

ภาคผนวก ง

เอกสารการสอบเทียบเครื่องมือตรวจวิเคราะห์



right solutions.
right partner.

รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Stack (CEMs)	Oxides of Nitrogen	Analyzer , System calibration, Stand	-	-	-	-
Stack (CEMs)	Sulfur Dioxide	Analyzer , System calibration, Stand	-	-	-	-
Stack (CEMs)	Oxygen	Analyzer , System calibration, Stand	-	-	-	-
Stack (CEMs)	Flow Rate	Analyzer , System calibration, Stand	-	-	-	-
Stack	Total Suspended Particulate	Console Control Unit	BKK_FS0485	24-May-25	23-Nov-25	6
Stack	Total Suspended Particulate	Pitot Tube	BKK_FS1105	24-May-25	23-Nov-25	6
Stack	Total Suspended Particulate	Fuel Gas Analyzer	BKK_FS1160	7-Nov-24	7-Nov-25	12
Stack	Total Suspended Particulate	Digital Balance	BKK_EN0309	5-Nov-24	5-Nov-25	12
Ambient	Nitrogen Dioxide	NO ₂ Analyzer	SGK_FS0092	3-Jul-25	3-Jan-26	6
Ambient	Nitrogen Dioxide	NO ₂ Analyzer	BKK_FS0773	2-Jul-25	2-Jan-26	6
Ambient	Nitrogen Dioxide	NO ₂ Analyzer	BKK_FS0776	2-Jul-25	2-Jan-26	6
Ambient	Nitrogen Dioxide	NO ₂ Analyzer	BKK_FS1084	3-Jul-25	3-Jan-26	6
Ambient	Particulate Matter (PM 2.5)	PM 2.5 Air SAMPLER	SGK_FS0125	-	-	On site Calibration
Ambient	Particulate Matter (PM 2.5)	PM 2.5 Air SAMPLER	SGK_FS0124	-	-	On site Calibration
Ambient	Particulate Matter (PM 2.5)	PM 2.5 Air SAMPLER	BKK_FS1435	-	-	On site Calibration
Ambient	Particulate Matter (PM 2.5)	PM 2.5 Air SAMPLER	SGK_FS0123	-	-	On site Calibration
Ambient	Particulate Matter (PM 2.5)	Digital Balance	BKK_EN0403	30-May-25	30-May-26	12
Ambient	Particulate Matter (PM-10)	High Volume	SGK_FS0121	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	High Volume	SGK_FS0087	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	High Volume	SGK_FS0066	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	High Volume	SGK_FS0086	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	Digital Balance	BKK_EN0403	30-May-25	30-May-26	12
Ambient	Total Suspended Particulate	High Volume	SGK_FS0119	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	SGK_FS0062	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	SGK_FS0060	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	SGK_FS0084	-	-	On site Calibration
Ambient	Total Suspended Particulate	Digital Balance	BKK_EN0403	30-May-25	30-May-26	12
Ambient	Sulfur Dioxide	SO ₂ Analyzer	SGK_FS0093	3-Jul-25	3-Jan-26	6
Ambient	Sulfur Dioxide	SO ₂ Analyzer	BKK_FS0772	2-Jul-25	2-Jan-26	6
Ambient	Sulfur Dioxide	SO ₂ Analyzer	BKK_FS0775	2-Jul-25	2-Jan-26	6
Ambient	Sulfur Dioxide	SO ₂ Analyzer	BKK_FS1083	2-Jul-25	2-Jan-26	6
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	SGK_FS0088	23-Aug-24	23-Feb-26	18
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	SGK_FS0035	3-Jul-24	3-Jan-26	18
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	BKK_FS0919	26-Aug-24	26-Feb-26	18
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	SGK_FS0089	23-Aug-24	23-Feb-26	18
Noise	Leq 24 hrs	Sound Calibrator	SGK_FS0114	11-Dec-24	11-Dec-25	12
Noise	Leq 24 hrs	Sound Level Meter	SGK_FS0128	6-Feb-25	5-Feb-26	12
Noise	Leq 24 hrs	Sound Level Meter	SGK_FS0130	5-Jun-25	4-Jun-26	12
Noise	Leq 24 hrs	Sound Level Meter	SGK_FS0132	5-Jun-25	4-Jun-26	12
Noise	Leq 24 hrs	Sound Level Meter	SGK_FS0129	6-Feb-25	5-Feb-26	12
Noise	Leq 24 hrs	Sound Level Meter	SGK_FS0030	13-Dec-24	13-Dec-25	12
Noise	Leq 24 hrs	Sound Level Meter	SGK_FS0029	13-Dec-24	13-Dec-25	12
Heat	Heat Stress	Heat Stress Monitor	SGK_FS0010	7-Oct-25	6-Oct-26	12
Heat	Heat Stress	Heat Stress Monitor	SGK_FS0043	2-Dec-24	2-Dec-25	12
Illuminance	Illuminance	Lux Meter	SGK_FS0020	16-Aug-25	15-Aug-26	12
Noise	Leq 8 hrs	Sound Calibrator	SGK_FS0114	11-Dec-24	11-Dec-25	12
Noise	Leq 8 hrs	Sound Level Meter	SGK_FS0131	5-Jun-25	4-Jun-26	12
Noise	Leq 8 hrs	Sound Level Meter	SGK_FS0134	5-Jun-25	4-Jun-26	12
Noise	Noise Dose, TWA	Dose Badge Reader	SGK_FS0006	30-Jun-25	29-Jun-26	12
Noise	Noise Dose, TWA	Dosimeter	SGK_FS0098	7-Feb-25	6-Feb-26	12
Noise	Noise Dose, TWA	Dose Badge Reader	SGK_FS0006	30-Jun-25	29-Jun-26	12
Noise	Noise Dose, TWA	Dosimeter	SGK_FS0005	5-Sep-25	4-Sep-26	12



right solutions.
right partner.

รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Workplace	Total Dust, Respirable Dust	DRYCAL FLOWMETER	BKK_FS0614	9-Sep-24	9-Sep-25	12
Workplace		DRYCAL FLOWMETER	BKK_FS0619	9-Sep-24	9-Sep-25	12
Workplace		Air Sampling Pump	SGK_FS0145	1-Sep-25	1-Dec-25	3
Workplace		Air Sampling Pump	SGK_FS0148	1-Sep-25	1-Dec-25	3
Workplace		Air Sampling Pump	SGK_FS0160	1-Sep-25	1-Dec-25	3
Workplace		Air Sampling Pump	SGK_FS0161	1-Sep-25	1-Dec-25	3
Workplace		Air Sampling Pump	SGK_FS0165	1-Sep-25	1-Dec-25	3
Workplace	Total Dust	Analytical Balance 5 D.	SGK_CL0077	10-Jan-25	10-Jan-26	12
Workplace	Respirable Dust	Analytical Balance 5 D.	SGK_CL0077	10-Jan-25	10-Jan-26	12
Songkhla Lab	Residual Free Chlorine	Chlorine Meter	SGK_FS0049	24-Jan-25	24-Jan-26	12
Songkhla Lab	Calcium	ICP-MS	SGK_CL0048	3-Feb-25	3-Aug-26	18
Songkhla Lab	Calcium	Cold Room Water	SGK_CL0065	1-Jul-24	1-Jan-26	18
Songkhla Lab	Magnesium	ICP-MS	SGK_CL0048	3-Feb-25	3-Aug-26	18
Songkhla Lab	Magnesium	Cold Room Water	SGK_CL0065	1-Jul-24	1-Jan-26	18
Songkhla Lab	SAR	ICP-MS	SGK_CL0048	3-Feb-25	3-Aug-26	18
Songkhla Lab	SAR	Cold Room Water	SGK_CL0065	1-Jul-24	1-Jan-26	18
Songkhla Lab	Sodium	ICP-MS	SGK_CL0048	3-Feb-25	3-Aug-26	18
Songkhla Lab	Sodium	Cold Room Water	SGK_CL0065	1-Jul-24	1-Jan-26	18
Songkhla Lab	pH at 25 °C	pH meter	SGK_CL0030	19-Oct-24	19-Apr-26	18
Songkhla Lab	Oil & Grease	Electronic Top-Loading Balance	SGK_CL0045	10-Jan-25	10-Jan-26	12
Songkhla Lab	Oil & Grease	Oven	SGK_CL0024	19-Oct-24	19-Apr-26	18
Songkhla Lab	Oil & Grease	Water Bath	SGK_CL0035	10-Jan-25	10-Jul-26	18
Songkhla Lab	Temperature	pH meter	SGK_FS0019	4-Feb-25	4-Feb-26	12
Songkhla Lab	Total Dissolved Solids 180°C	Electronic Top-Loading Balance	SGK_CL0045	10-Jan-25	10-Jan-26	12
Songkhla Lab	Total Dissolved Solids 180°C	Oven	SGK_CL0024	19-Oct-24	19-Apr-26	18
Songkhla Lab	Total Suspended Solids	Electronic Top-Loading Balance	SGK_CL0045	10-Jan-25	10-Jan-26	12
Songkhla Lab	Total Suspended Solids	Oven	SGK_CL0024	19-Oct-24	19-Apr-26	18
Water Lab	Ammonia Nitrogen	Discrete analyzer	BKK_EN0438	3-Sep-25	3-Sep-26	12
Water Lab	Nitrate	Discrete analyzer	BKK_EN0438	3-Sep-25	3-Sep-26	12
Water Lab	Phosphate	Discrete analyzer	BKK_EN0438	3-Sep-25	3-Sep-26	12
Songkhla Lab	Dissolved Oxygen (on site)	DO Meter	SGK_FS0018	11-Apr-25	10-Apr-26	12
Songkhla Lab	Total Kjeldahl Nitrogen	KJELDATHERM®BLOCK-DIGESTION U	SGK_CL0092	25-Feb-25	25-Feb-26	12
Songkhla Lab	BOD	Incubator	SGK_CL0028	10-Jan-25	10-Jul-26	18
Songkhla Lab	BOD	DO Meter With Sensor	SGK_CL0101	24-Feb-25	24-Feb-26	12
Water Lab	Total Trihalomethanes	Gas Chromatography (MSD)	BKK_EN0059	25-Jun-25	25-Dec-26	18
Songkhla Lab	Total Coliform	Autoclave	SGK_ML0001	1-Jul-24	1-Jan-26	18
Songkhla Lab	Total Coliform	Incubator	SGK_ML0013	3-Jul-25	3-Jan-27	18
Songkhla Lab	Total Coliform	pH Meter	SGK_ML0016	2-Jul-24	2-Jan-26	18
Songkhla Lab	Total Coliform	Water Bath	SGK_ML0021	1-Jul-24	1-Jan-26	18
Songkhla Lab	Fecal Coliform	Autoclave	SGK_ML0001	1-Jul-24	1-Jan-26	18
Songkhla Lab	Fecal Coliform	Incubator	SGK_ML0013	3-Jul-25	3-Jan-27	18
Songkhla Lab	Fecal Coliform	pH Meter	SGK_ML0016	2-Jul-24	2-Jan-26	18
Songkhla Lab	Fecal Coliform	Water Bath	SGK_ML0021	1-Jul-24	1-Jan-26	18
Water Lab	Chloride	Ion Chromatography	BKK_EN0069	24-Jun-25	24-Jun-26	12
Water Lab	Nitrate nitrogen	Discrete analyzer	BKK_EN0438	3-Sep-25	3-Sep-26	12
Songkhla Lab	Arsenic	ICP-MS	SGK_CL0048	3-Feb-25	3-Aug-26	18
Songkhla Lab	Arsenic	Cold Room Water	SGK_CL0065	1-Jul-24	1-Jan-26	18
Songkhla Lab	Cadmium	ICP-MS	SGK_CL0048	3-Feb-25	3-Aug-26	18
Songkhla Lab	Cadmium	Cold Room Water	SGK_CL0065	1-Jul-24	1-Jan-26	18
Songkhla Lab	Hexavalent Chromium	Spectrophotometer	SGK_CL0040	15-Jan-25	15-Jan-26	12
Songkhla Lab	Hexavalent Chromium	Cold Room	SGK_CL0065	1-Jul-24	1-Jan-26	18
Songkhla Lab	Iron	ICP-MS	SGK_CL0048	3-Feb-25	3-Aug-26	18
Songkhla Lab	Iron	Cold Room Water	SGK_CL0065	1-Jul-24	1-Jan-26	18
Songkhla Lab	Lead	ICP-MS	SGK_CL0048	3-Feb-25	3-Aug-26	18
Songkhla Lab	Lead	Cold Room Water	SGK_CL0065	1-Jul-24	1-Jan-26	18



right solutions.
right partner.

รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Songkhla Lab	Nickel	ICP-MS	SGK_CL0048	3-Feb-25	3-Aug-26	18
Songkhla Lab	Nickel	Cold Room Water	SGK_CL0065	1-Jul-24	1-Jan-26	18
Songkhla Lab	Copper	ICP-MS	SGK_CL0048	3-Feb-25	3-Aug-26	18
Songkhla Lab	Copper	Cold Room Water	SGK_CL0065	1-Jul-24	1-Jan-26	18
Songkhla Lab	Mercury	ICP-MS	SGK_CL0048	3-Feb-25	3-Aug-26	18
Songkhla Lab	Mercury	Cold Room Water	SGK_CL0065	1-Jul-24	1-Jan-26	18
Songkhla Lab	Chromium	ICP-MS	SGK_CL0048	3-Feb-25	3-Aug-26	18
Songkhla Lab	Chromium	Cold Room Water	SGK_CL0065	1-Jul-24	1-Jan-26	18
Songkhla Lab	Selenium	ICP-MS	SGK_CL0048	3-Feb-25	3-Aug-26	18
Songkhla Lab	Selenium	Cold Room Water	SGK_CL0065	1-Jul-24	1-Jan-26	18
Songkhla Lab	Zinc	ICP-MS	SGK_CL0048	3-Feb-25	3-Aug-26	18
Songkhla Lab	Zinc	Cold Room Water	SGK_CL0065	1-Jul-24	1-Jan-26	18
Songkhla Lab	Conductivity	Conductivity Meter	SGK_CL0032	2-May-25	2-May-26	12



Lot No. 2576889-1

ANALYZER CALIBRATION DATA

Client : Gulf Chana Green Co., Ltd. Location : S1 ปล่อง Boiler No.PB1511
Date : 28 Oct 25 Test Operator : Anuvat M.

O₂ ANALYZER

Model : TELEDYNE API T200H Serial No. : 922
Span (%) : 25

	Cylinder Value (%)	Initial Analyzers Calibration Response (%)	Final Analyzers Calibration Response (%)	Difference (Percent of Span)
Zero Gas	0.00	0.10	0.12	0.08
Low-Level Gas	7.98	8.00	8.12	0.48
Span Gas	16.04	15.88	16.00	0.48

NO_x ANALYZER

Model : TELEDYNE API T200H Serial No. : 922
Span (ppm) : 200

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.00	0.00
Low-Level Gas	80.91	80.00	80.66	0.33
Span Gas	162.90	163.20	161.80	0.70

SO₂ ANALYZER

Model : TELEDYNE API T100H Serial No. : 534
Span (ppm) : 100

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.05	0.00	0.05
Low-Level Gas	50.27	49.88	49.00	0.88
Span Gas	79.51	80.24	80.77	0.53

CO ANALYZER

Model : TELEDYNE API T300M Serial No. : 844
Span (ppm) : 200

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.00	0.00
Low-Level Gas	80.24	79.88	79.12	0.38
Span Gas	156.00	157.60	157.20	0.20

CO₂ ANALYZER

Model : TELEDYNE API T300M Serial No. : 844
Span (%) : 25

	Cylinder Value (%)	Initial Analyzers Calibration Response (%)	Final Analyzers Calibration Response (%)	Difference (Percent of Span)
Zero Gas	0.00	0.11	0.00	0.44
Low-Level Gas	16.08	16.00	15.88	0.48
Span Gas	22.05	21.60	21.70	0.40

Calibrated by



(Mr.Anuvat Mounpair)

Environmental Field Scientist (2)



Lot No. 2576889-1

SYSTEM CALIBRATION BIAS AND DRIFT DATA

Client : Gulf Chana Green Co., Ltd. Location : S1 ปล่อง Boiler No.PB1511
Date : 28 Oct 25 Test Operator : Anuvat M.

O₂ ANALYZER
Cylinder Conc. (%) : 16.04 Span (%) : 25

	O ₂ Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
		System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	
Zero Gas	0.10	0.11	0.04	0.00	0.40	0.44
Upscale Gas	15.88	16.00	0.48	16.13	1.00	0.52

NO_x ANALYZER
Cylinder Conc. (ppm) : 162.90 Span (ppm) : 200

	NO _x Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
		System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	
Zero Gas	0.00	0.11	0.06	0.10	0.05	0.01
Upscale Gas	163.20	161.20	1.00	160.00	1.60	0.60

SO₂ ANALYZER
Cylinder Conc. (ppm) : 79.51 Span (ppm) : 100

	SO ₂ Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
		System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	
Zero Gas	0.05	0.00	0.05	0.00	0.05	0.00
Upscale Gas	80.24	79.00	1.24	79.20	1.04	0.20

CO ANALYZER
Cylinder Conc. (ppm) : 156.00 Span (ppm) : 200

	CO Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
		System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	
Zero Gas	0.00	0.10	0.05	0.12	0.06	0.01
Upscale Gas	157.60	156.00	0.80	156.70	0.45	0.35

CO₂ ANALYZER
Cylinder Conc. (%) : 22.05 Span (%) : 25

	CO ₂ Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
		System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	
Zero Gas	0.11	0.10	0.04	0.00	0.44	0.40
Upscale Gas	21.60	22.00	1.60	22.10	2.00	0.40

Calibrated by



(Mr.Anuvat Mounpair)

Environmental Field Scientist (2)



EMISSION TEST RESULT

Client		Gulf Chana Green Co., Ltd.	Run #	1
Date		28 Oct 25	Location	S1 ปล่อง Boiler No.PB1511
Start Time		10:40	Test Operator	Anuvat M.
SO ₂ Analyzer	Model	TELEDYNE API T100H	Finish Time	11:00
NO _x /O ₂ Analyzer	Model	TELEDYNE API T200H	Serial No.	534
CO/CO ₂ Analyzer	Model	TELEDYNE API T300M	Serial No.	922
			Serial No.	844

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
10:40	8.35	12.39	148.44	1.86	126.65	
10:41	8.26	12.22	145.78	1.77	128.09	
10:42	7.99	12.54	146.52	1.75	115.04	
10:43	8.09	12.58	150.07	1.62	112.42	
10:44	8.35	12.31	151.59	1.57	117.65	
10:45	8.55	12.17	150.04	1.53	121.54	
10:46	8.70	11.88	148.70	1.48	118.06	
10:47	8.64	11.93	148.27	1.43	112.45	
10:48	8.70	11.98	148.46	1.37	104.42	
10:49	8.81	11.80	148.63	1.35	108.72	
10:50	8.70	11.85	149.66	1.30	108.51	
10:51	8.60	11.95	150.82	1.28	111.23	
10:52	8.12	12.29	151.40	1.28	102.46	
10:53	7.52	12.94	151.91	1.24	84.46	
10:54	7.23	13.38	159.90	1.35	74.73	
10:55	7.24	13.48	160.22	1.30	76.68	
10:56	7.28	13.33	160.18	1.25	83.83	
10:57	7.38	13.33	160.17	1.24	87.04	
10:58	7.54	13.21	160.20	1.23	90.88	
10:59	7.31	13.12	159.63	1.21	90.36	
11:00	7.13	13.41	159.52	1.19	82.10	
Average	8.02	12.58	152.86	1.41	102.73	



(Mr.Anuvat Mounpair)

Environmental Field Scientist (2)



EMISSION TEST RESULT

Client		Gulf Chana Green Co., Ltd.	Run #	2
Date		28 Oct 25	Location	S1 ปล่อง Boiler No.PB1511
Start Time		11:01	Test Operator	Anuvat M.
SO ₂ Analyzer	Model	TELEDYNE API T100H	Finish Time	11:21
NO _x /O ₂ Analyzer	Model	TELEDYNE API T200H	Serial No.	534
CO/CO ₂ Analyzer	Model	TELEDYNE API T300M	Serial No.	922
			Serial No.	844

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
11:01	7.41	13.31	159.50	2.51	83.86	
11:02	7.52	13.10	158.49	2.46	93.05	
11:03	7.76	12.88	156.59	2.48	97.48	
11:04	8.15	12.62	154.31	2.45	104.98	
11:05	8.23	12.46	153.13	2.37	106.18	
11:06	8.40	12.21	152.15	2.36	110.60	
11:07	8.63	12.02	151.62	2.31	112.15	
11:08	8.83	11.89	151.50	2.20	114.75	
11:09	8.73	11.78	151.09	2.26	111.06	
11:10	8.55	11.92	151.26	2.23	108.04	
11:11	8.40	12.18	152.06	2.23	103.20	
11:12	8.19	12.36	149.81	2.25	93.72	
11:13	8.19	12.41	150.64	2.20	92.94	
11:14	8.14	12.44	151.47	2.26	88.60	
11:15	8.08	12.64	152.12	2.24	87.41	
11:16	8.37	12.26	153.03	2.20	97.95	
11:17	8.27	12.21	153.69	2.26	95.19	
11:18	8.06	12.49	154.74	2.26	89.25	
11:19	7.97	12.63	155.74	2.29	89.36	
11:20	8.05	12.59	155.58	2.23	91.54	
11:21	8.12	12.60	155.27	2.25	94.19	
Average	8.19	12.43	153.51	2.30	98.36	



(Mr.Anuvat Mounpair)

Environmental Field Scientist (2)



EMISSION TEST RESULT

Client	Gulf Chana Green Co., Ltd.	Run #	3
Date	28 Oct 25	Location	S1 ปลีล้ง Boiler No.PB1511
Start Time	11:22	Test Operator	Anuvat M.
SO ₂ Analyzer Model	TELEDYNE API T100H	Finish Time	11:42
NO _x /O ₂ Analyzer Model	TELEDYNE API T200H	Serial No.	534
CO/CO ₂ Analyzer Model	TELEDYNE API T300M	Serial No.	922
		Serial No.	844

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
11:22	7.99	12.58	154.88	2.27	94.23	
11:23	7.86	12.65	154.64	2.20	87.27	
11:24	7.91	12.72	155.19	2.26	90.87	
11:25	8.07	12.69	155.79	2.22	96.64	
11:26	8.35	12.33	155.08	2.23	114.94	
11:27	8.55	11.98	152.35	2.08	118.25	
11:28	8.55	11.98	149.96	2.15	118.28	
11:29	8.03	12.33	148.48	2.15	108.60	
11:30	7.69	12.80	150.70	2.16	92.21	
11:31	7.56	12.97	153.51	2.35	84.82	
11:32	7.08	13.44	156.71	2.46	79.89	
11:33	6.96	13.68	158.22	2.51	77.58	
11:34	7.25	13.40	158.01	2.45	87.37	
11:35	7.12	13.36	155.49	2.52	93.72	
11:36	6.91	13.60	153.97	2.51	88.34	
11:37	7.14	13.59	153.58	2.53	93.60	
11:38	7.18	13.44	152.23	2.45	97.16	
11:39	7.37	13.33	149.35	2.47	99.95	
11:40	7.57	13.10	147.77	2.43	108.09	
11:41	7.57	13.02	146.44	2.40	112.35	
11:42	7.55	12.98	144.26	2.42	114.07	
Average	7.63	12.95	152.69	2.34	98.01	



(Mr.Anuvat Mounpair)

Environmental Field Scientist (2)



Lot No. 2576907-1

ANALYZER CALIBRATION DATA

Client : Gulf Chana Green Co., Ltd. Location : S1 ปล่อง Boiler No.PB1511
Date : 28 Oct 25 Test Operator : Anuvat M.

O₂ ANALYZER

Model : TELEDYNE API T200H Serial No. : 922
Span (%) : 25

	Cylinder Value (%)	Initial Analyzers Calibration Response (%)	Final Analyzers Calibration Response (%)	Difference (Percent of Span)
Zero Gas	0.00	0.10	0.12	0.08
Low-Level Gas	7.98	8.00	8.12	0.48
Span Gas	16.04	15.88	16.00	0.48

NO_x ANALYZER

Model : TELEDYNE API T200H Serial No. : 922
Span (ppm) : 200

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.00	0.00
Low-Level Gas	80.91	80.00	80.66	0.33
Span Gas	162.90	163.20	161.80	0.70

SO₂ ANALYZER

Model : TELEDYNE API T100H Serial No. : 534
Span (ppm) : 100

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.05	0.00	0.05
Low-Level Gas	50.27	49.88	49.00	0.88
Span Gas	79.51	80.24	80.77	0.53

CO ANALYZER

Model : TELEDYNE API T300M Serial No. : 844
Span (ppm) : 200

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.00	0.00
Low-Level Gas	80.24	79.88	79.12	0.38
Span Gas	156.00	157.60	157.20	0.20

Calibrated by



(Mr. Anuvat Mounpair)

Environmental Field Scientist (2)

Lot No. 2576907-1**SYSTEM CALIBRATION BIAS AND DRIFT DATA**

Client : Gulf Chana Green Co., Ltd. Location : S1 ปล่อง Boiler No.PB1511
Date : 28 Oct 25 Test Operator : Anuvat M.

O₂ ANALYZER
Cylinder Conc. (%) : 16.04 Span (%) : 25

	O ₂ Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
		System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	
Zero Gas	0.10	0.11	0.04	0.00	0.40	0.44
Upscale Gas	15.88	16.00	0.48	16.13	1.00	0.52

NO_x ANALYZER
Cylinder Conc. (ppm) : 162.90 Span (ppm) : 200

	NO _x Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
		System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	
Zero Gas	0.00	0.11	0.06	0.10	0.05	0.01
Upscale Gas	163.20	161.20	1.00	160.00	1.60	0.60

SO₂ ANALYZER
Cylinder Conc. (ppm) : 79.51 Span (ppm) : 100

	SO ₂ Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
		System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	
Zero Gas	0.05	0.00	0.05	0.00	0.05	0.00
Upscale Gas	80.24	79.00	1.24	79.20	1.04	0.20

CO ANALYZER
Cylinder Conc. (ppm) : 156.00 Span (ppm) : 200

	CO Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
		System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	
Zero Gas	0.00	0.10	0.05	0.12	0.06	0.01
Upscale Gas	157.60	156.00	0.80	156.70	0.45	0.35

Calibrated by



(Mr. Anuvat Mounpair)

Environmental Field Scientist (2)



CEMs Data

Client Name Gulf Chana Green Co., Ltd.
Plant Name GCG

Date 28 Oct 25
Location S1 ปล่อง Boiler No.PB1511

Run No: 1

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
28 Oct 25	10:40	0.00	145.60	145.90	7.89	-
28 Oct 25	10:41	1.53	150.25	127.90	7.53	-
28 Oct 25	10:42	1.10	155.45	125.20	7.51	-
28 Oct 25	10:43	0.37	154.93	132.00	7.65	-
28 Oct 25	10:44	0.02	149.03	133.90	7.86	-
28 Oct 25	10:45	0.01	149.20	133.10	8.21	-
28 Oct 25	10:46	0.30	149.80	128.40	8.05	-
28 Oct 25	10:47	0.37	150.63	117.20	8.05	-
28 Oct 25	10:48	0.31	150.53	123.00	8.33	-
28 Oct 25	10:49	1.02	151.38	119.40	8.14	-
28 Oct 25	10:50	0.99	154.23	127.00	8.08	-
28 Oct 25	10:51	1.05	152.48	116.80	7.87	-
28 Oct 25	10:52	1.78	155.00	99.70	7.33	-
28 Oct 25	10:53	3.26	163.73	90.20	6.76	-
28 Oct 25	10:54	3.49	165.25	93.60	6.70	-
28 Oct 25	10:55	2.43	164.23	101.90	6.87	-
28 Oct 25	10:56	2.23	164.82	105.10	6.77	-
28 Oct 25	10:57	1.90	164.95	105.20	6.80	-
28 Oct 25	10:58	1.76	162.50	107.10	7.07	-
28 Oct 25	10:59	2.16	164.40	98.30	6.72	-
28 Oct 25	11:00	2.77	165.38	98.30	6.70	-
Max		3.49	165.38	145.90	8.33	-
Avg		1.37	156.37	115.68	7.47	-

Run No: 2

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
28 Oct 25	11:01	1.75	161.28	111.20	7.01	-
28 Oct 25	11:02	1.97	159.73	112.70	7.19	-
28 Oct 25	11:03	1.32	156.40	120.40	7.42	-
28 Oct 25	11:04	0.67	154.32	120.10	7.61	-
28 Oct 25	11:05	0.38	153.50	125.60	7.89	-
28 Oct 25	11:06	0.01	152.75	124.40	7.96	-
28 Oct 25	11:07	0.16	151.98	131.00	8.07	-
28 Oct 25	11:08	0.02	149.98	123.60	8.31	-
28 Oct 25	11:09	0.37	152.73	122.60	8.05	-
28 Oct 25	11:10	0.16	153.38	116.90	7.82	-
28 Oct 25	11:11	1.17	154.98	108.20	7.70	-
28 Oct 25	11:12	1.06	155.55	109.50	7.68	-
28 Oct 25	11:13	1.34	156.18	101.80	7.60	-
28 Oct 25	11:14	1.02	157.55	101.20	7.43	-
28 Oct 25	11:15	1.10	157.48	113.10	7.76	-
28 Oct 25	11:16	1.11	157.13	109.50	7.89	-
28 Oct 25	11:17	1.20	160.75	103.40	7.49	-
28 Oct 25	11:18	1.20	160.55	104.10	7.41	-
28 Oct 25	11:19	1.72	159.82	106.40	7.57	-
28 Oct 25	11:20	1.64	160.65	108.30	7.45	-
28 Oct 25	11:21	1.92	157.63	109.10	7.51	-
Max		1.97	161.28	131.00	8.31	-
Avg		1.01	156.40	113.48	7.66	-

Run No: 3

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
28 Oct 25	11:22	1.71	159.28	100.80	7.45	-
28 Oct 25	11:23	1.57	160.57	108.80	7.32	-
28 Oct 25	11:24	1.37	160.73	108.20	7.30	-
28 Oct 25	11:25	0.88	156.48	131.00	7.75	-
28 Oct 25	11:26	0.99	153.63	132.80	8.00	-
28 Oct 25	11:27	0.66	151.63	131.30	7.90	-
28 Oct 25	11:28	0.66	148.48	122.50	7.81	-
28 Oct 25	11:29	1.86	157.70	105.50	7.33	-
28 Oct 25	11:30	2.31	161.03	99.00	7.10	-
28 Oct 25	11:31	2.89	162.30	98.90	6.96	-
28 Oct 25	11:32	2.89	162.30	98.90	6.96	-
28 Oct 25	11:33	3.68	160.28	105.80	6.89	-
28 Oct 25	11:34	2.68	157.57	112.40	6.79	-
28 Oct 25	11:35	2.85	159.25	104.10	6.46	-
28 Oct 25	11:36	3.00	159.82	111.00	6.59	-
28 Oct 25	11:37	2.54	155.00	113.90	6.66	-
28 Oct 25	11:38	2.62	152.90	115.60	6.70	-
28 Oct 25	11:39	2.38	151.88	122.50	7.01	-
28 Oct 25	11:40	2.46	149.07	128.00	7.06	-
28 Oct 25	11:41	2.48	146.35	131.90	7.15	-
28 Oct 25	11:42	2.48	147.43	117.40	6.71	-
Max		3.68	162.30	132.80	8.00	-
Avg		2.14	155.89	114.30	7.14	-

Run No: 4

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
28 Oct 25	11:43	3.27	153.15	114.20	6.66	-
28 Oct 25	11:44	2.29	148.60	147.10	7.35	-
28 Oct 25	11:45	0.88	142.68	158.80	7.81	-
28 Oct 25	11:46	1.00	139.78	145.10	7.68	-
28 Oct 25	11:47	1.56	138.15	151.90	7.90	-
28 Oct 25	11:48	1.92	135.40	144.70	7.55	-
28 Oct 25	11:49	2.98	144.32	121.80	6.67	-
28 Oct 25	11:50	2.69	148.03	126.20	6.61	-
28 Oct 25	11:51	1.89	150.13	125.10	6.81	-
28 Oct 25	11:52	2.38	152.45	122.20	6.88	-
28 Oct 25	11:53	1.32	150.90	130.60	7.33	-
28 Oct 25	11:54	1.24	147.82	138.90	7.70	-
28 Oct 25	11:55	0.52	144.32	153.20	8.16	-
28 Oct 25	11:56	0.66	146.53	131.00	8.05	-
28 Oct 25	11:57	1.05	150.18	127.40	8.02	-
28 Oct 25	11:58	1.59	153.90	122.60	7.73	-
28 Oct 25	11:59	1.54	157.73	109.60	7.34	-
28 Oct 25	12:00	2.16	160.80	110.30	7.15	-
28 Oct 25	12:01	1.75	160.98	108.30	7.38	-
28 Oct 25	12:02	2.15	157.55	125.20	7.76	-
28 Oct 25	12:03	2.01	157.53	119.00	7.49	-
Max		3.27	160.98	158.80	8.16	-
Avg		1.75	149.57	130.15	7.43	-

Run No: 5

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
28 Oct 25	12:04	2.45	160.82	106.90	7.13	-
28 Oct 25	12:05	2.24	159.30	112.40	7.20	-
28 Oct 25	12:06	1.62	156.05	123.80	7.44	-
28 Oct 25	12:07	1.45	155.88	114.20	7.39	-
28 Oct 25	12:08	2.69	158.18	106.50	7.16	-
28 Oct 25	12:09	2.95	159.70	108.80	6.86	-
28 Oct 25	12:10	2.20	159.35	117.40	6.84	-
28 Oct 25	12:11	2.30	156.10	124.00	7.11	-
28 Oct 25	12:12	1.54	148.70	140.80	7.78	-
28 Oct 25	12:13	1.32	147.63	130.90	7.69	-
28 Oct 25	12:14	2.32	153.25	113.90	6.96	-
28 Oct 25	12:15	2.66	157.73	116.10	6.91	-
28 Oct 25	12:16	3.11	157.23	115.70	6.68	-
28 Oct 25	12:17	2.20	153.80	121.40	6.85	-
28 Oct 25	12:18	2.16	147.48	137.80	7.17	-
28 Oct 25	12:19	2.78	146.45	129.50	7.15	-
28 Oct 25	12:20	3.43	148.07	111.40	6.50	-
28 Oct 25	12:21	2.89	154.98	116.80	6.64	-
28 Oct 25	12:22	2.19	152.10	129.10	6.86	-
28 Oct 25	12:23	1.95	150.78	116.00	6.73	-
28 Oct 25	12:24	2.68	156.60	101.20	6.20	-
Max		3.43	160.82	140.80	7.78	-
Avg		2.34	154.29	118.79	7.01	-

Run No: 6

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
28 Oct 25	12:25	3.25	159.28	107.30	6.15	-
28 Oct 25	12:26	3.43	161.18	103.00	6.00	-
28 Oct 25	12:27	2.40	160.43	108.00	6.41	-
28 Oct 25	12:28	2.34	159.73	112.10	6.64	-
28 Oct 25	12:29	1.88	158.38	125.50	7.06	-
28 Oct 25	12:30	1.57	153.18	132.60	7.32	-
28 Oct 25	12:31	1.13	150.25	129.10	7.54	-
28 Oct 25	12:32	0.92	148.63	135.60	7.86	-
28 Oct 25	12:33	0.68	148.70	131.60	7.83	-
28 Oct 25	12:34	0.40	145.50	143.70	8.32	-
28 Oct 25	12:35	0.01	143.70	143.40	8.45	-
28 Oct 25	12:36	0.43	141.68	141.90	8.49	-
28 Oct 25	12:37	0.36	139.23	128.00	8.48	-
28 Oct 25	12:38	0.99	140.50	132.00	8.56	-
28 Oct 25	12:39	0.49	138.50	137.30	8.46	-
28 Oct 25	12:40	1.04	138.57	146.10	8.36	-
28 Oct 25	12:41	0.30	135.40	149.40	8.47	-
28 Oct 25	12:42	0.44	137.28	138.90	8.16	-
28 Oct 25	12:43	1.46	145.78	115.40	7.33	-
28 Oct 25	12:44	2.45	153.63	109.50	7.13	-
28 Oct 25	12:45	1.93	156.55	107.80	7.22	-
Max		3.43	161.18	149.40	8.56	-
Avg		1.33	148.38	127.53	7.63	-



CEMs Data

Client Name Gulf Chana Green Co., Ltd.
Plant Name GCG

Date 28 Oct 25
Location S1 ปล่อง Boiler No.PB1511

Run No: 7

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
28 Oct 25	12:46	1.94	157.50	119.80	7.19	-
28 Oct 25	12:47	1.61	157.73	119.00	7.20	-
28 Oct 25	12:48	1.68	153.35	123.30	7.36	-
28 Oct 25	12:49	2.44	153.73	122.90	7.08	-
28 Oct 25	12:50	2.75	158.40	108.90	6.64	-
28 Oct 25	12:51	2.61	160.78	111.40	6.68	-
28 Oct 25	12:52	3.61	161.98	105.20	6.43	-
28 Oct 25	12:53	2.23	159.60	119.30	6.78	-
28 Oct 25	12:54	1.10	153.50	134.00	7.37	-
28 Oct 25	12:55	1.31	149.85	127.70	7.46	-
28 Oct 25	12:56	2.16	153.60	118.70	6.97	-
28 Oct 25	12:57	1.89	156.90	119.00	6.99	-
28 Oct 25	12:58	1.65	155.85	121.20	7.27	-
28 Oct 25	12:59	0.35	147.05	156.80	8.19	-
28 Oct 25	13:00	0.70	148.20	144.20	7.87	-
28 Oct 25	13:01	1.68	150.60	122.60	7.35	-
28 Oct 25	13:02	2.78	160.53	110.30	6.93	-
28 Oct 25	13:03	2.48	163.07	103.80	6.69	-
28 Oct 25	13:04	2.85	161.75	110.70	6.73	-
28 Oct 25	13:05	3.04	160.07	109.10	6.76	-
28 Oct 25	13:06	2.05	157.73	117.10	6.96	-
Max		3.61	163.07	156.80	8.19	-
Avg		2.04	156.27	120.24	7.09	-

Run No: 8

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
28 Oct 25	13:07	1.27	157.28	119.40	7.31	-
28 Oct 25	13:08	1.28	157.70	114.50	7.40	-
28 Oct 25	13:09	0.98	156.60	123.40	7.77	-
28 Oct 25	13:10	1.17	155.68	134.90	7.46	-
28 Oct 25	13:11	1.85	156.98	117.20	7.28	-
28 Oct 25	13:12	1.85	156.98	117.20	7.28	-
28 Oct 25	13:13	2.19	151.03	123.00	7.93	-
28 Oct 25	13:14	2.74	156.53	111.00	7.29	-
28 Oct 25	13:15	2.33	159.40	107.10	7.11	-
28 Oct 25	13:16	2.52	162.78	114.80	7.05	-
28 Oct 25	13:17	1.61	154.75	137.50	7.69	-
28 Oct 25	13:18	1.79	156.48	133.10	7.63	-
28 Oct 25	13:19	1.09	155.73	129.20	7.56	-
28 Oct 25	13:20	2.44	157.98	109.90	7.14	-
28 Oct 25	13:21	2.45	164.90	102.30	6.51	-
28 Oct 25	13:22	3.26	167.00	104.40	6.10	-
28 Oct 25	13:23	3.68	168.40	93.30	6.19	-
28 Oct 25	13:24	4.16	168.75	92.50	6.06	-
28 Oct 25	13:25	3.28	170.73	97.90	6.01	-
28 Oct 25	13:26	3.72	168.20	101.90	5.96	-
28 Oct 25	13:27	2.41	163.05	115.70	6.62	-
Max		4.16	170.73	137.50	7.93	-
Avg		2.29	160.33	114.30	7.02	-

Run No: 9

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
28 Oct 25	13:28	2.28	162.03	122.90	6.65	-
28 Oct 25	13:29	1.27	157.85	147.20	7.39	-
28 Oct 25	13:30	0.88	156.18	141.50	7.55	-
28 Oct 25	13:31	0.74	154.70	156.30	7.73	-
28 Oct 25	13:32	0.74	147.63	155.30	7.83	-
28 Oct 25	13:33	0.44	141.55	153.50	8.26	-
28 Oct 25	13:34	0.77	139.30	156.70	8.15	-
28 Oct 25	13:35	0.77	135.23	175.30	8.26	-
28 Oct 25	13:36	0.88	137.63	151.70	7.94	-
28 Oct 25	13:37	0.95	145.05	129.60	7.56	-
28 Oct 25	13:38	2.49	149.13	130.60	7.43	-
28 Oct 25	13:39	1.23	146.03	146.70	7.96	-
28 Oct 25	13:40	0.67	145.48	141.00	7.81	-
28 Oct 25	13:41	2.20	156.25	114.00	7.30	-
28 Oct 25	13:42	1.76	157.73	124.80	7.53	-
28 Oct 25	13:43	0.75	153.85	133.30	7.79	-
28 Oct 25	13:44	1.28	156.25	120.30	7.51	-
28 Oct 25	13:45	2.29	159.23	109.00	7.22	-
28 Oct 25	13:46	2.31	162.00	100.80	6.80	-
28 Oct 25	13:47	2.67	164.25	103.70	6.87	-
28 Oct 25	13:48	2.02	163.20	110.70	6.99	-
Max		2.67	164.25	175.30	8.26	-
Avg		1.40	151.93	134.52	7.55	-

Run No: 10

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
28 Oct 25	13:49	1.90	159.28	120.10	7.28	-
28 Oct 25	13:50	2.08	159.00	120.00	7.13	-
28 Oct 25	13:51	2.09	150.90	128.10	7.34	-
28 Oct 25	13:52	1.36	145.63	144.30	7.45	-
28 Oct 25	13:53	1.53	141.90	151.00	7.46	-
28 Oct 25	13:54	1.46	143.53	144.60	7.42	-
28 Oct 25	13:55	1.76	151.35	120.60	6.77	-
28 Oct 25	13:56	2.37	157.45	125.20	6.63	-
28 Oct 25	13:57	1.97	159.40	114.80	6.28	-
28 Oct 25	13:58	3.10	159.13	113.30	6.08	-
28 Oct 25	13:59	2.31	158.48	118.40	6.17	-
28 Oct 25	14:00	2.65	161.20	116.50	6.23	-
28 Oct 25	14:01	2.64	160.63	110.00	6.28	-
28 Oct 25	14:02	2.32	159.98	121.60	6.54	-
28 Oct 25	14:03	0.96	158.43	140.80	7.02	-
28 Oct 25	14:04	0.01	152.10	162.40	7.83	-
28 Oct 25	14:05	0.01	146.28	169.60	8.15	-
28 Oct 25	14:06	0.02	144.53	165.40	7.99	-
28 Oct 25	14:07	0.01	138.82	153.70	8.00	-
28 Oct 25	14:08	0.64	144.98	143.30	7.84	-
28 Oct 25	14:09	0.00	145.00	160.00	8.10	-
Max		3.10	161.20	169.60	8.15	-
Avg		1.49	152.29	135.41	7.14	-

Run No: 11

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
28 Oct 25	14:10	0.01	138.50	162.60	8.23	-
28 Oct 25	14:11	0.01	139.23	147.10	8.12	-
28 Oct 25	14:12	0.81	145.65	126.10	7.68	-
28 Oct 25	14:13	0.99	150.35	124.80	7.62	-
28 Oct 25	14:14	0.75	149.05	123.10	7.93	-
28 Oct 25	14:15	0.81	152.95	122.30	7.83	-
28 Oct 25	14:16	1.13	153.90	126.70	7.73	-
28 Oct 25	14:17	0.38	152.07	125.60	8.00	-
28 Oct 25	14:18	0.81	150.55	130.40	8.11	-
28 Oct 25	14:19	0.30	148.53	132.40	8.12	-
28 Oct 25	14:20	1.31	152.78	119.40	7.46	-
28 Oct 25	14:21	1.50	156.45	112.20	7.11	-
28 Oct 25	14:22	1.98	160.45	116.10	7.11	-
28 Oct 25	14:23	1.68	163.53	105.60	6.73	-
28 Oct 25	14:24	2.27	165.03	106.70	6.60	-
28 Oct 25	14:25	1.82	164.63	107.00	6.85	-
28 Oct 25	14:26	1.24	163.35	113.20	7.01	-
28 Oct 25	14:27	1.63	164.03	117.10	6.92	-
28 Oct 25	14:28	0.34	159.75	126.70	7.53	-
28 Oct 25	14:29	0.33	160.18	129.50	7.50	-
28 Oct 25	14:30	0.45	158.68	144.80	7.47	-
Max		2.27	165.03	162.60	8.23	-
Avg		0.98	154.74	124.73	7.51	-

Run No: 12

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
28 Oct 25	14:31	0.23	159.55	134.40	7.42	-
28 Oct 25	14:32	0.23	159.73	132.90	7.51	-
28 Oct 25	14:33	0.02	158.55	135.40	7.83	-
28 Oct 25	14:34	0.01	157.48	133.70	7.83	-
28 Oct 25	14:35	0.34	159.63	125.50	7.74	-
28 Oct 25	14:36	0.27	158.20	134.50	7.90	-
28 Oct 25	14:37	0.00	151.13	154.50	8.30	-
28 Oct 25	14:38	0.01	147.85	149.90	8.43	-
28 Oct 25	14:39	0.00	152.30	123.30	7.81	-
28 Oct 25	14:40	0.74	158.07	110.00	7.25	-
28 Oct 25	14:41	0.84	158.53	116.80	7.26	-
28 Oct 25	14:42	0.73	156.88	129.20	7.64	-
28 Oct 25	14:43	0.53	156.20	121.60	7.48	-
28 Oct 25	14:44	1.16	152.73	119.70	7.19	-
28 Oct 25	14:45	1.06	151.82	128.00	7.40	-
28 Oct 25	14:46	1.09	147.80	128.50	7.46	-
28 Oct 25	14:47	1.60	143.82	140.00	7.32	-
28 Oct 25	14:48	1.05	143.40	134.60	7.21	-
28 Oct 25	14:49	1.43	147.38	124.60	6.98	-
28 Oct 25	14:50	1.48	153.70	131.00	7.09	-
28 Oct 25	14:51	1.57	157.43	116.90	6.82	-
Max		1.60	159.73	154.50	8.43	-
Avg		0.69	153.91	129.76	7.52	-



Reference Method Data

Client Name Gulf Chana Green Co., Ltd.
Plant Name GCG

Date 28 Oct 25
Location S1 ปล่อง Boiler No.PB1511

Run No: 1

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
28 Oct 25	10:40	1.86	148.44	126.65	8.35	12.39
28 Oct 25	10:41	1.77	145.78	128.09	8.26	12.22
28 Oct 25	10:42	1.75	146.52	115.04	7.99	12.54
28 Oct 25	10:43	1.62	150.07	112.42	8.09	12.58
28 Oct 25	10:44	1.57	151.59	117.65	8.35	12.31
28 Oct 25	10:45	1.53	150.04	121.54	8.55	12.17
28 Oct 25	10:46	1.48	148.70	118.06	8.70	11.88
28 Oct 25	10:47	1.43	148.27	112.45	8.64	11.93
28 Oct 25	10:48	1.37	148.46	104.42	8.70	11.98
28 Oct 25	10:49	1.35	148.63	108.72	8.81	11.80
28 Oct 25	10:50	1.30	149.66	108.51	8.70	11.85
28 Oct 25	10:51	1.28	150.82	111.23	8.60	11.95
28 Oct 25	10:52	1.28	151.40	102.46	8.12	12.29
28 Oct 25	10:53	1.24	151.91	84.46	7.52	12.94
28 Oct 25	10:54	1.35	159.90	74.73	7.23	13.38
28 Oct 25	10:55	1.30	160.22	76.68	7.24	13.48
28 Oct 25	10:56	1.25	160.18	83.83	7.28	13.33
28 Oct 25	10:57	1.24	160.17	87.04	7.38	13.33
28 Oct 25	10:58	1.23	160.20	90.88	7.54	13.21
28 Oct 25	10:59	1.21	159.63	90.36	7.31	13.12
28 Oct 25	11:00	1.19	159.52	82.10	7.13	13.41
Max		1.86	160.22	128.09	8.81	13.48
Avg		1.41	152.86	102.73	8.02	12.58

