3	Pass
Oven	120	121	1	±3	Pass
	140	141	1	±3	Pass
	100	101	1	±3	Pass
Filter	120	121	1	±3	Pass
	140	141	1	±3	Pass
	100	101	1	±3	Pass
Exit	0	0	0	±3	Pass
	10	10	0	±3	Pass
	20	20	0	±3	Pass
Meter	0	-1	-1	±3	Pass
	25	24	-1	±3	Pass
	50	48	-2	±3	Pass
AUX	0	0	0	±3	Pass
	25	25	0	±3	Pass
	50	50	0	±3	Pass

MPE : (Maximum permissible error of measurement) ค่าความคลาดเคลื่อนสูงสุดในการวัด

Calibrated by : Saksit Phaisanphisit  
( Mr. Saksit Phaisanphisit )  
RYG Field Service Scientist (4)

Approved by : Nattapol Jengwareewong  
( Mr. Nattapol Jengwareewong )  
RYG Field Service Specialist (1)

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



### PROBE NOZZLE DIAMETER CALIBRATION DATA SHEET

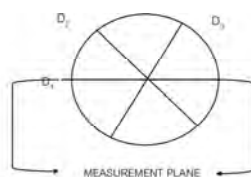
Calibration Date	9 Jan 24			Nozzle Set ID. :	RYG_FS0319
Calibration Sheet No. : C-090124-RYG_FS0319				Vernier Caliper ID.:	BKK_FS1123
Nozzle ID #	Nozzle Diameter (cm.)			Hi - Lo	$(D_1 + D_2 + D_3) / 3$
	D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	ΔD	D <sub>avg</sub>
1	0.296	0.300	0.305	0.007	0.301
2	0.465	0.475	0.465	0.010	0.468
3	0.605	0.605	0.605	0.000	0.605
4	0.770	0.760	0.785	0.010	0.765
5	0.930	0.928	0.930	0.002	0.929
6	1.082	1.080	1.085	0.005	1.082
7	1.240	1.230	1.235	0.010	1.235
8	1.594	1.558	1.551	0.043	1.568

Where :

D<sub>1</sub>, D<sub>2</sub>, D<sub>3</sub> = 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<sub>avg</sub> = (D<sub>1</sub> + D<sub>2</sub> + D<sub>3</sub>) / 3



Calibrated by : Saksit Phaisanphisit  
( Mr. Saksit Phaisanphisit )  
RYG Field Service Scientist (4)

Approved by : Nattapol Jengwareewong  
( Mr. Nattapol Jengwareewong )  
RYG Field Service Specialist (1)

FORM NO. : F-06-029 REVISION NO. : 2 ISSUE DATE : 16/2/23



### CONSOLE CONTROL UNIT CALIBRATION TEST REPORT

Calibration of Date : 9-Jun-24  
Next Cal. Date : 9-Jul-24  
Barometric Pressure (mmHg) : 754.7  
Relative Humidity (%) : 55.0  
Temperature (°C) : 27.2  
Reference Dry Gas Meter Data  
Reference Dry Gas Meter ID : BKK\_FS1122  
Serial No. : A2003240  
Correction Factor (Y) : 0.9824  
Next Calibration Date : 7-Nov-24

ΔH (mm H <sub>2</sub> O)	θ (Minutes)	Reference Dry Gas Meter Calibration				Console Control Dry Gas Meter				Dry Gas Meter Correction Factor (Y)	Orifice Calibration Factor ΔAvg
		Final	Initial	Total	°C	Final	Initial	Total	°C		
15	11.67	150.00	0.00	150.00	30.0	551964.6	551514.0	150.60	30.0	0.9771	41.9540
25	9.00	150.00	0.00	150.00	31.0	551943.8	551684.0	149.80	30.0	0.9781	41.9647
50	6.36	150.00	0.00	150.00	31.0	552544.6	552386.0	148.60	30.0	0.9836	41.8720
80	5.02	150.00	0.00	150.00	31.0	552196.2	552048.0	148.20	29.0	0.9802	41.8173
120	4.11	150.00	0.00	150.00	30.0	552975.6	552288.0	147.60	28.0	0.9803	41.9065
Avg										0.9788	41.8718

Y = Ratio of reading of reference to dry gas meter; tolerance for individual values ± 0.02 from average.

ΔAvg = Orifice pressure differential that equates to 21.34 in of air @ 25°C and 760 mm of mercury; mmH<sub>2</sub>O tolerance for individual values ± 5.08 from average.

Procedure: 40 CFR 60 APP A METH. SEC 5.3 & 7

Calibrated by : Saksit Phaisanphisit  
( Mr. Saksit Phaisanphisit )  
RYG Field Service Scientist (4)

Approved by : Nattapol Jengwareewong  
( Mr. Nattapol Jengwareewong )  
RYG Field Service Specialist (1)

FORM NO. : F-06-029 REVISION NO. : 2 ISSUE DATE : 16/2/23



## Stopwatch Calibration Test Report

Calibration Date : 9 Jan 24 Next Cal. Date : 9 Jul 24  
Barometric Pressure (mmHg) : 754.7 Temperature (°C) : 27.2  
Relative Humidity (%) : 55.0

### 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\_FS518  
Model : XC-572-V  
Serial No. : 1504025

Run No.	Time Actual (m:ss.ms)	Time Reading (m:ss)	Diff. (ms)	Diff. (min)
1	5:00.03	5:00	3	0.00005
2	5:00.09	5:00	9	0.00013
3	5:00.09	5:00	9	0.00015
4	5:00.11	5:00	11	0.00018
5	5:00.05	5:00	5	0.00008
6	5:00.06	5:00	6	0.00010
7	5:00.06	5:00	6	0.00010
8	5:00.08	5:00	8	0.00013
9	5:00.09	5:00	9	0.00015
10	5:00.07	5:00	7	0.00012
Average			0.00012	
SD			0.00004	

Calibrated by : Saksit Phaisanphisit  
Mr. Saksit Phaisanphisit  
RYG Field Service Scientist (4)

Approved by : Nattaporn Jengwarewong  
Mr. Nattaporn Jengwarewong  
RYG Field Service Specialist (1)



## DIGITAL TEMPERATURE CALIBRATION DATA SHEET

Calibration Date :	9 Jan 24	Ambient Temperature (°C)	27.2		
Calibration sheet No. :	C-090124-BKK_FS0519	Relative Humidity (%) :	55		
Digital Temperature ID	BKK_FS0519	Reference Temperature ID	RYG_FS0681		
Serial No. :	1504025	Serial No. :	201090014918		
Model :	XC-572-V	Model :	Digicon-CC-VT-MS		
		Next Calibrate :	13 Nov 24		
Location	Reference Temperature °C	Digital Temperature °C	Error °C	MPE	Pass / Fail
Stack	0	0	0	±3	Pass
	25	25	0	±3	Pass
	50	50	0	±3	Pass
	100	100	0	±3	Pass
	150	150	0	±3	Pass
	200	200	0	±3	Pass
Probe	250	250	0	±3	Pass
	300	300	0	±3	Pass
	500	500	0	±3	Pass
	100	100	0	±3	Pass
	120	120	0	±3	Pass
	140	140	0	±3	Pass
Oven	100	100	0	±3	Pass
	120	120	0	±3	Pass
	140	140	0	±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	10	0	±3	Pass
	20	20	0	±3	Pass
Meter	0	0	0	±3	Pass
	25	25	0	±3	Pass
	50	50	0	±3	Pass
AUX	0	0	0	±3	Pass
	25	25	0	±3	Pass
	50	50	0	±3	Pass

MPE : (Maximum permissible error of measurement) ค่าความคลาดเคลื่อนสูงสุดที่อนุญาต

Calibrated by : Saksit Phaisanphisit  
Mr. Saksit Phaisanphisit  
RYG Field Service Scientist (4)

Approved by : Nattaporn Jengwarewong  
Mr. Nattaporn Jengwarewong  
RYG Field Service Specialist (1)

FORM NO. : F-06-027 REVISION NO. : 2 ISSUE DATE : 9 Feb 23



## PROBE NOZZLE DIAMETER CALIBRATION DATA SHEET

Calibration Date	9 Jan 24			Nozzle Set ID. :	BKK_FS0524
Calibration Sheet No. : C-090124-BKK_FS0524				Vernier Caliper ID.:	BKK_FS1123

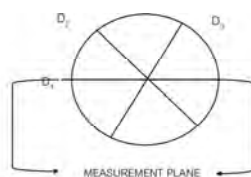
Nozzle ID #	Nozzle Diameter (cm.)			Hi - Lo	$(D_1 + D_2 + D_3) / 3$
	D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	ΔD	D <sub>avg</sub>
1	0.318	0.318	0.318	0.000	0.318
2	0.472	0.474	0.475	0.003	0.474
3	0.632	0.635	0.634	0.003	0.634
4	0.792	0.792	0.792	0.000	0.792
5	0.952	0.952	0.952	0.000	0.952
6	1.091	1.110	1.092	0.019	1.098
7	1.256	1.262	1.262	0.006	1.260
8	1.601	1.598	1.600	0.003	1.600

Where :

D<sub>1</sub>, D<sub>2</sub>, D<sub>3</sub> = 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<sub>avg</sub> = (D<sub>1</sub> + D<sub>2</sub> + D<sub>3</sub>) / 3



Calibrated by : Saksit Phaisanphisit  
( Mr. Saksit Phaisanphisit )  
RYG Field Service Scientist (4)

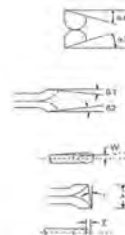
Approved by : Nattaporn Jengwarewong  
( Mr. Nattaporn Jengwarewong )  
RYG Field Service Specialist (1)

FORM NO. : F-06-024 REVISION NO. : 0 ISSUE DATE : 25/12/23



## Type S Pitot Tube Calibration

Date Calibration : 9-Jan-24 Due Date : 9-Jul-24  
Pitot ID : RYG\_FS0321 Inclinator ID : BKK\_FS1131  
Pitot SN : - Vernier ID : RYG\_FS0539



Parameter	Value	Allowable Range	Check
α1	-1.4	-10° < α1 < +10°	OK
α2	-0.2	-10° < α2 < +10°	OK
β1	0.8	-5° < β1 < +5°	OK
β2	-0.4	-5° < β2 < +5°	OK
γ	0.8	-	-
θ	0.5	-	-
Z = A tan γ	0.013	Z ≤ 0.125"	OK
W = A tan θ	0.008	W ≤ 0.031"	OK
Dt	0.310	0.188" to 0.375"	OK
A/2Dt	1.484	1.05 ≤ PA/Dt ≤ 1.5	OK
A	0.92	2.1Dt ≤ A ≤ 3Dt	OK

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

Calibrated by : Saksit Phaisanphisit  
( Mr. Saksit Phaisanphisit )  
RYG Field Services Scientist (4)

Approved by : Nattaporn Jengwarewong  
( Mr. Samart Roo-ngan )  
RYG Field Services Specialist (1)

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



## Type S Pitot Tube Calibration

Date Calibration 9-Jan-24 Due Date 9-Jul-24  
 Pitot ID BKK\_FS0522 Inclinator ID BKK\_FS1131  
 Pitot SN Vernier ID RYG\_FS0539

Parameter	Value	Allowable Range	Check
$\alpha 1$	-1.8	$-10^\circ < \alpha 1 < +10^\circ$	OK
$\alpha 2$	-1.4	$-10^\circ < \alpha 2 < +10^\circ$	OK
$\beta 1$	-1.7	$-5^\circ < \beta 1 < +5^\circ$	OK
$\beta 2$	-2	$-5^\circ < \beta 2 < +5^\circ$	OK
$\gamma$	-1.3	-	-
$\theta$	-0.4	-	-
$Z = A \tan \gamma$	-0.021	$Z \leq 0.125''$	OK
$W = A \tan \theta$	-0.006	$W \leq 0.031''$	OK
Dt	0.330	0.188" to 0.375"	OK
A/2Dt	1.394	$1.05 \leq PA/Dt \leq 1.5$	OK
A	0.92	$2.10Dt \leq A \leq 3Dt$	OK

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

Calibrated by: Saksit Phaisanphut  
 (Mr. Saksit Phaisanphut)  
 RYG Field Services Scientist (4)

Approved By: Natthapong Jengwareewong  
 (Mr. Natthapong Jengwareewong)  
 RYG Field Services Specialist (1)

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



## Type S Pitot Tube Calibration

Date Calibration 9-Jan-24 Due Date 9-Jul-24  
 Pitot ID BKK\_FS0523 Inclinator ID BKK\_FS1131  
 Pitot SN Vernier ID RYG\_FS0539

Parameter	Value	Allowable Range	Check
$\alpha 1$	-0.2	$-10^\circ < \alpha 1 < +10^\circ$	OK
$\alpha 2$	2.4	$-10^\circ < \alpha 2 < +10^\circ$	OK
$\beta 1$	-1.2	$-5^\circ < \beta 1 < +5^\circ$	OK
$\beta 2$	-1.6	$-5^\circ < \beta 2 < +5^\circ$	OK
$\gamma$	-1.1	-	-
$\theta$	0.2	-	-
$Z = A \tan \gamma$	-0.018	$Z \leq 0.125''$	OK
$W = A \tan \theta$	0.003	$W \leq 0.031''$	OK
Dt	0.308	0.188" to 0.375"	OK
A/2Dt	1.494	$1.05 \leq PA/Dt \leq 1.5$	OK
A	0.92	$2.10Dt \leq A \leq 3Dt$	OK

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

Calibrated by: Saksit Phaisanphut  
 (Mr. Saksit Phaisanphut)  
 RYG Field Services Scientist (4)

Approved By: Natthapong Jengwareewong  
 (Mr. Natthapong Jengwareewong)  
 RYG Field Services Specialist (1)

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



## Calibration Certificate



Certificate No.: G 660705  
 Date of issue: 14-Nov-23

Instrument description : 1 Flue Gas Analyzer  
 Instrument model : 2 Testo 340  
 Control unit serial no. : 3 -  
 Instrument serial no. : 4 6319028  
 ID no. or control no. : 5 RYG\_FS0565  
 Manufacturer : 6 Testo SE & Co. KGaA  
 Probe description : 7 -  
 Probe model : 8 -  
 Probe serial no. : 9 -  
 Customer name : 10 ALS LABORATORY GROUP (THAILAND) CO., LTD.  
 Customer address : 11 104 Phatthanakarn 40, Phatthanakarn Road, Khwaeng Phatthanakarn, Khet Suan Luang, Bangkok, 10259 Thailand  
 Total pages of certificate : 12 Pages  
 Receiving no. : 13 L-233748  
 Receiving date : 14 08-Nov-23  
 Parameter of calibration : 15 Gas Calibration (Oxygen: 2.498, 10.04, 21.02 %Vol, Carbon Monoxide 80.14, 302, 1003 ppm, Nitric Oxide 30.01, 151.5, 322.5 ppm, Sulphur Dioxide 50.36, 100.8, 600.8 ppm)

Condition of UUC. : 1 Used  
 Ambient condition : 2 All of the Measurement were carried out the stabilized laboratory  
 Temperature : 3  $23 \pm 5^\circ\text{C}$   
 Humidity : 4  $55 \pm 15\% \text{RH}$   
 Calibration place : 5 17/121 Soi Ngamwongwan 47 Yaek 48, Toongsongkhong, Lakso, Bangkok 10210  
 Calibration procedure no. : 6 This instrument was calibrated by comparison with Standard gas mixture according to calibration Work Instruction no. WI-CL-28-C

The calibration certificate expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by coverage factor  $k=2$ , which for a normal distribution corresponds to a coverage probability of approximately 95%. This certificate is applied only to item under test Environmental condition.  
 This Calibration Certificate may not be reproduced other than in full except with the permission of the issuing laboratory. Calibration certificates without signature and seal are not valid and the results relate only to the items tested/calibrated.  
 This calibration certificate documents are traceability to national standards, which realize measurement according to the International System of Units (SI).

Date of calibration : 13-Nov-23

Kwanchoi K.  
 Mr. Kwanchoi Khamsung  
 Calibration Technician

Wongluck W.  
 Mr. Wongluck Wonglucktee  
 Technical Manager



## Calibration Certificate



Certificate No.: G 660705

### Standard References (Table 1)

Standard	Certificate No.	Vendor	Due date
Oxygen (O2) 2.498 % Vol	4219/21	Linde	30-Sep-25
Oxygen (O2) 10.04 % Vol	CG-0153-21	Nemt	18-Nov-26
Oxygen (O2) 21.02 % Vol	CG-0041-22	Nemt	10-Feb-27
Carbon monoxide (CO) 80.14 ppm	CG-0040-22	Nemt	14-Feb-27
Carbon monoxide (CO) 302 ppm	1915/23	Linde	16-Jun-25
Carbon monoxide (CO) 1003 ppm	2584/23	Linde	10-Sep-25
Nitric Oxide (NO) 30.01 ppm	CG-0014-23	Nemt	19-Feb-25
Nitric Oxide (NO) 151.5 ppm	0161/22	Linde	22-Jan-25
Nitric Oxide (NO) 322.5 ppm	1974/23	Linde	17-Jul-25
Sulphur Dioxide (SO2) 50.36 ppm	2004/23	Linde	17-Jul-25
Sulphur Dioxide (SO2) 100.8 ppm	3507/22	Linde	09-Nov-24
Sulphur Dioxide (SO2) 600.8 ppm	2003/23	Linde	17-Jul-25

### Measured room conditions

Temperature : 22.4 °C Humidity : 67.8 %RH Pressure : 1010.2 mbar

### Calibration conditions

Gas Temperature : 23 °C Flow rate : 630 ml/min Gas pressure : 1017.2 mbar

### Calibration Results (Before adjustment) (Table 2)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (±)
O2 (%Vol)	2.498	2.44	-0.058	0.15
O2 (%Vol)	10.04	9.96	-0.08	0.20
O2 (%Vol)	21.02	21.13	0.11	0.30
CO (ppm)	80.14	86	5.86	3.0
CO (ppm)	302	318	16	6.0
CO (ppm)	1003	1049	46	12
NO (ppm)	30.01	27	-3.01	8.0
NO (ppm)	151.5	148	-3.5	8.0
NO (ppm)	322.5	309	-13.5	12
SO2 (ppm)	50.36	52	1.64	6.0
SO2 (ppm)	100.8	103	2.2	6.0
SO2 (ppm)	600.8	604	3.2	13



## Calibration Results (After adjustment) (Table 3)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (±)
O <sub>2</sub> (%Vol)	2.498	2.44	-0.058	0.15
O <sub>2</sub> (%Vol)	10.44	9.96	-0.08	0.20
O <sub>2</sub> (%Vol)	21.02	21.13	0.11	0.30
CO (ppm)	80.14	81	0.86	3.0
CO (ppm)	302	302	0	6.0
CO (ppm)	1003	1001	-2	12
NO (ppm)	30.81	32	1.99	8.0
NO (ppm)	151.5	153	1.5	6.0
NO (ppm)	322.5	319	-3.5	12
SO <sub>2</sub> (ppm)	3036	52	1.64	6.0
SO <sub>2</sub> (ppm)	150.8	103	2.2	6.0
SO <sub>2</sub> (ppm)	600.8	604	3.2	13

Remark : 1 cmol/mol = 1 %vol, 1 μmol/mol = 1 ppm.

## End of Report

Sartorius (Thailand) Co., Ltd.  
129 Rama 9 Road, Huaykwang, Huaykwang, Bangkok 10310  
Tel : +66 2643 8361-8, e-mail: service.thailand@sartorius.com



SARTORIUS

## Certificate of Calibration

REVIEW BY *Thirathall*  
APPROVED BY *D. L.*  
NEXT CAL DATE 09/05/24

Model Number : MSE224S-100-DU Certificate No. : 23BCI0115  
Description : Analytical Balance Issued Date : Friday, March 03, 2023  
Serial Number : 0031709552 Reference No. : 204833  
ID No. : RYG\_EN0003  
Manufacturer : Sartorius Page No. : 1 of 2

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

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

Calibrated By : Mr. Chonchai Inthana  
Calibration Date : Wednesday, March 01, 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  
Reasons for calibration : ☐ New Installation ☐ Service / Repair ☒ Re-calibration/ Maintenance  
Ambients Conditions : Temperature : 23.0 °C ± 6.0 °C  
Humidity : 58.0 % RH ± 10.0 % RH  
Pressure : ±  
Equipment Condition : ☒ Good Operator ☐ Fair

## Measurement Method UKAS Publication Ref : Lab 14

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

## Traceability:

Model Number	Description	Traceability	Certificate No.	Due Date
YCS011-522-00	Sartorius weight set 1mg - 5000g E2 TC0011-522-00	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.

Mr. Chonchai Inthana (Technical Manager)



SOP FM 33 03 February 2022



FM-CL-09-C Rev.8

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Issued Date 26/02/16

Entech Industrial Solution Co., Ltd.

129 Rama 9 Road, Huaykwang, Huaykwang, Bangkok 10310 THAILAND Tel: 0-2770-8888 Calibration@entech.co.th  
Tel: 0-2643-0301-0 Fax: 0-2643-0307, e-mail: service.thailand@sartorius.com

Sartorius (Thailand) Co., Ltd.

129 Rama 9 Road, Huaykwang, Huaykwang, Bangkok 10310  
Tel: +66 2643 8361-8, e-mail: service.thailand@sartorius.com

SARTORIUS

## Certificate of Calibration



Model Number : MSE224S-100-DU Certificate No. : 23BCI0115  
Description : Analytical Balance Issued Date : Friday, March 03, 2023  
Serial Number : 0031709552 Reference No. : 204833  
ID No. : RYG\_EN0003  
Manufacturer : Sartorius Page No. : 2 of 2

## Calibration Results : Without Adjustment

Repeatability			Eccentricity (Off-center loading error)		
The reproducibility is the ability of a weighing instrument to display nearly identical readings under constant test conditions when the same load within a measurement series is placed repeatedly on the weighing pan in the same manner. The standard deviation is used to express reproducibility quantitatively.			The off-center loading error is yielded by the difference between the readout of the load, i.e. 1/3 or 1/4 of maximum capacity, placed at the middle of the weighing pan and between each of four additional measurement points (positions defined according to OIML R110).		
Nominal Value : (Low Load)	20.0000	200.0000	Nominal value :	100	g
20 g	20.0001	200.0000	Tolerance	0.0004	g
Tolerance	20.0000	200.0001	Difference		
0.0001 g	20.0000	200.0000	1		
	20.0000	200.0001	2	0.0001	
Nominal Value : (High Load)	20.0001	200.0001	3	0.0000	
200 g	20.0000	200.0001	4	0.0000	
Tolerance	20.0000	200.0000	5	0.0001	
0.0001 g	20.0000	200.0001	6	-	
	20.0000	200.0001			
Standard Deviation	0.00004	0.00005			

## Linearity

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

Tolerance	0.0002 g				
Nominal Value (g)	Conventional Mass Value (g)	Displayed Value (g)	Deviation (g)	Uncertainty (g)	
0.01	0.0100	0.0100	0.0000	0.00013	
0.05	0.0500	0.0500	0.0000	0.00013	
0.1	0.1000	0.1000	0.0000	0.00013	
0.5	0.5000	0.5000	0.0000	0.00014	
1	1.0000	1.0000	0.0000	0.00014	
5	5.0000	5.0000	0.0000	0.00014	
10	10.0000	10.0000	0.0000	0.00014	
20	20.0000	20.0000	0.0000	0.00024	
50	50.0000	50.0000	0.0000	0.00013	
100	100.0000	100.0000	0.0000	0.00019	
200	200.0000	200.0001	0.0001	0.00032	

End of Report

## DRY GAS METER CALIBRATION TEST REPORT

Calibration of Date : 9-Jan-24 Barometric Pressure ( mm.Hg ) : 754.7  
Next Calibration Date : 9-Jul-24 Relative Humidity (%) : 55.0  
Temperature ( °C ) : 27.2  
Dry Gas Meter Data : Calibration sheet No. : C-090124-RYG\_FS0317  
Dry Gas Meter ID : RYG\_FS0317 Reference Dry Gas Meter ID : BKK\_FS1122  
Serial No. : 1706003 Serial No. : A2003240  
Model No. : XC-62-CV Correction Factor (Y) : 0.9624  
Next Calibration Date : 7-Nov-24

Reference Dry Gas Meter Calibration				Dry Gas Meter					Div Gas Meter Correction Factor (Y)
V (liters)			T <sub>r</sub> (°C)	V <sub>m</sub> (liters)			T <sub>i</sub> (°C)	T <sub>o</sub> (°C)	
Final	Initial	Total	(°C)	Final	Initial	Total	(°C)	(°C)	(Y)
30.00	0.00	30.00	29.0	30.14	0.00	30.14	26.0	26.0	0.9682
30.00	0.00	30.00	29.0	30.14	0.00	30.14	26.0	26.0	0.9682
60.00	0.00	60.00	29.0	60.05	0.00	60.05	26.0	26.0	0.9718
60.00	0.00	60.00	29.0	60.05	0.00	60.05	26.0	26.0	0.9718
90.00	0.00	90.00	28.0	90.77	0.00	90.77	26.0	26.0	0.9676
90.00	0.00	90.00	28.0	90.77	0.00	90.77	26.0	26.0	0.9676
Avg.									0.9692

Y = Ratio of reading of reference dry gas meter to dry gas meter : tolerance for individual ± 0.05 from average.

Calibrate by :

Mr. Jittakorn Srivasa  
RYG Field Service Scientist (2)

approved by :

Mr. Nithaporn Jitgumwong  
RYG Field Service Specialist (1)



### Stopwatch Calibration Test Report

Calibration Date : 9 Jan 24      Next Cal. Date : 9 Jul 24  
Barometric Pressure (mmHg) : 754.7      Temperature (°C) : 27.2  
Relative Humidity (%) : 55.0

#### 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. : RYG\_FS0317  
Model : XC-62-CV  
Serial No. : 1706003

Run No.	Time Actual (m:ss.ms)	Time Reading (m:ss)	Diff. (ms)	Diff. (min)
1	5:00.03	5:00	3	0.00005
2	5:00.09	5:00	9	0.00013
3	5:00.09	5:00	9	0.00015
4	5:00.11	5:00	11	0.00018
5	5:00.05	5:00	5	0.00008
6	5:00.06	5:00	6	0.00010
7	5:00.06	5:00	6	0.00010
8	5:00.08	5:00	8	0.00013
9	5:00.09	5:00	9	0.00015
10	5:00.07	5:00	7	0.00012
Average				0.00012
SD				0.00004

Calibrate by : Saksit Phaisanphisit  
Mr. Saksit Phaisanphisit  
Field Scientist (4)

Approved by : Nattapong Jengwareewong  
Mr. Nattapong Jengwareewong  
Specialist (1)



### DIGITAL TEMPERATURE CALIBRATION DATA SHEET

Calibration Date :	9 Jan 24	Ambient Temperature (°C)	27.2		
Calibration sheet No. :	C-090124-RYG_FS0317	Relative Humidity (%) :	55		
Digital Temperature ID	RYG_FS0317	Reference Temperature ID	RYG_FS0681		
Serial No. :	1706003	Serial No. :	201090014918		
Model :	XC-62-CV	Model :	Digicon-CC-VT-MS		
Next Calibrate :		13 Nov 24			
Location	Reference Temperature °C	Digital Temperature °C	Error °C	MPE	Pass / Fail
Stack	0	0	0	±3	Pass
	25	25	0	±3	Pass
	50	50	0	±3	Pass
	100	100	0	±3	Pass
	150	150	0	±3	Pass
	200	200	0	±3	Pass
	250	251	1	±3	Pass
	300	301	1	±3	Pass
	500	501	1	±3	Pass
	1000	101	1	±3	Pass
Probe	120	121	1	±3	Pass
	140	141	1	±3	Pass
	100	101	1	±3	Pass
Oven	120	120	0	±3	Pass
	140	140	0	±3	Pass
	100	101	1	±3	Pass
Filter	120	121	1	±3	Pass
	140	141	1	±3	Pass
	0	0	0	±3	Pass
Exit	10	10	0	±3	Pass
	20	20	0	±3	Pass
	0	0	0	±3	Pass
Meter	25	25	0	±3	Pass
	50	50	0	±3	Pass
	0	1	1	±3	Pass
AUX	25	26	1	±3	Pass
	50	51	1	±3	Pass

MPE : (Maximum permissible error of measurement) ค่าความคลาดเคลื่อนสูงสุดในการวัด

Calibrated by : Jittakorn Srivasa  
( Mr. Jittakorn Srivasa )  
Enviro Field Service Scientist (2)

Approved by : Nattapong Jengwareewong  
Mr. Nattapong Jengwareewong  
Enviro Field Service Specialist (1)  
FORM NO. : F 06-027    REVISION NO. : 2    ISSUE DATE : 16/2/23



### DRY GAS METER CALIBRATION TEST REPORT

Calibration of Date : 9-Jan-24      Barometric Pressure ( mm.Hg ) : 754.7  
Next Calibration Date : 9-Jul-24      Relative Humidity (%) : 55.0  
Temperature (°C) : 27.2  
Dry Gas Meter Data : Reference Dry Gas Meter Data  
Calibration sheet No. : C-090124-BKK\_FS0534      Reference Dry Gas Meter ID : BKK\_FS1122  
Dry Gas Meter ID : BKK\_FS0534      Serial No. : A2003240  
Serial No. : 1509020      Correction Factor (Y) : 0.9824  
Model No. : XC-60-CV      Next Calibration Date : 7-Nov-24

Reference Dry Gas Meter Calibration				Dry Gas Meter							Dry Gas Meter Correction:
Vr (Liters)			Tr (°C)	Vm (Liters)			Ti (°C)	To (°C)	Avg Tm (°C)	Factor (Y)	
Final	Initial	Total		Final	Initial	Total					
30.00	0.00	30.00	28.0	30.42	0.00	30.42	29.0	29.0	29.0	0.9720	
30.00	0.00	30.00	28.0	30.43	0.00	30.43	29.0	29.0	29.0	0.9719	
60.00	0.00	60.00	29.0	61.00	0.00	61.00	30.0	30.0	30.0	0.9695	
60.00	0.00	60.00	29.0	61.01	0.00	61.01	30.0	30.0	30.0	0.9694	
90.00	0.00	90.00	29.0	92.27	0.00	92.27	30.0	30.0	30.0	0.9614	
90.00	0.00	90.00	29.0	92.28	0.00	92.28	31.0	31.0	31.0	0.9645	
Avg:										0.9681	

Y = Ratio of reading of reference dry gas meter to dry gas meter ; tolerance for individual ± 0.05 from average.

