

ภาคผนวก ง

ใบรับรองเอกสารการสอบเทียบเครื่องมือตรวจวิเคราะห์



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รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Stack (EEMs)	Oxides of Nitrogen	Analyzer - System calibration, Star	-	-	-	-
Stack	Total Suspended Particulate	Console Control Unit	BKK_F50556	6-Jan-26	6-Jul-26	6
Stack	Total Suspended Particulate	Console Control Unit	RYG_F50315	6-Jan-26	6-Jul-26	6
Stack	Total Suspended Particulate	Pitot Tube	BKK_F50560	6-Jan-26	6-Jul-26	6
Stack	Total Suspended Particulate	Pitot Tube	RYG_F50320	6-Jan-26	6-Jul-26	6
Stack	Total Suspended Particulate	Fuel Gas Analyzer	RYG_F50564	8-May-26	7-May-27	12
Stack	Total Suspended Particulate	Digital Balance	RYG_EH0003	3-Feb-26	3-Feb-27	12
Stack	Acrylic Acid	Console Control Unit	RYG_F50315	6-Jan-26	6-Jul-26	6
Stack	Acrylic Acid	Pitot Tube	RYG_F50320	6-Jan-26	6-Jul-26	6
Stack	Acrylic Acid	DRYCAL FLOWMETER	BKK_F50614	10-Sep-25	9-Sep-26	12
Stack	Acrylic Acid	DRYCAL FLOWMETER	BKK_F50619	10-Sep-25	9-Sep-26	12
Stack	Acrylic Acid	Air Sampling Pump	RYG_F50109	7-Jul-26	7-Jul-26	3
Stack	Acrylic Acid	HPLC	BKK_FL0034	6-Jan-26	6-Jan-27	12
Stack	Total VOC	Console Control Unit	RYG_F50315	6-Jan-26	6-Jul-26	6
Stack	Total VOC	Pitot Tube	RYG_F50320	6-Jan-26	6-Jul-26	6
Stack	Total VOC	DRYCAL FLOWMETER	BKK_F50614	10-Sep-25	9-Sep-26	12
Stack	Total VOC	DRYCAL FLOWMETER	BKK_F50619	10-Sep-25	9-Sep-26	12
Stack	Total VOC	Air Sampling Pump	RYG_F50097	6-Jul-26	6-Jul-26	3
Stack	Total VOC	FID Analyzer	BKK_F50758	12-Mar-26	11-Mar-27	6
Ambient	Total Suspended Particulate	High Volume	BKK_F50367	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	BKK_F50371	-	-	On site Calibration
Ambient	Total Suspended Particulate	Digital Balance	RYG_EH0001	3-Feb-26	3-Feb-27	12
Ambient	Nitrogen Dioxide	NO ₂ Analyzer	BKK_F50776	5-Jan-26	5-Jul-26	6
Ambient	Nitrogen Dioxide	NO ₂ Analyzer	BKK_F51098	5-Jan-26	5-Jul-26	6
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	RYG_F50608	21-Jan-26	20-Jul-27	18
Noise	Leq 24 hrs	Sound Calibrator	RYG_F50213	9-Jan-26	8-Jan-27	12
Noise	Leq 24 hrs	Sound Level Meter	RYG_F50622	21-Jan-26	20-Jan-27	12
Noise	Leq 24 hrs	Sound Level Meter	RYG_F50627	21-Jan-26	20-Jan-27	12
Noise	Leq 24 hrs	Sound Level Meter	RYG_F50628	21-Jan-26	20-Jan-27	12
Noise	Leq 24 hrs	Sound Level Meter	RYG_F50629	21-Jan-26	20-Jan-27	12
Noise	Leq 12 hrs & Octave band	Sound Calibrator	RYG_F50216	19-Aug-25	18-Aug-26	12
Noise	Leq 12 hrs & Octave band	Sound Level Meter	RYG_F50494	28-Jan-26	27-Jan-27	12
Noise	Leq 12 hrs & Octave band	Sound Level Meter	RYG_F50495	28-Jan-26	27-Jan-27	12
Noise	Leq 12 hrs & Octave band	Sound Level Meter	RYG_F50612	22-Dec-25	21-Dec-26	12
Noise	Leq 12 hrs & Octave band	Sound Level Meter	RYG_F50613	22-Dec-25	21-Dec-26	12
Noise	Leq 12 hrs & Octave band	Sound Level Meter	RYG_F50614	24-Dec-25	23-Dec-26	12
Noise	Leq 12 hrs & Octave band	Sound Level Meter	RYG_F50615	22-Dec-25	21-Dec-26	12
Noise	Leq 12 hrs & Octave band	Sound Calibrator	RYG_F50213	9-Jan-26	8-Jan-27	12
Noise	Leq 12 hrs & Octave band	Sound Level Meter	RYG_F50439	5-Nov-25	4-Nov-26	12
Noise	Leq 12 hrs & Octave band	Sound Level Meter	RYG_F50491	28-Jan-26	27-Jan-27	12
Noise	Leq 12 hrs & Octave band	Sound Level Meter	RYG_F50492	28-Jan-26	27-Jan-27	12
Noise	Leq 12 hrs & Octave band	Sound Level Meter	RYG_F50493	28-Jan-26	27-Jan-27	12
Noise	Leq 12 hrs & Octave band	Sound Level Meter	RYG_F50494	28-Jan-26	27-Jan-27	12
Noise	Leq 12 hrs & Octave band	Sound Level Meter	RYG_F50495	28-Jan-26	27-Jan-27	12
Noise	Noise Dose, TWA	Dose Badge Reader	RYG_F50635	26-May-25	25-May-26	12
Noise	Noise Dose, TWA	Dosimeter	RYG_F50636	19-Sep-25	18-Sep-26	12
Noise	Noise Dose, TWA	Dosimeter	RYG_F50637	24-Oct-25	23-Oct-26	12
Noise	Noise Dose, TWA	Dosimeter	RYG_F50638	27-Jun-25	26-Jun-26	12
Noise	Noise Dose, TWA	Dosimeter	RYG_F50642	30-Jun-25	29-Jun-26	12
Noise	Noise Dose, TWA	Dosimeter	RYG_F50639	19-Sep-25	18-Sep-26	12
Noise	Noise Dose, TWA	Dose Badge Reader	BKK_FS1367	14-Jul-25	14-Jul-26	12
Noise	Noise Dose, TWA	Dosimeter	RYG_F50636	19-Sep-25	18-Sep-26	12
Noise	Noise Dose, TWA	Dosimeter	RYG_F50637	24-Oct-25	23-Oct-26	12
Noise	Noise Dose, TWA	Dosimeter	RYG_F50638	27-Jun-25	26-Jun-26	12
Noise	Noise Dose, TWA	Dosimeter	RYG_F50639	19-Sep-25	18-Sep-26	12
Noise	Noise Dose, TWA	Dosimeter	RYG_F50640	19-Sep-25	18-Sep-26	12

1

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รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Workplace	Acrylic Acid	DRYCAL FLOWMETER	BKK_F50614	10-Sep-25	9-Sep-26	12
Workplace	Acrylic Acid	DRYCAL FLOWMETER	BKK_F50619	10-Sep-25	9-Sep-26	12
Workplace	Acrylic Acid	HPLC	BKK_FL0034	6-Jan-26	6-Jan-27	12
Workplace	Total Dust	DRYCAL FLOWMETER	BKK_F50614	10-Sep-25	9-Sep-26	12
Workplace	Total Dust	DRYCAL FLOWMETER	BKK_F50619	10-Sep-25	9-Sep-26	12
Workplace	Total Dust	Digital Balance	RYG_EH0004	3-Feb-26	3-Feb-27	12
Workplace	Respirable Dust	DRYCAL FLOWMETER	BKK_F50614	10-Sep-25	9-Sep-26	12
Workplace	Respirable Dust	DRYCAL FLOWMETER	BKK_F50619	10-Sep-25	9-Sep-26	12
Workplace	Respirable Dust	Digital Balance	RYG_EH0004	3-Feb-26	3-Feb-27	12
Workplace	Propylene Glycol	DRYCAL FLOWMETER	BKK_F50614	10-Sep-25	9-Sep-26	12
Workplace	Propylene Glycol	DRYCAL FLOWMETER	BKK_F50619	10-Sep-25	9-Sep-26	12
Workplace	Propylene Glycol	GC-FID	BKK_EN0126	23-Oct-25	21-Oct-26	12
Rayong Lab	BOD	DO meter with Sensor	RYG_EN0032	20-Jan-25	20-Jul-26	18
Rayong Lab	BOD	Incubator	RYG_EN0134	18-Jul-26	18-Sep-27	18
Rayong Lab	BOD	Burette	RYG_EN0216	18-Sep-25	18-Sep-26	12
Rayong Lab	COD	Spectrophotometer	RYG_EN0037	18-Jul-25	18-Sep-26	18
Rayong Lab	Oil & Grease	Electronic Balance	RYG_EN0003	3-Feb-26	3-Feb-27	12
Rayong Lab	Oil & Grease	Liquid Bath (Water)	RYG_EN0220	27-Nov-25	27-Nov-26	12
Rayong Lab	pH on site	pH meter	RYG_F50594	18-Jul-25	18-Jul-26	12
Rayong Lab	Temperature	pH meter	RYG_F50594	18-Jul-25	18-Jul-26	12
Rayong Lab	Total Suspended Solids	Electronic Balance	RYG_EN0163	3-Feb-26	3-Feb-27	12
Rayong Lab	Total Suspended Solids	Chamber (Oven)	RYG_EN0012	10-Sep-25	10-Jul-27	18
Rayong Lab	Total Kjeldahl Nitrogen	Block Digestion Unit	RYG_EN0188	10-Sep-25	10-Jul-27	18
Rayong Lab	Total Kjeldahl Nitrogen	pH Meter	RYG_EN0132	18-Jun-25	18-Dec-26	18
Rayong Lab	Phosphate	Spectrophotometer	RYG_EN0037	18-Jul-25	18-Sep-26	18

2

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Lot No. 2646570-1

ANALYZER CALIBRATION DATA

Client : BASF (Thai) Limited Location : Boiler Stack
Date : 12 Jun 26 Test Operator : Naratip T.

O₂ ANALYZER
Model : TELEDYNE API T200H Serial No. : 101
Span (%) : 25

	Cylinder Value (%)	Initial Analyzers Calibration Response (%)	Final Analyzers Calibration Response (%)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.00	0.00
Low-Level Gas	8.19	8.20	8.20	0.00
Span Gas	16.07	16.07	16.08	0.04

NO_x ANALYZER
Model : TELEDYNE API T200H Serial No. : 101
Span (ppm) : 100

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.01	0.01	0.00
Low-Level Gas	55.91	55.90	55.89	0.01
Span Gas	62.51	62.50	62.50	0.00

SO₂ ANALYZER
Model : TELEDYNE API T100H Serial No. : 68
Span (ppm) : 100

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.02	0.03	0.01
Low-Level Gas	56.28	56.27	56.27	0.00
Span Gas	79.76	79.76	79.74	0.02

CO ANALYZER
Model : TELEDYNE API T300M Serial No. : 80
Span (ppm) : 100

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.00	0.00
Low-Level Gas	55.20	55.18	55.19	0.01
Span Gas	79.74	79.74	79.72	0.02

Calibrated by

Naratip T.

Naratip Thueakchaikam
RYG Field Services Scientist (1)



Lot No. 2646570-1

SYSTEM CALIBRATION BIAS AND DRIFT DATA

Client : BASF (Thai) Limited Location : Boiler Stack
Date : 12 Jun 26 Test Operator : Naratip T.

O₂ ANALYZER
Cylinder Conc. (%) : 16.07 Span (%) : 25

	O ₂ Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
		System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	
Zero Gas	0.00	0.01	0.04	0.02	0.08	0.04
Upscale Gas	16.07	16.10	0.12	16.10	0.12	0.00

NO_x ANALYZER
Cylinder Conc. (ppm) : 82.51 Span (ppm) : 100

	NO _x Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
		System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	
Zero Gas	0.01	0.05	0.04	0.05	0.04	0.00
Upscale Gas	82.50	82.45	0.05	82.45	0.05	0.00

SO₂ ANALYZER
Cylinder Conc. (ppm) : 79.76 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	0.02	0.03	0.01	0.03	0.01	0.00
Upscale Gas	79.76	79.71	0.05	79.70	0.06	0.01

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

	CO Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
		System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	
Zero Gas	0.00	0.00	0.00	0.00	0.00	0.00
Upscale Gas	79.74	79.68	0.06	79.68	0.06	0.00

Calibrated by

Naratip T.

Naratip Thueakchaikam
RYG Field Services Scientist (1)



EMISSION TEST RESULT

Client		BASF (Thai) Limited	Run #	1
Date		12 Jun 26	Location	Boiler Stack
Start Time		11:25	Test Operator	Naratip T.
SO ₂ Analyzer	Model	TELEDYNE API T100H	Finish Time	11:45
NO _x /O ₂ Analyzer	Model	TELEDYNE API T200H	Serial No.	68
CO/CO ₂ Analyzer Model		TELEDYNE API T300M	Serial No.	101
			Serial No.	80

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	NO ₂ (ppm)
11:25	5.55	8.58	50.13	0.00	0.29	2.24
11:26	5.55	8.65	50.35	0.01	0.25	2.34
11:27	5.61	8.60	50.53	0.01	0.22	2.42
11:28	5.78	8.56	50.37	0.03	0.19	2.41
11:29	5.89	8.46	50.13	0.02	0.18	2.36
11:30	5.93	8.42	50.08	0.03	0.18	2.33
11:31	5.74	8.45	50.03	0.08	0.18	2.31
11:32	5.61	8.58	50.04	0.07	0.20	2.36
11:33	5.69	8.59	50.31	0.10	0.22	2.35
11:34	5.70	8.56	50.73	0.14	0.24	2.39
11:35	5.61	8.57	50.62	0.10	0.23	2.39
11:36	5.62	8.55	50.65	0.10	0.26	2.40
11:37	5.98	8.40	51.14	0.11	0.42	2.34
11:38	5.91	8.40	51.53	0.09	0.47	2.36
11:39	5.70	8.54	51.69	0.10	0.47	2.54
11:40	5.69	8.57	51.45	0.09	0.48	2.60
11:41	5.62	8.56	51.40	0.07	0.46	2.70
11:42	5.51	8.68	51.47	0.08	0.34	2.70
11:43	5.86	8.50	51.72	0.10	0.33	2.59
11:44	5.96	8.40	52.07	0.13	0.32	2.56
11:45	5.96	8.40	52.34	0.17	0.30	2.56
Average	5.75	8.52	50.90	0.08	0.30	2.44

Naratip T.

Naratip Thueakchakam
RYG Field Services Scientist (1)

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

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EMISSION TEST RESULT

Client		BASF (Thai) Limited	Run #	2
Date		12 Jun 26	Location	Boiler Stack
Start Time		11:46	Test Operator	Naratip T.
SO ₂ Analyzer	Model	TELEDYNE API T100H	Finish Time	12:06
NO _x /O ₂ Analyzer	Model	TELEDYNE API T200H	Serial No.	68
CO/CO ₂ Analyzer Model		TELEDYNE API T300M	Serial No.	101
			Serial No.	80

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	NO ₂ (ppm)
11:46	5.79	8.41	51.89	0.18	0.25	2.60
11:47	5.56	8.57	51.53	0.16	0.21	2.60
11:48	5.57	8.63	51.14	0.17	0.23	2.59
11:49	5.49	8.66	51.37	0.16	0.26	2.71
11:50	5.78	8.59	51.32	0.13	0.30	2.75
11:51	5.84	8.46	51.12	0.13	0.33	2.66
11:52	5.89	8.44	50.97	0.14	0.29	2.61
11:53	5.91	8.43	50.89	0.12	0.24	2.51
11:54	5.78	8.44	50.87	0.13	0.19	2.53
11:55	5.60	8.59	50.85	0.16	0.14	2.50
11:56	5.65	8.60	50.88	0.17	0.12	2.73
11:57	5.64	8.57	50.80	0.09	0.13	2.83
11:58	5.63	8.57	50.80	0.10	0.13	2.76
11:59	5.68	8.58	50.81	0.10	0.12	2.50
12:00	5.72	8.54	50.65	0.17	0.12	2.40
12:01	5.72	8.55	50.32	0.18	0.12	2.39
12:02	5.57	8.58	50.13	0.16	0.12	2.41
12:03	5.63	8.61	50.44	0.16	0.10	2.47
12:04	5.61	8.59	50.77	0.17	0.10	2.56
12:05	5.56	8.60	50.82	0.16	0.09	2.61
12:06	5.52	8.63	50.70	0.17	0.08	2.61
Average	5.67	8.56	50.91	0.15	0.18	2.59

Naratip T.

Naratip Thueakchakam
RYG Field Services Scientist (1)

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

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EMISSION TEST RESULT

Client		BASF (Thai) Limited	Run #	3
Date		12 Jun 26	Location	Boiler Stack
Start Time		12:07	Test Operator	Naratip T.
SO ₂ Analyzer	Model	TELEDYNE API T100H	Finish Time	12:27
NO _x /O ₂ Analyzer	Model	TELEDYNE API T200H	Serial No.	68
CO/CO ₂ Analyzer Model		TELEDYNE API T300M	Serial No.	101
			Serial No.	80

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	NO ₂ (ppm)
12:07	5.55	8.65	50.47	0.11	0.11	2.60
12:08	5.54	8.63	50.20	0.13	0.16	2.65
12:09	5.54	8.63	50.18	0.13	0.19	2.66
12:10	5.60	8.64	50.51	0.14	0.19	2.62
12:11	5.62	8.59	51.10	0.13	0.21	2.62
12:12	5.65	8.59	51.28	0.13	0.18	2.71
12:13	5.60	8.57	51.15	0.12	0.15	2.75
12:14	5.56	8.58	50.90	0.10	0.14	2.78
12:15	5.50	8.63	50.58	0.09	0.14	2.76
12:16	5.48	8.69	50.34	0.11	0.13	2.78
12:17	5.47	8.70	50.43	0.09	0.13	2.78
12:18	5.52	8.69	50.51	0.12	0.12	2.78
12:19	5.54	8.62	50.62	0.11	0.11	2.76
12:20	5.57	8.63	50.72	0.16	0.12	2.79
12:21	5.57	8.60	50.77	0.13	0.12	2.85
12:22	5.49	8.64	50.51	0.12	0.14	2.87
12:23	5.51	8.67	50.18	0.12	0.16	2.81
12:24	5.52	8.65	49.87	0.11	0.15	2.67
12:25	5.53	8.63	49.93	0.11	0.13	2.66
12:26	5.56	8.63	50.07	0.10	0.10	2.68
12:27	5.54	8.61	50.26	0.14	0.07	2.73
Average	5.55	8.63	50.50	0.12	0.14	2.73

Naratip T.

Naratip Thueakchakam
RYG Field Services Scientist (1)

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

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ANALYZER CALIBRATION DATA

Lot No. 2646573-1

Client	: BASF (Thai) Limited	Location	: Scrubber Stack
Date	: 12 Jun 26	Test Operator	: Naratip T.

O ₂ ANALYZER			
Model	: TELEDYNE API T200H	Serial No.	: 101
Span (%)	: 25		

	Cylinder Value (%)	Initial Analyzers Calibration Response (%)	Final Analyzers Calibration Response (%)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.00	0.00
Low-Level Gas	8.19	8.20	8.20	0.00
Span Gas	16.07	16.07	16.08	0.04

NO _x ANALYZER			
Model	: TELEDYNE API T200H	Serial No.	: 101
Span (ppm)	: 100		

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.01	0.01	0.00
Low-Level Gas	55.91	55.90	55.89	0.01
Span Gas	82.51	82.50	82.50	0.00

SO ₂ ANALYZER			
Model	: TELEDYNE API T100H	Serial No.	: 68
Span (ppm)	: 100		

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.00	0.00
Low-Level Gas	56.28	56.27	56.27	0.00
Span Gas	79.76	79.76	79.74	0.02

CO ANALYZER			
Model	: TELEDYNE API T300M	Serial No.	: 80
Span (ppm)	: 100		

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.00	0.00
Low-Level Gas	55.20	55.18	55.18	0.01
Span Gas	79.74	79.74	79.72	0.02

Calibrated by

Naratip T.

Naratip Thueakchakam
RYG Field Services Scientist (1)

FORM NO.: F 06-062 ISSUE NO.: 5 ISSUE DATE: 02/02/26

ALS Laboratory Group



Lot No. 2646573-1

SYSTEM CALIBRATION BIAS AND DRIFT DATA

Client : BASF (Thai) Limited Location : Scrubber Stack
Date : 12 Jun 26 Test Operator : Naratip T.O₂ ANALYZER : 16.07 Span (%) : 25
Cylinder Conc. (%)

	O ₂ Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
		System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	
Zero Gas	0.00	0.01	0.04	0.02	0.06	0.04
Upscale Gas	16.07	16.10	0.12	16.10	0.12	0.00

NO_x ANALYZER : 82.51 Span (ppm) : 100
Cylinder Conc. (ppm)

	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	0.01	0.02	0.01	0.02	0.01	0.00
Upscale Gas	82.50	82.45	0.05	82.45	0.05	0.00

SO₂ ANALYZER : 79.76 Span (ppm) : 100
Cylinder Conc. (ppm)

	SO ₂ Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
		System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	
Zero Gas	0.00	0.00	0.00	0.00	0.00	0.00
Upscale Gas	79.76	79.71	0.05	79.70	0.06	0.01

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

	CO Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
		System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	
Zero Gas	0.00	0.00	0.00	0.00	0.00	0.00
Upscale Gas	79.74	79.68	0.06	79.68	0.06	0.00

Calibrated by

Naratip T.

Naratip Thueakchaikam

RYG Field Services Scientist (1)

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

ALS Laboratory Group

Page 2 of 5.



EMISSION TEST RESULT

Client		BASF (Thai) Limited	Run #	1
Date		12 Jun 26	Location	Scrubber Stack
Start Time		13:40	Test Operator	Naratip T.
SO ₂ Analyzer Model		TELEDYNE API T100H	Finish Time	14:00
NO _x /O ₂ Analyzer Model		TELEDYNE API T200H	Serial No.	68
CO/CO ₂ Analyzer Model		TELEDYNE API T300M	Serial No.	101
			Serial No.	80

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	NO ₂ (ppm)
13:40	18.96	0.96	1.17	0.00	39.41	0.77
13:41	18.98	0.95	1.20	0.01	38.96	0.77
13:42	18.97	0.95	1.20	0.00	38.23	0.75
13:43	18.99	0.95	1.21	0.03	38.41	0.78
13:44	18.96	0.95	1.20	0.03	38.57	0.80
13:45	18.97	0.94	1.19	0.05	39.05	0.80
13:46	18.97	0.95	1.22	0.05	39.32	0.81
13:47	18.96	0.95	1.24	0.03	39.74	0.81
13:48	18.97	0.95	1.22	0.03	39.54	0.78
13:49	18.97	0.95	1.21	0.01	39.88	0.74
13:50	18.96	0.95	1.21	0.01	39.67	0.73
13:51	18.95	0.95	1.19	0.01	39.34	0.72
13:52	18.95	0.96	1.22	0.01	39.40	0.73
13:53	18.95	0.97	1.25	0.04	39.60	0.77
13:54	18.95	0.96	1.24	0.04	39.66	0.78
13:55	18.96	0.95	1.23	0.04	39.59	0.81
13:56	18.97	0.96	1.19	0.04	39.52	0.75
13:57	18.97	0.95	1.19	0.02	39.39	0.76
13:58	18.97	0.95	1.20	0.01	39.20	0.82
13:59	18.97	0.95	1.16	0.01	38.81	0.80
14:00	18.97	0.94	1.15	0.01	39.57	0.75
Average	18.97	0.95	1.20	0.02	39.28	0.77

Naratip T.

Naratip Thueakchaikam
RYG Field Services Scientist (1)

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

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Page 3 of 5.



EMISSION TEST RESULT

Client		BASF (Thai) Limited	Run #	2
Date		12 Jun 26	Location	Scrubber Stack
Start Time		14:01	Test Operator	Naratip T.
SO ₂ Analyzer Model		TELEDYNE API T100H	Finish Time	14:21
NO _x /O ₂ Analyzer Model		TELEDYNE API T200H	Serial No.	68
CO/CO ₂ Analyzer Model		TELEDYNE API T300M	Serial No.	101
			Serial No.	80

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	NO ₂ (ppm)
14:01	18.96	0.95	1.14	0.01	39.51	0.72
14:02	18.96	0.95	1.14	0.04	39.50	0.73
14:03	18.98	0.95	1.17	0.05	38.95	0.74
14:04	18.98	0.95	1.20	0.05	38.87	0.81
14:05	18.97	0.95	1.21	0.04	38.24	0.82
14:06	18.96	0.95	1.19	0.05	38.04	0.77
14:07	18.96	0.95	1.21	0.02	38.13	0.75
14:08	18.96	0.95	1.19	0.01	38.37	0.78
14:09	18.96	0.95	1.13	0.00	39.18	0.76
14:10	18.96	0.95	1.15	0.02	39.45	0.77
14:11	18.95	0.95	1.17	0.02	39.67	0.76
14:12	18.95	0.95	1.17	0.03	39.97	0.73
14:13	18.97	0.95	1.17	0.04	40.17	0.71
14:14	18.95	0.95	1.17	0.05	39.57	0.71
14:15	18.94	0.95	1.18	0.04	39.49	0.78
14:16	18.96	0.96	1.14	0.03	39.34	0.77
14:17	18.97	0.95	1.15	0.02	38.88	0.79
14:18	18.95	0.95	1.15	0.02	38.66	0.76
14:19	18.95	0.95	1.17	0.01	38.47	0.82
14:20	18.96	0.96	1.15	0.01	38.10	0.76
14:21	18.96	0.96	1.17	0.00	38.05	0.75
Average	18.96	0.95	1.17	0.03	38.98	0.76

Naratip T.

Naratip Thueakchaikam
RYG Field Services Scientist (1)

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

ALS Laboratory Group

Page 4 of 5.



EMISSION TEST RESULT

Client		BASF (Thai) Limited	Run #	3
Date		12 Jun 26	Location	Scrubber Stack
Start Time		14:22	Test Operator	Naratip T.
SO ₂ Analyzer Model		TELEDYNE API T100H	Finish Time	14:42
NO _x /O ₂ Analyzer Model		TELEDYNE API T200H	Serial No.	68
CO/CO ₂ Analyzer Model		TELEDYNE API T300M	Serial No.	101
			Serial No.	80

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	NO ₂ (ppm)
14:22	18.95	0.95	1.15	0.03	38.03	0.73
14:23	18.95	0.95	1.12	0.06	37.79	0.73
14:24	18.96	0.95	1.13	0.05	37.49	0.75
14:25	18.95	0.95	1.13	0.05	37.59	0.71
14:26	18.95	0.95	1.15	0.03	38.01	0.73
14:27	18.94	0.96	1.16	0.05	38.14	0.80
14:28	18.94	0.96	1.15	0.03	38.46	0.80
14:29	18.95	0.96	1.13	0.02	38.37	0.74
14:30	18.93	0.96	1.14	0.02	37.70	0.76
14:31	18.95	0.96	1.12	0.01	37.34	0.74
14:32	18.95	0.95	1.12	0.03	36.95	0.73
14:33	18.95	0.94	1.14	0.04	37.30	0.75
14:34	18.97	0.94	1.14	0.05	37.96	0.76
14:35	18.95	0.95	1.11	0.05	38.60	0.72
14:36	18.96	0.95	1.08	0.05	39.00	0.72
14:37	18.94	0.95	1.07	0.03	39.62	0.74
14:38	18.93	0.95	1.12	0.04	40.09	0.79
14:39	18.95	0.95	1.16	0.02	40.16	0.84
14:40	18.96	0.95	1.09	0.01	40.28	0.80
14:41	18.95	0.96	1.08	0.01	40.16	0.77
14:42	18.95	0.95	1.07	0.00	40.15	0.77
Average	18.95	0.95	1.12	0.03	38.53	0.76

Naratip T.

Naratip Thueakchaikam
RYG Field Services Scientist (1)

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

ALS Laboratory Group

Page 5 of 5.