Run No: 2

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
28 Oct 25	11:01	2.51	159.50	83.86	7.41	13.31
28 Oct 25	11:02	2.46	158.49	93.05	7.52	13.10
28 Oct 25	11:03	2.48	156.59	97.48	7.76	12.88
28 Oct 25	11:04	2.45	154.31	104.98	8.15	12.62
28 Oct 25	11:05	2.37	153.13	106.18	8.23	12.46
28 Oct 25	11:06	2.36	152.15	110.60	8.40	12.21
28 Oct 25	11:07	2.31	151.62	112.15	8.63	12.02
28 Oct 25	11:08	2.20	151.50	114.75	8.83	11.89
28 Oct 25	11:09	2.26	151.09	111.06	8.73	11.78
28 Oct 25	11:10	2.23	151.26	108.04	8.55	11.92
28 Oct 25	11:11	2.23	152.06	103.20	8.40	12.18
28 Oct 25	11:12	2.25	149.81	93.72	8.19	12.36
28 Oct 25	11:13	2.20	150.64	92.94	8.19	12.41
28 Oct 25	11:14	2.26	151.47	88.60	8.14	12.44
28 Oct 25	11:15	2.24	152.12	87.41	8.08	12.64
28 Oct 25	11:16	2.20	153.03	97.95	8.37	12.26
28 Oct 25	11:17	2.26	153.69	95.19	8.27	12.21
28 Oct 25	11:18	2.26	154.74	89.25	8.06	12.49
28 Oct 25	11:19	2.29	155.74	89.36	7.97	12.63
28 Oct 25	11:20	2.23	155.58	91.54	8.05	12.59
28 Oct 25	11:21	2.25	155.27	94.19	8.12	12.60
Max		2.51	159.50	114.75	8.83	13.31
Avg		2.30	153.51	98.36	8.19	12.43

Run No: 3

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
28 Oct 25	11:22	2.27	154.88	94.23	7.99	12.58
28 Oct 25	11:23	2.20	154.64	87.27	7.86	12.65
28 Oct 25	11:24	2.26	155.19	90.87	7.91	12.72
28 Oct 25	11:25	2.22	155.79	96.64	8.07	12.69
28 Oct 25	11:26	2.23	155.08	114.94	8.35	12.33
28 Oct 25	11:27	2.08	152.35	118.25	8.55	11.98
28 Oct 25	11:28	2.15	149.96	118.28	8.55	11.98
28 Oct 25	11:29	2.15	148.48	108.60	8.03	12.33
28 Oct 25	11:30	2.16	150.70	92.21	7.69	12.80
28 Oct 25	11:31	2.35	153.51	84.82	7.56	12.97
28 Oct 25	11:32	2.46	156.71	79.89	7.08	13.44
28 Oct 25	11:33	2.51	158.22	77.58	6.96	13.68
28 Oct 25	11:34	2.45	158.01	87.37	7.25	13.40
28 Oct 25	11:35	2.52	155.49	93.72	7.12	13.36
28 Oct 25	11:36	2.51	153.97	88.34	6.91	13.60
28 Oct 25	11:37	2.53	153.58	93.60	7.14	13.59
28 Oct 25	11:38	2.45	152.23	97.16	7.18	13.44
28 Oct 25	11:39	2.47	149.35	99.95	7.37	13.33
28 Oct 25	11:40	2.43	147.77	108.09	7.57	13.10
28 Oct 25	11:41	2.40	146.44	112.35	7.57	13.02
28 Oct 25	11:42	2.42	144.26	114.07	7.55	12.98
Max		2.53	158.22	118.28	8.55	13.68
Avg		2.34	152.69	98.01	7.63	12.95

Run No: 4

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
28 Oct 25	11:43	2.07	146.67	104.94	7.06	13.51
28 Oct 25	11:44	2.16	148.25	107.21	7.40	13.39
28 Oct 25	11:45	2.12	148.90	132.83	8.13	12.62
28 Oct 25	11:46	2.00	140.97	142.52	8.32	12.24
28 Oct 25	11:47	1.96	140.86	137.58	8.30	12.30
28 Oct 25	11:48	1.91	140.08	143.92	8.41	12.18
28 Oct 25	11:49	1.90	138.78	132.26	7.70	12.69
28 Oct 25	11:50	2.03	144.42	112.75	7.07	13.42
28 Oct 25	11:51	2.07	147.46	113.00	7.21	13.48
28 Oct 25	11:52	2.11	148.33	113.19	7.37	13.26
28 Oct 25	11:53	2.02	150.11	111.94	7.61	13.12
28 Oct 25	11:54	1.99	150.51	120.37	8.08	12.63
28 Oct 25	11:55	1.94	149.17	129.24	8.48	12.23
28 Oct 25	11:56	1.96	147.13	137.88	8.81	11.85
28 Oct 25	11:57	1.91	147.10	121.48	8.54	11.95
28 Oct 25	11:58	1.91	149.42	114.50	8.44	12.10
28 Oct 25	11:59	1.97	152.35	109.68	8.13	12.37
28 Oct 25	12:00	1.98	155.31	96.58	7.70	12.79
28 Oct 25	12:01	2.68	158.31	96.38	7.74	12.92
28 Oct 25	12:02	2.65	159.24	97.22	8.06	12.71
28 Oct 25	12:03	2.63	158.31	113.38	8.28	12.32
Max		2.68	159.24	143.92	8.81	13.51
Avg		2.09	148.65	118.52	7.94	12.67

Run No: 5

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
28 Oct 25	12:04	2.66	157.65	109.69	7.82	12.65
28 Oct 25	12:05	2.35	158.54	97.80	7.61	12.96
28 Oct 25	12:06	2.36	158.88	101.44	7.85	12.90
28 Oct 25	12:07	2.33	157.60	110.84	8.00	12.60
28 Oct 25	12:08	2.31	156.50	103.22	7.80	12.68
28 Oct 25	12:09	2.37	156.92	95.63	7.54	12.95
28 Oct 25	12:10	2.32	157.64	97.25	7.36	13.22
28 Oct 25	12:11	2.43	157.66	103.84	7.40	13.31
28 Oct 25	12:12	2.42	156.45	112.29	7.94	12.90
28 Oct 25	12:13	2.22	153.24	127.19	8.40	12.26
28 Oct 25	12:14	2.27	149.83	118.76	7.90	12.52
28 Oct 25	12:15	2.37	151.45	104.31	7.38	13.14
28 Oct 25	12:16	2.41	153.95	101.82	7.22	13.25
28 Oct 25	12:17	2.36	155.72	103.99	7.34	13.35
28 Oct 25	12:18	2.37	153.89	111.70	7.48	13.24
28 Oct 25	12:19	2.34	149.50	123.00	7.76	12.85
28 Oct 25	12:20	2.31	147.49	116.94	7.41	12.93
28 Oct 25	12:21	2.42	147.59	100.81	6.96	13.59
28 Oct 25	12:22	2.46	150.15	105.01	7.18	13.57
28 Oct 25	12:23	2.42	151.81	114.08	7.42	13.27
28 Oct 25	12:24	2.44	151.32	103.19	6.98	13.42
Max		2.66	158.88	127.19	8.40	13.59
Avg		2.38	153.99	107.75	7.56	13.03

Run No: 6

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
28 Oct 25	12:25	2.48	152.28	87.70	6.41	14.05
28 Oct 25	12:26	2.53	154.50	88.58	6.48	14.13
28 Oct 25	12:27	2.63	156.18	90.46	6.86	14.06
28 Oct 25	12:28	2.57	157.15	95.39	6.98	13.66
28 Oct 25	12:29	2.48	157.24	99.35	7.25	13.46
28 Oct 25	12:30	2.44	156.58	112.90	7.74	12.95
28 Oct 25	12:31	2.50	153.63	121.11	7.97	12.65
28 Oct 25	12:32	2.49	150.97	120.59	8.14	12.52
28 Oct 25	12:33	2.42	149.39	123.65	8.44	12.20
28 Oct 25	12:34	2.37	148.84	124.21	8.65	12.09
28 Oct 25	12:35	2.28	148.06	131.80	8.90	11.68
28 Oct 25	12:36	2.32	146.31	132.42	9.07	11.52
28 Oct 25	12:37	2.21	144.40	130.58	9.24	11.43
28 Oct 25	12:38	2.30	142.95	119.46	9.10	11.47
28 Oct 25	12:39	2.30	142.34	121.23	9.09	11.49
28 Oct 25	12:40	2.34	142.06	127.44	9.04	11.52
28 Oct 25	12:41	2.32	141.58	136.03	9.10	11.53
28 Oct 25	12:42	2.31	141.21	140.38	8.98	11.54
28 Oct 25	12:43	2.37	141.39	127.53	8.39	11.89
28 Oct 25	12:44	2.43	150.50	104.72	7.73	12.75
28 Oct 25	12:45	2.59	153.24	98.02	7.71	12.97
Max		2.63	157.24	140.38	9.24	14.13
Avg		2.41	149.09	115.88	8.16	12.46



Reference Method Data

Client Name Gulf Chana Green Co., Ltd.
Plant Name GCG

Date 28 Oct 25
Location S1 ผลิต Boiler No.PB1511

Run No: 7

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
28 Oct 25	12:46	2.58	154.78	95.36	7.58	12.95
28 Oct 25	12:47	2.61	156.81	105.73	7.79	12.88
28 Oct 25	12:48	2.70	157.22	108.10	7.84	12.86
28 Oct 25	12:49	2.55	155.89	112.34	7.70	12.77
28 Oct 25	12:50	2.61	154.48	108.56	7.32	13.06
28 Oct 25	12:51	2.69	155.92	98.10	7.18	13.46
28 Oct 25	12:52	2.59	158.24	96.46	6.97	13.51
28 Oct 25	12:53	2.76	159.63	94.47	6.96	13.67
28 Oct 25	12:54	2.68	158.54	106.61	7.64	13.19
28 Oct 25	12:55	2.60	155.82	121.27	8.01	12.67
28 Oct 25	12:56	2.41	152.98	116.75	7.69	12.67
28 Oct 25	12:57	2.53	152.77	106.81	7.52	13.09
28 Oct 25	12:58	2.54	154.11	107.49	7.58	13.06
28 Oct 25	12:59	2.54	155.11	116.01	8.26	12.57
28 Oct 25	13:00	2.53	153.00	140.03	8.61	11.89
28 Oct 25	13:01	2.42	150.76	133.73	8.30	12.08
28 Oct 25	13:02	2.52	151.37	112.18	7.55	12.81
28 Oct 25	13:03	2.52	159.41	97.52	7.35	13.14
28 Oct 25	13:04	2.70	160.05	92.00	7.23	13.33
28 Oct 25	13:05	2.70	159.86	95.94	7.24	13.32
28 Oct 25	13:06	2.57	158.55	97.98	7.32	13.35
Max		2.76	160.05	140.03	8.61	13.67
Avg		2.59	155.97	107.78	7.60	12.97

Run No: 8

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
28 Oct 25	13:07	2.67	157.17	104.32	7.69	13.04
28 Oct 25	13:08	2.53	156.61	106.56	7.89	12.75
28 Oct 25	13:09	2.60	156.98	103.81	8.04	12.60
28 Oct 25	13:10	2.48	156.96	109.80	8.26	12.31
28 Oct 25	13:11	2.42	156.26	119.37	7.81	12.60
28 Oct 25	13:12	2.57	155.72	109.23	7.83	12.81
28 Oct 25	13:13	2.57	155.45	110.14	8.22	12.53
28 Oct 25	13:14	2.50	155.21	111.45	8.04	12.32
28 Oct 25	13:15	2.65	155.67	101.15	7.73	12.77
28 Oct 25	13:16	2.62	157.74	95.84	7.51	12.93
28 Oct 25	13:17	2.66	158.89	105.28	7.92	12.88
28 Oct 25	13:18	2.64	158.17	122.97	8.19	12.36
28 Oct 25	13:19	2.67	156.69	123.26	8.23	12.35
28 Oct 25	13:20	2.54	156.68	118.36	7.92	12.44
28 Oct 25	13:21	2.65	157.20	98.50	7.35	13.05
28 Oct 25	13:22	2.69	160.31	87.22	6.78	13.69
28 Oct 25	13:23	2.88	163.31	87.19	6.61	13.97
28 Oct 25	13:24	2.84	164.26	81.97	6.61	14.03
28 Oct 25	13:25	2.85	165.29	79.18	6.52	14.11
28 Oct 25	13:26	2.92	166.12	83.00	6.37	14.16
28 Oct 25	13:27	2.73	165.64	90.18	6.90	13.96
Max		2.92	166.12	123.26	8.26	14.16
Avg		2.65	158.87	102.32	7.54	13.03

Run No: 9

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
28 Oct 25	13:28	2.64	163.70	101.21	7.04	13.53
28 Oct 25	13:29	2.59	161.04	112.27	7.52	13.31
28 Oct 25	13:30	2.61	159.44	131.32	7.99	12.65
28 Oct 25	13:31	2.41	157.58	130.25	8.06	12.53
28 Oct 25	13:32	2.47	155.41	140.68	8.38	12.26
28 Oct 25	13:33	2.41	145.89	147.83	8.64	12.02
28 Oct 25	13:34	2.29	143.26	145.74	8.82	11.73
28 Oct 25	13:35	2.30	142.73	147.62	8.70	11.84
28 Oct 25	13:36	2.28	140.60	159.79	8.76	11.77
28 Oct 25	13:37	2.33	140.01	143.19	8.46	11.99
28 Oct 25	13:38	2.37	148.60	120.64	7.89	12.49
28 Oct 25	13:39	2.49	149.36	118.51	8.18	12.58
28 Oct 25	13:40	2.42	148.65	135.57	8.61	12.01
28 Oct 25	13:41	2.34	148.35	128.25	8.04	12.41
28 Oct 25	13:42	2.53	156.57	108.19	7.99	12.67
28 Oct 25	13:43	2.53	156.90	114.44	8.28	12.42
28 Oct 25	13:44	2.43	156.17	121.09	8.27	12.23
28 Oct 25	13:45	2.54	156.12	110.05	7.84	12.57
28 Oct 25	13:46	2.68	158.03	96.24	7.59	12.86
28 Oct 25	13:47	2.63	159.48	89.14	7.37	13.18
28 Oct 25	13:48	2.79	161.69	91.81	7.38	13.20
Max		2.79	163.70	159.79	8.82	13.53
Avg		2.48	152.84	123.51	8.09	12.49

Run No: 10

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
28 Oct 25	13:49	2.68	162.15	99.08	7.70	13.00
28 Oct 25	13:50	2.60	161.03	107.44	7.78	12.73
28 Oct 25	13:51	2.64	158.50	110.43	7.67	12.85
28 Oct 25	13:52	2.54	155.02	117.08	7.90	12.73
28 Oct 25	13:53	2.51	144.75	130.85	8.07	12.60
28 Oct 25	13:54	2.50	144.34	137.83	8.00	12.51
28 Oct 25	13:55	2.53	145.41	130.05	7.61	12.70
28 Oct 25	13:56	2.52	154.15	110.58	7.20	13.34
28 Oct 25	13:57	2.57	157.09	110.48	7.07	13.45
28 Oct 25	13:58	2.54	157.82	102.36	6.53	13.89
28 Oct 25	13:59	2.61	157.71	99.87	6.59	14.06
28 Oct 25	14:00	2.59	157.16	103.11	6.65	13.96
28 Oct 25	14:01	2.67	157.46	102.86	6.72	13.91
28 Oct 25	14:02	2.54	158.14	100.74	6.81	13.81
28 Oct 25	14:03	2.54	158.16	110.22	7.26	13.44
28 Oct 25	14:04	2.47	157.37	127.52	7.92	12.98
28 Oct 25	14:05	2.26	155.07	154.95	8.66	11.98
28 Oct 25	14:06	2.21	151.43	156.92	8.57	11.86
28 Oct 25	14:07	2.08	147.28	155.69	8.69	11.89
28 Oct 25	14:08	2.20	144.57	141.60	8.35	12.06
28 Oct 25	14:09	2.23	144.09	132.12	8.46	12.19
Max		2.68	162.15	156.92	8.69	14.06
Avg		2.48	153.75	121.04	7.63	12.95

Run No: 11

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
28 Oct 25	14:10	2.25	145.46	147.59	8.85	11.82
28 Oct 25	14:11	2.20	143.74	149.44	8.83	11.66
28 Oct 25	14:12	2.25	142.01	133.63	8.41	11.94
28 Oct 25	14:13	2.38	143.68	115.89	8.20	12.30
28 Oct 25	14:14	2.43	148.29	113.93	8.39	12.34
28 Oct 25	14:15	2.47	150.23	115.27	8.46	12.11
28 Oct 25	14:16	2.49	151.64	112.06	8.29	12.14
28 Oct 25	14:17	2.50	153.39	115.79	8.47	12.19
28 Oct 25	14:18	2.49	153.36	115.57	8.57	11.99
28 Oct 25	14:19	2.43	152.17	118.42	8.64	11.92
28 Oct 25	14:20	2.56	151.35	120.23	8.52	11.85
28 Oct 25	14:21	2.48	152.63	109.28	7.79	12.64
28 Oct 25	14:22	2.57	155.29	101.62	7.45	13.09
28 Oct 25	14:23	2.67	157.83	101.47	7.56	12.98
28 Oct 25	14:24	2.59	160.67	92.82	7.18	13.29
28 Oct 25	14:25	2.65	162.06	92.98	7.19	13.45
28 Oct 25	14:26	2.69	162.65	96.72	7.49	13.23
28 Oct 25	14:27	2.71	162.32	101.17	7.53	12.99
28 Oct 25	14:28	2.52	161.92	109.59	7.85	12.85
28 Oct 25	14:29	2.53	161.13	116.57	7.93	12.52
28 Oct 25	14:30	2.51	160.05	119.38	8.07	12.55
Max		2.71	162.65	149.44	8.85	13.45
Avg		2.49	153.90	114.26	8.08	12.47

Run No: 12

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
28 Oct 25	14:31	2.44	159.69	129.41	8.03	12.50
28 Oct 25	14:32	2.31	159.58	121.94	7.89	12.61
28 Oct 25	14:33	2.37	159.54	121.03	8.20	12.53
28 Oct 25	14:34	2.35	159.22	123.30	8.49	12.10
28 Oct 25	14:35	2.36	158.81	120.91	8.28	12.09
28 Oct 25	14:36	2.39	158.95	117.35	8.23	12.27
28 Oct 25	14:37	2.39	158.18	125.40	8.76	11.99
28 Oct 25	14:38	2.31	155.35	141.14	8.99	11.60
28 Oct 25	14:39	2.29	152.20	136.04	8.76	11.60
28 Oct 25	14:40	2.32	152.57	111.97	8.08	12.31
28 Oct 25	14:41	2.50	154.67	99.44	7.85	12.72
28 Oct 25	14:42	2.52	157.61	104.51	7.91	12.77
28 Oct 25	14:43	2.60	157.81	116.32	8.16	12.40
28 Oct 25	14:44	2.53	156.24	112.09	7.92	12.49
28 Oct 25	14:45	2.60	154.24	109.73	7.76	12.81
28 Oct 25	14:46	2.62	152.13	116.70	7.93	12.69
28 Oct 25	14:47	2.62	149.45	119.60	7.96	12.60
28 Oct 25	14:48	2.62	146.99	125.57	7.90	12.68
28 Oct 25	14:49	2.69	145.28	121.04	7.61	12.81
28 Oct 25	14:50	2.62	146.07	111.76	7.49	13.02
28 Oct 25	14:51	2.75	155.44	115.32	7.60	12.99
Max		2.75	159.69	141.14	8.99	13.02
Avg		2.48	154.76	119.07	8.09	12.46



CEMs Opacity Data

Client Name Gulf Chana Green Co., Ltd.

Date 28-Oct-25

Plant Name GCG

Location S1 ปล่อง Boiler No.PB1511

Run No.1		Run No.2		Run No.3		Run No.4		Run No.5	
Time	Opacity (%)	Time	Opacity (%)	Time	Opacity (%)	Time	Opacity (%)	Time	Opacity (%)
10:40	3.75	11:40	3.34	12:40	5.21	13:30	3.59	14:15	3.54
10:41	4.46	11:41	3.30	12:41	3.61	13:31	4.24	14:16	3.72
10:42	3.79	11:42	4.13	12:42	3.44	13:32	3.59	14:17	3.55
10:43	3.99	11:43	3.55	12:43	3.48	13:33	3.72	14:18	4.45
10:44	3.79	11:44	11.58	12:44	3.31	13:34	4.29	14:19	3.56
10:45	3.82	11:45	3.47	12:45	3.26	13:35	4.69	14:20	3.50
10:46	3.85	11:46	3.48	12:46	3.45	13:36	4.36	14:21	3.61
10:47	3.78	11:47	3.70	12:47	3.44	13:37	3.50	14:22	3.46
10:48	4.48	11:48	3.36	12:48	3.36	13:38	3.65	14:23	3.38
10:49	3.88	11:49	3.30	12:49	3.61	13:39	3.70	14:24	3.39
10:50	3.66	11:50	3.67	12:50	3.42	13:40	3.35	14:25	3.50
10:51	3.54	11:51	3.34	12:51	3.27	13:41	3.42	14:26	3.59
10:52	3.44	11:52	3.43	12:52	3.35	13:42	3.78	14:27	3.86
10:53	3.45	11:53	3.78	12:53	3.66	13:43	3.65	14:28	3.67
10:54	4.09	11:54	3.77	12:54	4.01	13:44	3.48	14:29	3.89
10:55	3.64	11:55	3.57	12:55	3.35	13:45	3.55	14:30	3.85
10:56	3.59	11:56	3.64	12:56	3.46	13:46	3.51	14:31	3.82
10:57	3.77	11:57	3.50	12:57	3.50	13:47	3.42	14:32	4.62
10:58	3.60	11:58	3.82	12:58	4.77	13:48	3.66	14:33	3.82
10:59	3.46	11:59	3.48	12:59	3.65	13:49	3.46	14:34	3.66
11:00	3.54	12:00	3.40	13:00	3.30	13:50	5.17	14:35	3.76
11:01	3.39	12:01	3.51	13:01	3.41	13:51	3.65	14:36	3.98
11:02	4.25	12:02	3.54	13:02	3.40	13:52	3.60	14:37	3.94
11:03	3.68	12:03	3.28	13:03	3.36	13:53	3.59	14:38	3.88
11:04	3.98	12:04	3.30	13:04	3.33	13:54	3.48	14:39	3.60
11:05	3.65	12:05	3.47	13:05	3.31	13:55	3.39	14:40	3.54
11:06	3.85	12:06	3.49	13:06	3.54	13:56	3.44	14:41	3.69
11:07	4.08	12:07	3.48	13:07	3.59	13:57	3.37	14:42	3.50
11:08	3.79	12:08	3.80	13:08	5.98	13:58	3.38	14:43	3.40
11:09	3.57	12:09	3.40	13:09	3.53	13:59	3.37	14:44	3.43
11:10	3.54	12:10	3.61	13:10	3.44	14:00	3.29	14:45	3.60
11:11	3.49	12:11	3.78	13:11	3.58	14:01	3.49	14:46	4.73
11:12	3.56	12:12	5.76	13:12	3.60	14:02	3.59	14:47	3.57
Avg.	3.76	Avg.	3.85	Avg.	3.64	Avg.	3.68	Avg.	3.73

CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

Customer: AIR LIQUIDE
(THAILAND) LTD
Part Number: E04NI99E3HA0002
Cylinder Number: GN0029445
Laboratory: 124 - Plumsteadville - PA
PGVP Number: A12023
Gas Code: CO,NO,NOX,SO2,BALN
Reference Number: 160-402885482-1
Cylinder Volume: 247.0 CF
Cylinder Pressure: 2215 PSIG
Valve Outlet: 660
Certification Date: Nov 21, 2023

Expiration Date: Nov 21, 2031

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted. The results relate only to the items tested. The report shall not be reproduced except in full without approval of the laboratory. Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	80.00 PPM	80.91 PPM	G1	+/- 0.8% NIST Traceable	11/14/2023, 11/21/2023
CARBON MONOXIDE	80.00 PPM	80.24 PPM	G1	+/- 0.6% NIST Traceable	11/14/2023
NITRIC OXIDE	80.00 PPM	80.89 PPM	G1	+/- 0.9% NIST Traceable	11/14/2023, 11/21/2023
SULFUR DIOXIDE	80.00 PPM	79.51 PPM	G1	+/- 0.8% NIST Traceable	11/14/2023, 11/21/2023
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	110101-08	KAL003090	97.31 PPM CARBON MONOXIDE/NITROGEN	+/- 0.4%	May 25, 2028
PRM	C2219101	APE1514048	100.19 PPM NITRIC OXIDE/NITROGEN	+/- 0.3%	Feb 28, 2025
GMIS	2023042502	CC754074	98.48 PPM NITRIC OXIDE/NITROGEN	+/- 0.4%	May 25, 2031
PRM	12409	D913660	15.01 PPM NITROGEN DIOXIDE/AIR	+/- 1.5%	Feb 17, 2023
GMIS	401648675101	CC500133	4.981 PPM NITROGEN DIOXIDE/NITROGEN	+/- 1.6%	Sep 29, 2025
NTRM	160102-22	KAL003820	97.69 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Nov 01, 2027

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

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet iS50 FTIR AUP2010245 CO	FTIR	Nov 09, 2023
Nicolet iS50 FTIR AUP2010245 NO	FTIR	Nov 16, 2023
Nicolet iS50 FTIR AUP2010245 NO2	FTIR	Nov 02, 2023
Nicolet iS50 FTIR AUP2010245 SO2	FTIR	Oct 26, 2023

Triad Data Available Upon Request

NOTES: Gross Weight: 48.4 Kg

Net Weight: 8.1 Kg



Approved for Release

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E04NI99E3HA0021
Cylinder Number: ND11221
Laboratory: 124 - Plumsteadville - PA
PGVP Number: A12021
Gas Code: CO,NO,NOX,SO2,BALN

Reference: 160-402138466-1
Cylinder Volume: 247.2 CF
Cylinder Pressure: 2215 PSIG
Valve Outlet: 660
Certification Date: Jul 15, 2021

Expiration Date: Jul 15, 2029

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

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

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	160.0 PPM	162.9 PPM	G1	+/- 1.4% NIST Traceable	07/08/2021, 07/15/2021
CARBON MONOXIDE	160.0 PPM	156.0 PPM	G1	+/- 0.6% NIST Traceable	07/08/2021
NITRIC OXIDE	160.0 PPM	162.9 PPM	G1	+/- 1.0% NIST Traceable	07/08/2021, 07/15/2021
SULFUR DIOXIDE	160.0 PPM	162.6 PPM	G1	+/- 1.0% NIST Traceable	07/08/2021, 07/15/2021
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	090103-29	KAL004559	970.0 PPM CARBON MONOXIDE/NITROGEN	+/- 0.4%	Dec 21, 2026
PRM	12386	D685025	9.91 PPM AIR/NITROGEN DIOXIDE	2.0%	Feb 20, 2020
NTRM	13010312	KAL003449	243.4 PPM NITRIC OXIDE/NITROGEN	+/- 0.5%	May 04, 2026
GMIS	124206889	CC323707	4.028 PPM NITROGEN DIOXIDE/NITROGEN	2.1%	Aug 15, 2021
NTRM	10010234	AAL073227	255.3 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Apr 25, 2022

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

ANALYTICAL EQUIPMENT

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

Triad Data Available Upon Request

NOTES:

Gross Weight: 48.8 Kg
Net Weight: 8.5 Kg



Approved for Release

CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

Customer:	AIR LIQUIDE (THAILAND) LTD	Reference Number:	160-402340009-1
Part Number:	E02NI92E3HA0000	Cylinder Volume:	248.4 CF
Cylinder Number:	GN0027033	Cylinder Pressure:	2214 PSIG
Laboratory:	124 - Plumsteadville - PA	Valve Outlet:	590
PGVP Number:	A12022	Certification Date:	Feb 10, 2022
Gas Code:	O2,BALN		

Expiration Date: Feb 10, 2030

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

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

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
OXYGEN	8.000 %	7.975 %	G1	+/- 0.4% NIST Traceable	02/10/2022
NITROGEN	Balance				

CALIBRATION STANDARDS

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

ANALYTICAL EQUIPMENT

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

Triad Data Available Upon Request

NOTES: Gross Weight: 48.3 Kg
Net Weight: 8.1 Kg



Approved for Release

CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

Customer: AIR LIQUIDE
(THAILAND) LTD
Part Number: E02NI84E3HA0001
Cylinder Number: GN0027201
Laboratory: 124 - Plumsteadville - PA
PGVP Number: A12022
Gas Code: O2,BALN
Reference Number: 160-402340010-1
Cylinder Volume: 249.8 CF
Cylinder Pressure: 2214 PSIG
Valve Outlet: 590
Certification Date: Feb 02, 2022

Expiration Date: Feb 02, 2030

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

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

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
OXYGEN	16.00 %	16.04 %	G1	+/- 0.4% NIST Traceable	02/02/2022
NITROGEN	Balance				

CALIBRATION STANDARDS

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

ANALYTICAL EQUIPMENT

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

Triad Data Available Upon Request

NOTES: Gross Weight: 48.8 Kg

Net Weight: 8.2 Kg



Approved for Release



CONSOLE CONTROL UNIT CALIBRATION TEST REPORT

Calibration of Date : 24 May 25
Next Cal. Date : 23 Nov 25

Barometric Pressure (mmHg) : 754.5
Relative Humidity (%) : 81.0
Temperature (C°) : 30.0

Console Control Meter Data

Calibration No. : C-240525-BKK_FS0485
Dry Gas Meter ID : BKK_FS0485
Serial No. : 1310055
Model No. : XC-572-V

Reference Dry Gas Meter Data

Reference Dry Gas Meter ID : BKK_FS0629
Serial No. : 1607009
Correction Factor (Y) : 1.0000
Next Calibration Date : 10 Jan 26

ΔH (mm.H ₂ O)	Θ Minutes	Reference Dry Gas Meter Calibration				Console Control ; Drygas Meter							Dry Gas Meter Correction Factor (Y)	Orifice Calibration Factor $\Delta H@$
		Vr (Liters)			Tr (°C)	Vm (Liters)			Ti (°C)	To (°C)	Avg.Tm (°C)			
		Final	Initial	Total		Final	Initial	Total						
15	12.40	150.01	0.00	150.01	31.0	171516.4	171363.0	153.40	32.0	32.0	32.0	0.9797	47.3759	
25	9.55	149.84	0.00	149.84	31.0	171692.2	171539.0	153.20	33.0	33.0	33.0	0.9821	46.7878	
50	6.76	149.94	0.00	149.94	32.0	171861.8	171709.0	152.80	33.0	33.0	33.0	0.9797	47.1327	
80	5.25	149.89	0.00	149.89	33.0	172025.4	171873.0	152.40	33.0	33.0	33.0	0.9759	45.8143	
120	4.23	150.04	0.00	150.04	33.0	172231.2	172079.0	152.20	33.0	33.0	33.0	0.9744	44.5231	
											Avg.	0.9784	46.3268	

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

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

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

Calibrated by:

Approved by:

Field Scientist(2)

Field Specialist(1)

Mr.Samart Roo-ngan



DIGITAL TEMPERATURE CALIBRATION DATA SHEET

Calibration Date :	24 May 25	Ambient Temperature (°C)	30.0
Calibration sheet No. :	C-240525-BKK_FS0485	Relative Humidity (%) :	81.0
Digital Temperature ID :	BKK_FS0485	Reference Temperature ID	BKK_FS1144
Serial No. :	1310055	Serial No. :	201090006013
Model :	XC-572-V	Model :	Digicon-CC-VT-MS
		Next Calibrate :	5 Jan 26

Location	Reference Temperature °C	Digital Temperature °C	Error °C	MPE	Pass / Fail
Stack	0	2	2	±3	Pass
	25	25	0	±3	Pass
	50	50	0	±3	Pass
	100	100	0	±3	Pass
	150	149	-1	±3	Pass
	200	198	-2	±3	Pass
	250	247	-3	±3	Pass
	300	297	-3	±3	Pass
	500	497	-3	±3	Pass
Probe	100	100	0	±3	Pass
	120	120	0	±3	Pass
	140	140	0	±3	Pass
Oven	100	100	0	±3	Pass
	120	120	0	±3	Pass
	140	140	0	±3	Pass
Filter	100	99	-1	±3	Pass
	120	119	-1	±3	Pass
	140	139	-1	±3	Pass
Exit	0	1	1	±3	Pass
	10	11	1	±3	Pass
	20	21	1	±3	Pass
Meter	0	1	1	±3	Pass
	25	25	0	±3	Pass
	50	49	-1	±3	Pass
AUX	0	1	1	±3	Pass
	25	25	0	±3	Pass
	50	49	-1	±3	Pass

MPE : (Maximum permissible error of measurement) ค่าความผิดพลาดสูงสุดของการวัดที่ยอมรับได้

Calibrated by :



(Mr.Kritsana Saiwan)
Field Scientist (2)

Approved by :



Mr.Samart Roo-ngan
Field Specialist (1)



PROBE NOZZLE DIAMETER CALIBRATION DATA SHEET

Calibration Date : 24 May 25	Nozzle Set ID. : BKK_FS0491
Calibration Sheet No. : C-240525-BKK_FS0491	Vernier Caliper ID.: RYG_FS0539

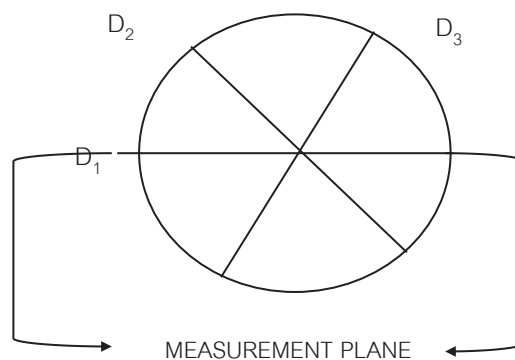
Nozzle ID #	Nozzle Diameter (cm.)			Hi - Lo	$(D_1 + D_2 + D_3) / 3$
	D_1	D_2	D_3	ΔD	D_{avg}
1	0.315	0.315	0.315	0.000	0.315
2	0.475	0.475	0.475	0.000	0.475
3	0.530	0.530	0.530	0.000	0.530
4	0.635	0.635	0.635	0.000	0.635
5	0.790	0.790	0.790	0.000	0.790
6	0.950	0.950	0.950	0.000	0.950
7	1.110	1.110	1.110	0.000	1.110
8	1.270	1.270	1.270	0.000	1.270
9	1.600	1.600	1.600	0.000	1.600

Where :

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

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

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



Calibrated by : _____

(Mr. Kritsana Saiwan)

Field Scientist (2)

Approved by : _____

(Mr.Samart Roo-ngan)

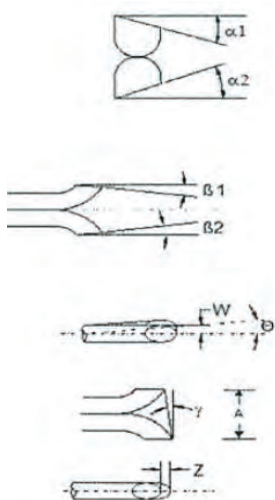
Field Specialist (1)



Type S Pitot Tube Calibration

Date Calibration 24-May-25
Pitot ID BKK_FS1105
Pitot SN -

Due Date 23-Nov-25
Inclinometer ID BKK_FS1131
Vernier ID BKK_FS1405



Parameter	Value	Allowable Range	Check
$\alpha 1$	1.2	$-10^{\circ} < \alpha 1 < +10^{\circ}$	OK
$\alpha 2$	3	$-10^{\circ} < \alpha 2 < +10^{\circ}$	OK
$\beta 1$	3.3	$-5^{\circ} < \beta 1 < +5^{\circ}$	OK
$\beta 2$	3.3	$-5^{\circ} < \beta 2 < +5^{\circ}$	OK
γ	4	-	-
θ	1.2	-	-
$Z = A \tan \gamma$	0.074	$Z \leq 0.125''$	OK
$W = A \tan \theta$	0.022	$W \leq 0.031''$	OK
Dt	0.375	0.188" to 0.375"	OK
$A/2Dt$	1.413	$1.05 \leq PA/Dt \leq 1.5$	OK
A	1.06	$2.1Dt \leq A \leq 3Dt$	OK

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

Calibrated by :

[Redacted Signature]

(Mr.Prasert.Surakhan)
 Enviro Field Services Scientist (3)

Approved By :

[Redacted Signature]

(Mr.Samart Roo-ngan)
 Enviro Field Services Specialist (1)

Certificate No: G 670782

Date of issue : 07-Nov-24

Instrument description : Flue Gas Analyzer
Instrument model : Testo 340
Instrument serial no. : 63119044
Control unit serial no. : -
ID no. or control no. : BKK_FS1160
Manufacturer : Testo SE & Co. KGaA
Probe description : -
Probe model : -
Probe serial no. : -
Customer name : ALS LABORATORY GROUP (THAILAND) CO.,LTD.
Customer address : 104 Phatthanakan 40, Phatthanakan Road, Khwaeng Phatthanakan, Khet Suan Luang, Bangkok, 10250 Thailand
Total pages of certificate : 3 Pages
Receiving no. : L-244322
Receiving date. : 05-Nov-24
Parameter of calibration : Gas Calibration(Oxygen 2.50,9.984,21.02 %vol, Carbon Monoxide 80.18,302,1007 ppm, Nitric Oxide 30.0, 151.5, 322.5 ppm, Sulphur Dioxide 50.36, 100.8, 600.8 ppm)
Condition of UUC. : Used
Ambient condition : All of the Measurment ware caried out the stabilized labotary
 Temperature : 23 ±5 °C
 Humidity : 55 ± 15 %RH
Calibration place : 17/121 Soi Ngamwongwan 47 Yaek 48, Toongsonghong, Laksi, Bangkok 10210 THAILAND
Calibration procedure no. : This instrument was calibrated by comparison with Standard gas mixture according to calibration Work Instruction no. WI-CL-28-C

REVIEW BY

APPROVED BY....

NEXT CAL DATE..... 07/11/25

The calibration certificate expanded uncertainty of measurement is stated as the standard uncertainty of measurent Multiplied by coverage factor $k=2$, which for a normal distribution corresponds to a coverage probability of approximately 95%.

This certificate is applied only to item under test Environmental condition.

This Calibration Certificate may not be reporduced other than in full except with the permission of the issuing laboratory. Calibration certificates without signature and seal not valid and The results relate only to the items tested/calibrated.

This calibration certificate documents are tracebility to national standards, which realize measurement according to the International System of Units (SI).

Date of calibration : 07-Nov-24



Mr. Kwanchai Khamdoung
Calibration Technician



Mrs. Nongluck Wongsettee
Technical Manager

Certificate No.: G 670782

Standard References (Table 1)

Standard	Certificate No.	Vendor	Due date
Oxygen (O ₂) 2.50 % Vol	2412/23	Linde	27-Aug-27
Oxygen (O ₂) 9.984 % Vol	CG-0113-24	Nimt	01-Aug-29
Oxygen (O ₂) 21.02 % Vol	CG-0041-22	Nimt	10-Feb-27
Carbon monoxide (CO) 80.18 ppm	CG-0002-24	Nimt	11-Jan-29
Carbon monoxide (CO) 302 ppm	1915/23	Linde	16-Jun-25
Carbon monoxide (CO) 1007 ppm	1870/24	Linde	17-Jun-26
Nitric Oxide (NO) 30.0 ppm	CG-0065-24	Nimt	06-May-26
Nitric Oxide (NO) 151.5 ppm	0161/23	Linde	22-Jan-25
Nitric Oxide (NO) 322.5 ppm	1974/23	Linde	17-Jul-25
Sulphur Dioxide (SO ₂) 50.36 ppm	2004/23	Linde	17-Jul-25
Sulphur Dioxide (SO ₂) 100.8 ppm	3507/22	Linde	09-Nov-24
Sulphur Dioxide (SO ₂) 600.8 ppm	2003/23	Linde	17-Jul-25

Measured room conditions

Temperature : 21.7 °C Humidity : 59.9 %RH Pressure : 1010.2 mbar

Calibration conditions

Gas Temperature : 23 °C Flow rate : 600 ml/min Gas pressure : 1012.6 mbar

Calibration Results (Before adjustment) (Table 2)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (±)
O ₂ (%Vol)	2.50	2.45	-0.05	0.15
O ₂ (%Vol)	9.984	9.91	-0.074	0.20
O ₂ (%Vol)	21.02	21.13	0.11	0.30
CO (ppm)	80.18	78	-2.18	3.0
CO (ppm)	302	298	-4	6.0
CO (ppm)	1007	990	-17	12
NO (ppm)	30.0	28	-2.0	8.0
NO (ppm)	151.5	148	-3.5	8.0
NO (ppm)	322.5	309	-13.5	12
SO ₂ (ppm)	50.36	51	0.64	6.0
SO ₂ (ppm)	100.8	103	2.2	6.0
SO ₂ (ppm)	600.8	601	0.2	13

Calibration Results (After adjustment) (Table 3)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (±)
O2 (%Vol)	2.50	2.45	-0.05	0.15
O2 (%Vol)	9.984	9.91	-0.074	0.20
O2 (%Vol)	21.02	21.13	0.11	0.30
CO (ppm)	80.18	81	0.82	3.0
CO (ppm)	302	303	1	6.0
CO (ppm)	1007	1006	-1	12
NO (ppm)	30.0	31	1.0	8.0
NO (ppm)	151.5	154	2.5	8.0
NO (ppm)	322.5	325	2.5	12
SO2 (ppm)	50.36	51	0.64	6.0
SO2 (ppm)	100.8	103	2.2	6.0
SO2 (ppm)	600.8	601	0.2	13

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

End of Report

Accredited by

NSC-TISI-TIS 17025

Calibration 0426



Calibration certificate

Calibration Certificate No. 24BCI0440

Object	Electronic non-automatic weighing instrument	This calibration certificate documents the traceability to national standards.
Manufacturer	Sartorius	Uncertainties of measurements are taken into account when only statements of compliance are made.
Type	SECURA224-1S	This certificate was prepared by Sartorius Corporation in accordance to the current ISO/IEC 17025:2017 standard and Sartorius Work Instruction (Method) SOP WI 08.
Serial QM Ident. no.	38304165 BKK_EN0309	This certificate relate and apply this equipment only.
Customer	ALS Laboratory Group (Thailand)Co., Ltd. 104 Phatthanakarn 40,Phattanakarn Rd.,Khwaeng Phatthanakarn ,Khet Suan Luang,Bangkok 10250	
Order no.	246928	REVIEW BY 
Number of pages	4	APPROVED BY
Date of calibration	05 Nov 2024	NEXT CAL DATE.....05/11/25

This calibration certificate may not be reproduced other than in full except with the permission of NSC-TISI-TIS-17025 and the issuing laboratory. Calibration certificates without signature are not valid.

The user is obliged to have the object recalibrated at appropriate intervals.

Date	05 Nov 2024	Approval of the Calibration Certificate  Mr. Chonchai Inthana	Person in charge  Chonchai Inthana
------	-------------	--	---

Calibration object

Single range instrument

Model	SECURA224-1S
Serial Number	38304165
QM Ident. no Inventory no.	BKK_EN0309 ---

Maximum capacity (Max. load)	220.0000 g
Measured range	220.0000 g
Scale interval	0.0001 g

Place of calibration

Address	According to page 1
Department Cost center	Laboratory Department. ---
Building Floor	--- 1st Floor.
Room	Laboratory Room.
Maximum temperature variation at place of calibration	5 K

Calibration procedure

EURAMET cg-18, V4.0 - Guidelines on the Calibration of Non-Automatic Weighing Instruments

Test equipment

Test equipment type	Test equipment ID	Valid until
Thermometer	MHB-382SD s/nB011342 Traceable to SI unit through DKSH	21 Aug 2025
Test weight set OIML R111 E2	Certificate No.M2308197S ,E2(Traceable to SI unit through TCS)	23 Aug 2025

Adjustment Status

The measuring device was internally adjusted before the calibration.

Environmental and measuring conditions

Date of calibration	05 Nov 2024
Temperature at place of calibration Temp. diff. <i>T</i> _{weights} - <i>T</i> _{place}	19.6 °C 0.4 K
Measuring conditions	The installation site is suitable. The device was levelled. Balance was loaded up to Max before test.
Comments	Humidity 68.0 %RH.

Measurement results | Measurement uncertainties

Repeatability			Eccentricity	
Test load (nominal): 10 g 100 g			Test load (nominal): 100 g	
	10 g	100 g		
1	10.0000 g	100.0000 g	Center	
2	10.0000 g	99.9999 g	Front left	
3	10.0001 g	100.0000 g	Back left	
4	10.0000 g	99.9999 g	Back right	
5	10.0000 g	100.0000 g	Front right	
6	9.9999 g	99.9999 g	Maximum deviation from centric loading indication	
7	10.0000 g	100.0000 g	Δ _{ecc} max = 0.0001 g	
8	9.9999 g	100.0000 g		
9	10.0000 g	99.9999 g		
10	10.0001 g	100.0000 g		
	<i>s</i> = 0.00007 g	<i>s</i> = 0.00005 g		

Error of indication

Testload	Indication	Error	Expansion factor	Uncertainty	Uncertainty relative
<i>L</i>	<i>I</i>	<i>E</i>	<i>k</i>	<i>U</i> (<i>E</i>)	<i>U</i> _{rel} (<i>E</i>)
0.0100 g	0.0100 g	0.0000 g	2.00	0.00016 g	1.6 %
0.0500 g	0.0500 g	0.0000 g	2.00	0.00013 g	0.26 %
0.1000 g	0.1000 g	0.0000 g	2.00	0.00013 g	0.13 %
0.5000 g	0.5000 g	0.0000 g	2.00	0.00013 g	0.027 %
1.0000 g	1.0000 g	0.0000 g	2.00	0.00013 g	0.013 %
2.0000 g	2.0000 g	0.0000 g	2.00	0.00013 g	0.0067 %
5.0000 g	5.0000 g	0.0000 g	2.00	0.00014 g	0.0027 %
10.0000 g	10.0000 g	0.0000 g	2.00	0.00014 g	0.0014 %
20.0000 g	20.0000 g	0.0000 g	2.00	0.00014 g	0.00071 %
200.0000 g	199.9999 g	-0.0001 g	2.00	0.00028 g	0.00014 %
210.0000 g	210.0000 g	0.0000 g	2.00	0.00031 g	0.00015 %
Maximum error of indication		<i>E</i> _{max} = 0.0001 g			

*U*_{rel}(*E*) is the quotient of *U*(*E*) and test load *L*. The uncertainty of measurement *U*(*E*) is valid only if error *E* is considered. You will find reference notes on the uncertainty of measurement in use under: Appendix to the calibration certificate | Interpretation of measurement results.
Reference note: The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the documented Expansion factor, determined in accordance with the European Calibration Guideline EURAMET cg-18, V4.0. There is a 95 % probability that the value of the measurand will be in the assigned value range.

End of calibration certificate

Uncertainty of measurement in use

Device adjusted before measurement	Yes
Temperature deviation considered	1 K (isoCAL active)
Temperature coefficient considered	$2 \cdot 10^{-6}/\text{K}$

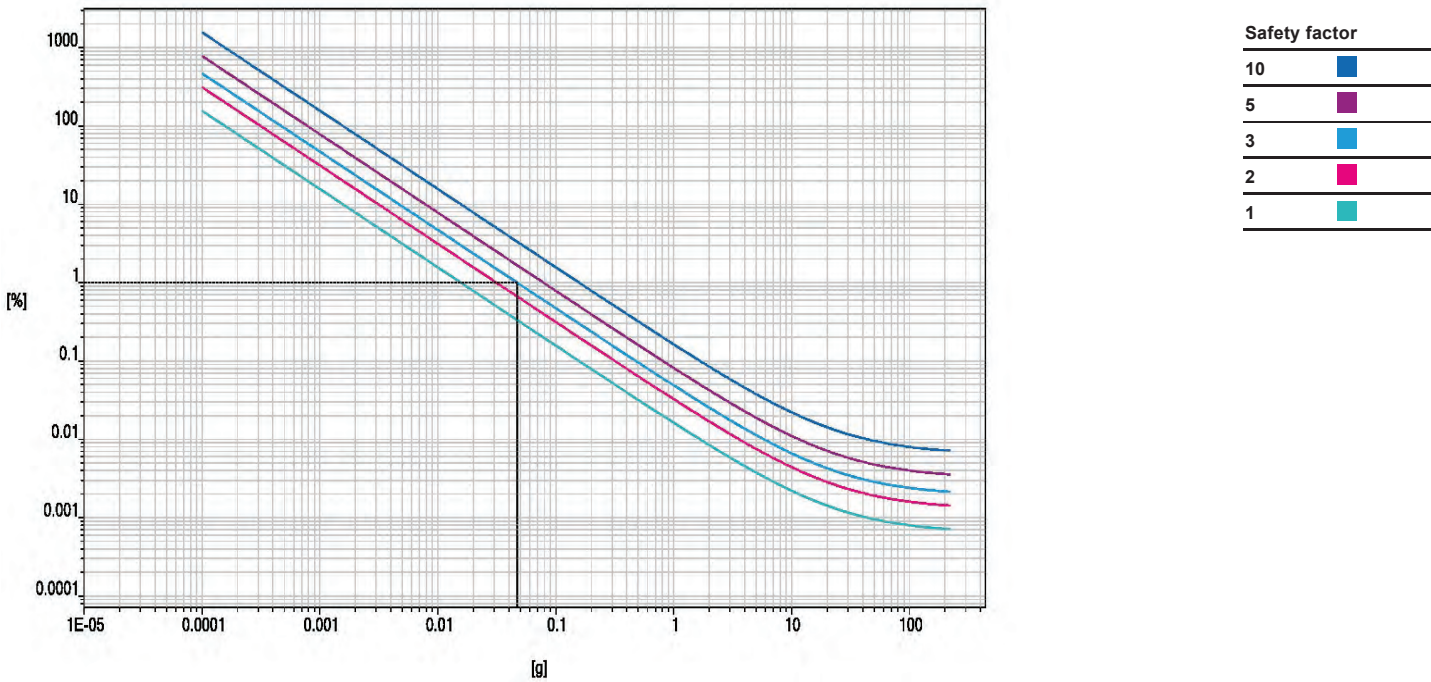
Uncertainty of the weighing result $U_{gl}(W)$

$U_{gl}(W) = 0.00016 \text{ g} + 6.42 \cdot 10^{-6} \cdot R$

Reference note: The current uncertainty of measurement is calculated by entering of the reading R into this formula. In relation to this, there is no need for a correction of the indication error. The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied with an Expansion factor of 2, determined in accordance with the European Calibration Guideline EURAMET cg-18, V4.0. There is a 95 % probability that the value of the measurand will be in the assigned value range.

