

# ภาคผนวก จ

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ใบรับรองการสอบเทียบเครื่องมือ



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รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Stack (CEMs)	Carbon Monoxide	Analyzer , System calibration, Standard gas	-	-	-	-
Stack (CEMs)	Oxides of Nitrogen	Analyzer , System calibration, Standard gas	-	-	-	-
Stack (CEMs)	Sulfur Dioxide	Analyzer , System calibration, Standard gas	-	-	-	-
Stack	Total Suspended Particulate	Console Control Unit	BKK_FS0518	9-Jan-24	9-Jul-24	6
Stack	Total Suspended Particulate	Pitot Tube	BKK_FS0523	9-Jan-24	9-Jul-24	6
Stack	Total Suspended Particulate	Digital Balance	RYG_EN0003	22-Feb-24	22-Feb-25	12
Ambient	Nitrogen Dioxide	NO <sub>2</sub> Analyzer	RYG_FS0455	4-Jan-24	4-Jul-24	6
Ambient	Nitrogen Dioxide	NO <sub>2</sub> Analyzer	RYG_FS0255	4-Jan-24	4-Jul-24	6
Ambient	Nitrogen Dioxide	NO <sub>2</sub> Analyzer	BKK_FS0797	3-Jan-24	3-Jul-24	6
Ambient	Sulfur Dioxide	SO <sub>2</sub> Analyzer	RYG_FS0454	4-Jan-24	4-Jul-24	6
Ambient	Sulfur Dioxide	SO <sub>2</sub> Analyzer	RYG_FS0254	4-Jan-24	4-Jul-24	6
Ambient	Sulfur Dioxide	SO <sub>2</sub> Analyzer	BKK_FS0796	3-Jan-24	3-Jul-24	6
Ambient	Particulate Matter (PM-10)	High Volume	RYG_FS0189	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	High Volume	RYG_FS0191	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	High Volume	RYG_FS0187	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	Digital Balance	RYG_EN0001	22-Feb-24	22-Feb-25	12
Ambient	Total Suspended Particulate	High Volume	RYG_FS0395	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	RYG_FS0396	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	RYG_FS0292	-	-	On site Calibration
Ambient	Total Suspended Particulate	Digital Balance	RYG_EN0001	22-Feb-24	22-Feb-25	12
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	RYG_FS0413	10-Feb-23	10-Aug-24	18
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	RYG_FS0414	10-Feb-23	10-Aug-24	18
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	RYG_FS0412	10-Feb-23	10-Aug-24	18
Noise	Leq 24 hrs	Sound Calibrator	RYG_FS0215	20-Sep-23	20-Sep-24	12
Noise	Leq 24 hrs	Sound Level Meter	RYG_FS0390	7-Nov-23	7-Nov-24	12
Noise	Leq 24 hrs	Sound Level Meter	RYG_FS0007	25-Jan-24	24-Jan-25	12
Noise	Leq 8 hrs	Sound Calibrator	RYG_FS0216	20-Sep-23	20-Sep-24	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0439	19-Oct-23	19-Oct-24	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0438	19-Oct-23	19-Oct-24	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0491	23-Feb-24	22-Feb-25	12
Noise	Leq 8 hrs	Sound Calibrator	RYG_FS0213	28-Feb-24	27-Feb-25	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0493	23-Feb-24	22-Feb-25	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0494	23-Feb-24	22-Feb-25	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0495	23-Feb-24	22-Feb-25	12
Water Lab	pH at 25 °C	pH meter	BKK_EN0342	27-Oct-23	27-Oct-24	12
Rayong Lab	BOD	DO meter with Sensor	RYG_EN0032	24-Jul-23	24-Jan-25	18
Rayong Lab	BOD	Incubator	RYG_EN0154	29-May-23	29-Nov-24	18
Rayong Lab	COD	Spectrophotometer	RYG_EN0037	18-Sep-23	18-Mar-25	18
Rayong Lab	Temperature	pH meter	RYG_FS0606	4-Sep-23	4-Sep-24	12
Rayong Lab	Total Suspended Solids	Electronic Balance	RYG_EN0002	22-Feb-24	22-Feb-25	12
Rayong Lab	Total Suspended Solids	Hot Air Oven	RYG_EN0010	21-Mar-24	21-Sep-25	18
Rayong Lab	Total Dissolved Solids 180°C	Electronic Balance	RYG_EN0002	22-Feb-24	22-Feb-25	12
Rayong Lab	Total Dissolved Solids 180°C	Hot Air Oven	RYG_EN0010	21-Mar-24	21-Sep-25	18
Rayong Lab	Oil & Grease	Electronic Balance	RYG_EN0002	22-Feb-24	22-Feb-25	12
Rayong Lab	Oil & Grease	Hot Air Oven	RYG_EN0213	21-Mar-24	21-Mar-25	12
Rayong Lab	Oil & Grease	Water Bath	RYG_EN0061	21-Mar-24	21-Sep-25	18
Rayong Lab	Nitrate	Spectrophotometer	RYG_EN0037	18-Sep-23	18-Mar-25	18
Rayong Lab	Dissolved Oxygen	Chamber (Cooling Room)	RYG_EN0184	25-Jan-23	25-Jul-24	18
Water Lab	Chloroform	Gas Chromatography (MSD)	BKK_EN0059	13-Dec-23	13-Jun-25	18
Water Lab	Bromoform	Gas Chromatography (MSD)	BKK_EN0059	13-Dec-23	13-Jun-25	18
Water Lab	Dibromochloromethane	Gas Chromatography (MSD)	BKK_EN0059	13-Dec-23	13-Jun-25	18
Water Lab	Total Trihalomethanes	Gas Chromatography (MSD)	BKK_EN0059	13-Dec-23	13-Jun-25	18
Water Lab	Bromodichloromethane	Gas Chromatography (MSD)	BKK_EN0059	13-Dec-23	13-Jun-25	18
Water Lab	Total Trihalomethanes	Gas Chromatography (MSD)	BKK_EN0059	13-Dec-23	13-Jun-25	18



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รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Water Lab	Calcium	ICP-OES	BKK_EL0037	29-Feb-24	28-Feb-25	12
Water Lab	Calcium	Hot Block	BKK_EL0054	22-Sep-23	22-Mar-25	18
Water Lab	Calcium	Chamber (Cooling Room)	BKK_EN0167	6-Dec-23	6-Jun-25	18
Water Lab	Magnesium	ICP-OES	BKK_EL0037	29-Feb-24	28-Feb-25	12
Water Lab	Magnesium	Hot Block	BKK_EL0054	22-Sep-23	22-Mar-25	18
Water Lab	Magnesium	Chamber (Cooling Room)	BKK_EN0167	6-Dec-23	6-Jun-25	18
Water Lab	SAR	ICP-OES	BKK_EL0037	29-Feb-24	28-Feb-25	12
Water Lab	SAR	Hot Block	BKK_EL0054	22-Sep-23	22-Mar-25	18
Water Lab	SAR	Chamber (Cooling Room)	BKK_EN0167	6-Dec-23	6-Jun-25	18
Rayong Lab	Conductivity	Conductivity meter	RYG_EN0029	4-Sep-23	4-Mar-25	18
Rayong Lab	Total Kjeldahl Nitrogen	Block Digestion Unit	RYG_EN0188	11-Mar-24	11-Sep-25	18
Rayong Lab	Total Kjeldahl Nitrogen	pH Meter	RYG_EN0152	14-Dec-23	14-Dec-24	12
Water Lab	Iron	ICP-MS	BKK_EL0043	6-Apr-23	6-Oct-24	18
Water Lab	Iron	Hot Block	BKK_EL0054	22-Sep-23	22-Mar-25	18
Water Lab	Iron	Chamber (Cooling Room)	BKK_EN0167	6-Dec-23	6-Jun-25	18
Water Lab	Copper	ICP-MS	BKK_EL0043	6-Apr-23	6-Oct-24	18
Water Lab	Copper	Hot Block	BKK_EL0054	22-Sep-23	22-Mar-25	18
Water Lab	Copper	Chamber (Cooling Room)	BKK_EN0167	6-Dec-23	6-Jun-25	18
Water Lab	Zinc	ICP-MS	BKK_EL0043	6-Apr-23	6-Oct-24	18
Water Lab	Zinc	Hot Block	BKK_EL0054	22-Sep-23	22-Mar-25	18
Water Lab	Zinc	Chamber (Cooling Room)	BKK_EN0167	6-Dec-23	6-Jun-25	18



<b>Client</b>	General Electric International CO.	<b>Location</b>	HROPO #1	
<b>Date</b>	03 Mar 24	<b>Test Operator</b>	Balagopal, T	
<b>O<sub>2</sub> ANALYZER</b>				
<b>Model</b>	TELETYPE API 200EH	<b>Serial No.</b>	776	
<b>Span (ppm)</b>	200			
	<b>Cylinder Value (ppm)</b>	<b>Initial Analyzers Calibration Response (ppm)</b>	<b>Final Analyzers Calibration Response (ppm)</b>	<b>Difference (Percent of Span)</b>
Zero Gas	0.00	0.02	0.02	0.00
Low-Level Gas	8.04	8.00	8.07	0.00
Span Gas	16.00	16.01	16.01	0.00
<b>H<sub>2</sub> ANALYZER</b>				
<b>Model</b>	TELETYPE API 200EH	<b>Serial No.</b>	776	
<b>Span (ppm)</b>	100			
	<b>Cylinder Value (ppm)</b>	<b>Initial Analyzers Calibration Response (ppm)</b>	<b>Final Analyzers Calibration Response (ppm)</b>	<b>Difference (Percent of Span)</b>
Zero Gas	0.00	0.02	0.02	0.00
Low-Level Gas	54.86	54.82	54.83	0.00
Span Gas	82.51	82.50	82.48	0.02
<b>CO ANALYZER</b>				
<b>Model</b>	TELETYPE API 100EH	<b>Serial No.</b>	410	
<b>Span (ppm)</b>	100			
	<b>Cylinder Value (ppm)</b>	<b>Initial Analyzers Calibration Response (ppm)</b>	<b>Final Analyzers Calibration Response (ppm)</b>	<b>Difference (Percent of Span)</b>
Zero Gas	0.00	0.00	0.00	0.00
Low-Level Gas	55.58	55.54	55.53	0.01
Span Gas	79.76	79.76	79.75	0.01
<b>CO ANALYZER</b>				
<b>Model</b>	TELETYPE API 1700M	<b>Serial No.</b>	877	
<b>Span (ppm)</b>	100			
	<b>Cylinder Value (ppm)</b>	<b>Initial Analyzers Calibration Response (ppm)</b>	<b>Final Analyzers Calibration Response (ppm)</b>	<b>Difference (Percent of Span)</b>
Zero Gas	0.00	0.00	0.00	0.00
Low-Level Gas	54.84	54.82	54.81	0.01
Span Gas	79.74	79.73	79.72	0.01

Calibrated by

( Mr.Sethaporn Thaksew )  
Environmental Field Scientist (3)

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

Page 1 of 5



Client		Run #	1
General Electric International OGI		Location	HRSG #1
Date	02 Mar 24	Test Operator	Bathapom.T
Start Time	8:59	Finish Time	10:10
SO <sub>2</sub> Analyzer Model	TELEDYNE API 100SH	Serial No.	410
NO <sub>2</sub> /O <sub>2</sub> Analyzer Model	TELEDYNE API 200SH	Serial No.	786
CO/O <sub>2</sub> Analyzer Model	TELEDYNE API 200SH	Serial No.	877

Time (s)	O <sub>2</sub> (%)	CO <sub>2</sub> (%)	HCN (ppm)	HC <sub>2</sub> (ppm)	CO (ppm)	Remark
0:00	16.14	3.50	0.00	0.00	0.00	
0:01	16.43	3.61	0.00	0.00	4.63	
0:02	16.43	3.61	0.00	0.00	4.63	
0:03	16.43	3.61	0.00	0.00	4.63	
0:04	16.43	3.61	0.00	0.00	4.63	
0:05	16.44	3.62	0.04	0.16	4.58	
0:06	16.43	3.63	0.00	0.12	4.59	
0:07	16.43	3.63	0.04	0.12	4.62	
0:08	16.44	3.63	0.04	0.07	4.31	
0:09	16.43	3.63	0.00	0.00	4.58	
0:10	16.43	3.63	0.08	0.03	4.20	
0:11	16.44	3.63	0.00	0.00	4.58	
0:12	16.44	3.63	0.00	0.00	4.51	
0:13	16.44	3.63	0.00	0.07	4.13	
0:14	16.44	3.63	0.00	0.00	4.58	
0:15	16.44	3.63	0.00	0.00	4.58	
0:16	16.44	3.63	0.00	0.00	4.58	
0:17	16.44	3.63	0.00	0.00	4.58	
0:18	16.44	3.63	0.00	0.00	4.58	
0:19	16.44	3.63	0.00	0.00	4.58	
0:20	16.44	3.63	0.00	0.00	4.58	
0:21	16.44	3.63	0.00	0.00	4.58	
0:22	16.44	3.63	0.00	0.00	4.58	
0:23	16.44	3.63	0.00	0.00	4.58	
0:24	16.44	3.63	0.00	0.00	4.58	
0:25	16.44	3.63	0.00	0.00	4.58	
0:26	16.44	3.63	0.00	0.00	4.58	
0:27	16.44	3.63	0.00	0.00	4.58	
0:28	16.44	3.63	0.00	0.00	4.58	
0:29	16.44	3.63	0.00	0.00	4.58	
0:30	16.44	3.63	0.00	0.00	4.58	
0:31	16.44	3.63	0.00	0.00	4.58	
0:32	16.44	3.63	0.00	0.00	4.58	
0:33	16.44	3.63	0.00	0.00	4.58	
0:34	16.44	3.63	0.00	0.00	4.58	
0:35	16.44	3.63	0.00	0.00	4.58	
0:36	16.44	3.63	0.00	0.00	4.58	
0:37	16.44	3.63	0.00	0.00	4.58	
0:38	16.44	3.63	0.00	0.00	4.58	
0:39	16.44	3.63	0.00	0.00	4.58	
0:40	16.44	3.63	0.00	0.00	4.58	
0:41	16.44	3.63	0.00	0.00	4.58	
0:42	16.44	3.63	0.00	0.00	4.58	
0:43	16.44	3.63	0.00	0.00	4.58	
0:44	16.44	3.63	0.00	0.00	4.58	
0:45	16.44	3.63	0.00	0.00	4.58	
0:46	16.44	3.63	0.00	0.00	4.58	
0:47	16.44	3.63	0.00	0.00	4.58	
0:48	16.44	3.63	0.00	0.00	4.58	
0:49	16.44	3.63	0.00	0.00	4.58	
0:50	16.44	3.63	0.00	0.00	4.58	
0:51	16.44	3.63	0.00	0.00	4.58	
0:52	16.44	3.63	0.00	0.00	4.58	
0:53	16.44	3.63	0.00	0.00	4.58	
0:54	16.44	3.63	0.00	0.00	4.58	
0:55	16.44	3.63	0.00	0.00	4.58	
0:56	16.44	3.63	0.00	0.00	4.58	
0:57	16.44	3.63	0.00	0.00	4.58	
0:58	16.44	3.63	0.00	0.00	4.58	
0:59	16.44	3.63	0.00	0.00	4.58	
1:00	16.44	3.63	0.00	0.00	4.58	
1:01	16.44	3.63				

Sathaporn.T

( Mr. Nathaniel Thelway )

Environmental Field Scientist (30)

FORM NO.: F-06-060 REVISION NO.: 1 ISSUE DATE: 18/01/2018



		Run #	3
Client	General Electric International OOL	Location	HR80 #1
Date	02 Mar 24	Test Operator	Bathpam.T
Start Time	10:52	Finish Time	10:52
SO <sub>2</sub> Analyzer Model	TELEDYNE API 100SH	Serial No.	410
NO <sub>x</sub> /O <sub>2</sub> Analyzer Model	TELEDYNE API 200SH	Serial No.	786
CO/CO <sub>2</sub> Analyzer Model	TELEDYNE API T900M	Serial No.	877

Time (min)	CO <sub>2</sub> (g)	CO <sub>2</sub> (g)	HCN (g/mol)	B <sub>2</sub> O <sub>3</sub> (g)	Sum
10:32	14.42	0.93		0.56	1.25
10:33	14.42	1.34	0.58	0.53	1.18
10:34	14.43	1.33	0.54	0.59	1.09
10:35	14.42	1.35	0.58	0.53	1.09
10:36	14.43	1.35	0.58	0.53	1.09
10:37	14.43	1.34	0.58	0.49	1.14
10:38	14.42	1.37	0.58	0.56	1.08
10:39	14.42	1.36	0.58	0.55	1.09
10:40	14.42	1.34	0.58	0.52	1.18
10:41	14.42	1.31	0.56	0.49	1.19
10:42	14.42	1.35	0.53	0.57	1.18
10:43	14.42	1.35	0.53	0.54	1.18
10:44	14.43	1.35	0.53	0.51	1.25
10:45	14.43	1.31	0.58	0.49	1.25
10:46	14.44	1.31	0.58	0.48	1.22
10:47	14.43	1.32	0.57	0.48	1.22
10:48	14.44	1.31	0.56	0.47	1.22
10:49	14.43	1.37	0.58	0.44	1.22
10:50	14.44	1.32	0.57	0.43	1.24
10:51	14.43	1.33	0.56	0.43	1.26
10:52	14.42	1.32	0.58	0.44	1.26
<b>Average</b>	<b>14.43</b>	<b>1.33</b>	<b>0.56</b>	<b>0.51</b>	<b>1.18</b>

Subgroup:

**/ Mr. Robinson, Thank you.**

Environmental Field Scientist (30)

Page 5 of 5



## SYSTEM CALIBRATION BIAS AND DRIFT DATA

Start Date :	General Electric International OCL	Location :	H2800 #1
End Date :	02 Mar 24	Test Operator :	Balaphum.T
<b>O<sub>2</sub> ANALYZER</b>			
Cylinder Conc. (K)	18.00		Span (K) : 20
O <sub>2</sub> Analyzer Calibration Responses	Initial Values		Final Values
	System Calibration Response	System Cal Bias (% of Span)	System Calibration Response      System Cal Bias (% of Span)
Zero Gas	0.02	0.01	0.02      0.12
Unclean Gas	18.01	16.03	16.04      0.18
<b>NO<sub>2</sub> ANALYZER</b>			
Cylinder Conc. (ppm)	82.81		Span (ppm) : 100
NO <sub>2</sub> Analyzer Calibration Responses	Initial Values		Final Values
	System Calibration Response	System Cal Bias (% of Span)	System Calibration Response      System Cal Bias (% of Span)
Zero Gas	0.02	0.01	0.02      0.00
Unclean Gas	82.80	82.43	82.43      0.00
<b>SO<sub>2</sub> ANALYZER</b>			
Cylinder Conc. (ppm)	79.78		Span (ppm) : 100
SO <sub>2</sub> Analyzer Calibration Responses	Initial Values		Final Values
	System Calibration Response	System Cal Bias (% of Span)	System Calibration Response      System Cal Bias (% of Span)
Zero Gas	0.01	0.02	0.01      0.00
Unclean Gas	79.78	79.73	79.72      0.01
<b>CO ANALYZER</b>			
Cylinder Conc. (ppm)	79.74		Span (ppm) : 100
CO Analyzer Calibration Responses	Initial Values		Final Values
	System Calibration Response	System Cal Bias (% of Span)	System Calibration Response      System Cal Bias (% of Span)
Zero Gas	0.02	0.02	0.00      0.01
Unclean Gas	79.73	79.76	79.76      0.00