Calibrate by : Jittakorn Srivasa  
Mr. ( Jittakorn Srivasa )  
RYG Field Service Scientist (2)

Approved by : Nattapong Jengwareewong  
Mr. ( Nattapong Jengwareewong )  
RYG Field Service Specialist (1)



### Stopwatch Calibration Test Report

Calibration Date : 9 Jan 24      Next Cal. Date : 9 Jul 24  
Barometric Pressure (mmHg) : 754.7      Temperature (°C) : 27.2  
Relative Humidity (%) : 55.0  
Reference Stopwatch Data : Console Control Meter Data  
Stopwatch ID No. : E18061      Dry Gas Meter No. : BKK\_FS0534  
Model : F808      Model : XC-60-CV  
Serial No. : -      Serial No. : 1509020  
Calibration Date : 8 Sep 20  
Certificate No. : E-2009018

Run No.	Time Actual (m:ss.ms)	Time Reading (m:ss)	Diff. (ms)	Diff. (min)
1	5:00.03	5:00	3	0.00005
2	5:00.09	5:00	9	0.00013
3	5:00.09	5:00	9	0.00015
4	5:00.11	5:00	11	0.00018
5	5:00.05	5:00	5	0.00008
6	5:00.06	5:00	6	0.00010
7	5:00.06	5:00	6	0.00010
8	5:00.08	5:00	8	0.00013
9	5:00.09	5:00	9	0.00015
10	5:00.07	5:00	7	0.00012
Average				0.00012
SD				0.00004

Calibrate by : Saksit Phaisanphisit  
Mr. Saksit Phaisanphisit  
RYG Field Service Scientist (4)

Approved by : Nattapong Jengwareewong  
Mr. Nattapong Jengwareewong  
RYG Field Service Specialist (1)



# DIGITAL TEMPERATURE CALIBRATION DATA SHEET

Calibration Date	9 Jan 24	Ambient Temperature (°C)	27.2		
Calibration sheet No. :	C-090124-BKK_FS0534	Relative Humidity (%) :	55		
Digital Temperature ID	BKK_FS0534	Reference Temperature ID	RYG_FS0681		
Serial No. :	1509020	Serial No. :	201090014918		
Model :	XC-60-CV	Model :	Digicon-CC-VT-MS		
		Next Calibrate :	13 Nov 24		
Location	Reference Temperature °C	Digital Temperature °C	Error °C	MPE	Pass / Fail
Stack	0	0	0	±3	Pass
	25	26	0	±3	Pass
	50	50	0	±3	Pass
	100	100	0	±3	Pass
	150	150	0	±3	Pass
	200	200	0	±3	Pass
Probe	250	251	1	±3	Pass
	300	301	1	±3	Pass
	500	501	1	±3	Pass
	100	100	0	±3	Pass
	120	121	1	±3	Pass
	140	141	1	±3	Pass
Oven	100	100	0	±3	Pass
	120	120	0	±3	Pass
	140	140	0	±3	Pass
Filter	100	100	0	±3	Pass
	120	121	1	±3	Pass
	140	141	1	±3	Pass
Exit	0	0	0	±3	Pass
	10	10	0	±3	Pass
	20	21	1	±3	Pass
Meter	0	0	0	±3	Pass
	25	25	0	±3	Pass
	50	50	0	±3	Pass
AUX	0	0	0	±3	Pass
	25	25	0	±3	Pass
	50	50	0	±3	Pass

MPE : (Maximum permissible error of measurement) ค่าความคลาดเคลื่อนสูงสุดที่ยอมรับได้

Calibrated by: Jittakorn (Mr. Jittakorn Srivasa) RYG Field Service Scientist (2)  
 Approved by: Nattapon Jengwareewong (Mr. Nattapon Jengwareewong) RYG Field Service Specialist (1)

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



Certificate No.: C06220464 Page 2 of 3

## Calibration Results:

Without Adjustment

Wavelength Accuracy (nm), The spectral bandwidth of 81d at 2 nm and UUC at 2 nm				
Standard Wavelength	Unit Under Calibration	Correction	Uncertainty	
418.61	418.4	0.21	0.14	
536.66	536.7	-0.04	0.14	
637.98	638.3	-0.32	0.14	
748.48	748.8	-0.32	0.14	
807.03	807.4	-0.37	0.13	
Photometric Accuracy (Absorbance)				
Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
420 nm	0.0000	0.000	0.0000	0.0045
	0.5605	0.563	-0.0025	0.0045
	0.7334	0.737	-0.0036	0.0045
	1.0534	1.057	-0.0036	0.0045
440 nm	0.0000	0.000	0.0000	0.0045
	0.5503	0.553	-0.0027	0.0045
	0.7179	0.720	-0.0021	0.0045
	1.0312	1.034	-0.0028	0.0045
465 nm	0.0000	0.000	0.0000	0.0045
	0.5024	0.506	-0.0036	0.0045
	0.6693	0.672	-0.0027	0.0045
	0.9604	0.964	-0.0036	0.0045
546.1 nm	0.0000	0.000	0.0000	0.0045
	0.5168	0.519	-0.0022	0.0045
	0.6903	0.691	-0.0007	0.0045
	0.9904	0.992	-0.0016	0.0045
590 nm	0.0000	0.000	0.0000	0.0045
	0.5525	0.554	-0.0015	0.0045
	0.7175	0.718	-0.0005	0.0045
	1.0301	1.031	-0.0009	0.0045
635 nm	0.0000	0.000	0.0000	0.0045
	0.5367	0.538	-0.0013	0.0045
	0.6847	0.685	-0.0003	0.0046
	0.9823	0.983	-0.0007	0.0045

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 Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/calibration-thailand

Delivering Growth - In Asia and Beyond.

CALFM-C06-13: 20 Jul 2022



## Certificate of Calibration

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

Certificate No.: C06220464  
 Issued Date: 27 September 2022  
 Job No.: KSPR2212224  
 Page: 1 of 3

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

Environment Condition: Temperature 23.1 °C ±  
 Humidity 65.4 %RH ±

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

Calibration By: Mr. Chattaphon Foithong  
 Calibration Date: 27 September 2022  
 The Method used: In house method, CAL-WI-24, base on ASTM E 275-08 and ASTM E 387-04  
 Traceability: This certificate is traceable to the CRM maintained by National Institute of Standards and Technology (NIST) through Starna Scientific Limited.

The standard for Wavelength Certificate No. 91416 and 91435  
 The standard for Photometric Certificate No. 91441 and 101088  
 The standard for Stray light Certificate No. 101041 and 101040  
 The standard for Spectral resolution Certificate No. 101037

(Mr. Chattaphon Foithong)  
 Person in charge

(Mr. Thalemgkeat Pongnang)  
 Authorized signatory

This certificate is issued for 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.

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Delivering Growth - In Asia and Beyond.

CALFM-C06-13: 20 Jul 2022



Certificate No.: C06220464 Page 3 of 3

## Calibration Results:

Without Adjustment

Photometric Accuracy (Absorbance)				
Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
235 nm	0.0000	0.009	0.0000	0.0080
	0.7423	0.744	-0.0017	0.0083
257 nm	0.0000	0.009	0.0000	0.0080
	0.8609	0.861	-0.0001	0.0084
313 nm	0.0000	0.009	0.0000	0.0080
	0.2895	0.292	-0.0025	0.0080
350 nm	0.0000	0.009	0.0000	0.0080
	0.6381	0.638	0.0001	0.0080
Stray light *				
Standard: cut-off	UUC: Wavelength (nm)	UUC: Transmission (%T)	Absorbance (A)	
260.67 +/- 0.11 nm	260.7	2.1	1.678	
391.94 +/- 0.11 nm	391.9	1.7	1.770	
Spectral Resolution *				
Nominal Concentration 0.02 % v/v	Peak	Trough	Ratio	SBW
Standard Wavelength ( nm )	266.60	266.63	1.39	2.00
UUC: Wavelength (nm)	266.2	266.1		
Std Absorbance (A)	0.4810	0.3176		
Absorbance (A)	0.373	0.268		

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

The End of Certificate

DKSH Technology Limited  
 2533 Sukhumvit Road, Bangkok, Prachinburi, Bangkok 10260  
 Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/calibration-thailand

Delivering Growth - In Asia and Beyond.

CALFM-C06-13: 20 Jul 2022



## ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: KSPR2212224

ชนิดเครื่องมือ: SPECTROPHOTOMETER

รุ่น: DR6000

หมายเลขเครื่อง: 1627845

ตรวจสอบ (รับ)	ตรวจสอบ (ส่ง)	หมายเหตุ
27 Sep 2022	27 Sep 2022	
ปกติ	ปกติ	
<b>General</b>		
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	1. ความสมบูรณ์เครื่อง
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	2. ความสะอาด (ช่องใส่ตัวอย่าง, ภายใน-นอกเครื่อง)
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	3. สวิตช์ ปิด - เปิด เครื่อง (On-Off Switch)
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	4. ปุ่มกด (Keypad)
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	5. หน้าจอ (Display, Screen Contrast)
<b>Spectrophotometer</b>		
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	6. แบตเตอรี่ (Battery Backup) >= 2.5 VDC
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	7. ตัวควบคุมความยาวคลื่น (Wavelength Control)
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	8. ความยาวคลื่น (Wavelength Check)
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	9. แสงยูวี (UV < 3,000 hour)
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	10. แสงที่มองเห็น (Visible < 5,000 hour)
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	11. ช่องวัดหลายตัวอย่าง (Carousel Module)
<b>pH Meter and Conductivity Meter</b>		
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	12. อิเล็กโทรด (Electrode and Connection Cable)
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	13. ระดับสารละลายใน Electrode (Level KCl)
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	14. ฝาปิดกันปลาย Electrode (Dust Protection Hood)
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	15. ขาตั้งอิเล็กโทรด (Stand)
<b>Turbidimeter</b>		
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	16. ค่าความขุ่นที่ค่าสูง (No Sample)
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	17. ระดับการส่องสว่างของแสง (>= 2.5 ไม่น้อย 3.0)
<b>Automatic Dilutor</b>		
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	18. สภาพ Piston Burettes
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	19. Function Rinsing and Dosing
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	20. ระบบท่อสายยางและอุปกรณ์ประกอบ

เซ็นเซอร์อุณหภูมิ:

Mr. Chattaphon Folthong  
Service Engineer

บริษัท ดีเคเอส เอเซีย จำกัด  
DKSH Technology Limited  
3533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260  
3533 Sukhumvit Road, Bangkok, Thailand 10260  
Phone: +66 2678 7000 Email: info.asia@dksh.com Website: www.dksh.com/asia-thailand

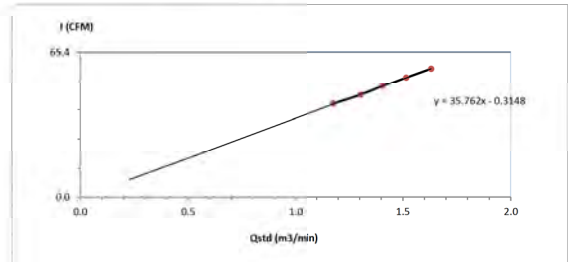
Delivering Growth - in Asia and Beyond.

CAL-FM-R31-03: 20 Jul 2022

## High Volume Air Sampler Calibration Worksheet

Project Site:	Global Power Synergy Public Company Limited	Barometric Pressure (mm Hg):	756
Calibrate Location:	วัดหนองแม่เหล็ก	Temperature (°C):	30
Calibrate Date:	9-Feb-24	High Volume ID:	RYG_FS0291
CalibrationSheet No.:	C-090224-RYG_FS0291	High Volume Model:	TE-S170D
Calibrator ID:	RYG_FS0206	High Volume S/N:	5333
Calibrator Model:	TE-S028A	Calibrator Slope:	1.47433
Calibrator S/N:	1543	Calibrator Intercept:	-0.01503

Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>del</sub> (m <sup>3</sup> /min)	I: Chart (CFM)	Linear Regression
1	3.0	1.1770	42	Slope: 35.7625 Intercept: -0.3148 Correlation Coefficient: 0.9994
2	3.7	1.3055	46	
3	4.3	1.4062	50	
4	5.0	1.5152	54	
5	5.8	1.6307	58	



Calibrated by:   
(Mr. Norranon Tathongkham)  
Field Scientist(2)

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

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

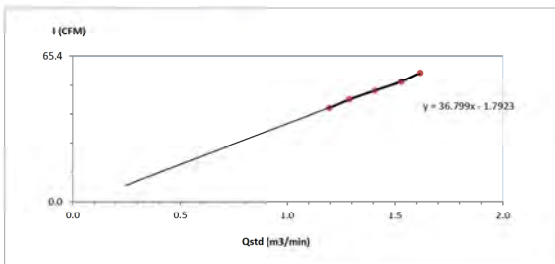
RYG\_EN0001



## High Volume Air Sampler Calibration Worksheet

Project Site:	Global Power Synergy Public Company Limited	Barometric Pressure (mm Hg):	756
Calibrate Location:	วัดบางพลีใหญ่	Temperature (°C):	30
Calibrate Date:	9-Feb-24	High Volume ID:	RYG_FS0174
CalibrationSheet No.:	C-090224-RYG_FS0174	High Volume Model:	TE-S170D
Calibrator ID:	RYG_FS0206	High Volume S/N:	4800
Calibrator Model:	TE-S028A	Calibrator Slope:	1.47433
Calibrator S/N:	1543	Calibrator Intercept:	-0.01503

Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>del</sub> (m <sup>3</sup> /min)	I: Chart (CFM)	Linear Regression
1	3.1	1.1962	42	Slope: 36.7991 Intercept: -1.7923 Correlation Coefficient: 0.9982
2	3.6	1.2879	46	
3	4.3	1.4062	50	
4	5.1	1.5301	54	
5	5.7	1.6167	58	



Calibrated by:   
(Mr. Norranon Tathongkham)  
Field Scientist(2)

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

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

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

Certificate of Calibration



REVIEW BY:   
APPROVED BY:   
NEXT CAL DATE: 01/03/24

Model Number:	LA130S-F	Certificate No.:	23BC0110
Description:	Analytical Balance	Issued Date:	Friday, March 03, 2023
Serial Number:	25409864	Reference No.:	204833
ID No.:	RYG_EN0001	Page No.:	1 of 2
Manufacturer:	Sartorius		

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

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

Calibrated By: Mr Chonchai Inthana  
Calibration Date: Wednesday, March 01, 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: 150 g Readability: 0.0001 g  
Reasons for calibration: ☒ New Installation ☐ Service / Repair ☐ In-calibration Maintenance  
Ambients Conditions: Temperature: 24.2 °C ± 5.0 °C  
Humidity: 60.0 % RH ± 10.0 % RH  
Pressure: ±

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

## Traceability:

Model Number	Description	Traceability	Certificate No.	Due Date
YCS011-522-00	Sartorius weight set 1mg - 5000g E2.YCS011-522-00	SPC-RT	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)



SOP FM 33 03 February 2022



MULTIPOINT CALIBRATION REPORT

# Certificate of Calibration

Model Number: LA1005-F Certificate No.: 23BC10110  
Description: Analytical Balance Issued Date: Friday, March 03, 2023  
Serial Number: 25408684 Reference No.: 204833  
ID No.: RYG\_EN0001  
Manufacturer: Sartorius Page No.: 2 of 2

## Calibration Results : Without Adjustment

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

Nominal Value : (Low Load)  
10 g  
Tolerance  
0.0001 g

Nominal Value : (High Load)  
100 g  
Tolerance  
0.0001 g

Standard Deviation 0.00009 0.00006

**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 0.0000  
3 ~0.0001  
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.

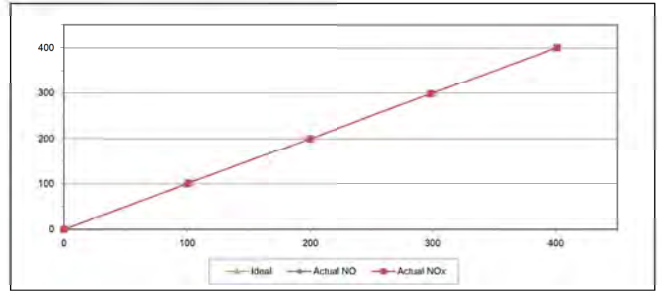
Tolerance 0.0002 g

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

End of Report.

Calibration Date: 4-Jan-24 Equipment Name: NOx Analyzer  
Manufacturer: HORIBA Model: APNA-370  
Serial No.: AWWG87CR Equipment ID: RYG\_FS0453  
Calibrator Manufacturer: Teledyne API Model: 700  
Serial No.: 947  
Std. Gas Concentration (PPM): 55.88 Cylinder No.: GN0027222  
Cylinder Pressure (psi): 1800 Certified By: Airgas Inc.  
Certified Date: 9-Feb-22 Expired Date: 9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	99.60	-0.40	-0.40	101.40	1.40	1.40
2	200.00	198.80	-1.40	-0.70	199.80	-0.20	-0.10
3	300.00	299.00	-1.00	-0.33	298.60	-1.40	-0.47
4	400.00	401.10	1.10	0.28	401.10	1.10	0.28
AVERAGE (%)				-0.21			0.24



Calibrated By

Approved By

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

(Mr. Sarayuth Jitranont)  
Assistant General Manager

SOP FM 33 03 February 2022

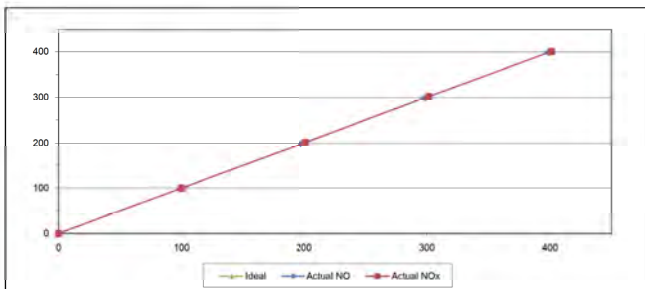
ALS Laboratory Group  
FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



## MULTIPOINT CALIBRATION REPORT

Calibration Date: 4-Jan-24 Equipment Name: NOx Analyzer  
Manufacturer: HORIBA Model: APNA-370  
Serial No.: SEAW53E Equipment ID: RYG\_FS0261  
Calibrator Manufacturer: Teledyne API Model: 700  
Serial No.: 947  
Std. Gas Concentration (PPM): 55.88 Cylinder No.: GN0027222  
Cylinder Pressure (psi): 1800 Certified By: Airgas Inc.  
Certified Date: 9-Feb-22 Expired Date: 9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	98.70	-1.30	-1.30	100.20	0.20	0.20
2	200.00	197.70	-2.30	-1.15	201.50	1.50	0.75
3	300.00	298.10	-1.90	-0.63	302.00	2.00	0.67
4	400.00	398.50	-1.50	-0.38	401.40	1.40	0.35
AVERAGE (%)				-0.67			0.41



Calibrated By

Approved By

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

(Mr. Sarayuth Jitranont)  
Assistant General Manager

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



JIRANATEE ASSOCIATES CO., LTD.

Jirante Associates Co., Ltd.  
63/14-15, 67/25-26  
Pattana 2, 2/1, Na-Norasingha, Bangkok,  
(Bangkok 10000) (Thailand)  
Tel: +66(0)20412  
Mobile: +66(0)20412  
Email: jnac-calibration@jiranatee.com  
Web site: www.jiranatee.com

Accredited calibration laboratory  
ISO/IEC 17025:2017  
NAC-TS1715 17025  
CALIBRATION 0367

Air speed measurement laboratory  
Calibration services department.

REVIEW BY: [Signature]  
APPROVED BY: [Signature]  
NEXT CAL DATE: 18/7/24

Certificate Number

CL-009-66

## CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM  
MANUFACTURER  
MODEL/TYPE

1) Cup anemometer  
2) Novolyns  
3) Sensor: WS-02E  
Data logger: 110-WS-16H

SERIAL NUMBER

1) Sensor: -  
Data logger: 11559  
RYG\_FS0261

10 NUMBER

1) Used item

CUSTOMER

1) ALS laboratory group (Thailand) co., ltd.  
104 Phatthanakan 43, Phatthanakan Rd, Khwaeng Suan Luang,  
Khet Suan Luang, Bangkok 10250 Thailand.

RECEIVED DATE

16 Jan 2023

MEASUREMENT DATE

16 Jan 2023

ISSUE DATE

20 Jan 2023

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

Temperature

23.0 ± 1.0 °C

Relative Humidity

55.0 ± 15.0 %RH

Atmospheric Pressure

1010 ± 10 hPa

PLACE OF CALIBRATION

1) Eiffel-type wind tunnel of Jiranatee Associates Co., Ltd.

CALIBRATION CONDITIONS

1) Wind tunnel cross-section area

500 cm²

Win direction frontal area

100 cm²

Diameter of mounting pipe

11 mm

Blockage rate of test object

0.111 %

Preconditioning

1) 24 hours at ambient conditions.

Measurement Condition

1) The average values during measurement are (23.5) °C, (52.2) %RH and (1014.5) hPa.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

1) Mr. Sarawat Jitranont  
2) Miss Jitranont Jitranont

Approved signature:

Mr. Parinya Booncharoen  
Calibration Department Manager

Remarks:

1) Nozzle cross-section area of the wind tunnel

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

3) Diameter of mounting pipe

4) Ratio 1/3 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

Certificate Number
CL-009-66

Page 2 of 2 Pages

#### MEASUREMENT RESULTS<sup>1</sup>

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

$v_{std}$ (m/s)	Temp. wind tunnel (°C)	Temp. room (°C)	$v_{uuc}$ (m/s)	Error (m/s)	$U$ (k=2) (m/s)
0.981	23.36	23.45	0.8	-0.2	0.15
2.030	23.40	23.45	1.9	-0.2	0.16
3.049	23.50	23.45	2.9	-0.2	0.17
4.129	23.50	23.45	3.9	-0.3	0.20
5.01	23.50	23.45	4.8	-0.2	0.17
5.97	23.54	23.45	5.7	-0.3	0.17
7.05	23.42	23.45	6.8	0.3	0.18
8.18	23.50	23.45	7.9	-0.3	0.19
9.10	23.34	23.45	8.8	-0.3	0.19
10.10	23.40	23.45	9.7	-0.4	0.19
11.14	23.40	23.45	10.8	-0.4	0.20
12.13	23.32	23.45	11.8	-0.4	0.20
13.20	23.10	23.45	12.9	-0.3	0.20
14.25	23.36	23.45	13.9	-0.4	0.22
15.24	23.22	23.45	14.8	-0.4	0.21
16.30	23.40	23.45	15.8	-0.5	0.22

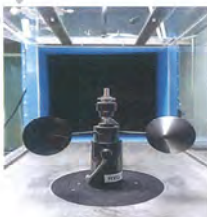
#### Remark:

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

<sup>2</sup> Velocity of standard

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

#### PHOTO OF CALIBRATION SET-UP



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

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

Page 2 of 2 Pages

#### MEASUREMENT RESULTS<sup>1</sup>

The wind direction sensor was calibrated against standard rotary encoder by comparison method. During calibration, the measurement was carried out at 45° 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 (°)
	0.000	0	0	0.58
	45.000	43	-3	0.76
	90.000	89	-2	0.76
	135.000	134	-1	0.74
	180.000	177	-3	0.74
	225.000	229	4	0.58
	270.000	273	3	0.68
	315.000	317	2	0.74

#### Remark:

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

<sup>2</sup> Direction of standard

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

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

Certificate Number

CL 009 66

## CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

#### MEASUREMENT ITEM

MANUFACTURER

MODEL/TYPE

SERIAL NUMBER

10/NUMBER

CONDITION AS RECEIVED

CUSTOMER

Wind Direction Sensor

Navalys

Sensor: WS-02E

Data logger: L10-WS-16M

Sensor:

Data logger: 1159

XTM, PSC081

Used item

ALS laboratory group (Thailand) Co., Ltd.

104 Phatthananak 40, Phatthananak Rd, Khwaeng Suan Luang,

Khut Suan Luang, Bangkok 10250 Thailand.

RECEIVED DATE

16 Jan 2023

MEASUREMENT DATE

19 Jan 2023

ISSUE DATE

19 Jan 2023

#### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follows:

Temperature: 23.0 ± 3.0 °C

Relative Humidity: 55.0 ± 15.0 %RH

Atmospheric Pressure: 1010 ± 10 hPa

#### PLACE OF CALIBRATION:

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

#### CALIBRATION CONDITION

: Wind tunnel cross-section area 900 cm<sup>2</sup>

Win direction frontal area 129 cm<sup>2</sup>

Diameter of mounting pipe 1 mm

Blockage ratio of test object 0.143 [-]

#### Preconditioning

: 24 hours at ambient conditions.

#### Measurement Condition

: The average values during measurement are (23.8)°C, (47.3) %RH and (1014.8) hPa.

#### TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

☒ Mr. Soravit Thirakul

☐ Miss Jittrapa Lerttongphol



Approved signature:

*Mr. Parinya Booncharoen*

Calibration Department Manager

#### Remark:

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

<sup>2</sup> Projected cross-section area of the tested object including mounting pipe

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

<sup>4</sup> Ratio "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

Certificate Number
CL-009-66

Page 2 of 2 Pages

#### MEASUREMENT RESULTS<sup>1</sup>

The wind direction sensor was calibrated against standard rotary encoder by comparison method. During calibration, the measurement was carried out at 45° 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 (°)
	0.000	0	0	0.58
	45.000	43	-3	0.76
	90.000	89	-2	0.76
	135.000	134	-1	0.74
	180.000	177	-3	0.74
	225.000	229	4	0.58
	270.000	273	3	0.68
	315.000	317	2	0.74

#### Remark:

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

<sup>2</sup> Direction of standard

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

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

## Calibration Certificate

Certificate No. 551422

Sold To:

Product 200-510M Delander 510 Medium Flow

Serial No. 208345

Cal. Date 18-Aug-2023

All calibrations are performed in accordance with ISO 17025 at Mesa Laboratories, Inc., 12100 W. 8th Ave, Lakewood, CO 80228, an ISO 17025:2017 accredited laboratory through NVLAP. This report shall not be reproduced except in full without the written approval of the laboratory. Results only relate to the items calibrated. This report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S. Government.

## As Received Calibration Data

Technician	Aaron Schwartz		Lab. Pressure	620.1 mmHg
			Lab. Temperature	23.5 °C
Instrument Reading	Lab Standard Reading	Deviation	Allowable Deviation	As Received
4523.09 ccm	4519.02 ccm	0.09%	1.00%	In Tolerance
999.43 ccm	999.31 ccm	0.01%	1.00%	In Tolerance
245.22 ccm	245.88 ccm	-0.27%	1.00%	In Tolerance

## Mesa Laboratories Standards Used

Description	Standard Serial Number	Calibration Date	Calibration Due Date
ML_800_24	205307	25-May-2023	25-May-2024

REVIEW BY *Parinya P*  
APPROVED BY *TL*  
NEXT CAL DATE 18/1/24



## As Shipped Calibration Data

Certificate No	551422	Lab. Pressure	618.8 mmHg
Technician	Xiem Ly	Lab. Temperature	24.2 °C
Instrument Reading	Lab Standard Reading	Deviation	Allowable Deviation
4516.61 ccm	4516.56 ccm	0.02%	1.00%
1000.87 ccm	1000.87 ccm	0.02%	1.00%
249.84 ccm	249.93 ccm	-0.04%	1.00%
As Shipped			
In Tolerance			
In Tolerance			
In Tolerance			

## Mesa Laboratories Standards Used

Description	Standard Serial Number	Calibration Date	Calibration Due Date
ML_800_24	100439	14-Sep-2022	14-Sep-2023

## Calibration Notes

The expanded uncertainty of flow has a coverage factor of  $k = 2$  for a confidence interval of approximately 95%.  
Flow testing is in accordance with our test number MP-00672 with an expanded uncertainty of 0.27% using high-purity nitrogen or filtered laboratory air.  
Traceability to the International System of Units (SI) is verified by accreditation to ISO/IEC 17025 by NVLAP under NVLAP Code 200661-0.

## Technician Notes:

By:

Xiem Ly  
Production Technician II

Approved By:

Norma Aragon  
QC Inspector

Mesa Laboratories, Inc. certifies that the above instrument meets or exceeds published specifications, and that the calibration results in this certificate were obtained using equipment capable of producing results that are traceable through NIST to the International System of Units (SI). Calibration results are in compliance with ISO/IEC 17025:2017. Calibrations process has a Test Uncertainty Ratio (TUR) of 4:1 or greater. Any Pass/Fail determination is made without taking measurement uncertainty into account and is based on UUT performance against required tolerance only.

Mesa Laboratories Inc. 12100 W. 6th Ave, Lakewood, CO 80228 USA  
(303) 987-8000 www.mesalabs.com Symbol "MLAB" on the NASDAQ



## Calibration Certificate

Certificate No. 561587  
Product 200-510L Defender 510 Low Flow  
Serial No. 130026  
Cal. Date 25-Sep-2023

Sold To:

All calibrations are performed in accordance with ISO 17025 at Mesa Laboratories, Inc., 12100 W. 6th Ave, Lakewood, CO 80228, an ISO 17025:2017 accredited laboratory through NVLAP. This report shall not be reproduced except in full without the written approval of the laboratory. Results only relate to the items calibrated. This report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S. Government.

## As Received Calibration Data

Technician	Aaron Schwartz	Lab. Pressure	616.1 mmHg
		Lab. Temperature	24 °C
Instrument Reading	Lab Standard Reading	Deviation	Allowable Deviation
0 ccm	456.41 ccm	-100.0%	1.00%
0 ccm	101.19 ccm	-100.0%	1.00%
0 ccm	30.36 ccm	-100.0%	1.00%
As Received			
Out of Tolerance			
Out of Tolerance			
Out of Tolerance			

## Mesa Laboratories Standards Used

Description	Standard Serial Number	Calibration Date	Calibration Due Date
ML_800_10	103743	25-Jan-2023	25-Jan-2024



Mesa Laboratories Inc. 12100 W. 6th Ave, Lakewood, CO 80228 USA  
(303) 987-8000 www.mesalabs.com Symbol "MLAB" on the NASDAQ



## As Shipped Calibration Data

Certificate No	561587	Lab. Pressure	622.2 mmHg
Technician	Aaron Schwartz	Lab. Temperature	23.6 °C
Instrument Reading	Lab Standard Reading	Deviation	Allowable Deviation
449.75 ccm	450.46 ccm	-0.16%	1.00%
100.96 ccm	100.52 ccm	0.14%	1.00%
30.63 ccm	30.38 ccm	0.82%	1.00%
As Shipped			
In Tolerance			
In Tolerance			
In Tolerance			

## Mesa Laboratories Standards Used

Description	Standard Serial Number	Calibration Date	Calibration Due Date
ML_800_10	103743	25-Jan-2023	25-Jan-2024

## Calibration Notes

The expanded uncertainty of flow has a coverage factor of  $k = 2$  for a confidence interval of approximately 95%.  
Flow testing is in accordance with our test number MP-00672 with an expanded uncertainty of 0.27% using high-purity nitrogen or filtered laboratory air.  
Traceability to the International System of Units (SI) is verified by accreditation to ISO/IEC 17025 by NVLAP under NVLAP Code 200661-0.