CERTIFICATE OF ANALYSIS
Grade of Product: EPA PROTOCOL STANDARD

Customer: AIR LIQUIDE
(THAILAND) LTD
Part Number: E04NI99E3HA0066
Cylinder Number: GN0027216
Laboratory: 124 - Plumsteadville - PA
PGVP Number: A12022
Gas Code: CO,NO,NOX,SO2,BALN

Reference Number: 160-402340012-1
Cylinder Volume: 247.2 CF
Cylinder Pressure: 2215 PSIG
Valve Outlet: 660
Certification Date: Feb 09, 2022

Expiration Date: Feb 09, 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
NOX	55.00 PPM	55.91 PPM	G1	+/- 1.0% NIST Traceable	02/02/2022, 02/09/2022
CARBON MONOXIDE	55.00 PPM	55.20 PPM	G1	+/- 0.5% NIST Traceable	02/02/2022
NITRIC OXIDE	55.00 PPM	55.91 PPM	G1	+/- 0.9% NIST Traceable	02/02/2022, 02/09/2022
SULFUR DIOXIDE	55.00 PPM	55.28 PPM	G1	+/- 0.8% NIST Traceable	02/02/2022, 02/09/2022
NITROGEN	Balance				

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

ANALYTICAL EQUIPMENT		
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet iS50 FTIR AUP2010245 CO	FTIR	Jan 06, 2022
Nicolet iS50 FTIR AUP2010245 NO	FTIR	Jan 12, 2022
Nicolet iS50 FTIR AUP2010245 NO2	FTIR	Jan 27, 2022
Nicolet iS50 FTIR AUP2010245 SO2	FTIR	Jan 20, 2022

Triad Data Available Upon Request

NOTES: Gross Weight: 49.4 Kg
Net Weight: 8.4 Kg
Approved for Release

Page 1 of 160-402340012-1

CERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

Part Number: E04NI99E3HA0002
Cylinder Number: ND11222
Laboratory: 124 - Plumsteadville - PA
PGVP Number: A12021
Gas Code: CO,NO,NOX,SO2,BALN

Reference Number: 160-402138465-1
Cylinder Volume: 247.2 Cubic Feet
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 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
NOX	80.00 PPM	82.51 PPM	G1	+/- 1.4% NIST Traceable	07/08/2021, 07/15/2021
CARBON MONOXIDE	80.00 PPM	79.74 PPM	G1	+/- 0.5% NIST Traceable	07/08/2021
NITRIC OXIDE	80.00 PPM	82.51 PPM	G1	+/- 1.4% NIST Traceable	07/08/2021, 07/15/2021
SULFUR DIOXIDE	80.00 PPM	79.76 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	11010130	KAL004538	97.31 PPM CARBON MONOXIDE/NITROGEN	+/- 0.4%	Oct 04, 2022
PRM	12388	D685025	9.91 PPM AIR/NITROGEN DIOXIDE	2.0%	Feb 20, 2020
NTRM	200610-15	CC733426	98.61 PPM NITRIC OXIDE/NITROGEN	+/- 0.9%	Oct 06, 2026
GMIS	124206889	CC323707	4.028 PPM NITROGEN DIOXIDE/NITROGEN	2.1%	Aug 15, 2021
NTRM	16010224	KAL003838	97.69 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Dec 23, 2021

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

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

Triad Data Available Upon Request

NOTES: Gross Weight: 48.0 Kg
Net Weight: 7.8 Kg
Approved for Release

Page 1 of 160-402138465-1

CERTIFICATE OF ANALYSIS
Grade of Product: EPA PROTOCOL STANDARD

Customer: AIR LIQUIDE
(THAILAND) LTD
Part Number: E02NI92E3HA0001
Cylinder Number: GN0029535
Laboratory: 124 - Plumsteadville - PA
PGVP Number: A12023
Gas Code: O2,BALN

Reference Number: 160-402830555-1
Cylinder Volume: 250.0 CF
Cylinder Pressure: 2214 PSIG
Valve Outlet: 590
Certification Date: Sep 05, 2023

Expiration Date: Sep 05, 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
OXYGEN	16.00 %	16.07 %	G1	+/- 0.4% NIST Traceable	09/05/2023
NITROGEN	Balance				

CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	08010205	K001516	23.2 % OXYGEN/NITROGEN	+/- 0.4%	Jun 01, 2024

ANALYTICAL EQUIPMENT		
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
SIEMENS OXYMAT 6 - N1-W5-951 - O2	PARAMAGNETIC	Aug 16, 2023

Triad Data Available Upon Request

NOTES: Gross Weight: 50.0 Kg
Net Weight: 8.4 Kg
Approved for Release

Page 1 of 1

CERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

Part Number: E02NI92E3HA0000
Cylinder Number: GN0025098
Laboratory: 124 - Plumsteadville - PA
PGVP Number: A12020
Gas Code: O2,BALN

Reference Number: 160-401948144-1
Cylinder Volume: 248.4 CF
Cylinder Pressure: 2214 PSIG
Valve Outlet: 590
Certification Date: Nov 11, 2020

Expiration Date: Nov 11, 2028

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 %	8.186 %	G1	+/- 0.3% NIST Traceable	11/11/20
NITROGEN	Balance				

CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	10010602	1038055	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	Oct 26, 2020

Triad Data Available Upon Request

NOTES: Gross Weight: 48.1 Kg
Net Weight: 8.2 Kg

Approved for Release

Page 1 of 160-401948144-1



DIGITAL TEMPERATURE CALIBRATION DATA SHEET

Calibration Date :	6 Jan 26	Ambient Temperature (°C)	27
Calibration sheet No. :	C-060126-BKK_FS0557	Relative Humidity (%) :	46,5
Digital Temperature ID :	BKK_FS0557	Reference Temperature ID	RYF_FS0681
Serial No. :	1302005	Serial No. :	201090014918
Model :	XC-572-V	Model :	DIGICON CC-VT-MS
		Next Calibrate :	16 Jan 27

Location	Reference Temperature °C	Digital Temperature °C	Error °C	MPE	Pass / Fail
Stack	0	0	0	±3	Pass
	25	26	1	±3	Pass
	50	50	0	±3	Pass
	100	101	1	±3	Pass
	150	151	1	±3	Pass
	200	200	0	±3	Pass
	250	250	0	±3	Pass
Probe	300	301	1	±3	Pass
	500	501	1	±3	Pass
	100	101	1	±3	Pass
	120	121	1	±3	Pass
	140	141	1	±3	Pass
	100	101	-2	±3	Pass
	120	121	-3	±3	Pass
Filter	140	141	3	±3	Pass
	100	100	0	±3	Pass
	120	120	0	±3	Pass
Exit	140	141	1	±3	Pass
	0	0	0	±3	Pass
	10	11	1	±3	Pass
Meter	20	21	1	±3	Pass
	0	0	0	±3	Pass
	25	25	0	±3	Pass
AUX	50	51	1	±3	Pass
	0	0	0	±3	Pass
	25	26	1	±3	Pass
	50	51	1	±3	Pass

MPE : (Maximum permissible error of measurement) ค่าความผิดพลาดสูงสุดของการวัดที่ยอมรับได้

Calibrated by : Mr. Apisit Singha Approved by : Mr. Natthapol Jengwareewong
(Mr. Apisit Singha) (Mr. Natthapol Jengwareewong)
Field Scientist (4) Field Specialist (1)

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

CONSOLE CONTROL UNIT CALIBRATION TEST REPORT



Calibration of Date : 6-Jan-26 Barometric Pressure (mm.Hg) : 756.1
Next Calibration Date : 06-Jul-26 Relative Humidity (%) : 46.5
Certificate No. : C-060126-BKK_FS0556 Temperature (°C) : 27.0

ΔH (mm.Hg)	Θ Minutes	Reference Dry Gas Meter Calibration						Console Control : Drygas Meter						Dry Gas Meter Correction Factor (Y)	Orifice Calibration Factor ΔH _g
		Vn (Liters)			T _r (°C)	T _g (°C)	Vn (Liters)			T _r (°C)	T _g (°C)	Avg.Tm (°C)			
		Final	Initial	Total			Final	Initial	Total						
15	11.00	156.03	150.01	150.03	20	70796.08	70751.52	144.56	20.0	28.0	26.0	26.0	0.2499	43.6169	
25	9.25	150.12	0.08	150.12	20.0	70744.81	70730.04	14.78	28.0	26.0	26.0	1.0000	43.7368		
50	6.60	150.10	0.10	150.10	20.0	70759.64	70745.44	14.20	28.0	28.0	28.0	1.0073	44.2943		
75	4.87	150.04	0.04	150.04	27.0	70769.52	70765.52	4.00	28.0	28.0	28.0	1.0000	43.7372		
100	3.80	150.11	0.09	150.11	20.0	70766.48	70770.22	3.74	28.0	28.0	28.0	1.0204	43.7900		
												Avg.	1.0209	43.7900	

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

ΔH_g : Orifice pressure differential that equals to 21.24 in of air @ 25°C and 760 mm of mercury . mm.Hg : tolerance for individual values ± 5.08 from average .

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

Calibrated by : Mr. Apisit Singha Approved by : Mr. Natthapol Jengwareewong
(Mr. Apisit Singha) (Mr. Natthapol Jengwareewong)
Field Services Scientist (4) Field Services Specialist (1)

Issue date : 07-Jan-26

Page 1 of 1

FORM NO.: F 06-024 Issue NO.: 1 ISSUE DATE: 01/08/25

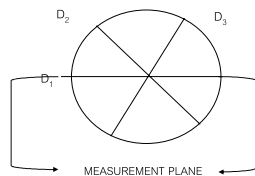


PROBE NOZZLE DIAMETER CALIBRATION DATA SHEET

Calibration Date :	6 Jan 26	Nozzle Set ID. :	BKK_FS0562
Calibration Sheet No. :	C-060126-BKK_FS0562	Vernier Caliper ID.:	BKK_FS0626

Nozzle ID #	Nozzle Diameter (cm.)			Hi - Lo ΔD	(D ₁ + D ₂ + D ₃) / 3 D _{avg}
	D ₁	D ₂	D ₃		
1	0.300	0.300	0.302	0.002	0.301
2	0.475	0.475	0.469	0.006	0.473
3	0.530	0.525	0.530	0.005	0.528
4	0.625	0.628	0.630	0.005	0.628
5	0.759	0.760	0.765	0.006	0.761
6	0.975	0.977	0.980	0.005	0.977
7	1.082	1.085	1.081	0.004	1.083
8	1.272	1.270	1.275	0.005	1.272
9	1.605	1.601	1.609	0.008	1.605

Where :
D₁, D₂, D₃ = 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} = (D₁ + D₂ + D₃) / 3



Calibrated by : Mr. Warawut Pubpa Approved by : Mr. Natthapol Jengwareewong
(Mr. Warawut Pubpa) (Mr. Natthapol Jengwareewong)
Field Scientist (3) Field Specialist (1)

FORM NO.: F 06-026 REVISION NO.: 1 ISSUE DATE: 01/01/23

CONSOLE CONTROL UNIT CALIBRATION TEST REPORT



Calibration of Date : 6-Jan-26 Barometric Pressure (mm.Hg) : 756.1
Next Calibration Date : 06-Jul-26 Relative Humidity (%) : 46.5
Certificate No. : C-060126-RYG_FS0315 Temperature (°C) : 27.0

ΔH (mm.Hg)	Θ Minutes	Reference Dry Gas Meter Calibration					Console Control : Drygas Meter							Dry Gas Meter Correction Factor (Y)	Orifice Calibration Factor ΔH _g
		Vn (Liters)			T _r (°C)	T _g (°C)	Vn (Liters)			T _r (°C)	T _g (°C)	Avg.Tm (°C)	Factor		
		Final	Initial	Total			Final	Initial	Total						
15	12.33	100.0	0.00	100.0	29.0	23378.0	23367.0	148.0	27.0	27.0	27.0	1.2478	0.9891	0.6896	
25	9.48	105.15	0.00	105.15	29.0	23381.6	23367.0	148.0	26.0	26.0	26.0	0.9891	0.9891	0.6896	
50	6.67	105.15	0.00	105.15	29.0	23423.4	23367.0	148.0	25.0	25.0	25.0	0.9891	0.9891	0.6896	
100	4.73	150.03	0.00	150.03	30.0	23438.0	23323.2	148.0	33.0	33.0	33.0	0.9891	0.9891	0.6896	
150	3.67	195.44	0.00	195.44	31.2	23454.0	23296.0	150.0	32.0	32.0	32.0	0.9891	0.9891	0.6896	

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

ΔH_g : Orifice pressure differential that equals to 21.24 in of air @ 25°C and 760 mm of mercury . mm.Hg : tolerance for individual values ± 5.08 from average .

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

Calibrated by : Mr. Apisit Singha Approved by : Mr. Natthapol Jengwareewong
(Mr. Apisit Singha) (Mr. Natthapol Jengwareewong)
Field Services Scientist (4) Field Services Specialist (1)

Issue date : 07-Jan-26

Page 1 of 1

FORM NO.: F 06-024 Issue NO.: 1 ISSUE DATE: 01/08/25



DIGITAL TEMPERATURE CALIBRATION DATA SHEET

Calibration Date : 6 Jan 26		Ambient Temperature (°C) 27			
Calibration sheet No. : C-060126-RYG_FS0316		Relative Humidity (%) : 46,5			
Digital Temperature ID : RYG_FS0316		Reference Temperature ID RYF_FS0681			
Serial No. : 1302005		Serial No. : 201090014918			
Model : XC-572-V		Model : DIGICON CC-VT-MS			
Next Calibrate : 16 Jan 27					
Location	Reference Temperature °C	Digital Temperature °C	Error °C	MPE	Pass / Fail
Stack	0	0	0	±3	Pass
	25	27	2	±3	Pass
	50	53	3	±3	Pass
	100	103	3	±3	Pass
	150	153	3	±3	Pass
	200	203	3	±3	Pass
	250	253	3	±3	Pass
	300	303	3	±3	Pass
	500	503	3	±3	Pass
	Probe	100	102	2	±3
120		122	2	±3	Pass
140		143	3	±3	Pass
Oven	100	103	-2	±3	Pass
	120	123	-3	±3	Pass
Filter	140	143	3	±3	Pass
	100	103	3	±3	Pass
	120	123	3	±3	Pass
Exit	140	143	3	±3	Pass
	0	0	0	±3	Pass
	10	12	2	±3	Pass
Meter	20	22	2	±3	Pass
	0	0	0	±3	Pass
	25	27	2	±3	Pass
AUX	50	53	3	±3	Pass
	0	0	0	±3	Pass
	25	28	3	±3	Pass
	50	53	3	±3	Pass

MPE : (Maximum permissible error of measurement) ค่าความผิดพลาดสูงสุดของผลการวัดที่ยอมรับได้

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

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

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



PROBE NOZZLE DIAMETER CALIBRATION DATA SHEET

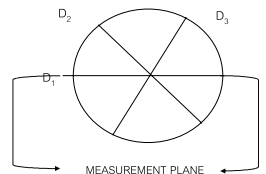
Calibration Date : 6 Jan 26				Nozzle Set ID. : BKK_FS0319	
Calibration Sheet No. : C-060126-BKK_FS0319				Vernier Caliper ID.: BKK_FS0626	
Nozzle ID #	Nozzle Diameter (cm.)			Hi - Lo	(D ₁ + D ₂ + D ₃) / 3
	D ₁	D ₂	D ₃	ΔD	D _{avg}
1	0.300	0.302	0.299	0.003	0.300
2	0.465	0.466	0.467	0.002	0.466
3	0.541	0.542	0.541	0.001	0.541
4	0.605	0.606	0.605	0.001	0.605
5	0.764	0.764	0.765	0.001	0.764
6	0.930	0.930	0.929	0.001	0.930
7	1.082	1.082	1.081	0.001	1.082
8	1.233	1.234	1.234	0.001	1.234
9	1.594	1.595	1.593	0.002	1.594

Where :

D₁, D₂, D₃ = 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} = (D₁ + D₂ + D₃) / 3



Calibrated by : Saksit Phaisanphisit
(Mr.Apisit Sing-ha)
Field Scientist (4)

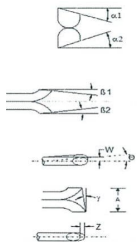
Approved by : Nattaporn Jengwareewong
Mr.Nattaporn Jengwareewong
Field Specialist (1)

FORM NO.: F 06-026 REVISION NO.: 1 ISSUE DATE: 9/1/03



Type S Pitot Tube Calibration

Date Calibration 6-Jan-26 Due Date 6-Jul-26
Pitot ID BKK_FS0560 Inclinator ID BKK_FS1131
Pitot SN 1803811 Vernier ID RYG_FS0539



Parameter	Value	Allowable Range	Check
α1	0.4	-10° < α1 < +10°	OK
α2	1.6	-10° < α2 < +10°	OK
β1	1.7	-5° < β1 < +5°	OK
β2	0.2	-5° < β2 < +5°	OK
γ	2.2	-	-
θ	1.6	-	-
Z = A tan γ	0.032	Z ≤ 0.125"	OK
W = A tan θ	0.023	W ≤ 0.031"	OK
Dt	0.300	0.188" to 0.375"	OK
A/2Dt	1.373	1.05 ≤ PA/Dt ≤ 1.5	OK
A	0.824	2.1Dt ≤ A ≤ 3Dt	OK

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

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

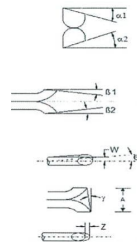
Approved by : Nattaporn Jengwareewong
(Mr.Nattaporn Jengwareewong)
RYG Field Services Specialist (1)

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



Type S Pitot Tube Calibration

Date Calibration 6-Jan-26 Due Date 6-Jul-26
Pitot ID RYG_FS0320 Inclinator ID BKK_FS1131
Pitot SN Vernier ID RYG_FS0539



Parameter	Value	Allowable Range	Check
α1	0.6	-10° < α1 < +10°	OK
α2	1.3	-10° < α2 < +10°	OK
β1	0.4	-5° < β1 < +5°	OK
β2	0.8	-5° < β2 < +5°	OK
γ	0.9	-	-
θ	1.1	-	-
Z = A tan γ	0.013	Z ≤ 0.125"	OK
W = A tan θ	0.016	W ≤ 0.031"	OK
Dt	0.300	0.188" to 0.375"	OK
A/2Dt	1.372	1.05 ≤ PA/Dt ≤ 1.5	OK
A	0.823	2.1Dt ≤ A ≤ 3Dt	OK

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

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

Approved by : Nattaporn Jengwareewong
(Mr.Nattaporn Jengwareewong)
RYG Field Services Specialist (1)

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

Certificate No: G 260304
Date of issue : 08-May-26

Instrument description : Flue Gas Analyzer
Instrument model : Testo 350
Instrument serial no. : 62985049/1121
Control unit serial no. : 03580182/1121
ID no. or control no. : RYG_FS0564
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 : 2 Pages
Receiving no. : L-261141
Receiving date. : 23-Apr-26
Parameter of calibration : Gas Calibration(Oxygen, Carbon Monoxide, Nitrogen Dioxide, Nitric Oxide, Sulphur Dioxide)

Condition of UUC. : Used
Ambient condition : All of the Measurement were carried out the stabilized laboratory
Temperature : 23 ±5 °C
Humidity : 55 ± 15 %RH

Calibration place : 17/121 Soi Ngamwongwan 47 Yaek 48, Toongsonghong, Lakki, Bangkok 10210

Calibration procedure no : This instrument was calibrated by comparison with Standard gas mixture according to calibration Work Instruction no. WI-CL-28-C

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

Date of calibration : 08-May-26

REVIEW BY *[Signature]*
APPROVED BY *[Signature]*
NEXT CAL DATE...07/05/2027

[Signature]
Mr. Kwanchai Khamdoun
Calibration Technician

[Signature]
Mrs. Nongluck Wongsettee
Technical Manager

FM-CL-09-C Rev.8

Page 1 of 2

Issued Date 26/02/16

Entech Industrial Solution Co.,Ltd.

17/121 Soi Ngamwongwan 47 Yaek 48, Toongsonghong, Lakki, Bangkok 10210 THAILAND Tel. 0-2779-8888 Calibration@entech.co.th
Tax ID : 0105536035591 www.entech.co.th

Certificate No.: G 260304

Standard References (Table 1)

Standard	Certificate No.	Vendor	Due date
Oxygen (O2) 2.506 % Vol	1287/25	Linde	08-May-29
Oxygen (O2) 9.984 % Vol	CG-0090-25	Nimit	24-Jun-30
Oxygen (O2) 21.01 % Vol	CG-0112-24	Nimit	01-Aug-29
Carbon monoxide (CO) 80.47 ppm	3276/25	Linde	09-Nov-27
Carbon monoxide (CO) 300.9 ppm	1422/25	Linde	21-May-29
Carbon monoxide (CO) 1000 ppm	3131/25	Linde	27-Oct-29
Nitrogen Dioxide (NO2) 30.68 ppm	2832/24	Linde	08-Sep-26
Nitrogen Dioxide (NO2) 81.32 ppm	3246/25	Linde	09-Nov-27
Nitrogen Dioxide (NO2) 202.4 ppm	0029/26	Linde	04-Jan-28
Nitric Oxide (NO) 29.8 ppm	CG-0145-25	Nimit	27-Oct-27
Nitric Oxide (NO) 151.8 ppm	0404/25	Linde	09-Feb-27
Nitric Oxide (NO) 322 ppm	1234/25	Linde	04-May-27
Sulphur Dioxide (SO2) 50.4 ppm	1306/25	Linde	12-May-27
Sulphur Dioxide (SO2) 100.7 ppm	2662/24	Linde	25-Aug-26
Sulphur Dioxide (SO2) 605.9 ppm	1229/25	Linde	04-May-27

Measured room conditions

Temperature : 24.5 °C Humidity : 59.7 %RH Pressure : 1009.4 mbar

Calibration conditions

Gas Temperature : 24 °C Flow rate : 1,300 ml/min Gas pressure : 1016.8 mbar

Calibration Results (Without adjustment) (Table 2)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (±)
O2 (%Vol)	2.506	2.44	-0.066	0.15
O2 (%Vol)	9.984	9.93	-0.054	0.20
O2 (%Vol)	21.01	21.14	0.13	0.30
CO (ppm)	80.47	81	0.53	3.0
CO (ppm)	300.9	304	3.1	6.0
CO (ppm)	1000	1006	6	12
NO2 (ppm)	30.68	28.7	-1.98	8.0
NO2 (ppm)	81.32	79.2	-2.12	8.0
NO2 (ppm)	202.4	199.6	-2.8	12
NO (ppm)	29.8	32	2.2	8.0
NO (ppm)	151.8	155	3.2	8.0
NO (ppm)	322	327	5	12
SO2 (ppm)	50.4	49	-1.4	6.0
SO2 (ppm)	100.7	101	0.3	6.0
SO2 (ppm)	605.9	608	2.1	13

Remark : 1 cmol/mol = 1 %vol. 1 µmol/mol = 1 ppm, Sensor(O2, CO, NO2)New.

End of Certificate of Calibration

FM-CL-09-C Rev.8

Page 2 of 2

Issued Date 26/02/16

Entech Industrial Solution Co.,Ltd.

17/121 Soi Ngamwongwan 47 Yaek 48, Toongsonghong, Lakki, Bangkok 10210 THAILAND Tel. 0-2779-8888 Calibration@entech.co.th
Tax ID : 0105536035591 www.entech.co.th

Accredited by

NSC-TISI-TIS 17025
Calibration 0426



Calibration certificate

Calibration Certificate No. 26BCI0066

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	MSU224S-100-DU	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.	31709552 RYG_EN0003	This certificate relate and apply this equipment only.
Customer	ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)	
Order no.	278579	
Number of pages	4	
Date of calibration	03 Feb 2026	

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 of issue 03 Feb 2026 Approval of the Calibration Certificate Person in charge
[Signature] *[Signature]*
Mr. Chonchai Inthana Chonchai Inthana

Calibration certificate No.: 26BCI0066

Calibration Certificate

Calibration object

Single range instrument

Model MSU224S-100-DU
Serial Number 31709552
QM Ident. no. | Inventory no. RYG_EN0003 | —

Maximum capacity (Max. load) 220.0000 g
Measured up to 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 Balance Room.
Maximum temperature variation at place of calibration 5 K

Calibration procedure

EURAMET Calibration Guide No. 18, Version 4.0 (11/2015) - Guidelines on the Calibration of Non-Automatic Weighing Instruments

Test equipment

Test equipment type	Test equipment ID	Valid until
Thermometer	Testo 174H H/T250743 (Traceable to SI unit through ENTECH)	18 Nov 2026
Test weight set OIML R111 E2	Certificate No.M2508149S ,E2(Traceable to SI unit through TCS)	19 Aug 2027

Adjustment Status

The measuring device was internally adjusted before the calibration.

Environmental and measuring conditions

Date of calibration 03 Feb 2026

Temperature at place of calibration | Temp. diff. 24,5 °C | 0,5 K

Weights - Tplace

Measuring conditions

The installation site is suitable. The device is level. Balance was loaded up to Max before test.

Comments

Humidity 52.0 %RH.

Measurement results | Measurement uncertainties

Repeatability

Test load (nominal): 10 g | 200 g

	10 g	200 g
1	10,0000 g	200,0000 g
2	10,0000 g	200,0001 g
3	10,0000 g	200,0001 g
4	10,0001 g	200,0001 g
5	10,0000 g	200,0001 g
6	10,0000 g	200,0000 g
7	10,0000 g	200,0000 g
8	10,0000 g	200,0000 g
9	10,0000 g	200,0000 g
10	10,0000 g	200,0000 g
s =	0,00003 g	s = 0,00005 g

Eccentricity

Test load (nominal): 100 g

Center	100,0000 g
Front left	100,0000 g
Back left	99,9999 g
Back right	100,0000 g
Front right	100,0000 g
Maximum deviation from centric loading indication	
Δ _{ecc} _{max} = 0,0001 g	

Error of indication

Testload <i>L</i>	Indication <i>I</i>	Error <i>E</i>	Expansion factor <i>k</i>	Uncertainty <i>U(E)</i>	Uncertainty relative <i>U_{rel}(E)</i>
0,0100 g	0,0100 g	0,0000 g	2,00	0,00010 g	1,0 %
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 %
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 %
50,0000 g	50,0001 g	0,0001 g	2,00	0,00015 g	0,00030 %
100,0000 g	100,0000 g	0,0000 g	2,00	0,00018 g	0,00018 %
200,0000 g	200,0000 g	0,0000 g	2,00	0,00028 g	0,00014 %
220,0000 g	220,0000 g	0,0000 g	2,00	0,00032 g	0,00015 %
Maximum error of indication		E _{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

Sartorius (Thailand) Co., Ltd.
129 Rama 9 Road, Huaykwang
10310 Bangkok

Verical®
Version 6.7

Page 3 | 4

Uncertainty of measurement in use

Device adjusted before measurement

Yes

Temperature deviation considered

1.5 K (isoCAL active)

Temperature coefficient considered

1 · 10⁻⁴/K

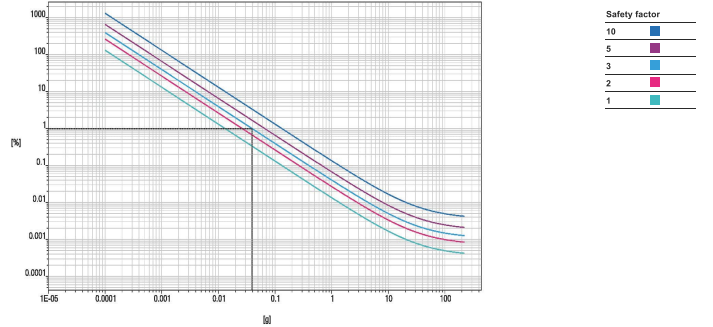
Uncertainty of the weighing result *U_{gl}(W)*

U_{gl}(W) = 0.00013 g + 3.65 · 10⁻⁴ · 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 <i>R</i>	Uncertainty <i>U_{gl}(W)</i>	Uncertainty relative <i>U_{gl}(W)_{rel}</i>
1 %	2,2000 g	0,00014 g	0,0063 %
25 %	55,0000 g	0,00033 g	0,00060 %
50 %	110,0000 g	0,00053 g	0,00048 %
75 %	165,0000 g	0,00073 g	0,00044 %
100 %	220,0000 g	0,00093 g	0,00042 %

Graphic realization of the relative uncertainty of measurement | process accuracy



Displayed example

Process accuracy 1.00 %
Safety factor 3
Minimum sample weight 0,0395 g

Sartorius (Thailand) Co., Ltd.
129 Rama 9 Road, Huaykwang
10310 Bangkok

Verical®
Version 6.7

Page 4 | 4

INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7/139 MOO 13, SOI SUNTINAKORN 11 TAMBON BANG KAE0,
AMPHOE BANG PHI SAMUT PRAKAN PROVINCE 10540 THAILAND
TEL: (660-2116-5860-1 FAX: (660-2116-7140



Page 1/2.

Certificate of Calibration

Customer

Name : ALS Laboratory Group Thailand Co., Ltd.

Certificate No : 25-AFM-208

Request No : Req-2025-1986

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

Unit Under Calibration Details

Measurement Item : Air Flow Meter

Manufacturer : Mesa Labs

Sensor Model : -

Model : 200-S10M

Sensor Serial Number : -

Serial Number : 151114

Instrument Status : Used

ID : BKK_FS0614

Location of Calibration : LAB 4 AIR VELOCITY METER

Calibration Environment and Details

Temperature : 23 °C ± 3 °C

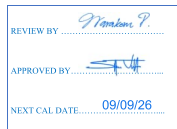
Humidity : 55 %RH ± 20 %RH

Barometric Pressure : 1013 hPa ± 10 hPa

Received Date : 3 September 2025

Calibration Date : 10 September 2025

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



Reference Standard	Model	Serial Number	Traceble	Due Calibration
Air Flow Meter	Gilibrator 3 Low flow	18501010006	Sensidyne	5 May 2026
Air Flow Meter	Gilibrator 3 Standard flow	19031011003	Sensidyne	6 May 2026
Temperature meter	GT 11	08000057	Qreborn	15 October 2025
Pressure meter	CPG2400	41000KDU/651882	TPA	21 October 2025

Traceability :

This Certificate is traceable to SI Unit through Sensidyne A2LA Accreditation No. 3943.01 and MIT NSC-TISI-TIS Accreditation No. 0052

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 : 10 September 2025

INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7/139 MOO 13, SOI SUNTINAKORN 11 TAMBON BANG KAE0,
AMPHOE BANG PHI SAMUT PRAKAN PROVINCE 10540 THAILAND
TEL: (660-2116-5860-1 FAX: (660-2116-7140



Page 2/2.