Indication in % from max load	Net indication R	Uncertainty $U_{gl}(W)$	Uncertainty relative $U_{gl}(W)_{rel}$
1 %	2.2000 g	0.00017 g	0.0079 %
25 %	55.0000 g	0.00051 g	0.00093 %
50 %	110.0000 g	0.00087 g	0.00079 %
75 %	165.0000 g	0.0012 g	0.00074 %
100 %	220.0000 g	0.0016 g	0.00071 %

Graphic realization of the relative uncertainty of measurement | process accuracy



Displayed example

Process accuracy	1.00 %
Safety factor	3
Minimum sample weight	0.0470 g

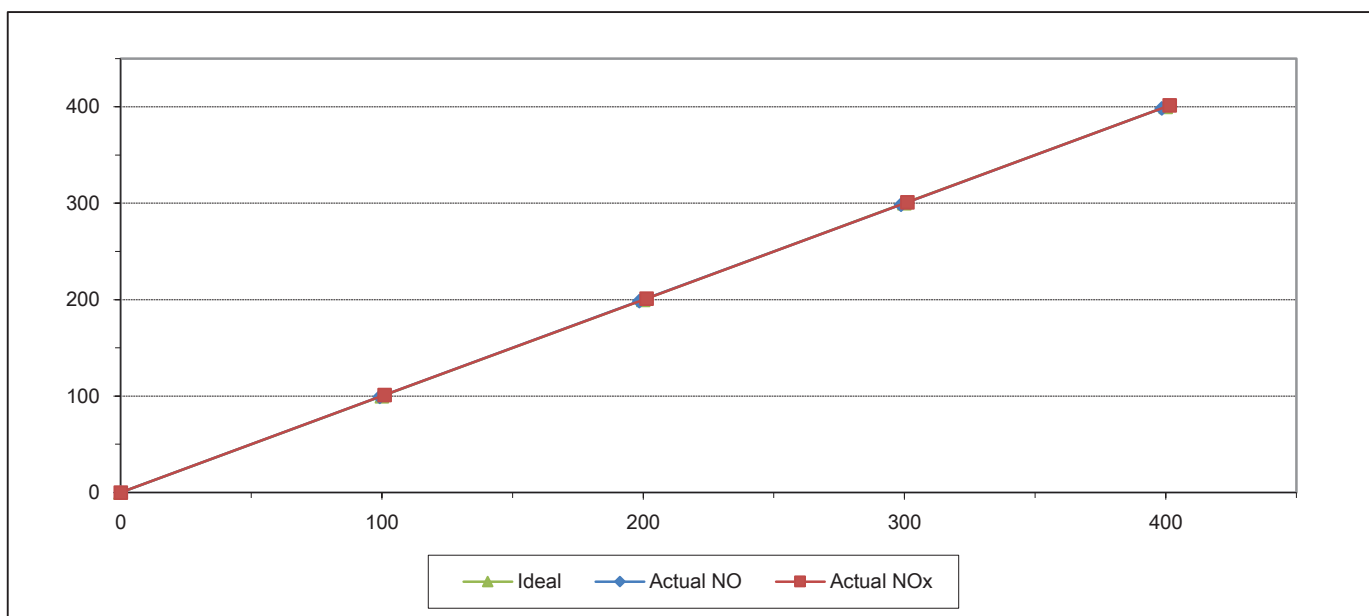


MULTIPOINT CALIBRATION REPORT

Calibration Date 3-Jul-25
Manufacturer HORIBA
Serial No. WNBBGLLL
Calibrator Manufacturer Teledyne API
Serial No. 947
Std. Gas Concentration (PPM) 55.88
Cylinder Pressure (psi) 1800
Certified Date 9-Feb-22

Equipment Name NOx Analyzer
Model APNA-370
Equipment ID SGK_FS0092
Model 700
Cylinder No. GN0027222
Certified By Airgas Inc.
Expired Date 9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	99.20	-0.80	-0.80	101.10	1.10	1.10
2	200.00	198.50	-1.50	-0.75	201.30	1.30	0.65
3	300.00	298.70	-1.30	-0.43	301.10	1.10	0.37
4	400.00	398.50	-1.50	-0.38	401.50	1.50	0.38
AVERAGE (%)				-0.45			0.52



Calibrated By



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

Approved By



(Mr.Sarayuth Jitranont)
Assistant General Manager

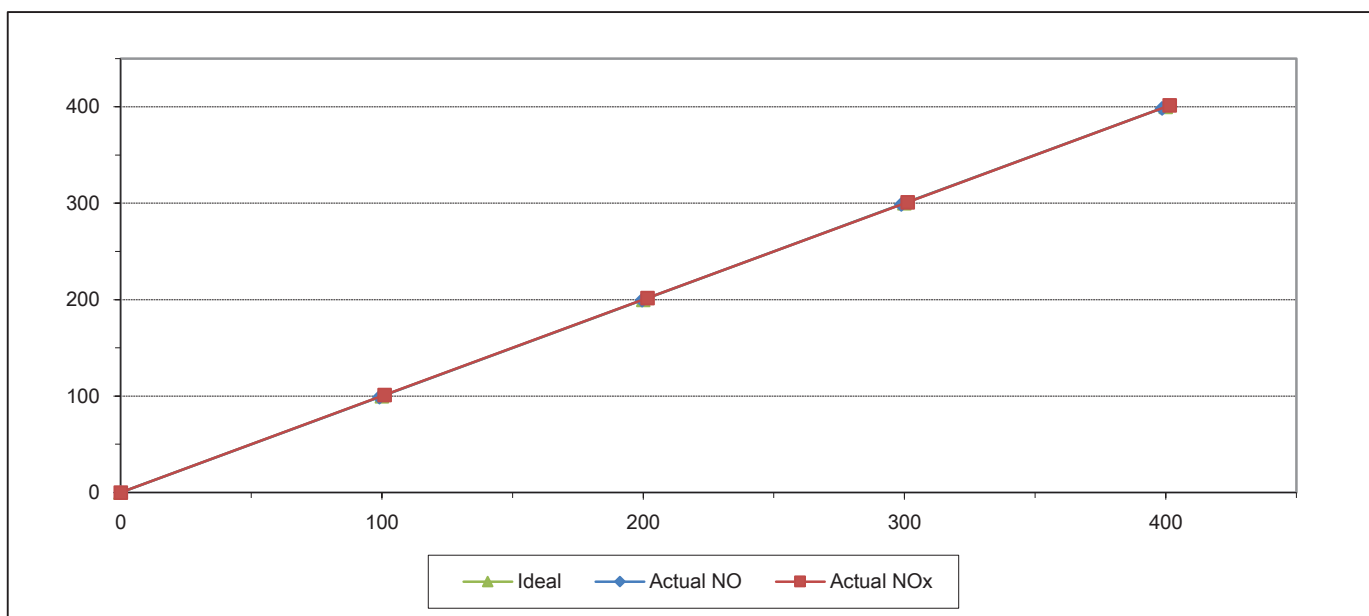


MULTIPOINT CALIBRATION REPORT

Calibration Date 2-Jul-25
Manufacturer Teledyne API
Serial No. 4378
Calibrator Manufacturer Teledyne API
Serial No. 947
Std. Gas Concentration (PPM) 55.88
Cylinder Pressure (psi) 1800
Certified Date 9-Feb-22

Equipment Name NOx Analyzer
Model 200E
Equipment ID BKK_FS0773
Model 700
Cylinder No. GN0027222
Certified By Airgas Inc.
Expired Date 9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	99.10	-0.90	-0.90	101.10	1.10	1.10
2	200.00	199.60	-0.40	-0.20	201.70	1.70	0.85
3	300.00	298.80	-1.20	-0.40	301.20	1.20	0.40
4	400.00	398.60	-1.40	-0.35	401.50	1.50	0.38
AVERAGE (%)				-0.35			0.56



Calibrated By

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

Approved By

(Mr.Sarayuth Jittranont)
Assistant General Manager

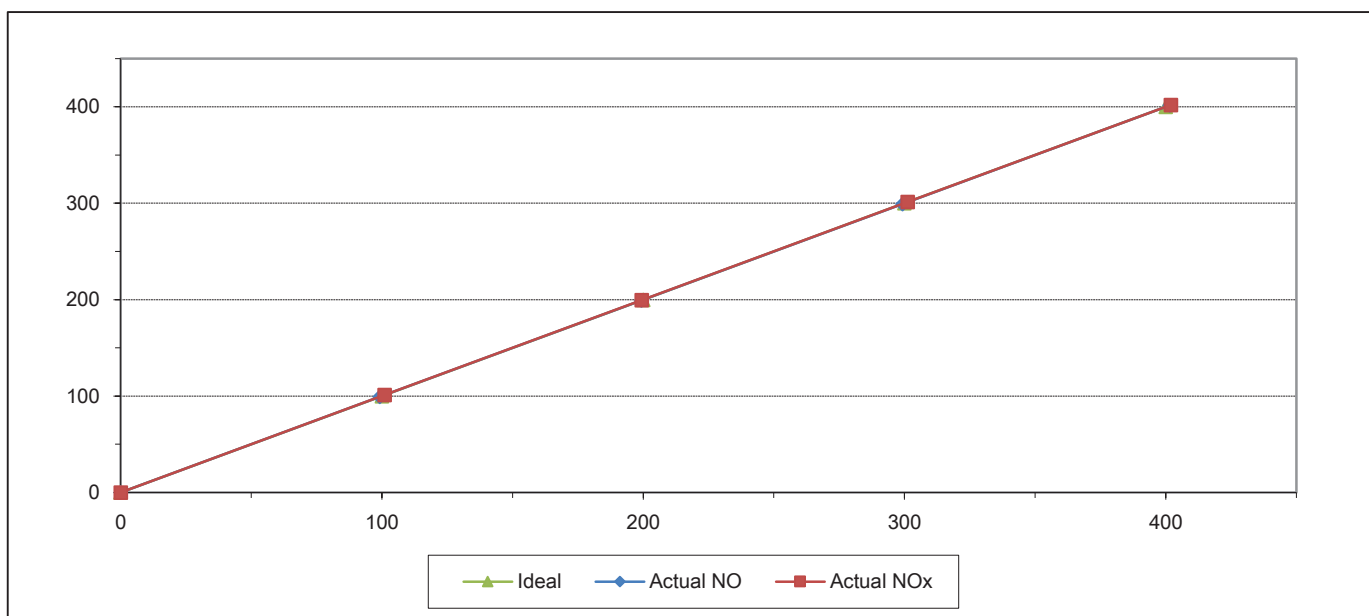


MULTIPOINT CALIBRATION REPORT

Calibration Date 2-Jul-25
Manufacturer Teledyne API
Serial No. 4379
Calibrator Manufacturer Teledyne API
Serial No. 947
Std. Gas Concentration (PPM) 55.88
Cylinder Pressure (psi) 1800
Certified Date 9-Feb-22

Equipment Name NOx Analyzer
Model 200E
Equipment ID BKK_FS0776
Model 700
Cylinder No. GN0027222
Certified By Airgas Inc.
Expired Date 9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	99.20	-0.80	-0.80	101.10	1.10	1.10
2	200.00	199.30	-0.70	-0.35	199.50	-0.50	-0.25
3	300.00	299.30	-0.70	-0.23	301.30	1.30	0.43
4	400.00	401.50	1.50	0.38	402.00	2.00	0.50
AVERAGE (%)				-0.18			0.38



Calibrated By

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

Approved By

(Mr.Sarayuth Jitranont)
Assistant General Manager

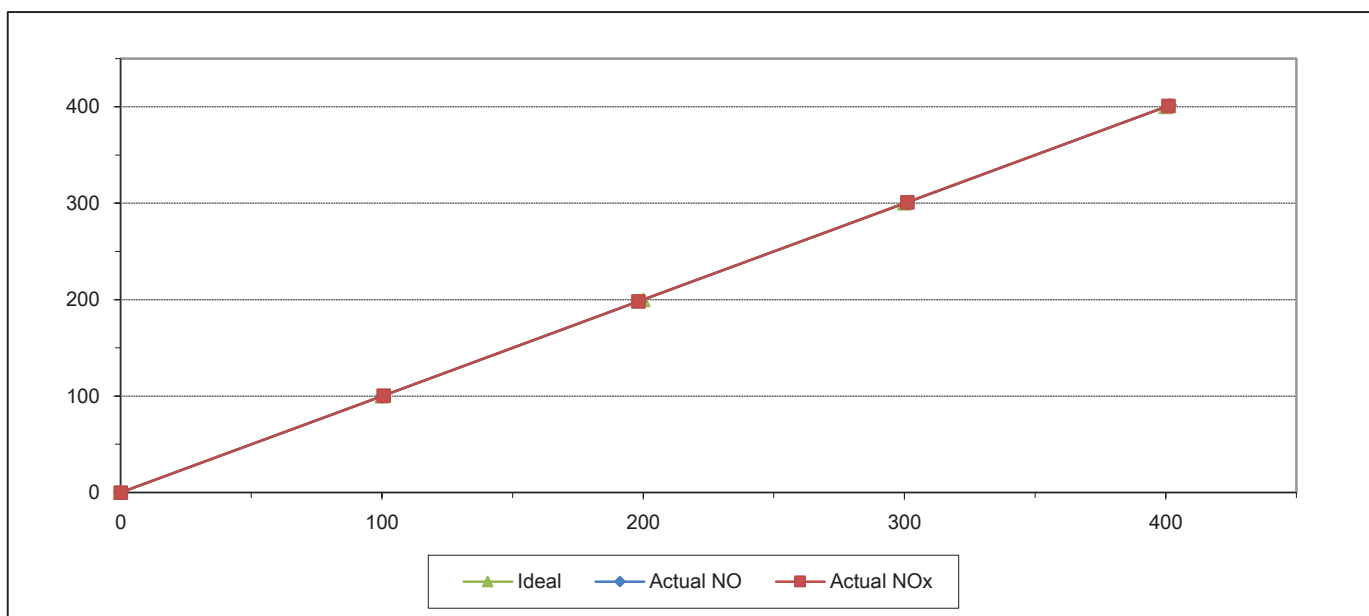


MULTIPOINT CALIBRATION REPORT

Calibration Date 3-Jul-25
Manufacturer HORIBA
Serial No. WJ38T7NG
Calibrator Manufacturer Teledyne API
Serial No. 947
Std. Gas Concentration (PPM) 55.88
Cylinder Pressure (psi) 1800
Certified Date 9-Feb-22

Equipment Name NOx Analyzer
Model APNA-370
Equipment ID BKK_FS1084
Model 700
Cylinder No. GN0027222
Certified By Airgas Inc.
Expired Date 9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	100.10	0.10	0.10	100.70	0.70	0.70
2	200.00	198.50	-1.50	-0.75	198.20	-1.80	-0.90
3	300.00	301.20	1.20	0.40	301.10	1.10	0.37
4	400.00	401.50	1.50	0.38	401.10	1.10	0.28
AVERAGE (%)				0.04			0.11



Calibrated By



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

Approved By



(Mr.Sarayuth Jittranont)
Assistant General Manager



PM 2.5 Calibration Data Sheet

Project :	Gulf Chana Green Co.,Ltd.	Barometric Pressure (mmHg) :	753.6
Calibrate Location :	มัตยิดนุรฐาชี	Temperature (°C) :	29
Calibrate Date :	22-Oct-25	Calibrate Sheet :	C-221025-SGK_FS0125
Calibrator ID :	SGK_FS0118	PM 2.5 ID :	SGK_FS0125
Calibrator Brand :	DELTA CAL (For PM2.5)	PM 2.5 Brand :	TISCH
Calibrator Model :	BGI	PM 2.5 Model :	TE-WILBUR-2.5
Calibrator S/N :	204831	PM 2.5 S/N :	1004

Calibration Data					
Leak Check	Criteria	Time Start	Time Stop	Check	
External Leak*	> 75 cm of water	13.30	13.45	Passed	
Pressure	Criteria	STD. Pressure	Sample Pressure	Check	
Ambient Pressure	STD. $\pm$ 10 mmHg	753.6	753.6	Passed	
Temperature	Criteria	STD. Temp.	Sample Temp.	Check	
Ambient Sensor	STD. $\pm$ 2°C	29	29	Passed	
Filter Sensor	STD. $\pm$ 2°C	29	29	Passed	
Flow rate	Criteria	Design Flow	Sample Flow	Adjustment	Remark
Flow Rate Check	$15.84 \leq \text{Flow} \leq 17.51$	16.67 Lpm	16.7	-	

*Passed = that indicates a leak of less than 80 mL/min.

Calibrated By



(Mr. Narathorn Keawpongsa)

SGK Field Services Scientist (1)

Approved By



(Mr. Sarayuth Jittranont)

Assistant General Manager



PM 2.5 Calibration Data Sheet

Project :	Gulf Chana Green Co.,Ltd.	Barometric Pressure (mmHg) :	753.6
Calibrate Location :	A2 โรงเรียนจณะนูปถัมภ์	Temperature (°C) :	29
Calibrate Date :	22-Oct-25	Calibrate Sheet :	C-221025-SGK_FS0124
Calibrator ID :	SGK_FS0118	PM 2.5 ID :	SGK_FS0124
Calibrator Brand :	DELTA CAL (For PM2.5)	PM 2.5 Brand :	TISCH
Calibrator Model :	BGI	PM 2.5 Model :	TE-WILBUR-2.5
Calibrator S/N :	204831	PM 2.5 S/N :	1003

Calibration Data					
Leak Check	Criteria	Time Start	Time Stop	Check	
External Leak*	> 75 cm of water	14.30	14.45	Passed	
Pressure	Criteria	STD. Pressure	Sample Pressure	Check	
Ambient Pressure	STD. $\pm$ 10 mmHg	753.6	753.6	Passed	
Temperature	Criteria	STD. Temp.	Sample Temp.	Check	
Ambient Sensor	STD. $\pm$ 2°C	29	29	Passed	
Filter Sensor	STD. $\pm$ 2°C	29	29	Passed	
Flow rate	Criteria	Design Flow	Sample Flow	Adjustment	Remark
Flow Rate Check	$15.84 \leq \text{Flow} \leq 17.51$	16.67 Lpm	16.7	-	

*Passed = that indicates a leak of less than 80 mL/min.

Calibrated By



(Mr. Narathorn Keawpongsa)

SGK Field Services Scientist (1)

Approved By



(Mr. Sarayuth Jittrantont)

Assistant General Manager



PM 2.5 Calibration Data Sheet

Project :	Gulf Chana Green Co.,Ltd.	Barometric Pressure (mmHg) :	753.6
Calibrate Location :	A3 มัสยิดเจ้าพระหมื่น	Temperature (°C) :	29
Calibrate Date :	22-Oct-25	Calibrate Sheet :	C-221025-BKK_FS1435
Calibrator ID :	SGK_FS0118	PM 2.5 ID :	BKK_FS1435
Calibrator Brand :	DELTA CAL (For PM2.5)	PM 2.5 Brand :	Qingdao Junray Intelligent Instrument
Calibrator Model :	BGI	PM 2.5 Model :	ZR-3930B
Calibrator S/N :	204831	PM 2.5 S/N :	3930C90052932

Calibration Data					
Leak Check	Criteria	Time Start	Time Stop	Check	
External Leak*	> 75 cm of water	11.30	11.45	Passed	
Pressure	Criteria	STD. Pressure	Sample Pressure	Check	
Ambient Pressure	STD. $\pm$ 10 mmHg	753.6	753.6	Passed	
Temperature	Criteria	STD. Temp.	Sample Temp.	Check	
Ambient Sensor	STD. $\pm$ 2°C	29	29	Passed	
Filter Sensor	STD. $\pm$ 2°C	29	29	Passed	
Flow rate	Criteria	Design Flow	Sample Flow	Adjustment	Remark
Flow Rate Check	$15.84 \leq \text{Flow} \leq 17.51$	16.67 Lpm	16.67	-	

*Passed = that indicates a leak of less than 80 mL/min.

Calibrated By



(Mr. Narathorn Keawpongsa)

SGK Field Services Scientist (1)

Approved By



(Mr. Sarayuth Jittranont)

Assistant General Manager



PM 2.5 Calibration Data Sheet

Project :	Gulf Chana Green Co.,Ltd.	Barometric Pressure (mmHg) :	753.6
Calibrate Location :	A4 บ้านม่วงหวาน	Temperature (°C) :	29
Calibrate Date :	22-Oct-25	Calibrate Sheet :	C-221025-SGK_FS0123
Calibrator ID :	SGK_FS0118	PM 2.5 ID :	SGK_FS0123
Calibrator Brand :	DELTA CAL (For PM2.5)	PM 2.5 Brand :	TISCH
Calibrator Model :	BGI	PM 2.5 Model :	TE-WILBUR-2.5
Calibrator S/N :	204831	PM 2.5 S/N :	1001

Calibration Data					
Leak Check	Criteria	Time Start	Time Stop	Check	
External Leak*	> 75 cm of water	12.30	12.45	Passed	
Pressure	Criteria	STD. Pressure	Sample Pressure	Check	
Ambient Pressure	STD. $\pm$ 10 mmHg	753.6	753.6	Passed	
Temperature	Criteria	STD. Temp.	Sample Temp.	Check	
Ambient Sensor	STD. $\pm$ 2°C	29	29	Passed	
Filter Sensor	STD. $\pm$ 2°C	29	29	Passed	
Flow rate	Criteria	Design Flow	Sample Flow	Adjustment	Remark
Flow Rate Check	$15.84 \leq \text{Flow} \leq 17.51$	16.67 Lpm	16.67	-	

*Passed = that indicates a leak of less than 80 mL/min.

Calibrated By

(Mr. Narathorn Keawpongsa)

SGK Field Services Scientist (1)

Approved By

(Mr. Sarayuth Jittranont)

Assistant General Manager

Accredited by

NSC-TISI-TIS 17025

Calibration 0426



Calibration certificate

Calibration Certificate No. 25BCI0197

Object	Electronic non-automatic weighing instrument	This calibration certificate documents the traceability to national standards.
Manufacturer	Ohaus	Uncertainties of measurements are taken into account when only statements of compliance are made.
Type	EX225D/AD	This certificate was prepared by Sartorius Corporation in accordance to the current ISO/IEC 17025:2017 standard and Sartorius Work Instruction (Method) SOP WI 08.
Serial QM Ident. no.	C309774648 BKK_EN0403	This certificate relate and apply this equipment only.
Customer	ALS Laboratory Group (Thailand)Co., Ltd. 104 Phatthanakarn 40,Phattanakarn Rd.,Khwaeng Phatthanakarn ,Khet Suan Luang,Bangkok 10250	
Order no.	261969	REVIEW BY ...
Number of pages	6	APPROVED BY ...
Date of calibration	30 May 2025	NEXT CAL DATE.....30/05/26.....

This calibration certificate may not be reproduced other than in full except with the permission of NSC-TISI-TIS-17025 and the issuing laboratory. Calibration certificates without signature are not valid.

The user is obliged to have the object recalibrated at appropriate intervals.

Date	30 May 2025	Approval of the Calibration Certificate	Person in charge
		Mr. Chonchai Inthana	Chonchai Inthana

Calibration object

Multi range instrument

Model	EX225D/AD	
Serial Number	C309774648	
QM Ident. no Inventory no.	BKK_EN0403 ---	
Range	1	2
Maximum capacity (Max. load)	120.00000 g	220.0000 g
Measured range	120.00000 g	220.0000 g
Scale interval	0.00001 g	0.0001 g

Place of calibration

Address	According to page 1
Department Cost center	Environment Department. ---
Building Floor	--- 1st Floor.
Room	Laboratory Room.
Maximum temperature variation at place of calibration	5 K

Calibration procedure

EURAMET cg-18, V4.0 - Guidelines on the Calibration of Non-Automatic Weighing Instruments

Test equipment

Test equipment type	Test equipment ID	Valid until
Thermometer	Testo 174(Traceable to Si unit through ENTECH)	11 Nov 2025
Test weight set OIML R111 E2	Certificate No.M2308197S ,E2(Traceable to SI unit through TCS)	23 Aug 2025

Range 1

Adjustment Status

The measuring device was internally adjusted before the calibration.

Environmental and measuring conditions

Date of calibration	30 May 2025
Temperature at place of calibration Temp. diff. <i>T</i> _{weights} - <i>T</i> _{place}	21.7 °C 0.5 K
Measuring conditions	The installation site is suitable. The device was levelled. Balance was loaded up to Max before test.
Comments	Humidity 60.0 %RH.

Measurement results | Measurement uncertainties

Repeatability			Eccentricity	
Test load (nominal): 1 g 100 g			Test load (nominal): 50 g	
	1 g	100 g		
1	0.99993 g	99.99971 g	Center	49.99996 g
2	0.99991 g	99.99971 g	Front left	49.99993 g
3	0.99992 g	99.99974 g	Back left	49.99993 g
4	0.99993 g	99.99973 g	Back right	49.99994 g
5	0.99992 g	99.99974 g	Front right	49.99990 g
6	0.99991 g	99.99970 g	Maximum deviation from centric loading indication	
7	0.99993 g	99.99973 g	Δ _{ecc} max = 0.00006 g	
8	0.99994 g	99.99972 g		
9	0.99995 g	99.99971 g		
10	0.99995 g	99.99969 g		
	<i>s</i> = 0.000014 g	<i>s</i> = 0.000017 g		

Error of indication

Testload	Indication	Error	Expansion factor	Uncertainty	Uncertainty relative
<i>L</i>	<i>I</i>	<i>E</i>	<i>k</i>	<i>U</i> (<i>E</i>)	<i>U</i> _{rel} (<i>E</i>)
0.00000 g	0.00000 g	0.00000 g	2.00	0.000030 g	---
0.01000 g	0.00995 g	-0.00005 g	2.00	0.000037 g	0.37 %
0.10000 g	0.09991 g	-0.00009 g	2.00	0.000038 g	0.038 %
0.50000 g	0.49985 g	-0.00015 g	2.00	0.000040 g	0.0080 %
1.00000 g	0.99991 g	-0.00009 g	2.00	0.000041 g	0.0041 %
5.00002 g	4.99997 g	-0.00005 g	2.00	0.000050 g	0.0010 %
10.00002 g	10.00003 g	0.00001 g	2.00	0.000069 g	0.00069 %
50.00002 g	49.99972 g	-0.00030 g	2.00	0.000091 g	0.00018 %
70.00004 g	69.99975 g	-0.00029 g	2.00	0.00017 g	0.00024 %
100.00001 g	99.99958 g	-0.00043 g	2.00	0.00017 g	0.00017 %
115.00006 g	114.99966 g	-0.00040 g	2.00	0.00028 g	0.00024 %
Maximum error of indication		<i>E</i> _{max} = 0.00043 g			

*U*_{rel}(*E*) is the quotient of *U*(*E*) and test load *L*. The uncertainty of measurement *U*(*E*) is valid only if error *E* is considered. You will find reference notes on the uncertainty of measurement in use under: Appendix to the calibration certificate | Interpretation of measurement results.
Reference note: The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the documented Expansion factor, determined in accordance with the European Calibration Guideline EURAMET cg-18, V4.0. There is a 95 % probability that the value of the measurand will be in the assigned value range.

Range 2

Adjustment Status

The measuring device was internally adjusted before the calibration.

Environmental and measuring conditions

Date of calibration	30 May 2025
Temperature at place of calibration Temp. diff. $T_{\text{weights}} - T_{\text{place}}$	21.7 °C 0.5 K
Measuring conditions	The installation site is suitable. The device was levelled. Balance was loaded up to Max before test.
Comments	Humidity 60.0 %RH.

Measurement results | Measurement uncertainties

Repeatability		Eccentricity	
Test load (nominal): 200 g		Test load (nominal): 100 g	
200 g			
1	199.9998 g	Center	99.99984 g
2	199.9998 g	Front left	99.99990 g
3	199.9998 g	Back left	99.99983 g
4	200.0000 g	Back right	99.99979 g
5	199.9998 g	Front right	99.99979 g
6	199.9999 g	Maximum deviation from centric loading indication	
7	199.9999 g	$ \Delta_{\text{ecc}} _{\text{max}} = 0.00006 \text{ g}$	
8	200.0000 g		
9	199.9998 g		
10	199.9999 g		
$s = 0.00008 \text{ g}$			

Error of indication

Testload	Indication	Error	Expansion factor	Uncertainty	Uncertainty relative
L	I	E	k	$U(E)$	$U_{\text{rel}}(E)$
0.00000 g	0.00000 g	0.00000 g	2.00	0.000030 g	---
20.00002 g	19.99986 g	-0.00016 g	2.00	0.000069 g	0.00034 %
50.00002 g	49.99978 g	-0.00024 g	2.00	0.000091 g	0.00018 %
70.00004 g	69.99981 g	-0.00023 g	2.00	0.00017 g	0.00024 %
90.00007 g	89.99976 g	-0.00031 g	2.00	0.00018 g	0.00020 %
110.00003 g	109.99986 g	-0.00017 g	2.00	0.00028 g	0.00025 %
130.0001 g	129.9999 g	-0.0002 g	2.00	0.00028 g	0.00022 %
150.0000 g	149.9999 g	-0.0001 g	2.00	0.00028 g	0.00019 %
170.0000 g	170.0000 g	0.0000 g	2.00	0.00028 g	0.00016 %
200.0000 g	199.9998 g	-0.0002 g	2.00	0.00028 g	0.00014 %
220.0000 g	219.9999 g	-0.0001 g	2.00	0.00029 g	0.00013 %
Maximum error of indication		$ E _{\text{max}} = 0.0003 \text{ g}$			

$U_{\text{rel}}(E)$ is the quotient of $U(E)$ and test load L . The uncertainty of measurement $U(E)$ is valid only if error E is considered. You will find reference notes on the uncertainty of measurement in use under: Appendix to the calibration certificate | Interpretation of measurement results.
Reference note: The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the documented Expansion factor, determined in accordance with the European Calibration Guideline EURAMET cg-18, V4.0. There is a 95 % probability that the value of the measurand will be in the assigned value range.

End of calibration certificate

Uncertainty of measurement in use

Range 1

Device adjusted before measurement	Yes
Temperature deviation considered	5 K
Temperature coefficient considered	$2 \cdot 10^{-6}/\text{K}$

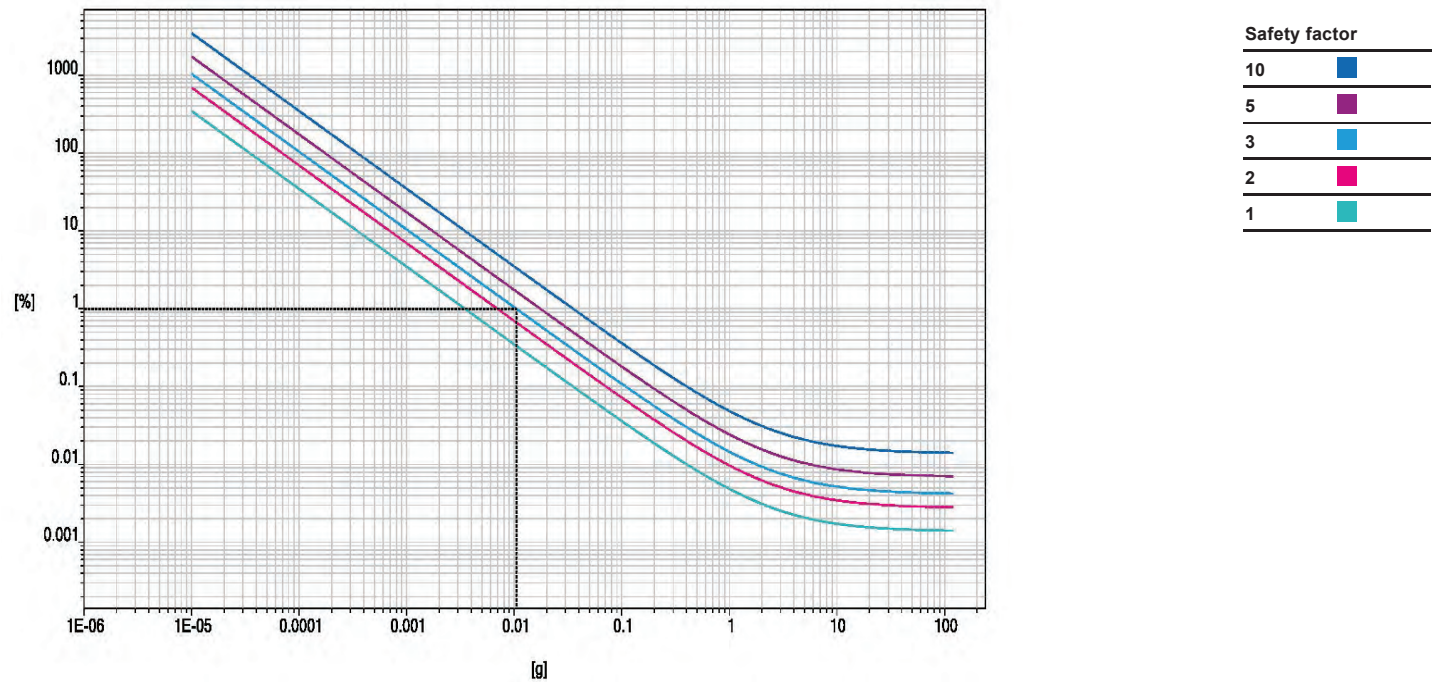
Uncertainty of the weighing result $U_{gl}(W)$

$U_{gl}(W) = 0.000035 \text{ g} + 1.38 \cdot 10^{-5} \cdot R$

Reference note: The current uncertainty of measurement is calculated by entering of the reading R into this formula. In relation to this, there is no need for a correction of the indication error. The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied with an Expansion factor of 2, determined in accordance with the European Calibration Guideline EURAMET cg-18, V4.0. There is a 95 % probability that the value of the measurand will be in the assigned value range.

Indication in % from max load	Net indication R	Uncertainty $U_{gl}(W)$	Uncertainty relative $U_{gl}(W)_{rel}$
1 %	1.20000 g	0.000052 g	0.0043 %
25 %	30.00000 g	0.00045 g	0.0015 %
50 %	60.00000 g	0.00086 g	0.0014 %
75 %	90.00000 g	0.0013 g	0.0014 %
100 %	120.00000 g	0.0017 g	0.0014 %

Graphic realization of the relative uncertainty of measurement | process accuracy



Displayed example

Process accuracy	1.00 %
Safety factor	3
Minimum sample weight	0.01045 g

Uncertainty of measurement in use

Range 2

Device adjusted before measurement	Yes
Temperature deviation considered	5 K
Temperature coefficient considered	$2 \cdot 10^{-6}/\text{K}$

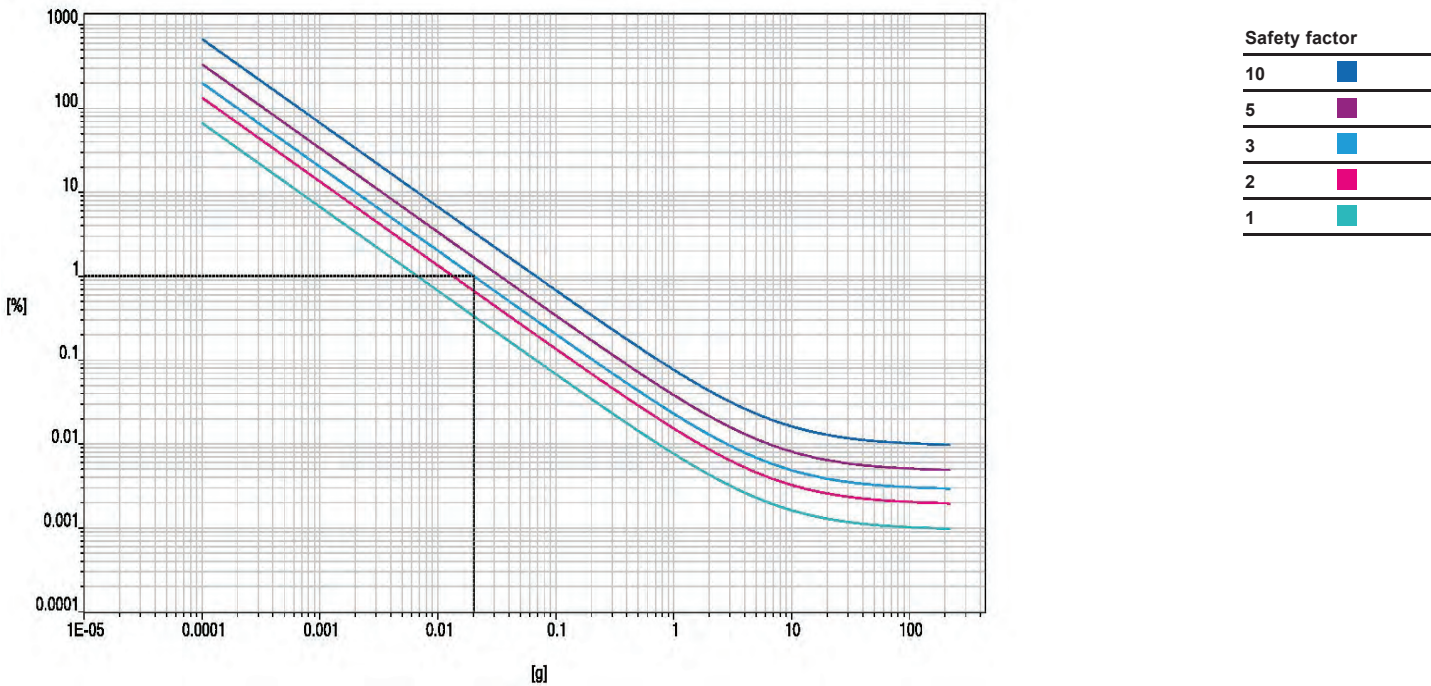
Uncertainty of the weighing result $U_{gl}(W)$

$U_{gl}(W) = 0.000067 \text{ g} + 9.52 \cdot 10^{-6} \cdot R$

Reference note: The current uncertainty of measurement is calculated by entering of the reading R into this formula. In relation to this, there is no need for a correction of the indication error. The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied with an Expansion factor of 2, determined in accordance with the European Calibration Guideline EURAMET cg-18, V4.0. There is a 95 % probability that the value of the measurand will be in the assigned value range.

Indication in % from max load	Net indication R	Uncertainty $U_{gl}(W)$	Uncertainty relative $U_{gl}(W)_{rel}$
1 %	2.20000 g	0.000088 g	0.0040 %
25 %	55.00000 g	0.00059 g	0.0011 %
50 %	110.00000 g	0.0011 g	0.0010 %
75 %	165.0000 g	0.0016 g	0.00099 %
100 %	220.0000 g	0.0022 g	0.00098 %

Graphic realization of the relative uncertainty of measurement | process accuracy



Displayed example

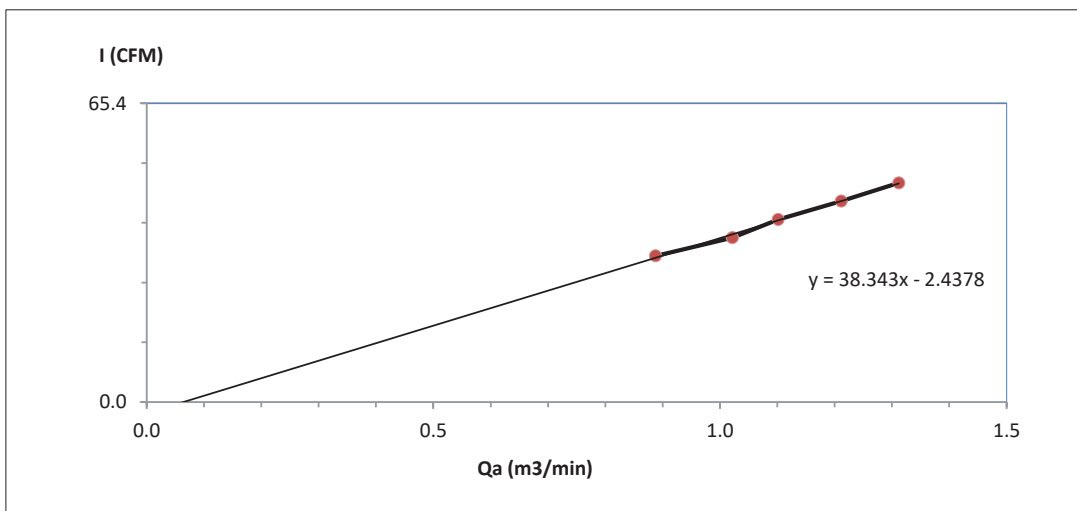
Process accuracy	1.00 %
Safety factor	3
Minimum sample weight	0.02019 g



High Volume Air Sampler Calibration Worksheet

Project Site :	Gulf Chana Green Co.,Ltd.	Barometric Pressure (mm Hg) :	753.6
Calibrate Location :	A1 มัสยิดนุรุษซาลี	Temperature (°C) :	29.0
Calibrate Date :	22-Oct-25	High Volume ID :	SGK_FS0121
CalibrationSheet No.:	C-221025-SGK_FS0121	High Volume Model :	TE-5009X
Calibrator ID:	SGK_FS0034	High Volume S/N :	1088
Calibrator Model :	TE-5028A	Calibrator Slope :	0.98245
Calibrator S/N :	3449	Calibrator Intercept :	-0.02325

Test No.	Delta H ₂ O (inch)	Qa (m ³ /min)	I : Chart (CFM)	Linear Regression
1	1.8	0.888	32	Slope : 38.3428 Intercept : -2.4378 Correlation Coefficient : 0.9977
2	2.4	1.021	36	
3	2.8	1.101	40	
4	3.4	1.211	44	
5	4.0	1.312	48	



Calibrated by

(Mr. Narathorn Keawpongsa)
SGK Field Services Scientist (1)

Approved by :

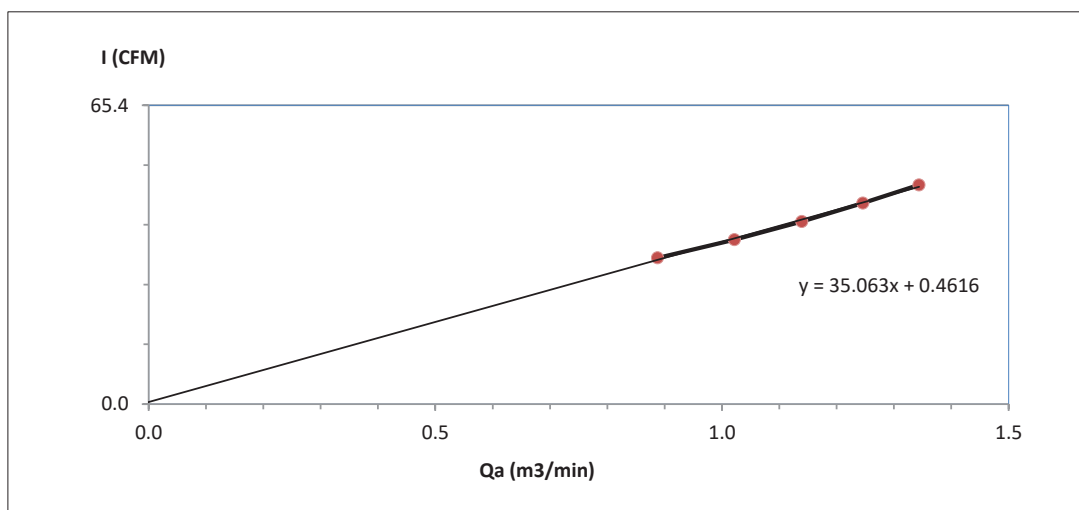
(Mr. Supot Salamteh)
Field Services Section Head



High Volume Air Sampler Calibration Worksheet

Project Site :	Gulf Chana Green Co.,Ltd.	Barometric Pressure (mm Hg) :	753.6
Calibrate Location :	A2 โรงเรียนจนะขุบลัมภ์	Temperature (°C) :	29.0
Calibrate Date :	22-Oct-25	High Volume ID :	SGK_FS0087
CalibrationSheet No.:	C-221025-SGK_FS0087	High Volume Model :	TE-5009X
Calibrator ID:	SGK_FS0034	High Volume S/N :	5993
Calibrator Model :	TE-5028A	Calibrator Slope :	0.98245
Calibrator S/N :	3449	Calibrator Intercept :	-0.02325

Test No.	Delta H ₂ O (inch)	Qa (m ³ /min)	I : Chart (CFM)	Linear Regression
1	1.8	0.888	32	Slope : 35.0635 Intercept : 0.4616 Correlation Coefficient : 0.9981
2	2.4	1.021	36	
3	3.0	1.139	40	
4	3.6	1.246	44	
5	4.2	1.344	48	



Calibrated by



(Mr. Narathorn Keawpongsa)
SGK Field Services Scientist (1)

Approved by :



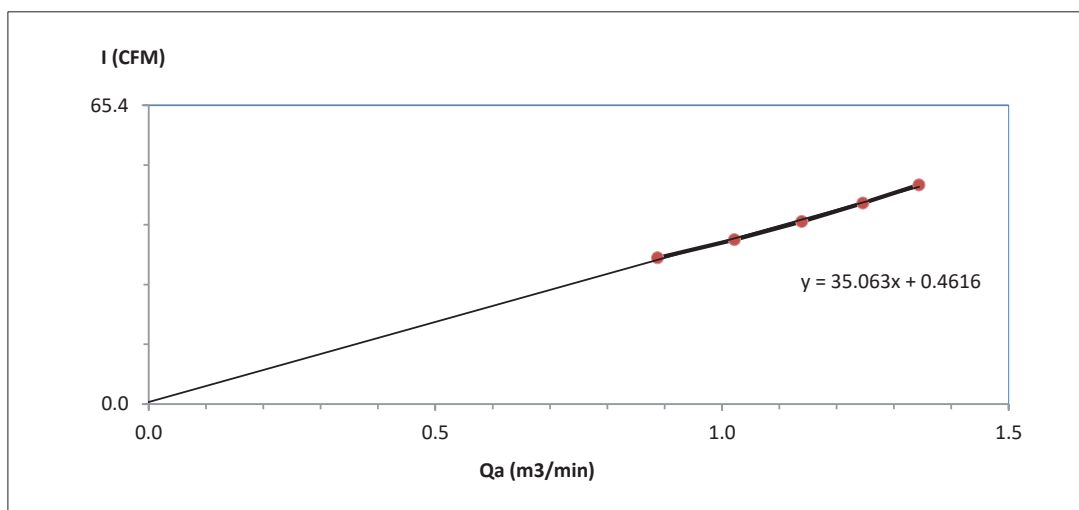
(Mr. Supot Salamteh)
Field Services Section Head



High Volume Air Sampler Calibration Worksheet

Project Site :	Gulf Chana Green Co.,Ltd.	Barometric Pressure (mm Hg) :	753.6
Calibrate Location :	A3 มัสยิดเร้าะหม๊ะ	Temperature (°C) :	29.0
Calibrate Date :	22-Oct-25	High Volume ID :	SGK_FS0066
CalibrationSheet No.:	C-221025-SGK_FS0066	High Volume Model :	TE-5009X
Calibrator ID:	SGK_FS0034	High Volume S/N :	5581
Calibrator Model :	TE-5028A	Calibrator Slope :	0.98245
Calibrator S/N :	3449	Calibrator Intercept :	-0.02325