## Technician Notes:

By:

Aaron Schwartz  
Assembler I

Approved By:

David Thomas  
Quality Engineer

Mesa Laboratories, Inc. certifies that the above instrument meets or exceeds published specifications, and that the calibration results in this certificate were obtained using equipment capable of producing results that are traceable through NIST to the International System of Units (SI). Calibration results are in compliance with ISO/IEC 17025:2017. Calibrations process has a Test Uncertainty Ratio (TUR) of 4:1 or greater. Any Pass/Fail determination is made without taking measurement uncertainty into account and is based on UUT performance against required tolerance only.

Mesa Laboratories Inc. 12100 W. 6th Ave, Lakewood, CO 80228 USA  
(303) 987-8000 www.mesalabs.com Symbol "MLAB" on the NASDAQ



## Calibration Certificate

Certificate No. 561588  
Product 200-510M Defender 510 Medium Flow  
Serial No. 151114  
Cal. Date 30-Sep-2023

Sold To:

All calibrations are performed in accordance with ISO 17025 at Mesa Laboratories, Inc., 12100 W. 6th Ave, Lakewood, CO 80228, an ISO 17025:2017 accredited laboratory through NVLAP. This report shall not be reproduced except in full without the written approval of the laboratory. Results only relate to the items calibrated. This report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S. Government.

## As Received Calibration Data

Technician	Xiem Ly	Lab. Pressure	616.8 mmHg
		Lab. Temperature	25.8 °C
Instrument Reading	Lab Standard Reading	Deviation	Allowable Deviation
0 ccm	4499.86 ccm	-100.0%	1.00%
0 ccm	997.38 ccm	-100.0%	1.00%
0 ccm	250.32 ccm	-100.0%	1.00%
As Received			
Out of Tolerance			
Out of Tolerance			
Out of Tolerance			

## Mesa Laboratories Standards Used

Description	Standard Serial Number	Calibration Date	Calibration Due Date
ML_800_24	117991	16-Aug-2023	16-Aug-2024



Mesa Laboratories Inc. 12100 W. 6th Ave, Lakewood, CO 80228 USA  
(303) 987-8000 www.mesalabs.com Symbol "MLAB" on the NASDAQ



### As Shipped Calibration Data

Certificate No	561588	Lab. Pressure	616.2 mmHg
Technician	Xiem Ly	Lab. Temperature	26.1 °C
Instrument Reading	Lab Standard Reading	Deviation	Allowable Deviation
4406.74 ccm	4494.43 ccm	0.05%	1.00%
997.03 ccm	997.16 ccm	-0.01%	1.00%
249.84 ccm	250.5 ccm	-0.26%	1.00%
			As Shipped
			In Tolerance
			In Tolerance
			In Tolerance

### Mesa Laboratories Standards Used

Description	Standard Serial Number	Calibration Date	Calibration Due Date
ML_800_24	117991	06-Dec-2022	05-Dec-2023

#### Calibration Notes

The expanded uncertainty of flow has a coverage factor of  $k = 2$  for a confidence interval of approximately 95%. Flow testing is in accordance with our test number MP-00672 with an expanded uncertainty of 0.27% using high-purity nitrogen or filtered laboratory air. Traceability to the International System of Units (SI) is verified by accreditation in ISO/IEC 17025 by NVLAP under NVLAP Code 200661-0.

#### Technician Notes:

By:

*Xiem Ly*

Xiem Ly  
Production Technician II

Approved By:

*Norma Aragon*

Norma Aragon  
QC Inspector

Mesa Laboratories, Inc. certifies that the above instrument meets or exceeds published specifications, and that the calibration results in this certificate were obtained using equipment capable of producing results that are traceable through NIST to the International System of Units (SI). Calibration results are in compliance with ISO/IEC 17025:2017. Calibration process has a Test Uncertainty Ratio (TUR) of 4:1 or greater. Any Pass/Fail determination is made without taking measurement uncertainty into account and is based on UUT performance against required tolerance only.

Mesa Laboratories Inc. 12100 W. 8th Ave. Lakewood, CO 80228 USA  
(303) 987-8000 www.mesalabs.com Symbol "MLAB" on the NASDAQ

FM-00228 Rev. B

INNOVATIVE INSTRUMENT CALIBRATION LAB  
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE  
7/19 MOO 13, SOI SUTINAKORN 11 TAMBON BANG KAEO,  
AMPHOE BANG PHU SAMUT PRAKAN PROVINCE 10540 THAILAND  
TEL: 1660-2116-5860-1 FAX: 1660-2116-7140



### Certificate of Calibration

Certificate No : 24-AFM-018 Rev.1

Request No : Req-2024-0043

#### Customer

Name : ALS Laboratory Group Thailand Co., Ltd.  
Address : 104 Soi Phatthanakan 40, Phatthanakan Road, Suan Luang, Bangkok  
10250

#### Unit Under Calibration Details

Measurement Item : Air Flow Meter

Manufacturer : Bios

Model : Defender 510-L

Sensor Model : -

Serial Number : 206895

Sensor Serial Number : -

ID : BKK\_FS1246

Location of Calibration : LAB 4 AIR VELOCITY METER

#### Calibration Environment and Details

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

Humidity :  $55\% \text{RH} \pm 20\% \text{RH}$

Barometric Pressure :  $1013 \text{ hPa} \pm 10 \text{ hPa}$

Received Date : 3 January 2024

Calibration Date : 29 January 2024

Calibration Procedure : In-house method CP-AFM-01 by Comparison technique with Standard Primary Flow Calibrator

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Gilibrator 3 Low flow	18501010006	Sensidyne	12 July 2024
Air Flow Meter	Gilibrator 3 Standard flow	19031011003	Sensidyne	12 July 2024
Temperature meter	GT 11	08000057	Qreborn	27 February 2024
Pressure meter	CPG2400	41000KDU/651882	TPA	9 November 2024

#### Traceability :

This Certificate is traceable to SI Unit through Sensidyne A2LA Accreditation No. 3943.01

#### Note :

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

This Certificate was issued to replace to Calibration Certificate No. 24-AFM-018

Calibration By :

*Mr. Noppadon Luangart*  
Service Calibration Engineer

Approved By :

*Mr. Paci Mathavorn*  
Calibration Engineer Supervisor

Issue Date : 1 February 2024

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

FM-708-AFM-01 Rev.01 Issue date 25/01/24

INNOVATIVE INSTRUMENT CALIBRATION LAB  
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE  
7/19 MOO 13, SOI SUTINAKORN 11 TAMBON BANG KAEO,  
AMPHOE BANG PHU SAMUT PRAKAN PROVINCE 10540 THAILAND  
TEL: 1660-2116-5860-1 FAX: 1660-2116-7140



Certificate No : 24-AFM-018 Rev.1

Request No : Req-2024-0043

#### Result of Calibration : Without Adjustment

Temperature	Pressure	STD	UUC	Error	Uncertainty
(°C)	(kPa)	(ml/min)	(ml/min)	(ml/min)	(ml/min)
25.00	101.66	20	20.148	0.1	1.3
25.00	101.67	100	99.409	-0.6	2.8
24.90	101.63	199	197.46	-1.5	5.6
25.00	101.61	300	298.15	-1.8	8.4
24.90	101.60	399	400.13	1	11
24.90	101.59	480	478.02	-2.0	6.8

#### Note

STD : Standard UUC : Unit Under Calibration

-UUC Reference Condition : At atmospheric pressure and room temperature condition

- Flow Rate was corrected for non-standard operating condition by using equation :

$$Q_{\text{meas}} = Q_{\text{ref}} \times \frac{P_{\text{ref}}}{P_{\text{meas}}} \times \frac{T_{\text{meas}}}{T_{\text{ref}}}$$

where Q = Flow Rate P = Absolute Pressure T = Absolute Temperature

Meas = Measurement Condition

ref = Standard Condition

\* Indicates non accredited

End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

FM-708-AFM-01 Rev.01 Issue date 25/01/24

INNOVATIVE INSTRUMENT CALIBRATION LAB  
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE  
7/19 MOO 13, SOI SUTINAKORN 11 TAMBON BANG KAEO,  
AMPHOE BANG PHU SAMUT PRAKAN PROVINCE 10540 THAILAND  
TEL: 1660-2116-5860-1 FAX: 1660-2116-7140



### Certificate of Calibration

Certificate No : 24-AFM-033

Request No : Req-2024-0241

#### Customer

Name : ALS Laboratory Group Thailand Co., Ltd.  
Address : 104 Soi Phatthanakan 40, Phatthanakan Road, Suan Luang, Bangkok  
10250

#### Unit Under Calibration Details

Measurement Item : Primary Flow Calibrator

Manufacturer : Bios

Model : Defender 510-L

Sensor Model : -

Serial Number : 130027

Sensor Serial Number : -

ID : RYG\_FS0208

Location of Calibration : LAB 4 AIR VELOCITY METER

#### Calibration Environment and Details

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

Humidity :  $55\% \text{RH} \pm 20\% \text{RH}$

Barometric Pressure :  $1013 \text{ hPa} \pm 10 \text{ hPa}$

Received Date : 31 January 2024

Calibration Date : 13 February 2024

Calibration Procedure : In-house method CP-AFM-01 by Comparison technique with Standard Primary Flow Calibrator

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Gilibrator 3 Low flow	18501010006	Sensidyne	12 July 2024
Air Flow Meter	Gilibrator 3 Standard flow	19031011003	Sensidyne	12 July 2024
Temperature meter	GT 11	08000057	Qreborn	27 February 2024
Pressure meter	CPG2400	41000KDU/651882	TPA	9 November 2024

#### Traceability :

This Certificate is traceable to SI Unit through Sensidyne A2LA Accreditation No. 3943.01

#### Note :

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

Calibration By :

*Mr. Noppadon Luangart*  
Service Calibration Engineer

Approved By :

*Mr. Paci Mathavorn*  
Calibration Engineer Supervisor

Issue Date : 13 February 2024

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

FM-708-AFM-01 Rev.01 Issue date 25/01/24

Certificate No : 24-AFM-033  
Request No : Req-2024-0241

Result of Calibration : Without Adjustment

Temperature (°C)	Pressure (kPa)	STD (cc/min)	UUC (cc/min)	Error (cc/min)	Uncertainty (cc/min)
24.50	101.26	20	19.965	0.0	1.3
24.20	101.25	101	100.50	-0.5	2.8
24.00	101.31	200	199.13	-0.9	5.6
23.90	101.42	301	303.56	2.6	8.4
24.10	101.41	401	404.57	4	11
24.10	101.49	480	483.81	3.8	7.0

Note  
STD : Standard UUC : Unit Under Calibration  
- UUC Reference Condition : At atmospheric pressure and room temperature condition  
- Flow Rate was corrected for non-standard operating condition by using equation :

$$Q_{meas} = Q_{ref} \times \frac{P_{ref}}{P_{meas}} \times \frac{T_{meas}}{T_{ref}}$$

where Q = Flow Rate P = Absolute Pressure T = Absolute Temperature  
Meas = Measurement Condition ref = Standard Condition

\* Indicates non accredited

End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

FM-708-AFM-01 Rev.01 Issue date 25/01/24

Certificate of Calibration

Certificate No : 24-AFM-032  
Request No : Req-2024-0240

Customer  
Name : ALS Laboratory Group Thailand Co., Ltd.  
Address : 104 Soi Phantakan 40, Phantakan Road, Suan Luang, Bangkok  
10250

Unit Under Calibration Details

Measurement Item : Primary Flow Calibrator  
Manufacturer : Bios  
Model : Defender 510-M  
Serial Number : 129958  
ID : RVG\_FS0209  
Location of Calibration : LAB 4 AIR VELOCITY METER  
Sensor Model : -  
Sensor Serial Number : -

Calibration Environment and Details

Temperature : 23 °C ± 3 °C  
Humidity : 55 %RH ± 20 %RH  
Barometric Pressure : 1013 hPa ± 10 hPa  
Received Date : 31 January 2024  
Calibration Date : 13 February 2024

Calibration Procedure : In-house method CP-AFM-01 by Comparison technique with Standard Primary Flow Calibrator


Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Gilibrator 3 Low flow	18501010006	Sensidyne	12 July 2024
Air Flow Meter	Gilibrator 3 Standard flow	19031011003	Sensidyne	12 July 2024
Temperature meter	GT 11	08000057	Qreborn	27 February 2024
Pressure meter	CPG2400	41000KDU/651882	TPA	9 November 2024


Traceability :

This Certificate is traceable to SI Unit through Sensidyne A2LA Accreditation No. 3943.01

Note :

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

Calibration By :   
Mr. Noppadon Liangart  
Service Calibration Engineer

Approved By :   
Mr. Pacin Mathavorn  
Calibration Engineer Supervisor  
Issue Date : 13 February 2024

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

FM-708-AFM-01 Rev.01 Issue date 25/01/24

Certificate No : 24-AFM-032  
Request No : Req-2024-0240

Result of Calibration : Without Adjustment

Temperature (°C)	Pressure (kPa)	STD (cc/min)	UUC (cc/min)	Error (cc/min)	Uncertainty (cc/min)
23.80	101.89	95	100.13	5.1	2.8
23.90	101.71	501	513.93	12.9	7.2
24.18	101.62	1006	1019.3	13	14
24.00	101.81	1997	2023.0	26	29
24.10	101.87	2999	3035.5	37	45
24.60	102.00	3944	3991.8	48	59
24.60	102.08	4739	4790.5	52	72

Note  
STD : Standard UUC : Unit Under Calibration  
- UUC Reference Condition : At atmospheric pressure and room temperature condition  
- Flow Rate was corrected for non-standard operating condition by using equation :

$$Q_{meas} = Q_{ref} \times \frac{P_{ref}}{P_{meas}} \times \frac{T_{meas}}{T_{ref}}$$

where Q = Flow Rate P = Absolute Pressure T = Absolute Temperature  
Meas = Measurement Condition ref = Standard Condition

\* Indicates non accredited

End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

FM-708-AFM-01 Rev.01 Issue date 25/01/24



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

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

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

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

  
Operator Signature:   
(Mr. Nudana Laekhwan)  
Application Chemist

Date: Jan 12, 2024

# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

451-451/1 Srinthorn 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. : ACC23029  
Pages : 1 of 3

## Calibration Certificate

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

REVIEW BY *Nathakorn P.*  
APPROVED BY *[Signature]*  
NEXT CAL DATE *20/9/24*

Condition As Found : GOOD

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

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

Received Date : 07 SEPTEMBER 2023  
Calibration Date : 20 SEPTEMBER 2023  
Date of Issue : 20 SEPTEMBER 2023

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.

QF-TS12-04-04-020664

# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACC23029  
Job No. : VC66AC0100  
Pages : 2 of 3

Calibration Procedure : CP-AC-03

## Calibration Method :

This equipment was calibrated by based on IEC-60942:2003 Standard.  
The sound pressure level, frequency and total distortion of the sound calibrator was measured using the reference microphone.

## Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33511B	MY52302742	EF-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-42KAL	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).

QF-TS12-04-04-020664

*[Signature]*

# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACC23029  
Job No. : VC66AC0100  
Pages : 3 of 3

## Result of calibration :

### 1. Sound pressure level

Specified sound pressure level (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (dB)	Acceptance limit (dB)
94	94.1	0.10	0.14	0.40

### 2. Frequency

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

### 3. Total distortion

Measured value (%)	Uncertainty (%)	Acceptance 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

QF-TS12-04-04-020664

*[Signature]*

# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

451-451/1 Srinthorn 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. : ACL23320  
Pages : 1 of 8

## Calibration Certificate

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

Condition As Found : GOOD

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

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

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

REVIEW BY *Nathakorn P.*  
APPROVED BY *[Signature]*  
NEXT CAL DATE *19/10/24*

Calibrated by : Nathakorn Pisutpaisan

Approved by :

*[Signature]*  
( Thanakul Petchurai )

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QF-TS12-04-04-020664

## Continuation of Calibration Certificate

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

Calibration Procedure : CP-AC-01

## Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).

The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

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

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

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

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

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

3.1 National Institute of Metrology (Thailand).

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

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7. Retu.

## Continuation of Calibration Certificate

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

## Summary of Measurement Result :

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

Note : Pass/Fail evaluation for each parameter,

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

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7. Retu.

## Continuation of Calibration Certificate

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

## Result of calibration :

## 1. Absolute sensitivity

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

## 2. Self-generated noise

## 2.1 Normal test

Measured Value (dB)
14.6

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

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

## 3. Acoustical signal tests of frequency weightings

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

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

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7. Retu.

## Continuation of Calibration Certificate

Cert. No. : ACL23320  
Job No. : VC67AC0011  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

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

## 5.2 Time weighting at 1 kHz

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

## 6. Long - term stability

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

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7. Retu.

Cert. No. : ACL23320  
Job No. : VC67AC0011  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.0	0.0	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.0	0.0	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.0	0.0	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	63.9	-0.1	±1.1
59.0	59.0	0.0	±1.1
54.0	53.9	-0.1	±1.1
49.0	48.9	-0.1	±1.1
44.0	43.9	-0.1	±1.1
39.0	38.9	-0.1	±1.1
34.0	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

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Cert. No. : ACL23320  
Job No. : VC67AC0011  
Pages : 7 of 8

## 8. Level linearity including the level range control

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

## 9. Tone burst response

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

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lepeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.1	0.1	±3.0
One	136.4	136.1	-0.3	±3.0

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

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Cert. No. : ACL23320  
Job No. : VC67AC0011  
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## 11. Overload indication

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

## 12. High level stability

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

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

End of Calibration Certificate

469/451/1 Sirinon Road, Bangkokmu, Bangkok, 10710 Thailand  
Tel. +66 2433 8331 Email : calibration@sithiporn.comCert. No. : ACC24008  
Pages : 1 of 3

## Calibration Certificate

Equipment : SOUND CALIBRATOR  
Manufacturer : RION  
Model : NC-75  
Serial No. : 35002736  
ID No. : RYG-FS0496

Condition As Found : GOOD

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

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

Received Date : 19 JANUARY 2024  
Calibration Date : 26 JANUARY 2024  
Date of Issue : 29 JANUARY 2024

Calibrated by : Nithakorn Pisunpaisan

Approved by : T. Petchur  
( Thanakul Petchurai )



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QF-TS12-04-04-020664

T. Petchur

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

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



Cert. No. : ACC24008  
Job No. : VC67AC0058  
Pages : 2 of 3

Calibration Procedure : CP-AC-03

**Calibration Method :**

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

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

**Condition of this result of calibration :**

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33511B	MY52302742	EF-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).

*T. Petchur*

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

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



Cert. No. : ACC24008  
Job No. : VC67AC0058  
Pages : 3 of 3

**Result of calibration :**

**1. Sound pressure level**

Specified sound pressure level (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (dB)	Acceptance limit (dB)
94	93.98	-0.02	0.14	0.40

**2. Frequency**

Specified Frequency (Hz)	Measured value (Hz)	Deviated value (%)	Uncertainty (%)	Acceptance limit (%)
1000	1000.0	0.0	0.1	1.0

**3. Total distortion**

Measured value (%)	Uncertainty (%)	Acceptance limit (%)
0.83	0.10	3.0

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor  $k = 2$

or any value following calculation, providing a level of confidence of approximately 95 %.

End of Calibration Certificate

*T. Petchur*

**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. : ACL23262  
Pages : 1 of 8

**Calibration Certificate**

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No.: 00572561 / 170398 / 72899  
ID No.: RYG\_FS0300

Condition As Found : GOOD

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

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

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

Calibrated by : Nathakorn Pisutpaisan

Approved by :

*T. Petchur*  
( Thanakul Petchurai )

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

**Continuation of Calibration Certificate**

Cert. No. : ACL23262  
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 :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL_BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL_BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL_BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAI	34560495	AA-3002-23	14-FEB-24

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

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

3.1 National Institute of Metrology (Thailand).

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

*T. Petchur*

Summary of Measurement Result :

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

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

QF-TS12-04-04-020664

T. Petch

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)
16.1

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

Frequency Weighting	Measured value (dB)
A - weight	12.0
C - weight	18.2
Flat	24.0

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.2	0.2	0.2	± 1.5
1000	-0.1	-0.1	-0.1	± 1.0
8000	0.3	0.4	0.4	±5.0

QF-TS12-04-04-020664

T. Petch

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	-0.1	0.0	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.1	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	94.0	0.0	± 0.3

QF-TS12-04-04-020664

T. Petch

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	28.9	-0.1	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.9	-0.1	± 1.1

QF-TS12-04-04-020664

T. Petch

Cert. No. : ACL23262  
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	128.0	0.0	±1.0

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L <sub>peak</sub> (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	135.7	-0.7	±3.0

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

QF-TS12-04-04-020664

T. Petchurai

SITHIPORN ASSOCIATES CO.,LTD.  
CALIBRATION LABORATORY451-451/1 Sirthorn Rd, Bangbunru, Bangplud Bangkok 10700 THAILAND  
Tel:0-2433-8800 Fax:0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACL23248  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No.: 00472130 / 169816 / 72464  
ID No.: RYG\_FS0303

Condition As Found : GOOD

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

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

Received Date : 13 JULY 2023  
Calibration Date : 10 AUGUST 2023  
Date of Issue : 11 AUGUST 2023

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchurai  
( Thanakul Petchurai )

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

QF-TS12-04-04-020664

Cert. No. : ACL23262  
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		
89.7	89.5	-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	137.1	137.0	0.1	±0.3

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

End of Calibration Certificate

QF-TS12-04-04-020664

T. Petchurai

SITHIPORN SITHIPORN ASSOCIATES CO.,LTD.  
CALIBRATION LABORATORYCert. No. : ACL23248  
Job No. : VC66AC0085  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

## Calibration Method :

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

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

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL-BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL-BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL-BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KA1	34560495	AA-3002-23	14-FEB-24

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

3. This certificate is traceable to the international system of unit maintained at :  
3.1 National Institute of Metrology (Thailand).  
3.2 Thailand Institute of Scientific and Technological Research (TISTR).

QF-TS12-04-04-020664

T. Petchurai

## Continuation of Calibration Certificate

Cert. No. : ACL23248  
Job No. : VC66AC0085  
Pages : 3 of 8

## Summary of Measurement Result :

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

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

QF-TS12-04-04-020664

7. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL23248  
Job No. : VC66AC0085  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

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

## 2. Self-generated noise

## 2.1 Normal test

Measured Value (dB)
14.4

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

Frequency Weighting	Measured value (dB)
A - weight	12.0
C - weight	17.8
Flat	23.2

## 3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			Acceptance Limits
	Flat	C-weight	A-weight	
125	0.7	0.7	0.7	± 1.5
1000	-0.1	0.0	0.0	± 1.0
8000	-4.1	-4.0	-4.1	±5.0

QF-TS12-04-04-020664

7. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL23248  
Job No. : VC66AC0085  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

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

## 5.2 Time weighting at 1 kHz

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

## 6. Long - term stability

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

QF-TS12-04-04-020664

7. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL23248  
Job No. : VC66AC0085  
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	63.9	-0.1	± 1.1
59.0	59.0	0.0	± 1.1
54.0	53.9	-0.1	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	38.9	-0.1	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.0	0.0	± 1.1
26.0	26.0	0.0	± 1.1
25.0	25.0	0.0	± 1.1

QF-TS12-04-04-020664

7. Petch

Cert. No. : ACL23248  
Job No. : VC66AC0085  
Pages : 7 of 8

## 8. Level linearity including the level range control

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

## 9. Tone burst response

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

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L <sub>peak</sub> (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	135.6	-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	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

QF-TS12-04-04-020664

T. Petchur

SITHIPORN ASSOCIATES CO.,LTD.  
CALIBRATION LABORATORY451-451/1 Sirinthorn Rd.,Bangumru, Banglud Bangkok 10700 THAILAND  
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACL23261  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No. : 00472132 / 169445 / 72466  
ID No. : RYG\_FS0304

Condition As Found : GOOD

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

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

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

Calibrated by : Nathakorn Pisutpaisan

Approved by :

( Thamakul Petchur )

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

QF-TS12-04-04-020664

Cert. No. : ACL23248  
Job No. : VC66AC0085  
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

QF-TS12-04-04-020664

T. Petchur

SITHIPORN / SITHIPORN ASSOCIATES CO.,LTD.  
CALIBRATION LABORATORYCert. No. : ACL23261  
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 :

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

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

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

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

QF-TS12-04-04-020664

T. Petchur

Summary of Measurement Result :

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

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

QF-TS12-04-04-020664

*g. Petch*

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 )
16.0

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

Frequency Weighting	Measured value ( dB )
A - weight	8.7
C - weight	15.9
Flat	21.8

3. Acoustical signal tests of frequency weightings

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

Frequency ( Hz )	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.3	0.3	0.3	± 1.5
1000	-0.1	-0.1	-0.1	± 1.0
8000	-1.4	-1.5	-1.5	±5.0

QF-TS12-04-04-020664

*g. Petch*

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	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

QF-TS12-04-04-020664

*g. Petch*

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	127.6	0.0	±1.0
	0.25	1	99.0	98.8	-0.2	1.5 ; -5.0
SEL	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value ( dB )	Measured Value, L <sub>peak</sub> ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Continuous	133.0	133.0	0.0	±3.0
One	136.4	135.5	-0.9	±3.0

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

QF-TS12-04-04-020664

*g. Petch*

## Continuation of Calibration Certificate

Cert. No. : ACL233261  
Job No. : VC66AC0094  
Pages : 8 of 8

## 11. Overload indication

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

## 12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

451-451/1 Sirthorn Rd, Bangbunru, Bangkok 10700 THAILAND.  
Tel: 0-2435-8800 Fax: 0-2431-1679 e-mail: cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACL23323  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-S2 / Preamplifier NH-24  
Serial No.: 00873057 / 171591 / 73333  
ID No.: RYG\_FS0381

Condition As Found : GOOD

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

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

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

REVIEW BY : *Nathakorn P.*  
APPROVED BY : *[Signature]*  
NEXT CAL. DATE : 19/10/24

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.

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL23323  
Job No. : VC67AC0011  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

## Calibration Method :

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

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33211A	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-42KA1	34560495	AA-3002-23	14-FEB-24

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

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

3.1 National Institute of Metrology (Thailand).

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

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL23323  
Job No. : VC67AC0011  
Pages : 3 of 8

## Summary of Measurement Result :

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

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

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL23323  
Job No. : VC67AC0011  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

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

## 2. Self-generated noise

## 2.1 Normal test

Measured Value ( dB )
15.8

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

Frequency Weighting	Measured value ( dB )
A - weight	12.0
C - weight	18.7
Flat	24.0

## 3. Acoustical signal tests of frequency weightings

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

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

QF-TS12-04-04-020664

T. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL23323  
Job No. : VC67AC0011  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

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

## 5.2 Time weighting at 1 kHz

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

## 6. Long - term stability

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

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T. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL23323  
Job No. : VC67AC0011  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value ( dB )	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	53.9	-0.1	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	38.9	-0.1	± 1.1
34.0	33.9	-0.1	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	26.8	-0.2	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.8	-0.2	± 1.1

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T. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL23323  
Job No. : VC67AC0011  
Pages : 7 of 8

## 8. Level linearity including the level range control

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

## 9. Tone burst response

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

## 10. Peak C sound level

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

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

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T. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL23323  
Job No. : VC67AC0011  
Pages : 8 of 8

## 11. Overload indication

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

## 12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

T. Petchur

451-451/1 Sirinthon Rd, Bangumru, Bangplud Bangkok 10700 THAILAND.  
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:center@sithiporn.com http://www.sithiporn.comCert. No. : ACL23324  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No.: 00873109 / 171842 / 73485  
ID No.: RYG\_FS0384

Condition As Found : GOOD

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

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

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



Calibrated by : Nathakorn Pisupaisan

Approved by : T. Petchur  
( Thanakul Petchurai )

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

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL23324  
Job No. : VC67AC0011  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

## Calibration Method :

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

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

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL_BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL_BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL_BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAI	34560495	AA-3002-23	14-FEB-24

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

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

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

QF-TS12-04-04-020664

T. Petchur

## Continuation of Calibration Certificate

Cert. No. : ACL23324  
Job No. : VC67AC0011  
Pages : 3 of 8

## Summary of Measurement Result :

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

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

QF-TS12-04-04-020664

T. Petchur

## Continuation of Calibration Certificate

Cert. No. : ACL23324  
Job No. : VC67AC0011  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

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

## 2. Self-generated noise

## 2.1 Normal test

Measured Value ( dB )
16.8

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

Frequency Weighting	Measured value ( dB )
A - weight	11.3
C - weight	17.5
Flat	23.1

## 3. Acoustical signal tests of frequency weightings

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

Frequency ( Hz )	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.4	0.4	0.5	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-1.2	-1.1	-1.1	±5.0

QF-TS12-04-04-020664

T. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL23324  
Job No. : VC67AC0011  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

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

## 5.2 Time weighting at 1 kHz

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

QF-TS12-04-04-020664

T. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL23324  
Job No. : VC67AC0011  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value ( dB )	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	53.9	-0.1	± 1.1
49.0	49.0	0.0	± 1.1
44.0	43.9	-0.1	± 1.1
39.0	38.9	-0.1	± 1.1
34.0	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	25.8	-0.2	± 1.1
25.0	24.9	-0.1	± 1.1

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T. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL23324  
Job No. : VC67AC0011  
Pages : 7 of 8

## 8. Level linearity including the level range control

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

## 9. Tone burst response

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

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value ( dB )	Measured Value, Lepeak ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Continuous	133.0	133.0	0.0	±3.0
One	136.4	135.8	-0.6	±3.0

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

QF-TS12-04-04-020664

T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL23324  
Job No. : VC67AC0011  
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11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

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



Cert. No. : ACL23325  
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No.: 01073423 / 169513 / 73684  
ID No.: RYG\_FS0386

Condition As Found : GOOD

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

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

VIEW BY : *Nathakorn P.*  
APPROVED BY : *Thakorn P.*  
EXT CAL DATE : 11/10/24

Calibrated by : Nathakorn Pisutpaisan

Approved by : *Thakorn P.*  
( Thanakul Petchurai )

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QF-TS12-04-04-020664

Continuation of Calibration Certificate

Calibration Procedure : CP-AC-01

Cert. No. : ACL23325  
Job No. : VC67AC0011  
Pages : 2 of 8

Calibration Method :

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL-BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL-BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL-BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAI	34560495	AA-3002-23	14-FEB-24

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

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

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23325  
Job No. : VC67AC0011  
Pages : 3 of 8

Summary of Measurement Result :

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

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

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL23325  
Job No. : VC67AC0011  
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## Result of calibration :

## 1. Absolute sensitivity

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

## 2. Self-generated noise

## 2.1 Normal test

Measured Value ( dB )
15.4

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

Frequency Weighting	Measured value ( dB )
A - weight	13.1
C - weight	18.8
Flat	24.6

## 3. Acoustical signal tests of frequency weightings

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

Frequency ( Hz )	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.2	0.2	0.2	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	1.6	1.7	1.6	±5.0

QF-TS12-04-04-020664

P.T.M.