Certificate No : 25-AFM-208

Request No : Req-2025-1986

Result of Calibration : Without Adjustment

STD Reading			UUC Reading			Error (cc/min)	Uncertainty		
Temperature (°C)	Pressure (kPa)	Flow (cc/min)	Temperature (°C)	Pressure (kPa)	Flow (cc/min)		(cc/min)	(°C)	(kPa)
25.5	100.98	100	-	-	100.02	0.0	3.6	1.0	0.50
25.7	100.97	503	-	-	500.81	-2.2	9.5	1.0	0.50
25.8	100.89	1003	-	-	1000.4	-3	19	1.0	0.50
26.1	100.88	2000	-	-	2001.9	2	38	1.0	0.50
26.5	100.85	3014	-	-	3002.2	-12	57	1.0	0.50
26.7	100.81	4027	-	-	4000.9	-26	76	1.0	0.50
27.0	100.74	5048	-	-	5001.8	-46	95	1.0	0.50

Note

STD : Standard UUC : Unit Under Calibration

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

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

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

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

* Indicates non accredited

End of Certificate

Certificate of Calibration

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

Certificate No : 25-AFM-207
Request No : Req-2025-1987

Unit Under Calibration Details

Measurement Item : Air Flow Meter
Manufacturer : Mesa Labs
Model : 200-510L
Serial Number : 130026
ID : BKK_FS0619
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 : 3 September 2025
Calibration Date : 10 September 2025
Calibration Procedure : In-house method CP-AFM-01 by Comparison technique with Standard Primary Flow Calibrator

REVIEW BY: *Namron*
APPROVED BY: *[Signature]*
NEXT CAL DATE: 09/09/26

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Gilibrator 3 Low flow	18501010006	Sensidyne	5 May 2026
Air Flow Meter	Gilibrator 3 Standard flow	19031011003	Sensidyne	6 May 2026
Temperature meter	GT 11	08000057	Qreborn	15 October 2025
Pressure meter	CPG2400	41000KDU/651882	TPA	21 October 2025

Traceability :

This Certificate is traceable to SI Unit through Sensidyne A2LA Accreditation No. 3943.01 and MIT NSC-TIS-TIS Accreditation No. 0052

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 : 10 September 2025

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

FM-708-AFM-01 Rev.06 Issue date 21/2/25

Certificate No : 25-AFM-207

Request No : Req-2025-1987

Result of Calibration : Without Adjustment

STD Reading			UUC Reading			Error (cc/min)	Uncertainty	
Temperature (°C)	Pressure (kPa)	Flow (cc/min)	Temperature (°C)	Pressure (kPa)	Flow (cc/min)		(cc/min)	(°C)
25.5	100.98	20	-	-	20.042	0.0	1.6	1.0
25.5	100.90	50	-	-	49.921	-0.1	4.0	1.0
25.5	100.91	100	-	-	100.09	0.1	3.6	1.0
25.4	100.86	150	-	-	150.34	0.3	5.4	1.0
25.6	100.93	199	-	-	200.17	1.2	7.2	1.0
25.6	100.95	301	-	-	300.05	-1	11	1.0
25.7	100.96	402	-	-	401.03	-1	14	1.0
25.7	100.95	503	-	-	500.26	-3	10	1.0

Note

STD : Standard

UUC : Unit Under Calibration

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

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

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

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

* Indicates non accredited

End of Certificate

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

FM-708-AFM-01 Rev.06 Issue date 21/2/25

ALS Laboratory Group (Thailand) Co., Ltd.
104 Phathanakan 40, Phathanakan Rd.,
Phathanakan, Suan Luang, Bangkok 10250
T +66 2 760 3000 F +66 2 760 3197



Certificate of Calibration

Certificate No. : C-070426-RYG_FS0109

Air Sampling Pump Detail

Equipment name : Personal Air Sampling Pump
Brand : Gillian
Model/Type : GILAir Plus
Equipment ID : RYG_FS0109
Serial No. : 20170731525
Calibration Date : 07-Apr-26
Next calibration date : 07-Jul-26

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 : 10-Sep-25
Due Date : 09-Sep-26

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 : 10-Sep-25
Due Date : 09-Sep-26

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	19,8	19,8	19,8	5%	19 - 21	Passed
50	49,9	49,3	49,4	49,5	5%	48 - 53	Passed
100	102,9	103,0	102,6	102,8	5%	95 - 105	Passed
200	202,6	202,5	202,6	202,6	5%	190 - 210	Passed
High Flow							
500	507,7	507,0	506,0	506,9	3%	485 - 515	Passed
1000	1001,1	1015,1	1004,4	1006,9	3%	970 - 1030	Passed
2000	2011,4	2001,7	2005,8	2006,3	3%	1940 - 2060	Passed
2500	2512,6	2510,2	2514,9	2512,6	3%	2425 - 2575	Passed

END OF REPORT

Calibrated By : *[Signature]*
(Mr. Nantawat Sarin)
RYG Field Services Scientist (1)
Issue date : 08-Apr-26

Approved By : *[Signature]*
(Mr. Supot Salameh)
Field Services Section Head

Archemica

Certificate of Calibration

HPLC_U-3000 ID#690 (BKK_FL0034)

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

DGP-3600SD S/N : 8105093
WPS-3000TSL S/N : 8107446
TCC-3000SD S/N : 6006552
DAD-3000 S/N : 8107298

For

ALS Laboratory Group (Thailand) Co., Ltd.

[Signature]
Archemica Lab Co., Ltd.
ARCHIMICA LAB CO., LTD.

Operator Signature: _____ Date: 6-7/Jan/2026

(Mr. Nutitep Moungon)

Application Chemist

ALS Laboratory Group (Thailand) Co., Ltd.
104 Phatthanakan Rd., Phatthanakan, Suan Luang, Bangkok 10250
T +66 2 760 3000 F +66 2 760 3197



Certificate of Calibration

Certificate No. : C-060426-RYG_FS0097

Air Sampling Pump Detail

Equipment name : Personal Air Sampling Pump Equipment ID : RYG_FS0097
Brand : Gilian Serial No. : 20150210164
Model/Type : GLIAir Plus Calibration Date : 06-Apr-26
Next calibration date : 06-Jul-26

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 : 10-Sep-25
Due Date : 09-Sep-26

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 : 10-Sep-25
Due Date : 09-Sep-26

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	20,2	19,4	21,0	20,2	5%	19 - 21	Passed
50	51,0	51,1	51,0	51,0	5%	48 - 53	Passed
100	99,3	100,1	101,2	100,2	5%	95 - 105	Passed
200	199,3	199,3	199,3	199,3	5%	190 - 210	Passed
High Flow							
500	497,3	502,6	503,8	501,2	3%	485 - 515	Passed
1000	1006,7	1000,7	1002,4	1003,3	3%	970 - 1030	Passed
2000	2000,2	2007,2	2006,0	2004,5	3%	1940 - 2060	Passed
2500	2498,2	2505,2	2497,6	2500,3	3%	2425 - 2575	Passed

END OF REPORT

Calibrated By :

(Mr. Nantawat Sarin)

RYG Field Services Scientist (1)

Issue date : 07-Apr-26

Approved By :

(Mr. Supot Salameh)

Field Services Section Head



JIRANATHE ASSOCIATES CO., LTD.

CALIBRATION REPORT

CUSTOMER NAME : ALS Laboratory Group (Thailand) Co., Ltd.			
EQUIPMENT NAME : Total Hydrocarbon Analyzer			
MANUFACTURER : Baseline	MODEL : 9000 HTHA	SERIAL NO : 0315EF0047	
STANDARD GAS CONCENTRATION (PPM) : 506.1 PPM (Methane)		CYLINDER NO : CC734373	
CYLINDER PRESSURE (psig) : 1,000 PSI		CERTIFIED DATE : 12/05/2020	
CERTIFIED BY : AIRGAS		EXPIRED DATE : 12/05/2028	

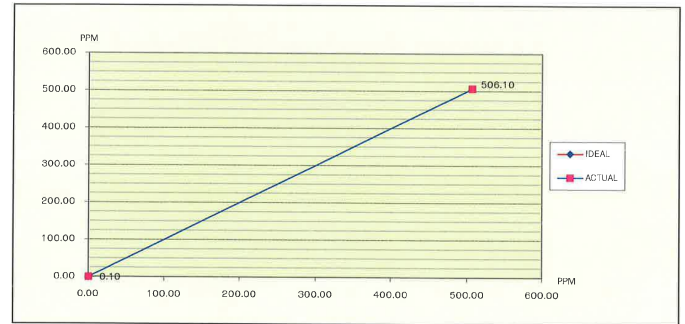
CALIBRATION RESULTS

POINT NO	CALIBRATION RESULTS			
	IDEAL	ACTUAL	ERROR	%ERROR
ZERO	0.00	0.10	0.10	-
1	506.10	506.10	0.0	0.00
AVERAGE (%)				0.00

REVIEW BY :

APPROVED BY :

NEXT CAL DATE : 11/03/2027



CALIBRATED BY : DATE : 12/3/19

CHECKED BY : DATE : 12/3/19

ต้องการข้อมูลทางด้านเทคนิคเพิ่มเติม : เจ้าหน้าที่ฝ่ายบริการหลังการขาย โทร 02-868-0812 # 31, E-Mail : Engineer@jiranatee.com
เลขที่ 63/14-15, 67/35-36 ถนน เพชรเกษม 7, 7/1 แขวง วัดท่าพระ เขต บางกอกใหญ่ กรุงเทพมหานคร 10600 โทร 02-868-0812-13 โทรสาร 02868-1889



FLOW CALIBRATE

CUSTOMER NAME : ALS Laboratory Group (Thailand) Co., Ltd.			
EQUIPMENT NAME : Flow Calibrator			
MANUFACTURER : Bios	MODEL : 510 L	SERIAL NO : 129549	

Flow Parameter	Step	Set	Display	Flow Meter
Sample	Before	40	39	28.75 cc/min
	After	40	40	40.90 cc/min
Air	Before	175	174	163.58 cc/min
	After	175	175	175.13 cc/min
Fuel	Before	35	34	29.67 cc/min
	After	35	35	34.12 cc/min



CALIBRATED BY : DATE : 12/3/19

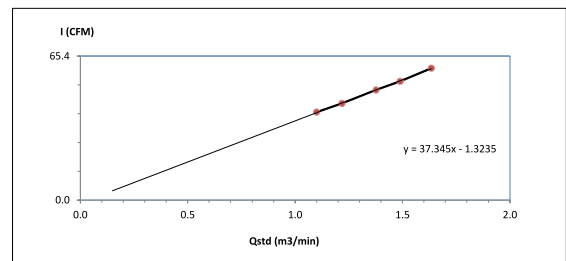
CHECKED BY : DATE : 12/3/19

ต้องการข้อมูลทางด้านเทคนิคเพิ่มเติม : เจ้าหน้าที่ฝ่ายบริการหลังการขาย โทร 02-868-0812 # 15-16, E-Mail : Engineer@jiranatee.com
เลขที่ 63/14-15, 67/35-36 ถนน เพชรเกษม 7, 7/1 แขวง วัดท่าพระ เขต บางกอกใหญ่ กรุงเทพมหานคร 10600 โทร 02-868-0812-13 โทรสาร 02868-1889

High Volume Air Sampler Calibration Worksheet

Project Site :	BASF (Thai) Limited	Barometric Pressure (mm Hg) :	756.6
Calibrate Location :	ภายในถนนอุตสาหกรรม	Temperature (°C) :	30.2
Calibrate Date :	8-Jun-26	High Volume ID :	BKK_FS0367
Calibration Sheet No. :	C-080626-BKK_FS0367	High Volume Model :	TE-5009X
Calibrator ID :	RYG_FS0206	High Volume S/N :	4162
Calibrator Model :	TE-5028A	Calibrator Slope :	1.4719
Calibrator S/N :	1543	Calibrator Intercept :	-0.01614

Test No.	Delta H ₂ O (inch)	Q _{std} (m ³ /min)	I: Chart (CFM)	Linear Regression
1	2.6	1.0998	40	Slope : 37.3447 Intercept : -1.3235 Correlation Coefficient : 0.9995
2	3.2	1.2183	44	
3	4.1	1.3769	50	
4	4.8	1.4885	54	
5	5.8	1.6346	60	



Calibrated by :
(Mr. Chatchai Sukpia)
RYG Field Services Scientist (1)

Approved by :
(Mr. Supot Salameh)
Field Services Section Head



Test No.	Delta H ₂ O (inch)	Q _{add} (m ³ /min)	1 : Chart (CFM)	Linear Regression	
1	2.7	1.1204	40	Slope :	39.6075
2	3.4	1.2553	44	Intercept :	-4.8657
3	4.1	1.3769	50	Correlation Coefficient :	0.9978
4	4.8	1.4885	54		
5	5.8	1.6346	60		



Accredited by

NSC-TISI-TIS 17025

Calibration 0426



Calibration certificate

Calibration Certificate No. 26BCI0067

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.

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129 Rama 9 Road, Huaykwang
10310 Bangkok

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Page 11

Calibration certificate No.: 26BCI0067

Calibration Certificate

Calibration object

Single range instrument

Place of calibration

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

Calibration procedure

EURAMET Calibration Guide No. 18, Version 4.0 (11/2015) - Guidelines on the Calibration of Non-Automatic Weighing Instruments

Test equipment

Test equipment type	Test equipment ID	Valid until
Thermometer	Testo 174H H/T250743 (Traceable to SI unit through ENTECH)	18 Nov 2026
Test weight set OIML R111 E2	Certificate No.M2508149S_E2(Traceable to SI unit through TCS)	19 Aug 2027

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Page 2 | 4

Calibration certificate No.: 26BCI0067

Calibration Certificate

Adjustment Status

The measuring device was internally adjusted before the calibration.

Environmental and measuring conditions

Date of calibration	03 Feb 2026
Temperature at place of calibration Temp. diff.	24.5 °C 0.5 K
Tweights • Tplace	
Measuring conditions	The installation site is suitable. The device is level. Balance was loaded up to Max before test.
Comments	Humidity 52,0 %RH.

Measurement results | Measurement uncertainties

Repeatability		
Test load (nominal): 10 g 100 g		
	10 g	100 g
1	10,0000 g	100,0000 g
2	10,0000 g	99,9998 g
3	9,9999 g	100,0000 g
4	10,0001 g	100,0000 g
5	10,0000 g	99,9999 g
6	9,9999 g	100,0000 g
7	9,9999 g	99,9999 g
8	9,9999 g	100,0000 g
9	9,9999 g	100,0000 g
10	9,9999 g	99,9999 g
$s = 0,00007 \text{ g}$ $s = 0,00007 \text{ g}$		

Eccentricity	
Test load (nominal): 50 g	
Center	50,0000 g
Front left	50,0001 g
Back left	50,0001 g
Back right	50,0000 g
Front right	50,0001 g
Maximum deviation from centric loading indication	
$ \Delta_{\text{ecc}} _{\text{max}} = 0,0001 \text{ g}$	

Error of indication

Testload <i>L</i>	Indication <i>I</i>	Error <i>E</i>	Expansion factor <i>k</i>	Uncertainty <i>U(E)</i>	Uncertainty relative <i>U_{rel}(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	0,00016 g	0,33 %
0,1000 g	0,1000 g	0,0000 g	2,00	0,00016 g	0,16 %
0,5000 g	0,5000 g	0,0000 g	2,00	0,00016 g	0,033 %
1,0000 g	1,0000 g	0,0000 g	2,00	0,00016 g	0,016 %
2,0000 g	2,0000 g	0,0000 g	2,00	0,00017 g	0,0083 %
5,0000 g	5,0001 g	0,0001 g	2,00	0,00017 g	0,0033 %
10,0000 g	10,0001 g	0,0001 g	2,00	0,00017 g	0,0017 %
20,0000 g	20,0000 g	0,0000 g	2,00	0,00017 g	0,00086 %
100,0000 g	100,0001 g	0,0001 g	2,00	0,00023 g	0,00023 %
150,0000 g	150,0001 g	0,0001 g	2,00	0,00030 g	0,00020 %
Maximum error of indication		E _{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

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10310 Bangkok

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Page 3 | 4

Uncertainty of measurement in use

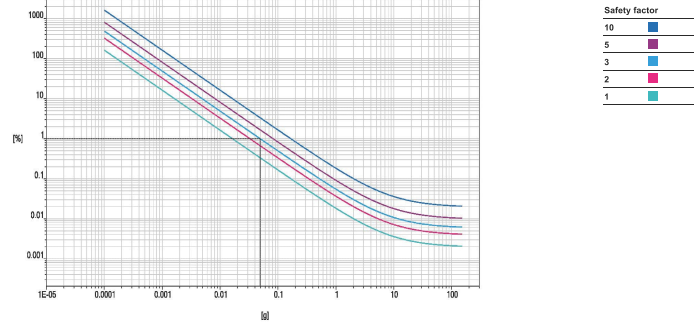
Device adjusted before measurement Yes
Temperature deviation considered 1.5 K (isoCAL active)
Temperature coefficient considered $1 \cdot 10^{-6}/K$

Uncertainty of the weighing result $U_{gI}(W)$ $U_{gI}(W) = 0.00016 \text{ g} + 1.95 \cdot 10^{-4} \cdot R$

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 $U_{gI}(W)$	Uncertainty relative $U_{gI}(W)_{rel}$
1 %	1,5000 g	0,00019 g	0,013 %
25 %	37,5000 g	0,00089 g	0,0024 %
50 %	75,0000 g	0,0016 g	0,0022 %
75 %	112,5000 g	0,0024 g	0,0021 %
100 %	150,0000 g	0,0031 g	0,0021 %

Graphic realization of the relative uncertainty of measurement | process accuracy



Displayed example

Process accuracy 1.00 %
Safety factor 3
Minimum sample weight 0.0493 g

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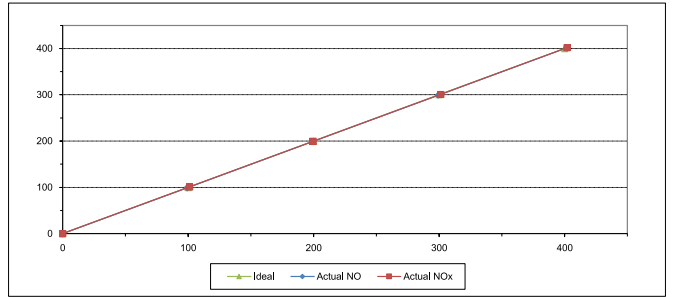
Page 4 | 4



MULTIPOINT CALIBRATION REPORT

Calibration Date	5-Jan-26	Equipment Name	NOx Analyzer
Manufacturer	Teledyne API	Model	200E
Serial No.	4379	Equipment ID	BKK_FS0776
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947	Cylinder No.	GN0027222
Std. Gas Concentration (PPM)	55.88	Certified By	Algac Inc.
Cylinder Pressure (psi)	1800	Expired Date	9-Feb-30
Certified Date	9-Feb-22		

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	101.00	1.00	1.00
2	200.00	199.40	-0.60	-0.30	199.50	-0.50	-0.25
3	300.00	299.30	-0.70	-0.23	301.20	1.20	0.40
4	400.00	401.50	1.50	0.38	402.00	2.00	0.50
AVERAGE (%)				-0.17			0.35



Calibrated By

(Mr.Jirawut Sakam)

Field Environmental Scientist (3)

Approved By

(Mr.Sarayuht Jitranont)

Assistant General Manager

ALS Laboratory Group

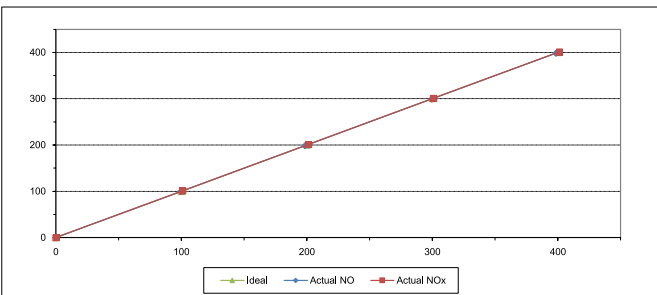
FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



MULTIPOINT CALIBRATION REPORT

Calibration Date	5-Jan-26	Equipment Name	NOx Analyzer
Manufacturer	Teledyne API	Model	T200
Serial No.	6305	Equipment ID	BKK_FS1098
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947	Cylinder No.	GN0027222
Std. Gas Concentration (PPM)	55.88	Certified By	Algac Inc.
Cylinder Pressure (psi)	1800	Expired Date	9-Feb-30
Certified Date	9-Feb-22		

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	99.60	-0.40	-0.40	101.20	1.20	1.20
2	200.00	198.50	-1.50	-0.75	201.40	1.40	0.70
3	300.00	299.50	-0.50	-0.17	301.00	1.00	0.33
4	400.00	398.50	-1.50	-0.38	401.30	1.30	0.33
AVERAGE (%)				-0.32			0.53



Calibrated By

(Mr.Jirawut Sakam)

Field Environmental Scientist (3)

Approved By

(Mr.Sarayuht Jitranont)

Assistant General Manager

ALS Laboratory Group

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



JIRANATEE ASSOCIATES CO., LTD.
Jiranatee Associates Co., Ltd.
63/14-15, 6/35-36
Petchkasem 7,7/1, Rd. Wattapara, Bangkok,
Bangkok 10600 (Thailand)
Tel: +6688080812
Mobile: +66863999453
E-mail: jnac.calibration@jiranatee.com
Web site: www.jiranatee.com

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

Air speed measurement laboratory
Calibration services department.



NSC - TIS - TIS 17025
CALIBRATION 0367

Certificate Number

CWS-009-69

CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM
MANUFACTURER
MODEL/TYPE

SERIAL NUMBER

ID NUMBER

CONDITION AS-RECEIVED

CUSTOMER

RECEIVED DATE

MEASUREMENT DATE

ISSUE DATE

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as 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
Cup anemometer frontal area² 100 cm²
Diameter of mounting pipe³ 10 mm
Blockage ratio of test object⁴ 0.111 [-]

Preconditioning

Measurement Condition

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

☒ Mr. Sorawit Thachalad
☐ Miss Jitranont Lertsitthiphol



Approved signatory:

Mr. Parinya Booncharoen
Calibration Department Manager

Remarks:

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

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

Certificate Number

CWS-009-69

Page 2 of 2 Pages

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} (m/s)	Temp. wind tunnel (°C)	Temp. room (°C)	V_{ref} (m/s)	Error (m/s)	U (k=2) (m/s)
1.039	23.30	23.35	0.9	-0.1	0.31
2.182	23.40	23.35	2.0	-0.2	0.31
2.997	23.32	23.35	2.9	-0.1	0.31
4.241	23.32	23.35	4.0	-0.2	0.31
4.96	23.18	23.35	5.0	0.0	0.31
6.02	23.50	23.35	6.0	0.0	0.31
6.96	23.08	23.35	6.9	0.0	0.31
7.96	23.50	23.35	8.0	0.0	0.31
8.94	22.90	23.35	9.1	0.2	0.31
9.96	23.48	23.35	10.1	0.1	0.31
10.95	23.00	23.35	11.2	0.2	0.31
12.01	23.22	23.35	12.2	0.2	0.31
13.00	23.06	23.35	13.4	0.4	0.31
14.02	23.06	23.35	14.3	0.3	0.31
14.98	22.86	23.35	15.5	0.5	0.31
15.99	22.84	23.35	16.5	0.5	0.31

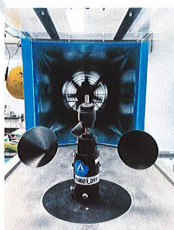
Remark:

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

¹ Velocity of standard

² 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-009-69

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- A5909

Data logger: A5909

ID NUMBER

: RYG_F50608

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

: 09 Jan 2026

MEASUREMENT DATE

: 21 Jan 2026

ISSUE DATE

: 21 Jan 2026

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	800	cm ²
: Wind direction frontal area ²	120	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 (23.5)°C, (62.6) %RH and (1008.6) hPa.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

☒ Mr. Sorawit Thalchalad
☐ Miss Jittrapon Lertsomphol

Approved signatory:

[Signature]
Mr. Parinya Booncharoen
Calibration Department Manager

Remark:

¹ Nozzle cross-section area of the wind tunnel

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

³ Diameter of mounting pipe

⁴ Ratio $\frac{A}{A_0}$

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Certificate Number

CWD-009-69

Page 2 of 2 Pages

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'_{use} Degree (°)	Error Degree (°)	U (k=2) Degree (°)
5.02	0.000	0	0	0.60
	45.000	42	-3	0.93
	90.000	87	-3	0.60
	135.000	132	-3	0.60
	180.000	178	-2	0.60
	225.000	226	1	0.60
	270.000	273	3	0.60
	315.000	320	5	0.60

Remark:

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

¹ Direction of standard

² Direction of Unit Under Calibration

End of Certificate of Calibration



CERTIFICATE OF CALIBRATION

Certificate No. : CDT-029-69

Page 1 of 2 Pages

MEASUREMENT ITEM

: Data Logger with Temperature sensor

MANUFACTURER

: Novalynx

MODEL/TYPE

: 110-WS-25DL-D

SERIAL NUMBER

: A5909

ID NUMBER

: RYG_F50608

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

: 09 Jan 2026

MEASUREMENT DATE

: 21 Jan 2026

ISSUE DATE

: 21 Jan 2026

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 a date and place of calibration.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibration procedure:

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

Traceability:

The measurement results are traceable to the international system of units (SI) through National Institute of Metrology Thailand (NIMT) Certificate number: TT-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 Thalchalad
☐ Miss Jittrapon Lertsomphol
☐ Miss Rungprum Poommitt

Approved signatory:

[Signature]
Mr. Parinya Booncharoen
Calibration Department Manager

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Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 °C to 40 °C

Function:

Table 1: This equipment was connected with temperature sensor Model: HMP60 S/N: U3641220.
Dimension: Diameter 12 mm. Length 80 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.047	19.8	-0.2	0.099
80	25.031	24.8	-0.2	0.099
80	30.030	29.8	-0.2	0.099
80	35.015	34.7	-0.3	0.099
80	40.001	39.8	-0.2	0.099

UUC*: Unit Under Calibration

End of Certificate of Calibration



Jiranatee Associates Co.,Ltd
63/14-15, 63/25-36
Petchkasem 7/1, Rd. Wattapra, Bangkokyai,
Bangkok 10500 (Thailand)
Tel: +66(0)888117
Mobile: +66(0)83999453
E-mail: jnac-calibration@jiranatee.com
Web site: www.jiranatee.com

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

Relative humidity and Air Temperature measurement laboratory
Calibration services department.

CERTIFICATE OF CALIBRATION

Certificate No. : CRT-005-69

Page 1 of 2 Pages

MEASUREMENT ITEM : Relative humidity with data logger
MANUFACTURER : Novolyrix
MODEL/TYPE : Data Logger: 110-WS-25DL-D
Sensor: HMP60
SERIAL NUMBER : Data Logger: A5909
Sensor: U3641220
ID NUMBER : RYG_FS0608
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 : 09 Jan 2026
MEASUREMENT DATE : 21 Jan 2026
ISSUE DATE : 21 Jan 2026

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

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

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

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibration procedure:
The Relative humidity and Air Temperature calibration was done by In-House calibration method as WI-CL-009 and WI-CL-010 according to comparison method with Standard Chilled Mirror hygrometer with Temperature sensor and standard Humidity generator chamber.

Traceability:
The measurements are traceable to the International system of units (SI) through National Institute of Metrology Thailand (NIMT). Certificate number: TH-0146-24 and Jiranatee Associates Co., Ltd. Certificate number: CDT-026-68.

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 Jitraporn Lertsomphol
☐ Miss Ruangrumpai Phoommit



Approved signatory:

Mr. Parinya Booncharoen
Calibration Department Manager

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Measurement Results:

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

Result of Calibration: ☐ Without Adjustment ☒ With Adjustment

Table 1: The results of calibration of relative humidity at 30 °C are reported in table below.
Calibration Range: 20%RH to 80%RH

Air Temperature (°C)	Standard Reading (%RH)	UUC Reading (%RH)	Error (%RH)	Uncertainty ±(%RH)
30.10	19.96	21.3	1.3	0.78
30.11	49.95	50.4	0.4	1.3
30.11	80.06	79.2	-0.9	2.1

UUC*: Unit Under Calibration

End of Certificate of Calibration



INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7/139 MOO 13, SOI SUNTINAKORN 11 TAMBON BANG KAE0,
AMPHOE BANG PHLI SAMUT PRAKAN PROVINCE 10540 THAILAND
TEL: (66)0-2116-5860-1 FAX: (66)0-2116-7140

Certificate of Calibration

Customer

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

Certificate No : 26-ACT-007

Request No : Req-2026-0043

Unit Under Calibration Details

Measurement item : Acoustic Calibrator Class : 1
Manufacturer : RION Range : 94 dB / 1000 Hz
Model : NC-74 Instrument Status : Used
Serial Number : 34178121
ID : RYG_FS0213

Calibration Environment and Details

Temperature : (23 ±2 °C)
Humidity : (50 ± 20 %RH)
Barometric Pressure : (1013 ±10.0 hPa)
Received Date : 7 January 2026
Calibration Date : 9 January 2026
Location of Calibration : LAB 1 Acoustic

Calibration Procedure : In-house method CP-ACT-02 based on IEC 60942:2017 Electroacoustics - Sound calibrators

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Sound Calibrator	SV 35A	58079	EEL	20 June 2026
THD Multimeter	2015	1047765	NIMT	4 February 2026

Traceability : This certificate provides traceability of measurement to recognized national standard, and to the realization of the international System of Units (SI).

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 : 9 January 2026

Certificate No : 26-ACT-007
Request No : Req-2026-0043

Calibration Results : Without Adjustment					
Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty (± dB)
	Measured	Deviated value	Measured	Deviated value	
94 dB / 1000 Hz	94.08	0.08	-	-	0.12

Frequency of Sound pressure level					
Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)
	Measured (Hz)	Deviated value (%)	Measured (Hz)	Deviated value (%)	
94 dB / 1000 Hz	1000.00	0.000	-	-	0.010

Total Harmonic Distortion plus Noise of Sound pressure level (THD+N %)			
Calibration Range (Hz)	Without Adjustment	Adjustment	Uncertainty (± %)
	Measured (%)	Measured (%)	
94 dB / 1000 Hz	1.84	-	0.17

Note :
• The calibration results exclude the calibrator pressure correction
• The calibration results exclude the microphone volume correction

End of Calibration

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
FM-708-ACT-02 Rev.04 Issue date 17/2/25

SITHIPORN ASSOCIATES CO., LTD. CALIBRATION LABORATORY

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



Cert. No. : ACL26084
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-52A / Microphone UC-59 / Preamplifier NH-25
Serial No. : 00920831 / 22191 / 22220
ID No. : RYG_FS0622

Condition As Found : GOOD

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

Location : -
Ambient Temperature : (23.0 ± 3) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (50.0 ± 20) %
Received Date : 05 JANUARY 2026
Calibration Date : 21 - 23 JANUARY 2026
Date of Issue : 26 JANUARY 2026

REVIEW BY	
APPROVED BY	
NEXT CAL DATE	20/ 01 /2027

Calibrated by : Nathakorn Pisutpaisan

Approved by : 
(Nitinun Srihawan)

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

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CALIBRATION LABORATORY

Cert. No. : ACL26084
Job No. : VC69AC0053
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 24/0268	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).