Calibrated by

( Mr Bathroom Thainew )

Environmental Field Scientist (3)

FORM NO.: F-06-063 REVISION NO.: 4 ISSUE DATE: 18/01/20  
ALS Laboratory Group



		Run #	2
Client	General Electric International OCL	Location	HRSO 01
Date	02 Mar 24	Test Operator	Bethpage,T
Start Time	10:11	Finish Time	10:31
SO <sub>2</sub> Analyzer Model	TELESTRYME API 1000SH	Serial No.	410
NO <sub>2</sub> /O <sub>3</sub> Analyzer Model	TELESTRYME API 2000SH	Serial No.	736
CO/O <sub>2</sub> Analyzer Model	TELESTRYME API 1200M	Serial No.	577

Time (s)	Q <sub>1</sub> (g)	Q <sub>2</sub> (g)	CO <sub>2</sub> (%)	H <sub>2</sub> O (gsm)	SO <sub>2</sub> (gsm)	CO (gsm)	Remark
10:11	14.43	14.43	1.09	0.27	0.97		
10:12	14.44	14.44	1.10	0.27	0.92		
10:13	14.44	14.44	1.10	0.27	0.97		
10:14	14.44	14.44	1.10	0.28	0.97		
10:15	14.44	14.44	1.10	0.28	0.97		
10:16	14.43	14.43	1.07	0.27	0.98		
10:17	14.43	14.43	1.05	0.28	0.98		
10:18	14.43	14.43	1.03	0.29	0.97		
10:19	14.43	14.43	1.03	0.29	0.98		
10:20	14.42	14.42	1.08	0.28	0.94		
10:21	14.42	14.42	1.09	0.29	0.92		
10:22	14.42	14.42	1.09	0.29	0.92		
10:23	14.41	14.41	1.04	0.28	0.93		
10:24	14.43	14.43	1.05	0.27	0.92		
10:25	14.42	14.42	1.06	0.28	0.94		
10:26	14.42	14.42	1.02	0.28	0.93		
10:27	14.42	14.42	1.04	0.28	0.94		
10:28	14.42	14.42	1.04	0.28	0.93		
10:29	14.41	14.41	1.05	0.29	0.93		
10:30	14.41	14.41	1.05	0.29	0.93		
10:31	14.41	14.41	1.05	0.29	0.93		
10:32	14.41	14.41	1.05	0.29	0.93		
10:33	14.41	14.41	1.05	0.29	0.93		
10:34	14.41	14.41	1.05	0.29	0.93		
10:35	14.41	14.41	1.05	0.29	0.93		
10:36	14.41	14.41	1.05	0.29	0.93		
10:37	14.41	14.41	1.05	0.29	0.93		
10:38	14.41	14.41	1.05	0.29	0.93		
10:39	14.41	14.41	1.05	0.29	0.93		
10:40	14.41	14.41	1.05	0.29	0.93		
10:41	14.41	14.41	1.05	0.29	0.93		
10:42	14.41	14.41	1.05	0.29	0.93		
10:43	14.41	14.41	1.05	0.29	0.93		
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10:59	14.41	14.41	1.05	0.29	0.93		
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13:08	14.41	14.41	1.05	0.29	0.93		

Sathaporn<sup>2</sup>

( Mr. Nathaniel Thelme )

Environmental Field Scientist C

FORM NO.: F 06-060 REVISION NO.: 1 ISSUE DATE: 18/01/9



**CERTIFICATE OF ANALYSIS**  
Grade of Product: EPA Protocol

Part Number:	ED4N896 15A021C	Reference Number:	160-40200199-1
Cylinder Number:	CC709609	Cylinder Volume:	144.8 CF
Laboratory:	124 - Plumsteadville / PA	Cylinder Pressure:	2015 PSIG
PGVP Number:	A12921	Valve Outlet:	600
Gas Code:	CO,N <sub>2</sub> ,NO <sub>x</sub> ,SO <sub>2</sub> ,BALN	Certification Date:	Feb 22, 2021
Expiration Date:		Feb 22, 2025	

[illegible]

ANALYTICAL RESULTS						
Component	Request Concentration	Actual Concentration	Protocol Method	Total Residue %	Residue Type	Assay Date
NOI	0.05 PPM	0.42 PPM	01	< 0.4% Meq/T	Traceable	01/19/01 01/22/01
CARBON SUCROSE	0.05 PPM	0.4 PPM	01	< 0.4% Meq/T	Traceable	01/19/01 01/22/01
CHLOROPYRIFOS	0.05 PPM	0.4 PPM	01	< 0.4% Meq/T	Traceable	01/19/01 01/22/01
BULFUR FOS	0.05 PPM	0.4 PPM	01	< 0.4% Meq/T	Traceable	01/19/01 01/22/01
ACETOPYRIFOS	0.05 PPM	0.4 PPM	01	< 0.4% Meq/T	Traceable	01/19/01 01/22/01
CALIBRATION STANDARDS						
ATIME	Lot ID	Cylinder No.	Concentration	Residue %	Expiration Date	
ATIME	54007013	0274600	0.05 PPM CARBON SUCROSE CONCENTRATION	< 0.05%	Jan 19, 2001	
ATIME	54007013	0274600	0.05 PPM CHLOROPYRIFOS CONCENTRATION	< 0.05%	Jan 19, 2001	
ATIME	54007013	0274600	0.05 PPM BULFUR FOS CONCENTRATION	< 0.05%	Jan 19, 2001	
ATIME	54007013	0274600	0.05 PPM CHLOROPYRIFOS CONCENTRATION	< 0.05%	Jan 19, 2001	
ATIME	54007013	0274600	0.05 PPM BULFUR FOS CONCENTRATION	< 0.05%	Jan 19, 2001	
The above calibration standards are used in accordance with the following protocol:						
ANALYTICAL PROCEDURE						
Instrument/Model/Model			Analytical Principle		Least Multiline Calibration	
Nelson III FPK 400102424 GC			FID		Feb. 04, 2001	
Nelson III FPK 400102424 GC			FID		Jan. 11, 2001	
Nelson III FPK 400102424 GC			FID		Dec. 22, 2001	
Nelson III FPK 400102424 GC			FID		Jan. 11, 2001	

Full Data Available Upon Request

NOTES

Discs Weight: 28.8 Kg

*Michael A. Tucker*  
Approved for Release

8000 9 28 190-8000000000











### Stopwatch Calibration Test Report

Calibration Date : 9 Jan 24  
Barometric Pressure (mmHg) : 754.7  
Relative Humidity (%) : 55.0

Next Cal. Date : 9 Jul 24  
Temperature (°C) : 27.2

Reference Stopwatch Data  
Stopwatch ID No. : E1861  
Model : F808  
Serial No. : -  
Calibration Date : 8 Sep 20  
Certificate No. : E-0009018

Console Control Meter Data  
Dry Gas Meter No. : BKK\_F5018  
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	8	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			7	0.00012
SD				0.00004

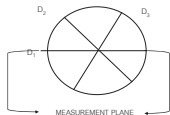
Calibrate by : Saksit Phaisanphut Approved by : Nattapong Jengwareepong  
Mr. Saksit Phaisanphut Mr. Nattapong Jengwareepong  
RYG Field Service Scientist (4) RYG Field Service Specialist (1)



### PROBE NOZZLE DIAMETER CALIBRATION DATA SHEET

Nozzle ID #	Nozzle Diameter (cm.)			H - Lo	D <sub>av</sub> (D <sub>1</sub> + D <sub>2</sub> + D <sub>3</sub> ) / 3
	D <sub>1</sub>	D <sub>2</sub>	D <sub>3</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	1.296	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 between the nearest 0.025 mm.  
ΔD = Maximum distance between any two diameters, must be ≤ 0.100 mm.  
D<sub>av</sub> = (D<sub>1</sub> + D<sub>2</sub> + D<sub>3</sub>) / 3



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

FORM NO. F-06-124 REVISION NO. 0 ISSUE DATE: 24/12/23



### DIGITAL TEMPERATURE CALIBRATION DATA SHEET

Calibration Date : 9 Jan 24		Ambient Temperature (°C) : 27.2			
Calibration sheet No. : C-000124-BKK_F50519		Relative Humidity (%) : 55			
Digital Temperature ID : BKK_F50519		Reference Temperature ID : RYGL_F50611			
Serial No. : 1504025		Serial No. : 20100014918			
Model : XC-672-V		Model : Digicon-CC-VT-M8			
		Next Calibrate : 13 Nov 24			
Location	Reference Temperature °C	Digital Temperature °C	Error °C	MPE	Pass / Fail
Block	0	0	0	±3	Pass
	25	25	0	±3	Pass
	50	50	0	±3	Pass
	100	100	0	±3	Pass
	150	150	0	±3	Pass
Probe	200	200	0	±3	Pass
	250	250	0	±3	Pass
	300	300	0	±3	Pass
	350	350	0	±3	Pass
	400	400	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
ALIX	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 Phaisanphut Approved by : Nattapong Jengwareepong  
Mr. Saksit Phaisanphut Mr. Nattapong Jengwareepong  
RYG Field Service Scientist (4) RYG Field Service Specialist (1)

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



### Type S Pitot Tube Calibration

Date Calibration : 9-Jan-24  
Pitot ID : BKK\_F50523  
Pitot SN : -

Due Date : 9-Jul-24  
Inclinometer ID : BKK\_F51131  
Vernier ID : RYG\_F50539



Parameter	Value	Allowable Range	Check
a1	-0.2	-10° < a1 < +10°	OK
a2	2.4	-10° < a2 < +10°	OK
B1	-1.2	-5° < B1 < +5°	OK
B2	-1.6	-5° < B2 < +5°	OK
γ	-1.1	-	-
θ	0.2	-	-
Z = A tan γ	-0.018	Z ≤ 0.125°	OK
W = A tan θ	0.003	W ≤ 0.031°	OK
Dt	0.308	0.188" to 0.375"	OK
A/2Dt	1.494	1.05 ≤ A/2Dt ≤ 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 factor of 0.84. See 40 CFR Pt. 60, App. A, EPA Method 2.

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

FORM NO. F-06-124 REVISION NO. 0 ISSUE DATE: 24/12/23

**Sartorius (Thailand) Co., Ltd.**  
224 Klong 1 Road, Klongkum Suburb, Bangkok 10110  
Tel: +66 282 8781-5 Fax: +66 282 8781-7 Email: sarthai@th.sartorius.com

**Certificate of Calibration**

Model Number : MSU2245-100-DU  
Description : Analytical Balance  
Serial Number : 0031709502  
ID No. : RYG\_F50523  
Manufacturer : Sartorius

Certificate No. : 24BC03073  
Issued Date : Friday, February 23, 2024  
Reference No. : 229181  
Page No. : 1 of 2

Customer Name : ALS Laboratory Group (Thailand) Co., Ltd. (Rangsit Branch)  
615/15 Moo 51 Maesuen Khlu, A Phrak Deang, Rangsit 21140, Thailand

Calibrated By : Mr. Chonchai Wattana  
Calibration Date : Thursday, February 27, 2024

Calibration Procedure No. : This calibration was conducted by using Sartorius calibration procedure (customer (W-NET)) based on UKAS Lab 14, 2018

Measurement Data :  
Capacity : 220 g Repeatability : 0.0001 g  
Temperature : 23.7 °C ± 5.0 °C  
Humidity : 52.0 % RH ± 10.0 % RH  
Pressure : 1013.25 hPa ± 0.1 hPa

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 the Expression of Uncertainty in Measurement (GUM). The calibration certificate documents the traceability to National Standards, which provides the link of measurement according to the International System of Units (SI). Origin of Traceability comes from list of Selected Measurement Standards.

Traceability :  
Model Number : MSU2245-100-DU  
Description : Analytical Balance  
Serial Number : 0031709502  
ID No. : RYG\_F50523  
Manufacturer : Sartorius

This certificate is valid only for the equipment only.  
This certificate may not be reproduced or used in full or part without the prior written approval of the Verification Operations Division, Sartorius (Thailand) Co., Ltd.

SCF PH 32 02 February 2024

**Sartorius (Thailand) Co., Ltd.**  
224 Klong 1 Road, Klongkum Suburb, Bangkok 10110  
Tel: +66 282 8781-5 Fax: +66 282 8781-7 Email: sarthai@th.sartorius.com

**Certificate of Calibration**

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Serial Number : 0031709502  
ID No. : RYG\_F50523  
Manufacturer : Sartorius

Certificate No. : 24BC03073  
Issued Date : Friday, February 23, 2024  
Reference No. : 229181  
Page No. : 2 of 2

Calibration Results : Without Adjustment

Repeatability :  
Nominal Value : 20 g  
Tolerance : 0.0001 g  
Standard Deviation : 0.00005 g

Linearity :  
Nominal Value : 20 g  
Tolerance : 0.0001 g  
Standard Deviation : 0.00005 g

Excentricity (Off-center loading error) :  
Nominal Value : 20 g  
Tolerance : 0.0004 g

Linearity :  
Nominal Value : 20 g  
Tolerance : 0.0001 g  
Standard Deviation : 0.00005 g

SCF PH 33 10 February 2024

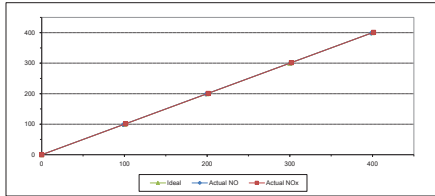




### MULTIPOINT CALIBRATION REPORT

Calibration Date 4-Jan-24 Equipment Name NOx Analyzer  
Manufacturer HORIBA Model APNA-370  
Serial No. ALPOVOWY Equipment ID RYG\_F80486  
Calibrator Manufacturer Teledyne API Model 700  
Serial No. 947  
Std. Gas Concentration (PPM) 66.88 Cylinder No. GN0027222  
Cylinder Pressure (psf) 1800 Certified By Algas Inc.  
Certified Date 9-Feb-22 Expired Date 9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	98.60	-1.40	-1.40	101.60	1.60	1.60
2	200.00	198.60	-1.20	-0.60	201.20	1.20	0.60
3	300.00	301.00	1.00	0.33	301.80	1.80	0.60
4	400.00	398.50	-1.50	-0.38	401.30	1.30	0.33
AVERAGE (%)				-0.39			0.94



Calibrated By

(Mr. Arvind S. Salm)  
Field Environmental Scientist (3)

Approved By

(Mr. Saravath Jitramont)  
Assistant General Manager

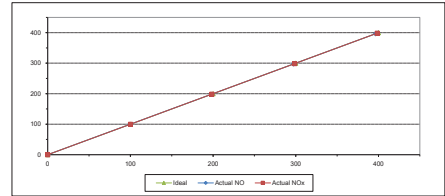
ALS Laboratory Group  
FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



### MULTIPOINT CALIBRATION REPORT

Calibration Date 4-Jan-24 Equipment Name NOx Analyzer  
Manufacturer Teledyne API Model T200  
Serial No. 2187 Equipment ID RYG\_F80286  
Calibrator Manufacturer Teledyne API Model 700  
Serial No. 947  
Std. Gas Concentration (PPM) 66.88 Cylinder No. GN0027222  
Cylinder Pressure (psf) 1800 Certified By Algas Inc.  
Certified Date 9-Feb-22 Expired Date 9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	99.60	-0.40	-0.40	100.10	0.10	0.10
2	200.00	198.00	-2.00	-1.00	198.50	-1.50	-0.75
3	300.00	297.30	-2.70	-0.90	298.70	-1.30	-0.43
4	400.00	398.40	-1.60	-0.40	398.50	-1.50	-0.38
AVERAGE (%)				-0.62			-0.27



Calibrated By

(Mr. Arvind S. Salm)  
Field Environmental Scientist (3)

Approved By

(Mr. Saravath Jitramont)  
Assistant General Manager

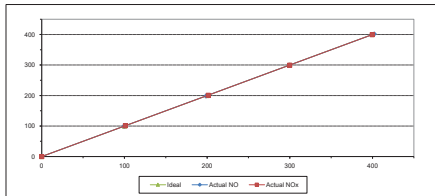
ALS Laboratory Group  
FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



### MULTIPOINT CALIBRATION REPORT

Calibration Date 3-Jan-24 Equipment Name NOx Analyzer  
Manufacturer HORIBA Model APNA-370  
Serial No. H78KYD1M Equipment ID BKOC\_F80787  
Calibrator Manufacturer Teledyne API Model 700  
Serial No. 947  
Std. Gas Concentration (PPM) 66.88 Cylinder No. GN0027222  
Cylinder Pressure (psf) 1800 Certified By Algas Inc.  
Certified Date 9-Feb-22 Expired Date 9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	99.70	-0.30	-0.30	101.00	1.00	1.00
2	200.00	198.60	-1.40	-0.70	201.30	1.30	0.65
3	300.00	299.10	-0.90	-0.30	299.60	-0.20	-0.07
4	400.00	402.10	2.10	0.53	399.50	-0.50	-0.13
AVERAGE (%)				-0.18			0.31



Calibrated By

(Mr. Arvind S. Salm)  
Field Environmental Scientist (3)

Approved By

(Mr. Saravath Jitramont)  
Assistant General Manager

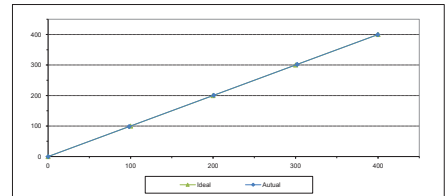
ALS Laboratory Group  
FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



### MULTIPOINT CALIBRATION REPORT

Calibration Date 4-Jan-24 Equipment Name SO2 Analyzer  
Manufacturer HORIBA Model APBA-370  
Serial No. H083D9FA Equipment ID RYG\_F80454  
Calibrator Manufacturer Teledyne API Model 700  
Serial No. 947  
Std. Gas Concentration (PPM) 66.3 Cylinder No. GN0027222  
Cylinder Pressure (psf) 1800 Certified By Algas Inc.  
Certified Date 9-Feb-22 Expired Date 9-Feb-30

Point	CALIBRATION RESULTS			
	Ideal	Actual	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	98.30	-1.70	-1.70
2	200.00	200.80	0.80	0.40
3	300.00	301.50	1.50	0.50
4	400.00	399.70	-0.30	-0.08
AVERAGE (%)				-0.18



Calibrated By

(Mr. Arvind S. Salm)  
Field Environmental Scientist (3)

Approved By

(Mr. Saravath Jitramont)  
Assistant General Manager

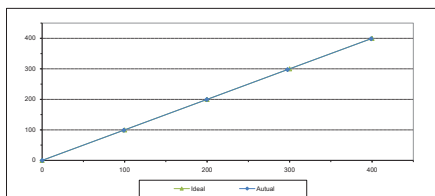
ALS Laboratory Group  
FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



