

ภาคผนวก จ

ใบรับรองการสอบเทียบเครื่องมือ

รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

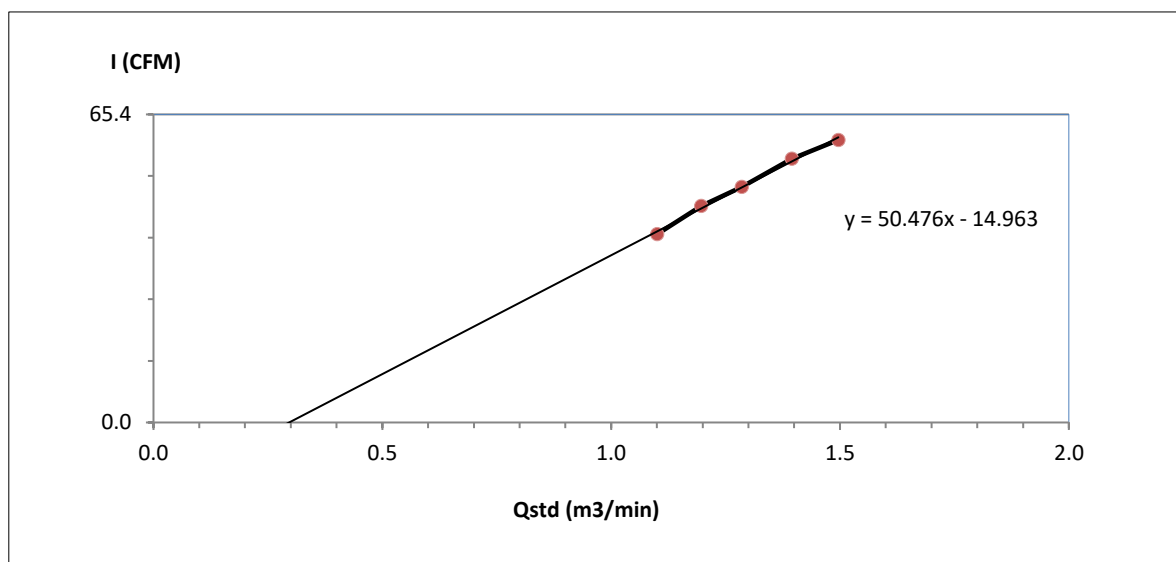
Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Ambient	Total Suspended Particulate	High Volume	BKK_FS1059	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	BKK_FS0369	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	BKK_FS0365	-	-	On site Calibration
Ambient	Total Suspended Particulate	Digital Balance	BKK_EN0004	25-Feb-22	25-Feb-23	12
Ambient	Particulate Matter (PM-10)	High Volume	BKK_FS0383	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	High Volume	BKK_FS0381	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	High Volume	BKK_FS0389	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	Digital Balance	BKK_EN0004	25-Feb-22	25-Feb-23	12
Ambient	Nitrogen Dioxide	NO ₂ Analyzer	BKK_FS0789	1-Jul-22	1-Jan-23	6
Ambient	Nitrogen Dioxide	NO ₂ Analyzer	BKK_FS0785	1-Jul-22	1-Jan-23	6
Ambient	Nitrogen Dioxide	NO ₂ Analyzer	BKK_FS0782	1-Jul-22	1-Jan-23	6
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	BKK_FS0165	3-May-22	1-Nov-23	18
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	BKK_FS0888	30-May-22	28-Nov-23	18
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	BKK_FS0887	30-May-22	28-Nov-23	18
Stack	Oxides of Nitrogen	Console Control Unit	BKK_FS0507	3-Jul-22	3-Jan-23	6
Stack	Oxides of Nitrogen	Console Control Unit	BKK_FS0536	3-Jul-22	3-Jan-23	6
Stack	Oxides of Nitrogen	Vacuum Gauge	BKK_FS0422	9-May-22	7-Nov-23	18
Stack	Oxides of Nitrogen	Spectrophotometer	BKK_EN0018	16-Sep-22	16-Sep-23	12
Stack	Total Suspended Particulate	Console Control Unit	BKK_FS0507	3-Jul-22	3-Jan-23	6
Stack	Total Suspended Particulate	Console Control Unit	BKK_FS0536	3-Jul-22	3-Jan-23	6
Stack	Total Suspended Particulate	Digital Balance	BKK_EN0002	25-Feb-22	25-Feb-23	12
Workplace	Total Dust	Field Rotameter	BKK_FS1202	1-Jul-22	1-Oct-22	3
Workplace	Total Dust	Digital Balance	BKK_EN0004	25-Feb-22	25-Feb-23	12
Workplace	Respirable Dust	Field Rotameter	BKK_FS1202	1-Jul-22	1-Oct-22	3
Workplace	Respirable Dust	Digital Balance	BKK_EN0004	25-Feb-22	25-Feb-23	12
Noise	Leq 8 hrs	Sound Calibrator	BKK_FS0617	9-Sep-22	9-Sep-23	12
Noise	Leq 8 hrs	Sound Level Meter	BKK_FS0115	14-Dec-21	14-Dec-22	12
Noise	Leq 8 hrs	Sound Level Meter	BKK_FS0922	12-Jan-22	12-Jan-23	12
Noise	Leq 8 hrs	Sound Level Meter	BKK_FS0930	12-Jan-22	12-Jan-23	12
Noise	Leq 8 hrs	Sound Level Meter	BKK_FS0994	7-Sep-22	7-Sep-23	12
Noise	Leq 8 hrs	Sound Level Meter	BKK_FS0996	15-Aug-22	15-Aug-23	12
Noise	Leq 8 hrs	Sound Level Meter	BKK_FS0997	12-Jan-22	12-Jan-23	12
Noise	Leq 24 hrs	Sound Calibrator	BKK_FS0618	18-Oct-21	18-Oct-22	12
Noise	Leq 24 hrs	Sound Level Meter	BKK_FS0025	9-Jun-22	9-Jun-23	12
Noise	Leq 24 hrs	Sound Level Meter	BKK_FS0097	9-Nov-21	9-Nov-22	12
Noise	Leq 24 hrs	Sound Level Meter	BKK_FS0098	15-Aug-22	15-Aug-23	12
Noise	Leq 24 hrs	Sound Level Meter	BKK_FS0103	9-Nov-21	9-Nov-22	12
Noise	Leq 24 hrs	Sound Level Meter	BKK_FS0116	14-Dec-21	14-Dec-22	12
Noise	Leq 24 hrs	Sound Level Meter	BKK_FS0880	25-Oct-21	25-Oct-22	12
Noise	Leq 24 hrs	Sound Calibrator	BKK_FS0618	18-Oct-21	18-Oct-22	12
Noise	Leq 24 hrs	Sound Level Meter	BKK_FS0033	25-Oct-21	25-Oct-22	12
Heat	Heat Stress	Heat Stress Monitor	BKK_FS0640	26-May-22	26-May-23	12
Heat	Heat Stress	Heat Stress Monitor	BKK_FS0641	26-May-22	26-May-23	12
Heat	Heat Stress	Heat Stress Monitor	BKK_FS0642	14-Feb-22	14-Feb-23	12
Heat	Heat Stress	Heat Stress Monitor	BKK_FS0644	31-May-22	31-May-23	12



High Volume Air Sampler Calibration Worksheet

Project Site :	Kosei Aluminum (Thailand) Co.,Ltd	Barometric Pressure (mm Hg) :	757
Calibrate Location :	วัดโคกมะยม	Temperature (°C) :	31
Calibrate Date :	23-Sep-22	High Volume ID :	BKK_FS1059
CalibrationSheet No.:	C-230922-BKK_FS1059	High Volume Model :	TE-5009X
Calibrator ID:	BKK_FS0624	High Volume S/N :	5693
Calibrator Model :	TE-5028A	Calibrator Slope :	1.64942
Calibrator S/N :	2584	Calibrator Intercept :	-0.02902

Test No.	Delta H ₂ O (inch)	Q _{std} (m ³ /min)	I : Chart (CFM)	Linear Regression
1	3.2	1.1007	40	Slope : 50.4760 Intercept : -14.9633 Correlation Coefficient : 0.9974
2	3.8	1.1968	46	
3	4.4	1.2856	50	
4	5.2	1.3951	56	
5	6.0	1.4964	60	



Calibrated by Vornich P.

(Mr.Prommee Sripatnet)
Field Scientist(3)

Approved by : [Signature]

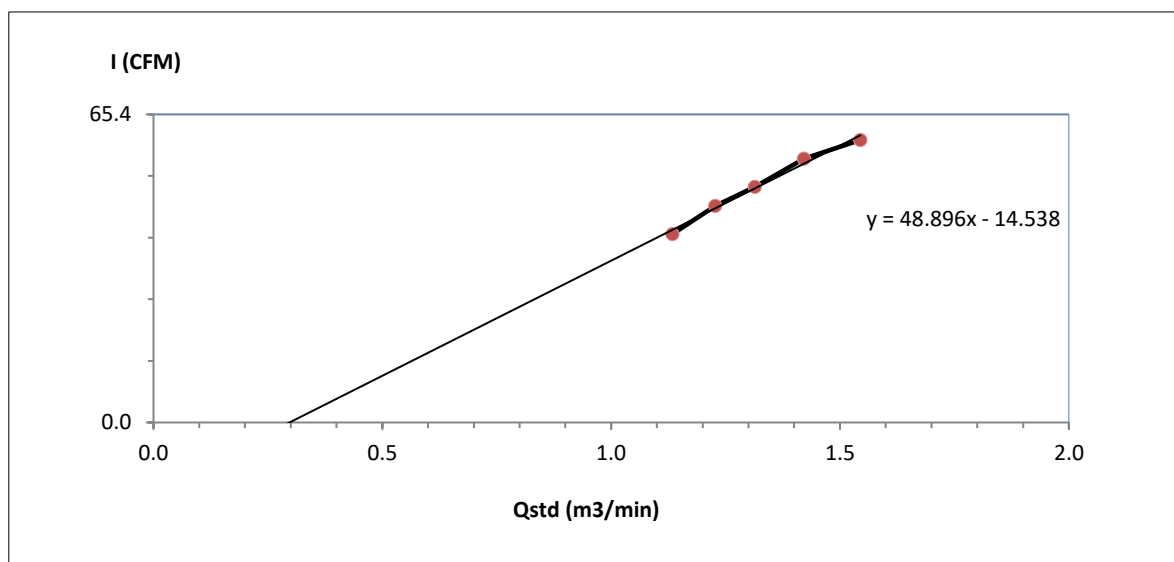
(Mr. Noppong Juntarupan)
Enviro Field Coordinator Scientist (3)



High Volume Air Sampler Calibration Worksheet

Project Site :	Kosei Aluminum (Thailand) Co.,Ltd	Barometric Pressure (mm Hg) :	757
Calibrate Location :	วัดคานหาม	Temperature (°C) :	31
Calibrate Date :	23-Sep-22	High Volume ID :	BKK_FS0369
CalibrationSheet No.:	C-230922-BKK_FS0369	High Volume Model :	TE-5009X
Calibrator ID:	BKK_FS0624	High Volume S/N :	4166
Calibrator Model :	TE-5028A	Calibrator Slope :	1.64942
Calibrator S/N :	2584	Calibrator Intercept :	-0.02902

Test No.	Delta H ₂ O (inch)	Q _{std} (m ³ /min)	I : Chart (CFM)	Linear Regression
1	3.4	1.1337	40	Slope : 48.8960 Intercept : -14.5377 Correlation Coefficient : 0.9935
2	4.0	1.2272	46	
3	4.6	1.3139	50	
4	5.4	1.4211	56	
5	6.4	1.5446	60	



Calibrated by Vornich P.
 (Mr.Prommee Sripatnet)
 Field Scientist(3)

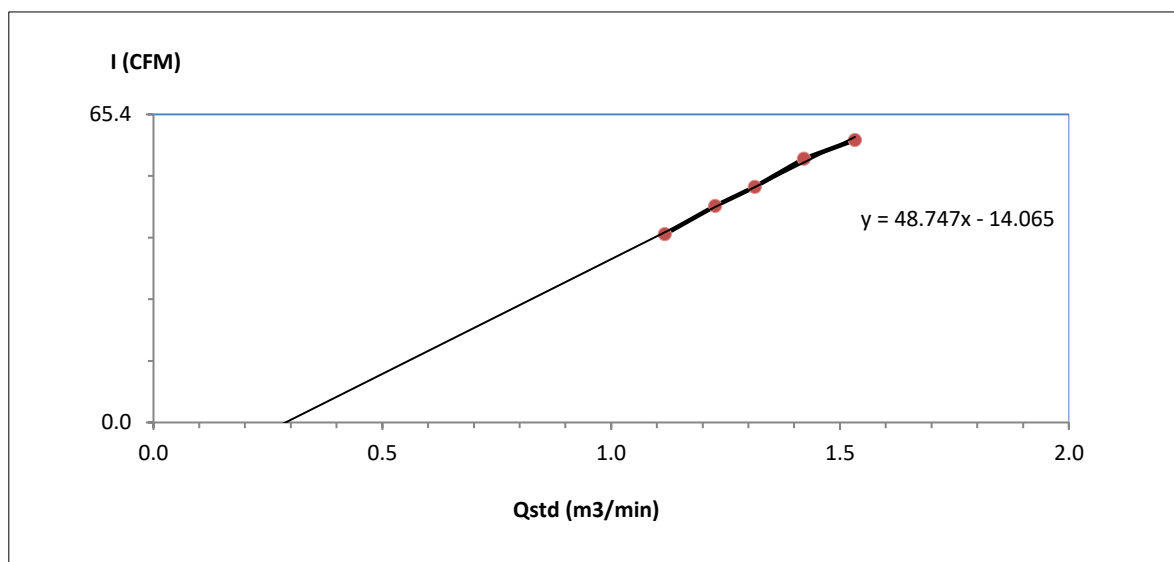
Approved by : Noppong Juntarupan
 (Mr. Noppong Juntarupan)
 Enviro Field Coordinator Scientist (3)