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CALIBRATION LABORATORY

Cert. No. : ACL26084
Job No. : VC69AC0053
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. : ACL26084
Job No. : VC69AC0053
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	8.7
C - weight	14.0
Flat	19.7

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.3	0.3	0.3	± 1.0
1000	0.2	0.2	0.2	± 0.7
8000	0.7	0.8	0.8	+ 1.5, - 2.5

Cert. No. : ACL26084
Job No. : VC69AC0053
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. : ACL26084
Job No. : VC69AC0053
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	38.9	-0.1	±0.8
34.0	33.9	-0.1	±0.8
30.0	29.9	-0.1	±0.8
29.0	28.9	-0.1	±0.8
28.0	27.9	-0.1	±0.8
27.0	26.9	-0.1	±0.8
26.0	25.9	-0.1	±0.8
25.0	24.9	-0.1	±0.8

Cert. No. : ACL26084
Job No. : VC69AC0053
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	134.0	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	128.0	0.0	±0.5

Cert. No. : ACL26084
Job No. : VC69AC0053
Pages : 8 of 8

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lepeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	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

Cert. No. : ACL26085
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-52A / Microphone UC-59 / Preamplifier NH-25
Serial No.: 01120936 / 21737 / 22325
ID No.: RYG_FS0627

Condition As Found : GOOD

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

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

Received Date : 05 JANUARY 2026
Calibration Date : 21 - 23 JANUARY 2026
Date of Issue : 26 JANUARY 2026

REVIEW BY : *Supt. S.*
APPROVED BY : *[Signature]*
NEXT CAL DATE : 20/ 01/ 2027

Calibrated by : Nathakorn Pisutpaisan

Approved by : *[Signature]*
(Nitinun Srihawan)

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. : ACL26085
Job No. : VC69AC0053
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. : ACL26085
Job No. : VC69AC0053
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. : ACL26085
Job No. : VC69AC0053
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)
14.3

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

Frequency Weighting	Weighting (dB)
A - weight	8.7
C - weight	14.1
Flat	19.7

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.2	0.2	0.2	± 1.0
1000	0.2	0.1	0.1	± 0.7
8000	0.3	0.4	0.4	+ 1.5, - 2.5

Cert. No. : ACL26085
Job No. : VC69AC0053
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	±1.0
125	0.0	0.0	0.0	±1.0
250	0.0	0.0	-0.1	±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	0.1	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. : ACL26085
Job No. : VC69AC0053
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	83.9	-0.1	±0.8
79.0	78.9	-0.1	±0.8
74.0	73.9	-0.1	±0.8
69.0	68.9	-0.1	±0.8
64.0	63.9	-0.1	±0.8
59.0	58.9	-0.1	±0.8
54.0	53.9	-0.1	±0.8
49.0	48.9	-0.1	±0.8
44.0	43.9	-0.1	±0.8
39.0	38.9	-0.1	±0.8
34.0	33.9	-0.1	±0.8
30.0	29.9	-0.1	±0.8
29.0	28.9	-0.1	±0.8
28.0	28.0	0.0	±0.8
27.0	26.9	-0.1	±0.8
26.0	25.9	-0.1	±0.8
25.0	24.9	-0.1	±0.8

Cert. No. : ACL26085
Job No. : VC69AC0053
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	94.1	0.1	±0.8

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	29.0	29.1	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	134.0	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	128.0	0.0	±0.5

Cert. No. : ACL26085
Job No. : VC69AC0053
Pages : 8 of 8

10. Peak C sound level

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

M. S.

Cert. No. : ACL26086
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-S2A / Microphone UC-59 / Preamplifier NH-25
Serial No. : 01220937 / 21845 / 22326
ID No. : RYG_FS0628

Condition As Found : GOOD

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

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

Received Date : 05 JANUARY 2026
Calibration Date : 21 - 23 JANUARY 2026
Date of Issue : 26 JANUARY 2026

REVIEW BY	S. S.
APPROVED BY	N. S.
NEXT CAL DATE	20/01/2027

Calibrated by : Nathakorn Pisutpaisan

Approved by : N. S.
(Nitinun Srihawan)

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. : ACL26086
Job No. : VC69AC0053
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 (EPI).

M. S.

Cert. No. : ACL26086
Job No. : VC69AC0053
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

M. S.

Cert. No. : ACL26086
Job No. : VC69AC0053
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)
14.2

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	14.3
Flat	19.9

3. Acoustical signal tests of frequency weightings

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

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

M1100005

Cert. No. : ACL26086
Job No. : VC69AC0053
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	0.1	0.1	±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	-1.1	+ 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

M1100005

Cert. No. : ACL26086
Job No. : VC69AC0053
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	29.0	0.0	±0.8
28.0	28.0	0.0	±0.8
27.0	27.0	0.0	±0.8
26.0	26.0	0.0	±0.8
25.0	25.0	0.0	±0.8

M1100005

Cert. No. : ACL26086
Job No. : VC69AC0053
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	128.0	0.0	±0.5

M1100005

Cert. No. : ACL26086
Job No. : VC69AC0053
Pages : 8 of 8

10. Peak C sound level

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

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	132.9	-0.1	±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		
89.6	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	±0.1

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. : ACL26087
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-52A / Microphone UC-59 / Preamplifier NH-25
Serial No.: 01220938 / 21888 / 22327
ID No.: RYG_FS0629

Condition As Found : GOOD

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

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

Received Date : 05 JANUARY 2026
Calibration Date : 21 - 23 JANUARY 2026
Date of Issue : 26 JANUARY 2026

REVIEW BY : *[Signature]*
APPROVED BY : *[Signature]*
NEXT CAL DATE : 20/01/2027

Calibrated by : Nathakorn Pisutpaisan

Approved by : *[Signature]*
(Nitinun Srihawan)

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. : ACL26087
Job No. : VC69AC0053
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 (EII).

Cert. No. : ACL26087
Job No. : VC69AC0053
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. : ACL26087
Job No. : VC69AC0053
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)
14.2

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	14.6
Flat	20.3

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	0.2	0.2	0.2	± 1.0
1000	0.2	0.2	0.2	± 0.7
8000	0.9	1.0	1.0	+ 1.5, - 2.5

CYT69AC0053

Cert. No. : ACL26087
Job No. : VC69AC0053
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	0.0	0.1	0.0	±1.0
250	0.1	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	0.1	0.0	±1.0
8000	0.0	0.1	0.1	+ 1.5, - 2.5
16000	0.0	-1.2	-1.1	+ 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	94.1	0.1	± 0.1

CYT69AC0053

Cert. No. : ACL26087
Job No. : VC69AC0053
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	104.1	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	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

CYT69AC0053

Cert. No. : ACL26087
Job No. : VC69AC0053
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

CYT69AC0053

Cert. No. : ACL26087
Job No. : VC69AC0053
Pages : 8 of 8

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	130.0	130.0	0.0	±2.0
One	133.4	133.4	0.0	±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	89.5	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

Cert. No. : ACC25042
Pages : 1 of 3

Calibration Certificate

Equipment : SOUND CALIBRATOR
Manufacturer : RION
Model : NC-74
Serial No. : 34178124
ID No. : RYG_FS0216REVIEW BY
APPROVED BY
NEXT CAL DATE 18/ 08/ 2026

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 : 04 AUGUST 2025
Calibration Date : 19 AUGUST 2025
Date of Issue : 20 AUGUST 2025

Calibrated by : Nathakorn Pisutpaisan

Approved by :
Wichok B.
(Wichok Ekpongpradit)

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other than in full, except with the prior written approval of the head of Calibration Laboratory.

Cert. No. : ACC25042
Job No. : VC68AC0162
Pages : 2 of 3

Calibration Procedure : CP-AC-03

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33511B	MY52302742	EF-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	33461A	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-42KA1	34560495	AA-3002-25	19-FEB-26
Audio Analyzer	AVR-3360A	V744B6069	EF-0013-25	13-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).

End of Calibration Certificate

Cert. No. : ACC25042
Job No. : VC68AC0162
Pages : 3 of 3

Result of calibration :

1. Sound pressure level

Specified sound pressure level (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (dB)	Acceptance limit (dB)
94	94.17	0.17	0.14	0.40

2. Frequency

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

3. Total distortion

Measured value (%)	Uncertainty (%)	Acceptance limit (%)
2.07	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

Cert. No. : ACL26108
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00900073 / 188466 / 01735
ID No.: RYG_FS0494

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 : 12 JANUARY 2026
Calibration Date : 28-30 JANUARY 2026
Date of Issue : 02 FEBRUARY 2026

REVIEW BY *Spt S*
APPROVED BY *Spt S*
NEXT CAL DATE: 27/ 01/ 2027

Calibrated by : Nathakorn Pisutpaisan

Approved by : *Nitinun S.*
(Nitinun Srihawan)

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. : ACL26108
Job No. : VC69AC0058
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. : ACL26108
Job No. : VC69AC0058
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. : ACL26108
Job No. : VC69AC0058
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)
17.9

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

Frequency Weighting	Weighting (dB)
A - weight	12.5
C - weight	18.5
Flat	24.1

3. Acoustical signal tests of frequency weightings

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

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

Cert. No. : ACL26108
Job No. : VC69AC0058
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	94.0	0.0	± 0.1
Slow	94.0	93.9	-0.1	± 0.1
Leq	94.0	93.9	-0.1	± 0.1

6. Long - term stability

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

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Cert. No. : ACL26108
Job No. : VC69AC0058
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.1	0.1	± 1.1
134.0	134.1	0.1	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.1	0.1	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.1	0.1	± 1.1
114.0	114.1	0.1	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.1	0.1	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.0	0.0	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.9	-0.1	± 1.1

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Cert. No. : ACL26108
Job No. : VC69AC0058
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	28.8	-0.2	±1.1

9. Tone burst response

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

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Cert. No. : ACL26108
Job No. : VC69AC0058
Pages : 8 of 8

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	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	135.1	-0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±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

NITISORN S.

Cert. No. : ACL26109
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00900074 / 188467 / 01736
ID No.: RYG_FS0495

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 : 12 JANUARY 2026
Calibration Date : 28-30 JANUARY 2026
Date of Issue : 02 FEBRUARY 2026

REVIEW BY *Sgt S.*
APPROVED BY *[Signature]*
NEXT CAL DATE: 27/ 01/ 2027

Calibrated by : Nathakorn Pisutpaisan

Approved by : *Nitinun S.*
(Nitinun Srihawan)

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Cert. No. : ACL26109
Job No. : VC69AC0058
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. : ACL26109
Job No. : VC69AC0058
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. : ACL26109
Job No. : VC69AC0058
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)
14.8

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	17.4
Flat	23.2

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.1	0.2	0.3	± 1.5
1000	-0.1	0.0	0.0	± 1.0
8000	-0.4	-0.3	-0.3	±5.0

Cert. No. : ACL26109
Job No. : VC69AC0058
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

NTHONGS

Cert. No. : ACL26109
Job No. : VC69AC0058
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	132.9	-0.1	± 1.1
132.0	131.9	-0.1	± 1.1
131.0	130.9	-0.1	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	27.0	0.0	± 1.1
26.0	26.0	0.0	± 1.1
25.0	24.9	-0.1	± 1.1

NTHONGS

Cert. No. : ACL26109
Job No. : VC69AC0058
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	29.0	0.0	±1.1

9. Tone burst response

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

NTHONGS

Cert. No. : ACL26109
Job No. : VC69AC0058
Pages : 8 of 8

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	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	135.1	-0.3	±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

NTHONGS

Cert. No. : ACL25498
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42A / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00623387 / 198634 / 26415
ID No.: RYG_FS0612

Condition As Found : GOOD

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

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

Received Date : 11 DECEMBER 2025
Calibration Date : 22 DECEMBER 2025
Date of Issue : 24 DECEMBER 2025

Calibrated by : Nathakorn Pisutpaisan

Approved by : Nitinun S.
(Nitinun Srihawan)

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. : ACL25498
Job No. : VC69AC0045
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. : ACL25498
Job No. : VC69AC0045
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. : ACL25498
Job No. : VC69AC0045
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)
15.4

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

Frequency Weighting	Weighting (dB)
A - weight	12.6
C - weight	18.7
Flat	24.4

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.2	0.3	0.3	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	0.4	0.5	0.5	±5.0

Cert. No. : ACL25498
Job No. : VC69AC0045
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

PMS-Test-5

Cert. No. : ACL25498
Job No. : VC69AC0045
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	48.9	-0.1	± 1.1
44.0	44.0	0.0	± 1.1
39.0	38.9	-0.1	± 1.1
34.0	33.9	-0.1	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.9	-0.1	± 1.1

PMS-Test-5

Cert. No. : ACL25498
Job No. : VC69AC0045
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	1.0 ; -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

PMS-Test-5

Cert. No. : ACL25498
Job No. : VC69AC0045
Pages : 8 of 8

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	130.0	130.0	0.0	±3.0
One	133.4	133.3	-0.1	±3.0

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

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

PMS-Test-5

Cert. No. : ACL25499
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42A / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00623388 / 198638 / 26416
ID No.: RYG_FS0613

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 : 11 DECEMBER 2025
Calibration Date : 22 DECEMBER 2025
Date of Issue : 24 DECEMBER 2025

Calibrated by : Nathakorn Pisutpaisan

Approved by :
(Nitinun Srihawan)

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. : ACL25499
Job No. : VC69AC0045
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. : ACL25499
Job No. : VC69AC0045
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. : ACL25499
Job No. : VC69AC0045
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)
15.2

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

Frequency Weighting	Weighting (dB)
A - weight	12.6
C - weight	18.8
Flat	24.0

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.0	0.1	0.1	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	1.1	1.2	1.2	±5.0

Cert. No. : ACL25499
Job No. : VC69AC0045
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

NIST traceable

Cert. No. : ACL25499
Job No. : VC69AC0045
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	134.1	0.1	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.1	0.1	± 1.1
114.0	114.1	0.1	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.1	0.1	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	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

NIST traceable

Cert. No. : ACL25499
Job No. : VC69AC0045
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	116.9	-0.1	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	107.9	-0.1	1.0 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.8	-0.2	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

NIST traceable

Cert. No. : ACL25499
Job No. : VC69AC0045
Pages : 8 of 8

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	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	135.1	-0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±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

NIST traceable

Cert. No. : ACL25504
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42A / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00623389 / 198636 / 26417
ID No.: RYG_FS0614

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
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 : 15 DECEMBER 2025
Calibration Date : 24 DECEMBER 2025
Date of Issue : 26 DECEMBER 2025



Calibrated by : Nathakorn Pisutpaisan

Approved by : [Signature]
(Nitinun Srihawan)

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. : ACL25504
Job No. : VC69AC0047
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	EP-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. : ACL25504
Job No. : VC69AC0047
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. : ACL25504
Job No. : VC69AC0047
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)
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	17.1
Flat	22.9

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.1	0.1	0.2	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	1.0	1.1	1.1	±5.0

Cert. No. : ACL25504
Job No. : VC69AC0047
Pages : 5 of 84. Electrical signal tests of frequency weightings
Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	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
Lcq	94.0	94.0	0.0	± 0.1

6. Long - term stability

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

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Cert. No. : ACL25504
Job No. : VC69AC0047
Pages : 6 of 8

7. Level linearity on the reference level range

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

MS990005

Cert. No. : ACL25504
Job No. : VC69AC0047
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	28.8	-0.2	±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	1.0 ; -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

MS990005

Cert. No. : ACL25504
Job No. : VC69AC0047
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	133.1	0.1	±2.0
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

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

MS990005

Cert. No. : ACL25500
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42A / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00623890 / 198637 / 26418
ID No.: RYG_FS0615

Condition As Found : GOOD

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

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

Received Date : 11 DECEMBER 2025
Calibration Date : 22 DECEMBER 2025
Date of Issue : 24 DECEMBER 2025

Calibrated by : Nathakorn Pisutpaisan

Approved by : (Nitinun Srihawan)

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. : ACL25500
Job No. : VC69AC0045
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. : ACL25500
Job No. : VC69AC0045
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. : ACL25500
Job No. : VC69AC0045
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)
18.6

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

Frequency Weighting	Weighting (dB)
A - weight	11.6
C - weight	18.1
Flat	23.6

3. Acoustical signal tests of frequency weightings

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

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

Cert. No. : ACL25500
Job No. : VC69AC0045
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

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

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

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Cert. No. : ACL25500
Job No. : VC69AC0045
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	134.1	0.1	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.1	0.1	± 1.1
114.0	114.1	0.1	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.1	0.1	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	26.0	0.0	± 1.1
25.0	24.9	-0.1	± 1.1

MS990005

Cert. No. : ACL25500
Job No. : VC69AC0045
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	116.9	-0.1	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.0 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.8	-0.2	1.5 ; -5.0
	2	8	108.0	107.9	-0.1	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

MS990005

Cert. No. : ACL25500
Job No. : VC69AC0045
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	135.1	-0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±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

MS990005

Cert. No. : ACL25414
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00597169 / 158770 / 34370
ID No.: RYG_FS0439

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 : 20 OCTOBER 2025
Calibration Date : 05 NOVEMBER 2025
Date of Issue : 06 NOVEMBER 2025

REVIEW BY
APPROVED BY
NEXT CAL DATE.....04/11/2026.....

Calibrated by : Nathakorn Pisutpaisan

Approved by : Nitinun Srihawan

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. : ACL25414
Job No. : VC69AC0014
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. : ACL25414
Job No. : VC69AC0014
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. : ACL25414
Job No. : VC69AC0014
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)
15.2

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

Frequency Weighting	Weighting (dB)
A - weight	8.7
C - weight	15.8
Flat	21.5

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	0.9	0.9	0.9	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-3.2	-3.1	-3.1	±5.0

Cert. No. : ACL25414
Job No. : VC69AC0014
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

DISSEM. S.

Cert. No. : ACL25414
Job No. : VC69AC0014
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	53.9	-0.1	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.9	-0.1	± 1.1

DISSEM. S.

Cert. No. : ACL25414
Job No. : VC69AC0014
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	1.0 ; -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

DISSEM. S.

Cert. No. : ACL25414
Job No. : VC69AC0014
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	133.3	-0.1	±3.0

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

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

DISSEM. S.

Cert. No. : ACL26104
Pages : 1 of 8

Calibration Certificate

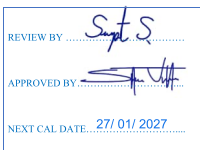
Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00709746 / 187332 / 01297
ID No.: RYG_FS0491

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 : 12 JANUARY 2026
Calibration Date : 28-30 JANUARY 2026
Date of Issue : 02 FEBRUARY 2026

**Calibrated by :** Nathakorn Pisutpaisan

Approved by : Nitinun Srihawan
(Nitinun Srihawan)

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. : ACL26104
Job No. : VC69AC0058
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. : ACL26104
Job No. : VC69AC0058
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. : ACL26104
Job No. : VC69AC0058
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)
14.8

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	17.9
Flat	23.8

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.2	0.2	0.2	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	0.9	1.0	1.0	±5.0

Cert. No. : ACL26104
Job No. : VC69AC0058
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

CST1604-5

Cert. No. : ACL26104
Job No. : VC69AC0058
Pages : 6 of 8

7. Level linearity on the reference level range

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

CST1604-5

Cert. No. : ACL26104
Job No. : VC69AC0058
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	1.0 ; -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

CST1604-5

Cert. No. : ACL26104
Job No. : VC69AC0058
Pages : 8 of 8

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	130.0	130.0	0.0	±3.0
One	133.4	133.3	-0.1	±3.0

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

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

CST1604-5

Cert. No. : ACL26106
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00900071 / 188464 / 01733
ID No.: RYG_FS0492

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 : 12 JANUARY 2026
Calibration Date : 28-30 JANUARY 2026
Date of Issue : 02 FEBRUARY 2026

REVIEW BY *Spt S*
APPROVED BY *[Signature]*
NEXT CAL DATE *27/ 01/ 2027*

Calibrated by : Nathakorn Pisutpaisan

Approved by : *Nitinun S*
(Nitinun Srihawan)

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. : ACL26106
Job No. : VC69AC0058
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. : ACL26106
Job No. : VC69AC0058
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. : ACL26106
Job No. : VC69AC0058
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	18.5
Flat	24.2

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	0.5	0.5	0.5	± 1.5
1000	0.1	0.1	0.2	± 1.0
8000	0.1	0.2	0.2	±5.0

Cert. No. : ACL26106
Job No. : VC69AC0058
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

CYT000005

Cert. No. : ACL26106
Job No. : VC69AC0058
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.1	0.1	± 1.1
136.0	136.1	0.1	± 1.1
135.0	135.1	0.1	± 1.1
134.0	134.1	0.1	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.1	0.1	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.1	0.1	± 1.1
114.0	114.1	0.1	± 1.1
109.0	109.1	0.1	± 1.1
104.0	104.1	0.1	± 1.1
99.0	99.1	0.1	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.9	-0.1	± 1.1

CYT000005

Cert. No. : ACL26106
Job No. : VC69AC0058
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	29.0	0.0	±1.1

9. Tone burst response

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

CYT000005

Cert. No. : ACL26106
Job No. : VC69AC0058
Pages : 8 of 8

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	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	135.1	-0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±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

CYT000005

Cert. No. : ACL26107
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00900072 / 188465 / 01734
ID No.: RYG_FS0493

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 : 12 JANUARY 2026
Calibration Date : 28-30 JANUARY 2026
Date of Issue : 02 FEBRUARY 2026

REVIEW BY: *S. S.*
APPROVED BY: *[Signature]*
NEXT CAL DATE: 27/ 01/ 2027

Calibrated by : Nathakorn Pisutpaisan

Approved by : *Nitinun S.*
(Nitinun Srihawan)

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. : ACL26107
Job No. : VC69AC0058
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. : ACL26107
Job No. : VC69AC0058
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. : ACL26107
Job No. : VC69AC0058
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)
14.2

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

Frequency Weighting	Weighting (dB)
A - weight	10.4
C - weight	17.2
Flat	23.1

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.6	0.6	0.6	± 1.5
1000	0.1	0.1	0.1	± 1.0
8000	-0.5	-0.4	-0.4	± 5.0

Cert. No. : ACL26107
Job No. : VC69AC0058
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

NTS1000-5

Cert. No. : ACL26107
Job No. : VC69AC0058
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	78.9	-0.1	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	63.9	-0.1	± 1.1
59.0	58.9	-0.1	± 1.1
54.0	53.9	-0.1	± 1.1
49.0	48.9	-0.1	± 1.1
44.0	43.9	-0.1	± 1.1
39.0	38.9	-0.1	± 1.1
34.0	33.9	-0.1	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.8	-0.2	± 1.1

NTS1000-5

Cert. No. : ACL26107
Job No. : VC69AC0058
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	28.8	-0.2	±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	1.0 ; -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

NTS1000-5

Cert. No. : ACL26107
Job No. : VC69AC0058
Pages : 8 of 8

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	130.0	130.0	0.0	±3.0
One	133.4	133.3	-0.1	±3.0

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

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

NTS1000-5

Certificate of Calibration

Customer

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

Certificate No : 25-ACT-077
Request No : Req-2025-1050

Unit Under Calibration Details

Measurement item : Acoustic Calibrator Class : 2
Manufacturer : Cirrus Range : 94 , 114 dB / 1000 Hz
Model : CR:516 Instrument Status : Used
Serial Number : 100249
ID : RYG_FS0635

Calibration Environment and Details

Temperature : (23 ±2 °C)
Humidity : (50 ± 20 %RH)
Barometric Pressure : (1013 ±10.0 hPa)
Received Date : 14 May 2025
Calibration Date : 26 May 2025
Location of Calibration : LAB 1 Acoustic
Calibration Procedure : In-house method CP-ACT-02 based on IEC 60942:2017 Electroacoustics - Sound calibrators

REVIEW BY 
APPROVED BY 
NEXT CAL DATE: 25/ 05/ 2026

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Sound Calibrator	SV 35A	58079	EEI	12 June 2025
THD Multimeter	2015	1047765	NIMT	4 February 2026

Traceability : This certificate provides traceability of measurement to recognized national standard, and to the realization of the international System of Units (SI).

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 : 26 May 2025

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

FM-708-ACT-02 Rev.D4 Issue date 17/2/25

Certificate No : 25-ACT-077

Request No : Req-2025-1050

Sound pressure level

Calibration Results : Without Adjustment

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty (± dB)
	Measured	Deviated value	Measured	Deviated value	
94 dB / 1000 Hz	93.86	-0.14	-	-	0.11
114 dB / 1000 Hz	113.83	-0.17	-	-	0.11

Frequency of Sound pressure level

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)
	Measured (Hz)	Deviated value	Measured (Hz)	Deviated value	
94 dB / 1000 Hz	1000.0	0.00	-	-	0.01
114 dB / 1000 Hz	1000.0	0.00	-	-	0.010

Total Harmonic Distortion plus Noise of Sound pressure level (THD+N %)

Calibration Range (Hz)	Without Adjustment	Adjustment	Uncertainty (± %)
	Measured (%)	Measured (%)	
94 dB / 1000 Hz	2.31	-	0.17
114 dB / 1000 Hz	0.91	-	0.17

Note :

- The calibration results exclude the calibrator pressure correction
- The calibration results exclude the microphone volume correction

End of Calibration

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

FM-708-ACT-02 Rev.D4 Issue date 17/2/25



Jiranatee Associates Co., Ltd.
63/14-15, 67/35-36
Petchkasem 7/71, Rd. Wattapara, Bangkokkai,
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E-mail: jnac-calibration@jiranatee.com
Web site: www.jiranatee.com

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

Acoustic calibration laboratory
Calibration services department.

CALIBRATION REPORT

Page 1 of 1 Pages

MEASUREMENT ITEM : Dose meter
MANUFACTURER : Cirrus Research plc
MODEL/TYPE : CR:120A
SERIAL NUMBER : MK502815
ID NUMBER : RYG_FS0636
CONDITION AS-RECEIVED
CUSTOMER : Used item

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

RECEIVED DATE : 18 Sep 2025
MEASUREMENT DATE : 19 Sep 2025
ISSUE DATE : 19 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.

STANDARD USED DURING CALIBRATION:

Instrument name: Sound Calibrator Manufacturer: Cirrus Research plc Model: CR:516 Serial number: 99808
Remark: Sound Calibrator 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.

Sound Calibrator Level (dB)	Noise Dosimeter reading (dB)	Error (dB)	Status
114.0	114.0	0.0	✓

Calibrated by:
☒ Mr. Sorawit Thattad
☐ Miss Jitrasri Lertbongphol
☐ Miss Ruangsuda Phoommit

REVIEW BY 
APPROVED BY 
NEXT CAL DATE: 18/ 09/ 2026

Approved signatory: 
Mr. Parinya Booncharoen
Calibration Department Manager

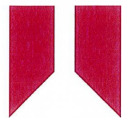
Remark:
1 The Rec'd level of standard Sound Calibrator that supplied to Unit Under Calibration.
2 The measurement reading of Unit Under Calibration.

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

CERTIFICATE OF CALIBRATION

ISSUED BY Cirrus Research plc

DATE OF ISSUE 27 October 2025 CERTIFICATE NUMBER 252185

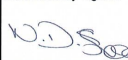


Cirrus Research plc
Acoustic House
Bridlington Road
Hunmanby
North Yorkshire
YO14 0PH
United Kingdom

RYG_FS0637
REVIEW BY 
APPROVED BY 
NEXT CAL DATE: 23/ 10/ 2026

Page 1 of 8

Approved signatory
N.Smith
Electronically signed:



Dosimeter : IEC 61252-1993+A1:2000

Instrument information

Manufacturer: Cirrus Research plc Notes:
Model: CR:120A
Serial number: MK502816
Firmware version: 1.1.1840

Test summary

Date of calibration: 24 October 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	SDG1XDD7R6629
Attenuator	Cirrus Research	ZE:952	96919
Environmental Monitor	Comet	T7510	16966334

Notes

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CERTIFICATE OF CALIBRATION

Certificate Number:
252185
Page 2 of 8

Environmental conditions

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

Before	Pressure: 98.61 kPa	Temperature: 22.0 °C	Humidity: 41.4 %
After	Pressure: 98.61 kPa	Temperature: 22.4 °C	Humidity: 42.9 %

Test results summary

Test	Result
Absolute Acoustic Sensitivity	Complies
Linearity	Complies
Short Duration	Complies
Response to unipolar pulses	Complies
Overload Latching	Complies
Frequency weighting	Complies

CERTIFICATE OF CALIBRATION

Certificate Number:
252185
Page 3 of 8

Laboratory uncertainties

Requirement	Value
Absolute acoustic sensitivity	0.2 dB
Level linearity	0.15 dB
Short duration signals	0.2 dB
Unipolar Pulses	0.2 dB
Overload latching indication	0.2 dB
Electrical freq. weighting 63 Hz	0.15 dB
Electrical freq. weighting 125 Hz	0.15 dB
Electrical freq. weighting 250 Hz	0.15 dB
Electrical freq. weighting 500 Hz	0.15 dB
Electrical freq. weighting 2 kHz	0.15 dB
Electrical freq. weighting 4 kHz	0.15 dB
Electrical freq. weighting 8 kHz	0.15 dB

CERTIFICATE OF CALIBRATION

Certificate Number:
252185
Page 4 of 8

B1: Absolute Acoustical Sensitivity

Result: **Passed**

Frequency: 1000 Hz Uncertainty: 0.2 dB

Name	Input Level (dB)	Reading (dB)	Deviation (dB)	Limits (dB)
Initial	94	93.77	0.23	93 / 95
Adjusted	94	94.00	0	93 / 95

B2: Linearity Of Response To Steady Signals

Result: **Passed**

Frequency: 63 Hz Uncertainty: 0.2 dB Range: 93.8 – 113 dB

Input Level (dB)	Expected Exposure (Pa²h)	Exposure (Pa²h)	Duration (s)	Deviation (Pa²h)	Limits (Pa²h)	Deviation (%)	Limits (%)
93.8	0.005331	0.005211	20	0.004211 / 0.006717		-2	-21 / +26
98.8	0.016857	0.016542	20	0.013317 / 0.021240		-2	-21 / +26
103.8	0.053307	0.054906	20	0.042113 / 0.067167		3	-21 / +26
108.8	0.168573	0.169942	20	0.133173 / 0.212402		1	-21 / +26
113	0.443392	0.436984	20	0.350280 / 0.558674		-1	-21 / +26

CERTIFICATE OF CALIBRATION

Certificate Number:
252185
Page 5 of 8

Frequency: 1000 Hz Uncertainty: 0.2 dB Range: 65 – 140 dB

Input Level (dB)	Expected Exposure (Pa²h)	Exposure (Pa²h)	Duration (s)	Deviation (Pa²h)	Limits (Pa²h)	Deviation (%)	Limits (%)
65	0.000007	0.000008	20	-0.000001	0.000006 / 0.000009	14	-21 / +26
70	0.000022	0.000022	20	-0.000000	0.000017 / 0.000028	0	-21 / +26
75	0.000070	0.000071	20	-0.000001	0.000055 / 0.000088	1	-21 / +26
80	0.000222	0.000215	20	0.000007	0.000175 / 0.000280	-3	-21 / +26
85	0.000703	0.000663	20	0.000040	0.000555 / 0.000886	-6	-21 / +26
90	0.002222	0.002151	20	0.000071	0.001755 / 0.002800	-3	-21 / +26
95	0.007027	0.007122	20	-0.000095	0.005551 / 0.008544	1	-21 / +26
100	0.022222	0.022196	20	0.000026	0.017555 / 0.028000	-0	-21 / +26
105	0.070273	0.071949	20	-0.001676	0.055516 / 0.088544	2	-21 / +26
110	0.222222	0.230012	20	-0.007790	0.175555 / 0.280000	4	-21 / +26
115	0.702728	0.713564	20	-0.010836	0.555155 / 0.885437	2	-21 / +26
120	2.222222	2.270663	20	-0.048441	1.755555 / 2.800000	2	-21 / +26
125	7.027284	7.024119	20	0.003165	5.551554 / 8.854378	-0	-21 / +26
130	22.222223	22.834055	20	-0.611832	17.555556 / 28.000001	3	-21 / +26
135	70.272839	70.635384	20	-0.362545	55.515543 / 88.543777	1	-21 / +26
140	222.222228	224.771851	20	-2.549623	175.555560 / 280.000007	1	-21 / +26

CERTIFICATE OF CALIBRATION

Certificate Number:

252185

Page 6 of 8

Frequency: 8000 Hz Uncertainty: 0.2 dB Range: 88.9 – 108.9 dB

Input Level (dB)	Expected Exposure (Pa ² h)	Exposure (Pa ² h)	Duration (s)	Deviation (Pa ² h)	Limits (Pa ² h)	Deviation (%)	Limits (%)
88.9	0.001725	0.001680	20	0.000045	0.001363 / 0.002174	-3	-21 / +26
93.9	0.005455	0.005382	20	0.000073	0.004309 / 0.006873	-1	-21 / +26
98.9	0.017250	0.017047	20	0.000203	0.013628 / 0.021735	-1	-21 / +26
103.9	0.054549	0.052762	20	0.001787	0.043094 / 0.068732	-3	-21 / +26
108.9	0.172499	0.170635	20	0.001864	0.136274 / 0.217349	-1	-21 / +26

CERTIFICATE OF CALIBRATION

Certificate Number:

252185

Page 7 of 8

B3: Frequency Weightings

Result: **Passed**

Reference Frequency: 1000 Hz

Reference Exposure: 111.92945098876

Reference Input Level: 137 dB

Duration: 20 Seconds

Frequency (Hz)	Exposure (Pa ² h)	Exposure Ratio	Ratio Limit	Uncertainty
63	0.271906	0.0024	0.0015 / 0.0038	0.15
125	2.785332	0.0249	0.0174 / 0.0347	0.15
250	15.239908	0.1362	0.098 / 0.195	0.15
500	53.314217	0.4763	0.339 / 0.676	0.15
2000	145.463776	1.2996	0.832 / 2.089	0.15
4000	118.585121	1.0595	0.631 / 2.512	0.15
8000	66.246986	0.5919	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 (Pa ² h)	Exposure (Pa ² h)	Deviation (%)	Limits (%)
114	95	1:100	10	10	990	0.002791	0.003136	12	-21 / +26
124	95	1:1000	10	1	999	0.002791	0.003114	12	-21 / +26
129	100	1:1000	10	1	999	0.008826	0.009751	10	-29 / +41
129	100	1:1000	10	10	9990	0.008826	0.010142	15	-29 / +41
139	110	1:1000	10	1	999	0.088259	0.102458	16	-29 / +41

CERTIFICATE OF CALIBRATION

Certificate Number:

252185

Page 8 of 8

B5: Response to Unipolar Pulses

Result: **Passed**

Uncertainty: 0.2 dB Frequency: 1000 Hz

Positive Exposure (Pa ² h)	Negative Exposure (Pa ² h)	Integration Time (s)	Deviation (Pa ² h)	Limits (Pa ² h)	Deviation (%)	Limits (%)
11.450032	11.450032	30	0	9.045525 / 14.427041	0	-21 / +26

B6: Latching Overload Indicator

Result: **Passed**

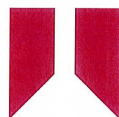
Frequency: 1000 Hz Uncertainty: 0.2 dB

Level (dB)	Expected To Overload	Overloaded
140	No	No
143	Yes	Yes

CERTIFICATE OF CALIBRATION

ISSUED BY Cirrus Research plc

DATE OF ISSUE 27 October 2025 CERTIFICATE NUMBER 252184



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

Page 1 of 3

Approved signatory
N.Smith
Electronically signed:

[Signature]

Octave-band filter : IEC 61260-3:2016

Instrument information

Manufacturer: Cirrus Research plc

Notes:

Model: CR-120A

Serial number: MK502816

Firmware version: 1.1.1840

Test summary

Date of calibration: 24 October 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 61260-3:2016.