### MULTIPOINT CALIBRATION REPORT

Calibration Date 4-Jan-24 Equipment Name SO2 Analyzer  
Manufacturer Teledyne API Model T100  
Serial No. 1772 Equipment ID RYG\_F80284  
Calibrator Manufacturer Teledyne API Model 700  
Serial No. 947  
Std. Gas Concentration (PPM) 66.3 Cylinder No. GN0027222  
Cylinder Pressure (psf) 1800 Certified By Algas Inc.  
Certified Date 9-Feb-22 Expired Date 9-Feb-30

Point	CALIBRATION RESULTS			
	Ideal	Actual	Error	%Error
ZERO	0.00	0.05	0.05	0.05
1	100.00	99.10	-0.90	-0.90
2	200.00	199.60	-0.40	-0.20
3	300.00	297.50	-2.50	-0.83
4	400.00	398.90	-1.10	-0.28
AVERAGE (%)				-0.48



Calibrated By

(Mr. Arvind S. Salm)  
Field Environmental Scientist (3)

Approved By

(Mr. Saravath Jitramont)  
Assistant General Manager

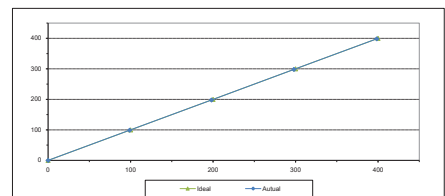
ALS Laboratory Group  
FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



### MULTIPOINT CALIBRATION REPORT

Calibration Date 3-Jan-24 Equipment Name SO2 Analyzer  
Manufacturer HORIBA Model APBA-370  
Serial No. G2CH438B Equipment ID BKOC\_F80786  
Calibrator Manufacturer Teledyne API Model 700  
Serial No. 947  
Std. Gas Concentration (PPM) 66.3 Cylinder No. GN0027222  
Cylinder Pressure (psf) 1800 Certified By Algas Inc.  
Certified Date 9-Feb-22 Expired Date 9-Feb-30

Point	CALIBRATION RESULTS			
	Ideal	Actual	Error	%Error
ZERO	0.00	0.05	0.05	0.05
1	100.00	98.91	-1.09	-1.09
2	200.00	198.10	-1.90	-0.95
3	300.00	298.10	-1.90	-0.63
4	400.00	398.50	-1.50	-0.38
AVERAGE (%)				-0.60



Calibrated By

(Mr. Arvind S. Salm)  
Field Environmental Scientist (3)

Approved By

(Mr. Saravath Jitramont)  
Assistant General Manager

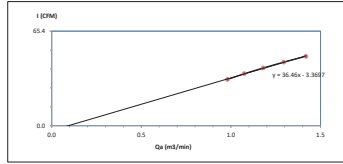
ALS Laboratory Group  
FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



### High Volume Air Sampler Calibration Worksheet

Project Site:	General Electric International Operations Company Inc.	Barometric Pressure (mm Hg):	760
Calibrate Location:	Ban Mahong	Temperature (°C):	33
Calibrate Date:	1-Mar-24	High Volume ID:	RYG_P30189
CalibrationSheet No.:	C-010324-RYG_P30189	High Volume Model:	TE-5000X
Calibrator ID:	RYG_P30206	High Volume S/N:	4797
Calibrator Model:	TE-5020A	Calibrator Slope:	0.9245
Calibrator S/N:	1543	Calibrator Intercept:	-0.0052

Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>a</sub> (m <sup>3</sup> /min)	I-Chart (CFM)	Linear Regression
1	2.0	0.991	32	Slope: 36.4398
2	2.4	1.074	36	Intercept: -3.3697
3	2.9	1.180	40	Correlation Coefficient: 0.9985
4	3.5	1.295	44	
5	4.2	1.418	48	



Calibrated by: John  
(Mr Jaradawee Srikrakha)  
Field Scientist(2)

Approved by: Ngong  
(Mr Ngong Jintarapong)  
Entire Field Coordinator Scientist (3)

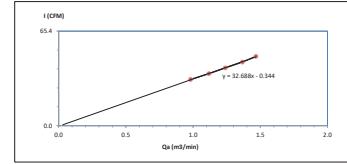
FORM NO. F-06-074 REVISION NO.2 ISSUE DATE: 20/11/23



### High Volume Air Sampler Calibration Worksheet

Project Site:	General Electric International Operations Company Inc.	Barometric Pressure (mm Hg):	760
Calibrate Location:	Ban Kachadung (Wat Kachadung)	Temperature (°C):	33
Calibrate Date:	1-Mar-24	High Volume ID:	RYG_P30191
CalibrationSheet No.:	C-010324-RYG_P30191	High Volume Model:	TE-5000X
Calibrator ID:	RYG_P30206	High Volume S/N:	5330
Calibrator Model:	TE-5020A	Calibrator Slope:	0.9245
Calibrator S/N:	1543	Calibrator Intercept:	-0.0052

Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>a</sub> (m <sup>3</sup> /min)	I-Chart (CFM)	Linear Regression
1	2.0	0.991	32	Slope: 32.6883
2	2.4	1.117	36	Intercept: -0.3440
3	3.2	1.229	40	Correlation Coefficient: 0.9988
4	3.9	1.366	44	
5	4.5	1.467	48	



Calibrated by: John  
(Mr Jaradawee Srikrakha)  
Field Scientist(2)

Approved by: Ngong  
(Mr Ngong Jintarapong)  
Entire Field Coordinator Scientist (3)

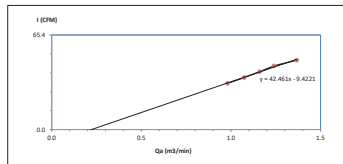
FORM NO. F-06-074 REVISION NO.2 ISSUE DATE: 20/11/23



### High Volume Air Sampler Calibration Worksheet

Project Site:	General Electric International Operations Company Inc.	Barometric Pressure (mm Hg):	760
Calibrate Location:	Ban Nongkrak (Wat Nongkrak)	Temperature (°C):	33
Calibrate Date:	1-Mar-24	High Volume ID:	RYG_P30187
CalibrationSheet No.:	C-010324-RYG_P30187	High Volume Model:	TE-5000X
Calibrator ID:	RYG_P30206	High Volume S/N:	4795
Calibrator Model:	TE-5020A	Calibrator Slope:	0.9245
Calibrator S/N:	1543	Calibrator Intercept:	-0.0055

Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>a</sub> (m <sup>3</sup> /min)	I-Chart (CFM)	Linear Regression
1	2.0	0.981	32	Slope: 42.6610
2	2.4	1.074	36	Intercept: -9.4221
3	2.9	1.159	40	Correlation Coefficient: 0.9963
4	3.2	1.239	44	
5	3.9	1.366	48	



Calibrated by: John  
(Mr Jaradawee Srikrakha)  
Field Scientist(2)

Approved by: Ngong  
(Mr Ngong Jintarapong)  
Entire Field Coordinator Scientist (3)

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

Sartorius (Thailand) Co., Ltd.  
119 Rama 9 Road, Bangkok, Thailand 10330  
Tel: +66 2043 82810, E-mail: service.thailand@sartorius.com



## Certificate of Calibration

Model Number:	LA1105-F	Certificate No.:	24820018
Description:	Analytical Balance	Issued Date:	Friday, February 23, 2024
Serial Number:	25020884	Expiry Date:	22/01/25
ID No.:	RYG_EN0001	Page No.:	1/1
Manufacturer:	Sartorius	REVIEWED BY:	Thanyam M.

Customer Name: AJS Laboratory Group (Thailand) Co., Ltd. (Banyang Branch)  
815/10 Moo 5 T. Maesat Kh. A. Prachin Buri, Rayong 21140, Thailand

Calibrated Place: AJS Laboratory Group (Thailand) Co., Ltd. (Banyang Branch)  
815/10 Moo 5 T. Maesat Kh. A. Prachin Buri, Rayong 21140, Thailand

Calibrated By: Mr. Chanchai Pichai  
Calibration Date: Thursday, February 22, 2024

Calibration Procedure No.: This calibration was conducted by using in-house calibration procedure number (W-023) Based on UKAS LAB 14: 2019

Metrological data: Capacity: 150 g Repeatability: 0.0001 g Ambient Conditions: Temperature: 23.6 °C ± 0.5 °C Humidity: 54.0 % RH ± 5.0 % RH Pressure: Equipped Condition: ☒ Load: ☐ Air: ☐

Measurement Method: UKAS Publication Ref. Lab 14

The measurement result is the measured 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 Decision by Expansion of Uncertainty in Measurement (D-08). The calibration certificate complies with the requirements of National Standards, which realize the units of measurement according to the International System of Units (SI). Report of Test result can be sent to Sartorius Marketing Specifications.

Traceability:

Model Number	Description	Traceability	Calibration No.	Due Date
Y0011-020-00	Reference weight 100 mg (100.000102000 g)	TC5	162001010	23-Aug-2025
M010-020-00	Reference weight 10 mg (10.000102000 g)	DN34	C19231845	23-Aug-2024

This certificate may only be reproduced after prior written consent with the prior written approval of the Verification Operations Division, Sartorius (Thailand) Co., Ltd.

30F RM 33 04 February 2022



Sartorius (Thailand) Co., Ltd.  
119 Rama 9 Road, Bangkok, Thailand 10330  
Tel: +66 2043 82810, E-mail: service.thailand@sartorius.com



## Certificate of Calibration

Model Number:	LA1105-F	Certificate No.:	24820018
Description:	Analytical Balance	Issued Date:	Friday, February 23, 2024
Serial Number:	25020884	Reference No.:	220105
ID No.:	RYG_EN0001	Page No.:	2 of 2
Manufacturer:	Sartorius		

### Calibration Results : Without Adjustment

Repeatability		Eccentricity (Off-center loading error)	
The repeatability is the ability of a weighing instrument to display the same result for the same mass when the same mass is weighed repeatedly under the same conditions. The standard deviation is used to express the repeatability.		The off-center loading error is caused by the off-center loading of the mass on the weighing pan. The standard deviation is used to express the repeatability.	
Normal Value (Low Load)	10.0000 g	Normal Value	50.0000 g
Tolerance	±0.0001 g	Tolerance	±0.0001 g
Measured Value	9.9999 g	Measured Value	49.9999 g
Standard Deviation	0.00005 g	Standard Deviation	0.00005 g

Linearity	
The linearity is the ability of a weighing instrument to display the same result for the same mass when the same mass is weighed repeatedly under the same conditions. The standard deviation is used to express the repeatability.	
Normal Value	Measured Value
10.0000 g	9.9999 g
20.0000 g	19.9998 g
30.0000 g	29.9997 g
40.0000 g	39.9996 g
50.0000 g	49.9995 g
60.0000 g	59.9994 g
70.0000 g	69.9993 g
80.0000 g	79.9992 g
90.0000 g	89.9991 g
100.0000 g	99.9990 g

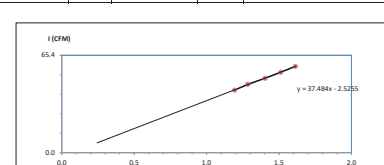
30F RM 33 04 February 2022



### High Volume Air Sampler Calibration Worksheet

Project Site:	General Electric International Operations Company Inc.	Barometric Pressure (mm Hg):	760
Calibrate Location:	Ban Mahong	Temperature (°C):	33
Calibrate Date:	1-Mar-24	High Volume ID:	RYG_P30195
CalibrationSheet No.:	C-010324-RYG_P30195	High Volume Model:	TE-5170D
Calibrator ID:	RYG_P30206	High Volume S/N:	5692
Calibrator Model:	TE-5020A	Calibrator Slope:	1.47433
Calibrator S/N:	1543	Calibrator Intercept:	-0.01503

Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>a</sub> (m <sup>3</sup> /min)	I-Chart (CFM)	Linear Regression
1	3.1	1.1935	45	Slope: 37.4841
2	3.6	1.2850	46	Intercept: -2.5255
3	4.3	1.4630	50	Correlation Coefficient: 0.9994
4	5.0	1.5317	54	
5	5.7	1.6331	58	



Calibrated by: John  
(Mr Jaradawee Srikrakha)  
Field Scientist(2)

Approved by: Ngong  
(Mr Ngong Jintarapong)  
Entire Field Coordinator Scientist (3)

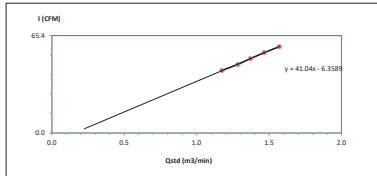
FORM NO. F-06-073 REVISION NO.2 ISSUE DATE: 20/11/23



### High Volume Air Sampler Calibration Worksheet

Project Site :	General Electric International Operations Company Inc.	Barometric Pressure (mm Hg) :	760
Calibrate Location :	Ban Krachadeng (Wad Krachadeng)	Temperature (°C) :	33
Calibrate Date :	1-Mar-24	High Volume ID :	RYG-F30296
Calibration Sheet No. :	C-010324-RYG-F30296	High Volume Model :	TE-5170D
Calibrator ID :	RYG-F30296	High Volume S/N :	5688
Calibrator Model :	TE-5028A	Calibrator Slope :	1.47433
Calibrator S/N :	1543	Calibrator Intercept :	-0.01503

Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>std</sub> (m³/min)	1: Chart (CFM)	Linear Regression
1	3.0	1.1744	42	Slope: 41.0401
2	3.6	1.2850	46	Intercept: -6.3589
3	4.1	1.3703	50	Correlation Coefficient: 0.9993
4	4.7	1.4661	54	
5	5.4	1.5704	58	



Calibrated by : *Jan*  
(Mr. Jaradrawee Struksa)  
Field Scientist (2)

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

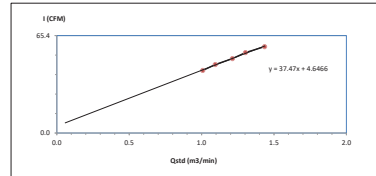
FORM NO.: F-06-073 REVISION NO.: 2 ISSUE DATE: 20/11/23



### High Volume Air Sampler Calibration Worksheet

Project Site :	General Electric International Operations Company Inc.	Barometric Pressure (mm Hg) :	760
Calibrate Location :	Ban Nongabok (Wad Nongabok)	Temperature (°C) :	33
Calibrate Date :	1-Mar-24	High Volume ID :	RYG-F30292
Calibration Sheet No. :	C-010324-RYG-F30292	High Volume Model :	TE-5170D
Calibrator ID :	RYG-F30296	High Volume S/N :	5497
Calibrator Model :	TE-5028A	Calibrator Slope :	1.47433
Calibrator S/N :	1543	Calibrator Intercept :	-0.01503

Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>std</sub> (m³/min)	1: Chart (CFM)	Linear Regression
1	2.2	1.0078	42	Slope: 37.4698
2	2.6	1.0943	46	Intercept: 4.6466
3	3.2	1.2124	50	Correlation Coefficient: 0.9976
4	3.7	1.3025	54	
5	4.5	1.4349	58	



Calibrated by : *Jan*  
(Mr. Jaradrawee Struksa)  
Field Scientist (2)

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

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

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

Accredited calibration laboratory  
ISO/IEC 17025:2017  
ACC-100-10-2002  
CALIBRATION 0367

Air speed measurement laboratory  
Calibration services department.

Certificate Number  
CL-058-68

### CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

**MEASUREMENT ITEM**  
MANUFACTURE  
MODEL/TYPE  
SERIAL NUMBER  
IS NUMBER  
CONDITION AS RECEIVED  
CUSTOMER

**RECEIVED DATE**  
17 Jan 2023

**MEASUREMENT DATE**  
18 Jan 2023

**ISSUE DATE**  
19 Jan 2023

**ENVIRONMENTAL CONDITIONS**  
Ambient condition in the laboratory is as follows:  
Temperature: 23.0 ± 0.5 °C  
Relative Humidity: 55.0 ± 0.5 %RH  
Atmospheric Pressure: 1013.0 ± 0.5 hPa

**PLACE OF CALIBRATION**  
- Effect type wind tunnel of Jiranatee Associates Co., Ltd.

**CALIBRATION CONDITIONS**  
- Wind tunnel cross section area: 300 cm²  
- Wind direction: Upward flow  
- Diameter of measuring pipe: 129 mm  
- Backflow rate of test object: 0.143 l/s

**Preconditioning**  
Measurement condition: 24 hours at ambient conditions.  
The average values during measurement are 23.40 °C, 55.0 %RH and 1013.0 hPa.

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

Calibrated by: *Mr. Jaradrawee Struksa*  
J NAC  
JIRANATEE ASSOCIATES CO., LTD.

Approved signature: *Mr. Noppong Juntanaporn*  
Calibration Department Manager

**Remarks:**  
- Fully calibrated area of the wind tunnel.  
- Provided measurement area of the tested object include mounting pipe.  
- Diameter of measuring pipe: 129 mm.  
- Backflow rate: 0.143 l/s.

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

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

Accredited calibration laboratory  
ISO/IEC 17025:2017  
ACC-100-10-2002  
CALIBRATION 0367

Air speed measurement laboratory  
Calibration services department.

Certificate Number  
CL-058-68

### CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

**MEASUREMENT RESULTS**  
The cup anemometer, Unit Under Calibration (UUC) was received at 10 m/s for 5 minutes prior to calibration being performed. The standard air velocity 5.0 m/s to 3 m/s was calculated by a standard air velocity transducer and given 5 m/s to 30 m/s was calculated by a pitot tube with pressure differential pressure meter which was installed at 10 m/s and 30 m/s 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 30 m/s in calibration interval of 1 m/s. The results of calibration and associated measurement uncertainties are reported in the table below.

UUC (m/s)	Temp. wind tunnel (°C)	Temp. room (°C)	UUC (m/s)	Error (m/s)	U (m/s)
0.584	24.59	24.00	2.7	-0.3	0.24
2.029	24.98	24.00	1.0	-0.3	0.18
3.544	25.06	24.00	1.0	-0.2	0.15
4.136	24.20	24.00	1.0	-0.3	0.20
5.40	24.80	24.00	4.0	-0.2	0.22
5.96	24.24	24.00	5.0	-0.2	0.17
7.05	23.90	24.00	6.0	-0.2	0.18
8.17	24.14	24.00	6.0	-0.3	0.19
9.25	23.68	24.00	6.0	-0.6	0.20
10.10	23.68	24.00	8.0	-0.2	0.19
11.16	23.74	24.00	10.0	-0.2	0.21
12.10	23.62	24.00	10.0	-0.2	0.24
13.19	23.70	24.00	10.0	-0.3	0.23
14.20	23.76	24.00	10.0	-0.3	0.26
15.24	23.66	24.00	11.0	-0.1	0.21
16.30	23.75	24.00	10.0	-0.3	0.25

**Remarks:**  
- Calibration results only valid for the tested measurement and environmental conditions during the calibration test only.  
- Uncertainty of standard.  
- Uncertainty 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. Remarks: The operation of the cup anemometer is not in use due to being obsolete.

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

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

Accredited calibration laboratory  
ISO/IEC 17025:2017  
ACC-100-10-2002  
CALIBRATION 0367

Air speed measurement laboratory  
Calibration services department.

