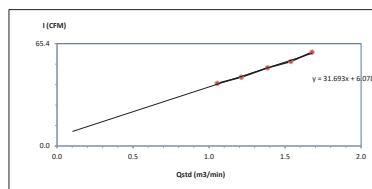



ภาคผนวก ง

ใบรับรองการสอบเทียบเครื่องมือ



Test No.	Delta H ₂ O (inch)	Q ₉₀ (m ³ /min)	I: Chart (CFM)	Linear Regression	
1	2.4	1.0532	40	Slope:	31.6925
2	3.2	1.2122	44	Intercept:	6.0788
3	4.2	1.3851	50	Correlation Coefficient:	0.9964
4	5.2	1.5383	54		
5	6.2	1.6774	60		

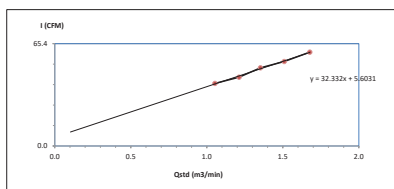



Approved by: 
(Mr. Noppong Juntarupan)
Enviro Field Coordinator Scientist (3)

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



Test No.	Delta H ₂ O (inch)	Q _{air} (m ³ /min)	I: Chart (CFM)	Linear Regression	
1	2.4	1.0532	40	Slope :	32.3317
2	3.2	1.2122	44	Intercept :	5.6031
3	4.0	1.3523	50	Correlation Coefficient :	0.9972
4	5.0	1.5089	54		
5	6.2	1.6774	60		



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

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



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

APPROVED BY: [Signature]

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

NEXT CAL DATE: 01/02/2019

Micrologix data:

Capacity: 150 g Repeatability: 0.0001 g

Reasons for calibration:

☐ Use Evaluation ☐ Service / Repair ☒ Re-calibration / Maintenance

Ambients Conditions:

Temperature: 23.6 °C ± 5.0 °C

Humidity: 54.0 % RH ± 10.0 % RH

Pressure: ±

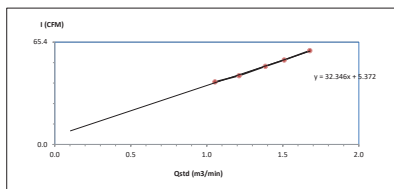
Equipment Condition: ☒ Good ☐ Bad


Traceability:

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Test No.	Delta H ₂ O (inch)	Q _{add} (m ³ /min)	1: Chart (CFM)	Linear Regression	
1	2.4	1.0532	40	Slope :	32.9457
2	3.2	1.2122	44	Intercept :	5.3720
3	4.2	1.3851	50	Correlation Coefficient :	0.9983
4	5.0	1.5089	54		
5	6.2	1.6774	60		



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

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



Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal.	Pres. Calibration (months)
Ambient	Total Suspended Particulate	High Volume	RWS F50603	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	RWS F50604	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	RWS F50605	-	-	On site Calibration
Ambient	Total Suspended Particulate	Static Balance	RWS00001	22-Feb-26	22-Feb-26	12
Ambient	Organic Dissolve	RG Analyzer	RWS F50553	3-Jan-24	3-Jan-24	6
Ambient	Organic Dissolve	RG Analyzer	RWS F50554	3-Jan-24	3-Jan-24	6
Ambient	Organic Dissolve	RG Analyzer	RWS F50555	3-Jan-24	3-Jan-24	6
Ambient	Organic Dissolve	RG Analyzer	RWS F50556	3-Jan-24	3-Jan-24	6
Ambient	Organic Dissolve	RG Analyzer	RWS F50557	3-Jan-24	3-Jan-24	6
Ambient	Wind Speed & Wind Direction	Wind Speed & Wind Direction	BWP F52511	20-May-24	20-May-24	18
Stack (CFLD)	Amount of Nitrogen	Analyzer - System Calibration, Stack	RWS F50518	10-Jan-24	10-Jan-25	6
Stack (CFLD)	Acrylic Acid	High Volume	RWS F50518	10-Jan-24	10-Jan-25	6
Stack	Acrylic Acid	Dry Gas	RWS F50534	10-Jan-24	10-Jan-25	6
Stack	Acrylic Acid	Wet Gas FLOWMETER	RWS F50534	29-Jan-24	29-Jan-25	12
Stack	Acrylic Acid	Wet Gas FLOWMETER	RWS F50534	16-Feb-24	16-Feb-25	12
Stack	Methyl Methacrylate	Dry Gas	RWS F50518	10-Jan-24	10-Jan-25	6
Stack	Methyl Methacrylate	Dry Gas	RWS F50534	10-Jan-24	10-Jan-25	6
Stack	Methyl Methacrylate	Wet Gas FLOWMETER	RWS F50534	29-Jan-24	10-Jan-25	6
Stack	Methyl Methacrylate	Wet Gas FLOWMETER	RWS F50534	16-Feb-24	10-Jan-25	6
Stack	Methyl Methacrylate	SC-MSD	RWS00019	18-May-23	18-Oct-24	18
Stack	Toluene	SC-MSD	RWS F50518	10-Jan-24	10-Jan-25	6
Stack	Toluene	Dry Gas	RWS F50534	10-Jan-24	10-Jan-25	6
Stack	Toluene	Dry Gas	RWS F50534	10-Jan-24	10-Jan-25	6
Stack	Toluene	Wet Gas FLOWMETER	RWS00019	18-May-23	18-Oct-24	18
Stack	Methanol	SC-MSD	RWS F50518	10-Jan-24	10-Jan-25	6
Stack	Methanol	Dry Gas	RWS F50534	10-Jan-24	10-Jan-25	6
Stack	Methanol	Dry Gas	RWS F50534	10-Jan-24	10-Jan-25	6
Stack	Methanol	Wet Gas FLOWMETER	RWS00019	18-May-23	18-Oct-24	18
Stack	Methanol	SC-MSD	RWS00026	21-May-23	21-Oct-24	18
Stack	Total Suspended Particulate	SC-MSD	RWS F50518	10-Jan-24	10-Jan-25	6
Stack	Total Suspended Particulate	SC-MSD	RWS F50534	10-Jan-24	10-Jan-25	6
Stack	Total Suspended Particulate	SC-MSD	RWS F50534	10-Jan-24	10-Jan-25	6
Stack	Total Suspended Particulate	SC-MSD	RWS F50534	10-Jan-24	10-Jan-25	6
Wetlab/Stack	Acrylic Acid	Wet Gas Analyzer	RWS F51006	2-Feb-24	2-Oct-24	18
Wetlab/Stack	Acrylic Acid	Wet Gas FLOWMETER	RWS F51006	29-Jan-24	28-Feb-25	12
Wetlab/Stack	Acrylic Acid	Wet Gas FLOWMETER	RWS F51006	16-Feb-24	28-Feb-25	12
Wetlab/Stack	Methyl Methacrylate	Wet Gas Analyzer	RWS F51006	2-Feb-24	2-Oct-24	18
Wetlab/Stack	Methyl Methacrylate	Wet Gas FLOWMETER	RWS F51006	29-Jan-24	28-Feb-25	12
Wetlab/Stack	Methyl Methacrylate	Wet Gas FLOWMETER	RWS F51006	16-Feb-24	28-Feb-25	12
Wetlab/Stack	Toluene	Wet Gas Analyzer	RWS F51006	2-Feb-24	2-Oct-24	18
Wetlab/Stack	Toluene	Wet Gas FLOWMETER	RWS F51346	29-Jan-24	28-Feb-25	12
Wetlab/Stack	Methanol	SC-MSD	RWS F50518	21-May-23	21-Oct-24	18
Wetlab/Stack	Methanol	SC-MSD	RWS F50526	22-Oct-24	22-Oct-24	12
Wetlab/Stack	Total Hydrocarbon	Total Hydrocarbon Analyzer	RWS F50038	25-Feb-24	25-Jul-24	12
Wetlab/Stack	Total Hydrocarbon	Total Hydrocarbon Analyzer	RWS F50038	25-Feb-24	25-Jul-24	12
Wetlab/Stack	Toluene	SC-MSD	RWS F51346	29-Jan-24	28-Feb-25	12
Wetlab/Stack	Toluene	SC-MSD	RWS00026	21-May-24	20-Nov-25	12
None	Long 24 hrs	Source Level Meter	RWS F50000	30-May-24	30-Aug-25	12
None	Long 24 hrs	Source Level Meter	RWS F50000	25-May-24	25-Aug-25	12
None	Long 24 hrs	Source Level Meter	RWS F50000	30-May-24	30-Aug-25	12
None	Long 12 hrs	Source Calibrator	RWS F50023	28-Feb-24	27-Feb-25	12
None	Long 12 hrs	Source Level Meter	RWS F50023	25-Mar-24	21-Jan-25	12
None	Long 12 hrs	Source Level Meter	RWS F50026	22-Nov-24	21-Jan-25	12
None	Long 12 hrs	Source Level Meter	RWS F50026	25-Nov-24	26-Jan-25	12
None	Long 12 hrs	Source Level Meter	RWS F50026	19-Oct-24	19-Oct-24	12
None	Long 12 hrs	Source Level Meter	RWS F50034	19-Oct-23	19-Oct-24	12

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Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal.	Freq. Calibration (months)
None	Lang 12 hrs	Standard Lunar Meter	RVS-F50586	19-01-23	19-01-24	12
None	Lang 12 hrs	Standard Lunar Meter	RVS-F50587	12-04-20	11-04-21	12
None	Lang 12 hrs	Standard Lunar Meter	RVS-F50588	22-04-20	20-04-21	12
None	Lang 12 hrs	Standard Lunar Meter	RVS-F50589	22-04-20	21-04-21	12
None	Lang 12 hrs	Standard Lunar Meter	RVS-F50589	22-04-20	21-04-21	12
Baywing Lab	Lang 25 °C, 100% RH	Relative Humidity	RHS-150152	14-06-23	14-06-24	12
Baywing Lab	Lang 25 °C, 100% RH	Relative Humidity	RHS-150153	14-06-23	14-06-24	12
Baywing Lab	ISO1	ISO with Sensor	RHS-150154	1-06-24	1-06-25	12
Baywing Lab	ISO2	ISO with Sensor	RHS-150154	1-06-24	1-06-25	12
Baywing Lab	CO2	CO2 analyser	RHS-150037	18-05-23	18-04-24	12
Baywing Lab	CO2	CO2 analyser	RHS-150038	18-05-23	18-04-24	12
Baywing Lab	CO2	CO2 analyser	RHS-150039	18-05-23	18-04-24	12
Baywing Lab	CO2	CO2 analyser	RHS-150040	18-05-23	18-04-24	12
Baywing Lab	CO2	CO2 analyser	RHS-150041	18-05-23	18-04-24	12
Baywing Lab	CO2	CO2 analyser	RHS-150042	18-05-23	18-04-24	12
Baywing Lab	CO2	CO2 analyser	RHS-150043	18-05-23	18-04-24	12
Baywing Lab	CO2	CO2 analyser	RHS-150044	18-05-23	18-04-24	12
Baywing Lab	CO2	CO2 analyser	RHS-150045	18-05-23	18-04-24	12
Baywing Lab	CO2	CO2 analyser	RHS-150046	18-05-23	18-04-24	12
Baywing Lab	CO2	CO2 analyser	RHS-150047	18-05-23	18-04-24	12
Baywing Lab	CO2	CO2 analyser	RHS-150048	18-05-23	18-04-24	12
Baywing Lab	CO2	CO2 analyser	RHS-150049	18-05-23	18-04-24	12
Baywing Lab	CO2	CO2 analyser	RHS-150050	18-05-23	18-04-24	12
Baywing Lab	CO2	CO2 analyser	RHS-150051	18-05-23	18-04-24	12
Baywing Lab	CO2	CO2 analyser	RHS-150052	18-05-23	18-04-24	12
Baywing Lab	CO2	CO2 analyser	RHS-150053	18-05-23	18-04-24	12
Baywing Lab	CO2	CO2 analyser	RHS-150054	18-05-23	18-04-24	12
Baywing Lab	CO2	CO2 analyser	RHS-150055	18-05-23	18-04-24	12
Baywing Lab	CO2	CO2 analyser	RHS-150056	18-05-23	18-04-24	12
Baywing Lab	CO2	CO2 analyser	RHS-150057	18-05-23	18-04-24	12
Baywing Lab	CO2	CO2 analyser	RHS-150058	18-05-23	18-04-24	12
Baywing Lab	CO2	CO2 analyser	RHS-150059	18-05-23	18-04-24	12
Baywing Lab	CO2	CO2 analyser	RHS-150060	18-05-23	18-04-24	12
Baywing Lab	CO2	CO2 analyser	RHS-150061	18-05-23	18-04-24	12
Baywing Lab	CO2	CO2 analyser	RHS-150062	18-05-23	18-04-24	12
Baywing Lab	CO2	CO2 analyser	RHS-150063	18-05-23	18-04-24	12
Baywing Lab	CO2	CO2 analyser	RHS-150064	18-05-23	18-04-24	12
Baywing Lab	CO2	CO2 analyser	RHS-150065	18-05-23	18-04-24	12
Baywing Lab	CO2	CO2 analyser	RHS-150066	18-05-23	18-04-24	12
Baywing Lab	CO2	CO2 analyser	RHS-150067	18-05-23	18-04-24	12
Baywing Lab	CO2	CO2 analyser	RHS-150068	18-05-23	18-04-24	12
Baywing Lab	CO2	CO2 analyser	RHS-150069	18-05-23	18-04-24	12
Baywing Lab	CO2	CO2 analyser	RHS-150070	18-05-23	18-04-24	12
Baywing Lab	CO2	CO2 analyser	RHS-150071	18-05-23	18-04-24	12
Baywing Lab	CO2	CO2 analyser	RHS-150072	18-05-23	18-04-24	12
Baywing Lab	CO2	CO2 analyser	RHS-150073	18-05-23	18-04-24	12
Baywing Lab	CO2	CO2 analyser	RHS-150074	18-05-23	18-04-24	12
Baywing Lab	CO2	CO2 analyser	RHS-150075	18-05-23	18-04-24	12
Baywing Lab	CO2	CO2 analyser	RHS-150076	18-05-23	18-04-24	12
Baywing Lab	CO2	CO2 analyser	RHS-150077	18-05-23	18-04-24	12
Baywing Lab	CO2	CO2 analyser	RHS-150078	18-05-23	18-04-24	12
Baywing Lab	CO2	CO2 analyser	RHS-150079	18-05-23	18-04-24	12
Baywing Lab	CO2	CO2 analyser	RHS-150080	18-05-23	18-04-24	12

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Lot No. 24107673-1

SYSTEM CALIBRATION BIAS AND DRIFT DATA

Client : THAI MMA Co., Ltd. Location : Jalan 22-4219
Date : 28 Sep 24 Test Operator : Sathaporn T.
O₂ ANALYZER :
Cylinder Conc. (%) : 15.00 Span (%) : 25

	O ₂ Analyzer Calibration Response	Initial Values System Cal Bias (% of Span)	System Cal Bias (% of Span)	System Cal Bias (% of Span)	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.01	0.02	0.02	0.02	0.02	0.00
Span Gas	15.00	15.05	0.00	15.08	0.24	0.12

NO_x ANALYZER :
Cylinder Conc. (ppm) : 164.40 Span (ppm) : 200

	NO _x Analyzer Calibration Response	Initial Values System Cal Bias (% of Span)	System Cal Bias (% of Span)	System Cal Bias (% of Span)	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.01	0.02	0.01	0.02	0.01	0.00
Span Gas	164.35	164.30	0.02	164.30	0.02	0.00

Calibrated by

(Mr. Sathaporn Thakaw) (3)

Environmental Field Scientist (3)

FORM NO. F-05-003 REVISION NO. 4 ISSUE DATE: 18/10/24

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EMISSION TEST RESULT

Run # 3
Client : THAI MMA Co., Ltd. Location : Jalan 22-4219
Date : 28 Sep 24 Test Operator : Sathaporn T.
Start Time : 11:42 Finish Time : 12:52
SO₂ Analyzer Model :
NO_x/O₂ Analyzer Model :
CO/CO₂ Analyzer Model :
Serial No. : TDBARGKP
Serial No. :
Serial No. : -

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
11:42	4.91	8.67	10.29	-	-	-
11:43	4.85	8.72	10.29	-	-	-
11:44	4.82	8.75	10.42	-	-	-
11:45	4.80	8.74	10.44	-	-	-
11:46	4.79	8.75	10.32	-	-	-
11:47	4.78	8.74	10.39	-	-	-
11:48	4.70	8.75	10.35	-	-	-
11:49	4.70	8.74	10.21	-	-	-
11:50	4.70	8.75	10.51	-	-	-
11:51	4.77	8.75	10.21	-	-	-
11:52	4.86	8.71	10.16	-	-	-
11:53	4.93	8.71	10.51	-	-	-
11:54	4.98	8.67	10.72	-	-	-
11:55	5.00	8.68	10.56	-	-	-
11:56	5.00	8.68	10.38	-	-	-
11:57	4.98	8.68	10.35	-	-	-
11:58	4.93	8.69	10.40	-	-	-
11:59	4.88	8.74	10.56	-	-	-
12:00	4.77	8.78	10.58	-	-	-
12:01	4.78	8.75	10.52	-	-	-
12:02	4.77	8.77	10.45	-	-	-
Average	4.84	8.72	10.39	-	-	-

(Mr. Sathaporn Thakaw) (3)

Environmental Field Scientist (3)

FORM NO. F-05-000 REVISION NO. 1 ISSUE DATE: 18/10/24

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EMISSION TEST RESULT

Run # 1
Client : THAI MMA Co., Ltd. Location : Jalan 22-4219
Date : 28 Sep 24 Test Operator : Sathaporn T.
Start Time : 11:00 Finish Time : 11:29
SO₂ Analyzer Model :
NO_x/O₂ Analyzer Model :
CO/CO₂ Analyzer Model :
Serial No. : TDBARGKP
Serial No. :
Serial No. : -

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
11:00	4.80	8.69	10.50	-	-	-
11:01	4.91	8.68	10.50	-	-	-
11:02	4.85	8.70	10.57	-	-	-
11:03	4.93	8.68	10.46	-	-	-
11:04	4.87	8.72	10.44	-	-	-
11:05	4.83	8.72	10.42	-	-	-
11:06	4.83	8.72	10.39	-	-	-
11:07	4.76	8.74	10.42	-	-	-
11:08	4.75	8.77	10.57	-	-	-
11:09	4.75	8.76	10.61	-	-	-
11:10	4.67	8.76	10.50	-	-	-
11:11	4.80	8.75	10.79	-	-	-
11:12	4.84	8.72	10.57	-	-	-
11:13	4.85	8.74	10.48	-	-	-
11:14	4.80	8.74	10.55	-	-	-
11:15	4.83	8.74	10.57	-	-	-
11:16	4.88	8.72	10.44	-	-	-
11:17	4.87	8.71	10.42	-	-	-
11:18	4.89	8.70	10.50	-	-	-
11:19	4.93	8.69	10.40	-	-	-
11:20	4.93	8.68	10.48	-	-	-
Average	4.85	8.72	10.50	-	-	-

(Mr. Sathaporn Thakaw) (3)

Environmental Field Scientist (3)

FORM NO. F-05-000 REVISION NO. 1 ISSUE DATE: 18/10/24

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EMISSION TEST RESULT

Run # 1
Client : THAI MMA Co., Ltd. Location : Jalan 22-4219
Date : 28 Sep 24 Test Operator : Sathaporn T.
Start Time : 11:45 Finish Time : 12:55
SO₂ Analyzer Model :
NO_x/O₂ Analyzer Model :
CO/CO₂ Analyzer Model :
Serial No. : TDBARGKP
Serial No. :
Serial No. : -

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
11:45	8.23	7.31	10.79	-	-	-
11:46	8.35	7.31	10.70	-	-	-
11:47	8.33	7.35	10.75	-	-	-
11:48	8.19	7.42	10.52	-	-	-
11:49	8.23	7.35	10.29	-	-	-
11:50	8.30	7.35	10.31	-	-	-
11:51	8.21	7.40	10.33	-	-	-
11:52	8.24	7.38	10.76	-	-	-
11:53	8.43	7.31	10.74	-	-	-
11:54	8.39	7.34	10.77	-	-	-
11:55	8.15	7.43	10.67	-	-	-
11:56	8.20	7.41	10.80	-	-	-
11:57	8.24	7.40	10.84	-	-	-
11:58	8.13	7.42	10.76	-	-	-
11:59	8.30	7.37	10.80	-	-	-
12:00	8.39	7.35	10.51	-	-	-
12:01	8.26	7.40	10.72	-	-	-
12:02	8.25	7.40	10.85	-	-	-
12:03	8.30	7.38	10.79	-	-	-
12:04	8.14	7.45	10.64	-	-	-
12:05	8.17	7.43	10.73	-	-	-
Average	8.26	7.35	10.67	-	-	-

(Mr. Sathaporn Thakaw) (3)

Environmental Field Scientist (3)

FORM NO. F-05-000 REVISION NO. 1 ISSUE DATE: 18/10/24

ALS Laboratory Group

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ANALYZER CALIBRATION DATA

Lot No. 24107673-1

Run # 1
Client : THAI MMA Co., Ltd. Location : Jalan 22-4219
Date : 28 Sep 24 Test Operator : Sathaporn T.
O₂ ANALYZER :
Model : HORIBA PG-350 Serial No. : TDBARGKP
Span (%) : 25

	Cylinder Value (%)	Initial Analyzers Calibration Response (%)	Final Analyzers Calibration Response (%)	Difference (Percent of Span)
Zero Gas	0.00	0.01	0.02	0.04
Span Gas	15.00	15.02	15.04	0.08
Average	15.00	15.02	15.03	0.04

NO_x ANALYZER :
Model : HORIBA PG-350 Serial No. : TDBARGKP
Span (ppm) : 200

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.01	0.01	0.00
Span Gas	164.35	164.35	164.35	0.00
Average	164.40	164.35	164.35	0.00

Calibrated by

(Mr. Sathaporn Thakaw) (3)

Environmental Field Scientist (3)

FORM NO. F-05-002 REVISION NO. 4 ISSUE DATE: 18/10/24

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EMISSION TEST RESULT

Run # 2
Client : THAI MMA Co., Ltd. Location : Jalan 22-4219
Date : 28 Sep 24 Test Operator : Sathaporn T.
Start Time : 11:21 Finish Time : 11:41
SO₂ Analyzer Model :
NO_x/O₂ Analyzer Model :
CO/CO₂ Analyzer Model :
Serial No. : TDBARGKP
Serial No. :
Serial No. : -

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
11:21	4.92	8.70	10.42	-	-	-
11:22	4.92	8.71	10.44	-	-	-
11:23	4.76	8.72	10.44	-	-	-
11:24	4.88	8.72	10.48	-	-	-
11:25	4.93	8.69	10.35	-	-	-
11:26	4.94	8.69	10.38	-	-	-
11:27	4.88	8.72	10.38	-	-	-
11:28	4.85	8.72	10.31	-	-	-
11:29	4.76	8.76	10.31	-	-	-
11:30	4.69	8.77	10.37	-	-	-
11:31	4.68	8.76	10.31	-	-	-
11:32	4.71	8.77	10.31	-	-	-
11:33	4.76	8.76	10.45	-	-	-
11:34	4.77	8.76	10.43	-	-	-
11:35	4.82	8.74	10.35	-	-	-
11:36	4.88	8.72	10.34	-	-	-
11:37	4.75	8.68	10.52	-	-	-
11:38	4.95	8.68	10.24	-	-	-
11:39	4.97	8.68	10.35	-	-	-
11:40	5.01	8.67	10.38	-	-	-
11:41	4.94	8.70	10.38	-	-	-
Average	4.84	8.72	10.38	-	-	-

(Mr. Sathaporn Thakaw) (3)

Environmental Field Scientist (3)

FORM NO. F-05-000 REVISION NO. 1 ISSUE DATE: 18/10/24

ALS Laboratory Group

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CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: EDAN0903H40000 Reference Number: 82-021916725-1
Cylinder Number: N0000016 Cylinder Volume: 348.4 CF
Laboratory: 124 - Newark (SAP) - NJ Cylinder Pressure: 2214 PSIG
PQVP Number: 800517 Valve Outlet: 800
Gas Code: CO2BALN Certification Date: Oct 22, 2017

Expiration Date: Oct 23, 2025

Customer provided or requested analysis. Analytical Methodology used for regular correction for analytical maintenance. This certificate is valid only when used in conjunction with a certificate of analysis. The certificate is valid only when used in conjunction with a certificate of analysis. The certificate is valid only when used in conjunction with a certificate of analysis.

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Date
CO2BALN	9.999 %	9.999 %	OT	+/- 0.4% NOT Testable	08/09/17
CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No.	Concentration	Uncertainty	Expiration Date
CO2BALN	00000001	00000001	9.999 % CO2/NITROGEN	+/- 0.3%	Nov 02, 2022
ANALYTICAL EQUIPMENT					
Instrument/Make/Model			Last Multipoint Calibration		
Fisher 6500 FTIR ALPHACON 02			08/28/2017		

Test Data Available Upon Request

NOTES:
This calibration has been certified in accordance with the May 2012 EPA Traceability Protocol, Document EPA-800/R-12-031. All testing processes and measurements conform to the requirements of ISO/IEC 17025 and to the ISO 9001:2008 and shall only be used for internal use only. All values are certified to be within 1% of the actual value with a maximum of 1% uncertainty. This document shall not be reproduced or full without written approval of this issue.



Approved for Release

Sheet 1 of 01-01-01-01-01

CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

Customer: AIR LIQUIDE (THAILAND) LTD
Part Number: EDAN0903H40000 Reference Number: 190-002340013-1
Cylinder Number: 040027210 Cylinder Volume: 247.2 CF
Laboratory: 124 - Newark (SAP) - NJ Cylinder Pressure: 2215 PSIG
PQVP Number: A12022 Valve Outlet: 600
Gas Code: CO,NO,NOX,SO2,BALN Certification Date: Feb 11, 2022

Expiration Date: Feb 15, 2025

Customer provided or requested analysis. Analytical Methodology used for regular correction for analytical maintenance. This certificate is valid only when used in conjunction with a certificate of analysis. The certificate is valid only when used in conjunction with a certificate of analysis. The certificate is valid only when used in conjunction with a certificate of analysis.