The dosimeter submitted for testing conforms to the specifications in IEC 61260-3:2016.

Test equipment

Equipment	Manufacturer	Model	Serial number
Signal Generator	SIGLENT	SDG1032X	SDG1XDDD7R6629
Attenuator	Cirrus Research	ZE-952	96919
Environmental Monitor	Comet	T7510	16966334

Notes

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End of results

CERTIFICATE OF CALIBRATION

Certificate Number:

252184

Page 2 of 3

Environmental conditions

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

Before Pressure: 98.61 kPa Temperature: 22.0 °C Humidity: 41.4 %
After Pressure: 98.61 kPa Temperature: 22.4 °C Humidity: 42.9 %

Test results summary

Test	Result
Relative attenuation	Complies

CERTIFICATE OF CALIBRATION

Certificate Number:

252184

Page 3 of 3

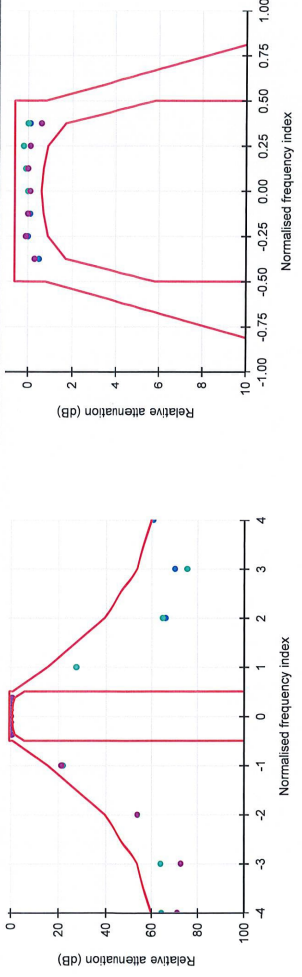
Result: Passed

Reference input level at 1 kHz on the 1 kHz filter: 139.00 dB

Measurement of Relative Attenuation

Band	Normalised frequency index														
	-4	-3	-2	-1	-0.375	-0.25	-0.125	0	0.125	0.25	0.375	1	2	3	4
63 Hz				+21.9	+0.5	+0.0	+0.1	+0.1	+0.0	-0.2	+0.1	+27.5	+66.2	+70.1	+60.7
1 kHz	+64.6	+64.3	+54.3	+21.5	+0.3	-0.1	+0.0	+0.0	+0.0	-0.1	+0.0	+27.6	+65.0	+75.5	
8 kHz	+71.2	+72.8	+54.0	+21.3	+0.3	-0.1	+0.0	+0.1	+0.0	+0.1	+0.6				
Max. attenuation limit	+∞	+∞	+∞	+∞	+1.7	+0.9	+0.7	+0.8	+0.7	+0.9	+1.7	+∞	+∞	+∞	+∞
Min. attenuation limit	+60.0	+54.0	+39.5	+15.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	+15.6	+39.5	+54.0	+60.0

Cells with a grey background represent test frequencies outside of the range specified in section 13.4 of IEC 61260-3:2016.



CERTIFICATE OF CALIBRATION

RYG_FS0638

ISSUED BY Cirrus Research plc
DATE OF ISSUE 30 June 2025 CERTIFICATE NUMBER 243780

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

Page 1 of 8
Approved signatory
N.Smith
Electronically signed:

N.Smith

Dosimeter : IEC 61252-1993+A1:2000

Instrument information

Manufacturer: Cirrus Research plc Notes:
Model: CR:120A
Serial number: MK502817
Firmware version: 1.1.1840

Test summary

Date of calibration: 27 June 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	SDG1XDDDR6629
Attenuator	Cirrus Research	ZE:952	96919
Environmental Monitor	Comet	T7510	16986334

Notes

REVIEW BY *SJS*
APPROVED BY *[Signature]*
NEXT CAL DATE: 26/ 06/ 2026

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CERTIFICATE OF CALIBRATION

Certificate Number:

243780

Page 2 of 8

Environmental conditions

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

Before Pressure: 100.80 kPa Temperature: 22.0 °C Humidity: 47.0 %
After Pressure: 100.80 kPa Temperature: 22.3 °C Humidity: 47.5 %

Test results summary

Test	Result
Absolute Acoustic Sensitivity	Complies
Linearity	Complies
Short Duration	Complies
Response to unipolar pulses	Complies
Overload Latching	Complies
Frequency weighting	Complies

CERTIFICATE OF CALIBRATION

Certificate Number:
243780
Page 3 of 8

CERTIFICATE OF CALIBRATION

Certificate Number:
243780
Page 4 of 8

B1: Absolute Acoustical Sensitivity

Result: Passed

Frequency: 1000 Hz Uncertainty: 0.2 dB

Name	Input Level (dB)	Reading (dB)	Deviation (dB)	Limits (dB)
Initial	94	94.04	-0.04	93 / 95

B2: Linearity Of Responce To Steady Signals

Result: Passed

Frequency: 63 Hz Uncertainty: 0.2 dB Range: 93.8 – 113 dB

Input Level (dB)	Expected Exposure (Pa²h)	Exposure (Pa²h)	Duration (s)	Deviation (Pa²h)	Limits (Pa²h)	Deviation (%)	Limits (%)
93.8	0.005331	0.005163	20	0.000168	0.004211 / 0.006717	-3	-21 / +26
98.8	0.016857	0.016466	20	0.000391	0.013317 / 0.021240	-2	-21 / +26
103.8	0.053307	0.054906	20	-0.001599	0.042113 / 0.067167	3	-21 / +26
108.8	0.168573	0.172314	20	-0.003741	0.133173 / 0.212402	2	-21 / +26
113	0.443392	0.448480	20	-0.005088	0.350280 / 0.558674	1	-21 / +26

CERTIFICATE OF CALIBRATION

Certificate Number:
243780
Page 5 of 8

CERTIFICATE OF CALIBRATION

Certificate Number:
243780
Page 6 of 8

Frequency: 1000 Hz Uncertainty: 0.2 dB Range: 65 – 140 dB

Frequency: 8000 Hz Uncertainty: 0.2 dB Range: 88.9 – 108.9 dB

Input Level (dB)	Expected Exposure (Pa²h)	Exposure (Pa²h)	Duration (s)	Deviation (Pa²h)	Limits (Pa²h)	Deviation (%)	Limits (%)
65	0.000007	0.000007	20	-0.000000	0.000006 / 0.000009	0	-21 / +26
70	0.000022	0.000022	20	-0.000000	0.000017 / 0.000028	0	-21 / +26
75	0.000070	0.000069	20	0.000001	0.000055 / 0.000088	-1	-21 / +26
80	0.000222	0.000217	20	0.000005	0.000175 / 0.000280	-2	-21 / +26
85	0.000703	0.000723	20	-0.000020	0.000555 / 0.000886	3	-21 / +26
90	0.002222	0.002171	20	0.000051	0.001755 / 0.002800	-2	-21 / +26
95	0.007027	0.007171	20	-0.000144	0.005551 / 0.008854	2	-21 / +26
100	0.022222	0.021428	20	0.000794	0.017555 / 0.028000	-4	-21 / +26
105	0.070273	0.072617	20	-0.002344	0.055516 / 0.088544	3	-21 / +26
110	0.222222	0.222568	20	-0.000346	0.175555 / 0.280000	0	-21 / +26
115	0.702728	0.690470	20	0.012258	0.555155 / 0.885437	-2	-21 / +26
120	2.222222	2.233002	20	-0.010780	1.755555 / 2.800000	0	-21 / +26
125	7.027284	7.089338	20	-0.062054	5.551554 / 8.854378	1	-21 / +26
130	22.222223	22.559336	20	-0.337113	17.555556 / 28.000001	2	-21 / +26
135	70.272839	71.126678	20	-0.853839	55.515543 / 88.543777	1	-21 / +26
140	222.222228	233.905212	20	-11.682984	175.555560 / 280.000007	5	-21 / +26

Input Level (dB)	Expected Exposure (Pa²h)	Exposure (Pa²h)	Duration (s)	Deviation (Pa²h)	Limits (Pa²h)	Deviation (%)	Limits (%)
88.9	0.001725	0.001683	20	0.000042	0.001363 / 0.002174	-2	-21 / +26
93.9	0.005455	0.005213	20	0.000242	0.004309 / 0.006873	-4	-21 / +26
98.9	0.017250	0.016929	20	0.000321	0.013628 / 0.021735	-2	-21 / +26
103.9	0.054549	0.053499	20	0.001050	0.043094 / 0.068732	-2	-21 / +26
108.9	0.172499	0.170241	20	0.002258	0.136274 / 0.217349	-1	-21 / +26

CERTIFICATE OF CALIBRATION

Certificate Number:
243780
Page 7 of 8

B3: Frequency Weightings

Reference Frequency: 1000 Hz Reference Exposure: 114.65724945068
Reference Input Level: 137 dB Duration: 20 Seconds

Result: **Passed**

Frequency (Hz)	Exposure (Pa²h)	Exposure Ratio	Ratio Limit	Uncertainty
63	0.268783	0.0023	0.0015 / 0.0038	0.15
125	2.681637	0.0234	0.0174 / 0.0347	0.15
250	15.275144	0.1332	0.098 / 0.195	0.15
500	55.503876	0.4841	0.339 / 0.676	0.15
2000	146.137314	1.2746	0.832 / 2.089	0.15
4000	123.455620	1.0767	0.631 / 2.512	0.15
8000	67.861206	0.5919	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	0.002856	0.003008	5	-21 / +26
124	95	1:1000	10	1	999	0.002856	0.002981	4	-21 / +26
129	100	1:1000	10	1	999	0.009031	0.009729	8	-29 / +41
129	100	1:1000	10	10	9990	0.009031	0.009774	8	-29 / +41
139	110	1:1000	10	1	999	0.090314	0.091915	2	-29 / +41

CERTIFICATE OF CALIBRATION

Certificate Number:
243780
Page 8 of 8

B5: Response to Unipolar Pulses

Result: **Passed**

Uncertainty: 0.2 dB Frequency: 1000 Hz

Positive Exposure (Pa²h)	Negative Exposure (Pa²h)	Integration Time (s)	Deviation (Pa²h)	Limits (Pa²h)	Deviation (%)	Limits (%)
11.000920	11.529673	30	-0.528752	8.690727 / 13.86116	5	-21 / +26

B6: Latching Overload Indicator

Result: **Passed**

Frequency: 1000 Hz Uncertainty: 0.2 dB

Level (dB)	Expected To Overload	Overloaded
140	No	No
143	Yes	Yes

End of results

CERTIFICATE OF CALIBRATION

ISSUED BY **Cirrus Research plc**
DATE OF ISSUE **30 June 2025** CERTIFICATE NUMBER **243779**



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

Page 1 of 3

Approved signatory
N.Smith
Electronically signed:

[Signature]

Octave-band filter : IEC 61260-3:2016

Instrument information

Manufacturer: Cirrus Research plc Notes:
Model: CR:120A
Serial number: MK502817
Firmware version: 1.1.1840

Test summary

Date of calibration: 27 June 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 61260-3:2016.
The dosimeter submitted for testing conforms to the specifications in IEC 61260-3:2016.

Test equipment

Equipment	Manufacturer	Model	Serial number
Signal Generator	SIGLENT	SDG1032X	SDG1XDDDD7R6629
Attenuator	Cirrus Research	ZE:952	96919
Environmental Monitor	Comet	T7510	16966334

Notes

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CERTIFICATE OF CALIBRATION

Certificate Number:
243779
Page 2 of 3

Environmental conditions

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

Before Pressure: 100.80 kPa Temperature: 22.0 °C Humidity: 47.0 %
After Pressure: 100.80 kPa Temperature: 22.3 °C Humidity: 47.5 %

Test results summary

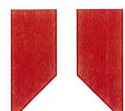
Test	Result
Relative attenuation	Complies

CERTIFICATE OF CALIBRATION

ISSUED BY Cirrus Research plc

DATE OF ISSUE 30 June 2025 CERTIFICATE NUMBER 243805

Page 1 of 8

Approved signatory
N.Smith
Electronically signed:**Cirrus Research plc**
Acoustic House
Bridlington Road
Hunmanby
North Yorkshire
YO14 0PH
United Kingdom

Dosemeter : IEC 61252-1993+A1:2000

Instrument information

Manufacturer: Cirrus Research plc

Notes:

Model: CR:120A

Serial number: MK502821

Firmware version: 1.1.1840

Test summary

Date of calibration: 30 June 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	SDG1XDDDD7R6629
Attenuator	Cirrus Research	ZE:952	96919
Environmental Monitor	Comet	T7510	16966334

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

Measurement of Relative Attenuation

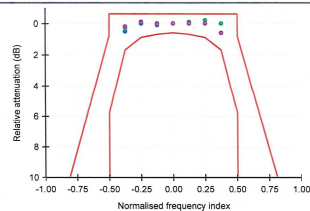
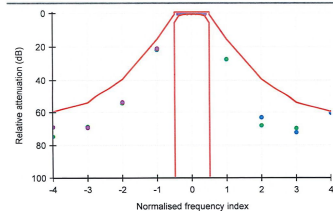
Reference input level at 1 kHz on the 1 kHz filter: 139.00 dB

Certificate Number:
243779
Page 3 of 3

Result: Passed

Band	Normalised frequency index															
	-4	-3	-2	-1	-0.375	-0.25	-0.125	0	0.125	0.25	0.375	1	2	3	4	
63 Hz																
1 kHz	+74.8	+68.9	+54.4	+21.9	+0.3	-0.1	+0.0	+0.0	-0.1	-0.2	+0.0	+27.5	+63.1	+72.3	+60.5	
8 kHz	+69.2	+69.5	+53.8	+21.2	+0.2	-0.1	+0.0	+0.0	+0.0	+0.0	+0.6					
Max. attenuation limit	++	++	++	++	+1.7	+0.9	+0.7	+0.6	+0.7	+0.9	+1.7	++	++	++	++	
Min. attenuation limit	+60.0	+54.0	+39.5	+15.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	+15.6	+39.5	+54.0	+60.0	

Cells with a grey background represent test frequencies outside of the range specified in section 13.4 of IEC 61260-3:2016.



CERTIFICATE OF CALIBRATION

Certificate Number:
243805

Page 2 of 8

Environmental conditions

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

Before Pressure: 101.28 kPa Temperature: 22.6 °C Humidity: 47.5 %

After Pressure: 101.27 kPa Temperature: 22.3 °C Humidity: 47.4 %

Test results summary

Test	Result
Absolute Acoustic Sensitivity	Complies
Linearity	Complies
Short Duration	Complies
Response to unipolar pulses	Complies
Overload Latching	Complies
Frequency weighting	Complies

CERTIFICATE OF CALIBRATION

Certificate Number:
243805

Page 3 of 8

Laboratory uncertainties

Requirement	Value
Absolute acoustic sensitivity	0.2 dB
Level linearity	0.15 dB
Short duration signals	0.2 dB
Unipolar Pulses	0.2 dB
Overload latching indication	0.2 dB
Electrical freq. weighting 63 Hz	0.15 dB
Electrical freq. weighting 125 Hz	0.15 dB
Electrical freq. weighting 250 Hz	0.15 dB
Electrical freq. weighting 500 Hz	0.15 dB
Electrical freq. weighting 2 kHz	0.15 dB
Electrical freq. weighting 4 kHz	0.15 dB
Electrical freq. weighting 8 kHz	0.15 dB

CERTIFICATE OF CALIBRATION

Certificate Number:
243805
Page 4 of 8

B1: Absolute Acoustical Sensitivity

Result: Passed

Frequency: 1000 Hz		Uncertainty: 0.2 dB		
Name	Input Level (dB)	Reading (dB)	Deviation (dB)	Limits (dB)
Initial	94	93.38	0.62	93 / 95
Adjusted	94	94.00	0	93 / 95

B2: Linearity Of Responce To Steady Signals

Result: Passed

Frequency: 63 Hz		Uncertainty: 0.2 dB		Range: 93.8 – 113 dB			
Input Level (dB)	Expected Exposure (Pa ² h)	Exposure (Pa ² h)	Duration (s)	Deviation (Pa ² h)	Limits (Pa ² h)	Deviation (%)	Limits (%)
93.8	0.005331	0.005223	20	0.000108	0.004211 / 0.006717	-2	-21 / +26
98.8	0.016857	0.016428	20	0.000429	0.013317 / 0.021240	-3	-21 / +26
103.8	0.053307	0.054780	20	-0.001473	0.042113 / 0.067167	3	-21 / +26
108.8	0.168573	0.166353	20	0.002220	0.133173 / 0.212402	-1	-21 / +26
113	0.443392	0.444109	20	-0.000717	0.350280 / 0.558674	0	-21 / +26

CERTIFICATE OF CALIBRATION

Certificate Number:
243805
Page 5 of 8

Frequency: 1000 Hz Uncertainty: 0.2 dB Range: 65 – 140 dB

Input Level (dB)	Expected Exposure (Pa ² h)	Exposure (Pa ² h)	Duration (s)	Deviation (Pa ² h)	Limits (Pa ² h)	Deviation (%)	Limits (%)
65	0.000007	0.000007	20	-0.000000	0.000006 / 0.000009	0	-21 / +26
70	0.000022	0.000023	20	-0.000001	0.000017 / 0.000028	5	-21 / +26
75	0.000070	0.000070	20	-0.000000	0.000055 / 0.000088	0	-21 / +26
80	0.000222	0.000218	20	0.000004	0.000175 / 0.000280	-2	-21 / +26
85	0.000703	0.000690	20	0.000013	0.000555 / 0.000886	-2	-21 / +26
90	0.002222	0.002166	20	0.000056	0.001755 / 0.002800	-3	-21 / +26
95	0.007027	0.007255	20	-0.000228	0.005551 / 0.008854	3	-21 / +26
100	0.022222	0.022133	20	0.000089	0.017555 / 0.028000	-0	-21 / +26
105	0.070273	0.070267	20	0.000006	0.055516 / 0.088544	-0	-21 / +26
110	0.222222	0.222054	20	0.000168	0.175555 / 0.280000	-0	-21 / +26
115	0.702728	0.700108	20	0.002620	0.555155 / 0.885437	-0	-21 / +26
120	2.222222	2.243343	20	-0.021121	1.755555 / 2.800000	1	-21 / +26
125	7.027284	7.138644	20	-0.111360	5.551554 / 8.854378	2	-21 / +26
130	22.222223	23.639277	20	-1.417054	17.555556 / 28.000001	6	-21 / +26
135	70.272839	71.786949	20	-1.514110	55.515543 / 88.543777	2	-21 / +26
140	222.222228	237.170334	20	-14.948106	175.555560 / 280.000007	7	-21 / +26

CERTIFICATE OF CALIBRATION

Certificate Number:
243805
Page 6 of 8

Frequency: 8000 Hz Uncertainty: 0.2 dB Range: 88.9 – 108.9 dB

Input Level (dB)	Expected Exposure (Pa ² h)	Exposure (Pa ² h)	Duration (s)	Deviation (Pa ² h)	Limits (Pa ² h)	Deviation (%)	Limits (%)
88.9	0.001725	0.001680	20	0.000045	0.001363 / 0.002174	-3	-21 / +26
93.9	0.005455	0.005345	20	0.000110	0.004309 / 0.006873	-2	-21 / +26
98.9	0.017250	0.016929	20	0.000321	0.013628 / 0.021735	-2	-21 / +26
103.9	0.054549	0.053623	20	0.000926	0.043094 / 0.068732	-2	-21 / +26
108.9	0.172499	0.175935	20	-0.003436	0.136274 / 0.217349	2	-21 / +26

CERTIFICATE OF CALIBRATION

Certificate Number:
243805
Page 7 of 8

B3: Frequency Weightings

Result: Passed

Reference Frequency: 1000 Hz Reference Exposure: 112.18860626220
Reference Input Level: 137 dB Duration: 20 Seconds

Frequency (Hz)	Exposure (Pa ² h)	Exposure Ratio	Ratio Limit	Uncertainty
63	0.270028	0.0024	0.0015 / 0.0038	0.15
125	2.712798	0.0242	0.0174 / 0.0347	0.15
250	15.829190	0.1411	0.098 / 0.195	0.15
500	55.503876	0.4947	0.339 / 0.676	0.15
2000	149.553223	1.3331	0.832 / 2.089	0.15
4000	119.686394	1.0668	0.631 / 2.512	0.15
8000	68.649803	0.6119	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 (Pa ² h)	Exposure (Pa ² h)	Deviation (%)	Limits (%)
114	95	1:100	10	10	990	0.002791	0.003093	11	-21 / +26
124	95	1:1000	10	1	999	0.002791	0.003071	10	-21 / +26
129	100	1:1000	10	1	999	0.008826	0.009774	11	-29 / +41
129	100	1:1000	10	10	9990	0.008826	0.009186	4	-29 / +41
139	110	1:1000	10	1	999	0.088259	0.100582	14	-29 / +41

B5: Response to Unipolar Pulses

Result: Passed

Uncertainty: 0.2 dB	Frequency: 1000 Hz					
Positive Exposure (Pa ² h)	Negative Exposure (Pa ² h)	Integration Time (s)	Deviation (Pa ² h)	Limits (Pa ² h)	Deviation (%)	Limits (%)
11.077435	11.529673	30	-0.452238	8.751173 / 13.957568	4	-21 / +26

B6: Latching Overload Indicator

Result: Passed

Frequency: 1000 Hz Uncertainty: 0.2 dB

Level (dB)	Expected To Overload	Overloaded
140	No	No
143	Yes	Yes

End of results

Octave-band filter : IEC 61260-3:2016

Instrument information

Manufacturer: Cirrus Research plc Notes:
Model: CR:120A
Serial number: MK502821
Firmware version: 1.1.1840

Test summary

Date of calibration: 30 June 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 61260-3:2016.

The dosimeter submitted for testing conforms to the specifications in IEC 61260-3:2016.

Equipment	Manufacturer	Model	Serial number
Signal Generator	SIGLENT	SDG1032X	SDG1XDDD7R6629
Attenuator	Cirrus Research	ZE:952	96919
Environmental Monitor	Comet	T7510	16966334

Notes

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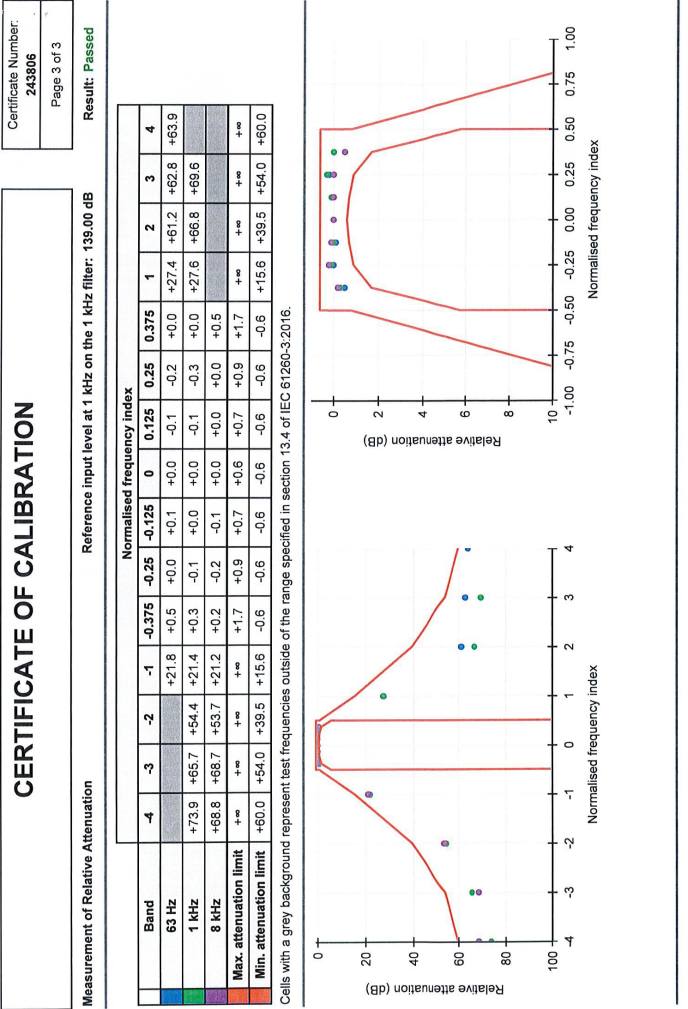
Environmental conditions

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

Before	Pressure: 101.28 kPa	Temperature: 22.6 °C	Humidity: 47.5 %
After	Pressure: 101.27 kPa	Temperature: 22.3 °C	Humidity: 47.4 %

Test results summary

Test	Result
Relative attenuation	Complies





Accredited by

NSC-TISI-TIS 17025

Calibration 0426

Calibration certificate

Calibration Certificate No. 26BCI0069

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	MSE125P-100-DU.	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.	33108993 RYG_EN0004	This certificate relate and apply this equipment only,
Customer	ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch)	
	616/10 Moo 5 T.Maenamkoo, A.Pluk Daeng, Rayong 21140, Thailand.	
Order no.	278579	
Number of pages	6	
Date of calibration	03 Feb 2026	

REVIEW BY *Thanitak.*

APPROVED BY *Dhames*

NEXT CAL DATE..... 03/02/27

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 of issue	03 Feb 2026	Approval of the Calibration Certificate Mr. Chonchai Inthana	Person in charge Chonchai Inthana
		<i>[Signature]</i>	<i>[Signature]</i>

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10310 Bangkok

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Page 1 | 6

Calibration certificate No.: 26BCI0069

Calibration Certificate

Calibration object

Multi range instrument

Model	MSE125P-100-DU.	
Serial Number	33108993	
QM Ident. no Inventory no.	RYG_EN0004 —	
Range	1	2
Maximum capacity (Max. load)	60.00000 g	120.0000 g
Measured up to	60.00000 g	120.0000 g
Scale interval	0.00001 g	0.0001 g

Place of calibration

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

Calibration procedure

EURAMET Calibration Guide No. 18, Version 4.0 (11/2015) - Guidelines on the Calibration of Non-Automatic Weighing Instruments

Test equipment

Test equipment type	Test equipment ID	Valid until
Thermometer	Testo 174H H/T250743 (Traceable to Si unit through ENTECH)	18 Nov 2026
Test weight set OIML R111 E2	Certificate No.M2508149S .E2(Traceable to SI unit through TCS)	19 Aug 2027

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Page 2 | 6

Calibration certificate No.: 26BCI0069

Calibration Certificate

Range 1

Adjustment Status

The measuring device was internally adjusted before the calibration.

Environmental and measuring conditions

Date of calibration	03 Feb 2026
Temperature at place of calibration Temp. diff.	24 °C 0.5 K
Tweights - Tplace	
Measuring conditions	The installation site is suitable. The device is level. Balance was loaded up to Max before test.
Comments	Humidity 54.0 %RH.