High Volume Air Sampler Calibration Worksheet

Project Site :	Kosei Aluminum (Thailand) Co.,Ltd	Barometric Pressure (mm Hg) :	757
Calibrate Location :	บ้านคานหมาม	Temperature (°C) :	31
Calibrate Date :	23-Sep-22	High Volume ID :	BKK_FS0365
CalibrationSheet No.:	C-230922-BKK_FS0365	High Volume Model :	TE-5009X
Calibrator ID:	BKK_FS0624	High Volume S/N :	4164
Calibrator Model :	TE-5028A	Calibrator Slope :	1.64942
Calibrator S/N :	2584	Calibrator Intercept :	-0.02902

Test No.	Delta H ₂ O (inch)	Q _{std} (m ³ /min)	I : Chart (CFM)	Linear Regression
1	3.3	1.1173	40	Slope : 48.7474 Intercept : -14.0649 Correlation Coefficient : 0.9975
2	4.0	1.2272	46	
3	4.6	1.3139	50	
4	5.4	1.4211	56	
5	6.3	1.5327	60	



Calibrated by _____

(Mr.Prommee Sripatnet)
Field Scientist(3)

Approved by : _____

(Mr. Noppong Juntarupan)
Enviro Field Coordinator Scientist (3)



Certificate of Calibration

Represent to Certificate of Calibration ,PTC/07/22072

Certificate No.:	PTC/07/22072	Page:	1 of 3
Equipment:	Digital Balance	Condition:	Normal
Manufacturer:	METTLER TOLEDO	Serial No:	1123091884
Model:	XP105	ID No:	BKK_EN0004
Type of Balance:	Multi interval		



Customer: ALS Laboratory Group (Thailand) Co.,Ltd.
104 Phatthanakarn 40 Phatthanakarn Rd.,
khwaeng Phatthanakarn, Khet Suan Luang, Bangkok 10250.

Environment Condition: Temperature 21.0 °C ± 0.4 °C
Humidity 62.8 %RH ± 3.7 %RH
Air density 1.20 kg/m³

Calibration Place: ALS Laboratory Group (Thailand) Co.,Ltd.
104 Phatthanakarn 40 Phatthanakarn Rd.,
khwaeng Phatthanakarn, Khet Suan Luang, Bangkok 10250.



The Method used: In house method, PTC-WI-07, base on Euramet cg. 18

Traceability: This certificate is traceable to the SI Units through Thai Calibration Service Co.,Ltd.
, NSC-ONSC Accreditation No.: Calibration 0189

Date Received: February 25, 2022

Calibration Date: February 25, 2022

Issued Date: March 01, 2022

Calibration By: Mr. Rungroj Metakul



PENTA CALIBRATION CO., LTD.

Kriangsak Kalasri

(Mr.Kriangsak Kalasri)
Reviewed by

Approved By :

Keattisak Kerdto

(Mr. Keattisak Kerdto)
Laboratory Manager

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognised national standard laboratories.

The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor ($k=2$) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM). The effect that the results relate only to the items calibrated.

This calibration certificate shall not be reproduced except in full only, without written approval from penta calibration co., ltd



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Certificate No.: PTC/07/22072

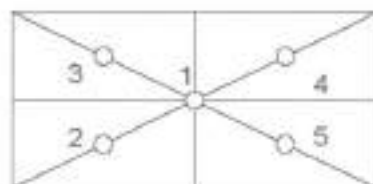
Page: 2 of 3

Measurement Results:

Without Adjustment :

Function Calibration: Non Adjustment

Eccentric Error: Weight to be $1/3, 1/2$ or of Maximum capacity



Eccentricity test 30 (g)

Position (g)				
1	2	3	4	5
0.0000	0.0000	0.0000	0.0000	0.0000
Maximum deviation:			0.0000	

Repeatability Test : Weight to be $1/2 \leq L_r \leq$ Maximum capacity

Determination of the standard deviation of weighing balance.. Readability 0.0001 (g)

Nominal test value (g)	Standard Deviation
100	0.00005

Error of indication : from nominal value., Readability 0.0001 (g)

Nominal Value (g)	Conventional Mass (g)	Indication (g)	Correction of Balance (g)	Uncertainty (g)	k
40	40.00005	40.0000	0.0000	0.00016	2.11
50	50.00001	50.0000	0.0000	0.00015	2.13
60	60.00003	60.0000	0.0000	0.00016	2.08
70	70.00003	70.0000	0.0000	0.00017	2.07
80	80.00005	80.0001	-0.0001	0.00019	2.04
90	90.00006	90.0001	0.0000	0.00020	2.03
100	100.00002	99.9999	0.0001	0.00018	2.06

Note: Weight of adjust - (g)



Represent to Certificate of Calibration ,PTC/07/22072

Certificate No.: PTC/07/22072

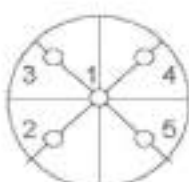
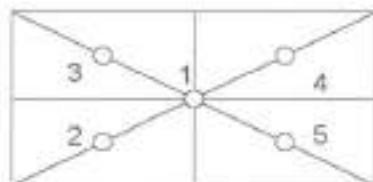
Page: 3 of 3

Measurement Results:

Without Adjustment :

Function Calibration: Non Adjustment

Eccentric Error: Weight to be 1/3 ,1/2 or of Maximum capacity



Eccentricity test 30 (g)

Position (g)				
1	2	3	4	5
0.00000	-0.00001	-0.00002	0.00000	0.00000
Maximum deviation:			0.00002	

Repeatability Test : Weight to be $1/2 \leq L_r \leq$ Maximum capacity

Determination of the standard deviation of weighing balance., Readability 0.00001 (g)

Nominal test value (g)	Standard Deviation
20	0.000005

Error of indication : from nominal value., Readability 0.00001 (g)

Nominal Value (g)	Conventional Mass (g)	Indication (g)	Correction of Balance (g)	Uncertainty (g)	k
0	0.000000	0.00000	0.00000	0.000016	2.52
0.1	0.100000	0.10000	0.00000	0.000019	2.00
0.5	0.499999	0.50000	0.00000	0.000019	2.00
2	2.000010	1.99999	0.00002	0.000024	2.00
5	5.000006	5.00001	0.00000	0.000027	2.00
10	10.000015	10.00001	0.00000	0.000031	2.00
20	20.000019	20.00001	0.00001	0.000042	2.00
30	30.000034	30.00006	-0.00003	0.000069	2.00

Note: Weight of adjust - (g)

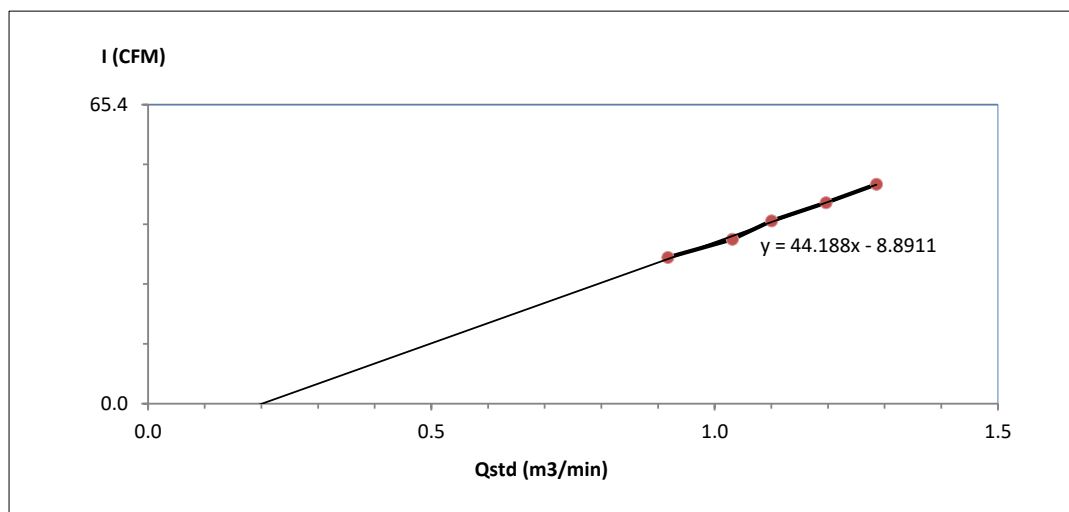
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High Volume Air Sampler Calibration Worksheet

Project Site :	Kosei Aluminum (Thailand) Co.,Ltd	Barometric Pressure (mm Hg) :	757
Calibrate Location :	วัดโคกมะยม	Temperature (°C) :	31
Calibrate Date :	23-Sep-22	High Volume ID :	BKK_FS0383
Calibration Sheet No.:	C-230922-BKK_FS0383	High Volume Model :	TE-5009X
Calibrator ID:	BKK_FS0624	High Volume S/N :	4787
Calibrator Model :	TE-5028A	Calibrator Slope :	1.64942
Calibrator S/N :	2584	Calibrator Intercept :	-0.02902

Test No.	Delta H ₂ O (inch)	Q _{std} (m ³ /min)	I : Chart (CFM)	Linear Regression
1	2.2	0.9176	32	Slope : 44.1879 Intercept : -8.8911 Correlation Coefficient : 0.9979
2	2.8	1.0315	36	
3	3.2	1.1007	40	
4	3.8	1.1968	44	
5	4.4	1.2856	48	



Calibrated by Vannich P.

(Mr. Prommee Sripatnet)
Field Scientist(3)

Approved by : N. Pongjuntarup

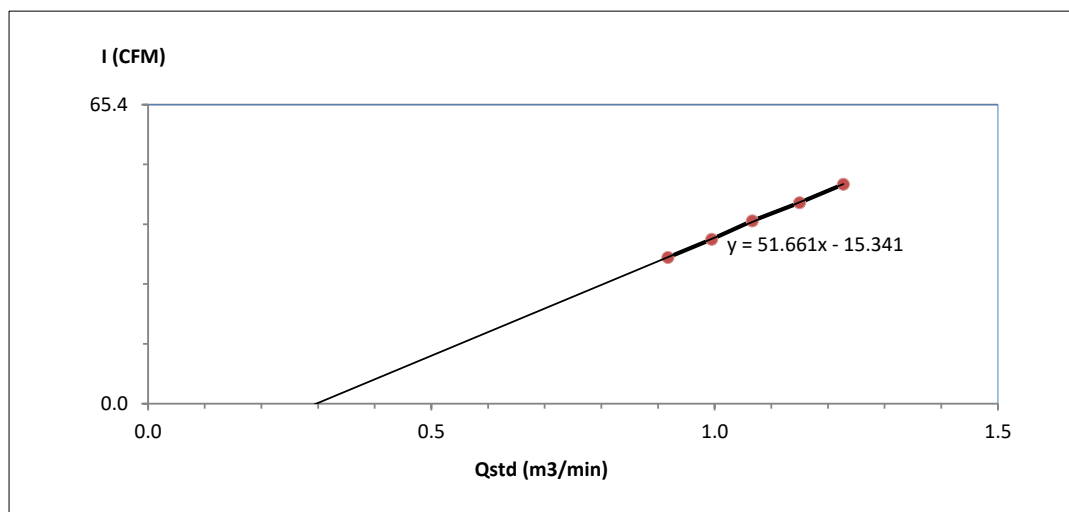
(Mr. Noppong Juntarupan)
Enviro Field Coordinator Scientist (3)



High Volume Air Sampler Calibration Worksheet

Project Site :	Kosei Aluminum (Thailand) Co.,Ltd	Barometric Pressure (mm Hg) :	757
Calibrate Location :	วัดคานหาม	Temperature (°C) :	31
Calibrate Date :	23-Sep-22	High Volume ID :	BKK_FS0381
CalibrationSheet No.:	C-230922-BKK_FS0381	High Volume Model :	TE-5009X
Calibrator ID:	BKK_FS0624	High Volume S/N :	4161
Calibrator Model :	TE-5028A	Calibrator Slope :	1.64942
Calibrator S/N :	2584	Calibrator Intercept :	-0.02902

Test No.	Delta H ₂ O (inch)	Q _{std} (m ³ /min)	I : Chart (CFM)	Linear Regression
1	2.2	0.9176	32	Slope : 51.6610 Intercept : -15.3409 Correlation Coefficient : 0.9998
2	2.6	0.9950	36	
3	3.0	1.0666	40	
4	3.5	1.1498	44	
5	4.0	1.2272	48	



Calibrated by Vannich P.