Certificate Number  
CL-058-68

### CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

**MEASUREMENT ITEM**  
MANUFACTURE  
MODEL/TYPE  
SERIAL NUMBER  
IS NUMBER  
CONDITION AS RECEIVED  
CUSTOMER

**RECEIVED DATE**  
17 Jan 2023

**MEASUREMENT DATE**  
18 Jan 2023

**ISSUE DATE**  
19 Jan 2023

**ENVIRONMENTAL CONDITIONS**  
Ambient condition in the laboratory is as follows:  
Temperature: 23.0 ± 0.5 °C  
Relative Humidity: 55.0 ± 0.5 %RH  
Atmospheric Pressure: 1013.0 ± 0.5 hPa

**PLACE OF CALIBRATION**  
- Effect type wind tunnel of Jiranatee Associates Co., Ltd.

**CALIBRATION CONDITION**  
- Wind tunnel cross section area: 300 cm²  
- Wind direction: Upward flow  
- Diameter of measuring pipe: 129 mm  
- Backflow rate of test object: 0.143 l/s

**Preconditioning**  
Measurement condition: 24 hours at ambient conditions.  
The average values during measurement are 23.40 °C, 55.0 %RH and 1013.0 hPa.

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

Calibrated by: *Mr. Jaradrawee Struksa*  
J NAC  
JIRANATEE ASSOCIATES CO., LTD.

Approved signature: *Mr. Noppong Juntanaporn*  
Calibration Department Manager

**Remarks:**  
- Fully calibrated area of the wind tunnel.  
- Provided measurement area of the tested object include mounting pipe.  
- Diameter of measuring pipe: 129 mm.  
- Backflow rate: 0.143 l/s.

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

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

Accredited calibration laboratory  
ISO/IEC 17025:2017  
ACC-100-10-2002  
CALIBRATION 0367

Air speed measurement laboratory  
Calibration services department.

Certificate Number  
CL-058-68

### CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

**MEASUREMENT RESULTS**  
The wind direction sensor was calibrated against standard rotary encoder by comparison method. During calibration, the measurement was carried out at 45° towards to clockwise and counterclockwise direction after offset adjustment has been made. The flow speed of wind tunnel usually 3 m/s is held 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)	θ° (°)	θ° (°)	Error (°)	U (°)
0.000	0	0	0	0.10
0.000	45	45	-4	0.06
0.001	90	90	-3	0.04
0.001	135	135	-3	0.14
0.001	180	180	0	0.14
0.001	225	225	0	0.08
0.001	270	270	4	0.08
0.001	315	315	2	0.14

**Remarks:**  
- Calibration results only valid for the tested measurement and environmental conditions during the calibration test only.  
- Uncertainty of standard.  
- Uncertainty of Unit Under Calibration.

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







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

Accredited calibration laboratory  
ISO/IEC 17025  
ACCREDITED  
CALIBRATION 2007

Accredited measurement laboratory  
CALIBRATION 2007

Private Association Co., Ltd.  
45/1-45/1-1 Sathitorn Rd., Banghuan, Bangkok 10700 Thailand  
Tel: 02-2433-8800  
Fax: 02-2433-8800  
E-mail: jira@jiranatee.com

Certificate Number  
G-007-06

### CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

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

**RECEIVED DATE**  
**MEASUREMENT DATE**  
**ISSUE DATE**

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

**PLACE OF CALIBRATION**

**CALIBRATION CONDITION**

**Preconditioning**  
**Measurement Condition**

**TABULATION OF RESULTS:**  
The table on next page gives the measurement results.

Calibrated by:  
[Signature]  
[Signature]

Approved signature:  
[Signature]  
[Signature]

Remarks:  
1. This certificate is valid for the period of 12 months.  
2. The calibration results are valid for the period of 12 months.  
3. The calibration results are valid for the period of 12 months.

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  
G-007-06

Page 1 of 2 Pages

### MEASUREMENT RESULTS

The wind direction sensor was calibrated against standard reference method. During calibration, the measurement was carried out at 45° intervals in clockwise and counter-clockwise directions after adjustment has been made. The flow speed of wind tunnel (usually 1 m/s) is kept constant with 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	W <sub>1</sub> Degree (°)	W <sub>2</sub> Degree (°)	W <sub>3</sub> Degree (°)	W <sub>4</sub> Degree (°)
0.000	0	0	0	0.03
0.000	45	45	45	0.03
0.000	90	90	90	0.03
0.000	135	135	135	0.03
0.000	180	180	180	0.03
0.000	225	225	225	0.03
0.000	270	270	270	0.03
0.000	315	315	315	0.03

Remarks:  
1. Calibration results are valid for the period of 12 months.  
2. The calibration results are valid for the period of 12 months.

Signature of issuing Laboratory

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

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

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

45/1-45/1-1 Sathitorn Rd., Banghuan, Bangkok 10700 THAILAND  
Tel: 02-2433-8800 Fax: 02-2433-8800 e-mail: center@sithiporn.com http://www.sithiporn.com

Cert. No.: ACC23029  
Job No.: YC6AC0100  
Page: 1 of 3

### Calibration Certificate

**Equipment:** SOUND CALIBRATOR  
**Manufacturer:** RION  
**Model:** NC-74  
**Serial No.:** 3478123  
**ID No.:** RYG\_F90215

**Condition As Found:** GOOD

**Customer:** ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATHANAKAN 40, PHATHANAKAN ROAD,  
KHWAENG PHATHANAKAN, 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:** [Signature]  
( Natchanon Pitsanum )

**Approved by:** [Signature]  
( Thanakul Petchum )

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

QP-TS12-04-04-02064

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

45/1-45/1-1 Sathitorn Rd., Banghuan, Bangkok 10700 THAILAND  
Tel: 02-2433-8800 Fax: 02-2433-8800 e-mail: center@sithiporn.com http://www.sithiporn.com

Cert. No.: ACC23029  
Job No.: YC6AC0100  
Page: 2 of 3

### Continuation of Calibration Certificate

**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 is 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	MY52201004	EF-0010-23	13-FEB-24
Digital Multimeter	33461A	MY52200716	EF-0010-23	13-FEB-24
Digital Multimeter	33461A	MY60024273	EF-0010-23	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4188	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAI	34560495	AA-3002-23	14-FEB-24
Audio Analyzer	AVR-3366A	V74488069	EF-0012-23	19-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)

QP-TS12-04-04-02064

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

45/1-45/1-1 Sathitorn Rd., Banghuan, Bangkok 10700 THAILAND  
Tel: 02-2433-8800 Fax: 02-2433-8800 e-mail: center@sithiporn.com http://www.sithiporn.com

Cert. No.: ACC23029  
Job No.: YC6AC0100  
Page: 3 of 3

### Continuation of Calibration Certificate

**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

QP-TS12-04-04-02064

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

45/1-45/1-1 Sathitorn Rd., Banghuan, Bangkok 10700 THAILAND  
Tel: 02-2433-8800 Fax: 02-2433-8800 e-mail: center@sithiporn.com http://www.sithiporn.com

Cert. No.: ACC23029  
Job No.: YC6AC0100  
Page: 1 of 3

### Calibration Certificate

**Equipment:** SOUND LEVEL METER  
**Manufacturer:** RION  
**Model:** NL-42 / Microphone UC-52 / Pre-amplifier NH-24  
**Serial No.:** 01173611 / 172173 / 74023  
**ID No.:** RYG\_F90390

**Condition As Found:** GOOD

**Customer:** ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATHANAKAN 40, PHATHANAKAN ROAD,  
KHWAENG PHATHANAKAN, 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:** 01 NOVEMBER 2023  
**Calibration Date:** 07-08 NOVEMBER 2023  
**Date of Issue:** 14 NOVEMBER 2023

**Calibrated by:** [Signature]  
( Natchanon Pitsanum )

**Approved by:** [Signature]  
( Thanakul Petchum )

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

QP-TS12-04-04-02064

## Continuation of Calibration Certificate

Cert. No. : ACL23348  
Job No. : VC67AC0023  
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 Acoustic chamber and Reference Standard Instruments.

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

## Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48917076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52300242	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53202104	EEL_BP 3000566	13-FEB-24
Digital Multimeter	33461A	MY5320076	EEL_BP 2000566	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL_BP 3100566	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-CKA1	34566495	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-TS12-04-04-02064

## Continuation of Calibration Certificate

Cert. No. : ACL23348  
Job No. : VC67AC0023  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
92.9 (93.98)	93.9	0.0	±0.3

## 2. Self-generated noise

## 2.1 Normal test

Measured Value (dB)
16.9

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

Frequency Weighting	Measured value (dB)
A-weight	14.3
C-weight	20.7
Flat	25.6

## 3. Acoustical signal tests of frequency weightings

Motor 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	0.6	0.7	0.6	±1.5
1000	-0.1	-0.1	-0.1	±1.0
8000	1.5	1.6	1.7	±5.0

QF-TS12-04-04-02064

## Continuation of Calibration Certificate

Cert. No. : ACL23348  
Job No. : VC67AC0023  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.1	0.1	±1.1
136.0	136.1	0.1	±1.1
135.0	135.1	0.1	±1.1
134.0	134.1	0.1	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.1	0.1	±1.1
124.0	124.0	0.0	±1.1
119.0	119.1	0.1	±1.1
114.0	114.1	0.1	±1.1
109.0	109.1	0.1	±1.1
104.0	104.1	0.1	±1.1
99.0	99.0	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
29.0	29.9	-0.1	±1.1
24.0	25.9	-0.1	±1.1
19.0	20.0	-0.1	±1.1
14.0	15.9	-0.1	±1.1
9.0	10.9	-0.1	±1.1
4.0	5.9	-0.1	±1.1

QF-TS12-04-04-02064

## Continuation of Calibration Certificate

Cert. No. : ACL23348  
Job No. : VC67AC0023  
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	✓	-	0.3	0.6
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	✓	-	0.3	0.6
For 10 Hz to 4 kHz	✓	-	0.3	0.7
For > 4 kHz to 10 kHz	✓	-	0.3	1.0
For > 10 kHz to 20 kHz	✓	-	0.2	0.2
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.3
6. Long-term stability	✓	-	0.2	0.3
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. Test 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 limits and the Maximum-permitted uncertainty of measurement.

QF-TS12-04-04-02064

## Continuation of Calibration Certificate

Cert. No. : ACL23348  
Job No. : VC67AC0023  
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	-0.1	-0.1	±1.5
500	0.0	0.0	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.0	0.0	±5.0

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

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

## 5.2 Time weighting at 1 kHz

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

## 6. Long-term stability

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

QF-TS12-04-04-02064

## Continuation of Calibration Certificate

Cert. No. : ACL23348  
Job No. : VC67AC0023  
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. Test burst response

Time Weighting	Test burst duration, T <sub>b</sub> (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	116.9	-0.1	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	0.25	1	108.0	108.0	0.0	1.5 ; -5.0
	2	8	117.0	117.0	0.0	±1.0
	200	800	134.0	134.0	0.0	±1.0
SEL	0.25	1	99.0	98.8	-0.2	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	136.4	0.0	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±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-TS12-04-04-02064



#### 11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.6	89.3	-0.1	+1.5

#### 12. High level stability

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

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

End of Calibration Certificate

QR-TS120404020864

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

403-405/1 Srinakharin Road, Bangkum, Bangkok, 10250 Thailand  
Tel: +66 2433 8331 Email: calibration@sithiporn.com



Cert. No. : ACL24095  
Job No. : VC67AC0058  
Pages : 2 of 9

#### Calibration Procedure : CP-AC-02

#### Calibration Method :

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

For test results of each item were made by observation of each instrument display and also with SLM's display.

#### Condition of this result of calibration :

##### 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY3202742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY3320104	EEL-RP 300266	12-FEB-24
Digital Multimeter	33461A	MY3320076	EEL-RP 290266	12-FEB-24
Digital Multimeter	33461A	MY80024273	EEL-RP 310266	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	34500495	AA-1002-23	14-FEB-24

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

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

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

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

403-405/1 Srinakharin Road, Bangkum, Bangkok, 10250 Thailand  
Tel: +66 2433 8331 Email: calibration@sithiporn.com



Cert. No. : ACL24095  
Job No. : VC67AC0058  
Pages : 4 of 9

#### 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)
24.0

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

Frequency Weighting	Measured value (dB)
A-weight	22.9
C-weight	24.9
Flat	27.0

##### 3. Electrical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			Acceptance Limits
	Flat	C-weight	A-weight	
125	0.3	0.3	0.3	+1.5
1000	0.1	0.1	0.1	+1.0
8000	0.1	0.2	0.2	+0.6

403-405/1 Srinakharin Road, Bangkum, Bangkok, 10250 Thailand  
Tel: +66 2433 8331 Email: calibration@sithiporn.com



Cert. No. : ACL24096  
Job No. : VC67AC0058  
Pages : 1 of 9

#### Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-21/ Microphone UC-52 / Preamplifier NF-21  
Serial No. : 00465461 / (00061 / 1951)  
ID No. : RYQ JS0007

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN-40, PHATTHANAKAN ROAD,  
KHWAENG PHATTHANAKAN, KHUET 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 : 23-26 JANUARY 2024  
Date of Issue : 29 JANUARY 2024

Calibrated by : Nitthikon Pimponan

Approved by :  
( Thumthorn Pichum )

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

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Tel: +66 2433 8331 Email: calibration@sithiporn.com



Cert. No. : ACL24095  
Job No. : VC67AC0058  
Pages : 3 of 9

#### Summary of Measurement Result :

Parameter	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	0.2	N/A
2. Self-generated noise	0.1	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. Time burst response	0.2	0.3
10. Peak C sound level	0.2	0.35
11. Overload indication	0.2	0.25
12. High level stability	0.1	0.1

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

403-405/1 Srinakharin Road, Bangkum, Bangkok, 10250 Thailand  
Tel: +66 2433 8331 Email: calibration@sithiporn.com



Cert. No. : ACL24095  
Job No. : VC67AC0058  
Pages : 5 of 9

#### 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	-0.3	-0.1	-0.1	+2.0
125	-0.1	-0.1	-0.2	+1.5
250	-0.1	-0.1	-0.1	+1.5
500	0.0	0.0	-0.1	+1.5
1000	0.0	0.0	0.0	+1.0
2000	0.1	0.1	0.1	+2.0
4000	0.1	0.1	0.0	+2.0
8000	0.1	0.1	0.1	+2.0

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

##### 5.1 Frequency weightings at 1 kHz

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

##### 5.2 Time weighting at 1 kHz

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

#### 6. Long-term stability

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

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

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
135.0	135.0	0.0	±1.1
134.0	134.0	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

T. Petch

#### 10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, 1 cycle (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	130.0	130.0	0.0	±3.0
One	133.4	132.6	-0.8	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	130.0	130.0	0.0	±2.0
Positive half cycle	132.4	133.0	1.2	±2.0
Negative half cycle	132.4	133.0	1.2	±2.0

#### 11. Overload indication

Measured value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	89.4	±1.5
Negative one-half cycle	89.3	±1.5

T. Petch

### Calibration Certificate

Equipment : SOUND CALIBRATOR  
Manufacturer : RION  
Model : NC-74  
Serial No. : 34178124  
ID No. : RYG 758216

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PIATTHANAKAN 40 PIATTHANAKAN ROAD,  
KIYAWONG PIATTHANAKAN, KHU 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 : Natsakorn Praprasan

Approved by : T. Petch  
( Thanakul Petchum )

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

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

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	94.0	94.0	0.0	±1.1
120	94.0	94.0	0.0	±1.1
110	94.0	94.0	0.0	±1.1
100	94.0	94.0	0.0	±1.1
90	94.0	94.0	0.0	±1.1

#### Level linearity on each level range

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	41.8	41.8	0.2	±1.1
120	32.3	32.0	-0.3	±1.1

#### 9. Tone burst response

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

T. Petch

#### 12. High level stability

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

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

End of Calibration Certificate

T. Petch

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 duration of the sound calibration 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	MY52202742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY51220104	EEJ-HP 3010266	13-FEB-24
Digital Multimeter	33461A	MY51220076	EEJ-HP 3010267	13-FEB-24
Digital Multimeter	33461A	MY60024273	EEJ-HP 3110266	14-FEB-24
Programmable Attenuator	MAT-1070	82100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAI	3456005	AA-3002-23	14-FEB-24
Audio Analyzer	AVR-3360A	V744B069	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. Petch



Result of calibration :

1. Sound pressure level

Specified sound pressure level (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (dB)	Acceptance limit (dB)
94	94.23	0.23	0.14	0.40

2. Frequency

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

3. Total distortion

Measured value (%)	Uncertainty (%)	Acceptance limit (%)
1.96	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

QI-FS12-04-01-02064

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by based on IEC-61672-1 (2013) Standard for sound level meter (SLM). The SLM had been in Acoustical and Electrical signal tests of frequency weighting with Acoustic chamber and Reference Standard Instruments.

For your results of each item were made by observation of each instrument display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY32202742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY3220104	EEL-RP 300266	13-FEB-24
Digital Multimeter	33461A	MY3220076	EEL-RP 290266	13-FEB-24
Digital Multimeter	34461A	MY00024273	EEL-RP 310266	14-FEB-24
Programmable Acoustical	NAT-107B	A2180114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1061-23	14-FEB-24
Measuring Amplifier	NA-42KA1	34560495	AA-5002-23	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).

QI-FS12-04-01-02064

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.90)	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	13.6
C-weight	17.7
Flat	23.2

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.0	0.0	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
8000	2.0	2.1	2.1	±5.0

QI-FS12-04-01-02064

Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42 Microphone UC-52 / Preamplifier N01-24  
Serial No. : 00597169 / 180411 / 83181  
ID No. : RYG\_FS0439

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
180 PHATHANAKAN 46 PHATHANAKAN ROAD,  
KHUWAENG PHATHANAKAN, KHUET SUAN LUANG,  
BANGKOK, 10250 THAILAND.

Location :  
Ambient Temperature : ( 23.0 ± 1 ) °C  
Pressure : ( 101.3 ± 0.3 ) 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 : Natchanon Pongpattana

Approved by :

T. Petchu  
( Thumak Petchu )

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

QI-FS12-04-01-02064

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	✓	-	0.2	0.6
125 Hz	✓	-	0.2	0.6
1000 Hz	✓	-	0.2	0.6
8000 Hz	✓	-	0.2	0.7
4. Electrical signal tests of frequency weightings	✓	-	0.2	0.6
For 10 Hz to 4 kHz	✓	-	0.2	0.6
For > 4 kHz to 10 kHz	✓	-	0.2	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-weight 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.