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Date
NOX	80.00 PPM	82.30 PPM	OT	+/- 1.0% NOT Testable	02/04/2022, 02/11/22
CARBON MONOXIDE	80.00 PPM	75.40 PPM	OT	+/- 0.4% NOT Testable	02/04/2022, 02/11/22
NITRIC OXIDE	80.00 PPM	82.30 PPM	OT	+/- 1.0% NOT Testable	02/04/2022, 02/11/22
SULFUR DIOXIDE	80.00 PPM	75.40 PPM	OT	+/- 0.4% NOT Testable	02/04/2022, 02/11/22
NITROGEN	80.00 PPM	75.40 PPM	OT	+/- 0.4% NOT Testable	02/04/2022, 02/11/22

CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No.	Concentration	Uncertainty	Expiration Date
NITRIC	00000001	00000001	80.00 PPM CARBON MONOXIDE/NITROGEN	+/- 0.3%	Oct 18, 2024
NITRIC	00000001	00000001	80.00 PPM NITRIC OXIDE/NITROGEN	+/- 0.3%	Oct 18, 2024
NITRIC	00000001	00000001	80.00 PPM NITRIC OXIDE/NITROGEN	+/- 0.3%	Oct 18, 2024
NITRIC	00000001	00000001	80.00 PPM NITRIC OXIDE/NITROGEN	+/- 0.3%	Oct 18, 2024
NITRIC	00000001	00000001	80.00 PPM NITRIC OXIDE/NITROGEN	+/- 0.3%	Oct 18, 2024

ANALYTICAL EQUIPMENT					
Instrument/Make/Model			Last Multipoint Calibration		
Fisher 6500 FTIR ALPHACON 02			08/28/2017		
Fisher 6500 FTIR ALPHACON 02			08/28/2017		
Fisher 6500 FTIR ALPHACON 02			08/28/2017		
Fisher 6500 FTIR ALPHACON 02			08/28/2017		

Test Data Available Upon Request

NOTES: Gross Weight: 45.5 Kg
Net Weight: 9.1 Kg

Approved for Release

Sheet 1 of 01-01-01-01-01

EMISSION TEST RESULT

Client		Run #	
THAI MMA Co., Ltd.		2	
Date		Location	
28 Sep 24		Udax 22-6210	
Start Time		Test Operator	
12:27		Sathaporn T.	
SO, Analyzer Model		Final Time	
-		12:28	
NO, Analyzer Model		Serial No.	
-		TDBAROP	
CO, Analyzer Model		Serial No.	
-		-	

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
12:27	6.17	7.37	10.76	-	-	-
12:27	6.24	7.42	10.80	-	-	-
12:28	6.16	7.47	10.80	-	-	-
12:28	6.25	7.43	10.10	-	-	-
12:10	6.14	7.47	9.93	-	-	-
12:11	6.16	7.47	10.08	-	-	-
12:12	6.32	7.41	10.17	-	-	-
12:13	6.34	7.44	10.30	-	-	-
12:14	6.07	7.33	10.30	-	-	-
12:15	6.14	7.47	10.37	-	-	-
12:16	6.15	7.46	10.47	-	-	-
12:17	6.09	7.51	10.38	-	-	-
12:18	6.20	7.47	10.41	-	-	-
12:19	6.30	7.47	10.38	-	-	-
12:20	6.16	7.55	10.40	-	-	-
12:21	6.17	7.53	10.42	-	-	-
12:22	6.13	7.56	10.77	-	-	-
12:23	6.16	7.50	10.68	-	-	-
12:24	6.24	7.57	10.98	-	-	-
12:25	6.10	7.48	10.14	-	-	-
12:26	6.12	7.48	10.68	-	-	-
Average	6.18	7.48	10.46	-	-	-

Sathaporn T.

(Mr. Sathaporn Thabaw)

Environmental Field Scientist (S)

FORM NO. F-06-08 REVISION NO. 1 ISSUE DATE: 08/01/24

ALS Laboratory Group

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EMISSION TEST RESULT

Client		Run #	
THAI MMA Co., Ltd.		3	
Date		Location	
28 Sep 24		Udax 22-6210	
Start Time		Test Operator	
12:27		Sathaporn T.	
SO, Analyzer Model		Final Time	
-		12:47	
NO, Analyzer Model		Serial No.	
-		TDBAROP	
CO, Analyzer Model		Serial No.	
-		-	

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
12:27	6.15	7.53	11.15	-	-	-
12:28	6.09	7.56	11.07	-	-	-
12:29	6.07	7.54	10.90	-	-	-
12:30	6.07	7.54	10.90	-	-	-
12:31	6.15	7.53	10.77	-	-	-
12:32	6.31	7.46	10.90	-	-	-
12:33	6.22	7.49	10.65	-	-	-
12:34	6.18	7.51	10.37	-	-	-
12:35	6.19	7.52	10.23	-	-	-
12:36	6.08	7.55	10.23	-	-	-
12:37	6.09	7.50	10.36	-	-	-
12:38	6.10	7.55	10.23	-	-	-
12:39	6.25	7.48	10.27	-	-	-
12:40	6.18	7.53	10.27	-	-	-
12:41	6.08	7.56	10.45	-	-	-
12:42	6.20	7.53	10.76	-	-	-
12:43	6.19	7.51	10.76	-	-	-
12:44	6.07	7.57	10.39	-	-	-
12:45	6.20	7.52	10.10	-	-	-
12:46	6.23	7.50	10.41	-	-	-
12:47	6.17	7.57	10.52	-	-	-
Average	6.14	7.51	10.55	-	-	-

Sathaporn T.

(Mr. Sathaporn Thabaw)

Environmental Field Scientist (S)

FORM NO. F-06-08 REVISION NO. 1 ISSUE DATE: 08/01/24

ALS Laboratory Group

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PROBE NOZZLE DIAMETER CALIBRATION DATA SHEET

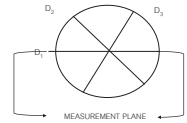
Calibration Date : 10 Jul 24				Nozzle Set ID : BKK_F50524	
Calibration Sheet No. : C-100724-BKK_F50524				Vernier Caliper ID : BKK_FS1123	
Nozzle ID #	Nozzle Diameter (cm.)			H - L ₀	(D ₁ + D ₂ + D ₃) / 3
	D ₁	D ₂	D ₃	ΔD	D _{avg}
1	0.318	0.318	0.318	0.000	0.318
2	0.472	0.474	0.475	0.003	0.474
3	0.632	0.635	0.634	0.003	0.634
4	0.792	0.792	0.792	0.000	0.792
5	0.952	0.952	0.952	0.000	0.952
6	1.091	1.110	1.092	0.019	1.098
7	1.256	1.262	1.262	0.006	1.260
8	1.601	1.598	1.600	0.003	1.600

Where :

D₁, D₂, D₃ = Three different nozzle diameters at 60 degrees to each other, each measured the nearest 0.025 mm.

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

D_{avg} = (D₁ + D₂ + D₃) / 3



Calibrated by : Sakitt Phaisanphut
(Mr. Sakitt Phaisanphut)
RYG Field Service Scientist (4)

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

FORM NO. : F 06-124 REVISION NO. : 0 ISSUE DATE: 26/12/23



Stopwatch Calibration Test Report

Calibration Date : 10 Jul 24 Next Cal. Date : 10 Jan 25
Barometric Pressure (mmHg) : 752.4 Temperature (°C) : 29.2
Relative Humidity (%) : 64.0

Reference Stopwatch Data

Stopwatch ID No. : RYG_FS0540
Model : F808
Serial No. : E18061
Calibration Date : 4 Jul 24
Certificate No. : E-2407022

Console Control Meter Data

Dry Gas Meter No. : BKK_FS518
Model : XC-572-V
Serial No. : 1504025

Run No.	Time Actual (m:ss.ms)	Time Reading (m:ss)	Diff. (ms)	Diff. (min)
1	5:00:03	5:00	3	0.00005
2	5:00:07	5:00	7	0.00012
3	5:00:07	5:00	7	0.00012
4	5:00:08	5:00	8	0.00013
5	5:00:05	5:00	5	0.00008
6	5:00:06	5:00	6	0.00010
7	5:00:06	5:00	6	0.00010
8	5:00:06	5:00	6	0.00010
9	5:00:07	5:00	7	0.00012
10	5:00:07	5:00	7	0.00012
Average			7	0.00010
SD				0.00002

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



DIGITAL TEMPERATURE CALIBRATION DATA SHEET

Calibration Date : 10 Jul 24			Ambient Temperature (°C)		29.2		
Calibration sheet No. : C-10724-BKK_FS0519			Relative Humidity (%) :		64		
Digital Temperature ID : BKK_FS0519			Reference Temperature ID :		RYG_FS0681		
Serial No. : 1504025			Serial No. : 20100014918				
Model : XC-572-V			Model : Digicon-CC-VT-MS				
			Next Calibrate : 13 Nov 24				
Location	Reference Temperature		Digital Temperature		Error	MPE	Pass / Fail
	°C	°C	°C	°C			
Stack	0	0	0	0	±3	Pass	
	25	25	0	0	±3	Pass	
	50	50	0	0	±3	Pass	
	100	100	0	0	±3	Pass	
	150	150	0	0	±3	Pass	
	200	201	1	1	±3	Pass	
	250	251	1	1	±3	Pass	
	300	301	1	1	±3	Pass	
	350	301	1	1	±3	Pass	
	500	501	1	1	±3	Pass	
Probe	100	100	0	0	±3	Pass	
	120	121	1	1	±3	Pass	
	140	141	1	1	±3	Pass	
	160	160	0	0	±3	Pass	
	180	180	0	0	±3	Pass	
Oven	100	100	0	0	±3	Pass	
	120	121	1	1	±3	Pass	
	140	141	1	1	±3	Pass	
	160	160	0	0	±3	Pass	
	180	180	0	0	±3	Pass	
Filter	100	100	0	0	±3	Pass	
	120	121	1	1	±3	Pass	
	140	141	1	1	±3	Pass	
	160	160	0	0	±3	Pass	
	180	180	0	0	±3	Pass	
Exit	0	0	0	0	±3	Pass	
	10	9	-1	-1	±3	Pass	
	20	19	-1	-1	±3	Pass	
	30	29	-1	-1	±3	Pass	
	40	39	-1	-1	±3	Pass	
Meter	0	0	0	0	±3	Pass	
	25	25	0	0	±3	Pass	
	50	51	1	1	±3	Pass	
	75	75	0	0	±3	Pass	
	100	100	0	0	±3	Pass	
AUX	0	0	0	0	±3	Pass	
	25	25	0	0	±3	Pass	
	50	51	1	1	±3	Pass	
	75	75	0	0	±3	Pass	
	100	100	0	0	±3	Pass	

MPE : (Maximum permissible error of measurement) ค่าความคลาดเคลื่อนสูงสุดที่อนุญาต

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

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



CERTIFICATE OF ANALYSIS

Analytical Result

Component	Reagent Concentration	Certified Concentration	Calculated Concentration	Method	Assay Date
Oxygen in Nitrogen	16.8 %	16.0 %	16.1 % relative	(2) 1-PB-356	24-Sep-2016

Reference Standard used in Assay

Reference Standard	Cylinder No.	Concentration	Expiry Date
Oxygen in Nitrogen	243625SG	25.08 ± 0.13 %	19-Aug-2017

Analytical Instruments used in Assay

Instrument Make/Model	Antibiotic Isotope	Last Multiscan Calibration
Servomex 4100 O2 Analyzer	Paramagnetic	24-Sep-2016

Method of Analysis
1. Gas Chromatograph
2. Paramagnetic Oxygen Analyzer
3. Chromatographic Oxygen Analyzer
4. Electrochemical Moisture Analyzer
5. Titrated Hydrocarbon Analyzer
6. Other specified

Cylinder Number 36375
Production Order Number 9013789

Certification Date: 24-Sep-2016
Expiration Date: 24-Sep-2024

Page 2 of 2

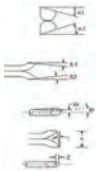
บริษัท ลินด์ (ประเทศไทย) จำกัด (มหาชน)
Head Office: 105 Moo 6, Bang Pakong Industrial Estate, Bang Pakong, Nakhon Si Thammarat 86110, Thailand
Tel: (662) 238-6100 Fax: (662) 238-6101
Branch Office: 105 Moo 6, Bang Pakong Industrial Estate, Bang Pakong, Nakhon Si Thammarat 86110, Thailand
Tel: (662) 238-6100 Fax: (662) 238-6101

Linde (Thailand) Public Company Limited
Head Office: 105 Moo 6, Bang Pakong Industrial Estate, Bang Pakong, Nakhon Si Thammarat 86110, Thailand
Tel: (662) 238-6100 Fax: (662) 238-6101
Branch Office: 105 Moo 6, Bang Pakong Industrial Estate, Bang Pakong, Nakhon Si Thammarat 86110, Thailand
Tel: (662) 238-6100 Fax: (662) 238-6101



Type S Pitot Tube Calibration

Date Calibration 10-Jul-24 Due Date 10-Jan-25
Pitot ID BKK_FS0523 Indinometer ID BKK_FS1131
Pitot SN - Vernier ID RYG_FS0539



Parameter	Value	Allowable Range	Check
α1	-0.2	-10° < α1 < +10°	OK
α2	2.4	-10° < α2 < +10°	OK
β1	-1.2	-5° < β1 < +5°	OK
β2	-1.6	-5° < β2 < +5°	OK
γ	-1.1	-	-
θ	0.2	-	-
Z = A tan γ	-0.018	Z ≤ 0.125"	OK
W = A tan θ	0.003	W ≤ 0.031"	OK
Dt	0.308	0.188" to 0.375"	OK
A/2Dt	1.494	1.05 ≤ A/2Dt ≤ 1.5	OK
A	0.92	2.1Dt ≤ A ≤ 3Dt	OK

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

Calibrated by : Sakitt Phaisanphut Approved by : Nattapong Jongsamreang
Mr. Sakitt Phaisanphut Mr. Nattapong Jongsamreang
RYG Field Services Scientist (4) RYG Field Services Specialist (1)

FORM NO. : F 06-124 REVISION NO. : 0 ISSUE DATE: 26/12/23



CONSOLE CONTROL UNIT CALIBRATION TEST REPORT

Calibration of Date : 10-Jul-24 Barometric Pressure (mmHg) : 752.4
Next Cal. Date : 10-Jan-25 Relative Humidity (%) : 64.0
Temperature (°C) : 29.2

Console Control Meter Data

Calibration No. : C-100724-BKK_FS0518
Dry Gas Meter ID : BKK_FS0518
Serial No. : 1504025
Model No. : XC-572-V

Reference Dry Gas Meter ID : BKK_FS1122
Serial No. : A2003240
Correction Factor (Y) : 0.9824
Next Calibration Date : 7-Nov-24

AH (mm H ₂ O)	θ	Reference Dry Gas Meter Calibration				Console Control : Drygas Meter						Dry Gas Meter Corrections		Orifice Calibration
		Wt (Lb/m ³)		T (°C)	Wt (Lb/m ³)		T (°C)	T (°C)	Avg T (°C)	Factor (F)	Factor (F)			
		Final	Initial		Final	Initial						Final	Initial	
15	12.00	150.00	0.00	150.00	29.0	701379.0	701230.0	149.0	29.0	29.0	0.9968	44.5279		
25	9.10	150.00	0.00	150.00	29.0	701528.0	701380.0	149.0	30.0	30.0	0.9985	42.3680		
50	6.34	150.00	0.00	150.00	29.0	701679.0	701530.0	149.0	30.0	30.0	0.9974	41.1305		
80	5.00	150.00	0.00	150.00	30.0	701830.0	701680.0	150.0	31.0	31.0	0.9780	41.0963		
120	4.08	150.00	0.00	150.00	30.0	701980.0	701830.0	150.0	31.0	31.0	0.9742	41.0164		
										Avg	0.9854	41.0378		

Y = Ratio of reading of reference to dry gas meter - tolerance for individual values ± 0.02 from average.
ΔW = Orifice pressure differential that equals to 21.24 in of air @ 25 °C and 760 mm of mercury - method; tolerance for individual values ± 0.08 from average.

Procedure: 40 CFR 60 APP A METH 3E C 3.3 & 7

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

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



Calibration Certificate

Certificate No. 610563

Sold To:

Product 200-610M Defender S10 Medium Flow
 Serial No. 151114
 Cal. Date 21-May-2024

All calibrations are performed in accordance with ISO 17025 at Mesa Laboratories, Inc., 12100 W. 8th Ave., Lakewood, CO 80226, an ISO 17025:2017 accredited laboratory through NVLAP. This report shall not be reproduced except in full without the written approval of the laboratory. Results only relate to the items calibrated. This report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S. Government.

As Received Calibration Data

Technician	Derek Delage	Lab. Pressure	514.2 mmHg
		Lab. Temperature	24.3 °C
Instrument Reading	Lab Standard Reading	Deviation	Alternate Deviation
0 ccm	4004.81 ccm	-100.0%	1.00%
0 ccm	1000.88 ccm	-100.0%	1.00%
0 ccm	249.56 ccm	-100.0%	1.00%

As Received:
 Out of Tolerance
 Out of Tolerance
 Out of Tolerance

Mesa Laboratories Standards Used

Description	Standard Serial Number	Calibration Date	Calibration Due Date
ML-800-24	117991	13-Nov-2023	13-Nov-2024

Mesa Laboratories Inc. 12100 W. 8th Ave., Lakewood, CO 80226 USA
 (303) 987-6200 www.mesalabs.com Symbol "MLAB" on the NASDAQ

FM-00228 Rev B



As Shipped Calibration Data

Certificate No	610563	Lab. Pressure	617 mmHg
Technician	Derek Delage	Lab. Temperature	24.6 °C
Instrument Reading	Lab Standard Reading	Deviation	Alternate Deviation
4482.47 ccm	4493.49 ccm	-0.25%	1.00%
997.25 ccm	998.53 ccm	-0.04%	1.00%
248.51 ccm	248.67 ccm	-0.06%	1.00%

As Shipped:
 In Tolerance
 In Tolerance
 In Tolerance

Mesa Laboratories Standards Used

Description	Standard Serial Number	Calibration Date	Calibration Due Date
ML-800-24	211063	04-Oct-2023	04-Oct-2024

Calibration Notes

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

Technician Notes:

By: *Troy Thacker*
 Approved By: *Troy Thacker*
 Production Assembly Engineer

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

Mesa Laboratories Inc. 12100 W. 8th Ave., Lakewood, CO 80226 USA
 (303) 987-6200 www.mesalabs.com Symbol "MLAB" on the NASDAQ

FM-00228 Rev B

INNOVATIVE INSTRUMENT CALIBRATION LAB
 INNOVATIVE INSTRUMENT CALIBRATION LAB
 7100 MIDWAY ROAD, SUITE 100, BANGOR, ME 04401
 AMERICAN BUREAU OF CALIBRATION (ABC) 10000 BANGOR, ME 04401
 TEL: (207) 625-7000 FAX: (207) 625-7001



Certificate of Calibration

Certificate No. : 24-AFM-018 Rev. 1

Request No. : Req-2024-0043

Customer : ALS Laboratory Group Thailand Co., Ltd.
 Address : 104 Soi Phatthanasak 40, Phatthanasak Road, Suan Lum, Bangkok
 10250

Unit Under Calibration Details

Measurement Item : Air Flow Meter

Manufacturer : Bree

Model : Definite S10-E

Serial Number : 200805

ID : BKK_FS1140

Location of Calibration : LAB-A AIR VELOCITY METER

Calibration Environment and Details

Temperature : 23 °C ± 1 °C

Humidity : 55 ± 5% RH ± 20% RH

Barometric Pressure : 1013 hPa ± 10 hPa

Exceeded Date : 3 January 2024

Calibration Date : 29 January 2024

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

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Griffin 3 Low Flow	1550100006	Accredited	12 July 2024
Air Flow Meter	Griffin 3 Standard Flow	1901011001	Accredited	12 July 2024
Temperature meter	Q1 T1	08000007	Qlabnet	27 February 2024
Pressure meter	CPQ2400	410000001002	IPA	9 November 2024

Traceability

This Certificate is traceable to SI Units through Secondary NIST Accreditation No. 1843-01

Note

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

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

Calibration By : *JSC*
 Mr. Jitakorn Srisawas
 Service Calibration Engineer

Approved By : *JSC*
 Mr. Paiton Mallawong
 Calibration Engineer Supervisor
 Issue Date : 1 February 2024

"The results related only to the items calibrated. This certificate shall not be reproduced except in full, without written approval of the Innovate Instrument Co., Ltd."
 FM-700-AFM-01 Rev 02 Issue date 25/01/24

INNOVATIVE INSTRUMENT CALIBRATION LAB
 INNOVATIVE INSTRUMENT CALIBRATION LAB
 7100 MIDWAY ROAD, SUITE 100, BANGOR, ME 04401
 AMERICAN BUREAU OF CALIBRATION (ABC) 10000 BANGOR, ME 04401
 TEL: (207) 625-7000 FAX: (207) 625-7001



Certificate No. : 24-AFM-018 Rev. 1

Request No. : Req-2024-0043

Result of Calibration : Without Adjustment

Temperature (°C)	Pressure (kPa)	STD (mbar)	UUC (mbar)	Error (mbar)	Uncertainty (mbar)
23.00	101.66	20	20.148	0.1	1.3
23.80	101.67	100	99.800	-0.6	2.8
24.90	101.65	199	197.64	-1.3	5.6
25.80	101.61	300	298.15	-1.9	8.4
26.90	101.60	399	400.13	1	11
26.90	101.59	499	478.02	-2.0	6.9

Note

STD = Standard UUC = Unit Under Calibration

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

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

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

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

* Indicates not accredited

End of Certificate

"The results related only to the items calibrated. This certificate shall not be reproduced except in full, without written approval of the Innovate Instrument Co., Ltd."
 FM-700-AFM-01 Rev 02 Issue date 25/01/24



DRY GAS METER CALIBRATION TEST REPORT

Calibration of Date 10-Jul-24 Barometric Pressure (mm.Hg) : 752.4
 Next Calibration Date 10-Jan-25 Relative Humidity (%) 64.0
 Temperature (°C) 29.2

Dry Gas Meter Data

Calibration sheet No. : C-100724-BKK_FS0534

Dry Gas Meter ID BKK_FS0534

Serial No. 1509020

Model No. XC-60-CV

Reference Dry Gas Meter Data

Reference Dry Gas Meter ID : BKK_FS1122

Serial No. A2003240

Correction Factor (Y) : 0.9824

Next Calibration Date : 7-Nov-24

Reference Dry Gas Meter Calibration					Dry Gas Meter								Dry Gas Meter Correction
V ₁ (liters)				T ₁	V ₂ (liters)				T ₁	T ₂	Avg. T ₁	Factor (T ₁)	
				(°C)					(°C)	(°C)		(T ₁)	
Final	Initial	Total			Final	Initial	Total						
30.00	0.00	30.00		29.0	30.23	0.00	30.23		30.0	30.0	30.0	0.9762	
30.00	0.00	30.00		29.0	30.11	0.00	30.11		30.0	30.0	30.0	0.9821	
60.00	0.00	60.00		30.0	60.17	0.00	60.17		31.0	31.0	31.0	0.9829	
60.00	0.00	60.00		30.0	60.42	0.00	60.42		31.0	31.0	31.0	0.9788	
90.00	0.00	90.00		30.0	91.63	0.00	91.63		31.0	31.0	31.0	0.9660	
90.00	0.00	90.00		31.0	91.96	0.00	91.96		32.0	32.0	32.0	0.9647	
												Avg	0.9794

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

Calibrated by : *Jitakorn Srisawas*
 Mr. J. (Jitakorn Srisawas)
 RYG Field Service Scientist (2)

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

FORM NO. I 06-023 REVISION NO. 1 ISSUE DATE: 30/02/22



DIGITAL TEMPERATURE CALIBRATION DATA SHEET

Calibration Date : 10 Jul 24		Ambient Temperature (°C) 29.2			
Calibration sheet No. : C-100724-BKK_FS0534		Relative Humidity (%) 64			
Digital Temperature ID : BKK_FS0534		Reference Temperature ID RYG_FS0081			
Serial No. : 1509020		Serial No. : 201000014918			
Model : XC-60-CV		Model : Digicon-CC-VT-AS			
		Next Calibrate : 13 Nov 24			
Location	Reference Temperature °C	Digital Temperature °C	Error °C	MPE	Pass / Fail
Stock	0	1	1	±3	Pass
	25	27	2	±3	Pass
	50	51	1	±3	Pass
	100	101	1	±3	Pass
	150	152	2	±3	Pass
	200	201	1	±3	Pass
	250	252	2	±3	Pass
	300	302	2	±3	Pass
	500	502	2	±3	Pass
	1000	102	2	±3	Pass
Probe	120	122	2	±3	Pass
	140	142	2	±3	Pass
	160	-	-	-	-
Oven	100	-	-	-	-
	120	-	-	-	-
	140	-	-	-	-
Filter	100	102	2	±3	Pass
	120	122	2	±3	Pass
	140	142	2	±3	Pass
Exit	0	1	1	±3	Pass
	10	11	1	±3	Pass
	20	21	1	±3	Pass
Meter	0	1	1	±3	Pass
	25	26	1	±3	Pass
	50	51	1	±3	Pass
AUX	0	2	2	±3	Pass
	25	27	2	±3	Pass
	50	51	1	±3	Pass

MPE : (Maximum permissible error of measurement) ค่าความคลาดเคลื่อนสูงสุดที่อนุญาต

Calibrated by : *Jitakorn Srisawas*
 (Mr. Jitakorn Srisawas)
 RYG Field Service Scientist (2)

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

FORM NO. I 06-027 REVISION NO. 2 ISSUE DATE: 16/02/23

Certificate of Calibration

Customer : Certificate No : 24-AFM-174
Name : AUS Laboratory Group Thailand Co., Ltd.
Address : 104 Soi Phatthanakarn 46, Phatthanakarn Road, Suan Lum,
Bangkok 10250
Request No : Req-2024-1801

Unit Under Calibration Details
Measurement Item : Air Flow Meter
Manufacturer : Minox
Model : 310-41
Serial Number : 308347
ID : BKG_791347
Accuracy : 1% of Reading
Sensor Model : -
Reference Serial Number : -
Instrument Status : Used
Location of Calibration : LAB 4 AIR VELOCITY METER

Calibration Environment and Details
Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 20 %RH
Barometric Pressure : 1013 kPa ± 10 kPa
Received Date : 22 August 2024
Calibration Date : 28 August 2024

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

REVIEW BY: 
APPROVED BY: 
NEXT CAL DATE: 26/8/29

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Gilibrator 3 Low flow	18501010060	Sensidyne	9 August 2025
Air Flow Meter	Gilibrator 3 Standard flow	19031011003	Sensidyne	2 August 2025
Temperature meter	GT 11	00000037	Qubase	1 March 2025
Pressure meter	CPG2400	410000201031002	TPA	9 November 2024

Traceability :
This Certificate is traceable to SI Unit through Sensidyne A2LA Accreditation No. 3943.01
Note :
The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor k = 2, providing a level of confidence approximately 95 %.