(Mr. Prommee Sripatnet)
Field Scientist(3)

Approved by : [Signature]

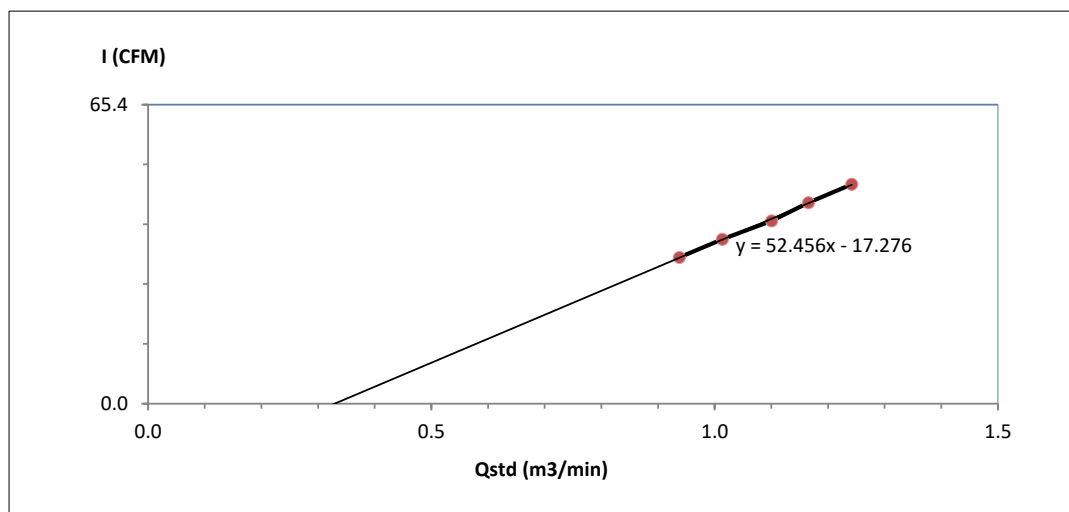
(Mr. Noppong Juntarupan)
Enviro Field Coordinator Scientist (3)



High Volume Air Sampler Calibration Worksheet

Project Site :	<u>Kosei Aluminum (Thailand) Co.,Ltd</u>	Barometric Pressure (mm Hg) :	<u>757</u>
Calibrate Location :	<u>บ้านคานหาม</u>	Temperature (°C) :	<u>31</u>
Calibrate Date :	<u>23-Sep-22</u>	High Volume ID :	<u>BKK_FS0389</u>
Calibration Sheet No.:	<u>C-230922-BKK_FS0389</u>	High Volume Model :	<u>TE-5009X</u>
Calibrator ID:	<u>BKK_FS0624</u>	High Volume S/N :	<u>5329</u>
Calibrator Model :	<u>TE-5028A</u>	Calibrator Slope :	<u>1.64942</u>
Calibrator S/N :	<u>2584</u>	Calibrator Intercept :	<u>-0.02902</u>

Test No.	Delta H ₂ O (inch)	Q _{std} (m ³ /min)	I : Chart (CFM)	Linear Regression
1	2.3	0.9376	32	Slope : 52.4565 Intercept : -17.2756 Correlation Coefficient : 0.9992
2	2.7	1.0134	36	
3	3.2	1.1007	40	
4	3.6	1.1657	44	
5	4.1	1.2420	48	



Calibrated by Vannich P.

(Mr. Prommee Sripatnet)
Field Scientist(3)

Approved by : N. Pong

(Mr. Noppong Juntarupan)
Enviro Field Coordinator Scientist (3)

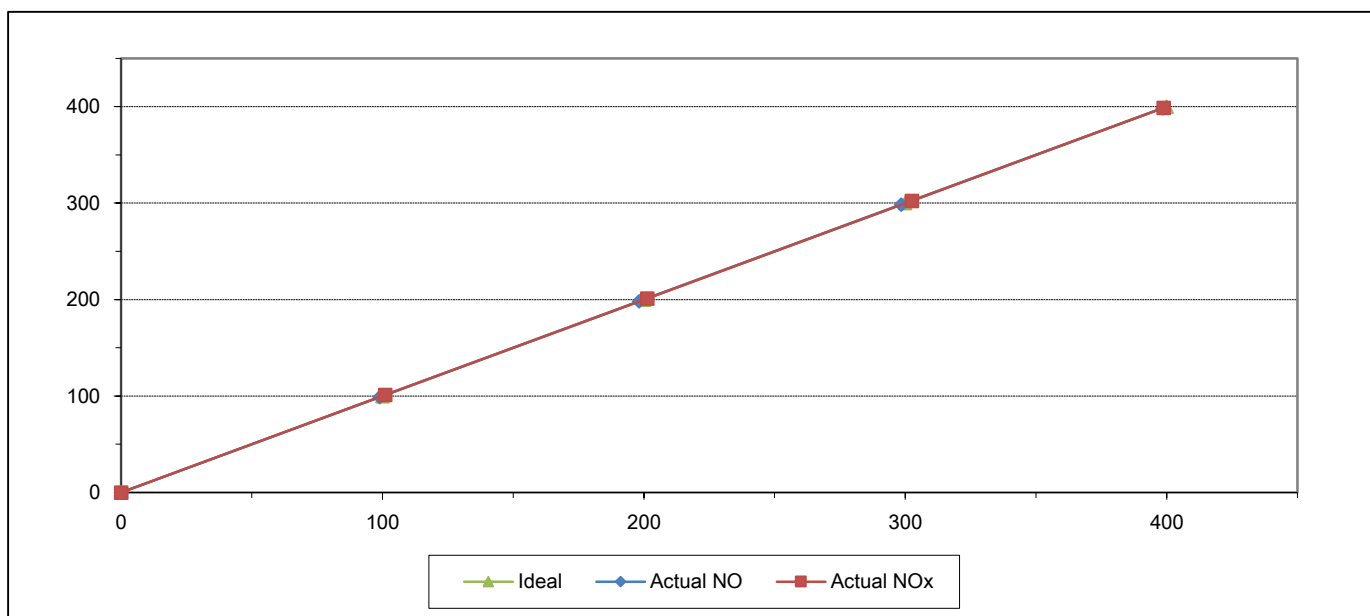


MULTIPOINT CALIBRATION REPORT

Calibration Date 1-Jul-22
Manufacturer HORIBA
Serial No. R26E09EW
Calibrator Manufacturer Teledyne API
Serial No. 947
Std. Gas Concentration (PPM) 55.88
Cylinder Pressure (psi) 1800
Certified Date 9-Feb-22

Equipment Name NOx Analyzer
Model APNA-370
Equipment ID BKK_FS0789
Model 700
Cylinder No. GN0027222
Certified By Airgas Inc.
Expired Date 9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	99.00	-1.00	-1.00	101.10	1.10	1.10
2	200.00	198.20	-1.80	-0.90	201.30	1.30	0.65
3	300.00	298.50	-1.50	-0.50	302.50	2.50	0.83
4	400.00	398.50	-1.50	-0.38	398.90	-1.10	-0.28
AVERAGE (%)				-0.54			0.48



Calibrated By

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

Approved By

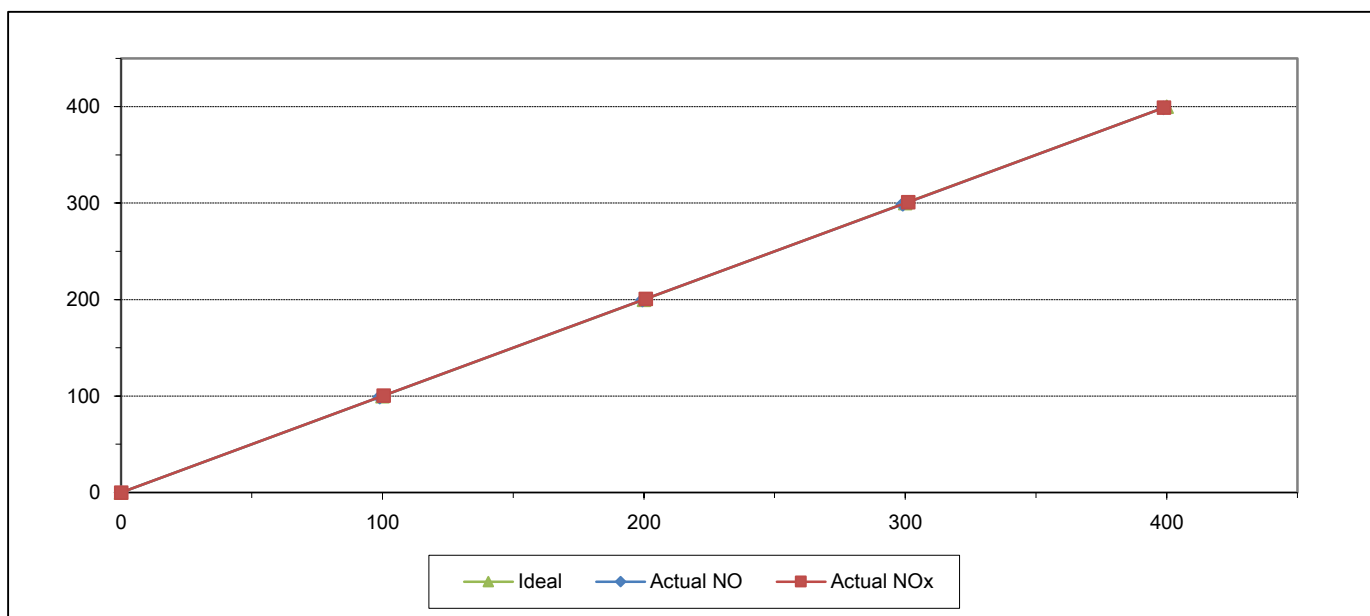
(Mr.Sarayuth Jitranont)
Assistant General Manager



MULTIPOINT CALIBRATION REPORT

Calibration Date	1-Jul-22	Equipment Name	NOx Analyzer
Manufacturer	HORIBA	Model	APNA-370
Serial No.	TLTATGDW	Equipment ID	BKK_FS0785
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	55.88	Cylinder No.	GN0027222
Cylinder Pressure (psi)	1800	Certified By	Airgas Inc.
Certified Date	9-Feb-22	Expired Date	9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	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	99.00	-1.00	-1.00	100.50	0.50	0.50
2	200.00	199.50	-0.50	-0.25	200.70	0.70	0.35
3	300.00	299.00	-1.00	-0.33	301.10	1.10	0.37
4	400.00	398.70	-1.30	-0.33	399.00	-1.00	-0.25
AVERAGE (%)				-0.36			0.21



Calibrated By

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

Approved By

(Mr.Sarayuth Jitranont)
Assistant General Manager

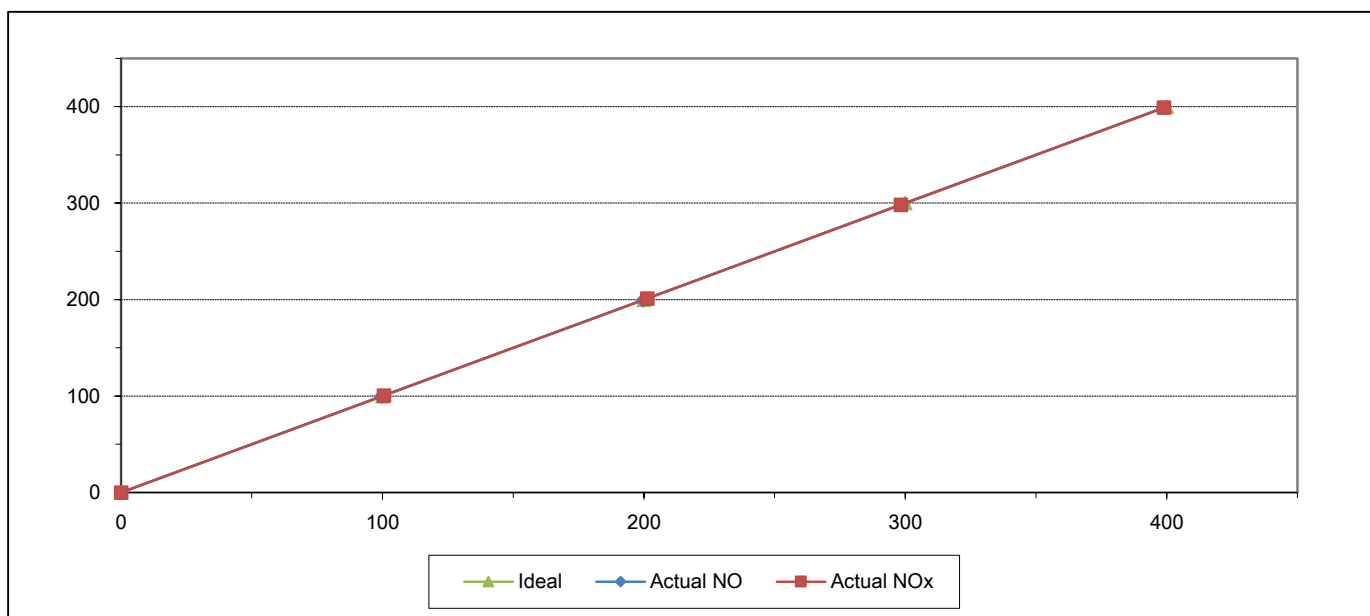


MULTIPOINT CALIBRATION REPORT

Calibration Date 1-Jul-22
Manufacturer HORIBA
Serial No. WPY0JMWD
Calibrator Manufacturer Teledyne API
Serial No. 947
Std. Gas Concentration (PPM) 55.88
Cylinder Pressure (psi) 1800
Certified Date 9-Feb-22