QI-FS12-04-01-02064

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long-term stability

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

QI-FS12-04-01-02064

Cert. No. : ACL23322  
Job No. : VC07AC0011  
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	±1.3
136.0	136.0	0.0	±1.3
135.0	135.0	0.0	±1.3
134.0	134.0	0.0	±1.3
133.0	133.0	0.0	±1.3
132.0	132.0	0.0	±1.3
131.0	131.0	0.0	±1.3
129.0	129.0	0.0	±1.3
124.0	124.0	0.0	±1.3
119.0	119.0	0.0	±1.3
114.0	114.0	0.0	±1.3
109.0	109.0	0.0	±1.3
104.0	104.0	0.0	±1.3
99.0	99.0	0.0	±1.3
94.0	94.0	0.0	±1.3
89.0	89.0	0.0	±1.3
84.0	84.0	0.0	±1.3
79.0	79.0	0.0	±1.3
74.0	74.0	0.0	±1.3
69.0	69.0	0.0	±1.3
64.0	64.0	0.0	±1.3
59.0	59.0	0.0	±1.3
54.0	54.0	0.0	±1.3
49.0	49.0	0.0	±1.3
44.0	44.0	0.0	±1.3
39.0	39.0	0.0	±1.3
34.0	34.0	0.0	±1.3
30.0	30.0	0.0	±1.3
29.0	29.0	0.0	±1.3
28.0	28.0	0.0	±1.3
27.0	27.0	0.0	±1.3
26.0	25.9	-0.1	±1.3
25.0	25.0	0.0	±1.3

QP-F312-04-04-02064

T. Petchu

Cert. No. : ACL23322  
Job No. : VC07AC0011  
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

QP-F312-04-04-02064

T. Petchu

Cert. No. : ACL23321  
Job No. : VC07AC0011  
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 been tested to Acoustic and Electrical signal tests of frequency weighting with Acoustic chamber and Reference Standard Instruments.

For test results of each item were made by observation of each instrument display and also with SLM's display.

## Condition of this result of calibration :

## 1. Reference standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017976	EF-0069-23	07-FEB-24
Waveform Generator	33511B	MY53202342	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL-RP 300066	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL-RP 290066	13-FEB-24
Digital Multimeter	34461A	MY60032273	EEL-RP 314066	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	34500495	AA-3002-23	14-FEB-24

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

3. This certificate is intended to be the international system of units maintained at:

3.1 National Institute of Metrology (Thailand).

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

QP-F312-04-04-02064

T. Petchu

Cert. No. : ACL23322  
Job No. : VC07AC0011  
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	±1.3

## 9. Tone burst response

Time Weighting	Tone burst duration, T <sub>b</sub> (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 : -5.0
	2	3	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
Cut	136.4	136.3	-0.1	±3.0

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

QP-F312-04-04-02064

T. Petchu

451-451/1 Sithiporn Rd., Bangbun, Bangkok 10700 THAILAND  
Tel: 2433-8800 Fax: 2433-4629 e-mail: cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACL23321  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NR-421 Microphone UC-52 / Preamplifier NH-24  
Serial No. : 00597168 / 179117 / 87524  
ID No. : RYG\_F90438

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATHANAKAN 40, PHATHANAKAN ROAD,  
KIRAWANG PHATHANAKAN, 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 : Natchakorn Pongpattana

Approved by : T. Petchu  
( Thanakorn Pongpattana )

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

QP-F312-04-04-02064

Cert. No. : ACL23321  
Job No. : VC07AC0011  
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				
For 125 Hz	✓	-	0.3	0.6
For 1000 Hz	✓	-	0.3	0.6
For 5000 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	0.25
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

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

QP-F312-04-04-02064

T. Petchu



## Continuation of Calibration Certificate

Cert. No. : ACL23321  
Job No. : VC67AC0011  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit
93.9 (93.90)	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	13.0
C-weight	17.9
Flat	23.2

## 3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.1	0.1	0.1	±1.5
1000	0.0	0.0	0.0	±1.0
8000	2.0	2.0	2.1	±5.0

QP-TS12-04-04-020040

T. Pithan

## Continuation of Calibration Certificate

Cert. No. : ACL23321  
Job No. : VC67AC0011  
Pages : 7 of 8

## 6. Level linearity including the level range control

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

## 9. Tone burst response

Time Weighting	Tone burst duration, T <sub>b</sub> (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5; -5.0
	2	8	117.0	117.0	0.0	1.0; -2.5
	200	800	134.0	134.0	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 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	135.6	-0.8	±3.0

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

QP-TS12-04-04-020040

T. Pithan



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67-0232

MTC No. EEL- BP. 1750167

## CALIBRATION CERTIFICATE

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

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

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

Sul IC, Bangpoo Industrial Estate, Sukharnvith Rd., A-Muang, Samutprakan 10280.

Instrument Calibrated :

Description : Sound Level Meter

Manufacturer : Rion

Model : NR-42

Serial No. : 00709746 (ID-RVGL F50491)

Microphone : UC-52 No.187332

Preamplifier : NR-24 No.01297

Standards used :

1. Band Pass Filter Waveform 752A S/N 90010494.
2. Condenser Microphone Brüel&Kjær 4180 S/N 288971.
3. Decade Attenuator Ando AI-206 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 128037.
6. Digital Multimeter Fluke 8520A S/N 4985007.
7. Photophone Rion NC-72 S/N 00402446.
8. Monitoring Amplifier Brüel&Kjær 2636 S/N 1517884.

Date of Receipt : 24 Jan. 2024

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

1/8

The results relate only to the items tested/calibrated on valid receipt.

Adhering the Request/Certificate and validity of the results except in full are prohibited unless written permission is obtained from the licensee of TISTR.

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1. Absolute Sensitivity

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

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

2. Self-generated noise

2.1 Normal test

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

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

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

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

3 / 9

The results relate only to the items tested/calibrated or value assigned.  
Adopting the Report/Certificate and validity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

Head Office: 25 Mu.3 Tambon Khlong Nu, Amphoe Khlong Luang, Changwat Pathumthani 12120, Thailand. Tel: 044 0 2577 9000 Fax: 044 0 2577 9000 E-mail: kumpapattana@tistr.go.th

Office/Laboratory: 101 K. Bangkeng Industrial Estate, Sukhumvit Road, Amphoe Bangkeng, Changwat Samutprakan 10560, Thailand. Tel: 046 0 2523 9100 Fax: 046 0 2523 9100 E-mail: mte@tistr.go.th

Office: 196 Phatthana Road, Chantaburi, Bangkok 10000, Thailand. Tel: 046 0 2579 1230 ext. 5275, 5276, 5277 Fax: 046 0 2579 0992 E-mail: kumpapattana@tistr.go.th

TISTR.MTC.002 Rev.4

5. Long-term stability

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

6. Frequency and time weightings at 1 kHz

6.1 Frequency weightings at 1 kHz

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

6.2 Time weightings at 1 kHz

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

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

5 / 9

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TISTR.MTC.002 Rev.4

7. Level linearity on the reference level range

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
84	83.9	-0.1	1.1	0.30	0.3
99	98.9	-0.1	1.1	0.30	0.3
94	93.9	-0.1	1.1	0.30	0.3
89	88.9	-0.1	1.1	0.30	0.3
44	43.9	-0.1	1.1	0.30	0.3
39	38.9	-0.1	1.1	0.30	0.3
34	33.9	-0.1	1.1	0.30	0.3
29	29.0	0.0	1.1	0.30	0.3
28	28.0	0.0	1.1	0.30	0.3
27	27.0	0.0	1.1	0.30	0.3
26	26.1	0.1	1.1	0.30	0.3
25	25.1	0.1	1.1	0.30	0.3

8. Level linearity including the level range control

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

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

7 / 9

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3. Acoustical signal test of frequency weightings

Frequency (Hz)	A-weight	C-weight	Flat	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
125	0.1	0.2	0.2	1.5	0.45	0.6
1 000	-0.1	-0.1	-0.1	1.0	0.45	0.6
8 000	1.3	1.3	1.4	5.0	0.45	0.7

4. Electrical signal test of frequency weightings

Frequency (Hz)	A-weight	C-weight	Flat	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
63	-0.2	-0.2	-0.1	2.0	0.20	0.6
125	-0.2	-0.1	-0.1	1.5	0.20	0.6
250	-0.1	-0.1	-0.1	1.5	0.20	0.6
500	-0.1	0.0	0.0	1.5	0.20	0.6
1 000	0.0	0.0	0.0	1.0	0.20	0.6
2 000	-0.1	0.0	-0.1	2.0	0.20	0.6
4 000	-0.1	0.0	-0.1	3.0	0.20	0.6
8 000	0.0	0.0	-0.1	5.0	0.20	0.7

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

4 / 9

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7. Level linearity on the reference level range

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

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

6 / 9

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8. Level linearity including the level range control

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

9. Tone burst response

Time Weighting	Duration, T <sub>b</sub> (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	200	126.1	0.1	±1.0	0.30	0.3
	2	109.0	0.0	+1.0; -2.5	0.20	0.3
	0.25	99.9	-0.1	+1.5; -5.0	0.20	0.3
Slow	200	119.6	0.0	±1.0	0.20	0.3
	2	100.0	0.0	+1.0; -5.0	0.20	0.3
	0.25	120.0	0.0	±1.0	0.20	0.3
SEL	2	100.0	0.0	+1.0; -2.5	0.20	0.3
	0.25	90.0	-0.1	+1.5; -5.0	0.20	0.3

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

8 / 9

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)  
Request No. 21-670232 MTC No. EEL-IP: 1750167

**10. Peak C sound level**

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

**11. Overload indication**

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

**12. High-level stability**

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

Calibrated by: (Mr. Tawikan Jamsamut) Approved by: (Mr. Pichai Kiatyong)

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

Electrical and Electronic Standards Laboratory  
Industrial Metrology and Testing Service Centre  
Ref: 2011267012400347005

End of Certificate 9/9

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)  
Request No. 21-670292 MTC No. EEL-IP: 830267

**CALIBRATION CERTIFICATE**

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

Instrument Calibrated: Ambient Environment  
Description: Sound Calibrator Temperature: (23 ± 3) °C  
Manufacturer: Rion Relative Humidity: (50 ± 15) %  
Model: NC/14 Ambient Pressure: (101.325 ± 1.500) kPa  
Serial No.: 3418121 (ID:RYG\_FSO131)

Standards used: 1. Digital Function Synthesizer NF Electronic DF-193A SN 12307.  
2. Measuring Amplifier BrüelKjær 2636 S/N 1537484.  
3. Programmable Attenuator Tansawa TPA-303A SN OF 2214.  
4. Digital Multimeter Agilent 34401A S/N MY4005560.  
5. Pressure Transducer Validus PTC02AD S/N T0650001.  
6. Audio Analyzer Keithley 2015-P S/N4106495.  
7. Condenser Microphone B&K 4180 S/N289871.

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

Date of Receipt: 19 Feb. 2024  
Date of Calibration: 28 Feb. 2024

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)  
Request No. 21-670292 MTC No. EEL-IP: 830267

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

Nominal Output of Unit Under Test = 94 dB re 20µPa at 1000 Hz  
Acoustic Output in dB re 20µPa, Corrected to Reference Conditions: 101.325 kPa, 23.0 °C and 50 %RH.

**1. Sound Pressure Level**

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit (dB)
1/2 inch BrüelKjær 4180	94.01	0.01	±0.10	±0.40 dB

**2. Frequency**

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit (Hz)
1/2 inch BrüelKjær 4180	1000.1	3.1	±1.5	±1.0%

**3. Total Distortion**

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit (%)
1/2 inch BrüelKjær 4180	1.80	±0.50	±3.0%

Note: 1. No adjustment.  
2. The calibrator pressure correction was not included.  
3. The microphone volume correction was included at 0.6 dB from calibration.

Calibrated by: (Mr. Watschai Detchaiyae) Approved by: (Mr. Pichai Kiatyong)

Date of Calibration: 28 Feb. 2024  
Date of Issue: 29 Feb. 2024

Electrical and Electronic Standards Laboratory  
Industrial Metrology and Testing Service Centre  
Ref: 2011267021900719001

End of Certificate 2/2

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)  
Request No. 21-670232 MTC No. EEL-IP: 1776167

**CALIBRATION CERTIFICATE**

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

Instrument Calibrated: Ambient Environment  
Description: Sound Level Meter Temperature: (23 ± 3) °C  
Manufacturer: Rion Relative Humidity: (50 ± 15) %  
Model: NL-42 Ambient Pressure: (101.325 ± 1.5) kPa  
Serial No.: 6090002 (ID:RYG\_FSO493)  
Microphone: UC-52 No.184465  
Preamplifier: N19-2A No.01734

Standards used: 1. Band Pass Filter Wavetek 752A S/N 90010494.  
2. Condenser Microphone BrüelKjær 4180 S/N 289871.  
3. Decade Attenuator Ando AI-205 S/N 00464602.  
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.  
5. Digital Function Synthesizer NF Electronic Instruments DF-193A SN 12307.  
6. Digital Multimeter Fluke 8520A S/N 4959007.  
7. Photophone Rion NC-72 S/N 00402446.  
8. Measuring Amplifier BrüelKjær 2636 S/N 1537484.

Date of Receipt: 24 Jan. 2024  
Date of Calibration: 23 Feb. 2024 - 1 Mar. 2024

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)  
Request No. 21-670232 MTC No. EEL-IP: 1776167

**9. Power Amplifier BrüelKjær 2706 S/N 1517650.**  
**10. Speaker Tannoy Limited, Great Britain British Patent No. 215300.**  
**11. Digital Multimeter Agilent 34401A S/N MY4005560.**  
**12. Programmable Attenuator Tansawa TPA-303A S/N 2212.**

**Calibration Procedure:**  
This instrument was calibrated by using calibration procedures on CP-102-02 and CP-102-01, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3: Periodic tests (2013). These calibration procedures were related to the electrical and acoustic signal sets. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.  
This instrument has been calibrated against standards maintained at the Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).  
The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.  
The reported expanded uncertainty is based upon a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%.

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

End of Certificate 2/9

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)  
Request No. 21-670232 MTC No. EEL-IP: 1776167

**1. Absolute Sensitivity**

Reference Acoustic Signal (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (dB)	Uncertainty (dB)	Maximum permitted uncertainty of measurement (dB)
113.91	114.0	113.9	0.0	±0.30	N/A

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

**2. Self-generated noise**

**2.1 Normal test**

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

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

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

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

End of Certificate 3/9

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3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)	Acceptance limit class 2 (dB)	Uncertainty (dB)	Maximum permitted uncertainty of measurement (dB)
125	0.3	0.4	1.5	0.45
1 000	-0.2	-0.2	1.0	0.45
8 000	-0.4	-0.5	5.0	0.45

4. Electrical signal test of frequency weightings

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

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

4/9

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Office: 100 Mahachulalongkornrajavidyalaya Road, Bangkok 10000, Thailand. Tel: 02-025-1672-80 ext. 5278, 5279, 5287. Fax: 02-025-1672-8100. E-mail: jayaprasit@tistr.go.th

5. Long-term stability

Time	Measured value (dB)	Deviation value (dB)	Acceptance limit (dB)	Uncertainty (dB)	Maximum permitted uncertainty of measurement (dB)
Begin	94.0	0.0	0.3	0.10	0.1
End	94.0	0.0	0.3	0.10	0.1

6. Frequency and time weightings at 1 kHz

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

6.2 Time weightings at 1 kHz

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

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

3/9

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7. Level linearity on the reference level range

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

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

6/9

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

Anticipated value (dB)	Measured value (dB)	Deviation value (dB)	Acceptance limit class 2 (dB)	Uncertainty (dB)	Maximum permitted uncertainty of measurement (dB)
64	64.0	0.0	1.1	0.30	0.3
59	59.0	0.0	1.1	0.30	0.3
54	53.9	-0.1	1.1	0.30	0.3
49	49.0	0.0	1.1	0.30	0.3
44	44.0	0.0	1.1	0.30	0.3
39	38.9	-0.1	1.1	0.30	0.3
34	33.9	-0.1	1.1	0.30	0.3
29	28.9	-0.1	1.1	0.30	0.3
24	23.9	-0.1	1.1	0.30	0.3
27	26.9	-0.1	1.1	0.30	0.3
26	25.9	-0.1	1.1	0.30	0.3
25	24.9	-0.1	1.1	0.30	0.3

8. Level linearity including the level range control

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

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

7/9

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8. Level linearity including the level range control

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

Time Weighting	Timebase, s	Measured value (dB)	Deviation value (dB)	Acceptance limit class 2 (dB)	Uncertainty (dB)	Maximum permitted uncertainty of measurement (dB)
Fast	200	126.0	0.0	±1.0	0.20	0.3
	2	109.0	0.0	±1.0	0.20	0.3
	0.25	99.9	-0.1	±1.5	0.20	0.3
Slow	200	119.6	0.0	±1.0	0.20	0.3
	2	100.0	0.0	±1.0	0.20	0.3
	0.25	100.0	0.0	±1.0	0.20	0.3
SEL	200	120.0	0.0	±1.0	0.20	0.3
	2	100.0	0.0	±1.0	0.20	0.3
	0.25	90.9	-0.1	±1.5	0.20	0.3

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8/9

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10. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviation value (dB)	Acceptance limit class 2 (dB)	Uncertainty (dB)	Maximum permitted uncertainty of measurement (dB)
Complete cycle	125.4	125.2	-0.2	3.0	0.30	0.35
Positive half cycle	124.4	124.1	-0.3	2.0	0.30	0.35
Negative half cycle	124.4	124.1	-0.3	2.0	0.30	0.35

11. Overload indication

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

12. High-level stability

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

Calibrated by :

Approved by :

(Mr. Tawakiat Immamun)

(Mr. Tawakiat Immamun)

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

Date of Issue : 1 Mar. 2024

Electrical and Acoustical Laboratory  
Industrial Metrology and Testing Service Centre  
Ref: 201126701240047007

End of Certificate

9/9

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-670232 MTC No. EEL-BP. 1780167

**CALIBRATION CERTIFICATE**

Submitted by : A.S. Laboratory Group (Thailand) Co., Ltd.  
Address : 104 Phatthanasak 40, Phatthanasak Rd., Khwaeng Phatthanasak, Khet Suan Luang, Bangkok 10230.  
Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Center:  
Sol 1C, Bangpoo Industrial Estate, Sukhumvit Rd., A.Mang, Samutprakan 10280.

**Instrument Calibrated :**

Description : Sound Level Meter  
Manufacturer : Rion  
Model : NL-42  
Serial No. : 60909073 (ID:RYG\_TSD494)  
Microphone : UC-52 No.18646  
Pre-amplifier : NH-24 No.01735

**Standards used :**

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

Date of Receipt : 24 Jan. 2024  
Date of Calibration : 23 Feb. 2024 - 1 Mar. 2024

1/8

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Request No. 21-670232 MTC No. EEL-BP. 1780167

**1. Absolute Sensitivity**

Reference Acoustic Signal (dB)	Measured value (dB)	Deviation value (dB)	Acceptance limit class 2 (dB)	Uncertainty (dB)	Maximum-permitted accuracy of measurement (dB)
113.91	114.1	113.9	0.0	1.0	0.20

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 124.6 dB.

**2. Self-generated noise**

**2.1 Normal test**

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

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

Frequency Weighting (dB)	Measured value (dB)	Uncertainty (dB)	Maximum-permitted accuracy of measurement (dB)
A-Weight	12.9	0.10	N/A
C-Weight	18.5	0.10	N/A
Flat	24.2	0.10	N/A

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

3/9

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Request No. 21-670232 MTC No. EEL-BP. 1780167

**5. Long-term stability**

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

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

**6.1 Frequency weightings at 1 kHz**

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

**6.2 Time weightings at 1 kHz**

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

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

5/9

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9. Power Amplifier Brüel&Kjær 2706 S/N 1517650.  
10. Speaker Tannoy Limited, Great Britain Patent No. 215300.  
11. Digital Multimeter Agilent 34401A S/N MY4409560.  
12. Programmable Attenuator Tannogwa TPA-903A S/N 2212.

