

ภาคผนวก ง

ใบรับรองเอกสารการสอบเทียบเครื่องมือตรวจวิเคราะห์



รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

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Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Stack (CEPH)	Carbon Monoxide	Analyzer - System calibration, Standard gas	-	-	-	-
Stack (CEPH)	Oxygen / Nitrogen	Analyzer - System calibration, Standard gas	-	-	-	-
Stack (CEPH)	Sulfur Dioxide	Analyzer - System calibration, Standard gas	-	-	-	-
Stack	Total Suspended Particulate	Console Control Unit	BK/F_550547	30 Nov 24	30 May 25	6
Stack	Total Suspended Particulate	Filter Tube	BK/F_550552	30 Nov 24	1 Jun 25	6
Stack	Total Suspended Particulate	Digital Balance	BK/F_550569	5 Nov 24	5 Nov 25	12
Stack	Flow Rate & Temperature	Console Control Unit	BK/F_550547	30 Nov 24	30 May 25	6
Stack	Flow Rate & Temperature	Filter Tube	BK/F_550552	30 Nov 24	1 Jun 25	6
Ambient	Nitrogen Dioxide	NO ₂ Analyzer	BK/F_550570	3 Jan 25	3 Jul 25	6
Ambient	Nitrogen Dioxide	NO ₂ Analyzer	BK/F_551070	3 Jan 25	3 Jul 25	6
Ambient	Nitrogen Dioxide	NO ₂ Analyzer	BK/F_550702	3 Jan 25	3 Jul 25	6
Ambient	Nitrogen Dioxide	NO ₂ Analyzer	BK/F_551457	3 Jan 25	3 Jul 25	6
Ambient	Sulfur Dioxide	SO ₂ Analyzer	BK/F_550779	3 Jan 25	3 Jul 25	6
Ambient	Sulfur Dioxide	SO ₂ Analyzer	BK/F_551069	3 Jan 25	3 Jul 25	6
Ambient	Sulfur Dioxide	SO ₂ Analyzer	BK/F_550781	3 Jan 25	3 Jul 25	6
Ambient	Sulfur Dioxide	SO ₂ Analyzer	BK/F_551456	3 Jan 25	3 Jul 25	6
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	BK/F_550807	4 Jan 24	4 Jul 25	18
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	BK/F_550909	28 Jun 24	21 Dec 25	18
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	BK/F_550910	10 Jun 24	10 Dec 25	18
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	BK/F_550530	4 Jan 24	4 Jul 25	18
Ambient	Temperature	Temperature Sensor	BK/F_550637	4 Jan 24	4 Jul 25	18
Ambient	Temperature	Temperature Sensor	BK/F_550909	28 Jun 24	28 Dec 25	18
Ambient	Temperature	Temperature Sensor	BK/F_550910	10 Jun 24	10 Dec 25	18
Ambient	Temperature	Temperature Sensor	BK/F_550888	4 Jan 24	4 Jul 25	18
Ambient	Particulate Matter (PM10)	High Volume	BK/F_551377	-	-	On site Calibration
Ambient	Particulate Matter (PM10)	High Volume	BK/F_551062	-	-	On site Calibration
Ambient	Particulate Matter (PM10)	High Volume	BK/F_551378	-	-	On site Calibration
Ambient	Particulate Matter (PM10)	High Volume	BK/F_550378	-	-	On site Calibration
Ambient	Particulate Matter (PM10)	Digital Balance	BK/F_550403	30 May 25	30 May 26	12
Ambient	Total Suspended Particulate	High Volume	BK/F_551375	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	BK/F_551058	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	BK/F_551056	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	BK/F_550365	-	-	On site Calibration
Ambient	Total Suspended Particulate	Digital Balance	BK/F_550403	30 May 25	30 May 26	12
Noise	Leq 24 hrs	Sound Calibrator	BK/F_550632	16 Jun 25	16 Jun 26	12
Noise	Leq 24 hrs	Sound Level Meter	BK/F_550913	28 Apr 25	28 Apr 26	12
Noise	Leq 24 hrs	Sound Level Meter	BK/F_550111	21 Jan 25	21 Jan 26	12
Noise	Leq 24 hrs	Sound Level Meter	BK/F_550930	28 Apr 25	28 Apr 26	12
Noise	Leq 8 hrs	Sound Calibrator	BK/F_550417	22 Oct 24	22 Oct 25	12
Noise	Leq 8 hrs	Sound Level Meter	BK/F_550033	21 Oct 24	21 Oct 25	12
Noise	Leq 8 hrs	Sound Level Meter	BK/F_550110	13 Dec 24	13 Dec 25	12
Noise	Leq 8 hrs	Sound Level Meter	BK/F_550929	19 Mar 25	19 Mar 26	12
Noise	Leq 8 hrs	Sound Level Meter	BK/F_551222	23 Dec 24	23 Dec 25	12
Noise	Leq 8 hrs	Sound Level Meter	BK/F_551225	23 Dec 24	23 Dec 25	12
Noise	Leq 8 hrs	Sound Level Meter	BK/F_550993	19 Sep 24	19 Sep 25	12
Noise	Leq 8 hrs	Sound Level Meter	BK/F_550994	12 Nov 24	12 Nov 25	12
Noise	Leq 8 hrs	Sound Level Meter	BK/F_550995	12 Nov 24	12 Nov 25	12
Noise	Leq 8 hrs	Sound Level Meter	BK/F_550996	23 Aug 24	23 Aug 25	12
Noise	Leq 8 hrs	Sound Level Meter	BK/F_550998	14 Nov 24	14 Nov 25	12
Noise	Leq 8 hrs	Sound Level Meter	BK/F_551000	14 Nov 24	14 Nov 25	12
Noise	Leq 8 hrs	Sound Level Meter	BK/F_551215	3 Dec 24	3 Dec 25	12
Noise	Leq 8 hrs	Sound Level Meter	BK/F_551218	3 Dec 24	3 Dec 25	12
Water Lab	Temperature	Self meter	BK/F_550696	1 Oct 24	1 Oct 25	12
Water Lab	pH at 25 °C	Self meter	BK/F_550342	17 Oct 24	17 Oct 25	12
Water Lab	Residual Free Chlorine	Chlorine Meter	BK/F_550670	1 Apr 25	1 Apr 26	12

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รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Water Lab	Oil & Grease	Electronic Top-Loading Balance	BK/F_550001	2 Aug 24	2 Aug 25	12
Water Lab	Oil & Grease	Water Bath	BK/F_550439	29 Oct 24	29 Oct 25	12
Water Lab	Total Dissolved Solids (TDS)	Electronic Top-Loading Balance	BK/F_550003	2 Aug 24	2 Aug 25	12
Water Lab	Total Dissolved Solids (TDS)	Oven	BK/F_550425	29 Oct 24	29 Oct 25	12
Water Lab	Copper	Cu-15	BK/F_551073	4 Oct 24	3 Oct 25	10
Water Lab	Copper	Hot Block	BK/F_550664	41 Jun 25	4 Sep 25	18
Water Lab	Copper	Chamber (Storage Room)	BK/F_550367	4 Jun 25	4 Dec 25	18
Water Lab	Zinc	Cu-15	BK/F_551074	4 Oct 24	3 Oct 25	10
Water Lab	Zinc	Hot Block	BK/F_550664	41 Jun 25	4 Sep 25	18
Water Lab	Zinc	Chamber (Cooling Room)	BK/F_550367	4 Jun 25	4 Dec 25	18

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Lot No. 2517995-1

ANALYZER CALIBRATION DATA

Client : Gulf JP UT Co., Ltd. Location : HRSG 11
Date : 26 Apr 25 Test Operator : Worawich T.

O₂ ANALYZER
Model : TELEDYNE API T200H Serial No. : 991
Span (%) : 25

	Cylinder Value (%)	Initial Analyzers Calibration Response (%)	Final Analyzers Calibration Response (%)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.02	0.08
Low-Level Gas	7.98	8.02	8.03	0.04
Span Gas	16.02	15.94	16.02	0.32

NO_x ANALYZER
Model : TELEDYNE API T200H Serial No. : 991
Span (ppm) : 100

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.02	0.02
Low-Level Gas	56.16	56.20	56.19	0.01
Span Gas	80.73	80.42	80.40	0.02

SO₂ ANALYZER
Model : TELEDYNE API T100H Serial No. : 553
Span (ppm) : 100

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.02	0.02
Low-Level Gas	55.55	55.78	55.67	0.11
Span Gas	79.43	80.10	80.12	0.02

CO ANALYZER
Model : TELEDYNE API T300M Serial No. : 924
Span (ppm) : 100

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.00	0.00
Low-Level Gas	54.22	54.20	54.37	0.17
Span Gas	76.82	79.90	80.00	0.10



Lot No. 2517995-1

SYSTEM CALIBRATION BIAS AND DRIFT DATA

Client : Gulf JP UT Co., Ltd. Location : HRSG 11
Date : 26 Apr 25 Test Operator : Worawich T.

O₂ ANALYZER
Cylinder Conc. (%) : 16.02 Span (%) : 25

	O ₂ Analyzer Calibration Response	Initial Values System Calibration Response	System Cal Bias (% of Span)	Final Values System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.00	0.00	0.00	0.02	0.08	0.08
Upscale Gas	15.94	15.96	0.08	16.00	0.24	0.16

NO_x ANALYZER
Cylinder Conc. (ppm) : 80.73 Span (ppm) : 100

	NO _x Analyzer Calibration Response	Initial Values System Calibration Response	System Cal Bias (% of Span)	Final Values System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.00	0.00	0.00	0.00	0.00	0.00
Upscale Gas	80.42	80.45	0.03	80.40	0.02	0.05

SO₂ ANALYZER
Cylinder Conc. (ppm) : 79.43 Span (ppm) : 100

	SO ₂ Analyzer Calibration Response	Initial Values System Calibration Response	System Cal Bias (% of Span)	Final Values System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.00	0.02	0.02	0.04	0.04	0.02
Upscale Gas	80.10	80.17	0.07	80.20	0.10	0.03

CO ANALYZER
Cylinder Conc. (ppm) : 79.82 Span (ppm) : 100

	CO Analyzer Calibration Response	Initial Values System Calibration Response	System Cal Bias (% of Span)	Final Values System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.00	0.03	0.03	0.04	0.04	0.01
Upscale Gas	79.90	80.12	0.22	80.21	0.31	0.09



CEMs Data

Client Name
Plant NameGulf JP UT Co. Ltd
GUT

Location

HRSG 11

Run No 1				Run No 2				Run No 3				Run No 4			
Date	Time	Flowrate kg/hr	Temperature °C	Date	Time	Flowrate kg/hr	Temperature °C	Date	Time	Flowrate kg/hr	Temperature °C	Date	Time	Flowrate kg/hr	Temperature °C
26-Apr-25	11:15	1708.4	83.2	26-Apr-25	11:36	1708.8	83.5	26-Apr-25	11:57	1709.3	83.5	26-Apr-25	12:18	1707.5	83.2
26-Apr-25	11:16	1705.0	83.3	26-Apr-25	11:37	1703.0	83.6	26-Apr-25	11:58	1702.6	83.6	26-Apr-25	12:19	1702.0	83.0
26-Apr-25	11:17	1699.1	83.4	26-Apr-25	11:38	1709.6	83.6	26-Apr-25	11:59	1699.2	83.6	26-Apr-25	12:20	1699.8	83.1
26-Apr-25	11:18	1754.9	83.4	26-Apr-25	11:39	1699.2	83.6	26-Apr-25	12:00	1709.7	83.5	26-Apr-25	12:21	1697.9	83.0
26-Apr-25	11:19	1699.5	83.5	26-Apr-25	11:40	1709.8	83.7	26-Apr-25	12:01	1698.4	83.2	26-Apr-25	12:22	1698.0	83.0
26-Apr-25	11:20	1671.1	83.5	26-Apr-25	11:41	1699.1	83.7	26-Apr-25	12:02	1709.6	82.8	26-Apr-25	12:23	1704.5	83.1
26-Apr-25	11:21	1722.5	83.5	26-Apr-25	11:42	1698.7	83.8	26-Apr-25	12:03	1698.5	82.8	26-Apr-25	12:24	1703.3	83.2
26-Apr-25	11:22	1693.1	83.5	26-Apr-25	11:43	1704.9	83.6	26-Apr-25	12:04	1704.1	82.6	26-Apr-25	12:25	1703.4	83.0
26-Apr-25	11:23	1694.6	83.5	26-Apr-25	11:44	1702.9	83.3	26-Apr-25	12:05	1709.5	82.4	26-Apr-25	12:26	1699.9	83.5
26-Apr-25	11:24	1719.3	83.5	26-Apr-25	11:45	1701.4	83.4	26-Apr-25	12:06	1708.5	82.8	26-Apr-25	12:27	1700.5	83.6
26-Apr-25	11:25	1693.7	83.6	26-Apr-25	11:46	1742.0	83.6	26-Apr-25	12:07	1708.5	82.9	26-Apr-25	12:28	1702.2	83.7
26-Apr-25	11:26	1754.6	83.5	26-Apr-25	11:47	1703.8	83.4	26-Apr-25	12:08	1699.4	83.1	26-Apr-25	12:29	1699.9	83.7
26-Apr-25	11:27	1693.6	83.5	26-Apr-25	11:48	1700.9	83.4	26-Apr-25	12:09	1701.4	83.2	26-Apr-25	12:30	1697.8	83.7
26-Apr-25	11:28	1687.0	83.5	26-Apr-25	11:49	1687.0	83.4	26-Apr-25	12:10	1702.5	83.3	26-Apr-25	12:31	1698.5	83.7
26-Apr-25	11:29	1705.5	83.4	26-Apr-25	11:50	1693.0	83.3	26-Apr-25	12:11	1703.4	83.4	26-Apr-25	12:32	1701.3	83.7
26-Apr-25	11:30	1693.1	83.4	26-Apr-25	11:51	1707.9	83.2	26-Apr-25	12:12	1709.6	83.6	26-Apr-25	12:33	1699.4	83.7
26-Apr-25	11:31	1691.9	83.4	26-Apr-25	11:52	1675.7	83.2	26-Apr-25	12:13	1699.3	83.5	26-Apr-25	12:34	1694.6	83.7
26-Apr-25	11:32	1726.5	83.4	26-Apr-25	11:53	1722.9	83.3	26-Apr-25	12:14	1692.0	83.6	26-Apr-25	12:35	1679.3	83.7
26-Apr-25	11:33	1743.9	83.4	26-Apr-25	11:54	1719.6	83.4	26-Apr-25	12:15	1700.1	83.6	26-Apr-25	12:36	1702.7	83.9
26-Apr-25	11:34	1706.0	83.5	26-Apr-25	11:55	1705.2	83.4	26-Apr-25	12:16	1706.7	83.5	26-Apr-25	12:37	1709.9	83.0
26-Apr-25	11:35	1692.9	83.5	26-Apr-25	11:56	1693.8	83.5	26-Apr-25	12:17	1703.4	83.4	26-Apr-25	12:38	1695.1	83.1
Max	1764.9	83.6	Max	1742.0	83.7	Max	1760.3	83.6	Max	1760.9	83.7	Max	1697.1	83.4	
Avg	1700.9	83.5	Avg	1704.0	83.5	Avg	1703.2	83.2	Avg	1697.1	83.4	Avg	1697.1	83.4	



CEMs Data

Client Name
Plant NameGulf JP UT Co. Ltd
GUT

Location

HRSG 11

Run No 5				Run No 6				Run No 7				Run No 8			
Date	Time	Flowrate kg/hr	Temperature °C	Date	Time	Flowrate kg/hr	Temperature °C	Date	Time	Flowrate kg/hr	Temperature °C	Date	Time	Flowrate kg/hr	Temperature °C
26-Apr-25	12:39	1689.9	83.1	26-Apr-25	13:00	1709.3	83.5	26-Apr-25	13:21	1660.2	83.4	26-Apr-25	13:42	1699.9	82.3
26-Apr-25	12:40	1716.6	83.3	26-Apr-25	13:01	1703.6	83.5	26-Apr-25	13:22	1660.3	83.4	26-Apr-25	13:43	1699.3	82.2
26-Apr-25	12:41	1712.7	83.4	26-Apr-25	13:02	1694.1	83.3	26-Apr-25	13:23	1699.8	83.1	26-Apr-25	13:44	1675.5	82.2
26-Apr-25	12:42	1709.7	83.4	26-Apr-25	13:03	1698.8	83.3	26-Apr-25	13:24	1703.7	82.7	26-Apr-25	13:45	1708.8	82.1
26-Apr-25	12:43	1702.1	83.7	26-Apr-25	13:04	1694.1	83.5	26-Apr-25	13:25	1709.6	82.5	26-Apr-25	13:46	1701.0	82.1
26-Apr-25	12:44	1702.6	83.7	26-Apr-25	13:05	1695.0	82.8	26-Apr-25	13:26	1678.6	82.3	26-Apr-25	13:47	1704.3	82.2
26-Apr-25	12:45	1708.8	83.3	26-Apr-25	13:06	1704.8	82.6	26-Apr-25	13:27	1699.3	82.2	26-Apr-25	13:48	1705.5	82.2
26-Apr-25	12:46	1688.4	83.6	26-Apr-25	13:07	1694.3	82.1	26-Apr-25	13:28	1703.9	82.1	26-Apr-25	13:49	1707.3	82.2
26-Apr-25	12:47	1713.9	83.9	26-Apr-25	13:08	1703.0	82.3	26-Apr-25	13:29	1704.4	82.0	26-Apr-25	13:50	1708.8	82.2
26-Apr-25	12:48	1685.3	83.8	26-Apr-25	13:09	1677.5	82.2	26-Apr-25	13:30	1703.1	82.5	26-Apr-25	13:51	1707.7	82.2
26-Apr-25	12:49	1691.9	83.8	26-Apr-25	13:10	1696.9	82.2	26-Apr-25	13:31	1699.9	82.2	26-Apr-25	13:52	1694.9	82.2
26-Apr-25	12:50	1688.3	83.8	26-Apr-25	13:11	1679.1	82.1	26-Apr-25	13:32	1702.0	82.1	26-Apr-25	13:53	1699.1	82.2
26-Apr-25	12:51	1715.1	83.6	26-Apr-25	13:12	1714.4	82.1	26-Apr-25	13:33	1705.2	82.2	26-Apr-25	13:54	1706.1	82.2
26-Apr-25	12:52	1697.2	83.2	26-Apr-25	13:13	1722.2	82.1	26-Apr-25	13:34	1674.6	82.2	26-Apr-25	13:55	1701.6	82.2
26-Apr-25	12:53	1714.6	83.3	26-Apr-25	13:14	1699.9	82.1	26-Apr-25	13:35	1748.4	82.2	26-Apr-25	13:56	1704.4	82.3
26-Apr-25	12:54	1703.6	83.8	26-Apr-25	13:15	1747.9	82.2	26-Apr-25	13:36	1703.8	82.2	26-Apr-25	13:57	1677.7	82.3
26-Apr-25	12:55	1688.8	82.5	26-Apr-25	13:16	1740.4	82.4	26-Apr-25	13:37	1675.3	82.2	26-Apr-25	13:58	1687.0	82.3
26-Apr-25	12:56	1700.7	82.4	26-Apr-25	13:17	1693.9	82.8	26-Apr-25	13:38	1690.1	82.2	26-Apr-25	13:59	1687.8	82.4
26-Apr-25	12:57	1694.1	82.5	26-Apr-25	13:18	1709.2	83.1	26-Apr-25	13:39	1698.8	82.2	26-Apr-25	14:00	1701.6	82.4
26-Apr-25	12:58	1682.3	82.7	26-Apr-25	13:19	1729.3	83.3	26-Apr-25	13:40	1709.8	82.2	26-Apr-25	14:01	1703.9	82.4
26-Apr-25	12:59	1713.1	82.8	26-Apr-25	13:20	1667.7	83.4	26-Apr-25	13:41	1709.3	82.3	26-Apr-25	14:02	1703.3	82.4
Max	1765.7	83.9	Max	1769.2	82.4	Max	1768.6	82.4	Max	1768.6	82.4	Max	1706.6	82.2	
Avg	1707.9	83.3	Avg	1706.2	82.7	Avg	1699.7	82.4	Avg	1699.7	82.4	Avg	1706.6	82.2	



CEMs Data

Client Name
Plant NameGulf JP UT Co. Ltd
GUT

Location

HRSG 11

Run No 9				Run No 10				Run No 11				Run No 12			
Date	Time	Flowrate kg/hr	Temperature °C	Date	Time	Flowrate kg/hr	Temperature °C	Date	Time	Flowrate kg/hr	Temperature °C	Date	Time	Flowrate kg/hr	Temperature °C
26-Apr-25	14:03	1692.9	82.5	26-Apr-25	14:24	1698.8	82.1	26-Apr-25	14:45	1708.9	82.5	26-Apr-25	15:06	1698.9	81.7
26-Apr-25	14:04	1748.9	82.5	26-Apr-25	14:25	1703.3	82.2	26-Apr-25	14:46	1712.2	82.1	26-Apr-25	15:07	1699.9	81.7
26-Apr-25	14:05	1682.0	82.3	26-Apr-25	14:26	1709.8	82.2	26-Apr-25	14:47	1709.4	82.0	26-Apr-25	15:08	1705.4	81.8
26-Apr-25	14:06	1698.3	82.4	26-Apr-25	14:27	1702.1	82.3	26-Apr-25	14:48	1722.9	82.1	26-Apr-25	15:09	1702.4	81.9
26-Apr-25	14:07	1706.6	82.4	26-Apr-25	14:28	1703.0	82.3	26-Apr-25	14:49	1691.3	82.1	26-Apr-25	15:10	1698.9	81.9
26-Apr-25	14:08	1693.0	82.4	26-Apr-25	14:29	1679.9	82.2	26-Apr-25	14:50	1671.1	82.1	26-Apr-25	15:11	1698.5	82.0
26-Apr-25	14:09	1741.0	82.4	26-Apr-25	14:30	1703.1	82.2	26-Apr-25	14:51	1695.6	82.1	26-Apr-25	15:12	1698.4	82.0
26-Apr-25	14:10	1690.9	82.3	26-Apr-25	14:31	1679.9	82.1	26-Apr-25	14:52	1680.3	82.0	26-Apr-25	15:13	1702.3	82.1
26-Apr-25	14:11	1706.7	82.3	26-Apr-25	14:32	1705.6	82.1	26-Apr-25	14:53	1679.7	81.9	26-Apr-25	15:14	1700.8	82.1
26-Apr-25	14:12	1699.8	82.2	26-Apr-25	14:33	1698.9	82.1	26-Apr-25	14:54	1706.4	81.8	26-Apr-25	15:15	1748.1	82.1
26-Apr-25	14:13	1694.4	82.2	26-Apr-25	14:34	1703.7	82.0	26-Apr-25	14:55	1699.3	81.7	26-Apr-25	15:16	1703.7	82.1
26-Apr-25	14:14	1724.8	82.2	26-Apr-25	14:35	1679.7	81.9	26-Apr-25	14:56	1699.2	81.7	26-Apr-25	15:17	1698.3	82.0
26-Apr-25	14:15	1698.3	82.2	26-Apr-25	14:36	1702.4	81.9	26-Apr-25	14:57	1679.3	81.6	26-Apr-25	15:18	1698.8	82.0
26-Apr-25	14:16	1712.0	82.2	26-Apr-25	14:37	1691.7	81.8	26-Apr-25	14:58	1702.4	81.6	26-Apr-25	15:19	1702.1	82.0
26-Apr-25	14:17	1703.9	82.2	26-Apr-25	14:38	1691.7	81.8	26-Apr-25	14:59	1680.2	81.5	26-Apr-25	15:20	1703.3	82.0
26-Apr-25	14:18	1690.5	82.2	26-Apr-25	14:39	1676.1	81.5	26-Apr-25	15:00	1701.8	81.5	26-Apr-25	15:21	1703.5	82.0
26-Apr-25	14:19	1698.1	82.2	26-Apr-25	14:40	1708.8	81.9	26-Apr-25	15:01	1692.4	81.5	26-Apr-25	15:22	1708.3	82.0
26-Apr-25	14:20	1704.0	82.1	26-Apr-25	14:41	1704.1	81.8	26-Apr-25	15:02	1693.7	81.5	26-Apr-25	15:23	1703.6	82.1
26-Apr-25	14:21	1694.1	82	26-Apr-25	14:42	1704.1	81.8	26-Apr-25	15:03	1693.7	81.5	26-Apr-25	15:24	1703.6	82.1
26-Apr-25	14:22	1697.2	82.0	26-Apr-25	14:43	1703.9	81.9	26-Apr-25	15:04	1690.3	81.4	26-Apr-25	15:25	1706.0	82.1
26-Apr-25	14:23	1694.6	82.0	26-Apr-25	14:44	1690.7	82.0	26-Apr-25	15:05	1698.8	81.6	26-Apr-25	15:26	1702.4	82.1
26-Apr-25	14:24	1693.0	82.0	26-Apr-25	14:45	1690.7	82.0	26-Apr-25	15:06	1698.8	81.6	26-Apr-25	15:27	1702.4	82.1
Max	17413	82.5		Max	17034	82.3		Max	17346	82.1		Max	17093	82.1	



Lot No. 2518009-1

SYSTEM CALIBRATION BIAS AND DRIFT DATA

Client: Gulf JP UT Co., Ltd. Location: HRSO 11
Date: 26 Apr 25 Test Operator: Worawich T.O₂ ANALYZER
Cylinder Conc. (%) : 16.02 Span (%) : 25

	O ₂ Analyzer Calibration Response	Initial Values System Calibration Response	System Cal Bias (% of Span)	Final Values System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.00	0.00	0.00	0.00	0.00	0.00
Upscale Gas	15.94	15.96	0.02	16.00	0.04	0.16

NO_x ANALYZER
Cylinder Conc. (ppm) : 89.73 Span (ppm) : 100

	NO _x Analyzer Calibration Response	Initial Values System Calibration Response	System Cal Bias (% of Span)	Final Values System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.00	0.00	0.00	0.00	0.00	0.00
Upscale Gas	89.42	89.45	0.03	90.40	0.02	0.05

SO₂ ANALYZER
Cylinder Conc. (ppm) : 79.43 Span (ppm) : 100

	SO ₂ Analyzer Calibration Response	Initial Values System Calibration Response	System Cal Bias (% of Span)	Final Values System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.00	0.02	0.02	0.04	0.04	0.02
Upscale Gas	80.10	80.17	0.07	80.20	0.10	0.03