Calibration By : 
Mr. Nopphadol Luangrat
Service Calibration Engineer
Approved By : 
Mr. Pait Mahaveon
Calibration Engineer Supervisor
Issue Date : 28 August 2024

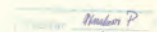
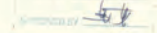
Certificate of Calibration

Customer : Certificate No : 24-AFM-032
Name : AUS Laboratory Group Thailand Co., Ltd.
Address : 104 Soi Phatthanakarn 46, Phatthanakarn Road, Suan Lum, Bangkok
10250
Request No : Req-2024-0240

Unit Under Calibration Details
Measurement Item : Primary Flow Calibrator
Manufacturer : Bios
Model : Deluder 310-M
Serial Number : 129598
ID : RYG_736209
Accuracy : 1% of Reading
Sensor Model : -
Reference Serial Number : -
Instrument Status : Used
Location of Calibration : LAB 4 AIR VELOCITY METER



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

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

REVIEW BY: 
APPROVED BY: 
NEXT CAL DATE: 13/6/26

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Gilibrator 3 Low flow	18501010060	Sensidyne	12 July 2024
Air Flow Meter	Gilibrator 3 Standard flow	19031011003	Sensidyne	12 July 2024
Temperature meter	GT 11	00000037	Qubase	27 February 2024
Pressure meter	CPG2400	410000201031002	TPA	9 November 2024

Traceability :
This Certificate is traceable to SI Unit through Sensidyne A2LA Accreditation No. 3943.01
Note :
The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor k = 2, providing a level of confidence approximately 95 %.

Calibration By : 
Mr. Nopphadol Luangrat
Service Calibration Engineer
Approved By : 
Mr. Pait Mahaveon
Calibration Engineer Supervisor
Issue Date : 13 February 2024

Certificate of Calibration

Customer : Certificate No : 24-AFM-031
Name : AUS Laboratory Group Thailand Co., Ltd.
Address : 104 Soi Phatthanakarn 46, Phatthanakarn Road, Suan Lum, Bangkok
10250
Request No : Req-2024-0241

Unit Under Calibration Details
Measurement Item : Primary Flow Calibrator
Manufacturer : Bios
Model : Deluder 310-E
Serial Number : 130827
ID : RYG_736208
Accuracy : 1% of Reading
Sensor Model : -
Reference Serial Number : -
Instrument Status : Used
Location of Calibration : LAB 4 AIR VELOCITY METER



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

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

REVIEW BY: 
APPROVED BY: 
NEXT CAL DATE: 13/6/26

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Gilibrator 3 Low flow	18501010060	Sensidyne	12 July 2024
Air Flow Meter	Gilibrator 3 Standard flow	19031011003	Sensidyne	12 July 2024
Temperature meter	GT 11	00000037	Qubase	27 February 2024
Pressure meter	CPG2400	410000201031002	TPA	9 November 2024

Traceability :
This Certificate is traceable to SI Unit through Sensidyne A2LA Accreditation No. 3943.01
Note :
The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor k = 2, providing a level of confidence approximately 95 %.

Calibration By : 
Mr. Nopphadol Luangrat
Service Calibration Engineer
Approved By : 
Mr. Pait Mahaveon
Calibration Engineer Supervisor
Issue Date : 13 February 2024

Certificate No : 24-AFM-174 Request No : Req-2024-1801

Result of Calibration : Without Adjustment

Temperature	Pressure	STD	UUC	Error	Uncertainty	MPE	Result
(°C)	(kPa)	(cc/min)	(cc/min)	(cc/min)	(cc/min)	(cc/min)	
22.30	100.27	100	99.526	-0.5	2.8	1	N/A
22.40	100.61	499	500.46	1.5	7.8	3	N/A
22.50	100.56	1004	1004.8	3	13	10	N/A
22.60	100.54	3008	3003.3	-5	29	20	N/A
22.80	100.62	3014	3012.1	-2	43	30	N/A
23.20	100.71	4022	4022.4	10	60	40	N/A
23.40	100.73	5060	5058.4	-4	79	51	N/A

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

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

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

* Indicates non-accepted
MPE = Maximum Permissible Error (Specified in Manufacturer's Specifications)
N/A = Not Available, Customer does not require a statement of conformity

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

Result of Calibration : Without Adjustment

Temperature	Pressure	STD	UUC	Error	Uncertainty
(°C)	(kPa)	(cc/min)	(cc/min)	(cc/min)	(cc/min)
22.80	101.89	95	100.13	5.3	2.8
23.90	101.71	501	513.93	12.9	7.2
24.10	101.62	1006	1019.3	13	14
24.06	101.61	1997	2023.0	26	29
24.30	101.87	2999	3035.5	37	45
24.80	102.09	3944	3991.9	48	59
24.80	102.08	4739	4780.5	52	72

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

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

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

* Indicates non-accepted

End of Certificate

Certificate No : 24-AFM-031 Request No : Req-2024-0241

Result of Calibration : Without Adjustment

Temperature	Pressure	STD	UUC	Error	Uncertainty
(°C)	(kPa)	(cc/min)	(cc/min)	(cc/min)	(cc/min)
28.10	101.26	20	19.965	0.6	1.3
28.20	101.25	101	100.30	-0.5	2.8
28.80	101.31	200	199.13	-0.9	5.6
23.90	101.42	301	303.56	2.6	6.4
28.10	101.41	401	404.37	4	11
28.10	101.49	400	403.81	3.8	7.0

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

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

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

* Indicates non-accepted

End of Certificate



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 : 8107412
WPS-30001SL	S/N : 8107446
FCC-3000SD	S/N : 81066547
DAD-3000	S/N : 8107298

For
ALS Laboratory Group (Thailand) Co.,Ltd

Operator Signature: _____ Date: 16-17/Jan/2024
 (Mr. Supanun Phumponum)
 Test Engineer

REVIEW BY: *Parity B...*
 APPROVED BY: *S. A...*
 NEXT CAL DATE: 16-Jan-25

INNOVATIVE INSTRUMENT CALIBRATION LAB
 INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
 7 CHOMDIT 15, MOH NITAYAKHIN 11 TAMBON BANG KAEU
 AMPHUR BANG PHRAE (BANG) PROVINCE 10140 THAILAND
 TEL : 08002730000 FAX : 0800273007000

Certificate No : 24-AFM-177
 Request No : Req/2024-1862

Result of Calibration : Without Adjustment

Temperature (°C)	Pressure (kPa)	STD (cc/min)	UUC (cc/min)	Error (cc/min)	Uncertainty (cc/min)	MPE (cc/min)	Result
24.70	100.92	20	20.192	0.2	1.3	0.2	N/A
24.70	100.90	100	99.923	-0.1	2.8	1.0	N/A
24.70	100.84	200	200.7	-0.3	5.6	2.0	N/A
24.70	100.97	298	298.1	-0.1	8.4	3.0	N/A
24.70	100.99	403	399.1	-4	11	4.0	N/A
24.80	101.07	482	477.6	-4.4	9.9	4.0	N/A

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




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

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

* Indicates not accredited
 MPE = Maximum Permissible Error (Specified in Manufacturer's Specifications)
 N/A = Not Available, Customer does not require a statement of conformity.

The results stated only to the user calibration. The certificate shall not be reproduced except in full, without written approval of the Issuance Issuance Co., Ltd.
 IAG-MRA-01 Rev.04 Issue Date 17/07/24

INNOVATIVE INSTRUMENT CALIBRATION LAB
 INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
 7 CHOMDIT 15, MOH NITAYAKHIN 11 TAMBON BANG KAEU
 AMPHUR BANG PHRAE (BANG) PROVINCE 10140 THAILAND
 TEL : 08002730000 FAX : 0800273007000

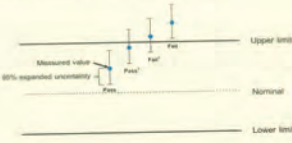




Certificate No : 24-AFM-174
 Request No : Req/2024-1861

Decision Rule for Statements of Conformity

The standard decision rule employed for the statements of conformity in each calibration result will be applied using IAG-MRA-01/2019 Guidelines on the Reporting of Conformity with Specification as following Fig. and statement:

Pass - The measurement result plus the expanded uncertainty with a 95% coverage probability was within the limit.
 Fail - The measurement result was outside the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.
 Fail - The measurement result was outside the limit. However, a portion of the expanded uncertainty of measurement at 95% is within the limit.
 Fail - The measurement result plus the expanded uncertainty with a 95% coverage probability was outside the limit.



End of Certificate

The results stated only to the user calibration. The certificate shall not be reproduced except in full, without written approval of the Issuance Issuance Co., Ltd.
 IAG-MRA-01 Rev.04 Issue Date 17/07/24

BKK_EN0119

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Certificate of System Qualification
 GC-QC + GCMS-QQ

System ID: DSA-2
 Organization Name: ALS Laboratory Group (Thailand) Co., Ltd.
 Organization Location: 104 Phatthanasuk 40, Phatthanasuk Rd, Khlongwong Suburb, Bang Khen District, Bangkok 10250

Date: April 16, 2023 3:15:25 PM
 EOP Name: AgilentRecommended, AgilentRecommended
 EOP Revision: GC-QC-01, GCMS-QC-01
 Overall Qualification Status: Pass

System Inspection and Basic Safety and Operation
 Name: 7880
 Setpoint Status: Pass

Overall System Inspection and Basic Safety and Operation Test Status
 Pass

Inlet Pressure Accuracy
 Name: 7880
 Front MM
 Setpoint Status: Pass
 Inlet Pressure: 25.0 psi Actual 25.0 psi
 Accuracy: 0.0 psi
 Agilent Recommended: 1.2




Overall Inlet Pressure Accuracy Test Status
 Pass

GC Oven Temperature Accuracy
 Name: 7880
 Date: April 16, 2023 3:15:25 PM
 System ID: DSA-2

REVIEW BY: *Suchada T.*
 APPROVED BY: *Supanun P.*
 NEXT CAL DATE: 16 Jan 25

Page 1/19

INNOVATIVE INSTRUMENT CALIBRATION LAB
 INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
 7 CHOMDIT 15, MOH NITAYAKHIN 11 TAMBON BANG KAEU
 AMPHUR BANG PHRAE (BANG) PROVINCE 10140 THAILAND
 TEL : 08002730000 FAX : 0800273007000

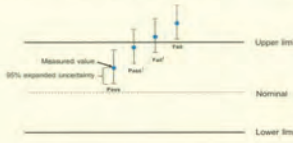




Certificate No : 24-AFM-177
 Request No : Req/2024-1862

Decision Rule for Statements of Conformity

The standard decision rule employed for the statements of conformity in each calibration result will be applied using IAG-MRA-01/2019 Guidelines on the Reporting of Conformity with Specification as following Fig. and statement:

Pass - The measurement result plus the expanded uncertainty with a 95% coverage probability was within the limit.
 Fail - The measurement result was outside the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.
 Fail - The measurement result was outside the limit. However, a portion of the expanded uncertainty of measurement at 95% is within the limit.
 Fail - The measurement result plus the expanded uncertainty with a 95% coverage probability was outside the limit.



End of Certificate

The results stated only to the user calibration. The certificate shall not be reproduced except in full, without written approval of the Issuance Issuance Co., Ltd.
 IAG-MRA-01 Rev.04 Issue Date 17/07/24

INNOVATIVE INSTRUMENT CALIBRATION LAB
 INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
 7 CHOMDIT 15, MOH NITAYAKHIN 11 TAMBON BANG KAEU
 AMPHUR BANG PHRAE (BANG) PROVINCE 10140 THAILAND
 TEL : 08002730000 FAX : 0800273007000





Certificate of Calibration

Customer: ALS Laboratory Group (Thailand) Co., Ltd.
 Address: 104 Soi Phatthanasuk 40, Phatthanasuk Road, Bang Khen District, Bangkok 10250

Certificate No : 24-AFM-177
 Request No : Req/2024-1862

Unit Under Calibration Details
 Measurement Item: Air Flow Meter
 Manufacturer: Bree
 Model: Defender 210-L
 Serial Number: 138080
 ID: BKK_F90019

Location of Calibration: LAB 4 AIR VELOCITY METER
 Calibration Environment and Details
 Temperature: 23.7°C ± 0.1°C
 Humidity: 55%RH ± 20%RH
 Barometric Pressure: 1013 hPa ± 10 hPa
 Received Date: 22 August 2024
 Calibration Date: 9 September 2024
 Calibration Procedure: Reference method (CF-APM-01) by Comparison technique with Standard Primary Flow Calibration

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Calibrator 3 Low flow	1850010000	Sensidyne	8 August 2025
Air Flow Meter	Calibrator 3 Standard flow	1901011001	Sensidyne	2 August 2025
Temperature sensor	42T 11	00000077	Quborn	1 March 2027
Pressure sensor	CP0200	41000420-051002	TEPA	9 November 2024

Traceability
 This Certificate is traceable to SI Unit through Sensidyne A2LA Accreditation No. 2943.04.
 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: *Supanun Phumponum*
 Mr. Supanun Phumponum
 Service Calibration Engineer

Approved By: *Parity B...*
 Mr. Parity B...
 Calibration Engineer Supervisor

Issue Date: 9 September 2024

REVIEW BY: *Suchada T.*
 APPROVED BY: *Supanun P.*
 NEXT CAL DATE: 9/9/26

The results stated only to the user calibration. The certificate shall not be reproduced except in full, without written approval of the Issuance Issuance Co., Ltd.
 IAG-MRA-01 Rev.04 Issue Date 17/07/24

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Agilent CrossLab Compliance Services

Instrument Details

Purpose

This section describes the six fluid system configuration.

Details

System

System ID

Q4-2

Manufacturer

Agilent Technologies

Name

7890

Flow Data Input

Manual Data

Temperature Data Input

Manual Data or Other Data Logged

Tested Combination 1

Injection Technique

Injection Tower

Flow

Front

Detector

External

LTM Included?

No

Sample 1

Manufacturer

Agilent Technologies

Type

Injection Tower

Name

7893A

Model Number

Q471A

Serial Number

CN10120121

Firmware Revision

A.10.08

Labels

Sample Injection

Location

Flow

Sample Volume (uL)

10

Date

April 18, 2022 6:15:05 PM

System ID

Q4-2

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Agilent CrossLab Compliance Services

Setpoint Status:

Completed

Injection Volume on Column

1.0

uL

Overall Scouting Run Status

Completed

Signal to Noise E1

Tested Combination 1

Front

MMH

/

External

SQ

Name

5875C Inert XL with TAD

Source

E1 - Inert

Flamelet

1

Setpoint Status:

Pass

Signal to Noise

456

Agilent Recommended

>=

320

Source

E1 - Inert

Flamelet

1

Setpoint Status:

Pass

Signal to Noise

2034

Agilent Recommended

>=

320

Overall Signal to Noise E1 Test Status

Pass

Injection Precision

Tested Combination 1

Front

MMH

/

External

SQ

Name

7893A

Source

E1 - Inert

Setpoint Status:

Pass

Injection Volume on Column

1.0

uL

Area RSD

1.88

%

Agilent Recommended

<=

2.00

Retention Time RSD

0.04

%

Agilent Recommended

<=

1.00

Overall Injection Precision Test Status

Pass

Date

April 18, 2022 5:15:25 PM

System ID

Q4-2

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Setpoint Status:

Pass

Zone

Over

Setpoint Actual

230.0

230.1

°C

Accuracy

0.1

°C

Agilent Recommended

>=

-1.0

% setpoint in K

(

-4.8

°C

)

<=

1.0

% setpoint in K

(

5.2

°C

)

Setpoint Status:

Pass

Zone

Over

Setpoint Actual

100.0

100.4

°C

Accuracy

0.4

°C

Agilent Recommended

>=

-1.0

% setpoint in K

(

-3.7

°C

)

<=

1.0

% setpoint in K

(

3.7

°C

)

Overall GC Oven Temperature Accuracy Test Status

Pass

GC Oven Temperature Stability

Name

7890

Setpoint Status:

Pass

Supertemperature

100.0

100.4

°C

Stability

0.0

°C

Agilent Recommended

<=

0.5

Overall GC Oven Temperature Stability Test Status

Pass

Log Amp

Tested Combination 1

Front

MMH

/

External

SQ

Name

5875C Inert XL with TAD

Setpoint Status:

Pass

Date

April 18, 2022 3:15:05 PM

System ID

Q4-2

Page 2 / 15

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Agilent CrossLab Compliance Services

Sample 1

Manufacturer

Agilent Technologies

Type

Tier

Name

7893A

Model Number

Q471A

Serial Number

CN10000098

Firmware Revision

A.10.10

Yrd Tester

Not Installed

Manifold 1

Manufacturer

Agilent Technologies

Name

7890

Model Number

Q471A

Serial Number

CN10141049

Firmware Revision

A.01.18

Over Type

Standard

Valve 1

Manufacturer

Agilent Technologies

Name

7890

Type

MMH

Location

Front

Control Gas

Heads

Control Type

Electronic Pressure Control (EPC)

Purged Inlet

Yes

Detector 1

Manufacturer

Agilent Technologies

Name

Mass Spectrometer

Type

Mass Spectrometer

Location

External

Date

April 18, 2022 3:15:25 PM

System ID

Q4-2

Page 7 / 15

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Agilent CrossLab Compliance Services

Mass Ratio Precision

Tested Combination 1

Front

MMH

/

External

SQ

Name

Injection Tower

Source

E1 - Inert

Setpoint Status:

Pass

Injection Volume on Column

1.0

uL

Area Mass

1.66

Abundance

1.66

%

Agilent Recommended

<=

5.00

Mass Ratio

0.39

%

Agilent Recommended

<=

5.00

Overall Mass Ratio Precision Test Status

Pass

Date

April 18, 2022 3:15:25 PM

System ID

Q4-2

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Agilent CrossLab Compliance Services

Overall Log Amp Test Status

Pass

RFFA

Tested Combination 1

Front

MMH

/

External

SQ

Name

5875C Inert XL with TAD

Setpoint Status:

Pass

Area

1000

uV

ORR After Five Minutes

4

mV

RFFA Voltage

481

mV

Agilent Recommended

>=

-100

and

<=

100

<=

1500

Overall RFFA Test Status

Pass

Tune E1

Tested Combination 1

Front

MMH

/

External

SQ

Name

5875C Inert XL with TAD

Setpoint Status:

Pass

Flamelet

1

Setpoint Status:

Pass

Flamelet

2

Overall Tune E1 Test Status

Pass

Scouting Run

Tested Combination 1

Front

MMH

/

External

SQ

Name

Injection Tower

7893A

Source

E1 - Inert

Date

April 18, 2022 3:15:25 PM

System ID

Q4-2

Page 3 / 15

Overall Inlet Pressure Decay Test Status

Pass

Inlet Pressure Accuracy

Name: 7890
Front SS

Setpoint Status:

Pass

Setpoint: 25.0 psi Actual: 25.2 psi

Accuracy: 0.2 psi

Agilent Recommended: ±1.2 psi

Overall Inlet Pressure Accuracy Test Status

Pass

Inlet Pressure Decay

Name: 7890
Back SS

Setpoint Status:

Pass

Pressure: 25.0 psi

Pressure Change: 0.5 psi 15 minutes

Agilent Recommended: ±2.0 psi and ±0.5

Overall Inlet Pressure Decay Test Status

Pass

Inlet Pressure Accuracy

Name: 7890
Back SS

Date: April 21, 2023 3:29:38 PM

System ID: CN11461096

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Setpoint Status:

Pass

Setpoint: 25.0 psi Actual: 24.8 psi

Accuracy: 0.2 psi

Agilent Recommended: ±1.2 psi

Overall Inlet Pressure Accuracy Test Status

Pass

Detector Flow Accuracy

Name: 7890
Front FID

Setpoint Status:

Pass

Flow Type: Fuel

Setpoint: 30.0 mL/min Measured Flow: 28.9 mL/min

Accuracy: 1.1 mL/min

Agilent Recommended: ±10.0 % setpoint (3.0 mL/min)

Limit is percentage of setpoint or 0.5 mL/min, whichever is largest.

Setpoint Status:

Pass

Flow Type: Oxidizer

Setpoint: 400.0 mL/min Measured Flow: 420 mL/min

Accuracy: 0.0 mL/min

Agilent Recommended: ±10.0 % setpoint (40.0 mL/min)

Limit is percentage of setpoint or 0.5 mL/min, whichever is largest.

Setpoint Status:

Pass

Flow Type: Makeup

Setpoint: 25.0 mL/min Measured Flow: 23.9 mL/min

Accuracy: 0.1 mL/min

Agilent Recommended: ±10.0 % setpoint (2.5 mL/min)

Limit is percentage of setpoint or 0.5 mL/min, whichever is largest.

Date: April 21, 2023 3:29:38 PM

System ID: CN11461096

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User Name: agilent\jimmyhuan

System ID: CN14

Print Date: April 18, 2023 5:10:16 PM

ALS 400 Transmittance Log

Time	Transmittance Data	Activity Performed	Type of Transmittance	Additional Information
April 15, 2023 2:01:00 PM	0.00	Sampling	Signal to Noise (S/N) - System Transmittance (S/N) - System Signal to Noise (S/N) - System Transmittance (S/N) - System	None
April 15, 2023 2:01:00 PM	0.00	Sampling	Signal to Noise (S/N) - System Transmittance (S/N) - System Signal to Noise (S/N) - System Transmittance (S/N) - System	None
April 15, 2023 2:01:00 PM	0.00	Sampling	Signal to Noise (S/N) - System Transmittance (S/N) - System Signal to Noise (S/N) - System Transmittance (S/N) - System	None
April 15, 2023 2:01:00 PM	0.00	Sampling	Signal to Noise (S/N) - System Transmittance (S/N) - System Signal to Noise (S/N) - System Transmittance (S/N) - System	None
April 15, 2023 2:01:00 PM	0.00	Sampling	Signal to Noise (S/N) - System Transmittance (S/N) - System Signal to Noise (S/N) - System Transmittance (S/N) - System	None
April 15, 2023 2:01:00 PM	0.00	Sampling	Signal to Noise (S/N) - System Transmittance (S/N) - System Signal to Noise (S/N) - System Transmittance (S/N) - System	None
April 15, 2023 2:01:00 PM	0.00	Sampling	Signal to Noise (S/N) - System Transmittance (S/N) - System Signal to Noise (S/N) - System Transmittance (S/N) - System	None
April 15, 2023 2:01:00 PM	0.00	Sampling	Signal to Noise (S/N) - System Transmittance (S/N) - System Signal to Noise (S/N) - System Transmittance (S/N) - System	None
April 15, 2023 2:01:00 PM	0.00	Sampling	Signal to Noise (S/N) - System Transmittance (S/N) - System Signal to Noise (S/N) - System Transmittance (S/N) - System	None
April 15, 2023 2:01:00 PM	0.00	Sampling	Signal to Noise (S/N) - System Transmittance (S/N) - System Signal to Noise (S/N) - System Transmittance (S/N) - System	None

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Date: April 18, 2023 5:10:16 PM

System ID: CN14

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User Name: agilent\jimmyhuan

System ID: CN14

Print Date: April 18, 2023 5:10:16 PM

ALS 400 Transmittance Log

Time	Transmittance Data	Activity Performed	Type of Transmittance	Additional Information
April 15, 2023 2:01:00 PM	0.00	Sampling	Signal to Noise (S/N) - System Transmittance (S/N) - System Signal to Noise (S/N) - System Transmittance (S/N) - System	None
April 15, 2023 2:01:00 PM	0.00	Sampling	Signal to Noise (S/N) - System Transmittance (S/N) - System Signal to Noise (S/N) - System Transmittance (S/N) - System	None
April 15, 2023 2:01:00 PM	0.00	Sampling	Signal to Noise (S/N) - System Transmittance (S/N) - System Signal to Noise (S/N) - System Transmittance (S/N) - System	None
April 15, 2023 2:01:00 PM	0.00	Sampling	Signal to Noise (S/N) - System Transmittance (S/N) - System Signal to Noise (S/N) - System Transmittance (S/N) - System	None
April 15, 2023 2:01:00 PM	0.00	Sampling	Signal to Noise (S/N) - System Transmittance (S/N) - System Signal to Noise (S/N) - System Transmittance (S/N) - System	None
April 15, 2023 2:01:00 PM	0.00	Sampling	Signal to Noise (S/N) - System Transmittance (S/N) - System Signal to Noise (S/N) - System Transmittance (S/N) - System	None
April 15, 2023 2:01:00 PM	0.00	Sampling	Signal to Noise (S/N) - System Transmittance (S/N) - System Signal to Noise (S/N) - System Transmittance (S/N) - System	None
April 15, 2023 2:01:00 PM	0.00	Sampling	Signal to Noise (S/N) - System Transmittance (S/N) - System Signal to Noise (S/N) - System Transmittance (S/N) - System	None
April 15, 2023 2:01:00 PM	0.00	Sampling	Signal to Noise (S/N) - System Transmittance (S/N) - System Signal to Noise (S/N) - System Transmittance (S/N) - System	None
April 15, 2023 2:01:00 PM	0.00	Sampling	Signal to Noise (S/N) - System Transmittance (S/N) - System Signal to Noise (S/N) - System Transmittance (S/N) - System	None

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Date: April 18, 2023 5:10:16 PM

System ID: CN14

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Certificate of System Qualification
GC-00

System ID: CN11461096

Organization Name: ALS Laboratory Group (Thailand) Co., Ltd.