Test No.	Delta H ₂ O (inch)	Qa (m ³ /min)	I : Chart (CFM)	Linear Regression
1	1.8	0.888	32	Slope : 35.0635 Intercept : 0.4616 Correlation Coefficient : 0.9981
2	2.4	1.021	36	
3	3.0	1.139	40	
4	3.6	1.246	44	
5	4.2	1.344	48	



Calibrated by

(Mr. Narathorn Keawpongsa)
SGK Field Services Scientist (1)

Approved by :

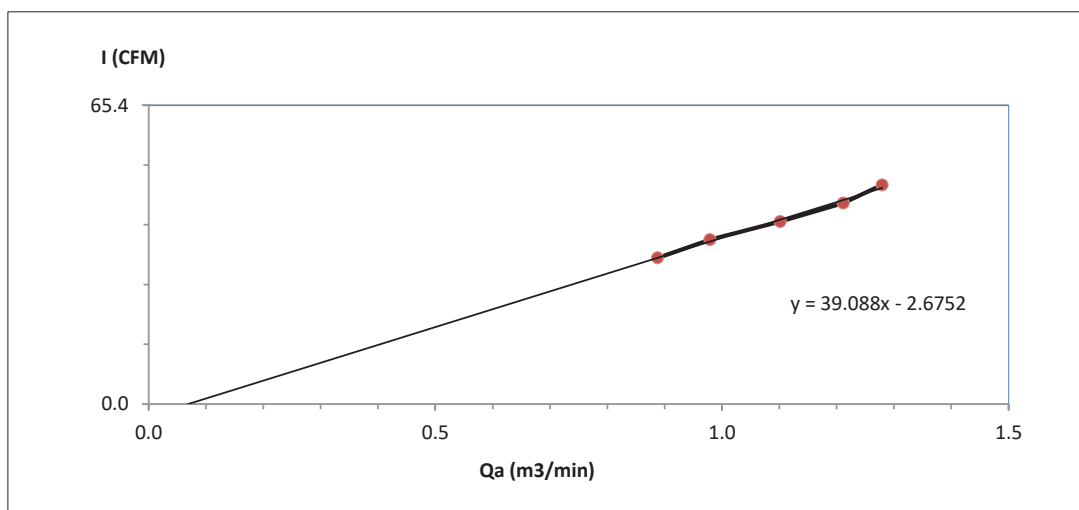
(Mr. Supot Salamteh)
Field Services Section Head



High Volume Air Sampler Calibration Worksheet

Project Site :	Gulf Chana Green Co.,Ltd.	Barometric Pressure (mm Hg) :	753.6
Calibrate Location :	A4 บ้านม่วงพรวน	Temperature (°C) :	29.0
Calibrate Date :	22-Oct-25	High Volume ID :	SGK_FS0086
CalibrationSheet No.:	C-221025-SGK_FS0086	High Volume Model :	TE-5009X
Calibrator ID:	SGK_FS0034	High Volume S/N :	5991
Calibrator Model :	TE-5028A	Calibrator Slope :	0.98245
Calibrator S/N :	3449	Calibrator Intercept :	-0.02325

Test No.	Delta H ₂ O (inch)	Qa (m ³ /min)	I : Chart (CFM)	Linear Regression
1	1.8	0.888	32	Slope : 39.0880 Intercept : -2.6752 Correlation Coefficient : 0.9962
2	2.2	0.979	36	
3	2.8	1.101	40	
4	3.4	1.211	44	
5	3.8	1.279	48	



Calibrated by



(Mr. Narathorn Keawpongsa)
SGK Field Services Scientist (1)

Approved by :



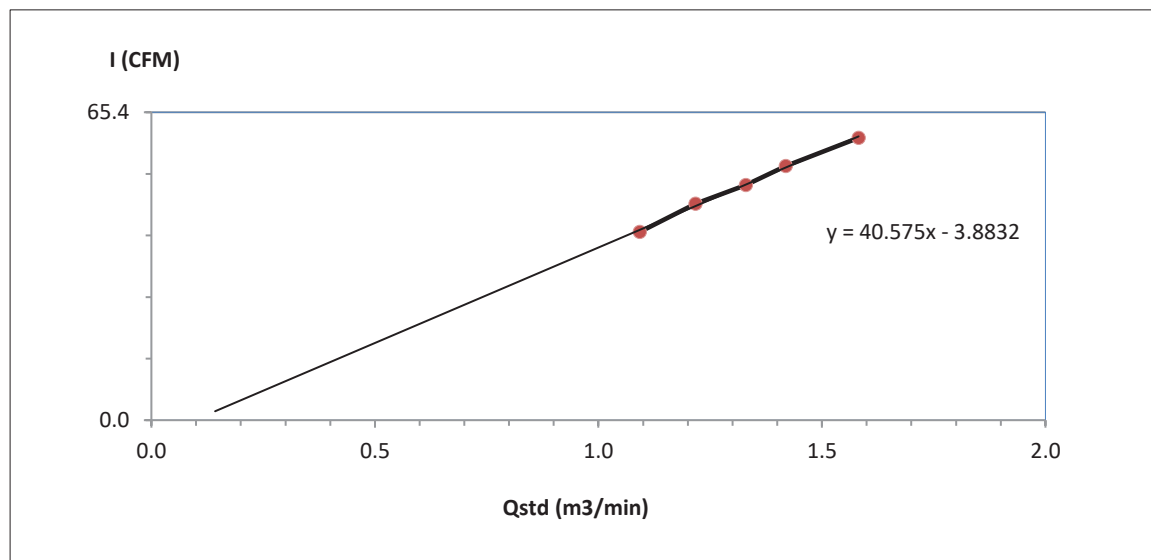
(Mr. Supot Salamteh)
Field Services Section Head



High Volume Air Sampler Calibration Worksheet

Project Site :	Gulf Chana Green Co.,Ltd.	Barometric Pressure (mm Hg) :	753.6
Calibrate Location :	A1 มัสยิดนุรุชชาชี	Temperature (°C) :	29.0
Calibrate Date :	22-Oct-25	High Volume ID :	SGK_FS0119
CalibrationSheet No.:	C-221025-SGK_FS0119	High Volume Model :	TE-5170D
Calibrator ID:	SGK_FS0034	High Volume S/N :	1062
Calibrator Model :	TE-5028A	Calibrator Slope :	1.56856
Calibrator S/N :	3449	Calibrator Intercept :	-0.03727

Test No.	Delta H ₂ O (inch)	Q _{std} (m ³ /min)	I : Chart (CFM)	Linear Regression
1	2.8	1.0925	40	Slope : 40.5746 Intercept : -3.8832 Correlation Coefficient : 0.9986
2	3.5	1.2170	46	
3	4.2	1.3296	50	
4	4.8	1.4189	54	
5	6.0	1.5820	60	



Calibrated by



(Mr. Narathorn Keawpongsa)
SGK Field Services Scientist (1)

Approved by :



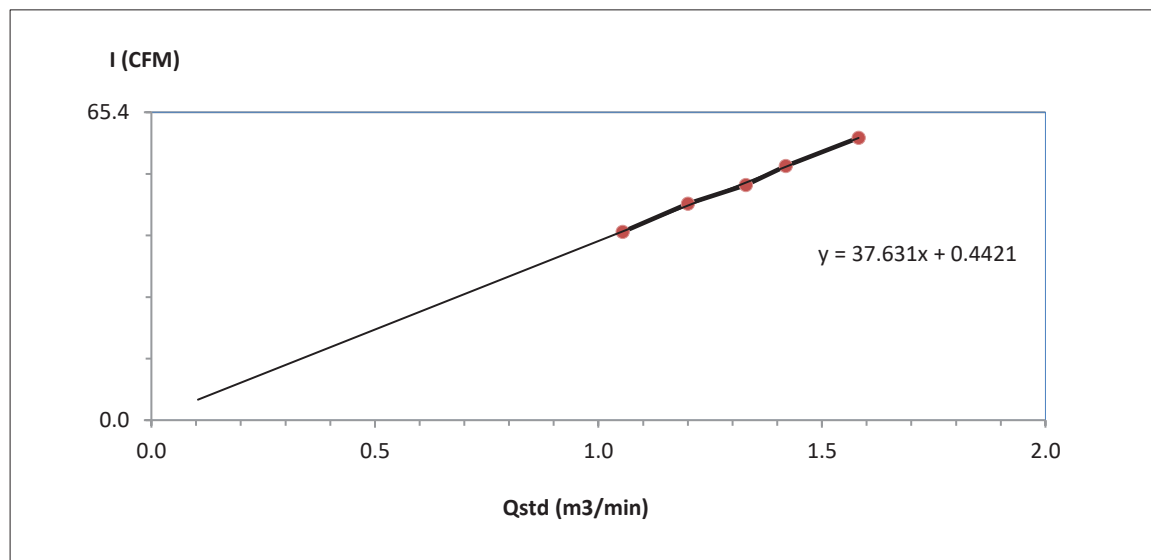
(Mr. Supot Salamteh)
Field Services Section Head



High Volume Air Sampler Calibration Worksheet

Project Site :	Gulf Chana Green Co.,Ltd.	Barometric Pressure (mm Hg) :	753.6
Calibrate Location :	A2 โรงเรียนจะนะชนูปถัมภ์	Temperature (°C) :	29.0
Calibrate Date :	22-Oct-25	High Volume ID :	SGK_FS0062
CalibrationSheet No.:	C-221025-SGK_FS0062	High Volume Model :	TE-5170D
Calibrator ID:	SGK_FS0034	High Volume S/N :	5588
Calibrator Model :	TE-5028A	Calibrator Slope :	1.56856
Calibrator S/N :	3449	Calibrator Intercept :	-0.03727

Test No.	Delta H ₂ O (inch)	Q _{std} (m ³ /min)	I : Chart (CFM)	Linear Regression
1	2.6	1.0541	40	Slope : 37.6314 Intercept : 0.4421 Correlation Coefficient : 0.9991
2	3.4	1.2001	46	
3	4.2	1.3296	50	
4	4.8	1.4189	54	
5	6.0	1.5820	60	



Calibrated by

(Mr. Narathorn Keawpongsa)
SGK Field Services Scientist (1)

Approved by :

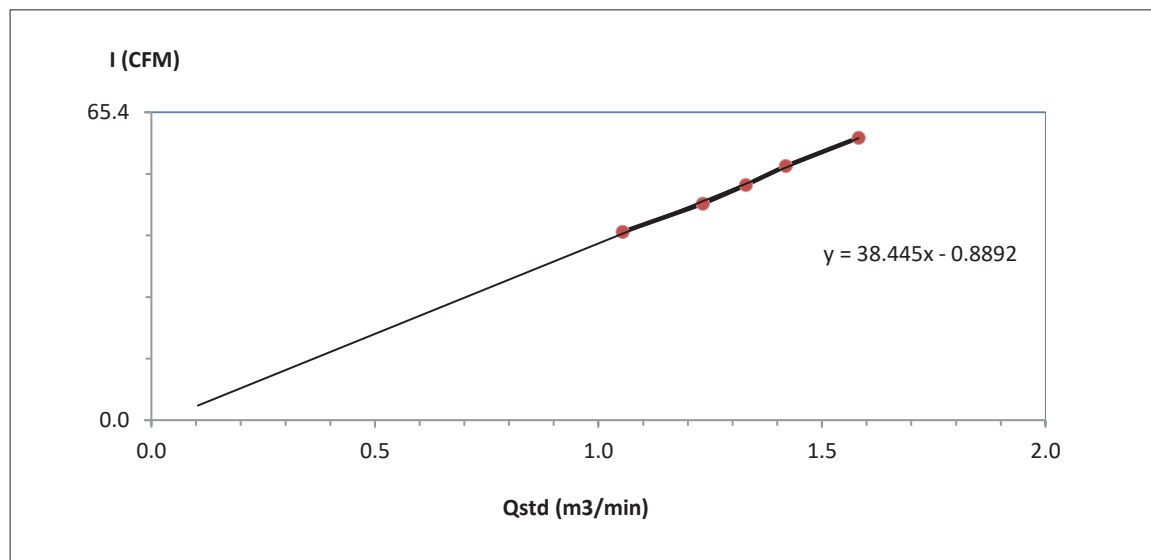
(Mr. Supot Salamteh)
Field Services Section Head



High Volume Air Sampler Calibration Worksheet

Project Site :	Gulf Chana Green Co.,Ltd.	Barometric Pressure (mm Hg) :	753.6
Calibrate Location :	A3 มัสยิดไร่ห่มมะ	Temperature (°C) :	29.0
Calibrate Date :	22-Oct-25	High Volume ID :	SGK_FS0060
CalibrationSheet No.:	C-221025-SGK_FS0060	High Volume Model :	TE-5170D
Calibrator ID:	SGK_FS0034	High Volume S/N :	5586
Calibrator Model :	TE-5028A	Calibrator Slope :	1.56856
Calibrator S/N :	3449	Calibrator Intercept :	-0.03727

Test No.	Delta H ₂ O (inch)	Q _{std} (m ³ /min)	I : Chart (CFM)	Linear Regression
1	2.6	1.0541	40	Slope : 38.4454 Intercept : -0.8892 Correlation Coefficient : 0.9987
2	3.6	1.2338	46	
3	4.2	1.3296	50	
4	4.8	1.4189	54	
5	6.0	1.5820	60	



Calibrated by



(Mr. Narathorn Keawpongsa)
SGK Field Services Scientist (1)

Approved by :



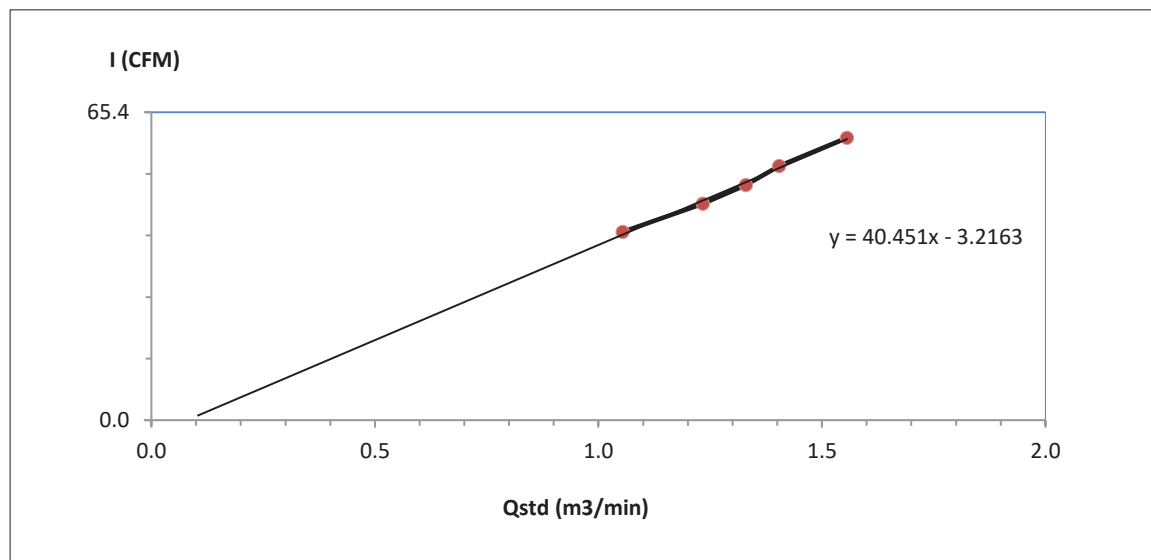
(Mr. Supot Salamteh)
Field Services Section Head



High Volume Air Sampler Calibration Worksheet

Project Site :	Gulf Chana Green Co.,Ltd.	Barometric Pressure (mm Hg) :	753.6
Calibrate Location :	A4 บ้านม่วงหวรรณ	Temperature (°C) :	29.0
Calibrate Date :	22-Oct-25	High Volume ID :	SGK_FS0084
CalibrationSheet No.:	C-221025-SGK_FS0084	High Volume Model :	TE-5170D
Calibrator ID:	SGK_FS0034	High Volume S/N :	5989
Calibrator Model :	TE-5028A	Calibrator Slope :	1.56856
Calibrator S/N :	3449	Calibrator Intercept :	-0.03727

Test No.	Delta H ₂ O (inch)	Q _{std} (m ³ /min)	I : Chart (CFM)	Linear Regression
1	2.6	1.0541	40	Slope : 40.4506 Intercept : -3.2163 Correlation Coefficient : 0.9970
2	3.6	1.2338	46	
3	4.2	1.3296	50	
4	4.7	1.4044	54	
5	5.8	1.5560	60	



Calibrated by



(Mr. Narathorn Keawpongsa)
SGK Field Services Scientist (1)

Approved by :



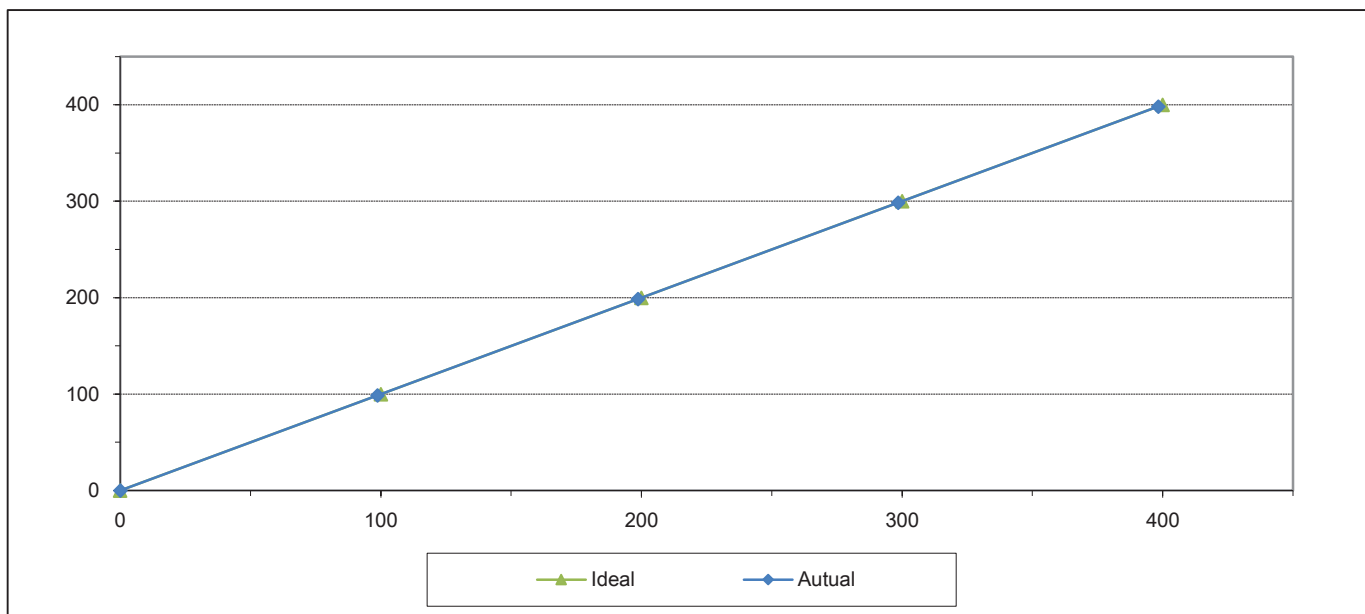
(Mr. Supot Salamteh)
Field Services Section Head



MULTIPOINT CALIBRATION REPORT

Calibration Date	3-Jul-25	Equipment Name	SO2 Analyzer
Manufacturer	HORIBA	Model	APSA-370
Serial No.	WPFJJTR6	Equipment ID	SGK_FS0093
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	56.3	Cylinder No.	GN0027222
Cylinder Pressure (psi)	1800	Certified By	Airgas Inc.
Certified Date	9-Feb-22	Expired Date	9-Feb-30

Point	CALIBRATION RESULTS			
	Ideal	Autual	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	98.70	-1.30	-1.30
2	200.00	198.70	-1.30	-0.65
3	300.00	298.50	-1.50	-0.50
4	400.00	398.30	-1.70	-0.42
AVERAGE (%)				-0.56



Calibrated By



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

Approved By



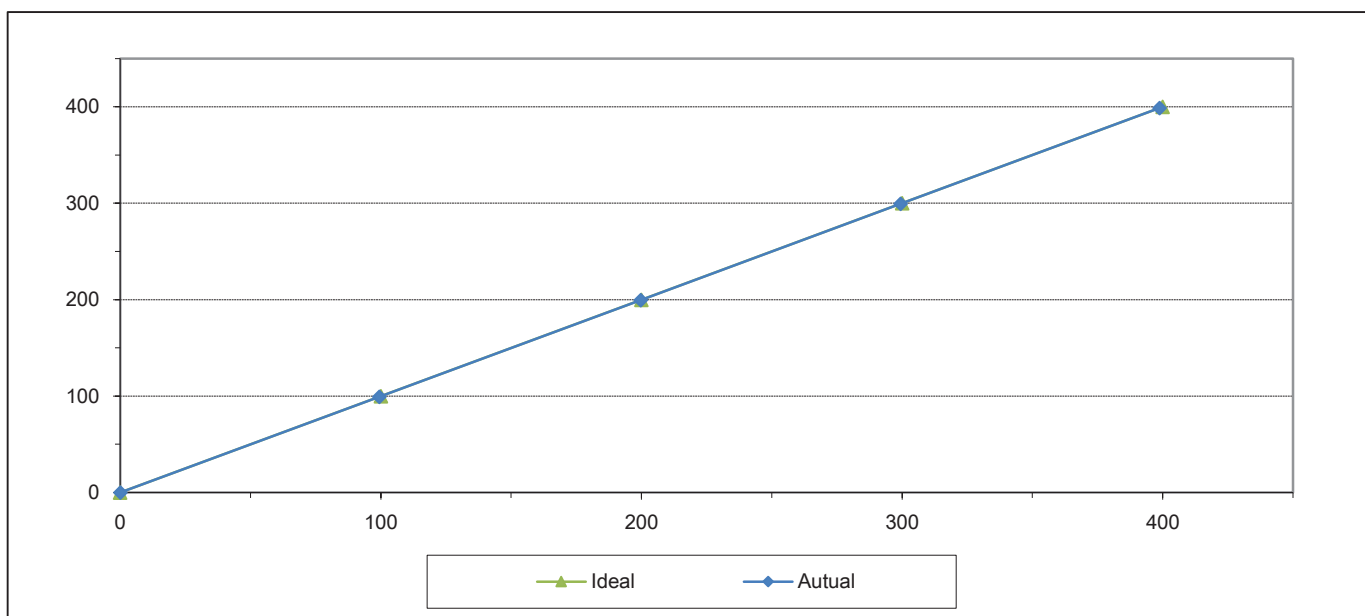
(Mr.Sarayuth Jittranont)
Assistant General Manager



MULTIPOINT CALIBRATION REPORT

Calibration Date	2-Jul-25	Equipment Name	SO2 Analyzer
Manufacturer	Teledyne API	Model	100E
Serial No.	3468	Equipment ID	BKK_FS0772
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	56.3	Cylinder No.	GN0027222
Cylinder Pressure (psi)	1800	Certified By	Airgas Inc.
Certified Date	9-Feb-22	Expired Date	9-Feb-30

Point	CALIBRATION RESULTS			
	Ideal	Autual	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	99.40	-0.60	-0.60
2	200.00	199.70	-0.30	-0.15
3	300.00	299.40	-0.60	-0.20
4	400.00	398.80	-1.20	-0.30
AVERAGE (%)				-0.23



Calibrated By



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

Approved By



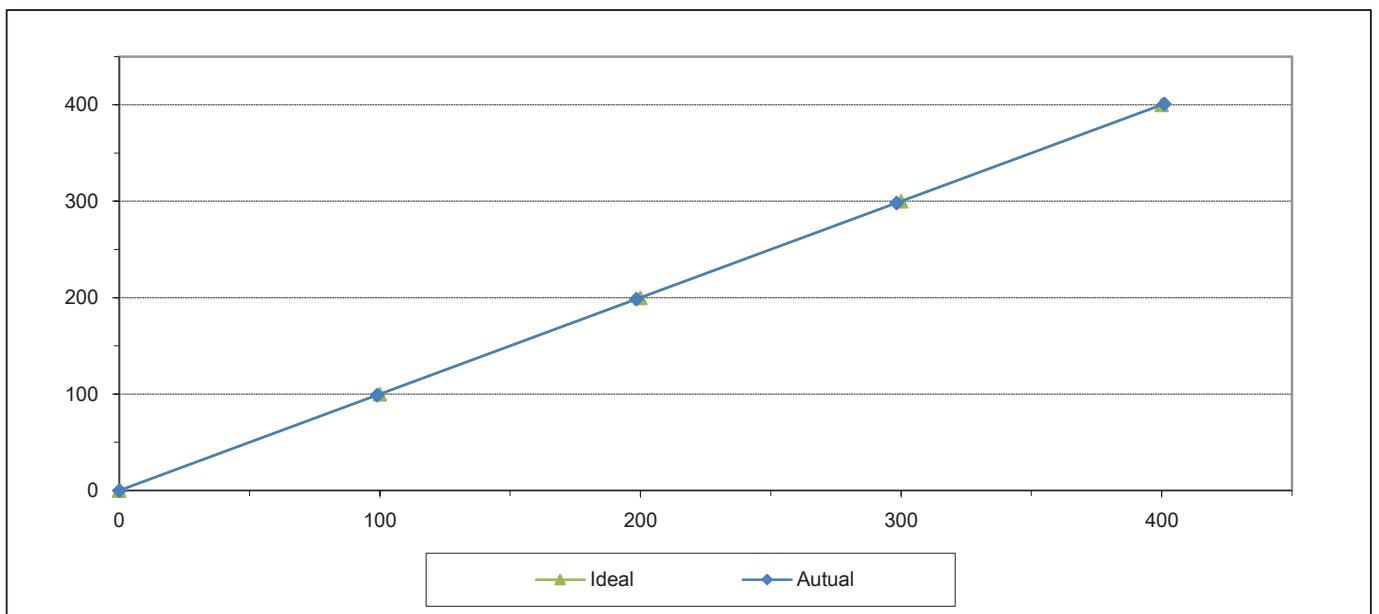
(Mr.Sarayuth Jittranont)
Assistant General Manager



MULTIPOINT CALIBRATION REPORT

Calibration Date	2-Jul-25	Equipment Name	SO2 Analyzer
Manufacturer	Teledyne API	Model	100E
Serial No.	3469	Equipment ID	BKK_FS0775
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	56.3	Cylinder No.	GN0027222
Cylinder Pressure (psi)	1800	Certified By	Airgas Inc.
Certified Date	9-Feb-22	Expired Date	9-Feb-30

Point	CALIBRATION RESULTS			
	Ideal	Autual	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	99.00	-1.00	-1.00
2	200.00	198.50	-1.50	-0.75
3	300.00	298.30	-1.70	-0.57
4	400.00	401.00	1.00	0.25
AVERAGE (%)				-0.39



Calibrated By



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

Approved By



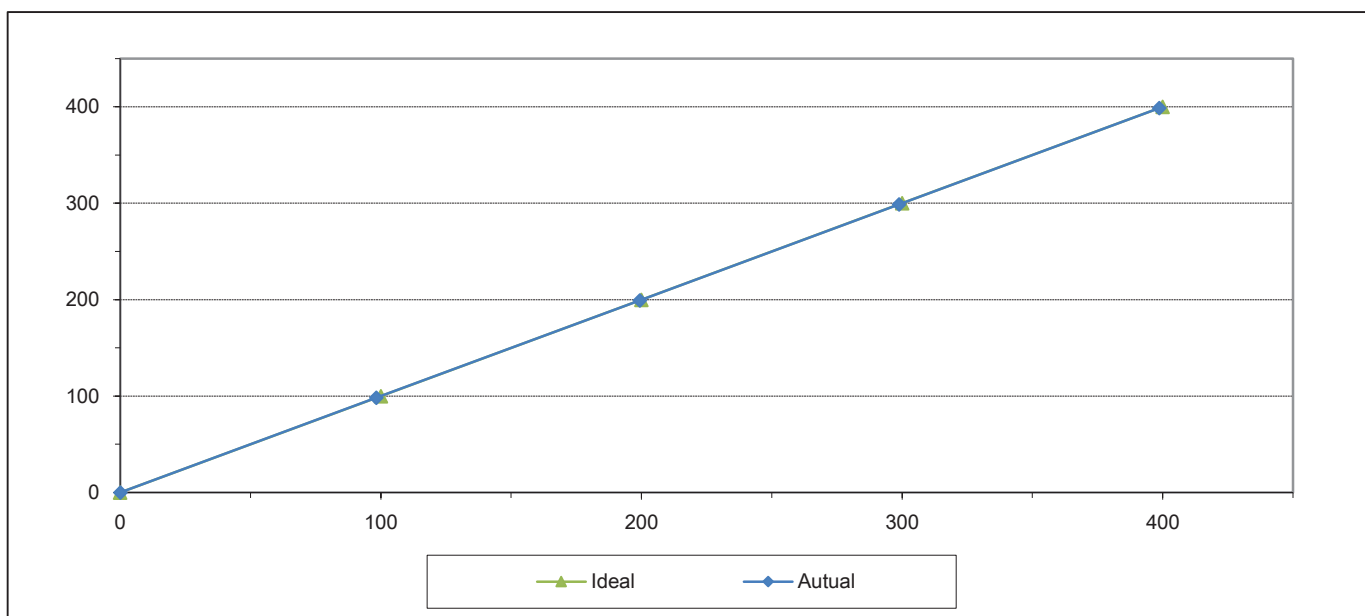
(Mr.Sarayuth Jittranont)
Assistant General Manager



MULTIPOINT CALIBRATION REPORT

Calibration Date	2-Jul-25	Equipment Name	SO2 Analyzer
Manufacturer	HORIBA	Model	APSA-370
Serial No.	AKU24TEY	Equipment ID	BKK_FS1083
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	56.3	Cylinder No.	GN0027222
Cylinder Pressure (psi)	1800	Certified By	Airgas Inc.
Certified Date	9-Feb-22	Expired Date	9-Feb-30

Point	CALIBRATION RESULTS			
	Ideal	Autual	Error	%Error
ZERO	0.00	0.05	0.05	0.05
1	100.00	98.30	-1.70	-1.70
2	200.00	199.40	-0.60	-0.30
3	300.00	298.90	-1.10	-0.37
4	400.00	398.70	-1.30	-0.33
AVERAGE (%)				-0.53



Calibrated By



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

Approved By



(Mr.Sarayuth Jittranont)
Assistant General Manager

Certificate Number

CWS-032-67

CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM : Cup anemometer
MANUFACTURER : Novalynx
MODEL/TYPE : Sensor: WS-02F
Data logger: 110-WS-25DL-D
SERIAL NUMBER : Sensor: WSD-A5791
Data logger: A5791
ID NUMBER : SGK_FS0088
CONDITION AS-RECEIVED : Used item
CUSTOMER : ALS laboratory group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang,
Khet Suan Luang, Bangkok 10250 Thailand.

RECEIVED DATE : 16 Aug 2024
MEASUREMENT DATE : 23 Aug 2024
ISSUE DATE : 23 Aug 2024

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

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

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

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

Preconditioning : 24 hours at ambient conditions.
Measurement Condition : The average values during measurement are (23.6) °C, (48.4) %RH and (1005.0) hPa.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

- ☒ Mr. Sorawit Thachalad
☐ Miss Jittraporn Lertsomphol



Approved signatory:

REVIEW BY

APPROVED BY

NEXT CAL. DATE 23/2/26

Mr. Parinya Booncharoen
Calibration Department Manager

Remark:

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

MEASUREMENT RESULTS ⁵

The Cup anemometer, Unit Under Calibration (UUC) was exercise at 10 m/s for 5 minutes prior to calibration being performed. The standard air velocity 0.5 m/s to 5 m/s was calculated by a standard air velocity transducer which was installed 50 mm away from wind tunnel nozzle and installed 40 mm away from top of the test section and the standard air velocity 5 m/s to 30 m/s was calculated by a pitot tube with precision differential pressure meter which was installed 50 mm away from wind tunnel nozzle and installed 40 mm away from top of the test section, UUC was mounted on a round vertical tube of the lower plate at center of test section. The calibration was carried out under both rising and falling air velocity in the range of 1 m/s to 16 m/s at calibration interval of 1 m/s. The results of calibration and associated measurement uncertainties are reported in the table below.

V_{std}^6 (m/s)	Temp. wind tunnel (°C)	Temp. room (°C)	V_{UUC}^7 (m/s)	Error (m/s)	$U (k=2)$ (m/s)
1.047	23.40	23.60	0.9	-0.1	0.31
2.008	23.60	23.60	1.8	-0.2	0.31
2.975	23.24	23.60	2.8	-0.2	0.31
4.042	23.26	23.60	3.8	-0.2	0.31
4.98	23.32	23.60	5.0	0.0	0.31
5.96	23.38	23.60	6.0	0.0	0.31
7.03	23.20	23.60	7.1	0.1	0.31
7.97	23.22	23.60	8.1	0.1	0.31
8.98	23.10	23.60	9.1	0.1	0.31
9.96	23.10	23.60	10.1	0.2	0.31
10.94	23.18	23.60	11.1	0.2	0.31
12.01	23.10	23.60	12.3	0.3	0.31
12.93	23.20	23.60	13.2	0.3	0.31
14.07	23.10	23.60	14.3	0.2	0.31
15.00	23.18	23.60	15.3	0.3	0.31
15.99	23.12	23.60	16.3	0.3	0.31

Remark:

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

⁶ Velocity of standard

⁷ Velocity of Unit Under Calibration

PHOTO OF CALIBRATION SET-UP

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

End of Certificate of Calibration

J
NAC
JIRANATEE ASSOCIATES CO., LTD.

Certificate Number

CWD-032-67

CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM : Wind Direction Sensor
MANUFACTURER : Novalynx
MODEL/TYPE : Sensor: WS-02F
Data logger: 110-WS-25DL-D
SERIAL NUMBER : Sensor: WSD-A5791
Data logger: A5791
ID NUMBER : SGK_FS0088
CONDITION AS-RECEIVED : Used item
CUSTOMER : ALS laboratory group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang,
Khet Suan Luang, Bangkok 10250 Thailand.

RECEIVED DATE : 16 Aug 2024
MEASUREMENT DATE : 23 Aug 2024
ISSUE DATE : 23 Aug 2024

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

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

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

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

Preconditioning : 24 hours at ambient conditions.
Measurement Condition : The average values during measurement are (23.2)°C, (43.7) %RH and (1007.7) hPa.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

- ☒ Mr. Sorawit Thachalad
☐ Miss Jittraporn Lertsomphol



Approved signatory:

Mr. Parinya Booncharoen
Calibration Department Manager

Remark:

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

MEASUREMENT RESULTS ⁵

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

Air speed m/s	D^{std} Degree (°)	D^{unc} Degree (°)	Error Degree (°)	$U (k=2)$ Degree (°)
5.04	45.000	42	-3	0.80
	90.000	88	-2	0.80
	135.000	135	0	0.80
	180.000	182	2	0.80
	225.000	228	3	0.80
	270.000	273	3	0.80
	315.000	318	3	0.80
	360.000	359	-1	0.80

Remark:

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

⁶ Direction of standard

⁷ Direction of Unit Under Calibration

End of Certificate of Calibration





JIRANATEE ASSOCIATES CO.,LTD.

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

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

Pressure measurement laboratory
Calibration services department.



CERTIFICATE OF CALIBRATION

Certificate No. : CPR-012-67

Page 1 of 2 Pages

MEASUREMENT ITEM : Digital barometer
MANUFACTURER : Novalynx
MODEL/TYPE : Sensor: 110-WS-25BP
Data logger: 110-WS-25DL-D
SERIAL NUMBER : Sensor: BP-A5791
Data logger: A5791
ID NUMBER : SGK_FS0088
CONDITION AS-RECEIVED : Used item
CUSTOMER : ALS laboratory group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd,
Khwaeng Suan Luang, Khet Suan Luang,
Bangkok 10250 Thailand.
RECEIVED DATE : 16 Aug 2024
MEASUREMENT DATE : 23 Aug 2024
ISSUE DATE : 23 Aug 2024

Calibration procedure:

The Digital barometer was calibrated against Digital pressure calibrator. The WI-CL-003 was used as a calibration guideline.

Traceability:

The measurement results are traceable to the international system of units (SI) through the NIMT (National Metrology Institute of Thailand) via Certificate number: MP-0009-24

Uncertainty of Measurement:

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

CONDITION OF THIS RESULT OF CALIBRATION:

1. Reference Standard Instrument:

Instrument	Model	Serial No.	Certificate No.	Due Date
Absolute Pressure Transducer	CPG2500	4100126P	MP-0009-24	27 Dec 2024

1. Calibration effort for calibration sequence C

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

3. Calibration conditions:

4. Condition : ☒ Normal ☐ Abnormal
Pressure transmitting medium : Air
 ρ_{Fl} (20°C, 1 bar) : 1.19 kg/m³
 H_{amb} : (55±15) %
 t_{amb} : (23±3) °C
 P_{amb} : (1010±10) mbar

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

Calibrated by:

☒ Mr. Sorawit Thachalad
☐ Miss Jitraporn Lertsomphol



Approved signatory:

Mr. Parinya Booncharoen
Calibration Department Manager



JIRANATEE ASSOCIATES CO.,LTD.

Jiranatee Associates Co.,Ltd
63/14-15, 67/35-36
Petchkasem 7,7/1, Rd.Watthapra, Bangkokyai,
Bangkok10600(Thailand)
Tel: +6608680812
Mobile: +66863999453
E-mail: jnac-calibration@jiranatee.com
Web site: www.jiranatee.com

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

Pressure measurement laboratory
Calibration services department.



CERTIFICATE OF CALIBRATION

Certificate No. : CPR-012-67

Page 2 of 2 Pages

MEASUREMENT RESULTS : ☐ Without adjustment ☒ With adjustment

CALIBRATION IN THE RANGE OF : 950 mbar to 1050 mbar

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

STD (mbar)	UUC* (mbar)	Error (mbar)	Uncertainty (k=2) (mbar)
950.03	951.6	1.6	0.37
970.01	971.3	1.3	0.37
989.96	990.8	0.9	0.39
1010.03	1010.4	0.4	0.37
1030.02	1030.0	0.0	0.40
1050.02	1049.4	-0.6	0.40

Note: UUC* Unit Under Calibration

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

End of certificate





JIRANATEE ASSOCIATES CO., LTD.

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

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

Air speed measurement laboratory
Calibration services department.



NSC - TISI - TIS 17025
CALIBRATION 0367

Certificate Number

CWS-022-67

CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM : Cup anemometer
MANUFACTURER : Novalynx
MODEL/TYPE : Sensor: WS-02F
Data logger: 200-WS-25LB
SERIAL NUMBER : Sensor: WSD-A5192
Data logger: A5192
ID NUMBER : SGK_FS0035
CONDITION AS-RECEIVED : Used item
CUSTOMER : ALS laboratory group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang,
Khet Suan Luang, Bangkok 10250 Thailand.

RECEIVED DATE : 27 Jun 2024
MEASUREMENT DATE : 03 Jul 2024
ISSUE DATE : 03 Jul 2024

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

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

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

CALIBRATION CONDITIONS

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

Preconditioning : 24 hours at ambient conditions.
Measurement Condition : The average values during measurement are (24.1) °C, (48.8) %RH and (1005.7) hPa.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

- ☒ Mr. Sorawit Thachalad
☐ Miss Jittrapon Lertsomphol



Approved signatory: .

Calibration Department Manager

Calibration procedure:

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

Traceability:

This certificate provides a traceability of The measurement to recognized the national standards, and to realization of the international system of units (SI) through the NIMT (National Metrology Institute of Thailand) via Certificate number: MW-0007-24 and MW-0055-23

Uncertainty of Measurement:

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

REVIEW BY

APPROVED BY

TEST DATE

3/1/26

Remark:

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

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

MEASUREMENT RESULTS ⁵

The Cup anemometer, Unit Under Calibration (UUC) was exercise at 10 m/s for 5 minutes prior to calibration being performed. The standard air velocity 0.5 m/s to 5 m/s was calculated by a standard air velocity transducer which was installed 50 mm away from wind tunnel nozzle and installed 40 mm away from top of the test section and the standard air velocity 5 m/s to 30 m/s was calculated by a pitot tube with precision differential pressure meter which was installed 50 mm away from wind tunnel nozzle and installed 40 mm away from top of the test section, UUC was mounted on a round vertical tube of the lower plate at center of test section. The calibration was carried out under both rising and falling air velocity in the range of 1 m/s to 16 m/s at calibration interval of 1 m/s. The results of calibration and associated measurement uncertainties are reported in the table below.

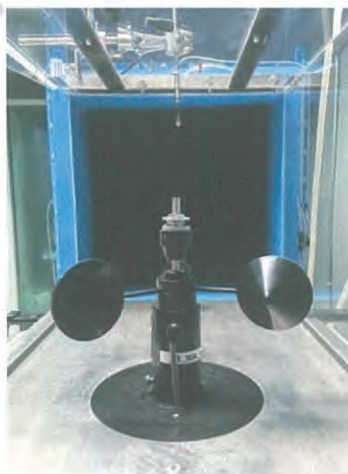
V_{std} ⁶ (m/s)	Temp. wind tunnel (°C)	Temp. room (°C)	V_{UUC} ⁷ (m/s)	Error (m/s)	$U (k=2)$ (m/s)
1.005	24.10	24.10	0.9	-0.1	0.31
2.008	24.10	24.10	1.8	-0.2	0.31
2.982	24.10	24.10	3.0	0.0	0.31
4.099	24.10	24.10	3.9	-0.2	0.31
4.98	24.00	24.10	5.1	0.1	0.31
5.99	24.26	24.10	6.1	0.1	0.31
7.04	23.86	24.10	7.2	0.2	0.31
7.99	24.06	24.10	8.1	0.1	0.31
9.04	23.62	24.10	9.2	0.2	0.31
10.00	23.86	24.10	10.2	0.2	0.31
10.99	23.60	24.10	11.3	0.3	0.31
11.99	23.70	24.10	12.2	0.2	0.31
12.99	23.68	24.10	13.3	0.3	0.31
14.03	23.66	24.10	14.4	0.4	0.31
15.05	23.60	24.10	15.4	0.4	0.31
15.98	23.70	24.10	16.4	0.4	0.31

Remark:

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

⁶ Velocity of standard

⁷ Velocity of Unit Under Calibration

PHOTO OF CALIBRATION SET-UP

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



Certificate Number

CWD-022-67

CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM : Wind Direction Sensor
MANUFACTURER : Novalynx
MODEL/TYPE : Sensor: WS-02F
Data logger: 200-WS-25LB
SERIAL NUMBER : Sensor: WSD-A5192
Data logger: A5192
ID NUMBER : SGK_FS0035
CONDITION AS-RECEIVED : Used item
CUSTOMER : ALS laboratory group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang,
Khet Suan Luang, Bangkok 10250 Thailand.

RECEIVED DATE : 27 Jun 2024
MEASUREMENT DATE : 03 Jul 2024
ISSUE DATE : 03 Jul 2024

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

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

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

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

Preconditioning : 24 hours at ambient conditions.
Measurement Condition : The average values during measurement are (23.9)°C, (48.2) %RH and (1008.5) hPa.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

- ☒ Mr. Sorawit Thachalad
☐ Miss Jittraporn Lertsomphol



Approved signatory

Mr. Parinya Booncharoen
Calibration Department Manager

Remark:

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

Calibration procedure:

The wind direction sensor was calibrated against Standard Rotary Encoder model: AX4009TS-DM04-P3-S-U0 in an close test-section of Eiffel-type wind tunnel with 900 cm² cross test section area. The WI-CL-008 based on IEC 61400-12-1, Wind energy generation systems – Part 12-1: Power performance measurements of electricity producing wind turbines, March 2017 was used as a calibration guideline.

Traceability:

This certificate provides a traceability of The measurement to recognized the national standards, and to realization of the international system of units (SI) through the NIMT (National Metrology Institute of Thailand) via Certificate number: DA-0036-23.

Uncertainty of Measurement:

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

MEASUREMENT RESULTS⁵

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

Air speed m/s	D_{std}^6 Degree (°)	D_{uuc}^7 Degree (°)	Error Degree (°)	$U (k=2)$ Degree (°)
5.03	45.000	42	-3	0.80
	90.000	87	-3	0.80
	135.000	132	-3	0.80
	180.000	178	-2	0.80
	225.000	227	2	0.80
	270.000	274	4	0.80
	315.000	319	4	0.80
	360.000	359	-1	0.80

Remark:

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

⁶ Direction of standard

⁷ Direction of Unit Under Calibration

End of Certificate of Calibration



Certificate Number

CWS-035-67

CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM : Cup anemometer
MANUFACTURER : Novalynx
MODEL/TYPE : Sensor: WS-02F
Data logger: 200-WS-25LB
SERIAL NUMBER : Sensor: WSD-A5379
Data logger: A5379
ID NUMBER : BKK_FS0919
CONDITION AS-RECEIVED : Used item
CUSTOMER : ALS laboratory group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang,
Khet Suan Luang, Bangkok 10250 Thailand.

RECEIVED DATE : 16 Aug 2024
MEASUREMENT DATE : 26 Aug 2024
ISSUE DATE : 26 Aug 2024

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

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

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

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

Preconditioning : 24 hours at ambient conditions.

Measurement Condition : The average values during measurement are (23.3) °C, (43.8) %RH and (1006.2) hPa.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

- ☒ Mr. Sorawit Thachalad
☐ Miss Jitraporn Lertsomphol



Approved signatory:

REVIEW BY

APPROVED

NEXT CAL. DATE

26/2/26

Mr. Parinya Booncharoen
Calibration Department Manager

Remark:

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

MEASUREMENT RESULTS ⁵

The Cup anemometer, Unit Under Calibration (UUC) was exercise at 10 m/s for 5 minutes prior to calibration being performed. The standard air velocity 0.5 m/s to 5 m/s was calculated by a standard air velocity transducer which was installed 50 mm away from wind tunnel nozzle and installed 40 mm away from top of the test section and the standard air velocity 5 m/s to 30 m/s was calculated by a pitot tube with precision differential pressure meter which was installed 50 mm away from wind tunnel nozzle and installed 40 mm away from top of the test section, UUC was mounted on a round vertical tube of the lower plate at center of test section. The calibration was carried out under both rising and falling air velocity in the range of 1 m/s to 16 m/s at calibration interval of 1 m/s. The results of calibration and associated measurement uncertainties are reported in the table below.

v_{std}^6 (m/s)	Temp. wind tunnel (°C)	Temp. room (°C)	v_{uuc}^7 (m/s)	Error (m/s)	$U (k=2)$ (m/s)
1.001	23.26	23.30	0.9	-0.1	0.31
2.069	23.40	23.30	1.9	-0.2	0.31
2.954	23.30	23.30	2.9	-0.1	0.31
4.068	23.30	23.30	3.9	-0.2	0.31
4.97	23.16	23.30	5.0	0.0	0.31
6.00	23.14	23.30	6.0	0.0	0.31
7.02	23.00	23.30	7.1	0.1	0.31
7.97	23.30	23.30	8.1	0.1	0.31
8.98	23.04	23.30	9.1	0.1	0.31
9.97	23.30	23.30	10.1	0.1	0.31
10.93	23.10	23.30	11.2	0.2	0.31
12.01	23.20	23.30	12.2	0.2	0.31
12.95	23.20	23.30	13.2	0.2	0.31
14.07	23.20	23.30	14.2	0.1	0.31
15.00	23.20	23.30	15.2	0.2	0.31
15.99	23.20	23.30	16.2	0.2	0.35

Remark:

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

⁶ Velocity of standard

⁷ Velocity of Unit Under Calibration

PHOTO OF CALIBRATION SET-UP



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

End of Certificate of Calibration

JIRANATEE ASSOCIATES CO., LTD.

Certificate Number

CWD-035-67

CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM : Wind Direction Sensor
MANUFACTURER : Novalynx
MODEL/TYPE : Sensor: WS-02F
Data logger: 200-WS-25LB
SERIAL NUMBER : Sensor: WSD-A5379
Data logger: A5379
ID NUMBER : BKK_FS0919
CONDITION AS-RECEIVED : Used item
CUSTOMER : ALS laboratory group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang,
Khet Suan Luang, Bangkok 10250 Thailand.