CO ANALYZER
Cylinder Conc. (ppm) : 78.82 Span (ppm) : 100

	CO Analyzer Calibration Response	Initial Values System Calibration Response	System Cal Bias (% of Span)	Final Values System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.00	0.03	0.03	0.04	0.04	0.01
Upscale Gas	79.90	80.12	0.22	80.21	0.31	0.09

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

ALS Laboratory Group



EMISSION TEST RESULT

Client: Gulf JP UT Co., Ltd. Run # 1
Date: 26 Apr 25 Location: HRSO 11
Start Time: 11:15 Test Operator: Worawich T.
SO₂ Analyzer Model: TELEDYNE API T100H Finish Time: 11:35
NO_x/O₂ Analyzer Model: TELEDYNE API T200H Serial No.: 553
CO/CO₂ Analyzer Model: TELEDYNE API T300M Serial No.: 991
Serial No.: 924

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
11:15	13.32	4.14	17.91	0.09	0.40	
11:16	13.33	4.15	18.24	0.10	0.37	
11:17	13.33	4.13	18.25	0.10	0.39	
11:18	13.34	4.12	18.08	0.08	0.33	
11:19	13.34	4.13	18.08	0.08	0.34	
11:20	13.34	4.14	18.31	0.09	0.35	
11:21	13.36	4.12	18.34	0.08	0.37	
11:22	13.35	4.13	18.07	0.08	0.49	
11:23	13.36	4.11	18.14	0.07	0.43	
11:24	13.35	4.11	18.47	0.07	0.41	
11:25	13.33	4.13	18.79	0.08	0.45	
11:26	13.39	4.13	18.82	0.08	0.41	
11:27	13.39	4.11	18.62	0.07	0.44	
11:28	13.38	4.10	18.41	0.06	0.47	
11:29	13.39	4.11	18.37	0.07	0.46	
11:30	13.36	4.11	18.51	0.07	0.51	
11:31	13.35	4.11	18.58	0.07	0.44	
11:32	13.39	4.13	18.42	0.08	0.48	
11:33	13.32	4.14	18.46	0.09	0.47	
11:34	13.36	4.13	18.70	0.09	0.36	
11:35	13.37	4.12	18.62	0.07	0.42	
Average	13.38	4.12	18.41	0.07	0.42	

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

ALS Laboratory Group



EMISSION TEST RESULT

Client: Gulf JP UT Co., Ltd. Run # 2
Date: 26 Apr 25 Location: HRSO 11
Start Time: 11:38 Test Operator: Worawich T.
SO₂ Analyzer Model: TELEDYNE API T100H Finish Time: 11:58
NO_x/O₂ Analyzer Model: TELEDYNE API T200H Serial No.: 553
CO/CO₂ Analyzer Model: TELEDYNE API T300M Serial No.: 991
Serial No.: 924

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
11:38	13.37	4.14	18.59	0.09	0.33	
11:39	13.37	4.14	18.72	0.09	0.31	
11:40	13.35	4.13	18.65	0.08	0.37	
11:41	13.35	4.13	18.72	0.08	0.41	
11:42	13.35	4.13	18.05	0.08	0.36	
11:43	13.35	4.12	18.81	0.07	0.37	
11:44	13.36	4.13	18.09	0.08	0.37	
11:45	13.41	4.12	18.06	0.07	0.39	
11:46	13.34	4.12	18.49	0.07	0.38	
11:47	13.37	4.13	18.57	0.08	0.36	
11:48	13.40	4.11	18.58	0.06	0.40	
11:49	13.37	4.11	18.62	0.06	0.39	
11:50	13.35	4.13	18.92	0.08	0.35	
11:51	13.39	4.14	18.00	0.09	0.35	
11:52	13.37	4.12	18.84	0.07	0.40	
11:53	13.38	4.11	18.70	0.06	0.36	
11:54	13.40	4.09	18.71	0.05	0.40	
11:55	13.39	4.12	18.53	0.07	0.34	
11:56	13.40	4.13	18.93	0.08	0.31	
11:57	13.38	4.13	18.00	0.08	0.39	
11:58	13.37	4.13	18.95	0.08	0.36	
Average	13.37	4.12	18.74	0.07	0.37	

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

ALS Laboratory Group



EMISSION TEST RESULT

Client: Gulf JP UT Co., Ltd. Run # 3
Date: 26 Apr 25 Location: HRSO 11
Start Time: 11:57 Test Operator: Worawich T.
SO₂ Analyzer Model: TELEDYNE API T100H Finish Time: 12:17
NO_x/O₂ Analyzer Model: TELEDYNE API T200H Serial No.: 553
CO/CO₂ Analyzer Model: TELEDYNE API T300M Serial No.: 991
Serial No.: 924

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
11:57	13.36	4.13	19.17	0.08	0.33	
11:58	13.40	4.12	19.10	0.07	0.31	
11:59	13.39	4.12	18.96	0.07	0.42	
12:00	13.41	4.11	18.70	0.06	0.39	
12:01	13.41	4.10	18.60	0.05	0.41	
12:02	13.39	4.10	18.55	0.05	0.44	
12:03	13.39	4.09	18.79	0.04	0.38	
12:04	13.34	4.11	18.92	0.06	0.32	
12:05	13.38	4.12	18.76	0.07	0.32	
12:06	13.36	4.14	18.79	0.09	0.36	
12:07	13.40	4.13	18.55	0.08	0.33	
12:08	13.39	4.11	18.76	0.06	0.36	
12:09	13.41	4.11	18.64	0.06	0.39	
12:10	13.41	4.12	18.70	0.07	0.35	
12:11	13.39	4.12	18.72	0.07	0.37	
12:12	13.39	4.12	18.70	0.07	0.43	
12:13	13.39	4.12	18.77	0.07	0.33	
12:14	13.36	4.11	18.79	0.06	0.38	
12:15	13.43	4.12	18.67	0.07	0.33	
12:16	13.39	4.12	18.55	0.07	0.36	
12:17	13.42	4.12	18.60	0.07	0.38	
Average	13.39	4.11	18.77	0.07	0.36	

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

ALS Laboratory Group



Airgas Specialty Gases
Airgas USA LLC
6141 Easton Road
Plumsteadville, PA 18949
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

Customer: AIR LIQUIDE
(THAILAND) LTD
Part Number: E04NI98E3HA0002
Cylinder Number: GN0027199
Laboratory: 124 - Plumsteadville - PA
PGVP Number: A12022
Gas Code: CO,NO,NOX,SO2,BALN

Reference Number: 160-402340013-1
Cylinder Volume: 247.2 CF
Cylinder Pressure: 2215 PSIG
Valve Outlet: 680
Certification Date: Feb 11, 2020

Expiration Date: Feb 11, 2030

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/231, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are in a mole/mole basis unless otherwise noted.

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

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	80.00 PPM	80.73 PPM	G1	+/- 1.0% NIST Traceable	02/04/2022, 02/11/2022
CARBON MONOXIDE	80.00 PPM	79.82 PPM	G1	+/- 0.6% NIST Traceable	02/04/2022
NITRIC OXIDE	80.00 PPM	80.73 PPM	G1	+/- 1.0% NIST Traceable	02/04/2022, 02/11/2022
SULFUR DIOXIDE	80.00 PPM	79.43 PPM	G1	+/- 0.8% NIST Traceable	02/04/2022, 02/11/2022
NITROGEN	Balance				

CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	09010212	KAL004777	88.48 PPM CARBON MONOXIDE/NITROGEN	+/- 0.5%	Oct 16, 2024
NTRM	200810-15	CC733105	98.61 PPM NITRIC OXIDE/NITROGEN	+/- 0.5%	Oct 05, 2026
NTRM	200810-04	CC708044	98.61 PPM NITRIC OXIDE/NITROGEN	+/- 0.5%	Oct 05, 2026
GMIS	12426869139	CC323707	4.097 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.0%	Sep 03, 2024
NTRM	11010419	KAL004813	99.5 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Jul 28, 2023

ANALYTICAL EQUIPMENT		
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet i550 FTIR AUP2010245 CO	FTIR	Feb 03, 2022
Nicolet i550 FTIR AUP2010245 NO	FTIR	Feb 10, 2022
Nicolet i550 FTIR AUP2010245 NO2	FTIR	Jan 27, 2022
Nicolet i550 FTIR AUP2010245 SO2	FTIR	Jan 20, 2022

Triad Data Available Upon Request

NOTES: Gross Weight: 48.5 Kg
Net Weight: 8.1 Kg



Airgas Specialty Gases
Airgas USA LLC
6141 Easton Road
Plumsteadville, PA 18949
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL

Part Number: E04NI98E3HA0066
Cylinder Number: ND11215
Laboratory: 124 - Plumsteadville - PA
PGVP Number: A12021
Gas Code: CO,NO,NOX,SO2,BALN

Reference Number: 160-402138464-1
Cylinder Volume: 247.2 CF
Cylinder Pressure: 2215 PSIG
Valve Outlet: 680
Certification Date: Jul 15, 2021

Expiration Date: Jul 15, 2029

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/231, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are in a mole/mole basis unless otherwise noted.

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

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	55.00 PPM	56.16 PPM	G1	+/- 1.4% NIST Traceable	07/08/2021, 07/15/2021
CARBON MONOXIDE	55.00 PPM	54.22 PPM	G1	+/- 0.5% NIST Traceable	07/08/2021
NITRIC OXIDE	55.00 PPM	56.15 PPM	G1	+/- 1.0% NIST Traceable	07/08/2021, 07/15/2021
SULFUR DIOXIDE	55.00 PPM	55.55 PPM	G1	+/- 1.1% NIST Traceable	07/08/2021, 07/15/2021
NITROGEN	Balance				

CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	11010130	KAL004536	97.31 PPM CARBON MONOXIDE/NITROGEN	+/- 0.4%	Oct 04, 2022
PRM	12386	D85025	9.91 PPM AIR/NITROGEN DIOXIDE	2.0%	Feb 20, 2020
NTRM	200810-50	CC733426	98.61 PPM NITRIC OXIDE/NITROGEN	+/- 0.9%	Oct 06, 2026
GMIS	124268689	CC323707	4.028 PPM NITROGEN DIOXIDE/NITROGEN	2.1%	Aug 15, 2021
NTRM	18010224	KAL003938	97.69 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.5%	Dec 23, 2021

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

ANALYTICAL EQUIPMENT		
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet i550 FTIR AUP2010245 CO	FTIR	Jun 24, 2021
Nicolet i550 FTIR AUP2010245 NO	FTIR	Jul 01, 2021
Nicolet i550 FTIR AUP2010245 NO2	FTIR	Jun 30, 2021
Nicolet i550 FTIR AUP2010245 SO2	FTIR	Jul 09, 2021

Triad Data Available Upon Request

NOTES: Gross Weight: 47.9 Kg
Net Weight: 7.8 Kg



Batch # 160-402138464-1



Airgas Specialty Gases
Airgas USA LLC
6141 Easton Road
Plumsteadville, PA 18949
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

Customer: AIR LIQUIDE
(THAILAND) LTD
Part Number: E02NI92E3HA0000
Cylinder Number: GN0027038
Laboratory: 124 - Plumsteadville - PA
PGVP Number: A12022
Gas Code: O2,BALN

Reference Number: 160-402340009-1
Cylinder Volume: 248.4 CF
Cylinder Pressure: 2214 PSIG
Valve Outlet: 590
Certification Date: Feb 10, 2022

Expiration Date: Feb 10, 2030

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/231, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are in a mole/mole basis unless otherwise noted.

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

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
OXYGEN	8.00 %	7.979 %	G1	+/- 0.5% NIST Traceable	02/10/2022
NITROGEN	Balance				

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

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

Triad Data Available Upon Request

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



Airgas Specialty Gases
Airgas USA LLC
6141 Easton Road
Plumsteadville, PA 18949
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

Customer: AIR LIQUIDE
(THAILAND) LTD
Part Number: E02NI84E3HA0001
Cylinder Number: GN0027207
Laboratory: 124 - Plumsteadville - PA
PGVP Number: A12022
Gas Code: O2,BALN

Reference Number: 160-402340010-1
Cylinder Volume: 249.8 CF
Cylinder Pressure: 2214 PSIG
Valve Outlet: 590
Certification Date: Feb 02, 2022

Expiration Date: Feb 02, 2030

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/231, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are in a mole/mole basis unless otherwise noted.

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

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
OXYGEN	16.00 %	16.02 %	G1	+/- 0.4% NIST Traceable	02/02/2022
NITROGEN	Balance				

CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	08010220	K005228	23.20 % OXYGEN/NITROGEN	+/- 0.4%	Jun 01, 2022

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

Triad Data Available Upon Request

NOTES: Gross Weight: 48.8 Kg
Net Weight: 8.2 Kg





CONSOLE CONTROL UNIT CALIBRATION TEST REPORT

Calibration of Date : 30 Nov 24
Next Cal Date : 30 May 25
Barometric Pressure (mmHg) : 760.5
Relative Humidity (%) : 50.0
Temperature (C°) : 30.0
Reference Dry Gas Meter Data
Reference Dry Gas Meter ID : BKK_FS069
Serial No. : 1607009
Correction Factor (Y) : 1.0000
Next Calibration Date : 10 Jun 25

ΔH (mm H ₂ O)	Θ Minutes	Reference Dry Gas Meter Calibration						Console Control Drygas Meter										Dry Gas Meter Correction Factor (Y)	Office Calibration Factor (Y)	ΔHg
		V ₁ (liters)			T ₁ (°C)	V ₂ (liters)			T ₂ (°C)	T ₃ (°C)	T ₄ (°C)	Avg Tm (°C)								
		Final	Initial	Total		Final	Initial	Total												
15	12.68	141.98	0.00	141.98	31.0	126.5080	126.5080	141.93	31.0	31.0	31.0	31.0	1.0051	49.3302						
25	9.75	150.02	0.00	150.02	32.0	126.5880	126.5880	146.00	32.0	32.0	32.0	32.0	1.0112	48.7446						
50	0.76	150.09	0.00	150.09	32.0	126.5850	126.5850	147.00	32.0	32.0	32.0	32.0	1.0151	48.8205						
80	5.25	150.27	0.00	150.27	32.0	126.6020	126.6020	147.03	32.0	32.0	32.0	32.0	1.0144	45.0754						
120	4.26	150.12	0.00	150.12	32.0	126.6190	126.6190	145.00	32.0	32.0	32.0	32.0	1.0224	44.6066						
													1.0141	46.9155						

Y Ratio of reading of reference to dry gas meter; tolerance for individual values ± 0.02 from average.
ΔH Office pressure differential that equates to 21.24 in. of air @ 25 C and 760 mm of mercury. mmH₂O tolerance for individual values ± 5.08 from average.

Procedure
Calibrated

DATE: 1 Jun 24



DIGITAL TEMPERATURE CALIBRATION DATA SHEET

Calibration Date :	30 Nov 24	Ambient Temperature (°C)	30
Calibration sheet No. :	C-301124-BKK_FS0548	Relative Humidity (%) :	60
Digital Temperature ID	BKK_FS0548	Reference Temperature ID	BKK_FS1144
Serial No. :	1606040	Serial No. :	201090008013
Model :	XC-572-V	Model :	Digicon-CC-VT-MS
		Next Calibrate :	16 Jan 25

Location	Reference Temperature °C	Digital Temperature °C	Error °C	MPE	Pass / Fail
Stack	0	0	0	±3	Pass
	25	25	0	±3	Pass
	50	51	1	±3	Pass
	100	102	2	±3	Pass
	150	152	2	±3	Pass
	200	202	2	±3	Pass
Probe	250	252	2	±3	Pass
	300	302	2	±3	Pass
	500	502	2	±3	Pass
	100	101	1	±3	Pass
	120	120	0	±3	Pass
	140	142	2	±3	Pass
Oven	100	101	1	±3	Pass
	120	121	1	±3	Pass
Filter	140	142	2	±3	Pass
	100	101	1	±3	Pass
Exit	120	121	1	±3	Pass
	140	141	1	±3	Pass
Meter	0	0	0	±3	Pass
	25	25	0	±3	Pass
	50	51	1	±3	Pass
AUX	0	0	0	±3	Pass
	25	25	0	±3	Pass
	50	51	1	±3	Pass

MPE : (Maximum permissible error of measurement) ค่าความผิดพลาดสูงสุดของค่าที่วัดได้

Calibrated by :

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



PROBE NOZZLE DIAMETER CALIBRATION DATA SHEET

Calibration Date	30 Nov 24	Nozzle Set ID. :	BKK_FS0547
Calibration Sheet No. :	C-301124-BKK_FS0547	Vernier Caliper ID. :	BKK_FS1123

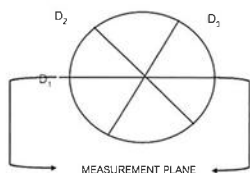
Nozzle ID #	Nozzle Diameter (cm.)			Hi - Lo ΔD	(D ₁ + D ₂ + D ₃) / 3 D _{avg}
	D ₁	D ₂	D ₃		
1	0.315	0.315	0.315	0.000	0.315
2	0.475	0.475	0.475	0.000	0.475
3	0.635	0.635	0.635	0.000	0.635
4	0.790	0.790	0.790	0.000	0.790
5	0.950	0.950	0.950	0.000	0.950
6	1.110	1.110	1.110	0.000	1.110
7	1.270	1.270	1.270	0.000	1.270
8	1.600	1.600	1.600	0.000	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 :

Field Scientist (2)

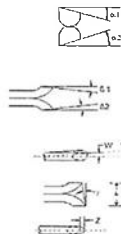
Field Scientist (1)

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



Type S Pitot Tube Calibration

Date Calibration	30-Nov-24	Due Date	1-Jun-25
Pitot ID	BKK_FS0552	Inclinometer ID	BKK_FS1131
Pitot SN	-	Vernier ID	BKK_FS1405



Parameter	Value	Allowable Range	Check
α1	2.2	-10° < α1 < +10°	OK
α2	3	-10° < α2 < +10°	OK
β1	-1.2	-5° < β1 < +5°	OK
β2	2.3	-5° < β2 < +5°	OK
γ	1.4	-	-
θ	1.2	-	-
Z = A tan γ	0.022	Z ≤ 0.125"	OK
W = A tan θ	0.018	W ≤ 0.031"	OK
Dt	0.375	0.188" to 0.375"	OK
A/2Dt	1.173	1.05 ≤ PA/Dt ≤ 1.5	OK
A	0.88	2.1Dt ≤ A ≤ 3Dt	OK

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

Calibrated by :

En

(1)

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



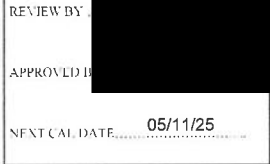
Accredited by

NSC-TISI-TIS 17025
Calibration 0426

Calibration certificate

Calibration Certificate No. 24BCI0440

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



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

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

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

Sartorius (Thailand) Co., Ltd.
129 Rama 9 Road, Huaykwang
10310 BangkokVerical®
Version 6.5

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Calibration certificate No.: 24BCI0440

Calibration Certificate

Calibration object

Single range instrument

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

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

Place of calibration

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

Calibration procedure

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

Test equipment

Test equipment type	Test equipment ID	Valid until
Thermometer	MHB-382SD s/nB011342 Traceable to SI unit through DKSH	21 Aug 2025
Test weight set OIML R111 E2	Certificale No.M2308197S_E2(Traceable to SI unit through TCS)	23 Aug 2025

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Calibration certificate No.: 24BCI0440

Calibration Certificate

Adjustment Status

The measuring device was internally adjusted before the calibration.

Environmental and measuring conditions

Date of calibration	05 Nov 2024
Temperature at place of calibration Temp. diff.	19.6 °C 0.4 K
Tweights - Tplace	
Measuring conditions	The installation site is suitable. The device was levelled. Balance was loaded up to Max before test.
Comments	Humidity 68.0 %RH.

Measurement results | Measurement uncertainties

Repeatability	Centricity
Test load (nominal): 10 g 100 g	Test load (nominal): 100 g
10 g	100 g
1 10.0000 g 100.0000 g	Center 100.0000 g
2 10.0000 g 99.9999 g	Front left 100.0001 g
3 10.0001 g 100.0000 g	Back left 100.0000 g
4 10.0000 g 99.9999 g	Back right 100.0000 g
5 10.0000 g 100.0000 g	Front right 100.0000 g
6 9.9999 g 99.9999 g	Maximum deviation from centric loading indication
7 10.0000 g 100.0000 g	Δf _{ecc} max = 0.0001 g
8 9.9999 g 100.0000 g	
9 10.0000 g 99.9999 g	
10 10.0001 g 100.0000 g	
s = 0.00007 g s = 0.00005 g	

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

U_{rel}(E) is the quotient of U(E) and test load L. The uncertainty of measurement U(E) is valid only if error E is determined. You will find reference notes on the uncertainty of measurement in use under: According to the calibration certificate | Interpretation of measurement results

Reference note: The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the documented Expansion factor, determined in accordance with the European Calibration Guideline EURAMET cg-18, V4.0. There is a 95 % probability that the value of the measurand will be in the assigned value range.

End of calibration certificate

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Page 3 | 4

Interpretation of measurement results | Appendix to the calibration certificate

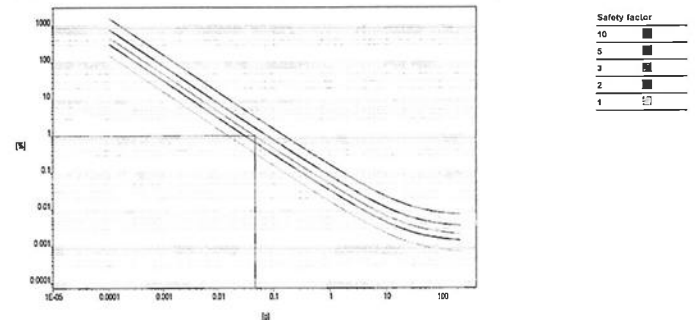
Uncertainty of measurement in use

Device adjusted before measurement	Yes
Temperature deviation considered	1 K (isoCAL active)
Temperature coefficient considered	2 · 10 ⁻⁴ /K
Uncertainty of the weighing result U _{rel} (W)	U _{rel} (W) = 0.00016 g + 6.42 · 10 ⁻⁴ · R

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

Indication in % from max load	Net indication R	Uncertainty U _{rel} (W)	Uncertainty relative U _{rel} (W) _{rel}
1 %	2.2000 g	0.00017 g	0.0078 %
25 %	55.0000 g	0.00051 g	0.00093 %
50 %	110.0000 g	0.00087 g	0.00079 %
75 %	165.0000 g	0.0012 g	0.00074 %
100 %	220.0000 g	0.0016 g	0.00071 %

Graphic realization of the relative uncertainty of measurement | process accuracy



Displayed example

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

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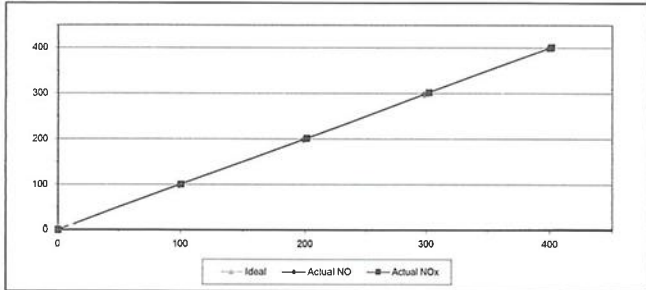
Page 4 | 4



MULTIPOINT CALIBRATION REPORT

Calibration Date 3-Jan-25 Equipment Name NOx Analyzer
Manufacturer HORIBA Model APNA-370
Serial No. HCWSR881 Equipment ID BKK_FS0800
Calibrator Manufacturer Teledyne API Model 700
Serial No. 947
Std. Gas Concentration (PPM) 55.88 Cylinder No. GN0027222
Cylinder Pressure (psi) 1800 Certified By Algas Inc.
Certified Date 9-Feb-22 Expired Date 9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	99.10	-0.90	-0.90	100.50	0.50	0.50
2	200.00	198.60	-1.40	-0.70	201.40	1.40	0.70
3	300.00	298.00	-2.00	-0.67	302.30	2.30	0.77
4	400.00	398.70	-1.30	-0.33	401.30	1.30	0.33
AVERAGE (%)				-0.50			0.48



Calibrated By

Approved By

Field Environmental Scientist (3)

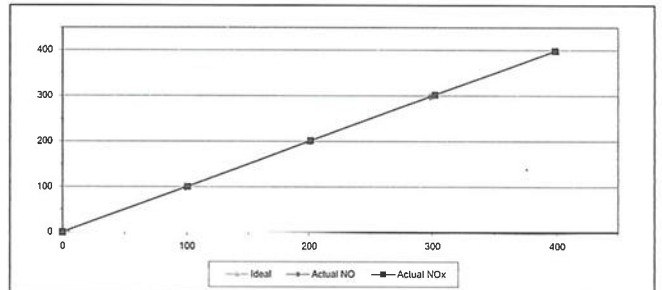
Assistant General Manager

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

MULTIPOINT CALIBRATION REPORT

Calibration Date 3-Jan-25 Equipment Name NOx Analyzer
Manufacturer HORIBA Model APNA-370
Serial No. PPGM9HKKH Equipment ID BKK_FS1070
Calibrator Manufacturer Teledyne API Model 700
Serial No. 947
Std. Gas Concentration (PPM) 55.88 Cylinder No. GN0027222
Cylinder Pressure (psi) 1800 Certified By Algas Inc.
Certified Date 9-Feb-22 Expired Date 9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	98.80	-1.20	-1.20	100.50	0.50	0.50
2	200.00	201.30	1.30	0.65	201.40	1.40	0.70
3	300.00	298.30	-1.70	-0.57	302.30	2.30	0.77
4	400.00	398.80	-1.20	-0.30	398.60	-1.40	-0.35
AVERAGE (%)				-0.26			0.34



Calibrated By

Approved By

Field Environmental Scientist (3)