**Calibration Procedure :**

This instrument was calibrated by using calibration procedures on CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2013). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

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

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

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

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

2/9

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Request No. 21-670232 MTC No. EEL-BP. 1780167

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

Frequency (dB)	A-weight	C-weight	Flat	Acceptance limit class 2 (dB)	Uncertainty (dB)	Maximum-permitted accuracy of measurement (dB)
125	0.1	0.2	0.2	1.5	0.45	0.6
1 000	-0.1	-0.1	-0.1	1.0	0.45	0.6
8 000	-0.7	-0.7	-0.7	5.0	0.45	0.7

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

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

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

4/9

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

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (dB)	Uncertainty (dB)	Maximum-permitted accuracy of measurement (dB)
136	136.0	0.0	1.1	0.30	0.3
135	135.0	0.0	1.1	0.30	0.3
134	134.0	0.0	1.1	0.30	0.3
133	133.0	0.0	1.1	0.30	0.3
132	132.0	0.0	1.1	0.30	0.3
131	131.0	0.0	1.1	0.30	0.3
130	130.0	0.0	1.1	0.30	0.3
129	129.0	0.0	1.1	0.30	0.3
124	124.0	0.0	1.1	0.30	0.3
119	119.0	0.0	1.1	0.30	0.3
114	114.0	0.0	1.1	0.30	0.3
109	109.0	0.0	1.1	0.30	0.3
104	104.0	0.0	1.1	0.30	0.3
99	99.0	0.0	1.1	0.30	0.3
94	94.0	0.0	1.1	0.30	0.3
89	89.0	0.0	1.1	0.30	0.3
84	84.0	0.0	1.1	0.30	0.3
79	79.0	0.0	1.1	0.30	0.3
74	74.0	0.0	1.1	0.30	0.3
69	69.0	0.0	1.1	0.30	0.3

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

6/9

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Request No. 21-670232 MTC No. EEL. RP. 1780167

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

Anticipated value (dB)	Measured value (dB)	Deviant value (dB)	Acceptance limit class 2 (dB)	Uncertainty (dB)	Maximum permitted uncertainty of measurement (dB)
64	63.9	-0.1	1.1	0.30	0.3
59	58.9	-0.1	1.1	0.30	0.3
54	53.9	-0.1	1.1	0.30	0.3
49	49.0	0.0	1.1	0.30	0.3
44	44.0	0.0	1.1	0.30	0.3
39	38.9	-0.1	1.1	0.30	0.3
34	33.9	-0.1	1.1	0.30	0.3
29	28.9	-0.1	1.1	0.30	0.3
24	23.9	-0.1	1.1	0.30	0.3
27	26.9	-0.1	1.1	0.30	0.3
26	25.9	-0.1	1.1	0.30	0.3
25	24.9	-0.1	1.1	0.30	0.3

8. Level linearity including the level range control

At reference sound level on the reference level range

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

Date of Calibration : 23 Feb. 2024 - 1 Mar. 2024 7/9

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Office: 176 Phatthanasirak Road, Chokmahachulabongkro, Bangkok 10900, Thailand. Tel: 044-0 2579 1121-50 ext. 5219, 5220, 5217. Fax: 044-0 2579 1009. E-mail: tistr@tistr.go.th

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Request No. 21-670232 MTC No. EEL. RP. 1780167

8. Level linearity including the level range control

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

Range	Anticipated value (dB)	Measured value (dB)	Deviant value (dB)	Acceptance limit class 2 (dB)	Uncertainty (dB)	Maximum permitted uncertainty of measurement (dB)
30-130	15.0	15.0	0.0	1.1	0.30	0.3

9. Tone burst response

Time Weighting	Tonotone Duration, T <sub>b</sub> (ms)	Measured value (dB)	Deviant value (dB)	Acceptance limit class 2 (dB)	Uncertainty (dB)	Maximum permitted uncertainty of measurement (dB)
Fast	200	126.0	0.0	±1.0	0.20	0.3
	2	109.0	0.0	+1.0, -2.5	0.20	0.3
	0.25	99.9	-0.1	+1.5, -5.0	0.20	0.3
Slow	200	119.6	0.0	±1.0	0.20	0.3
	2	100.0	0.0	+1.0, -5.0	0.20	0.3
	200	120.0	0.0	±1.0	0.20	0.3
SEL	2	100.0	0.0	+1.0, -2.5	0.20	0.3
	0.25	90.9	-0.1	+1.5, -5.0	0.20	0.3

Date of Calibration : 23 Feb. 2024 - 1 Mar. 2024 8/9

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Office Laboratory: 381/1, Bangkapi Industrial Estate, Suburban Road, Bangkok 10900, Thailand. Tel: 044-0 2325 1472-80 ext. 113, 114. Fax: 044-0 2325 1472. E-mail: info@tistr.go.th

Office: 176 Phatthanasirak Road, Chokmahachulabongkro, Bangkok 10900, Thailand. Tel: 044-0 2579 1121-50 ext. 5219, 5220, 5217. Fax: 044-0 2579 1009. E-mail: tistr@tistr.go.th

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-670232 MTC No. EEL. RP. 1780167

10. Peak sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviant value (dB)	Acceptance limit class 2 (dB)	Uncertainty (dB)	Maximum permitted uncertainty of measurement (dB)
Complete cycle	125.4	125.3	-0.1	1.0	0.20	0.35
Positive half cycle	124.4	124.1	-0.3	2.0	0.20	0.35
Negative half cycle	124.4	124.1	-0.3	2.0	0.20	0.35

11. Overload indication

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

12. High-level stability

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

Calibrated by: (Signature) Approved by: (Signature)

(Mr. Tawitak Jinnamun) (Mr. Pongsak Chantana)

Electrical and Calibration Laboratory  
Industrial Metrology and Testing Service Center  
Ref: 20120701240047008 9/9

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

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-670232 MTC No. EEL. RP. 1780167

CALIBRATION CERTIFICATE

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

Address: 104 Phatthanasirak Rd., Phatthanasirak Rd., Khlong Phatthanasirak, Khet Suan Luang, Bangkok 10250.

Calibrated at: Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Center, 381/1, Bangkapi Industrial Estate, Suburban Rd., A Muang, Samutprakan 10280.

Instrument Calibrated:

Description: Sound Level Meter

Manufacturer: Rion

Model: NL-42

Serial No.: 00900074 (ID: RYU\_F30495)

Microphone: UC-92 No. 138467

Pre-amplifier: NH-24 No. 01754

Ambient Environment:

Temperature: (23 ± 3) °C

Relative Humidity: (50 ± 15) %

Ambient Pressure: (101.325 ± 5) kPa

Standards used:

- Hand Pico Filer Wavec 752A S/N 90010494.
- Condenser Microphone BrüelKjær 4180 S/N 2838071.
- Decade Attenuator Ando AI-205 S/N 0044602.
- Function Arbitrary Waveform Generator Agilent 33220A S/N MY4404568.
- Digital Function Synthesizer NF Electronic Instruments DP-013A S/N 122037.
- Digital Multimeter Fluke 8520A S/N 4493907.
- Photophone Rion NC-72 S/N 10402446.
- Measuring Amplifier BrüelKjær 2636 S/N 137484.

Date of Receipt : 24 Jan. 2024  
Date of Calibration : 23 Feb. 2024 - 1 Mar. 2024 1/9

The results stated only in the form established in this value assigned. Adhering to the Request, Certificate and validity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-670232 MTC No. EEL. RP. 1780167

9. Power Amplifier BrüelKjær 2706 S/N 1517650.

10. Speaker Tannoy Limited, Great Britain Patent No. 213300.

11. Digital Multimeter Agilent 34401A S/N MY4400556.

12. Programmable Attenuator Tansgong TPA-303A S/N 2312.

Calibration Procedure:

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

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

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

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

Date of Calibration : 23 Feb. 2024 - 1 Mar. 2024 2/9

The results stated only in the form established in this value assigned. Adhering to the Request, Certificate and validity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-670232 MTC No. EEL. RP. 1780167

1. Absolute Sensitivity

Reference Acoustic Signal	Measured value (dB)	Deviant value (dB)	Acceptance limit class 2 (dB)	Uncertainty (dB)	Maximum permitted uncertainty of measurement (dB)		
Before adjust After adjust	113.94	114.1	113.9	0.0	1.0	0.30	N/A

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

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (dB)	Maximum permitted uncertainty of measurement (dB)
16.5	0.10	N/A

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

Frequency Weighting	Measured value (dB)	Uncertainty (dB)	Maximum permitted uncertainty of measurement (dB)
A-Weight	11.7	0.10	N/A
C-Weight	17.2	0.10	N/A
Flat	22.5	0.10	N/A

Date of Calibration : 23 Feb. 2024 - 1 Mar. 2024 3/9

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3 : EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, BANGKOK 10250  
TEL. 0-2715-3883 FAX. 0-2715-9844

Cert.No.: 23CH1369  
Page: 1 of 3

### Certificate of Calibration

Equipment : pH Meter  
Manufacturer : Hach  
Model : HQ411d  
Serial No. : 20010031163  
ID No. : BKK\_EN0342  
Condition As-Received: Used Item  
Received Date : 26 October 2023  
Calibration Date : 27 October 2023  
Reference : 2310-06SDSC-3  
Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd.,  
Khuang Phatthanakan, Khut Suan Luang,  
Bangkok 10250 Thailand

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

Calibrated by : Watsorn Lemphagikul  
Approved by : *Sathip*  
Approved Signatory  
( ) Sathip Meangrue  
( ) Watsorn Lemphagikul  
( ) Ponpan Pajorn  
Issue Date : 31 October 2023

The Uncertainties are for a confidence probability of approximately 95 %  
This certificate may not be reproduced either whole or in part, except with the prior written  
Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services

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Cert.No.: 23CH1369  
Page: 2 of 3

### Condition of this calibration result

1. Reference Standard Instruments :  
Instrument Serial No. ID No. Cert. No. Exp. Date  
1) Ref. Standard Thermometer 4980054 110RC004 23008 26 Jul 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.,  
ANIS-ASQ National Accreditation Board, Accredited No. AB-1635

Buffer Solution Manufacturer Lot No. Exp. date  
pH 4.008 CPA chem 913088 14 July 2025  
pH 6.865 CPA chem 913088 14 July 2024  
pH 9.997 CPA chem 931961 30 Sep 2024

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

### Calibration Results

Function : pH Measurement  
Performing three buffers standard curve by using buffer nominal pH (4.7,10)

Unit Under Calibration	Standard pH	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH measurement (%)	Coverage factor #
pH Electrode	4.008	4.002	166.5	0.0044	2.00
SAL 230473042902	6.865	6.987	-10.4	0.0094	2.00
	9.997	10.005	-189.3	0.0071	2.00

Remark : Can not connect the BNC because the plug does not match with the socket.

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Cert.No.: 23CH1369  
Page: 3 of 3

### Calibration Results

Function : Temperature Measurement  
(\*) Without adjustment  
This equipment was connected with Temperature Probe:  
- Model : PHC2B1  
- Serial No. : 230473042902  
Dimension of probe :  
- Length : 103 mm  
- Diameter : 12 mm  
- Immersion Depth : 80 mm

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement (± °C)	Coverage factor #
25.0	25.002	25.1	0.098	0.13	2.00

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

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Cert.No.: 23TH1468  
Page: 1 of 2

### Certificate of Testing

Equipment : DO Meter  
Manufacturer : YSI  
Model : 5000-115V  
Serial No. : 15E102796  
ID No. : RYG\_EN0032  
Received Date : 21 July 2023  
Test Date : 24 July 2023  
Reference : 2307-071305C-1  
Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.  
Rayong Branch  
616/10 Moo 5, T. Maenam Khut, A. Phatthadung,  
Rayong 21140, Thailand

Laboratory Condition :  
Temperature : (25 ± 5) °C  
Humidity : (50 ± 20) %  
Test Procedure : In-house method : CP-CH9  
by Comparison Technique with Acid Modification Method

Tested by : Waleak Srithean  
Approved by : *Sathip*  
Approved Signatory  
( ) Malee Bultruss  
( ) Sathip Meangrue  
( ) Watsorn Lemphagikul  
Issue Date : 28 July 2023

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
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Cert.No.: 23TH1468  
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.	Exp Date
1) Burette	130BU10	23CG1172	22MM50	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 190 %  
Dissolved Oxygen Probe No. : 15E100454

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

This report was certified only for the instrument we tested. It is allowable to use for study the system efficiency. The environmental impact control and present to organization it may 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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Cert.No.: 23M125  
Page: 1 of 2

### Certificate of Calibration

Equipment : DO Meter with Sensor  
Manufacturer : YSI  
Model : 5000-115V  
Serial No. : 15E102796  
ID No. : RYG\_EN0032  
Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.  
Rayong Branch  
616/10 Moo 5, T. Maenam Khut, A. Phatthadung,  
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 : (90 ± 30) %  
AC Line Voltage : (220 ± 22) V

Calibrated by : Preecha Hahn  
Approved by : *Sathip*  
Approved Signatory  
( ) Pongthapa Tanayakul  
( ) Malee Bultruss  
( ) Suwit Inpa  
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



**Equipment:** DO Meter with Sensor  
**Condition As-Received:** Used Item  
**Reference:** 2307-0713DSC-2  
**Procedure Used:** Calibration was conducted using in-house calibration procedure CP-0701 according to comparison with Industrial Platinum Resistance Thermometer (IPRT) into Temperature Bath.  
**Condition of this result of calibration:**  
1. Reference standard instrument:  
Instrument: Digital Thermometer  
Serial No.: 218800  
Cert. No.: 221285  
Traceable: TPA  
Due Date: 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
20.00	100	20.011	19.91	-0.101	6.15	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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1159515

**Equipment:** Low Temp. Incubator  
**Manufacturer:** Memmert  
**Model:** IP7750  
**Serial No.:** V818.0004  
**ID No.:** RYO\_EN0154  
**Submitted by:** ALS Laboratory Group (Thailand) Co., Ltd.  
(Rayong Branch)  
616/10 Moo 5 T. Maenam Khu,  
A. Phukdaeng, Rayong 21140 Thailand  
**Location:** BOO Room  
**Received Order:** 29 May 2023  
**Calibration Date:** 29 May 2023  
**Ambient Temperature:** (26 ± 10) °C  
**Relative Humidity:** (50 ± 30) %  
**Calibrated by:** Man Pattanasongboon  
**Approved by:**   
( ) Purnthipong Tamayakul  
( ) Manee Sudbua  
( ) Suwit Injai  
**Issue Date:** 7 June 2023

**Certificate of Calibration**  
Page: 1 of 3

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

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A 0054967

**Equipment:** Low Temp. Incubator  
**Condition As-Received:** Used Item  
**Reference:** 2305-0980C-2  
**Procedure Used:** Calibration was conducted using calibration procedure CP-0702 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).  
**Condition of this result of calibration:**  
1. Reference standard instrument:  
Instrument: Data Acquisition  
Model: 34872A  
Serial No.: MY57013711  
Cert. No.: 22LM03  
Due Date: 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
23	23	23
REL Humid. (%)	54	56
AC Supply (Voh)	223	222

**Probe Installation Details:**  
a = 12 cm  
b = 10 cm  
c = 10 cm  
**Dimension of Chamber:**  
D = 0.6 m  
W = 1.0 m  
H = 1.2 m  
Capacity = 0.75 m³

**Position:**

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

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1165130

**Equipment:** Low Temp. Incubator  
**Condition As-Received:** Used Item  
**Reference:** 2305-0980C-2  
**Result of Calibration:** (°) Without Adjustment  
**Function of UUC:** Temperature Source  
**Fresh air setting:** Close

Calibration Point (°C)	UUC Setting (°C)	UUC Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation	Coverage Factor
20.0	20.0	20.0	0.018	0.72	1.0	2

**Calibration Point (°C)**

Position	1	2	3	4	5	6	7	8	9 (ref.)	Uncertainty (°C)
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 %.

-000-

1165129

**DKSH**

**Certificate of Calibration**

**Equipment:** SPECTROPHOTOMETER  
**Model:** DR6000  
**Serial No. (or ID):** 1627945 (RYG\_EN0037)  
**Manufacturer:** HACH  
**Condition:** In Condition  
**Customer:** ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch)  
616/10 Moo 5 T. Maenam Khu,  
A. Phukdaeng, Rayong 21140, Thailand.  
**Environment Condition:** Temperature: 23.9 °C ± 0.2  
Humidity: 85.3 %RH ± 1.4  
**Calibration Place:** ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch) (Wet Chemistry)  
616/10 Moo 5 T. Maenam Khu,  
A. Phukdaeng, Rayong 21140, Thailand.  
**Calibration By:** Mr. Natapong Rungrueang  
**Calibration Date:** 18 September 2023  
**The Method used:** In house method, CAL-W-24, base on ASTM E 275-09 and ASTM E 387-04  
**Traceability:** This certificate is traceable to the CRM maintained by National Institute of Standards and Technology (NIST) through Sigma Scientific Limited.  
The standard for Wavelength Certificate No. 111583 and 111594  
The standard for Photometric Certificate No. 9114964 and 111588  
The standard for Stray light Certificate No. 111586 and 111585  
The standard for Spectral resolution Certificate No. 111587

**Authorized signatory**  
(Mr. Natapong Rungrueang)  
Person in charge  
(Mr. Helmut Schwenke)  
Authorized signatory

-000-

CAL-416-C06-15, 12 Sep 2022

**DKSH**

**Certificate of Calibration**

**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
418.01	416.3	0.31	0.13
536.66	536.6	0.06	0.13
637.96	638.3	-0.32	0.13
748.48	748.7	-0.22	0.13
807.03	807.4	-0.37	0.13

**Photometric Accuracy (Absorbance)**

Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
420 nm	0.0000	0.000	0.0000	0.0045
	0.0030	0.288	0.0040	0.0045
	0.0168	0.018	-0.0022	0.0045
	0.0296	1.028	0.0008	0.0045
440 nm	0.0000	0.000	0.0000	0.0045
	0.2867	0.283	0.0037	0.0045
	0.8073	0.806	-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
	0.4995	0.482	-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
	0.4882	0.488	-0.0008	0.0045
	0.8488	0.848	0.0008	0.0045
590 nm	0.0000	0.000	0.0000	0.0045
	0.2594	0.259	0.0004	0.0045
	0.5040	0.505	-0.0010	0.0045
	1.0032	1.002	0.0012	0.0045
635 nm	0.0000	0.000	0.0000	0.0045
	0.2579	0.257	0.0009	0.0045
	0.4971	0.497	0.0001	0.0045
	0.9720	0.971	0.0010	0.0045

**Authorized signatory**  
(Mr. Natapong Rungrueang)  
Person in charge  
(Mr. Helmut Schwenke)  
Authorized signatory

-000-

CAL-416-C06-15, 12 Sep 2022





# Certificate of Calibration

REVIEW BY: *Thantak*  
APPROVED BY: *Dharm*  
MEDICAL DATE: 01/02/2025

Model Number: MS2245-100-0U  
Description: Analytical Balance  
Serial Number: 004207958  
ID No.: RYG-EN0002  
Manufacturer: Sartorius  
Certificate No.: 24TM3295  
Issued Date: Friday, February 23, 2024  
Reference No.: 230198  
Page No.: 2 of 2

Customer Name: ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch)  
616/10 Moo 5 T. Maenam Khw. A. Phukdaeng, Rayong 21140, Thailand  
Calibrated Place: ALS Laboratory Group (Thailand) Co., Ltd. (Balance Room)  
616/10 Moo 5 T. Maenam Khw. A. Phukdaeng, Rayong 21140, Thailand

Calibrated By: Mr. Chonchai Intana  
Calibration Date: Thursday, February 22, 2024  
Calibration Procedure No.: This calibration was conducted by using in-house calibration procedure number: W-0889 based on UKAS LAB 14, 2018

Metological data:  
Capacity: 220 g Repeatability: 0.0001 g  
Temperature: 24.2 °C ± 0.5 °C  
Humidity: 57.0 % RH ± 10.0 % RH  
Pressure: 999.9 hPa  
Approved Condition: ☒ Normal ☐ Service ☐ Repair ☐ Recalibration ☐ Reuse

Measurement Method: UKAS Publication Ref. Lab 14  
The measurement uncertainty stated in this report is based on 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 the Expression of Uncertainty in Measurement (GUM). The calibration certificate also shows the traceability to National Standards, which related the unit of measurement according to the International System of Units (SI). Report of the National Bureau of Standards (NBS) Special Publication 400-1.