Equipment Name NOx Analyzer
Model APNA-370
Equipment ID BKK_FS0782
Model 700
Cylinder No. GN0027222
Certified By Airgas Inc.
Expired Date 9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	99.60	-0.40	-0.40	100.60	0.60	0.60
2	200.00	199.70	-0.30	-0.15	201.30	1.30	0.65
3	300.00	298.50	-1.50	-0.50	298.30	-1.70	-0.57
4	400.00	398.70	-1.30	-0.33	399.00	-1.00	-0.25
AVERAGE (%)				-0.26			0.11



Calibrated By

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

Approved By

(Mr.Sarayuth Jitranont)
Assistant General Manager

CERTIFICATE OF CALIBRATION

Certificate No: WS-01052022

Page 1 of 2 pages

Measurement Item : Cup anemometer with data logger.

Manufacturer : Data logger: Novaslynx
Cup anemometer: Novaslynx

Model/Type : Data logger: 200-WS-25DL
Cup anemometer: WS-02F

Serial Number : Data logger: A4940
Cup anemometer: -

ID No : Data logger: BKH_FSD160
Cup anemometer: -

Customer : ALS laboratory group (Thailand) co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10260 Thailand.

Test Conditions : Wind tunnel cross test section area 900 cm²
Anemometer frontal area 100 cm²
Diameter of mounting pipe - mm
Blockage ratio of test object 0.111 [-]

Test Conditions : Air temperature 25.3 ±0.8 °C
Air pressure 1013.3 ±0.4 hPa
Relative air humidity 51.1 ±3.5 %RH

Calibration Procedure : Calibration was carried out base on:
IEC 61400-12-1 ED.1: 2005-Power Performance Measurements of Electricity Producing Wind Turbines;
MSASNET Anemometer Calibration Procedure - Version 2: 2009;

Traceability : This calibration documents the traceable to national standard, which realize the unit of measurements according to the international system of units (SI) through National Institute of Metrology Thailand (NIMT).

Measurement Date : May 03, 2022.

Issued Date : May 04, 2022.



Calibrated by
☒ Mr. Sorawit Thachetad
☐ Miss Jitraporn Lerisomphol



Approved Signatory:

Mr. Parinya Booncharoen
Calibration Department Manager

Continuation of Certificate of Calibration Number

Certificate No: WS-01052022

Page 2 of 2 Pages

Result of calibration: ☒ Without adjustment ☐ With adjustment

Calibration in the range of 1 – 16 m/s at a calibration interval of 1 m/s.

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

V _{ISO} Reading m/s	V _{UUC} Reading m/s	Error (m/s)	Uncertainty (%)
2.079	2.0	-0.1	2.4
4.145	4.0	-0.1	1.2
6.01	6.0	0.0	1.0
8.01	8.0	0.0	0.74
10.00	10.0	0.0	0.68
11.99	12.0	0.0	0.72
14.02	14.0	0.0	0.47
16.00	16.0	0.0	0.43
18.02	18.0	0.0	0.65
12.99	13.0	0.0	0.51
11.01	11.0	0.0	0.53
9.01	9.0	0.0	0.69
7.00	7.0	0.0	0.90
5.165	5.0	-0.1	0.86
3.009	3.0	0.0	1.7
1.027	1.0	-0.2	4.8

UUC*: Unit Under Calibration

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

Appendix 1: Instrumentations

NO	Sensor	Manufacturer	Model/Type	Calibration Date	Certificate Report Number	Range
1	Pitot static	TESTO INC.	D6352145	Aug 07, 2021	MW-0034-21	5 – 30 m/s
2	Precision Differential Pressure Meter	Zoglab	DPM2500	Aug 07, 2021	MW-0034-21	5 – 30 m/s
3	Air velocity transducer (hot wire)	TSI INC.	B455-12	Aug 06, 2021	MW-0035-21	0 – 5 m/s
4	Temperature	Zoglab	D8R-THP	March 30, 2022	DL-027-65	-30 – 70°C
5	Relative humidity	Zoglab	D8R-THP	March 30, 2022	RH-03032022	0 – 100 %RH
6	Atmospheric pressure	Zoglab	D8R-THP	March 30, 2022	BP-01032022	500 – 1100 hPa
7	Wind tunnel	ESSOM	MP3300	-	-	0 – 50 Hz

End of certificate of calibration



CERTIFICATE OF CALIBRATION

Certificate No: WD-01052022

Page 1 of 2 pages

Measurement Item : Wind direction sensor with data logger.

Manufacturer : Data logger: Novolynx.
: Wind direction sensor: Novolynx.

Model/Type : Data logger: 200-WS-25DL
: Wind direction sensor: WS-02F

Serial Number : Data logger: A4940
: Wind direction sensor: -

ID No : Data logger: BKK_FS0165
: Wind direction sensor: -

Customer : ALS laboratory group (Thailand) co., ltd.
: 104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250
Thailand.

Environmental Condition:

The measurement was carried out in an ambient temperature of $(23 \pm 3) ^\circ\text{C}$, and relative humidity of $(40 \pm 10) \%$.

Measurement Method:

The wind direction sensor calibration according to comparison method with reference angle measurement electronic theodolite and line laser is used for axis control. The measurement were taken at 45° intervals in clockwise and counterclockwise directions.

Note: The UUC was warmed up for 1 hour prior to the calibration being performed

Traceability:

The measurement results are traceable to the international system of units (SI) through Certificate No: Q21086014, Certificate No: KW864/0025.

Measurement Date : May 03, 2022.

Issued Date : May 04, 2022.

Calibrated by

- ☒ Mr. Sorawit Thechsalad
☐ Miss Jitraporn Lertsomphol



Approved Signatory: _____

Mr. Parinya Booncharoen,
Calibration Department Manager

Continuation of Certificate of Calibration Number

Certificate No: WD-01052022

Pages 2 of 2 pages

Result of calibration: ☐ Without adjustment ☒ With adjustment

Calibration in the range of 0 - 360 ° at a calibration interval of 45°.

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

NO	Turning Direction	Nominal Angle (°)	Standard Reading (°)	UUC* Reading (°)	Error (°)	Uncertainty ±(°)
1	Clockwise	0/360	360	359	-1	3.0
2		45	45	41	-4	3.0
3		90	90	87	-3	3.0
4		135	135	132	-3	3.0
5		180	180	181	1	3.0
6		225	225	229	4	3.0
7		270	270	276	6	3.0
8		315	315	320	5	3.0
9	Counter Clockwise	0/360	360	359	-1	3.0
10		45	45	41	-4	3.0
11		90	90	87	-3	3.0
12		135	135	132	-3	3.0
13		180	180	181	1	3.0
14		225	225	229	4	3.0
15		270	270	276	6	3.0
16		315	315	320	5	3.0

UUC*: Unit Under Calibration The reported expanded uncertainty is based on standard uncertainty multiplied by a coverage factor k=2 providing a level of confidence of approximately 95%.

End of Certificate of Calibration



CERTIFICATE OF CALIBRATION

Certificate No.: CL-077-65

Page 1 of 2

Equipment Name: Data Logger with Temperature
Sensor

Manufacturer: Novalynx

Model: 200-WS-25LB

Serial No.: A5261

ID No.: BKK_FS0888

Customer

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

Received date: 23 May 2022

Calibration date: 30 May 2022

Issue date: 02 Jun 2022

Reference Used During Calibration

1. Standard Temperature Probe Model: STS-100 A500,
Serial No.: 667682-09, Due date: 23 Mar 2023
2. Digital Temperature Indicator Model: DTI-1000-A MK
II, Serial No.: 671407-00591 Due date: 04 June 2022

Calibration Condition

Temperature: $(23 \pm 3) ^\circ\text{C}$
Relative Humidity: $(55 \pm 15) \%$

Calibration Procedure

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

Traceability

The measurement results are traceable to the
international system of units (SI) through National
Institute of Metrology Thailand (NIMT) Certificate
number: TT-0034-22, Certificate number: ER-0032-
21

REVIEW BY

Manakorn P.

APPROVED BY

[Signature]

NEXT CAL DATE

28/11/23

Calibrated by

- ☒ Mr. Sorawit Thachalad
☐ Miss Jitraporn Lertsomphol



Approved Signatory:

[Signature]

Mr. Parinya Booncharoen
Calibration Department Manager

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20-40 °C

Function:

This equipment was connected with temperature sensor Model : HMP60 S/N : N0330783

Dimension : Diameter 12mm, Length 80 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
60	19.98	20.0	0.1	0.30
60	24.98	24.7	-0.3	0.30
60	30.02	29.6	-0.4	0.30
60	35.01	34.5	-0.5	0.30
60	40.01	39.3	-0.7	0.30

UUC*: Unit Under Calibration

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

★ End of Certificate ★



CALIBRATION REPORT

Calibration No. : RH-02062022

Page 1 of 1 Pages

Measurement Item : Relative humidity with data logger
Manufacturer : Novatynx
Model/Type : 200-W8-25LB
Serial Number : A5261
ID No. : BKK_F80868
Customer : ALS laboratory group (Thailand) Co.,Ltd.
: 104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250
Thailand.

Environmental Condition:

The measurement was carried out in an ambient temperature of $(25 \pm 3)^{\circ}\text{C}$, and relative humidity of $(50 \pm 15)\%$.

Measurement Method:

Unit Under Calibration (UUC) was calibrated by comparison method with standard thermo hygrometer in the humidity generator chamber to determine the errors.

Traceability:

This instrument was calibrated using standard equipment whose accuracy is traceability through National Institute of Standards and Technology to the international system of units (SI) via MCS Calibration, Inc. Certificate number: 20314-101. Due date: Mar 14, 2023.

Measurement Date : Jun 01, 2022

Issued Date : Jun 02, 2022

Measurement Results:

This equipment was connected with Indoor air quality probe and Displayed (UR) on display. Model: HMP60, Serial number: N0330763

Calibration was performed in the range of 20%RH to 80%RH

The results of calibration are reported in table below.

Determined (%RH)	Standard (Reading) (%RH)	UUC (Reading) (%RH)	Error (%RH)	Uncertainty \pm (%RH)
20	20.02	18.8	-1.2	0.61
50	50.22	49.4	-0.8	0.57
80	80.56	79.3	-1.3	0.69

Performed by

- ☒ Mr. Sorawit Thachalad
☐ Miss Jitraporn Lertsomphol



Approved Signatory:


Mr. Parinya Booncharoen
Calibration Department Manager

CERTIFICATE OF CALIBRATION

Certificate No: WS-02062022

Page 1 of 2 pages

Measurement Item	: Cup anemometer with data logger.		
Manufacturer	: Data logger: Novolynx : Cup anemometer: Novolynx		
Model/Type	: Data logger: 200-WS-25LB : Cup anemometer: WS-02P		
Serial Number	: Data logger: A5261 : Cup anemometer: -		
ID No	: Data logger: BKK_F80888 : Cup anemometer: -		
Customer	: ALS laboratory group (Thailand) co., Ltd. : 104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10260 Thailand.		
Test Conditions	: Wind tunnel cross test section area	900	cm ²
	: Anemometer frontal area	100	cm ²
	: Diameter of mounting pipe	-	mm
	: Blockage ratio of test object	0.111	[-]
Test Conditions	: Air temperature	24.7	±0.6 °C
	: Air pressure	1005.2	±0.4 hPa
	: Relative air humidity	46.1	±3.5 %RH
Calibration Procedure	Calibration was carried out base on: IEC 61400-12-1 Ed.1: 2005-Power Performance Measurements of Electricity Producing Wind Turbines; MCASNET Anemometer Calibration Procedure - Version 2: 2009;		
Traceability	This calibration documents the traceable to national standard, which realize the unit of measurements according to the international system of units (SI) through National Institute of Metrology Thailand (NIMT).		
Measurement Date	: Jun 01, 2022.		
Issued Date	: Jun 02, 2022.		