Measurement results | Measurement uncertainties

Repeatability	Eccentricity
Test load (nominal): 50 g	Test load (nominal): 50 g
50 g	Center
1 50,00001 g	50,00001 g
2 50,00001 g	Front left
3 50,00000 g	Back left
4 50,00001 g	Back right
5 50,00002 g	Front right
6 50,00001 g	Maximum deviation from centric loading indication
7 50,00001 g	Δf _{ecc} max = 0.00001 g
8 50,00002 g	
9 50,00001 g	
10 50,00000 g	
s = 0,000007 g	

Error of indication

Testload	Indication	Error	Expansion factor	Uncertainty	Uncertainty relative
L	I	E	k	U(E)	U _{rel} (E)
0,01000 g	0,01000 g	0,00000 g	2,00	0,000024 g	0,24 %
0,05000 g	0,05000 g	0,00000 g	2,00	0,000024 g	0,048 %
0,10000 g	0,10000 g	0,00000 g	2,00	0,000037 g	0,037 %
0,50000 g	0,50000 g	0,00000 g	2,00	0,000037 g	0,0074 %
1,00000 g	1,00000 g	0,00000 g	2,00	0,000037 g	0,0037 %
2,00003 g	2,00003 g	0,00000 g	2,00	0,000050 g	0,0025 %
5,00002 g	5,00002 g	0,00000 g	2,00	0,000050 g	0,0010 %
10,00001 g	10,00001 g	0,00000 g	2,00	0,000069 g	0,00069 %
19,99999 g	20,00000 g	0,00001 g	2,00	0,000069 g	0,00035 %
50,00001 g	50,00001 g	0,00000 g	2,00	0,000091 g	0,00018 %
57,00005 g	57,00006 g	0,00001 g	2,00	0,000117 g	0,00030 %
Maximum error of indication		E _{max} = 0,00001 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.

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Page 3 | 6

Calibration certificate No.: 26BCI0069

Calibration Certificate

Range 2

Adjustment Status

The measuring device was internally adjusted before the calibration.

Environmental and measuring conditions

Date of calibration	03 Feb 2026
Temperature at place of calibration Temp. diff.	24 °C 0.5 K
Tweights - Tplace	
Measuring conditions	The installation site is suitable. The device is level. Balance was loaded up to Max before test.
Comments	Humidity 54.0 %RH.

Measurement results | Measurement uncertainties

Repeatability	Eccentricity
Test load (nominal): 100 g	Test load (nominal): 100 g
100 g	Center
1 100,0000 g	50,00001 g
2 100,0000 g	Front left
3 100,0000 g	Back left
4 99,9999 g	Back right
5 100,0000 g	Front right
6 100,0000 g	Maximum deviation from centric loading indication
7 100,0000 g	Δf _{ecc} max = 0.00001 g
8 100,0000 g	
9 100,0000 g	
10 100,0000 g	
s = 0,00003 g	

Error of indication

Testload	Indication	Error	Expansion factor	Uncertainty	Uncertainty relative
L	I	E	k	U(E)	U _{rel} (E)
10,00001 g	10,00001 g	0,00000 g	2,00	0,000069 g	0,00069 %
65,00000 g	65,00000 g	0,00000 g	2,00	0,00017 g	0,00026 %
70,00000 g	70,00000 g	0,00000 g	2,00	0,00017 g	0,00024 %
75,00000 g	75,00000 g	0,00000 g	2,00	0,00018 g	0,00023 %
80,00000 g	80,00000 g	0,00000 g	2,00	0,00018 g	0,00023 %
85,00000 g	85,00000 g	0,00000 g	2,00	0,00021 g	0,00025 %
90,00000 g	90,00000 g	0,00000 g	2,00	0,00019 g	0,00021 %
95,00000 g	95,00000 g	0,00000 g	2,00	0,00022 g	0,00023 %
100,00000 g	100,00000 g	0,00000 g	2,00	0,00017 g	0,00017 %
110,00000 g	110,00000 g	0,00000 g	2,00	0,00028 g	0,00025 %
120,00000 g	120,00000 g	0,00000 g	2,00	0,00028 g	0,00023 %
Maximum error of indication		E _{max} = 0,00000 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

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Page 4 | 6

Uncertainty of measurement in use

Range 1

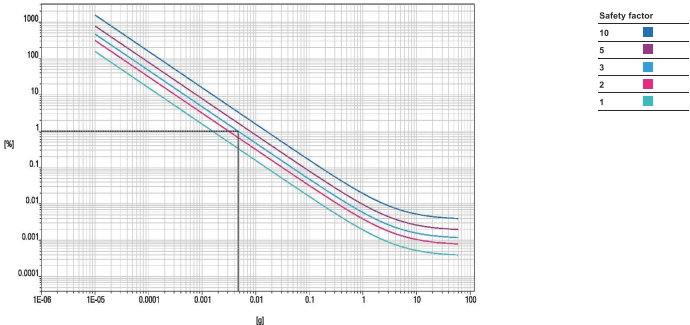
Device adjusted before measurement Yes
Temperature deviation considered 1.5 K (isoCAL active)
Temperature coefficient considered $2 \cdot 10^{-4}/K$

Uncertainty of the weighing result $U_{gI}(W)$ $U_{gI}(W) = 0.000016\text{ g} + 3.70 \cdot 10^{-6} \cdot R$

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 $U_{gI}(W)$	Uncertainty relative $U_{gI}(W)_{rel}$
1 %	0,80000 g	0,000018 g	0,0030 %
25 %	15,00000 g	0,000072 g	0,00048 %
50 %	30,00000 g	0,00013 g	0,00042 %
75 %	45,00000 g	0,00018 g	0,00041 %
100 %	60,00000 g	0,00024 g	0,00040 %

Graphic realization of the relative uncertainty of measurement | process accuracy



Displayed example

Process accuracy 1.00 %
Safety factor 3
Minimum sample weight 0.00470 g

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Uncertainty of measurement in use

Range 2

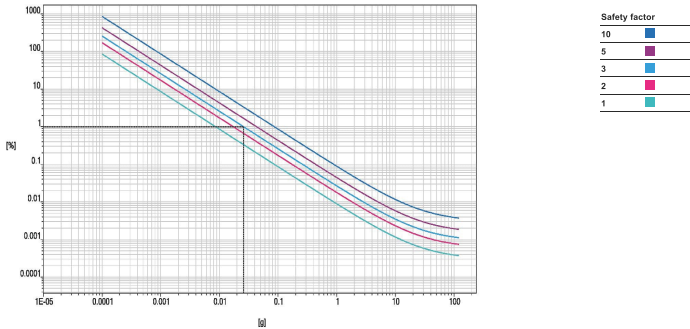
Device adjusted before measurement Yes
Temperature deviation considered 1.5 K (isoCAL active)
Temperature coefficient considered $2 \cdot 10^{-4}/K$

Uncertainty of the weighing result $U_{gI}(W)$ $U_{gI}(W) = 0.000086\text{ g} + 3.00 \cdot 10^{-6} \cdot R$

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 $U_{gI}(W)$	Uncertainty relative $U_{gI}(W)_{rel}$
1 %	1,20000 g	0,000090 g	0,0075 %
25 %	30,00000 g	0,00018 g	0,00059 %
50 %	60,00000 g	0,00027 g	0,00044 %
75 %	90,00000 g	0,00036 g	0,00040 %
100 %	120,00000 g	0,00045 g	0,00038 %

Graphic realization of the relative uncertainty of measurement | process accuracy



Displayed example

Process accuracy 1.00 %
Safety factor 3
Minimum sample weight 0.02577 g

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Agilent CrossLab Compliance Services

Certificate of System Qualification

GC-OQ

System ID: BKK_EN0126_GC6
Organization Name: ALS Laboratory Group (Thailand) Co., Ltd.
Organization Location: 104 Soi 40 Phattanakan Rd., Khwang Suan Luang, Khet Suan Luang, BANGKOK 10250

Date: October 22, 2025 2:51:58 PM
EQP Name: AgilentRecommended

EQP Revision: GC.02.53
Overall Qualification Status: Pass



CDS Logon Verification - GC

Logon: Suriya Thongkaew

Overall CDS Logon Verification - GC Test Status

Pass

System Inspection and Basic Safety and Operation

Name: 7890
Setpoint Status: Pass

Overall System Inspection and Basic Safety and Operation Test Status

Pass

Inlet Pressure Decay

Name: 7890
Front SSL

Setpoint Status: Pass
Pressure: 25,0 psi
Pressure Change: 0,3 psi /5 minutes
Agilent Recommended: >= -2,0 and <= 0,5

Date: October 22, 2025 2:51:58 PM
System ID: BKK_EN0126_GC6

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Agilent CrossLab Compliance Services

Overall Inlet Pressure Decay 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

Inlet Pressure Decay

Name: 7890
Back SSL

Setpoint Status: Pass

Pressure: 25,0 psi
Pressure Change: 0,4 psi /5 minutes
Agilent Recommended: >= -2,0 and <= 0,5

Overall Inlet Pressure Decay Test Status

Pass

Inlet Pressure Accuracy

Name: 7890
Back SSL

Date: October 22, 2025 2:51:58 PM
System ID: BKK_EN0126_GC6

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

22111dijeufhuie1

Detector Flow Accuracy

Name: 7890
Front FID

Setpoint Status:

Pass

Flow Type: Fuel
Setpoint: 30,0 mL/min Measured Flow: 30,8 mL/min
Accuracy: 0,8 mL/min
Agilent Recommended: <= 10,0 % setpoint (3,0 mL/min)
Limit is percentage of setpoint or 0.5 ml/minute, whichever is largest.

Setpoint Status:

Pass

Flow Type: Oxidizer
Setpoint: 400,0 mL/min Measured Flow: 396,0 mL/min
Accuracy: 4,0 mL/min
Agilent Recommended: <= 10,0 % setpoint (40,0 mL/min)
Limit is percentage of setpoint or 0.5 ml/minute, whichever is largest.

Setpoint Status:

Pass

Flow Type: Makeup
Setpoint: 25,0 mL/min Measured Flow: 24,7 mL/min
Accuracy: 0,3 mL/min
Agilent Recommended: <= 10,0 % setpoint (2,5 mL/min)
Limit is percentage of setpoint or 0.5 ml/minute, whichever is largest.

Date: October 22, 2025 2:51:58 PM
System ID: BKK_EN0126_GC6

Overall Detector Flow Accuracy Test Status

Pass

Detector Flow Accuracy

Name: 7890
Back FID

Setpoint Status:

Pass

Flow Type: Fuel
Setpoint: 30,0 mL/min Measured Flow: 29,5 mL/min
Accuracy: 0,5 mL/min
Agilent Recommended: <= 10,0 % setpoint (3,0 mL/min)
Limit is percentage of setpoint or 0.5 ml/minute, whichever is largest.

Setpoint Status:

Pass

Flow Type: Oxidizer
Setpoint: 400,0 mL/min Measured Flow: 397,0 mL/min
Accuracy: 3,0 mL/min
Agilent Recommended: <= 10,0 % setpoint (40,0 mL/min)
Limit is percentage of setpoint or 0.5 ml/minute, whichever is largest.

Setpoint Status:

Pass

Flow Type: Makeup
Setpoint: 25,0 mL/min Measured Flow: 24,8 mL/min
Accuracy: 0,2 mL/min
Agilent Recommended: <= 10,0 % setpoint (2,5 mL/min)
Limit is percentage of setpoint or 0.5 ml/minute, whichever is largest.

Overall Detector Flow Accuracy Test Status

Pass

GC Oven Temperature Accuracy

Name: 7890

Date: October 22, 2025 2:51:58 PM
System ID: BKK_EN0126_GC6

Setpoint Status:

Pass

Zone: Oven
Setpoint/Actual
Temperature: 230,0 229,1 °C
Accuracy: -0,9 °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 99,9 °C
Accuracy: -0,1 °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 99,95 °C
Stability: 0,1 °C
Agilent Recommended: <= 0,5

Overall GC Oven Temperature Stability Test Status

Pass

Scouting Run

Tested Combination1 Front SSL / Front FID
Injection Tower
Name: 7693A

Date: October 22, 2025 2:51:58 PM
System ID: BKK_EN0126_GC6

Setpoint Status:

Completed

Injection Volume on Column: 1,0 uL

Overall Scouting Run Status

Completed

Noise and Drift

Tested Combination1 Front SSL / Front FID
Name: 7890

Setpoint Status:

Pass

Base Signal: 14,3 pA
ASTM Noise pA
0,05
0,10
Agilent Recommended: <= 0,10
Drift pA/h
0,03
2,50
Agilent Recommended: <= 2,50
Status: Pass Pass

Overall Noise and Drift Test Status

Pass

Injection Precision

Tested Combination1 Front SSL / Front FID
Name: 7693A

Setpoint Status:

Pass

Injection Volume on Column: 1,0 uL
Area RSD: 0,33 % Retention Time RSD: 0,10 %
Agilent Recommended: <= 3,00 <= 1,00

Overall Injection Precision Test Status

Pass

Signal to Noise

Date: October 22, 2025 2:51:58 PM
System ID: BKK_EN0126_GC6

Tested Combination1	Front	SSL	/ Front	FID
Injection Tower				
Name:	7890			

Setpoint Status:	Pass
Signal to Noise:	1393680
Agilent Recommended:	>= 300000

Overall Signal to Noise Test Status
Pass

Scouting Run

Tested Combination2	Back	SSL	/ Back	FID
Injection Tower				
Name:	7693A			

Setpoint Status:	Completed
Injection Volume on Column:	1,0 uL

Overall Scouting Run Status
Completed

Noise and Drift

Tested Combination2	Back	SSL	/ Back	FID
Name:	7890			

Setpoint Status:	Pass
------------------	------

Base Signal: 13,3 pA

	ASTM Noise	Drift
	pA	pA/h
	0,05	0,01
Agilent Recommended:	<= 0,10	<= 2,50
Status:	Pass	Pass

Date: October 22, 2025 2:51:58 PM
System ID: BKK_EN0126_GC6

Overall Noise and Drift Test Status
Pass

Injection Precision

Tested Combination2	Back	SSL	/ Back	FID
Injection Tower				
Name:	7693A			

Setpoint Status:	Pass
------------------	------

Injection Volume on Column:	1,0 uL		
Area RSD:	0,43 %	Retention Time RSD:	0,09 %
Agilent Recommended:	<= 3,00		<= 1,00

Overall Injection Precision Test Status
Pass

Signal to Noise

Tested Combination2	Back	SSL	/ Back	FID
Injection Tower				
Name:	7890			

Setpoint Status:	Pass
------------------	------

Signal to Noise:	1251862
Agilent Recommended:	>= 300000

Overall Signal to Noise Test Status
Pass

Date: October 22, 2025 2:51:58 PM
System ID: BKK_EN0126_GC6

Instrument Details

Purpose
This section describes the as found system configuration.

Details

System	
System ID	BKK_EN0126_GC6
Manufacturer	Agilent Technologies
Name	7890
Flow Data Input	Manual Data
Temperature Data Input	Manual Data or Other Data Logging

Tested Combination1	Injection Tower
Injection Technique	Injection Tower
Sampler Identifier	Sampler 1
Inlet	Front
Detector	Front
LTM Included?	No

Tested Combination2	Injection Tower
Injection Technique	Injection Tower
Sampler Identifier	Sampler 2
Inlet	Back
Detector	Back
LTM Included?	No

Sampler 1	Agilent Technologies
Manufacturer	Agilent Technologies
Type	Injection Tower
Name	7693A
Model Number	G4513A
Serial Number	CN10340103
Firmware Revision	A.11.06
Usage	Sample Injection
Location	Front
Syringe Volume (µL)	10

Date: October 22, 2025 2:51:58 PM
System ID: BKK_EN0126_GC6

Sampler 2	Agilent Technologies
Manufacturer	Agilent Technologies
Type	Injection Tower
Name	7693A
Model Number	G4513A
Serial Number	CN16280128
Firmware Revision	A.11.06
Usage	Sample Injection
Location	Back
Syringe Volume (µL)	10

Sampler 3	Agilent Technologies
Manufacturer	Agilent Technologies
Type	Tray
Name	7693A
Model Number	G4514A
Serial Number	CN18250032
Firmware Revision	A.12.04
Vial Heater	Not installed

Mainframe 1	Agilent Technologies
Manufacturer	Agilent Technologies
Name	7890
Model Number	G3440A
Serial Number	CN11461066
Firmware Revision	A.01.16
Component ID/Asset No.	BKK_EN0126_GC-6
Oven Type	Standard

Date: October 22, 2025 2:51:58 PM
System ID: BKK_EN0126_GC6

Inlet 1

Manufacturer	Agilent Technologies
Name	7890
Type	SSL
Location	Front
Carrier Gas	Helium
Control Type	Electronic Pressure Control (EPC)
Purged Inlet	Yes

Inlet 2

Manufacturer	Agilent Technologies
Name	7890
Type	SSL
Location	Back
Carrier Gas	Helium
Control Type	Electronic Pressure Control (EPC)
Purged Inlet	Yes

Detector 1

Manufacturer	Agilent Technologies
Name	7890
Type	FID
Adapter	Capillary
Control Type	Electronic Pressure Control (EPC)
Location	Front
Makeup Gas	Nitrogen

Detector 2

Manufacturer	Agilent Technologies
Name	7890
Type	FID
Adapter	Capillary
Control Type	Electronic Pressure Control (EPC)
Location	Back
Makeup Gas	Nitrogen

Date: October 22, 2025 2:51:58 PM
System ID: BKK_EN0126_GC6

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 login 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:	Suriya Thongkaew
Logged On User Name:	suriya.thongkaew@non.agilent.com
Signature Creation Date:	October 22, 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.

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Date: October 22, 2025 2:51:58 PM
System ID: BKK_EN0126_GC6

User Name: suriya.thongkaew
Report Generated by Hostname: DESKTOP-2H6MTKJ
System ID: BKK_EN0126_GC6
Print Date: October 22, 2025 2:52:00 PM

OQ2025 GC ALS GC-6 CN11461066 Transaction Log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 21, 2025 1:44:51 PM	Audit	SessionCreated	Session	Host Name: DESKTOP-2H6MTKJ, Drive Serial Number: 76C1E981
October 21, 2025 1:44:51 PM	start	Configuration	Session	None
October 21, 2025 1:44:51 PM	Audit	Entitlement	Licensing	Session identifier generated: XYPO-PNEJ-QW00-0RZ5-HR 80
October 21, 2025 1:48:11 PM	Audit	Entitlement	Licensing	Successfully unlocked session identified by XYPO-PNEJ-QW00-0RZ5-HR 80 with unlock code 76BX-619E-XKYX-1JRT-JR6 0
October 21, 2025 1:57:15 PM	Audit	EqpLoaded	Session	EQP details for primary technique [Gc] - File path: [ProtocolPacks\Go\Configuration\02.53\Gc.02.53.eqp], EQP File Name: [Gc.02.53.eqp], EQP Name: [AgilentRecommended].Protocol Revision [Gc.02.53]
October 21, 2025 1:57:39 PM	End	Configuration	Session	None
October 21, 2025 1:57:46 PM	start	Qualification	Session	OQ
October 21, 2025 1:57:46 PM	start	Execution	CDS Logon Verification - GC - 7890 - Qualitative test	None
October 21, 2025 2:18:54 PM	End	Execution	CDS Logon Verification - GC - 7890 - Qualitative test	Run Count : 1

Date: October 22, 2025 2:51:58 PM
System ID: BKK_EN0126_GC6

User Name: suriya.thongkaew
Report Generated by Hostname: DESKTOP-2H6MTKJ
System ID: BKK_EN0126_GC6
Print Date: October 22, 2025 2:52:00 PM

OQ2025 GC ALS GC-6 CN11461066 Transaction Log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 21, 2025 2:19:27 PM	start	Execution	System Inspection and Basic Safety and Operation - 7890 - Qualitative Test - No setpoints associated	None
October 21, 2025 2:19:47 PM	End	Execution	System Inspection and Basic Safety and Operation - 7890 - Qualitative Test - No setpoints associated	Run Count : 1
October 21, 2025 2:19:50 PM	start	Execution	Inlet Pressure Decay - Front SSL - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi	None
October 21, 2025 2:25:44 PM	End	Execution	Inlet Pressure Decay - Front SSL - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi	Run Count : 1
October 21, 2025 2:25:52 PM	start	Execution	Inlet Pressure Accuracy - Front SSL - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	None
October 21, 2025 2:28:43 PM	End	Execution	Inlet Pressure Accuracy - Front SSL - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	Run Count : 1
October 21, 2025 2:28:45 PM	start	Execution	Inlet Pressure Decay - Back SSL - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi	None
October 21, 2025 2:33:42 PM	End	Execution	Inlet Pressure Decay - Back SSL - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi	Run Count : 1
October 21, 2025 2:33:50 PM	start	Execution	Inlet Pressure Accuracy - Back SSL - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	None

Date: October 22, 2025 2:51:58 PM
System ID: BKK_EN0126_GC6

User Name: suriyathongkaew
Report Generated by Hostname: DESKTOP-2H6MTKJ

System Id: BKK_EN0126_GC6
Print Date: October 22, 2025 2:52:00 PM

Q02025 GC ALS GC-6 CN11461066 Transaction Log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 21, 2025 2:34:27 PM	End	Execution	Inlet Pressure Accuracy - Back SSL - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	Run Count : 1
October 21, 2025 2:34:32 PM	start	Execution	Detector Flow Accuracy - Front FID - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	None
October 21, 2025 2:50:39 PM	Audit	Data	Detector Flow Accuracy - Front FID - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
October 21, 2025 2:50:41 PM	start	Execution	Detector Flow Accuracy - Front FID - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	None
October 21, 2025 2:50:45 PM	start	Execution	Detector Flow Accuracy - Front FID - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	None
October 21, 2025 2:50:53 PM	End	Execution	Detector Flow Accuracy - Front FID - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
October 21, 2025 2:50:56 PM	start	Execution	Detector Flow Accuracy - Front FID - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	None
October 21, 2025 2:54:08 PM	Audit	Data	Detector Flow Accuracy - Front FID - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
October 21, 2025 2:54:15 PM	Audit	Data	DataManager	DataManager was in a data verification state but the user chose to start over
October 21, 2025 2:54:31 PM	Audit	Data	Detector Flow Accuracy - Front FID - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
October 21, 2025 2:54:34 PM	End	Execution	Detector Flow Accuracy - Front FID - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	Run Count : 1

Date: October 22, 2025 2:51:58 PM
System ID: BKK_EN0126_GC6

User Name: suriyathongkaew
Report Generated by Hostname: DESKTOP-2H6MTKJ

System Id: BKK_EN0126_GC6
Print Date: October 22, 2025 2:52:00 PM

Q02025 GC ALS GC-6 CN11461066 Transaction Log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 21, 2025 2:54:48 PM	start	Execution	Detector Flow Accuracy - Front FID - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	None
October 21, 2025 2:57:00 PM	Audit	Data	Detector Flow Accuracy - Front FID - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
October 21, 2025 2:57:03 PM	End	Execution	Detector Flow Accuracy - Front FID - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
October 21, 2025 2:57:38 PM	start	Execution	Detector Flow Accuracy - Back FID - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	None
October 21, 2025 3:00:15 PM	Audit	Data	Detector Flow Accuracy - Back FID - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
October 21, 2025 3:00:17 PM	End	Execution	Detector Flow Accuracy - Back FID - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
October 21, 2025 3:00:20 PM	start	Execution	Detector Flow Accuracy - Back FID - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	None
October 21, 2025 3:03:03 PM	Audit	Data	Detector Flow Accuracy - Back FID - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
October 21, 2025 3:03:06 PM	End	Execution	Detector Flow Accuracy - Back FID - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
October 21, 2025 3:03:08 PM	start	Execution	Detector Flow Accuracy - Back FID - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	None
October 21, 2025 3:07:25 PM	Audit	Data	Detector Flow Accuracy - Back FID - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry

Date: October 22, 2025 2:51:58 PM
System ID: BKK_EN0126_GC6

User Name: suriyathongkaew
Report Generated by Hostname: DESKTOP-2H6MTKJ

System Id: BKK_EN0126_GC6
Print Date: October 22, 2025 2:52:00 PM

Q02025 GC ALS GC-6 CN11461066 Transaction Log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 21, 2025 3:07:28 PM	End	Execution	Detector Flow Accuracy - Back FID - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
October 21, 2025 3:07:53 PM	start	Execution	GC Oven Temperature Accuracy - 7890 - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
October 21, 2025 3:21:20 PM	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
October 21, 2025 3:21:22 PM	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
October 21, 2025 3:21:36 PM	start	Execution	GC Oven Temperature Accuracy - 7890 - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
October 21, 2025 3:30:43 PM	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
October 21, 2025 3:30:45 PM	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
October 21, 2025 3:30:48 PM	start	Execution	GC Oven Temperature Stability - 7890 - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	None
October 21, 2025 3:50:20 PM	Audit	Data	GC Oven Temperature Stability - 7890 - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Manual Data Entry

Date: October 22, 2025 2:51:58 PM
System ID: BKK_EN0126_GC6

User Name: suriyathongkaew
Report Generated by Hostname: DESKTOP-2H6MTKJ

System Id: BKK_EN0126_GC6
Print Date: October 22, 2025 2:52:00 PM

Q02025 GC ALS GC-6 CN11461066 Transaction Log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 21, 2025 3:50:24 PM	End	Execution	GC Oven Temperature Stability - 7890 - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Run Count : 1
October 21, 2025 3:50:31 PM	start	Execution	GC Scouting Run - Injection Tower, Front SSL, Front FID - Part of System Preparation - No Limits associated	None
October 21, 2025 3:55:30 PM	Audit	AcqClosed	Session	None
October 22, 2025 10:10:41 AM	Audit	AcqRestarted	Session	Host Name: DESKTOP-2H6MTKJ, Drive Serial Number: 76C1E961
October 22, 2025 10:10:42 AM	Audit	SessionReloaded	Session	None
October 22, 2025 10:10:44 AM	start	Qualification	Session	OQ
October 22, 2025 10:10:45 AM	start	Execution	GC Scouting Run - Injection Tower, Front SSL, Front FID - Part of System Preparation - No Limits associated	None
October 22, 2025 2:15:45 PM	Audit	Data	DataManager	DataManager was in a data verification state but the user chose to start over
October 22, 2025 2:16:36 PM	Audit	Data	GC Scouting Run - Injection Tower, Front SSL, Front FID - Part of System Preparation - No Limits associated	Data files Path : D:\ALS GC-6\Q02025\SCOUTING_0 1.D\FID1A1.ch

Date: October 22, 2025 2:51:58 PM
System ID: BKK_EN0126_GC6

User Name: suriya,zhongkaew

Report Generated by Hostname: DESKTOP-2H6MTKJ

System Id: BKK_EN0126_GC6

Print Date: October 22, 2025 2:52:00 PM

OQ2025 GC ALS GC-6 CN11461066 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 22, 2025 2:17:00 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: 100,Integration: Off at 0,Integration: On at 0.1,Integration: Off at 0.5]
October 22, 2025 2:17:42 PM	End	Execution	GC Scouting Run - Injection Tower, Front SSL, Front FID - Part of System Preparation - No limits associated	Run Count : 1
October 22, 2025 2:17:53 PM	start	Execution	Noise and Drift - Front FID - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	None
October 22, 2025 2:19:13 PM	Audit	Data	Noise and Drift - Front FID - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	Data files Path : D:\ALS GC-6\OQ2025\OQ2025 2025-10-22 11-05-22\SIGNSDRF_F_01.D\FID1A.ch
October 22, 2025 2:19:28 PM	End	Execution	Noise and Drift - Front FID - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	Run Count : 1
October 22, 2025 2:19:30 PM	start	Execution	Injection Precision - Injection Tower, Front SSL, Front FID - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	None

User Name: suriya,zhongkaew

Report Generated by Hostname: DESKTOP-2H6MTKJ

System Id: BKK_EN0126_GC6

Print Date: October 22, 2025 2:52:00 PM

OQ2025 GC ALS GC-6 CN11461066 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 22, 2025 2:19:56 PM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : D:\ALS GC-6\OQ2025\OQ2025 2025-10-22 11-05-22\INJPREC_F_02.D\FID1A.ch
October 22, 2025 2:19:56 PM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : D:\ALS GC-6\OQ2025\OQ2025 2025-10-22 11-05-22\INJPREC_F_03.D\FID1A.ch
October 22, 2025 2:19:56 PM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : D:\ALS GC-6\OQ2025\OQ2025 2025-10-22 11-05-22\INJPREC_F_04.D\FID1A.ch
October 22, 2025 2:19:56 PM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : D:\ALS GC-6\OQ2025\OQ2025 2025-10-22 11-05-22\INJPREC_F_05.D\FID1A.ch
October 22, 2025 2:19:56 PM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : D:\ALS GC-6\OQ2025\OQ2025 2025-10-22 11-05-22\INJPREC_F_06.D\FID1A.ch
October 22, 2025 2:19:56 PM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : D:\ALS GC-6\OQ2025\OQ2025 2025-10-22 11-05-22\INJPREC_F_07.D\FID1A.ch

User Name: suriya,zhongkaw

Report Generated by Hostname: DESKTOP-2H6MTKJ

System Id: BKK_EN0126_GC6

Print Date: October 22, 2025 2:52:00 PM

OQ2025 GC ALS GC-6 CN11461066 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 22, 2025 2:20:04 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: 100,Integration: Off at 0,Integration: On at 0.1,Integration: Off at 0.5]
October 22, 2025 2:20:24 PM	End	Execution	Injection Precision - Injection Tower, Front SSL, Front FID - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Run Count : 1
October 22, 2025 2:20:34 PM	start	Execution	Signal to Noise - Injection Tower, Front SSL, Front FID - Detector FID - L: >= 300000	None
October 22, 2025 2:20:58 PM	Audit	Data	Signal to Noise - Injection Tower, Front SSL, Front FID - Detector FID - L: >= 300000	Data files Path : D:\ALS GC-6\OQ2025\OQ2025 2025-10-22 11-05-22\SIGTONS_F_01.D\FID1A.ch
October 22, 2025 2:21:06 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: 100,Integration: Off at 0,Integration: On at 0.1,Integration: Off at 0.5]
October 22, 2025 2:21:19 PM	End	Execution	Signal to Noise - Injection Tower, Front SSL, Front FID - Detector FID - L: >= 300000	Run Count : 1