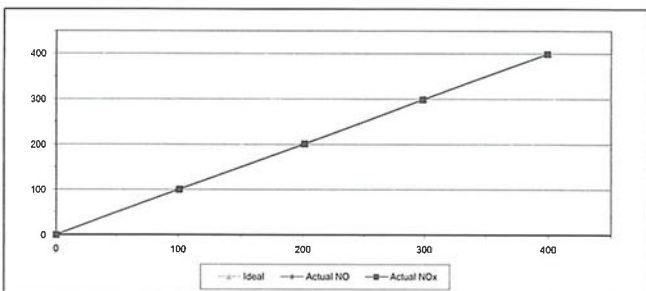
Assistant General Manager

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

MULTIPOINT CALIBRATION REPORT

Calibration Date 3-Jan-25 Equipment Name NOx Analyzer
Manufacturer HORIBA Model APNA-370
Serial No. WPY0JMWD Equipment ID BKK_FS0782
Calibrator Manufacturer Teledyne API Model 700
Serial No. 947
Std. Gas Concentration (PPM) 55.88 Cylinder No. GN0027222
Cylinder Pressure (psi) 1800 Certified By Algas Inc.
Certified Date 9-Feb-22 Expired Date 9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	99.60	-0.40	-0.40	100.60	0.60	0.60
2	200.00	199.70	-0.30	-0.15	201.10	1.10	0.55
3	300.00	299.70	-1.30	-0.43	299.50	-1.50	-0.50
4	400.00	398.70	-1.30	-0.33	399.10	-0.90	-0.22
AVERAGE (%)				-0.24			0.10



Calibrated By

Approved By

Field Environmental Scientist (3)

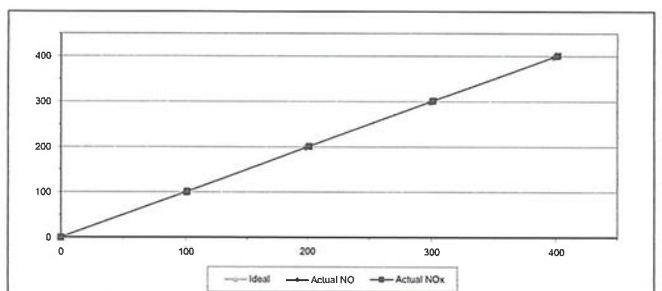
Assistant General Manager

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

MULTIPOINT CALIBRATION REPORT

Calibration Date 3-Jan-25 Equipment Name NOx Analyzer
Manufacturer HORIBA Model APNA-370
Serial No. V9L01NF0 Equipment ID BKK_FS1457
Calibrator Manufacturer Teledyne API Model 700
Serial No. 947
Std. Gas Concentration (PPM) 55.88 Cylinder No. GN0027222
Cylinder Pressure (psi) 1800 Certified By Algas Inc.
Certified Date 9-Feb-22 Expired Date 9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	99.60	-0.40	-0.40	101.10	1.10	1.10
2	200.00	198.30	-1.70	-0.85	201.20	1.20	0.60
3	300.00	299.00	-1.00	-0.33	301.50	1.50	0.50
4	400.00	398.20	-1.80	-0.45	401.50	1.50	0.38
AVERAGE (%)				-0.39			0.53



Calibrated By

Approved By

Field Environmental Scientist (3)

Assistant General Manager

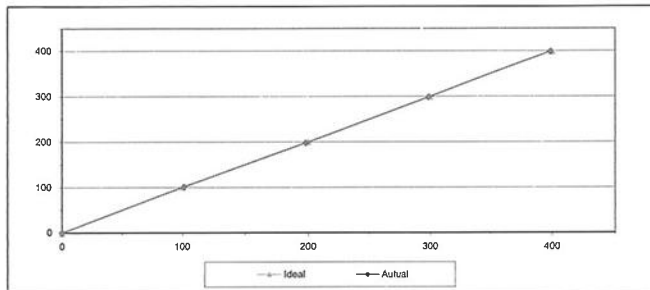
ALS Laboratory Group
FORM NO : F 06-056 REVISION NO : - ISSUE DATE: 02/04/12



MULTIPOINT CALIBRATION REPORT

Calibration Date 3-Jan-25 Equipment Name SO2 Analyzer
Manufacturer HORIBA Model APSA-370
Serial No. YU9BY9F9 Equipment ID BKK_FS0799
Calibrator Manufacturer Teledyne API Model 700
Serial No. 947
Std. Gas Concentration (PPM) 56.3 Cylinder No. GN0027222
Cylinder Pressure (psi) 1800 Certified By Algas Inc.
Certified Date 9-Feb-22 Expired Date 9-Feb-30

Point	CALIBRATION RESULTS			
	Ideal	Actual	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	101.30	1.30	1.30
2	200.00	198.10	-1.90	-0.95
3	300.00	298.50	-1.50	-0.50
4	400.00	398.60	-1.40	-0.35
AVERAGE (%)				-0.08



Calibrated By

Approved By

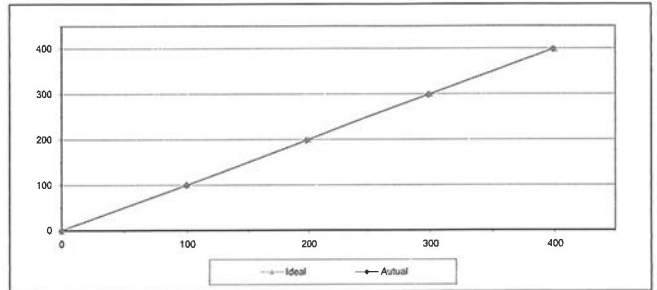
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ALS Laboratory Group
FORM NO.: F 06-056 REVISION NO.: ISSUE DATE: 02/04/12

MULTIPOINT CALIBRATION REPORT

Calibration Date 3-Jan-25 Equipment Name SO2 Analyzer
Manufacturer HORIBA Model APSA-370
Serial No. 70Y1R8R0 Equipment ID BKK_FS1069
Calibrator Manufacturer Teledyne API Model 700
Serial No. 947
Std. Gas Concentration (PPM) 56.3 Cylinder No. GN0027222
Cylinder Pressure (psi) 1800 Certified By Algas Inc.
Certified Date 9-Feb-22 Expired Date 9-Feb-30

Point	CALIBRATION RESULTS			
	Ideal	Actual	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	99.30	-0.70	-0.70
2	200.00	198.00	-2.00	-1.00
3	300.00	298.50	-1.50	-0.50
4	400.00	398.50	-1.50	-0.38
AVERAGE (%)				-0.50



Calibrated By

Approved By

Field Environmental Scientist (3)

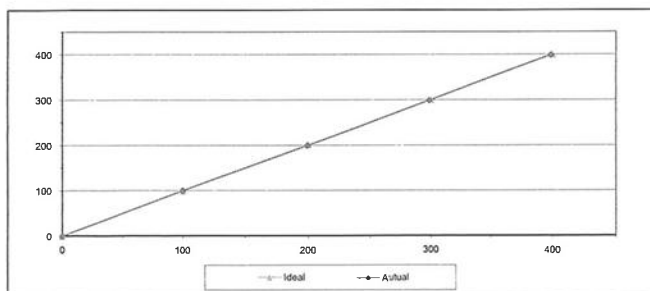
Assistant General Manager

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

MULTIPOINT CALIBRATION REPORT

Calibration Date 3-Jan-25 Equipment Name SO2 Analyzer
Manufacturer HORIBA Model APSA-370
Serial No. Y53SNSFB Equipment ID BKK_FS0781
Calibrator Manufacturer Teledyne API Model 700
Serial No. 947
Std. Gas Concentration (PPM) 56.3 Cylinder No. GN0027222
Cylinder Pressure (psi) 1800 Certified By Algas Inc.
Certified Date 9-Feb-22 Expired Date 9-Feb-30

Point	CALIBRATION RESULTS			
	Ideal	Actual	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	99.70	-0.30	-0.30
2	200.00	199.20	-0.80	-0.40
3	300.00	298.50	-1.50	-0.50
4	400.00	398.50	-1.50	-0.38
AVERAGE (%)				-0.30



Calibrated By

Approved By

Field Environmental Scientist (3)

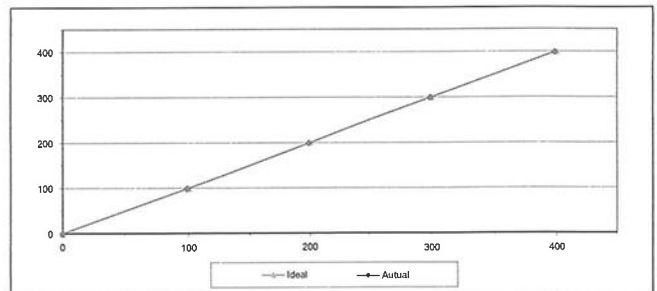
Assistant General Manager

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

MULTIPOINT CALIBRATION REPORT

Calibration Date 3-Jan-25 Equipment Name SO2 Analyzer
Manufacturer HORIBA Model APSA-370
Serial No. LRB7V8X Equipment ID BKK_FS1456
Calibrator Manufacturer Teledyne API Model 700
Serial No. 947
Std. Gas Concentration (PPM) 56.3 Cylinder No. GN0027222
Cylinder Pressure (psi) 1800 Certified By Algas Inc.
Certified Date 9-Feb-22 Expired Date 9-Feb-30

Point	CALIBRATION RESULTS			
	Ideal	Actual	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	98.60	-1.40	-1.40
2	200.00	196.80	-1.20	-0.60
3	300.00	298.80	-1.20	-0.40
4	400.00	398.50	-1.50	-0.38
AVERAGE (%)				-0.53



Calibrated By

Approved By

Field Environmental Scientist (3)

Assistant General Manager

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

CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM : Cup anemometer
MANUFACTURER : Novalyne
MODEL/TYPE : Sensor: WS-02F
Data logger: 200-WS-25LB
SERIAL NUMBER : Sensor: WSD-AS244
Data logger: AS244
ID NUMBER : BKK_F50587
CONDITION AS RECEIVED : Used item
CUSTOMER : ALS laboratory group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang,
Khet Suan Luang, Bangkok 10250 Thailand

RECEIVED DATE : 25 Dec 2023
MEASUREMENT DATE : 04 Jan 2024
ISSUE DATE : 05 Jan 2024

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follows:

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

PLACE OF CALIBRATION : Diff-type wind tunnel of Jirantee Associates Co., Ltd.

CALIBRATION CONDITIONS : Wind tunnel cross section area¹ 900 cm²
Wind direction frontal area² 100 cm²
Diameter of mounting pipe³ mm
Blockage ratio of test object⁴ 0.11 [-]

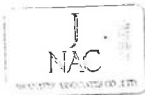
Preconditioning : 24 hours at ambient conditions

Measurement Condition : The average values during measurement are (23.8) °C, (52.2) %RH and (1010.8) hPa.

TABULATION OF RESULTS:

The table on next page give the measured values

Calibrated by:
☒ Mr. Sorawit Thairatid
☐ Miss Jiraporn Terntanaphol



Approved signatory

Remarks:

- ¹ Net area of the section area of the wind tunnel
- ² Projected cross-section area of the tested object include mounting pipe
- ³ Diameter of mounting pipe
- ⁴ Ratio to S_{ref}

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

Calibration procedure:
The Cup anemometer was calibrated against Standard air velocity transducer model: B455-12 and pitot tube with precision differential pressure meter model: DPA2200 in an open test section of Diff-type wind tunnel with 900 cm² cross test section area. The WDC-002 based on IEC 61400-12-1, Wind energy generation systems - Part 12-1: Power performance measurements of electricity producing wind turbines, March 2017 was used as a calibration guideline.

Traceability:

This certificate provides a traceability of the measurement to recognized the national standards, and to realization of the international system of units (SI) through the NMAT (National Metrology Institute of Thailand) via Certificate number: MIV-0001-23 and MIV-0055-23

Uncertainty of Measurement:

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

Page 2 of 2 Pages

MEASUREMENT RESULTS⁵

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

V_{ref} (m/s)	Temp. wind tunnel (°C)	Temp. room (°C)	V_{UUC} (m/s)	Error (m/s)	U (k=2) (m/s)
1.010	23.80	23.75	0.8	-0.2	0.31
2.007	23.64	23.75	1.9	-0.2	0.31
2.998	23.60	23.75	2.9	-0.1	0.31
4.160	23.64	23.75	4.0	-0.2	0.31
5.06	23.40	23.75	5.1	0.0	0.31
6.00	23.80	23.75	6.1	0.1	0.31
7.03	23.34	23.75	7.0	0.0	0.31
7.98	23.62	23.75	8.0	0.0	0.31
8.95	23.16	23.75	9.1	0.1	0.31
10.03	23.50	23.75	10.2	0.2	0.31
11.04	23.10	23.75	11.2	0.2	0.31
12.01	23.50	23.75	12.2	0.2	0.31
13.04	23.18	23.75	13.3	0.3	0.31
14.02	23.50	23.75	14.4	0.3	0.31
15.03	23.22	23.75	15.4	0.3	0.31
16.03	23.48	23.75	16.4	0.3	0.31

Remark:

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

⁵ Velocity of standard

⁶ Velocity of Unit Under Calibration

PHOTO OF CALIBRATION SET-UP



Calibration set-up of the Cup anemometer calibration in the wind tunnel of Jirantee Associates Co., Ltd. The Cup anemometer shown may differ from the calibrated one. Remarks: The proportion of the set-up is not true to scale and is for illustrative purposes only.



CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM : Wind Direction Sensor
MANUFACTURER : Novalyne
MODEL/TYPE : Sensor: WS-02F
Data logger: 200-WS-25LB
SERIAL NUMBER : Sensor: WSD-AS244
Data logger: AS244
ID NUMBER : BKK_F50587
CONDITION AS RECEIVED : Used item
CUSTOMER : ALS laboratory group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang,
Khet Suan Luang, Bangkok 10250 Thailand

RECEIVED DATE : 25 Dec 2023
MEASUREMENT DATE : 04 Jan 2024
ISSUE DATE : 05 Jan 2024

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follows:

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

PLACE OF CALIBRATION : Diff-type wind tunnel of Jirantee Associates Co., Ltd.

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

Preconditioning : 24 hours at ambient conditions

Measurement Condition : The average values during measurement are (23.6) °C, (57.5) %RH and (1011.1) hPa.

TABULATION OF RESULTS:

The table on next page give the measured values

Calibrated by:
☒ Mr. Sorawit Thairatid
☐ Miss Jiraporn Terntanaphol



Approved signatory

Remarks:

- ¹ Net area of the section area of the wind tunnel
- ² Projected cross-section area of the tested object include mounting pipe
- ³ Diameter of mounting pipe
- ⁴ Ratio to S_{ref}

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

Calibration procedure:
The wind direction sensor was calibrated against Standard Rotary Encoder model: AS4000FS-DIM4 P3-5 UD in an open test section of Diff-type wind tunnel with 900 cm² cross test section area. The WDC-002 based on IEC 61400-12-1, Wind energy generation systems - Part 12-1: Power performance measurements of electricity producing wind turbines, March 2017 was used as a calibration guideline.

Traceability:

This certificate provides a traceability of the measurement to recognized the national standards, and to realization of the international system of units (SI) through the NMAT (National Metrology Institute of Thailand) via Certificate number: MIV-0001-23 and MIV-0055-23

Uncertainty of Measurement:

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

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MEASUREMENT RESULTS⁵

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

Air speed m/s	D_{ref} Degree (°)	D_{UUC} Degree (°)	Error Degree (°)	U (k=2) Degree (°)
5.02	45.000	42	-3	0.80
	90.000	87	-3	0.80
	135.000	132	-3	0.80
	180.000	179	-1	0.80
	225.000	226	1	0.80
	270.000	273	3	0.80
	315.000	319	4	0.80
	360.000	359	-1	0.80

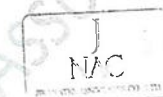
Remark:

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

⁵ Direction of standard

⁶ Direction of Unit Under Calibration

End of Certificate of Calibration





JIRANATE ASSOCIATES CO., LTD.

Jirante Associates Co., Ltd.
62/14-15, 67/35-36
Pattana 17/1, Rd. Watthana, Bangkok 10
Bangkok 10150 (Thailand)
Tel: +662-09912
Email: jirante@jirante.com
Website: www.jirante.com

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

Temperature measurement laboratory
Calibration services department.



NSC-TSI-TIS 17025
CALIBRATION 0367

CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

Certificate No. : CDT-002-67

MEASUREMENT ITEM : Data Logger with Temperature sensor
MANUFACTURER : Novolyx
MODEL/TYPE : 200-W5-25LB
SERIAL NUMBER : AS244
ID NUMBER : BKK_FS0847
CONDITION AS-RECEIVED : Used item
CUSTOMER : ALS laboratory group (thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khaeng Suan Luang, Khet Suan Luang,
Bangkok 10250 Thailand.

RECEIVED DATE : 25 Dec 2023
MEASUREMENT DATE : 04 Jan 2024
ISSUE DATE : 05 Jan 2024

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:
Temperature : 23.0 ± 3.0 °C
Relative Humidity : 55.0 ± 15.0 %RH

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

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibration procedure:

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

Traceability:

The measurement results are traceable to the international system of units (SI) through National Institute of Metrology Thailand (NIMT) Certificate number: TT-003-23, Certificate number: ER 0201 23

Reference Used During Calibration:

1. Standard Temperature Probe
Model: STS-100 AS00, Serial No: E6732 09,
Due date: 28 Mar 2024
2. Digital Temperature Indicator
Model: DTI-1000-A-MK II, Serial No: 671407-
06591 Due date: 14 Sep 2024

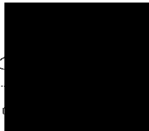
Uncertainty of Measurement:

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

Calibrated by:
☐ Mr. Sorawit Thachalad
☐ Ms. Jiraporn Lertsomphol
☒ Ms. Ruangrumpai Phoommit



Approved signatory:



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JIRANATE ASSOCIATES CO., LTD.

Continuation of Certificate of Calibration Number CDT-002-67

Page 2 of 2 Pages

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: $20 - 40$ °C

Function:

Table 3: This equipment was connected with temperature sensor Model: HMP60 S/N: N0330782.
Dimension: Diameter 12 mm. Length 80 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
70	20.054	19.9	-0.2	0.099
70	25.051	24.8	-0.1	0.099
70	30.042	29.7	-0.3	0.099
70	35.034	34.5	-0.5	0.099
70	40.030	39.4	-0.6	0.099

UUC*: Unit Under Calibration

End of Certificate of Calibration



JIRANATE ASSOCIATES CO., LTD.

Jirante Associates Co., Ltd.
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Website: www.jirante.com

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

Relative humidity measurement laboratory
Calibration services department.

CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

Certificate No. : CRH-003-67

MEASUREMENT ITEM : Relative humidity with data logger
MANUFACTURER : Novolyx
MODEL/TYPE : 200-W5-25LB
SERIAL NUMBER : AS244
ID NUMBER : BKK_FS0847
CONDITION AS-RECEIVED : Used item
CUSTOMER : ALS laboratory group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd, Khaeng Suan Luang,
Khet Suan Luang, Bangkok 10250 Thailand.

RECEIVED DATE : 25 Dec 2023
MEASUREMENT DATE : 04 Jan 2024
ISSUE DATE : 05 Jan 2024

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:
Temperature : 23.0 ± 3.0 °C
Relative Humidity : 55.0 ± 15.0 %RH

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

TABULATION OF RESULTS:

The table on next page give the measured values

Calibration procedure:

The Relative humidity calibration was done by In-House calibration method as W-CL-010 according to comparison method with Standard Relative Humidity hygrometer and standard Humidity generator chamber.

Traceability:

This instrument was calibrated using standard equipment whose accuracy is traceability through the NIMT (National Institute of Metrology of Thailand) to the international system of units (SI) via Certificate number: TT 0079 23

Uncertainty of Measurement:

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

Calibrated by:
☐ Mr. Sorawit Thachalad
☐ Ms. Jiraporn Lertsomphol
☒ Ms. Ruangrumpai Phoommit



Approved signatory:



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JIRANATE ASSOCIATES CO., LTD.

Continuation of Certificate of Calibration Number: CRH-003-67

Page 2 of 2 Pages

Measurement Results:

This equipment was connected with Indoor air quality probe and Displayed (UR) on display. Model: HMP60, Serial number: N0330782.

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20%RH to 80%RH

Table 1: The results of calibration of relative humidity are reported in table below.

Determined (%RH)	Standard Reading (%RH)	UUC Reading (%RH)	Error (%RH)	Uncertainty (%RH)
20.0	20.04	19.8	-1.3	0.40
50.0	51.32	49.0	-2.3	1.0
80.0	82.48	79.2	-3.3	1.6

UUC*: Unit Under Calibration

End of Certificate of Calibration



CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM

MANUFACTURER

MODEL/TYPE

SERIAL NUMBER

ID NUMBER

CONDITION AS-RECEIVED

CUSTOMER

RECEIVED DATE

MEASUREMENT DATE

ISSUE DATE

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

Temperature

Relative Humidity

Atmospheric Pressure

PLACE OF CALIBRATION

CALIBRATION CONDITIONS

Wind tunnel cross-section area¹

Wind direction frontal area¹

Diameter of mounting pipe¹

Blockage ratio of test object¹

Preconditioning

Measurement Condition

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

1) Mr. Sorawat Thachulak

2) Miss Jitaporn Jiranteamchai

Remark:

¹ Result on cross-section area of the wind tunnel

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

³ Diameter of mounting pipe

⁴ Ratio 1 to 1

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

Page 2 of 2 Pages

MEASUREMENT RESULTS¹

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

V_{ref} (m/s)	Temp. wind tunnel (°C)	Temp. room (°C)	V_{ref} (m/s)	Error (m/s)	U (k=2) (m/s)
1.015	24.10	24.15	0.9	-0.1	0.11
2.038	24.24	24.15	1.8	-0.2	0.31
3.031	24.34	24.15	2.9	-0.1	0.31
4.142	24.28	24.15	3.9	-0.2	0.31
4.08	24.10	24.15	5.0	0.0	0.31
6.04	24.16	24.15	6.1	0.1	0.31
7.05	24.10	24.15	7.1	0.0	0.31
7.98	24.30	24.15	8.1	0.1	0.31
9.05	24.12	24.15	9.1	0.0	0.31
9.98	24.12	24.15	10.2	0.2	0.31
11.01	24.20	24.15	11.1	0.1	0.31
11.99	24.10	24.15	12.2	0.2	0.31
13.01	24.14	24.15	13.2	0.2	0.31
14.06	24.10	24.15	14.4	0.2	0.31
15.06	24.20	24.15	15.7	0.2	0.31
15.99	24.10	24.15	16.9	0.9	0.31

Remarks:

¹ Calibration results only count for the tested circumstances and environmental condition during which calibration took place.

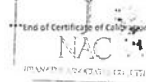
² Velocity of standard

³ Velocity of Unit Under Calibration

PHOTO OF CALIBRATION SET-UP



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



CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM

MANUFACTURER

MODEL/TYPE

SERIAL NUMBER

ID NUMBER

CONDITION AS-RECEIVED

CUSTOMER

RECEIVED DATE

MEASUREMENT DATE

ISSUE DATE

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

Temperature

Relative Humidity

Atmospheric Pressure

PLACE OF CALIBRATION

CALIBRATION CONDITIONS

Wind tunnel cross-section area¹

Wind direction frontal area¹

Diameter of mounting pipe¹

Blockage ratio of test object¹

Preconditioning

Measurement Condition

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

1) Mr. Sorawat Thachulak

2) Miss Jitaporn Jiranteamchai

Remark:

¹ Result on cross-section area of the wind tunnel

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

³ Diameter of mounting pipe

⁴ Ratio 1 to 1

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Page 2 of 2 Pages

MEASUREMENT RESULTS¹

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

Air speed m/s	D ¹ _{ref} Degree (°)	D ² _{ref} Degree (°)	Error Degree (°)	U (k=2) Degree (°)
5.03	45.000	41	-4	0.50
	90.000	87	-3	0.80
	135.000	132	3	0.80
	180.000	181	1	0.80
	225.000	228	3	0.80
	270.000	275	5	0.80
	315.000	320	5	0.80
	360.000	359	-1	0.80

Remarks:

¹ Calibration results only count for the tested circumstances and environmental condition during which calibration took place.

² Direction of standard

³ Direction of Unit Under Calibration

End of Certificate of Calibration



CERTIFICATE OF CALIBRATION

Certificate No. : CDT-107-67

Page 1 of 2 Pages

MEASUREMENT ITEM : Data Logger with Temperature sensor
MANUFACTURER : Novolyne
MODEL/TYPE : 200-WS-25LB
SERIAL NUMBER : AS262
ID NUMBER : BKK_F50909
CONDITION AS RECEIVED : Used item
CUSTOMER : ALS laboratory group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khwaeng Suan Luang, Khet Suan Luang,
Bangkok 10250 Thailand.

RECEIVED DATE : 10 Jun 2024
MEASUREMENT DATE : 28 Jun 2024
ISSUE DATE : 28 Jun 2024

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:
Temperature : 23.0 ± 3.0 °C
Relative Humidity : 55.0 ± 15.0 %RH

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

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibration procedure:
The temperature calibration was done by
in house calibration method as per CL-001
according to comparison method with standard
digital temperature indicator and standard
temperature probe. The temperature scale use
was based on ITS 90.

Traceability:
The measurement results are traceable to the
international system of units (SI) through
National Institute of Metrology Thailand (NIMT).
Certificate number: TT-0047-24, Certificate
number: CR-0103-23

Reference Used During Calibration:
1 Standard Temperature Probe
Model: STS-100 A500, Serial No. 34765, 03,
Due date: 26 Mar 2025
2 Digital Temperature Indicator
Model: UT-1000 A-MK II, Serial No. 671407-
00531 Due date: 14 Sep 2024

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

Calibrated by:
☐ Mr. Soravit Thachalad
☒ Miss Jitraporn Lertsomphol
☐ Miss Ruangrump Phoommit



Approved signatory

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IN WRITING FROM THE LABORATORY

Continuation of Certificate of Calibration Number CDT-107-67

Page 2 of 2 Pages

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 °C to 40 °C

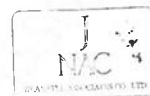
Function:

Table 3: This equipment was connected with temperature sensor Model: HMP60 S/N: N0330785.
Dimension: Diameter 12 mm, Length 80 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.054	19.6	-0.4	0.099
80	25.051	24.6	-0.5	0.099
80	30.046	29.7	-0.3	0.099
80	35.034	34.5	-0.5	0.099
80	40.042	39.5	-0.5	0.099

UUC*: Unit Under Calibration

End of Certificate of Calibration



CERTIFICATE OF CALIBRATION

Certificate No. : CRT-019-67

Page 1 of 2 Pages

MEASUREMENT ITEM : Relative humidity with data logger
MANUFACTURER : Novolyne
MODEL/TYPE : Data Logger 200-WS-25LB
SERIAL NUMBER : Sensor: HMP60
Data Logger: AS262
Sensor: NUS30785
ID NUMBER : JOK_F50909
CONDITION AS RECEIVED : Used item
CUSTOMER : ALS laboratory group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Suan Luang,
Khet Suan Luang, Bangkok 10250 Thailand.