Organization Location: 104 Soi 43 Phatthana Rajakong Road, Bang Luang, Bangkok 10250

Date: April 21, 2023 3:29:38 PM

EOP Name: AgilentRecommended

EOP Revision: GC-02.52

Overall Qualification Status: Pass

CDS Logon Verification - GC

Logon: Successful

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 SS

Setpoint Status: Pass

Pressure: 25.0 psi

Pressure Change: 0.1 psi 15 minutes

Agilent Recommended: ±2.0 psi and ±0.5

Date: April 21, 2023 3:29:38 PM

System ID: CN11461096

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User Name: agilent\jimmyhuan

System ID: CN14

Print Date: April 18, 2023 5:10:16 PM

ALS 400 Transmittance Log

Time	Transmittance Data	Activity Performed	Type of Transmittance	Additional Information
April 15, 2023 2:01:00 PM	0.00	Sampling	Signal to Noise (S/N) - System Transmittance (S/N) - System Signal to Noise (S/N) - System Transmittance (S/N) - System	None
April 15, 2023 2:01:00 PM	0.00	Sampling	Signal to Noise (S/N) - System Transmittance (S/N) - System Signal to Noise (S/N) - System Transmittance (S/N) - System	None
April 15, 2023 2:01:00 PM	0.00	Sampling	Signal to Noise (S/N) - System Transmittance (S/N) - System Signal to Noise (S/N) - System Transmittance (S/N) - System	None
April 15, 2023 2:01:00 PM	0.00	Sampling	Signal to Noise (S/N) - System Transmittance (S/N) - System Signal to Noise (S/N) - System Transmittance (S/N) - System	None
April 15, 2023 2:01:00 PM	0.00	Sampling	Signal to Noise (S/N) - System Transmittance (S/N) - System Signal to Noise (S/N) - System Transmittance (S/N) - System	None
April 15, 2023 2:01:00 PM	0.00	Sampling	Signal to Noise (S/N) - System Transmittance (S/N) - System Signal to Noise (S/N) - System Transmittance (S/N) - System	None
April 15, 2023 2:01:00 PM	0.00	Sampling	Signal to Noise (S/N) - System Transmittance (S/N) - System Signal to Noise (S/N) - System Transmittance (S/N) - System	None
April 15, 2023 2:01:00 PM	0.00	Sampling	Signal to Noise (S/N) - System Transmittance (S/N) - System Signal to Noise (S/N) - System Transmittance (S/N) - System	None
April 15, 2023 2:01:00 PM	0.00	Sampling	Signal to Noise (S/N) - System Transmittance (S/N) - System Signal to Noise (S/N) - System Transmittance (S/N) - System	None
April 15, 2023 2:01:00 PM	0.00	Sampling	Signal to Noise (S/N) - System Transmittance (S/N) - System Signal to Noise (S/N) - System Transmittance (S/N) - System	None

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Date: April 18, 2023 5:10:16 PM

System ID: CN14

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Overall Noise and Drift Test Status

Pass

Injection Precision

Tested Combination2 Back SSL / Back FID
Name: 7893A

Setpoint Status:

Pass

Injection Volume on Column: 1.0 µL

Area RSD: 1.28 % Retention Time RSD: 0.63 %
Agilent Recommended: <= 3.00 % <= 1.00 %

Overall Injection Precision Test Status

Pass

Signal to Noise

Tested Combination2 Back SSL / Back FID

Name: 7890

Setpoint Status:

Pass

Signal to Noise: 2404361

Agilent Recommended: >= 100000

Overall Signal to Noise Test Status

Pass

Date: April 21, 2023 3:26:38 PM
System ID: CN11481098

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Setpoint Status:

Completed

Injection Volume on Column: 1.0 µL

Overall Scouting Run Status

Completed

Noise and Drift

Tested Combination1 Front SSL / Front FID

Name: 7890

Setpoint Status:

Pass

Base Signal: 22.7 pA

ASTM Noise pA 0.06

Drift pA/hr 0.00

Agilent Recommended: <= 0.10 <= 2.00

Agilent Recommended:

Status: Pass

Pass

Overall Noise and Drift Test Status

Pass

Injection Precision

Tested Combination1 Front SSL / Front FID

Name: 7893A

Setpoint Status:

Pass

Injection Volume on Column: 1.0 µL

Area RSD: 0.32 % Retention Time RSD: 0.97 %
Agilent Recommended: <= 3.00 % <= 1.00 %

Overall Injection Precision Test Status

Pass

Signal to Noise

Signal to Noise

Date: April 21, 2023 3:26:38 PM
System ID: CN11481098

Page 6 / 23

Overall Detector Flow Accuracy Test Status

Pass

Detector Flow Accuracy

Name: 7890

Back FID

Setpoint Status:

Pass

Flow Type: Flat

Setpoint: 30.0 mL/min

Accuracy: 0.7 mL/min

Agilent Recommended: <= 10.0 % setpoint

Limit is percentage of setpoint or 0.5 mL/min, whichever is largest.

Setpoint Status:

Pass

Flow Type: Outflow

Setpoint: 400.0 mL/min

Accuracy: 1.8 mL/min

Agilent Recommended: <= 10.0 % setpoint

Limit is percentage of setpoint or 0.5 mL/min, whichever is largest.

Setpoint Status:

Pass

Flow Type: Makeup

Setpoint: 25.0 mL/min

Accuracy: 0.4 mL/min

Agilent Recommended: <= 10.0 % setpoint

Limit is percentage of setpoint or 0.5 mL/min, whichever is largest.

Overall Detector Flow Accuracy Test Status

Pass

GC Oven Temperature Accuracy

Name: 7890

Date: April 21, 2023 3:26:38 PM
System ID: CN11481098

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Instrument Details

Purpose:

This section summarizes the all found system configurations.

Details:

System ID:	CN11481098
Manufacturer:	Agilent Technologies
Name:	7890
Flow Data Input:	Manual Data
Temperature Data Input:	Manual Data or Other Data Logging
Tested Combination1:	
Injection Technique:	Injection Tower
Sampler Identifier:	Sampler 2
Inlet:	Front
Detector:	Front
ETM Installed?	No
Tested Combination2:	
Injection Technique:	Injection Tower
Sampler Identifier:	Sampler 3
Inlet:	Back
Detector:	Back
ETM Installed?	No
Detector 1:	
Manufacturer:	Agilent Technologies
Type:	ThiO
Name:	7893A
Model Number:	045144
Serial Number:	CN15360030
Firmware Revision:	A.11.01
Valve Header:	Not Installed

Date: April 21, 2023 3:26:38 PM
System ID: CN11481098

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Tested Combination1 Front SSL / Front FID

Injection Tower

Name: 7890

Setpoint Status:

Pass

Signal to Noise: 721709

Agilent Recommended: >= 100000

Overall Signal to Noise Test Status

Pass

Scouting Run

Tested Combination2 Back SSL / Back FID

Name: 7893A

Setpoint Status:

Completed

Injection Volume on Column: 1.0 µL

Overall Scouting Run Status

Completed

Noise and Drift

Tested Combination2 Back SSL / Back FID

Name: 7890

Setpoint Status:

Pass

Base Signal: 22.8 pA

ASTM Noise pA 0.07

Drift pA/hr 2.50

Agilent Recommended: <= 0.10 <= 2.50

Agilent Recommended:

Status: Pass

Pass

Date: April 21, 2023 3:26:38 PM
System ID: CN11481098

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Setpoint Status:

Pass

Zone: Over

Setpoint/Actual

Temperature: 230.0 230.6 °C

Accuracy: 0.6 °C

Agilent Recommended: <= -1.0 °C setpoint in K

<= 1.0 °C setpoint in K

(- 0.6 °C)

(- 5.0 °C)

Setpoint Status:

Pass

Zone: Over

Setpoint/Actual

Temperature: 100.0 100.9 °C

Accuracy: 0.9 °C

Agilent Recommended: <= -1.0 °C setpoint in K

<= 1.0 °C setpoint in K

(- 3.7 °C)

(- 3.7 °C)

Overall GC Oven Temperature Accuracy Test Status

Pass

GC Oven Temperature Stability

Name: 7890

Setpoint/Average

Temperature: 100.0 100.8833 °C

Stability: 0.1 °C

Agilent Recommended: <= 0.5 °C

Overall GC Oven Temperature Stability Test Status

Pass

Scouting Run

Tested Combination1 Front SSL / Front FID

Injection Tower

Name: 7893A

Date: April 21, 2023 3:26:38 PM
System ID: CN11481098

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User Name: wangqin@agilent.com

Hardware: L49100-00000000000000000000

System ID: C011401000

Print Date: April 21, 2023 3:29:49 PM

SGLA_SGLA_000017_ALA Transaction Log

Date	Transaction Date	Activity Performed	Type of Transaction	Optional Information
April 21, 2023 11:24:07 AM	04/21/2023 11:24:07 AM	Success	SW Pressure Display - Front	Run Count: 1 SGL - Pressure Control 100 + 0.00 gpa (-) to 0.00 gpa +/- 0.0 gpa
April 21, 2023 11:24:07 AM	04/21/2023 11:24:07 AM	Success	SW Pressure Display - Back	Run Count: 1 SGL - Pressure Control 100 + 0.00 gpa (-) to 0.00 gpa +/- 0.0 gpa
April 21, 2023 11:24:07 AM	04/21/2023 11:24:07 AM	Success	SW Pressure Display - Front	Run Count: 2 SGL - Pressure Control 100 + 0.00 gpa (-) to 0.00 gpa +/- 0.0 gpa
April 21, 2023 11:24:07 AM	04/21/2023 11:24:07 AM	Success	SW Pressure Display - Back	Run Count: 2 SGL - Pressure Control 100 + 0.00 gpa (-) to 0.00 gpa +/- 0.0 gpa
April 21, 2023 11:24:07 AM	04/21/2023 11:24:07 AM	Success	SW Pressure Display - Front	Run Count: 3 SGL - Pressure Control 100 + 0.00 gpa (-) to 0.00 gpa +/- 0.0 gpa
April 21, 2023 11:24:07 AM	04/21/2023 11:24:07 AM	Success	SW Pressure Display - Back	Run Count: 3 SGL - Pressure Control 100 + 0.00 gpa (-) to 0.00 gpa +/- 0.0 gpa
April 21, 2023 11:24:07 AM	04/21/2023 11:24:07 AM	Success	SW Pressure Display - Front	Run Count: 4 SGL - Pressure Control 100 + 0.00 gpa (-) to 0.00 gpa +/- 0.0 gpa
April 21, 2023 11:24:07 AM	04/21/2023 11:24:07 AM	Success	SW Pressure Display - Back	Run Count: 4 SGL - Pressure Control 100 + 0.00 gpa (-) to 0.00 gpa +/- 0.0 gpa
April 21, 2023 11:24:07 AM	04/21/2023 11:24:07 AM	Success	SW Pressure Display - Front	Run Count: 5 SGL - Pressure Control 100 + 0.00 gpa (-) to 0.00 gpa +/- 0.0 gpa
April 21, 2023 11:24:07 AM	04/21/2023 11:24:07 AM	Success	SW Pressure Display - Back	Run Count: 5 SGL - Pressure Control 100 + 0.00 gpa (-) to 0.00 gpa +/- 0.0 gpa

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Date: April 21, 2023 3:29:49 PM
System ID: C011401000

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User Name: wangqin@agilent.com

Hardware: L49100-00000000000000000000

System ID: C011401000

Print Date: April 21, 2023 3:29:49 PM

SGLA_SGLA_000017_ALA Transaction Log

Date	Transaction Date	Activity Performed	Type of Transaction	Optional Information
April 21, 2023 11:24:07 AM	04/21/2023 11:24:07 AM	Success	SW Pressure Display - Front	Run Count: 1 SGL - Pressure Control 100 + 0.00 gpa (-) to 0.00 gpa +/- 0.0 gpa
April 21, 2023 11:24:07 AM	04/21/2023 11:24:07 AM	Success	SW Pressure Display - Back	Run Count: 1 SGL - Pressure Control 100 + 0.00 gpa (-) to 0.00 gpa +/- 0.0 gpa
April 21, 2023 11:24:07 AM	04/21/2023 11:24:07 AM	Success	SW Pressure Display - Front	Run Count: 2 SGL - Pressure Control 100 + 0.00 gpa (-) to 0.00 gpa +/- 0.0 gpa
April 21, 2023 11:24:07 AM	04/21/2023 11:24:07 AM	Success	SW Pressure Display - Back	Run Count: 2 SGL - Pressure Control 100 + 0.00 gpa (-) to 0.00 gpa +/- 0.0 gpa
April 21, 2023 11:24:07 AM	04/21/2023 11:24:07 AM	Success	SW Pressure Display - Front	Run Count: 3 SGL - Pressure Control 100 + 0.00 gpa (-) to 0.00 gpa +/- 0.0 gpa
April 21, 2023 11:24:07 AM	04/21/2023 11:24:07 AM	Success	SW Pressure Display - Back	Run Count: 3 SGL - Pressure Control 100 + 0.00 gpa (-) to 0.00 gpa +/- 0.0 gpa
April 21, 2023 11:24:07 AM	04/21/2023 11:24:07 AM	Success	SW Pressure Display - Front	Run Count: 4 SGL - Pressure Control 100 + 0.00 gpa (-) to 0.00 gpa +/- 0.0 gpa
April 21, 2023 11:24:07 AM	04/21/2023 11:24:07 AM	Success	SW Pressure Display - Back	Run Count: 4 SGL - Pressure Control 100 + 0.00 gpa (-) to 0.00 gpa +/- 0.0 gpa
April 21, 2023 11:24:07 AM	04/21/2023 11:24:07 AM	Success	SW Pressure Display - Front	Run Count: 5 SGL - Pressure Control 100 + 0.00 gpa (-) to 0.00 gpa +/- 0.0 gpa
April 21, 2023 11:24:07 AM	04/21/2023 11:24:07 AM	Success	SW Pressure Display - Back	Run Count: 5 SGL - Pressure Control 100 + 0.00 gpa (-) to 0.00 gpa +/- 0.0 gpa

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Date: April 21, 2023 3:29:49 PM
System ID: C011401000

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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 authentication components: unique username and personal password. The Agilent representative who has delivered this variable understands the meaning and legal status of an electronic signature. As a trained official signatory, the Agilent representative has a unique password and sign-off to execute ACE, and electronically sign this document. (Other signatories can be applied to this document using a Document Content Management or other suitable method defined in your data security and control procedures.)

Details

Full Name of Signer:

Wangqin@agilent.com

Logged On User Name:

wangqin@agilent.com

Signature Creation Date:

April 21, 2023

Reason for Signature:

Executed and published the original version of document

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Date: April 21, 2023 3:29:49 PM
System ID: C011401000

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User Name: wangqin@agilent.com

Hardware: L49100-00000000000000000000

System ID: C011401000

Print Date: April 21, 2023 3:29:49 PM

SGLA_SGLA_000017_ALA Transaction Log

Date	Transaction Date	Activity Performed	Type of Transaction	Optional Information
April 21, 2023 11:24:07 AM	04/21/2023 11:24:07 AM	Success	SW Pressure Display - Front	Run Count: 1 SGL - Pressure Control 100 + 0.00 gpa (-) to 0.00 gpa +/- 0.0 gpa
April 21, 2023 11:24:07 AM	04/21/2023 11:24:07 AM	Success	SW Pressure Display - Back	Run Count: 1 SGL - Pressure Control 100 + 0.00 gpa (-) to 0.00 gpa +/- 0.0 gpa
April 21, 2023 11:24:07 AM	04/21/2023 11:24:07 AM	Success	SW Pressure Display - Front	Run Count: 2 SGL - Pressure Control 100 + 0.00 gpa (-) to 0.00 gpa +/- 0.0 gpa
April 21, 2023 11:24:07 AM	04/21/2023 11:24:07 AM	Success	SW Pressure Display - Back	Run Count: 2 SGL - Pressure Control 100 + 0.00 gpa (-) to 0.00 gpa +/- 0.0 gpa
April 21, 2023 11:24:07 AM	04/21/2023 11:24:07 AM	Success	SW Pressure Display - Front	Run Count: 3 SGL - Pressure Control 100 + 0.00 gpa (-) to 0.00 gpa +/- 0.0 gpa
April 21, 2023 11:24:07 AM	04/21/2023 11:24:07 AM	Success	SW Pressure Display - Back	Run Count: 3 SGL - Pressure Control 100 + 0.00 gpa (-) to 0.00 gpa +/- 0.0 gpa
April 21, 2023 11:24:07 AM	04/21/2023 11:24:07 AM	Success	SW Pressure Display - Front	Run Count: 4 SGL - Pressure Control 100 + 0.00 gpa (-) to 0.00 gpa +/- 0.0 gpa
April 21, 2023 11:24:07 AM	04/21/2023 11:24:07 AM	Success	SW Pressure Display - Back	Run Count: 4 SGL - Pressure Control 100 + 0.00 gpa (-) to 0.00 gpa +/- 0.0 gpa
April 21, 2023 11:24:07 AM	04/21/2023 11:24:07 AM	Success	SW Pressure Display - Front	Run Count: 5 SGL - Pressure Control 100 + 0.00 gpa (-) to 0.00 gpa +/- 0.0 gpa
April 21, 2023 11:24:07 AM	04/21/2023 11:24:07 AM	Success	SW Pressure Display - Back	Run Count: 5 SGL - Pressure Control 100 + 0.00 gpa (-) to 0.00 gpa +/- 0.0 gpa

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Date: April 21, 2023 3:29:49 PM
System ID: C011401000

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Manufacturer	Agilent Technologies
Type	Injection Tower
Name	7890A
Model Number	C0413A
Serial Number	CN1401000
Firmware Revision	A.10.30
Usage	Sample Injection
Location	Front
Storage Volume (GB)	16

Manufacturer	Agilent Technologies
Type	Injection Tower
Name	7890A
Model Number	C0413A
Serial Number	CN1401000
Firmware Revision	A.10.30
Usage	Sample Injection
Location	Back
Storage Volume (GB)	16

Manufacturer	Agilent Technologies
Name	7890
Model Number	C0413A
Serial Number	CN1401000
Firmware Revision	Version A.27
Order Type	Standard

Date: April 21, 2023 3:29:49 PM
System ID: C011401000

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Manufacturer	Agilent Technologies
Name	7890
Type	PSL
Location	Front
Control Type	Electronic Pressure Control (EPC)
Purged Inlet	Yes

Manufacturer	Agilent Technologies
Name	7890
Type	PSL
Location	Back
Control Type	Electronic Pressure Control (EPC)
Purged Inlet	Yes

Manufacturer	Agilent Technologies
Name	7890
Type	PSL
Location	Front
Control Type	Electronic Pressure Control (EPC)
Purged Inlet	Yes

Manufacturer	Agilent Technologies
Name	7890
Type	PSL
Location	Back
Control Type	Electronic Pressure Control (EPC)
Purged Inlet	Yes

Manufacturer	Agilent Technologies
Name	7890
Type	PSL
Location	Front
Control Type	Electronic Pressure Control (EPC)
Purged Inlet	Yes

Manufacturer	Agilent Technologies
Name	7890
Type	PSL
Location	Back
Control Type	Electronic Pressure Control (EPC)
Purged Inlet	Yes

Date: April 21, 2023 3:29:49 PM
System ID: C011401000

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[illegible]

— 474 —

Date: April 21, 2023 2:28:58 PM
 Symbol: CNY1681000

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[illegible]

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Date: April 21, 2023 6:28:53 PM
System ID: CH1181108

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[illegible]

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Date: April 11, 2003 9:26:08 PM
System ID: CHN1001000

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[illegible]

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Date: Aug 21, 2023 8:26:38 PM
System ID: CWT644108

Page 2

[illegible]

Page 1

Date: April 21, 2023 3:05:06 PM
System ID: C01149090

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[illegible]

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Date: April 21, 2023 3:26:58 PM
System ID: CN11401080

Page 1

Instrument Details

Purpose

This module describes the as found system configuration.

Details

System ID	QC-4_CNI1481009
Manufacturer	Agilent Technologies
Name	7890
Flow Data Input	Manual Data
Temperature Data Input	Manual Data or Other Data Logging
Tested Combination1	Injection Technique
Injection Technique	Injection Tower
Sample Location	Sample 1
Alert	Front
Detection	Front
LTM Included?	No
Tested Combination2	Injection Tower
Injection Technique	Injection Tower
Sample Location	Sample 2
Alert	Back
Detection	Back
LTM Included?	No
Sample 1	
Manufacturer	Agilent Technologies
Type	Injection Tower
Name	7893A
Model Number	04815A
Serial Number	CN2YH3M0103
Firmware Revision	A.11.06
Unit	Sample Injection
Location	Front
Syringe Volume (uL)	10

Date: October 22, 2024 9:27:05 AM
System ID: QC-4_CNI1481009

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Tested Combination1	Front	SSL	/	Front	FID
Name:	Injection Tower 7890				
Setup Status:	Pass				
Signal to Noise:	1107625				
Agilent Recommended:	≤ 30000				
Overall Signal to Noise Test Status	Pass				
Scouting Run					
Tested Combination2	Back	SSL	/	Back	FID
Name:	7893A				
Setup 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				
Setup Status:	Pass				
Base Signal:	13.79 pA				
ASTM Noise	0.05 pA				
Drift	0.01 pA				
Agilent Recommended:	≤ 0.10 pA				
Status:	Pass				

Date: October 22, 2024 9:27:05 AM
System ID: QC-4_CNI1481009

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Setup Status:	Pass				
Zone:	Open				
Temperature:	230.0 230.3 °C				
Accuracy:	0.3 °C				
Agilent Recommended:	≤ ± 1.0 °C				
Setup Status:	Pass				
Zone:	Open				
Temperature:	100.0 100.0 °C				
Accuracy:	0.0 °C				
Agilent Recommended:	≤ ± 1.0 °C				
Overall GC Oven Temperature Accuracy Test Status	Pass				
GC Oven Temperature Stability					
Name:	7890				
Setup Status:	Pass				
Temperature:	100.0 100.0187 °C				
Stability:	0.1 °C				
Agilent Recommended:	≤ ± 0.5 °C				
Overall GC Oven Temperature Stability Test Status	Pass				
Scouting Run					
Tested Combination1	Front	SSL	/	Front	FID
Name:	Injection Tower 7893A				

Date: October 22, 2024 9:27:05 AM
System ID: QC-4_CNI1481009

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Sample 2	
Manufacturer	Agilent Technologies
Type	Injection Tower
Name	7893A
Model Number	04815A
Serial Number	CN162B0128
Firmware Revision	A.11.06
Unit	Sample Injection
Location	Back
Syringe Volume (uL)	10
Sample 3	
Manufacturer	Agilent Technologies
Type	Tray
Name	7893A
Model Number	04815A
Serial Number	CN15280230
Firmware Revision	A.11.03
Unit	Not installable
Microphone 1	
Manufacturer	Agilent Technologies
Name	7890
Model Number	03403A
Serial Number	CN11481009
Firmware Revision	A.01.16
Alert Type	Standard

Date: October 22, 2024 9:27:05 AM
System ID: QC-4_CNI1481009

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Overall Noise and Drift Test Status	Pass				
Injection Precision					
Tested Combination2	Back	SSL	/	Back	FID
Name:	7893A				
Setup Status:	Pass				
Injection Volume on Column:	1.0 uL				
Area RSD:	1.38 %				
Agilent Recommended:	≤ 3.00 %				
Retention Time RSD:	0.93 %				
Agilent Recommended:	≤ 1.00 %				
Overall Injection Precision Test Status	Pass				
Signal to Noise					
Tested Combination2	Back	SSL	/	Back	FID
Name:	Injection Tower 7890				
Setup Status:	Pass				
Signal to Noise:	11271221				
Agilent Recommended:	≤ 30000				
Overall Signal to Noise Test Status	Pass				

Date: October 22, 2024 9:27:05 AM
System ID: QC-4_CNI1481009

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Setup 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				
Setup Status:	Pass				
Base Signal:	14.08 pA				
ASTM Noise	0.05 pA				
Drift	0.03 pA				
Agilent Recommended:	≤ 0.10 pA				
Status:	Pass				
Overall Noise and Drift Test Status	Pass				
Injection Precision					
Tested Combination1	Front	SSL	/	Front	FID
Name:	7893A				
Setup Status:	Pass				
Injection Volume on Column:	1.0 uL				
Area RSD:	0.30 %				
Agilent Recommended:	≤ 3.00 %				
Retention Time RSD:	0.63 %				
Agilent Recommended:	≤ 1.00 %				
Overall Injection Precision Test Status	Pass				
Signal to Noise					

Date: October 22, 2024 9:27:05 AM
System ID: QC-4_CNI1481009

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[illegible]

Date: October 22, 2024 9:57:02 AM
System ID: GC-0_CW 1401050

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[illegible]

Date: October 22, 2024 9:27:58 AM
System ID: GC-E_C011401302

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Table 1	
Manufacturer	Agilent Technologies
Model	7890
Type	SGL
Location	Front
Carrier Gas	Helium
Control Type	Electronic Pressure Control (EPC)
Purge Inlet	Yes
Inlet 2	
Manufacturer	Agilent Technologies
Model	7890
Type	SGL
Location	Back
Carrier Gas	Helium
Control Type	Electronic Pressure Control (EPC)
Purge Inlet	Yes
Detector 1	
Manufacturer	Agilent Technologies
Model	7890
Type	FID
Adapter	Capillary
Control Type	Electronic Pressure Control (EPC)
Location	Front
Making Gas	Nitrogen
Detector 2	
Manufacturer	Agilent Technologies
Model	7890
Type	FID
Adapter	Capillary
Control Type	Electronic Pressure Control (EPC)
Location	Back
Making Gas	Nitrogen

Date: October 22, 2024 9:27:55 AM
System ID: UC-6-DN11481066

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[illegible]

Date: October 22, 2024 9:27:00 AM
System ID: GC-6_CHEM1406

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[illegible]

Date: 08/08/2024 9:37:05 AM
System ID: GC-E_CN11401000

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Full Name of Signic:	Saengulal Tark
Logged On User Name:	saengulal.tark@non-ag/terk.com
Signature Creation Date:	October 22, 2024

Reason for Signature: Executed protocol and published the original version of document

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Date: October 22, 2024 9:11 AM
System ID: WDC-CLN114E1000

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[illegible]