RECEIVED DATE : 16 Aug 2024
MEASUREMENT DATE : 26 Aug 2024
ISSUE DATE : 26 Aug 2024

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

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

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

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

Preconditioning : 24 hours at ambient conditions.
Measurement Condition : The average values during measurement are (23.4)°C, (42.5) %RH and (1008.4) hPa.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

- ☒ Mr. Sorawit Thachalad
☐ Miss Jitraporn Lertsomphol



Approved signatory:

Mr. Parinya Booncharoen
Calibration Department Manager

Remark:

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

MEASUREMENT RESULTS⁵

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

Air speed m/s	D^{std} Degree (°)	D^{uc} Degree (°)	Error Degree (°)	$U (k=2)$ Degree (°)
5.03	0.000	0	0	0.80
	45.000	42	-3	0.80
	90.000	87	-3	0.80
	135.000	133	-2	0.80
	180.000	181	1	0.80
	225.000	229	4	0.80
	270.000	275	5	0.80
	315.000	320	5	0.80

Remark:

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

⁶ Direction of standard

⁷ Direction of Unit Under Calibration

End of Certificate of Calibration





JIRANATEE ASSOCIATES CO.,LTD.

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

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

Air speed measurement laboratory
Calibration services department.



NSC – TISI – TIS 17025
CALIBRATION 0367

Certificate Number

CWS-033-67

CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM : Cup anemometer
MANUFACTURER : Novalynx
MODEL/TYPE : Sensor: WS-02F
Data logger: 110-WS-25DL-D
SERIAL NUMBER : Sensor: WSD-A5792
Data logger: A5792
ID NUMBER : SGK_FS0089
CONDITION AS-RECEIVED : Used item
CUSTOMER : ALS laboratory group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang,
Khet Suan Luang, Bangkok 10250 Thailand.

RECEIVED DATE : 16 Aug 2024
MEASUREMENT DATE : 23 Aug 2024
ISSUE DATE : 23 Aug 2024

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

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

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

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

Preconditioning : 24 hours at ambient conditions.
Measurement Condition : The average values during measurement are (23.6) °C, (49.0) %RH and (1004.6) hPa.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

- ☒ Mr. Sorawit Thachalad
☐ Miss Jitraporn Lertsomphol



Approved signatory:

REVIEW BY

APPROVED BY

NEXT CAL. DATE

23/2/26

Calibration Department Manager

Remark:

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

MEASUREMENT RESULTS⁵

The Cup anemometer, Unit Under Calibration (UUC) was exercised at 10 m/s for 5 minutes prior to calibration being performed. The standard air velocity 0.5 m/s to 5 m/s was calculated by a standard air velocity transducer which was installed 50 mm away from wind tunnel nozzle and installed 40 mm away from top of the test section and the standard air velocity 5 m/s to 30 m/s was calculated by a pitot tube with precision differential pressure meter which was installed 50 mm away from wind tunnel nozzle and installed 40 mm away from top of the test section, UUC was mounted on a round vertical tube of the lower plate at center of test section. The calibration was carried out under both rising and falling air velocity in the range of 1 m/s to 16 m/s at calibration interval of 1 m/s. The results of calibration and associated measurement uncertainties are reported in the table below.

V_{std}^6 (m/s)	Temp. wind tunnel (°C)	Temp. room (°C)	V_{UUC}^7 (m/s)	Error (m/s)	$U (k=2)$ (m/s)
1.031	23.44	23.55	0.9	-0.1	0.31
2.029	23.58	23.55	1.8	-0.2	0.31
2.994	23.20	23.55	2.9	-0.1	0.31
4.064	23.24	23.55	3.9	-0.2	0.31
4.98	23.28	23.55	5.0	0.0	0.31
5.97	23.30	23.55	6.0	0.0	0.31
7.03	23.30	23.55	7.2	0.2	0.31
7.98	23.40	23.55	8.1	0.1	0.31
8.98	23.10	23.55	9.2	0.2	0.31
9.97	23.26	23.55	10.1	0.1	0.31
10.94	23.14	23.55	11.3	0.3	0.31
12.02	23.16	23.55	12.4	0.3	0.31
12.95	23.20	23.55	13.4	0.4	0.31
14.08	23.10	23.55	14.4	0.4	0.31
15.01	23.20	23.55	15.5	0.5	0.31
16.00	23.20	23.55	16.5	0.5	0.31

Remark:

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

⁶ Velocity of standard

⁷ Velocity of Unit Under Calibration

PHOTO OF CALIBRATION SET-UP

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

Certificate Number

CWD-033-67

CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM : Wind Direction Sensor
MANUFACTURER : Novalynx
MODEL/TYPE : Sensor: WS-02F
Data logger: 110-WS-25DL-D
SERIAL NUMBER : Sensor: WSD-A5792
Data logger: A5792
ID NUMBER : SGK_FS0089
CONDITION AS-RECEIVED : Used item
CUSTOMER : ALS laboratory group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang,
Khet Suan Luang, Bangkok 10250 Thailand.

RECEIVED DATE : 16 Aug 2024
MEASUREMENT DATE : 23 Aug 2024
ISSUE DATE : 23 Aug 2024

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

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

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

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

Preconditioning : 24 hours at ambient conditions.
Measurement Condition : The average values during measurement are (23.3)°C, (49.2) %RH and (1005.2) hPa.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

☒ Mr. Sorawit Thachalad
☐ Miss Jittraporn Lertsomphol



Approved signatory:

Mr. Parinya Booncharoen
Calibration Department Manager

Remark:

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

Calibration procedure:

The wind direction sensor was calibrated against Standard Rotary Encoder model: AX4009TS-DM04-P3-S-U0 in an close test-section of Eiffel-type wind tunnel with 900 cm² cross test section area. The WI-CL-008 based on IEC 61400-12-1, Wind energy generation systems – Part 12-1: Power performance measurements of electricity producing wind turbines, March 2017 was used as a calibration guideline.

Traceability:

This certificate provides a traceability of The measurement to recognized the national standards, and to realization of the international system of units (SI) through the NIMT (National Metrology Institute of Thailand) via Certificate number: DA-0036-23.

Uncertainty of Measurement:

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

MEASUREMENT RESULTS⁵

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

Air speed m/s	D°_{std} Degree (°)	D°_{unc} Degree (°)	Error Degree (°)	$U (k=2)$ Degree (°)
5.04	45.000	41	-4	0.80
	90.000	88	-3	0.80
	135.000	133	-2	0.80
	180.000	181	1	0.80
	225.000	229	4	0.80
	270.000	273	3	0.80
	315.000	318	3	0.80
	360.000	359	-1	0.80

Remark:

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

⁶ Direction of standard

⁷ Direction of Unit Under Calibration

End of Certificate of Calibration



Cert. No. : ACC24073

Pages : 1 of 3

Calibration Certificate

Equipment : SOUND CALIBRATOR
Manufacturer : RION
Model : NC-75
Serial No.: 35024429
ID No.: SGK_FS0114

Condition As Found : GOOD

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

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

Received Date : 26 NOVEMBER 2024
Calibration Date : 11 DECEMBER 2024
Date of Issue : 11 DECEMBER 2024

Calibrated by : Nathakorn Pisutpaisan

Approved by : 
(Thanakul Petchurai)

REVIEW BY

APPROVED BY

NEXT CAL DATE..... 11 /12 /25

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

SITHIPORN ASSOCIATES CO., LTD.

CALIBRATION LABORATORY

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

SITHIPORN
associates



Cert. No. : ACC24073

Job No. : VC67AC0167

Pages : 2 of 3

Calibration Procedure : CP-AC-03

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
Waveform Generator	33511B	MY52302742	EF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	EEL.BP 21/0267	13-FEB-25
Digital Multimeter	33461A	MY53220076	EEL.BP 20/0267	15-FEB-25
Digital Multimeter	33461A	MY60024273	EEL.BP 22/0267	15-FEB-25
Programmable Attenuator	MAT-1070	62100114	EF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KAI	34560495	AA-3001-24	05-FEB-25
Audio Analyzer	AVR-3360A	V744B6069	EF-0009-24	09-FEB-25

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

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

3.1 National Institute of Metrology (Thailand).

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



SITHIPORN ASSOCIATES CO., LTD.

CALIBRATION LABORATORY

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

SITHIPORN
associates



Cert. No. : ACC24073

Job No. : VC67AC0167

Pages : 3 of 3

Result of calibration :

1. Sound pressure level

Specified sound pressure level (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (dB)	Acceptance limit (dB)
94	93.97	-0.03	0.14	0.40

2. Frequency

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

3. Total distortion

Measured value (%)	Uncertainty (%)	Acceptance limit (%)
0.15	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 —————



Certificate of Calibration

Customer

Name : ALS Laboratory Group Thailand Co., Ltd.

Certificate No : 25-SLM-032

Address : 104 Soi Phatthanakan 40, Phatthanakan Road, Suan Luang, Bangkok 10250

Request No : Req-2025-0191

Unit Under Calibration Details

Measurement item : Sound Level Meter

Microphone Class : 1

Manufacturer : RION

Microphone Model : UC-59

Model : NL-52A

Microphone S/N : 21943

Serial Number : 01120941

Preamplifier Model : NH-25

ID : SGK_FS0128

Preamplifier S/N : 22330

Resolution : 0.1 dB

Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 2 °C

Humidity : 50 %RH ± 20 %RH

Barometric Pressure : 1013 hPa ± 10 hPa

Received Date : 24 January 2025

Calibrated Date : 6 February 2025

Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests

Location of Calibration : Lab Acoustic

REVIEW BY

APPROVED BY

NEXT CAL DATE..... 05/ 02/ 2026

Reference Standard

Instrument	Brand	Model	SN.	Due calibration	Traceability
Standard Microphone	Brüel & Kjær	4192	2294985	25 June 2025	NIMT
Audio Generator	Svantek	Svan401	131	15 October 2025	WK Electric

Note

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

Calibrated By :



Mr. Noppadon Luangart

Service Calibration Engineer

Approved By :



Mr. Pacit Mathavorn

Calibration Engineer Supervisor

Issue Date :

6 February 2025

Certificate No : 25-SLM-032

Request No : Req-2025-0191

1. Indication at the calibration check frequency

UUC Setting	Nominal	Before Adjust		After Adjust		UNCERTAINTY	Acceptance	Result
FAST / A / 30-130	Level	UUC	ERR	UUC	ERR	(± dB)	Limit	
Calibrator Setting	(dB)	(dB)	(dB)	(dB)	(dB)		(± dB)	
1000 Hz 114 dB	113.76	114.3	0.54	113.8	+0.04	0.20	0.30	Pass

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN.58079

2. Self-generated noise, Microphone installed

UUC Setting	Measured	UNCERTAINTY
FAST / 30-130		
UUC Weighting	(dB)	(± dB)
A	14.8	0.10

3. Self-generated noise, Microphone replaced by the electrical input signal device

UUC Setting	Measured	UNCERTAINTY
FAST / 30-130		
UUC Weighting	(dB)	(± dB)
A	11.3	0.10
C	14.7	0.10
Z	18.2	0.10

4. Acoustic signal test of frequency weightings (Without Windscreen)

UUC Setting	Deviation from various Frequency Weighting Responce curve			UNCERTAINTY	Acceptance	Result
FAST / 30-130	A	C	Z	(± dB)	Limit	
STD Setting	(dB)	(dB)	(dB)		(± dB)	
125 Hz	0.2	0.3	0.3	0.60	1.0	Pass
1000 Hz	0.0	0.0	0.0	0.60	0.7	Pass
4000 Hz	-0.1	-0.1	-0.1	0.60	1.0	Pass
8000 Hz	-0.6	-0.6	-0.6	0.70	+1.5 -2.5	Pass



Certificate No : 25-SLM-032

Request No : Req-2025-0191

5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz

UUC Setting	Deviation from various Frequency			UNCERTAINTY	Acceptance	Result
FAST / 30-130	Weighting Respone curve				Limit	
STD Setting	A (dB)	C (dB)	Z (dB)	(± dB)	(± dB)	
63 Hz	-0.2	-0.1	0.0	0.20	1.0	Pass
125 Hz	-0.1	0.0	0.0		1.0	Pass
250 Hz	0.0	0.0	0.0		1.0	Pass
500 Hz	0.0	0.1	0.0		1.0	Pass
1000 Hz	0.0	0.0	0.0		0.7	Pass
2000 Hz	0.0	0.1	0.0		1.0	Pass
4000 Hz	0.0	0.1	0.0		1.0	Pass
8000 Hz	0.1	0.1	0.1		+1.5, -2.5	Pass
16000 Hz	-1.3	-1.3	0.1		+2.5, -16.0	Pass

6. Frequency and time weightings at 1kHz

UUC Setting	STD	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
FAST / 30-130	REF	UUC	ERR			
UUC Weighting	(dB)	(dB)	(dB)	0.20	0.20	Pass
A	114.00	114.0	0.0			
C	114.00	114.0	0.0			
Z	114.00	114.0	0.0			

UUC Setting	STD	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
30-130 / A	REF	UUC	ERR			
UUC Time Response	(dB)	(dB)	(dB)	0.20	0.10	Pass1
Fast	114.00	114.0	0.0			
Slow	114.00	114.0	0.0			
Leq	114.00	114.0	0.0			

Certificate No : 25-SLM-032

Request No : Req-2025-0191

7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY (± dB)	Acceptance	Result
FAST / A / 30-130	UUC		Limit	
STD Setting	(dB)		(± dB)	
Initial	114.0			
Final	114.0			
Deviated	0.0	0.10	0.10	Pass

8. Level linearity on the reference level range

UUC Setting	Anticipated	Deviation		UNCERTAINTY	Acceptance	Result
FAST / A / 30-130	REF	UUC	ERR		Limit	
STD dB	(dB)	(dB)	(dB)		(± dB)	
138.00	138	138.0	0.0	0.30	0.8	Pass
134.00	134	134.0	0.0		0.8	Pass
129.00	129	129.0	0.0		0.8	Pass
124.00	124	124.0	0.0		0.8	Pass
119.00	119	119.0	0.0		0.8	Pass
114.00	114	114.0	0.0		0.8	Pass
109.00	109	109.0	0.0		0.8	Pass
104.00	104	104.0	0.0		0.8	Pass
99.00	99	99.0	0.0		0.8	Pass
94.00	94	94.0	0.0		0.8	Pass
89.00	89	89.0	0.0		0.8	Pass
84.00	84	84.0	0.0		0.8	Pass
79.00	79	79.0	0.0		0.8	Pass
74.00	74	74.0	0.0		0.8	Pass
69.00	69	69.0	0.0		0.8	Pass
64.00	64	64.0	0.0		0.8	Pass
59.00	59	59.0	0.0		0.8	Pass
54.00	54	54.0	0.0		0.8	Pass
49.00	49	49.0	0.0		0.8	Pass
44.00	44	44.0	0.0		0.8	Pass
39.00	39	39.0	0.0		0.8	Pass
34.00	34	34.0	0.0		0.8	Pass
29.00	29	29.0	0.0		0.8	Pass
24.00	24	24.0	0.0		0.8	Pass

Certificate No : 25-SLM-032

Request No : Req-2025-0191

9. Level linearity including the level range control

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance	Result
FAST / A	REF	UUC	ERR	(± dB)	Limit	
UUC Range	(dB)	(dB)	(dB)		(± dB)	
30-130	29.60	29.7	0.1	0.30	0.8	Pass
	114	114.0	0.0		0.8	Pass

10. Tone burst response

UUC Setting	STD	Anticipated	Measured		UNCERTAINTY	Acceptance	Result
A / 30-130	Toneburst	Ref	UUC	ERR	(± dB)	Limit	
UUC Time Response	(ms)	(dB)	(dB)	(dB)		(± dB)	
Fast	200	126.0	126.1	+0.1	0.20	0.5	Pass
	2	109.0	109.0	0.0		+1.0, -1.5	Pass
	0.25	100.0	99.9	-0.1		+1.0, -3.0	Pass
Slow	200	119.6	119.6	0.0		0.5	Pass
	2	100.0	100.0	0.0		+1.0, -3.0	Pass
SEL	200	120.0	120.0	0.0		0.5	Pass
	2	100.0	100.0	0.0		+1.0, -1.5	Pass
	0.25	91.0	90.9	-0.1		+1.0, -3.0	Pass

11. Peak C Sound level

UUC Setting	Anticipated	Measured		UNCERTAINTY	Acceptance	Result
FAST / C / 55-141	REF	UUC	ERR	(± dB)	Limit	
STD Setting	(dB)	(dB)	(dB)		(± dB)	
Complete cycle	136.4	136.3	-0.10	0.20	2.0	Pass
Positive half cycle	135.4	135.2	-0.20		1.0	Pass
Negative half cycle	135.4	135.2	-0.20		1.0	Pass

Certificate No : 25-SLM-032

Request No : Req-2025-0191

12. Overload indication

UUC Setting	Measured	UNCERTAINTY (± dB)	Acceptance	Result
FAST / A / 30-130	UUC		Limit	
STD Setting	(dB)		(± dB)	
Positive one-half cycle	139.5			
Negative one-half cycle	138.7			
Deviated	0.8	2.30	1.5	Pass1

13. High Level Stability

UUC Setting	Measured	UNCERTAINTY (± dB)	Acceptance	Result
FAST / A / 30-130	UUC		Limit	
STD Setting	(dB)		(± dB)	
Initial	129.0			
Final	129.0			
Deviated	0.0	0.10	0.10	Pass

Note :

Function	Maximum-permitted Uncertainty of measurement
1. Indication at the calibration check frequency	Not applicable
2. Self-generated noise, Microphone installed	Not applicable
3. Self-generated noise, Microphone replaced by the electrical input signal device	Not applicable
4. Acoustic signal test of frequency weightings at 10 Hz to 4 kHz	0.60 dB
4. Acoustic signal test of frequency weightings at >4 kHz to 10 kHz	0.70 dB
5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz	0.20 dB
6. Frequency and time weightings at 1kHz	0.20 dB
7. Long Term Stability	0.10 dB
8. Level linearity on the reference level range	0.30 dB
9. Level linearity including the level range control	0.30 dB
10. Tone burst response	0.30 dB
11. Peak C Sound level	0.35 dB
12. Overload indication	0.25 dB
13. High Level Stability	0.10 dB

- Acceptance limit and Maximum-permitted Uncertainty was IEC 61672-1:2013



Certificate No : 25-SLM-032

Request No : Req-2025-0191

Decision Rule for Statements of Conformity

The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09/2019; Guidelines on the

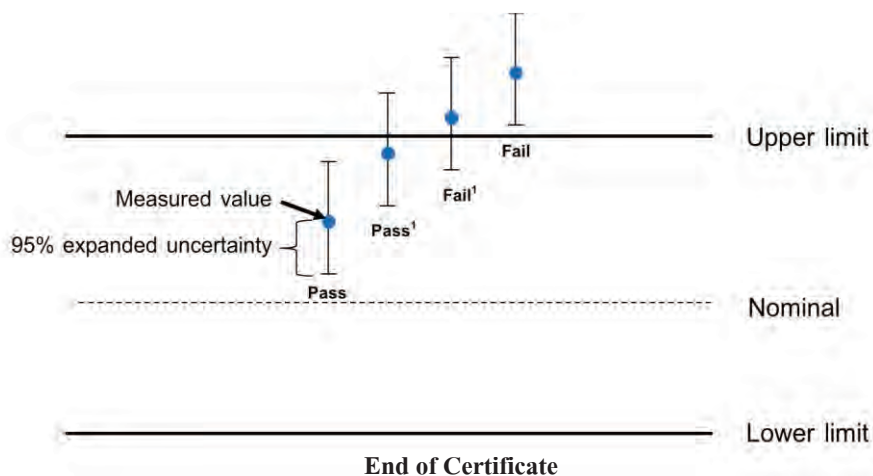
Reporting of Compliance with Specification as following Fig. and statements

Pass = The measurement result plus the expanded uncertainty with a 95% coverage probability were within the limit.

Pass¹ = The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.

Fail¹ = The measurement result was out of the limit. However, a portion of the expanded uncertainty of measurement at 95% is within the limit.

Fail = The measurement result plus the expanded uncertainty with a 95% coverage probability were outside the limit.



End of Certificate

Cert. No. : ACL25216
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-52A / Microphone UC-59 / Preamplifier NH-25
Serial No.: 01120951 / 22353 / 22340
ID No.: SGK_FS0130

Condition As Found : GOOD

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

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

Received Date : 26 MAY 2025
Calibration Date : 05 JUNE 2025
Date of Issue : 06 JUNE 2025

REVIEW BY ...

APPROVED BY

NEXT CAL DATE...04/ 06/ 2026

Calibrated by : Nathakorn Pisutpaisan

Approved by :
(Wichok Ekpongpradit)

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

Cert. No. : ACL25216

Job No. : VC68AC0112

Pages : 2 of 8

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0011-25	11-FEB-26
Waveform Generator	33511B	MY52302742	EF-0012-25	11-FEB-26
Digital Multimeter	33461A	MY53220104	EEL.BP 24/0268	22-APR-26
Digital Multimeter	33461A	MY53220076	EEL.BP 23/0268	22-APR-26
Digital Multimeter	34461A	MY60024273	CA2025120EA	18-MAR-26
Programmable Attenuator	MAT-1070	62100114	EF-0006-25	11-FEB-26
Condenser Microphone	4180	2977900	AA-1002-25	19-FEB-26
Measuring Amplifier	NA-42KAI	34560495	AA-3002-25	19-FEB-26

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).

3.3 Electrical And Electronics Institute (EEI).

Cert. No. : ACL25216
Job No. : VC68AC0112
Pages : 3 of 8

Summary of Measurement Result :

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

Cert. No. : ACL25216
Job No. : VC68AC0112
Page : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.94)	94.0	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
15.6

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

Frequency Weighting	Weighting (dB)
A - weight	13.1
C - weight	19.0
Flat	24.5

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.6	0.7	0.6	± 1.0
1000	0.3	0.3	0.3	± 0.7
8000	0.7	0.6	0.5	+ 1.5, - 2.5

Cert. No. : ACL25216

Job No. : VC68AC0112

Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	-0.1	0.0	±1.0
125	0.0	0.0	0.0	±1.0
250	0.0	0.0	0.0	±1.0
500	0.0	0.0	0.0	±1.0
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±1.0
4000	0.0	0.0	0.0	±1.0
8000	0.0	0.1	0.1	+ 1.5, - 2.5
16000	0.0	-1.2	-1.2	+ 2.5, -16.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

Cert. No. : ACL25216

Job No. : VC68AC0112

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	±0.8
136.0	136.0	0.0	±0.8
135.0	135.0	0.0	±0.8
134.0	134.0	0.0	±0.8
133.0	133.0	0.0	±0.8
132.0	132.0	0.0	±0.8
131.0	131.0	0.0	±0.8
129.0	129.0	0.0	±0.8
124.0	124.0	0.0	±0.8
119.0	119.0	0.0	±0.8
114.0	114.0	0.0	±0.8
109.0	109.0	0.0	±0.8
104.0	104.0	0.0	±0.8
99.0	99.0	0.0	±0.8
94.0	94.0	0.0	±0.8
89.0	89.0	0.0	±0.8
84.0	84.0	0.0	±0.8
79.0	78.9	-0.1	±0.8
74.0	74.0	0.0	±0.8
69.0	69.0	0.0	±0.8
64.0	64.0	0.0	±0.8
59.0	59.0	0.0	±0.8
54.0	53.9	-0.1	±0.8
49.0	48.9	-0.1	±0.8
44.0	44.0	0.0	±0.8
39.0	38.9	-0.1	±0.8
34.0	34.0	0.0	±0.8
30.0	30.0	0.0	±0.8
29.0	29.0	0.0	±0.8
28.0	28.0	0.0	±0.8
27.0	27.0	0.0	±0.8
26.0	26.1	0.1	±0.8
25.0	25.0	0.0	±0.8

Cert. No. : ACL25216
Job No. : VC68AC0112
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	94.0	94.0	0.0	±0.8

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	29.0	29.0	0.0	±0.8

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.0 ; -3.0
	2	8	117.0	117.0	0.0	1.0 ; -1.5
	200	800	134.0	134.0	0.0	±0.5
Slow	2	8	108.0	108.0	0.0	1.0 ; -3.0
	200	800	127.6	127.6	0.0	±0.5
SEL	0.25	1	99.0	98.9	-0.1	1.0 ; -3.0
	2	8	108.0	108.0	0.0	1.0 ; -1.5
	200	800	128.0	128.1	0.1	±0.5

Cert. No. : ACL25216
Job No. : VC68AC0112
Pages : 8 of 8

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{cpeak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	130.0	130.0	0.0	±2.0
One	133.4	133.3	-0.1	±2.0

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	±1.0
Positive half cycle	135.4	135.2	-0.2	±1.0
Negative half cycle	135.4	135.2	-0.2	±1.0

11. Overload indication

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

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	137.0	137.0	0.0	±0.1

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

End of Calibration Certificate

Cert. No. : ACL25218

Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-52A / Microphone UC-59 / Preamplifier NH-25
Serial No.: 00331095 / 21942 / 22329
ID No.: SGK_FS0132

Condition As Found : GOOD

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

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

Received Date : 26 MAY 2025
Calibration Date : 05 JUNE 2025
Date of Issue : 06 JUNE 2025

REVIEW BY ...

APPROVED BY ...

NEXT CAL DATE... 04/ 06/ 2026

Calibrated by :

Nathakorn Pisutpaisan

Approved by :

(Wichok Ekpongpradit)

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

Cert. No. : ACL25218
Job No. : VC68AC0112
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0011-25	11-FEB-26
Waveform Generator	33511B	MY52302742	EF-0012-25	11-FEB-26
Digital Multimeter	33461A	MY53220104	EEL.BP 24/0268	22-APR-26
Digital Multimeter	33461A	MY53220076	EEL.BP 23/0268	22-APR-26
Digital Multimeter	34461A	MY60024273	CA2025120EA	18-MAR-26
Programmable Attenuator	MAT-1070	62100114	EF-0006-25	11-FEB-26
Condenser Microphone	4180	2977900	AA-1002-25	19-FEB-26
Measuring Amplifier	NA-42KAI	34560495	AA-3002-25	19-FEB-26

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).

3.3 Electrical And Electronics Institute (EEI).

Cert. No. : ACL25218
Job No. : VC68AC0112
Pages : 3 of 8

Summary of Measurement Result :

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



Cert. No. : ACL25218
Job No. : VC68AC0112
Page : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.94)	94.0	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
13.8

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

Frequency Weighting	Weighting (dB)
A - weight	9.9
C - weight	15.7
Flat	21.2

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.3	0.4	0.4	± 1.0
1000	0.3	0.3	0.3	± 0.7
8000	0.4	0.5	0.5	+ 1.5, - 2.5

Cert. No. : ACL25218
Job No. : VC68AC0112
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	0.0	0.0	±1.0
125	0.0	0.0	0.0	±1.0
250	0.0	0.0	0.0	±1.0
500	0.0	0.1	0.0	±1.0
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	0.0	±1.0
4000	0.0	0.0	0.0	±1.0
8000	0.0	0.1	0.1	+ 1.5, - 2.5
16000	0.0	-1.2	-1.2	+ 2.5, -16.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

Cert. No. : ACL25218
Job No. : VC68AC0112
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	±0.8
136.0	136.0	0.0	±0.8
135.0	135.0	0.0	±0.8
134.0	134.0	0.0	±0.8
133.0	133.0	0.0	±0.8
132.0	132.0	0.0	±0.8
131.0	131.0	0.0	±0.8
129.0	129.0	0.0	±0.8
124.0	124.0	0.0	±0.8
119.0	119.0	0.0	±0.8
114.0	114.0	0.0	±0.8
109.0	109.0	0.0	±0.8
104.0	104.0	0.0	±0.8
99.0	99.0	0.0	±0.8
94.0	94.0	0.0	±0.8
89.0	89.0	0.0	±0.8
84.0	84.0	0.0	±0.8
79.0	79.0	0.0	±0.8
74.0	74.0	0.0	±0.8
69.0	69.0	0.0	±0.8
64.0	64.0	0.0	±0.8
59.0	59.0	0.0	±0.8
54.0	53.9	-0.1	±0.8
49.0	49.0	0.0	±0.8
44.0	43.9	-0.1	±0.8
39.0	39.0	0.0	±0.8
34.0	34.0	0.0	±0.8
30.0	30.0	0.0	±0.8
29.0	28.9	-0.1	±0.8
28.0	28.0	0.0	±0.8
27.0	27.0	0.0	±0.8
26.0	26.0	0.0	±0.8
25.0	25.0	0.0	±0.8

Cert. No. : ACL25218
Job No. : VC68AC0112
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	94.0	94.0	0.0	±0.8

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	29.0	28.9	-0.1	±0.8

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.0 ; -3.0
	2	8	117.0	117.0	0.0	1.0 ; -1.5
	200	800	134.0	134.1	0.1	±0.5
Slow	2	8	108.0	108.0	0.0	1.0 ; -3.0
	200	800	127.6	127.6	0.0	±0.5
SEL	0.25	1	99.0	98.9	-0.1	1.0 ; -3.0
	2	8	108.0	108.0	0.0	1.0 ; -1.5
	200	800	128.0	128.0	0.0	±0.5

Cert. No. : ACL25218

Job No. : VC68AC0112

Pages : 8 of 8

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{cpeak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	130.0	130.0	0.0	±2.0
One	133.4	133.3	-0.1	±2.0

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	±1.0
Positive half cycle	135.4	135.2	-0.2	±1.0
Negative half cycle	135.4	135.2	-0.2	±1.0

11. Overload indication

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

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	137.0	137.0	0.0	±0.1

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

End of Calibration Certificate

Certificate of Calibration

Customer

Name : ALS Laboratory Group Thailand Co., Ltd.

Certificate No : 25-SLM-033

Address : 104 Soi Phatthanakan 40, Phatthanakan Road, Suan Luang, Bangkok 10250

Request No : Req-2025-0192

Unit Under Calibration Details

Measurement item : Sound Level Meter

Microphone Class : 1

Manufacturer : RION

Microphone Model : UC-59

Model : NL-52A

Microphone S/N : 21945

Serial Number : 01120942

Preamplifier Model : NH-25

ID : SGK_FS0129

Preamplifier S/N : 22331

Resolution : 0.1 dB

Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 2 °C

Humidity : 50 %RH ± 20 %RH

Barometric Pressure : 1013 hPa ± 10 hPa

Received Date : 24 January 2025

Calibrated Date : 6 February 2025

Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests

Location of Calibration : Lab Acoustic

REVIEW BY
APPROVED BY.....
NEXT CAL DATE..... 05/ 02/ 26

Reference Standard

Instrument	Brand	Model	SN.	Due calibration	Traceability
Standard Microphone	Brüel & Kjær	4192	2294985	25 June 2025	NIMT
Audio Generator	Svantek	Svan401	131	15 October 2025	WK Electric

Note

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

Calibrated By :



Mr. Noppadon Luangart

Service Calibration Engineer

Approved By :



Mr. Pacit Mathavorn

Calibration Engineer Supervisor

Issue Date :

6 February 2025

Certificate No : 25-SLM-033

Request No : Req-2025-0192

1. Indication at the calibration check frequency

UUC Setting	Nominal	Before Adjust		After Adjust		UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
FAST / A / 30-130	Level	UUC	ERR	UUC	ERR			
Calibrator Setting	(dB)	(dB)	(dB)	(dB)	(dB)			
1000 Hz 114 dB	113.76	113.8	0.04	113.8	+0.04	0.20	0.30	Pass

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN.58079

2. Self-generated noise, Microphone installed

UUC Setting	Measured	UNCERTAINTY
FAST / 30-130		
UUC Weighting	(dB)	(± dB)
A	15.4	0.10

3. Self-generated noise, Microphone replaced by the electrical input signal device

UUC Setting	Measured	UNCERTAINTY
FAST / 30-130		
UUC Weighting	(dB)	(± dB)
A	10.9	0.10
C	14.1	0.10
Z	17.7	0.10

4. Acoustic signal test of frequency weightings (Without Windscreen)

UUC Setting	Deviation from various Frequency Weighting Responce curve			UNCERTAINTY	Acceptance Limit (± dB)	Result
FAST / 30-130	A	C	Z	(± dB)		
STD Setting	(dB)	(dB)	(dB)			
125 Hz	0.1	0.2	0.2	0.60	1.0	Pass
1000 Hz	0.0	0.0	0.0	0.60	0.7	Pass
4000 Hz	-0.2	-0.2	-0.1	0.60	1.0	Pass
8000 Hz	-0.5	-0.5	-0.6	0.70	+1.5 -2.5	Pass



Certificate No : 25-SLM-033

Request No : Req-2025-0192

5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz

UUC Setting	Deviation from various Frequency			UNCERTAINTY	Acceptance	Result
FAST / 30-130	Weighting Responce curve				Limit	
STD Setting	A (dB)	C (dB)	Z (dB)	(± dB)	(± dB)	
63 Hz	-0.3	-0.1	-0.1	0.20	1.0	Pass
125 Hz	-0.1	0.0	0.0		1.0	Pass
250 Hz	-0.1	0.0	0.0		1.0	Pass
500 Hz	0.0	0.0	0.0		1.0	Pass
1000 Hz	0.0	0.0	0.0		0.7	Pass
2000 Hz	0.0	0.1	0.0		1.0	Pass
4000 Hz	0.0	0.0	0.0		1.0	Pass
8000 Hz	0.1	0.1	0.0		+1.5, -2.5	Pass
16000 Hz	-1.3	-1.3	0.0		+2.5, -16.0	Pass

6. Frequency and time weightings at 1kHz

UUC Setting	STD	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
FAST / 30-130	REF	UUC	ERR			
UUC Weighting	(dB)	(dB)	(dB)	0.20	0.20	Pass
A	114.00	114.0	0.0			
C	114.00	114.0	0.0			
Z	114.00	114.0	0.0			

UUC Setting	STD	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
30-130 / A	REF	UUC	ERR			
UUC Time Response	(dB)	(dB)	(dB)	0.20	0.10	Pass1
Fast	114.00	114.0	0.0			
Slow	114.00	114.0	0.0			
Leq	114.00	114.0	0.0			

Certificate No : 25-SLM-033

Request No : Req-2025-0192

7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY (± dB)	Acceptance	Result
FAST / A / 30-130	UUC		Limit	
STD Setting	(dB)		(± dB)	
Initial	114.0			
Final	114.0			
Deviated	0.0	0.10	0.10	Pass

8. Level linearity on the reference level range

UUC Setting	Anticipated	Deviation		UNCERTAINTY	Acceptance	Result
FAST / A / 30-130	REF	UUC	ERR		Limit	
STD dB	(dB)	(dB)	(dB)		(± dB)	
138.00	138	137.9	-0.1	0.30	0.8	Pass
134.00	134	134.0	0.0		0.8	Pass
129.00	129	129.0	0.0		0.8	Pass
124.00	124	124.0	0.0		0.8	Pass
119.00	119	119.0	0.0		0.8	Pass
114.00	114	114.0	0.0		0.8	Pass
109.00	109	109.0	0.0		0.8	Pass
104.00	104	104.0	0.0		0.8	Pass
99.00	99	99.0	0.0		0.8	Pass
94.00	94	94.0	0.0		0.8	Pass
89.00	89	89.0	0.0		0.8	Pass
84.00	84	84.0	0.0		0.8	Pass
79.00	79	79.0	0.0		0.8	Pass
74.00	74	74.0	0.0		0.8	Pass
69.00	69	69.0	0.0		0.8	Pass
64.00	64	64.0	0.0		0.8	Pass
59.00	59	59.0	0.0		0.8	Pass
54.00	54	54.0	0.0		0.8	Pass
49.00	49	49.0	0.0		0.8	Pass
44.00	44	44.0	0.0		0.8	Pass
39.00	39	39.0	0.0		0.8	Pass
34.00	34	34.0	0.0		0.8	Pass
29.00	29	29.0	0.0		0.8	Pass
24.00	24	24.1	0.1		0.8	Pass

Certificate No : 25-SLM-033

Request No : Req-2025-0192

9. Level linearity including the level range control

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance	Result
FAST / A	REF	UUC	ERR	(± dB)	Limit	
UUC Range	(dB)	(dB)	(dB)		(± dB)	
30-130	29.50	29.6	0.1	0.30	0.8	Pass
	114	114.0	0.0		0.8	Pass

10. Tone burst response

UUC Setting	STD	Anticipated	Measured		UNCERTAINTY	Acceptance	Result
A / 30-130	Toneburst	Ref	UUC	ERR	(± dB)	Limit	
UUC Time Response	(ms)	(dB)	(dB)	(dB)		(± dB)	
Fast	200	126.0	126.0	0.0	0.20	0.5	Pass
	2	109.0	109.0	0.0		+1.0, -1.5	Pass
	0.25	100.0	99.9	-0.1		+1.0, -3.0	Pass
Slow	200	119.6	119.6	0.0		0.5	Pass
	2	100.0	100.0	0.0		+1.0, -3.0	Pass
SEL	200	120.0	120.0	0.0		0.5	Pass
	2	100.0	100.0	0.0		+1.0, -1.5	Pass
	0.25	91.0	90.9	-0.1		+1.0, -3.0	Pass

11. Peak C Sound level

UUC Setting	Anticipated	Measured		UNCERTAINTY	Acceptance	Result
FAST / C / 55-141	REF	UUC	ERR	(± dB)	Limit	
STD Setting	(dB)	(dB)	(dB)		(± dB)	
Complete cycle	136.4	136.2	-0.20	0.20	2.0	Pass
Positive half cycle	135.4	135.2	-0.20		1.0	Pass
Negative half cycle	135.4	135.2	-0.20		1.0	Pass



Certificate No : 25-SLM-033

Request No : Req-2025-0192

12. Overload indication

UUC Setting	Measured	UNCERTAINTY (± dB)	Acceptance	Result
FAST / A / 30-130	UUC		Limit	
STD Setting	(dB)		(± dB)	
Positive one-half cycle	139.3			
Negative one-half cycle	139.4			
Deviated	-0.1	0.20	1.5	Pass

13. High Level Stability

UUC Setting	Measured	UNCERTAINTY (± dB)	Acceptance Limit	Result
FAST / A / 30-130	UUC (dB)		(± dB)	
STD Setting				
Initial	129.0			
Final	129.0			
Deviated	0.0	0.10	0.10	Pass

Note :

Function	Maximum-permitted Uncertainty of measurement
1. Indication at the calibration check frequency	Not applicable
2. Self-generated noise, Microphone installed	Not applicable
3. Self-generated noise, Microphone replaced by the electrical input signal device	Not applicable
4. Acoustic signal test of frequency weightings at 10 Hz to 4 kHz	0.60 dB
4. Acoustic signal test of frequency weightings at >4 kHz to 10 kHz	0.70 dB
5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz	0.20 dB
6. Frequency and time weightings at 1kHz	0.20 dB
7. Long Term Stability	0.10 dB
8. Level linearity on the reference level range	0.30 dB
9. Level linearity including the level range control	0.30 dB
10. Tone burst response	0.30 dB
11. Peak C Sound level	0.35 dB
12. Overload indication	0.25 dB
13. High Level Stability	0.10 dB

- Acceptance limit and Maximum-permitted Uncertainty was IEC 61672-1:2013



Certificate No : 25-SLM-033

Request No : Req-2025-0192

Decision Rule for Statements of Conformity

The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09/2019; Guidelines on the

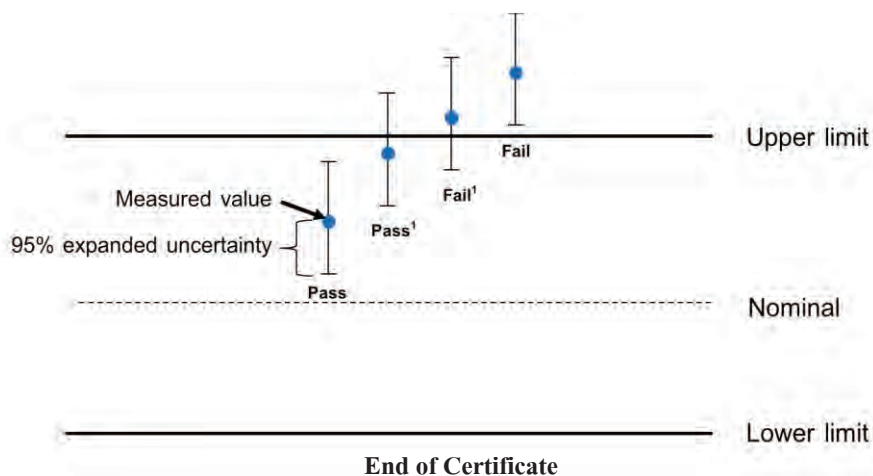
Reporting of Compliance with Specification as following Fig. and statements

Pass = The measurement result plus the expanded uncertainty with a 95% coverage probability were within the limit.

Pass¹ = The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.

Fail¹ = The measurement result was out of the limit. However, a portion of the expanded uncertainty of measurement at 95% is within the limit.

Fail = The measurement result plus the expanded uncertainty with a 95% coverage probability were outside the limit.



End of Certificate

Cert. No. : ACL24399
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 01173617 / 172179 / 74029
ID No.: SGK_FS0030

Condition As Found : GOOD

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

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

Received Date : 06 DECEMBER 2024
Calibration Date : 13-16 DECEMBER 2024
Date of Issue : 16 DECEMBER 2024

REVIEW BY

APPROVED BY

NEXT CAL DATE.....13./12 /25.....

Calibrated by : Nathakorn Pisutpaisan

Approved by :
(Thanakul Petchurai)

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

SITHIPORN ASSOCIATES CO., LTD.

CALIBRATION LABORATORY

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

SITHIPORN
associates



Cert. No. : ACL24399
Job No. : VC67AC0167
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
Waveform Generator	33210A	MY48017076	EF-0009-24	05-FEB-25
Waveform Generator	33511B	MY52302742	EF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	EEL.BP 21/0267	13-FEB-25
Digital Multimeter	33461A	MY53220076	EEL.BP 20/0267	15-FEB-25
Digital Multimeter	34461A	MY60024273	EEL.BP 22/0267	15-FEB-25
Programmable Attenuator	MAT-1070	62100114	EF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KAI	34560495	AA-3001-24	05-FEB-25

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

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

3.1 National Institute of Metrology (Thailand).

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

SITHIPORN ASSOCIATES CO., LTD.

CALIBRATION LABORATORY

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

SITHIPORN
associates



Cert. No. : ACL24399
Job No. : VC67AC0167
Pages : 3 of 8

Summary of Measurement Result :

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

SITHIPORN ASSOCIATES CO., LTD.

CALIBRATION LABORATORY

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

SITHIPORN
associates



Cert. No. : ACL24399
Job No. : VC67AC0167
Page : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
16.9

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

Frequency Weighting	Weighting (dB)
A - weight	14.8
C - weight	20.7
Flat	26.4

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.2	0.3	0.3	± 1.5
1000	0.2	0.2	0.2	± 1.0
8000	2.2	2.3	2.3	±5.0

Cert. No. : ACL24399
Job No. : VC67AC0167
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

SITHIPORN ASSOCIATES CO., LTD.

CALIBRATION LABORATORY

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

SITHIPORN
associates



Cert. No. : ACL24399

Job No. : VC67AC0167

Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	53.9	-0.1	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	38.9	-0.1	± 1.1
34.0	33.9	-0.1	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.0	0.0	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.9	-0.1	± 1.1

SITHIPORN ASSOCIATES CO., LTD.

CALIBRATION LABORATORY

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

SITHIPORN
associates



Cert. No. : ACL24399
Job No. : VC67AC0167
Pages : 7 of 8

8. Level linearity including the level range control

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

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	29.0	28.9	-0.1	±1.1

9. Tone burst response

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

SITHIPORN ASSOCIATES CO., LTD.

CALIBRATION LABORATORY

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

SITHIPORN
associates



Cert. No. : ACL24399
Job No. : VC67AC0167
Pages : 8 of 8

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lcpeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	130.0	130.0	0.0	±3.0
One	133.4	133.4	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	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.5	89.5	0.0	±1.5

12. High level stability

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

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

End of Calibration Certificate

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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

SITHIPORN
associates



Cert. No. : ACL24398
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 01173616 / 172178 / 74028
ID No.: SGK_FS0029

Condition As Found : GOOD

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

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

Received Date : 06 DECEMBER 2024
Calibration Date : 13-16 DECEMBER 2024
Date of Issue : 16 DECEMBER 2024

REVIEW BY

APPROVED BY...

NEXT CAL DATE..... 13 /12 /25

Calibrated by : Nathakorn Pisutpaisan

Approved by :
(Thanakul Petchurai)

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

SITHIPORN ASSOCIATES CO., LTD.

CALIBRATION LABORATORY

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

SITHIPORN
associates



Cert. No. : ACL24398

Job No. : VC67AC0167

Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
Waveform Generator	33210A	MY48017076	EF-0009-24	05-FEB-25
Waveform Generator	33511B	MY52302742	EF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	EEL.BP 21/0267	13-FEB-25
Digital Multimeter	33461A	MY53220076	EEL.BP 20/0267	15-FEB-25
Digital Multimeter	34461A	MY60024273	EEL.BP 22/0267	15-FEB-25
Programmable Attenuator	MAT-1070	62100114	EF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KAI	34560495	AA-3001-24	05-FEB-25

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

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

3.1 National Institute of Metrology (Thailand).

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

SITHIPORN ASSOCIATES CO., LTD.

CALIBRATION LABORATORY

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

SITHIPORN
associates



Cert. No. : ACL24398
Job No. : VC67AC0167
Pages : 3 of 8

Summary of Measurement Result :

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

SITHIPORN ASSOCIATES CO., LTD.

CALIBRATION LABORATORY

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

SITHIPORN
associates



Cert. No. : ACL24398

Job No. : VC67AC0167

Page : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
15.1

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

Frequency Weighting	Weighting (dB)
A - weight	12.0
C - weight	18.3
Flat	23.9

3. Acoustical signal tests of frequency weightings

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

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

Cert. No. : ACL24398
Job No. : VC67AC0167
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

SITHIPORN ASSOCIATES CO., LTD.

CALIBRATION LABORATORY

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

SITHIPORN
associates



Cert. No. : ACL24398

Job No. : VC67AC0167

Pages : 6 of 8

7. Level linearity on the reference level range

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

SITHIPORN ASSOCIATES CO., LTD.

CALIBRATION LABORATORY

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

SITHIPORN
associates



Cert. No. : ACL24398
Job No. : VC67AC0167
Pages : 7 of 8

8. Level linearity including the level range control

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

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	29.0	28.9	-0.1	±1.1

9. Tone burst response

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

SITHIPORN ASSOCIATES CO., LTD.

CALIBRATION LABORATORY

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

SITHIPORN
associates



Cert. No. : ACL24398
Job No. : VC67AC0167
Pages : 8 of 8

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lcpeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	130.0	130.0	0.0	±3.0
One	133.4	133.4	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	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate



JIRANATEE ASSOCIATES CO.,LTD.

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

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

Temperature measurement laboratory
Calibration services department.



CERTIFICATE OF CALIBRATION

Certificate No. : CDT-175-68

Page 1 of 2 Pages

MEASUREMENT ITEM : Heat Stress Monitor
MANUFACTURER : Delta OHM
MODEL/TYPE : HD32.2
SERIAL NUMBER : 17011751
ID NUMBER : SGK_FS0010
CONDITION AS-RECEIVED : Used item
CUSTOMER : ALS laboratory group (thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khwaeng Suan Luang, Khet Suan Luang,
Bangkok 10250 Thailand.

RECEIVED DATE : 24 Sep 2025
MEASUREMENT DATE : 07 Oct 2025
ISSUE DATE : 08 Oct 2025

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

Temperature : 23.0 ± 3.0 °C
Relative Humidity : 55.0 ± 15.0 %RH

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

TABULATION OF RESULTS:

The table on next page give the measured values.

REVIEW BY

APPROVE

NEXT CAL DATE.....06/ 10/ 2026.....

Calibration procedure:

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

Traceability:

The measurement results are traceable to the international system of units (SI) through National Institute of Metrology Thailand (NIMT) Certificate number: TT-1013-25, Certificate number: ER-0061-25.

Reference Used During Calibration:

1. Standard Temperature Probe
Model: STS-100 A500, Serial No.: 667682-09,
Due date: 9 Apr 2026
2. Digital Temperature Indicator
Model: DTI-1000-A MK II, Serial No.: 671407-00591 Due date: 22 Apr 2026

Uncertainty of Measurement:

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

Calibrated by:

- ☐ Mr. Sorawit Thachalad
☒ Miss Jittraporn Lertsomphol
☐ Miss Ruangrumpai Phoommit



Approved signatory:

Mr. Parinya Booncharoen
Calibration Department Manager

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 10 °C to 45 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2, S/N: 17015106.
Dimension: Diameter 3.3 mm. Length 170 mm.