Calibrated by

- ☒ Mr. Sorawit Thachalad
☐ Miss Jitraporn Lertsomphot



Approved Signatory:

Mr. Parinya Booncharoen
Calibration Department Manager

Continuation of Certificate of Calibration Number

Certificate No: WS-02062022

Page 2 of 2 Pages

Result of calibration: ☒ Without adjustment ☐ With adjustment

Calibration in the range of 1 - 16 m/s at a calibration interval of 1 m/s.

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

V _{REF} Reading m/s	V _{UUC} Reading m/s	Error (m/s)	Uncertainty (%)
2.087	2.0	-0.1	2.4
4.140	4.2	0.1	1.0
6.02	6.0	0.0	0.88
8.00	8.0	0.0	0.74
10.00	10.0	0.0	0.69
11.99	12.1	0.1	0.55
14.02	14.3	0.3	0.42
16.00	16.4	0.4	0.63
15.01	15.4	0.4	0.39
12.97	13.1	0.1	0.50
11.00	11.0	0.0	0.52
9.01	9.0	0.0	0.66
7.01	7.0	0.0	0.86
6.186	6.2	0.0	0.96
3.003	3.1	0.1	1.6
1.053	0.8	-0.3	4.8

UUC*: Unit Under Calibration

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

Appendix 1: Instrumentations

NO	Sensor	Manufacturer	Model/Type	Calibration Date	Certificate Report Number	Range
1	Pitot static	TESTO INC.	06352145	Aug 07, 2021	MW-0034-21	5 - 30 m/s
2	Precision Differential Pressure Meter	Zoglab	DPM2500	Aug 07, 2021	MW-0034-21	5 - 30 m/s
3	Air velocity transducer (hot wire)	TSI INC.	8455-12	Aug 08, 2021	MW-0036-21	0 - 5 m/s
4	Temperature	Zoglab	DSR-THP	March 30, 2022	CL-027-65	-30 - 70°C
5	Relative humidity	Zoglab	DSR-THP	March 30, 2022	PH-03032022	0 - 100 %RH
6	Atmospheric pressure	Zoglab	DSR-THP	March 30, 2022	BP-01032022	500 - 1100 hPa
7	Wind wheel	ESSOM	MP3300	-	-	0 - 50 Hz

End of certificate of calibration



CERTIFICATE OF CALIBRATION

Certificate No: WD-02062022

Page 1 of 2 pages

Measurement Item : Wind direction sensor with data logger.

Manufacturer : Data logger: Novalynx
: Wind direction sensor: Novalynx

Model/Type : Data logger: 200-WS-25LB
: Wind direction sensor: WS-02F

Serial Number : Data logger: A5261
: Wind direction sensor: -

ID No : Data logger: BKH_FSD888
: Wind direction sensor: -

Customer : ALS laboratory group (Thailand) co., ltd.
: 104 Phatthanasakan 40, Phatthanasakan Rd, Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250
Thailand.

Environmental Condition:

The measurement was carried out in an ambient temperature of $(23 \pm 3) ^\circ\text{C}$, and relative humidity of $(40 \pm 10) \%$.

Measurement Method:

The wind direction sensor calibration according to comparison method with reference angle measurement electronic theodolite and line laser is used for axis control. The measurement were taken at 45° intervals in clockwise and counterclockwise directions.

Note: The UUC was warmed up for 1 hour prior to the calibration being performed

Traceability:

The measurement results are traceable to the international system of units (SI) through Certificate No: Q21086014, Certificate No: KWS64/0025.

Measurement Date : Jun 01, 2022.

Issued Date : Jun 02, 2022.

Calibrated by

- ☒ Mr. Sorawit Thechalad
☐ Miss Jitraporn Lertanophol



Approved Signatory:



Mr. Parinya Booncharoen.
Calibration Department Manager

Continuation of Certificate of Calibration Number

Certificate No: WD-02062022

Pages 2 of 2 pages

Result of calibration: ☐ Without adjustment ☒ With adjustment.

Calibration in the range of 0 – 360 ° at a calibration interval of 45°.

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

NO	Turning Direction	Nominal Angle (°)	Standard Reading (°)	UUC* Reading (°)	Error (°)	Uncertainty ±(°)
1	Clockwise	0/360	360	359	-1	3.0
2		45	45	41	-4	3.0
3		90	90	87	-3	3.0
4		135	135	133	-2	3.0
5		180	180	181	1	3.0
6		225	225	229	4	3.0
7		270	270	274	4	3.0
8		315	315	319	4	3.0
9	Counter Clockwise	0/360	360	359	-1	3.0
10		45	45	41	-4	3.0
11		90	90	87	-3	3.0
12		135	135	133	-2	3.0
13		180	180	181	1	3.0
14		225	225	229	4	3.0
15		270	270	274	4	3.0
16		315	315	319	4	3.0

UUC*: Unit Under Calibration The reported expanded uncertainty is based on standard uncertainty multiplied by a coverage factor $k=2$ providing a level of confidence of approximately 95%

End of Certificate of Calibration



CERTIFICATE OF CALIBRATION

Certificate No.: CL-076-65

Page 1 of 2

Equipment Name: Data Logger with Temperature
Sensor

Manufacturer: Novallnux

Model: 200-WS-25LB

Serial No.: A5244

ID No.: BKK_FS0887

Customer

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

Received date: 23 May 2022

Calibration date: 30 May 2022

Issue date: 02 Jun 2022

Reference Used During Calibration

1. Standard Temperature Probe Model: STS-100 A500,
Serial No.: 667682-09, Due date: 23 Mar 2023

2. Digital Temperature Indicator Model: DTI-1000-A MK
II, Serial No.: 671407-00591 Due date: 04 June 2022

Calibration Condition

Temperature: $(23 \pm 3) ^\circ\text{C}$

Relative Humidity: $(55 \pm 15)\%$

Calibration Procedure

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

Traceability

The measurement results are traceable to the
international system of units (SI) through National
Institute of Metrology Thailand (NIMT) Certificate
number: TT-0034-22, Certificate number: ER-0032-
21

REVIEW BY

Manikom P.

APPROVED BY

[Signature]

NEXT CAL. DATE

28/11/23

Calibrated by

- ☒ Mr. Sorawit Thachalad
☐ Miss Jitraporn Lertsomphol



Approved Signatory:

[Signature]

Mr. Parinya Booncharoen
Calibration Department Manager

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20-40 °C

Function:

This equipment was connected with temperature sensor Model : HMP60 S/N : N0330782

Dimension : Diameter 12mm, Length 80 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
60	19.98	20.0	0.0	0.30
60	24.98	24.9	-0.1	0.30
60	30.02	29.8	-0.2	0.30
60	35.01	34.6	-0.4	0.30
60	40.01	39.5	-0.5	0.30

UUC*: Unit Under Calibration

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

★ End of Certificate ★

CALIBRATION REPORT

Calibration No. : RH-01062022

Page 1 of 1 Pages

Measurement Item : Relative humidity with data logger
Manufacturer : Novolynx
Model/Type : 200-W8-25LB
Serial Number : A5244
ID No. : BKK_F80887
Customer : ALS laboratory group (Thailand) Co.,Ltd.
: 104 Phatthanakan 40, Phatthanakan Rd,Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250
Thailand.

Environmental Condition:

The measurement was carried out in an ambient temperature of (25±3)°C, and relative humidity of (50±15)%.

Measurement Method:

Unit Under Calibration (UUC) was calibrated by comparison method with standard thermo hygrometer in the humidity generator chamber to determine the errors.

Traceability:

This instrument was calibrated using standard equipment whose accuracy is traceability through National Institute of Standards and Technology to the International system of units (SI) via MCS Calibration, Inc. Certificate number: 20314-101. Due date: Mar 14,2023.

Measurement Date : Jun 01, 2022

Issued Date : Jun 02, 2022

Measurement Results:

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

Calibration was performed in the range of 20%RH to 80%RH

The results of calibration are reported in table below.

Determined (%RH)	Standard (Reading) (%RH)	UUC (Reading) (%RH)	Error (%RH)	Uncertainty ±(%RH)
20	20.02	18.9	-1.1	0.51
50	50.22	49.4	-0.8	0.51
80	80.52	79.3	-1.3	0.65

Performed by

☒ Mr. Sorawit Thachalad

☐ Miss Jitraporn Lertsomphol



Approved Signatory: _____



Mr. Parinya Booncharoen
Calibration Department Manager

CERTIFICATE OF CALIBRATION

Certificate No: WS-01062022

Page 1 of 2 pages

Measurement Item	: Cup anemometer with data logger.		
Manufacturer	: Data logger: Novoslynx : Cup anemometer: Novoslynx		
Model/Type	: Data logger: 200-WS-25LB : Cup anemometer: WS-02P		
Serial Number	: Data logger: A5244 : Cup anemometer: -		
ID No	: Data logger: BKK_PSD887 : Cup anemometer: -		
Customer	: ALB laboratory group (Thailand) co., Ltd. : 104 Phatthanasak 40, Phatthanasak Rd, Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10260 Thailand.		
Test Conditions	: Wind tunnel cross test section area	900	cm ²
	: Anemometer frontal area	100	cm ²
	: Diameter of mounting pipe	-	mm
	: Blockage ratio of test object	0.111	[-]
Test Conditions	: Air temperature	24.7	±0.8 °C
	: Air pressure	1003.5	±0.4 hPa
	: Relative air humidity	51.1	±3.5 %RH
Calibration Procedure	Calibration was carried out base on: IEQ 61400-12-1 EQ1: 2005-Power Performance Measurements of Electricity Producing Wind Turbines. MEASNET Anemometer Calibration Procedure – Version 2: 2009.		
Traceability	This calibration documents the traceable to national standard, which realize the unit of measurements according to the international system of units (SI) through National Institute of Metrology Thailand (NIMT).		
Measurement Date	: Jun 01, 2022.		
Issued Date	: Jun 02, 2022.		

Calibrated by

- ☒ Mr. Sorawit Thachalad
☐ Miss Jitraporn Lertsomphol



Approved Signatory:

(Signature)

Mr. Parinya Booncharoen
Calibration Department Manager

Continuation of Certificate of Calibration Number

Certificate No: WS-01062022

Page 2 of 2 Pages

Result of calibration: ☒ Without adjustment ☐ With adjustment

Calibration in the range of 1 - 16 m/s at a calibration interval of 1 m/s.

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

V _{em} Reading m/s	V _{unc} Reading m/s	Error (m/s)	Uncertainty (%)
2.086	2.0	-0.1	2.4
4.179	4.1	-0.1	1.2
6.01	6.0	0.0	0.95
8.00	8.1	0.1	0.66
10.00	10.1	0.1	0.66
12.00	12.1	0.1	0.69
13.99	14.2	0.2	0.59
16.98	16.3	0.3	0.43
16.00	16.3	0.3	0.43
12.99	13.1	0.1	0.52
11.01	11.1	0.1	0.48
9.03	9.0	0.0	0.64
7.03	7.0	0.0	0.81
5.184	5.2	0.0	0.83
3.019	3.1	0.1	1.4
1.050	0.9	-0.2	4.6

UUC*: Unit Under Calibration

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

Appendix 1: Instrumentations

NO	Sensor	Manufacturer	Model/Type	Calibration Date	Certificate Report Number	Range
1	Pitot static	TESTO INC.	06362145	Aug 07, 2021	MW-0034-21	5 - 30 m/s
2	Precision Differential Pressure Meter	Zoglab	DFM2500	Aug 07, 2021	MW-0034-21	5 - 30 m/s
3	Air velocity transducer (hot wire)	TSI INC.	8455-12	Aug 08, 2021	MW-0035-21	0 - 5 m/s
4	Temperature	Zoglab	DSR-ThP	March 30, 2022	CL-027-65	-30 - 70°C
5	Relative humidity	Zoglab	DSR-ThP	March 30, 2022	RH-03032022	0 - 100 %RH
6	Atmospheric pressure	Zoglab	DSR-ThP	March 30, 2022	BP-01032022	500 - 1100 hPa
7	Wind tunnel	ESSOM	NP3300	-	-	0 - 50 Hz

End of certificate of calibration

CERTIFICATE OF CALIBRATION

Certificate No: WD-01062022

Page 1 of 2 pages

Measurement Item : Wind direction sensor with data logger.

Manufacturer : Data logger: Novolynx,
: Wind direction sensor: Novolynx.

Model/Type : Data logger: 200-WS-25LB
: Wind direction sensor: WS-02P

Serial Number : Data logger: A5244
: Wind direction sensor: -

ID No : Data logger: BKK_FS0667
: Wind direction sensor: -

Customer : ALS laboratory group (Thailand) co., ltd.
: 104 Phatthanasen 40, Phatthanasen Rd, Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250
Thailand.

Environmental Condition:

The measurement was carried out in an ambient temperature of $(23 \pm 3) ^\circ\text{C}$, and relative humidity of $(40 \pm 10) \%$.