Date: October 20, 2024 9:27:05 AM
System ID: 2024_CN11A21000

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Unit Tests: example3-ds90c03				Revision: 02-0-2019-00000	
Project Generated by automatically LAPF00030000				New User Creation: 02-2019-01000	
Unit, ALX, 020, 02010000, 0200, Project name: test					
Test	Transceiver	Activity	Test	Type of Transceiver	Additional Information
Test 1	DS90C03	Test 1	DS90C03	DS90C03	DS90C03
Test 2	DS90C03	Test 2	DS90C03	DS90C03	DS90C03
Test 3	DS90C03	Test 3	DS90C03	DS90C03	DS90C03
Test 4	DS90C03	Test 4	DS90C03	DS90C03	DS90C03
Test 5	DS90C03	Test 5	DS90C03	DS90C03	DS90C03
Test 6	DS90C03	Test 6	DS90C03	DS90C03	DS90C03
Test 7	DS90C03	Test 7	DS90C03	DS90C03	DS90C03
Test 8	DS90C03	Test 8	DS90C03	DS90C03	DS90C03
Test 9	DS90C03	Test 9	DS90C03	DS90C03	DS90C03
Test 10	DS90C03	Test 10	DS90C03	DS90C03	DS90C03
Test 11	DS90C03	Test 11	DS90C03	DS90C03	DS90C03
Test 12	DS90C03	Test 12	DS90C03	DS90C03	DS90C03
Test 13	DS90C03	Test 13	DS90C03	DS90C03	DS90C03
Test 14	DS90C03	Test 14	DS90C03	DS90C03	DS90C03
Test 15	DS90C03	Test 15	DS90C03	DS90C03	DS90C03
Test 16	DS90C03	Test 16	DS90C03	DS90C03	DS90C03
Test 17	DS90C03	Test 17	DS90C03	DS90C03	DS90C03
Test 18	DS90C03	Test 18	DS90C03	DS90C03	DS90C03
Test 19	DS90C03	Test 19	DS90C03	DS90C03	DS90C03
Test 20	DS90C03	Test 20	DS90C03	DS90C03	DS90C03
Test 21	DS90C03	Test 21	DS90C03	DS90C03	DS90C03
Test 22	DS90C03	Test 22	DS90C03	DS90C03	DS90C03
Test 23	DS90C03	Test 23	DS90C03	DS90C03	DS90C03
Test 24	DS90C03	Test 24	DS90C03	DS90C03	DS90C03
Test 25	DS90C03	Test 25	DS90C03	DS90C03	DS90C03
Test 26	DS90C03	Test 26	DS90C03	DS90C03	DS90C03
Test 27	DS90C03	Test 27	DS90C03	DS90C03	DS90C03
Test 28	DS90C03	Test 28	DS90C03	DS90C03	DS90C03
Test 29	DS90C03	Test 29	DS90C03	DS90C03	DS90C03
Test 30	DS90C03	Test 30	DS90C03	DS90C03	DS90C03
Test 31	DS90C03	Test 31	DS90C03	DS90C03	DS90C03
Test 32	DS90C03	Test 32	DS90C03	DS90C03	DS90C03
Test 33	DS90C03	Test 33	DS90C03	DS90C03	DS90C03
Test 34	DS90C03	Test 34	DS90C03	DS90C03	DS90C03
Test 35	DS90C03	Test 35	DS90C03	DS90C03	DS90C03
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Test 38	DS90C03	Test 38	DS90C03	DS90C03	DS90C03
Test 39	DS90C03	Test 39	DS90C03	DS90C03	DS90C03
Test 40	DS90C03	Test 40	DS90C03	DS90C03	DS90C03
Test 41	DS90C03	Test 41	DS90C03	DS90C03	DS90C03
Test 42	DS90C03	Test 42	DS90C03	DS90C03	DS90C03
Test 43	DS90C03	Test 43	DS90C03	DS90C03	DS90C03
Test 44	DS90C03	Test 44	DS90C03	DS90C03	DS90C03
Test 45	DS90C03	Test 45	DS90C03	DS90C03	DS90C03
Test 46	DS90C03	Test 46	DS90C03	DS90C03	DS90C03
Test 47	DS90C03	Test 47	DS90C03	DS90C03	DS90C03
Test 48	DS90C03	Test 48	DS90C03	DS90C03	DS90C03
Test 49	DS90C03	Test 49	DS90C03	DS90C03	DS90C03
Test 50	DS90C03	Test 50	DS90C03	DS90C03	DS90C03
Test 51	DS90C03	Test 51	DS90C03	DS90C03	DS90C03
Test 52	DS90C03	Test 52	DS90C03	DS90C03	DS90C03

Date: October 22, 2024 9:27:28 AM
System ID: OC-E_CHT1481008

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[illegible]

Date: October 22, 2024 9:27:05 AM
System ID: GC-R_CH11481036

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Time	Transaction Date	Activity Performed	Type of Transaction	Optional Information
October 22, 2018 9:12:00 AM	0nd	Execution	Assign to Entity - Register Time, Date, MS, Rate FD Duration FD -1, +- 00000	Not Done
October 22, 2018 9:12:13 AM	0nd	Continuation	Release	OK
October 22, 2018 9:12:15 AM	0nd	Reporting	Session	Done
October 22, 2018 9:14:05 AM	Ampl	Reporting	Session	Serial Download - Continuation
October 22, 2018 9:25:36 AM	Ampl	Reporting	Execution	Report Download - Register Done

Date: October 22, 2014 9:27:02 AM
System ID: GC-B_CN11481089

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[illegible]

Page: October 23, 2024 9:27:03 AM
System ID: GC-W_CN11401006

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[illegible]

Date: October 23, 2004 9:37:00 AM
System ID: DC-B_CN11481066

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Certificate of System Qualification
GC-QC + GCMS-QC

System ID: GMA-12
Organization Name: ALS Laboratory Group (Thailand) Co Ltd
Organization Location: 104 Phatthanakan Rd Phatthanakan Rd Bangkok 10250
Date: May 10, 2024 2:18:58 PM
EOP Name: Agilent Recommended - Agilent Recommended
EOP Revision: GC-QC 25, GCMS-QC 24
Overall Qualification Status: Pass

REVIEW BY: Sutakiat
APPROVED BY: Tempran
NEXT CAL DATE: 10 Mar 25

GC System Verification - GC

Logon: msak.shv02

Overall GC System Verification - GC Test Status

Pass

System Inspection and Basic Safety and Operation

Name: 8890Setup Status: Pass

Overall System Inspection and Basic Safety and Operation Test Status

Pass

Inlet Pressure Accuracy

Name: 8890Fund: SSASetup Status: PassInlet Pressure: 25.0 psiAccuracy: 0.0 psiAgilent Recommended: 1.2

Date: May 10, 2024 2:18:58 PM

System ID: GMA-12

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ROTA METER CALIBRATION RESULT JULY 2024

Rotameter ID	Calibration Date	Regression Result	Coefficient (R ²)
BKCF_FS0577	01 Jul 24	Y = 1.0001x + 0.0433	1.0000
BKCF_FS0584	01 Jul 24	Y = 1.0005x - 2.7974	1.0000
BKCF_FS0585	02 Jul 24	Y = 1.0315x + 3.0033	0.9998
BKCF_FS0587	02 Jul 24	Y = 1.0294x + 0.71	1.0000
BKCF_FS0588	01 Jul 24	Y = 0.9751x + 0.8452	0.9999
BKCF_FS0591	01 Jul 24	Y = 1.0035x - 8.2303	1.0000
BKCF_FS0592	02 Jul 24	Y = 1.002x + 14.273	1.0000
BKCF_FS0594	02 Jul 24	Y = 1.0003x + 7.0095	1.0000
BKCF_FS0595	01 Jul 24	Y = 1.0871x - 114.97	0.9985
BKCF_FS1004	02 Jul 24	Y = 0.9826x + 13.51	0.9999
BKCF_FS1005	02 Jul 24	Y = 1.0217x - 0.5833	0.9997
BKCF_FS1006	02 Jul 24	Y = 1.149x - 1.0422	0.9981
BKCF_FS1007	02 Jul 24	Y = 1.1116x + 3.3558	0.9994
BKCF_FS1008	02 Jul 24	Y = 1.1273x + 0.4837	0.9999
BKCF_FS1009	01 Jul 24	Y = 1.1044x - 0.8245	1.0000
BKCF_FS1017	02 Jul 24	Y = 1.0488x + 2.2027	0.9998
BKCF_FS1018	02 Jul 24	Y = 1.0173x - 0.1967	0.9999
BKCF_FS1019	02 Jul 24	Y = 1.0022x + 5.619	1.0000
BKCF_FS1026	01 Jul 24	Y = 1.072x - 2.4954	1.0000
BKCF_FS1027	01 Jul 24	Y = 1.0104x - 4.4788	0.9999
BKCF_FS1028	01 Jul 24	Y = 1.0009x - 3.7755	1.0000
BKCF_FS1029	01 Jul 24	Y = 1.1118x - 4.4431	0.9965
BKCF_FS1030	01 Jul 24	Y = 1.0159x - 0.395	1.0000
BKCF_FS1031	01 Jul 24	Y = 0.9973x - 5.3371	0.9999
BKCF_FS1039	02 Jul 24	Y = 0.9962x + 0.6833	0.9992
BKCF_FS1040	01 Jul 24	Y = 1.0034x - 2.5343	1.0000
BKCF_FS1041	02 Jul 24	Y = 1.0511x + 1.1272	0.9996
BKCF_FS1042	02 Jul 24	Y = 1.0016x + 10.387	0.9995
BKCF_FS1043	01 Jul 24	Y = 0.9965x + 0.3743	1.0000
BKCF_FS1044	02 Jul 24	Y = 1.1237x - 0.4231	0.9981
BKCF_FS1200	01 Jul 24	Y = 1.0337x - 0.1016	0.9994
BKCF_FS1201	01 Jul 24	Y = 0.9871x + 0.0031	0.9996
BKCF_FS1202	01 Jul 24	Y = 0.7978x + 301.39	0.9334
PKCF_FS0027	02 Jul 24	Y = 1.0722x + 3.4395	0.9988
PKCF_FS0028	02 Jul 24	Y = 1.0254x + 1.04	1.0000
PKCF_FS0029	02 Jul 24	Y = 0.999x + 12.73	1.0000
RYG_FS0197	01 Jul 24	Y = 1.0045x + 10.201	1.0000
RYG_FS0198	01 Jul 24	Y = 1.0056x + 1.8883	1.0000
RYG_FS0199	02 Jul 24	Y = 1.0029x + 3.2381	0.9990

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ALS Laboratory Group



ROTA METER CALIBRATION RESULT JULY 2024

Rotameter ID	Calibration Date	Regression Result	Coefficient (R ²)
RYG_FS0654	02 Jul 24	Y = 1.0421x + 1.4935	1.0000
RYG_FS0655	02 Jul 24	Y = 0.975x + 15.2	0.9994
RYG_FS0656	01 Jul 24	Y = 1.0042x + 7.1067	0.9999
RYG_FS0657	02 Jul 24	Y = 1.0337x + 1.8918	0.9998
RYG_FS0658	02 Jul 24	Y = 0.9921x + 10.87	0.9996
RYG_FS0659	01 Jul 24	Y = 1.0022x + 8.4152	1.0000
SGK_FS0135	02 Jul 24	Y = 1.0193x + 3.6833	0.9999
SGK_FS0136	02 Jul 24	Y = 1.0217x + 1.63	1.0000
SGK_FS0138	02 Jul 24	Y = 1.055x + 4.5833	0.9999
SGK_FS0139	02 Jul 24	Y = 1.0154x + 3.74	0.9998
SGK_FS0140	02 Jul 24	Y = 1.0008x + 13.353	1.0000
SGK_FS0141	02 Jul 24	Y = 1.1185x + 1.4867	0.9998
SGK_FS0142	02 Jul 24	Y = 1.0211x + 1.39	1.0000
SGK_FS0143	02 Jul 24	Y = 1.0045x + 5.6981	1.0000

Review By: Mr. Wichan Choonharat
(Mr. Wichan Choonharat)
Enviro Field Services Manager

Approved By: Mr. Sarayuth Jittranan
(Mr. Sarayuth Jittranan)
Assistant General Manager

Overall Inlet Pressure Accuracy Test Status

Pass

GC Oven Temperature Accuracy

Name: 8890Setup Status: PassZone: OpenTemperature: 230.0 °CAccuracy: 0.0 °CAgilent Recommended: 1.0 % setpoint to KAgilent Recommended: 1.0 % setpoint to KSetup Status: PassZone: OpenTemperature: 150.0 °CAccuracy: 1.1 °CAgilent Recommended: 1.0 % setpoint to KAgilent Recommended: 1.0 % setpoint to K

Overall GC Oven Temperature Accuracy Test Status

Pass

GC Oven Temperature Stability

Name: 8890Setup Status: PassTemperature: 150.0 °CStability: 0.0 °CAgilent Recommended: 0.5 °C

Overall GC Oven Temperature Stability Test Status

Pass

Date: May 10, 2024 2:18:58 PM

System ID: GMA-12

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SARTORIUS

Certificate of Calibration

REVIEW BY: Thirak
APPROVED BY: Thirak
NEXT CAL DATE: 01/01/2025

Model Number: MSU2345-100-DU Certificate No.: 24IC00073
Description: Analytical Balance Issued Date: Friday, February 23, 2024
Serial Number: 0031709552 Reference No.: 220196
ID No.: RYG_EN0003
Manufacturer: Sartorius Page No.: 1 of 2

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

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

Calibrated By: Mr. Chirachai Inthang Calibration Procedure No.: This calibration was conducted by using in-house calibration procedure number (MS-003)
Calibration Date: Thursday, February 22, 2024 Based on: UKAS LAB 14: 2019

Metrological data: Capacity: 220 g Repeatability: 0.0001 g Temperature: 23.1 °C Humidity: 62.0 % RH Pressure: 1010 hPa

Reasons for calibration: ☒ New installation ☐ Service / Repair ☐ No calibration / Maintenance

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

Traceability: MSU2345-100-DU Capacity: 220 g Repeatability: 0.0001 g Temperature: 23.1 °C Humidity: 62.0 % RH Pressure: 1010 hPa

Measurement Method: UKAS Publication Ref: Lab 14
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Traceability: MSU2345-100-DU Capacity: 220 g Repeatability: 0.0001 g Temperature: 23.1 °C Humidity: 62.0 % RH Pressure: 1010 hPa

SARTORIUS

Certificate of Calibration

Model Number: MSU2345-100-DU Certificate No.: 24IC00073
Description: Analytical Balance Issued Date: Friday, February 23, 2024
Serial Number: 0031709552 Reference No.: 220196
ID No.: RYG_EN0003
Manufacturer: Sartorius Page No.: 2 of 2

Calibration Results: Without Adjustment

Repeatability: MSU2345-100-DU Capacity: 220 g Repeatability: 0.0001 g Temperature: 23.1 °C Humidity: 62.0 % RH Pressure: 1010 hPa

Repeatability: MSU2345-100-DU Capacity: 220 g Repeatability: 0.0001 g Temperature: 23.1 °C Humidity: 62.0 % RH Pressure: 1010 hPa

Repeatability: MSU2345-100-DU Capacity: 220 g Repeatability: 0.0001 g Temperature: 23.1 °C Humidity: 62.0 % RH Pressure: 1010 hPa

Repeatability: MSU2345-100-DU Capacity: 220 g Repeatability: 0.0001 g Temperature: 23.1 °C Humidity: 62.0 % RH Pressure: 1010 hPa

Repeatability: MSU2345-100-DU Capacity: 220 g Repeatability: 0.0001 g Temperature: 23.1 °C Humidity: 62.0 % RH Pressure: 1010 hPa

Repeatability: MSU2345-100-DU Capacity: 220 g Repeatability: 0.0001 g Temperature: 23.1 °C Humidity: 62.0 % RH Pressure: 1010 hPa

Repeatability: MSU2345-100-DU Capacity: 220 g Repeatability: 0.0001 g Temperature: 23.1 °C Humidity: 62.0 % RH Pressure: 1010 hPa

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Repeatability: MSU2345-100-DU Capacity: 220 g Repeatability: 0.0001 g Temperature: 23.1 °C Humidity: 62.0 % RH Pressure: 1010 hPa

Repeatability: MSU2345-100-DU Capacity: 220 g Repeatability: 0.0001 g Temperature: 23.1 °C Humidity: 62.0 % RH Pressure: 1010 hPa

Repeatability: MSU2345-100-DU Capacity: 220 g Repeatability: 0.0001 g Temperature: 23.1 °C Humidity: 62.0 % RH Pressure: 1010 hPa

Repeatability: MSU2345-100-DU Capacity: 220 g Repeatability: 0.0001 g Temperature: 23.1 °C Humidity: 62.0 % RH Pressure: 1010 hPa

Repeatability: MSU2345-100-DU Capacity: 220 g Repeatability: 0.0001 g Temperature: 23.1 °C Humidity: 62.0 % RH Pressure: 1010 hPa

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Agilent CrossLab Compliance Services

Sample 1

Manufacturer

Type

Name

Model Number

Serial Number

Firmware Revision

Valve Handler

Manufacturer

Name

Model Number

Serial Number

Firmware Revision

Over Type

Model Number

Name

Type

Location

Carrier Gas

Control Type

Purge Inlet

Manufacturer

Name

Type

Location

Date: May 10, 2024 2:18:05 PM

System ID: QM-12

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Agilent CrossLab Compliance Services

Tested Combination 1

Front

SSL

/ External

SQ

Injection Tower

Name

Source

Setup Status

Injection Volume on Column

Area Miss 1

Abundance %

Area Ratio

RSD

Agilent Recommendation

Overall Mass Ratio Precision Test Status

Date: May 10, 2024 2:18:05 PM

System ID: QM-12

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Agilent CrossLab Compliance Services

Log Amp

Tested Combination 1

Front

SSL

/ External

SQ

Name

Setup Status

Overall Log Amp Test Status

RPPA

Tested Combination 1

Front

SSL

/ External

SQ

Name

Setup Status

Attenuation

Gain After Five Minutes

RPPA Voltage

Agilent Recommendation

Overall RPPA Test Status

Tune B1

Tested Combination 1

Front

SSL

/ External

SQ

Name

Setup Status

Flameout

Setup Status

Flameout

Overall Tune B1 Test Status

Scouting Run

Date: May 10, 2024 2:18:05 PM

System ID: QM-12

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Agilent CrossLab Compliance Services

Mass Spectrometer 1

Manufacturer

Type

Name

Model Number

Serial Number

Firmware Revision

High Vacuum System

Scouting Run Standard

Manufacturer

Name

Type

Location

Date: May 10, 2024 2:18:05 PM

System ID: QM-12

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Agilent CrossLab Compliance Services

Instrument Details

Purpose

This section describes the as found system configuration.

Details

System ID

Manufacturer

Name

Flow Data Input

Temperature Data Input

Tested Combination 1

Injection Technique

Front

External

SSL

Sample 1

Manufacturer

Type

Name

Model Number

Serial Number

Firmware Revision

Usage

Location

Sample Volume (uL)

Date: May 10, 2024 2:18:05 PM

System ID: QM-12

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Agilent CrossLab Compliance Services

Instrument Detection Limit

Tested Combination 1

Front

SSL

/ External

SQ

Name

Source

Setup Status

Injection Volume on Column

Overall Scouting Run Status

Instrument Detection Limit

Tested Combination 1

Front

SSL

/ External

SQ

Name

Source

Setup Status

Injection Volume on Column

Abundance RSD

Agilent Recommendation

Status

Instrument Detection Limit

Agilent Recommendation

Status

Overall Instrument Detection Limit Test Status

Mass Ratio Precision

Date: May 10, 2024 2:18:05 PM

System ID: QM-12

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[illegible]

Date: May 10, 2024 2:18:58 PM
System ID: CSE-12

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[illegible]

Date: May 10, 2024 2:12:55 PM
System ID: 026-12

Figure 9.6.20b

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 usernames and personal passwords. 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 the 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:	Gopalak Nirmongtham
Logged On User Name:	gopalak.nirmongtham@siglent.com
Signature Creation Date:	May 10, 2004
Reason for Signature:	Executed protocol and published this original version of document

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Date: May 31, 2024 11:55 PM
System ID: 126-12

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[illegible]

Date: May 10, 2024 2:18:58 PM
System ID: C80-72

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Hewlett-Packard Acquisition System				Report ID: 008-12	
Report Generated by: Software: 002-1100002				Print Date: May 10, 2024 10:27 PM	
Sheet 12 of 12 Transmittance log					
Date	Transmittance Date	Analyte	Method	Type of Transmittance	Comments/Remarks
May 10, 2024 10:50:40 AM	Start	Baseline		SC Clean Transmittance	None
				Aluminum 8000 - Transmittance	
				Chem.: 0.000000 L, μ = 0.0	
				MSD = 1.0 % signal in 0.0	
May 10, 2024 10:29:40 AM	Auto	Dist		SC Clean Transmittance	Aluminum 2100 Entry
				Aluminum 8000 - Transmittance	
				Chem.: 0.000000 L, μ = 0.0	
				MSD = 1.0 % signal in 0.0	
May 10, 2024 10:28:40 AM	Auto	Environ		SC Clean Transmittance	Dist Clean (1)
				Aluminum 8000 - Transmittance	
				Chem.: 0.000000 L, μ = 0.0	
				MSD = 1.0 % signal in 0.0	
May 10, 2024 10:28:00 AM	Dist	Environ		SC Dist Transmittance	None
				Aluminum 8000 - Transmittance	
				Chem.: 0.000000 L, μ = 0.0	
				MSD = 1.0 % signal in 0.0	
May 10, 2024 10:27:50 AM	Auto	AutoClean		Baseline	None
May 10, 2024 10:27:30 AM	Auto	AutoClean		Baseline	None
May 10, 2024 10:27:10 AM	Auto	AutoClean		Baseline	None
May 10, 2024 10:27:00 AM	Auto	AutoClean		Baseline	None
May 10, 2024 10:26:50 AM	Auto	AutoClean		Baseline	None
May 10, 2024 10:26:40 AM	Auto	AutoClean		Baseline	None
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May 10, 2024 10:09:10 AM	Auto	AutoClean		Baseline	None
May 10, 2024 10:09:00 AM	Auto	AutoClean		Baseline	None
May 10, 2024 10:08:50 AM	Auto	AutoClean		Baseline	None
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May 10, 2024 10:04:00 AM	Auto	AutoClean		Baseline	None
May 10, 2024 10:03:50 AM	Auto	AutoClean		Baseline	None
May 10, 2024 10:03:40 AM	Auto	AutoClean		Baseline	None
May 10, 2024 10:03:30 AM	Auto	AutoClean		Baseline	None
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May 10, 2024 10:01:50 AM	Auto	AutoClean		Baseline	None
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May 10, 2024 10:01:10 AM	Auto	AutoClean		Baseline	None
May 10, 2024 10:01:00 AM	Auto	AutoClean		Baseline	None
May 10, 2024 10:00:50 AM	Auto	AutoClean		Baseline	None
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May 10, 2024 10:00:30 AM	Auto	AutoClean		Baseline	None
May 10, 2024 10:00:20 AM	Auto	AutoClean		Baseline	None
May 10, 2024 10:00:10 AM	Auto	AutoClean		Baseline	None
May 10, 2024 10:00:00 AM	Auto	AutoClean		Baseline	None

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Date: May 18, 2024 2:12:58 PM
System ID: 186.12

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[illegible]

Date: May 15, 2024 2:18:55 PM
System ID: CMA-12

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CALIBRATION LABORATORY

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Cert. No. : ACL24265
Job No. : VC87AC0140
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)
17.7

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

Frequency Weighting	Weighting (dB)
A-weight	16.3
C-weight	20.6
Flat	26.4

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.2	0.3	0.2	±1.5
1000	0.0	0.0	0.0	±1.0
8000	1.1	1.2	1.2	±5.0

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Cert. No. : ACL24265
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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
Log	94.0	94.0	0.0	±0.1

6. Long-term stability

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

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Cert. No. : ACL24265
Job No. : VC87AC0140
Page : 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 test results of each item were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33510A	MY48017976	EF-0009-24	05-FEB-25
Waveform Generator	33511D	MY33302742	EF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY33220104	EEL-HP 2140267	13-FEB-25
Digital Multimeter	33461A	MY33220076	EEL-HP 2002067	15-FEB-25
Digital Multimeter	34461A	MY60024273	EEL-HP 2250267	15-FEB-25
Programmable Attenuator	MAT-1070	62100114	EF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KAJ	34560495	AA-3001-24	05-FEB-25

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

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

3.1 National Institute of Metrology (Thailand).

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

T. Petch

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CALIBRATION LABORATORY

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Tel: +66 2433 8338 Email: calibration@sithiporn.com



Cert. No. : ACL24265
Job No. : VC87AC0140
Page : 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. Time burst response	0.2	0.3
10. Peak C sound level	0.2	0.35
11. Overload indication	0.2	0.25
12. High level stability	0.1	0.1

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Cert. No. : ACC24088
Job No. : VC87AC0656
Page : 3 of 3

Result of calibration :

1. Sound pressure level

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

2. Frequency

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

3. Total distortion

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

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

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

End of Calibration Certificate

T. Petch

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Tel: +66 2433 8338 Email: calibration@sithiporn.com



Cert. No. : ACL24265
Page : 1 of 8

SOUND LEVEL METER

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Pre-amplifier NH-24
Serial No. : 00572361 / 170398 / 72899
ID No. : RYG_PSO000

Condition As Found : GOOD

Customer : A/S LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTANAKAN 40, PHATTANAKAN ROAD,
KHUANG PHATTANAKAN, KHET SUAN LUANG,
BANGKOK, 10250 THAILAND.