<u>Immersion Depth</u> (mm)	<u>Standard Reading</u> (°C)	<u>UUC Reading</u> (°C)	<u>Error</u> (°C)	<u>Uncertainty</u> (°C)
80	10.057	10.1	0.0	0.099
80	20.057	20.0	-0.1	0.099
80	25.033	25.0	0.0	0.099
80	30.028	30.0	0.0	0.099
80	35.010	34.9	-0.1	0.099
80	44.997	44.9	-0.1	0.099

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276.2, S/N: 17013820.
Dimension: Diameter 3.3 mm. Length 205 mm.

<u>Immersion Depth</u> (mm)	<u>Standard Reading</u> (°C)	<u>UUC Reading</u> (°C)	<u>Error</u> (°C)	<u>Uncertainty</u> (°C)
110	10.057	10.0	-0.1	0.099
110	20.057	20.0	-0.1	0.099
110	25.033	25.0	0.0	0.099
110	30.028	30.0	0.0	0.099
110	35.010	35.0	0.0	0.099
110	44.997	44.9	-0.1	0.099

Table 3: This equipment was connected with temperature probe Model: TP3207.2, S/N: 17009123.
Dimension: Diameter 14 mm. Length 150 mm.

<u>Immersion Depth</u> (mm)	<u>Standard Reading</u> (°C)	<u>UUC Reading</u> (°C)	<u>Error</u> (°C)	<u>Uncertainty</u> (°C)
75	10.057	10.2	0.1	0.099
75	20.057	20.0	-0.1	0.099
75	25.033	25.0	0.0	0.099
75	30.028	29.9	-0.1	0.099
75	35.010	34.8	-0.2	0.099
75	44.997	44.8	-0.2	0.099

UUC*: Unit Under Calibration

End of Certificate of Calibration



JIRANATEE ASSOCIATES CO.,LTD.

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

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

Temperature measurement laboratory
Calibration services department.



CERTIFICATE OF CALIBRATION

Certificate No. : CDT-208-67

Page 1 of 2 Pages

MEASUREMENT ITEM : Heat Stress Monitor
MANUFACTURER : Delta OHM
MODEL/TYPE : HD32.2
SERIAL NUMBER : 18006678
ID NUMBER : SGK_FS0043
CONDITION AS-RECEIVED : Used item
CUSTOMER : ALS laboratory group (thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khwaeng Suan Luang, Khet Suan Luang,
Bangkok 10250 Thailand.

RECEIVED DATE : 25 Nov 2024
MEASUREMENT DATE : 02 Dec 2024
ISSUE DATE : 02 Dec 2024

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

Temperature : 23.0 ± 3.0 °C
Relative Humidity : 55.0 ± 15.0 %RH

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

TABULATION OF RESULTS:

The table on next page give the measured values.

REVIEW BY

APPROVED BY

NEXT CAL DATE..... 2- Dec-25

Calibration procedure:

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

Traceability:

The measurement results are traceable to the international system of units (SI) through National Institute of Metrology Thailand (NIMT) Certificate number: TT-0047-24, Certificate number: ER-0113-24

Reference Used During Calibration:

1. Standard Temperature Probe
Model: STS-100 A500, Serial No.: 667682-09,
Due date: 26 Mar 2025
2. Digital Temperature Indicator
Model: DTI-1000-A MK II, Serial No.: 671407-00591 Due date: 21 Oct 2025

Uncertainty of Measurement:

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

Calibrated by:

- ☐ Mr. Sorawit Thachalad
☐ Miss Jittraporn Lertsomphol
☒ Miss Ruangrumpai Phoommit



Approved signatory:



Mr. Parinya Booncharoen
Calibration Department Manager



JIRANATEE ASSOCIATES CO.,LTD.

Continuation of Certificate of Calibration Number CDT-208-67

Page 2 of 2 Pages

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 °C to 40 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2, S/N: 18007970.
Dimension: Diameter 3.3 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.050	20.0	-0.1	0.099
80	25.056	25.0	-0.1	0.099
80	30.048	29.9	-0.1	0.16
80	35.041	34.9	-0.1	0.099
80	40.033	39.9	-0.1	0.099

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276.2, S/N: 18008102.
Dimension: Diameter 3.3 mm. Length 205 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.050	20.0	0.0	0.099
110	25.056	25.0	-0.1	0.099
110	30.048	30.0	0.0	0.099
110	35.041	35.0	0.0	0.099
110	40.032	40.0	0.0	0.099

Table 3: This equipment was connected with temperature probe Model: TP3207.2, S/N: 18007688.
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
75	20.050	20.1	0.1	0.099
75	25.056	25.0	-0.1	0.099
75	30.048	29.9	-0.1	0.099
75	35.041	34.9	-0.1	0.099
75	40.033	39.9	-0.1	0.099

UUC*: Unit Under Calibration

Remark: The reported uncertainty of measurement is 0.16, based on standard uncertainty multiplied by a coverage factor $k=2.21$ providing a level of confidence of approximately 95%.

End of Certificate of Calibration



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE	:	DIGITAL LUX METER
MANUFACTURER	:	DELTA OHM
MODEL / TYPE	:	HD2102.2
SERIAL NO.	:	17020596 [SGK_FS0020]
CLID. NO.	:	252502055
JOB CONTROL NO.	:	250815094790
CALIBRATION SERVICE	:	☒ IN-LABORATORY ☐ ON-SITE

REVIEW BY ...

APPROVED BY

NEXT CAL DATE... 15 /08/ 2026

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

DATE OF RECEIVED : 15 August 2025

DATE OF ISSUED : 18 August 2025

The report of calibration shall not be reproduced except in full without approval of the Calibration Laboratory Co., Ltd.

Calibrated By : Suwit Phuanbusabong
Calibration Engineer

Approved By : Mongkol Yotsoontorn
Authorized Signatory
18 August 2025



This Calibration Certificate documents the traceability to national standards, which realize the units of measurement according to the International System of Units (SI)

Certificate No. Q25094790

F3-011-05/12-23

page 1 of 3



REPORT OF CALIBRATION

FOR

NOMENCLATURE : DIGITAL LUX METER
MANUFACTURER : DELTA OHM
MODEL / TYPE : HD2102.2
SERIAL NO. : 17020596 [SGK_FS0020]
DATE OF CALIBRATION : 16 August 2025

ENVIRONMENT CONDITIONS :

Temperature : $(23 \pm 2) ^\circ\text{C}$

Relative Humidity : $(55 \pm 15) \% \text{RH}$

PROCEDURE USED :

This instrument was calibrated under procedure No. **CLC-CPEE-18** by comparison with Photometer/Radiometer & Illuminance Sensor which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

Photometer/Radiometer & Illuminance Sensor, Bentham Model ORM400/DH400VL S/N. 27710/1/27585/3.

TRACEABILITY :

The measurements are traceable to International System of Units (SI) , through Optical Test and Calibration Ltd.
Certificate No. 158628/ABU, Due Date 01 May 2027.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2,00$ which for a normal distribution corresponds to a coverage probability of approximately 95 %.
It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2022)"

Certificate No. Q25094790

F3-011-05/12-23

page 2 of 3



CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION

MEASUREMENT RESULTS : (X) without adjustment () adjustment

CALIBRATION DATA

DIGITAL LUX METER RESULT

STD Applied (lux)	DUC Reading (lux)	Correction (lux)	Uncertainty $\pm$ (% of rdg.)
0.00	0.00	0.00	-
15.00	14.99	+0.01	3.2
50.00	50.80	-0.80	2.6
100.00	101.97	-1.97	2.6
500.0	511.3	-11.3	2.6
1000.0	1022.9	-22.9	2.6
2000	2046	-46	3.8
3000	3069	-69	3.8
4000	4093	-93	3.8
5000	5116	-116	3.8

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 015 Page 56 of 68

This report is valid for the above stated instrument/s only.

End of Certificate

Certificate No. Q25094790

F3-011-05/12-23

page 3 of 3



Cert. No. : ACL25217
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-52A / Microphone UC-59 / Preamplifier NH-25
Serial No.: 00331094 / 22922 / 22569
ID No.: SGK_FS0131

Condition As Found : GOOD

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

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

Received Date : 26 MAY 2025
Calibration Date : 05 JUNE 2025
Date of Issue : 06 JUNE 2025

REVIEW BY ...	
APPROVED BY	
NEXT CAL DATE...04/ 06/ 2026.....	

Calibrated by : Nathakorn Pisutpaisan

Approved by :
(Wichok Ekpongpradit)

Cert. No. : ACL25217

Job No. : VC68AC0112

Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0011-25	11-FEB-26
Waveform Generator	33511B	MY52302742	EF-0012-25	11-FEB-26
Digital Multimeter	33461A	MY53220104	EEL.BP 24/0268	22-APR-26
Digital Multimeter	33461A	MY53220076	EEL.BP 23/0268	22-APR-26
Digital Multimeter	34461A	MY60024273	CA2025120EA	18-MAR-26
Programmable Attenuator	MAT-1070	62100114	EF-0006-25	11-FEB-26
Condenser Microphone	4180	2977900	AA-1002-25	19-FEB-26
Measuring Amplifier	NA-42KAI	34560495	AA-3002-25	19-FEB-26

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).

3.3 Electrical And Electronics Institute (EEI).

Cert. No. : ACL25217
Job No. : VC68AC0112
Pages : 3 of 8

Summary of Measurement Result :

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

Cert. No. : ACL25217
Job No. : VC68AC0112
Page : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.94)	94.0	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
13.8

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

Frequency Weighting	Weighting (dB)
A - weight	10.8
C - weight	16.0
Flat	21.3

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.5	0.6	0.6	± 1.0
1000	0.3	0.3	0.3	± 0.7
8000	0.5	0.6	0.6	+ 1.5, - 2.5

Cert. No. : ACL25217

Job No. : VC68AC0112

Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	0.0	0.1	±1.0
125	0.1	0.1	0.1	±1.0
250	0.0	0.1	0.0	±1.0
500	0.0	0.1	0.0	±1.0
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	0.0	±1.0
4000	0.0	0.0	0.0	±1.0
8000	0.0	0.1	0.1	+ 1.5, - 2.5
16000	0.0	-1.2	-1.2	+ 2.5, -16.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

Cert. No. : ACL25217
Job No. : VC68AC0112
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	±0.8
136.0	136.0	0.0	±0.8
135.0	135.0	0.0	±0.8
134.0	134.0	0.0	±0.8
133.0	133.0	0.0	±0.8
132.0	132.0	0.0	±0.8
131.0	131.0	0.0	±0.8
129.0	129.0	0.0	±0.8
124.0	124.0	0.0	±0.8
119.0	119.0	0.0	±0.8
114.0	114.0	0.0	±0.8
109.0	109.0	0.0	±0.8
104.0	104.0	0.0	±0.8
99.0	99.0	0.0	±0.8
94.0	94.0	0.0	±0.8
89.0	89.0	0.0	±0.8
84.0	84.0	0.0	±0.8
79.0	79.0	0.0	±0.8
74.0	74.0	0.0	±0.8
69.0	69.0	0.0	±0.8
64.0	64.0	0.0	±0.8
59.0	59.0	0.0	±0.8
54.0	54.0	0.0	±0.8
49.0	49.0	0.0	±0.8
44.0	44.0	0.0	±0.8
39.0	39.0	0.0	±0.8
34.0	34.0	0.0	±0.8
30.0	30.0	0.0	±0.8
29.0	28.9	-0.1	±0.8
28.0	27.9	-0.1	±0.8
27.0	27.0	0.0	±0.8
26.0	26.0	0.0	±0.8
25.0	24.9	-0.1	±0.8

Cert. No. : ACL25217

Job No. : VC68AC0112

Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	94.0	94.0	0.0	±0.8

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	29.0	29.0	0.0	±0.8

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.0 ; -3.0
	2	8	117.0	117.0	0.0	1.0 ; -1.5
	200	800	134.0	134.1	0.1	±0.5
Slow	2	8	108.0	108.0	0.0	1.0 ; -3.0
	200	800	127.6	127.6	0.0	±0.5
SEL	0.25	1	99.0	98.9	-0.1	1.0 ; -3.0
	2	8	108.0	108.0	0.0	1.0 ; -1.5
	200	800	128.0	128.1	0.1	±0.5

Cert. No. : ACL25217
Job No. : VC68AC0112
Pages : 8 of 8

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{cpeak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	130.0	130.0	0.0	±2.0
One	133.4	133.3	-0.1	±2.0

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	±1.0
Positive half cycle	135.4	135.1	-0.3	±1.0
Negative half cycle	135.4	135.1	-0.3	±1.0

11. Overload indication

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

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	137.0	137.0	0.0	±0.1

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

End of Calibration Certificate

Cert. No. : ACL25220

Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-52A / Microphone UC-59 / Preamplifier NH-25
Serial No.: 00331097 / 22940 / 22572
ID No.: SGK_FS0134

Condition As Found : GOOD

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

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

Received Date : 26 MAY 2025
Calibration Date : 05 JUNE 2025
Date of Issue : 06 JUNE 2025

REVIEW BY

APPROVED BY...

NEXT CAL DATE...04/ 06/ 2026.....

Calibrated by :

Nathakorn Pisutpaisan

Approved by :

(Wichok Ekpongpradit)

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

Cert. No. : ACL25220

Job No. : VC68AC0112

Pages : 2 of 8

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

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

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0011-25	11-FEB-26
Waveform Generator	33511B	MY52302742	EF-0012-25	11-FEB-26
Digital Multimeter	33461A	MY53220104	EEL.BP 24/0268	22-APR-26
Digital Multimeter	33461A	MY53220076	EEL.BP 23/0268	22-APR-26
Digital Multimeter	34461A	MY60024273	CA2025120EA	18-MAR-26
Programmable Attenuator	MAT-1070	62100114	EF-0006-25	11-FEB-26
Condenser Microphone	4180	2977900	AA-1002-25	19-FEB-26
Measuring Amplifier	NA-42KAI	34560495	AA-3002-25	19-FEB-26

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).

3.3 Electrical And Electronics Institute (EEI).

Cert. No. : ACL25220

Job No. : VC68AC0112

Pages : 3 of 8

Summary of Measurement Result :

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

Cert. No. : ACL25220
Job No. : VC68AC0112
Page : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.94)	94.0	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.6

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

Frequency Weighting	Weighting (dB)
A - weight	12.0
C - weight	16.8
Flat	22.6

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.4	0.4	0.4	± 1.0
1000	0.2	0.2	0.2	± 0.7
8000	0.5	0.6	0.6	+ 1.5, - 2.5

Cert. No. : ACL25220
Job No. : VC68AC0112
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	-0.1	0.0	±1.0
125	0.0	0.0	0.0	±1.0
250	0.0	0.0	0.0	±1.0
500	0.0	0.0	-0.1	±1.0
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±1.0
4000	0.0	0.0	0.0	±1.0
8000	0.0	0.0	0.0	+ 1.5, - 2.5
16000	0.0	-1.3	-1.2	+ 2.5, -16.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

Cert. No. : ACL25220
Job No. : VC68AC0112
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	±0.8
136.0	136.0	0.0	±0.8
135.0	135.1	0.1	±0.8
134.0	134.1	0.1	±0.8
133.0	133.0	0.0	±0.8
132.0	132.0	0.0	±0.8
131.0	131.0	0.0	±0.8
129.0	129.0	0.0	±0.8
124.0	124.0	0.0	±0.8
119.0	119.1	0.1	±0.8
114.0	114.1	0.1	±0.8
109.0	109.0	0.0	±0.8
104.0	104.1	0.1	±0.8
99.0	99.0	0.0	±0.8
94.0	94.0	0.0	±0.8
89.0	89.0	0.0	±0.8
84.0	84.0	0.0	±0.8
79.0	79.0	0.0	±0.8
74.0	74.0	0.0	±0.8
69.0	69.0	0.0	±0.8
64.0	64.0	0.0	±0.8
59.0	59.0	0.0	±0.8
54.0	54.0	0.0	±0.8
49.0	49.0	0.0	±0.8
44.0	44.0	0.0	±0.8
39.0	39.0	0.0	±0.8
34.0	34.0	0.0	±0.8
30.0	30.0	0.0	±0.8
29.0	29.0	0.0	±0.8
28.0	27.9	-0.1	±0.8
27.0	27.0	0.0	±0.8
26.0	26.0	0.0	±0.8
25.0	24.9	-0.1	±0.8

Cert. No. : ACL25220

Job No. : VC68AC0112

Pages : 7 of 8.

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	94.0	94.0	0.0	±0.8

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	29.0	28.9	-0.1	±0.8

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.0 ; -3.0
	2	8	117.0	116.9	-0.1	1.0 ; -1.5
	200	800	134.0	134.0	0.0	±0.5
Slow	2	8	108.0	108.0	0.0	1.0 ; -3.0
	200	800	127.6	127.6	0.0	±0.5
SEL	0.25	1	99.0	98.8	-0.2	1.0 ; -3.0
	2	8	108.0	107.9	-0.1	1.0 ; -1.5
	200	800	128.0	128.0	0.0	±0.5

Cert. No. : ACL25220
Job No. : VC68AC0112
Pages : 8 of 8

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{cpeak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	130.0	130.0	0.0	±2.0
One	133.4	133.3	-0.1	±2.0

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	±1.0
Positive half cycle	135.4	135.2	-0.2	±1.0
Negative half cycle	135.4	135.2	-0.2	±1.0

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.5	89.5	0.0	±1.5

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	137.0	137.0	0.0	±0.1

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

End of Calibration Certificate



CERTIFICATE OF CALIBRATION

ISSUED BY **Cirrus Research plc**DATE OF ISSUE **30 June 2025**CERTIFICATE NUMBER **243790**

Cirrus Research plc
Acoustic House
Bridlington Road
Hunmanby
North Yorkshire
YO14 0PH
United Kingdom

Page 1 of 2

Approved signatory

N.Smith

Electronically signed:

doseBadge Reader : IEC 60942:2003

Instrument information

Manufacturer: Cirrus Research plc**Notes:****Model:** RC:110A**Serial number:** 79623**Class:** 2

Test summary

Date of calibration: 30 June 2025

The doseBadge reader detailed above has been calibrated to the published data as described in the operating manual and in the half-inch configuration. The procedures and techniques used are as described in IEC60942_2003 Annex B – Periodic Tests and three determinations of the sound pressure level, frequency and total distortion were made.

The sound pressure level was measured using a WS2F condenser microphone type MK:224 manufactured by Cirrus Research plc.

The results have been corrected to the reference pressure of 101.33 kPa using the manufacturer's data.

The doseBadge Reader has been shown to conform to the Class 2 requirements for periodic testing, described in Annex B of IEC 60942:2003 for the sound pressure level(s) and frequency(ies) stated, for the environmental conditions under which the tests were performed.

However, as public evidence was not available, from a testing organisation responsible for pattern approval, to demonstrate that the model of doseBadge Reader conformed to the requirements for pattern evaluation described in Annex A of IEC 60942:2003, no general statement or conclusion can be made about conformance of the doseBadge Reader to the requirements of IEC 60942:2003.

Notes:

REVIEW BY

APPROVED BY:

NEXT CAL DATE..... 29/ 06/ 2026

This certificate provides traceability of measurement to the SI system of units and/or to units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory. The results within this certificate relate only to the items calibrated. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $k=2$, providing a coverage probability of approximately 95%.

CERTIFICATE OF CALIBRATION

Certificate Number:

243790

Page 2 of 2

Environmental conditions

The following conditions were recorded at the time of the test:

Before	Pressure: 101.20 kPa	Temperature: 23.8 °C	Humidity: 51.5 %
After	Pressure: 101.20 kPa	Temperature: 23.8 °C	Humidity: 51.1 %

Test equipment

Equipment	Manufacturer	Model	Serial number
Distortion Meter	Keithley	2015	1053426
Environmental Monitor	Comet	T7510	21962628

Acoustic Results

	Expected	Sample 1	Sample 2	Sample 3	Average	Deviation	Tolerance	Uncertainty
Level (dB)	114.00	113.99	113.98	113.97	113.98	-0.02	±0.75	0.11 dB
Distortion (%)	< 4.00	0.43	0.42	0.42	0.42	0.42	+4.00	0.13 %
Frequency (Hz)	1000.0	999.3	999.3	999.2	999.3	-0.7	±20.0	0.1 Hz

The measured quantities or deviations (as applicable), extended by the expanded combined uncertainty of measurement, must not exceed the corresponding tolerance.

Functionality Results

Function	Result
Keypad	Pass
Battery Power	Pass
Display	Pass
Communication	Pass
2 way IR link	Pass
Clock	Pass

End of results

CERTIFICATE OF CALIBRATION

ISSUED BY **Cirrus Research**

DATE OF ISSUE **13 February 2025** CERTIFICATE NUMBER **232791**



**Cirrus Research
Acoustic House
Bridlington Road
Hunmanby
North Yorkshire
YO14 0PH
United Kingdom**

Page 1 of 6

Approved signatory

R.Thomas

Electronically signed:



Dosemeter : IEC 61252-1993+A1:2000

Instrument information

Manufacturer: Cirrus Research plc

Notes:

Model: CR:110A

Serial number: CB1545

Firmware version: 5.4

Test summary

Date of calibration: 07 February 2025

The calibration was performed respecting the requirements of ISO/IEC 17025:2017.

The dosimeter submitted for testing successfully completed the periodic tests of IEC 61252-1993+A1:2000.

The dosimeter submitted for testing conforms to the specifications in IEC 61252-1993+A1:2000.

Test equipment

Equipment	Manufacturer	Model	Serial number
Signal Generator	SIGLENT	SDG1032X	SDG1XDDC7R0237
Attenuator	Cirrus Research	ZE:952	78713
Environmental Monitor	Comet	T7510	16966334
doseBadge Reader	Cirrus Research plc	RC:110A	79620

Notes

REVIEW BY ..

APPROVED BY

NEXT CAL DATE..... 06/ 02/ 2026

This certificate provides traceability of measurement to the SI system of units and/or to units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory. The results within this certificate relate only to the items calibrated. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $k=2$, providing a coverage probability of approximately 95%.

CERTIFICATE OF CALIBRATION

Certificate Number:
232791

Page 2 of 6

Environmental conditions

The following conditions were recorded at the time of the test:

Before	Pressure: 102.51 kPa	Temperature: 21.3 °C	Humidity: 40.1 %
After	Pressure: 102.46 kPa	Temperature: 21.3 °C	Humidity: 37.9 %

Test results summary

Test	Result
Absolute Acoustic Sensitivity	Complies
Linearity	Complies
Short Duration	Complies
Overload Latching	Complies
Frequency weighting	Complies

CERTIFICATE OF CALIBRATION

Certificate Number:
232791

Page 3 of 6

Laboratory uncertainties

Requirement	Value
Absolute acoustic sensitivity	0.2 dB
Level linearity	0.15 dB
Short duration signals	0.2 dB
Overload latching indication	0.2 dB
Electrical freq. weighting 125 Hz	0.15 dB
Electrical freq. weighting 8 kHz	0.15 dB

CERTIFICATE OF CALIBRATION

Certificate Number:
232791

Page 4 of 6

B1: Absolute Acoustical Sensitivity

Result: **Passed**

Frequency: 1000 Hz Uncertainty: 0.2 dB

Name	Input Level (dB)	Reading (dB)	Deviation (dB)	Limits (dB)
Initial	114	115.00	-1	113 / 115
Adjusted	114	114.00	0	113 / 115

B2: Linearity Of Responce To Steady Signals

Result: **Passed**

Frequency: 1000 Hz Uncertainty: 0.2 dB Range: 80 – 130 dB

Input Level (dB)	Expected Exposure (Pa²h)	Exposure (Pa²h)	Duration (s)	Deviation (Pa²h)	Limits (Pa²h)	Deviation (%)	Limits (%)
80	0.000222	0.000267	20	-0.000045	0.000175 / 0.000280	20	-21 / +26
90	0.002222	0.002122	20	0.000100	0.001755 / 0.002800	-5	-21 / +26
100	0.022222	0.021716	20	0.000506	0.017555 / 0.028000	-2	-21 / +26
110	0.222222	0.212221	20	0.010001	0.175555 / 0.280000	-5	-21 / +26
120	2.222222	2.171638	20	0.050584	1.755555 / 2.800000	-2	-21 / +26
130	22.222223	22.739845	20	-0.517622	17.555556 / 28.000001	2	-21 / +26

CERTIFICATE OF CALIBRATION

Certificate Number:
232791

Page 5 of 6

B3: Frequency Weightings

Result: **Passed**

Reference Frequency: 1000 Hz

Reference Exposure: 5.1970572512568

Reference Input Level: 127 dB

Duration: 10 Seconds

Frequency (Hz)	Exposure (Pa²h)	Exposure Ratio	Ratio Limit	Uncertainty
125	0.116348	0.0224	0.0174 / 0.0347	0.15
8000	2.021890	0.389	0.246 / 2.455	0.15

B4: Short-Duration Signals

Result: **Passed**

Uncertainty: 0.2 dB

Frequency: 4000 Hz

Input Level (dB)	Burst Level (dB)	Ratio	Duration (s)	Burst Duration (ms)	Duration Between Bursts (ms)	Expected Exposure (Pa²h)	Exposure (Pa²h)	Deviation (%)	Limits (%)
114	95	1:100	10	10	990	0.003514	0.003434	-2	-21 / +26
129	100	1:1000	10	1	999	0.011111	0.011906	7	-29 / +41

CERTIFICATE OF CALIBRATION

Certificate Number:
232791

Page 6 of 6

B6: Latching Overload Indicator

Result: **Passed**

Frequency: 1000 Hz Uncertainty: 0.2 dB

Level (dB)	Expected To Overload	Overloaded
130	No	No
133	Yes	Yes



JIRANATEE ASSOCIATES CO.,LTD.

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

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

Acoustic calibration laboratory
Calibration services department.

REVIEW BY ...

APPROVED BY ...

NEXT CAL DATE 04/ 09/ 2026

Calibration report Number

CDM-072-68

CALIBRATION REPORT

Page 1 of 1 Pages

MEASUREMENT ITEM : Dose meter
MANUFACTURER : Cirrus Research plc
MODEL/TYPE : CR:110AIS
SERIAL NUMBER : YG212
ID NUMBER : SGK_FS0005
CONDITION AS-RECEIVED : Used item
CUSTOMER : ALS laboratory group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang,
Khet Suan Luang, Bangkok 10250 Thailand.

RECEIVED DATE : 02 Sep 2025
MEASUREMENT DATE : 05 Sep 2025
ISSUE DATE : 05 Sep 2025

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

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

PRECONDITIONING : The dose meter (Unit Under Calibration) was preconditioning 24 hours at ambient conditions prior to calibration being performed.

Calibration procedure:

The Noise dosimeter (Unit Under Calibration) was calibrated against Standard dosebadge reader model: RC-110A which the calibration was performed respecting the requirements of ISO/IEC 17025:2017 and carried out in accordance with the requirements of IEC 60942:2003 where applicable.

Traceability:

This certificate provides a traceability of The measurement to recognized the national standards, and to realization of the international system of units (SI) through Cirrus research plc via Certificate number: 248239

STANDARD USED DURING CALIBRATION:

Instrument name: doseBadge Reader Manufacturer: Cirrus Research plc. Model: RC:110A Serial number: 81051

Remark: doseBadge Reader Unit with Internal Acoustic Calibrator to IEC 60942: 2003 Class 2.

CALIBRATION RESULTS:

Table 1: The results of dose meter calibration are reported in the table below.

DoseBadge Reader Level ¹ (dB)	Noise Dosimeter reading ² (dB)	Error (dB)	Status
114.0	114.0	0.0	✓

Calibrated by:

- ☒ Mr. Sorawit Thachalad
☐ Miss Jitraporn Lertsomphol



Approved signatory:

Mr. Parinya Booncharoen
Calibration Department Manager

Remark:

¹ The decibel level of standard doseBadge reader that supplied to Unit Under Calibration.

² The measurement reading of Unit Under Calibration.

Certificate of Calibration

Customer

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

Certificate No : 24-AFM-179

Request No : Req-2024-1987

Unit Under Calibration Details

Measurement Item : Air Flow Meter
Manufacturer : MesaLabs Accuracy : 1% of Reading
Model : Defender 510-M Sensor Model : -
Serial Number : 151114 Sensor Serial Number : -
ID : BKK_FS0614 Instrument Status : Used
Location of Calibration : LAB 4 AIR VELOCITY METER

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 30 August 2024
Calibration Date : 9 September 2024
Calibration Procedure : In-house method CP-AFM-01 by Comparison technique with Standard Primary Flow Calibrator

REVIEW BY	
APPROVED BY	
NEXT CAL. DATE	9/9/25

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Gilibrator 3 Low flow	18501010006	Sensidyne	6 August 2025
Air Flow Meter	Gilibrator 3 Standard flow	19031011003	Sensidyne	2 August 2025
Temperature meter	GT 11	08000057	Qreborn	1 March 2025
Pressure meter	CPG2400	41000KDU/651882	TPA	9 November 2024

Traceability :

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

Note :

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

Calibration By :

Mr. Noppadon Luangart
Service Calibration Engineer

Approved By :

Mr. Pacit Mathavorn
Calibration Engineer Supervisor

Issue Date : 9 September 2024

Certificate No : 24-AFM-179

Request No : Req-2024-1987

Result of Calibration : Without Adjustment

Temperature (°C)	Pressure (kPa)	STD (cc/min)	UUC (cc/min)	Error (cc/min)	Uncertainty (cc/min)	MPE (cc/min)	Result
24.70	100.95	100	100.41	0.4	2.8	1.0	N/A
24.90	100.90	502	500.47	-1.5	7.1	5.0	N/A
24.90	100.97	1003	1001.3	-2	14	10.0	N/A
25.00	100.92	2014	2009.9	-4	29	20.1	N/A
25.20	101.03	3043	3058.3	15	44	30.4	N/A
25.30	101.10	4043	4005.1	-38	57	40.4	N/A
25.50	101.15	5052	5003.9	-48	74	50.5	N/A

Note

STD : Standard UUC : Unit Under Calibration

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

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

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

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

Meas = Measurement Condition ref = Standard Condition

* Indicates non accredited

MPE = Maximum Permissible Error (Specified in Manufacturer's Specifications)

N/A = Not Available, Customer does not require a statement of conformity.

Certificate No : 24-AFM-179

Request No : Req-2024-1987

Decision Rule for Statements of Conformity

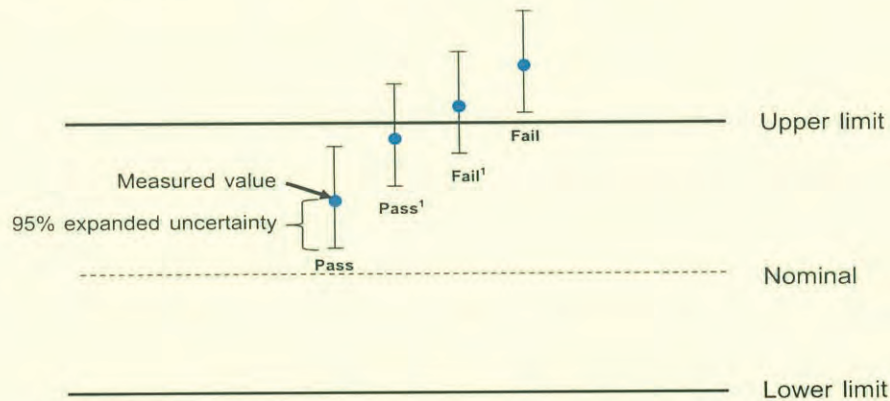
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09/2019; Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

Pass = The measurement result plus the expanded uncertainty with a 95% coverage probability were within the limit.

Passⁱ = The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.

Failⁱ = The measurement result was out of the limit. However, a portion of the expanded uncertainty of measurement at 95% is within the limit.

Fail = The measurement result plus the expanded uncertainty with a 95% coverage probability were outside the limit.



End of Certificate

Certificate of Calibration

Customer

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

Certificate No : 24-AFM-177

Request No : Req-2024-1862

Unit Under Calibration Details

Measurement Item : Air Flow Meter
Manufacturer : Bios
Model : Defender 510-L
Serial Number : 130026
ID : BKK_FS0619

Accuracy : 1% of Reading

Sensor Model : -

Sensor Serial Number : -

Instrument Status : Used

Location of Calibration : LAB 4 AIR VELOCITY METER

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 22 August 2024
Calibration Date : 9 September 2024
Calibration Procedure : In-house method CP-AFM-01 by Comparison technique with Standard Primary Flow Calibrator

REVIEW BY	<i>Manakorn P</i>
APPROVED BY	<i>[Signature]</i>
NEXT CAL. DATE	<i>9/9/26</i>

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Gilibrator 3 Low flow	18501010006	Sensidyne	6 August 2025
Air Flow Meter	Gilibrator 3 Standard flow	19031011003	Sensidyne	2 August 2025
Temperature meter	GT 11	08000057	Qreborn	1 March 2025
Pressure meter	CPG2400	41000KDU/651882	TPA	9 November 2024

Traceability :

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

Note :

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

Calibration By : *[Signature]*
Mr. Noppadon Luangart
Service Calibration Engineer

Approved By : *[Signature]*
Mr. Pacit Mathavorn
Calibration Engineer Supervisor

Issue Date : 9 September 2024

Certificate No : 24-AFM-177

Request No : Req-2024-1862

Result of Calibration : Without Adjustment

Temperature (°C)	Pressure (kPa)	STD (cc/min)	UUC (cc/min)	Error (cc/min)	Uncertainty (cc/min)	MPE (cc/min)	Result
24.70	100.92	20	20.192	0.2	1.3	0.2	N/A
24.70	100.90	100	99.923	-0.1	2.8	1.0	N/A
24.70	100.94	201	200.7	-0.3	5.6	2.0	N/A
24.70	100.97	298	300.1	2.1	8.4	3.0	N/A
24.70	100.99	403	399.1	-4	11	4.0	N/A
24.80	101.05	482	477.6	-4.4	6.9	4.8	N/A

Note

STD : Standard UUC : Unit Under Calibration

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

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

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

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

Meas = Measurement Condition ref = Standard Condition

* Indicates non accredited

MPE = Maximum Permissible Error (Specified in Manufacturer's Specifications)

N/A = Not Available, Customer does not require a statement of conformity.

Certificate No : 24-AFM-177

Request No : Req-2024-1862

Decision Rule for Statements of Conformity

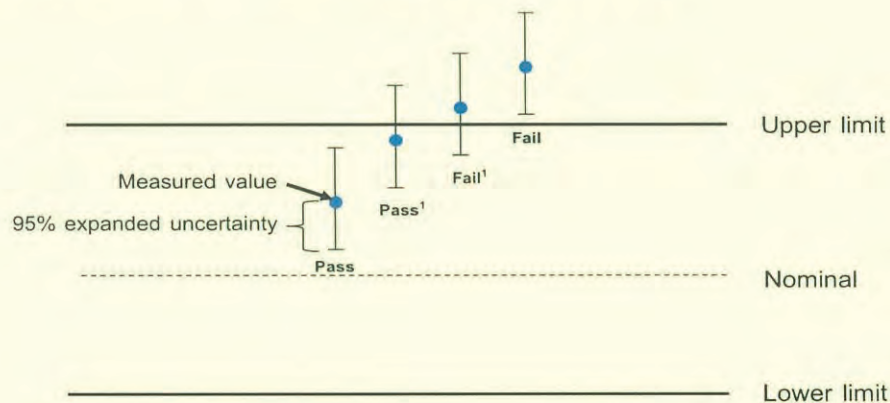
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09/2019; Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

Pass = The measurement result plus the expanded uncertainty with a 95% coverage probability were within the limit.

Pass¹ = The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.

Fail¹ = The measurement result was out of the limit. However, a portion of the expanded uncertainty of measurement at 95% is within the limit.

Fail = The measurement result plus the expanded uncertainty with a 95% coverage probability were outside the limit.



End of Certificate



Certificate of Calibration

Certificate No. C-010925-SGK_FS0145

Air Sampling Pump Detail

Equipment name : Personal Air Sampling Pump
Brand : Gilian
Model/Type : GilAir Plus

Equipment ID : SGK_FS0145
Serial No. : 20170410056
Calibration Date : 01-Sep-25
Next calibration date : 01-Dec-25

Reference Standard Low Flow Meter

Equipment name : Air Flow Meter
Brand : MesaLabs
Model/Type : Defender 510-L

Equipment ID : BKK_FS0619
Serial No. : 130026
Calibration Date : 9-Sep-24
Due Date : 9-Sep-25

Reference Standard High Flow Meter

Equipment name : Air Flow Meter
Brand : MesaLabs
Model/Type : Defender 510-M

Equipment ID : BKK_FS0614
Serial No. : 151114
Calibration Date : 9-Sep-24
Due Date : 9-Sep-25

Calibration Data

Air Sampling Pump setting (cc/min)	Reference Std. Flow Reading (cc/min)			Avg. (cc/min)	%Error acceptance	Acceptable range (cc/min)	Evaluation (Pass/ Fail)
	1	2	3				
Low Flow							
20	20.1	20.9	20.6	20.5	5%	19 - 21	Passed
50	50.2	49.7	51.4	50.4	5%	48 - 53	Passed
100	100.1	98.2	99.9	99.4	5%	95 - 105	Passed
200	198.3	200.3	199.7	199.4	5%	190 - 210	Passed
High Flow							
500	500.6	504.3	499.2	501.4	3%	485 - 515	Passed
1000	997.6	1002.3	1001.2	1000.4	3%	970 - 1030	Passed
2000	2001.3	1997.3	1996.5	1998.4	3%	1940 - 2060	Passed
2500	2496.5	2498.4	2499.2	2498.0	3%	2425 - 2575	Passed

END OF REPORT

Calibrated By: _____



(Mr. Apiwat Chanta)

SGK Field Services Scientist (2)

Issue date : 02-Sep-25

Approved By: _____



(Mr. Supot Salamteh)

Field Services Section Head



Certificate of Calibration

Certificate No. C-010925-SGK_FS0148

Air Sampling Pump Detail

Equipment name : Personal Air Sampling Pump
Brand : Gilian
Model/Type : GilAir Plus

Equipment ID : SGK_FS0148
Serial No. : 20170410060
Calibration Date : 01-Sep-25
Next calibration date : 01-Dec-25

Reference Standard Low Flow Meter

Equipment name : Air Flow Meter
Brand : MesaLabs
Model/Type : Defender 510-L

Equipment ID : BKK_FS0619
Serial No. : 130026
Calibration Date : 9-Sep-24
Due Date : 9-Sep-25

Reference Standard High Flow Meter

Equipment name : Air Flow Meter
Brand : MesaLabs
Model/Type : Defender 510-M

Equipment ID : BKK_FS0614
Serial No. : 151114
Calibration Date : 9-Sep-24
Due Date : 9-Sep-25

Calibration Data

Air Sampling Pump setting (cc/min)	Reference Std. Flow Reading (cc/min)			Avg. (cc/min)	%Error acceptance	Acceptable range (cc/min)	Evaluation (Pass/ Fail)
	1	2	3				
Low Flow							
20	20.1	20.2	20.3	20.2	5%	19 - 21	Passed
50	50.1	51.3	50.1	50.5	5%	48 - 53	Passed
100	102.1	100.1	103.4	101.9	5%	95 - 105	Passed
200	201.3	202.9	201.7	202.0	5%	190 - 210	Passed
High Flow							
500	503.4	504.6	502.1	503.4	3%	485 - 515	Passed
1000	999.7	998.4	1000.3	999.5	3%	970 - 1030	Passed
2000	1998.7	1996.4	1999.3	1998.1	3%	1940 - 2060	Passed
2500	2503.4	2502.3	2501.3	2502.3	3%	2425 - 2575	Passed

END OF REPORT

Calibrated By: _____

(Mr. Apiwat Chanta)

SGK Field Services Scientist (2)

Issue date : 02-Sep-25

Approved By: _____

(Mr. Supot Salamteh)

Field Services Section Head



Certificate of Calibration

Certificate No. C-010925-SGK_FS0160

Air Sampling Pump Detail

Equipment name : Personal Air Sampling Pump
Brand : Gilian
Model/Type : GilAir Plus

Equipment ID : SGK_FS0160
Serial No. : 20190710137
Calibration Date : 01-Sep-25
Next calibration date : 01-Dec-25

Reference Standard Low Flow Meter

Equipment name : Air Flow Meter
Brand : MesaLabs
Model/Type : Defender 510-L

Equipment ID : BKK_FS0619
Serial No. : 130026
Calibration Date : 9-Sep-24
Due Date : 9-Sep-25

Reference Standard High Flow Meter

Equipment name : Air Flow Meter
Brand : MesaLabs
Model/Type : Defender 510-M

Equipment ID : BKK_FS0614
Serial No. : 151114
Calibration Date : 9-Sep-24
Due Date : 9-Sep-25

Calibration Data

Air Sampling Pump setting (cc/min)	Reference Std. Flow Reading (cc/min)			Avg. (cc/min)	%Error acceptance	Acceptable range (cc/min)	Evaluation (Pass/ Fail)
	1	2	3				
Low Flow							
20	19.7	19.6	19.4	19.6	5%	19 - 21	Passed
50	49.8	49.9	49.7	49.8	5%	48 - 53	Passed
100	100.2	102.1	101.0	101.1	5%	95 - 105	Passed
200	197.0	198.0	201.3	198.8	5%	190 - 210	Passed
High Flow							
500	499.8	497.3	501.4	499.5	3%	485 - 515	Passed
1000	999.2	998.6	1000.0	999.3	3%	970 - 1030	Passed
2000	2003.6	2004.5	2002.1	2003.4	3%	1940 - 2060	Passed
2500	2497.3	2498.1	2499.3	2498.2	3%	2425 - 2575	Passed

END OF REPORT

Calibrated By:

(Mr. Apiwat Chanta)

SGK Field Services Scientist (2)

Issue date : 02-Sep-25

Approved By:

(Mr. Supot Salamteh)

Field Services Section Head



Certificate of Calibration

Certificate No. C-010925-SGK_FS0161

Air Sampling Pump Detail

Equipment name : Personal Air Sampling Pump	Equipment ID : SGK_FS0161
Brand : Gilian	Serial No. : 20190710138
Model/Type : GilAir Plus	Calibration Date : 01-Sep-25
	Next calibration date : 01-Dec-25

Reference Standard Low Flow Meter

Equipment name : Air Flow Meter	Equipment ID : BKK_FS0619
Brand : MesaLabs	Serial No. : 130026
Model/Type : Defender 510-L	Calibration Date : 9-Sep-24
	Due Date : 9-Sep-25

Reference Standard High Flow Meter

Equipment name : Air Flow Meter	Equipment ID : BKK_FS0614
Brand : MesaLabs	Serial No. : 151114
Model/Type : Defender 510-M	Calibration Date : 9-Sep-24
	Due Date : 9-Sep-25

Calibration Data

Air Sampling Pump setting (cc/min)	Reference Std. Flow Reading (cc/min)			Avg. (cc/min)	%Error acceptance	Acceptable range (cc/min)	Evaluation (Pass/ Fail)
	1	2	3				
Low Flow							
20	19.5	19.6	19.4	19.5	5%	19 - 21	Passed
50	49.8	49.7	48.1	49.2	5%	48 - 53	Passed
100	99.6	98.4	99.4	99.1	5%	95 - 105	Passed
200	200.1	198.0	201.3	199.8	5%	190 - 210	Passed
High Flow							
500	500.3	501.3	501.4	501.0	3%	485 - 515	Passed
1000	1002.1	998.6	1000.0	1000.2	3%	970 - 1030	Passed
2000	2003.6	2004.5	2002.1	2003.4	3%	1940 - 2060	Passed
2500	2505.0	2503.4	2501.3	2503.2	3%	2425 - 2575	Passed

----- END OF REPORT -----

Calibrated By: [Signature]

(Mr. Apiwat Chanta)

SGK Field Services Scientist (2)

Issue date : 02-Sep-25

Approved By: [Signature]

(Mr. Supot Salamteh)

Field Services Section Head



Certificate of Calibration

Certificate No. C-010925-SGK_FS0165

Air Sampling Pump Detail

Equipment name : Personal Air Sampling Pump
Brand : Gilian
Model/Type : GilAir Plus

Equipment ID : SGK_FS0165
Serial No. : 20190710142
Calibration Date : 01-Sep-25
Next calibration date : 01-Dec-25

Reference Standard Low Flow Meter

Equipment name : Air Flow Meter
Brand : MesaLabs
Model/Type : Defender 510-L

Equipment ID : BKK_FS0619
Serial No. : 130026
Calibration Date : 9-Sep-24
Due Date : 9-Sep-25

Reference Standard High Flow Meter

Equipment name : Air Flow Meter
Brand : MesaLabs
Model/Type : Defender 510-M

Equipment ID : BKK_FS0614
Serial No. : 151114
Calibration Date : 9-Sep-24
Due Date : 9-Sep-25

Calibration Data

Air Sampling Pump setting (cc/min)	Reference Std. Flow Reading (cc/min)			Avg. (cc/min)	%Error acceptance	Acceptable range (cc/min)	Evaluation (Pass/ Fail)
	1	2	3				
Low Flow							
20	19.6	20.2	20.3	20.0	5%	19 - 21	Passed
50	50.2	49.2	50.2	49.9	5%	48 - 53	Passed
100	99.2	97.8	99.1	98.7	5%	95 - 105	Passed
200	198.9	198.8	198.3	198.7	5%	190 - 210	Passed
High Flow							
500	504.5	502.2	503.4	503.4	3%	485 - 515	Passed
1000	994.6	991.2	994.2	993.4	3%	970 - 1030	Passed
2000	2008.5	2000.4	2005.2	2004.7	3%	1940 - 2060	Passed
2500	2508.4	2497.5	2506.4	2504.1	3%	2425 - 2575	Passed

----- END OF REPORT -----

Calibrated By: _____

(Mr. Apiwat Chanta)

SGK Field Services Scientist (2)

Issue date : 02-Sep-25

Approved By: _____

(Mr. Supot Salamteh)

Field Services Section Head

CALIBRATION CERTIFICATE

Issued Date : 13-Jan-2025

Certificate No. : 25MA0126

CSR No. : A101/05028

Page. : 1 of 3

Customer : ALS Laboratory Group (Thailand) Co., Ltd
114/1 Moo 8, Karnchanawanich Rd. Tambon, Ban Phru,
Amphoe Hat Yai, Songkhla, 90250

Calibration Place : Customer Laboratory

Instrument Name : Analytical Balance

Manufacturer : Sartorius

Model : MCE125P-2S00-U

Serial No. : 0038105237

ID No. : SGK_CL0077

Resolution : 0.00001 g / 0.0001 g

Received Date : 10-Jan-2025

Calibrated Date : 10-Jan-2025

Ambient Temperature : $(30 \pm 10) ^\circ\text{C}$

Relative Humidity : $(50 \pm 20) \%$

REVIEW BY	
APPROVED BY	
NEXT CAL. DATE	10/1/26

Calibration Method Used :

This instrument was calibrated using the Calibration In - house method : SCAL.WI.001 based on UKAS LAB 14 : 2015

The Southern Calibration Service Co.,Ltd.calibration control system complies with requirement of ISO/IEC 17025:2017

Traceability of measurement :

This Certificate is traceable to the International and /or national standards which realize the units of measurement according to the International System of Unit (SI) through :

- SCaL : Sounthern Calibration Service Co., Ltd.,

Calibrated by : Hadbordee Dettawee

Approved by :

Imron Rattanaylum / Technical Manager



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 Southern Calibration Service Co., Ltd.

Details of Calibration

1. Reference Standard Equipment Used:

Equipment	Model	Serial No.	Cert. no.	Due Date
Standard Weight Set	2 mg - 1 kg	11119514/01	24SWS001	3-Jul-2025

2. The results reported in this certificate refer to the condition of the instrument on the date of calibration and carry no implication regarding the longterm stability of instrument.

3. This certificate is not certified any commercial transaction

4. Condition of Item : normal condition , no indication for any damage or mulfunction

Result of Calibration :, (✓) Without Adjustment () After Adjustment

1. Repeatability

Nominal Value (g)	Standard Deviation (g)
5	0.00000
50	0.00000
100	0.0000

2. Effect of tare

Nominal Value (g)	Standard Value (g)	Balance Reading (g)	Correction (g)
10	10.00004	10.00000	0.00004
20	20.00000	20.00000	0.00000
30	30.00005	30.00000	0.00005
40	40.00006	40.00000	0.00006
50	50.00000	50.00000	0.00000

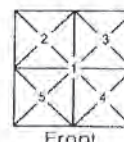
Result of Calibration :

3. Off-centre loading

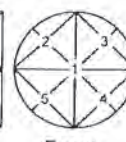
A mass approximately 50g was placed on a pan and moved to various position .