RECEIVED DATE : 10 Jun 2024
MEASUREMENT DATE : 29 Jun 2024
ISSUE DATE : 28 Jun 2024

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:
Temperature : 23.0 ± 3.0 °C
Relative Humidity : 55.0 ± 15.0 %RH

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

TABULATION OF RESULTS:

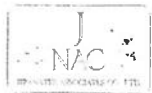
The table on next page give the measured values.

Calibration procedure:
The Relative humidity and Air Temperature
calibration was done by in house calibration
method as per CL-009 and WS-CL-020 according to
comparison method with Standard sealed Air-
Regulator with Temperature sensor and standard
humidity generator chamber.

Traceability:
The measurement results are traceable to the
international system of units (SI) through National
Institute of Metrology Thailand (NIMT). Certificate
number: TT-0047-24, Certificate number: CR-0103-23

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

Calibrated by:
☐ Mr. Soravit Thachalad
☒ Miss Jitraporn Lertsomphol
☐ Miss Ruangrump Phoommit



Approved signatory

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IN WRITING FROM THE LABORATORY

Continuation of Certificate of Calibration Number CRT-019-67

Page 2 of 2 Pages

Measurement Results:

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

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

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

Air Temperature (°C)	Standard Reading (%RH)	UUC Reading (%RH)	Error (%RH)	Uncertainty (%RH)
29.80	19.61	18.6	-1.0	0.83
29.50	50.49	49.8	-0.6	1.3
29.82	81.68	80.9	-0.7	2.3

UUC*: Unit Under Calibration

End of Certificate of Calibration



CERTIFICATE OF CALIBRATION

Certificate No. : CDT-094-67

Page 1 of 2 Pages

MEASUREMENT ITEM : Data Logger with Temperature sensor
MANUFACTURER : Novolynx
MODEL/TYPE : 200-WS-25L8
SERIAL NUMBER : AS263
ID NUMBER : RKK_F50910
CONDITION AS-RECEIVED : Used item
CUSTOMER : ALS laboratory group (Thailand) Co., Ltd.
104 Phatthanakan Rd., Phatthanakan Rd.,
Khaeng Suan Luang, Khet Suan Luang,
Bangkok 10250 Thailand.

RECEIVED DATE : 29 May 2024
MEASUREMENT DATE : 10 Jun 2024
ISSUE DATE : 10 Jun 2024

ENVIRONMENTAL CONDITIONS:
Ambient condition in the laboratory are as follows:
Temperature : 23.0 ± 3.0 °C
Relative Humidity : 55.0 ± 15.0 %RH

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

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

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

Traceability:
The measurement results are traceable to the international system of units (SI) through National Institute of Metrology Thailand (NIMT) Certificate number: TT-0047-24, Certificate number: ER0101-23

Reference Used During Calibration:
1. Standard Temperature Probe
Model: STS-100 A500, Serial No: 067682-09,
Due date: 26 Mar 2025
2. Digital Temperature Indicator
Model: DTI-1000-A MK II, Serial No: 671407
00591 Due date: 14 Sep 2024

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

Calibrated by:
☐ Mr. Sorawit Thachalai
☐ Miss Jittaporn Lertsomphol
☐ Miss Ruangrumpal Phoommit



Approved signatory

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Continuation of Certificate of Calibration Number CDT-094-67

Page 2 of 2 Pages

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 °C to 40 °C

Function:

Table 3: This equipment was connected with temperature sensor Model: HMP60 S/N: N0330786, Dimension: Diameter 12 mm, Length 80 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
70	20.060	19.6	-0.5	0.099
70	25.051	24.6	-0.5	0.099
70	30.042	29.5	-0.5	0.099
70	35.033	34.4	-0.6	0.16
70	40.021	39.4	-0.6	0.099

UUC: Unit Under Calibration

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

End of Certificate of Calibration



CERTIFICATE OF CALIBRATION

Certificate No. : CNT-012-67

Page 1 of 2 Pages

MEASUREMENT ITEM : Relative humidity with data logger
MANUFACTURER : Novolynx
MODEL/TYPE : Data Logger: 200-WS-25L8
SERIAL NUMBER : Sensor: HMP60
Data Logger: AS263
Sensor: N0330786
RKK_F50910
ID NUMBER : Used item
CONDITION AS-RECEIVED : ALS laboratory group (Thailand) Co., Ltd.
104 Phatthanakan Rd., Phatthanakan Rd.,
Khaeng Suan Luang, Khet Suan Luang,
Bangkok 10250 Thailand.

RECEIVED DATE : 29 May 2024
MEASUREMENT DATE : 10 Jun 2024
ISSUE DATE : 10 Jun 2024

ENVIRONMENTAL CONDITIONS:
Ambient condition in the laboratory are as follows:
Temperature : 23.0 ± 3.0 °C
Relative Humidity : 55.0 ± 15.0 %RH

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

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

Calibration procedure:
The Relative humidity and Air Temperature calibration was done by In House calibration method as WI-CL-001 and WI-CL-002 according to comparison method with Standard Certified Metrology hygrothermometer with Temperature sensor and standard Humidity generator chamber.

Traceability:
The measurements are traceable to the international system of units (SI) through National Institute of Metrology Thailand (NIMT) Certificate number: TH-0072-23 and through Jirana Associates Co., Ltd. Certificate number: CDT-001-67.

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

Calibrated by:
☐ Mr. Sorawit Thachalai
☐ Miss Jittaporn Lertsomphol
☐ Miss Ruangrumpal Phoommit



Approved signatory

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Continuation of Certificate of Calibration Number CNT-012-67

Page 2 of 2 Pages

Measurement Results:

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

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Table 1: The results of calibration of relative humidity at 30 °C are reported in table below
Calibration Range: 20% RH to 60% RH

Air Temperature (°C)	Standard Reading (%RH)	UUC Reading (%RH)	Error (%RH)	Uncertainty (%RH)
29.78	19.55	17.6	-2.0	0.81
29.80	50.35	47.7	-2.7	1.8
29.81	81.42	77.8	-3.6	2.3

UUC: Unit Under Calibration

End of Certificate of Calibration



CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM : Cup anemometer
MANUFACTURER : Novallux
MODEL/TYPE : Sensor: WS-02F
Data logger: J08-WS-25LB
SERIAL NUMBER : Sensor: WSD AS261
Data logger: AS261
ID NUMBER : BKK_F50888
CONDITION AS RECEIVED : Used item
CUSTOMER : ALS laboratory group (Thailand) Co., Ltd.
104 Phrahanon Rd, Khwaeng Suan Luang,
Khet Suan Luang, Bangkok 10250 Thailand.

RECEIVED DATE : 25 Dec 2023
MEASUREMENT DATE : 04 Jan 2024
ISSUE DATE : 05 Jan 2024

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

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

PLACE OF CALIBRATION : Effel type wind tunnel of Jirantee Associates Co., Ltd.

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

Preconditioning : 24 hours at ambient conditions.

Measurement Condition : The average values during measurement are (23.7) °C, (46.6) %RH and (1010.5) hPa

TABULATION OF RESULTS:

The table on next page give the measured values

Calibrated by:
☒ Mr. Sorawit Thachabai
☐ Miss Jiraporn Teisornkul



Approved signatory:

Remark:

¹ Inside cross section area of the wind tunnel

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

³ Diameter of mounting pipe

⁴ Ratio = $\frac{A}{A_0}$

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

Calibration procedure:
The Cup anemometer was calibrated against standard air velocity transducer model: S455-12 and pitot tube with precision differential pressure meter model: DP42200 in an open test section of Effel type wind tunnel with 500 cm² cross test section area. The WI-CL-007 heavy air (IC 61400-12-2, Wind energy generation system - Part 12-1: Power performance measurements of electricity producing wind turbines, March 2017 was used as a calibration guideline.

Traceability:

This certificate provides a traceability of the measurement to recognize the national standards, and to realization of the international system of units (SI) through the NIMT (National Metrology Institute of Thailand) via Certificate number: MN-0001-23 and MN-0005-23

Uncertainty of Measurement:

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

Page 2 of 2 Pages

MEASUREMENT RESULTS¹

The Cup anemometer, Unit Under Calibration (UUC) was exercised at 10 m/s for 5 minutes prior to calibration being performed. The standard air velocity 0.5 m/s to 5 m/s was calculated by a standard air velocity transducer which was installed 50 mm away from wind tunnel nozzle and installed 40 mm away from top of the test section and the standard air velocity 5 m/s to 30 m/s was calculated by a pitot tube with precision differential pressure meter which was installed 50 mm away from wind tunnel nozzle and installed 40 mm away from top of the test section. UUC was mounted on a round vertical tube of the 4-way plate at center or test section. The calibration was carried out under both rising and falling air velocity in the range of 1 m/s to 16 m/s at calibration interval of 2 m/s. The results of calibration and associated measurement uncertainties are reported in the table below.

V_{ref} (m/s)	Temp. wind tunnel (°C)	Temp. room (°C)	V_{UUC} (m/s)	Error (m/s)	U ($k=2$) (m/s)
1.016	23.70	23.65	0.9	-0.1	0.11
2.059	23.50	23.65	1.9	-0.2	0.11
2.998	23.78	23.65	2.9	-0.1	0.31
4.188	23.74	23.65	4.0	-0.2	0.31
5.66	23.60	23.65	5.1	0.1	0.31
5.98	23.84	23.65	6.1	0.1	0.31
7.00	23.38	23.65	7.1	0.1	0.31
7.95	23.62	23.65	8.1	0.1	0.31
8.96	23.36	23.65	9.2	0.1	0.31
10.03	23.76	23.65	10.2	0.2	0.31
11.03	23.40	23.65	11.3	0.3	0.31
12.04	23.60	23.65	12.3	0.2	0.31
13.02	23.40	23.65	13.4	0.4	0.31
14.03	23.54	23.65	14.3	0.3	0.31
15.01	23.40	23.65	15.4	0.4	0.31
16.02	23.44	23.65	16.4	0.3	0.33

Remark:

¹ Calibration results only valid for the tested circumstances and environmental conditions during which calibration took place

² Velocity of standard

³ Velocity of Unit Under Calibration

PHOTO OF CALIBRATION SET UP



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



Page 2 of 2 Pages

MEASUREMENT RESULTS¹

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

Air speed m/s	D^{+}_{ref} Degree (°)	D^{-}_{ref} Degree (°)	Error Degree (°)	U ($k=2$) Degree (°)
5.03	45.000	41	-4	0.50
	90.000	87	-3	0.80
	135.001	132	-3	0.80
	180.000	180	0	0.50
	225.000	228	3	0.80
	270.000	274	4	0.80
	315.000	319	4	0.80
	360.000	359	-1	0.80

Remark:

¹ Calibration results only valid for the tested circumstances and environmental conditions during which calibration took place

² Direction of standard

³ Direction of Unit Under Calibration

End of Certificate of Calibration



Page 1 of 2 Pages

MEASUREMENT ITEM : Wind Direction Sensor
MANUFACTURER : Novallux
MODEL/TYPE : Sensor: WS-02F
Data logger: J08-WS-25LB
SERIAL NUMBER : Sensor: WSD AS261
Data logger: AS261
ID NUMBER : BKK_F50888
CONDITION AS RECEIVED : Used item
CUSTOMER : ALS laboratory group (Thailand) Co., Ltd.
104 Phrahanon Rd, Khwaeng Suan Luang,
Khet Suan Luang, Bangkok 10250 Thailand.

RECEIVED DATE : 25 Dec 2023
MEASUREMENT DATE : 04 Jan 2024
ISSUE DATE : 05 Jan 2024

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

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

PLACE OF CALIBRATION : Effel type wind tunnel of Jirantee Associates Co., Ltd.

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

Preconditioning : 24 hours at ambient conditions.

Measurement Condition : The average values during measurement are (23.5) °C, (53.3) %RH and (1010.5) hPa

TABULATION OF RESULTS:

The table on next page give the measured values

Calibrated by:
☒ Mr. Sorawit Thachabai
☐ Miss Jiraporn Teisornkul



Approved signatory:

Remark:

¹ Inside cross section area of the wind tunnel

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

³ Diameter of mounting pipe

⁴ Ratio = $\frac{A}{A_0}$

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

Calibration procedure:
The wind direction sensor was calibrated against Standard Rotary Encoder model: AS480715-DM04-P3-S-10 in an open test section of Effel type wind tunnel with 900 cm² cross test section area. The WI-CL-008 based on IEC 61400-12-1, Wind energy generation systems - Part 12-1: Power performance measurements of electricity producing wind turbines, March 2017 was used as a calibration guideline.

Traceability:

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

Uncertainty of Measurement:

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

CERTIFICATE OF CALIBRATION

Certificate No. : CDT-003-67

Page 1 of 2 Pages

MEASUREMENT ITEM : Data Logger with Temperature sensor
MANUFACTURER : Novalynx
MODEL/TYPE : 200-WS-25LB
SERIAL NUMBER : A5261
ID NUMBER : BKK_F50848
CONDITION AS RECEIVED : Used item
CUSTOMER : ALS laboratory group (Thailand) Co., Ltd.,
104 Phatthanasukan Rd., Phatthanasukan Rd.,
Khuang Suan Luang, Khiet Suan Luang,
Bangkok 10250 Thailand.

RECEIVED DATE : 25 Dec 2023
MEASUREMENT DATE : 04 Jan 2024
ISSUE DATE : 05 Jan 2024

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:
Temperature : 23.0 ± 3.0 °C
Relative Humidity : 55.0 ± 15.0 %RH

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

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibration procedure:

The temperature calibration was done by In-House calibration method using WTC (L001) according to comparison method with standard digital temperature indicator and standard temperature probe. The temperature scale use was based on ITS 90.

Traceability:

The measurement results are traceable to the international system of units (SI) through National Institute of Metrology Thailand (NIMT) Certificate number: TT-0038-23, Certificate number: TR-0101-23

Reference Used During Calibration:

1. Standard Temperature Probe
Model: STS-100 A500, Serial No. 66762-09,
Due date: 28 Mar 2024
2. Digital Temperature Indicator
Model: DTI-1000-A MK II, Serial No. 671307,
00591 Due date: 14 Sep 2024

Uncertainty of Measurement:

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

Calibrated by:
☐ Mr. Sorawit Thuchalad
☐ Miss Jittaporn Lertsomphol
☒ Miss Ruangrump Phoommit



Approved signature



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Continuation of Certificate of Calibration Number CDT-003-67

Page 2 of 2 Pages

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 - 40 °C

Function:

Table 3: This equipment was connected with temperature sensor Model: HMP60 S/N: N0330783.
Dimension: Diameter 12 mm, Length 80 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
70	20.054	19.9	-0.3	0.099
70	25.051	24.6	-0.5	0.099
70	30.043	29.5	-0.5	0.099
70	35.035	34.4	-0.6	0.099
70	40.030	39.3	-0.7	0.099

UUC*: Unit Under Calibration

End of Certificate of Calibration



CERTIFICATE OF CALIBRATION

Certificate No. : CRH-004-67

Page 1 of 2 Pages

MEASUREMENT ITEM : Relative humidity with data logger
MANUFACTURER : Novalynx
MODEL/TYPE : 200-WS-25LB
SERIAL NUMBER : A5261
ID NUMBER : BKK_F50848
CONDITION AS RECEIVED : Used item
CUSTOMER : ALS laboratory group (Thailand) Co., Ltd.,
104 Phatthanasukan Rd., Phatthanasukan Rd.,
Khuang Suan Luang, Khiet Suan Luang,
Bangkok 10250 Thailand.

RECEIVED DATE : 25 Dec 2023
MEASUREMENT DATE : 04 Jan 2024
ISSUE DATE : 05 Jan 2024

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:
Temperature : 23.0 ± 3.0 °C
Relative Humidity : 55.0 ± 15.0 %RH

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

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibration procedure:

The relative humidity calibration was done by In-House calibration method using WTC (L001) according to comparison method with standard chilled mirror hygrometer and standard humidity generator chamber.

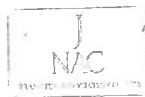
Traceability:

This instrument was calibrated using standard equipment whose accuracy is traceability through the NIMT (National Institute of Metrology of Thailand) to the international system of units (SI) via Certificate number: TH-0079-23.

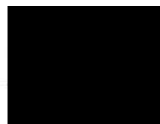
Uncertainty of Measurement:

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

Calibrated by:
☐ Mr. Sorawit Thuchalad
☐ Miss Jittaporn Lertsomphol
☒ Miss Ruangrump Phoommit



Approved signature



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Continuation of Certificate of Calibration Number: CRH-004-67

Page 2 of 2 Pages

Measurement Results:

This equipment was connected with indoor air quality probe and Displayed (UR) on display. Model: HMP60. Serial number: R0330783.

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20%RH to 80%RH

Table 1: The results of calibration of relative humidity are reported in table below.

Determined (RH)	Standard Reading (RH)	UUC Reading (RH)	Error (RH)	Uncertainty (RH)
20.0	20.04	18.6	-1.5	0.40
50.0	51.31	48.7	-2.6	1.0
80.0	82.85	78.9	-4.0	1.6

UUC*: Unit Under Calibration

End of Certificate of Calibration

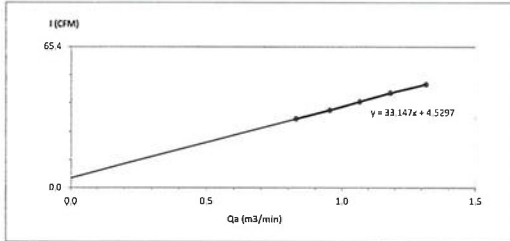




High Volume Air Sampler Calibration Worksheet

Project Site: Gulf IP UT Co., Ltd. Barometric Pressure (mm Hg): 754.4
Calibrate Location: โรงงานปูนซีเมนต์ Temperature (°C): 34.0
Calibrate Date: 20-Jun-25 High Volume ID: BKK-FS1377
CalibrationSheet No.: C-200625-BKK-FS1377 High Volume Model: TE-5009X
Calibrator ID: BKK-FS0625 High Volume S/N: 6262
Calibrator Model: TE-5028A Calibrator Slope: 1.04803
Calibrator S/N: 2585 Calibrator Intercept: -0.01206

Test No.	Delta H ₂ O (Inch)	Qa (m ³ /min)	I: Chart (CFM)	Linear Regression
1	1.8	0.829	32	Slope: 33.1466 Intercept: 4.5297 Correlation Coefficient: 0.9995
2	2.4	0.955	36	
3	3.0	1.066	40	
4	3.7	1.183	44	
5	4.6	1.310	48	



Calibrated by

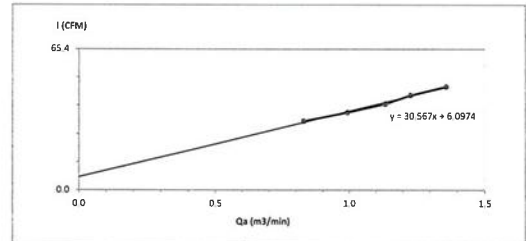
FORM NO.: F 06-074 REVISION NO.:2 ISSUE DATE: 20/11/23



High Volume Air Sampler Calibration Worksheet

Project Site: Gulf IP UT Co., Ltd. Barometric Pressure (mm Hg): 754.4
Calibrate Location: โรงงานปูนซีเมนต์ Temperature (°C): 34.0
Calibrate Date: 20-Jun-25 High Volume ID: BKK-FS1062
CalibrationSheet No.: C-200625-BKK-FS1062 High Volume Model: TE-5009X
Calibrator ID: BKK-FS0625 High Volume S/N: 5686
Calibrator Model: TE-5028A Calibrator Slope: 1.04803
Calibrator S/N: 2585 Calibrator Intercept: -0.01206

Test No.	Delta H ₂ O (Inch)	Qa (m ³ /min)	I: Chart (CFM)	Linear Regression
1	1.8	0.829	32	Slope: 30.5674 Intercept: 6.0974 Correlation Coefficient: 0.9957
2	2.6	0.994	36	
3	3.4	1.131	40	
4	4.0	1.229	44	
5	4.9	1.359	48	



Calibrated by

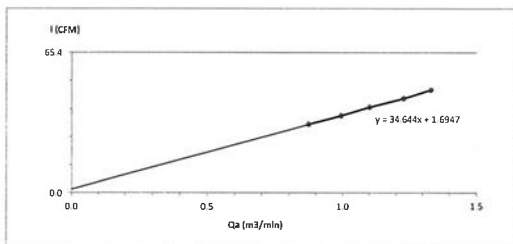
FORM NO.: F 06-074 REVISION NO.:2 ISSUE DATE: 20/11/23



High Volume Air Sampler Calibration Worksheet

Project Site: Gulf IP UT Co., Ltd. Barometric Pressure (mm Hg): 754.4
Calibrate Location: โรงงานปูนซีเมนต์ Temperature (°C): 34.0
Calibrate Date: 20-Jun-25 High Volume ID: BKK-FS1378
CalibrationSheet No.: C-200625-BKK-FS1378 High Volume Model: TE-5009X
Calibrator ID: BKK-FS0625 High Volume S/N: 6263
Calibrator Model: TE-5028A Calibrator Slope: 1.04803
Calibrator S/N: 2585 Calibrator Intercept: -0.01206

Test No.	Delta H ₂ O (Inch)	Qa (m ³ /min)	I: Chart (CFM)	Linear Regression
1	2.0	0.873	32	Slope: 34.6437 Intercept: 1.6947 Correlation Coefficient: 0.9995
2	2.6	0.994	36	
3	3.2	1.101	40	
4	4.0	1.229	44	
5	4.7	1.332	48	



Calibrated by

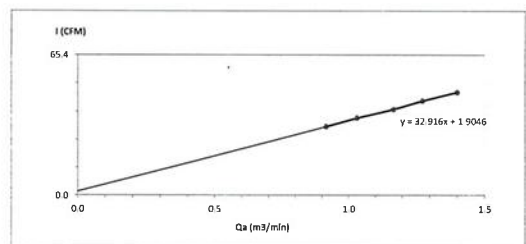
FORM NO.: F 06-074 REVISION NO.:2 ISSUE DATE: 20/11/23



High Volume Air Sampler Calibration Worksheet

Project Site: Gulf IP UT Co., Ltd. Barometric Pressure (mm Hg): 754.4
Calibrate Location: โรงงานปูนซีเมนต์ Temperature (°C): 34.0
Calibrate Date: 20-Jun-25 High Volume ID: BKK-FS0378
CalibrationSheet No.: C-200625-BKK-FS0378 High Volume Model: TE-5009X
Calibrator ID: BKK-FS0625 High Volume S/N: 4155
Calibrator Model: TE-5028A Calibrator Slope: 1.04803
Calibrator S/N: 2585 Calibrator Intercept: -0.01206

Test No.	Delta H ₂ O (Inch)	Qa (m ³ /min)	I: Chart (CFM)	Linear Regression
1	2.2	0.915	32	Slope: 32.9158 Intercept: 1.9046 Correlation Coefficient: 0.9995
2	2.8	1.031	36	
3	3.6	1.167	40	
4	4.3	1.274	44	
5	5.2	1.400	48	



Calibrated by

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



Accredited by

NSC-TISI-TIS 17025
Calibration 0426

Calibration certificate

Calibration Certificate No. 25BCI0197

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

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

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

Date	30 May 2025	Approval of the Calibration Certificate	Person in charge

Sartorius (Thailand) Co., Ltd.
129 Rama 9 Road, Huaykwang
10310 BangkokVerica®
Version 6.5

Page 1 | 6

Calibration certificate No.: 25BCI0197

Calibration Certificate

Calibration object

Multi range instrument

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

Place of calibration

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

Calibration procedure

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

Test equipment

Test equipment type	Test equipment ID	Valid until
Thermometer	Testo 174(Traceable to SI unit through ENTECH)	11 Nov 2025
Test weight set OIML R111 E2	Certificate No.M23081976_E2(Traceable to SI unit through TCS)	23 Aug 2025

Sartorius (Thailand) Co., Ltd.
129 Rama 9 Road, Huaykwang
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Version 6.5

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Calibration certificate No.: 25BCI0197

Calibration Certificate

Range 1

Adjustment Status

The measuring device was internally adjusted before the calibration.

Environmental and measuring conditions

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

Measurement results | Measurement uncertainties

Repeatability	Eccentricity
Test load (nominal): 1 g 100 g	Test load (nominal): 200 g
1 g 100 g	Center 49.99996 g
1 0.99993 g 99.99971 g	Front left 49.99993 g
2 0.99991 g 99.99971 g	Back left 49.99993 g
3 0.99992 g 99.99974 g	Back right 49.99994 g
4 0.99993 g 99.99973 g	Front right 49.99990 g
5 0.99992 g 99.99974 g	
6 0.99991 g 99.99970 g	Maximum deviation from centric loading indication
7 0.99993 g 99.99973 g	Δf _{ecc} max = 0.00006 g
8 0.99994 g 99.99972 g	
9 0.99995 g 99.99971 g	
10 0.99995 g 99.99969 g	
s = 0.000014 g s = 0.000017 g	

Error of indication

Testload	Indication	Error	Expansion factor	Uncertainty	Uncertainty relative
L	I	E	k	U(E)	U _{rel} (E)
0.00000 g	0.00000 g	0.00000 g	2.00	0.000030 g	---
0.01000 g	0.00995 g	-0.00005 g	2.00	0.000037 g	0.37 %
0.10000 g	0.09991 g	-0.00009 g	2.00	0.000038 g	0.038 %
0.50000 g	0.49985 g	-0.00015 g	2.00	0.000040 g	0.0080 %
1.00000 g	0.99991 g	-0.00009 g	2.00	0.000041 g	0.0041 %
5.00002 g	4.99997 g	-0.00005 g	2.00	0.000050 g	0.0010 %
10.00002 g	10.00003 g	0.00001 g	2.00	0.000069 g	0.00069 %
50.00002 g	49.99972 g	-0.00030 g	2.00	0.000091 g	0.00018 %
70.00004 g	69.99975 g	-0.00029 g	2.00	0.000117 g	0.00024 %
100.00001 g	99.99958 g	-0.00043 g	2.00	0.00017 g	0.00017 %
115.00006 g	114.99956 g	-0.00050 g	2.00	0.00028 g	0.00024 %
Maximum error of indication		E _{max} = 0.00043 g			

U_{rel}(E) is the quotient of U(E) and test load L. The uncertainty of measurement U(E) is valid only if error E is considered. You will find reference notes on the uncertainty of measurement in use under: Appendix to the calibration certificate | Interpretation of measurement results.