Measurement Method:

The wind direction sensor calibration according to comparison method with reference angle measurement electronic theodolite and line laser is used for axis control. The measurement were taken at 45° intervals in clockwise and counterclockwise directions.

Note: The UUC was warmed up for 1 hour prior to the calibration being performed.

Traceability:

The measurement results are traceable to the international system of units (SI) through Certificate No: Q21086014, Certificate No: KWS04/0026.

Measurement Date : Jun 01, 2022.

Issued Date : Jun 02, 2022.

Calibrated by

- ☒ Mr. Sorawit Thachalad
☐ Miss Jitraporn Lertsomphol



Approved Signatory:.....

Mr. Pariya Booncharoen,
Calibration Department Manager

Continuation of Certificate of Calibration Number

Certificate No: WD-01062022

Pages 2 of 2 pages

Result of calibration: ☐ Without adjustment ☒ With adjustment.

Calibration in the range of 0 – 360 ° at a calibration interval of 45°.

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

NO	Turning Direction	Nominal Angle (°)	Standard Reading (°)	UUC* Reading (°)	Error (°)	Uncertainty ±(°)
1	Clockwise	0/360	360	359	-1	3.0
2		45	45	42	-3	3.0
3		90	90	88	-2	3.0
4		135	135	135	0	3.0
5		180	180	182	2	3.0
6		225	225	228	3	3.0
7		270	270	273	3	3.0
8		315	315	318	3	3.0
9	Counter Clockwise	0/360	360	359	-1	3.0
10		45	45	42	-3	3.0
11		90	90	88	-2	3.0
12		135	135	135	0	3.0
13		180	180	182	2	3.0
14		225	225	228	3	3.0
15		270	270	273	3	3.0
16		315	315	318	3	3.0

UUC*: Unit Under Calibration. The reported expanded uncertainty is based on standard uncertainty multiplied by a coverage factor $k=2$ providing a level of confidence of approximately 95%.

End of Certificate of Calibration





CONSOLE CONTROL UNIT CALIBRATION TEST REPORT

Calibration of Date : 3 Jul 22
Next Calibration Date : 3 Jan 23

Barometric Pressure (mm.Hg) : 756
Relative Humidity (%) : 62.0
Temperature (°C) : 31.0

Console Control Meter Data

Calibration No. : C-030722-BKK_FS0507
Dry Gas Meter No. : BKK_FS0507
Serial No. : 1503017
Model No. : XC-572-V

Reference Dry Gas Meter Data

Reference Dry Gas Meter ID.: BKK_FS0629
Serial No. : 1607009
Correction Factor (Yr) : 1.0060
Next Calibration Date : 7 Oct 22

ΔH (mm.H ₂ O)	\ominus Minutes	Reference Dry Gas Meter Calibration				Console Control ; Drygas Meter						Dry Gas Meter Correction Factor (Y)	Orifice Calibration Factor $\Delta H@$
		Vr (Liters)			Tr (°C)	Vm (Liters)			Ti (°C)	To (°C)	Avg.Tm (°C)		
		Final	Initial	Total		Final	Initial	Total					
15	11.83	150.00	0.00	150.00	32.0	714127.0	713975.0	152.00	31.0	31.0	31.0	0.9881	43.4668
25	9.23	150.00	0.00	150.00	33.0	714309.2	714157.0	152.20	32.0	32.0	32.0	0.9858	44.2443
50	6.53	150.00	0.00	150.00	34.0	714473.0	714320.0	153.00	32.0	32.0	32.0	0.9751	44.5804
80	5.16	150.00	0.00	150.00	34.0	714655.6	714503.0	152.60	32.0	32.0	35.0	0.9844	44.5387
120	4.18	150.00	0.00	150.00	35.0	714818.6	714666.0	152.60	32.0	32.0	36.0	0.9806	44.1272
											Avg.	0.9828	44.1915

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

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

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

Calibrated by:

(Mr.Prasert Surakhan)

Field Scientist(3)

Approved by:

(Mr.Samart Roo-ngan)

Specialist(1)



Stopwatch Calibration Test Report

Calibration Date : 3 Jul 22

Next Cal. Date : 3 Jan 23

Barometric Pressure (mmHg) : 756

Temperature (°C) : 31.0

Relative Humidity (%) : 62.0

Reference Stopwatch Data

Stopwatch ID No. : E18061

Model : F808

Serial No. : -

Calibration Date : 8 Sep 20

Certificate No. : E-2009018

Console Control Meter Data

Dry Gas Meter No. : BKK_FS0507

Model : XC-572-V

Serial No. : 1503017

Run No.	Time Actual (m:ss.ms)	Time Reading (m:ss)	Diff. (ms)	Diff. (min)
1	5:00:08	5:00	8	0.00013
2	5:00:11	5:00	11	0.00018
3	5:00:10	5:00	10	0.00017
4	5:00:10	5:00	10	0.00017
5	5:00:10	5:00	10	0.00017
6	5:00:10	5:00	10	0.00017
7	5:00:08	5:00	8	0.00013
8	5:00:09	5:00	9	0.00015
9	5:00:11	5:00	11	0.00018
10	5:00:12	5:00	12	0.00020
			Average	0.00017
			SD	0.00002

Calibrate by :

Mr. Prasert Surakhan

Field Scientist (3)

Approved by :

Mr. Samart Roo-ngan

Specialist (1)



DIGITAL TEMPERATURE CALIBRATION DATA SHEET

Calibration Date :	3 Jul 22	Ambient Temperature (°C) :	31
Calibration sheet No. :	C-030722-BKK_FS0508	Relative Humidity (%) :	62

Digital Temperature ID	BKK_FS0508	Reference Temperature ID :	BKK_FS0609
Serial No. :	1503017	Serial No. :	7688004
Model :	XC-572-V	Model :	FLUKE 714
		Next Calibrate :	26 Jul 23

Location	Reference Temperature °C	Digital Temperature °C	Error °C	Remark
Stack	0	1	1	
	25	26	1	
	50	51	1	
	100	101	1	
	150	151	1	
	200	201	1	
	250	252	2	
	300	302	2	
	500	503	3	
	1000	1003	3	
	1200	1203	3	
Probe	100	101	1	
	125	126	1	
	150	151	1	
Oven	100	100	0	
	125	125	0	
	150	151	1	
Filter	100	100	0	
	125	125	0	
	150	151	1	
Exit	0	1	1	
	10	11	1	
	20	21	1	
Meter	0	0	0	
	25	25	0	
	50	50	0	
AUX	0	0	0	
	25	25	0	
	50	50	0	

Calibrated by : _____

(Mr. Prasert Surakhan)

Field Scientist (3)

Approved by : _____

(Mr.Samart Roo-ngan)

Specialist (1)



Pitot Tube Calibration Data

Pitot Tube Identification Number : BKK_FS0511 Calibration Date : 3 Jul 22
 Lab test duct Number : 258-1-13-01 Standard Pitot ID : BKK_FS0441
 Calibration Sheet No. : C-030722-BKK_FS0511 Cp Standard : 0.99

Type S Pitot Tube Coefficient Data					
	Type s pitot tube Leg A,B	Standard pitot tube (ΔP , mm.H ₂ O)	Type s pitot tube (ΔP , mm.H ₂ O)	Cp (s) Leg A	Cp (s) Leg B
Test 1	A	12.00	16.60	0.842	-
	B	12.00	16.60	-	0.842
Test 2	A	12.00	16.60	0.842	-
	B	12.00	16.60	-	0.842
Test 3	A	12.00	16.60	0.842	-
	B	12.00	16.60	-	0.842
			\bar{C}_p	0.842	0.842

$$Cp(S) = Cp_{(std)} \sqrt{\frac{\Delta P(std)}{\Delta P(s)}}$$

$$\left| \bar{C}_{p(A)} - \bar{C}_{p(B)} \right| \text{ must BE } \leq 0.01$$

$$\text{Average deviation(A or B)} = \frac{\sum_{i=1}^3 [Cp(s) - Cp(A \text{ or } B)]}{3} \text{ must BE } \leq 0.01$$

Calibrated by : _____

(Mr. Prasert Surakhan)

Field Scientist (3)

Approved by : _____

(Mr.Samart Roo-ngan)

Specialist (1)



Pitot Tube Calibration Data

Pitot Tube Identification Number : BKK_FS0512 Calibration Date : 3 Jul 22
 Lab test duct Number : 258-1-13-01 Standard Pitot ID : BKK_FS0441
 Calibration Sheet No. : C-030722-BKK_FS0512 Cp Standard : 0.99

Type S Pitot Tube Coefficient Data					
	Type s pitot tube Leg A,B	Standard pitot tube (ΔP , mm.H ₂ O)	Type s pitot tube (ΔP , mm.H ₂ O)	Cp (s) Leg A	Cp (s) Leg B
Test 1	A	12.00	16.60	0.842	-
	B	12.00	16.60	-	0.842
Test 2	A	12.00	16.60	0.842	-
	B	12.00	16.60	-	0.842
Test 3	A	12.00	16.60	0.842	-
	B	12.00	16.60	-	0.842
			\bar{C}_p	0.842	0.842

$$Cp(S) = Cp_{(std)} \sqrt{\frac{\Delta P(std)}{\Delta P(s)}}$$

$$| \bar{C}_{p(A)} - \bar{C}_{p(B)} | \text{ must BE } \leq 0.01$$

$$\text{Average deviation(A or B)} = \frac{\sum_{i=1}^3 [Cp(s) - Cp(A \text{ or } B)]}{3} \text{ must BE } \leq 0.01$$

Calibrated by : _____

(Mr. Prasert Surakhan)

Field Scientist (3)

Approved by : _____

(Mr.Samart Roo-ngan)

Specialist (1)



PROBE NOZZLE DIAMETER CALIBRATION DATA SHEET

Calibration Date	3 Jul 22	Nozzle Set ID.:	BKK_FS0513
Calibration Sheet No. :	C-030722-BKK_FS0513	Vernier Caliper ID.:	BKK_FS0626

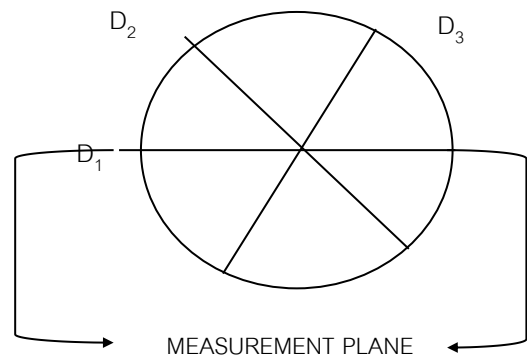
Nozzle ID #	Nozzle Diameter (cm.)			Hi - Lo ΔD	$(D_1 + D_2 + D_3) / 3$ D_{avg}
	D_1	D_2	D_3		
1	0.315	0.315	0.315	0.000	0.315
2	0.475	0.475	0.475	0.000	0.475
3	0.635	0.635	0.635	0.000	0.635
4	0.790	0.790	0.790	0.000	0.790
5	0.950	0.950	0.950	0.000	0.950
6	1.110	1.110	1.110	0.000	1.110
7	1.270	1.270	1.270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

Where :

D_1, D_2, D_3 = 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} = $(D_1 + D_2 + D_3) / 3$



Calibrated by : _____

(Mr.Prasert Surakhan)

Field Scientist (3)

Approved by : _____

Mr.Samart Roo-ngan

Specialist (1)



CONSOLE CONTROL UNIT CALIBRATION TEST REPORT

Calibration of Date : 3 Jul 22
Next Cal. Date : 3 Jan 23

Barometric Pressure (mm.Hg) : 756
Relative Humidity (%) : 62.0
Temperature : 31.0

Console Control Meter Data

Calibration No. : C-030722-BKK_FS0536
Dry Gas Meter No. : BKK_FS0536
Serial No. : 1508054
Model No. : SK25EX

Reference Dry Gas Meter Data

Reference Dry Gas Meter ID. : BKK_FS1122
Serial No. : A2003240
Correction Factor (Yr) : 1.0160
Next Calibration Date : 25 Dec 23

ΔH (mm.H ₂ O)	\ominus Minutes	Reference Dry Gas Meter Calibration				Console Control ; Drygas Meter						Dry Gas Meter Correction	Orifice Calibration
		Vr (Liters)			Tr (°C)	Vm (Liters)			Ti (°C)	To (°C)	Avg.Tm (°C)	Factor (Y)	Factor $\Delta H@$
		Final	Initial	Total		Final	Initial	Total					
15	12.20	150.00	0.00	150.00	31.0	790311.4	790156.0	155.40	31.0	31.0	31.0	0.9793	45.9257
25	9.28	150.00	0.00	150.00	32.0	790490.4	790334.0	156.40	32.0	32.0	32.0	0.9721	44.4331
50	6.48	150.00	0.00	150.00	33.0	790655.0	790500.0	155.00	32.0	32.0	32.0	0.9753	43.6148
80	5.03	150.00	0.00	150.00	35.0	791086.8	790933.0	153.80	34.0	34.0	34.0	0.9801	42.3214
120	4.13	150.00	0.00	150.00	36.0	791250.2	791097.0	153.20	34.0	34.0	34.0	0.9769	43.0756
											Avg.	0.9767	43.8741