The balance reading obtained are given in the table.

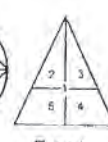
Position					Maximum Difference (g)
1	2	3	4	5	
50.00000	50.00000	50.00000	50.00000	50.00000	0.00000



Front



Front



Front

4. Departure from nominal value

Nominal Value (g)	Standard Value (g)	UUC Reading (g)	Correction (g)	Uncertainty ($\pm$ g)	Coverage Factor (k)
0.01	0.01001	0.01000	0.00001	0.000024	2.0
0.05	0.05001	0.05000	0.00001	0.000024	2.0
0.1	0.10002	0.10000	0.00002	0.000024	2.0
0.5	0.50002	0.50000	0.00002	0.000024	2.0
1	1.00003	1.00000	0.00003	0.000024	2.0
2	2.00003	2.00000	0.00003	0.000024	2.0
5	5.00003	5.00000	0.00003	0.000027	2.0
10	10.00004	10.00000	0.00004	0.000033	2.0
20	20.00000	20.00000	0.00000	0.000048	2.0
30	30.00005	30.00000	0.00005	0.000078	2.0
40	40.00006	40.00000	0.00006	0.000080	2.0
50	50.00000	50.00000	0.00000	0.000096	2.0
60	60.00000	60.00000	0.00000	0.00011	2.0
70	70.00000	70.00000	0.00000	0.00012	2.0
80	80.00000	80.00000	0.00000	0.00014	2.0
90	90.00001	90.00000	0.00001	0.00015	2.0
100	100.00000	100.00000	0.00000	0.00017	2.0
110	110.00000	110.00000	0.00000	0.00024	2.0
120	120.00000	120.00000	0.00000	0.00024	2.0

- UUC = Unit Under Calibration

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

...End...



REVIEW BY

APPROVED BY

NEXT CAL. DATE

24/01/26

Ref. Job number ; #4729

Test Report

Customers	: ALS Laboratory Group (Thailand) Co., Ltd.	Manufacturer	: HACH
Equipment	: Colorimeter	ID No.	: SGK_FS0049
Controller Model	: ☒ DR300 ☐ Pocket II	Sensor Serial No.	: -
Controller Serial No.	: 19040A000507	Period	: 1 Year
Date of test	: 24/01/2025	Humidity	: 62.0 %RH
Environment temperature	: 24.9 °C		

Results**Instrument Checked**

Item	Characteristic	Before	After	Remark
1	Visual Inspect	☒ Pass ☐ Fail	☒ Pass ☐ Fail	
2	Power Supply (4.5 – 6.0 VDC)	5.8 VDC	5.8 VDC	
3	Display Check	☒ Pass ☐ Fail	☒ Pass ☐ Fail	
4	Keyboard Check	☒ Pass ☐ Fail	☒ Pass ☐ Fail	
5	Function System Program	☒ Pass ☐ Fail	☒ Pass ☐ Fail	

Warning and Error Checked

Item	Event	Before	After
6	Error list	☒ None ☐ Appear	☒ None ☐ Appear

Check with Standard

Item	Characteristic	Before	After	Remark
	DPD-CHLORINE-LR			
7	Blank (0.0 mg/l)	0.00 mg/l	0.00 mg/l	
8	Standard Cl2 No. 1 (0.24 ± 0.09 mg/l)	0.26 mg/l	0.26 mg/l	
9	Standard Cl2 No. 2 (0.91 ± 0.1 mg/l)	0.93 mg/l	0.93 mg/l	
10	Standard Cl2 No. 3 (1.59 ± 0.14 mg/l)	1.62 mg/l	1.62 mg/l	
	DPD-CHLORINE-HR			
11	Blank (0.0 mg/l)	0.0 mg/l	0.0 mg/l	
12	Standard Cl2 No. 1 (2.3 ± 0.2 mg/l)	2.3 mg/l	2.3 mg/l	
13	Standard Cl2 No. 2 (3.9 ± 0.3 mg/l)	4.0 mg/l	4.0 mg/l	
14	Standard Cl2 No. 3 (7.1 ± 0.6 mg/l)	7.1 mg/l	7.1 mg/l	

Summary of checked

- ☒ The instrument can work normally and efficiently. (เครื่องมือวัดสามารถทำงานได้ปกติและมีประสิทธิภาพ)
☐ The instrument can work but it's requiring to maintenance. (เครื่องมือวัดสามารถทำงานได้แต่ต้องบำรุงรักษา)
☐ The instrument could not work it's requiring to repair. (เครื่องมือวัดไม่สามารถทำงานได้และต้องการซ่อมบำรุง)

Remark:

Standard Equipment Used

Equipment	Equipment I.D.	
Standard Absorbance DPD-CHLORINE-LR	Lot No. A4150	Exp date : Jun-26
Standard Absorbance DPD-CHLORINE-HR	Lot No. A4162	Exp date : Jun-26
Digital multi meter	S/N: 97820680	Due date: 15-Jul-25
Thermo hygrometer	S/N: 41432443	Due date: 29-Oct-25

Test By :



(Mr.Putthipong Duangsawat)

Service Engineer

Approved by :



(Suanun Sartyangkool)

Assistant Service Division Manager



Agilent Technologies

Agilent Technologies (Thailand) Limited
U CHU LIANG BLDG. 22/F UNIT A,D
968 RAMA 4 ROAD, SILOM, BANGRAK
Bangkok 10500 Thailand

Tel: +662 637 6363
Fax: +662 632 4334
Email: ccc-smt@agilent.com
Website: www.agilent.com/chem

Customer Contact:

ALS Laboratory Group (Thailand) Co
Ltd Head Office

104 Phatthanakan 40 Phatthanakan Rd
Khwaeng Phatthanakan Khet Suan

TAX ID : 0105540004859

tanyatorn.mongkonjirawut@alsglobal.com
027603077

Invoice To:

ALS Laboratory Group (Thailand) Co
Ltd Head Office

104 Phatthanakan 40 Phatthanakan Rd
Khwaeng Phatthanakan Khet Suan

Payer:

ALS Laboratory Group (Thailand) Co
Ltd Branch Number 0002
114/1 Moo8 Banplu Subdistric Hat
Yai District

SONGKHLA 90250

Delivery Site:

ALS Laboratory Group (Thailand) Co
Ltd
Branch Number 0002
114/1 Moo8 Banplu Subdistric Hat
Yai District

Location:

Room
Bldg
Lab
Dept

SERVICE REPORT

Customer Purchase Order Number:	Customer Number: 70371013
Service Request:	Service Request Date:
Service Order: 6007493912	Service Confirmation: 6906126918

REVIEW BY	
APPROVED BY	
NEXT CAL. DATE	3/8/26

Direct Inquiries to:

Contact Name:	Customer Contact Center
Contact E-mail:	ccc-smt@agilent.com
Contact Telephone:	+662 637 6363
Contact Fax:	+662 632 4334

products | applications | software | services

Learn more about Agilent's Special Offers, Products, Services and our
full range of laboratory productivity solutions optimized for your
applications and workflows. Visit us at www.agilent.com/chem

Agilent Technologies (Thailand) Limited. Head Office
U Chu Liang Bldg. 22/F Unit A,D
968 Rama 4 Road, Silom, Bangrak,
Bangkok 10500 Thailand
Tax ID : 0105542068218

Citibank N.A. Bangkok Branch
399 Interchange 21 Building, Sukhumvit Road, Klongtoey Nau
Sub-district, Wattana District, Bangkok 10110 Thailand
Acc. No: 012-4452-007 ;
THB:Krung Thai Bank PCL
Siam Square Br.,416/1-2 Rama I Rd.,Pathumwan, BKK 10330
Thailand

ORIGINAL

Service Confirmation Number: 6906126918

Service Confirmation Date: 04.02.2025

Service Instrument:

Model Number	Model Description	Serial Number	System Handle	Parent Asset
SYS-IM-7900	ICPMS 7900 System			
G7201C	ICP-MS MassHunter SW only (excludes PC)	USH3799575	ICP MS 7900	SYS-IM-7900
G8403A	Agilent 7900 ICP-MS	JP16511669	ICP MS 7900	SYS-IM-7900
G8411A	ISIS 3 for Agilent 7850/7900/8900	JP16510379	ICP MS 7900	SYS-IM-7900

Service Items:

Item	Service/Part #	Description	Qty	Entitlement	Service Start	Service End
1000	EOQ	Enterprise Operational Qualification	1.00	Agreement Entitlement 100 % covered	03.02.2025	04.02.2025
1010	5185-5850	ICP-MS Checkout Solutions	1.00	Agreement Entitlement 100 % covered		

Additional Information:

Service Confirmation Number: 6906126918

Service Confirmation Date: 04.02.2025

Service Information:

Problem Description: *PR-OQ-ICP MS 7900-5001391286		
Service Provided: OQ_SGK_CL0048 Perform oq test . Sensitivity, resolution background both He and H2 mode. Stability test all pass. Sent oq report to customer. Let s customer test run sample.		
Service Overview Code: Reason Code: Scheduled Service Diagnosis Code: Scheduled Service Resolution Code: Scheduled Service		
Reported Hours: 7.0	Travel Hours: 2.0	
Customer Field Service Representative Name: Worawit Timakul	Customer Field Service Representative Signature: 	Date: 04 Feb 2025
Customer Name: TANYATORN MONGKONJIRAWUT	Customer Signature: 	Date: 04 Feb 2025
Additional Comments:		

CALIBRATION CERTIFICATE

Issued Date : 4-Jul-2024

Certificate No. : 24TH2757

CSR No. : A150/07473

Page. : 1 of 3

Customer : ALS Laboratory Group (Thailand) Co., Ltd
114/1 Moo 8, Karnchanawanich Rd. Tambon, Ban Phru,
Amphoe Hat Yai, Songkhla, 90250

Calibration Place : Chemical Laboratory

Instrument Name : Cold Room

Manufacturer : Danfoss

Model : N/A

Serial No. : N/A

ID No. : SGK_CL0065

Resolution : 0.1 °C

Received Date : 1-Jul-2024

Calibrated Date : 1-Jul-2024

Ambient Temperature : (30 ± 10) °C

Relative Humidity : (50 ± 30) %

REVIEW BY

APPROVED BY

NEXT CAL. DATE

1/01/26

Calibration Method Used :

This instrument was calibrated using the Calibration In - house method : SCAL.WI.012 based on GLA - 20

The Southern Calibration Service Co.,Ltd.calibration control system complies with requirement of ISO/IEC 17025:2017

Traceability of measurement :

This Certificate is traceable to the International and /or national standards which realize the units of measurement according to the International System of Unit (SI) through :

- TISTR : Thailand Institute of Scientific and Technological Research

Calibrated by : Ibrorhim Saleemin

Approved by :

Imron Rattanaylum / Technical Manager



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 Southern Calibration Service Co., Ltd.

Details of Calibration

1. Reference Standard Equipment Used:

Equipment	Model	Serial No.	Cert. no.	Due Date
Data Acquisition/Switch Unit	34970A	MY58009813	PSL-T0707-1/67	22-May-2025

2. The results reported in this certificate refer to the condition of the instrument on the date of calibration

and carry no implication regarding the longterm stability of instrument.

3. This certificate is not certified any commercial transaction

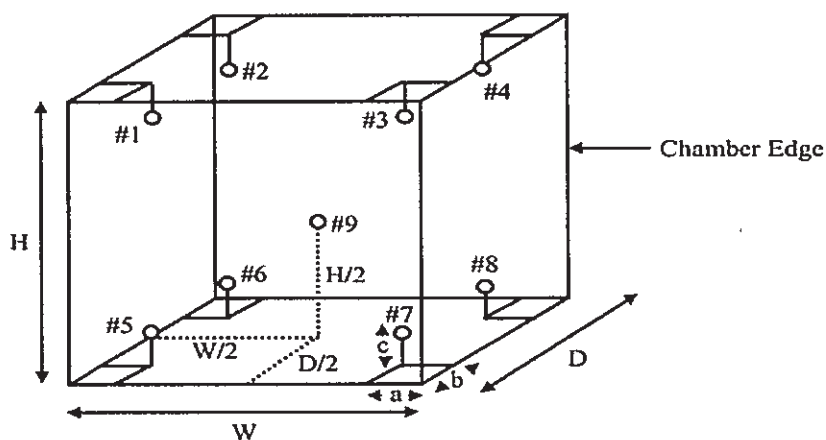
4. Condition of Item : normal condition , no indication for any damage or malfunction

Result of Calibration :.

(☒) Without Adjustment

(☐) After Adjustment

1. Sensor Installation Diagram



Sensor Installation Details

a = 5.0 cm

b = 5.0 cm

c = 5.0 cm

Dimension of the chamber

W = 40.0 cm

H = 40.0 cm

D = 33.0 cm



Certificate No. : 24TH2757

CSR No. : A150/07473

Page. : 3 of 3

Result of Calibration :

2. Temperature Measurement Accuracy Test

The measurement results of the Cold Room and associates are reported in the manner as shown below

Cal point (°C)	Measured Standard Temperature At Spread Locations (°C)									Uncertainty (± °C)
	#1	#2	#3	#4	#5	#6	#7	#8	Ref. 9	
4	3.90	4.04	3.72	3.78	3.69	3.76	3.55	3.43	3.34	0.39

3. Performance Result

The performance of the Cold Room are reported as shown below

Cal point (°C)	UUC Setting (°C)	UUC Reading (°C)	Temperature Stability (± °C)	Temperature Uniformity (°C)	Overall Variation (°C)
4	4.0	4.0	0.10	0.75	0.75

- UUC = Unit Under Calibration

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

... End ...

CALIBRATION CERTIFICATE

Issued Date : 22-Oct-2024

Certificate No. : 24CH0526

CSR No. : A163/08133

Page : 1 of 2

Customer : ALS Laboratory Group (Thailand) Co., Ltd
114/1 Moo 8, Karnchanawanich Rd. Tambon, Ban Phru,
Amphoe Hat Yai, Songkhla, 90250

Calibration Place : Chemical Laboratory

Instrument Name : pH meter

Manufacturer : Mettler Toledo

Model : S220

Serial No. : B625631849

ID No. : SGK_CL0030

Electrode No. : 2281592

Received Date : 19-Oct-2024

Calibrated Date : 19-Oct-2024

Ambient Temperature : $(25 \pm 3) ^\circ\text{C}$

Relative Humidity : $(55 \pm 15) \%$

REVIEW BY

APPROVED BY

NEXT CAL. DATE 19/4/26

Calibration Method Used :

This instrument was calibrated using the Calibration In - house method ; SCAL.WI.008 based on direct measurement by using certified reference Material (CRM)

The Southern Calibration Service Co.,Ltd.calibration control system complies with requirement of ISO/IEC 17025:2017

Traceability of measurement :

This Certificate is traceable to the International and /or national standards which realize the units of measurement according to the International System of Unit (SI) through :

- CPAchem : CPAchem Ltd
- WK : WK Electric Co., Ltd.
- SCaL : Sounthern Calibration Service Co., Ltd.,

Calibrated by : Alisara Ma

Approved by :

Imron Rattanaylum / Technical Manager



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 Southern Calibration Service Co., Ltd.

Details of Calibration

1. Reference Standard Equipment Used:

Equipment	Model	Serial No.	Cert. no.	Due Date
Standard Solution	4.000	61310674	1042701	26-Oct-2025
Standard Solution	7.000	61314184	1042700	26-Oct-2025
Standard Solution	10.01	61313804	1042702	26-Oct-2025
Temperature/Electrical Calibrator	MC2-TE	14987	WK2106-299-223	31-May-2025
Digital Thermometer With Sensor	DP-77	1.360896	24SDTH005	7-Aug-2025

2. The results reported in this certificate refer to the condition of the instrument on the date of calibration and carry no implication regarding the longterm stability of instrument.

3. This certificate is not certified any commercial transaction

4. Condition of Item : normal condition , no indication for any damage or malfunction

Result of Calibration :

1. Electrical Measurement

Applied Voltage (mV)	pH meter Reading		Correction (mV)	Uncertainty (± mV)
	(mV)	(pH)		
177.48	177.5	4.00	-0.02	0.17
0.00	0.0	7.00	0.00	0.13
-177.48	-177.5	10.00	0.02	0.17

2. Before Sample Test Measurement

Standard Buffer Solutions (pH)	pH meter Reading		Correction (pH)	Uncertainty (± pH)
	(pH)	(mV)		
4.007	3.99	178.1	0.017	0.0092
6.976	7.02	1.7	-0.044	0.019
10.009	9.96	-169.6	0.049	0.038

3. After Sample Test Measurement

Standard Buffer Solutions (pH)	pH meter Reading		Correction (pH)	Uncertainty (± pH)
	(pH)	(mV)		
4.007	3.99	177.7	0.017	0.0092
6.976	7.01	3.7	-0.034	0.019
10.009	10.00	-169.0	0.009	0.038

4. Temperature Measurement

Cal Point (°C)	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
25	25.021	25.0	0.02	0.060

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

... End ...

CALIBRATION CERTIFICATE

Issued Date : 13-Jan-2025

Certificate No. : 25MA0125

CSR No. : A101/05028

Page. : 1 of 3

Customer : ALS Laboratory Group (Thailand) Co., Ltd
114/1 Moo 8, Karnchanawanich Rd. Tambon, Ban Phru,
Amphoe Hat Yai, Songkhla, 90250

Calibration Place : Customer Laboratory

Instrument Name : Analytical Balance

Manufacturer : Sartorius

Model : MSE224S-100-DU

Serial No. : 34705158

ID No. : SGK_CL0045

Resolution : 0.0001 g

Received Date : 10-Jan-2025

Calibrated Date : 10-Jan-2025

Ambient Temperature : $(30 \pm 10) ^\circ\text{C}$

Relative Humidity : $(50 \pm 20) \%$

REVIEW BY

APPROVED BY

NEXT CAL. DATE 10/1/26

Calibration Method Used :

This instrument was calibrated using the Calibration In - house method : SCAL.WI.001 based on UKAS LAB 14 : 2015

The Southern Calibration Service Co.,Ltd.calibration control system complies with requirement of ISO/IEC 17025:2017

Traceability of measurement :

This Certificate is traceable to the International and /or national standards which realize the units of measurement according to the International System of Unit (SI) through :

- SCaL : Sounthern Calibration Service Co., Ltd.,

Calibrated by : Hadbordee Dettawee

Approved by :

Imron Rattanaylum / Technical Manager



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 Southern Calibration Service Co., Ltd.

Details of Calibration

1. Reference Standard Equipment Used;

Equipment	Model	Serial No.	Cert. no.	Due Date
Standard Weight Set	2 mg - 1 kg	11119514/01	24SWS001	3-Jul-2025

2. The results reported in this certificate refer to the condition of the instrument on the date of calibration and carry no implication regarding the longterm stability of instrument.

3. This certificate is not certified any commercial transaction

4. Condition of Item : normal condition , no indication for any damage or malfunction

Result of Calibration :. (✓) Without Adjustment () After Adjustment

1. Repeatability

Nominal Value (g)	Standard Deviation (g)
10	0.00000
20	0.00000
200	0.00000

2. Effect of tare

Nominal Value (g)	Standard Value (g)	Balance Reading (g)	Correction (g)
20	20.0000	20.0000	0.0000
40	40.0001	40.0000	0.0001
60	60.0000	60.0000	0.0000
80	80.0001	80.0000	0.0001
100	100.0000	100.0000	0.0000

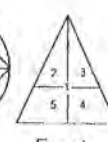
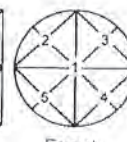
Result of Calibration :

3. Off-centre loading

A mass approximately 100g was placed on a pan and moved to various position .

The balance reading obtained are given in the table.

Position					Maximum Difference (g)
1	2	3	4	5	
100.0000	100.0000	100.0000	100.0000	100.0001	0.0001



4. Departure from nominal value

Nominal Value (g)	Standard Value (g)	UUC Reading (g)	Correction (g)	Uncertainty ($\pm$ g)	Coverage Factor (k)
0.01	0.0100	0.0100	0.0000	0.00008	2.0
0.1	0.1000	0.1000	0.0000	0.00008	2.0
0.5	0.5000	0.5000	0.0000	0.00008	2.0
1	1.0000	1.0000	0.0000	0.00008	2.0
2	2.0000	2.0000	0.0000	0.00008	2.0
5	5.0000	5.0000	0.0000	0.00009	2.0
10	10.0000	10.0000	0.0000	0.00009	2.0
20	20.0000	20.0000	0.0000	0.00009	2.0
40	40.0001	40.0000	0.0001	0.00011	2.0
50	50.0000	50.0000	0.0000	0.00013	2.0
60	60.0000	60.0000	0.0000	0.00013	2.0
80	80.0000	80.0000	0.0000	0.00016	2.0
100	100.0000	100.0001	-0.0001	0.00017	2.0
120	120.0000	120.0001	-0.0001	0.00024	2.0
140	140.0001	140.0000	0.0001	0.00024	2.0
160	160.0000	160.0000	0.0000	0.00026	2.0
180	180.0000	180.0000	0.0000	0.00029	2.0
200	200.0000	200.0000	0.0000	0.00030	2.0

- UUC = Unit Under Calibration

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

...End...



CALIBRATION CERTIFICATE

Issued Date : 22-Oct-2024

Certificate No. : 24TH4295

CSR No. : A163/08133

Page. : 1 of 3

Customer : ALS Laboratory Group (Thailand) Co., Ltd
114/1 Moo 8, Karnchanawanich Rd. Tambon, Ban Phru,
Amphoe Hat Yai, Songkhla, 90250

Calibration Place : Chemical Laboratory
Instrument Name : Hot Air Oven
Manufacturer : Memmert
Model : UF110
Serial No. : B416.3387
ID No. : SGK_CL0024
Resolution : 0.1 °C
Received Date : 19-Oct-2024
Calibrated Date : 19-Oct-2024
Ambient Temperature : (30 ± 10) °C
Relative Humidity : (50 ± 30) %

REVIEW BY	[Redacted]
APPROVED BY	[Redacted]
NEXT CAL. DATE	19/04/2026

Calibration Method Used :

This instrument was calibrated using the Calibration In - house method : SCAL.WI.012 based on GLA - 20

The Southern Calibration Service Co.,Ltd.calibration control system complies with requirement of ISO/IEC 17025:2017

Traceability of measurement :

This Certificate is traceable to the International and /or national standards which realize the units of measurement according to the International System of Unit (SI) through :

- TISTR : Thailand Institute of Scientific and Technological Research

Calibrated by : Ibrorhim Saleemin

Approved by :

Imron Rattanaylum / Technical Manager



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 Southern Calibration Service Co., Ltd.

Details of Calibration

1. Reference Standard Equipment Used:

Equipment	Model	Serial No.	Cert. no.	Due Date
Data Acquisition/Switch Unit	34970A	MY58009813	PSL-T0707-1/67	22-May-2025

2. The results reported in this certificate refer to the condition of the instrument on the date of calibration

and carry no implication regarding the longterm stability of instrument.

3. This certificate is not certified any commercial transaction

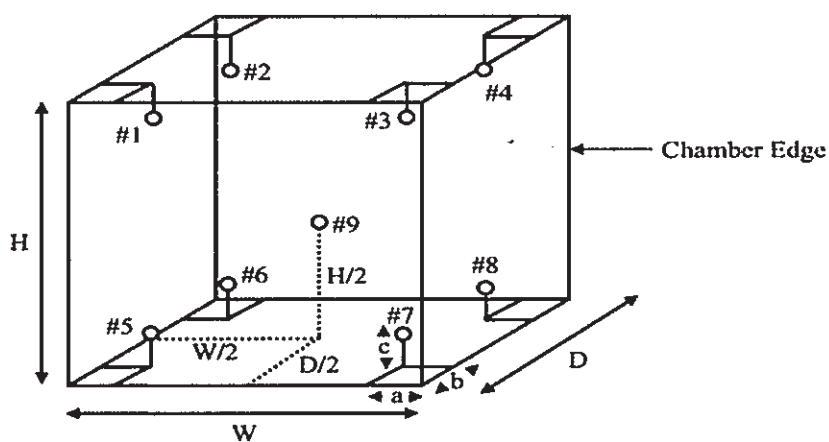
4. Condition of Item : normal condition , no indication for any damage or malfunction

Result of Calibration .:

(✓) Without Adjustment

() After Adjustment

1. Sensor Installation Diagram



Sensor Installation Details

a = 5.0 cm

b = 5.0 cm

c = 5.0 cm

Dimension of the chamber

W = 55.0 cm

H = 48.0 cm

D = 40.0 cm

Result of Calibration :

2. Temperature Measurement Accuracy Test

The measurement results of the Hot Air Oven and associates are reported in the manner as shown below

Cal point (°C)	Measured Standard Temperature At Spread Locations (°C)									Uncertainty (± °C)
	#1	#2	#3	#4	#5	#6	#7	#8	Ref. 9	
40	40.36	40.40	40.51	40.43	40.05	40.24	40.09	40.14	39.75	0.38
70	70.27	70.30	70.45	70.24	70.24	70.43	70.29	70.30	69.95	0.36
103	102.94	102.90	103.55	102.96	103.22	103.14	103.10	103.01	102.88	0.36
104	104.15	103.99	104.27	104.06	104.09	104.23	104.26	104.15	103.90	0.36
105	105.04	104.90	105.05	104.87	104.91	104.80	104.82	104.98	104.70	0.36
180	179.19	178.93	179.82	179.10	179.27	179.68	179.12	179.73	179.12	0.41

3. Performance Result

The performance of the Hot Air Oven are reported as shown below

Cal point (°C)	UUC Setting (°C)	UUC Reading (°C)	Temperature Stability (± °C)	Temperature Uniformity (°C)	Overall Variation (°C)
40	40.0	40.0	0.20	0.84	0.84
70	70.0	70.0	0.10	0.59	0.59
103	103.0	103.0	0.20	0.73	0.74
104	104.0	104.0	0.20	0.47	0.56
105	105.0	105.0	0.20	0.44	0.46
180	180.0	180.0	0.50	0.86	1.11

- UUC = Unit Under Calibration

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

... End ...

CALIBRATION CERTIFICATE

Issued Date : 13-Jan-2025

Certificate No. : 25TH0227

CSR No. : A101/05028

Page. : 1 of 3

Customer : ALS Laboratory Group (Thailand) Co., Ltd
114/1 Moo 8, Kamchanawanich Rd. Tambon, Ban Phru,
Amphoe Hat Yai, Songkhla, 90250

Calibration Place : Customer Laboratory

Instrument Name : Liquid Bath

Manufacturer : Memmert

Model : WNE29

Serial No. : L616.0538

ID No. : SGK_CL0035

Resolution : 0.1 °C

Received Date : 10-Jan-2025

Calibrated Date : 10-Jan-2025

Ambient Temperature : (30 ± 10) °C

Relative Humidity : (50 ± 30) %

REVIEW BY	
APPROVED BY	
NEXT CAL. DATE	10/7/26

Calibration Method Used :

This instrument was calibrated using the Calibration In - house method : SCAL.WI.014 based on ASTM E 715 : 1980 (reapproved 2001)

The Southern Calibration Service Co.,Ltd.calibration control system complies with requirement of ISO/IEC 17025:2017

Traceability of measurement :

This Certificate is traceable to the International and /or national standards which realize the units of measurement according to the International System of Unit (SI) through :

- TISTR : Thailand Institute of Scientific and Technological Research

Calibrated by : Ibrorhim Saleemin

Approved by :

Imron Rattanaylum / Technical Manager



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 Southern Calibration Service Co., Ltd.

Details of Calibration

1. Reference Standard Equipment Used:

Equipment	Model	Serial No.	Cert. no.	Due Date
Data Acquisition/Switch Unit	34970A	MY58009813	PSL-T0707-1/67	22-May-2025

2. The results reported in this certificate refer to the condition of the instrument on the date of calibration

and carry no implication regarding the longterm stability of instrument.

3. This certificate is not certified any commercial transaction

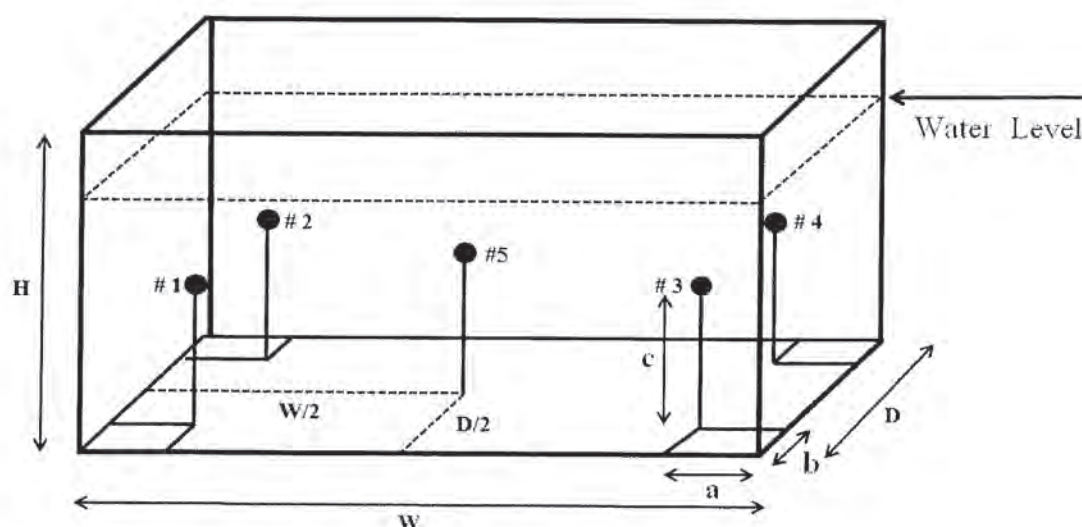
4. Condition of Item : normal condition , no indication for any damage or malfunction

Result of Calibration :

(☒) Without Adjustment

(☐) After Adjustment

1. Sensor Installation Diagram



Sensor Installation Details

a = 5 cm

b = 5 cm

c = 5 cm

Dimension of the chamber

W = 59.0 cm

H = 14.0 cm

D = 35.0 cm

Result of Calibration :

2. Temperature Measurement Accuracy Test

The measurement results of the Liquid Bath and associates are reported in the manner as shown below

Cal point (°C)	Measured Standard Temperature At Spread Locations (°C)					Uncertainty (± °C)
	#1	#2	#3	#4	Ref.5	
80	80.05	80.07	79.98	80.05	80.06	0.17

3. Performance Result

The performance of the Liquid Bath are reported as shown below

Cal point (°C)	UUC Setting (°C)	UUC Reading (°C)	Temperature Stability (± °C)	Temperature Uniformity (°C)	Overall Variation (°C)
80	80.0	80.0	0.20	0.17	0.26

- UUC = Unit Under Calibration

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

... End ...



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



Certificate of Calibration

Cert.No.: 25CH155

Page.: 1 of 3

Equipment : pH Meter
Manufacturer : Mettler Toledo
Model : S2Field Kit
Serial No. : B731459205
ID No. : SGK_FS0019
Condition As-Received: Used Item
Received Date : 03 February 2025
Calibration Date : 04 February 2025
Reference : 2502-0019DSC-3
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.
Songkhla Branch.
114/1 Moo 8 Karnchanawanich Rd.,
T.Ban Phru, A.Hat Yai, Songkhla 90250 Thailand

REVIEW BY

APPROVED

NEXT CAL DATE..... 04/02/26

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

Calibrated by : Walalak Sirithean

Approved by :

Approved Signatory

- () Chakrit Waewwanjua
() Ponpan Paipim
(✓) Saithip Meangmai

Issue Date : 5 February 2025

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.



Cert.No.: 25CH155

Page.: 2 of 3

Condition of this calibration result

1. Reference Standard Instrument

<u>Instrument</u>	<u>Serial No.</u>	<u>ID No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
1)Document Process Calibrator	54030049	130RC116	24E2759	25 Aug 2025
2)Ref. Standard Thermometer	4982054	110RC044	24I757	14 July 2025

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

2. Certified Reference Materials :The measurement results are traceable to SI through Hach Lenge GmbH Ltd.,
Deutsche Akkreditierungsstelle, Accredited No.D-RM-15184-01-00
:The measurement results are traceable to SI through CPA chem Ltd.,
ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

<u>Buffer Solution</u>	<u>Manufacturer</u>	<u>Lot No.</u>	<u>Exp. date</u>
pH 4.008	CPA chem	1034203	27 Sep 2026
pH 6.999	Hach Lenge GmbH	C03220	29 Oct 2026
pH 10.010	CPA chem	1066669	18 Jan 2026

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

Calibration Results

Function : mV Measurement

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

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (±mV)	Coverage factor <i>k</i>
	pH	mV	mV	pH		
pH Meter S/N.: B731459205	4.00	177.48	177	4.00	0.58	2.00
	7.00	0.00	0	7.00	0.58	2.00
	10.00	-177.48	-178	10.00	0.58	2.00



Cert.No.: 25CH155

Page.: 3 of 3

Calibration Results

Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH Measurement ($\pm$)	Coverage factor k
pH Electrode S/N.: 2234848	4.008	4.01	160	0.0071	2.00
	6.999	7.00	-15	0.0095	2.00
	10.010	10.01	-187	0.0092	2.00

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : InLabExpert Go-ISM

- Serial No. : 2234848

Dimension of probe

- Length : 120 mm.

- Diameter : 12 mm.

- Immersion Depth : 100 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement ($\pm$ °C)	Coverage factor k
25.0	25.000	25.2	0.200	0.13	2.00
45.0	45.001	45.3	0.299	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 %.

-o0o-



Calibration Instrument Report

Instrument: Automated Discrete Analyzer

Manufacturer: AMS

Model: SmartChem 600

Serial number: 2401055

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

Address: 104 Phatthanakan 40 Alley, Phatthanakan, Suan Luang, Bangkok 10250

Calibration date: 3 Sep 2025

Place: ALS Laboratory Group (Thailand) Co., Ltd.

REVIEW BY ..	
APPROVED BY ..	
NEXT CAL. DATE	3/9/2026

Check fluid to validate the correct functioning of the instrument

INTENDED USE

Check fluid to validate the correct functioning of the instrument.

Purpose

The purpose of this document is to aim at the correct execution of the method and the installation of the Check fluid to validate the correct functioning of the instrument.

COMPOSITION

Fluidic Test CHECK-01 20 x 4.5 mL (liquid) Lot number: 45751 Expiry date: 2027-04

PROCEDURE

The reagent is ready to use. Check fluid to validate the correct functioning of the instrument following method CHECK-01 and WORKPLAN CHECK01 DILUTION.

Results For the correct operation of the machine, the expected results are as follows:

1. Evaluation of calibration Results: R^2

	R^2
Result	1
Range	>0.995 - 1

2. Evaluation of Samples Results:

Dilution	Replicates	Results mg/L	Range	CV% calculated	CV%
1/1	x10	0.604	0.599 – 0.610	0.17	≤ 1
1/10	x10	0.611	0.590 – 0.625	1.37	≤ 2
1/20	x10	0.643	0.535 – 0.675	3.49	≤ 5
1/50	x10	0.689	0.510 – 0.750	7.70	≤ 10
1/75	x10	0.758	0.500 – 0.895	11.11	≤ 15

Validation by (...
Apirom Ekviriyakul



แบบฟอร์มการประเมินเครื่อง Discrete Analyzer หลังการสอบเทียบ

ชื่อเครื่องมือ :Discrete Analyzer

ID No. BKK_EN0438

S/N :2401055

Parameter	Range	Test Results	Pass	Fail	Remark
Evaluation of calibration	>0.995 -1	1.00	☒	☐	
CV% calculated Dilution1/1	≤ 1	0.17	☒	☐	
CV% calculated Dilution1/10	≤ 2	1.4	☒	☐	
CV% calculated Dilution1/20	≤ 5	3.5	☒	☐	
CV% calculated Dilution1/50	≤ 10	7.70	☒	☐	
CV% calculated Dilution1/75	≤ 15	11.11	☒	☐	

ผู้ตรวจสอบ


(Arraya Meechai)
(05/09/2025)

ผู้อนุมัติ


(Siriluk Bunnak)
(05/09/2025)



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3 : EQUIPMENT CALIBRATION AND TESTING SERVICES

534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250

TEL. 0-2717-3000 FAX. 0-2719-9484

Certificate of Testing

Cert.No.: 25TW72

Page.: 1 of 2

Equipment : DO Meter
Manufacturer : Mettler Toledo
Model : Seven2Go Pro
Serial No. : B728366470
ID No. : SGK_FS0018
Received Date : 10 April 2025
Test Date : 11 April 2025
Reference : 2504-0309DSC-1
Submitted by :

ALS Laboratory Group (Thailand) Co.,Ltd.
Songkhla Branch.
114/1 Moo 8 Karnchanawanich Rd., T.Ban Phru,
A.Hat Yai, Songkhla 90250 Thailand

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

Tested by : Walalak Sirithean

Approved by :

Approved Signatory

() Chakrit Waewwanjua
() Ponpan Paipim
(✓) Saithip Meangmai

Issue Date : 11 April 2025

REVIEW BY

APPROVED BY

NEXT CAL DATE.....10/04/26.....



Cert.No.: 25TW72

Page.: 2 of 2

Condition of this result of calibration

1. Reference Standard Instruments :

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

<u>Instruments</u>	<u>Serial No.</u>	<u>ID No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1. Burette	-	130BU10	25CG1126	18 Mar 2027
2. Balance	14233821	110RC001	24MM131	04 July 2025

2. Standard Material :-

<u>Material</u>	<u>Manufacturer</u>	<u>Lot.No.</u>	<u>Assay</u>
Sodium Thiosulfate 5-Hydrate AR	KEMAUS	2203162447	99.6%

Result : Dissolved Oxygen Meter Adjustment With Air 100 %

Dissolved Oxygen Probe No.: 526334

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.20	8.22	0.0045

This report was certified only for the instrument we tested. It is allowable to use for study
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

-o0o-



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



Certificate of Calibration

Cert. No.: 25LM61

Page.: 1 of 2

Equipment : Do Meter with Sensor

Manufacturer : Mettler Toledo

Model : Seven2Go Pro

Serial No. : B728366470

ID No. : SGK_FS0018

Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.
(Songkhla Branch)
114/1 Moo 8 Kanjanavanij Rd., Banphru,
Hatyai, Songkhla 90250 Thailand

Location : TPA On Site Calibration Laboratory

Received Order : 10 April 2025

Calibrated Date : 11 April 2025

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 30) %

AC Line Voltage : (220 ± 22) V

Calibrated by : Warakorn Lerngagtrakul

Approved by :

Approved Signatory

- () Chakrit Waewwanjua
(✓) Suwit Imjai
() Kunchit Promprat

Issue Date : 16 April 2025

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 : Do Meter with Sensor
Condition As-Received : Used Item
Reference : 2504-0309DSC-2

Cert. No.: 25LM61
Page.: 2 of 2

Procedure Used :-

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

<u>Instrument</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Traceable</u>	<u>Due Date</u>
1) Digital Thermometer	2188080	2411022	TPA	17 Sep 2025
2. This certificate is valid only to the item calibrated on date and place of calibration.				
3. This certification is traceable to the International System of Unit.				

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

Result of Calibration :- (*) Without Adjustment

Function : Temperature measurement.

This instrument was connected with temperature sensor, S/N.: 526334

<u>Calibration Point</u> (°C)	<u>Immersion Depth</u> (mm)	<u>Standard Temperature</u> (°C)	<u>UUC* Reading</u> (°C)	<u>Error</u> (°C)	<u>Uncertainty</u> (± °C)	<u>Coverage Factor</u> <i>k</i>
20.0	90	20.006	20.2	0.194	0.16	2.00

UUC* : Unit Under Calibration

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

-o0o-



Southern Calibration Service Co., Ltd.

669/35 Karnjanavanit Rd., Banpru, Hatyai, Songkla 90250 Thailand
Tel : 08 1599 0417 Fax : 0 7480 5133 Email : s.calibration@gmail.com www.scal-lab.com

CALIBRATION CERTIFICATE

Issued Date : 28-Feb-2025

Certificate No. : 25TH1073

CSR No. : A185/09219

Page. : 1 of 3

Customer : ALS Laboratory Group (Thailand) Co., Ltd
114/1 Moo 8, Karnchanawanich Rd. Tambon, Ban Phru,
Amphoe Hat Yai, Songkhla, 90250

Calibration Place : Customer Laboratory

Instrument Name : Digester Block

Manufacturer : Gerhardt

Model : KT-L205BS

Serial No. : 5770230038

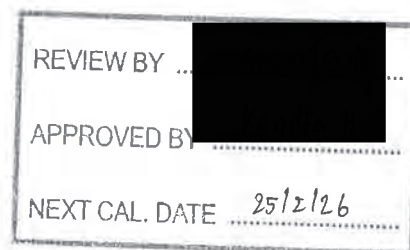
ID No. : SGK_CL0092

Receipt Date : 25-Feb-2025

Calibration Date : 25-Feb-2025

Ambient Temperature : (30 ± 10) °C

Relative Humidity : (50 ± 30) %



Calibration Method Used :

This instrument was calibrated using the Calibration In - house method : SC.WI.12.016 based on G-20

The Southern Calibration Service Co.,Ltd.calibration control system complies with requirement of ISO/IEC 17025:2017

Traceability of measurement :

This Certificate is traceable to the International and /or national standards which realize the units of measurement according to the International System of Unit (SI) through :

- SCaL : Sounthern Calibration Service Co., Ltd.,

Calibrated by : Ibrorhim Saleemin

Approved by :

Imron Rattanaylum / Technical Manager



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 Southern Calibration Service Co., Ltd.

Details of Calibration

1. Reference Standard Equipment Used:

Equipment	Model	Serial No.	Cert. no.	Due Date
Data Acquisition/Switch Unit	34970A	MY58009813	PSL-T0707-1/67	22-May-2025

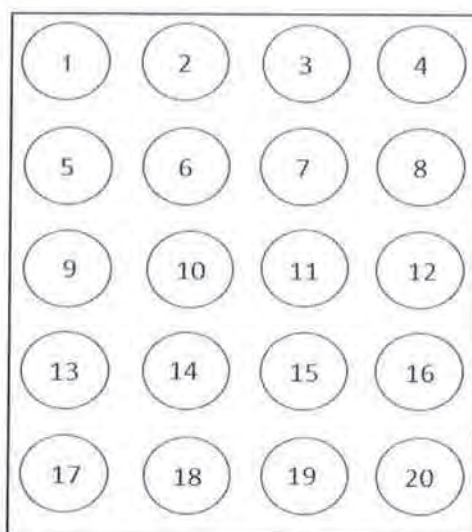
2. The results reported in this certificate refer to the condition of the instrument on the date of calibration and carry no implication regarding the longterm stability of instrument.

3. This certificate is not certified any commercial transaction

4. Condition of Item : normal condition , no indication for any damage or malfunction

Result of Calibration :

Sensor Installation Diagram



Measurement for Heating Block

Position	UUC Reading (°C)	Standard Temperature (°C)	Correction (°C)	Uncertainty (± °C)
No.1	383	380.24	-2.76	0.32
No.2	383	379.87	-3.13	0.32
No.3	383	379.92	-3.08	0.32
No.4	383	379.94	-3.06	0.32
No.5	383	379.88	-3.12	0.32

Result of Calibration :. (Cont.)
Measurement for Heating Block

Position	UUC Reading (°C)	Standard Temperature (°C)	Correction (°C)	Uncertainty (± °C)
No.6	383	379.97	-3.03	0.32
No.7	383	380.42	-2.58	0.32
No.8	383	380.47	-2.53	0.32
No.9	383	380.21	-2.79	0.32
No.10	383	380.44	-2.56	0.32
No.11	383	379.24	-3.76	0.32
No.12	383	380.27	-2.73	0.32
No.13	383	380.28	-2.72	0.32
No.14	383	379.93	-3.07	0.32
No.15	383	379.92	-3.08	0.32
No.16	383	379.98	-3.02	0.32
No.17	383	379.84	-3.16	0.32
No.18	383	379.82	-3.18	0.32
No.19	383	379.81	-3.19	0.32
No.20	383	380.21	-2.79	0.32

Remark : Calibration Points : 380 °C

UUC Setting : 383 °C

- UUC = Unit Under Calibration

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

...End...

CALIBRATION CERTIFICATE

Issued Date : 13-Jan-2025

Certificate No. : 25TH0226

CSR No. : A101/05028

Page. : 1 of 3

Customer : ALS Laboratory Group (Thailand) Co., Ltd
114/1 Moo 8, Karnchanawanich Rd. Tambon, Ban Phru,
Amphoe Hat Yai, Songkhla, 90250

Calibration Place : Customer Laboratory

Instrument Name : Incubator

Manufacturer : Memmert

Model : ICP750

Serial No. : F816.0063

ID No. : SGK_CL0028

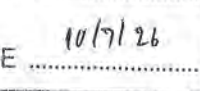
Resolution : 0.1 °C

Received Date : 10-Jan-2025

Calibrated Date : 10-Jan-2025

Ambient Temperature : (30 ± 10) °C

Relative Humidity : (50 ± 30) %

REVIEW BY	
APPROVED BY	
NEXT CAL. DATE	10/7/26

Calibration Method Used :

This instrument was calibrated using the Calibration In - house method : SCAL.WI.012 based on GLA - 20

The Southern Calibration Service Co.,Ltd.calibration control system complies with requirement of ISO/IEC 17025:2017

Traceability of measurement :

This Certificate is traceable to the International and /or national standards which realize the units of measurement according to the International System of Unit (SI) through :

- TISTR : Thailand Institute of Scientific and Technological Research

Calibrated by : Ibrorhim Saleemin

Approved by :

Imron Rattanaylum / Technical Manager



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 Southern Calibration Service Co., Ltd.

Details of Calibration

1. Reference Standard Equipment Used:

Equipment	Model	Serial No.	Cert. no.	Due Date
Data Acquisition/Switch Unit	34970A	MY58009813	PSL-T0707-1/67	22-May-2025

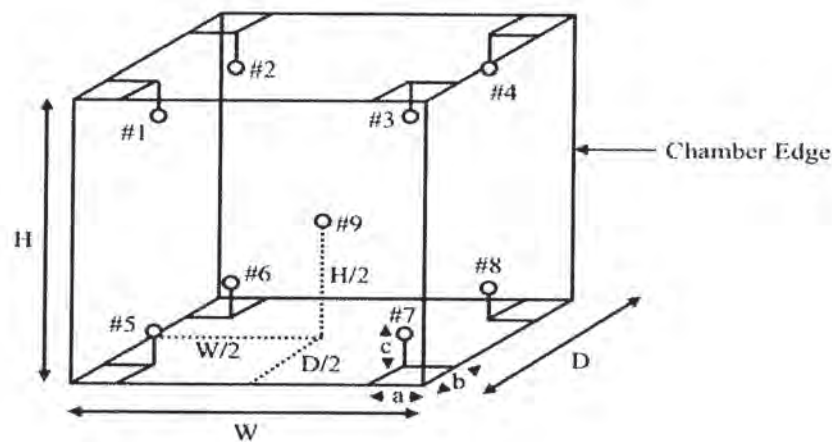
2. The results reported in this certificate refer to the condition of the instrument on the date of calibration and carry no implication regarding the longterm stability of instrument.

3. This certificate is not certified any commercial transaction

4. Condition of Item : normal condition , no indication for any damage or malfunction

Result of Calibration : (☒) Without Adjustment (☐) After Adjustment

1. Sensor Installation Diagram



Sensor Installation Details

a = 5.0 cm
b = 5.0 cm
c = 5.0 cm

Dimension of the chamber

W = 104.0 cm
H = 120.0 cm
D = 60.0 cm

Result of Calibration .:

2. Temperature Measurement Accuracy Test

The measurement results of the Incubator and associates are reported in the manner as shown below

Cal point (°C)	Measured Standard Temperature At Spread Locations (°C)									Uncertainty (± °C)
	#1	#2	#3	#4	#5	#6	#7	#8	Ref. 9	
20	20.03	20.23	20.37	20.34	20.32	20.03	20.19	20.31	20.06	0.38

3. Performance Result

The performance of the Incubator are reported as shown below

Cal point (°C)	UUC Setting (°C)	UUC Reading (°C)	Temperature Stability (± °C)	Temperature Uniformity (°C)	Overall Variation (°C)
20	20.0	20.0	0.10	0.31	0.40

- UUC = Unit Under Calibration

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

... End ...