Relative note: The reported expanded uncertainty of measurement is stated as the standard uncertainty multiplied by the documented Expansion factor, determined in accordance with the European Calibration Guideline EURAMET cg-18, V4.0. There is a 95 % probability that the value of the measurand will be in the assigned value range.

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Calibration certificate No.: 25BCI0197

Calibration Certificate

Range 2

Adjustment Status

The measuring device was internally adjusted before the calibration.

Environmental and measuring conditions

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

Measurement results | Measurement uncertainties

Repeatability	Eccentricity
Test load (nominal): 200 g	Test load (nominal): 100 g
200 g	Center 99.99996 g
1 199.9998 g	Front left 99.99990 g
2 199.9998 g	Back left 99.99983 g
3 199.9998 g	Back right 99.99979 g
4 200.0000 g	Front right 99.99979 g
5 199.9998 g	
6 199.9999 g	Maximum deviation from centric loading indication
7 199.9999 g	Δf _{ecc} max = 0.00006 g
8 200.0000 g	
9 199.9998 g	
10 199.9999 g	
s = 0.00008 g	

Error of indication

Testload	Indication	Error	Expansion factor	Uncertainty	Uncertainty relative
L	I	E	k	U(E)	U _{rel} (E)
0.00000 g	0.00000 g	0.00000 g	2.00	0.000030 g	---
20.00002 g	19.99985 g	-0.00016 g	2.00	0.000069 g	0.00034 %
50.00002 g	49.99978 g	-0.00024 g	2.00	0.000091 g	0.00018 %
70.00004 g	69.99981 g	-0.00023 g	2.00	0.00017 g	0.00024 %
90.00007 g	89.99976 g	-0.00031 g	2.00	0.00018 g	0.00020 %
110.00003 g	109.99966 g	-0.00017 g	2.00	0.00028 g	0.00025 %
130.00011 g	129.99959 g	-0.00052 g	2.00	0.00028 g	0.00022 %
150.00000 g	149.99959 g	-0.00041 g	2.00	0.00028 g	0.00019 %
170.00000 g	170.00000 g	0.00000 g	2.00	0.00028 g	0.00016 %
200.00000 g	199.99998 g	-0.00002 g	2.00	0.00028 g	0.00014 %
220.00000 g	219.99999 g	-0.00001 g	2.00	0.00029 g	0.00013 %
Maximum error of indication		E _{max} = 0.00053 g			

U_{rel}(E) is the quotient of U(E) and test load L. The uncertainty of measurement U(E) is valid only if error E is considered. You will find reference notes on the uncertainty of measurement in use under: Appendix to the calibration certificate | Interpretation of measurement results.

Relative note: The reported expanded uncertainty of measurement is stated as the standard uncertainty multiplied by the documented Expansion factor, determined in accordance with the European Calibration Guideline EURAMET cg-18, V4.0. There is a 95 % probability that the value of the measurand will be in the assigned value range.

End of calibration certificate

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Uncertainty of measurement in use

Range 1

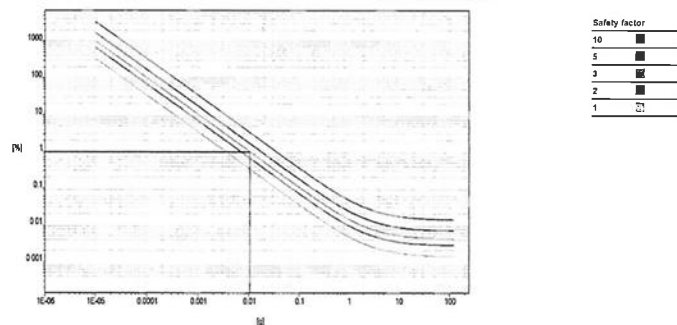
Device adjusted before measurement Yes
Temperature deviation considered 5 K
Temperature coefficient considered $2 \cdot 10^{-6}/K$

Uncertainty of the weighing result $U_{95}(W)$ $U_{95}(W) = 0.000036 \text{ g} + 1.38 \cdot 10^{-6} \cdot R$

Reference note: The current uncertainty of measurement is calculated by entering of the reading R into this formula. In relation to this, there is no need for a correction of the indication error. The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied with an Expansion factor of 2, determined in accordance with the European Calibration Guideline EURAMET cg-16, v4.0. There is a 95 % probability that the value of the measurand will be in the assigned value range.

Indication in % from max load	Net indication R	Uncertainty $U_{95}(W)$	Uncertainty relative $U_{95}(W)_{rel}$
1 %	120000 g	0.000052 g	0.0043 %
25 %	3000000 g	0.00045 g	0.0015 %
50 %	6000000 g	0.00086 g	0.0014 %
75 %	9000000 g	0.0013 g	0.0014 %
100 %	12000000 g	0.0017 g	0.0014 %

Graphic realization of the relative uncertainty of measurement | process accuracy



Displayed example

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

Uncertainty of measurement in use

Range 2

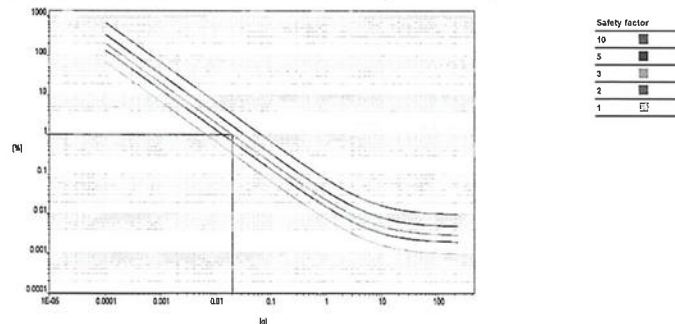
Device adjusted before measurement Yes
Temperature deviation considered 5 K
Temperature coefficient considered $2 \cdot 10^{-6}/K$

Uncertainty of the weighing result $U_{95}(W)$ $U_{95}(W) = 0.000067 \text{ g} + 9.62 \cdot 10^{-6} \cdot R$

Reference note: The current uncertainty of measurement is calculated by entering of the reading R into this formula. In relation to this, there is no need for a correction of the indication error. The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied with an Expansion factor of 2, determined in accordance with the European Calibration Guideline EURAMET cg-16, v4.0. There is a 95 % probability that the value of the measurand will be in the assigned value range.

Indication in % from max load	Net indication R	Uncertainty $U_{95}(W)$	Uncertainty relative $U_{95}(W)_{rel}$
1 %	220000 g	0.000088 g	0.0040 %
25 %	5500000 g	0.00059 g	0.0011 %
50 %	11000000 g	0.0011 g	0.0010 %
75 %	16500000 g	0.0016 g	0.00099 %
100 %	22000000 g	0.0022 g	0.00098 %

Graphic realization of the relative uncertainty of measurement | process accuracy



Displayed example

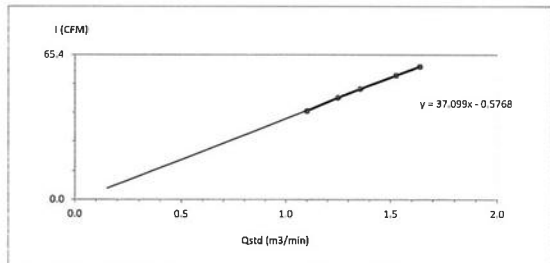
Process accuracy 1.00 %
Safety factor 3
Minimum sample weight 0.02019 g

High Volume Air Sampler Calibration Worksheet



Project Site: Gulf/P UT Co., Ltd. Barometric Pressure (mm Hg): 754.4
Calibrate Location: รพ.รพ.รพ.รพ. Temperature (°C): 34.0
Calibrate Date: 20-Jun-25 High Volume ID: BKK FS1375
CalibrationSheet No.: C-200625-BKK FS1375 High Volume Model: TE-5009X
Calibrator ID: BKK FS0625 High Volume S/N: 6256
Calibrator Model: TE-5028A Calibrator Slope: 1.67329
Calibrator S/N: 2585 Calibrator Intercept: -0.01925

Test No.	Delta H ₂ O (inch)	Q _{std} (m ³ /min)	I : Chart (CFM)	Linear Regression
1	3.4	1.1009	40	Slope: 37.0989
2	4.4	1.2498	46	Intercept: -0.5768
3	5.2	1.3570	50	Correlation Coefficient: 0.9996
4	6.6	1.5263	56	
5	7.6	1.6365	60	



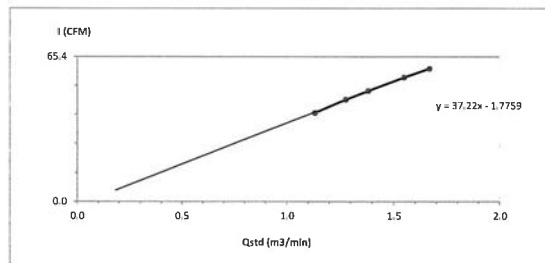
Calibrated by

High Volume Air Sampler Calibration Worksheet



Project Site: Gulf/P UT Co., Ltd. Barometric Pressure (mm Hg): 754.4
Calibrate Location: รพ.รพ.รพ.รพ. Temperature (°C): 34.0
Calibrate Date: 20-Jun-25 High Volume ID: BKK FS1058
CalibrationSheet No.: C-200625-BKK FS1058 High Volume Model: TE-5009X
Calibrator ID: BKK FS0625 High Volume S/N: 5689
Calibrator Model: TE-5028A Calibrator Slope: 1.67329
Calibrator S/N: 2585 Calibrator Intercept: -0.01925

Test No.	Delta H ₂ O (inch)	Q _{std} (m ³ /min)	I : Chart (CFM)	Linear Regression
1	3.6	1.1523	40	Slope: 37.2197
2	4.6	1.2774	46	Intercept: -1.7759
3	5.4	1.3824	50	Correlation Coefficient: 0.9992
4	6.8	1.5490	56	
5	7.9	1.6681	60	



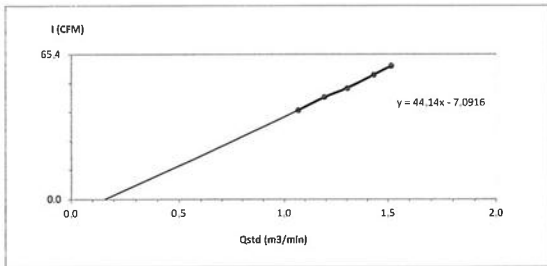
Calibrated by



High Volume Air Sampler Calibration Worksheet

Project Site : Gulf P UT Co., Ltd. Barometric Pressure (mm Hg) : 754.4
Calibrate Location : โรงเรือนผลิตอาหาร Temperature (°C) : 34.0
Calibrate Date : 20-Jun-25 High Volume ID : BKK_FS1056
CalibrationSheet No. : C-200625-BKK_FS1056 High Volume Model : TE-5009X
Calibrator ID : BKK_FS0625 High Volume S/N : 5499
Calibrator Model : TE-5028A Calibrator Slope : 1.67329
Calibrator S/N : 2585 Calibrator Intercept : -0.01925

Test No.	Delta H ₂ O (inch)	Q _{ad} (m ³ /min)	I: Chart (CFM)	Linear Regression
1	3.2	1.0686	40	Slope : 44.1395 Intercept : -7.0916 Correlation Coefficient : 0.9990
2	4.0	1.1925	46	
3	4.8	1.3045	50	
4	5.8	1.4320	56	
5	6.5	1.5149	60	



Calibrated by

BKK Field Services Scientist (2)

Field Services Supervisor

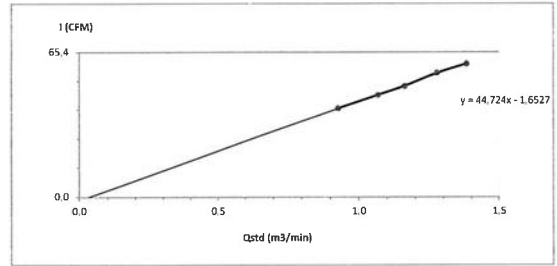
FORM NO.: F 06-073 REVISION NO.:2 ISSUE DATE: 20/11/23



High Volume Air Sampler Calibration Worksheet

Project Site : Gulf P UT Co., Ltd. Barometric Pressure (mm Hg) : 754.4
Calibrate Location : ลานผลิตอาหารโรงเรือน โรงฟ 1-4 Temperature (°C) : 34.0
Calibrate Date : 20-Jun-25 High Volume ID : BKK_FS0365
CalibrationSheet No. : C-200625-BKK_FS0365 High Volume Model : TE-5009X
Calibrator ID : BKK_FS0625 High Volume S/N : 4164
Calibrator Model : TE-5028A Calibrator Slope : 1.67329
Calibrator S/N : 2585 Calibrator Intercept : -0.01925

Test No.	Delta H ₂ O (inch)	Q _{ad} (m ³ /min)	I: Chart (CFM)	Linear Regression
1	2.4	0.9280	40	Slope : 44.7241 Intercept : -1.6527 Correlation Coefficient : 0.9991
2	3.2	1.0686	46	
3	3.8	1.1629	50	
4	4.6	1.2774	56	
5	5.4	1.3824	60	



Calibrated by

BKK Field Services Scientist (2)

Field Services Supervisor

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

INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7139 MOO 13, SOI SUTINAKORN 11 TAMBON BANG KAE0,
AMPHUE BANG PHLI SAMUT PRAKAN PROVINCE 10540 THAILAND
TEL: (660-2116-5100) FAX: (660-2116-7140)



Page 1 of 3

Certificate of Calibration

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

Certificate No : 25-ACT-009
Request No : Req-2025-0090

Unit Under Calibration Details

Measurement item : Acoustic Calibrator
Manufacturer : RION
Model : NC-74
Serial Number : 34178119
ID : BKK_FS0632

Class : 1
Range : 94 dB / 1000 Hz
Instrument Status : Used

Calibration Environment and Details

Temperature : (23 ± 2 °C)
Humidity : (50 ± 20 %RH)
Barometric Pressure : (1013 ± 10.0 hPa)
Received Date : 15 January 2025
Calibration Date : 16 January 2025

Location of Calibration : LAB 1 Acoustic

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

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Sound Calibrator	SV 35A	58079	EET	12 June 2025
THD Multimeter	2015	1047765	NIMT	16 January 2025

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

Note

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

Calibrated By :

Service Calibration Engineer

Calibration Engineer Supervisor

Issue Date : 16 January 2025

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

FM-758 ACT-02 Rev 03 Issue date 5/6/24

INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
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TEL: (660-2116-5100) FAX: (660-2116-7140)



Page 2 of 3

Certificate No : 25-ACT-009
Request No : Req-2025-0090

Sound pressure level

Calibration Results : Without Adjustment

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty (± dB)	Acceptance limit Class 1 (± dB)	Result
	Measured	Deviated value	Measured	Deviated value			
94 dB / 1000 Hz	93.82	-0.18	-	-	0.13	0.25	Pass

Frequency of Sound pressure level

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)	Acceptance limit Class 1 (± %)	Result
	Measured (Hz)	Deviated	Measured (Hz)	Deviated			
94 dB / 1000 Hz	1000.00	0.00	-	-	0.01	0.70	Pass

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

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)	Acceptance limit Class 1 (± %)	Result
	Measured (%)	Deviated (%)	Measured (%)	Deviated (%)			
94 dB / 1000 Hz	0.71	-	-	-	0.40	2.5	Pass

Note :

Function	Maximum-permitted Uncertainty of measurement
Sound pressure level	0.15 dB
Frequency	0.20%
Total distortion+noise	0.50%

• Acceptance limit was IEC 60912:2017 Class 1

• The calibration results exclude the calibration pressure correction

• The calibration results exclude the microphone volume correction

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

FM-758 ACT-02 Rev 03 Issue date 5/6/24

Certificate No : 25-ACT-009
Request No : Req-2025-0090

Decision Rule for Statements of Conformity

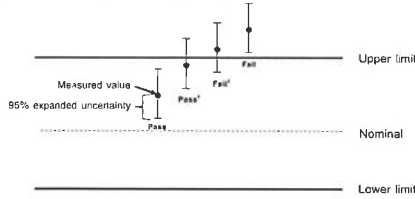
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09:2019, Guidelines on the Reporting of Compliance with Specification as following 1) μ and statements.

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

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

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

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



End of Calibration

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

FM-708-ACT-01 Rev 03 Issue date 5/6/24

Certificate of Calibration

Customer

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

Certificate No : 25-SLM-148
Request No : Req-2025-0773

Unit Under Calibration Details

Measurement item : Sound Level Meter
Microphone Class : 2
Manufacturer : RION
Microphone Model : UC-52
Model : NL-42
Microphone S/N : 179112
Serial Number : 00296511
Preamplifier Model : N11-24
ID : BKK_F30368
Preamplifier S/N : 87520
Resolution : 0.1 dB
Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 2 °C
Humidity : 50 % RH ± 10 % RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 28 March 2025
Calibrated Date : 28 April 2025
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests
Location of Calibration : Lab Acoustic

Reference Standard

Instrument	Brand	Model	SN	Due calibration	Traceability
Standard Microphone	Briel Kjaer	4192	2294985	25 June 2025	NIMT
Audio Generator	Svanek	Svan401	131	15 October 2025	WK Electric

Note

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

Calibrated By :

Mr.

Service

Issue Date : 28 April 2025

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

FM-708-SLM-01 Rev 06 Issue date 17/2/25

Certificate No : 25-SLM-148
Request No : Req-2025-0773

1. Indication at the calibration check frequency

UUC Setting	Nominal	Before Adjust		After Adjust		UNCERTAINTY
FAST / A / 30-130	Level	UUC	ERR	UUC	ERR	
Calibrator Setting	(dB)	(dB)	(dB)	(dB)	(dB)	
					(± dB)	
1000 Hz 94 dB	93.77	93.5	-0.27	93.8	0.03	0.20

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand Svanek, Model SV35A, SN, 58079

2. Self-generated noise, Microphone installed

UUC Setting	Measured	UNCERTAINTY
FAST / 30-130		
UUC Weighting	(dB)	(± dB)
A	14.9	0.10

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

UUC Setting	Measured	UNCERTAINTY
FAST / 30-130		
UUC Weighting	(dB)	(± dB)
A	11.5	0.10
C	15.9	0.10
Z	19.9	0.10

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

UUC Setting	Deviation from various Frequency Weighting Response curve	UNCERTAINTY
FAST / 30-130	A C Z	
STD Setting	(dB) (dB) (dB)	(± dB)
125 Hz	0.5 0.7 0.7	0.60
1000 Hz	0.0 0.0 0.0	0.60
4000 Hz	-1.4 -1.4 -1.5	0.60
8000 Hz	-3.1 -3.0 -2.9	0.70

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

FM-708-SLM-01 Rev 06 Issue date 17/2/25

Certificate No : 25-SLM-148
Request No : Req-2025-0773

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

UUC Setting	Deviation from various Frequency Weighting Response curve	UNCERTAINTY
FAST / 30-130	A (dB) C (dB) Z (dB)	(± dB)
STD Setting		
63 Hz	-0.3 -0.2 -0.1	0.20
125 Hz	-0.2 0.0 -0.1	
250 Hz	-0.1 -0.1 -0.1	
500 Hz	-0.1 0.0 0.0	
1000 Hz	0.0 0.0 0.0	
2000 Hz	0.0 0.0 0.0	
4000 Hz	0.0 0.0 0.0	
8000 Hz	0.0 0.0 0.0	
16000 Hz	-1.4 -1.4 0.0	

6. Frequency and time weightings at 1kHz

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

UUC Setting	STD	Measured		UNCERTAINTY
30-130 / A	REF	UUC	ERR	
UUC Time Response	(dD)	(dB)	(dI)	(± dB)
Fast	114.00	114.0	0.0	0.20
Slow	114.00	114.0	0.0	
Eq	114.00	114.0	0.0	

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

FM-708-SLM-01 Rev 06 Issue date 17/2/25

Certificate No : 25-SLM-148
Request No : Req-2025-0773

7. Long Term Stability

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

8. Level linearity on the reference level range

UUC Setting		Anticipated	Deviation		UNCERTAINTY (± dB)
FAST / A / 30-130		REF	UUC	ERR	
STD dB		(dB)	(dB)	(dB)	
138.00		138	138.0	0.0	0.30
134.00		134	134.0	0.0	
129.00		129	129.0	0.0	
124.00		124	124.0	0.0	
119.00		119	119.0	0.0	
114.00		114	114.0	0.0	
109.00		109	109.0	0.0	
104.00		104	104.0	0.0	
99.00		99	99.0	0.0	
94.00		94	94.0	0.0	
89.00		89	89.0	0.0	
84.00		84	84.0	0.0	
79.00		79	79.0	0.0	
74.00		74	74.0	0.0	
69.00		69	69.0	0.0	
64.00		64	64.0	0.0	
59.00		59	59.0	0.0	
54.00		54	54.0	0.0	
49.00		49	49.0	0.0	
44.00		44	44.1	0.1	
39.00		39	39.0	0.0	
34.00		34	34.1	0.1	
29.00		29	29.0	0.0	
24.00		24	23.9	-0.1	

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
FM-709-SLM-01 Rev 06 Issue date 17/2/25

Certificate No : 25-SLM-148
Request No : Req-2025-0773

9. Level linearity including the level range control

Level 1 uncertainty including the UUC range effects				UNCERTAINTY (± dB)
UUC Setting	STD	Measured		
FAST/A	REF	UUC	ERR	
UUC Range	(dB)	(dB)	(dB)	
30-130	29.50	29.6	0.1	0.30
	114	114.0	0.0	

10. Tone burst response

UUC Setting	STD	Anticipated	Measured		UNCERTAINTY (± dB)
A / 30-130	Toneburst	Ref	UUC	ERR	
UUC Time Response	(ms)	(dB)	(dB)	(dB)	
Fast	200	126.0	126.0	0.0	0.20
	2	109.0	108.9	-0.1	
	0.25	100.0	99.9	-0.1	
Slow	200	119.6	119.5	-0.1	
	2	100.0	99.9	-0.1	
	200	120.0	120.0	0.0	
SEL	2	100.0	100.0	0.0	
	0.25	91.0	90.8	-0.2	

11. Peak C Sound level

UUC Setting	Anticipated REF	Measured		UNCERTAINTY (± dB)
FAST / C / 55-141		UUC (dB)	ERR (dB)	
STD Setting	(dB)	(dB)	(dB)	
Complete cycle	136.4	136.3	-0.10	0.20
Positive half cycle	135.4	135.1	-0.30	
Negative half cycle	135.4	135.1	-0.30	

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FM-709-SLM-01 Rev 06 Issue date 17/2/25

Certificate No : 25-SLM-148
Request No : Req-2025-0773

12. Overload indication

UUC Setting	Measured	UNCERTAINTY
FAST / A / 30-130	UUC	(± dB)
STD Setting	(dB)	
Positive one-half cycle	139.4	
Negative one-half cycle	139.4	
Deviated	0.0	0.20

13. High Level Stability

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

End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
FM-709-SLM-01 Rev 06 Issue date 17/2/25

SITHIPORN ASSOCIATES CO., LTD. CALIBRATION LABORATORY

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

Cert. No. : ACL25066
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No. : 00858521 / 158765 / 58767
ID No. : BKK_FS0111

Condition As Found : GOOD

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

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

Received Date : 07 JANUARY 2025
Calibration Date : 21 - 23 JANUARY 2025
Date of Issue : 24 JANUARY 2025

Calibrated by : Nathakorn Pisutpaisan

Approved by :

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

Cert. No. : ACL25066
Job No. : VC68AC0058
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-0009-24	05-FEB-25
Waveform Generator	33511B	MY52302742	EF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	EEL-BP 21/0267	13-FEB-25
Digital Multimeter	33461A	MY53220076	EEL-BP 20/0267	15-FEB-25
Digital Multimeter	34461A	MY60024273	EEL-BP 22/0267	15-FEB-25
Programmable Attenuator	MA1-1070	62100114	EF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KAI	34560495	AA-3001-24	05-FEB-25

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

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

3.1 National Institute of Metrology (Thailand).

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

Cert. No. : ACL25066
Job No. : VC68AC0058
Pages : 3 of 8**Summary of Measurement Result :**

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

Cert. No. : ACL25066
Job No. : VC68AC0058
Page : 4 of 8**Result of calibration :**

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.2

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

Frequency Weighting	Weighting (dB)
A - weight	10.8
C - weight	17.4
Flat	23.0

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	0.6	0.6	0.6	± 1.5
1000	0.1	0.1	0.1	± 1.0
8000	-1.9	-1.9	-1.9	± 5.0

Cert. No. : ACL25066
Job No. : VC68AC0058
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long-term stability

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

Cert. No. : ACL25066
Job No. : VC68AC0058
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	53.9	-0.1	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.1	0.1	± 1.1
26.0	26.1	0.1	± 1.1
25.0	25.1	0.1	± 1.1

Cert. No. : ACL25066
Job No. : VC68AC0058
Pages : 7 of 8

8. Level linearity including the level range control

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

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	29.0	29.0	0.0	± 1.1

9. Tone burst response

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

Cert. No. : ACL25066
Job No. : VC68AC0058
Pages : 8 of 8

10. Peak C sound level

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

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

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7139 MOO 13, SOI SUTINAKORN 11 TAMBON BANG KAO,
AMPHIE BANG PHU SAMUT PRAKAN PROVINCE 10549 THAILAND
TEL: (669) 2116-5569-1 FAX: (669) 2116-7140

Certificate of Calibration

Customer

Name: ALS Laboratory Group Thailand Co., Ltd.
Address: 104 Soi Phatthanakan 40, Phatthanakan Road, Suan Luang, Bangkok 10250Certificate No: 35-SLM-147
Request No: Req-2025-0772

Unit Under Calibration Details

Measurement item: Sound Level Meter
Manufacturer: RION
Model: NL-42
Serial Number: 00872053
ID: BKK_FS0930
Resolution: 0.1 dB
Microphone Class: 2
Microphone Model: UC-52
Microphone S/N: 171587
Preamplifier Model: NH-24
Preamplifier S/N: 73329
Instrument Status: Used