Model Number	Description	Traceability	Calibration No.	Due Date
YCR01-1-22-00	Reference weight set 10g, 100g, 1000g, 10000g	TC5	1405291578	23-Aug-2025
MH5-52250	1000g/0.0001g/0.0001g/0.0001g/0.0001g	DKB1	016231945	23-Aug-2024

This certificate must be kept by the customer for the period of the validity of the calibration. The certificate is valid only if it is accompanied by the original copy of the certificate. The certificate is not valid if it is reproduced or altered in any way. The certificate is not valid if it is used for any other purpose than the one for which it was issued. The certificate is not valid if it is used for any other purpose than the one for which it was issued.

SGP 131-33 03 February 2022

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAPONG ROAD 50-18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL: 0-2717-3000-29 FAX: 0-2718-9484

## Certificate of Calibration

Cert. No.: 24TM332  
Page: 1 of 3

Equipment: Hot Air Oven  
Manufacturer: Memmert  
Model: UFE 500  
Serial No.: G511-1572  
ID No.: RYG-EN0010  
Submitted by: ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch)  
616/10 Moo 5 T. Maenam Khw., A. Phukdaeng, Rayong 21140 Thailand  
Location: Oven Room  
Received Order: 21 March 2024  
Calibration Date: 21 March 2024  
Ambient Temperature: (26 ± 10) °C  
Relative Humidity: (50 ± 30) %  
Calibrated by: Man Pattanapongpaboon  
Approved by: *Thantak*  
( ) Pomthippa Tameyakul  
( ) Unnophol Harachai  
(X) Suwit Intai  
Issue Date: 22 March 2024

The Uncertainties are for a confidence probability of approximately 95%  
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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
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TEL: 0-2717-3000-29 FAX: 0-2718-9484

## Certificate of Calibration

Cert. No.: 24TM332  
Page: 3 of 3

Equipment: Hot Air Oven  
Condition As-Received: Used Item  
Reference: 2403-05630C-1  
Result of Calibration: (\*) Without Adjustment  
Function of UUC: Temperature Source  
Fresh air setting: Close

Calibration Point (°C)	UUC Setting (°C)	UUC Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor
150.0	150.0	150.0	0.15	0.59	0.62	2

Calibration Point (°C)	Measured Temperature (°C)	Uncertainty (± °C)
150.0	150.0	1.7

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

Model Number: MS2245-100-0U  
Description: Analytical Balance  
Serial Number: 004207958  
ID No.: RYG-EN0002  
Manufacturer: Sartorius  
Certificate No.: 24TM3295  
Issued Date: Friday, February 23, 2024  
Reference No.: 230198  
Page No.: 2 of 2

## Calibration Results : Without Adjustment

Repeatability	Repeatability (Off-center loading error)
The repeatability is the ability of a weighing instrument to display nearly identical results when constant load remains while the center of mass shifts within a measurement device to permit measurement of the weighing unit of the calibration. The relevant parameter is used to measure repeatability (repeatability).	The off-center loading error is defined as the difference between the result of the test, in 120 g of stainless steel, placed at the nominal weighing point and the average of 100 additional measurement points (average defined according to GUM, 1995).
Normal Value : (Low Load) 20.0001 g Tolerance 0.0001 g	Normal value : 100 g Tolerance 0.0001 g
Normal Value : (High Load) 200 g Tolerance 0.0001 g	Normal value : 100 g Tolerance 0.0001 g
Standard Deviation : 0.00002 g	Standard Deviation : 0.00002 g

SGP 131-33 03 February 2022

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
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TEL: 0-2717-3000-29 FAX: 0-2718-9484

## Certificate of Calibration

Cert. No.: 24TM332  
Page: 2 of 3

Equipment: Hot Air Oven  
Condition As-Received: Used Item  
Reference: 2403-05630C-1  
Procedure Used: Calibration was conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD) and Thermocouple Type T.  
The temperature scale used was based on ITS-90.  
Condition of this result of calibration  
1. Reference standard instrument:  
Instrument: 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		
Temp. (°C)	Beginning	Finished
REL Humid. (%)	57	59
AC Supply (Volt)	222	224

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

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

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
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TEL: 0-2717-3000-29 FAX: 0-2718-9484

## Certificate of Calibration

Cert. No.: 24TM334  
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 Khw., A. Phukdaeng, Rayong 21140 Thailand  
Location: Oven Room  
Received Order: 21 March 2024  
Calibration Date: 21 - 22 March 2024  
Ambient Temperature: (26 ± 10) °C  
Relative Humidity: (50 ± 30) %  
Calibrated by: Man Pattanapongpaboon  
Approved by: *Thantak*  
( ) Pomthippa Tameyakul  
( ) Unnophol Harachai  
(X) Suwit Intai  
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  
Cert. No.: 24TM634  
Page : 2 of 3

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

The temperature scale used was based on ITS-90.

#### Condition of this result of calibration

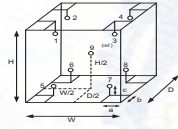
- Reference standard instrument:-  
Instrument Serial No. Cert. No. Traceable Due Date  
1) Data Acquisition MYS7013711 23LM115 TPA 11 Jul 2024
- This certificate is valid only to the item calibrated on date and place of calibration.
- This certification is traceable to the International System of Unit.

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

Result of Calibration :- ( \*) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Close



Probe Installation Details : Dimension of Chamber :  
a = 5.0 cm D = 0.40 m  
b = 5.0 cm W = 0.66 m  
c = 5.0 cm H = 0.48 m  
Capacity = 0.11 m<sup>3</sup>

Environment during calibration		
	Beginning	Finished
Temp. (°C)	27	27
REL.Humid. (%)	59	59
AC Supply ( Volt )	224	223

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



Equipment : Hot Air Oven  
Condition As-Received : Used Item  
Reference : 2403-0563OC-3  
Cert. No.: 24TM634  
Page : 3 of 3

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

Fresh air setting : Close

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
104.0	104.0	104.0	0.085	0.52	0.60	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	104.168	103.506	103.888	103.712	103.772	103.730	104.289	103.805	103.798	0.42
180.0	180.701	179.228	179.855	179.999	180.127	180.138	180.858	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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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
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TEL.0-2717-3000-29 FAX.0-2718-8484



## Certificate of Calibration

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

Equipment : Water Bath  
Manufacturer : Memmert  
Model : WNB22  
Serial No. : L513.0648  
ID No. : RYG\_EN0081

Submitted by : ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch)  
616/10 Moo 5, T. Maenam Khui,  
A. Phakdang,  
Rayong 21140, Thailand  
Location : Wet Chemistry Lab

Received Order : 21 March 2024  
Calibration Date : 21 March 2024  
Ambient Temperature : (26 ± 10) °C  
Relative Humidity : (50 ± 30) %  
Calibrated by : Man Pattanapongpaiboon

Approved by :  
( ) Pornthippa Tameyakul  
( ) Urothong Harschai  
(✓) Suwit Injai

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 : Water Bath  
Condition As-Received : Used Item  
Reference : 2403-0563OC-4  
Cert. No.: 24TM635  
Page : 2 of 3

Procedure Used :-  
Calibration were conducted using in-house calibration procedure CP-OT04 Based on ASTM E715 according to direct measurement method with Data Acquisition which connected with Industrial Platinum Resistance Thermometer (PRT).

The temperature scale used was based on ITS-90.

#### Condition of this result of calibration

- Reference standard instrument:-  
Instrument Serial No. Cert. No. Traceable Due Date  
1) Data Acquisition MYS7013711 23LM115 TPA 11 Jul 2024
- This certificate is valid only to the item calibrated on date and place of calibration.
- This certification is traceable to the International System of Unit.

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

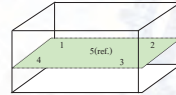
Result of Calibration :- ( \*) Without Adjustment

Function of UUC\* : Temperature Source

Heat transfer medium used : Water

Beginning of Calibration (°C)	Environmental (%R.H.)		AC Voltage Supply ( Volt )
	25	55	
Finished of Calibration	25	57	223

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



Front



Equipment : Water Bath  
Condition As-Received : Used Item  
Reference : 2403-0563OC-4  
Cert. No.: 24TM635  
Page : 3 of 3

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

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

-00-

Metrological Center  
SCI ECO Services Company Limited  
350 Moo 3, T. Banay, A. Kiangkhai, Samut Prakan 10110, Thailand  
Sanatou Tel: +66 2627 2095 Fax: +66 2627 2100  
(Bangkok Tel: +66 2627 6881 +66 2627 2280)  
Website: www.sci-eco.co.th E-Mail: cal@sci-eco.com

Certificate No. T230116

Page 1 of 4

## Certificate of Calibration

Equipment : Chamber ( Cooling Room )  
Manufacturer : MODULAR  
Model : BREVCOCOC  
Serial No. : C00351439  
Customer Code : RYG\_EN0184  
ID No : T1939A5  
Customer : ALS Laboratory Group (Thailand) Co., Ltd. ( Rayong Branch )  
616/10 Moo 5 T. Maenam Khui,  
A. Phakdang, Rayong 21140  
Customer Location : Laboratory  
Date of Receipt : 23 January 2023  
Calibrated By : Aiythong Rungrai ( Technician )  
Approved By : [Signature] / Boonchai Surisaywong (Site Calibration Manager)  
Date of Issue : 8 FEB 2023

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

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

31032300000000000000



Certificate No. T230116

Page 2 of 4

## Calibration Report

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

## Condition of this results of calibration :

1. This equipment was calibrated by using 16 standard thermocouples type T in its chamber, the values are standard thermocouples type T for ambient temperature measurement. The calibration was done according to VIM-T26 (based on ASTM E145-04 (Reapproved 2011) and ASTM E1196).  
All data shown below were final values and the initial data from customer request. The temperature scale used was based on ITS-90.

## 2. Reference Standard Instrument :

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

## 3. This certificate is traceable to :

National Institute of Metrology (Thailand) through Metrological Center (SCI ECO) T230116 (2023) CALIBRATION 0044

## 4. Condition of calibrated item :

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

Adjustment : ( X ) within adjustment ( ) after adjustment

Approved By:

T.M.C. (P) Co., Ltd.

Certificate No. T230116

Page 4 of 4

## Calibration Report

## Measurement Results

Calibration Point	Average Standard Reading at each position (°C)											
	TN141	TN142	TN143	TN144	TN145	TN146	TN147	TN148	TN149	TN150	TN151	TN152
2.0	2.03	2.18	2.13	2.15	2.43	2.45	2.27	2.25	2.24	2.43	2.24	2.24
	TN141	TN144	TN155	TN156								
	2.26	2.22	2.23	2.21								

Chamber (Cooling Room)	Temperature Characteristics					Centering Factor
	Reading (°C)	Stability (°C)	Uniformity (°C)	Uncertainty (±°C)		
Setting (°C)	Min, Max	Average				
2.0	2.1, 4.1	3.7	4.20	1.20	1.90	2.07

The calibration result apply only to the items calibrated item.

The result of test was found accurate to above on date and place of test only.

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

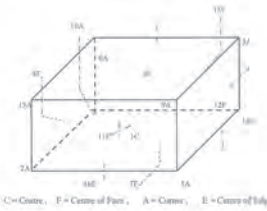
Approved By:

T.M.C. (P) Co., Ltd.

Certificate No. T230116

Page 3 of 4

## Calibration Report



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

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

Approved By:

T.M.C. (P) Co., Ltd.

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## Certificate of System Qualification

GC-QG + GCMS-QG

REVIEW BY:   
APPROVED BY:   
NEXT CAL DATE: 03-01-25

System ID: QM-7  
Organization Name: ALS Laboratory Group (Thailand) Co., Ltd.  
Organization Location: 104 Pathumwan Rd., Pathumwan Rd., Khwaeng San Luang, Khet San Luang, Bangkok

Date: December 13, 2023 3:32:46 PM  
SOP Name: Agilent Recommended, Agilent Recommended  
EQP Revision: GC-QG, GCMS-QG  
Overall Qualification Status: Pass

## System Inspection and Basic Safety and Operation

Name: T860  
Setup Status: Pass

## Overall System Inspection and Basic Safety and Operation Test Status

Pass

## Inlet Pressure Accuracy

Name: T860  
Front: SQ  
Setup Status: Pass  
Actual: 25.0 psi  
Inlet Pressure: 25.0 psi  
Accuracy: 0.0 psi  
Agilent Recommended: ± 0.2

## Overall Inlet Pressure Accuracy Test Status

Pass

## GC Oven Temperature Accuracy

Name: T860

Date: December 13, 2023 3:32:46 PM  
System ID: QM-7  
Page 2 / 16

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Agilent CrossLab Compliance Services

Setup Status: Pass  
Zone: Open  
Setup Status: Pass  
Temperature: 230.0 230.3 °C  
Accuracy: 2.3 °C  
Agilent Recommended: ± 4.0 °C  
% setup in R: ( -4.0 °C )  
± 1.0 °C  
% setup in R: ( 5.0 °C )  
Setup Status: Pass  
Zone: Open  
Setup Status: Pass  
Temperature: 100.0 100.7 °C  
Accuracy: 0.7 °C  
Agilent Recommended: ± 1.0 °C  
% setup in R: ( -3.7 °C )  
± 1.0 °C  
% setup in R: ( 3.7 °C )

## Overall GC Oven Temperature Accuracy Test Status

Pass

## GC Oven Temperature Stability

Name: T860  
Setup Status: Pass  
Setup Status: Pass  
Temperature: 100.0 100.4 °C  
Stability: 0.0 °C  
Agilent Recommended: ± 0.5

## Overall GC Oven Temperature Stability Test Status

Pass

## Log Amp

Tested Combination: Front SBL / External SQ  
Name: 5877A  
Setup Status: Pass

Date: December 13, 2023 3:32:46 PM  
System ID: QM-7  
Page 2 / 16

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Agilent CrossLab Compliance Services

## Overall Log Amp Test Status

Pass

## RPFA

Tested Combination: Front SBL / External SQ  
Name: 5877A  
Setup Status: Pass  
Amplitude: 100 mV  
Offset After Five Minutes: 2 mV  
RPFA Voltage: 504 mV  
Agilent Recommended: ± 100 mV and ± 100 mV ± 150 mV

## Overall RPFA Test Status

Pass

## Tune E1

Tested Combination: Front SBL / External SQ  
Name: 5877A  
Setup Status: Pass  
Flame: 1  
Setup Status: Pass  
Flame: 2

## Overall Tune E1 Test Status

Pass

## Signal to Noise E1

Tested Combination: Front SBL / External SQ  
Name: 5877A

Date: December 13, 2023 3:32:46 PM  
System ID: QM-7  
Page 3 / 16





[illegible]

Date: December 13, 2023 2:32:46 PM  
System ID: CM-7

Page 10 / 10

Time	Transmission Mode	Activity Pathway	Type of Transmission	Optional Information
December 11, 2002 17:02:00 AM	Short	Excitation	Tune B1 - 50754.500 - (Stomach - None) B1 - Estimated Flarewood 2 (2-photon - No capture measured)	
December 11, 2002 17:03:00 AM	Short	Excitation	Signal to Noise B1 - 50754.500 Impulses: From B1B, B2 Source: B1 - Excitation along Flarewood 1 - L = 1000	None
December 11, 2002 17:03:00 AM	Short	Excitation	Tune B1 - 50754.500 - (Stomach - None) B1 - Estimated Flarewood 2 (2-photon - No capture measured)	
December 11, 2002 17:04:00 AM	Short	Excitation	Tune B1 - 50754.500 - (Stomach - None) B1 - Estimated Flarewood 2 (2-photon - No capture measured)	Run Count = 1
December 11, 2002 17:04:00 AM	Short	Excitation	Signal to Noise B1 - 50754.500 Impulses: From B1B, B2 Source: B1 - Excitation along Flarewood 1 - L = 1000	None
December 12, 2002 17:02:00 AM	Auto	Auto/Check	Excitation	None
December 12, 2002 17:03:00 AM	Auto	Auto/Check	Excitation	None
December 12, 2002 17:04:00 AM	Auto	Auto/Check	Excitation	None
December 12, 2002 17:05:00 AM	Short	Qualification	Excitation	Q2
December 12, 2002 17:06:00 AM	Short	Excitation	Signal to Noise B1 - 50754.500 Impulses: From B1B, B2 Source: B1 - Excitation along Flarewood 1 - L = 1000	None

Date: December 13, 2023 3:32:46 PM  
System ID: ORA-7

Page 17 / 40

[illegible]

Date: December 13, 2023 3:32:48 PM  
System ID: CAL-7

Page 48/18

User Name: support\_mcm@hawaii.gov  
Report Generated by Username: ADMIN@HAWAII

System ID: 2084  
Print Date: December 11, 2023 at 10:47 AM

2023-12-03 Transaction Log

Time	Transaction Date	Activity Performed	Types of Transaction	Optional Information
December 13, 2023 14:33:04 PM	End	Execution	Signal to Release E-1 (Signal) Aperture: From RM5_500 -> Reason: E-1-Execution using Element 2 (L) -> 1200	Run Count: 1
December 14, 2023 15:04:01 PM	Auto	Test/Execution	Signal to Release E-1 (Signal) Aperture: From RM5_500 -> Reason: E-1-Execution using Element 1 (L) -> 1200	Execution Result for Run Count: 2
December 15, 2023 13:04:01 PM	Auto	Execution	Signal to Release E-1 (Signal) Aperture: From RM5_500 -> Reason: E-1-Execution using Element 1 (L) -> 1200	None
December 15, 2023 17:04:02 PM	Auto	Stop	Signal to Release E-1 (Signal) Aperture: From RM5_500 -> Reason: E-1-Execution using Element 1 (L) -> 1200	Ends Test Path: C:\Users\support_mcm\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\X292929292\170402_1200
December 15, 2023 18:02:00 PM	End	Execution	Signal to Release E-1 (Signal) Aperture: From RM5_500 -> Reason: E-1-Execution using Element 1 (L) -> 1200	Run Count: 3
December 15, 2023 18:02:00 PM	Auto	Test/Execution	Signal to Release E-1 (Signal) Aperture: From RM5_500 -> Reason: E-1-Execution using Element 1 (L) -> 1200	Execution Result for Run Count: 4
December 16, 2023 14:02:00 PM	Auto	Execution	Signal to Release E-1 (Signal) Aperture: From RM5_500 -> Reason: E-1-Execution using Element 1 (L) -> 1200	None
December 16, 2023 21:14:02 PM	Auto	Stop	Signal to Release E-1 (Signal) Aperture: From RM5_500 -> Reason: E-1-Execution using Element 1 (L) -> 1200	Ends Test Path: C:\Users\support_mcm\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\X292929292\211402_1200