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

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

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

Calibrated by:

(Mr.Khanetson Khamphet)
Field Scientist(3)

Approved by:

Mr.Samart Roo-ngan
Specialist (1)



Stopwatch Calibration Test Report

Calibration Date : 3 Jul 22

Next Cal. Date : 3 Jan 23

Barometric Pressure (mmHg) : 756

Temperature (°C) : 31.0

Relative Humidity (%) : 62.0

Reference Stopwatch Data

Stopwatch ID No. : E18061

Model : F808

Serial No. : -

Calibration Date : 8 Sep 20

Certificate No. : E-2009018

Console Control Meter Data

Dry Gas Meter No. : BKK_FS0536

Model : XC-572-V

Serial No. : 1924

Run No.	Time Actual (m:ss.ms)	Time Reading (m:ss)	Diff. (ms)	Diff. (min)
1	5:00:12	5:00	12	0.00020
2	5:00:12	5:00	12	0.00020
3	5:00:11	5:00	10	0.00017
4	5:00:12	5:00	12	0.00020
5	5:00:11	5:00	11	0.00018
6	5:00:12	5:00	10	0.00017
7	5:00:11	5:00	11	0.00018
8	5:00:12	5:00	10	0.00017
9	5:00:12	5:00	10	0.00017
10	5:00:12	5:00	11	0.00018
			Average	0.00018
			SD	0.00001

Calibrate by :

Mr. Prasert Surakhan

Field Scientist (3)

Approved by :

Mr. Samart Roo-ngan

Specialist (1)



DIGITAL TEMPERATURE CALIBRATION DATA SHEET

Calibration Date : 3 Jul 22	Ambient Temperature (°C) : 31
Calibration sheet No. : C-030722-BKK_FS0537	Relative Humidity (%) : 62
Digital Temperature ID : BKK_FS0537	Reference Temperature ID BKK_FS1144
Console Serial No. : 1508054	Serial No. : 201090006013
Console Model : XC-572-V	Model : Digicon-CC-VT-M3
	Next Calibrate : 31 Jan 23

Location	Reference Temperature °C	Digital Temperature °C	Error °C	Remark
Stack	0	0	0	
	25	25	0	
	50	50	0	
	100	100	0	
	150	150	0	
	200	200	0	
	250	250	0	
	300	300	0	
	500	501	1	
	1000	1001	1	
	1200	1202	2	
Probe	100	101	1	
	125	126	1	
	150	151	1	
Oven	100	101	1	
	125	126	1	
	150	151	1	
Filter	100	101	1	
	125	126	1	
	150	151	1	
Exit	0	1	1	
	10	11	1	
	20	21	1	
Meter	0	0	0	
	25	25	0	
	50	50	0	
AUX	0	0	0	
	25	25	0	
	50	50	0	

Calibrated by : _____

(Mr. Prasert Surakhan)

Field Scientist (3)

Approved by : _____

(Mr.Samart Roo-ngan)

Specialist (1)



Pitot Tube Calibration Data

Pitot Tube Identification Number : BKK_FS0540

Calibration Date : 3 Jul 22

Lab test duct Number : 258-1-13-01

Standard Pitot ID : BKK_FS0441

Calibration Sheet No. : C-030722-BKK_FS0540

Cp Standard : 0.99

Type S Pitot Tube Coefficient Data					
	Type s pitot tube Leg A,B	Standard pitot tube (ΔP , mm.H ₂ O)	Type s pitot tube (ΔP , mm.H ₂ O)	Cp (s) Leg A	Cp (s) Leg B
Test 1	A	12.00	16.60	0.842	-
	B	12.00	16.60	-	0.842
Test 2	A	12.00	16.60	0.842	-
	B	12.00	16.60	-	0.842
Test 3	A	12.00	16.60	0.842	-
	B	12.00	16.60	-	0.842
			\bar{C}_p	0.842	0.842

$$Cp(S) = Cp_{(std)} \sqrt{\frac{\Delta P(std)}{\Delta P(s)}}$$

$$\left| \bar{C}_{p(A)} - \bar{C}_{p(B)} \right| \text{ must BE } \leq 0.01$$

$$\text{Average deviation}(A \text{ or } B) = \frac{\sum_{i=1}^3 [Cp(s) - Cp(A \text{ or } B)]}{3} \text{ must BE } \leq 0.01$$

Calibrated by : _____

(Mr. Prasert Surakhan)

Field Scientist (3)

Approved by : _____

(Mr.Samart Roo-ngan)

Specialist (1)



Pitot Tube Calibration Data

Pitot Tube Identification Number : BKK_FS0541 Calibration Date : 3 Jul 22
 Lab test duct Number : 258-1-13-01 Standard Pitot ID : BKK_FS0441
 Calibration Sheet No. : C-030722-BKK_FS0541 Cp Standard : 0.99

Type S Pitot Tube Coefficient Data					
	Type s pitot tube Leg A,B	Standard pitot tube (ΔP , mm.H ₂ O)	Type s pitot tube (ΔP , mm.H ₂ O)	Cp (s) Leg A	Cp (s) Leg B
Test 1	A	12.00	16.60	0.842	-
	B	12.00	16.60	-	0.842
Test 2	A	12.00	16.60	0.842	-
	B	12.00	16.60	-	0.842
Test 3	A	12.00	16.60	0.842	-
	B	12.00	16.60	-	0.842
			\bar{C}_p	0.842	0.842

$$Cp(S) = Cp_{(std)} \sqrt{\frac{\Delta P(std)}{\Delta P(s)}}$$

$$| \bar{C}_{p(A)} - \bar{C}_{p(B)} | \text{ must BE } \leq 0.01$$

$$\text{Average deviation}(A \text{ or } B) = \frac{\sum_{i=1}^3 [Cp(s) - Cp(A \text{ or } B)]}{3} \text{ must BE } \leq 0.01$$

Calibrated by : _____

(Mr. Prasert Surakhan)

Field Scientist (3)

Approved by : _____

(Mr.Samart Roo-ngan)

Specialist (1)



PROBE NOZZLE DIAMETER CALIBRATION DATA SHEET

Calibration Date	3 Jul 22	Nozzle Set ID. :	BKK_FS0542
Calibration Sheet No. :	C-030722-BKK_FS0542	Vernier Caliper ID. :	BKK_FS0626

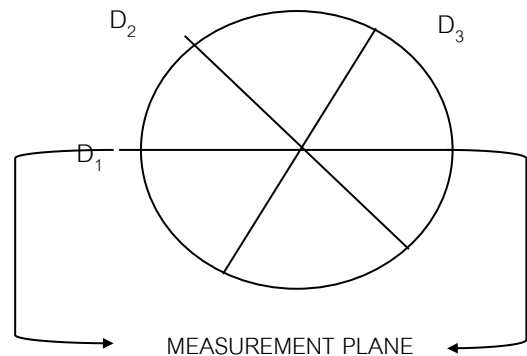
Nozzle ID #	Nozzle Diameter (cm.)			Hi - Lo	$(D_1 + D_2 + D_3) / 3$
	D_1	D_2	D_3	ΔD	D_{avg}
1	0.315	0.315	0.315	0.000	0.315
2	0.475	0.475	0.475	0.000	0.475
3	0.635	0.635	0.635	0.000	0.635
4	0.790	0.790	0.790	0.000	0.790
5	0.950	0.950	0.950	0.000	0.950
6	1.110	1.110	1.110	0.000	1.110
7	1.270	1.270	1.270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

Where :

D_1, D_2, D_3 = 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} = $(D_1 + D_2 + D_3) / 3$



Calibrated by : _____

(Mr. Prasert Surakhan)

Field Scientist (3)

Approved by : _____

Mr. Samart Roo-ngan

Specialist (1)



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Mechanical Engineering Standards Laboratory Soi 1, Bangpoo Industrial Estate, Muang, Samutprakan 10280, Thailand.

Request No. 23-65/0316-01

MTC.No. 23-65/0316-01

Number of Pages(S) 2

CALIBRATION CERTIFICATE

Nomenclature : "Dwyer" DIGITAL PRESSURE GAUGE

Manufactured by DWYER INSTRUMENTS, INC. U.S.A.

Model : DVGA-00

Serial No. : DVG02 ID. BKK_FS0422

Range : -30 in Hg to 0 in Hg

Resolution : 0.01 in Hg

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

104 Phatthanakan 40, Phattanakarn Rd.,

Khwaeng Phattanakarn, Khet Suan Luang, Bangkok 10250, Thailand.

Calibration method : Normal

Received date : 17 March 2022

Calibration date : 9 May 2022

Standard : Reference Pressure Monitor, Serial 1950, Certificate no. 23-64/0581-01

Due Date 3 August 2022

The Standard used for the measurement is traceable to SI Unit through
National Institute of Metrology (THAILAND).

REVIEW BY	<i>Makorn P.</i>
APPROVED BY	<i>[Signature]</i>
NEXT CAL. DATE	7/11/23

CALIBRATED BY : *[Signature]*

(Mr.Uthai Chaiyapat)

APPROVED BY : *[Signature]*

(Ms.Kirana Luanghin)

Director

Mechanical Engineering Standards Laboratory

Ref. 2013265031701244001

Issued Date : 12 May 2022

The results relate only to the items tested/calibrated or value assigned.

Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

FM.BLMTC.002 Rev.4

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Mechanical Engineering Standards Laboratory Sol 1, Bangpoo Industrial Estate, Muang, Samutprakan 10280, Thailand.

Reques 23-65/0316-01

2 / 2

MTC.No. 23-65/0316-01

Calibration range : -27 in Hg to 0 in Hg

Calibration method : The Digital Pressure Gauge Under Calibration (UUC) was calibrated by comparison method followed DAkkS-DKD-R 6-1: Calibration of Pressure Gauge, edition 03/2014

Calibration condition : Temperature (23.1 ± 2) °C , Relative Humidity (62 ± 10) %
Atmospheric pressure (1006 ± 10) hPa,
Local gravity (9.783003 ± 0.000050) m/s²

Measurement Data :

Gauge position : Vertical

Medium : Air

Reference level : Gauge inlet

Unit : in Hg

UUC Reading	Gauge Pressure	Error	(±) Uncertainty
0.00	0.000	0.000	0.090
-10.00	-9.914	-0.086	0.090
-20.00	-19.820	-0.180	0.090
-26.00	-25.759	-0.241	0.090
-27.00	-26.659	-0.341	0.095
-28.00	-27.748	-0.252	0.090

The reported expanded uncertainties are based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95 % .

The End of Calibration Certificate



The results relate only to the items tested/calibrated or value assigned.

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FM.BLMTC.002 Rev.A

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196 Phahonyothin Road, Chatuchak, Bangkok 10900,
Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
Fax. (66) 0 2579 8592
E-mail : sumalee@tistr.or.th

Certificate of Calibration

Number of Page(s) 1 of 3

Certificate No. BSQC-UV-307122
Equipment UV/Vis Spectrophotometer
Model UV-1800
Manufacturer Shimadzu
Serial No. A1-454908533CD
ID No. BKK_EN0018
Date of receipt 15 September 2022
Date of calibration 16 September 2022
Date of issue 23 September 2022

REVIEW BY *Sinitak P.*
APPROVED BY *Mr. An*
NEXT CAL. DATE *23/9/23*

Customer name ALS Laboratory Group (Thailand) Co., Ltd.

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

Temperature (22.1-23.3) °C (On site)

Humidity (58.8-63.2) %RH (On site)

Equipment condition Good Operation

Calibration Location Organic Prep

Calibration Procedure In-house method WI-UV-702-01 based on ASTM E275-01

Traceability Wavelength Accuracy is traceable to certificate No 95917 and 95918
Photometric Accuracy is traceable to certificate No 95924 and 95937
Stray Light is traceable to certificate No 95908
The above certificate are traceable to SI unit through Starna Scientific Ltd
(UKAS accredited calibration laboratory NO. 0659)

Calibrated by Mr. Waruth Choothong

Approved by



Mr. Kanchit Choothong
Technical Manager

The above results are valid exclusively for the calibrated items/ as mention in this report / certificate
Advertising the report / Certificate and publicity of the results are prohibited and also shall not be reproduced
except in full, without written approval of the Bara Scientific Co., Ltd.

Certificate of Calibration

Certificate No. **BSCC-UV-307/22** Number of Page(s) **2 of 3**

Calibration Results:

1. Wavelength Accuracy

Certified Wavelength (nm)	UUC (nm)	Error (nm)	Uncertainty (\pm nm)
241.70	241.65	-0.05	0.18
334.02	333.92	-0.10	0.18
418.53	418.46	-0.07	0.18
572.99	572.96	-0.03	0.18
879.41	879.17	-0.24	0.18

2. Photometric Accuracy (UV)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty (\pm A)
235	0.0000	0.0000	0.0000	0.0075
	0.7467	0.7461	-0.0006	0.0075
257	0.0000	0.0000	0.0000	0.0075
	0.8662	0.8647	-0.0015	0.0075
313	0.0000	0.0000	0.0000	0.0075
	0.2904	0.2911	0.0007	0.0075
350	0.0000	0.0000	0.0000	0.0075
	0.6429	0.6426	-0.0003	0.0075

*CNR = Customer not request

The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate.
Advertising the report / Certificate and publicity of the results are prohibited and also shall not be reproduced
except in full, without written approval of the Bara Scientific Co., Ltd.