Calibration Environment and Details

Temperature: 23 °C ± 2 °C
Humidity: 50 %RH ± 20 %RH
Barometric Pressure: 1013 hPa ± 10 hPa
Received Date: 28 March 2025
Calibrated Date: 28 April 2025
Calibration Procedure: In-house method CP-SLM-01 based on IEC 61672-3:2013 Electroacoustics - Sound level meters - Part 3: Periodic tests
Location of Calibration: Lab Acoustic
Reference Standard

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

Note

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor $k = 2$, providing a level of confidence approximately 95 %.Calibrated By: [Signature]
Service Calibration EngineerApproved By: [Signature]
Issue Date: [Signature]

Certificate No : 25-SLM-147
Request No : Req-2025-0772

1. Indication at the calibration check frequency

UUC Setting	Nominal Level	Before Adjust	After Adjust	UNCERTAINTY
FAST / A / 30-130	(dB)	UUC (dB) ERR (dB)	UUC (dB) ERR (dB)	(± dB)
Calibrator Setting	(dB)			
1000 Hz 94 dB	93.77	94.1 0.33	93.8 0.03	0.20

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand Syntek, Model SV35A, SN. 58079

2. Self-generated noise, Microphone installed

UUC Setting	Measured	UNCERTAINTY
FAST / 30-130	(dB)	(± dB)
UUC Weighting		
A	15.7	0.10

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

UUC Setting	Measured	UNCERTAINTY
FAST / 30-130	(dB)	(± dB)
UUC Weighting		
A	12.4	0.10
C	16.3	0.10
Z	20.4	0.10

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

UUC Setting	Deviation from various Frequency Weighting Response curve	UNCERTAINTY
FAST / 30-130	A (dB) C (dB) Z (dB)	(± dB)
STD Setting	(dB)	
125 Hz	0.2 0.4 0.4	0.60
1000 Hz	0.0 0.0 0.0	0.60
4000 Hz	0.0 0.1 0.0	0.60
8000 Hz	+1.3 +1.4 +1.4	0.70

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

FM-708-SLM-01 Rev.06 Issue date 17-2-25

Certificate No : 25-SLM-147
Request No : Req-2025-0772

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

UUC Setting	Deviation from various Frequency Weighting Response curve	UNCERTAINTY
FAST / 30-130	A (dB) C (dB) Z (dB)	(± dB)
STD Setting		
63 Hz	-0.2 0.0 0.0	0.20
125 Hz	-0.1 0.1 0.0	
250 Hz	0.0 0.0 0.0	
500 Hz	0.0 0.1 0.1	
1000 Hz	0.0 0.0 0.1	
2000 Hz	0.1 0.1 0.1	
4000 Hz	0.0 0.1 0.1	
8000 Hz	0.1 0.1 0.1	
16000 Hz	-1.3 -1.3 0.1	

6. Frequency and time weightings at 1kHz

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

UUC Setting	STD	Measured	UNCERTAINTY
30-130 / A	kLF	UUC (dB) ERR (dB)	(± dB)
UUC Time Response	(dB)		
Fast	114.00	114.0 0.0	0.20
Slow	114.00	114.0 0.0	
Leq	114.00	114.0 0.0	

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

FM-708-SLM-01 Rev.06 Issue date 17-2-25

Certificate No : 25-SLM-147
Request No : Req-2025-0772

7. Long Term Stability

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

8. Level linearity on the reference level range

UUC Setting	Anticipated	Deviation	UNCERTAINTY
FAST / A / 30-130	REF	UUC (dB) ERR (dB)	(± dB)
STD dB	(dB)		
138.00	138	138.0 0.0	0.30
134.00	134	134.0 0.0	
129.00	129	129.0 0.0	
124.00	124	124.0 0.0	
119.00	119	119.0 0.0	
114.00	114	114.0 0.0	
109.00	109	109.0 0.0	
104.00	104	104.0 0.0	
99.00	99	99.0 0.0	
94.00	94	94.0 0.0	
89.00	89	89.0 0.0	
84.00	84	84.0 0.0	
79.00	79	79.0 0.0	
74.00	74	74.0 0.0	
69.00	69	69.0 0.0	
64.00	64	64.0 0.0	
59.00	59	59.0 0.0	
54.00	54	54.0 0.0	
49.00	49	49.0 0.0	
44.00	44	44.0 0.0	
39.00	39	39.1 0.1	
34.00	34	34.1 0.1	
29.00	29	29.1 0.1	
24.00	24	24.0 0.0	

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

FM-708-SLM-01 Rev.06 Issue date 17-2-25

Certificate No : 25-SLM-147
Request No : Req-2025-0772

9. Level linearity including the level range control

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

10. Tone burst response

UUC Setting	STD	Anticipated	Measured	UNCERTAINTY
A / 30-130	Toneburst	Ref	UUC (dB) ERR (dB)	(± dB)
UUC Time Response	(ms)			
Fast	200 2	126.0 109.0	126.1 109.0	+0.1 0.0
Slow	0.25 200 2	100.0 119.6 100.0	99.9 119.6	-0.1 0.0
SEL	200 2	120.0 100.0	120.0 100.0	0.0 0.0
	0.25	91.0 90.9		+0.1

11. Peak C Sound level

UUC Setting	Anticipated	Measured	UNCERTAINTY
FAST / C / 55-141	REF	UUC (dB) ERR (dB)	(± dB)
STD Setting	(dB)		
Complete cycle	136.4	135.8 -0.60	0.20
Positive half cycle	135.4	135.2 -0.20	
Negative half cycle	135.4	135.2 -0.20	

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

FM-708-SLM-01 Rev.06 Issue date 17-2-25

Certificate No : 25-SLM-147
Request No : Req-2025-0772

12. Overload indication

UUC Setting	Measured	UNCERTAINTY (\pm dB)
FAST / A / 30-130	UUC	
STD Setting	(dB)	
Positive one-half cycle	139.3	
Negative one-half cycle	139.5	
Deviated	-0.2	0.20

13. High Level Stability

UUC Setting	Measured	UNCERTAINTY (\pm dB)
FAST / A / 30-130	UUC	
STD Setting	(dB)	
Initial	129.0	
Final	129.0	
Deviated	0.0	0.10

End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
FSI-708-SLM-01 Rev.06 Issue date 17/2/25

SITHIPORN ASSOCIATES CO., LTD. CALIBRATION LABORATORY

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

Cert. No. : ACC24056
Pages : 1 of 3

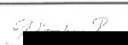
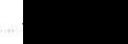

Calibration Certificate

Equipment : SOUND CALIBRATOR
Manufacturer : RION
Model : NC-74
Serial No.: 34425566
ID No.: BKK_FS0617

Condition As Found : GOOD

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

Location :
Ambient Temperature : (23.0 \pm 3) °C
Pressure : (101.3 \pm 3) kPa
Relative Humidity : (50.0 \pm 20) %
Received Date : 04 OCTOBER 2024
Calibration Date : 22 OCTOBER 2024
Date of Issue : 24 OCTOBER 2024

REVIEW BY : 
APPROVED BY : 
NEXT CAL DATE : 

Calibrated by : Nathakorn Pisutpaisan

Approved by :

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

SITHIPORN ASSOCIATES CO., LTD. CALIBRATION LABORATORY

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

Cert. No. : ACC24056
Job No. : VC67AC0170
Pages : 2 of 3

Calibration Procedure : CP-AC-03

Calibration Method :

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

Condition of this result of calibration :

1. Reference Standard Instruments :

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

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.
3. This certificate is traceable to the international system of unit maintained at :

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

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Cert. No. : ACC24056
Job No. : VC67AC0170
Pages : 3 of 3

Result of calibration :

1. Sound pressure level

Specified sound pressure level (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (dB)	Acceptance limit (dB)
94	94.14	0.14	0.14	0.40

2. Frequency

Specified Frequency (Hz)	Measured value (Hz)	Deviated value (%)	Uncertainty (%)	Acceptance limit (%)
1000	1001.9	0.2	0.1	1.0

3. Total distortion

Measured value (%)	Uncertainty (%)	Acceptance limit (%)
1.12	0.10	3.0

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

End of Calibration Certificate

Cert. No. : ACL24329
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 01122504 / 169436 / 72457
ID No.: BKK_FS0033

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 : 04 OCTOBER 2024
Calibration Date : 21-22 OCTOBER 2024
Date of Issue : 24 OCTOBER 2024

Calibrated by : Nathakorn Pisutpaisan

Approved by :

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

Cert. No. : ACL24329
Job No. : VC68AC0005
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-0009-24	05-FEB-25
Waveform Generator	33511B	MY52302742	EF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	EEL_BP 21/0267	13-FEB-25
Digital Multimeter	33461A	MY53220076	EEL_BP 20/0267	15-FEB-25
Digital Multimeter	34461A	MY60024273	EEL_BP 22/0267	15-FEB-25
Programmable Attenuator	MAT-1070	62100114	EF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KAI	34560495	AA-3001-24	05-FEB-25

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

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

3.1 National Institute of Metrology (Thailand).

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

Cert. No. : ACL24329
Job No. : VC68AC0005
Pages : 3 of 8

Summary of Measurement Result :

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

Cert. No. : ACL24329
Job No. : VC68AC0005
Page : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
16.1

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

Frequency Weighting	Weighting (dB)
A-weight	13.8
C-weight	20.8
Flat	25.7

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.6	0.6	0.6	± 1.5
1000	0.1	0.1	0.1	± 1.0
8000	-1.8	-1.8	-1.8	± 5.0

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Cert. No. : ACL24329
Job No. : VC68AC0005
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	-0.1	-0.1	-0.1	±2.0
125	-0.1	-0.1	-0.1	±1.5
250	0.0	0.0	-0.1	±1.5
500	0.0	0.0	-0.1	±1.5
1000	0.0	0.1	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.0	0.1	±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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Cert. No. : ACL24329
Job No. : VC68AC0005
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	132.9	-0.1	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	25.0	0.0	± 1.1

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Cert. No. : ACL24329
Job No. : VC68AC0005
Pages : 7 of 8

8. Level linearity including the level range control

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

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	29.0	28.8	-0.2	±1.1

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -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
SLL	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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Job No. : VC68AC0005
Pages : 8 of 8

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lepeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	130.0	130.0	0.0	±3.0
One	133.4	133.2	-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	135.1	-0.3	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

Cert. No. : ACL24400
Pages : 1 of 8

Calibration Certificate

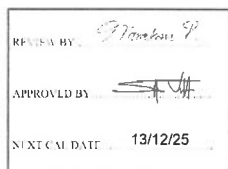
Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No. : 00858520 / 158771 / 58772
ID No. : BKK_FS0110

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



Calibrated by : Nathakorn Pinutpaisan

Approved by :

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Cert. No. : ACL24400
Job No. : VC68AC0045
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 Anecoic 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	FF-0009-24	05-FEB-25
Waveform Generator	33511B	MY52302742	EF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	EEL_BP 21/0267	13-FEB-25
Digital Multimeter	33461A	MY53220076	EEL_BP 20/0267	15-FEB-25
Digital Multimeter	34461A	MY60024273	EEL_BP 22/0267	15-FEB-25
Programmable Attenuator	MAT-1070	62100114	EF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KAI	34560495	AA-3001-24	05-FEB-25

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

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

3.1 National Institute of Metrology (Thailand).

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

Cert. No. : ACL24400
Job No. : VC68AC0045
Pages : 3 of 8

Summary of Measurement Result :

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

Cert. No. : ACL24400
Job No. : VC68AC0045
Page : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.8

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

Frequency Weighting	Weighting (dB)
A-weight	10.8
C-weight	16.9
Flat	22.6

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.5	0.6	0.6	± 1.5
1000	0.2	0.2	0.2	± 1.0
8000	-0.7	-0.6	-0.6	± 5.0

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Job No. : VC68AC0045
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	0.1	±1.5
250	0.1	0.0	0.0	±1.5
500	0.0	0.1	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

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Pages : 6 of 8

7. Level linearity on the reference level range

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

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Cert. No. : ACL24400
Job No. : VC68AC0045
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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	29.0	29.0	0.0	±1.1

9. Tone burst response

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

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Cert. No. : ACL24400
Job No. : VC68AC0045
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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	130.0	130.0	0.0	±3.0
One	133.4	133.4	0.0	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	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

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

Certificate of Calibration

Customer

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

Certificate No : 25-SLM-115
Request No : Req-2025-0603

Unit Under Calibration Details

Measurement item : Sound Level Meter
Manufacturer : RION
Model : NL-12
Serial Number : 00672749
ID : BKK_FS0929
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : UC-52
Microphone S/N : 158774
Preamplifier Model : NH 24
Preamplifier S/N : 58775
Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 30 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 6 March 2025
Calibrated Date : 19 March 2025
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests
Location of Calibration : Lab Acoustic

Reference Standard

Instrument	Brand	Model	SN	Due calibration	Traceability
Standard Microphone	Briel & Kjaer	4192	2294985	25 June 2025	NIMT
Audio Generator	Svanteck	Svan401	131	15 October 2025	WK Electric

Note

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



Calibrated By :

Issue Date : 19 March 2025

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FM-706-SLM-01 Rev.04 Issue date 5/6/24

Certificate No : 25-SLM-115
Request No : Req-2025-0603

1. Indication at the calibration check frequency

UUC Setting	Nominal	Before Adjust		After Adjust		UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
	Level	UUC	ERR	UUC	ERR			
		(dB)	(dB)	(dB)	(dB)			
FAST / A / 30-130								
Calibrator Setting	(dB)	(dB)	(dB)	(dB)	(dB)			
1000 Hz 94 dB	94.05	93.7	-0.36	94.1	+0.01	0.20	0.30	Pass

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand RION, Model NC-75, SN.35002736

2. Self-generated noise, Microphone installed

UUC Setting	Measured	UNCERTAINTY
FAST / 30-130		
UUC Weighting	(dB)	(± dB)
A	14.3	0.10

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

UUC Setting	Measured	UNCERTAINTY
FAST / 30-130		
UUC Weighting	(dB)	(± dB)
A	10.1	0.10
C	15.1	0.10
Z	18.2	0.10

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

UUC Setting	Deviation from various Frequency Weighting Response curve	UNCERTAINTY	Acceptance Limit	Result
FAST / 30-130	A C Z	(± dB)	(± dB)	
STD Setting	(dB) (dB) (dB)	(± dB)	(± dB)	
125 Hz	0.5 0.6 0.8	0.60	1.2	Pass
1000 Hz	0.0 0.0 0.0	0.60	1.0	Pass
1000 Hz	-2.2 -2.2 -2.2	0.60	3.0	Pass
8000 Hz	-3.6 -3.5 -3.6	0.70	5.0	Pass

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FM-706-SLM-01 Rev.04 Issue date 5/6/24

Certificate No : 25-SLM-115
Request No : Req-2025-0603

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

UUC Setting	Deviation from various Frequency Weighting Response curve	UNCERTAINTY	Acceptance Limit	Result
FAST / 30-130	A (dB) C (dB) Z (dB)	(± dB)	(± dB)	
STD Setting	(dB) (dB) (dB)	(± dB)	(± dB)	
63 Hz	-0.1 0.1 0.0	0.20	2.0	Pass
125 Hz	0.0 0.1 0.1	0.20	1.5	Pass
250 Hz	0.0 0.1 0.1	0.20	1.5	Pass
500 Hz	0.0 0.1 0.1	0.20	1.5	Pass
1000 Hz	0.0 0.0 0.0	0.20	1.0	Pass
2000 Hz	-0.1 -0.1 -0.1	0.20	2.0	Pass
4000 Hz	-0.3 -0.3 -0.3	0.20	3.0	Pass
8000 Hz	0.0 0.0 0.0	0.20	5.0	Pass
16000 Hz	-1.9 -1.9 -0.5	0.20	+5.0 -INF	Pass

6. Frequency and time weightings at 1kHz

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

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

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FM-706-SLM-01 Rev.04 Issue date 5/6/24

Certificate No : 25-SLM-115
Request No : Req-2025-0603

7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance Limit	Result
FAST / A / 30-130	UUC	(± dB)	(± dB)	
STD Setting	(dB)	(± dB)	(± dB)	
Initial	114.0			
Final	114.0			
Deviated	0.0	0.10	0.30	Pass

8. Level linearity on the reference level range

UUC Setting	Anticipated	Deviation	UNCERTAINTY	Acceptance Limit	Result
FAST / A / 30-130	REF	UUC ERR	(± dB)	(± dB)	
STD dB	(dB)	(dB) (dB)	(± dB)	(± dB)	
138.00	138	138.0 0.0	0.20	1.1	Pass
134.00	134	134.0 0.0	0.20	1.1	Pass
129.00	129	129.0 0.0	0.20	1.1	Pass
124.00	124	124.0 0.0	0.20	1.1	Pass
119.00	119	119.0 0.0	0.20	1.1	Pass
114.00	114	114.0 0.0	0.20	1.1	Pass
109.00	109	109.0 0.0	0.20	1.1	Pass
104.00	104	104.0 0.0	0.20	1.1	Pass
99.00	99	99.0 0.0	0.20	1.1	Pass
94.00	94	94.0 0.0	0.20	1.1	Pass
89.00	89	89.0 0.0	0.20	1.1	Pass
84.00	84	84.0 0.0	0.20	1.1	Pass
79.00	79	79.0 0.0	0.20	1.1	Pass
74.00	74	74.0 0.0	0.20	1.1	Pass
69.00	69	69.0 0.0	0.20	1.1	Pass
64.00	64	64.0 0.0	0.20	1.1	Pass
59.00	59	59.0 0.1	0.20	1.1	Pass
54.00	54	54.0 0.0	0.20	1.1	Pass
49.00	49	49.0 0.0	0.20	1.1	Pass
44.00	44	44.0 0.0	0.20	1.1	Pass
39.00	39	39.0 0.0	0.20	1.1	Pass
34.00	34	34.0 0.0	0.20	1.1	Pass
29.00	29	29.0 0.0	0.20	1.1	Pass
24.00	24	24.0 0.0	0.20	1.1	Pass

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FM-706-SLM-01 Rev.04 Issue date 5/6/24

Certificate No : 25-SLM-115
Request No : Req-2025-0603

9. Level linearity including the level range control

UUC Setting	STD	Measured			UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)	Result
		UUC	ERR				
FAST / A	REF						
UUC Range	(dB)	(dB)	(dB)				
30-130	29.50	29.6	0.1	0.30	1.1	Pass	
	114	114.0	0.0		1.1	Pass	

10. Tone burst response

UUC Setting	STD	Anticipated	Measured			UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)	Result
			UUC	ERR				
A / 30-130	Toneburst	Ref						
UUC Time Response	(ms)							
Fast	200	126.0	126.0	0.0	0.20	1.0	Pass	
	2	109.0	109.0	0.0		+1.0, -2.5	Pass	
	0.25	100.0	100.0	0.0		+1.5, -5.0	Pass	
Slow	200	119.6	119.6	0.0		1.0	Pass	
	2	100.0	100.0	0.0		+1.0, -5.0	Pass	
	0.25	91.0	90.9	-0.1		+1.5, -5.0	Pass	

11. Peak C Sound level

UUC Setting	Anticipated	Measured			UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)	Result
		UUC	ERR				
FAST / C / 55-144	REF						
STD Setting	(dB)	(dB)	(dB)				
Complete cycle	136.1	136.2	-0.20	0.20	3.0	Pass	
Positive half cycle	135.4	135.1	-0.30		2.0	Pass	
Negative half cycle	135.4	135.1	-0.30		2.0	Pass	

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ISM-708-SLM-01 Rev.04 Issue date 5/6/24

Certificate No : 25-SLM-115
Request No : Req-2025-0603

12. Overload indication

UUC Setting	Measured	UNCERTAINTY	Acceptance Limit	Result
FAST / A / 30-130	UUC			
STD Setting	(dB)	(\pm dB)	(\pm dB)	
Positive one-half cycle	139.2			
Negative one-half cycle	139.1			
Deviated	0.1	0.20	1.5	Pass

13. High Level Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance Limit	Result
FAST / A / 30-130	UUC			
STD Setting	(dB)	(\pm dB)	(\pm dB)	
Initial	129.0			
Final	129.0			
Deviated	0.0	0.10	0.30	Pass

Note :

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

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

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ISM-708-SLM-01 Rev.04 Issue date 5/6/24

Certificate No : 25-SLM-115
Request No : Req-2025-0603

Decision Rule for Statements of Conformity

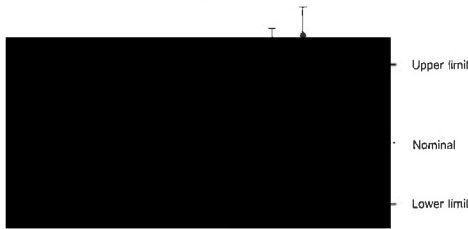
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:19/2019, Guidelines on the Reporting of Conformance with Specification as follows:

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

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

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

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



The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
ISM-708-SLM-01 Rev.04 Issue date 5/6/24

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

451-451/1 Sirthorn Road, Bangburni, Bangkok, 10700 Thailand
Tel: +66 2433 8331 Email: calibration@sithiphom.com

Cert. No. : ACL24413
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42A / Microphone UC-52 / Preamplifier NH-24
Serial No. : 00222486 / 198967 / 15317
ID No. : BKK_FS1222

Condition As Found : GOOD

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

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

Received Date : 12 DECEMBER 2024
Calibration Date : 23 - 24 DECEMBER 2024
Date of Issue : 26 DECEMBER 2024

Calibrated by : Nathakorn Pisutpaian

Approved by :

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

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

45/-45/1 Sirinthorn Road, Bangbunru, Bangplud, Bangkok, 10700 Thailand
Tel. +66 2433 8331 Email : calibration@sithiporn.com



Cert. No. : ACL24413
Job No. : VC68AC0050
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-0009-24	05-FEB-25
Waveform Generator	33511B	MY52302742	EF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	EEL_BP 21/0267	13-FEB-25
Digital Multimeter	33461A	MY53220076	EEL_BP 20/0267	15-FEB-25
Digital Multimeter	34461A	MY60024273	EEL_BP 22/0267	15-FEB-25
Programmable Attenuator	MAT-1070	62100114	EF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KAI	34560495	AA-3001-24	05-FEB-25

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

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

3.1 National Institute of Metrology (Thailand).

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

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Cert. No. : ACL24413
Job No. : VC68AC0050
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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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Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.6

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

Frequency Weighting	Weighting (dB)
A - weight	13.1
C - weight	19.9
Flat	25.3

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	0.6	0.6	0.6	± 1.5
1000	0.2	0.2	0.2	± 1.0
8000	-1.0	-0.9	-0.9	±5.0

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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	0.0	-0.1	0.0	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.0	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

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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	78.9	-0.1	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	63.9	-0.1	± 1.1
59.0	59.0	0.0	± 1.1
54.0	53.9	-0.1	± 1.1
49.0	48.9	-0.1	± 1.1
44.0	43.9	-0.1	± 1.1
39.0	38.9	-0.1	± 1.1
34.0	34.0	0.0	± 1.1
30.0	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	26.1	0.1	± 1.1
25.0	25.1	0.1	± 1.1

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8. Level linearity including the level range control

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

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

9. Tone burst response

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

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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	130.0	130.0	0.0	±3.0
One	133.4	133.3	-0.1	±3.0

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

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

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Cert. No. : ACL24416
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42A / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00222513 / 195822 / 15345
ID No.: BKK_FS1225

Condition As Found : GOOD

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

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

Received Date : 12 DECEMBER 2024
Calibration Date : 23 - 24 DECEMBER 2024
Date of Issue : 26 DECEMBER 2024

Calibrated by : Nathakorn Pisutpaisan

Approved by :

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Cert. No. : ACL24416
Job No. : VC68AC0050
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-0009-24	05-FEB-25
Waveform Generator	33511B	MY52302742	EF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	EEL-BP 21/0267	13-FEB-25
Digital Multimeter	33461A	MY53220076	EEL-BP 20/0267	15-FEB-25
Digital Multimeter	34461A	MY60024273	EEL-BP 22/0267	15-FEB-25
Programmable Attenuator	MAT-1070	62100114	EF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KAI	34560495	AA-3001-24	05-FEB-25

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

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

3.1 National Institute of Metrology (Thailand).

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

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Cert. No. : ACL24416
Job No. : VC68AC0050
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. : ACL24416
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Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
13.8

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

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

3. Acoustical signal tests of frequency weightings

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

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

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Job No. : VC68AC0050
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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	0.0	0.0	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.0	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

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7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.1	0.1	± 1.1
27.0	27.1	0.1	± 1.1
26.0	26.1	0.1	± 1.1
25.0	25.1	0.1	± 1.1

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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	29.0	28.9	-0.1	±1.1

9. Tone burst response

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

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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	130.0	130.0	0.0	±3.0
One	133.4	133.4	0.0	±3.0

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

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

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Cert. No. : ACL24284
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Pre-amplifier NH-24
Serial No. : 00597155 / 180398 / 88168
ID No. : BKK_FS0993

Condition As Found : GOOD

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

Location :
Ambient Temperature : (23.0 ± 3) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (59.0 ± 20) %

Received Date : 04 SEPTEMBER 2024
Calibration Date : 19 SEPTEMBER 2024
Date of Issue : 20 SEPTEMBER 2024

Calibrated by : Nuthakorn Pisutpaolun

Approved by :

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Cert. No. : ACL24284
Job No. : VC67AC0149
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-0009-24	05-FEB-25
Waveform Generator	33511B	MY52302742	FF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	EEL-BP 21/0267	13-FEB-25
Digital Multimeter	33461A	MY53220076	EEL-BP 20/0267	15-FEB-25
Digital Multimeter	34461A	MY60024273	EEL-BP 22/0267	15-FEB-25
Programmable Attenuator	MAT-1070	62100114	EF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KAI	34560495	AA-3001-24	05-FEB-25

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

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

3.1 National Institute of Metrology (Thailand).

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

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Cert. No. : ACL24284
Job No. : VC67AC0149
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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Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
15.1

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

Frequency Weighting	Weighting (dB)
A-weight	10.8
C-weight	17.2
Flat	23.1

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.0	0.0	0.0	+ 1.5
1000	-0.1	-0.1	-0.1	+ 1.0
8000	-0.9	-0.9	-0.8	+5.0

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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	0.0	-0.1	0.0	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.1	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long-term stability

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

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

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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	108.0	0.0	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.1	0.1	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.1	0.1	±1.0

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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	136.4	0.0	±3.0