User Name: suriya,zhongkaew

Report Generated by Hostname: DESKTOP-2H6MTKJ

System Id: BKK_EN0126_GC6

Print Date: October 22, 2025 2:52:00 PM

OQ2025 GC ALS GC-6 CN11461066 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 22, 2025 2:21:25 PM	start	Execution	GC Scouting Run - Injection Tower, Back SSL, Back FID - Part of System Preparation - No limits associated	None
October 22, 2025 2:25:23 PM	Audit	Data	GC Scouting Run - Injection Tower, Back SSL, Back FID - Part of System Preparation - No limits associated	Data files Path : D:\ALS GC-6\OQ2025_B\SCOUTING_B_01.D\FID2B.ch
October 22, 2025 2:26:18 PM	End	Execution	GC Scouting Run - Injection Tower, Back SSL, Back FID - Part of System Preparation - No limits associated	Run Count : 1
October 22, 2025 2:26:21 PM	start	Execution	Noise and Drift - Back FID - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	None
October 22, 2025 2:27:00 PM	Audit	Data	Noise and Drift - Back FID - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	Data files Path : D:\ALS GC-6\OQ2025_B\OQ2025 2025-10-22 11-05-22\SIGNSDRF_B_01.D\FID2B.ch
October 22, 2025 2:27:42 PM	End	Execution	Noise and Drift - Back FID - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	Run Count : 1
October 22, 2025 2:27:46 PM	start	Execution	Injection Precision - Injection Tower, Back SSL, Back FID - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	None
October 22, 2025 2:28:07 PM	Audit	Data	Injection Precision - Injection Tower, Back SSL, Back FID - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : D:\ALS GC-6\OQ2025_B\OQ2025 2025-10-22 11-05-22\INJPREC_B_02.D\FID2B.ch

User Name: suriyathongkaew
Report Generated by Hostname: DESKTOP-2H6MTKJ
System Id: BKK_EN0126_GC6
Print Date: October 22, 2025 2:52:00 PM

Q02025 GC ALS GC-6 CN11461066 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 22, 2025 2:28:07 PM	Audit	Data	Injection Precision - Injection Tower, Back SSL, Back FID - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : D:\ALS GC-6\Q02025_B\Q02025 2025-10-22 11-05-22\INJPREC_B_03.D\FID28.ch
October 22, 2025 2:28:07 PM	Audit	Data	Injection Precision - Injection Tower, Back SSL, Back FID - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : D:\ALS GC-6\Q02025_B\Q02025 2025-10-22 11-05-22\INJPREC_B_04.D\FID28.ch
October 22, 2025 2:28:07 PM	Audit	Data	Injection Precision - Injection Tower, Back SSL, Back FID - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : D:\ALS GC-6\Q02025_B\Q02025 2025-10-22 11-05-22\INJPREC_B_05.D\FID28.ch
October 22, 2025 2:28:07 PM	Audit	Data	Injection Precision - Injection Tower, Back SSL, Back FID - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : D:\ALS GC-6\Q02025_B\Q02025 2025-10-22 11-05-22\INJPREC_B_06.D\FID28.ch
October 22, 2025 2:28:07 PM	Audit	Data	Injection Precision - Injection Tower, Back SSL, Back FID - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : D:\ALS GC-6\Q02025_B\Q02025 2025-10-22 11-05-22\INJPREC_B_07.D\FID28.ch
October 22, 2025 2:28:21 PM	End	Execution	Injection Precision - Injection Tower, Back SSL, Back FID - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Run Count : 1
October 22, 2025 2:28:28 PM	start	Execution	Signal to Noise - Injection Tower, Back SSL, Back FID - Detector FID - L: >= 300000	None

Page 11 / 12

Date: October 22, 2025 2:51:58 PM
System ID: BKK_EN0126_GC6

Page 23 / 24

User Name: suriyathongkaew
Report Generated by Hostname: DESKTOP-2H6MTKJ
System Id: BKK_EN0126_GC6
Print Date: October 22, 2025 2:52:00 PM

Q02025 GC ALS GC-6 CN11461066 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 22, 2025 2:28:47 PM	Audit	Data	Signal to Noise - Injection Tower, Back SSL, Back FID - Detector FID - L: >= 300000	Data files Path : D:\ALS GC-6\Q02025_B\Q02025 2025-10-22 11-05-22\SIGTONS_B_01.D\FID28.ch
October 22, 2025 2:29:53 PM	End	Execution	Signal to Noise - Injection Tower, Back SSL, Back FID - Detector FID - L: >= 300000	Run Count : 1
October 22, 2025 2:30:01 PM	End	Qualification	Session	OQ
October 22, 2025 2:30:01 PM	start	Reporting	Session	None
October 22, 2025 2:50:41 PM	Audit	Reporting	Session	Report Generated : Certificate
October 22, 2025 2:51:22 PM	Audit	Reporting	Session	Report Generated : Report

Page 12 / 12

Date: October 22, 2025 2:51:58 PM
System ID: BKK_EN0126_GC6

Page 24 / 24



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.: 25LM10
Page.: 1 of 2

Equipment : DO Meter with Sensor
Manufacturer : YSI
Model : 5000-115V
Serial No. : 15E102796
ID No. : RYG_EN0032

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

Received Order : 17 January 2025
Calibrated Date : 20 January 2025
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
AC Line Voltage : (220 ± 22) V

Calibrated by : Warakorn Lernagatrakul

Approved by :
Approved Signatory
() Chakrit Waewwanjua
(✓) Suwit Imjai
() Kunchit Promprat

Issue Date : 23 January 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 : 2501-0600DSC-2

Cert. No.: 25LM10
Page.: 2 of 2

Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-OT01 according to comparison with Industrial Platinum Resistance Thermometer (IPRT) into Temperature Bath.
The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-
- | Instrument | Serial No. | Cert. No. | Traceable | Due Date |
|------------------------|------------|-----------|-----------|-------------|
| 1) Digital Thermometer | 2188080 | 24H1022 | 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.: 15E100464

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty (± °C)	Coverage Factor k
20.00	60	20.002	19.81	-0.192	0.15	2.00

UUC* : Unit Under Calibration

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

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Certificate of Testing

Cert.No.: 25TW15
Page.: 1 of 2

Equipment : DO Meter
Manufacturer : YSI
Model : 5000-115V
Serial No. : 15E102796
ID No. : RYG_EN0032
Received Date : 17 January 2025
Test Date : 20 January 2025
Reference : 2501-0600DSC-1
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.
(Rayong Branch)
616/10 Moo 5, T.Maenam Khu, A.Pluakdaeng,
Rayong 21140, Thailand
Laboratory Condition : Temperature (25 ± 5) °C
Humidity (50 ± 20) %
Test Procedure : In - house method : CP-CH9
by Comparison Technique with Azide Modification Method
Tested by : Watalak Sirithean
Approved by : 
Approved Signatory
() Pornthippa Tameyakul
() Ponpan Paipim
(✓) Saithip Meangmai
Issue Date : 21 January 2025



Cert.No.: 25TW15
Page.: 2 of 2

Condition of this result of calibration

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

Instruments	Serial No.	ID No.	Certificate No.	Due Date
1. Burette	-	130BU10	23CG1172	22 Mar 2025
2. Balance	14233821	110RC001	24MM131	04 July 2025

2. Standard Material :-

Material	Manufacturer	Lot.No.	Assay
Sodium Thiosulfate 5-Hydrate AR	KEMAUS	2203162447	99.6%

Result : Dissolved Oxygen Meter Adjustment With Air 100 %
Dissolved Oxygen Probe No.: 15E100464

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.20	8.20	0.0084

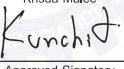
This report was certified only for the instrument we tested. It is allowable to use for study
Intend to use for advertising and referral purpose is prohibited. This report may not be reproduced
other in full, without written approval of the laboratory

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Certificate of Calibration

Cert. No.: 24TM1663
Page : 1 of 3

Equipment : Low Temp. Incubator
Manufacturer : Memmert
Model : IPP750
Serial No. : V818.0084
ID No. : RYG_EN0154
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd. Rayong Branch
616/10 Moo 5, T.Maenam Khu,
A.Pluakdaeng,
Rayong 21140, Thailand
Location : BOD Room
Received Order : 01 November 2024
Calibration Date : 01 November 2024
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
AC Line Voltage : (220 ± 22) V
Calibrated by : Krisda Malee
Approved by : 
Approved Signatory
() Ponpan Paipim
() Suwit Imjai
(✓) Kunchit Promprat
Issue Date : 07 November 2024

REVIEW BY 
APPROVED BY 
NEXT CAL DATE: 01/05/26



Equipment : Low Temp. Incubator
Condition As-Received : Used Item
Reference : 2411-0002OC-1
Procedure Used :-

Cert. No.: 24TM1663
Page : 2 of 3

Calibration were conducted using calibration procedure CP-OT02 based on TLAS G-20 according to direct
measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).
The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-
Instrument Serial No. Cert. No. Traceable Due Date
1) Data Acquisition MY44073381 24LM73 TPA 18 May 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.

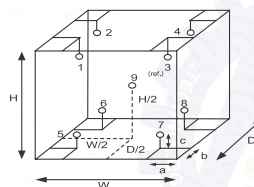
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close

Environment during calibration		
	Beginning	Finished
Temp. (°C)	24	25
REL.Humid. (%)	55	53
AC Supply (Volt)	220	221



Probe Installation Details :

a = 10 cm
b = 10 cm
c = 10 cm

Dimension of Chamber :

D = 0.60 m
W = 1.0 m
H = 1.2 m
Capacity = 0.72 m³

Position :	Ref. Std. ID No.:
1	1RTD-2/1
2	1RTD-2/2
3	22-01RTD-03
4	1RTD-2/4
5	1RTD-2/5
6	1RTD-2/6
7	23-01RTD-07
8	1RTD-2/8
9 (ref.)	23-01RTD-09

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 : Low Temp. Incubator
Condition As-Received : Used Item
Reference : 2411-0020C-1
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Close

Cert. No.: 24TM1663
Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
20.0	20.0	20.0	0.026	0.26	0.53	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (±°C)
	1	2	3	4	5	6	7	8	9 (ref.)	
20.0	20.071	19.915	20.273	20.179	19.977	19.782	20.056	20.026	20.033	0.30

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

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

Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.

UUC* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity .

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

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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.: 26TM461
Page : 1 of 3

Equipment : Low Temp. Incubator

Manufacturer : Memmert

Model : IPP750

Serial No. : V818.0084

ID No. : RYG_EN0154

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

Location : BOD Room

Received Order : 18 March 2026

Calibration Date : 18 March 2026

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 30) %

AC Line Voltage : (220 ± 22) V

Calibrated by : Preecha Hlahib

Approved by :

() Chakrit Waewwanjua

() Suwit Imjai

(✓) Kunchit Promprat

Issue Date : 31 March 2026

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 : Low Temp. Incubator
Condition As-Received : New Item
Reference : 2603-0502OC-2

Cert. No.: 26TM461
Page : 2 of 3

Procedure Used :-

Calibration were conducted using calibration procedure CP-OT02 based on TLAS G-20 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY49023932	25LM121	TPA,	27 Jul 2026

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

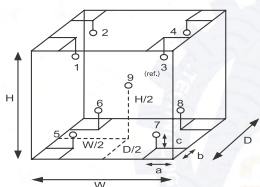
3. This measurement result is traceable to the International System of Unit maintained through :

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

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available



Probe Installation Details :

a = 10 cm
b = 10 cm
c = 10 cm

Dimension of Chamber :

D = 0.60 m
W = 1.0 m
H = 1.2 m
Capacity = 0.72 m³

Environment during calibration		
	Beginning	Finished
Temp. (°C)	23	21
REL.Humid. (%)	37	33
AC Supply (Volt)	220	221

Position :	Ref. Std. ID No.:
1	19-16RTD-01
2	19-16RTD-02
3	19-16RTD-03
4	23-16RTD-04
5	19-16RTD-05
6	19-14RTD-06
7	21-16RTD-07
8	19-16RTD-08
9 (ref.)	19-16RTD-09



Equipment : Low Temp. Incubator
Condition As-Received : New Item
Reference : 2603-0502OC-2
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Not Available

Cert. No.: 26TM461
Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
20.0	20.0	20.0	0.019	0.19	0.34	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (±°C)
	1	2	3	4	5	6	7	8	9 (ref.)	
20.0	20.185	20.132	20.303	20.160	20.001	20.054	19.983	20.060	20.163	0.30

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

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

Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.

UUC* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity .

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

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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.: 25CG3668
Page.: 1 of 2

Equipment : Burette
Capacity : 50 mL
Serial No. : -
ID. No. : RYG_EN0216
Manufacturer : Witeg
Made in : Germany
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.
Rayong Branch
616/10 Moo 5 T.MaenamKoo, A.Plukdaeng
Rayong 21140, Thailand
Ambient Temperature : (20 ± 2.5) °C
Relative Humidity : (50 ± 10) %
Barometric Pressure : 753 mmHg
Calibration Procedure : ASTM E 542 - 01
Calibrated by : Srisuda Khamtha
Approved by :
() Ponpan Paipim
(✓) Chakrit Waewwanjua
Issue Date : 19 September 2025

REVIEW BY
APPROVED BY
NEXT CAL DATE 18/09/26

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.



Equipment : Burette
Received Date : 16 September 2025
Condition As-Received : Used Item
Calibration Date : 18 September 2025
Reference : 2509-0564DSC-3

Cert.No.: 25CG3668
Page.: 2 of 2

Condition of this result of calibration

- Reference Standard Instruments :

Instruments	Model	Serial No.	ID. No.	Certificate No.	Traceability	Due date
1) Balance	XP205	B134206712	140RC007	25MM296	TPA	16 July 2026
2) Humidity/Baro/Temp	MHB-382SD	AM42259	140EC016	25H1616	TPA	14 Aug 2026
3) Digital Thermometer	HH376	230806555	140EC013	25I1740	TPA	17 Jan 2026

This measurement result is traceable to SI Unit
- The certificate is valid only to the item calibrated on date and place of calibration.
- True value is converted to true volume at the standard temperature of 20 °C

Calibration result :

Nominal capacity (mL)	Reading (mL)	Uncertainty (± mL)	k Factor
10	10.0264	0.0082	2.00
25	25.0141	0.0087	2.00
50	49.9952	0.010	2.00

Remark mL = cm³

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

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Certificate of Calibration

Equipment: SPECTROPHOTOMETER
Model: DR6000
Serial No. (or ID.): 1627845 (RYG_EN0037)
Manufacturer: HACH
Condition: In Condition
Certificate No.: C06250108
Issued Date: 18 March 2025
Job No.: WO-00064379
Page: 1 of 3
Customer: ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)
616/10 Moo 5 T.Maenam Khu,
A.Plukdaeng, Rayong 21140, Thailand.
Environment Condition: Temperature 24.4 °C ± 0.3 °C
Humidity 60.8 %RH ± 3.5 %RH
Calibration Place: ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)
(Wet Chemistry Lab)
616/10 Moo 5 T.Maenam Khu, A.Plukdaeng, Rayong 21140, Thailand.
Calibration By: Mr.Preecha Phooarsai
Calibration Date: 18 March 2025
The Method used: In house method, CAL-WI-24, base on ASTM E 275-08 and ASTM E 387-04
Traceability: This certificate is traceable to the CRM maintained by National Institute of Standards and Technology (NIST) through Starna Scientific Limited.
The standard for Wavelength Certificate No. 111583 and 111584
The standard for Photometric Certificate No. 9114984 and 111588
The standard for Stray light Certificate No. 111586 and 111585
The standard for Spectral resolution Certificate No. 111587

APPROVED BY
NEXT CAL DATE 18/09/26

(Mr. Preecha Phooarsai)
Person in charge

(Miss Kaewkan Suradech)
Authorized signatory

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

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

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CAL-FM-C06-16: 11 Mar 2024



Certificate No.: C06250108 Page 2 of 3

Calibration Results:

Without Adjustment

Wavelength Accuracy (nm), The spectral bandwidth of Std at 2 nm and UUC at 2 nm				
Standard Wavelength	Unit Under Calibration	Correction	Uncertainty	
418.61	418.5	0.11	0.13	
536.66	536.7	-0.04	0.13	
637.98	638.3	-0.32	0.13	
748.48	748.8	-0.32	0.13	
807.03	807.5	-0.47	0.13	
Photometric Accuracy (Absorbance)				
Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
420 nm	0.0000	0.000	0.0000	0.0045
	0.2930	0.291	0.0020	0.0045
	0.5168	0.518	-0.0012	0.0045
	1.0298	1.031	-0.0012	0.0045
440 nm	0.0000	0.000	0.0000	0.0045
	0.2867	0.285	0.0017	0.0045
	0.5073	0.508	-0.0007	0.0045
	1.0083	1.009	-0.0007	0.0045
465 nm	0.0000	0.000	0.0000	0.0045
	0.2516	0.250	0.0016	0.0045
	0.4595	0.461	-0.0015	0.0045
	0.9334	0.935	-0.0016	0.0045
546.1 nm	0.0000	0.000	0.0000	0.0045
	0.2461	0.246	0.0001	0.0045
	0.4652	0.466	-0.0008	0.0045
	0.9468	0.948	-0.0012	0.0045
590 nm	0.0000	0.000	0.0000	0.0045
	0.2594	0.259	0.0004	0.0045
	0.5040	0.505	-0.0010	0.0045
	1.0032	1.004	-0.0008	0.0045
635 nm	0.0000	0.000	0.0000	0.0045
	0.2579	0.258	-0.0001	0.0045
	0.4971	0.497	0.0001	0.0045
	0.9720	0.973	-0.0010	0.0045

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CAL-FM-C06-16: 11 Mar 2024

Calibration Results:

Without Adjustment

Photometric Accuracy (Absorbance)				
Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
235 nm	0.0000	0.000	0.0000	0.0080
	0.7355	0.738	-0.0025	0.0080
257 nm	0.0000	0.000	0.0000	0.0080
	0.8574	0.857	0.0004	0.0080
313 nm	0.0000	0.000	0.0000	0.0080
	0.2864	0.290	-0.0036	0.0080
350 nm	0.0000	0.000	0.0000	0.0080
	0.6374	0.637	0.0004	0.0080

Stray light *

Standard: cut-off	UUC: Wavelength (nm)	UUC: Transmission (%T)	Absorbance (A)
260.62 +/- 0.11 nm	260.6	1.7	1.770
391.44 +/- 0.11 nm	391.4	1.4	1.854

Spectral Resolution *

Nominal Concentration 0.02 % v/v	Peak	Trough	Ratio	SBW
Standard Wavelength (nm)	268.66	266.69	1.38	2.00
UUC: Wavelength (nm)	268.2	266.2		
Std Absorbance (A)	0.4566	0.2780		
UUC: Absorbance (A)	0.413	0.299		

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

The End of Certificate

บริษัท ดีเคเอสเอช (ประเทศไทย) จำกัด
DKSH Technology Limited
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CAL-FM-C06-16: 11 Mar 2024

ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดลอม

เลขที่ใบงาน: WO-00064379

ชนิดเครื่องมือ: SPECTROPHOTOMETER รุ่น: DR6000

หมายเลขเครื่อง: 1627845

ตรวจสอบ (วัน)		รายการตรวจเช็ค		ตรวจสอบ (ส่ง)		หมายเหตุ
18 Mar 2025				18 Mar 2025		
ปกติ	ไม่ปกติ			ปกติ	ไม่ปกติ	
General						
☒	☐	1. ความสมบูรณ์เครื่อง		☒	☐	
☒	☐	2. ความสะอาด (ช่องใส่ตัวอย่าง, ภายใน-นอกเครื่อง)		☒	☐	
☒	☐	3. สวิตช์ ปิด - เปิด เครื่อง (On-Off Switch)		☒	☐	
☒	☐	4. ปุ่มกด (Keypad)		☒	☐	
☒	☐	5. หน้าจอ (Display, Screen Contrast)		☒	☐	
Spectrophotometer						
☐	☐	6. แรงดันไฟฟ้า (Battery Backup) >= 2.5 VDC		☐	☐	
☐	☐	7. ตัวหมุนเลือกความยาวคลื่น (Wavelength Control)		☐	☐	
☒	☐	8. ความยาวคลื่น (Wavelength Check)		☒	☐	*
☒	☐	9. แหล่งกำเนิดแสง (UV < 3,000 hour)		☒	☐	13.5 Hours
☒	☐	10. แหล่งกำเนิดแสง (Visible < 5,000 hour)		☒	☐	893.0 Hours
☒	☐	11. ช่องวัดหลายตัวอย่าง (Carousel Module)		☒	☐	
pH Meter and Conductivity Meter						
☐	☐	12. อิเล็กโทรด (Electrode and Connection Cable)		☐	☐	
☐	☐	13. ระดับสารละลายใน Electrode (Level KCl)		☐	☐	
☐	☐	14. ฝาปิดกันเปื้อน Electrode (Dust Protection Hood)		☐	☐	
☐	☐	15. ขาจับอิเล็กโทรด (Stand)		☐	☐	
Turbidimeter						
☐	☐	16. ค่าความขุ่นที่ต่ำสุด (No Sample)		☐	☐	
☐	☐	17. ระดับการส่องสว่างของแสง (>= 2.5 ไม่นเกิน 3.0)		☐	☐	
Automatic titrator						
☐	☐	18. สภาพ Piston Burettes		☐	☐	
☐	☐	19. Function Rinsing and Dosing		☐	☐	
☐	☐	20. ระบบท่อสายยางและอุปกรณ์ประกอบ		☐	☐	

เข็มวัดแสง: * 656.1nm = 656.1nm

* 486.0nm = 485.7nm

Mr.Preecha Phooarsai

Service Engineer

บริษัท ดีเคเอสเอช (ประเทศไทย) จำกัด
DKSH Technology Limited
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CAL-FM-R31-03: 20 Jul 2022



Accredited by

NSC-TISI-TIS 17025

Calibration 0426

Calibration certificate

Calibration Certificate No. 25BK10003

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	MSU224S-100-DU	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.	31709552 RYG_EN0003	This certificate relate and apply this equipment only.
Customer	ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)	
Order no.	2230	
Number of pages	4	
Date of calibration	20 Feb 2025	

REVIEW BY *Thanitak*
APPROVED BY *D. Kachen*
NEXT CAL DATE: 20/02/26

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	06 Mar 2025	Approval of the Calibration Certificate	Person in charge
		<i>Mr. Chonchai Inthana</i>	<i>Kachen Latee</i>

Calibration certificate No.: 25BK10003

Calibration Certificate

Calibration object

Single range instrument

Model	MSU224S-100-DU
Serial Number	31709552
QM Ident. no Inventory no.	RYG_EN0003 —

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	Balance 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 20 Feb 2025

Temperature at place of calibration | Temp. diff. 24,7 °C | 0,3 K

Weights - T_{place}

Measuring conditions

The installation site is suitable. The device was levelled. Balance was loaded up to Max before test.

Comments Humidity 62,3 %RH.

Measurement results | Measurement uncertainties

Repeatability

Test load (nominal): 10 g 200 g	
10 g	200 g
1	10,0000 g 200,0000 g
2	10,0000 g 200,0001 g
3	9,9999 g 200,0000 g
4	10,0000 g 200,0000 g
5	10,0000 g 200,0001 g
6	9,9999 g 200,0000 g
7	10,0000 g 200,0000 g
8	10,0000 g 200,0000 g
9	10,0000 g 200,0000 g
10	10,0000 g 200,0001 g
s = 0,00004 g s = 0,00005 g	

Eccentricity

Test load (nominal): 100 g	
Center	100,0000 g
Front left	100,0000 g
Back left	100,0001 g
Back right	99,9999 g
Front right	99,9999 g
Maximum deviation from centric loading indication	
Δ _{ecc} _{max} = 0,0001 g	

Error of indication

Testload L	Indication I	Error E	Expansion factor k	Uncertainty U(E)	Uncertainty relative U _{rel} (E)
0,0100 g	0,0100 g	0,0000 g	2,00	0,00012 g	1,2 %
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	0,026 %
1,0000 g	1,0000 g	0,0000 g	2,00	0,00013 g	0,013 %
5,0000 g	5,0000 g	0,0000 g	2,00	0,00013 g	0,0026 %
10,0000 g	10,0000 g	0,0000 g	2,00	0,00013 g	0,0013 %
20,0000 g	20,0000 g	0,0000 g	2,00	0,00014 g	0,00068 %
50,0000 g	50,0000 g	0,0000 g	2,00	0,00015 g	0,00029 %
100,0000 g	100,0001 g	0,0001 g	2,00	0,00018 g	0,00018 %
200,0000 g	200,0000 g	0,0000 g	2,00	0,00028 g	0,00014 %
220,0000 g	220,0000 g	0,0000 g	2,00	0,00032 g	0,00015 %
Maximum error of indication		E _{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

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Page 3 | 4

Uncertainty of measurement in use

Device adjusted before measurement

Yes

Temperature deviation considered

1,5 K (isoCAL active)

Temperature coefficient considered

1 · 10⁻⁴/K

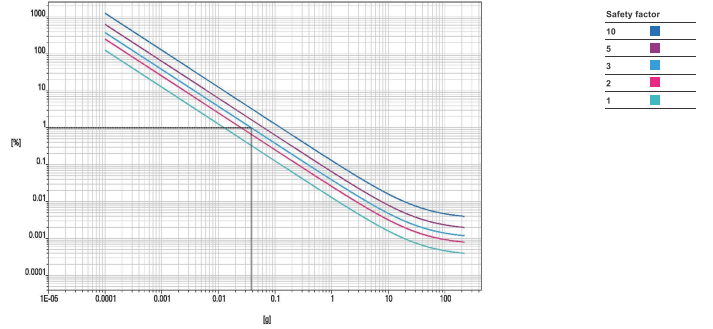
Uncertainty of the weighing result U₉₅(W)

$$U_{95}(W) = 0.00013 \text{ g} + 3.42 \cdot 10^{-4} \cdot R$$

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 ₉₅ (W)	Uncertainty relative U ₉₅ (W)/net
1 %	2,2000 g	0,00014 g	0,0063 %
25 %	55,0000 g	0,00032 g	0,00058 %
50 %	110,0000 g	0,00051 g	0,00046 %
75 %	165,0000 g	0,00069 g	0,00042 %
100 %	220,0000 g	0,00088 g	0,00040 %

Graphic realization of the relative uncertainty of measurement | process accuracy



Displayed example

Process accuracy	1.00 %
Safety factor	3
Minimum sample weight	0,0380 g

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Page 4 | 4

SARTORIUS



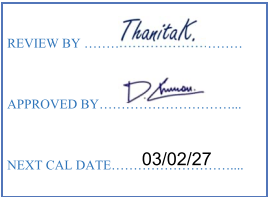
Accredited by

NSC-TISI-TIS 17025
Calibration 0426

Calibration certificate

Calibration Certificate No. 26BCI0066

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	MSU224S-100-DU	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.	31709552 RYG_EN0003	This certificate relate and apply this equipment only.
Customer	ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch)	
Order no.	278579	
Number of pages	4	
Date of calibration	03 Feb 2026	



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

Date of issue	03 Feb 2026	Approval of the Calibration Certificate	Person in charge
		Mr. Chonchai Inthana	Chonchai Inthana

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Page 1 | 4

Calibration object

Single range instrument

Model	MSU224S-100-DU
Serial Number	31709552
QM Ident. no Inventory no.	RYG_EN0003 —
Maximum capacity (Max. load)	220.0000 g
Measured up to	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	Balance Room.
Maximum temperature variation at place of calibration	5 K

Calibration procedure

EURAMET Calibration Guide No. 18, Version 4.0 (11/2015) - Guidelines on the Calibration of Non-Automatic Weighing Instruments

Test equipment

Test equipment type	Test equipment ID	Valid until
Thermometer	Testo 174H H/T250743 (Traceable to Si unit through ENTECH)	18 Nov 2026
Test weight set OIML R111 E2	Certificate No.M2508149S ,E2(Traceable to SI unit through TCS)	19 Aug 2027

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Page 2 | 4

Adjustment Status

The measuring device was internally adjusted before the calibration.

Environmental and measuring conditions

Date of calibration 03 Feb 2026

Temperature at place of calibration | Temp. diff. 24.5 °C | 0.5 K

Weights - T_{place}

Measuring conditions

The installation site is suitable. The device is level. Balance was loaded up to Max before test.

Comments

Humidity 52.0 %RH.

Measurement results | Measurement uncertainties

Repeatability

Test load (nominal): 10 g | 200 g

	10 g	200 g
1	10,0000 g	200,0000 g
2	10,0000 g	200,0001 g
3	10,0000 g	200,0001 g
4	10,0001 g	200,0001 g
5	10,0000 g	200,0001 g
6	10,0000 g	200,0000 g
7	10,0000 g	200,0000 g
8	10,0000 g	200,0000 g
9	10,0000 g	200,0000 g
10	10,0000 g	200,0000 g
s = 0,00003 g	s = 0,00005 g	

Eccentricity

Test load (nominal): 100 g

Center	100,0000 g
Front left	100,0000 g
Back left	99,9999 g
Back right	100,0000 g
Front right	100,0000 g
Maximum deviation from centric loading indication	
Δ _{ecc} _{max} = 0,0001 g	

Error of indication

Testload <i>L</i>	Indication <i>I</i>	Error <i>E</i>	Expansion factor <i>k</i>	Uncertainty <i>U(E)</i>	Uncertainty relative <i>U_{rel}(E)</i>
0,0100 g	0,0100 g	0,0000 g	2,00	0,00010 g	1,0 %
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 %
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 %
50,0000 g	50,0001 g	0,0001 g	2,00	0,00015 g	0,00030 %
100,0000 g	100,0000 g	0,0000 g	2,00	0,00018 g	0,00018 %
200,0000 g	200,0000 g	0,0000 g	2,00	0,00028 g	0,00014 %
220,0000 g	220,0000 g	0,0000 g	2,00	0,00032 g	0,00015 %
Maximum error of indication		E _{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

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Page 3 | 4

Uncertainty of measurement in use

Device adjusted before measurement

Yes

Temperature deviation considered

1.5 K (isoCAL active)

Temperature coefficient considered

1 · 10⁻⁴/K

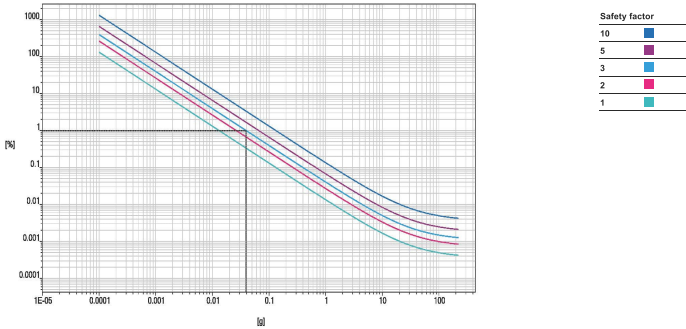
Uncertainty of the weighing result *U_{gl}(W)*

U_{gl}(W) = 0.00013 g + 3.65 · 10⁻⁴ · 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 <i>R</i>	Uncertainty <i>U_{gl}(W)</i>	Uncertainty relative <i>U_{gl}(W)_{rel}</i>
1 %	2,2000 g	0,00014 g	0,0063 %
25 %	55,0000 g	0,00033 g	0,00060 %
50 %	110,0000 g	0,00053 g	0,00048 %
75 %	165,0000 g	0,00073 g	0,00044 %
100 %	220,0000 g	0,00093 g	0,00042 %

Graphic realization of the relative uncertainty of measurement | process accuracy



Displayed example

Process accuracy 1.00 %
Safety factor 3
Minimum sample weight 0,0395 g

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Page 4 | 4



Metrology Center
SCI ECO Services Company Limited
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Bangkok Tel : +668 9205 6851 , +669 81924 0059
Saraburi Tel : +669 8247 2360
Website : www.scieco.co.th E-Mail : calibrate@scg.co.th



Page 1 of 3

Certificate No. T252169

Certificate of Calibration

Equipment : Liquid Bath (Water)

Manufacturer : Memmert

Model : WNE29

Serial No. : L623.0105

Customer Code : RYG_EN0220

ID No. : T5650A5

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

616/10 Moo 5 T.Maenamkoo,

A.Phuakdaeng, Rayong 21140

Customer Location : Wet Chemistry Lab

Date of Receipt : 19 November 2025

Calibrated By : Sujjar Naknakred (Site Calibration Manager)

Approved By :  / Boonchai Suriyawong (Site Calibration Manager)

Date of Issue : 01 DEC 2025

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

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



Metrology Center
SCI ECO Services Company Limited
51 Moo 8, Tubkwang, Kaeng Khoi, Saraburi, Thailand 18260



Certificate No. T252169

Calibration Report

Page 2 of 3

Equipment : Liquid Bath (Water)

Date of Calibration : 27 November 2025

Environment : Temperature : 25.5-25.7 °C

Line Voltage : 221.8-225.5 V

Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

1. This equipment was calibrated by insert five resistance thermometer detectors into its water bath , the other one thermocouple type T use for ambient temperature measurement . The calibration was done in according to WI-T36 (based on ASTM E715-80 (Reapproved 2022)).