## Continuation of Calibration Certificate

Cert. No. : ACL23325  
Job No. : VC67AC0011  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

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

## 5.2 Time weighting at 1 kHz

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

## 6. Long - term stability

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

QF-TS12-04-04-020664

P.T.M.

## Continuation of Calibration Certificate

Cert. No. : ACL23325  
Job No. : VC67AC0011  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value ( dB )	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	53.9	-0.1	± 1.1
49.0	49.0	0.0	± 1.1
44.0	43.9	-0.1	± 1.1
39.0	38.9	-0.1	± 1.1
34.0	33.9	-0.1	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.8	-0.2	± 1.1

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P.T.M.

## Continuation of Calibration Certificate

Cert. No. : ACL23325  
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## 8. Level linearity including the level range control

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

## 9. Tone burst response

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

## 10. Peak C sound level

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

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

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P.T.M.

Cert. No. : ACL23325  
Job No. : VC67AC0011  
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## 11. Overload indication

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

## 12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

SITHIPORN ASSOCIATES CO., LTD.  
CALIBRATION LABORATORY451-451/1 Sirinthorn Road, Bangsue, Bangkok, 10700 Thailand  
Tel: +66 2433 8331 Email: calibration@sithiporn.comCert. No. : ACL24007  
Job No. : VC67AC0044  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

## Calibration Method :

This equipment was calibrated by follow on IEC-61672-3 (2013) Standard for sound level meter (SLM).

The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

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

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	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).

451-451/1 Sirinthorn Road, Bangsue, Bangkok, 10700 Thailand  
Tel: +66 2433 8331 Email: calibration@sithiporn.comCert. No. : ACL24007  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42 / Microphone LC-52 / Preamplifier NH-24  
Serial No. : 01173609 / 172170 / 74021  
ID No. : RYG\_FS0388

Condition As Found : GOOD

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

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



Calibrated by : Nathakorn 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.

SITHIPORN ASSOCIATES CO., LTD.  
CALIBRATION LABORATORY451-451/1 Sirinthorn Road, Bangsue, Bangkok, 10700 Thailand  
Tel: +66 2433 8331 Email: calibration@sithiporn.comCert. No. : ACL24007  
Job No. : VC67AC0044  
Pages : 3 of 8

## Summary of Measurement Result :

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

**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	13.4
C - weight	19.9
Flat	25.3

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

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

Frequency ( Hz )	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.3	0.3	0.3	± 1.5
1000	0.1	0.1	0.1	± 1.0
8000	0.8	0.9	0.9	± 5.0

*T. Petin*

**4. Electrical signal tests of frequency weightings**

Weighting network response with relative to 1 kHz.

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

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

**5.1 Frequency weightings at 1 kHz**

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

**5.2 Time weighting at 1 kHz**

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

**6. Long - term stability**

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

*T. Petin*

**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	28.1	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

*T. Petin*

**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 <sub>peak</sub> ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Continuous	133.0	133.0	0.0	±3.0
One	136.4	136.3	-0.1	±3.0

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

*T. Petin*

Cert. No. : ACL24007  
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## 11. Overload indication

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

## 12. High level stability

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

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

End of Calibration Certificate

T. Retan

Cert. No. : ACL24008  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42 / Microphone UC-52 / Preamplicifier NH-24  
Serial No. : 01173610 / 143485 / 12619  
ID No. : RYG\_FS0389

Condition As Found : GOOD

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

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

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



Calibrated by : Nathakorn Pisutpaisani

Approved by : T. Retan  
( Thanakul Petchurai )

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

Cert. No. : ACL24008  
Job No. : VC67AC0044  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

## Calibration Method :

This equipment was calibrated by follow on IEC-61672-3 (2013) Standard for sound level meter (SLM).

The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

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

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33216A	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-42KA1	34560495	AA-3002-23	14-FEB-24

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

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

3.1 National Institute of Metrology (Thailand).

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

T. Retan

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

## Summary of Measurement Result :

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

T. Retan

**Result of calibration :**

**1. Absolute sensitivity**

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

**2. Self-generated noise**

**2.1 Normal test**

Measured Value ( dB )
18.6

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

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

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

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

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

*T. Petch.*

**4. Electrical signal tests of frequency weightings**

Weighting network response with relative to 1 kHz.

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

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

**5.1 Frequency weightings at 1 kHz**

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

**5.2 Time weighting at 1 kHz**

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

**6. Long - term stability**

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

*T. Petch.*

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

Anticipated Value ( dB )	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.1	0.1	± 1.1
84.0	84.1	0.1	± 1.1
79.0	79.1	0.1	± 1.1
74.0	74.1	0.1	± 1.1
69.0	69.1	0.1	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.1	0.1	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.1	0.1	± 1.1
30.0	30.1	0.1	± 1.1
29.0	29.1	0.1	± 1.1
28.0	28.2	0.2	± 1.1
27.0	27.4	0.4	± 1.1
26.0	26.3	0.3	± 1.1
25.0	25.4	0.4	± 1.1

*T. Petch.*

**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 <sub>peak</sub> ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Continuous	133.0	133.0	0.0	±3.0
One	136.4	135.7	-0.7	±3.0

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

*T. Petch.*

**11. Overload indication**

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

**12. High level stability**

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

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

End of Calibration Certificate

**Calibration Certificate**

**Equipment :** SOUND LEVEL METER  
**Manufacturer :** RION  
**Model :** NL-42/ Microphone UC-52 / Preamplifier NH-24  
**Serial No.:** 00734223 / 169439 / 72460  
**ID No.:** RYG\_FS0029

**Condition As Found :** GOOD

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

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

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

**Calibrated by :** Nathakorn Pisutpaisan

**Approved by :**

*T. Petchur*  
( Thanakul Petchurai )

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

QF-TS12-04-04-020664

**Continuation of Calibration Certificate**

Cert. No. : ACL23196  
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 test results of each items were made by observation of each Instruments display and also with SLM's display.

**Condition of this result of calibration :**

**1. Reference Standard Instruments :**

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	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. : ACL23196  
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	✓	-	0.1	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. : ACL23196  
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 )
14.3

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

Frequency Weighting	Measured value ( dB )
A - weight	10.8
C - weight	17.0
Flat	22.8

## 3. Acoustical signal tests of frequency weightings

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

Frequency ( Hz )	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.5	0.5	0.5	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-2.1	-2.1	-2.1	±5.0

QF-TS12-04-04-020664

T. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL23196  
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	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	132.9	-0.1	± 1.1
132.0	131.9	-0.1	± 1.1
131.0	130.9	-0.1	± 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	24.9	-0.1	± 1.1

QF-TS12-04-04-020664

T. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL23196  
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)			Acceptance Limits
	Flat	C-weight	A-weight	
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

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T. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL23196  
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	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
SEL	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value ( dB )	Measured Value, L <sub>peak</sub> ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Continuous	133.0	133.0	0.0	±3.0
One	136.4	135.7	-0.7	±3.0

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

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T. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL23196  
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	89.5	-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

QF-TS12-04-04-020664

T. Petchurai

## Continuation of Calibration Certificate

Cert. No. : ACL23247  
Job No. : VC66AC0085  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

## Calibration Method :

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

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL_BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL_BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL_BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAI	34560495	AA-3002-23	14-FEB-24

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

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

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

QF-TS12-04-04-020664

T. Petchurai

451-451/1 Sirinthorn Rd., Bangbunru, Bangplud fangkak 10700 THAILAND.  
Tel.0-2435-8800 Fax.0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACL23247  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No.: 00472127 / 169440 / 72461  
ID No.: RYG\_FS0302

Condition As Found : GOOD

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

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

Received Date : 13 JULY 2023  
Calibration Date : 10 AUGUST 2023  
Date of Issue : 11 AUGUST 2023



Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchurai  
( Thanakul Petchurai )

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

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL23247  
Job No. : VC66AC0085  
Pages : 3 of 8

## Summary of Measurement Result :

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

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

QF-TS12-04-04-020664

T. Petchurai

## Continuation of Calibration Certificate

Cert. No. : ACL23247  
Job No. : VC66AC0085  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

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

## 2. Self-generated noise

## 2.1 Normal test

Measured Value ( dB )
18.0

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

Frequency Weighting	Measured value ( dB )
A - weight	13.8
C - weight	20.3
Flat	25.9

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

QF-TS12-04-04-020664

7. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL23247  
Job No. : VC66AC0085  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

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

## 5.2 Time weighting at 1 kHz

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

## 6. Long - term stability

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

QF-TS12-04-04-020664

7. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL23247  
Job No. : VC66AC0085  
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	28.1	0.1	± 1.1
27.0	27.1	0.1	± 1.1
26.0	26.2	0.2	± 1.1
25.0	25.1	0.1	± 1.1

QF-TS12-04-04-020664

7. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL23247  
Job No. : VC66AC0085  
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 <sub>peak</sub> ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Continuous	133.0	133.0	0.0	±3.0
One	136.4	136.3	-0.1	±3.0

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

QF-TS12-04-04-020664

7. Petch

Cert. No. : ACL23247  
Job No. : VC66AC0085  
Pages : 8 of 8

## 11. Overload indication

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

## 12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

Cert. No. : ACL24011  
Job No. : VC67AC0044  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

## Calibration Method :

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

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

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	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).

Cert. No. : ACL24011  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42A / Microphone UC-52 / Preamplifier NH-24  
Serial No. : 00623389 / 198636 / 26417  
ID No. : RYG\_FS0614

Condition As Found : GOOD

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

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



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.

Cert. No. : ACL24011  
Job No. : VC67AC0044  
Pages : 3 of 8

## Summary of Measurement Result :

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

Cert. No. : ACL24011  
Job No. : VC67AC0044  
Pages : 4 of 8

**Result of calibration :**

**1. Absolute sensitivity**

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

**2. Self-generated noise**

**2.1 Normal test**

Measured Value ( dB )
14.2

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

Frequency Weighting	Measured value ( dB )
A - weight	9.9
C - weight	16.7
Flat	22.5

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

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

Frequency ( Hz )	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.1	0.1	0.1	± 1.5
1000	-0.1	-0.1	-0.1	± 1.0
8000	1.2	1.3	1.3	±5.0

*7. Reten*

Cert. No. : ACL24011  
Job No. : VC67AC0044  
Pages : 5 of 8

**4. Electrical signal tests of frequency weightings**

Weighting network response with relative to 1 kHz.

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

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

**5.1 Frequency weightings at 1 kHz**

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

**5.2 Time weighting at 1 kHz**

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

**6. Long - term stability**

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

*7. Reten*

Cert. No. : ACL24011  
Job No. : VC67AC0044  
Pages : 6 of 8

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

Anticipated Value ( dB )	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	38.9	-0.1	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	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

*7. Reten*

Cert. No. : ACL24011  
Job No. : VC67AC0044  
Pages : 7 of 8

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

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

**9. Tone burst response**

Time Weighting	Tone burst duration, 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, Lepeak ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Continuous	133.0	133.0	0.0	±3.0
One	136.4	136.0	-0.4	±3.0

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

*7. Reten*

**SITHIPORN ASSOCIATES CO., LTD.**  
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Cert. No. : ACL24011  
Job No. : VC67AC0044  
Pages : 8 of 8

**11. Overload indication**

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

*T. Petchur*

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Cert. No. : ACL24012  
Job No. : VC67AC0044  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

**Calibration Method :**

This equipment was calibrated by follow on IEC-61672-3 (2013) Standard for sound level meter (SLM).

The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

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

**Condition of this result of calibration :**

**1. Reference Standard Instruments :**

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	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).

*T. Petchur*

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Cert. No. : ACL24012  
Pages : 1 of 8

**Calibration Certificate**

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42A / Microphone UC-52 / Preamplifier NH-24  
Serial No. : 00623390 / 198637 / 26418  
ID No. : RYG\_FS0615

Condition As Found : GOOD

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

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

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



Calibrated by : Nathakorn Pisupaisan

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

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

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

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Tel. +66 2433 8331 Email : calibration@sithiporn.com

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Cert. No. : ACL24012  
Job No. : VC67AC0044  
Pages : 3 of 8

**Summary of Measurement Result :**

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

*T. Petchur*

**Result of calibration :**

**1. Absolute sensitivity**

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

**2. Self-generated noise**

**2.1 Normal test**

Measured Value ( dB )
14.6

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

Frequency Weighting	Measured value ( dB )
A - weight	12.6
C - weight	19.2
Flat	24.8

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

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

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

*T. Retin*

**4. Electrical signal tests of frequency weightings**

Weighting network response with relative to 1 kHz.

Frequency ( Hz )	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	0.0	0.0	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.1	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	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	SIM Display at initial ( dB )	SIM Display at final ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
A - weight	94.0	94.0	0.0	± 0.3

*T. Retin*

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

Anticipated Value ( dB )	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	38.9	-0.1	± 1.1
34.0	34.0	0.0	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	26.8	-0.2	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.9	-0.1	± 1.1

*T. Retin*

**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	128.0	0.0	±1.0

**10. Peak C sound level**

Number of cycle in test signal	Anticipated Value ( dB )	Measured Value, L <sub>peak</sub> ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Continuous	133.0	133.0	0.0	±3.0
One	136.4	136.3	-0.1	±3.0

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

*T. Retin*

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Cert. No. : ACL24012  
Job No. : VC67AC0044  
Pages : 8 of 8

**11. Overload Indication**

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

**12. High level stability**

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

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

End of Calibration Certificate

*T. Petchum*

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

Calibration Procedure : CP-AC-01

**Calibration Method :**

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

**Condition of this result of calibration :**

**1. Reference Standard Instruments :**

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL-BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL-BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL-BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KA1	34560495	AA-3002-23	14-FEB-24

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

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

3.1 National Institute of Metrology (Thailand).

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

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Cert. No. : ACL24013  
Pages : 1 of 8

**Calibration Certificate**

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42A / Microphone UC-52 / Preamplifier NH-24  
Serial No. : 00623391 / 198638 / 26419  
ID No. : RYG\_FS0616

Condition As Found : GOOD

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

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

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



Calibrated by : Nathakorn Pisutpaisan

Approved by : *T. Petchum*  
( Thanakul Petchum )

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*T. Petchum*

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

**Summary of Measurement Result :**

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

**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	13.8
C - weight	20.3
Flat	25.8

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

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

Frequency ( Hz )	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.2	0.2	0.2	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	1.5	1.6	1.6	±5.0

*g. Retina*

**4. Electrical signal tests of frequency weightings**

Weighting network response with relative to 1 kHz

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

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

**5.1 Frequency weightings at 1 kHz**

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

**5.2 Time weighting at 1 kHz**

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

**6. Long - term stability**

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

*g. Retina*

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

Anticipated Value ( dB )	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.1	0.1	± 1.1
84.0	84.1	0.1	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.1	0.1	± 1.1
69.0	69.1	0.1	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.1	0.1	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.1	0.1	± 1.1
30.0	30.1	0.1	± 1.1
29.0	29.1	0.1	± 1.1
28.0	28.1	0.1	± 1.1
27.0	27.2	0.2	± 1.1
26.0	26.2	0.2	± 1.1
25.0	25.3	0.3	± 1.1

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

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

**9. Tone burst response**

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

**10. Peak C sound level**

Number of cycle in test signal	Anticipated Value ( dB )	Measured Value, L <sub>peak</sub> ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Continuous	133.0	133.0	0.0	±3.0
One	136.4	135.8	-0.6	±3.0

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

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Cert. No. : ACL24013  
Job No. : VC67AC0044  
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**11. Overload indication**

Measured value ( dB )		Deviated Value ( dB )	Acceptance Limits ( dB )
Positive one-half cycle	Negative one-half cycle		
89.5	89.8	0.3	±1.5

**12. High level stability**

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

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

End of Calibration Certificate

*T. Petchur*

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Cert. No. : ACL24033  
Pages : 1 of 8

**Calibration Certificate**

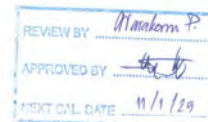
**Equipment :** SOUND LEVEL METER  
**Manufacturer :** RION  
**Model :** NL-42A / Microphone UC-52 / Preamplifier NH-24  
**Serial No.:** D0623392 / 198639 / 26420  
**ID No.:** RYG\_FS0617

**Condition As Found :** GOOD

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

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

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



**Calibrated by :** Nithakorn Pisutpaisam

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

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Cert. No. : ACL24033  
Job No. : VC67AC0052  
Pages : 2 of 8

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

**Calibration Method :**

This equipment was calibrated by follow on IEC-61672-2 (2013) Standard for sound level meter (SLM).  
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference  
Standard Instruments.  
For tests results of each items were made by observation of each Instruments display and also with SLM's display.

**Condition of this result of calibration :**

**1. Reference Standard Instruments :**

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	3321JA	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	3351IB	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	3346IA	MY53220104	EEL_BP 30/0266	13-FEB-24
Digital Multimeter	3346IA	MY53220076	EEL_BP 29/0266	13-FEB-24
Digital Multimeter	3446.A	MY60024273	EEL_BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KA1	34560495	AA-3002-23	14-FEB-24

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

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

3.1 National Institute of Metrology (Thailand).

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

*T. Petchur*

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Cert. No. : ACL24033  
Job No. : VC67AC0052  
Pages : 3 of 8

**Summary of Measurement Result :**

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

*T. Petchur*

Cert. No. : ACL24033  
Job No. : VC67AC0052  
Pages : 4 of 8

**Result of calibration :**

**1. Absolute sensitivity**

Reference Acoustic Signal ( dB )	Measured Value ( dB )	Deviation ( dB )	Acceptance Limit ( dB )
93.9 (93.9%)	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	13.8
C - weight	20.6
Flat	26.1

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

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

Frequency ( Hz )	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.1	0.1	0.1	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	1.2	1.3	1.3	±5.0

*7. Return*

Cert. No. : ACL24033  
Job No. : VC67AC0052  
Pages : 5 of 8

**4. Electrical signal tests of frequency weightings**

Weighting network response with relative to 1 kHz.

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

*7. Return*

Cert. No. : ACL24033  
Job No. : VC67AC0052  
Pages : 6 of 8

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

Anticipated Value ( dB )	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	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

*7. Return*

Cert. No. : ACL24033  
Job No. : VC67AC0052  
Pages : 7 of 8

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

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

**9. Tone burst response**

Time Weighting	Tone burst duration, 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, L <sub>peak</sub> ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Continuous	133.0	133.0	0.0	±3.0
One	136.4	136.0	-0.4	±3.0

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

*7. Return*

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Cert. No. : ACL24033  
Job No. : VC67AC0052  
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

T. Petchur

SITHIPORN ASSOCIATES CO., LTD.  
CALIBRATION LABORATORY

45/1-45/1 Sirinthorn Road, Bangburm, Bangkok, 10700 Thailand  
Tel. +66 2433 8331 Email: calibration@sithiporn.com

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associates



Cert. No. : ACL24034  
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42A / Microphone UC-52 / Preamplifier NH-24  
Serial No. : 00623393 / 198640 / 26421  
ID No. : RYG\_FS0618

Condition As Found : GOOD

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

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

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



Calibrated by : Nathakorn Pisutpaisan

Approved by : T. Petchur  
( Thanakul Petchur )

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

SITHIPORN ASSOCIATES CO., LTD.  
CALIBRATION LABORATORY

45/1-45/1 Sirinthorn Road, Bangburm, Bangkok, 10700 Thailand  
Tel. +66 2433 8331 Email: calibration@sithiporn.com

SITHIPORN  
associates



Cert. No. : ACL24034  
Job No. : VC67AC0052  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	3346.A	MY53220104	EEL.BP 30/0266	13-FEB-24
Digital Multimeter	3346.A	MY53220076	EEL.BP 29/0266	13-FEB-24
Digital Multimeter	3446.A	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).

T. Petchur

SITHIPORN ASSOCIATES CO., LTD.  
CALIBRATION LABORATORY

45/1-45/1 Sirinthorn Road, Bangburm, Bangkok, 10700 Thailand  
Tel. +66 2433 8331 Email: calibration@sithiporn.com

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Cert. No. : ACL24034  
Job No. : VC67AC0052  
Pages : 3 of 8

Summary of Measurement Result :

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

T. Petchur

Cert. No. : ACL24034  
Job No. : VC67AC0052  
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value ( dB )
14.6

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

Frequency Weighting	Measured value ( dB )
A - weight	10.8
C - weight	17.4
Flat	23.3

3. Acoustical signal tests of frequency weightings

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

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

*7. Pich*

Cert. No. : ACL24034  
Job No. : VC67AC0052  
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

*7. Pich*

Cert. No. : ACL24034  
Job No. : VC67AC0052  
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value ( dB )	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	53.9	-0.1	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.0	0.0	± 1.1
26.0	26.1	0.1	± 1.1
25.0	24.9	-0.1	± 1.1

*7. Pich*

Cert. No. : ACL24034  
Job No. : VC67AC0052  
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value ( dB )	Measured Value, L <sub>peak</sub> ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Continuous	133.0	133.0	0.0	±3.0
One	136.4	135.5	-0.9	±3.0

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

*7. Pich*

SITHIPORN ASSOCIATES CO., LTD.  
CALIBRATION LABORATORY

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Cert. No. : ACL24034  
Job No. : VC67AC0052  
Pages : 8 of 8

J  
NAC  
JIRANATEE ASSOCIATES CO., LTD.

Jiranatee Associates Co., Ltd.  
63/14-15, 67/35-36  
Petchkasem 7/71 Rd, Wattana, Bangkok  
Bangkok 10250 (Thailand)  
Tel: +6628080812  
Mobile: +6623994113  
Email: jnac-calibration@jiranatee.com  
Web site: www.jiranatee.com

Accredited calibration laboratory  
ISO/IEC 17025:2017  
NSC-TIS-TIS 17025  
CALIBRATION 0367  
Temperature measurement laboratory  
Calibration services department.



NSC-TIS-TIS 17025  
CALIBRATION 0367

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

CERTIFICATE OF CALIBRATION

Certificate No. : CDT-029-67

Page 1 of 2 Pages

MEASUREMENT ITEM : Heat Stress Monitor  
MANUFACTURER : Delta OHM  
MODEL/TYPE : HD32.2  
SERIAL NUMBER : 200322A1  
ID NUMBER : RYG\_FS0521  
CONDITION AS-RECEIVED : Used item  
CUSTOMER : ALS laboratory group (thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd.,  
Khaewang Suan Luang, Khet Suan Luang,  
Bangkok 10250 Thailand.

RECEIVED DATE : 24 Jan 2024  
MEASUREMENT DATE : 25 Jan 2024  
ISSUE DATE : 30 Jan 2024

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:  
Temperature :  $23.0 \pm 3.0$  °C  
Relative humidity :  $55.0 \pm 15.0$  %RH

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

TABULATION OF RESULTS:

The table on next page give the measured values.

REVIEW BY : *Manakorn P.*  
APPROVED BY : *[Signature]*  
NEXT CAL. DATE : 24/1/25



Calibrated by:  
☐ Mr. Sorawit Thachalad  
☐ Miss Jitraporn Lertsomphol  
☒ Miss Ruangrumpal Phoommit

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

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



JIRANATEE ASSOCIATES CO., LTD.

Continuation of Certificate of Calibration Number CDT-029-67

Page 2 of 2 Pages

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 - 40 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 21001217.  
Dimension: Diameter 3.3 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.052	20.1	0.0	0.099
80	25.054	25.1	0.0	0.099
80	30.047	30.1	0.1	0.099
80	35.041	35.1	0.1	0.099
80	40.035	40.1	0.1	0.099

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 21001242.  
Dimension: Diameter 3.3 mm. Length 205 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.052	20.0	-0.1	0.099
110	25.055	25.0	-0.1	0.099
110	30.047	30.0	0.0	0.099
110	35.041	35.0	0.0	0.099
110	40.035	40.0	0.0	0.099

Table 3: This equipment was connected with temperature probe Model: TP3207.2 S/N: 21001783.  
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
75	20.052	20.1	0.0	0.099
75	25.054	25.1	0.0	0.099
75	30.047	30.0	0.0	0.099
75	35.041	35.0	-0.1	0.099
75	40.035	39.8	-0.2	0.099

UUC\*: Unit Under Calibration

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



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

CERTIFICATE OF CALIBRATION

Certificate No. : CDT-036-66  
Page 1 of 2

Equipment Name: Heat Stress Monitor  
Manufacturer: Delta OHM  
Model: HD32.2  
Serial No: 22016391  
ID No: RYG\_FS0581

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

Received date: 11 Jul 2023  
Calibration date: 20 Jul 2023  
Issue date: 20 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±3) °C  
Relative Humidity: (55±15)%

Calibration Procedure

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

Traceability

The measurement results are traceable to the international system of units (SI) through National Institute of Metrology Thailand (NIMT) Certificate number: TT-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 Jitraporn Lertsomphol  
☐ Miss Ruangrumpal Phoommit



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

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

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: 22025583.  
Dimension: Diameter 14 mm, Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.053	19.9	-0.2	0.099
80	25.050	24.9	-0.2	0.099
80	30.045	29.9	-0.1	0.099
80	35.038	34.8	-0.2	0.099
80	40.030	39.8	-0.2	0.099

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 22023943.  
Dimension: Diameter 3.3 mm, Length 205 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.053	20.0	-0.1	0.099
110	25.051	25.0	-0.1	0.099
110	30.045	30.0	0.0	0.099
110	35.038	35.0	0.0	0.099
110	40.030	40.0	0.0	0.099

Table 3: This equipment was connected with temperature probe Model: TP3207.2 S/N: 22025054.  
Dimension: Diameter 14 mm, Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
75	20.053	20.0	-0.1	0.099
75	25.051	24.9	-0.2	0.099
75	30.045	29.8	-0.2	0.099
75	35.038	34.8	-0.2	0.099
75	40.030	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

Equipment Name: Heat Stress Monitor  
Manufacturer: Delta OHM  
Model: HD32.2  
Serial No: 22016369  
ID No: RYG\_FS0579

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

Received date: 11 Jul 2023  
Calibration date: 20 Jul 2023  
Issue date: 20 Jul 2023

REVIEW BY: *Manon P.*  
APPROVED BY: *[Signature]*  
NEXT CAL DATE: 20/7/24

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

### Calibration Procedure

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

### Traceability

The measurement results are traceable to the international system of units (SI) through National Institute of Metrology Thailand (NIMT) Certificate number: TT-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 Thachalai  
☒ Miss Jitraporn Lertsomphol  
☒ Miss Ruangrumpal Phoommit



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

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

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: 22015701.  
Dimension: Diameter 14 mm, Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.053	20.0	-0.1	0.099
80	25.051	25.0	-0.1	0.099
80	30.043	30.0	0.0	0.099
80	35.038	34.9	-0.1	0.099
80	40.032	39.9	-0.1	0.099

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 22023934.  
Dimension: Diameter 3.3 mm, Length 205 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.054	20.1	0.0	0.099
110	25.051	25.1	0.0	0.099
110	30.043	30.1	0.1	0.099
110	35.038	35.1	0.1	0.099
110	40.031	40.1	0.1	0.099

Table 3: This equipment was connected with temperature probe Model: TP3207.2 S/N: 22025053.  
Dimension: Diameter 14 mm, Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
75	20.054	20.1	0.0	0.099
75	25.051	25.0	-0.1	0.099
75	30.043	29.9	-0.1	0.099
75	35.038	34.9	-0.1	0.099
75	40.032	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 ★



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

Temperature measurement laboratory  
Calibration services department.

## CERTIFICATE OF CALIBRATION

Certificate No.: CDT-032-67

### MEASUREMENT ITEM

MANUFACTURER: Heat Stress Monitor  
MODEL/TYPE: Delta OHM  
SERIAL NUMBER: HD32.2  
ID NUMBER: 20032249  
CONDITION AS-RECEIVED: RYG\_FS0524  
CUSTOMER: Used Item

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

RECEIVED DATE: 24 Jan 2024  
MEASUREMENT DATE: 26 Jan 2024  
ISSUE DATE: 30 Jan 2024

### ENVIRONMENTAL CONDITIONS:

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

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

### TABULATION OF RESULTS:

The table on next page give the measured values.

REVIEW BY: *Manon P.*  
APPROVED BY: *[Signature]*  
NEXT CAL DATE: 26/1/25

### 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-0101-23

### 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: 14 Sep 2024

### Uncertainty of Measurement:

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



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

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

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 – 40 °C

Function: Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 21001215.  
Dimension: Diameter 3.3 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.035	20.1	0.1	0.099
80	25.051	25.2	0.1	0.099
80	30.044	30.2	0.2	0.099
80	35.036	35.2	0.2	0.099
80	40.031	40.2	0.2	0.099

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 21001244.  
Dimension: Diameter 3.3 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.035	20.0	0.0	0.099
110	25.051	25.0	-0.1	0.099
110	30.044	30.0	0.0	0.099
110	35.035	35.0	0.0	0.099
110	40.031	40.0	0.0	0.099

Table 3: This equipment was connected with temperature probe Model: TP3207.2 S/N: 21001790.  
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
75	20.035	20.1	0.1	0.099
75	25.051	25.0	-0.1	0.099
75	30.044	29.9	-0.1	0.099
75	35.035	34.8	-0.2	0.099
75	40.031	39.7	-0.3	0.16

UUC\*: Unit Under Calibration

Remark: The reported uncertainty of measurement is 0.16, based on standard uncertainty multiplied by a coverage factor  $k=2.1$  providing a level of confidence of approximately 95%.