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

11. Overload indication

Measured value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	89.6	±1.5
Negative one-half cycle	89.6	±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. : ACL24344
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00597156 / 170403 / 72904
ID No.: BKK_FS0994

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 : 01 NOVEMBER 2024
Calibration Date : 12 NOVEMBER 2024
Date of Issue : 13 NOVEMBER 2024

Calibrated by : Nathakorn Pisutpaisan

Approved by :

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Cert. No. : ACL24344
Job No. : VC68AC0027
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-0009-24	05-FEB-25
Waveform Generator	33511B	MY52302742	EF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	EELBP 21/0267	13-FEB-25
Digital Multimeter	33461A	MY53220076	EELBP 20/0267	15-FEB-25
Digital Multimeter	34461A	MY60024273	EELBP 22/0267	15-FEB-25
Programmable Attenuator	MAT-1070	62100114	EF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KAI	34560495	AA-3001-24	05-FEB-25

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

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

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

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Cert. No. : ACL24344
Job No. : VC68AC0027
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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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Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
13.8

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

Frequency Weighting	Weighting (dB)
A - weight	9.9
C - weight	16.0
Flat	21.9

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
125	0.7	0.7	0.8	± 1.5
1000	0.1	0.1	0.1	± 1.0
8000	-1.8	-1.8	-1.7	±5.0

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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	0.0	-0.1	-0.1	±2.0
125	-0.1	0.0	0.0	±1.5
250	0.0	0.0	-0.1	±1.5
500	0.0	0.0	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

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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	28.0	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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8. Level linearity including the level range control

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

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	29.0	29.0	0.0	±1.1

9. Tone burst response

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

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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	130.0	130.0	0.0	±3.0
One	133.4	133.4	0.0	±3.0

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

11. Overload indication

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

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. : ACL24345
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No. : 00597159 / 180402 / 88172
ID No. : BKK_FS0995

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 : 01 NOVEMBER 2024
Calibration Date : 12 NOVEMBER 2024
Date of Issue : 13 NOVEMBER 2024

Calibrated by : Nathekom Pisutpaisan

Approved by :

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Cert. No. : ACL24345
Job No. : VC68AC0027
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-0009-24	05-FEB-25
Waveform Generator	33511B	MY52302742	EF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	EEL_BP 21/0267	13-FEB-25
Digital Multimeter	33461A	MY53220076	EEL_BP 20/0267	15-FEB-25
Digital Multimeter	34461A	MY60024273	EEL_BP 22/0267	15-FEB-25
Programmable Attenuator	MAT-1070	62100114	EF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KAI	34560495	AA-3001-24	05-FEB-25

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

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

3.1 National Institute of Metrology (Thailand).

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

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Cert. No. : ACL24345
Job No. : VC68AC0027
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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Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
15.7

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

Frequency Weighting	Weighting (dB)
A-weight	14.8
C-weight	20.9
Flat	26.4

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
125	0.2	0.3	0.3	±1.5
1000	0.1	0.1	0.1	±1.0
8000	2.4	2.5	2.5	±5.0

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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	-0.1	-0.1	-0.1	±2.0
125	-0.1	0.0	-0.1	±1.5
250	0.0	0.0	-0.1	±1.5
500	0.0	0.0	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.0	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long-term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	94.0	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	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	30.1	0.1	± 1.1
29.0	29.1	0.1	± 1.1
28.0	28.0	0.0	± 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

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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	29.0	29.1	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
	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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10. Peak C sound level

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

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

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

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Cert. No. : ACL24261
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No. : 00597161 / 180404 / 88174
ID No. : BKK FS0996

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHAI THANAKAN 40, PHAI THANAKAN ROAD,
KHAENG PHAI THANAKAN, 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 : 23 AUGUST 2024
Date of Issue : 26 AUGUST 2024

Calibrated by :

Nathakorn Pisutpisan

Approved by :

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Cert. No. : ACL24261
Job No. : VC67AC0139
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 :

I. 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	EELBP 21/0267	13-FEB-25
Digital Multimeter	33461A	MY53220076	EELBP 20/0267	15-FEB-25
Digital Multimeter	34461A	MY60024273	EELBP 22/0267	15-FEB-25
Programmable Attenuator	MAT-1070	62100114	EF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KAI	34560495	AA-3001-24	05-FEB-25

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

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

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

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Cert. No. : ACL24261
Job No. : VC67AC0139
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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. : ACL24261
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Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
15.4

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

Frequency Weighting	Weighting (dB)
A - weight	11.6
C - weight	17.7
Flat	23.6

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.2	0.2	0.2	± 1.5
1000	0.1	0.1	0.1	± 1.0
8000	0.7	0.7	0.7	± 5.0

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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	0.0	-0.1	-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

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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	78.9	-0.1	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	63.9	-0.1	± 1.1
59.0	59.0	0.0	± 1.1
54.0	53.9	-0.1	± 1.1
49.0	48.9	-0.1	± 1.1
44.0	44.0	0.0	± 1.1
39.0	38.9	-0.1	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.1	0.1	± 1.1
26.0	26.1	0.1	± 1.1
25.0	25.1	0.1	± 1.1

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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	29.0	29.1	0.1	± 1.1

9. Tone burst response

Time Weighing	Tone burst duration, Th (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

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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	130.0	130.0	0.0	± 3.0
One	133.4	133.3	-0.1	± 3.0

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

11. Overload indication

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

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Cert. No. : ACL24353
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No. : 00597163 / 180406 / 88176
ID No. : BKK_FS0998

Condition As Found : GOOD

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

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

Received Date : 05 NOVEMBER 2024
Calibration Date : 14-18 NOVEMBER 2024
Date of Issue : 18 NOVEMBER 2024

Calibrated by : Nathakorn Pisutpaisan

Approved by :

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Cert. No. : ACL24353
Job No. : VC68AC0029
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-0009-24	05-FEB-25
Waveform Generator	33511B	MY52302742	EF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	EEL_BP 21/0267	13-FEB-25
Digital Multimeter	33461A	MY53220076	EEL_BP 20/0267	15-FEB-25
Digital Multimeter	34461A	MY60024273	EEL_BP 22/0267	15-FEB-25
Programmable Attenuator	MAT-1070	62100114	EF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KA1	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).

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Cert. No. : ACL24353
Job No. : VC68AC0029
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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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Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.6

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	17.2
Flat	22.8

3. Acoustical signal tests of frequency weightings

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

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

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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	0.0	-0.1	0.0	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.0	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

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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	53.9	-0.1	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	38.9	-0.1	± 1.1
34.0	34.0	0.0	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.0	0.0	± 1.1
26.0	26.0	0.0	± 1.1
25.0	25.0	0.0	± 1.1

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8. Level linearity including the level range control

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

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

9. Tone burst response

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

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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	130.0	130.0	0.0	±3.0
One	133.4	133.3	-0.1	±3.0

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

11. Overload indication

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

12. High level stability

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

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

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Cert. No. : ACL24355
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00597165 / 180408 / 88178
ID No.: BKK_FS1000

Condition As Found : GOOD

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

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

Received Date : 05 NOVEMBER 2024
Calibration Date : 14-18 NOVEMBER 2024
Date of Issue : 18 NOVEMBER 2024

Calibrated by : Nathakorn Pisutpaisan

Approved by :

REVIEW BY: *Nathakorn P.*
APPROVED BY: *[Signature]*
NEXT CAL DATE: 14/11/25

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Cert. No. : ACL24355
Job No. : VC68AC0029
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	EL-0009-24	05-FEB-25
Waveform Generator	33511B	MY52302742	EL-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	EEL.BP 21/0267	13-FEB-25
Digital Multimeter	33461A	MY53220076	EEL.BP 20/0267	15-FEB-25
Digital Multimeter	34461A	MY60024273	EEL.BP 22/0267	15-FEB-25
Programmable Attenuator	MAT-1070	62100114	EF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-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).

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Cert. No. : ACL24355
Job No. : VC68AC0029
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. : ACL24355
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Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.8

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

Frequency Weighting	Weighting (dB)
A-weight	11.6
C-weight	17.8
Flat	23.7

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
125	0.3	0.3	0.3	±1.5
1000	0.2	0.2	0.2	±1.0
8000	1.0	1.1	1.1	±5.0

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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	0.1	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.0	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	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	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	53.9	-0.1	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.1	0.1	± 1.1
26.0	26.1	0.1	± 1.1
25.0	25.0	0.0	± 1.1

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Job No. : VC68AC0029
Pages : 7 of 8

8. Level linearity including the level range control

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

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

9. Tone burst response

Time Weighing	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

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Cert. No. : ACL24355
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Pages : 8 of 8

10. Peak C sound level

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

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

11. Overload indication

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

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Cert. No. : ACL24380
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42A / Microphone UC-S2 / Preampifier NH-24
Serial No. : 00623382 / 198628 / 26410
ID No. : BKK_FS1215

Condition As Found : GOOD

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

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

Received Date : 15 NOVEMBER 2024
Calibration Date : 03-04 DECEMBER 2024
Date of Issue : 04 DECEMBER 2024

Calibrated by : Nathakorn Pisutpaisan

Approved by :

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Cert. No. : ACL24380
Job No. : VC68AC0032
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 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-0009-24	05-FEB-25
Waveform Generator	33511B	MY52302742	EF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	EEL_BP 21/0267	13-FEB-25
Digital Multimeter	33461A	MY53220076	EEL_BP 20/0267	15-FEB-25
Digital Multimeter	34461A	MY60024273	EEL_BP 22/0267	15-FEB-25
Programmable Attenuator	MAT-1070	62100114	EF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KAI	34560495	AA-3001-24	05-FEB-25

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

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

3.1 National Institute of Metrology (Thailand).

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

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Cert. No. : ACL24380
Job No. : VC68AC0032
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. : ACL24380
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Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.2

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

Frequency Weighting	Weighting (dB)
A - weight	10.8
C - weight	16.8
Flat	22.5

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
125	0.4	0.4	0.4	± 1.5
1000	0.1	0.1	0.1	± 1.0
8000	-0.2	-0.1	-0.1	+5.0

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Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

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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	29.0	28.9	-0.1	±1.1

9. Tone burst response

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

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Pages : 8 of 8

10. Peak C sound level

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

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

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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

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Cert. No. : ACL24383
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42A / Microphone UC-52 / Preamplifier NH-24
Serial No. : 00623386 / 198633 / 26414
ID No. : BKK_FS1218

Condition As Found : GOOD

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

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

Received Date : 15 NOVEMBER 2024
Calibration Date : 03-04 DECEMBER 2024
Date of Issue : 04 DECEMBER 2024

Calibrated by : Nulhakorn Pisutpaisan

Approved by :

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. : ACL24383
Job No. : VC68AC0032
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-0009-24	05-FEB-25
Waveform Generator	33511B	MY52302742	EF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	EEL_BP 21/0267	13-FEB-25
Digital Multimeter	33461A	MY53220076	EEL_BP 20/0267	15-FEB-25
Digital Multimeter	34461A	MY60024273	EEL_BP 22/0267	15-FEB-25
Programmable Attenuator	MAT-1070	62100114	EF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KAI	34560495	AA-3001-24	05-FEB-25

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

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

3.1 National Institute of Metrology (Thailand).

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

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Cert. No. : ACL24383
Job No. : VC68AC0032
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. : ACL24383
Job No. : VC68AC0032
Page : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.2

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

Frequency Weighting	Weighting (dB)
A - weight	11.6
C - weight	19.2
Flat	24.4

3. Acoustical signal tests of frequency weightings

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

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

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Cert. No. : ACL24383
Job No. : VC68AC0032
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

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Cert. No. : ACL24383
Job No. : VC68AC0032
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	136.1	0.1	± 1.1
135.0	135.1	0.1	± 1.1
134.0	134.1	0.1	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.1	0.1	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.1	0.1	± 1.1
114.0	114.1	0.1	± 1.1
109.0	109.1	0.1	± 1.1
104.0	104.1	0.1	± 1.1
99.0	99.1	0.1	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.0	0.0	± 1.1
26.0	26.0	0.0	± 1.1
25.0	24.9	-0.1	± 1.1

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Cert. No. : ACL24383
Job No. : VC68AC0032
Pages : 7 of 8

8. Level linearity including the level range control

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

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	29.0	29.0	0.0	±1.1

9. Tone burst response

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

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Cert. No. : ACL24383
Job No. : VC68AC0032
Pages : 8 of 8

10. Peak C sound level

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

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

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate



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TEL 0-2717-3000-29 FAX 0-2719-9484

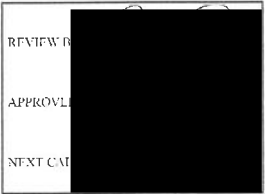


Certificate of Calibration

Cert.No.: 24CH780
Page: 1 of 2

Equipment :
Manufacturer :
Model :
Serial No. :
ID No. :
Condition As-Received :
Received Date :
Calibration Date :
Reference :
Submitted by :

pH Meter
Mettler Toledo
Seven2Go
C312875331
BKK_LG0076
Used item
28 June 2024
01 July 2024
2406-0970DSC-4



Ambient Temperature :
Relative Humidity :
Calibration Procedure :

(25 ± 2.5) °C
(50 ± 15) %
In - house method :
- CP-CH5 by direct measurement with DC voltage standard and direct measurement with certified reference material (CRM)

Calibrated by :

Approved by :

() Unnopphol Harachai
() Ponpan Palpim
(✓) Sathip Moangmai

Issue Date :

3 July 2024

The Uncertainties are for a confidence probability of approximately 95%

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Cert.No.: 24CH780
Page: 2 of 2

Condition of this calibration result

1. Reference Standard Instrument

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC116	23E2802	27 Aug 2024

- 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.,
ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	970851	25 Apr 2026
pH 6.986	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	Coverage factor
	pH	mV	mV	pH	(\pm mV)	k
pH Meter	4.00	177.48	178	4.00	0.58	2.00
S/N : C312875331	7.00	0.00	0	7.00	0.58	2.00
	10.00	-177.48	-177	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 (\pm)	Coverage factor k
pH Electrode	4.008	4.01	190	0.0079	2.00
S/N : 2484158	6.986	6.99	14	0.011	2.00
	9.997	9.99	-160	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 %.

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Certificate of Calibration

Cert. No.: 24LM110
Page: 1 of 2

Equipment : pH Meter with Sensor

Manufacturer : Mettler Toledo

Model : Seven2Go

Serial No. : C312875331

ID No. : BKK_LG0076

Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khwaeng Phatthanakan, Khet Suan Luang,
Bangkok 10250 Thailand

Location : TPA On Site Calibration Laboratory

Received Order : 28 June 2024

Calibrated Date : 02 July 2024

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 30) %

AC Line Voltage : (220 ± 22) V

Calibrated by : Warekom Lemgagtrakul

Approved by :

() Ponpan Paipim
(✓) Suwil Imjai
() Kunchit Promprat

Issue Date : 03 July 2024

The Uncertainties are for a confidence probability of approximately 95%

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Equipment : pH Meter with Sensor
Condition As-Received : Used Item
Reference : 2406-0970DSC-5

Cert. No.: 24LM110
Page: 2 of 2

Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-OT01 according to comparison with Industrial Platinum Resistance Thermometer (IPRT) into Temperature Bath.

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Digital Thermometer	2188080	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: 2484158

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty (\pm °C)	Coverage Factor k
20.0	100	20.002	19.9	-0.102	0.16	2.00
25.0	100	25.002	24.9	-0.102	0.16	2.00
30.0	100	30.004	29.9	-0.104	0.16	2.00
35.0	100	35.004	34.9	-0.104	0.16	2.00
40.0	100	40.004	39.9	-0.104	0.16	2.00
45.0	100	45.003	44.9	-0.103	0.16	2.00
50.0	100	50.001	49.9	-0.101	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 %.

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Certificate of Calibration

Cert.No.: 24CH1295
Page: 1 of 3

Equipment : pH Meter

Manufacturer : Hach

Model : HQ411d

Serial No. : 200100031163

ID No. : BKK_EN0342

Condition As-Received: Used Item

Received Date : 16 October 2024

Calibration Date : 17 October 2024

Reference : 2410-0548DSC-5

Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khwaeng Phatthanakan, Khet Suan Luang,
Bangkok 10250 Thailand

Ambient Temperature : (25 ± 2.5) °C

Relative Humidity : (50 ± 15) %

Calibration Procedure :

- CP-CH5 by direct measurement with
certified reference material (CRM)

- CP-CH8 by comparison with temperature standard

Calibrated by : Warekom Lemgagtrakul

Approved by :

() Unnopphol Harschai
() Ponpan Paipim
(✓) Sailip Meangmai

Issue Date : 21 October 2024

The Uncertainties are for a confidence probability of approximately 95%

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Cert.No.: 24CH1295
Page.: 2 of 3

Condition of this calibration result

1. Reference Standard Instrument

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1)Ref. Standard Thermometer	2188080	130RC044	2411022	16 Sep 2025

- This Certification is traceable to SI Through Technology Promotion Association (Thailand - Japan)

2. Certified Reference Materials :The measurement results are traceable to SI through Hach Lenge GmbH Ltd
Deutsche Akkreditierungsstelle, Accredited No D-RM-15184-01-00
:The measurement results are traceable to SI through CPA chem Ltd.
ANSI-ASQ National Accreditation Board, Accredited No AR-1835

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	1034203	27 Sep 2026
pH 6.999	Hach Lenge GmbH	C03145	28 Feb 2026
pH 10.010	CPA chem	1034205	27 Sep 2025

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

Calibration Results

Function : pH Measurement

Performing three buffers standard curve by using buffer nominal pH (4,7,10)

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH Measurement (±)	Coverage factor k
pH Electrode	4.008	4.028	174.6	0.0044	2.00
S/N.: 230473042902	6.999	7.014	1.4	0.0084	2.05
	10.010	10.016	-172.8	0.0066	2.00

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



Cert.No.: 24CH1295
Page.: 3 of 3

Calibration Results

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model :	PHC281
- Serial No. :	230473042902
Dimension of probe	
- Length :	103 mm.
- Diameter :	12 mm.
- Immersion Depth :	90 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement (± °C)	Coverage factor k
25.0	25.002	25.0	-0.002	0.13	2.00

Remark : UUC* = Unit Under Calibration

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

-000-



Job number : #5971

Test Report

Customers	ALS Laboratory Group (Thailand) Co., Ltd.		
Equipment	Colorimeter	Manufacturer	HACH
Controller Model	<input checked="" type="checkbox"/> DR300 <input type="checkbox"/> Pocket II	ID No	BKK_LG0070
Controller Serial No.	23020801804	Sensor Serial No.	*
Date of test	01/04/2025	Period	1 Year
Environment temperature	25.1 °C	Humidity	60.8 %RH

Results

Instrument Checked

Item	Characteristic	Before	After	Remark
1	Visual Inspect	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail	
2	Power Supply (4.5 - 6.0 VDC)	5.8 VDC	5.8 VDC	
3	Display Check	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail	
4	Keypad Check	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail	
5	Function System Program	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail	

Warning and Error Checked

Item	Event	Before	After
6	Error list	<input checked="" type="checkbox"/> None <input type="checkbox"/> Appear	<input checked="" type="checkbox"/> None <input type="checkbox"/> Appear

Check with Standard

Item	Characteristic	Before	After	Remark
7	Blank (0.0 mg/l)	0.00 mg/l	0.00 mg/l	
8	Standard C2 No. 1 (0.24 ± 0.09 mg/l)	0.26 mg/l	0.26 mg/l	
9	Standard C2 No. 2 (0.81 ± 0.1 mg/l)	0.83 mg/l	0.83 mg/l	
10	Standard C2 No. 3 (1.59 ± 0.14 mg/l)	1.61 mg/l	1.61 mg/l	
11	Blank (0.0 mg/l)	0.0 mg/l	0.0 mg/l	
12	Standard C2 No. 1 (0.23 ± 0.2 mg/l)	2.4 mg/l	2.4 mg/l	
13	Standard C2 No. 2 (3.9 ± 0.3 mg/l)	3.9 mg/l	3.9 mg/l	
14	Standard C2 No. 3 (7.1 ± 0.6 mg/l)	7.1 mg/l	7.1 mg/l	



Ref. Job number : #5971

Summary of checked

- ☒ The instrument can work normally and efficiently. (เครื่องมือสามารถทำงานได้ตามปกติและมีประสิทธิภาพ)
☐ The instrument can work but it's requiring to maintenance. (เครื่องมือสามารถทำงานได้แต่ต้องบำรุงรักษา)
☐ The instrument could not work it's requiring to repair. (เครื่องมือใช้ไม่ได้และต้องทำการซ่อมบำรุง)

Remark:

Standard Equipment Used

Equipment	Equipment ID
Standard Absorbance DPD CHLORINE-LR	Lot No. A4150 Exp date : Jun-28
Standard Absorbance DPD-CHLORINE HR	Lot No. A4162 Exp date : Jun-30
Digital multi meter	S/N: 97820660 Due date: 15-Jul-25
Thermo hygrometer	S/N: 41432443 Due date 28-Oct 25

Test By :



REVIEW BY: *Jinda K.*
SARTORIUS
APPROVED BY: *Sinluk P.*
NEXT CAL DATE: 02/08/25

Certificate of Calibration

Model Number: MSE224S-100-OU
Description: Analytical Balance
Serial Number: 0027405555
ID No.: BKK_EN0003
Manufacturer: Sartorius
Certificate No.: 24800270
Issued Date: Monday, August 05, 2024
Reference No.: 240942
Page No.: 1 of 2

Customer Name: ALS Laboratory Group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250.

Calibrated Place: Lab Room

Calibrated By: Mr Chonchai Intahana
Calibration Date: Friday, August 02, 2024
Calibration Procedure No.: This calibration was conducted by Using in-house calibration procedure number (WI-003) Based on UKAS LAB 14 : 2019

Metrological data :
Capacity: 220 g Readability: 0.0001 g
Reasons for calibration
☒ New Installation ☐ Service / Repair ☐ Re-calibration / Maintenance
Ambient Conditions:
Temperature: 23.0 °C ± 5.0 °C
Humidity: 55.0 % RH ± 10.0 % RH
Pressure: *
Equipment Condition: ☒ Good Operate ☐ Fail

Measurement Method UKAS Publication Ref: Lab 14

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

Traceability:

Model Number	Description	Traceability	Certificate No.	Due Date
YCS011-522-00	Sartorius weight set 1mg - 5000g YCS011-522-00	TCS	M23081975	23-Aug-2025
Testo 174 H	Thermo-Hygrometer, Testo 174H	ENTECH	U/T 661303.H661140	12-Nov-2024

This certificate relate and apply this equipment only.
This certificate may not be reproduced other than in full except with the prior written approval of the Verification Operation Division Sartorius (Thailand) Co., Ltd.

Mr Chonchai Intahana (Technical Manager)



SOP FM 33 03 February 2022

SARTORIUS

Certificate of Calibration

Model Number: MSE224S-100-OU
Description: Analytical Balance
Serial Number: 0027405555
ID No.: BKK_EN0003
Manufacturer: Sartorius
Certificate No.: 24800270
Issued Date: Monday, August 05, 2024
Reference No.: 240942
Page No.: 2 of 2

Calibration Results: Without Adjustment

Repeatability			Eccentricity (Off-center loading error)		
The repeatability is the ability of a weighing instrument to display nearly identical results under the same conditions when the same load within a maximum limit is placed repeatedly on the weighing pan in the same manner. The standard deviation is used to express repeatability.			The off-center loading error is verified by the difference between the results of the load, i.e. 1/2 or 1/4 of maximum capacity placed in the center of the weighing pan and between each of four additional measurement points (positions defined according to OIML R110).		
Nominal Value: (Low Load)	20.0000	200.0000	Nominal value:	100	g
20 g	20.0000	199.9999	Tolerance:	0.0004	g
0.0001 g	20.0001	200.0000	Difference		
	20.0000	200.0000	1	-	-
	20.0000	200.0000	2	0.0000	-
Nominal Value: (High Load)	20.0000	200.0000	3	0.0000	-
200 g	20.0001	200.0001	4	0.0000	-
0.0001 g	20.0000	200.0000	5	0.0001	-
	20.0000	199.9999	6	-	-
	20.0000	200.0000			
Standard Deviation	0.00004	0.00006			

Linearity

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

Tolerance 0.0002 g				
Nominal Value	Conventional Mass Value	Displayed Value	Deviation	Uncertainty
(g)	(g)	(g)	(g)	(g)
0.01	0.0100	0.0100	0.0000	0.00015
0.1	0.1000	0.1000	0.0000	0.00015
1	1.0000	1.0000	0.0000	0.00015
2	2.0000	2.0000	0.0000	0.00015
5	5.0000	5.0000	0.0000	0.00015
10	10.0000	10.0000	0.0000	0.00015
20	20.0000	20.0000	0.0000	0.00015
50	50.0000	50.0001	0.0001	0.00016
100	100.0000	100.0001	0.0001	0.00019
200	200.0000	200.0000	0.0000	0.00029
End of Report				

SOP FM 33 03 February 2022



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.: 24TM1618
Page: 1 of 3

Equipment: Water Bath
Manufacturer: Memmert
Model: WNE29
Serial No.: L622.0282
ID No.: BKK_EN0439
Submitted by: ALS Laboratory Group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khwaeng Phatthanakan, Khet Suan Luang,
Bangkok 10250 Thailand
Organic Preparation Lab
Location: Organic Preparation Lab
Received Order: 29 October 2024
Calibration Date: 29 October 2024
Ambient Temperature: (26 ± 1) °C
Relative Humidity: (50 ± 30) %
Calibrated by: Mr. [Redacted]
Approved by: [Redacted]
() Ponpen Paipim
() Suwit Imjai
(✓) Kunchit Promprat
Issue Date: 30 October 2024

REVIEW BY: *Jinda K.*
SARTORIUS
APPROVED BY: *Sinluk P.*
NEXT CAL DATE: 29/10/25



Equipment: Water Bath
Condition As-Received: Used Item
Reference: 2410-0782OC-4
Procedure Used: -

Cert. No.: 24TM1618
Page: 2 of 3

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY57013711	24LM115	TPA	13 Jul 2025

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

3. This certification is traceable to the International System of Unit.

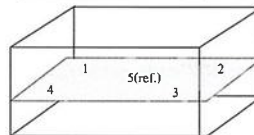
Remark: TPA: Technology Promotion Association (Thailand - Japan)

Result of Calibration: (*) Without Adjustment

Function of UUC*: Temperature Source

Heat transfer medium used: Water

	Environmental		AC Voltage Supply
	(°C)	(%R.H.)	(Volt)
Beginning of Calibration	25	54	222
Finished of Calibration	25	57	226



Front

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

The Uncertainties are for a confidence probability of approximately 95%

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Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2410-07820C-4
Result of Calibration : (*) Without Adjustment
Function of UUC* : Temperature Source

Cert. No.: 24TM1618
Page : 3 of 3

Calibration point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Average* Standard Reading (°C)					Uncertainty (± °C)
			Position					
			1	2	3	4	5 (ref.)	
85.0	85.0	85.0	85.133	85.212	85.150	84.983	85.096	0.22

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Coverage Factor k
85.0	0.21	0.13	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 %.