Page 8 / 9

Date: December 19, 2023 3:32:48 PM

Page 53 / 60

User Name: request_information Report Generated by: ShirleyAnn.ABDOU@GMAIL			System ID: 1007 Print Date: December 13, 2013 2:22:47 PM	
G06 P200 Transmission log :				
Time	Transmission	Activity	Type of Transmission	Optional Information
December 13, 2013 2:20:00 PM	End	Emulation :	Signal to Noise 0% - Liquid Injection, Front 50% - 50% Source: 0% - Emulation using Parameter 2: (i, i) = 1000	Plot Curve : 1
December 13, 2013 2:20:47 PM	Start	Emulation :	Signal to Noise 0% - Liquid Injection, Front 50% - 50% Source: 0% - Emulation using Parameter 2: (i, i) = 1000	Download Data for Plot Curve : 1
December 13, 2013 2:20:52 PM	Start	Emulation :	Signal to Noise 0% - Liquid Injection, Front 50% - 50% Source: 0% - Emulation using Parameter 2: (i, i) = 1000	None
December 13, 2013 2:20:58 PM	End	Data :	Signal to Noise 0% - Liquid Injection, Front 50% - 50% Source: 0% - Emulation using Parameter 2: (i, i) = 1000	Download Data for Plot Curve : 1 G:\Data\G06_P200_P10
December 13, 2013 2:20:59 PM	End	Emulation :	Signal to Noise 0% - Liquid Injection, Front 50% - 50% Source: 0% - Emulation using Parameter 2: (i, i) = 1000	Plot Curve : 2
December 13, 2013 2:20:59 PM	Start	Emulation :	Signal to Noise 0% - Liquid Injection, Front 50% - 50% Source: 0% - Emulation using Parameter 2: (i, i) = 1000	Download Data for Plot Curve : 2
December 13, 2013 2:21:00 PM	Start	Emulation :	Signal to Noise 0% - Liquid Injection, Front 50% - 50% Source: 0% - Emulation using Parameter 2: (i, i) = 1000	None
December 13, 2013 2:21:07 PM	Start	Data :	Signal to Noise 0% - Liquid Injection, Front 50% - 50% Source: 0% - Emulation using Parameter 2: (i, i) = 1000	Data File Path : G:\Data\G06_P200_P10

Date: December 13, 2023 3:32:46 PM  
System ID: 086.2

Page 18 / 30

Project Information

Dear Name, attached chronogram

Report ID: 0087

Project Description by Reference: A550000042

Print Date: December 15, 2023 at 02:46 PM

008-63533 Transmittal Log

Date	Transmittal Date	Activity Description	Types of Transmittal	Optional Information
December 13, 2023 5:57:43 PM	Site	Construction	Signal to Release 0 - Liquid Inspection, From 001, 002 Inspection 0 - Contractor upon Release 0 - L = 1000	Per Chapter 3
December 13, 2023 2:05:16 PM	Asst.	Construction	Signal to Release 0 - Liquid Inspection, From 001, 002 Inspection 0 - Contractor upon Release 0 - L = 1000	Inspection Report by Don Evans L
December 13, 2023 1:20:14 PM	Site	Construction	Signal to Release 0 - Liquid Inspection, From 001, 002 Inspection 0 - Contractor upon Release 0 - L = 1000	None
December 13, 2023 1:04:02 PM	Site	Construction	Signal to Release 0 - Liquid Inspection, From 001, 002 Inspection 0 - Contractor upon Release 0 - L = 1000	None
December 13, 2023 2:41:03 PM	Site	Construction	Signal to Release 0 - Liquid Inspection, From 001, 002 Inspection 0 - Contractor upon Release 0 - L = 1000	None
December 13, 2023 1:53:02 PM	Asst.	Site	Signal to Release 0 - Liquid Inspection, From 001, 002 Inspection 0 - Contractor upon Release 0 - L = 1000	Inspection Report L Inspection Report by Don Evans 0080000000_02_00010
December 13, 2023 2:44:02 PM	Site	Construction	Signal to Release 0 - Liquid Inspection, From 001, 002 Inspection 0 - Contractor upon Release 0 - L = 1000	Per Chapter 3
December 13, 2023 2:43:10 PM	Site	Construction	Inspection	OS
December 13, 2023 2:44:02 PM	Site	Construction	Inspection	None

Page 1/1

Date: December 13, 2023 3:52:46 PM

Page 18/18

Start Name: Agilent CrossLab  
Report Generated by: Agilent CrossLab  
Print Date: December 15, 2023 3:52:47 PM

Agilent 5100-7

QMS-7023 Transactions Log

Date	Transaction	Activity	Type of Transaction	Optional Information
December 15, 2023 3:51:12 PM	Auto	AutoCheck	System	None
December 15, 2023 3:51:14 PM	Auto	AutoPosterior	System	None
December 15, 2023 3:51:16 PM	Auto	Service/Posterior	System	None
December 15, 2023 3:51:17 PM	Auto	Qualification	System	OK
December 15, 2023 3:51:18 PM	Auto	Flushing	System	Report Generated: Certificate
December 15, 2023 3:51:19 PM	Auto	Recovery	System	Report Generated: Report

Page 1 of 1

Date: December 15, 2023 3:52:48 PM  
System ID: QMS-7

Page 18 / 18

## Agilent CrossLab Start Up Services

Agilent 5100 5110 ICP-OES  
Preventive Maintenance

Agilent  
CrossLab  
From Insight to Success

REVIEW BY: T. Kline  
APPROVED BY: S. L. M.  
NEXT CAL DATE: 11/01/2024

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

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

Revision A-02, Revised: 21 January 2023  
Document Number: 00014-0107-9  
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Page 1 of 12

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Agilent 5100, 5110 Preventive Maintenance Checklist

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## Introduction

## Customer Information

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

Agilent 5100, 5110 Preventive Maintenance Checklist

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## Important Customer Web Links

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

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Page 1 of 12

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Agilent 5100, 5110 Preventive Maintenance Checklist

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## Service Engineer's Responsibilities

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

Agilent 5100, 5110 Preventive Maintenance Checklist

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## Instrument Maintenance

## System Information

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

Instrument System Name and ID	5100A / 511010005
Instrument System File and Location	MS Inventory Comp (checked) / C:\5100
List System Component Product Numbers	List the Serial Numbers of each Component
1. ICP-OES	FW 12010005
2. ICP-OES	AG 1544-0116
3. ICP-OES (3000)	3000 / 001149
4.	
5.	
6.	
7.	
8.	
9.	

ICP-OES Configuration Table	Circle the type or write in the type if other
Instrument Type	ICP-OES / ICP-MS / ICP-MS / ICP-MS
Spray Chamber	Dynamic Single Pass / Dynamic Double Pass / Other
Torch	Radial / Dual View / Other
Torch Type	One Piece / Semi-Dismountable / Fully Dismountable / Other
Injector Diameter	2.0mm / 1.0mm / 1.0mm / 0.8mm / Other
Injector Material	Quartz / Ceramic / Other

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Page 1 of 12

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Page 1 of 12

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## Preparation

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

## Preventive Maintenance Procedures

## Record Pre-PM instrument performance

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

## Clean and inspect ICP-OES system

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

## Agilent Water Recirculator

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

## SPS 3 Auto Sampler

- ☒ Service not applicable.
- ☐ Power cycle the autosampler and verify successful initialization.
- ☐ Inspect X and Z axis belts for wear. Replace if necessary.
- ☐ Clean X and Z axis slide shafts.
- ☐ Using customer's racks and the Agilent software move the sample probe to the 4 outermost corners and raise port, ensure that the probe is approximately centered in the vial.

## SPS 4 Auto sampler

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

## AVE 4, 6, 7 Advanced Valve System

- ☒ Service not applicable.
- ☐ Replace valve rotor seal.
- ☐ Check fittings for signs of leaks.
- ☐ Check tubing including autosampler tubing for leaks or excessive wear.
- ☐ Check high flow pump for signs of leaks.

## ICP-OES adjustment

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

## Record Post-PM instrument performance

- ☒ Run Instrument Performance test.
- ☒ Record results in Instrument Performance Test Results Table - Post PM.
- ☒ For systems using ICP Expert version 7.3 and above, run the following instrument tests:
  - ☒ Subsystem Communication Test
  - ☒ Air Flow
  - ☒ Water Flow
  - ☒ Gas Flow
  - ☒ RF Generator
  - ☒ Camera Test
  - ☒ Optics Test
  - ☒ Nebulizer Test
- ☒ Record the result in the Instrument Test Results Table.

## Restore Instrument

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

## Service Review

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

## Test Results

## Instrument Performance Test Results Table

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

	Pre PM Sensitivity Check		Post PM Sensitivity Check	
	Result	Accept *	Result	Accept *
Zn 213.857 nm DBB	1541.6	2416.3	1910.0	3621.8
Mn 279.478 nm DBB	2561.1	11651.6	7141.5	12198.3
Al 356.102 nm DBB	1.1	16.0	5.4	16.0
K 766.493 nm DBB	8.5	16.0	3.6	12.5

\* Accept result is not applicable for GB01AA, GB012AA Radial View Instruments.

## Instrument Test Results Table

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

Instrument Test	Result
Subsystem Communication Test	Pass
Air Flow	Pass
Water Flow	Pass
Gas Flow	Pass
RF Generator	Pass
Camera Test	Pass
Optics Test	Pass
Nebulizer Test	Pass











Calibration Results:  
Without adjustment

Certificate No.: 232943011 Page: 4 of 4

Accessories	Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature (°C)	Correction of ISE (°C)	Uncertainty (K °C)
A1				586.5	17.5	1.5
A2				262.4	17.4	1.5
A3				262.1	17.1	1.5
A4				378.7	14.7	1.5
A5				378.3	13.3	1.5
B1				388.1	15.1	1.5
B2				265.1	15.1	1.5
B3				275.5	13.5	1.5
B4				378.3	13.3	1.5
B5				378.1	14.1	1.5
C1				388.1	15.1	1.5
C2				388.1	15.1	1.5
C3				378.9	13.9	1.5
C4				378.2	13.2	1.5
C5				377.5	17.5	1.5
D1				385.5	15.5	1.5
D2				385.9	15.9	1.5
D3				378.1	15.1	1.5
D4				378.7	15.7	1.5
D5				377.7	12.7	1.5

The End of Certificate

## ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

รุ่นเครื่อง: Block Digestion Unit รุ่น: KT-20i-  
เลขเครื่อง: 5720100065770000075

เลขใบงาน: WO-0000429

วันที่ตรวจ (No)		วันที่ตรวจ (No)		วันที่ตรวจ (No)	
11 Mar 2024		11 Mar 2024		11 Mar 2024	
วันที่	เวลา	วันที่	เวลา	วันที่	เวลา
General					
0	1	0	1	0	1
0	2	0	2	0	2
0	3	0	3	0	3
0	4	0	4	0	4
0	5	0	5	0	5
0	6	0	6	0	6
0	7	0	7	0	7
0	8	0	8	0	8

Calibration Certificate  
This certificate is valid for the duration of the calibration period.  
The calibration was performed in accordance with the requirements of the International System of Units (SI).  
The calibration was performed by the following person(s):  
Calibration Certificate

Calibration Certificate

Calibration Certificate  
This certificate is valid for the duration of the calibration period.  
The calibration was performed in accordance with the requirements of the International System of Units (SI).  
The calibration was performed by the following person(s):  
Calibration Certificate

Mr. Theeraporn Pongpattana  
Service Engineer

**TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)**  
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES  
55/1 INTANALAY ROAD NO. 11, SUAN LIANG, SUAN LIANG, BANGKOK 10250  
TEL: 02-2715-0000 FAX: 02-2715-0001

**Certificate of Calibration** Certificate No.: 23E3904  
Page: 1 of 2

Equipment: pH Meter  
Manufacturer: Mettler Toledo  
Model: SevenExcellence  
Serial No.: 803291445  
ID No.: RYG\_E390152  
Condition As-Received: Used Item  
Received Date: 08 December 2023  
Calibration Date: 14 December 2023  
Reference: 2315-0150SC  
Ambient Temperature: (25 ± 2) °C  
Relative Humidity: (50 ± 10) %

Submitted by: ALS Laboratory Group (Thailand) Co., Ltd. Rong Branch  
618/10 Moo 5, T. Maenam Khu, A. Phatthana, Rong 21140, Thailand

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

Condition of this result of calibration

1. Reference standards instrument(s):

Instrument	Model	Serial No.	Certificate No.	Exp. Date
1) Multi-Product Calibrator	5500A	242562	EE-0041-23	28 Apr 2024

2. The result of calibration was made on request as per specified by customer.

3. The 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)

Reviewed by: N. Banwit  
Approved by: [Signature]  
Next Cal. Date: 14/12/24

Calibrated by: Nopachon Phasomson  
Issue Date: 15 December 2023

Approved Signatory:  
[Signature]  
[Signature]  
[Signature]

a 0331105

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TEL: 02-2715-0000 FAX: 02-2715-0001

**Certificate of Calibration** Certificate No.: 23E3904  
Page: 2 of 2

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

Function: DC voltage measurement Range: 2000 mV

Standard Value (mV)	UUC Reading (mV)	Error (mV)	Uncertainty (± mV)
-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.

o-o-o-

a 1193422

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CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES  
55/1 INTANALAY ROAD NO. 11, SUAN LIANG, SUAN LIANG, BANGKOK 10250  
TEL: 02-2715-0000 FAX: 02-2715-0001

**Certificate of Calibration** Certificate No.: 23CH1574  
Page: 1 of 3

Equipment: pH Meter  
Manufacturer: Mettler Toledo  
Model: SevenExcellence  
Serial No.: 8034291445  
ID No.: RYG\_E390152  
Condition As-Received: Used Item  
Received Date: 08 December 2023  
Calibration Date: 15 December 2023  
Reference: 2315-0150SC-3  
Submitted by: ALS Laboratory Group (Thailand) Co., Ltd. Rong Branch  
618/10 Moo 5, T. Maenam Khu, A. Phatthana, Rong 21140, Thailand

Ambient Temperature: (25 ± 2) °C  
Relative Humidity: (50 ± 15) %  
Calibration Procedure: In-house method:  
- CP-CH8 by direct measurement with standard voltage calibrator and direct measurement with certified reference material (CRM)  
- CP-CH8 by comparison with standard thermometer

Calibrated by: Warorn Lemgattakul  
Approved by: [Signature]  
[Signature]  
[Signature]

Issue Date: 19 December 2023

The Uncertainty is for a confidence probability of approximately 95 %

This certificate may be reproduced either in whole or in part, provided that the DKSH logo and the DKSH name are included.

Approved by the head of Department of Calibration and Testing Services

A 0061696

**TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)**  
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Page: 2 of 3

Condition of this calibration result

1. Reference Standard Instrument

Instrument	Serial No.	ID No.	Cert. No.	Exp. Date
1) Document Process Calibrator	54030048	130R0116	23E2902	27 Aug 2024
2) Ref. Standard Thermometer	4802054	110R0044	23E008	28 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., ANS-ASQ National Accreditation Board, Accredited No. AN-1535

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	913598	14 July 2025
pH 6.868	CPA chem	931959	01 Oct 2024
pH 9.997	CPA chem	940105	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 Fluks at pH (4.7, 16)

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading	Uncertainty of Measurement (mV)	Coverage factor
pH Meter	4.000	177.48	177.3	4.000	2.00
S/N: 8034291445	7.000	0.00	-0.1	7.000	2.00
	10.000	-177.48	-177.5	10.000	2.00

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

**Calibration Results**  
Function: pH Measurement  
Performing three buffers standard curve by using buffer nominal pH (4.7,10)

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH measurement (±)	Coverage factor k
pH Electrode	4.008	4.013	104.1	0.0045	2.00
	6.996	6.998	8.7	0.0064	2.00
	9.997	10.002	-164.7	0.0098	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 (4°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-

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Service Confirmation Number: 090437523  
Service Confirmation Date: 09.04.2023

## Service Instrument:

Model Number	Model Description	Serial Number	System Handle	Parent Asset
ETS-8A 7900	CPMS 7900 System			
G8418A	SPS 4 Autosampler	AJ1543072	ICP-MS 7900	SYS-8A-7900
G8411A	DGS 3 for Agilent	JP1691027	ICP-MS 7900	SYS-8A-7900
	7900/7900-7900			
G3202A	7500 S1007 Driver	TU15A1848	ICP-MS 7900	SYS-8A-7900
G8483A	Agilent 7900 ICP-MS	JP16471199	ICP-MS 7900	SYS-8A-7900

## Service Item:

Item	Service/Part #	Description	Qty	Exhaustion	Service Start	Service End
1000	EQC	External Operational Qualification	1.00	Agreement Exhaustion: 100 % covered	08.04.2023	08.04.2023
1010	2020-SB01	ICP-MS Check-out Solutions	1.00	Agreement Exhaustion: 100 % covered		

## Additional Information:

Page 2 of 3

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**Agilent Technologies**

**Customer Contact:**  
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**Service To:**  
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**Delivery Site:**  
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**Location:**  
Room  
Bldg  
Lvl  
Dept

**Service Request:**  
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Contact Email: [service@agilent.com](mailto:service@agilent.com)  
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**Service Request:**  
Customer Purchase Order Number: 7027010  
Service Request: Service Request Date:  
Service Order: 000000207 Service Confirmation: 090437523

**REVIEW BY:** Pichai K.  
**APPROVED BY:** Pichai K.  
**NEXT CAL. DATE:** 05/10/2024

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Page 1 of 3

Service Confirmation Number: 090437523  
Service Confirmation Date: 09.04.2023

## Service Information:

**Problem Description:**  
WU-S-GO-ICP-MS 7900-000140313

**Service Provided:**  
Test OK control of instrument ICP-MS = ICP-MS 7900, after done all instrument test ok Pass

**Service Overview Code:**  
Reason Code: Scheduled Service  
Signature Code: Scheduled Service  
Resolution Code: Scheduled Service

Reported Name:	Travel Name:
Customer Field Service Representative Name: Panchai K.	Customer Field Service Representative Signature: Panchai K.
Customer Name: Aukhira Khunjan	Customer Signature: Panchai K.

**Additional Comments:**

Page 3 of 3