All data show below were final values and the initial data from customer request . The temperature scale used was based on ITS - 90 .

2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
RTD	100 OHM	M18 (CH1-CH5)	T251758	17 October 2026
DATA LOGGER	34970A	T261	T251758	17 October 2026

3. This certificate is traceable to :

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

4. Condition of calibrated item : good

Equipment Description :

Time Constant 1 Hour 3 Minute At 63 °C

5. Adjustment :

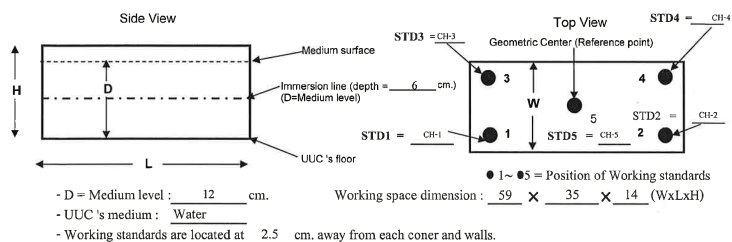
(X) without adjustment () after adjustment

Approved By: 

Certificate No. T252169

Page 3 of 3

Calibration Report



Measurement Results:

Calibration Point	Average Standard Reading at each position (°C)				
	CH-1	CH-2	CH-3	CH-4	CH-5
63	62.93	63.13	62.94	63.10	63.09
85	85.15	85.33	85.21	85.43	85.20

Liquid Bath (Water)			Temperature Distribution				
Setting (°C)	Reading (°C)		Average (°C)	Stability (±°C)	Uniformity (±°C)	Uncertainty (±°C)	Coverage Factor k
	Min, Max	Average					
63.0	62.9, 63.1	63.0	63.04	0.08	0.17	0.27	2.06
85.0	84.8, 85.2	85.0	85.26	0.13	0.24	0.43	2.23

* The quoted uncertainty exclude "uniformity"

The calibration result apply only the above calibrated item.

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

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

End of Certificate.

Approved By: 

FM-TL07 102/27-03-68

Certificate of Calibration

Cert.No.: 25CH846

Page.: 1 of 3

Equipment :

Manufacturer :

Model :

Serial No. :

ID No. :

Condition As-Received:

Received Date :

Calibration Date :

Reference :

Submitted by :

pH Meter

Mettler Toledo

SevenGo S2

C222171779

RYG_FS0594

Used Item

17 July 2025

18 July 2025

2507-0561DSC-2

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

Ambient Temperature :

(25 ± 2.5) °C

Relative Humidity :

(50 ± 15) %

Calibration Procedure :

In - house method :

- CP-CH5 by direct measurement with DC voltage
standard and direct measurement with
certified reference material (CRM)
- CP-CH8 by comparison with temperature standard

Calibrated by :

Walalak Sirithean

Approved by :

Sathip
Approved Signatory

() Chakrit Waewwanjua

() Ponpan Paipim

(✓) Sathip Meangmai

Issue Date :

21 July 2025

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services 3: Equipment Calibration and Testing Services.Cert.No.: 25CH846
Page.: 2 of 3

Condition of this calibration result

1. Reference Standard Instrument

Instrument

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC116	24E2759	25 Aug 2025
2) Ref. Standard Thermometer	3240076	60RC033	25I394	01 Apr 2026

- This measurement result is traceable to SI through Technology Promotion Association (Thailand - Japan)

2. Certified Reference Materials

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

Buffer Solution

Manufacturer

Lot No.

Exp. date

pH 4.007	CPA chem	1066665	18 Jan 2027
pH 6.965	CPA chem	1066667	18 Jan 2026
pH 10.010	CPA chem	1114385	08 June 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 k
	pH	mV	mV	pH	mV	pH		
pH Meter	4.00	177.48	178	4.00	0.58	2.00	0.58	2.00
S/N.: C222171779	7.00	0.00	0	7.00	0.58	2.00		
	10.00	-177.48	-177	10.00	0.58	2.00		

Cert.No.: 25CH846
Page.: 3 of 3

Calibration Results

Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH Measurement (±)	Coverage factor k
pH Electrode S/N.: 2465866	4.007	4.02	167	0.0071	2.00
	6.965	6.97	-6	0.0093	2.00
	10.010	10.02	-173	0.0096	2.00

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : InLabExpert Go-ISM

- Serial No. : 2465866

Dimension of probe

- Length : 120 mm.

- Diameter : 12 mm.

- Immersion Depth : 100 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement (±°C)	Coverage factor k
25.0	25.000	25.1	0.100	0.13	2.00
45.0	45.002	45.2	0.198	0.13	2.00

Remark : - UUC* = Unit Under Calibration

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

-o-o-



Accredited by

NSC-TISI-TIS 17025

Calibration 0426

Calibration certificate

Calibration Certificate No. 25BKL0002

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	MCE224S-2S00-U	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.	38101399 RYG_EN0163	This certificate relate and apply this equipment only,
Customer	ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch)	
	616/10 Moo 5 T.Maenam Khu, A.Pluak Daeng, Rayong 21140, Thailand.	
Order no.	2230	
Number of pages	4	
Date of calibration	20 Feb 2025	



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	06 Mar 2025	Approval of the Calibration Certificate	Person in charge
		Mr. Chonchai Inthana	Kachen Lalee

Sartorius (Thailand) Co., Ltd.
129 Rama 9 Road, Huaykwang
10310 Bangkok

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Page 1 | 4

Calibration certificate No.: 25BKL0002

Calibration Certificate

Calibration object

Single range instrument

Model	MCE224S-2S00-U
Serial Number	38101399
QM Ident. no Inventory no.	RYG_EN0163 —
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	Balance 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

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Page 2 | 4

Calibration certificate No.: 25BKL0002

Calibration Certificate

Adjustment Status

The measuring device was internally adjusted before the calibration.

Environmental and measuring conditions

Date of calibration	20 Feb 2025
Temperature at place of calibration Temp. diff.	24.4 °C 0.6 K
Twights - T _{place}	
Measuring conditions	The installation site is suitable. The device was levelled. Balance was loaded up to Max before test.
Comments	Humidity 58.0 %RH.

Measurement results | Measurement uncertainties

Repeatability	Eccentricity
Test load (nominal): 10 g 200 g	Test load (nominal): 100 g
10 g 200 g	Center 100,0000 g
1 10,0000 g 200,0000 g	Front left 100,0000 g
2 10,0000 g 200,0000 g	Back left 100,0000 g
3 10,0000 g 200,0001 g	Back right 100,0000 g
4 9,9999 g 200,0000 g	Front right 99,9999 g
5 9,9999 g 200,0000 g	Maximum deviation from centric loading indication
6 10,0000 g 200,0001 g	Δ _{fec} max = 0,0001 g
7 10,0000 g 200,0000 g	
8 10,0000 g 200,0000 g	
9 9,9999 g 200,0001 g	
10 10,0000 g 200,0000 g	
s = 0,00005 g s = 0,00005 g	

Error of indication

Testload L	Indication I	Error E	Expansion factor k	Uncertainty U(E)	Uncertainty relative U _{rel} (E)
0,0100 g	0,0100 g	0,0000 g	2,00	0,00013 g	1,3 %
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	0,026 %
1,0000 g	1,0000 g	0,0000 g	2,00	0,00013 g	0,013 %
5,0000 g	5,0000 g	0,0000 g	2,00	0,00013 g	0,0026 %
10,0000 g	9,9999 g	-0,0001 g	2,00	0,00013 g	0,0013 %
20,0000 g	20,0000 g	0,0000 g	2,00	0,00014 g	0,00068 %
50,0000 g	50,0001 g	0,0001 g	2,00	0,00015 g	0,00028 %
100,0000 g	100,0000 g	0,0000 g	2,00	0,00018 g	0,00018 %
200,0000 g	200,0000 g	0,0000 g	2,00	0,00028 g	0,00014 %
220,0000 g	220,0000 g	0,0000 g	2,00	0,00032 g	0,00015 %

Maximum error of indication |E|_{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

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Page 3 | 4

Interpretation of measurement results | Appendix to the calibration certificate

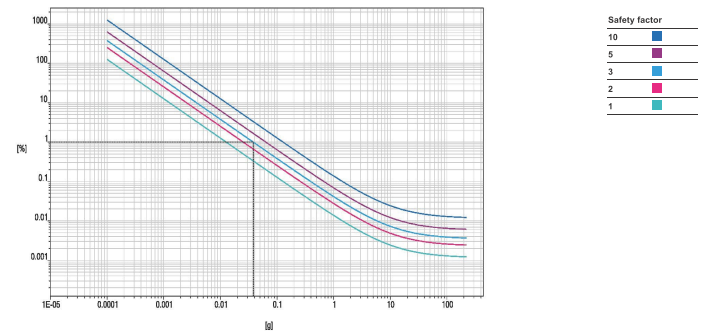
Uncertainty of measurement in use

Device adjusted before measurement	Yes
Temperature deviation considered	1.5 K (isoCAL active)
Temperature coefficient considered	1 · 10 ⁻⁹ /K
Uncertainty of the weighing result U _{GI} (W)	U _{GI} (W) = 0.00013 g + 1.16 · 10 ⁻⁵ · 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 _{GI} (W)	Uncertainty relative U _{GI} (W) _{rel}
1 %	2,2000 g	0,00016 g	0,0071 %
25 %	55,0000 g	0,00077 g	0,0014 %
50 %	110,0000 g	0,0014 g	0,0013 %
75 %	165,0000 g	0,0020 g	0,0012 %
100 %	220,0000 g	0,0027 g	0,0012 %

Graphic realization of the relative uncertainty of measurement | process accuracy



Displayed example

Process accuracy	1,00 %
Safety factor	3
Minimum sample weight	0,0381 g

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Page 4 | 4



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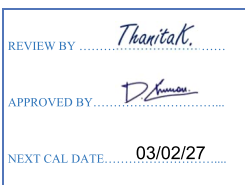
NSC-TISI-TIS 17025

Calibration 0426

Calibration certificate

Calibration Certificate No. 26BCI0064

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	MCE224S-2S00-U	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.	38101399 RYG_EN0163	This certificate relate and apply this equipment only.
Customer	ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch)	
	616/10 Moo 5 T.Maenamkoo, A.Pluak Daeng, Rayong 21140, Thailand.	
Order no.	278579	
Number of pages	4	
Date of calibration	03 Feb 2026	



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 of issue	03 Feb 2026	Approval of the Calibration Certificate	Person in charge
		Mr. Chonchai Inthana	Chonchai Inthana

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129 Rama 9 Road, Huaykwang
10310 Bangkok

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Page 1 | 4

Calibration certificate No.: 26BCI0064

Calibration Certificate

Calibration object

Single range instrument

Model	MCE224S-2S00-U
Serial Number	38101399
QM Ident. no Inventory no.	RYG_EN0163 —

Maximum capacity (Max. load)	220.0000 g
Measured up to	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	Balance Room.
Maximum temperature variation at place of calibration	5 K

Calibration procedure

EURAMET Calibration Guide No. 18, Version 4.0 (11/2015) - Guidelines on the Calibration of Non-Automatic Weighing Instruments

Test equipment

Test equipment type	Test equipment ID	Valid until
Thermometer	Testo 174H H/T250743 (Traceable to Si unit through ENTECH)	18 Nov 2026
Test weight set OIML R111 E2	Certificate No.M2508149S_E2(Traceable to SI unit through TCS)	19 Aug 2027

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10310 Bangkok

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Page 2 | 4

Calibration certificate No.: 26BCI0064

Calibration Certificate

Adjustment Status

The measuring device was internally adjusted before the calibration.

Environmental and measuring conditions

Date of calibration	03 Feb 2026
Temperature at place of calibration Temp. diff.	25 °C 0.5 K
Twights - Tplace	
Measuring conditions	The installation site is suitable. The device is level. Balance was loaded up to Max before test.
Comments	Humidity 49.0 %RH.

Measurement results | Measurement uncertainties

Repeatability	Eccentricity
Test load (nominal): 10 g 200 g	Test load (nominal): 100 g
10 g 200 g	Center 100,0001 g
1 10,0000 g 200,0000 g	Front left 100,0002 g
2 10,0000 g 199,9999 g	Back left 100,0002 g
3 10,0000 g 200,0000 g	Back right 100,0000 g
4 10,0000 g 200,0001 g	Front right 100,0000 g
5 9,9999 g 199,9999 g	Maximum deviation from centric loading indication
6 10,0000 g 200,0000 g	Δ[lecc] max = 0,0001 g
7 10,0000 g 199,9999 g	
8 10,0000 g 200,0000 g	
9 9,9999 g 200,0001 g	
10 10,0000 g 200,0000 g	
s = 0,00004 g s = 0,00007 g	

Error of indication

Testload L	Indication I	Error E	Expansion factor k	Uncertainty U(E)	Uncertainty relative Urel(E)
0,0100 g	0,0100 g	0,0000 g	2,00	0,00012 g	1,2 %
0,1000 g	0,1000 g	0,0000 g	2,00	0,00017 g	0,17 %
0,5000 g	0,5000 g	0,0000 g	2,00	0,00017 g	0,034 %
1,0000 g	1,0000 g	0,0000 g	2,00	0,00017 g	0,017 %
5,0000 g	5,0000 g	0,0000 g	2,00	0,00017 g	0,0034 %
10,0000 g	10,0000 g	0,0000 g	2,00	0,00017 g	0,0017 %
20,0000 g	20,0000 g	0,0000 g	2,00	0,00018 g	0,00088 %
50,0000 g	50,0000 g	0,0000 g	2,00	0,00018 g	0,00037 %
100,0000 g	100,0001 g	0,0001 g	2,00	0,00021 g	0,00021 %
200,0000 g	200,0000 g	0,0000 g	2,00	0,00030 g	0,00015 %
220,0000 g	220,0001 g	0,0001 g	2,00	0,00034 g	0,00015 %
Maximum error of indication		E[_{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

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Page 3 | 4

Interpretation of measurement results | Appendix to the calibration certificate

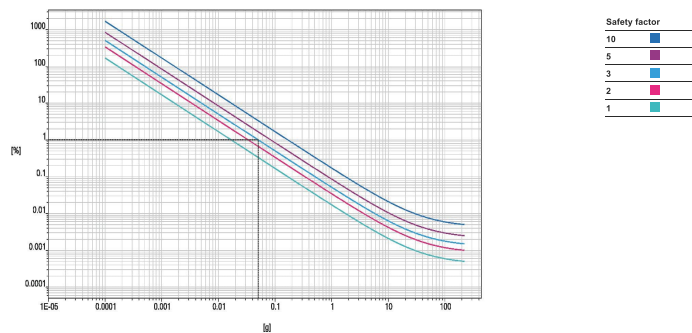
Uncertainty of measurement in use

Device adjusted before measurement	Yes
Temperature deviation considered	1.5 K (isoCAL active)
Temperature coefficient considered	1 · 10 ⁻⁴ /K
Uncertainty of the weighing result U _{GI} (W)	U _{GI} (W) = 0.00017 g + 4.25 · 10 ⁻⁴ · 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 _{GI} (W)	Uncertainty relative U _{GI} (W) _{rel}
1 %	2,2000 g	0,00018 g	0,0082 %
25 %	55,0000 g	0,00040 g	0,00073 %
50 %	110,0000 g	0,00064 g	0,00058 %
75 %	165,0000 g	0,00087 g	0,00053 %
100 %	220,0000 g	0,0011 g	0,00050 %

Graphic realization of the relative uncertainty of measurement | process accuracy



Displayed example

Process accuracy	1,00 %
Safety factor	3
Minimum sample weight	0,0507 g

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10310 Bangkok

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Page 4 | 4



Certificate No. T251530

Certificate of Calibration

Page 1 of 3

Equipment : Chamber (Oven)
Manufacturer : MEMMERT
Model : UF 110
Serial No. : B416.2420
Customer Code : RYG_EN0012
ID No. : T6444A5
Customer : ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)
616/10 Moo 5 T.Maenamkoo,
A.Pluakdaeng, Rayong 21140
Customer Location : ENVIRONMENT LABORATORY
Date of Receipt : 3 September 2025
Calibrated By : Sujjar Naknakred (Site Calibration Manager)
Approved By : Donchai Suriyawong Boonchai Suriyawong (Site Calibration Manager)
Date of Issue : 17 SEP 2025



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

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

FM-TL06 102/27-03-68



Certificate No. T251530

Page 2 of 3

Calibration Report

Equipment : Chamber (Oven)
Date of Calibration : 10 September 2025
Environment : Temperature : 35.7-36.6 °C
Line Voltage : 226.8-233.7 V
Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

- This equipment was calibrated by insert nine resistance thermometer detectors into its chamber , the other one resistance thermometer detector use for ambient temperature measurement . The calibration was done in according to WI-T20 (based on ASTM E145-94 (Reapproved 2019) and AS2853-1986). All data show below were final values and the initial data from customer request . The temperature scale used was based on ITS - 90 .
- Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
RTD	100 ohm	30-(CH1-10)	T242203	9 November 2025
DATA LOGGER	34970A	T47	T242203	9 November 2025
- This certificate is traceable to :
National Institute of Metrology (Thailand) through Metrological Center (NSC-TISI-TIS 17025 CALIBRATION 0244.
- Condition of calibrated item : good
Equipment Description :
Time Constant $\frac{3}{\text{Hour}}$ 29 Minute At 104 °C
Fresh Air Damper ☒ Open ☒ Min ☐ Medium ☐ Max
☐ Close
☐ Not Available
- Adjustment :
() without adjustment (X) after adjustment

Approved By: Donchai Suriyawong

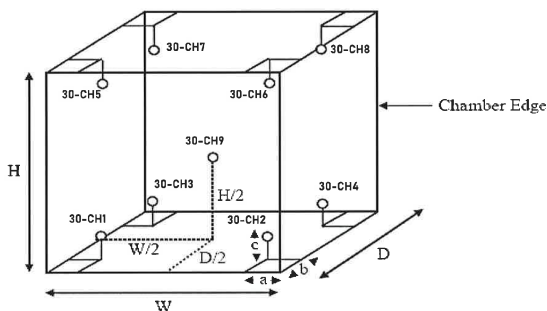
FM-TL07 102/27-03-68



Certificate No. T251530

Page 3 of 3

Calibration Report



Remark : Internal Dimensions of Chamber : W (Width) = 56 cm. , H (Height) = 48 cm. and D (Depth) = 40 cm.
Size of Installed Standard sensor number 30-CH1 to number 30-CH8 : a = 5 cm. , b = 5 cm. and c = 5 cm.
Size of Installed Standard sensor number 30-CH9 : W/2 = 56 cm./2 , H/2 = 48 cm./2 and D/2 = 40cm./2

Measurement Results

Calibration Point	Average Standard Reading at each position (°C)								
	30-CH1	30-CH2	30-CH3	30-CH4	30-CH5	30-CH6	30-CH7	30-CH8	30-CH9
104	104.02	103.70	104.01	104.16	104.11	104.08	104.01	104.33	103.61
180	180.67	178.78	180.38	179.85	179.16	180.27	180.98	181.04	179.49

Chamber (Oven)			Temperature Distribution				
Setting °C	Reading (°C)		Average (°C)	Stability (± °C)	Uniformity (°C)	Uncertainty (± °C)	Coverage Factor k
	Min , Max	Average					
104.0	103.9 , 104.1	104.0	104.00	0.08	0.61	0.42	2.00
180.0	179.9 , 180.1	180.0	180.07	0.21	1.51	0.52	2.00

* The quoted uncertainty exclude "uniformity"

The calibration result apply only the above calibrated item.

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

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

End of Certificate.

Approved By: Donchai Suriyawong

FM-TL07 102/27-03-68

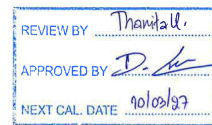


Certificate No. T251529

Page 1 of 3

Certificate of Calibration

Equipment : DIGESTION UNIT
Manufacturer : Gerhardt, Germany
Model : KT - 20S
Serial No. : 572021009
Customer Code : RYG_EN0188
ID No. : T6452A5
Customer : ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)
616/10 Moo 5 T.Maenamkoo,
A.Pluakdaeng, Rayong 21140
Customer Location : ENVIRONMENT LABORATORY
Date of Receipt : 3 September 2025
Calibrated By : Sujjar Naknakred (Site Calibration Manager)
Approved By : Donchai Suriyawong / Boonchai Suriyawong (Site Calibration Manager)
Date of Issue : 17 SEP 2025
The uncertainties are for a confidence probability of approximately 95%.



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

FM-TL04 102/27-03-68



Certificate No. T251529

Page 2 of 3

Calibration Report

Equipment : DIGESTION UNIT
Date of Calibration : 10 September 2025
Environment : Temperature : 21.7 - 24.3 °C
Line Voltage : 226.9 - 232.1 V
Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

- This equipment was calibrated by insert four standard thermocouples type S into its chamber , the other one thermocouple type T use for ambient temperature measurement . The calibration was done in according to WI-T10.
- Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	Type S	M20A1-(CH1-CH4)	T250750	14 May 2026
DATA LOGGER	34970A	T261	T250750	14 May 2026
- This certificate is traceable to :
National Institute of Metrology (Thailand) through Metrological Center (NSC-TISI-TIS 17025 CALIBRATION 0244.)
- Condition of calibrated item : good
Equipment Description :
Time Constant 1 Hour 46 Minute At 380 °C
Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max
☐ Close
☒ Not Available
- Adjustment :
(X) without adjustment () after adjustment

Approved By.

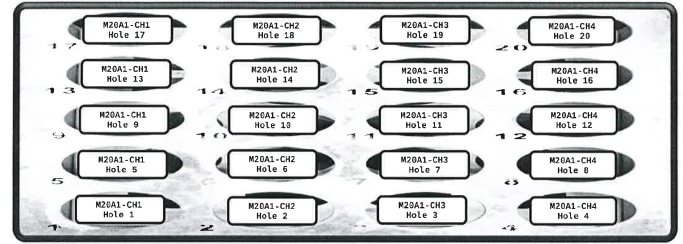
FM-TL05 102/27-03-68



Certificate No. T251529

Page 3 of 3

Calibration Report



DISPLAY CONTROL (FRONT)

Measurement Results

Cal.Point	Setting	Reading	STD.	Position of Standards at Block															
(°C)	(°C)	(°C)	Reading	M20A1-CH1 Hole 1	M20A1-CH2 Hole 2	M20A1-CH3 Hole 3	M20A1-CH4 Hole 4	M20A1-CH1 Hole 5	M20A1-CH2 Hole 6	M20A1-CH3 Hole 7	M20A1-CH4 Hole 8	M20A1-CH1 Hole 9	M20A1-CH2 Hole 10	M20A1-CH3 Hole 11	M20A1-CH4 Hole 12	M20A1-CH1 Hole 13	M20A1-CH2 Hole 14	M20A1-CH3 Hole 15	M20A1-CH4 Hole 16
380	360	360	Max °C	381.2	380.5	381.0	381.0	379.2	380.8	381.3	377.7	382.8	381.5						
			Min °C	380.7	380.0	380.4	380.5	378.6	380.1	380.9	377.2	381.9	380.9						
			Average °C	381.0	380.3	380.7	380.8	378.9	380.4	381.1	377.5	382.4	381.2						
			Stability °C	0.3	0.3	0.3	0.2	0.3	0.2	0.2	0.5	0.3							

Cal.Point	Setting	Reading	STD.	Position of Standards at Block															
(°C)	(°C)	(°C)	Reading	M20A1-CH3 Hole 11	M20A1-CH4 Hole 12	M20A1-CH1 Hole 13	M20A1-CH2 Hole 14	M20A1-CH3 Hole 15	M20A1-CH4 Hole 16	M20A1-CH1 Hole 17	M20A1-CH2 Hole 18	M20A1-CH3 Hole 19	M20A1-CH4 Hole 20						
380	360	360	Max °C	382.5	377.2	378.7	378.8	378.5	379.9	383.3	381.0	382.4	381.1						
			Min °C	381.7	376.5	378.5	378.5	378.1	379.5	382.7	380.6	381.6	380.4						
			Average °C	382.1	376.8	378.6	378.7	378.3	379.7	383.0	380.8	382.0	380.8						
			Stability °C	0.4	0.4	0.1	0.2	0.2	0.2	0.3	0.2	0.4	0.4						

The expanded uncertainty of temperature measurement was ± 1.8 °C

The calibration result apply only the above calibrated item.

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

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

End of Certificate.

Approved By.

FM-TL05 102/27-03-68



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.: 25CH709/1
Page.: 1 of 3

This Certificate was issued to replace to the Certificate No.25CH709

Equipment : pH Meter
Manufacturer : Mettler Toledo
Model : SevenExcellence
Serial No. : B834291445
ID No. : RYG_EN0152
Condition As-Received: Used Item
Received Date : 12 June 2025
Calibration Date : 18 June 2025
Reference : 2506-0407DSC-2
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.
Rayong Branch
616/10 Moo 5, T.Maenam Khu,
A.Pluakdaeng, Rayong 21140, Thailand

Ambient Temperature : (25 $\pm$ 2.5) °C
Relative Humidity : (50 $\pm$ 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 : Watalak Sirithean

Approved by :
Approved Signatory

() Chakrit Waewwanjua
() Ponpan Paipim
(✓) Sathip Meangmai

Issue Date : 1 July 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.: 25CH709/1
Page.: 2 of 3

Condition of this calibration result

1. Reference Standard Instrument

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC116	24E2759	25 Aug 2025
2) Ref. Standard Thermometer	4982054	110RC044	24T757	14 July 2025

- This measurement result 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

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.007	CPA chem	1066665	18 Jan 2027
pH 7.000	Hach Lenge GmbH	C03232	02 Dec 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 ($\pm$ mV)	Coverage factor k
			pH	mV		
pH Meter S/N.: B834291445	4.000	177.48	177.3	4.000	0.058	2.00
	7.000	0.00	-0.1	7.000	0.058	2.00
	10.000	-177.48	-177.5	10.000	0.058	2.00



Cert.No.: 25CH709/1
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.: 5211504	4.007	4.006	181.1	0.0044	2.00
	7.000	7.000	4.9	0.0084	2.00
	10.010	10.007	-170.6	0.0066	2.00

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : InLabExpert Pro-ISM

- Serial No. : 5211504

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	25.001	25.1	0.099	0.13	2.00

Remark - UUC* = Unit Under Calibration

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

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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TEL: 0-2717-3000-24 FAX: 0-2719-9484



Certificate of Calibration

Certificate No.: 25E1979/1
Page: 1 of 2

This Certificate was issued to replace to the Certificate No. 25E1979

Equipment : pH Meter
Manufacturer: Mettler Toledo
Model : SevenExcellence
Serial No.: B834291445
ID No.: RYG_EN0152
Condition As-Received: Used Item
Received Date: 12 June 2025
Calibration Date: 16 June 2025

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.

Reference: 2506-0407DSC Submitted by: **ALS Laboratory Group (Thailand) Co.,Ltd. Rayong Branch**

Ambient Temperature: (23 $\pm$ 2) °C

Relative Humidity: (50 $\pm$ 10) %

**618/10 Moo 5, T.Maenam Khu, A.Pluakdaeng,
Rayong 21140, Thailand**

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

Condition of this result of calibration

1.Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Multi-Product Calibrator	5500A	6315011	25E1627	19 May 2026
2.This result of calibration was made on requested at the point specified by customer.				
3.The certificate is valid only to the item calibrated on date and place of calibration.				
4.This measurement result is traceable to the International System of Unit maintained through:-				
-Technology Promotion Association (Thailand-Japan), NSC-ONSC Accredited No. Calibration 0008				

Calibrated by : Wutchareeporn Peethong
Issue Date : 01 July 2025

Approved Signatory :
[] Phalinee Prabpaipal
[x] Nuntawat Khamchai
[] Pongsagorn Boonyaporn



Cert. No.: 25E1979/1
Page.: 2 of 2

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

Function: DC voltage measurement	Range: 2000 mV		
Standard Value (mV)	UUC* Reading (mV)	Error (mV)	Uncertainty ($\pm$ μ V)
-200.0000	-199.9	0.1	68
-150.0000	-150.0	0.0	65
-100.0000	-100.0	0.0	63
-50.0000	-50.0	0.0	61
0.0000	0.0	0.0	58
50.0000	50.0	0.0	61
100.0000	100.0	0.0	63
150.0000	149.9	-0.1	65
200.0000	199.9	-0.1	68

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

UUC* = Unit Under Calibration.

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