Location :
Ambient Temperature : (23.0 ± 3) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (50.0 ± 30) %
Received Date : 09 AUGUST 2024
Calibration Date : 30 AUGUST 2024
Date of Issue : 03 SEPTEMBER 2024

REVIEW BY : *Thunakul P.*
APPROVED BY : *Thunakul P.*
NEXT CAL. DATE : 30/8/25

Calibrated by : Nuthakorn Pitsuporn

Approved by :

T. Petch
(Thunakul Pichurani)

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SITHIPORN ASSOCIATES CO., LTD. CALIBRATION LABORATORY

401-402 Sathorn Road, Bangkok, Bangkok, 10120 Thailand
Tel: +66 2433 8330 Email: calibration@sithiporn.com



Cert. No. : ACL24268
Job No. : VC67ACB140
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 instrument display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-24	05-FEB-25
Waveform Generator	33511B	MY52302742	EF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	EEL_BP 216267	13-FEB-25
Digital Multimeter	33461A	MY53220076	EEL_BP 206267	13-FEB-25
Digital Multimeter	34461A	MY60024273	EEL_BP 226267	13-FEB-25
Programmable Attenuator	MAT-1070	62100114	EF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KAI	34560495	AA-3001-24	05-FEB-25

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

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

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

T. Petch...

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Cert. No. : ACL24268
Job No. : VC67ACB140
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

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Cert. No. : ACL24268
Job No. : VC67ACB140
Pages : 8 of 8

10. Peak C sound level

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

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

11. Overload indication

Measured value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	89.7	-0.2
Negative one-half cycle	89.5	+1.3

12. High level stability

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

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

End of Calibration Certificate

T. Petch...

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Cert. No. : ACL24268
Pages : 3 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Pre-amplifier N81-24
Serial No. : 00472130 / 169816 / 72464
ID No. : RYG_P80303

Condition As Found : GOOD

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

Location :
Ambient Temperature : (23.0 ± 3) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (50.0 ± 20) %
Received Date : 09 AUGUST 2024
Calibration Date : 23 AUGUST 2024
Date of issue : 26 AUGUST 2024



Calibrated by : Nattakorn Pitsupattana

Approved by : T. Petch...
(Thanakul Petchum)

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Cert. No. : ACL24268
Job No. : VC67ACB140
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
127.0	127.0	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	34.0	0.0	±1.1
29.0	29.9	+0.1	±1.1
24.0	24.9	+0.1	±1.1
19.0	19.9	+0.1	±1.1
14.0	14.9	+0.1	±1.1
9.0	9.9	+0.1	±1.1
4.0	4.9	+0.1	±1.1
-1.0	-1.9	-0.1	±1.1
-6.0	-6.9	-0.1	±1.1
-11.0	-11.9	-0.1	±1.1
-16.0	-16.9	-0.1	±1.1
-21.0	-21.9	-0.1	±1.1
-26.0	-26.9	-0.1	±1.1
-31.0	-31.9	-0.1	±1.1
-36.0	-36.9	-0.1	±1.1
-41.0	-41.9	-0.1	±1.1
-46.0	-46.9	-0.1	±1.1
-51.0	-51.9	-0.1	±1.1
-56.0	-56.9	-0.1	±1.1
-61.0	-61.9	-0.1	±1.1
-66.0	-66.9	-0.1	±1.1
-71.0	-71.9	-0.1	±1.1
-76.0	-76.9	-0.1	±1.1
-81.0	-81.9	-0.1	±1.1
-86.0	-86.9	-0.1	±1.1
-91.0	-91.9	-0.1	±1.1
-96.0	-96.9	-0.1	±1.1
-101.0	-101.9	-0.1	±1.1
-106.0	-106.9	-0.1	±1.1
-111.0	-111.9	-0.1	±1.1
-116.0	-116.9	-0.1	±1.1
-121.0	-121.9	-0.1	±1.1
-126.0	-126.9	-0.1	±1.1
-131.0	-131.9	-0.1	±1.1
-136.0	-136.9	-0.1	±1.1
-141.0	-141.9	-0.1	±1.1
-146.0	-146.9	-0.1	±1.1
-151.0	-151.9	-0.1	±1.1
-156.0	-156.9	-0.1	±1.1
-161.0	-161.9	-0.1	±1.1
-166.0	-166.9	-0.1	±1.1
-171.0	-171.9	-0.1	±1.1
-176.0	-176.9	-0.1	±1.1
-181.0	-181.9	-0.1	±1.1
-186.0	-186.9	-0.1	±1.1
-191.0	-191.9	-0.1	±1.1
-196.0	-196.9	-0.1	±1.1
-201.0	-201.9	-0.1	±1.1
-206.0	-206.9	-0.1	±1.1
-211.0	-211.9	-0.1	±1.1
-216.0	-216.9	-0.1	±1.1
-221.0	-221.9	-0.1	±1.1
-226.0	-226.9	-0.1	±1.1
-231.0	-231.9	-0.1	±1.1
-236.0	-236.9	-0.1	±1.1
-241.0	-241.9	-0.1	±1.1
-246.0	-246.9	-0.1	±1.1
-251.0	-251.9	-0.1	±1.1

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Cert. No. : ACL24268
Job No. : VC67ACB140
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	30.0	29.9	-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	0.25	1	108.0	108.0	0.0	1.5 ; -5.0
	2	8	108.0	108.0	0.0	±1.0
	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

T. Petch...

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CALIBRATION LABORATORY

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Cert. No. : ACL24260
Job No. : VC87ACB140
Pages : 6 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	±0.0
One	133.4	133.4	0.0	±0.0

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	±0.0
Positive half cycle	135.4	135.2	-0.2	±0.0
Negative half cycle	135.4	135.2	-0.2	±0.0

11. Overload indication

Measured value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle 89.5	Negative one-half cycle 89.5	0.0 ±0.3

12. High level stability

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

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

End of Calibration Certificate

T. Petch

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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



Cert. No. : ACL24264
Pages : 3 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier N31-24
Serial No.: 00472132 / 169445 / 72466
ID No.: RYG J50304

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 : 09 AUGUST 2024
Calibration Date : 30 AUGUST 2024
Date of Issue : 03 SEPTEMBER 2024

Calibrated by : Nattakorn Pongpattana

Approved by :

T. Petch
(Thanakul Petchurai)

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SITHIPORN ASSOCIATES CO., LTD.
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Cert. No. : ACL24268
Job No. : VC87ACB140
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	±0.1
136.0	135.9	-0.1	±0.1
135.0	135.0	0.0	±0.1
134.0	134.0	0.0	±0.1
133.0	132.9	-0.1	±0.1
132.0	131.9	-0.1	±0.1
131.0	130.9	-0.1	±0.1
129.0	129.0	0.0	±0.1
126.0	124.0	-2.0	±0.1
119.0	119.0	0.0	±0.1
114.0	114.0	0.0	±0.1
109.0	109.0	0.0	±0.1
104.0	104.0	0.0	±0.1
99.0	99.0	0.0	±0.1
94.0	94.0	0.0	±0.1
89.0	89.0	0.0	±0.1
84.0	84.0	0.0	±0.1
79.0	79.0	0.0	±0.1
74.0	74.0	0.0	±0.1
69.0	69.0	0.0	±0.1
64.0	64.0	0.0	±0.1
59.0	59.0	0.0	±0.1
54.0	54.0	0.0	±0.1
49.0	49.0	0.0	±0.1
44.0	44.0	0.0	±0.1
39.0	39.0	0.0	±0.1
34.0	34.0	0.0	±0.1
30.0	30.0	0.0	±0.1
29.0	29.0	0.0	±0.1
28.0	28.1	0.1	±0.1
27.0	27.1	0.1	±0.1
26.0	26.1	0.1	±0.1
25.0	25.0	0.0	±0.1

T. Petch

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CALIBRATION LABORATORY

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Cert. No. : ACL24260
Job No. : VC87ACB140
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	±0.1

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	29.0	29.1	0.1	±0.1

9. Tone burst response

Time Weighting	Tone burst duration, T _b (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	±0.0
Slow	0.25	1	108.0	108.0	0.0	1.5; -5.0
	200	800	127.6	127.6	0.0	±0.0
	0.25	1	99.0	98.9	-0.1	1.5; -5.0
SEL	2	8	108.0	108.0	0.0	1.0; -2.5
	200	800	128.0	128.0	0.0	±0.0

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Cert. No. : ACL24268
Job No. : VC87ACB140
Page : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limits (dB)
93.9 (93.94)	93.9	0.0	±0.2

2. Self-generated noise

2.1 Noise test

Measured Value (dB)
14.5000003

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

Frequency Weighting	Weighting (dB)
A-weight	7.5
C-weight	14.8
Flat	20.5

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
125	1.3	1.4	1.4	±1.5
1000	0.1	0.1	0.1	±1.0
8000	-0.1	-0.0	-0.0	±0.0

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Cert. No. : ACL24260
Job No. : VC87ACB140
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	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	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long-term stability

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

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7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.0	0.0	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.0	0.0	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.0	0.0	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.1	0.1	±1.1
84.0	84.1	0.1	±1.1
79.0	79.0	0.0	±1.1
74.0	74.1	0.1	±1.1
69.0	69.1	0.1	±1.1
64.0	64.0	0.0	±1.1
59.0	59.1	0.1	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	34.0	0.0	±1.1
30.0	30.0	0.0	±1.1
29.0	29.0	0.0	±1.1
28.0	28.0	0.0	±1.1
27.0	27.0	0.0	±1.1
26.0	26.0	0.0	±1.1
25.0	24.9	-0.1	±1.1

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Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
16.6

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	18.0
Flat	23.4

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	-0.3	0.4	0.4	±1.5
1000	-0.1	0.1	0.1	±1.0
8000	-0.5	-0.7	-0.8	±5.0

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8. Level linearity including the level range control

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

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	30.0	29.8	-0.2	±1.1

9. Tone burst response

Time Weighting	Time burst duration, T _b (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	124.0	124.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5/-5.0
	200	800	127.6	127.6	0.0	±1.0
	0.25	1	99.0	98.9	-0.1	1.5/-5.0
SEL	2	8	108.0	108.0	0.0	1.0/-2.5
	200	800	128.0	128.0	0.0	±1.0

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4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long-term stability

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

T. Petch

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 some 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	33310A	MY48017076	EF-0009-24	05-FEB-25
Waveform Generator	33511B	MY52302742	EF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	EEL-BP 210267	13-FEB-25
Digital Multimeter	33461A	MY53220076	EEL-BP 220267	13-FEB-25
Digital Multimeter	34461A	MY60024273	EEL-BP 220267	13-FEB-25
Programmable Attenuator	MAT-1070	62100114	EF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KAI	34560495	AA-1001-24	05-FEB-25

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

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

3.1 National Institute of Metrology (Thailand).

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

T. Petch

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

T. Petch

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Cert. No. : ACL24094
Job No. : VC67AC0658
Page : 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 been to Acoustical and Electrical signal tests of frequency weighting with Acoustic chamber and Reference Standard Instruments.

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL-IP 300266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL-IP 294026	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL-IP 310266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977800	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAI	34560495	AA-3002-23	14-FEB-24

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

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

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

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Cert. No. : ACL24094
Job No. : VC67AC0658
Page : 3 of 8

Summary of Measurement Result :

Parameter	Uncertainty (dB)	Maximum permitted uncertainty of measurement (dB)
1. Absolute sensitivity	0.2	±0.4
2. Self-generated noise	0.2	±0.4
3. Acoustical signal tests of frequency weightings		
125 Hz	0.3	±0.6
1000 Hz	0.3	±0.6
8000 Hz	0.3	±0.7
4. Electrical signal tests of frequency weightings		
For 10 Hz to 4 kHz	0.3	±0.6
For 4 kHz to 10 kHz	0.3	±0.7
For > 10 kHz to 20 kHz	-	±1.0
5. Frequency and time weightings at 1 kHz	0.2	±0.2
6. Long-term stability	0.1	±0.1
7. Level linearity on the reference level range	0.2	±0.3
8. Level linearity including the level range control	0.2	±0.3
9. Tone burst response	0.2	±0.3
10. Peak C sound level	0.2	±0.35
11. Overload indication	0.2	±0.25
12. High level stability	0.1	±0.1



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)
Request No. : 21-670292 MTC No. EEL-IP : 83/0267

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

Nominal Output of Unit Under Test = 94 dB re 20µPa at 1000 Hz

Acoustic Output in dB re 20µPa, Corrected to Reference Conditions: 101.325 kPa, 23.0 °C and 50 %RH.

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class I
1/2 inch Brüel&Kjær 4180	94.01	0.01	±0.10	±0.40 dB

2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class I
1/2 inch Brüel&Kjær 4180	1003.1	3.1	± 1.5	±1.0%

3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class I
1/2 inch Brüel&Kjær 4180	1.80	± 0.50	±3.0%

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was included at level of 0.16 dB from nominal.

Calibrated by : *[Signature]* Approved by : *[Signature]*
(Mr. Worachai Deechaisue) (Mr. Pongkaj Klaya)

Date of Calibration : 28 Feb. 2024
Date of Issue : 28 Feb. 2024
Ref : 201/26702/19007/19001

End of Certificate 2 / 2

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

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Cert. No. : ACL24094
Page : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No. : 01222723 / 143841 / 22770
ID No. : RYG_F80032

Condition As Found : GOOD

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

Location : -
Ambient Temperature : (23.0 ± 3) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (50.0 ± 2.0) %

Received Date : 19 JANUARY 2024
Calibration Date : 25-26 JANUARY 2024
Date of Issue : 29 JANUARY 2024

Calibrated by : Nathakorn Petchumai

Approved by : *[Signature]*
(Thanasak Petchumai)

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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Cert. No. : ACL24264
Job No. : VC67AC0140
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10. Peak C sound level

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

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

11. Overload indication

Measured value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	89.5	±1.5
Negative one-half cycle	89.4	±1.5

12. High level stability

Frequency Weighting	SLM Display in Initial (dB)	SLM Display in final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weighting	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

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)
Request No. : 21-670292 MTC No. EEL-IP : 83/0267

CALIBRATION CERTIFICATE

Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.
Address : 104 Phatthanan 40, Phatthanan Rd., Khwaeng Phatthanan, Khet Suan Luang, Bangkok, 10250
Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre,
Sri IC, Banggo Industrial Estate, Sukhumvit Rd., Muang, Samprakan 10280.

Instrument Calibrated : Ambient Environment
Description : Sound Calibrator Temperature : (23 ± 3) °C
Manufacturer : Rion Relative Humidity : (50 ± 15) %
Model : NC-74 Ambient Pressure : (101.325 ± 1.500) kPa
Serial No. : 34178121 (ID: RYG_F80713)

- Standards used :
- Digital Function Synthesizer NF Electronic DF-193A-S/N 122037.
 - Measuring Amplifier Brüel&Kjær 2636-S/N 1537484.
 - Programmable Attenuator Tammag TPA-303A-S/N OF 2214.
 - Digital Multimeter Agilent 34401A-S/N MY44005560.
 - Pressure Transmitter Vaisala PTB202-AD-S/N T0650001.
 - Audio Analyzer Keithley 2015-P-S/N H106495.
 - Condenser Microphone B&K 4180-S/N 2489871.

Calibration Procedure : CP-102-04 based on IEC 60942:2003. The sound pressure level generated by sound calibrator under test shall be measured by standard microphone using an insert volume technique.

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

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

Date of Receipt : 19 Feb. 2024

Date of Calibration : 28 Feb. 2024

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

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Cert. No. : ACL24094
Job No. : VC67AC0658
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11. Overload indication

Measured value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle	
89.8	89.6	-0.2 ±1.5

12. High level stability

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

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

End of Calibration Certificate

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7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.0	0.0	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.0	0.0	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.0	0.0	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	34.0	0.0	±1.1
30.0	30.0	0.0	±1.1
29.0	29.0	0.0	±1.1
28.0	28.1	0.1	±1.1
27.0	27.1	0.1	±1.1
26.0	26.2	0.2	±1.1
25.0	25.1	0.1	±1.1

T. Petch

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CALIBRATION LABORATORY

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Cert. No. : ACL24094
Job No. : VC67AC0658
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.98)	93.9	0.0	±0.1

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.8

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

Frequency Weighting	Measured value (dB)
A-weight	12.0
C-weight	18.4
Flat	24.1

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	-0.4	0.4	0.4	±1.5
1000	-0.0	0.0	0.0	±1.0
8000	-0.7	0.8	-0.7	±5.0

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Cert. No. : ACL24071
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-02 / Microphone UC-52 / Pre-amplifier NH-24
Serial No.: 01222724 / 143466 / 22620
ID No.: RYO_P50023

Condition As Found : GOOD

Customer : AER LABORATORY GROUP (THAILAND) CO., LTD.
104 PIATTANAKAN 40, PIATTANAKAN ROAD,
KHWAENG PIATTANAKAN, KHUET SUAN LUANG,
BANGKOK, 10250 THAILAND.

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

Received Date : 11 JANUARY 2024
Calibration Date : 22-24 JANUARY 2024
Date of Issue : 24 JANUARY 2024

Calibrated by : Natsakorn Petchum

Approved by : *T. Petch*
(Thanakul Petchum)

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

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Cert. No. : ACL24094
Job No. : VC67AC0658
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Time burst response

Time Weighting	Time burst duration, T _b (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 ; -0.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.1	0.1	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -0.0
	200	800	127.6	127.6	0.0	±1.0
	0.25	1	96.0	96.9	-0.1	1.5 ; -0.0
SEL	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lepen (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	135.0	133.0	0.0	±3.0
One	136.4	136.3	-0.1	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	132.9	-0.1	±2.0
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±2.0

T. Petch

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CALIBRATION LABORATORY

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Cert. No. : ACL24094
Job No. : VC67AC0658
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz

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

6. Long-term stability

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

T. Petch

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.3
136.0	136.0	0.0	±1.3
135.0	135.0	0.0	±1.3
134.0	134.0	0.0	±1.3
133.0	133.0	0.0	±1.3
132.0	132.0	0.0	±1.3
131.0	131.0	0.0	±1.3
129.0	129.0	0.0	±1.3
124.0	124.0	0.0	±1.3
119.0	119.0	0.0	±1.3
114.0	114.0	0.0	±1.3
109.0	109.0	0.0	±1.3
104.0	104.0	0.0	±1.3
99.0	99.0	0.0	±1.3
94.0	94.0	0.0	±1.3
89.0	89.0	0.0	±1.3
84.0	84.0	0.0	±1.3
79.0	79.0	0.0	±1.3
74.0	74.0	0.0	±1.3
69.0	69.0	0.0	±1.3
64.0	64.0	0.0	±1.3
59.0	59.0	0.0	±1.3
54.0	53.9	-0.1	±1.3
49.0	48.9	-0.1	±1.3
44.0	43.9	-0.1	±1.3
39.0	38.9	-0.1	±1.3
34.0	33.9	-0.1	±1.3
30.0	29.9	-0.1	±1.3
29.0	28.9	-0.1	±1.3
28.0	27.9	-0.1	±1.3
27.0	26.9	-0.1	±1.3
26.0	25.8	-0.2	±1.3
25.0	24.9	-0.1	±1.3

7. Petch

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limits (dB)
93.9 (93.96)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
71.3

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

Frequency Weighting	Measured value (dB)
A-weight	14.8
C-weight	20.6
Flat	26.4

3. Acoustical signal tests of frequency weightings

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

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

7. Petch

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±1.3

9. Tone burst response

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	135.9	-0.5	±3.0

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

7. Petch

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long-term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	94.0	0.0	±0.2

7. Petch

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by follow on IEC-61672-1 (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 item were made by observation of each instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33401A	MY5320104	EEL-IP 30/0266	13-FEB-24
Digital Multimeter	33401A	MY5320676	EEL-IP 29/0266	13-FEB-24
Digital Multimeter	34401A	MY60034273	EEL-IP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KA	34560495	AA-3002-23	14-FEB-24

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

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

3.1 National Institute of Metrology (Thailand).

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

7. Petch

Summary of Measurement Result :

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

7. Petch

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CALIBRATION LABORATORY

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



Cert. No. : ACL24091
Job No. : VC67AC0658
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
-14.6

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

Frequency Weighting	Measured value (dB)
A-weight	10.6
C-weight	17.3
Flat	23.0

3. Acoustical signal tests of frequency weightings

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

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

T. Petch

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CALIBRATION LABORATORY

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



Cert. No. : ACL24091
Job No. : VC67AC0658
Pages : 2 of 8

Calibration Procedure : (T-AC-01)

Calibration Method :

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

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY3302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY3320104	EEL-BP 306266	13-FEB-24
Digital Multimeter	33461A	MY3320076	EEL-BP 280266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL-BP 310266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4130	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KA1	34560495	AA-1002-23	14-FEB-24

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

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

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR)

T. Petch

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CALIBRATION LABORATORY

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



Cert. No. : ACL24091
Job No. : VC67AC0654
Pages : 8 of 8

11. Overload indication

Measured value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle	
89.7	89.5	-0.2 ±1.2

12. High level stability

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

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

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

End of Calibration Certificate

T. Petch

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Cert. No. : ACL24091
Job No. : VC67AC0658
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz:

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	-0.1	0.0	0.0	±2.0
125	0.0	0.0	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	±5.0
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
Long	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. : ACL24091
Job No. : VC67AC0658
Pages : 5 of 8

Summary of Measurement Result :

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

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Cert. No. : ACL24091
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Pre-amplifier NH-24
Serial No.: 00231184 / 144837 / 23232
ID No.: RYO JS0025

Condition As Found : GOOD

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

Location : -
Ambient Temperature : (23.0 ± 1) °C
Pressure : (101.3 ± 1) kPa
Relative Humidity : (50.9 ± 2.9) %

Received Date : 19 JANUARY 2024
Calibration Date : 25-26 JANUARY 2024
Date of Issue : 29 JANUARY 2024

Calibrated by : Nithakorn Pitsupattana

Approved by : *T. Petch*
(Thanakul Petchum)

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Cert. No. : ACL24092
Job No. : VC87AC0658
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 been to Acoustical and Electrical signal tests of frequency weighting with Acoustic 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	33310A	MY4807076	EP-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EP-0010-23	07-FEB-24
Digital Multimeter	33461A	MY51220104	EEL_BP 240266	13-FEB-24
Digital Multimeter	33461A	MY51220076	EEL_BP 240266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL_BP 110266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EP-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KA1	34560495	AA-3002-23	14-FEB-24

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

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

3.1 National Institute of Metrology (Thailand).

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

T. Petchum

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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Cert. No. : ACL24092
Job No. : VC87AC0658
Pages : 3 of 8

Summary of Measurement Result :

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

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Cert. No. : ACL24091
Job No. : VC87AC0658
Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

T. Petchum

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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



Cert. No. : ACL24092
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No. : 00734220 / 145266 / 34371
ID No. : RYG_F50026

Condition As Found : GOOD

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

Location :
Ambient Temperature : (23.0 ± 3) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (30.0 ± 20) %

Received Date : 19 JANUARY 2024
Calibration Date : 25-26 JANUARY 2024
Date of Issue : 29 JANUARY 2024

Calibrated by : Nithakorn Petchum

Approved by : *T. Petchum*
(Thanakul Petchum)

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

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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Cert. No. : ACL24091
Job No. : VC87AC0658
Pages : 8 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.0	0.0	±1.1
133.0	132.9	-0.1	±1.1
132.0	131.9	-0.1	±1.1
131.0	130.9	-0.1	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.0	0.0	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.0	0.0	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	34.0	0.0	±1.1
30.0	30.0	0.0	±1.1
29.0	29.0	0.0	±1.1
28.0	28.1	0.1	±1.1
27.0	27.0	0.0	±1.1
26.0	26.1	0.1	±1.1
25.0	25.1	0.1	±1.1

T. Petchum

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CALIBRATION LABORATORY

403-403/1 Srinakharin Road, Bangkum, Bangkok, 10700 Thailand
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Cert. No. : ACL24091
Job No. : VC87AC0658
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)
A-weight	94.0	94.1	0.1	±1.1

9. Tone burst response

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

10. Peak C sound level

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

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

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Cert. No. : ACL24092
Job No. : VC67AC0058
Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

T. Petchu-

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Cert. No. : ACL24092
Job No. : VC67AC0058
Pages : 8 of 8

1. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviation 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
29.0	29.0	0.0	±1.1
24.0	24.0	0.0	±1.1
19.0	19.0	0.0	±1.1
14.0	14.0	0.0	±1.1
9.0	9.0	0.0	±1.1
4.0	4.0	0.0	±1.1

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Cert. No. : ACL24092
Job No. : VC67AC0058
Pages : 4 of 8

Result of calibration 2.

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.96)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
16.3

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

Frequency Weighting	Measured value (dB)
A-weight	13.4
C-weight	19.5
Flat	25.4

3. Acoustic signal tests of frequency weightings

Master 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	2.3	2.3	2.3	±5.0

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Cert. No. : ACL23323
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 Microphone UC-52 / Preamplifier NH-24
Serial No. : 00873057 / 171591 / 73333
ID No. : RYG_P80381

Condition As Found : GOOD

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

Location :
Ambient Temperature : (23.0 ± 3) °C
Pressure : (101.3 ± 1) kPa
Relative Humidity : (50.0 ± 20) %

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

Calibrated by : Naitikom Pinpissun

Approved by : T. Petchu-
(Thanukul Petchu-)

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.