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



Jirantee Associates Co.,Ltd.  
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Accredited calibration laboratory  
ISO/IEC 17025:2017  
NSC-TIS-17025  
CALIBRATION 0367  
Temperature measurement laboratory  
Calibration services department.

## CERTIFICATE OF CALIBRATION

Certificate No. : CDT-020-67

Page 1 of 2 Pages

MEASUREMENT ITEM : Heat Stress Monitor  
MANUFACTURER : Delta OHM  
MODEL/TYPE : HD32.2  
SERIAL NUMBER : 18018313  
ID NUMBER : RYG\_F50358  
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 : 13 Jan 2024  
MEASUREMENT DATE : 15 Jan 2024  
ISSUE DATE : 17 Jan 2024

ENVIRONMENTAL CONDITIONS:  
Ambient condition in the laboratory are as follow:  
Temperature : 23.0 ± 3.0 °C  
Relative Humidity : 25.0 ± 15.0 %RH

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

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



Calibration procedure:  
The temperature calibration was done by in-house calibration method as WPC-001 according to comparison method with standard digital temperature indicator and standard temperature probe. The temperature scale 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-0101-23

Reference Used During Calibration:  
1. Standard Temperature Probe  
Model: STS-100 AS50, 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: 14 Sep 2024

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

Calibrated by:  
☒ Mr. Sorawit Thachalad  
☒ Miss Jiraporn Lertsomphol  
☐ Miss Ruangrumpal Phoommit



Approved signatory:  
Mr. Parinya Booncharoen  
Calibration Department Manager

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

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: 18021467.  
Dimension: Diameter 3.3 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.039	20.1	0.1	0.099
80	25.051	25.1	0.0	0.099
80	30.045	30.0	0.0	0.099
80	35.036	35.1	0.1	0.099
80	40.030	40.0	0.0	0.099

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 18020497.  
Dimension: Diameter 3.3 mm. Length 205 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.039	20.1	0.1	0.099
110	25.051	25.1	0.0	0.099
110	30.045	30.1	0.1	0.099
110	35.036	35.1	0.1	0.099
110	40.030	40.1	0.1	0.099

Table 3: This equipment was connected with temperature probe Model: TP3207.2 S/N: 18021270.  
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
75	20.039	20.2	0.2	0.099
75	25.051	25.1	0.0	0.099
75	30.045	30.1	0.1	0.099
75	35.036	35.0	0.0	0.099
75	40.030	39.9	-0.1	0.099

UUC\*: Unit Under Calibration

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



Jirantee Associates Co.,Ltd.  
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Accredited calibration laboratory  
ISO/IEC 17025:2017  
NSC-TIS-17025  
CALIBRATION 0367  
Temperature measurement laboratory  
Calibration services department.

## CERTIFICATE OF CALIBRATION

Certificate No. : CDT-023-67

Page 1 of 2 Pages

MEASUREMENT ITEM : Heat Stress Monitor  
MANUFACTURER : Delta OHM  
MODEL/TYPE : HD32.2  
SERIAL NUMBER : 22016387  
ID NUMBER : RYG\_F50577  
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 : 13 Jan 2024  
MEASUREMENT DATE : 15 Jan 2024  
ISSUE DATE : 17 Jan 2024

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

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

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



Calibration procedure:  
The temperature calibration was done by in-house calibration method as WPC-001 according to comparison method with standard digital temperature indicator and standard temperature probe. The temperature scale 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-0101-23

Reference Used During Calibration:  
1. Standard Temperature Probe  
Model: STS-100 AS50, 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: 14 Sep 2024

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

Calibrated by:  
☒ Mr. Sorawit Thachalad  
☒ Miss Jiraporn Lertsomphol  
☐ Miss Ruangrumpal Phoommit



Approved signatory:  
Mr. Parinya Booncharoen  
Calibration Department Manager

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Continuation of Certificate of Calibration Number CDT-023-67

Page 2 of 2 Pages

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 ~ 40 °C

**Function:**

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 22025572.  
Dimension: Diameter 3.3 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.060	19.9	-0.2	0.099
80	25.051	24.9	-0.2	0.099
80	30.042	29.9	-0.1	0.099
80	35.035	34.9	-0.1	0.099
80	40.025	39.9	-0.1	0.099

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 21001243.  
Dimension: Diameter 3.3 mm. Length 205 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.060	20.0	-0.1	0.099
110	25.051	25.0	-0.1	0.099
110	30.042	30.0	0.0	0.099
110	35.035	35.0	0.0	0.099
110	40.025	40.1	0.1	0.099

Table 3: This equipment was connected with temperature probe Model: TP3207.2 S/N: 22025042.  
Dimension: Diameter 1.6 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
75	20.060	20.0	-0.1	0.099
75	25.051	24.9	-0.2	0.099
75	30.042	29.8	-0.2	0.099
75	35.035	34.7	-0.3	0.099
75	40.025	39.7	-0.3	0.099

UUC\*: Unit Under Calibration

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



Certificate No. : CDT-028-67

MEASUREMENT ITEM : Heat Stress Monitor  
MANUFACTURER : Delta OHM  
MODEL/TYPE : HD32.2  
SERIAL NUMBER : 20032240  
ID NUMBER : RYG\_F50520  
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 : 24 Jan 2024  
MEASUREMENT DATE : 25 Jan 2024  
ISSUE DATE : 30 Jan 2024

ENVIRONMENTAL CONDITIONS:  
Ambient condition in the laboratory are as follow:  
Temperature : 23.0 ± 1.0 °C  
Relative Humidity : 55.0 ± 15.0 %RH

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

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

REVIEW BY : *Nirakorn P.*  
APPROVED BY : *[Signature]*  
NEXT CAL DATE : 24/1/25



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

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

Continuation of Certificate of Calibration Number CDT-026-67

Page 2 of 2 Pages

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 ~ 40 °C

**Function:**

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 21001213.  
Dimension: Diameter 3.3 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.054	20.1	0.0	0.099
80	25.054	25.2	0.1	0.099
80	30.046	30.2	0.2	0.099
80	35.043	35.2	0.2	0.099
80	40.033	40.2	0.2	0.099

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 21001245.  
Dimension: Diameter 3.3 mm. Length 205 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.054	20.1	0.0	0.099
110	25.055	25.1	0.0	0.099
110	30.046	30.1	0.1	0.099
110	35.043	35.1	0.1	0.099
110	40.033	40.1	0.1	0.099

Table 3: This equipment was connected with temperature probe Model: TP3207.2 S/N: 21001785.  
Dimension: Diameter 1.6 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
75	20.053	20.1	0.0	0.16
75	25.055	25.0	-0.1	0.099
75	30.046	30.0	0.0	0.099
75	35.043	35.0	0.0	0.099
75	40.033	39.9	-0.1	0.099

UUC\*: Unit Under Calibration

Remark: The reported uncertainty of measurement is 0.16, based on standard uncertainty multiplied by a coverage factor k=2.21 providing a level of confidence of approximately 95%.

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



Certificate No. : CDT-031-67

MEASUREMENT ITEM : Heat Stress Monitor  
MANUFACTURER : Delta OHM  
MODEL/TYPE : HD32.2  
SERIAL NUMBER : 20032243  
ID NUMBER : RYG\_F50523  
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 : 24 Jan 2024  
MEASUREMENT DATE : 26 Jan 2024  
ISSUE DATE : 30 Jan 2024

ENVIRONMENTAL CONDITIONS:  
Ambient condition in the laboratory are as follow:  
Temperature : 23.0 ± 1.0 °C  
Relative Humidity : 55.0 ± 15.0 %RH

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

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

REVIEW BY : *Nirakorn P.*  
APPROVED BY : *[Signature]*  
NEXT CAL DATE : 25/1/25



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

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

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 ~ 40 °C

Function: Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 21001219.  
Dimension: Diameter 3.3 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.056	19.9	-0.1	0.16
80	25.047	25.0	0.0	0.099
80	30.041	30.0	0.0	0.099
80	35.032	35.0	0.0	0.099
80	40.023	40.0	0.0	0.099

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 22023935.  
Dimension: Diameter 3.3 mm. Length 205 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.056	20.1	0.0	0.099
110	25.047	25.1	0.1	0.099
110	30.040	30.1	0.1	0.099
110	35.033	35.0	0.0	0.099
110	40.023	40.0	0.0	0.099

Table 3: This equipment was connected with temperature probe Model: TP3207.2 S/N: 21001786.  
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
75	20.056	20.1	0.0	0.099
75	25.047	25.0	0.0	0.099
75	30.040	30.0	0.0	0.099
75	35.033	34.9	-0.1	0.099
75	40.023	39.9	-0.1	0.099

UUC\*: Unit Under Calibration

Remark: The reported uncertainty of measurement is 0.16, based on standard uncertainty multiplied by a coverage factor  $k=2.1$  providing a level of confidence of approximately 95%.

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



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: 18021464.  
Dimension: Diameter 3.3 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.039	20.0	0.0	0.099
80	25.051	25.0	-0.1	0.099
80	30.045	30.0	0.0	0.099
80	35.036	35.0	0.0	0.099
80	40.030	40.0	0.0	0.099

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 18020495.  
Dimension: Diameter 3.3 mm. Length 205 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.038	20.0	0.0	0.099
110	25.051	25.1	0.0	0.099
110	30.045	30.1	0.1	0.099
110	35.036	35.1	0.1	0.099
110	40.030	40.1	0.1	0.099

Table 3: This equipment was connected with temperature probe Model: TP3207.2 S/N: 18021263.  
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
75	20.039	20.1	0.1	0.099
75	25.051	25.0	-0.1	0.099
75	30.045	30.0	0.0	0.099
75	35.036	34.9	-0.1	0.099
75	40.030	39.9	-0.1	0.099

UUC\*: Unit Under Calibration

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



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Accredited calibration laboratory  
ISO/IEC 17025:2017  
NISC-TIS-175 17025  
CALIBRATION 0367

Temperature measurement laboratory  
Calibration services department.

## CERTIFICATE OF CALIBRATION

Certificate No. : CDT-019-67

Page 1 of 2 Pages

MEASUREMENT ITEM : Heat Stress Monitor  
MANUFACTURER : Delta OHM  
MODEL/TYPE : HD32.2  
SERIAL NUMBER : 18018312  
ID NUMBER : RYG\_FS0357  
CONDITION AS-RECEIVED : Used item  
CUSTOMER : ALS laboratory group (thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd.,  
Khwang Suan Luang, Khet Suan Luang,  
Bangkok 10250 Thailand.

RECEIVED DATE : 11 Jan 2024  
MEASUREMENT DATE : 12 Jan 2024  
ISSUE DATE : 17 Jan 2024

### ENVIRONMENTAL CONDITIONS:

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

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

### TABULATION OF RESULTS:

The table on next page give the measured values.



Calibration procedure:  
The temperature calibration 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-0101-23

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: 14 Sep 2024

Uncertainty of Measurement:  
The reported uncertainty of measurement is based on the standard uncertainty multiplied by a coverage factor  $k=2$ . Which in 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"



Approved signatory: Mr. Parinya Booncharoen  
Calibration Department Manager

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

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

## CERTIFICATE OF CALIBRATION

Certificate No. : CDT-035-66  
Page 1 of 2

Equipment Name: Heat Stress Monitor  
Manufacturer: Delta OHM  
Model: HD32.2  
Serial No: 22016390  
ID No: RYG\_FS0580

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

Received date: 11 Jul 2023  
Calibration date: 20 Jul 2023  
Issue date: 20 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±3) °C  
Relative Humidity: (55±15)%

### Calibration Procedure

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

### Traceability

The measurement results are traceable to the international system of units (SI) through National Institute of Metrology Thailand (NIMT). Certificate number: TT-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 Jitraporn Lertsomphol  
☒ Miss Ruangrumpal Phoommit



Approved Signatory: Mr. Parinya Booncharoen  
Calibration Department Manager

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

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: 22025580.  
Dimension: Diameter 14 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.053	20.0	-0.1	0.099
80	25.050	25.0	-0.1	0.099
80	30.043	30.0	0.0	0.099
80	35.038	35.0	0.0	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: 22023942.  
Dimension: Diameter 3.3 mm. Length 205 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.053	20.1	0.0	0.099
110	25.050	25.1	0.0	0.099
110	30.043	30.1	0.1	0.099
110	35.038	35.0	0.0	0.099
110	40.031	40.0	0.0	0.099

Table 3: This equipment was connected with temperature probe Model: TP3207.2 S/N: 22025040.  
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
75	20.054	20.1	0.0	0.099
75	25.050	25.0	-0.1	0.099
75	30.043	29.9	-0.1	0.099
75	35.038	34.8	-0.2	0.099
75	40.031	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 No.: CDT-021-67

Page 1 of 2 Pages

MEASUREMENT ITEM: Heat Stress Monitor  
MANUFACTURER: Delta DHM  
MODEL/TYPE: H032.2  
SERIAL NUMBER: 1801J314  
ID NUMBER: RYQ\_F50359  
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: 11 Jan 2024  
MEASUREMENT DATE: 15 Jan 2024  
ISSUE DATE: 17 Jan 2024

#### ENVIRONMENTAL CONDITIONS:

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

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

#### TABULATION OF RESULTS:

The table on next page give the measured values.



Calibration procedure:  
The temperature calibration 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-0238-23. Certificate number: ER-0101-23

Reference Used During Calibration:  
1. Standard Temperature Probe Model: STS-100 AS00, 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: 14 Sep 2024

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

Calibrated by:  
☐ Mr. Sorawit Thachalad  
☒ Miss Jittaporn Lertsomphol  
☐ Miss Kuangrumpal Phoommit



Approved signatory: Mr. Parinya Booncharoen  
Calibration Department Manager

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

Continuation of Certificate of Calibration Number CDT-021-67

Page 2 of 2 Pages

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 ~ 40 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 18021465.  
Dimension: Diameter 14 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.038	20.0	0.0	0.099
80	25.047	25.0	0.0	0.099
80	30.042	30.0	0.0	0.099
80	35.037	35.0	0.0	0.099
80	40.030	40.0	-0.1	0.14

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 20008280.  
Dimension: Diameter 3.3 mm. Length 205 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.038	20.0	0.0	0.099
110	25.047	25.0	0.0	0.14
110	30.042	30.1	0.1	0.099
110	35.037	35.1	0.1	0.099
110	40.031	40.1	0.1	0.099

Table 3: This equipment was connected with temperature probe Model: TP3207.2 S/N: 18021262.  
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
75	20.038	20.1	0.0	0.14
75	25.047	24.9	-0.1	0.099
75	30.042	29.8	-0.2	0.099
75	35.037	34.8	-0.3	0.099
75	40.031	39.7	-0.3	0.099

UUC\*: Unit Under Calibration  
Remark: The reported uncertainty of measurement is 0.14, based on standard uncertainty multiplied by a coverage factor k=2.14 providing a level of confidence of approximately 95%.

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



Certificate No.: CDT-030-67

Page 1 of 2 Pages

MEASUREMENT ITEM: Heat Stress Monitor  
MANUFACTURER: Delta DHM  
MODEL/TYPE: H032.2  
SERIAL NUMBER: 20032242  
ID NUMBER: RYQ\_F50322  
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: 14 Jan 2024  
MEASUREMENT DATE: 25 Jan 2024  
ISSUE DATE: 30 Jan 2024

#### ENVIRONMENTAL CONDITIONS:

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

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

#### TABULATION OF RESULTS:

The table on next page give the measured values.



Calibration procedure:  
The temperature calibration 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-0238-23. Certificate number: ER-0101-23

Reference Used During Calibration:  
1. Standard Temperature Probe Model: STS-100 AS00, 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: 14 Sep 2024

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

Calibrated by:  
☐ Mr. Sorawit Thachalad  
☒ Miss Jittaporn Lertsomphol  
☐ Miss Kuangrumpal Phoommit



Approved signatory: Mr. Parinya Booncharoen  
Calibration Department Manager

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Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 ~ 40 °C

**Function:**

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 21001206.  
Dimension: Diameter 3.3 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.055	20.0	-0.1	0.099
80	25.051	25.0	-0.1	0.099
80	30.040	30.1	0.1	0.099
80	35.032	35.1	0.1	0.099
80	40.032	40.1	0.1	0.099

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 21001250.  
Dimension: Diameter 3.3 mm. Length 205 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.055	20.0	-0.1	0.099
110	25.051	25.1	0.0	0.099
110	30.040	30.1	0.1	0.099
110	35.032	35.1	0.1	0.099
110	40.023	40.1	0.1	0.099

Table 3: This equipment was connected with temperature probe Model: TP3207.2 S/N: 21001796.  
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
75	20.055	20.1	0.0	0.099
75	25.051	25.0	-0.1	0.099
75	30.040	30.0	0.0	0.099
75	35.032	34.9	-0.1	0.099
75	40.023	39.8	-0.2	0.099

UUC\*: Unit Under Calibration

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



**CERTIFICATE OF CALIBRATION**

Certificate No.: CDT-033-66  
Page 1 of 2

Equipment Name: Heat Stress Monitor  
Manufacturer: Delta OHM  
Model: HD32.2  
Serial No: 22016388  
ID No: RYG\_FS0578

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

Received date: 11 Jul 2023  
Calibration date: 20 Jul 2023  
Issue date: 20 Jul 2023

Reference Used During Calibration  
1. Standard Temperature Probe Model: STS-100 A500,  
Serial No: 867682-00, Due date: 28 Mar 2024  
2. Digital Temperature Indicator Model: DTI-1000-A MK  
II, Serial No.: 671407-00591 Due date: 22 July 2023

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

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

Traceability  
The measurement results are traceable to the  
international system of units (SI) through National  
Institute of Metrology Thailand (NIMT) Certificate  
number: IT-0038-23, Certificate number: 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 Jitraporn Lertsomphol  
☐ Miss Ruangrumpal Phoommit



Approved Signatory:   
Mr. Parinya Booncharoen  
Calibration Department Manager

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

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: 22015694.  
Dimension: Diameter 14 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.034	19.9	-0.1	0.099
80	25.052	24.9	-0.2	0.099
80	30.043	29.9	-0.1	0.099
80	35.036	34.9	-0.1	0.099
80	40.035	39.8	-0.2	0.099

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 22023956.  
Dimension: Diameter 3.3 mm. Length 205 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.034	20.1	0.1	0.099
110	25.051	25.1	0.0	0.099
110	30.043	30.1	0.1	0.099
110	35.036	35.1	0.1	0.099
110	40.035	40.1	0.1	0.099

Table 3: This equipment was connected with temperature probe Model: TP3207.2 S/N: 22025031.  
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
75	20.034	20.1	0.1	0.099
75	25.051	25.0	-0.1	0.099
75	30.043	29.9	-0.1	0.099
75	35.037	34.8	-0.2	0.099
75	40.035	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  
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL 0-2717-3000 FAX 0-2719-9484

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

**Certificate of Testing**

Equipment : DO Meter  
Manufacturer : YS

Model : 5000-115V  
Serial No. : 15E102796

ID No. : RYG\_EN0032

Received Date : 21 July 2023

Test Date : 24 July 2023

Reference : 2307-0713DSC-1

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

Laboratory Condition : Temperature (25 ± 5) °C  
Humidity (50 ± 20) %  
Test Procedure : In-house method : CP-CH9  
by Comparison Technique with Azide Modification Method

Tested by : Walalak Sirithan

Approved by :   
Approved Signatory

( ) Malee Butkrua  
( ) Saitip Meangmai  
( ) Warakorn Lernagatrakul

Issue Date : 26 July 2023



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

#### Condition of this result of calibration

##### 1. Reference Standard Instruments :

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

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

##### 2. Standard Material :-

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

Result : Dissolved Oxygen Meter Adjustment With Air 100 %

Dissolved Oxygen Probe No.: 15E100464

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

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

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
5344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL: 0-2717-3000-29 FAX: 0-2719-9484



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

## Certificate of Calibration

Equipment : DO Meter with Sensor  
Manufacturer : YSI  
Model : 5000-115V  
Serial No. : 15E102796  
ID No. : RYG\_EN0032  
Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.  
Rayong Branch  
816/10 Moo 5 T. Maenam Khu, A. Pluakdaeng,  
Rayong 21140 Thailand  
Location : TPA On Site Calibration Laboratory  
Received Order : 25 July 2023  
Calibrated Date : 27 July 2023  
Ambient Temperature : (26 ± 10) °C  
Relative Humidity : (50 ± 30) %  
AC Line Voltage : (220 ± 22) V

Calibrated by : Preecha Hlahib

Approved by :   
Approved Signatory

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

Issue Date : 31 July 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 0053616



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

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

#### Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-OT01 according to comparison with Industrial Platinum Resistance Thermometer (IPRT) into Temperature Bath.  
The temperature scale used was based on ITS-90.

#### Condition of this result of calibration

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

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Digital Thermometer	2168080	2211285	TPA	21 Oct 2023

2. This certificate is valid only to the item calibrated on date and place of calibration.  
3. This certification is traceable to the International System of Unit.

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

Result of Calibration :- (°) Without Adjustment

Function : Temperature measurement.

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

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

UUC\* : Unit Under Calibration

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

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Switip

a 1159515



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
5344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL: 0-2717-3000-29 FAX: 0-2719-9484



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

## Certificate of Calibration

Equipment : Low Temp. Incubator  
Manufacturer : Memmert  
Model : PP750  
Serial No. : V818.0084  
ID No. : RYG\_EN0154

Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.  
(Rayong Branch)  
816/10 Moo 5 T. Maenam Khu,  
A. Pluakdaeng, Rayong 21140 Thailand  
BOD Room  
Location :  
Received Order : 29 May 2023  
Calibration Date : 29 May 2023  
Ambient Temperature : (26 ± 10) °C  
Relative Humidity : (50 ± 30) %

Calibrated by : Man Pattanapongpaiboon

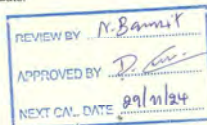
Approved by :   
Approved Signatory

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

Issue Date : 7 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 0054967

Equipment : Low Temp. Incubator  
Condition As-Received : Used Item  
Reference : 2305-0898OC-2  
Procedure Used :-  
Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector ( RTD ).  
The temperature scale used was based on ITS-90.  
Condition of this result of calibration  
1. Reference standard instrument-  
Instrument Model Serial No. Cert. No. Due Date  
1) Data Acquisition 34972A MY57013711 22LM93 02 Jul 2023  
2. This certificate is valid only to the item calibrated on date and place of calibration.  
3. This certification is traceable to the International System of Unit.  
Result of Calibration :- ( ° ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Close  
Environment during calibration  
Temp. ( °C ) Beginning Finished  
REL Humid. ( % ) 54 56  
AC Supply ( Volt ) 223 222  
Position : Ref. Std. ID No.:  
1 18-18RTD-01  
2 18-18RTD-02  
3 18-18RTD-03  
4 18-18RTD-04  
5 18-18RTD-05  
6 18-18RTD-10  
7 18-18RTD-07  
8 22-18RTD-08  
9 (ref.) 18-18RTD-09  
Probe Installation Details : Dimension of Chamber :  
a = 10 cm D = 0.60 m  
b = 10 cm W = 1.0 m  
c = 10 cm H = 1.2 m  
Capacity = 0.75 m³

Equipment : Low Temp. Incubator  
Condition As-Received : Used Item  
Reference : 2305-0898OC-2  
Result of Calibration :- ( ° ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Close  
Calibration Point Setting Reading Temperature stability Temperature uniformity Overall Variation Coverage  
20.0 20.0 20.0 0.019 0.72 1.0 2  
Calibration Point Measured Temperature ( °C ) Position Uncertainty  
20.0 19.547 19.780 19.487 19.529 19.408 20.139 20.112 20.406 20.116 0.30  
Average\* : The average of 30 values in each position.  
Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.  
Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.  
Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.  
UUC\* : Unit Under Calibration  
Note : The reported uncertainty of measurement was included stability and excluded uniformity .  
The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k, providing a level of confidence of approximately 95 %.

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  
Certificate of Calibration  
Model Number : MSE224S-100-DU  
Description : Analytical Balance  
Serial Number : 0026207038  
ID No. : RYG\_EN0002  
Manufacturer : Sartorius  
Certificate No. : 24BC10069  
Issued Date : Friday, February 23, 2024  
Reference No. : 229196  
Page No. : 1 of 2  
Customer Name : ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch)  
616/10 Moo 5 T.Maenam Khu, A.Pluak Daeng, Rayong 21140, Thailand.  
Calibrated Place : ALS Laboratory Group (Thailand) Co., Ltd.(Balance Room)  
616/10 Moo 5 T.Maenam Khu, A.Pluakdaeng, Rayong 21140, Thailand.  
Calibrated By : Mr.Chonchai Inthana  
Calibration Date : Thursday, February 22, 2024  
Metrological data : Capacity : 220 g Readability : 0.0001 g  
Reasons for calibration  
New Installation Service / Repair / Re-calibration / Maintenance  
Measurement Method UKAS Publication Ref : Lab 14  
The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM). The calibration certificate documents the traceability to National Standards, which realise the unit of measurement according to the International Standard System of Units (SI). Report of Tolerance came from list of Sartorius Metrological Specifications.  
Traceability:  
Model Number Description Traceability Certificate No. Due Date  
YCS011-522-00 Sartorius weight set 1mg - 5000g E2.YCS011-522-00 TCS M23081978 23-Aug-2025  
MHB-382SD Humidity/Barometer/Temp Lutron MHB-382SD DKSH C19231845 23-Aug-2024  
This certificate relate and apply this equipment only.  
This certificate may not be reproduced other than in full except with the prior written approval of the Verification Operation Division Sartorius (Thailand) Co., Ltd.  
Mr.Chonchai Inthana(Technical Manager)

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  
Certificate of Calibration  
Model Number : MSE224S-100-DU  
Description : Analytical Balance  
Serial Number : 0026207038  
ID No. : RYG\_EN0002  
Manufacturer : Sartorius  
Certificate No. : 24BC10069  
Issued Date : Friday, February 23, 2024  
Reference No. : 229196  
Page No. : 2 of 2  
Calibration Results : Without Adjustment  
Repeatability  
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 g  
Tolerance  
0.0001 g  
Nominal Value : (High Load)  
200 g  
Tolerance  
0.0001 g  
Standard Deviation 0.00007 0.00006  
Eccentricity (Off-center loading error)  
The eccentricity loading error is caused by the difference in 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 : 100 g  
Tolerance : 0.0004 g  
Difference  
1 -  
2 -0.0001  
3 -0.0001  
4 0.0000  
5 -0.0001  
6 -  
Linearity  
The linearity, also called linearity error, describes the deviation of the characteristic curve of a weighing instrument from the linear slope.  
Tolerance 0.0002 g  
Nominal Value Conventional Mass Value Displayed Value Deviation Uncertainty  
(g) (g) (g) (g) (g)  
0.01 0.0100 0.0100 0.0000 0.00018  
0.05 0.0500 0.0500 0.0000 0.00018  
0.1 0.1000 0.1000 0.0000 0.00018  
0.5 0.5000 0.5000 0.0000 0.00018  
1 1.0000 1.0000 0.0000 0.00018  
5 5.0000 5.0000 0.0000 0.00018  
10 10.0000 10.0000 0.0000 0.00018  
20 20.0000 20.0000 0.0000 0.00018  
50 50.0000 49.9999 -0.0001 0.00019  
100 100.0000 100.0000 0.0000 0.00023  
200 200.0000 199.9999 -0.0001 0.00032  
End of Report



## Certificate of Calibration

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

Equipment : Hot Air Oven  
Manufacturer : Memmert  
Model : UF 110  
Serial No. : B423.0853  
ID No. : RYG\_EN0213

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

Received Order : 21 March 2024  
Calibration Date : 21 - 22 March 2024  
Ambient Temperature :  $(26 \pm 10) ^\circ\text{C}$   
Relative Humidity :  $(50 \pm 30) \%$

Calibrated by : Man Pattanapongpaiboon

Approved by :   
Approved Signatory

( ) Pornthippa Tameyakul  
( ) Unnopphol Harachai  
(x) Suwit Imjai

Issue Date : 23 March 2024

The Uncertainties are for a confidence probability of approximately 95%

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



Equipment : Hot Air Oven  
Condition As-Received : Used Item  
Reference : 2403-0563OC-3  
Procedure Used :-

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

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

The temperature scale used was based on ITS-90.

### Condition of this result of calibration

#### 1. Reference standard instrument:-

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

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

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

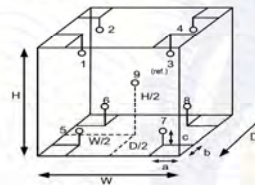
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Close

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	27	27
REL.Humid. ( % )	59	59
AC Supply ( Volt )	224	223



Probe Installation Details : Dimension of Chamber :  
a = 5.0 cm D = 0.40 m  
b = 5.0 cm W = 0.56 m  
c = 5.0 cm H = 0.48 m  
Capacity = 0.11 m<sup>3</sup>

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



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

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

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

Calibration Point ( °C )	Measured Temperature ( °C )									Uncertainty ( ± °C )
	1	2	3	4	5	6	7	8	9 (ref.)	
104.0	104.169	103.506	103.698	103.712	103.772	103.730	104.289	103.805	103.798	0.42
180.0	180.701	179.239	179.935	179.999	180.127	180.138	180.895	179.313	180.211	1.1

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

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

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

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

UUC\* : Unit Under Calibration

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

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

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## Certificate of Calibration

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

Equipment : Water Bath  
Manufacturer : Memmert  
Model : WNB22  
Serial No. : L513.0648  
ID No. : RYG\_EN0061

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

Received Order : 21 March 2024  
Calibration Date : 21 March 2024  
Ambient Temperature :  $(26 \pm 10) ^\circ\text{C}$   
Relative Humidity :  $(50 \pm 30) \%$

Calibrated by : Man Pattanapongpaiboon

Approved by :   
Approved Signatory

( ) Pornthippa Tameyakul  
( ) Unnopphol Harachai  
(x) Suwit Imjai

Issue Date : 23 March 2024

The Uncertainties are for a confidence probability of approximately 95%

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Equipment : Water Bath  
Condition As-Received : Used Item  
Reference : 2403-0563OC-4  
Procedure Used :-

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

Calibration were conducted using in-house calibration procedure CP-OT04 Based on ASTM E715 according to direct measurement method with Data Acquisition which connected with Industrial Platinum Resistance Thermometer ( IPRT ).

The temperature scale used was based on ITS-90.