-o0o-



SCG

Metrology

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110, Thailand.

Saraburi Tel : +66 3627 3096 Fax : +66 3627 3100

Bangkok Tel : +668 9205 6851 , +669 8247 2360

Website : www.scieco.co.th E-Mail : calibrate@scg.com



Certificate No. T241770

Page 1 of 3

Certificate of Calibration

Equipment : Chamber (Oven)

Manufacturer : Memmert

Model : UF 110

Serial No. : B423.1549

Customer Code : BKK_EN0425

ID No. : T4671A5

Customer : ALS Laboratory Group (Thailand) Co.,Ltd.


104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanaka

Khet Suan Luang, Bangkok 10250

Customer Location : Oven Room

Date of Receipt : 22 October 2024

Calibrated By : Boonchai Suriyawong (Site Calibration Manager)

Approved By :  / Sujjar Naknakred (Site Calibration Manager)

Date of Issue : 11 NOV 2024

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

This Certificate is Issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrology.

FM-L14 11/9/18-08-66



SCG

Metrology

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110, Thailand.



Certificate No. T241770

Calibration Report

Page 2 of 3

Equipment : Chamber (Oven)
Date of Calibration : 29 October 2024
Environment : Temperature : 22.4-27.7 °C
Line Voltage : 221.7-225.9 V
Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

1. This equipment was calibrated by insert nine resistance thermometer detectors into its chamber , the other one resistance thermometer detector use for ambient temperature measurement . The calibration was done in according to WI-T20 (based on ASTM E145-94 (Reapproved 2001) and AS2853-1986).
All data show below were final values and the initial data from customer request , The temperature scale used was based on ITS - 90 .

2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
RTD	100 ohm	31-(CHI-10)	T240399	16 March 2025
DATA LOGGER	34970A	T193	T240399	16 March 2025

3. This certificate is traceable to :

National Institute of Metrology (Thailand) through Metrological Center (NSC-TISI-TIS 17025 CALIBRATION 0244)

4. Condition of calibrated item : good

Equipment Description :

Time Constant : 1 Hour 35 Minute At 104 °C
Fresh Air Damper ☐ Open ☒ Min ☐ Medium ☐ Max
☐ Close
☐ Not Available

5. Adjustment :

(X) without adjustment () after adjustment



SCG

Metrology

SCI ECO Services Company Limited

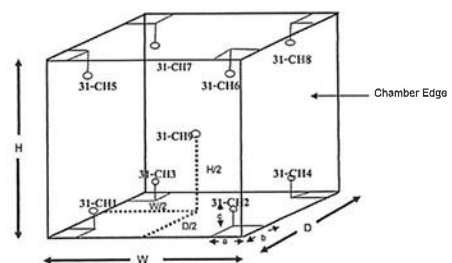
33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110, Thailand.



Certificate No. T241770

Page 3 of 3

Calibration Report



Remark :

Internal Dimensions of Chamber : W (Width) = 56 cm , H (Height) = 55 cm and D (Depth) = 41 cm.
Size of Installed Standard sensor number 31-CH8 : a = 5 cm, b = 5 cm and c = 5 cm.
Size of Installed Standard sensor number 31-CH9 : W/2 = 56 cm/2 , H/2 = 55 cm/2 and D/2 = 41 cm/2

Measurement Results

Calibration Point	Average Standard Reading at each position (°C)							
	31-CH1	31-CH2	31-CH3	31-CH4	31-CH5	31-CH6	31-CH7	31-CH8
104	104.19	104.20	103.83	104.26	104.02	104.34	103.76	104.42
180	180.29	180.40	179.84	180.15	179.27	180.23	180.36	180.68

Setting (°C)	Reading (°C)		Temperature Distribution				
	Min , Max	Average	Average (°C)	Stability (± °C)	Uniformity (°C)	Uncertainty (± °C)	Coverage Factor k
104.0	103.9 , 104	104.0	104.14	0.14	0.60	0.42	2.00
180.0	179.9 , 180	180.0	180.23	0.27	0.76	0.63	2.00

* The quoted uncertainty exclude "uniformity"

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on date and place of test only.

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

End of Certificate

FM-L15 11/8/18-08-66

FM-L15 11/8/18-08-66



Agilent Technologies (Thailand) Limited
U CHU LING BLDG 27/F UNIT A/D
908 Rama 4 Road, S10M, BANGKOK
Bangkok 10500 Thailand

Tel: +662 637 6363
Fax: +662 632 4334
Email: ccc-smt@agilent.com
Website: www.agilent.com/thai

Service Confirmation Number: 6905905441

Service Confirmation Date: 08.10.2024

Customer Contact:

ALS Laboratory Group (Thailand) Co
Ltd Head Office

104 Phatthanakan 40 Phatthanakan Rd
Khwaeng Phatthanakan Khet Suan
Luk (TAX ID : 0105540044659
chanatagarn.michom@aloglobal.com
227158760

Invoice To:

ALS Laboratory Group (Thailand) Co
Ltd Head Office

104 Phatthanakan 40 Phatthanakan Rd
Khwaeng Phatthanakan Khet Suan

Delivery Site:

ALS Laboratory Group (Thailand) Co
Ltd Head Office

104 Phatthanakan 40 Phatthanakan Rd
Khwaeng Phatthanakan Khet Suan

Location:
Room
Bldg
Lab
Dept

SERVICE REPORT

Customer Purchase
Order Number: 70371013

Service Request: Service Request Date:

Service Order: 6006676868
Service Confirmation: 6905905441

REVIEW BY: [Redacted]
APPROVED BY: [Redacted]
NEXT CAL DATE: 31/1/2026

Direct Inquiries to:

Contact Name: Customer Contact Center
Contact Email: ccc-smt@agilent.com
Contact Telephone: +662 637 6363
Contact Fax: +662 632 4334

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Tax ID : 0105540044659

Agilent Bank N/A, Bangkok Branch
359 Interchange 21 Building, Sukhumi Road, Kingkong Road
Sub-district, Wattana District, Bangkok 10110 Thailand
Acc. No: 012-4452-607
THB Krong Thai Bank PCL
Siam Square Bldg, 116/1-2 Rama 1 Rd, Pathumwan, BKK 10330
Thailand

Service Instrument:

Model Number	Model Description	Serial Number	System Handle	Parent Asset
SYS-IM-7900	ICPMS 7900 System			
G8410A	SPS 4 Autosampler	AU15420722	ICP MS 7900	SYS-IM-7900
G8411A	ISIS 3 for Agilent 7850/7900/6900	JP15510227	ICP MS 7900	SYS-IM-7900
G3292A	PSC 6105T Chiller	ZU15A1948	ICP MS 7900	SYS-IM-7900
G8403A	Agilent 7900 ICP-MS	JP15471169	ICP MS 7900	SYS-IM-7900

Service Items:

Item	Service/Part #	Description	Qty	Entitlement	Service Start	Service End
1000	EQO	Enterprise Operational Qualification	1.00	Agreement Entitlement 100 % covered	04.10.2024	04.10.2024
1010	5185-5850	ICP-MS Checkout Solutions	1.00	Agreement Entitlement 100 % covered		

Additional Information:

Service Confirmation Number: 6905905441

Service Confirmation Date: 08.10.2024

Service Information:

Problem Description:
*WU-EQO-IM-7900-6001253655

Service Provided:

Perform OQ Hardware. Test CDS logon, auto sampler, Auto tune, BG and 20 Min stability.
I calibrate the instrument No BKK_EL0043 test all pass.

Service Overview Code:

Reason Code: Scheduled Service
Diagnosis Code: Scheduled Service
Resolution Code: Scheduled Service

Reported Hours:
7.0

Travel Hours:
2.0

Customer Field Service
Representative Name:
Pantep Kurasathai

Date:
08 Oct 2024

Customer Name:
Supakwan Mak

Date:
08 Oct 2024

Additional Comments:



Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhloi, Saraburi 18110

Telephone : +66 2 586 5792-4 Fax : +66 2 586 5109

Website : www.scieco.co.th E-Mail : calibrate@scg.co.th

Certificate No. T250355

Page 1 of 6

Certificate of Calibration

Equipment : HEATING BLOCK

Manufacturer : Environmental Express

Model : SC 196

Serial No. : 6974CECW3285

Customer Code : BKK_EL0054

ID No. : TS306A3

Customer : ALS Laboratory Group (Thailand) Co.,Ltd.

104 Phatthanakan 40, Phatthanakan Rd.,

Khwaeng Phatthanakan, Khet Suan Luang, Bangkok 10250

Customer Location : Acid Digestion Lab

Date of Receipt : 26 February 2025

Calibrated By : Atiphong Rongrat (Technician)

Approved By : [Redacted] Boonchai Suriyawong (Site Calibration Manager)

Date of Issue : 17 MAR 2025

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

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrological Center.



Metrological Center

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Telephone : +66 2 586 5792-4 Fax : +66 2 586 5109

Website : www.scieco.co.th E-Mail : calibrate@scg.co.th

Certificate No. T250355

Page 2 of 6

Calibration Report

Equipment : HEATING BLOCK
Date of Calibration : 4 March 2025
Environment : Temperature : 24.4-24.9 °C
Line Voltage : 221.6-226.3 V
Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

1. This equipment was calibrated by insert nine standard thermocouples type T into its chamber , the other one standard thermocouples type T use for ambient temperature measurement . The calibration was done in according to WI-T20.

All data show below were final values and the initial data from customer request . The temperature scale used was based on ITS - 90 .

2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	TYPE T	TN221-TN230	T240712	19 April 2025
TC	TYPE T	TN231-TN240	T240712	19 April 2025
TC	TYPE T	TN241-TN250	T240401	16 March 2025
TC	TYPE T	TN251-TN260	T240401	16 March 2025
DATA LOGGER	34970A	T193	T240401	16 March 2025

3. This certificate is traceable to :

National Institute of Metrology (Thailand) through Metrological Center (NSC-TISI-TIS 17025 CALIBRATION 0244.)

4. Condition of calibrated item : good

Equipment Description :

Time Constant 2 Hour 40 Minute At 95 °C
Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max
☐ Close
☒ Not Available

5. Adjustment :

() without adjustment (X) after adjustment

Approved By. [Signature]

FM-L13 108/30-05-57



Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110

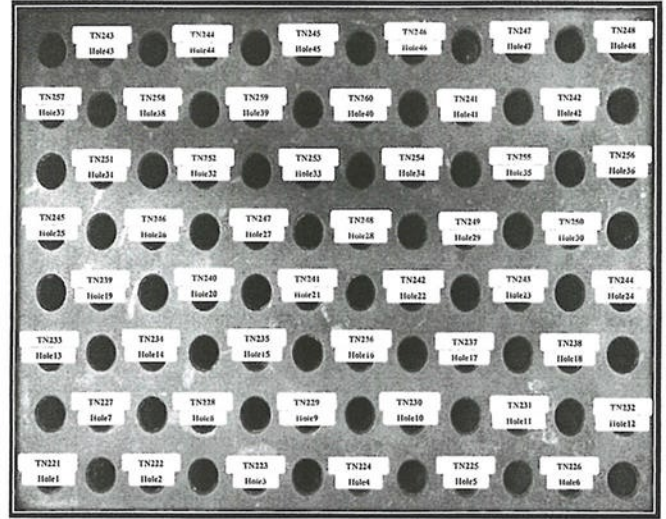
Telephone : +66 2 586 5792-4 Fax : +66 2 586 5109

Website : www.scieco.co.th E-Mail : calibrate@scg.co.th

Certificate No. T250355

Page 3 of 6

Calibration Report



FRONT CONTROL

Approved By. [Signature]

FM-L13 108/30-05-57



Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110

Telephone : +66 2 586 5792-4 Fax : +66 2 586 5109

Website : www.scieco.co.th E-Mail : calibrate@scg.co.th

Certificate No. T250355

Page 4 of 6

Calibration Report

Measurement Results

Calibration Point	Average Standard Reading at each position (°C)					
R1 Hole1-Hole6	TN221	TN222	TN223	TN224	TN225	TN226
CAL POINT	Max	94.85	95.37	95.03	95.25	95.52
95	Min	94.17	94.66	94.38	94.63	94.87
Average	94.51	95.02	94.70	94.94	95.20	94.43
R2 Hole7-Hole12	TN227	TN228	TN229	TN230	TN231	TN232
Max	94.71	94.56	94.79	95.32	95.44	95.06
Min	94.05	93.88	94.10	94.65	94.90	94.65
Average	94.38	94.22	94.44	94.99	95.17	94.85
R3 Hole13-Hole18	TN233	TN234	TN235	TN236	TN237	TN238
Max	95.26	95.43	95.40	95.71	95.41	95.06
Min	94.54	94.64	94.71	95.10	94.86	94.42
Average	94.90	95.03	95.06	95.41	95.13	94.74
R4 Hole19-Hole24	TN239	TN240	TN241	TN242	TN243	TN244
Max	95.13	95.06	95.68	96.16	95.35	95.80
Min	94.39	94.43	94.86	95.51	94.85	95.12
Average	94.76	94.75	95.27	95.83	95.12	95.46
R5 Hole25-Hole30	TN245	TN246	TN247	TN248	TN249	TN250
Max	94.95	95.81	95.39	95.82	95.66	95.66
Min	94.47	95.03	94.67	94.99	94.84	94.87
Average	94.71	95.42	95.03	95.41	95.25	95.27
R6 Hole31-Hole36	TN251	TN252	TN253	TN254	TN255	TN256
Max	96.07	95.34	96.28	95.39	94.95	95.12
Min	95.28	94.55	95.51	94.62	94.13	94.35
Average	95.67	94.95	95.90	95.00	94.54	94.73
R7 Hole37-Hole42	TN257	TN258	TN259	TN260	TN261	TN262
Max	95.15	95.63	96.11	95.09	95.34	95.51
Min	94.38	94.88	95.32	94.28	94.54	94.72
Average	94.76	95.25	95.71	94.69	94.94	95.11
R8 Hole43-Hole48	TN243	TN244	TN245	TN246	TN247	TN248
Max	95.84	95.87	95.44	95.72	95.65	95.75
Min	95.06	95.10	94.60	94.95	94.87	94.98
Average	95.45	95.48	95.02	95.34	95.26	95.36

Approved By. [Signature]

FM-L13 108/30-05-57



Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110

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Website : www.scieco.co.th E-Mail : calibrate@scg.co.th

Certificate No. T250355

Page 5 of 6

Calibration Report

Measurement Results

Calibration Point	Average Standard Reading at each position (°C)					
R1 Hole1-Hole6	TN221	TN222	TN223	TN224	TN225	TN226
CAL POINT	Max	104.48	104.40	104.60	105.27	105.24
105	Min	104.15	104.02	104.25	104.94	104.91
Average	104.32	104.21	104.42	105.10	105.08	105.06
R2 Hole7-Hole12	TN227	TN228	TN229	TN230	TN231	TN232
Max	105.20	105.45	105.58	105.96	105.81	106.03
Min	104.92	105.14	105.29	105.64	105.53	105.79
Average	105.06	105.29	105.43	105.80	105.67	105.91
R3 Hole13-Hole18	TN233	TN234	TN235	TN236	TN237	TN238
Max	106.09	106.14	105.83	106.25	105.97	105.88
Min	105.80	105.89	105.57	106.00	105.69	105.65
Average	105.94	106.01	105.70	106.13	105.83	105.77
R4 Hole19-Hole24	TN239	TN240	TN241	TN242	TN243	TN244
Max	105.87	105.75	105.30	105.07	105.22	105.66
Min	105.62	105.52	105.13	104.90	105.05	105.49
Average	105.74	105.63	105.21	104.98	105.14	105.57
R5 Hole25-Hole30	TN245	TN246	TN247	TN248	TN249	TN250
Max	105.62	105.54	105.52	105.75	105.97	105.69
Min	105.45	105.35	105.31	105.57	105.81	105.49
Average	105.53	105.44	105.41	105.66	105.89	105.59
R6 Hole31-Hole36	TN251	TN252	TN253	TN254	TN255	TN256
Max	106.19	106.34	106.47	105.96	105.76	105.35
Min	106.02	106.16	106.31	105.77	105.58	105.18
Average	106.10	106.25	106.39	105.87	105.67	105.27
R7 Hole37-Hole42	TN257	TN258	TN259	TN260	TN261	TN262
Max	106.21	105.59	105.45	105.36	106.08	105.09
Min	106.04	105.42	105.28	105.20	105.90	105.92
Average	106.12	105.51	105.37	105.28	105.99	105.00
R8 Hole43-Hole48	TN243	TN244	TN245	TN246	TN247	TN248
Max	106.54	106.33	105.78	105.38	105.42	105.69
Min	106.38	106.16	105.60	105.20	105.25	105.52
Average	106.46	106.25	105.69	105.29	105.33	105.61

Approved By. [Signature]

FM-L13 108/30-05-57



Metrological Center

SCI ECO Services Company Limited

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Certificate No. T250355

Page 6 of 6

Calibration Report

Measurement Results:

Setting (°C)	HEATING BLOCK		Temperature Distribution	
	Reading (°C)		Stability (±°C)	Uncertainty (±°C)
	Min	Max		
102.0	-	102.0	0.43	0.83
107.0	-	107.0	0.20	0.70

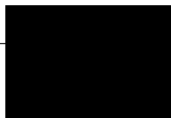
* The quoted uncertainty exclude " uniformity "

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on date and place of test only.

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

Approved By:



FM-L13 108/30-05-57



Metrology

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Bangkok Tel : +668 9205 6851, +669 8247 2360

Website : www.scieco.co.th E-Mail : calibrate@scg.co.th



Certificate No. T232160

Page 1 of 4

Certificate of Calibration

Equipment : Chamber (Cooling Room)

Manufacturer : KOLDTECH

Model : KM 320

Serial No. : TBN-1012061/05

Customer Code : BKK_EN0167

ID No. : T2463A3

Customer : ALS Laboratory Group (Thailand) Co.,Ltd.

104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,

Khet Suan Luang, Bangkok 10250

Customer Location : Laboratory

Date of Receipt : 29 November 2023

Calibrated By : Atiphong Rongrat (Technician)

Approved By : [Signature] / Boonchai Suriyawong (Site Calibration Manager)

Date of Issue

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

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrology.

FM-L14 119/18-08-66



Metrology

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoh, Saraburi 18110, Thailand.



Certificate No. T232160

Page 2 of 4

Calibration Report

Equipment : Chamber (Cooling Room)

Date of Calibration : 6 December 2023

Environment : Temperature : 23.4-24.9 °C

Line Voltage : 221.4-230.2 V

Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

1. This equipment was calibrated by insert 16 standard thermocouples type T into its chamber , the other one standard thermocouples type T use for ambient temperature measurement . The calibration was done in according to WI-T20 (based on ASTM E145-94 (Reapproved 2001) and AS2853-1986).

All data show below were final values and the initial data from customer request . The temperature scale used was based on ITS - 90 .

2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	TYPE T	TN161-TN170	T230773	10 April 2024
TC	TYPE T	TN171-TN180	T230773	10 April 2024
DATA LOGGER	34970A	T149	T230773	10 April 2024

3. This certificate is traceable to :

National Institute of Metrology (Thailand) through Metrological Center (NSC-TIS-TIS 17025 CALIBRATION 0244.)

4. Condition of calibrated item : good

Equipment Description :

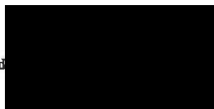
Time Constant 1 Hour 30 Minute At 3 °C
Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max
☐ Close
☒ Not Available

5. Adjustment :

(X) without adjustment

() after adjustment

Approved



FM-L15 118/18-08-66



Metrology

SCI ECO Services Company Limited

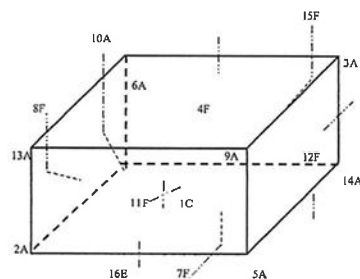
33/2 Moo 3, T.Banpa, A.Kaengkhoh, Saraburi 18110, Thailand.



Certificate No. T232160

Page 3 of 4

Calibration Report



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

1C = TN161	12F = TN172
2A = TN162	13A = TN173
3A = TN163	14A = TN174
4F = TN164	15F = TN175
5A = TN165	16E = TN176
6A = TN166	
7F = TN167	
8F = TN168	
9A = TN169	
10A = TN170	
11F = TN171	

Approved By:



FM-L15 118/18-08-66



Metrology

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoh, Saraburi 18110, Thailand.



NSC-TIS-118 17025
CALIBRATION 0244

Certificate No. T232160

Page 4 of 4

Calibration Report

Measurement Results

Calibration Point	Average Standard Reading at each position (°C)											
	TN161	TN162	TN163	TN164	TN165	TN166	TN167	TN168	TN169	TN170	TN171	TN172
3.0	2.83	3.34	2.95	3.46	3.45	3.76	3.25	3.46	3.39	3.50	3.58	3.42
	TN173	TN174	TN175	TN176								
	3.33	3.39	3.15	3.43								

Chamber (Cooling Room)			Temperature Distribution				
Setting (°C)	Reading (°C)		Average (°C)	Stability (± °C)	Uniformity (°C)	Uncertainty (± °C)	Coverage Factor k
	Min , Max	Average					
3.0	2.8 , 4.1	3.5	3.36	1.10	2.00	1.90	2.09

The calibration result apply only the above calibrated item.
The result of test was found accurate as shown on date and place of test only.
The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k which for a t-distribution, providing a level of confidence of approximately 95%.

Approved By: [Signature]

FM-L15 118/18-08-66



Metrology Center

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NSC-TIS-118 17025
CALIBRATION 0244

Certificate No. T250873

Page 1 of 4

Certificate of Calibration

Equipment : Chamber (Cooling Room)
Manufacturer : KOLDTECH
Model : KM 320
Serial No. : TBN-1012061/05
Customer Code : BKK_EN0167
ID No. : T2463A3
Customer : ALS Laboratory Group (Thailand) Co.,Ltd.
104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,
Khet Suan Luang, Bangkok 10250
Customer Location : Laboratory Room
Date of Receipt : 28 May 2025
Calibrated By : Atiphong Rongrat (Technician)
Approved By : [Signature] Boonchai Suriyawong (Site Calibration Manager)
Date of Issue : [Signature]

REVIEW BY: [Signature]
APPROVED BY: [Signature]
NEXT CAL DATE: 04/12/26

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

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrological Center.

FM-TL06 102/27-03-68



Metrology Center

SCI ECO Services Company Limited

51 Moo B, Tubkwang, Kaeng Khoi, Saraburi, Thailand 18260



NSC-TIS-118 17025
CALIBRATION 0244

Certificate No. T250873

Page 2 of 4

Calibration Report

Equipment : Chamber (Cooling Room)
Date of Calibration : 4 June 2025
Environment : Temperature : 23.4-24.9 °C
Line Voltage : 221.4-230.2 V
Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

1. This equipment was calibrated by insert 16 standard thermocouples type T into its chamber, the other one standard thermocouples type T use for ambient temperature measurement. The calibration was done in according to WI-T20 (based on ASTM E145-94 (Reapproved 2001) and AS2853-1986).
All data show below were final values and the initial data from customer request. The temperature scale used was based on ITS - 90.

2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	TYPE T	TN91-TN100	T242036	3 December 2025
TC	TYPE T	TN101-TN110	T242036	3 December 2025
DATA LOGGER	34970A	T121	T242036	3 December 2025

3. This certificate is traceable to :

National Institute of Metrology (Thailand) through Metrological Center (NSC-TIS-118 17025 CALIBRATION 0244).

4. Condition of calibrated item : good

Equipment Description :

Time Constant : 2 Hour 20 Minute At 3 °C
Fresh Air Damper : ☐ Open ☐ Min ☐ Medium ☐ Max
☐ Close
☒ Not Available

5. Adjustment :

(X) without adjustment () after adjustment

Approved By: [Signature]

FM-TL07 102/27-03-68



Metrology Center

SCI ECO Services Company Limited

51 Moo 8, Tubkwang, Kaeng Khoi, Saraburi, Thailand 18260

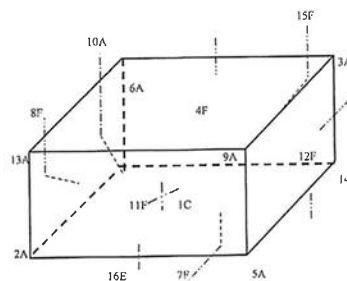


NSC-TIS-118 17025
CALIBRATION 0244

Certificate No. T250873

Page 3 of 4

Calibration Report



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

1C = TN91	12F = TN102
2A = TN92	13A = TN103
3A = TN93	14A = TN104
4F = TN94	15F = TN105
5A = TN95	16E = TN106
6A = TN96	
7F = TN97	
8F = TN98	
9A = TN99	
10A = TN100	
11F = TN101	

Approved By: [Signature]

FM-TL07 102/27-03-68

Calibration Report

Measurement Results

Average Standard Reading at each position (°C)												
Calibration Point	TN91	TN92	TN93	TN94	TN95	TN96	TN97	TN98	TN99	TN100	TN101	TN102
3.0	2.95	2.92	3.09	2.92	3.16	3.50	3.40	3.03	3.14	2.98	3.44	3.13
	TN103	TN104	TN105	TN106								
	3.19	3.06	3.46	2.92								

Chamber (Cooling Room)			Temperature Distribution				
Setting (°C)	Reading (°C)		Average (°C)	Stability (± °C)	Uniformity (°C)	Uncertainty (± °C)	Coverage Factor <i>k</i>
	Min , Max	Average					
3.0	2.8 , 3.9	3.4	3.14	1.20	1.30	1.90	2.04

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on date and place of test only.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor *k* which for *n* (t-distribution), providing a level of confidence of approximately 95 %.

Approved By: _____