QHS/TS/200-04-022004

SITHIPORN ASSOCIATES CO., LTD. CALIBRATION LABORATORY

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Cert. No. : ACL24092
Job No. : VC67AC0058
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Time burst response

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

10. Peak C sound level

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

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

T. Petchu-

SITHIPORN ASSOCIATES CO., LTD. CALIBRATION LABORATORY

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Cert. No. : ACL24092
Job No. : VC67AC0058
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

6. Long-term stability

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

T. Petchu-

Cert. No. : ACL23323
Job No. : VC87AC0011
Pages : 6 of 8

7. Level linearity on the reference level range

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

QP-TS12-04-04-02064

T. Petch.

Cert. No. : ACL23323
Job No. : VC87AC0011
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
15.8

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

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

3. Acoustical signal tests of frequency weightings

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

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

QP-TS12-04-04-02064

T. Petch.

Cert. No. : ACL23323
Job No. : VC87AC0011
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by based on IEC-61672-1 (2013) Standard for sound level meter (SLM).
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with anechoic chamber and Reference Standard Instruments.
For test results of each item were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY53202742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL_BP 3040266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL_BP 2902066	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL_BP 31-02066	14-FEB-24
Programmable Attenuator	MAT-1070	82100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2577960	AA-1001-23	14-FEB-24
Monitoring Amplifier	NA-42KAI	34560495	AA-3002-23	14-FEB-24

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

3. This certificate is acceptable to the international system of unit maintained as :

3.1 National Institute of Metrology (Thailand).

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

QP-TS12-04-04-02064

T. Petch.

Cert. No. : ACL23323
Job No. : VC87AC0011
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Time burst response

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

10. Peak C sound level

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

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

QP-TS12-04-04-02064

T. Petch.

Cert. No. : ACL23323
Job No. : VC87AC0011
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

QP-TS12-04-04-02064

T. Petch.

Cert. No. : ACL23323
Job No. : VC87AC0011
Pages : 3 of 8

Summary of Measurement Result :

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

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

QP-TS12-04-04-02064

T. Petch.

Continuation of Calibration Certificate

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

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
16.6

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

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

3. Acoustical signal tests of frequency weightings

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

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

QP-TS12-04-04-020044

T. Petch

Continuation of Calibration Certificate

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

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

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

Condition of this result of calibration :

1. Reference Standard Instruments

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY32302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY3320104	EEL-BP 300266	13-FEB-24
Digital Multimeter	33461A	MY3320076	EEL-BP 290266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL-BP 310266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAI	34560495	AA-3002-23	14-FEB-24

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

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

3.1 National Institute of Metrology (Thailand).

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

QP-TS12-04-04-020044

T. Petch

Continuation of Calibration Certificate

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

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle	0.0	±1.3
89.6	89.6	0.0	±1.3

12. High level stability

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

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

End of Calibration Certificate

QP-TS12-04-04-020044

T. Petch

Continuation of Calibration Certificate

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

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long-term stability

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

QP-TS12-04-04-020044

T. Petch

Continuation of Calibration Certificate

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

Summary of Measurement Result :

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

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

QP-TS12-04-04-020044

T. Petch

451-05171 Srinakharin Rd., Bangna, Bangkok 10700 THAILAND.
Tel: 2433-8800 Fax: 2433-1679 e-mail: cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACL23324
Pages : 3 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 Microphone UC-52 / Preamplifier NH-54
Serial No. : 00973109 / 171842 / 73485
ID No. : RYG_P80384

Condition As Found : GOOD

Customer : A-LS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 46, PHATTHANAKAN ROAD,
KHUAEANG PHATTHANAKAN, KHUET SUAN LUANG,
BANGKOK, 10250 THAILAND.Location :
Ambient Temperature : (23.0 ± 3) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (50.0 ± 20) %Received Date : 11 OCTOBER 2023
Calibration Date : 19-20 OCTOBER 2023
Date of Issue : 24 OCTOBER 2023

Calibrated by :

Nathakorn Petchum

Approved by :

T. Petch
(Thanakul Petchum)This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced
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QP-TS12-04-04-020044

Continuation of Calibration Certificate

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

Calibration Procedure : CP-AC-01

Calibration Method :

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY51202742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY5120004	EEL-HP 300266	13-FEB-24
Digital Multimeter	33461A	MY51220076	EEL-HP 290266	13-FEB-24
Digital Multimeter	34461A	MY6902473	EEL-HP 310266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977000	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAI	34560495	AA-3002-23	14-FEB-24

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

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

3.1 National Institute of Metrology (Thailand).

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

QP-TS12-04-04-02064

T. Pichan

Continuation of Calibration Certificate

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

Summary of Measurement Result :

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

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

QP-TS12-04-04-02064

T. Pichan

Continuation of Calibration Certificate

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

11. Overload indication

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

QP-TS12-04-04-02064

T. Pichan

451-451/3 Srinakharin Rd., Jungsathorn, Bangkai, Bangkok 10700 THAILAND.
Tel: 2435-8800 Fax: 2433-1079 e-mail: cal-center@hphom.com http://www.hphom.comCert. No. : ACL23325
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NR-42; Microphone UC-52 / Pre-amplifier NR-24
Serial No. : 01073423 / 160511 / 73684
ID No. : RYO_J30386

Condition As Found : GOOD

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

Location :
Ambient Temperature : (23.0 ± 1) °C
Pressure : (101.3 ± 0.3) kPa
Relative Humidity : (50.0 ± 2.0) %
Received Date : 11 OCTOBER 2023
Calibration Date : 19-20 OCTOBER 2023
Date of Issue : 24 OCTOBER 2023

Calibrated by : Natchanon Pichan

Approved by : T. Pichan
(Thanikul Pichan)

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QP-TS12-04-04-02064

Continuation of Calibration Certificate

Cert. No. : ACL23324
Job No. : VC67AC0011
Pages : 8 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
128.0	128.0	0.0	±1.1
119.0	119.0	0.0	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.0	0.0	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	53.9	-0.1	±1.1
49.0	49.0	0.0	±1.1
44.0	43.9	-0.1	±1.1
39.0	38.9	-0.1	±1.1
34.0	34.0	0.0	±1.1
30.0	29.9	-0.1	±1.1
29.0	28.9	-0.1	±1.1
28.0	27.9	-0.1	±1.1
27.0	26.9	-0.1	±1.1
26.0	25.8	-0.2	±1.1
25.0	24.9	-0.1	±1.1

QP-TS12-04-04-02064

T. Pichan

Continuation of Calibration Certificate

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

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

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

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

QP-TS12-04-04-02064

T. Pichan

Continuation of Calibration Certificate

Cert. No. : ACL23325
Job No. : YC07AC0011
Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

QP-TS12-04-04-020604

T. Petchur

401-1021 Moo 10, Bangkhen, Bangkok 10260, Thailand
Tel: +66 2483 8339 Email: sithiporn@sithiporn.comCert. No. : ACL24033
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42A / Microphone UC-52 / Pre-amplifier NH-24
Serial No. : 00623392 / 198639 / 26420
ID No. : RYGL_F30617

Condition As Found : GOOD

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

Location : -
Ambient Temperature : (23.0 ± 3) °C
Pressure : (101.3 ± 1) kPa
Relative Humidity : (50.0 ± 20) %

Received Date : 05 JANUARY 2024
Calibration Date : 12-15 JANUARY 2024
Date of Issue : 16 JANUARY 2024

Calibrated by : Nuthakorn Petchur

Approved by : T. Petchur
(Thanakul Petchur)

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Continuation of Calibration Certificate

Cert. No. : ACL23325
Job No. : YC07AC0011
Pages : 6 of 8

7. Level linearity on the reference level range

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

QP-TS12-04-04-020604

T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL23325
Job No. : YC07AC0011
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

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

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

QP-TS12-04-04-020604

T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL23325
Job No. : YC07AC0011
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
93.9 (93.96)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
15.4

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

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

3. Acoustical signal tests of frequency weightings

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

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

QP-TS12-04-04-020604

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Continuation of Calibration Certificate

Cert. No. : ACL23325
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4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviated from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	0.0	-0.1	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.0	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
9000	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
Imp	94.0	94.0	0.0	±0.1

6. Long-term stability

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

QP-TS12-04-04-020604

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Cert. No. : ACL24033
Job No. : VC67AC0052
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
127.0	127.0	0.0	±1.1
126.0	126.0	0.0	±1.1
125.0	125.0	0.0	±1.1
124.0	124.0	0.0	±1.1
123.0	123.0	0.0	±1.1
122.0	122.0	0.0	±1.1
121.0	121.0	0.0	±1.1
120.0	120.0	0.0	±1.1
119.0	119.0	0.0	±1.1
118.0	118.0	0.0	±1.1
117.0	117.0	0.0	±1.1
116.0	116.0	0.0	±1.1
115.0	115.0	0.0	±1.1
114.0	114.0	0.0	±1.1
113.0	113.0	0.0	±1.1
112.0	112.0	0.0	±1.1
111.0	111.0	0.0	±1.1
110.0	110.0	0.0	±1.1
109.0	109.0	0.0	±1.1
108.0	108.0	0.0	±1.1
107.0	107.0	0.0	±1.1
106.0	106.0	0.0	±1.1
105.0	105.0	0.0	±1.1
104.0	104.0	0.0	±1.1
103.0	103.0	0.0	±1.1
102.0	102.0	0.0	±1.1
101.0	101.0	0.0	±1.1
100.0	100.0	0.0	±1.1
99.0	99.0	0.0	±1.1
98.0	98.0	0.0	±1.1
97.0	97.0	0.0	±1.1
96.0	96.0	0.0	±1.1
95.0	95.0	0.0	±1.1
94.0	94.0	0.0	±1.1
93.0	93.0	0.0	±1.1
92.0	92.0	0.0	±1.1
91.0	91.0	0.0	±1.1
90.0	90.0	0.0	±1.1
89.0	89.0	0.0	±1.1
88.0	88.0	0.0	±1.1
87.0	87.0	0.0	±1.1
86.0	86.0	0.0	±1.1
85.0	85.0	0.0	±1.1
84.0	84.0	0.0	±1.1
83.0	83.0	0.0	±1.1
82.0	82.0	0.0	±1.1
81.0	81.0	0.0	±1.1
80.0	80.0	0.0	±1.1
79.0	79.0	0.0	±1.1
78.0	78.0	0.0	±1.1
77.0	77.0	0.0	±1.1
76.0	76.0	0.0	±1.1
75.0	75.0	0.0	±1.1
74.0	74.0	0.0	±1.1
73.0	73.0	0.0	±1.1
72.0	72.0	0.0	±1.1
71.0	71.0	0.0	±1.1
70.0	70.0	0.0	±1.1
69.0	69.0	0.0	±1.1
68.0	68.0	0.0	±1.1
67.0	67.0	0.0	±1.1
66.0	66.0	0.0	±1.1
65.0	65.0	0.0	±1.1
64.0	64.0	0.0	±1.1
63.0	63.0	0.0	±1.1
62.0	62.0	0.0	±1.1
61.0	61.0	0.0	±1.1
60.0	60.0	0.0	±1.1
59.0	59.0	0.0	±1.1
58.0	58.0	0.0	±1.1
57.0	57.0	0.0	±1.1
56.0	56.0	0.0	±1.1
55.0	55.0	0.0	±1.1
54.0	54.0	0.0	±1.1
53.0	53.0	0.0	±1.1
52.0	52.0	0.0	±1.1
51.0	51.0	0.0	±1.1
50.0	50.0	0.0	±1.1
49.0	49.0	0.0	±1.1
48.0	48.0	0.0	±1.1
47.0	47.0	0.0	±1.1
46.0	46.0	0.0	±1.1
45.0	45.0	0.0	±1.1
44.0	44.0	0.0	±1.1
43.0	43.0	0.0	±1.1
42.0	42.0	0.0	±1.1
41.0	41.0	0.0	±1.1
40.0	40.0	0.0	±1.1
39.0	39.0	0.0	±1.1
38.0	38.0	0.0	±1.1
37.0	37.0	0.0	±1.1
36.0	36.0	0.0	±1.1
35.0	35.0	0.0	±1.1
34.0	34.0	0.0	±1.1
33.0	33.0	0.0	±1.1
32.0	32.0	0.0	±1.1
31.0	31.0	0.0	±1.1
30.0	30.0	0.0	±1.1
29.0	29.0	0.0	±1.1
28.0	28.0	0.0	±1.1
27.0	27.0	0.0	±1.1
26.0	26.0	0.0	±1.1
25.0	25.0	0.0	±1.1

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Cert. No. : ACL24033
Job No. : VC67AC0052
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.8

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

Frequency Weighting	Measured value (dB)
A-weight	13.8
C-weight	20.6
Flat	26.1

3. Acoustical signal test of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.1	0.1	0.1	±1.5
1000	0.0	0.0	0.0	±1.0
8000	1.2	1.3	1.3	±5.0

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Cert. No. : ACL24033
Job No. : VC67AC0052
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by follow on IEC-61672-3 (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 item were made by observation of each instrument display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	13-FEB-24
Digital Multimeter	33461A	MY53220104	EEL-BP 304064	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL-BP 294066	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL-BP 314066	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KA1	34560495	AA-3002-23	14-FEB-24

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

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

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

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Cert. No. : ACL24033
Job No. : VC67AC0052
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8. Level linearity including the level range control

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

9. Tone burst response

Time Weighting	Time burst duration, T_b (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	108.0	0.0	1.5 : -5.0
	2	8	117.0	117.0	0.0	1.0 : -2.5
	200	800	124.0	124.1	0.1	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 : -5.0
	200	800	127.6	127.6	0.0	±1.0
	0.25	1	99.0	99.0	-0.1	1.5 : -5.0
SEL	2	8	108.0	108.0	0.0	1.0 : -2.5
	200	800	128.0	128.1	0.1	±1.0

10. Peak C sound level

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

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
Positive half cycle	135.4	135.1	-0.3	±3.0
Negative half cycle	135.4	135.1	-0.3	±3.0

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Cert. No. : ACL24033
Job No. : VC67AC0052
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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
40	0.0	0.0	0.0	±2.0
125	0.0	0.1	0.1	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.1	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	0.0	±2.0
4000	0.0	0.0	0.0	±2.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long-term stability

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

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Cert. No. : ACL24033
Job No. : VC67AC0052
Pages : 3 of 8

Summary of Measurement Result :

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

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Cert. No. : ACL24081
Job No. : VC67AC0654
Pages : 4 of 8

Result of calibration:

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.98)	94.0	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
13.4

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

Frequency Weighting	Measured value (dB)
A-weight	8.7
C-weight	13.7
Flat	19.3

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	0.3	0.3	±1.0
1000	0.2	0.2	0.2	±0.7
8000	0.4	0.5	0.5	+1.5, -2.5

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Cert. No. : ACL24081
Job No. : VC67AC0654
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 Acoustic chamber and Reference Standard Instruments.
For tests results of each item were made by observation of each instrument display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48817076	EE-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EE-0019-23	07-FEB-24
Digital Multimeter	33461A	MY5320104	EEL-HP 304056	13-FEB-24
Digital Multimeter	33461A	MY5320076	EEL-HP 294056	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL-HP 314056	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EE-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KA1	34560495	AA-3002-23	14-FEB-24

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

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

3.1 National Institute of Metrology (Thailand).

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

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Cert. No. : ACL24083
Job No. : VC67AC0852
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
99.7	89.7	0.0	±1.5

12. High level stability

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

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

End of Calibration Certificate

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Cert. No. : ACL24081
Job No. : VC67AC0654
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	0.0	0.1	±1.0
125	0.1	0.1	0.0	±1.0
250	0.1	0.0	0.0	±1.0
500	0.1	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, -4.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long-term stability

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

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Cert. No. : ACL24081
Job No. : VC67AC0654
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

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Cert. No. : ACL24081
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-52A / Microphone U/C-59 / Pre-amplifier N01-25
Serial No. : 01120936 / 21737 / 22325
ID No. : RYO, F80627

Condition As Found : GOOD

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

Location :
Ambient Temperature : (33.6 ± 1) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (50.0 ± 20) %
Received Date : 11 JANUARY 2024
Calibration Date : 22-24 JANUARY 2024
Date of Issue : 24 JANUARY 2024



Calibrated by : Nuthakorn Pinitaporn

Approved by : *T. Petchum*
(Thumkul Petchum)

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

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Cert. No. : ACL24082
Job No. : VC07AC0054
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53201094	EEL-BP 3040266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL-BP 2040266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL-BP 3140266	14-FEB-24
Programmable Attenuator	MAT-1079	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	297900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAI	34560495	AA-3002-23	14-FEB-24

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

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

3.1 National Institute of Metrology (Thailand).

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

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Cert. No. : ACL24081
Job No. : VC07AC0054
Pages : 3 of 8

11. Overload indication

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

12. High level stability

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

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

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Job No. : VC07AC0054
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±0.8
136.0	136.0	0.0	±0.8
135.0	135.1	0.1	±0.8
134.0	134.0	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
29.0	29.0	-0.1	±0.8
24.0	24.0	-0.1	±0.8
19.0	19.0	-0.1	±0.8
14.0	14.0	-0.1	±0.8
9.0	9.0	-0.1	±0.8
4.0	4.0	-0.1	±0.8

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Job No. : VC07AC0054
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. Time burst response	0.2	0.3
10. Peak C sound level	0.2	0.3
11. Overload indication	0.2	0.25
12. High-level stability	0.1	0.1

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Cert. No. : ACL24082
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-52A / Microphone UC-59 / Pre-amplifier NF-25
Serial No. : 0120937 / 21845 / 22326
ID No. : RYG_J30028

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 ± 1) kPa
Relative Humidity : (50.0 ± 29) %

Received Date : 11 JANUARY 2024
Calibration Date : 22-24 JANUARY 2024
Date of Issue : 24 JANUARY 2024

Calibrated by : Nattakorn Pitsuporn

Approved by : *T. Petch*
(Thanakul Petcharni)

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Cert. No. : ACL24081
Job No. : VC07AC0054
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Time burst response

Time Weighting	Time burst duration, T _b (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; -1.5
	2	8	117.0	116.9	-0.1	1.0; -1.5
	200	800	134.0	134.0	0.0	±0.5
Slow	2	8	108.0	107.9	-0.1	1.0; -1.5
	200	800	127.6	127.5	-0.1	±0.5
	0.25	1	99.0	98.8	-0.2	1.0; -1.5
SEL	2	8	108.0	107.9	-0.1	1.0; -1.5
	200	800	128.0	128.0	0.0	±0.5

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±2.0
One	136.4	136.4	-0.3	±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	135.6	135.1	-0.5	±1.0
Negative half cycle	135.6	135.1	-0.5	±1.0

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Cert. No. : ACL24082
Job No. : VC67AC0854
Pages : 8 of 8

11. Overload indication

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

12. High level stability

Frequency Weighting (dB)	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 $k = 2$ at any value following calculation, providing a level of confidence of approximately 95 %.

End of Calibration Certificate

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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	±0.8
136.0	136.0	0.0	±0.8
135.0	135.1	0.1	±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
128.0	128.0	0.0	±0.8
119.0	119.0	0.0	±0.8
114.0	114.0	0.0	±0.8
109.0	109.0	0.0	±0.8
104.0	104.0	0.0	±0.8
99.0	99.0	0.0	±0.8
94.0	94.0	0.0	±0.8
89.0	89.0	0.0	±0.8
84.0	84.0	0.0	±0.8
79.0	79.0	0.0	±0.8
74.0	74.0	0.0	±0.8
69.0	69.0	0.0	±0.8
64.0	64.0	0.0	±0.8
59.0	59.0	0.0	±0.8
54.0	54.0	0.0	±0.8
49.0	49.0	0.0	±0.8
44.0	44.0	0.0	±0.8
39.0	39.0	0.0	±0.8
34.0	34.0	0.0	±0.8
30.0	30.0	0.0	±0.8
29.0	28.9	-0.1	±0.8
28.0	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

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Cert. No. : ACL24082
Job No. : VC67AC0854
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limits (dB)
93.9 (93.98)	94.0	0.0	±0.3

2. Self-generated noise

2.1 Nominal test

Measured Value (dB)
14.2

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

Frequency Weighting (dB)	Measured value (dB)
A-weight	9.9
C-weight	14.3
Flat	19.9

3. Acoustical signal tests of frequency weightings

Measure 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	0.4	0.5	0.5	±1.5, ±2.5

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Cert. No. : ACL24083
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-52A / Microphone UC-59 / Pre-amplifier NH-25
Serial No.: 01120938 / 21888 / 22327
ID No.: RYG_FS0629

Condition As Found : GOOD

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

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

Received Date : 11 JANUARY 2024
Calibration Date : 22-24 JANUARY 2024
Date of Issue : 24 JANUARY 2024

Calibrated by : *Thamkul Petchurai*

Approved by : *T. Petch*
(Thamkul Petchurai)

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Cert. No. : ACL24082
Job No. : VC67AC0854
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Time burst response

Time Weighting	Tone burst duration, T _b (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	108.0	0.0	1.0; -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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±2.0
One	136.4	136.4	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

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Cert. No. : ACL24082
Job No. : VC67AC0854
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	0.7	±1.5, ±2.5
16000	0.0	-1.2	-1.1	±2.5, ±6.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long-term stability

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

T. Petch

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±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
128.0	128.0	0.0	±0.8
118.0	118.0	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

T. Petch

Result of calibration:

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.98)	94.0	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.4

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

Frequency Weighting	Measured value (dB)
A-weight	9.9
C-weight	14.3
Flat	20.2

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			Acceptance Limits
	Flat	C-weight	A-weight	
125	0.1	0.1	0.1	±1.0
1000	0.2	0.2	0.2	±0.7
8000	0.7	0.8	0.8	±1.5, -2.5

T. Petch

8. Level linearity including the level range control

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

9. Time burst response

Time Weighting	Time burst duration, T _b (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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±2.0
One	136.4	136.3	-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	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

T. Petch

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			Acceptance Limits
	Flat	C-weight	A-weight	
63	0.0	0.0	0.0	±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
Log	94.0	94.0	0.0	±0.1

6. Long-term stability

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

T. Petch

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 Acoustic chamber and Reference Standard Instruments.

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	53210A	MY6807076	EF-0069-23	07-FEB-24
Waveform Generator	31511B	MY5302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL-JP-3040246	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL-JP-2940246	13-FEB-24
Digital Multimeter	33461A	MY6002471	EEL-JP-3140246	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	06-FEB-24
Condenser Microphone	A180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KA	34560495	AA-1002-23	14-FEB-24

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

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

3.1 National Institute of Metrology (Thailand).

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

T. Petch

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. Time burst response	0.2	0.3
10. Peak C sound level	0.2	0.35
11. Overload indication	0.2	0.25
12. High level stability	0.1	0.1

T. Petch



Cert. No.: 23C3024
Page: 2 of 2

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

Function: DC voltage measurement	Range:	2000 mV	Uncertainty
Standard Value	UUC* Reading	Error	(k=1)
(mV)	(mV)	(mV)	(mV)
-200.0000	-199.9	0.1	0.6
-150.0000	-150.0	0.0	0.5
-100.0000	-100.0	0.0	0.5
-50.0000	-50.0	0.0	0.1
0.0000	0.0	0.0	0.1
50.0000	50.0	0.0	0.1
100.0000	100.0	0.0	0.1
150.0000	150.0	0.0	0.5
200.0000	199.8	-0.1	0.6

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

-00-

W 1193422

CERTIFICATE OF CALIBRATION

Certificate Number:
207437
Page 2 of 2

Environmental conditions

The following conditions were recorded at the time of the test:
Before Pressure: 101.44 kPa Temperature: 21.3 °C Humidity: 35.6 %
After Pressure: 101.44 kPa Temperature: 21.3 °C Humidity: 35.6 %

Test equipment

Equipment	Manufacturer	Model	Serial number
Distortion Meter	Kathley	2015	0094018
Acoustic Calibrator	Bruel & Kjaer	4231	2610257
Environmental Monitor	Comet	77510	21902528

Initial Acoustic Results

	Expected	Sample 1	Sample 2	Sample 3	Average	Deviation	Tolerance	Uncertainty
Level (dB)	114.00	114.31	114.31	114.29	114.30	0.30	±0.75	0.11 dB
Distortion (%)	< 4.00	0.32	0.26	0.40	0.33	0.33	+4.00	0.13 %
Frequency (Hz)	1000.0	998.2	998.3	998.3	998.3	-1.7	±20.0	0.1 Hz

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

Adjusted Acoustic Results

	Expected	Sample 1	Sample 2	Sample 3	Average	Deviation	Tolerance	Uncertainty
Level (dB)	114.00	114.01	114.01	114.02	114.01	0.01	±0.75	0.11 dB
Distortion (%)	< 4.00	0.30	0.34	0.34	0.33	0.33	+4.00	0.13 %
Frequency (Hz)	1000.0	998.1	998.3	998.3	998.2	-1.8	±20.0	0.1 Hz

Functionality Results

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

End of results

SITHIPORN ASSOCIATES CO., LTD. CALIBRATION LABORATORY

439-4035 Srinakharin Road, Bangkokmae, Bangkok, 10700 Thailand
Tel: +66 2422 9331 Email: calibration@sithiporn.com



Cert. No.: ACL34083
Job No.: VCV3AC0854
Pages: 8 of 8

11. Overload indication

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

12. High level stability

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

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

W. P. P.

CERTIFICATE OF CALIBRATION

ISSUED BY: Citrus Research plc
DATE OF ISSUE: 29 January 2024
CERTIFICATE NUMBER: 207437

Citrus Research plc
Acoustic House
Hammanby
North Yorkshire
YO14 0PH
United Kingdom

PREPARED BY: [Signature]
APPROVED BY: [Signature]
TEXT CAL DATE: 25/1/24

Page 1 of 2
Approved signatory
N Smith
Electronically signed:
[Signature]

doseBadge Reader : IEC 60942:2003

Instrument information

Manufacturer: Citrus Research plc
Model: RC 110A
Serial number: 73729
Class: 2

Test summary

Date of calibration: 29 January 2024

The doseBadge reader detailed above has been calibrated to the published data as described in the operating manual and in the half-inch configuration. The procedures and techniques used are as described in IEC60942:2003 Annex B - Periodic Tests and three determinations of the sound pressure level, frequency and total distortion were made.

The sound pressure level was measured using a V52F condenser microphone type MC224 manufactured by Citrus Research plc.

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

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

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

Notes:

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 metrology institutions. 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%.



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
104 PATTANABALABHUTHI RD. BANGKOK, THAILAND 10260
TEL: +66 2271 5888 FAX: +66 2271 5884



Cert. No.: 23CH1574
Page: 1 of 2

Certificate of Calibration

Equipment: pH Meter
Manufacturer: Mettler Toledo
Model: SevenExcellence
Serial No.: B04291445
ID No.: RYG_IN0152
Condition As-Received: Used Item
Received Date: 08 December 2023
Calibration Date: 15 December 2023
Reference: 2312-0151DSC-3
Submitted by: ALS Laboratory Group (Thailand) Co., Ltd. Rayong Branch
616710 Moo 5, T. Maenam Klu, A. Phatthadang,
Rayong 21140, Thailand

Ambient Temperature: (25 ± 2.5) °C
Relative Humidity: (50 ± 15) %
Calibration Procedure:
- CP-Cert by direct measurement with diamond voltage calibrator and direct measurement with certified reference material (CRM)
- CP-Cert by comparison with standard thermocouple

Calibrated by: Warakorn Lempayakul

Approved by: [Signature]
Approved Signatory

() Sathit, Miangnoi
() Warakorn Lempayakul
() Porpan Papi

Issue Date: 18 December 2023

The Uncertainties are for a confidence probability of approximately 95%

W 0061696



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
104 PATTANABALABHUTHI RD. BANGKOK, THAILAND 10260
TEL: +66 2271 5888 FAX: +66 2271 5884



Certificate of Calibration

Certificate No.: 23C3024
Page: 1 of 2

Equipment: pH Meter
Manufacturer: Mettler Toledo
Model: SevenExcellence
Serial No.: B04291445
ID No.: RYG_IN0152
Condition As-Received: Used Item
Received Date: 08 December 2023
Calibration Date: 14 December 2023
Reference: 2312-0151DSC-3
Submitted by: ALS Laboratory Group (Thailand) Co., Ltd. Rayong Branch
616710 Moo 5, T. Maenam Klu, A. Phatthadang,
Rayong 21140, Thailand

Procedure used: Calibrations were performed using calibrator protocol No. CP-671 according to JISAMET up 15

Conditions of this certificate of calibration

1. Reference standards (reference materials)
1) Multi-Product Calibrator
2) The result of calibration was made on the basis of the point specified by customer.
3) The certificate is valid only for the item calibrated on date and place of calibration.
4) This Certificate is issued to the International System of Units (SI) International System of Units (SI) units.
5) The certificate is issued to the International System of Units (SI) units.