#### Condition of this result of calibration

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

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

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

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

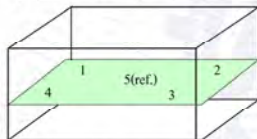
Remark : TPA : Technology Promotion Association ( Thailand - Japan )

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Heat transfer medium used : Water

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



Front

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



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

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

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

Calibration point ( °C )	Uniformity ( °C )	Stability ( ± °C )	Coverage Factor k
85.0	0.19	0.11	2

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

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

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

UUC\* : Unit Under Calibration

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

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

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL: 0-2717-3800-29 FAX: 0-2719-9484



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

## Certificate of Calibration

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

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

Calibrated by : Warakorn Lerngagrakul

Approved by :   
Approved Signatory

(✓) Saithip Meangmai  
( ) Warakorn Lerngagrakul  
( ) Ponpan Paipim

Issue Date : 24 January 2024

The Uncertainties are for a confidence probability of approximately 95%

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



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

#### Condition of this calibration result

##### 1. Reference Standard Instrument

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC116	23E2802	27 Aug 2024
2) Ref. Standard Thermometer	4982054	110RC044	23I908	26 July 2024

This certification is traceable to the International System of Unit maintained through:-

- Technology Promotion Association (Thailand-Japan)

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

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

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

#### Calibration Results

Function : mV Measurement

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

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

Saithip



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

#### Calibration Results

Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH Measurement ( $\pm$ )	Coverage factor $k$
pH Electrode S/N.: 3225367	4.008 6.986 9.997	4.013 6.983 9.996	176.0 2.2 -174.1	0.0054 0.0084 0.0065	2.07 2.00 2.00

Function : Temperature Measurement

( $^{\circ}$ ) Without adjustment

This equipment was connected with Temperature Probe;

- Model : InLab®Expert Pro-ISM

- Serial No. : 3225367

Dimension of probe

- Length : 120 mm.

- Diameter : 12 mm.

- Immersion Depth : 100 mm.

Calibration Point ( $^{\circ}$ C)	Standard Temperature ( $^{\circ}$ C)	UUC* Reading ( $^{\circ}$ C)	Error ( $^{\circ}$ C)	Uncertainty of measurement ( $\pm$ $^{\circ}$ C)	Coverage factor $k$
25.0	25.001	25.2	0.199	0.13	2.00

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

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*Sailthip*

a 1198288



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
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5344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250  
TEL. 0-2717-3000-24 FAX: 3-2719-9484



## Certificate of Calibration

Certificate No.: 24E289  
Page: 1 of 2

Equipment : pH Meter  
Manufacturer: Mettler Toledo  
Model : SevenCompact S220  
Serial No.: C104059460  
ID No.: RYG\_EN0163

Condition As-Received: Used Item  
Received Date: 18 January 2024  
Calibration Date: 23 January 2024

Reference: 2401-0579DSC  
Ambient Temperature: ( $23 \pm 2$ )  $^{\circ}$ C  
Relative Humidity: ( $50 \pm 10$ ) %

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

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

#### Condition of this result of calibration

1. Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Multi-Product Calibrator	5506A	6315011	E2U2300035	29 May 2024

2. This result of calibration was made on requested at the point specified by customer.  
3. The certificate is valid only to the item calibrated on date and place of calibration.  
4. This Certification is traceable to the International System of Unit maintained through:-  
-NA Caltechnologies Co., Ltd., ANAB Accredited No. Calibration AC-2658

Calibrated by : Wutthareeporn Wongchutikrane  
Issue Date : 24 January 2024

Approved Signatory :

[ ] Phalinee Prabpaipal  
[ ] Nuntawat Khamchai  
[ ] Pongsagorn Boonyaporn

B 0333296



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

Result of calibration:- ( $^{\circ}$ ) Without adjustment ( $^{\circ}$ ) After adjustment

Function: DC voltage measurement

Range: 2000 mV

Standard Value (mV)	UUC* Reading (mV)	Error (mV)	Uncertainty ( $\pm$ $\mu$ V)
-200.0000	-200.0	0.0	68
-150.0000	-150.0	0.0	65
-100.0000	-100.0	0.0	63
-50.0000	-50.0	0.0	61
0.0000	0.0	0.0	58
50.0000	50.0	0.0	61
100.0000	99.9	-0.1	63
150.0000	149.9	-0.1	65
200.0000	199.9	-0.1	68

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

UUC\* = Unit Under Calibration.

-o0o-

a 1198963



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TEL. 0-2717-3000-24 FAX: 3-2719-9484



## Certificate of Calibration

Cert.No.: 24CH81  
Page.: 1 of 3

Equipment : pH Meter  
Manufacturer: Mettler Toledo  
Model : Seven2Go  
Serial No.: B628755984  
ID No.: RYG\_FS0392

Condition As-Received: Used Item  
Received Date : 17 January 2024  
Calibration Date : 18 January 2024  
Reference : 2401-0551DSC-1

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

Ambient Temperature : ( $25 \pm 2.5$ )  $^{\circ}$ C  
Relative Humidity : ( $50 \pm 15$ ) %  
Calibration Procedure :  
In - house method :  
- CP-CH5 by direct measurement with standard standard voltage and direct measurement with certified reference material (CRM)  
- CP-CH8 by comparison with temperature standard

Calibrated by : Warakorn Lemgagtrakul

Approved by : *Sailthip*  
Approved Signatory

(☒) Sailthip Meangmai  
( ) Warakorn Lemgagtrakul  
( ) Ponpan Paipim

Issue Date : 19 January 2024

The Uncertainties are for a confidence probability of approximately 95%

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REVIEW BY *P. Pinyan*  
APPROVED BY *Supt S*  
NEXT CAL DATE *18/01/25*

A 0062731

Cert.No.: 24CH81

Page.: 2 of 3

Condition of this calibration result

1. Reference Standard Instrument : -

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC116	23E2802	27 Aug 2024
2) Ref. Standard Thermometer	4982054	110RC044	23I908	26 July 2024

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

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

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	940102	27 Nov 2025
pH 6.986	CPA chem	931959	01 Oct 2024
pH 9.997	CPA chem	940106	02 Nov 2024

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

Calibration Results

Function : mV Measurement

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

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading	Uncertainty of Measurement	Coverage factor
	pH	mV	mV	( $\pm$ mV)	k
pH Meter	4.00	177.48	178	0.58	2.00
S/N.: B628755084	7.00	0.00	0	0.58	2.00
	10.00	-177.48	-177	0.58	2.00

Signature

a 1198003

Cert.No.: 24CH81

Page.: 3 of 3

Calibration Results

Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH Measurement ( $\pm$ )	Coverage factor k
pH Electrode	4.008	4.02	182	0.0085	2.05
S/N.: 2465866	6.986	7.00	7	0.011	2.00
	9.997	10.00	-166	0.011	2.05

Function : Temperature Measurement

(\*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : InLab®Expert Go-ISM

- Serial No. : 2465866

Dimension of probe

- Length : 120 mm.

- Diameter : 12 mm.

- Immersion Depth : 100 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement ( $\pm$ °C)	Coverage factor k
25.0	25.002	25.1	0.098	0.13	2.00
30.0	30.002	30.1	0.098	0.13	2.00
40.0	40.003	40.1	0.097	0.13	2.00

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

-o0o-

Signature

a 1198002

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)

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5344 PATTANAKARN ROAD SOI 18, SUANLIANG, SUANLIANG, BANGKOK 10250

TEL. 0-2717-3900-24 FAX. 0-2719-9484

Certificate of Calibration

Certificate No. : 23T1767

Page : 1 of 2

Equipment : Digital Thermometer With Sensor

Manufacturer: Testo

Model : 106

Serial No.: 51162979/811

ID No.: RYG\_FS0418

Condition AS-Received: Used item

Received Date: 04 October 2023

Calibration Date: 10 October 2023

Reference: 2310-0110DSC

Ambient Temperature: ( 25  $\pm$  3 ) °C

Relative Humidity: ( 50  $\pm$  20 ) %

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

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

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

Condition of this result of calibration

1.Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Black Stack Thermometer	1560	8C454	23I600	30 May 2024
2) PRT Scanner Module	2562	A01903	23I600	30 May 2024
3) Industrial Platinum Resistance Thermometer	5627-12	571971	23I600	30 May 2024

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

3.This Certification is traceable to the International System of Unit maintained through:-  
-Technology Promotion Association (Thailand-Japan), NSC-ONSC Accredited No. Calibration 0008

Signature

B 0326170

Cert. No.: 23T1767

Page.: 2 of 2

Result of Calibration:-

Without Adjustment

Function: Temperature measurement

Dimension of probe : Diameter 3 mm., Length 56 mm. Sheath material : Stainless Steel

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

UUC\* : Unit Under Calibration

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

-o0o-

Signature

a 1184741



## Certificate of Calibration

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

Equipment : Hot Air Oven  
Manufacturer : Memmert  
Model : UFE 500  
Serial No. : GS11.15/2  
ID No. : RYG\_EN0010  
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)  
616/10 Moo 5 T. Maenam Khu,  
A. Pluakdaeng,  
Rayong 21140 Thailand  
Location : Oven Room  
Received Order : 21 March 2024  
Calibration Date : 21 March 2024  
Ambient Temperature :  $(26 \pm 10) ^\circ\text{C}$   
Relative Humidity :  $(50 \pm 30) \%$   
Calibrated by : Man Pattanapongpaiboon  
Approved by :   
( ) Ponthipha Tameyakul  
( ) Unnopphol Harachai  
(x) Suwit Imjai  
Issue Date : 22 March 2024

REVIEW BY:   
APPROVED BY:   
NEXT CAL DATE: 21/09/25

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



Equipment : Hot Air Oven  
Condition As-Received : Used Item  
Reference : 2403-0563OC-1  
Procedure Used :-

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

Calibration were conducted using calibration procedure CP-U102 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD) and Thermocouple Type T.

The temperature scale used was based on ITS-90.

### Condition of this result of calibration

#### 1. Reference standard instrument:-

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

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

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

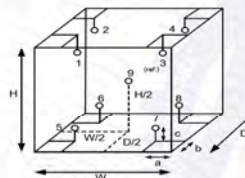
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration : ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Close

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	27	27
REL.Humid. ( % )	57	59
AC Supply ( Volt )	222	224



Probe Installation Details : Dimension of Chamber :  
a = 5.0 cm D = 0.40 m  
b = 5.0 cm W = 0.56 m  
c = 5.0 cm H = 0.48 m  
Capacity = 0.11 m<sup>3</sup>

Ref. Std. ID No.: @ Calibration Point		
Position :	( 189 ) °C	( 104 ) °C
1	18-18TC-01	18-18RTD-01
2	18-18TC-02	18-18RTD-02
3	18-18TC-03	18-18RTD-03
4	18-18TC-04	18-18RTD-04
5	18-18TC-05	18-18RTD-05
6	18-18TC-06	23-18RTD-06
7	18-18TC-07	18-18RTD-07
8	18-18TC-08	22-18RTD-08
9 (ref.)	18-18TC-09	18-18RTD-09



Equipment : Hot Air Oven  
Condition As-Received : Used Item  
Reference : 2403-0563OC-1  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Close

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

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

Calibration Point ( °C )	Measured Temperature ( °C )									Uncertainty ( ± °C )
	1	2	3	4	5	6	7	8	9 (ref.)	
104.0	103.921	103.786	103.757	103.759	103.950	103.817	104.213	103.672	103.673	0.42
180.0	179.614	179.270	179.145	179.599	180.001	180.423	180.293	180.629	179.429	1.1

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

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

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

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

UUC\* : Unit Under Calibration

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

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

-000-



## Certificate of Calibration

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

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

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

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

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

Calibration By: Mr. Nattapat Rungrueang  
Calibration Date: 18 September 2023

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

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

The standard for Wavelength Certificate No. 111583 and 111584

The standard for Photometric Certificate No. 9114984 and 111588

The standard for Stray light Certificate No. 111586 and 111585

The standard for Spectral resolution Certificate No. 111587

(Mr. Nattapat Rungrueang)  
Person in charge

(Mr. Nitinun 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.

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## Calibration Results:

Without Adjustment

Wavelength Accuracy (nm), The spectral bandwidth of Std at 2 nm and UUC at 2 nm				
Standard Wavelength	Unit Under Calibration	Correction	Uncertainty	
418.61	418.3	0.31	0.13	
536.66	536.6	0.06	0.13	
637.98	638.3	-0.32	0.13	
748.48	748.7	-0.22	0.13	
807.03	807.4	-0.37	0.13	
Photometric Accuracy (Absorbance)				
Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
420 nm	0.0000	0.000	0.0000	0.0045
	0.2930	0.289	0.0040	0.0045
	0.5168	0.519	-0.0022	0.0045
	1.0298	1.029	0.0008	0.0045
440 nm	0.0000	0.000	0.0000	0.0045
	0.2867	0.283	0.0037	0.0045
	0.5073	0.509	-0.0017	0.0045
	1.0083	1.007	0.0013	0.0045
465 nm	0.0000	0.000	0.0000	0.0045
	0.2516	0.250	0.0016	0.0045
	0.4595	0.462	-0.0025	0.0045
	0.9334	0.933	0.0004	0.0045
546.1 nm	0.0000	0.000	0.0000	0.0045
	0.2461	0.245	0.0011	0.0045
	0.4652	0.466	-0.0008	0.0045
	0.9468	0.946	0.0008	0.0045
590 nm	0.0000	0.000	0.0000	0.0045
	0.2584	0.259	0.0004	0.0045
	0.5040	0.505	-0.0010	0.0045
	1.0032	1.002	0.0012	0.0045
635 nm	0.0000	0.000	0.0000	0.0045
	0.2579	0.257	0.0009	0.0045
	0.4971	0.497	0.0001	0.0045
	0.9720	0.971	0.0010	0.0045

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CAL-FM-C06-15: 12 Sep 2022

## Calibration Results:

Without Adjustment

Photometric Accuracy (Absorbance)					
Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty	
235 nm	0.0000	0.000	0.0000	0.0080	
	0.7355	0.737	-0.0015	0.0080	
257 nm	0.0000	0.000	0.0000	0.0080	
	0.8574	0.857	0.0004	0.0080	
313 nm	0.0000	0.000	0.0000	0.0080	
	0.2864	0.280	-0.0036	0.0080	
350 nm	0.0000	0.000	0.0000	0.0080	
	0.6374	0.637	0.0004	0.0080	
Stray light *					
Standard: cut-off		UUC: Wavelength (nm)	UUC: Transmission (%T)	Absorbance (A)	
260.62 +/- 0.11 nm		260.6	1.3	1.886	
391.44 +/- 0.11 nm		391.4	1.3	1.886	
Spectral Resolution *					
Nominal Concentration 0.02 % v/v		Peak	Trough	Ratio	3BW
Standard Wavelength ( nm )		268.66	266.69	1.36	2.00
UUC: Wavelength (nm)		268.2	266.1		
Std Absorbance ( A)		0.4566	0.2780		
Absorbance ( Å)		0.413	0.300		

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

The End of Certificate

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CAL-FM-C06-15: 12 Sep 2022

## ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: WO-00005382

ชนิดเครื่องมือ: SPECTROPHOTOMETER รุ่น: DR6000

หมายเลขเครื่อง: 1627845

ตรวจสอบ (วัน)		รายการตรวจเช็ค	ตรวจสอบ (สัปดาห์)		หมายเหตุ
18 Sep 2023			18 Sep 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. สวิตช์ ปิด - เปิด เครื่อง (On-Off Switch)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. ปุ่มกด (Keypad)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. หน้าจอ (Display, Screen Contrast)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
		Spectrophotometer			
<input type="checkbox"/>	<input type="checkbox"/>	6. แบตเตอรี่ไฟฟ้า (Battery Backup) >= 2.5 VDC	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	7. ตัวหมุนเลือกความยาวคลื่น (Wavelength Control)	<input type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. ความยาวคลื่น (Wavelength Check)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	*
<input checked="" type="checkbox"/>	<input type="checkbox"/>	9. แหล่งกำเนิดแสง (UV < 3,000 hour)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	9.2 Hours
<input checked="" type="checkbox"/>	<input type="checkbox"/>	10. แหล่งกำเนิดแสง (Visible < 5,000 hour)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	741.5 Hours
<input checked="" type="checkbox"/>	<input type="checkbox"/>	11. ช่องวัดหลายตัวอย่าง (Carousel Module)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
		pH Meter and Conductivity Meter			
<input type="checkbox"/>	<input type="checkbox"/>	12. อิเล็กโทรด ( Electrode and Connection Cable )	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	13. ระดับสารละลายใน Electrode (Level KCl )	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	14. ฝาปิดกันปลาย Electrode (Dust Protection Hood)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	15. ขาจับอิเล็กโทรด (Stand)	<input type="checkbox"/>	<input type="checkbox"/>	
		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 ไม่น้อย 3.0)			
		Automatic titrator			
<input type="checkbox"/>	<input type="checkbox"/>	18. ภาพ 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			

เซ็นเซอร์อุณหภูมิ: \*656.1nm=656.1nm

\*486.0nm=485.5nm

Mr.Nattapat Rungueang  
Service Engineer

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CAL-FM-R31-03: 20 Jul 2022

RYG\_EN0188

## Certificate of Calibration

Represent to Certificate of Calibration No. C29240007

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

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

Environment Condition:	Temperature: 25 °C ± 0.7 °C	Humidity: 54 %RH ± 4.1 %RH	Voltage: 225 VAC ± 1.7 VAC
------------------------	-----------------------------	----------------------------	----------------------------

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

Calibration By: Mr. Thanathorn Phunook  
Calibration Date: 11 March 2024  
The Method used: In house method, base on by comparison with standard  
Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through N.M. Technical Center Laboratory (NTL)  
Certificate No.: TC22/D080

Signature of Mr. Thanathorn Phunook

(Mr. Thanathorn Phunook)  
Person in charge

Signature of Mr. Udon Srithana

(Mr. Udon Srithana)  
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.

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CAL-FM-C29-07: 20 Jul 2022

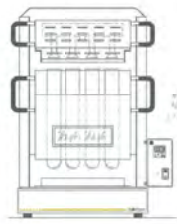
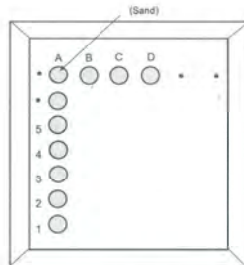


Fig. 1.: Front view



Location of standard

Fig. 2.: Digestion block

## Definitions

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

**Measured Temperature:** The average reading of working standard at any positions or location.

## Calibration Results:

## Pre Calibration

Locations	Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature (°C)	Correction of UUC (°C)	Uncertainty (± °C)
A1	380	380	380	401.5	21.5	1.5
A2				401.2	21.2	1.5
A3				398.1	19.1	1.5
A4				397.8	17.8	1.5
A5				395.1	15.1	1.5
B1				396.6	16.6	1.5
B2				396.1	16.1	1.5
B3				392.9	12.9	1.5
B4				391.6	11.6	1.5
B5				380.7	10.7	1.5
C1				395.3	15.3	1.5
C2				395.6	15.6	1.5
C3				392.8	12.8	1.5
C4				391.7	11.7	1.5
C5				390.3	10.3	1.5
D1				397.8	17.8	1.5
D2				396.6	16.6	1.5
D3				395.0	15.0	1.5
D4				394.2	14.2	1.5
D5				393.6	13.6	1.5

Calibration Results:  
Without adjustment

Locations	Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature (°C)	Correction of UUC (°C)	Uncertainty (± °C)
A1	380	365	365	382.5	17.5	1.5
A2				382.4	17.4	1.5
A3				382.1	17.1	1.5
A4				379.7	14.7	1.5
A5				378.3	13.3	1.5
B1				380.1	15.1	1.5
B2				380.1	15.1	1.5
B3				378.5	13.5	1.5
B4				378.3	13.3	1.5
B5				379.1	14.1	1.5
C1				380.1	15.1	1.5
C2				380.1	15.1	1.5
C3				378.9	13.9	1.5
C4				378.2	13.2	1.5
C5				377.3	12.3	1.5
D1				380.5	15.5	1.5
D2				380.6	15.6	1.5
D3				378.1	13.1	1.5
D4				378.7	13.7	1.5
D5				377.7	12.7	1.5

The End of Certificate

## ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

เลขที่ใบงาน: WO-00020429

ชนิดเครื่องมือ: Block Digestion Unit

รุ่น: KT-20s

หมายเลขเครื่อง: 5720210009/5770200073

ตรวจสอบ (รับ)	รายการตรวจเช็ค		ตรวจสอบ (ส่ง)	หมายเหตุ	
11 Mar 2024			11 Mar 2024		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
General					
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. สายไฟ	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. การทำงาน Main Switch	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. การทำงาน Selector Key	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. การแสดงผล Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. สภาพ Hole	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	6. สภาพฝาปิด	<input type="checkbox"/>	<input type="checkbox"/>	ไม่มี
<input checked="" type="checkbox"/>	<input type="checkbox"/>	7. สภาพตัวเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. สภาพแวดล้อม ณ สถานที่ตั้งเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

เซ็นแน:

Mr. Thanathorn Phunook  
Service Engineer



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, BANGKOK 10250  
TEL. 0-2717-3000-21 FAX. 0-2719-9484



## Certificate of Calibration

Certificate No.: 23E3924  
Page: 1 of 2

Equipment: pH Meter  
Manufacturer: Mettler Toledo  
Model: SevenExcellence  
Serial No.: B834291445  
ID No.: RYG\_EN0152  
Condition As-Received: Used Item  
Received Date: 08 December 2023  
Calibration Date: 14 December 2023  
Reference: 2312-0151DSC  
Submitted by: ALS Laboratory Group (Thailand) Co., Ltd. Rayong Branch  
Ambient Temperature: ( 23 ± 2 ) °C  
Relative Humidity: ( 50 ± 10 ) %  
616/10 Moo 5, T.Maenam Khu, A.Pluakdaeng,  
Rayong 21140, Thailand  
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Corporate Services 3: Equipment Calibration and Testing Services.  
Procedure used: Calibration were conducted using calibration procedure No. CP-E17 according to EURAMET cg-15.

### Condition of this result of calibration

#### 1. Reference standards instruments:

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Multi-Product Calibrator	5502A	2435802	EE-0041-23	26 Apr 2024

2. This result of calibration was made on requested at the point specified by customer.  
3. This certificate is valid only to the item calibrated on date and place of calibration.  
4. This Calibration is traceable to the International System of Unit maintained through:-  
- National Institute of Metrology Thailand (NIMT)



Calibrated by: Napachanok Prasomsosiri  
Issue Date: 15 December 2023  
Approved Signatory: [Signature]  
[ ] Phalinee Prabpaipal  
[x] Nuntawat Khamchai  
[ ] Pongsagom Boonyaporn

B 0331106



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

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

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

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

UUC\*= Unit Under Calibration.

-000-

a 1193422



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534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, BANGKOK 10250  
TEL. 0-2717-3000-29 FAX. 0-2719-9484



## Certificate of Calibration

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

Equipment: pH Meter  
Manufacturer: Mettler Toledo  
Model: SevenExcellence  
Serial No.: B834291445  
ID No.: RYG\_EN0152  
Condition As-Received: Used Item  
Received Date: 08 December 2023  
Calibration Date: 15 December 2023  
Reference: 2312-0151DSC-3  
Submitted by: ALS Laboratory Group (Thailand) Co., Ltd. Rayong Branch  
616/10 Moo 5, T.Maenam Khu, A.Pluakdaeng,  
Rayong 21140, Thailand  
Ambient Temperature: (25 ± 2.5) °C  
Relative Humidity: (50 ± 15) %  
Calibration Procedure: In-house method:  
- CP-CH5 by direct measurement with standard voltage calibrator and direct measurement with certified reference material (CRM)  
- CP-CH8 by comparison with standard thermometer

Calibrated by: Warakorn Lemgagtrakul

Approved by: [Signature]  
Approved Signatory

( ) Saitip Meangmai  
( ) Warakorn Lemgagtrakul  
(x) Ponpan Paipim

Issue Date: 19 December 2023

The Uncertainties are for a confidence probability of approximately 95%

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

A 0061696



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

### Condition of this calibration result

#### 1. Reference Standard Instrument :-

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC116	23E2802	27 Aug 2024
2) Ref. Standard Thermometer	4982054	110RC044	231908	26 July 2024

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

2. Certified Reference Materials : The measurement results are traceable to SI through CPA chem Ltd.,  
ANSI-A3Q National Accreditation Board, Accredited No. AR-1835

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	913598	14 July 2025
pH 6.866	CPA chem	931959	01 Oct 2024
pH 9.997	CPA chem	940106	02 Nov 2024

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

### Calibration Results

Function: mV Measurement

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

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement ( mV )	Coverage factor k
	pH	mV	mV	pH		
pH Meter	4.000	177.48	177.3	4.000	0.058	2.00
S/N.: B834291445	7.000	0.00	-0.1	7.000	0.058	2.00
	10.000	-177.48	-177.5	10.000	0.058	2.00

a 1193852



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

#### Calibration Results

##### Function : pH Measurement

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

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

##### Function : Temperature Measurement

(\*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : InLab®Expert Pro-ISM

- Serial No. : 3225368

Dimension of probe;

- Length : 120 mm

- Diameter : 12 mm

- Immersion Depth : 100 mm

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement ( $\pm$ °C)	Coverage factor $k$
25.0	25.003	24.3	-0.703	0.13	2.00

Remark : - UUC\* = Unit Under Calibration

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

-00-

RL

a 1193851

Agilent Technologies

Agilent Technologies (Thailand) Limited  
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Bangkok 10500 Thailand

Tel. +662 637 6363  
Fax. +662 637 6334  
Email. ccc-smf@agilent.com  
Website. www.agilent.com/chem

#### Customer Contact:

ALS Laboratory Group (Thailand) Co., Ltd.  
Head Office  
104 Phatthanakan 40 Phatthanakan Rd  
Khaeng Phatthanakan Khet Suan  
TAX ID : 0105540004859  
bounced-inchom.chonittagarn@alsglobal.com  
22715870519

#### Invoice To:

ALS Laboratory Group (Thailand) Co., Ltd.  
Head Office  
104 Phatthanakan 40 Phatthanakan Rd  
Khaeng Phatthanakan Khet Suan

#### SERVICE REPORT

Customer Purchase Order Number:	Customer Number: 70371013
Service Request:	Service Request Date:
Service Order: 690483207	Service Confirmation: 6904837529

REVIEW BY Anchalee K.  
APPROVED BY Sau-b N.  
NEXT CAL DATE 01/10/2024

#### Delivery Site:

ALS Laboratory Group (Thailand) Co., Ltd.  
Head Office  
104 Phatthanakan 40 Phatthanakan Rd  
Khaeng Phatthanakan Khet Suan

#### Location:

Room  
Bldg  
Lab  
Dept.

#### Direct Inquiries to:

Contact Name: Customer Contact Center  
Contact E-mail: ccc-smf@agilent.com  
Contact Telephone: +662 637 6363  
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Tax ID : 0105540004859

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Sub-district, Wattana District, Bangkok 10110 Thailand  
Acc. No. 012-4452-007  
7100 Rung Thae Bank PCL  
Siam Square Bldg./116/1-2 Rama 1 Rd./Pathumwan, BKK 10330  
Thailand

Page 1 of 3

Service Confirmation Number: 6904837529  
Service Confirmation Date: 06.04.2023

Service Confirmation Number: 6904837529  
Service Confirmation Date: 06.04.2023

#### Service Instrument:

Model Number	Model Description	Serial Number	System Handle	Parent Asset
SYS-IM-7900	ICPMS 7900 System			
G8410A	SPS 4 Autosampler	AU15436722	ICP MS 7900	SYS-IM-7900
G8411A	ISIS 3 for Agilent 7850/7900/8900	JP15512227	ICP MS 7900	SYS-IM-7900
G3292A	PSC 6106T Chiller	ZU15A11948	ICP MS 7900	SYS-IM-7900
G8403A	Agilent 7900 ICP-MS	JP15471169	ICP MS 7900	SYS-IM-7900

#### Service Items:

Item	Service/Part #	Description	Qty	Entitlement	Service Start	Service End
1000	EQO	Enterprise Operational Qualification	1.00	Agreement Entitlement - 100 % covered	06.04.2023	06.04.2023
1010	5185-5850	ICP-MS Checkout Solutions	1.00	Agreement Entitlement - 100 % covered		

#### Additional Information:

#### Service Information:


<b>Problem Description:</b> WU-S-QO-ICP MS 7900-5001143313		
<b>Service Provided:</b> Test DQ control of instrument ICPMS = BKK_EL0043. After done all instrument test all Pass.		
<b>Service Overview Code:</b> Reason Code: Scheduled Service Diagnosis Code: Scheduled Service Resolution Code: Scheduled Service		
<b>Reported Hours:</b> 6.0	<b>Travel Hours:</b> 1.0	
<b>Customer Field Service Representative Name:</b> Panthep Kurassathain	<b>Customer Field Service Representative Signature:</b> 	<b>Date:</b> 06 Apr 2023
<b>Customer Name:</b> Anchalee Khamjan	<b>Customer Signature:</b> 	<b>Date:</b> 06 Apr 2023
<b>Additional Comments:</b>		



Certificate No. T231676

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### 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., Kwaeng Phatthanakan,  
Khet Suan Luang, Bangkok 10250)  
Customer Location : Acid Digestion Lab  
Date of Receipt : 13 September 2023  
Calibrated By : Saneek Musikanwan (Site Calibration Manager)  
Approved By :  / Sujjar Naknakred (Site Calibration Manager)  
Date of Issue : 26 SEP 2023

REVIEW BY Jattaporn C.  
APPROVED BY   
NEXT CAL. DATE 02/03/25

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.