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



Certificate of Calibration

Cert. No.: 25LM26

Page.: 1 of 2

Equipment : DO Meter with Sensor

Manufacturer : YSI

Model : 4010-1W

Serial No. : 24200618

ID No. : -

Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd. Songkhla Branch.
114/1 Moo 8 Karnchanawanich Rd.,
T.Ban Phru, A.Hat Yai,
Songkhla 90250 Thailand

Location : TPA Calibration Laboratory

Received Order : 21 February 2025

Calibrated Date : 24 February 2025

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 30) %

AC Line Voltage : (220 ± 22) V

Calibrated by : Warakorn Lerngagtrakul

Approved by :

Approved Signatory

() Chakrit Waewwanjua

() Suwit Imjai

(✓) Kunchit Promprat

Issue Date : 25 February 2025

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.

REVIEW BY	
APPROVED BY	
NEXT CAL. DATE	24/2/26



Equipment : DO Meter with Sensor
Condition As-Received : Used Item
Reference : 2502-0715WC-2

Cert. No.: 25LM26

Page.: 2 of 2

Procedure Used :-

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

<u>Instrument</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Traceable</u>	<u>Due Date</u>
1) Digital Thermometer	2188080	2411022	TPA	17 Sep 2025

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

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

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

Result of Calibration :- (*) Without Adjustment

Function : Temperature measurement.

This instrument was connected with temperature sensor, S/N.: 24F102419

<u>Calibration Point</u> (°C)	<u>Immersion Depth</u> (mm)	<u>Standard Temperature</u> (°C)	<u>UUC* Reading</u> (°C)	<u>Error</u> (°C)	<u>Uncertainty</u> (± °C)	<u>Coverage Factor</u> <i>k</i>
20.0	60	20.003	20.0	-0.003	0.16	2.00

UUC* : Unit Under Calibration

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

-o0o-



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3 : EQUIPMENT CALIBRATION AND TESTING SERVICES

534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250

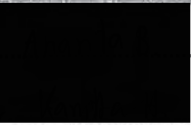
TEL. 0-2717-3000 FAX. 0-2719-9484

Certificate of Testing

Cert.No.: 25TW32

Page.: 1 of 2

Equipment :	DO Meter
Manufacturer :	YSI
Model :	4010-1W
Serial No. :	24200618
ID No. :	-
Received Date :	21 February 2025
Test Date :	24 February 2025
Reference :	2502-0715WC-1
Submitted by :	ALS Laboratory Group (Thailand) Co.,Ltd. Songkhla Branch. 114/1 Moo 8 Karnchanawanich Rd., T.Ban Phru, A.Hat Yai, Songkhla 90250 Thailand
Laboratory Condition :	Temperature (25 ± 5) °C Humidity (50 ± 20) %
Test Procedure :	In - house method : CP-CH9 by Comparison Technique with Azide Modification Method
Tested by :	Walalak Sirithean 
Approved by :	 Approved Signatory
() Chakrit Waewwanjua () Ponpan Paipim (✓) Saithip Meangmai	
Issue Date :	25 February 2025

REVIEW BY ...	
APPROVED BY	
NEXT CAL. DATE	24/2/26



Cert.No.: 25TW32

Page.: 2 of 2

Condition of this result of calibration

1. Reference Standard Instruments :

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

<u>Instruments</u>	<u>Serial No.</u>	<u>ID No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1. Burette	-	130BU10	23CG1172	22 Mar 2025
2. Balance	14233821	110RC001	24MM131	04 July 2025

2. Standard Material :-

<u>Material</u>	<u>Manufacturer</u>	<u>Lot.No.</u>	<u>Assay</u>
Sodium Thiosulfate 5-Hydrate AR	KEMAUS	2203162447	99.6%

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

Dissolved Oxygen Probe No.: 24F102419

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.22	8.28	0.0089

This report was certified only for the instrument we tested. It is allowable to use for study
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

-o0o-

Certificate of System Qualification

GC-OQ + GCMS-OQ

System ID:	BKK_EN0059(GM-7)
Organization Name:	ALS Laboratory Group (Thailand) Co., Ltd.
Organization Location:	104 Patthanakarn 40, Patthanakarn Rd., Khwang Suan Luang, Khet Suan Luang, Bangkok
Date:	June 25, 2025 8:40:18 PM
EQP Name:	AgilentRecommended , AgilentRecommended
EQP Revision:	GC.02.50, GCMS.02.50
Overall Qualification Status:	Pass

REVIEW BY ...

APPROVED BY

NEXT CAL. DATE 25-Dec-26

System Inspection and Basic Safety and Operation

Name:	7890
Setpoint Status:	Pass

Overall System Inspection and Basic Safety and Operation Test Status

Pass

Inlet Pressure Accuracy

Name:	7890
	Front SSL
Setpoint Status:	Pass
	Setpoint Actual
Inlet Pressure:	25.0 psi 25.2 psi
Accuracy:	0.2 psi
Agilent Recommended:	<= 1.2

Overall Inlet Pressure Accuracy Test Status

Pass

GC Oven Temperature Accuracy

Name:

7890

Setpoint Status:

Pass

Zone:

Oven

Setpoint/Actual

Temperature:

230.0

228.8

°C

Accuracy:

-1.2

°C

Agilent Recommended:

>=

-1.0

% setpoint in K

(

-5.0

°C

)

<=

1.0

% setpoint in K

(

5.0

°C

)

Setpoint Status:

Pass

Zone:

Oven

Setpoint/Actual

Temperature:

100.0

100.8

°C

Accuracy:

0.8

°C

Agilent Recommended:

>=

-1.0

% setpoint in K

(

-3.7

°C

)

<=

1.0

% setpoint in K

(

3.7

°C

)

Overall GC Oven Temperature Accuracy Test Status

Pass

GC Oven Temperature Stability

Name:

7890

Setpoint Status:

Pass

Setpoint/Average

Temperature:

100.0

101.0

°C

Stability:

0.0

°C

Agilent Recommended:

<=

0.5

Overall GC Oven Temperature Stability Test Status

Pass

Log Amp

Tested Combination1

Front

SSL

/ External

SQ

Name:

5977A

Setpoint Status:

Pass

Overall Log Amp Test Status

Pass

RFPA

Tested Combination1FrontSSL/ ExternalSQ

Name:5977A

Setpoint Status:Pass

Amu:1050m/zDrift After Five Minutes:RFPA Voltage:

2mV462mV

Agilent Recommended:>=-100and<=100<=1100

Overall RFPA Test Status

Pass

Tune EI

Tested Combination1FrontSSL/ ExternalSQ

Name:5977A

Setpoint Status:Pass

Filament:1

Setpoint Status:Pass

Filament:2

Overall Tune EI Test Status

Pass

Signal to Noise EI

Tested Combination1FrontSSL/ ExternalSQ

Name:5977A

Source:	El - Extractor	Filament:	1
Setpoint Status:	Pass		
Signal to Noise:	35794093956		
Agilent Recommended:	>=	1200	

Source:	El - Extractor	Filament:	2
Setpoint Status:	Pass		
Signal to Noise:	32894968229		
Agilent Recommended:	>=	1200	

Overall Signal to Noise EI Test Status

Pass

NOTE: This test's 0 comment(s) and 3 deviation(s) are available in the Attachments section.

Instrument Details

Purpose

This section describes the as found system configuration.

Details

System

System ID	BKK_EN0059(GM-7)
Manufacturer	Agilent Technologies
Name	7890

Tested Combination1

Injection Technique	Manual Injection
Inlet	Front
Detector	External
LTM Included?	No

Sampler 1

Manufacturer	Agilent Technologies
Type	Manual Injection
Usage	Sample Injection
Syringe Volume (µL)	10

Mainframe 1

Manufacturer	Agilent Technologies
Name	7890
Model Number	G3442B
Serial Number	CN14133181
Firmware Revision	B.02.03
Oven Type	Standard

Inlet 1

Manufacturer	Agilent Technologies
Name	7890
Type	SSL
Location	Front
Carrier Gas	Helium
Control Type	Electronic Pressure Control (EPC)
Purged Inlet	Yes

Detector 1

Manufacturer	Agilent Technologies
Name	Mass Spectrometer
Type	Mass Spectrometer
Location	External

Mass Spectrometer 1

Manufacturer	Agilent Technologies
Type	SQ
Name	5977A
Serial Number	US1415M209
Firmware Revision	5977 6.00.21
High Vacuum System	Turbo Pump
Scouting Run Standard	OFN Std

MS EI Source 1

Manufacturer	Agilent Technologies
Source Type	EI - Extractor
Number of filaments	2

Electronic Signature

Purpose

This signature page was created and published because the ACE sign-off action was executed, which is valid for the entire document, including attachments. The ACE sign-off is an electronic signature that requires two distinct identification components: unique username and personal password. The Agilent representative who has delivered this service understands the meaning and legal status of an electronic signature. As a trained official operator, the Agilent representative has a unique password and logon to access ACE and electronically sign this document. (Other e-signatures can be applied to this document using a Document Content Management or other suitable method defined in your data access and control procedures.)

Details

Full Name of Signer:	Supasak Nimsongtham
Logged On User Name:	supasak.nimsongtham@agilent.com
Signature Creation Date:	June 25, 2025
Reason for Signature:	Executed protocol and published this original version of document

ACE Self Qualification Status

The installed version of ACE used to deliver this service passed qualification; the results conform with expected values. The self qualification summary report is available in the session folder location SDS\ClearStore\AceSelfQualification.

Regulatory Disclaimer

This document provides a protocol to verify and record instrument configuration and evidence of proper operation. It has been prepared from our interpretation of applicable regulations as well as industry best practices. The document is designed to provide an important component of a complete compliance package. Validation depends upon many factors and use of this protocol alone does not assure compliance. Agilent Technologies makes no promises or representations as to its sufficiency for any specific regulatory program.

Warranty

Agilent Technologies makes no warranty of any kind to this material, including but not limited to, the implied warranties or merchantability and fitness for a particular purpose. Agilent Technologies shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material.

User Name: supasak.nimsongtham
Report Generated by Hostname: 5CG1115HKC

System Id: BKK_EN0059(GM-7)
Print Date: June 25, 2025 8:40:20 PM

GM-7-2025 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
June 13, 2025 10:01:23 AM	Audit	SessionCreated	Session	Host Name: 5CG1115HKC, Drive Serial Number: C2031778
June 13, 2025 10:01:24 AM	start	Configuration	Session	None
June 13, 2025 10:01:24 AM	Audit	Entitlement	Licensing	User is FieldEngineer and does not require an unlock code
June 13, 2025 10:04:40 AM	Audit	EqpLoaded	Session	EQP details for primary technique [Gc] - File path: [ProtocolPacks/Gc/Configurat ions/02.50/Gc.02.50.eqp], EQP File Name: [Gc.02.50.eqp], EQP Name: [AgilentRecommended], Proto col Revision :[Gc.02.50] EQP details for hyphenated technique [GcMs] - File path: [ProtocolPacks/GcMs/Config urations/02.50/GcMs.02.50.e qp], EQP File Name: [GcMs.02.50.eqp], EQP Name: [AgilentRecommended]
June 13, 2025 10:04:51 AM	End	Configuration	Session	None
June 13, 2025 10:05:03 AM	start	Qualification	Session	OQ
June 13, 2025 10:05:05 AM	start	Execution	System Inspection and Basic Safety and Operation - 7890: - Qualitative Test - No setpoints associated	None
June 13, 2025 10:05:35 AM	End	Execution	System Inspection and Basic Safety and Operation - 7890: - Qualitative Test - No setpoints associated	Run Count : 1

Page 1 / 9

User Name: supasak.nimsongtham
Report Generated by Hostname: 5CG1115HKC

System Id: BKK_EN0059(GM-7)
Print Date: June 25, 2025 8:40:20 PM

GM-7-2025 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
June 13, 2025 10:06:49 AM	start	Execution	Inlet Pressure Accuracy - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	None
June 13, 2025 10:06:58 AM	End	Execution	Inlet Pressure Accuracy - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	Run Count : 1
June 13, 2025 10:07:00 AM	start	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
June 13, 2025 10:07:30 AM	Audit	Data	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry
June 13, 2025 10:07:35 AM	End	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Run Count : 1
June 13, 2025 10:07:59 AM	start	Execution	RFPA - 5977A SQ: - Source: EI - Extractor	None
June 13, 2025 10:11:14 AM	start	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
June 13, 2025 10:12:12 AM	Audit	Data	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry
June 13, 2025 10:12:17 AM	End	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Run Count : 1

User Name: supasak.nimsongtham
Report Generated by Hostname: 5CG1115HKC

System Id: BKK_EN0059(GM-7)
Print Date: June 25, 2025 8:40:20 PM

GM-7-2025 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
June 13, 2025 10:12:19 AM	start	Execution	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	None
June 13, 2025 10:30:39 AM	Audit	Data	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Manual Data Entry
June 13, 2025 10:30:45 AM	End	Execution	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Run Count : 1
June 13, 2025 10:30:56 AM	start	Execution	Log Amp - 5977A SQ: - Source: EI - Extractor	None
June 13, 2025 10:31:15 AM	End	Execution	Log Amp - 5977A SQ: - Source: EI - Extractor	Run Count : 1
June 13, 2025 10:34:14 AM	Audit	AceClosed	Session	None
June 16, 2025 11:55:53 AM	Audit	AceRestarted	Session	Host Name: DESKTOP-6PKI2AL, Drive Serial Number: 9494EA83
June 16, 2025 11:55:55 AM	Audit	SessionReloaded	Session	None
June 16, 2025 11:58:07 AM	start	Qualification	Session	OQ
June 16, 2025 5:47:31 PM	Audit	AceClosed	Session	None
June 17, 2025 1:34:47 PM	Audit	AceRestarted	Session	Host Name: DESKTOP-6PKI2AL, Drive Serial Number: 9494EA83
June 17, 2025 1:39:58 PM	Audit	AceClosed	Session	None
June 17, 2025 1:52:55 PM	Audit	AceRestarted	Session	Host Name: DESKTOP-6PKI2AL, Drive Serial Number: 9494EA83
June 17, 2025 2:03:56 PM	Audit	SessionReloaded	Session	None
June 17, 2025 2:03:58 PM	start	Qualification	Session	OQ
June 17, 2025 2:04:08 PM	Audit	AceClosed	Session	None

Page 3 / 9

Date: June 25, 2025 8:40:18 PM
System ID: BKK_EN0059(GM-7)

User Name: supasak.nimsongtham
Report Generated by Hostname: 5CG1115HKC

System Id: BKK_EN0059(GM-7)
Print Date: June 25, 2025 8:40:20 PM

GM-7-2025 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
June 25, 2025 3:07:51 PM	Audit	AceRestarted	Session	Host Name: 5CG1115HKC, Drive Serial Number: C2031778
June 25, 2025 3:07:54 PM	Audit	SessionReloaded	Session	None
June 25, 2025 3:09:13 PM	start	Qualification	Session	OQ
June 25, 2025 3:09:36 PM	start	Execution	RFPA - 5977A SQ: - Source: EI - Extractor	None
June 25, 2025 3:10:29 PM	End	Execution	RFPA - 5977A SQ: - Source: EI - Extractor	Run Count : 1
June 25, 2025 3:10:35 PM	start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	None
June 25, 2025 3:10:40 PM	start	Execution	Tune EI - 5977A SQ: - Source: - EI - Extractor Filament 1 (Qualitative - No setpoints associated)	None
June 25, 2025 4:10:20 PM	start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	None
June 25, 2025 4:10:23 PM	start	Execution	Tune EI - 5977A SQ: - Source: - EI - Extractor Filament 1 (Qualitative - No setpoints associated)	None
June 25, 2025 4:10:43 PM	End	Execution	Tune EI - 5977A SQ: - Source: - EI - Extractor Filament 1 (Qualitative - No setpoints associated)	Run Count : 1
June 25, 2025 4:10:45 PM	start	Execution	Tune EI - 5977A SQ: - Source: - EI - Extractor Filament 2 (Qualitative - No setpoints associated)	None

Page 4 / 9

User Name: supasak.nimsongtham
Report Generated by Hostname: 5CG1115HKC

System Id: BKK_EN0059(GM-7)
Print Date: June 25, 2025 8:40:20 PM

GM-7-2025 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
June 25, 2025 4:11:08 PM	End	Execution	Tune EI - 5977A SQ: - Source: - EI - Extractor Filament 2 (Qualitative - No setpoints associated)	Run Count : 1
June 25, 2025 4:11:11 PM	start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	None
June 25, 2025 4:30:52 PM	start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	None
June 25, 2025 5:23:59 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	Data files Path : C:\Users\lmsongth\Download s\OQ data\OQ data\OQ_SN_F1_001.D
June 25, 2025 5:24:19 PM	Audit	Data	DataManager	DataManager was in a data verification state but the user chose to start over
June 25, 2025 5:26:41 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	Data files Path : C:\Users\lmsongth\Download s\OQ data\OQ data\OQ_SN_F1_001.D
June 25, 2025 5:27:29 PM	Audit	Reporting	Reintegration	Reintegration Count: 1 -- [Integration Type: Injection; Baseline Correction Mode: Advanced; Initial Slope Sensitivity: 10; Initial Peak Width: 0.01; Initial Area Reject: 0; Initial Height Reject: 20000; Integration: Off at 0; Integration: On at 4]

User Name: supasak.nimsongtham
Report Generated by Hostname: 5CG1115HKC

System Id: BKK_EN0059(GM-7)
Print Date: June 25, 2025 8:40:20 PM

GM-7-2025 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
June 25, 2025 5:29:45 PM	End	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	Run Count : 1
June 25, 2025 5:31:32 PM	Audit	TestUnlocked	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	Deviation filed for Run Count : 1
June 25, 2025 5:31:32 PM	start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	None
June 25, 2025 5:34:18 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	Data files Path : C:\Users\lmsongth\Download s\OQ data\OQ data\OQ_SN_F1_001.D
June 25, 2025 5:35:03 PM	Audit	Data	DataManager	DataManager was in a data verification state but the user chose to start over
June 25, 2025 5:37:01 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	Data files Path : C:\Users\lmsongth\Download s\OQ data\OQ data\OQ_SN_F1_001.D
June 25, 2025 5:37:47 PM	Audit	Reporting	Reintegration	Reintegration Count: 1 -- [Integration Type: Injection; Baseline Correction Mode: Advanced; Initial Slope Sensitivity: 10; Initial Peak Width: 0.01; Initial Area Reject: 0; Initial Height Reject: 25000; Integration: OFF at 0; Integration: ON at 4]

User Name: supasak.nimsongtham
Report Generated by Hostname: 5CG1115HKC

System Id: BKK_EN0059(GM-7)
Print Date: June 25, 2025 8:40:20 PM

GM-7-2025 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
June 25, 2025 5:40:08 PM	End	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	Run Count : 2
June 25, 2025 5:41:09 PM	start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	None
June 25, 2025 5:44:37 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	Data files Path : C:\Users\lmsongth\Download s\OQ data\OQ data\OQ_SN_F2_001.D
June 25, 2025 5:48:28 PM	End	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	Run Count : 1
June 25, 2025 5:49:39 PM	Audit	TestUnlocked	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	Deviation filed for Run Count : 1
June 25, 2025 5:49:40 PM	start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	None
June 25, 2025 5:57:10 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	Data files Path : C:\Users\lmsongth\Download s\OQ data\OQ data\OQ_SN_F2_001.D
June 25, 2025 5:57:46 PM	Audit	Data	DataManager	DataManager was in a data verification state but the user chose to start over

User Name: supasak.nimsongtham
Report Generated by Hostname: 5CG1115HKC

System Id: BKK_EN0059(GM-7)
Print Date: June 25, 2025 8:40:20 PM

GM-7-2025 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
June 25, 2025 5:59:51 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	Data files Path : C:\Users\lmsongth\Download s\OQ data\OQ data\OQ_SN_F2_001.D
June 25, 2025 6:00:02 PM	Audit	Data	DataManager	DataManager was in a data verification state but the user chose to start over
June 25, 2025 6:02:07 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	Data files Path : C:\Users\lmsongth\Download s\OQ data\OQ data\OQ_SN_F2_001.D
June 25, 2025 6:02:24 PM	Audit	Data	DataManager	DataManager was in a data verification state but the user chose to start over
June 25, 2025 6:19:36 PM	Audit	Data	DataManager	DataManager was in a data verification state but the user chose to start over
June 25, 2025 6:27:38 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	Data files Path : C:\Users\lmsongth\Download s\OQ data\OQ data\OQ_SN_F2_002.D
June 25, 2025 6:33:07 PM	End	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	Run Count : 2
June 25, 2025 6:34:17 PM	Audit	TestUnlocked	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	Deviation filed for Run Count : 2
June 25, 2025 6:34:17 PM	start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	None

User Name: supasak.nimsongtham
Report Generated by Hostname: 5CG1115HKC

System Id: BKK_EN0059(GM-7)
Print Date: June 25, 2025 8:40:20 PM

GM-7-2025 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
June 25, 2025 6:35:07 PM	Audit	AceClosed	Session	None
June 25, 2025 6:35:57 PM	Audit	AceRestarted	Session	Host Name: 5CG1115HKC, Drive Serial Number: C2031778
June 25, 2025 6:35:59 PM	Audit	SessionReloaded	Session	None
June 25, 2025 6:36:12 PM	start	Qualification	Session	OQ
June 25, 2025 6:36:13 PM	start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	None
June 25, 2025 6:39:41 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	Data files Path : C:\Users\lmsongth\Download s\OQ data\OQ data\OQ_SN_F2_002.D
June 25, 2025 6:42:57 PM	End	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	Run Count : 3
June 25, 2025 6:43:11 PM	End	Qualification	Session	OQ
June 25, 2025 6:43:11 PM	start	Reporting	Session	None
June 25, 2025 8:04:02 PM	Audit	Reporting	Session	Report Generated : Certificate
June 25, 2025 8:32:04 PM	Audit	Reporting	Session	Report Generated : Report

Southern Calibration Service Co., Ltd.

669/35 Karnjanavanit Rd., Banpru, Hatyai, Songkla 90250 Thailand
Tel : 08 1599 0417 Fax : 0 7480 5133 Email : s.calibration@gmail.com www.scal-lab.com



CALIBRATION CERTIFICATE

Issued Date : 4-Jul-2024

Certificate No. : 24TH2760

CSR No. : A150/07473

Page. : 1 of 3

Customer : ALS Laboratory Group (Thailand) Co., Ltd
114/1 Moo 8, Karnchanawanich Rd. Tambon, Ban Phru,
Amphoe Hat Yai, Songkhla, 90250

Calibration Place : Microbiological Laboratory
Instrument Name : Autoclave
Manufacturer : TOMY
Model : SX-700
Serial No. : 52134079
ID No. : SGK_ML0001
Resolution : 1 °C
Received Date : 1-Jul-2024
Calibrated Date : 1-Jul-2024
Ambient Temperature : (30 ± 10) °C
Relative Humidity : (50 ± 30) %

REVIEW BY

APPROVED BY

NEXT CAL. DATE 1/01/26

Calibration Method Used :

This instrument was calibrated using the Calibration In - house method : SCAL.WI.013 based on BS 2646 : 1993 (part 5)

The Southern Calibration Service Co.,Ltd.calibration control system complies with requirement of ISO/IEC 17025:2017

Traceability of measurement :

This Certificate is traceable to the International and /or national standards which realize the units of measurement according to the International System of Unit (SI) through :

- SCaL : Sounthern Calibration Service Co., Ltd.,

Calibrated by : Ibrorhim Saleemin

Approved by :

Imron Rattanaylum / Technical Manager



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 Southern Calibration Service Co., Ltd.

Details of Calibration

1. Reference Standard Equipment Used:

Equipment	Model	Serial No.	Cert. no.	Due Date
Data logger With Sensor	GL240	C90432223	24SDAT005	2-May-2025

2. The results reported in this certificate refer to the condition of the instrument on the date of calibration

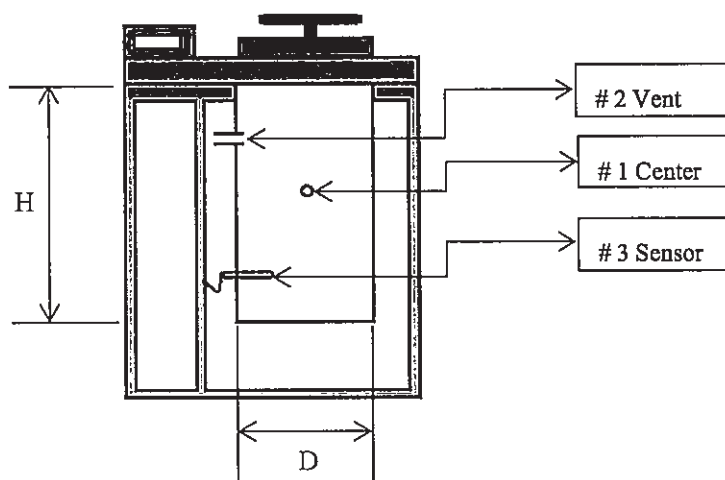
and carry no implication regarding the longterm stability of instrument.

3. This certificate is not certified any commercial transaction

4. Condition of Item : normal condition , no indication for any damage or malfunction

Result of Calibration : (✓) Without Adjustment () After Adjustment

1. Sensor Installation Diagram



Chamber Diameter (D) : 30 cm

Chamber Height (H) : 70 cm



Certificate No. : 24TH2760

CSR No. : A150/07473

Page. : 3 of 3

Result of Calibration :

2. Temperature Measurement Accuracy Test

The measurement results of the Autoclave and associates are reported in the manner as shown below

Cal point (°C)	Measured Standard Temperature At Spread Locations (°C)			Pressure Reading	Uncertainty (± °C)
	Center #1	Vent #2	Sensor #3		
115	116.3	116.4	116.3	0.07 MPa	0.76
118	119.2	119.2	119.2	0.09 MPa	0.76
121	121.8	121.5	121.6	0.11 MPa	0.76

3. Performance Result

The performance of the Autoclave are reported as shown below

Cal point (°C)	UUC Setting (°C)	UUC Reading (°C)	Temperature Stability (± °C)	Temperature Uniformity (°C)	Overall Variation (°C)
115	115	115	0.10	0.17	0.17
118	118	118	0.10	0.10	0.10
121	121	121	0.70	0.50	0.84

- UUC = Unit Under Calibration

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

... End ...

CALIBRATION CERTIFICATE

Issued Date : 6-Jul-2025

Certificate No. : 25TH3013

CSR No. : A202/10083

Page. : 1 of 3

Customer : ALS Laboratory Group (Thailand) Co., Ltd
114/1 Moo 8, Karnchanawanich Rd. Tambon, Ban Phru,
Amphoe Hat Yai, Songkhla, 90250

Calibration Place : Customer Laboratory
Instrument Name : Incubator
Manufacturer : Memmert
Model : ICP750
Serial No. : F816.0061
ID No. : SGK_ML0013
Resolution : 0.1 °C
Received Date : 3-Jul-2025
Calibrated Date : 3-Jul-2025
Ambient Temperature : (30 ± 10) °C
Relative Humidity : (50 ± 30) %

**Calibration Method Used :**

This instrument was calibrated using the Calibration In - house method : SCAL.WI.012 based on GLA - 20

The Southern Calibration Service Co.,Ltd.calibration control system complies with requirement of ISO/IEC 17025:2017

Traceability of measurement :

This Certificate is traceable to the International and /or national standards which realize the units of measurement according to the International System of Unit (SI) through :

- TISTR : Thailand Institute of Scientific and Technological Research

Calibrated by : Ibrorhim Saleemin**Approved by :**

Imron Rattanaylum / Technical Manager

SCAL.FO.018/a010723

**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 Southern Calibration Service Co., Ltd.

Details of Calibration

1. Reference Standard Equipment Used:

Equipment	Model	Serial No.	Cert. no.	Due Date
Data Acquisiton/Switch Unit	34970A	MY58009813	PSL-T0707-2/67	22-Nov-2025

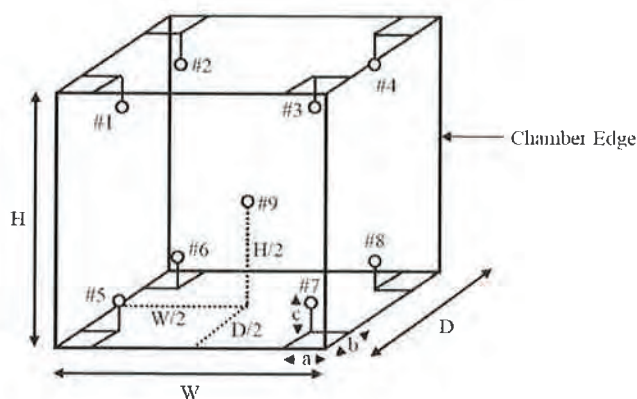
2. The resultes reported in this certificate refer to the condition of the instrument on the date of calibration and carry no implication regarding the longterm stability of instrument.

3. This certificate is not certified any commercial transaction

4. Condition of Item : normal condition , no indication for any damage or mulfunction

Result of Calibration .: ☒ Without Adjustment ☐ After Adjustment

1. Sensor Installation Diagram



Sensor Installation Details

a = 5.0 cm
 b = 5.0 cm
 c = 5.0 cm

Dimension of the chamber

W = 104.0 cm
 H = 120.0 cm
 D = 60.0 cm

Result of Calibration :

2. Temperature Measurement Accuracy Test

The measurement results of the Incubator and associates are reported in the manner as shown below

Cal point (°C)	Measured Standard Temperature At Spread Locations (°C)									Uncertainty (±°C)
	#1	#2	#3	#4	#5	#6	#7	#8	Ref. 9	
35	34.97	35.05	35.09	35.04	35.02	34.91	34.99	35.01	34.98	0.38

3. Temperature Performance Result

The performance of the Incubator are reported as shown below

UUC Setting (°C)	UUC Reading (°C)	Temperature Stability (±°C)	Temperature Uniformity (°C)	Overall Variation (°C)
35.0	35.0	0.10	0.24	0.31

- UUC = Unit Under Calibration

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

... End ...

Southern Calibration Service Co., Ltd.

669/35 Karnjanavanit Rd., Banpru, Hatyai, Songkla 90250 Thailand
Tel : 08 1599 0417 Fax : 0 7480 5133 Email : s.calibration@gmail.com www.scal-lab.com



CALIBRATION CERTIFICATE

Issued Date : 5-Jul-2024

Certificate No. : 24CH0342

CSR No. : A150/07473

Page. : 1 of 2

Customer : ALS Laboratory Group (Thailand) Co., Ltd
114/1 Moo 8, Karnchanawanich Rd. Tambon, Ban Phru,
Amphoe Hat Yai, Songkhla, 90250

Calibration Place : Microbiological Laboratory

Instrument Name : pH meter

Manufacturer : Sartorius

Model : PB-10

Serial No. : C07160695

ID No. : SGK_ML0016

Electrode No. : P20067003

Received Date : 2-Jul-2024

Calibrated Date : 2-Jul-2024

Ambient Temperature : $(25 \pm 3) ^\circ\text{C}$

Relative Humidity : $(55 \pm 15) \%$

REVIEW BY	
APPROVED BY	
NEXT CAL. DATE	2/07/26

Calibration Method Used :

This instrument was calibrated using the Calibration In - house method : SCAL.WI.008 based on direct measurement by using certified reference Material (CRM)

The Southern Calibration Service Co.,Ltd.calibration control system complies with requirement of ISO/IEC 17025:2017

Traceability of measurement :

This Certificate is traceable to the International and /or national standards which realize the units of measurement according to the International System of Unit (SI) through :

- CPAchem : CPAchem Ltd

- WK : WK Electric Co., Ltd.

Calibrated by : Alisara Ma

Approved by :

Imron Rattanaylum / Technical Manager



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 Southern Calibration Service Co., Ltd.



Details of Calibration

1. Reference Standard Equipment Used:

Equipment	Model	Serial No.	Cert. no.	Due Date
Standard Solution	4.000	61278486	986239	10-May-2025
Standard Solution	7.000	61281486	986241	10-May-2025
Standard Solution	10.01	61287532	986240	10-May-2025
Temperature/Electrical Calibrator	MC2-TE	14987	WK2106-299-223	31-May-2025

2. The results reported in this certificate refer to the condition of the instrument on the date of calibration

and carry no implication regarding the longterm stability of instrument.

3. This certificate is not certified any commercial transaction

4. Condition of Item : normal condition , no indication for any damage or malfunction

Result of Calibration :.

1. Electrical Measurement

Applied Voltage (mV)	pH meter Reading		Correction (mV)	Uncertainty (± mV)
	(mV)	(pH)		
177.48	177.5	3.80	-0.02	0.17
0.00	0.0	6.90	0.00	0.13
-177.48	-177.5	10.00	0.02	0.17

2. Before Sample Test Measurement

Standard Buffer Solutions (pH)	pH meter Reading		Correction (pH)	Uncertainty (± pH)
	(pH)	(mV)		
4.008	4.07	164.0	-0.062	0.011
6.985	7.02	-7.1	-0.035	0.020
10.010	10.03	-182.1	-0.020	0.037

3. After Sample Test Measurement

Standard Buffer Solutions (pH)	pH meter Reading		Correction (pH)	Uncertainty (± pH)
	(pH)	(mV)		
4.008	4.02	164.2	-0.012	0.011
6.985	7.00	-0.9	-0.015	0.020
10.010	10.01	-170.7	0.000	0.037

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

... End ...

CALIBRATION CERTIFICATE

Issued Date : 4-Jul-2024

Certificate No. : 24TH2782

CSR No. : A150/07474

Page. : 1 of 3

Customer : ALS Laboratory Group (Thailand) Co., Ltd
114/1 Moo 8, Karnchanawanich Rd. Tambon, Ban Phru,
Amphoe Hat Yai, Songkhla, 90250

Calibration Place : Microbiological Laboratory

Instrument Name : Liquid Bath

Manufacturer : Memmert

Model : WPE45

Serial No. : L716.0558

ID No. : SGK_ML0021

Resolution : 0.1 °C

Received Date : 1-Jul-2024

Calibrated Date : 1-Jul-2024

Ambient Temperature : (30 ± 10) °C

Relative Humidity : (50 ± 30) %

REVIEW BY ...

APPROVED BY

NEXT CAL. DATE 1/01/26

Calibration Method Used :

This instrument was calibrated using the Calibration In - house method : SCAL.WI.014 based on ASTM E 715 : 1980
(reapproved 2001)

The Southern Calibration Service Co.,Ltd.calibration control system complies with requirement of ISO/IEC 17025:2017

Traceability of measurement :

This Certificate is traceable to the International and /or national standards which realize the units of measurement
according to the International System of Unit (SI) through :

- TISTR : Thailand Institute of Scientific and Technological Research

Calibrated by : Ibrorhim Saleemin

Approved by :

Imron Rattanaylum / Technical Manager



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 Southern Calibration Service Co., Ltd.

Details of Calibration

1. Reference Standard Equipment Used:

Equipment	Model	Serial No.	Cert. no.	Due Date
Data Acquisition/Switch Unit	34970A	MY58009813	PSL-T0707-1/67	22-May-2025

2. The results reported in this certificate refer to the condition of the instrument on the date of calibration

and carry no implication regarding the longterm stability of instrument.

3. This certificate is not certified any commercial transaction

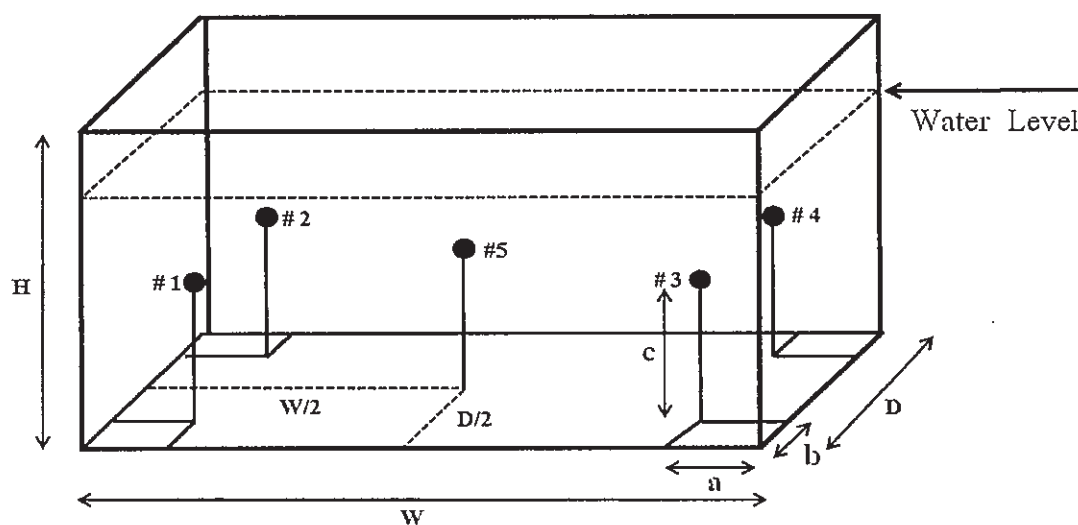
4. Condition of Item : normal condition , no indication for any damage or malfunction

Result of Calibration :

(✓) Without Adjustment

() After Adjustment

1. Sensor Installation Diagram



Sensor Installation Details

a = 5 cm
b = 5 cm
c = 5 cm

Dimension of the chamber

W = 45 cm
H = 30 cm
D = 35 cm



Certificate No. : 24TH2782

CSR No. : A150/07474

Page. : 3 of 3

Result of Calibration :

2. Temperature Measurement Accuracy Test

The measurement results of the Liquid Bath and associates are reported in the manner as shown below

Cal point (°C)	Measured Standard Temperature At Spread Locations (°C)					Uncertainty (± °C)
	#1	#2	#3	#4	Ref.5	
44.5	44.48	44.46	44.51	44.49	44.47	0.14

3. Performance Result

The performance of the Liquid Bath are reported as shown below

Cal point (°C)	UUC Setting (°C)	UUC Reading (°C)	Temperature Stability (± °C)	Temperature Uniformity (°C)	Overall Variation (°C)
44.5	44.5	44.5	0.10	0.14	0.25

- UUC = Unit Under Calibration

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

... End ...



ARCHEMICA

REVIEW BY

APPROVED BY

NEXT CAL. DATE 24/06/26

Certificate of Calibration

ICS-2100: Anion (ID#659)

This certificate is to verify that instrument below are calibrated

by Archemica Lab Co., Ltd.

ICS-2100 S/N: 11080010

AS-HV S/N: 5450A36659

For

ALS Laboratory Group (Thailand) Co., Ltd.



ARCHEMICA LAB

บริษัท อาร์เคมีกา แล็บ จำกัด
ARCHEMICA LAB CO.,LTD

Operator Signature: _____

Date: June 17-24, 2025

(Mr.Soranat Thongnop)

Application Chemist



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



Certificate of Calibration

Cert.No.: 25CHO12/1

Page.: 1 of 4

This Certificate was issued to replace to the Certificate No. 25CHO12

Equipment :	UV-VIS Spectrophotometer
Manufacturer :	Agilent
Model :	Cary 60 UV-Vis
Serial No. :	MY16510028
ID No. :	SGK_CL0040
Condition As-Received:	Used Item
Received Date :	15 January 2025
Calibration Date :	15 January 2025
Reference :	2501-0343OC-1
Submitted by :	ALS Laboratory Group (Thailand) Co.,Ltd. (Songkhla Branch) 114/1 Moo 8 Kamchanawanich Rd., T.Ban Phru, A.Hat Yai, Songkhla 90250 Thailand
Calibration Place :	Chemistry Lab
Ambient Temperature :	(22.6 to 22.2) °C (On-Site)
Relative Humidity :	(57.0 to 56.0) % (On-Site)
Calibration Procedure :	In - house method : CP-OCH4 based on ASTM E 275-08
Calibrated by :	Uthen Kankawi 
Approved by :	 Approved Signatory
(✓) Chakrit Waewwanjua () Ponpan Paipim () Saithip Meangmai	
Issue Date :	13 February 2025

REVIEW BY

APPROVED BY..

NEXT CAL DATE.....15/01/26

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written
Approval of the head of Corporate Services 3: Equipment Calibration and Testing Services.



Cert. No. : 25CHO12/1

Page : 2 of 4

Condition of calibration result

1. Reference Standard Material :

<u>Material</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due date</u>
1. Absorbance Standard set	43532	119613	22 Feb 2026
2. Absorbance Standard set	44487	122584	31 May 2026
3. Wavelength Standard set	36730	118120	15 Jan 2026
4. Wavelength Standard set	36730	118121	15 Jan 2026

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

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

- Starna Scientific Ltd.

4. Spectral BandWidth : 1.5 nm
Scan Speed : 40 nm/min

Calibration Results : without adjustment

Wavelength Accuracy

Certified Values of Reference Material (nm)	UUC Reading (nm)	Uncertainty of Measurement ($\pm$ nm)	Coverage Factor <i>k</i>
241.72	241.0	0.13	2.00
334.06	333.4	0.13	2.00
418.59	418.2	0.13	2.00
573.17	573.3	0.16	2.05
879.29	879.0	0.13	2.00



Cert. No. : 25CHO12/1

Page : 3 of 4

Calibration Results : without adjustment

Photometric Accuracy

Wavelength (nm)	Certified Values of Reference Material (Abs)	UUC Reading (Abs)	Uncertainty of Measurement ($\pm$ Abs)	Coverage Factor <i>k</i>
235.0	Zero	0.0000	0.0046	2.00
	0.4911	0.4925	0.0046	2.00
	0.7389	0.7383	0.0050	2.00
257.0	Zero	0.0000	0.0046	2.00
	0.5719	0.5704	0.0046	2.00
	0.8605	0.8574	0.0050	2.00
313.0	Zero	0.0000	0.0046	2.00
	0.1928	0.1937	0.0046	2.00
	0.2878	0.2881	0.0050	2.00
350.0	Zero	0.0000	0.0046	2.00
	0.4271	0.4261	0.0046	2.00
	0.6391	0.6373	0.0050	2.00
420.0	Zero	0.0000	0.0028	2.00
	0.5750	0.5742	0.0028	2.00
	0.7156	0.7138	0.0028	2.00
	1.0176	1.0156	0.0028	2.00

Remark

- The Potassium Dichromate filled cells are measured against a Perchloric acid blank.
- Each individual filter is measured against the empty filter holder (blank) used to zero the spectrophotometer
- UUC = Unit Under Calibration



Cert. No. : 25CHO12/1

Page : 4 of 4

Calibration Results : without adjustment

Photometric Accuracy

Wavelength (nm)	Certified Values of Reference Material (Abs)	UUC Reading (Abs)	Uncertainty of Measurement ($\pm$ Abs)	Coverage Factor <i>k</i>
440.0	Zero	0.0000	0.0028	2.00
	0.5598	0.5590	0.0028	2.00
	0.7037	0.7021	0.0028	2.00
	1.0013	0.9995	0.0028	2.00
465.0	Zero	0.0000	0.0028	2.00
	0.5222	0.5219	0.0028	2.00
	0.6646	0.6637	0.0028	2.00
	0.9444	0.9436	0.0028	2.00
546.1	Zero	0.0000	0.0028	2.00
	0.5234	0.5233	0.0028	2.00
	0.7007	0.6994	0.0028	2.00
	0.9992	0.9982	0.0028	2.00
590.0	Zero	0.0000	0.0028	2.00
	0.5573	0.5572	0.0028	2.00
	0.7760	0.7743	0.0028	2.00
	1.1104	1.1090	0.0028	2.00
635.0	Zero	0.0000	0.0028	2.00
	0.5648	0.5651	0.0028	2.00
	0.7654	0.7644	0.0028	2.00
	1.0961	1.0947	0.0028	2.00

Remark

- Each individual filter is measured against the empty filter holder (blank) used to zero the spectrophotometer
- UUC = Unit Under Calibration

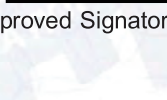
The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor *k* , providing a level of confidence of approximately 95 %.



Certificate of Calibration

Cert.No.: 25CH504

Page.: 1 of 2

Equipment :	Conductivity Meter
Manufacturer :	Mettler Toledo
Model :	SevenCompact S230
Serial No. :	B608134488
ID No. :	SGK_CL0032
Condition As-Received:	Used Item
Received Date :	25 April 2025
Calibration Date :	02 May 2025
Reference :	2504-0711DSC-1
Submitted by :	ALS Laboratory Group (Thailand) Co.,Ltd. Songkhla Branch. 114/1 Moo 8 Kamchanawanich Rd., T.Ban Phru, A.Hat Yai, Songkhla 90250 Thailand
Ambient Temperature :	(25 ± 2.5) °C
Relative Humidity :	(50 ± 15) %
Calibration Procedure:	In -house method : - CP-CH6 by direct measurement with reference material (RM)
Calibrated by :	Warakorn Lerngagtrakul 
Approved by :	 Approved Signatory
(✓) Chakrit Waewwanjua () Ponpan Paipim () Saithip Meangmai	
Issue Date :	05 May 2025

REVIEW BY

APPROVED BY

NEXT CAL DATE.....02/05/26.....

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 Calibration and Testing Equipment Services.



Cert.No.: 25CH504

Page.: 2 of 2

Condition of this result of calibration

1. Reference Standard Instrument :-

<u>Instrument</u>	<u>Serial No.</u>	<u>ID No.</u>	<u>Certificate No.</u>	<u>Due date</u>
1) Thermometer	1963878	130RC095	24I995	09 Sep 2025

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

2. Certified Reference Materials :-

- Conductivity calibration solution, Thermo Scientific (Traceable to NIST)

<u>Conductivity Solution</u>	<u>Manufacturer</u>	<u>Lot No.</u>	<u>Exp. date</u>
84 $\mu\text{S/cm}$	Thermo Scientific	424/02	18 Oct 2025
1413 $\mu\text{S/cm}$	Thermo Scientific	174/03	26 Apr 2027
12.88 mS/cm	Thermo Scientific	422/01	21 Oct 2025

- Control Conductivity calibration solution temperature by Water bath (25 ± 0.1) $^{\circ}\text{C}$

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

Calibration results

Function : Conductivity Measurement

(*) Without Adjustment

Conductivity Electrode Serial No.: 5820120321

Standard Conductivity Solution	UUC* Reading	Uncertainty of Measurement ($\pm$)	Coverage factor k
84 $\mu\text{S/cm}$	84.3 $\mu\text{S/cm}$	4.3 $\mu\text{S/cm}$	2.00
1413 $\mu\text{S/cm}$	1426 $\mu\text{S/cm}$	15 $\mu\text{S/cm}$	2.00
12.88 mS/cm	12.88 mS/cm	0.14 mS/cm	2.00

Remark : - UUC* = Unit Under Calibration

- Cell constant = 0.574487 cm^{-1}

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

-o0o-



Certificate of Calibration

Cert.No.: 25CH505

Page.: 1 of 2

Equipment : Conductivity Meter
Manufacturer : Mettler Toledo
Model : SevenCompact S230
Serial No. : B608134488
ID No. : SGK_CL0032
Condition As-Received: Used Item
Received Date : 25 April 2025
Calibration Date : 02 May 2025
Reference : 2504-0711DSC-2
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd. Songkhla Branch.
114/1 Moo 8 Kamchanawanich Rd., T.Ban Phru,
A.Hat Yai, Songkhla 90250 Thailand

Ambient Temperature : $(25 \pm 2.5) ^\circ\text{C}$
Relative Humidity : $(50 \pm 15) \%$
Calibration Procedure: In -house method :
- CP-CH6 by direct measurement
with reference material (RM)

Calibrated by : Warakorn Lerngagtrakul

Approved by : 
Approved Signatory

(✓) Chakrit Waewwanjua
() Ponpan Paipim
() Saithip Meangmai

Issue Date : 05 May 2025

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 Calibration and Testing Equipment Services.



Cert.No.: 25CH505

Page.: 2 of 2

Condition of this result of calibration

1. Reference Standard Instrument :-

<u>Instrument</u>	<u>Serial No.</u>	<u>ID No.</u>	<u>Certificate No.</u>	<u>Due date</u>
1) Thermometer	9549224	130RC003	25I440	16 Apr 2026

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

2. Certified Reference Materials :-

- Conductivity calibration solution, Thermo Scientific (Traceable to NIST)

<u>Conductivity Solution</u>	<u>Manufacturer</u>	<u>Lot No.</u>	<u>Exp. date</u>
84 $\mu\text{S/cm}$	Thermo Scientific	424/02	18 Oct 2025

- Control Conductivity calibration solution temperature by Water bath (25 ± 0.1) $^{\circ}\text{C}$

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

Calibration results

Function : Conductivity Measurement

(*) After Adjustment at 84 $\mu\text{S/cm}$

Conductivity Electrode Serial No.: 5816340156

Standard Conductivity Solution	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement ($\pm$)	Coverage factor k
84 $\mu\text{S/cm}$	81.1 $\mu\text{S/cm}$	84.1 $\mu\text{S/cm}$	4.3 $\mu\text{S/cm}$	2.00

Remark : - UUC* = Unit Under Calibration

- Cell constant = 0.103477 cm^{-1}

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

-o0o-