Calibrated by: [Signature]
Issue Date: 15 December 2023
Approved Signatory: [Signature]
() Phatthadang
() Warakorn Lempayakul
() Porpan Papi

W 0331106



Cert.No.: 23LM125
Page: 1 of 2

Certificate of Calibration

Equipment : DO Meter with Sensor
Manufacturer : YSI
Model : 5000-115V
Serial No. : 15E102796
ID No. : RYG_EN0032
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.
Rayong Branch
616/10 Moo 5 T. Maenam Khu. A. Phakdaeng,
Rayong 21140 Thailand
Location : TPA On Site Calibration Laboratory
Received Order : 25 July 2023
Calibrated Date : 27 July 2023
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
AC Line Voltage : (220 ± 22) V

Calibrated by : Preecha Hahib

Approved by :
Approved Signatory

() Ponthippa Tameyaku
() Malee Butnua
(x) Sawit Inpi

Issue Date : 31 July 2023

The Uncertainty is for a confidence probability of approximately 95%

This certificate was not the original order due to full, except with the previous version.
Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

A 0053616



Cert.No.: 23TW108
Page: 1 of 2

Certificate of Testing

Equipment : DO Meter
Manufacturer : YSI
Model : 5000-115V
Serial No. : 15E102796
ID No. : RYG_EN0032
Received Date : 21 July 2023
Test Date : 24 July 2023
Reference : 2307-071305C-1
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.
Rayong Branch
616/10 Moo 5, T. Maenam Khu. A. Phakdaeng,
Rayong 21140, Thailand
Laboratory Condition : Temperature (25 ± 5) °C
Humidity (50 ± 20) %
Test Procedure : In-house method : CP-CH8
by Comparison Technique with Azide Modification Method

Tested by : Watsak Srinthen

Approved by :
Approved Signatory

() Mahite Butnua
(x) Sathip Meangma
() Wanarom Lengagratul

Issue Date : 28 July 2023

B 0320211



Cert.No.: 23CH1074
Page: 2 of 3

Condition of this calibration result

1. Reference Standard Instrument
- | Instrument | Serial No. | ID No. | Cert. No. | Exp. Date |
|--------------------------------|------------|----------|-----------|--------------|
| 1) Document Process Calibrator | 54020049 | 100RC116 | 23E2003 | 27 Aug 2024 |
| 2) Ref. Standard Thermometer | 4862054 | 110RC044 | 23R068 | 26 July 2024 |
- This certification is traceable to the International System of Unit maintained through:
- Technology Promotion Association (Thailand-Japan)

2. Certified Reference Materials : The measurement results are traceable to SI through CMA chem (Ltd.),
ANIS-ASQ National Accreditation Board, Accredited No. AN-1020

Buffer Solution	Manufacturer	Lot No.	Exp. Date
pH 4.008	CMA chem	910388	14 July 2025
pH 6.865	CMA chem	931959	01 Oct 2024
pH 8.987	CMA chem	940106	02 Nov 2024

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

Calibration Results

Function : mV Measurement

Performing standard curve by Fluke at pH (4.7,10)

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (mV)	Coverage factor k
	pH	mV	mV	pH		
pH Meter	4.700	177.48	177.3	4.696	0.008	3.00
S/N : B034291443	7.000	0.00	-0.4	7.000	0.008	2.00
	10.000	-177.48	-177.5	10.000	0.008	2.00

a 1193952



Equipment : DO Meter with Sensor
Condition As-Received : Used Item
Reference : 2307-071305C-2
Cert.No.: 23LM125
Page: 2 of 2

Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-OT01 according to comparison with Industrial Platinum Resistance Thermometer (IPRT) into Temperature Bath.

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:
- | Instrument | Serial No. | Cert. No. | Traceable | Due Date |
|------------------------|------------|-----------|-----------|-------------|
| 1) Digital Thermometer | 2168080 | 2211285 | TPA | 21 Oct 2023 |
2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This certification is traceable to the International System of Unit.

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

Result of Calibration :- (°C) Without Adjustment

Function : Temperature measurement.

This instrument was connected with temperature sensor, S/N: 1228475367

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	UUC ^o Reading (°C)	Error (°C)	Uncertainty (± °C)	Coverage Factor k
20.00	100	20.011	19.91	-0.101	0.15	2.00

UUC^o : 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 %.

-000-

a 1159515



Cert.No.: 23TW108
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	1308U10	23C01172	22 Mar 2023	
2) Balance	1126143764	140RC004	22 Mar 2023	20 Sep 2023

2. Standard Material :-

Material	Manufacturer	Lot No.	Assay
Sodium Thiosulfate pentahydrate	Merck	AM1763316	100.2%

Result : Dissolved Oxygen Meter Adjustment With Air 100 %

Dissolved Oxygen Probe No.: 15E100464

Titration Method (Azide Modification Method)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.16	8.17	0.0055

This report was certified only for the instrument we tested. It is allowable to use for study the system efficiency. The environmental impact control and present to organization it may concerned intend to use for advertising and referral purpose is prohibited. This report may not be reproduced other in full without written approval of the laboratory.

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a 1172155



Cert.No.: 23CH1514
Page: 3 of 3

Calibration Results

Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH measurement (±)	Coverage factor k
pH Electrode	4.008	4.013	164.1	0.0045	2.00
S/N: 3225068	6.866	6.998	6.7	0.0084	2.00
	9.997	10.002	-164.7	0.0085	2.11

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe.

Model : HiLabExpert Pro-ISM

Serial No. : 3225368

Dimension of probe:

Length : 120 mm

Diameter : 12 mm

Immersion Depth : 100 mm

Calibration Point (°C)	Standard Temperature (°C)	UUC ^o Reading (°C)	Error (°C)	Uncertainty of measurement (± °C)	Coverage factor k
25.0	25.003	24.3	-0.703	0.13	3.00

Remark :- UUC^o = Unit Under Calibration

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

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a 1193951



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

Procedure Used :-

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

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 MYST013711 23LM115 TPA 11 Jul 2024

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

3. This certification is traceable to the International System of Unit.

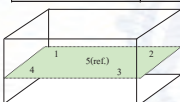
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Heat transfer medium used : Water

	Environmental (°C)	AC Voltage Supply (Volt)
Beginning of Calibration	25	55
Finished of Calibration	25	57



Front

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



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

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Calibration point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Average* Standard Reading (°C)	Uncertainty (± °C)
85.0	85.0	85.0	84.428	0.18

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Coverage Factor #
85.0	0.19	0.11	2

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

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

Stability : One-half of the greatest maximum difference of measured temperature at any one probe.

UUC* : Unit Under Calibration

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

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

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

Result of Calibration :-

Function of UUC* : Temperature Source

Fresh air setting : Close

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor #
104.0	104.0	104.0	0.085	0.52	0.90	2
180.0	180.0	180.0	0.20	1.2	2.0	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	1	2	3	4	5	6	7	8	9 (ref.)	
104.0	104.169	103.506	103.988	103.712	103.772	103.730	104.289	103.308	103.786	0.42
180.0	180.701	179.238	179.935	179.989	180.127	180.138	180.885	179.313	180.211	1.1

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

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

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

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

UUC* : Unit Under Calibration

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

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

-o0o-



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
3344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL.0-2717-3000-29 FAX.0-2719-9484



Certificate of Calibration

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

Equipment : Water Bath

Manufacturer : Memmert

Model : WNB22

Serial No. : L513.0648

ID No. : RYG_EN0061

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

616/10 Moo 5, T. Maenam Khu,

A. Pluakdaeng,

Rayong 21140, Thailand

Wet Chemistry Lab

Received Order : 21 March 2024

Calibration Date : 21 March 2024

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 30) %

Calibrated by : Man Pattanapongpaiboon

Approved by :

() Ponthippa Tameyakul

() Unnopphol Harachai

✓ Suwit Injai

Issue Date : 23 March 2024

The Uncertainties are for a confidence probability of approximately 95%

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TEL.0-2717-3000-29 FAX.0-2719-9484



Certificate of Calibration

Cert. No.: 24TM634
Page : 1 of 3

Equipment : Hot Air Oven

Manufacturer : Memmert

Model : UF 110

Serial No. : B423.0853

ID No. : RYG_EN0213

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

616/10 Moo 5 T. Maenam Khu,

A. Pluakdaeng,

Rayong 21140 Thailand

Oven Room

Received Order : 21 March 2024

Calibration Date : 21 - 22 March 2024

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 30) %

Calibrated by : Man Pattanapongpaiboon

Approved by :

() Ponthippa Tameyakul

() Unnopphol Harachai

✓ Suwit Injai

Issue Date : 23 March 2024

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written approval of the Head of Corporate Services & Equipment Calibration and Testing Services.



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2403-0563OC-3
Cert. No.: 24TM634
Page : 2 of 3

Procedure Used :-

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument-

Instrument Serial No. Cert. No. Traceable Due Date
1) Data Acquisition MYST013711 23LM115 TPA 11 Jul 2024

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

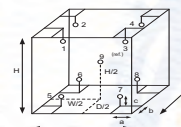
3. This certification is traceable to the International System of Unit.

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

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close



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

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

Position :	(180) °C	(104) °C
------------	------------	------------

1	18-18TC-01	18-18RTD-01
2	18-18TC-02	18-18RTD-02
3	18-18TC-03	18-18RTD-03
4	18-18TC-04	18-18RTD-04
5	18-18TC-05	18-18RTD-05
6	18-18TC-06	23-18RTD-06
7	18-18TC-07	18-18RTD-07
8	18-18TC-08	22-18RTD-08
9 (ref.)	18-18TC-09	18-18RTD-09

Certificate of System Qualification
GC-QC + GCMS-QC

System ID: GM-7
Organization Name: ALS Laboratory Group (Thailand) Co., Ltd.
Organization Location: 104 Pattanakarn Rd., Pattanakarn Rd., Khwaeng Suan Luang, Khet Suan Luang, Bangkok.
Date: December 13, 2023 3:32:48 PM
EQP Name: AgilentRecommended, AgilentRecommended
EQP Revision: GC-02.05, GCMS-02.00
Overall Qualification Status: Pass

System Inspection and Basic Safety and Operation

Name: 7890
Setpoint Status: Pass

Overall System Inspection and Basic Safety and Operation Test Status
Pass

Inlet Pressure Accuracy

Name: 7890
Fork: SBL

Setpoint Status: Pass

Setpoint: Actual
Inlet Pressure: 25.0 psi 35.0 psi
Accuracy: 0.0 psi
Agilent Recommended: ± 1.2

Overall Inlet Pressure Accuracy Test Status

Pass

GC Oven Temperature Accuracy

Name: 7890

Date: December 13, 2023 3:32:48 PM
System ID: GM-7
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Setpoint Status: Pass
Zone: Oven
Setpoint/Actual
Temperature: 230.0 232.3 °C
Accuracy: 2.3 °C
Agilent Recommended: ± 1.0 % setpoint in K (-4.8 °C)
 ± 1.0 % setpoint in K (5.5 °C)

Setpoint Status: Pass
Zone: Oven
Setpoint/Actual
Temperature: 190.0 190.7 °C
Accuracy: 0.7 °C
Agilent Recommended: ± 1.0 % setpoint in K (-3.3 °C)
 ± 1.0 % setpoint in K (3.3 °C)

Overall GC Oven Temperature Accuracy Test Status

Pass

GC Oven Temperature Stability

Name: 7890
Setpoint Status: Pass
Setpoint/Average
Temperature: 100.0 100.4 °C
Stability: 0.0 °C
Agilent Recommended: ± 0.5

Overall GC Oven Temperature Stability Test Status

Pass

Log Amp

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

Setpoint Status: Pass

Date: December 13, 2023 3:32:48 PM
System ID: GM-7
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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.: 24LM108
Page: 1 of 2

Equipment: pH Meter with Sensor
Manufacturer: Mettler Toledo
Model: SevenGo S2
Serial No.: C221115514
ID No.: RYG_FS0596
Submitted by: ALS Laboratory Group (Thailand) Co., Ltd.
(Rayong Branch)
61610 Moo 5 T. Maenam Khu. A. Phukdaeng,
Rayong 21140 Thailand
Location: TPA On Site Calibration Laboratory
Received Order: 28 June 2024
Calibrated Date: 01 July 2024
Ambient Temperature: (28 ± 10) °C
Relative Humidity: (50 ± 30) %
AC Line Voltage: (220 ± 22) V
Calibrated by: Warakorn Lemngatrakul
Approved by:
Approved Signatory
Issue Date: 03 July 2024

The Uncertainties are for a confidence probability of approximately 95%
This certificate may not be reproduced other than in full, except with the prior written
Approval of the Head of Corporate Services 3: Equipment Calibration and Testing Services.



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Certificate of Calibration

Cert.No.: 24CH774
Page: 1 of 2

Equipment: pH Meter
Manufacturer: Mettler Toledo
Model: SevenGo S2
Serial No.: C221115514
ID No.: RYG_FS0596
Condition As-Received: Used Item
Received Date: 28 June 2024
Calibration Date: 01 July 2024
Reference: 2406-0969DSC-6
Submitted by: ALS Laboratory Group (Thailand) Co., Ltd. Rayong Branch
61610 Moo 5, T. Maenam Khu.
A Phukdaeng, Rayong 21140, Thailand
Ambient Temperature: (25 ± 2.5) °C
Relative Humidity: (50 ± 15) %
Calibration Procedure: In-house method:
- CP-QHS by direct measurement with DC voltage
standard and direct measurement with
certified reference material (CRM)
Calibrated by: Warakorn Lemngatrakul
Approved by:
Approved Signatory
Issue Date: 03 July 2024

The Uncertainties are for a confidence probability of approximately 95%
This certificate may not be reproduced other than in full, except with the prior written
Approval of the Head of Corporate Services 3: Equipment Calibration and Testing Services.



Equipment: pH Meter with Sensor
Condition As-Received: Used Item
Reference: 2406-0969DSC-7
Procedure Used: Calibration was 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.

Cert. No.: 24LM108
Page: 2 of 2

Condition of this result of calibration
1. Reference standard instrument:-
Instrument Serial No. Cert. No. Traceable Due Date
1) Digital Thermometer 218090 231216 TPA 11 Oct 2024
2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This certification is traceable to the International System of Unit.
Remark: TPA : Technology Promotion Association (Thailand - Japan)
Result of Calibration: () Without Adjustment
Function: Temperature measurement.
This instrument was connected with temperature sensor, S/N: 3293232

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	Reading (°C)	Error (°C)	Uncertainty (± °C)	Coverage Factor k
25.0	100	25.003	25.1	0.097	0.16	2.00
30.0	100	30.002	30.2	0.198	0.16	2.00
40.0	100	40.003	40.2	0.197	0.16	2.00
50.0	100	50.002	50.2	0.198	0.16	2.00

UUC: Unit Under Calibration

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

-oOo-



Condition of this calibration result
1. Reference Standard Instrument
Instrument Serial No. ID No. Cert. No. Due Date
1) Document Process Calibrator 5403049 130RC116 23E2802 27 Aug 2024

- This Certification 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., ANSISQ National Accreditation Board, Accredited No. AR-1835

Buffer Solution	Manufacturer	Lot No.	Exp. Date
pH 4.009	CPA chem	970851	25 Apr 2025
pH 6.996	CPA chem	970852	25 Apr 2025
pH 9.997	CPA chem	970853	25 Apr 2025

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
			mV	pH		
pH Meter S/N: C221115514	4.00	177.45	178	4.00	0.58	2.00
	7.00	0.00	0	7.00	0.58	2.00
	10.00	-177.45	-178	10.00	0.58	2.00

Function: pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH Measurement	Coverage factor k
pH Electrode S/N: 3293232	4.008	4.01	180	0.0079	2.00
	6.986	6.99	5	0.011	2.00
	9.997	10.00	-172	0.0092	2.00

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

-oOo-

User Name: support@amazon.com
 Report Generated by: hrudayam_A88900492

System ID: 626 -
 Print Date: December 15, 2022 3:02:47 PM

DR-2022 Transaction log:

Time	Transaction	Activity	Type of Transaction	Optional Information
	Bank	Emulation		
December 13, 2022 12:53:54 PM	End	Emulation	Signal to NMSB 01 - Local - Ignition, Front SBL, S2 - - Release, 01 - Emulation using Flamelet 1, L, L = 1200	Run Config: 1
December 13, 2022 1:50:47 PM	Auto	Test/Modifies	Signal to NMSB 01 - Local - Ignition, Front SBL, S2 - - Release, 01 - Emulation using Flamelet 1, L, L = 1200	Disable Run for Run Config: 2
December 13, 2022 3:58:41 PM	Start	Emulation	Signal to NMSB 01 - Local - Ignition, Front SBL, S2 - - Release, 01 - Emulation using Flamelet 1, L, L = 1200	None
December 13, 2022 4:10:52 PM	Auto	Data	Signal to NMSB 01 - Local - Ignition, Front SBL, S2 - - Release, 01 - Emulation using Flamelet 1, L, L = 1200	Zero New Path: C:\Users\support\Documents\NMSB01\NMSB01_P1.d
December 13, 2022 1:09:22 PM	End	Emulation	Signal to NMSB 01 - Local - Ignition, Front SBL, S2 - - Release, 01 - Emulation using Flamelet 1, L, L = 1200	Run Config: 2
December 13, 2022 1:00:00 PM	Auto	Test/Modifies	Signal to NMSB 01 - Local - Ignition, Front SBL, S2 - - Release, 01 - Emulation using Flamelet 1, L, L = 1200	Disable Run for Run Config: 3
December 13, 2022 1:50:50 PM	Bank	Emulation	Signal to NMSB 01 - Local - Ignition, Front SBL, S2 - - Release, 01 - Emulation using Flamelet 1, L, L = 1200	None
December 13, 2022 2:14:20 PM	Auto	Data	Signal to NMSB 01 - Local - Ignition, Front SBL, S2 - - Release, 01 - Emulation using Flamelet 1, L, L = 1200	Zero New Path: C:\Users\support\Documents\NMSB01\NMSB01_P1.d

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Date: December 13, 2023 3:32:46 PM
System ID: 0667

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Date	Transaction	Activity Performed	Type of Transaction	Optional Information
December 10, 2022 11:52:58 AM	Sale	CashSale	Tune #1 - DORTA SD - (Owner - None) #1 - Entrance Flament 2 Cylindrical - No response received	None
December 10, 2022 11:53:05 AM	Sale	Exchange	Signal in Noise #1 - Liquid Injection, Front Sds, SD - Booster #1 - Detector using Flament 1 / L = 1000	None
December 10, 2022 11:52:59 AM	Sale	Exchange	Tune #1 - DORTA SD - (Owner - None) #1 - Entrance Flament 2 Cylindrical - No response received	None
December 11, 2022 11:42:42 AM	Sale	Exchange	Tune #1 - DORTA SD - (Owners - Best Control : 1 #1 - Entrance Flament 2 Cylindrical - No response received)	None
December 13, 2022 11:49:47 AM	Sale	Exchange	Signal in Noise #1 - Liquid Injection, Front Sds, SD - Booster #1 - Detector using Flament 1 / L = 1000	None
December 13, 2022 11:49:46 AM	AirB	AirColored	Sensors	None
December 13, 2022 12:30:34 PM	AirB	AirPostPumped	Sensors	None
December 13, 2022 12:35:45 PM	AirB	ControlledPumped	Sensors	None
December 13, 2022 12:34:42 PM	Sale	Qualification	Sensors	OQ
December 13, 2022 12:35:45 PM	Sale	Exchange	Signal in Noise #1 - Liquid Injection, Front Sds, SD - Booster #1 - Detector using Flament 1 / L = 1000	None

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

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Date	Transaction Date	Activity Performed	Type of Transaction	Optional Information:
December 19, 2023 10:44:16 AM	End	Estimate	System Inactivation or Error Safety and Compliance - FMSI - Classification Type: No scenario.	Run Chart : 1
December 19, 2023 10:44:17 AM	Start	Estimate	Test Pressure Accuracy - Point (S), - Pressure Controlled Stop - S: 28.0 psi <= 1.2 psi	
December 19, 2023 10:44:18 AM	End	Estimate	Test Pressure Accuracy - Point (S), - Pressure Controlled Stop - S: 28.0 psi <= 1.2 psi	Run Chart : 1
December 19, 2023 10:45:07 AM	Test	Estimate	GL Down Temperature Accuracy - FMSI - Temperature (Down - S: 200.0°F, L = +0.8 AND +> 1.2 to support 0.8)	Name
December 19, 2023 10:45:08 AM	Audit	Data	GL Down Temperature Accuracy - FMSI - Temperature (Down - S: 200.0°F, L = +0.8 AND +> 1.2 to support 0.8)	Manual Data Entry
December 19, 2023 10:45:17 AM	End	Estimate	GL Down Temperature Accuracy - FMSI - Temperature (Down - S: 200.0°F, L = +0.8 AND +> 1.2 to support 0.8)	Run Chart : 1
December 19, 2023 10:45:18 AM	Start	Estimate	GL Down Temperature Accuracy - FMSI - Temperature (Down - S: 100.0°F, L = +0.8 AND +> 1.2 to support 0.8)	Name
December 19, 2023 10:45:19 AM	Audit	Data	GL Down Temperature Accuracy - FMSI - Temperature (Down - S: 100.0°F, L = +0.8 AND +> 1.2 to support 0.8)	Manual Data Entry
December 19, 2023 10:45:20 AM	End	Estimate	GL Down Temperature Accuracy - FMSI - Temperature (Down - S: 100.0°F, L = +0.8 AND +> 1.2 to support 0.8)	Run Chart : 1

Date: December 15, 2023 3:32:46 PM
System ID: GSA-7

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Time	Transaction Date	Activity Performed	Type of Transaction	Optional Information
November 13, 2023 2:20:57 PM	End	Execution	Signal to Mixer D1 - Liquid Injection, Front SBL, SQ - Source D1 - Execution using Flament 2 - L - L - L200	Hot (Chem. 1)
December 13, 2023 2:20:57 PM	Abort	Test/Recheck	Signal to Mixer D1 - Liquid Injection, Front SBL, SQ - Source D1 - Execution using Flament 2 - L - L - L200	Sample Not for Run Count 1
December 13, 2023 2:20:57 PM	Start	Execution	Signal to Mixer D1 - Liquid Injection, Front SBL, SQ - Source D1 - Execution using Flament 2 - L - L - L200	None
December 13, 2023 2:20:57 PM	Abort	End	Signal to Mixer D1 - Liquid Injection, Front SBL, SQ - Source D1 - Execution using Flament 2 - L - L - L200	2166 Run Count 1 C:\Documents\2166\MSDC00000000_F10
December 13, 2023 2:20:57 PM	End	Execution	Signal to Mixer D1 - Liquid Injection, Front SBL, SQ - Source D1 - Execution using Flament 2 - L - L - L200	Hot (Chem. 2)
December 13, 2023 2:20:57 PM	Abort	Test/Recheck	Signal to Mixer D1 - Liquid Injection, Front SBL, SQ - Source D1 - Execution using Flament 2 - L - L - L200	Deviation Not for Run Count 2
December 13, 2023 2:20:57 PM	Start	Execution	Signal to Mixer D1 - Liquid Injection, Front SBL, SQ - Source D1 - Execution using Flament 2 - L - L - L200	None
December 13, 2023 2:20:57 PM	Abort	End	Signal to Mixer D1 - Liquid Injection, Front SBL, SQ - Source D1 - Execution using Flament 2 - L - L - L200	2166 Run Count 1 C:\Documents\2166\MSDC00000000_F10

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

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Sheet Name: Logsheet_transaction

System No: 2087

Report Generated by Username: A300694002

Print Date: December 11, 2022 3:47 PM

QBR-2022 Transaction Log

Time	Transaction Status	Activity Performed	Type of Transaction	Optional Information
December 11, 2022 12:37:32 PM	Auto	Stop	Signal to Release RD - Liquid Injection: From 905_002 - Source: RD - Extension using Flameout 1 - L = 1000	Data Sheet Path: D:\Research\QBR\Notes \QBR2022\RDN_P1.D
December 11, 2022 12:38:16 PM	Start	Execution	Signal to Release RD - Liquid Injection: From 905_002 - Source: RD - Extension using Flameout 1 - L = 1000	Run Count: 1
December 11, 2022 12:38:51 PM	Auto	Test/Shutdown	Signal to Release RD - Liquid Injection: From 905_002 - Source: RD - Extension using Flameout 1 - L = 1000	Overhaul Start Run Count: 1
December 11, 2022 12:39:01 PM	Stop	Execution	Signal to Release RD - Liquid Injection: From 905_002 - Source: RD - Extension using Flameout 1 - L = 1000	Notes
December 11, 2022 12:40:14 PM	Auto	Stop	Signal to Release RD - Liquid Injection: From 905_002 - Source: RD - Extension using Flameout 1 - L = 1000	Data Sheet Path: D:\Research\QBR\Notes \QBR2022\RDN_P1.D
December 11, 2022 12:42:00 PM	Start	Execution	Signal to Release RD - Liquid Injection: From 905_002 - Source: RD - Extension using Flameout 1 - L = 1000	Run Count: 2
December 11, 2022 12:42:00 PM	Stop	Execution	Signal to Release RD - Liquid Injection: From 905_002 - Source: RD - Extension using Flameout 1 - L = 1000	Notes
December 11, 2022 12:43:07 PM	Auto	Stop	Signal to Release RD - Liquid Injection: From 905_002 - Source: RD - Extension using Flameout 1 - L = 1000	Data Sheet Path: D:\Research\QBR\Notes \QBR2022\RDN_P1.D

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Date: December 13, 2023 3:32:46 PM
System ID: 0867

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User Name: isapah@hawaii.gov			System Job: 008-7	
Report Generated by: HistoView - A300000002			Print Date: December 13, 2013 10:27 AM	
QMR-0023 Transaction Log				
Date	Transaction Date	Activity Performed	Type of Transaction	Optional Information
December 13, 2013	10:55:46 AM	Start	QC Oven Temperature Stability	None
			- 100% - Temperature - Oven	
			9. 100.0°C - $\pm 0.5^\circ\text{C}$	
December 13, 2013	10:58:37 AM	Start	Evaporator	None
			Signal to Heats 81 - Liquid	
			Manifold, Flow, Bld, SD	
			Source: B1 - Evaporator using	
			Flowset 1 - 1, $\pm 0.1\text{ L/min}$	
December 13, 2013	10:58:40 AM	Start	QC Oven Temperature Stability	None
			- 100% - Temperature - Oven	
			9. 100.0°C - $\pm 0.5^\circ\text{C}$	
December 13, 2013	10:59:10 AM	End	QC Oven Temperature Stability	Manual Data Entry
			- 100% - Temperature - Oven	
			9. 100.0°C - $\pm 0.5^\circ\text{C}$	
December 13, 2013	11:01:12 AM	End	Evaporator	QC Oven Temperature Stability - Run Count: 1
			- 100% - Temperature - Oven	
			9. 100.0°C - $\pm 0.5^\circ\text{C}$	
December 13, 2013	11:01:15 AM	Start	Evaporator	Log Amp - 007FA SQ - Source: None
			E1 - Evaporator	
December 13, 2013	11:01:42 AM	End	Evaporator	Log Amp - 007FA SQ - Source: Run Count: 1
			E1 - Evaporator	
December 13, 2013	11:01:43 AM	Start	Evaporator	007FA - 007FA SQ - Source: E1 - None
			- Evaporator	
December 13, 2013	11:01:44 AM	End	Evaporator	007FA - 007FA SQ - Source: E1 - Run Count: 1
			- Evaporator	
December 13, 2013	11:01:45 AM	Start	Evaporator	Turn On - 007FA SQ - Source: E1 - None
			E1 - Evaporator Flowsheet 1	
			(Qualitative - Not Reported)	
December 13, 2013	11:01:45 AM	End	Evaporator	Turn On - 007FA SQ - Source: E1 - Run Count: 1
			E1 - Evaporator Flowsheet 1	
			(Qualitative - Not Reported)	

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

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

Date: December 13, 2023 3:32:46 PM
System ID: CMA7