FM-L12 108/30-05-57



Certificate No. T231676

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### 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 :

- 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 .
- 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
- This certificate is traceable to :  
National Institute of Metrology ( Thailand ) through Metrological Center ( NSC-TISI-TIS 17025 CALIBRATION 0244 )
- Condition of calibrated item : good  
Equipment Description :  
Time Constant : 2 Hour 20 Minute At 95 °C  
Fresh Air Damper : ☐ Open ☐ Min ☐ Medium ☐ Max  
☐ Close  
☒ Not Available
- Adjustment :  
( ) without adjustment ( X ) after adjustment

Approved By 

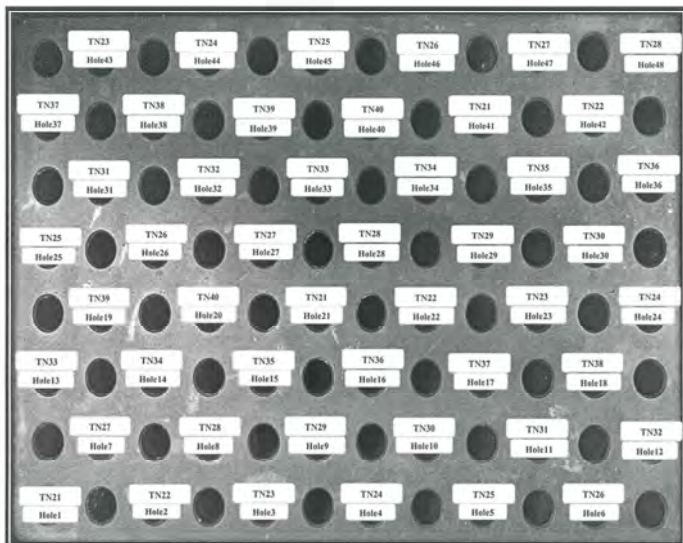
FM-L13 108/30-05-57



Certificate No. T231676

Page 3 of 6

### Calibration Report



FRONT CONTROL

Approved By 

FM-L13 108/30-05-57



Certificate No. T231676

Page 4 of 6

### Calibration Report

#### Measurement Results

Calibration Point	Average Standard Reading at each position (°C)					
R1 Hole1-Hole6	TN21	TN22	TN23	TN24	TN25	TN26
CAL POINT	Max	95.01	94.41	95.20	95.41	95.17
	Min	94.57	93.95	94.75	94.92	94.00
	Average	94.79	94.18	94.98	95.17	94.26
R2 Hole7-Hole12	TN27	TN28	TN29	TN30	TN31	TN32
	Max	95.36	95.43	95.19	95.16	95.35
	Min	94.94	94.95	94.72	94.71	94.90
	Average	95.15	95.19	94.96	94.94	95.13
R3 Hole13-Hole18	TN33	TN34	TN35	TN36	TN37	TN38
	Max	95.37	95.50	95.22	95.21	95.33
	Min	94.99	95.09	94.78	94.82	94.88
	Average	95.18	95.30	95.00	95.02	95.11
R4 Hole19-Hole24	TN39	TN40	TN21	TN22	TN23	TN24
	Max	95.59	94.42	94.52	94.24	94.63
	Min	95.21	94.06	94.13	93.88	94.28
	Average	95.40	94.24	94.33	94.06	94.45
R5 Hole25-Hole30	TN25	TN26	TN27	TN28	TN29	TN30
	Max	95.19	95.38	92.93	95.30	95.14
	Min	94.83	95.03	92.56	94.95	94.79
	Average	95.01	95.20	92.75	95.12	94.96
R6 Hole31-Hole36	TN31	TN32	TN33	TN34	TN35	TN36
	Max	94.63	94.90	94.77	94.31	94.24
	Min	94.24	94.55	94.44	93.98	93.92
	Average	94.43	94.72	94.60	94.14	94.08
R7 Hole37-Hole42	TN37	TN38	TN39	TN40	TN21	TN22
	Max	94.30	94.44	94.04	93.81	94.89
	Min	93.95	94.05	93.67	93.48	94.39
	Average	94.13	94.24	93.86	93.63	94.64
R8 Hole43-Hole48	TN23	TN24	TN25	TN26	TN27	TN28
	Max	95.99	95.63	95.28	95.29	95.45
	Min	95.57	95.15	94.82	94.84	94.99
	Average	95.78	95.39	95.05	95.07	95.22

Approved By 

FM-L13 108/30-05-57



Certificate No T231676

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### Calibration Report

#### Measurement Results

Calibration Point		Average Standard Reading at each position (°C)					
R1 Hole1-Hole6		TN21	TN21	TN23	TN24	TN25	TN26
CAL POINT	Max	105.23	104.32	105.43	105.25	104.44	105.27
	Min	104.94	103.95	105.15	105.04	104.11	104.96
	Average	105.09	104.12	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	105.62	105.02	104.80	104.69	105.19
Min		105.17	105.37	104.75	104.59	104.50	105.00
Average		105.27	105.59	104.88	104.69	104.60	105.09
R4 Hole19-Hole24		TN39	TN40	TN21	TN22	TN23	TN24
Max		105.31	104.42	106.41	104.71	105.63	105.82
Min		105.08	104.22	106.15	104.41	105.37	105.56
Average		105.19	104.32	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	104.88	104.80	105.20	104.50	104.39
Min		104.54	104.65	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	104.99	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	105.82	105.39	105.61	105.42	105.19
Min		105.45	105.61	105.14	105.27	105.18	104.94
Average		105.58	105.72	105.27	105.44	105.30	105.07

Approved By.

FM-L13 108/30-05-57

Certificate No. T231676

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### 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 imply only the above calibrated item.

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

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

Approved By.

FM-L13 108/30-05-57



Page 2 of 4

Certificate No. T232160

### Calibration Report

Equipment : Chamber ( Cooling Room )  
Date of Calibration : 6 December 2023  
Environment : Temperature : 23.4-24.9 °C  
Line Voltage : 221.4-230.2 V  
Relative Humidity : 55 - 65 %RH

#### Condition of this results of calibration :

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

Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	TYPE T	TN161-TN170	T230773	10 April 2024
TC	TYPE T	TN171-TN180	T230773	10 April 2024
DATA LOGGER	34970A	T149	T230773	10 April 2024
- This certificate is traceable to :  
National Institute of Metrology ( Thailand ) through Metrological Center ( NSC-TISI-TIS 17025 CALIBRATION 0244 ).
- Condition of calibrated item : good  
Equipment Description :  
Time Constant  $\frac{1}{30}$  Hour Minute At  $\frac{3}{3}$  °C  
Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max  
☐ Close  
☒ Not Available
- Adjustment :  
( X ) without adjustment ( ) after adjustment

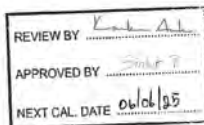
Approved By.

Certificate No. T232160

Page 1 of 4

### Certificate of Calibration

Equipment : Chamber ( Cooling Room )  
Manufacturer : KOLDTECH  
Model : KM 320  
Serial No. : TBN-1012061/05  
Customer Code : BKK\_EN0167  
ID No. : T2463A3  
Customer : ALS Laboratory Group (Thailand) Co.,Ltd.  
104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,  
Khet Suan Luang, Bangkok 10250  
Customer Location : Laboratory  
Date of Receipt : 29 November 2023  
Calibrated By : Atiphong Rongrat ( Technician )  
Approved By : Boonchai Suriyawong (Site Calibration Manager)  
Date of Issue : 09 JAN 2024



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

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

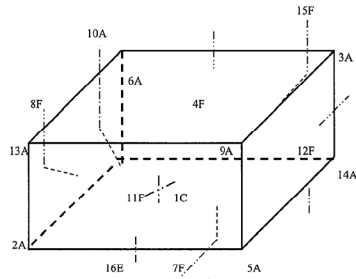
FM-L14 119/18-08-66

FM-L15 118/18-08-66

Certificate No. T232160

Page 3 of 4

## Calibration Report



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

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

Approved By.

FM-L15 118/18-08-66

Certificate No. T232160

Page 4 of 4

## Calibration Report

### Measurement Results

Calibration Point	Average Standard Reading at each position (°C)											
	TN161	TN162	TN163	TN164	TN165	TN166	TN167	TN168	TN169	TN170	TN171	TN172
3.0	2.83	3.34	2.95	3.46	3.45	3.76	3.25	3.46	3.39	3.50	3.58	3.42
	TN173	TN174	TN175	TN176								
	3.33	3.39	3.15	3.43								

Chamber (Cooling Room)			Temperature Distribution				
Setting (°C)	Reading (°C)		Average (°C)	Stability (± °C)	Uniformity (°C)	Uncertainty (± °C)	Coverage Factor <i>k</i>
	Min, Max	Average					
3.0	2.8, 4.1	3.5	3.36	1.10	2.00	1.90	2.09

The calibration result apply only the above calibrated item.

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

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

Approved By.

FM-L15 118/18-08-66

ภาคผนวก จ

สำเนาหนังสืออนุญาตขึ้นทะเบียน  
ห้องปฏิบัติการวิเคราะห์เอกชน





ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
19	Copper	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
20	Cyanide	Distillation, Colorimetric Method <sup>(4)</sup>
21	2,4'-DDD	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
22	4,4'-DDD	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
23	2,4'-DDE	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
24	4,4'-DDE	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
25	2,4'-DDT	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
26	4,4'-DDT	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
27	Dieldrin	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
28	Endosulfan Sulfate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
29	Endosulfan I	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
30	Endosulfan II	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
31	Endrin	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
32	Endrin Aldehyde	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
33	Formaldehyde	Distillation, Colorimetric Method <sup>(3)</sup>
34	Free Chlorine	1) DPD Ferrous Titrimetric Method <sup>(3)</sup> 2) DPD Colorimetric Method <sup>(4)</sup>
35	Heptachlor	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
36	Heptachlor Epoxide	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
37	Hexavalent Chromium	Colorimetric Method <sup>(4)</sup>
38	3-Hydroxycarbofuran	High-Performance Liquid Chromatographic Method <sup>(4)</sup>
39	Lead	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>

40 Manganese...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
40	Manganese	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
41	Mercury	1) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
42	Methiocarb	High-Performance Liquid Chromatographic Method <sup>(4)</sup>
43	Methoxychlor	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
44	Methomyl	High-Performance Liquid Chromatographic Method <sup>(4)</sup>
45	Nickel	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
46	Oil & Grease	1) Liquid-Liquid, Partition-Gravimetric Method <sup>(4)</sup> 2) Soxhlet Extraction Method <sup>(4)</sup>
47	Oxamyl	High-Performance Liquid Chromatographic Method <sup>(4)</sup>
48	Propoxur	High-Performance Liquid Chromatographic Method <sup>(4)</sup>
49	pH	Electrometric Method <sup>(3)</sup>
50	Phenols	1) Distillation, Chloroform Extraction Method <sup>(4)</sup> 2) Distillation, Direct Photometric Method <sup>(4)</sup>
51	Selenium	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
52	Sulfide	Iodometric Method <sup>(4)</sup>
53	Temperature	Laboratory and Field Methods <sup>(4)</sup>
54	Total Dissolved Solids	Dried at 180 °C <sup>(4)</sup>
55	Total Kjeldahl Nitrogen	Semi-Micro Kjeldahl Method <sup>(4)</sup>
56	Total Phosphorous	Digestion, Colorimetric Method <sup>(4)</sup>
57	Total Suspended Solids	Dried from 103-105 °C <sup>(4)</sup>
58	Toxaphene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
59	Trivalent Chromium	1) Digestion, Inductively Coupled Plasma Method; Colorimetric Method; Calculation <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method; Colorimetric Method; Calculation <sup>(4)</sup>
60	Zinc	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(4)</sup>

น้ำใต้ดิน...

น้ำใต้ดิน จำนวน 126 รายการ

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

18 Bis(2-ethylhexyl)phthalate...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
18	Bis(2-ethylhexyl)phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
19	Bromodichloromethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
20	Bromoform	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
21	Butanol	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
22	Butyl benzyl phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
23	Cadmium	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
24	Carbazole	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
25	Carbon disulfide	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
26	Carbon tetrachloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
27	Chlordane	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
28	p-Chloroaniline	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
29	Chlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
30	Chlorodibromomethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
31	Chloroform	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
32	2-Chlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
33	Chromium	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
34	Chromium (III)	1) Digestion, Inductively Coupled Plasma Method; Colorimetric Method; Calculation <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method; Colorimetric Method; Calculation <sup>(4)</sup>
35	Chromium (VI)	Colorimetric Method <sup>(4)</sup>

36 Chrysene...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
36	Chrysene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
37	Cyanide	Distillation, Colorimetric Method <sup>(4)</sup>
38	2,4-D	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
39	DDD	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
40	DDE	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
41	DDT	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
42	Dibenz(a,h)anthracene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
43	Di-n-Butyl Phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
44	1,2-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
45	1,3-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
46	1,4-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
47	3,3-Dichlorobenzidine	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
48	1,1-Dichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
49	1,2-Dichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
50	1,1-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
51	cis-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
52	trans-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
53	2,4-Dichlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
54	1,2-Dichloropropane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
55	1,3-Dichloropropane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>

56 1,3-Dichloropropene...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
56	1,3-Dichloropropene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
57	Dieldrin	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
58	Diethyl Phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
59	2,4-Dimethylphenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
60	2,4-Dinitrophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
61	2,4-Dinitrotoluene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
62	2,6-Dinitrotoluene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
63	Di-n-octyl phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
64	Endosulfan	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
65	Endrin	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
66	Ethylbenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
67	Fluoranthene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
68	Fluorene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
69	Heptachlor	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
70	Heptachlor epoxide	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
71	Hexachlorobenzene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
72	Hexachloro-1,3-butadiene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
73	n-Hexane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
74	α-HCH	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
75	β-HCH	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>

76 γ-HCH...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
76	γ-HCH	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
77	Hexachlorocyclopentadiene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
78	Hexachloroethane	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
79	Indeno(1,2,3-cd)pyrene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
80	Isophorone	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
81	Lead	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
82	Manganese	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
83	Mercury	1) Digestion, Cold Vapor Atomic Absorption Spectrometric Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
84	Methanol	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
85	Methoxychlor	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
86	Methyl bromide	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
87	Methylene chloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
88	2-Methylphenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
89	2-Methylnaphthalene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
90	Methyl tert-butyl Ether	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
91	Naphthalene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
92	Nickel	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
93	Nitrobenzene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>

94 N-Nitrosodiphenylamine...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
94	N-Nitrosodiphenylamine	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
95	N-Nitrosodi-n-Propylamine	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
96	Polychlorinated Biphenyls - PCB 1016 - PCB 1221 - PCB 1232 - PCB 1242 - PCB 1248 - PCB 1254 - PCB 1260	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
97	Pentachlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
98	pH	Electrometric Method <sup>(4)</sup>
99	Phenanthrene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
100	Phenol	1) Distillation, Chloroform Extraction Method <sup>(4)</sup> 2) Distillation, Direct Photometric Method <sup>(4)</sup> 3) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
101	Pyrene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
102	Selenium	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
103	Silver	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
104	Styrene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
105	1,1,2,2-Tetrachloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
106	Tetrachloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
107	Toluene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
108	Toxaphene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
109	TPH (C <sub>9</sub> -C <sub>14</sub> )	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4,25)</sup>

110 TPH (C<sub>10</sub>-C<sub>15</sub>)...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
110	TPH (C <sub>10</sub> -C <sub>16</sub> )	Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(9,22)</sup>
111	TPH (C <sub>11</sub> -C <sub>15</sub> )	Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(9,22)</sup>
112	1,2,4-Trichlorobenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>
113	1,1,1-Trichloroethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>
114	1,1,2-Trichloroethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>
115	Trichloroethylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>
116	2,4,5-Trichlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>
117	2,4,6-Trichlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>
118	1,3,5-Trimethylbenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>
119	Vanadium	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(4)</sup>
120	Vinyl acetate	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>
121	Vinyl chloride	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>
122	m-Xylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>
123	o-Xylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>
124	p-Xylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>
125	Xylene (Total)	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>
126	Zinc	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(4)</sup>

จากผลเสีย

จากผลเสีย (ปล่อยรวม) จำนวน 28 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Antimony	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>(3)</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(3)</sup>
2	Arsenic	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>(3)</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(3)</sup>
3	Beryllium	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>(3)</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(3)</sup>
4	Cadmium	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>(3)</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(3)</sup>
5	Carbon Monoxide	1) Instrumental Analyzer Method <sup>(3)</sup> 2) Sampling Bag Non-Dispersive Infrared Method <sup>(3)</sup>
6	Chlorine	1) Adsorption Sampling, Ion Chromatographic Method <sup>(3)</sup> 2) Isokinetic Sampling, Ion Chromatographic Method <sup>(3)</sup>
7	Chromium	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>(3)</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(3)</sup>
8	Cobalt	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>(3)</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(3)</sup>
9	Copper	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>(3)</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(3)</sup>
10	Cresol	Adsorption Sampling, Gas Chromatographic Method <sup>(3)</sup>
11	Dioxins	Isokinetic Sampling <sup>(3)</sup>
12	Hydrogen Chloride	1) Adsorption Sampling, Ion Chromatographic Method <sup>(3)</sup> 2) Isokinetic Sampling, Ion Chromatographic Method <sup>(3)</sup>
13	Hydrogen Fluoride	1) Adsorption Sampling, Ion Chromatographic Method <sup>(3)</sup> 2) Isokinetic Sampling, Ion Chromatographic Method <sup>(3)</sup>
14	Hydrogen Sulfide	Absorption Sampling, Iodometric Method <sup>(3)</sup>

15 Lead...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
15	Lead	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>(3)</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(3)</sup>
16	Manganese	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>(3)</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(3)</sup>
17	Mercury	1) Isokinetic Sampling, Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>(3)</sup> 2) Isokinetic Sampling, Digestion, Cold-Vapor Atomic Fluorescence Spectrometric Method <sup>(3)</sup>
18	Nickel	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>(3)</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(3)</sup>
19	Opacity	Ringelmann's Method <sup>(2)</sup>
20	Oxides of Nitrogen	1) Absorption Sampling, Phenoldisulfonic Acid Method <sup>(3)</sup> 2) Absorption Sampling, Alkaline Permanganate/Colorimetric Method <sup>(3)</sup> 3) Instrumental Analyzer Method <sup>(3)</sup>
21	Selenium	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>(3)</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(3)</sup>
22	Sulfur Dioxide	1) Absorption Sampling, Barium-Thorin Titrimetric Method <sup>(3)</sup> 2) Instrumental Analyzer Method <sup>(3)</sup>
23	Sulfuric Acid	Isokinetic Sampling, Barium-Thorin Titrimetric Method <sup>(3)</sup>
24	Tellurium	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>(3)</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(3)</sup>
25	Tin	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>(3)</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(3)</sup>
26	Total Suspended Particulate	1) Isokinetic Sampling, Gravimetric Method <sup>(3)</sup> 2) Paired Train, Isokinetic Sampling, Gravimetric Method <sup>(3)</sup>

27 Vanadium...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
27	Vanadium	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>(3)</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(3)</sup>
28	Xylene	Adsorption Sampling, Gas Chromatographic Method <sup>(3)</sup>

สิ่งปลูกสร้างหรือวัตถุที่ไม่ใช่พื้นผิว จำนวน 35 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Aldrin	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1,9,26)</sup> 2) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(9,26)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1,26)</sup>
2	Antimony	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,16)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,17)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7,16)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,17)</sup>
3	Arsenic	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,16)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,17)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7,16)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,17)</sup>
4	Barium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,16)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,17)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7,16)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,17)</sup>

5 Beryllium...

ลำดับที่	สารพิษ	วิธีวิเคราะห์
5	Beryllium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1.6.14)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1.6.17)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7.14)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7.17)</sup>
6	Cadmium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1.6.14)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1.6.17)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7.14)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7.17)</sup>
7	Chlordane	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1.9.24)</sup> 2) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10.28)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11.26)</sup>
8	Chromium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1.6.14)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1.6.17)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7.14)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7.17)</sup>
9	Chromium (III)	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method; Waste Extraction, Colorimetric Method; Calculation Method <sup>(1.6.16,19)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method; Waste Extraction, Colorimetric Method; Calculation Method <sup>(1.6.17,19)</sup> 3) Digestion, Inductively Coupled Plasma Method; Alkaline Digestion, Colorimetric Method; Calculation Method <sup>(7.16,19)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method; Alkaline Digestion, Colorimetric Method; Calculation Method <sup>(7.17,19)</sup>

10 Chromium (VI)...

ลำดับที่	สารพิษ	วิธีวิเคราะห์
10	Chromium (VI)	1) Waste Extraction, Colorimetric Method <sup>(1.6.19)</sup> 2) Alkaline Digestion, Colorimetric Method <sup>(8.40)</sup>
11	Cobalt	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1.6.14)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1.6.17)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7.14)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7.17)</sup>
12	Copper	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1.6.14)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1.6.17)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7.14)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7.17)</sup>
13	2,4-D	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1.9.24)</sup> 2) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10.28)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11.26)</sup>
14	DDD	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1.9.24)</sup> 2) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10.28)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11.26)</sup>
15	DDE	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1.9.24)</sup> 2) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10.28)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11.26)</sup>
16	DDT	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1.9.24)</sup>

2) Soxhlet...

ลำดับที่	สารพิษ	วิธีวิเคราะห์
17	Dieldrin	2) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10.28)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11.26)</sup> 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1.9.24)</sup> 2) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10.28)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11.26)</sup>
18	Endrin	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1.9.24)</sup> 2) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10.28)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11.26)</sup>
19	Heptachlor	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1.9.24)</sup> 2) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10.28)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11.26)</sup>
20	Lead	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1.6.14)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1.6.17)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7.14)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7.17)</sup>
21	Lindane	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1.9.24)</sup> 2) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10.28)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11.26)</sup>

22 Mercury...

ลำดับที่	สารพิษ	วิธีวิเคราะห์
22	Mercury	1) Waste Extraction, Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>(1.6.20)</sup> 2) Waste Extraction, Digestion, Cold-Vapor Atomic Fluorescence Spectrometric Method <sup>(1.6.20)</sup> 3) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>(28)</sup> 4) Digestion, Cold-Vapor Atomic Fluorescence Spectrometric Method <sup>(29)</sup> 5) Thermal Decomposition Amalgamation and Atomic Absorption Spectrometric Method <sup>(21)</sup>
23	Methoxychlor	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1.9.24)</sup> 2) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10.28)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11.26)</sup>
24	Mirex	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1.9.24)</sup> 2) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10.28)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11.26)</sup>
25	Molybdenum	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1.6.14)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1.6.17)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7.14)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7.17)</sup>
26	Nickel	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1.6.14)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1.6.17)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7.14)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7.17)</sup>
27	Polychlorinated biphenyls (PCBs) - Aroclor 1016 - Aroclor 1221 - Aroclor 1232 - Aroclor 1242 - Aroclor 1248 - Aroclor 1254 - Aroclor 1260	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1.9.24)</sup> 2) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10.28)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11.26)</sup>

- 2-Chlorobiphenyl...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
28	- 2-Chlorobiphenyl - 2,3-Dichlorobiphenyl - 2,2',5'-Trichlorobiphenyl - 2,4',5'-Trichlorobiphenyl - 2,2',3,5'-Tetrachlorobiphenyl - 2,2',5,5'-Tetrachlorobiphenyl - 2,3',4,4'-Tetrachlorobiphenyl - 2,2',3,4,5'-Pentachlorobiphenyl - 2,2',4,5,5'-Pentachlorobiphenyl - 2,3,3',4,6-Pentachlorobiphenyl - 2,2',3,4,4',5'-Hexachlorobiphenyl - 2,2',3,4,5,5'-Hexachlorobiphenyl - 2,2',3,5,5',6-Hexachlorobiphenyl - 2,2',4,4',5,5'-Hexachlorobiphenyl - 2,2',3,3',4,4',5'-Heptachlorobiphenyl - 2,2',3,4,4',5,5'-Heptachlorobiphenyl - 2,2',3,4,4',5',6-Heptachlorobiphenyl - 2,2',3,4',5,5',6-Heptachlorobiphenyl - 2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl Pentachlorophenol	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1,9,24)</sup> 2) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,26)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11,26)</sup> Electrometric Method <sup>(25,25)</sup> 4) Digestion, Inductively Coupled Plasma Method <sup>(1,6,16)</sup> 5) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,6,17)</sup> 6) Digestion, Inductively Coupled Plasma Method <sup>(7,16)</sup> 7) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,17)</sup>
29	pH	
30	Selenium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,6,16)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,6,17)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7,16)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,17)</sup>

31 Silver...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
31	Silver	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,6,16)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,6,17)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7,16)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,17)</sup>
32	Thallium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,6,16)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,6,17)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7,16)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,17)</sup>
33	Toxaphene	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1,9,24)</sup> 2) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,26)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11,26)</sup>
34	Vanadium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,6,16)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,6,17)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7,16)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,17)</sup>
35	Zinc	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,6,16)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,6,17)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7,16)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,17)</sup>

31...

สืบ จำนวน 125 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Acenaphthene	1) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11,26)</sup>
2	Acetone	1) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(15,25)</sup> 2) Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method <sup>(13,23)</sup>
3	Aldrin	1) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11,26)</sup>
4	Anthracene	1) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11,26)</sup>
5	Antimony	1) Digestion, Inductively Coupled Plasma Method <sup>(7,16)</sup> 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,17)</sup>
6	Arsenic	1) Digestion, Inductively Coupled Plasma Method <sup>(7,16)</sup> 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,17)</sup>
7	Atrazine	1) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11,26)</sup>
8	Barium	1) Digestion, Inductively Coupled Plasma Method <sup>(7,16)</sup> 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,17)</sup>
9	Benz(a)anthracene	1) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11,26)</sup>
10	Benzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(15,25)</sup>

11 Benzol(b)fluoranthene

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
11	Benzol(b)fluoranthene	1) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11,26)</sup>
12	Benzol(k)fluoranthene	1) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11,26)</sup>
13	Benzoic acid	1) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11,26)</sup>
14	Benzo(a)pyrene	1) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11,26)</sup>
15	Benzo(g,h,i)perylene	1) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11,26)</sup>
16	Beryllium	1) Digestion, Inductively Coupled Plasma Method <sup>(7,16)</sup> 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,17)</sup>
17	Bis(2-chloroethyl)ether	1) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11,26)</sup>
18	Bis(2-ethylhexyl)phthalate	1) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11,26)</sup>
19	Bromodichloromethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(15,25)</sup>
20	Bromoform	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(15,25)</sup>
21	Butanol	Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method <sup>(13,23)</sup>
22	Butyl Benzyl Phthalate	1) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11,26)</sup>

23 Cadmium...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
23	Cadmium	1) Digestion, Inductively Coupled Plasma Method <sup>(7,14)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7,17)</sup>
24	Carbazole	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
25	Carbon Disulfide	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>
26	Carbon tetrachloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>
27	Chlordane	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
28	p-Chloroaniline	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
29	Chlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>
30	Chlorodibromomethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>
31	Chloroform	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>
32	2-Chlorophenol	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
33	Chromium	1) Digestion, Inductively Coupled Plasma Method <sup>(7,14)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7,17)</sup>
34	Chromium (III)	1) Digestion, Inductively Coupled Plasma Method; Alkaline Digestion, Colorimetric Method; Calculation Method <sup>(7,8,16,19)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method; Alkaline Digestion, Colorimetric Method; Calculation Method <sup>(7,8,17,19)</sup>
35	Chromium (VI)	Alkaline Digestion, Colorimetric Method <sup>(8,19)</sup>

36 Chrysene...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
36	Chrysene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
37	Cyanide	Extraction, Distillation, Colorimetric Method <sup>(27,28,29)</sup>
38	2,4-D	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
39	DDD	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
40	DDE	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
41	DDT	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
42	Dibenz(a,h)anthracene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
43	Di-n-Butyl Phthalate	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
44	1,2-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>
45	1,3-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>
46	1,4-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>
47	3,3-Dichlorobenzidine	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
48	1,1-Dichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>

49 1,2-Dichloroethane...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
49	1,2-Dichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>
50	1,1-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>
51	cis-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>
52	trans-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>
53	2,4-Dichlorophenol	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
54	1,2-Dichloropropane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>
55	1,3-Dichloropropane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>
56	1,3-Dichloropropene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>
57	Dieldrin	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
58	Diethyl Phthalate	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
59	2,4-Dimethylphenol	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
60	2,4-Dinitrophenol	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
61	2,4-Dinitrotoluene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
62	2,6-Dinitrotoluene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>

63 Di-n-Octyl Phthalate...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
63	Di-n-Octyl Phthalate	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
64	Endosulfan	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
65	Endrin	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
66	Ethylbenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>
67	Fluoranthene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
68	Fluorene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
69	Heptachlor	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
70	Heptachlor epoxide	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
71	Hexachlorobenzene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
72	Hexachloro-1,3-butadiene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>
73	n-Hexane	1) Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup> 2) Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method <sup>(13)</sup>

73 n-Hexane...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
74	$\alpha$ -HCH	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
75	$\beta$ -HCH	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
76	$\gamma$ -HCH	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
77	Hexachlorocyclopentadiene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
78	Hexachloroethane	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
79	Indeno(1,2,3-cd)pyrene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
80	Isophorone	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
81	Lead	1) Digestion, Inductively Coupled Plasma Method <sup>(7,16)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7,17)</sup>
82	Manganese	1) Digestion, Inductively Coupled Plasma Method <sup>(7,16)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7,17)</sup>
83	Mercury	1) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>(20)</sup> 2) Thermal Decomposition, Amalgamation, and Atomic Absorption Spectrophotometry <sup>(21)</sup> 3) Digestion, Cold-Vapor Atomic Fluorescence Spectrometric Method <sup>(20)</sup>

86 Methanol...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
84	Methanol	1) Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,28)</sup> 2) Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method <sup>(13,29)</sup>
85	Methoxychlor	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
86	Methyl Bromide	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,29)</sup>
87	Methylene Chloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,29)</sup>
88	2-methylphenol	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
89	2-Methylnaphthalene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
90	Methyl tert-Butyl Ether	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,29)</sup>
91	Naphthalene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
92	Nickel	1) Digestion, Inductively Coupled Plasma Method <sup>(7,16)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7,17)</sup>
93	Nitrobenzene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
94	N-Nitrosodiphenylamine	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
95	N-Nitrosodi-n-propylamine	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>

96 Polychlorinated biphenyls (PCBs)

ลำดับที่	สารเคมี	วิธีวิเคราะห์
96	Polychlorinated biphenyls (PCBs) - Aroclor 1016 - Aroclor 1221 - Aroclor 1232 - Aroclor 1242 - Aroclor 1248 - Aroclor 1254 - Aroclor 1260 - 2-Chlorobiphenyl - 2,2',3,5'-Tetrachlorobiphenyl - 2,2',5,5'-Tetrachlorobiphenyl - 2,3',4,4'-Tetrachlorobiphenyl - 2,2',3,4,5'-Pentachlorobiphenyl - 2,2',4,5,5'-Pentachlorobiphenyl - 2,3,3',4,6-Pentachlorobiphenyl - 2,2',3,4,4',5'-Hexachlorobiphenyl - 2,2',3,4,5,5'-Hexachlorobiphenyl - 2,2',3,5,5',6'-Hexachlorobiphenyl - 2,2',4,4',5,5'-Hexachlorobiphenyl - 2,2',3,3',4,4',5'-Heptachlorobiphenyl - 2,2',3,4,4',5,5'-Heptachlorobiphenyl - 2,2',3,4,4',5,5',6'-Heptachlorobiphenyl - 2,2',3,3',4,4',5,5',6'-Nonachlorobiphenyl	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
97	Pentachlorophenol	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
98	Phenanthrene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>

99 Phenol...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
99	Phenol	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
100	Pyrene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
101	Selenium	1) Digestion, Inductively Coupled Plasma Method <sup>(7,16)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7,17)</sup>
102	Silver	1) Digestion, Inductively Coupled Plasma Method <sup>(7,16)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7,17)</sup>
103	Styrene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,29)</sup>
104	1,1,2,2-Tetrachloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,29)</sup>
105	Tetrachloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,29)</sup>
106	Toluene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,29)</sup>
107	Toxaphene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
108	TPH (C <sub>5</sub> -C <sub>8</sub> )	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,29)</sup>
109	TPH (C <sub>8</sub> -C <sub>15</sub> )	1) Automate Extraction, Gas Chromatographic Method <sup>(11,29)</sup> 2) Solvent Extraction, Gas Chromatographic Method <sup>(12,22)</sup> 3) Ultrasonic Extraction, Gas Chromatographic Method <sup>(22,31)</sup>
110	TPH (C <sub>15</sub> -C <sub>35</sub> )	1) Automate Extraction, Gas Chromatographic Method <sup>(11,29)</sup> 2) Solvent Extraction, Gas Chromatographic Method <sup>(12,22)</sup> 3) Ultrasonic Extraction, Gas Chromatographic Method <sup>(22,31)</sup>
111	1,2,4-Trichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,29)</sup>
112	1,1,1-Trichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,29)</sup>
113	1,1,2-Trichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,29)</sup>
114	Trichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,29)</sup>

115 2,4,5-Trichlorophenol...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
115	2,4,5-Trichlorophenol	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,28)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,28)</sup>
116	2,4,6-Trichlorophenol	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,28)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,28)</sup>
117	1,3,5-Trimethylbenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>
118	Vanadium	1) Digestion, Inductively Coupled Plasma Method <sup>(7,16)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7,17)</sup>
119	Vinyl Acetate	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>
120	Vinyl Chloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>
121	m-Xylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>
122	o-Xylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>
123	p-Xylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>
124	Xylene (Total)	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>
125	Zinc	1) Digestion, Inductively Coupled Plasma Method <sup>(7,16)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7,17)</sup>

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ที่ ๒๓ ๐๓๑๐๒/ ๔๑๒๑



กรมโรงงานอุตสาหกรรม  
ถนนพหลโยธินที่ ๒ แขวงทุ่งพญาไท  
เขตราชเทวี กรุงเทพฯ ๑๐๕๐๐

๒๕ เมษายน ๒๕๖๗

เรื่อง เปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์

เรียน กรรมการผู้จัดการ บริษัท แอลแอล แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และขอขึ้นสารบบรายชื่อของห้องปฏิบัติการวิเคราะห์เอกชน  
ลงวันที่ ๒๔ มีนาคม ๒๕๖๗

ตามที่ข้าพเจ้าอ้างถึง บริษัท แอลแอล แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด ห้องปฏิบัติการ  
วิเคราะห์เอกชน เลขทะเบียน ๖-๒๐๔ สังกัดที่ตั้งเลขที่ ๑๐๔ ซอยพัฒนาการ ๔๐ ถนนพัฒนาการ แขวงพัฒนาการ  
เขตสวนหลวง กรุงเทพมหานคร ขอเปลี่ยนแปลงบุคลากร ความละเอียดแจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว มีความเห็นดังนี้

๑. ให้อยู่แก่เจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๓ ราย

๑) นางสาวพรณิศา หุ่นคง ทะเบียนเลขที่ ๖-๒๐๔-๖-๐๐๒๕

๒) นายกำชัย สุทธะ ทะเบียนเลขที่ ๖-๒๐๔-๖-๐๑๒๑

๓) นางสาวศุภรดา ปิ่นมูรา ทะเบียนเลขที่ ๖-๒๐๔-๖-๐๑๒๘

๒. ให้เพิ่มเจ้าหน้าที่ห้องปฏิบัติการวิเคราะห์เอกชน จำนวน ๑๒ ราย

๑) นางสาวฐานิดา กสินเขียว ทะเบียนเลขที่ ๖-๒๐๔-๖-๐๑๔๒

๒) นางสาวกัญญ์วิมล สายคำ ทะเบียนเลขที่ ๖-๒๐๔-๖-๐๑๔๓

๓) นางสาวณัฐนันทน์ กิตติวงค์ ทะเบียนเลขที่ ๖-๒๐๔-๖-๐๑๔๔

๔) นายธนากร วงษาเคน ทะเบียนเลขที่ ๖-๒๐๔-๖-๐๑๔๕

๕) นายฤทธิพล ปัญญาวัฒน์ ทะเบียนเลขที่ ๖-๒๐๔-๖-๐๑๔๖

๖) นายณฐกร หาราชา ทะเบียนเลขที่ ๖-๒๐๔-๖-๐๑๔๗

๗) นายวิรัตน์ ผ่องใสสวน ทะเบียนเลขที่ ๖-๒๐๔-๖-๐๑๔๘

๘) นายณัฐพงศ์ โสภา ทะเบียนเลขที่ ๖-๒๐๔-๖-๐๑๔๙

๙) นายดิเรกพร ปานเพ็ง ทะเบียนเลขที่ ๖-๒๐๔-๖-๐๑๕๐

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๑๒) นายณรรักษ์ นววิทย์ชา ทะเบียนเลขที่ ๖-๒๐๔-๖-๐๑๕๓

อนึ่ง หนังสือฉบับนี้

อนึ่ง หนังสือฉบับนี้จะหมดอายุพร้อมหนังสือต่ออายุรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน  
ในวันที่ ๒ กันยายน ๒๕๖๔

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

  
(นายพรศ กัณการอง)  
รองอธิบดี ปฏิบัติราชการแทน  
อธิบดีกรมโรงงานอุตสาหกรรม

กองวิจัยและเตือนภัยมลพิษโรงงาน  
กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ  
โทร. ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๐๓-๕  
โทรสาร ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๕๔  
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ที่ อ.ก ๐๔๑๐(๓)/ ๖๔๗๐



กรมโรงงานอุตสาหกรรม  
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท  
เขตราชเทวี กรุงเทพฯ ๑๐๔๐๐

๒๔ มิถุนายน ๒๕๖๔

เรื่อง ขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

เรียน กรรมการผู้จัดการ บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และขอรับทราบผลของห้องปฏิบัติการวิเคราะห์เอกชน  
ลงวันที่ ๒๔ เมษายน ๒๕๖๔

สิ่งที่ส่งมาด้วย เอกสารแนบท้ายหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด จำนวน ๒ แผ่น

ตามหนังสือที่ยังมีถึง บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด ขอขึ้นทะเบียน  
ห้องปฏิบัติการวิเคราะห์เอกชน พร้อมรายชื่อผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ เจ้าหน้าที่ประจำ  
ห้องปฏิบัติการวิเคราะห์ และรายการสารเคมีที่จะทำการวิเคราะห์ ต่อกรมโรงงานอุตสาหกรรม นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว ให้บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป  
(ประเทศไทย) จำกัด ขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน มีเลขทะเบียน ๖-๒๒๓ สถานที่ยื่นขอขึ้นทะเบียน  
๖๒๖/๑๐ หมู่ที่ ๕ ตำบลแม่ไม้ อำเภอลำปาง จังหวัดลำปาง โดยมีองค์ประกอบดังนี้

ก. ผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์

๑) นายเดช ช้างชน	ทะเบียนเลขที่	๖-๒๒๓-๖-๑๙๔๖๒
๒) นางวิลาวัลย์ บริรักษ์	ทะเบียนเลขที่	๖-๒๒๓-๖-๑๙๔๖๓
๓) นายสุพจน์ สลมาเต๊ะ	ทะเบียนเลขที่	๖-๒๒๓-๖-๑๙๔๖๔

ข. เจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์

๑) นางสาวณัฐพร บรรจงกิจ	ทะเบียนเลขที่	๖-๒๒๓-๖-๑๙๔๖๕
๒) นางพจนา สีดา	ทะเบียนเลขที่	๖-๒๒๓-๖-๑๙๔๖๖
๓) นางสาวนิตา กุลสุริวงศ์	ทะเบียนเลขที่	๖-๒๒๓-๖-๑๙๔๖๗
๔) นายพิทยา ทองแดง	ทะเบียนเลขที่	๖-๒๒๓-๖-๑๙๔๖๘
๕) นางชลธิชา สูงเกษ	ทะเบียนเลขที่	๖-๒๒๓-๖-๑๙๔๖๙
๖) ว่าที่ ร.ต.รมชย์ ม่วนมา	ทะเบียนเลขที่	๖-๒๒๓-๖-๑๙๔๗๐
๗) นายวรวิทย์ ทับทา	ทะเบียนเลขที่	๖-๒๒๓-๖-๑๙๔๗๑
๘) นายศักดิ์กรีนทร์ จรัสกาย	ทะเบียนเลขที่	๖-๒๒๓-๖-๑๙๔๗๒
๙) นายสุรศักดิ์ สาชิน	ทะเบียนเลขที่	๖-๒๒๓-๖-๑๙๔๗๓
๑๐) นางสาวพรพรรณ ภาวุดานนท์	ทะเบียนเลขที่	๖-๒๒๓-๖-๑๙๔๗๔
๑๑) นายสถาพร งามแก้ว	ทะเบียนเลขที่	๖-๒๒๓-๖-๑๙๔๗๕
๑๒) นายสุทธิดำรง โชคิณินันท์	ทะเบียนเลขที่	๖-๒๒๓-๖-๑๙๔๗๖

(๓๓) นายวัลลภ...



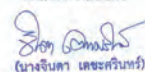
"อุตสาหกรรมก้าวไกล ประเทศไทยก้าวหน้า ร่วมกันพัฒนา อุตสาหกรรมสีเขียว"



๓๓) นายวัลลภ หันไชยเนาว์	ทะเบียนเลขที่	๖-๒๒๓-๖-๑๙๔๗๗
๓๔) นางสาวนาถิณี เจริญบุตรกุล	ทะเบียนเลขที่	๖-๒๒๓-๖-๑๙๔๗๘
๓๕) นางสาวนิตา ผดุงจิตต์	ทะเบียนเลขที่	๖-๒๒๓-๖-๑๙๔๗๙
๓๖) นายธนเชษฐา วงศ์ไชย	ทะเบียนเลขที่	๖-๒๒๓-๖-๑๙๔๘๐
๓๗) นายชัยสุนทร เลิศนันท์กุลชัย	ทะเบียนเลขที่	๖-๒๒๓-๖-๑๙๔๘๑
๓๘) นายสังจา เพ็ชรแสง	ทะเบียนเลขที่	๖-๒๒๓-๖-๑๙๔๘๒
๓๙) นายกันตภณ มณีสัมพันธ์	ทะเบียนเลขที่	๖-๒๒๓-๖-๑๙๔๘๓
๔๐) นางสาวจันทิพย์ โกเมนชนะ	ทะเบียนเลขที่	๖-๒๒๓-๖-๑๙๔๘๔
๔๑) นายอริณันท์ อธิจินดา	ทะเบียนเลขที่	๖-๒๒๓-๖-๑๙๔๘๕
๔๒) นายคุณวุฒิ พิสัยพันธ์	ทะเบียนเลขที่	๖-๒๒๓-๖-๑๙๔๘๖
๔๓) นายศุภชัย วงศ์สุริยธาย	ทะเบียนเลขที่	๖-๒๒๓-๖-๑๙๔๘๗
๔๔) นายปฐมพงศ์ กรสวัชร์	ทะเบียนเลขที่	๖-๒๒๓-๖-๑๙๔๘๘
๔๕) นายโสว ตันโพธิ์	ทะเบียนเลขที่	๖-๒๒๓-๖-๑๙๔๘๙
๔๖) นางสาวกิตติยา สันญายาธิยานันท์	ทะเบียนเลขที่	๖-๒๒๓-๖-๑๙๔๙๐
๔๗) นางสาวเจษฎาพร ศรีบุญเรือง	ทะเบียนเลขที่	๖-๒๒๓-๖-๑๙๔๙๑
๔๘) นางสาวมธุรินทร์ สิงห์เงา	ทะเบียนเลขที่	๖-๒๒๓-๖-๑๙๔๙๒
๔๙) นางสาวอริศรัตน์ ศรีมงคลโร	ทะเบียนเลขที่	๖-๒๒๓-๖-๑๙๔๙๓
๕๐) นายพิพัฒน์ นิภัทร์เศรษฐี	ทะเบียนเลขที่	๖-๒๒๓-๖-๑๙๔๙๔
๕๑) นายศิริวิทย์ เรืองสม	ทะเบียนเลขที่	๖-๒๒๓-๖-๑๙๔๙๕
๕๒) นายปารเมศ สัตยาคุณ	ทะเบียนเลขที่	๖-๒๒๓-๖-๑๙๔๙๖
๕๓) นายณัฐพล ธรรมสระโร	ทะเบียนเลขที่	๖-๒๒๓-๖-๑๙๔๙๗
๕๔) นางสาวศุภรัตน์ ไส้จันทร์	ทะเบียนเลขที่	๖-๒๒๓-๖-๑๙๔๙๘
๕๕) นายพรกร อินทรเสนา	ทะเบียนเลขที่	๖-๒๒๓-๖-๑๙๔๙๙
๕๖) นายพิวกร เชื้อมาก	ทะเบียนเลขที่	๖-๒๒๓-๖-๑๙๕๐๐
๕๗) นายอนุวัชร ทองขจรศักดิ์	ทะเบียนเลขที่	๖-๒๒๓-๖-๑๙๕๐๑
๕๘) นายอติชาต วิลาศ	ทะเบียนเลขที่	๖-๒๒๓-๖-๑๙๕๐๒
๕๙) นายจรัสระวี ศรีรักษา	ทะเบียนเลขที่	๖-๒๒๓-๖-๑๙๕๐๓
๕๐) นายประสาธมิตร เชื้อนเพชร	ทะเบียนเลขที่	๖-๒๒๓-๖-๑๙๕๐๔
๕๑) นายภาณุวัฒน์ วัชรบง	ทะเบียนเลขที่	๖-๒๒๓-๖-๑๙๕๐๕
๕๒) นายสันติ ชัยชนะ	ทะเบียนเลขที่	๖-๒๒๓-๖-๑๙๕๐๖
๕๓) นายสิทธิชัย แก้วมากุ	ทะเบียนเลขที่	๖-๒๒๓-๖-๑๙๕๐๗
๕๔) นายทินกร กุลชาติ	ทะเบียนเลขที่	๖-๒๒๓-๖-๑๙๕๐๘

ค. ขอขยายสารเคมีที่ได้รับขึ้นทะเบียนให้วิเคราะห์ได้อีก จำนวน ๑๕ รายการ  
อากาศเสีย (ปล่องระบาย) จำนวน ๗ รายการ และน้ำเสีย จำนวน ๓ รายการ รวมทั้งสิ้นจำนวน ๒๔ รายการ  
ตามสิ่งที่ส่งมาด้วย

ขอแสดงความนับถือ

  
(นางจินดา เลอะศรีจันทร์)  
ผู้อำนวยการกองวิจัยและเตือนภัยมลพิษโรงงาน  
ปฏิบัติราชการแทนอธิบดีกรมโรงงานอุตสาหกรรม

๒๔ มิ.ย. ๒๕๖๔

กองวิจัยและเตือนภัยมลพิษโรงงาน

ศูนย์วิจัยและเตือนภัยมลพิษโรงงานภาคตะวันออก

โทร. ๐ ๓๘๐๕ ๓๒๖๑-๓

ไปรษณีย์อิเล็กทรอนิกส์ elw@dlw.mail.go.th

เอกสารแนบท้ายหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

บริษัท แอลเอส แลบริทอรี กรุ๊ป (ประเทศไทย) จำกัด เลขทะเบียน ๖-๒๒๓

ที่ อก ๐๓๑๐(๓)/ ๖๔๗๐ ลงวันที่ ๒๔ มิถุนายน ๒๕๖๔

ขอข้ายสารมลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๒๔ รายการ  
น้ำเสีย จำนวน 14 รายการ

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

อากาศเสีย (ปล่อยระบาย) จำนวน 7 รายการ

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

วิภา สิมะกุล

(นางสาววิภา สิมะกุล)

ผู้อำนวยการ

ศูนย์วิจัยและเตือนภัยมลพิษโรงงานภาคตะวันออก

Sulfuric Acid...

-2-

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
6	Sulfuric Acid	Isokinetic Sampling, Barium - Thorin Titrimetric Method <sup>(4)</sup>
7	Total Suspended Particulate	Isokinetic Sampling, Gravimetric Method <sup>(7)</sup>

น้ำใต้ดิน จำนวน 3 รายการ

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

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10. United States Environmental Protection Agency. Determination of Sulfur Dioxide Emissions from Stationary Sources; Instrumental Analyzer Procedure. 40 CFR 60. Appendix A Method 6C, 2017.

วิภา สิมะกุล

(นางสาววิภา สิมะกุล)

ผู้อำนวยการ

ศูนย์วิจัยและเตือนภัยมลพิษโรงงานภาคตะวันออก

ศูนย์วิจัยและเตือนภัยมลพิษโรงงานภาคตะวันออก กองวิจัยและเตือนภัยมลพิษโรงงาน กรมโรงงานอุตสาหกรรม โทร ๐ ๒๑๐๕ ๙๕๖๓-๔

สำเนา

ที่ อก ๐๓๑๐/ ๖๐๕๓

กรมโรงงานอุตสาหกรรม  
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท  
เขตราชเทวี กรุงเทพฯ ๑๐๔๐๐

๒๒ มิ.ย. ๒๕๖๔

เรื่อง เปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์

เรียน กรรมการผู้จัดการ บริษัท แอลเอส แลบริทอรี กรุ๊ป (ประเทศไทย) จำกัด

อ้างถึง คำขอเปลี่ยนแปลงบุคลากร ของห้องปฏิบัติการวิเคราะห์เอกชน ลงวันที่ ๑๔ มีนาคม ๒๕๖๒

ตามที่หนังสืออ้างอิงถึง บริษัท แอลเอส แลบริทอรี กรุ๊ป (ประเทศไทย) จำกัด ห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ๖-๒๒๓ สถานที่ตั้งเลขที่ ๖๑๖/๑๐ หมู่ที่ ๕ ตำบลแม่ไม้ อำเภอลวกแดง จังหวัดระยอง ขอเปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์ ความละเอียดแจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว มีความเห็นดังนี้

ก. ให้ยกเลิกเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๕ ราย

๑) นางสาวเจษฎาพร ศรีบุญเรือง ทะเบียนเลขที่ ๖-๒๒๓-๖-๑๔๗๑๓

๒) นางสาวอรุณพร สิงห์ใจ ทะเบียนเลขที่ ๖-๒๒๓-๖-๑๔๗๑๒

๓) นางสาววันิดา ผดุงจิตต์ ทะเบียนเลขที่ ๖-๒๒๓-๖-๑๔๕๔๙

๔) นายคุณวุฒิ พิสัยพันธุ์ ทะเบียนเลขที่ ๖-๒๒๓-๖-๑๔๖๖๖

๕) นายสิทธิชัย แก้วเกตุ ทะเบียนเลขที่ ๖-๒๒๓-๖-๑๔๔๘๗

ข. ให้เพิ่มเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๒ ราย

๑) นายณัฐพงษ์ เพ็ชรขาวมา ทะเบียนเลขที่ ๖-๒๒๓-๖-๑๐๐๐๑

๒) นางสาวกัญญ์พรรณ วิภาติ ทะเบียนเลขที่ ๖-๒๒๓-๖-๑๐๐๐๒

๓) นางสาวจุฑาจันทร์ สีทองกลาง ทะเบียนเลขที่ ๖-๒๒๓-๖-๑๐๐๐๓

๔) นางสาวจิตติภา ประเทืองสุข ทะเบียนเลขที่ ๖-๒๒๓-๖-๑๐๐๐๔

๕) นายสมรสิทธิ์ คุ้มบุญสุข ทะเบียนเลขที่ ๖-๒๒๓-๖-๑๐๐๐๕

๖) นายณัฐวุฒิ ออมพรพรราช ทะเบียนเลขที่ ๖-๒๒๓-๖-๑๐๐๐๖

๗) นายจิตรกร สีวะสา ทะเบียนเลขที่ ๖-๒๒๓-๖-๑๐๐๐๗

๘) นายสิทธิพรวิทย์ สุวรรณรัตน์ ทะเบียนเลขที่ ๖-๒๒๓-๖-๑๐๐๐๘

๙) นายสิทธิพันธ์ แสนศิริ ทะเบียนเลขที่ ๖-๒๒๓-๖-๑๐๐๐๙

๑๐) นายอนุวัฒน์ เตมามี ทะเบียนเลขที่ ๖-๒๒๓-๖-๑๐๐๑๐

๑๑) นายสุรวิทย์ นราพงษ์ ทะเบียนเลขที่ ๖-๒๒๓-๖-๑๐๐๑๑

๑๒) นายอดิศักดิ์ ตะริศบุญ ทะเบียนเลขที่ ๖-๒๒๓-๖-๑๐๐๑๒

อนึ่ง หนังสือฉบับนี้จะหมดอายุพร้อมหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน ที่ อก ๐๓๑๐(๓)/๖๐๕๓ ลงวันที่ ๒๔ มิถุนายน ๒๕๖๔ คือในวันที่ ๒๔ มิถุนายน ๒๕๖๗ ทั้งนี้ สามารถยื่นคำขอผ่านระบบอิเล็กทรอนิกส์ได้ที่หน้าเว็บไซต์กรมโรงงานอุตสาหกรรมตาม QR Code ที่แนบมานี้

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

(นายทรี อำพันพันธ์)

ผู้อำนวยการศูนย์วิจัยและเตือนภัยมลพิษโรงงานภาคตะวันออก  
ปฏิบัติราชการแทนอธิบดีกรมโรงงานอุตสาหกรรม

ศูนย์วิจัยและเตือนภัยมลพิษโรงงานภาคตะวันออก

โทร. ๐ ๒๑๐๕ ๖๐๕๔ ต่อ ๕๐๐๓-๒

ไปรษณีย์อิเล็กทรอนิกส์: elrwg@dlw.mail.go.th



ยื่นคำขอผ่านระบบอิเล็กทรอนิกส์



ที่ อก ๐๓๒๐/๒๕๖๓



กรมโรงงานอุตสาหกรรม  
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท  
เขตราชเทวี กรุงเทพฯ ๑๐๕๐๐

๑๐ พ.ย. ๒๕๖๓

เรื่อง เปลี่ยนแปลงสารมลพิษของห้องปฏิบัติการวิเคราะห์

เรียน กรรมการผู้จัดการ บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด

อ้างถึง คำขอเปลี่ยนแปลงสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน ลงวันที่ ๒๕ ตุลาคม ๒๕๖๒

สิ่งที่ส่งมาด้วย เอกสารแนบท้ายหนังสือเปลี่ยนแปลงสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน

บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำนวน ๓ แผ่น

ตามหนังสือที่อ้างถึง บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด ห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ๖-๓๒๓ สถานที่ตั้งเลขที่ ๖๑๖/๑๐ หมู่ที่ ๕ ตำบลแม่ไม้คู่ อำเภอลำลูกเกด จังหวัดยะลา ขอเปลี่ยนแปลงสารมลพิษของห้องปฏิบัติการวิเคราะห์ ความละเอียดแจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว ให้บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด เพิ่มขอบข่ายสารมลพิษที่วิเคราะห์ในน้ำเสีย จำนวน ๑๓ รายการ และนำได้สิน ๓ รายการ ตามสิ่งที่ส่งมาด้วย

อนึ่ง หนังสือฉบับนี้จะหมดอายุพร้อมหนังสือต่ออายุรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชนที่ อก ๐๓๒๐(๓)/๒๕๖๓ ลงวันที่ ๒๘ มิถุนายน ๒๕๖๔ คือในวันที่ ๒๘ มิถุนายน ๒๕๖๔ ทั้งนี้ สามารถยื่นคำขอผ่านระบบอิเล็กทรอนิกส์ได้ที่หน้าเว็บไซต์กรมโรงงานอุตสาหกรรม

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

(นายทวี อ่ำพินธุ์)

ผู้อำนวยการศูนย์วิจัยและเตือนภัยมลพิษโรงงานภาคตะวันออก

ปฏิบัติราชการแทนอธิบดีกรมโรงงานอุตสาหกรรม

ศูนย์วิจัยและเตือนภัยมลพิษโรงงานภาคตะวันออก

โทร. ๐ ๓๓๑๓ ๖๐๕๕ ต่อ ๕๐๐๑-๒

ไปรษณีย์อิเล็กทรอนิกส์ einw@dw.mail.go.th



"อุตสาหกรรมก้าวไกล ประเทศไทยก้าวหน้า ร่วมกันพัฒนา อุตสาหกรรมสีเขียว"



เอกสารแนบท้ายหนังสือเปลี่ยนแปลงสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน  
บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด เลขทะเบียน ๖-๓๒๓  
ที่ อก ๐๓๒๐/๒๕๖๓ ลงวันที่ ๑๐ พ.ย. ๒๕๖๓

ขอบข่ายสารมลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๑๖ รายการ  
น้ำเสีย จำนวน 13 รายการ

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

น้ำได้สิน จำนวน 3 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Cyanide	Distillation, Colorimetric Method
2	pH	Electrometric Method
3	Phenols	Distillation, Direct Photometric Method

เอกสารอ้างอิง

APHA, AWWA, WEF. Standard Methods for the Examination of Water and Wastewater. 24<sup>th</sup> ed. Washington, DC : APHA, 2023

ที่ อก ๐๓๒๐/๔๖๐๐



กรมโรงงานอุตสาหกรรม  
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท  
เขตราชเทวี กรุงเทพฯ ๑๐๕๐๐

๑๔ พฤษภาคม ๒๕๖๓

เรื่อง เปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์

เรียน กรรมการผู้จัดการ บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และขอขึ้นทะเบียนของห้องปฏิบัติการวิเคราะห์เอกชน

ลงวันที่ ๒๐ มีนาคม ๒๕๖๓

ตามคำขอที่อ้างถึง บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด ห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ๖-๓๒๓ สถานที่ตั้งเลขที่ ๖๑๖/๑๐ หมู่ที่ ๕ ตำบลแม่ไม้คู่ อำเภอลำลูกเกด จังหวัดยะลา ขอเปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์ ความละเอียดแจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว มีความเห็นดังนี้

๑. ให้ยกเลิกเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑ ราย

นางสาวพรศุมน ภวภูตานนท์ ทะเบียนเลขที่ ๖-๓๒๓-๖-๔๕๕๔

๒. ให้เพิ่มเจ้าหน้าที่ห้องปฏิบัติการวิเคราะห์เอกชน จำนวน ๑๕ ราย

๑) นายณัฐพล เชื้อวรวิงศ์ ทะเบียนเลขที่ ๖-๓๒๓-๖-๐๐๑๓

๒) นายชานนท์ บุญชื่น ทะเบียนเลขที่ ๖-๓๒๓-๖-๐๐๑๔

๓) นายณัฐกานต์ วงศ์อินทร์อยู่ ทะเบียนเลขที่ ๖-๓๒๓-๖-๐๐๑๕

๔) นายอานนท์ โพธิ์ทอง ทะเบียนเลขที่ ๖-๓๒๓-๖-๐๐๑๖

๕) นายณัฐพล อักกลาง ทะเบียนเลขที่ ๖-๓๒๓-๖-๐๐๑๗

๖) นายศุภณัฐ พิสิทธิ์พันธ์ ทะเบียนเลขที่ ๖-๓๒๓-๖-๐๐๑๘

๗) นายสันต์ ศิรินันท์ ทะเบียนเลขที่ ๖-๓๒๓-๖-๐๐๑๙

๘) นายวิญญู อิมพาสี ทะเบียนเลขที่ ๖-๓๒๓-๖-๐๐๒๐

๙) นายศุภณัฐ สุกกิตติมงคล ทะเบียนเลขที่ ๖-๓๒๓-๖-๐๐๒๑

๑๐) นายเอกชัย ดันทอง ทะเบียนเลขที่ ๖-๓๒๓-๖-๐๐๒๒

๑๑) นายพงษ์เทพ สิทธิธะ ทะเบียนเลขที่ ๖-๓๒๓-๖-๐๐๒๓

๑๒) นายพินกร กุมภักดิ์ ทะเบียนเลขที่ ๖-๓๒๓-๖-๐๐๒๔

๑๓) นางสาวนันทยา เบญจรัตน์ ทะเบียนเลขที่ ๖-๓๒๓-๖-๐๐๒๕

๑๔) นายสิทธิชัย ยันพิมาย ทะเบียนเลขที่ ๖-๓๒๓-๖-๐๐๒๖

๑๕) นางสาวภาณิน หลอดทอง ทะเบียนเลขที่ ๖-๓๒๓-๖-๐๐๒๗

อนึ่ง หนังสือฉบับนี้จะสิ้นอายุพร้อมหนังสือต่ออายุรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน  
ในวันที่ ๒๗ มิถุนายน ๒๕๖๓

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

(นายพรศุมน ภวภูตานนท์)  
อธิบดีกรมโรงงานอุตสาหกรรม  
อธิบดีกรมโรงงานอุตสาหกรรม

ศูนย์วิจัยและเตือนภัยมลพิษโรงงานภาคตะวันออก

โทร. ๐ ๓๓๑๓ ๖๐๕๕ ต่อ ๕๐๐๑-๒

ไปรษณีย์อิเล็กทรอนิกส์ einw@dw.mail.go.th



"อุตสาหกรรมก้าวไกล ประเทศไทยก้าวหน้า ร่วมกันพัฒนา อุตสาหกรรมสีเขียว"



"อุตสาหกรรมก้าวไกล ประเทศไทยก้าวหน้า ร่วมกันพัฒนา อุตสาหกรรมสีเขียว"





right solutions.  
right partner.

บริษัท เอแอลเอส แล็บอราทอรี กรุ๊ป (ประเทศไทย) จำกัด (สำนักงานใหญ่)  
104 ซอยพัฒนาการ 40 ถนนพัฒนาการ  
แขวงพัฒนาการ เขตสวนหลวง กรุงเทพฯ 10250



ติดต่อเรา