Certificate of Calibration

Certificate No. **BSCC-UV-307/22**

Number of Page(s) **3 of 3**

Calibration Results:

3. Photometric Accuracy (Visible)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty ($\pm A$)
420.0	0.0000	0.0000	0.0000	0.0042
	0.5783	0.5777	-0.0006	0.0042
	0.7628	0.7635	0.0007	0.0046
	1.0206	1.0230	0.0024	0.0042
440.0	0.0000	0.0000	0.0000	0.0042
	0.5621	0.5618	-0.0003	0.0042
	0.7455	0.7460	0.0005	0.0046
	0.9185	1.0305	0.0020	0.0042
485.0	0.0000	0.0000	0.0000	0.0042
	0.5227	0.5219	-0.0008	0.0042
	0.6880	0.6884	0.0004	0.0051
	0.9487	0.9503	0.0016	0.0042
546.1	0.0000	0.0000	0.0000	0.0042
	0.5207	0.5199	-0.0008	0.0042
	0.6873	0.6971	-0.0002	0.0049
	0.9959	0.9964	0.0005	0.0042
593.0	0.0000	0.0000	0.0000	0.0042
	0.5544	0.5534	-0.0010	0.0042
	0.7253	0.7242	-0.0011	0.0050
	1.0942	1.0943	0.0001	0.0042
635.0	0.0000	0.0000	0.0000	0.0042
	0.5616	0.5605	-0.0010	0.0042
	0.6927	0.6921	-0.0006	0.0053
	1.0681	1.0985	0.0034	0.0042

*CNR = Customer request

4. Stray Light*

Standard cut-off wavelength (nm)	Unit Under Calibration(UUC)		
	Wavelength (nm)	Transmission (%)	Absorbance (A)
200.96 \pm 0.11nm	200.30	0.9505	2.0229

The Stray light transmission reference is less than 1.0%T and Stray light absorbance reference is greater than 2.00A

*Stray Light not NSC-ONSC Accredited.

The measurement uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2 providing a level of confidence of approximately 95%.

*****End of Certificate*****

The above results are valid exclusively for the calibrated item(s) as mentioned in this report / certificate.
Advertising the report / Certificate and publicity of the results are prohibited and also shall not be reproduced
except in full, without written approval of the Bara Scientific Co., Ltd.



Certificate of Calibration



Represent to Certificate of Calibration ,PTC/07/22071

Certificate No.:	PTC/07/22071	Page:	1 of 2
Equipment:	Digital Balance	Condition:	Normal
Manufacturer:	Sartorius	Serial No:	26207042
Model:	MSE224-100-DU	ID No:	BKK_EN0002
Type of Balance:	Single interval		

Customer: ALS Laboratory Group (Thailand) Co.,Ltd.
104 Phatthanakarn 40 Phatthanakarn Rd.,
khwaeng Phatthanakarn, Khet Suan Luang, Bangkok 10250.

Environment Condition: Temperature 21.5 °C ± 0.7 °C
Humidity 61.8 %RH ± 4.7 %RH
Air density 1.19 kg/m³

Calibration Place: ALS Laboratory Group (Thailand) Co.,Ltd.
104 Phatthanakarn 40 Phatthanakarn Rd.,
khwaeng Phatthanakarn, Khet Suan Luang, Bangkok 10250.



The Method used: In house method, PTC-WI-07, base on Euramet cg. 18

Traceability: This certificate is traceable to the SI Units through Thai Calibration Service Co.,Ltd.
, NSC-ONSC Accreditation No.: Calibration 0189

Date Received: February 25, 2022

Calibration Date: February 25, 2022

Issued Date: March 01, 2022

Calibration By: Mr. Rungroje Metakul



PENTA CALIBRATION CO.,LTD

Kriangsak Kalasri
(Mr.Kriangsak Kalasri)
Reviewed by

Approved By : Keattisak Kerdto
(Mr. Keattisak Kerdto)
Laboratory Manager

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognised national standard laboratories.

The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor ($k=2$) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM). The effect that the results relate only to the items calibrated.

This calibration certificate shall not be reproduced except in full only, without written approval from penta calibration co., ltd



Represent to Certificate of Calibration ,PTC/07/22071

Certificate No.: PTC/07/22071

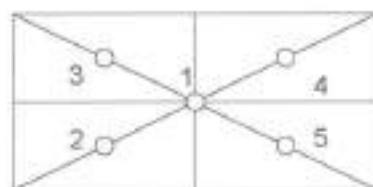
Page: 2 of 2

Measurement Results:

Without Adjustment :

Function Calibration: Non Adjustment

Eccentric Error: Weight to be 1/3 ,1/2 or of Maximum capacity



Eccentricity test 100 (g)

Position (g)				
1	2	3	4	5
0.0000	-0.0002	-0.0001	0.0001	-0.0001
Maximum deviation:				0.0002

Repeatability Test : Weight to be $1/2 \leq L_1 \leq$ Maximum capacity

Determination of the standard deviation of weighing balance., Readability 0.0001 (g)

Nominal test value (g)	Standard Deviation
200	0.00005

Error of indication : from nominal value., Readability 0.0001 (g)

Nominal Value (g)	Conventional Mass (g)	Indication (g)	Correction of Balance (g)	Uncertainty (g)	k
0	0.00000	0.0000	0.0000	0.00016	2.52
0.1	0.10000	0.1000	0.0000	0.00017	2.20
0.5	0.50000	0.5000	0.0000	0.00016	2.28
1	1.00001	1.0000	0.0000	0.00016	2.28
2	2.00001	2.0000	0.0000	0.00016	2.28
5	5.00001	5.0000	0.0000	0.00016	2.28
10	10.00002	10.0000	0.0000	0.00016	2.28
20	20.00002	20.0000	0.0000	0.00016	2.23
50	50.00001	50.0000	0.0000	0.00017	2.15
100	100.00002	99.9999	0.0001	0.00020	2.06
120	120.00004	120.0000	0.0000	0.00023	2.03
150	150.00003	150.0000	0.0000	0.00026	2.00
200	200.00003	199.9999	0.0001	0.00030	2.00

Note: Weight of adjust - (g)

The End of Certificate



ROTA METER CALIBRATION RESULT JULY 2022

Rotameter ID.	Calibration Date	Regression Result	Coefficient (R ²)
BKK_FS0577	01 Jul 22	$Y = 1.0202x + 0.1976$	1.0000
BKK_FS0579	01 Jul 22	$Y = 1.0078x + 0.4789$	0.9998
BKK_FS0583	01 Jul 22	$Y = 1.016x + 0.3922$	1.0000
BKK_FS0584	01 Jul 22	$Y = 1.0036x + 2.2262$	0.9997
BKK_FS0585	01 Jul 22	$Y = 1.0189x - 5.6476$	0.9997
BKK_FS0586	01 Jul 22	$Y = 1.0095x - 1.1524$	0.9995
BKK_FS0587	01 Jul 22	$Y = 1.013x - 3.6619$	0.9996
BKK_FS0588	01 Jul 22	$Y = 1.0154x + 4.8357$	0.9999
BKK_FS0589	01 Jul 22	$Y = 0.9918x + 4.8069$	0.9999
BKK_FS0590	01 Jul 22	$Y = 1.0038x - 0.4857$	0.9996
BKK_FS0591	01 Jul 22	$Y = 0.9705x - 52.174$	0.9986
BKK_FS0592	01 Jul 22	$Y = 0.9646x - 37.642$	0.9985
BKK_FS0593	01 Jul 22	$Y = 0.9767x - 58.445$	0.9988
BKK_FS0594	01 Jul 22	$Y = 0.9902x - 62.87$	0.9999
BKK_FS0595	01 Jul 22	$Y = 1.0249x - 98.162$	0.9999
BKK_FS0596	01 Jul 22	$Y = 0.9843x - 26.806$	0.9991
BKK_FS0597	01 Jul 22	$Y = 0.9802x - 61.653$	0.9978
BKK_FS1004	01 Jul 22	$Y = 0.9696x + 17.69$	0.9990
BKK_FS1005	01 Jul 22	$Y = 1.0092x + 2.4571$	0.9999
BKK_FS1006	01 Jul 22	$Y = 1.168x - 5.566$	0.9997
BKK_FS1007	01 Jul 22	$Y = 0.9917x + 1.6592$	1.0000
BKK_FS1008	01 Jul 22	$Y = 1.0132x + 0.7207$	1.0000
BKK_FS1009	01 Jul 22	$Y = 1.0132x + 1.1633$	0.9960
BKK_FS1010	01 Jul 22	$Y = 1.0033x + 0.5758$	0.9999
BKK_FS1011	01 Jul 22	$Y = 1.0234x + 0.1759$	0.9996
BKK_FS1012	01 Jul 22	$Y = 1.0106x - 2.0048$	0.9997
BKK_FS1013	01 Jul 22	$Y = 0.9677x - 35.851$	0.9997
BKK_FS1014	01 Jul 22	$Y = 1.0021x + 0.3148$	0.9998
BKK_FS1015	01 Jul 22	$Y = 0.9994x + 1.786$	1.0000
BKK_FS1016	01 Jul 22	$Y = 1.0105x - 80.256$	0.9998
BKK_FS1017	01 Jul 22	$Y = 0.9995x + 0.649$	1.0000
BKK_FS1018	01 Jul 22	$Y = 1.0011x + 1.1786$	1.0000
BKK_FS1019	01 Jul 22	$Y = 1.0023x - 68.424$	0.9996
BKK_FS1020	01 Jul 22	$Y = 1.0547x - 0.666$	0.9998
BKK_FS1021	01 Jul 22	$Y = 1.018x - 3.3286$	0.9998
BKK_FS1022	01 Jul 22	$Y = 0.9932x - 57.035$	0.9986
BKK_FS1023	01 Jul 22	$Y = 1.0094x + 0.0717$	0.9999
BKK_FS1024	01 Jul 22	$Y = 1.0042x + 0.4086$	0.9997
BKK_FS1025	01 Jul 22	$Y = 1.0132x - 88.507$	0.9996



ROTA METER CALIBRATION RESULT JULY 2022

Rotameter ID.	Calibration Date	Regression Result	Coefficient (R ²)
BKK_FS1026	01 Jul 22	$Y = 1.0018x + 1.0776$	0.9997
BKK_FS1027	01 Jul 22	$Y = 1.0053x + 0.231$	0.9995
BKK_FS1028	01 Jul 22	$Y = 0.9792x - 60.312$	0.9982
BKK_FS1029	01 Jul 22	$Y = 0.9935x + 0.8234$	1.0000
BKK_FS1030	01 Jul 22	$Y = 1.0039x + 0.515$	0.9999
BKK_FS1031	01 Jul 22	$Y = 1.009x - 79.295$	0.9998
BKK_FS1039	01 Jul 22	$Y = 0.9879x + 7.3524$	0.9996
BKK_FS1040	01 Jul 22	$Y = 0.9704x + 88.336$	0.9987
BKK_FS1041	01 Jul 22	$Y = 1.0645x - 1.7878$	0.9999
BKK_FS1042	01 Jul 22	$Y = 0.9983x + 3.6262$	0.9998
BKK_FS1043	01 Jul 22	$Y = 1.0069x - 6.9619$	1.0000
BKK_FS1044	01 Jul 22	$Y = 1.0355x - 0.6214$	0.9997
BKK_FS1161	01 Jul 22	$Y = 1.0126x + 0.7738$	0.9999
BKK_FS1162	01 Jul 22	$Y = 0.9994x + 2.6357$	0.9995
BKK_FS1163	01 Jul 22	$Y = 0.977x - 55.03$	0.9987
BKK_FS1164	01 Jul 22	$Y = 0.9914x + 0.8427$	0.9997
BKK_FS1165	01 Jul 22	$Y = 0.9893x + 6.5919$	0.9998
BKK_FS1166	01 Jul 22	$Y = 1.0031x - 77.881$	0.9996
BKK_FS1200	01 Jul 22	$Y = 1.0313x - 0.4602$	0.9995
BKK_FS1201	01 Jul 22	$Y = 1.0045x + 0.15$	0.9996
BKK_FS1202	01 Jul 22	$Y = 0.9702x - 44.156$	0.9994
RYG_FS0197	01 Jul 22	$Y = 1.0039x - 0.179$	0.9999
RYG_FS0198	01 Jul 22	$Y = 0.9971x + 16.648$	0.9999
RYG_FS0199	01 Jul 22	$Y = 1.0832x - 2.6367$	1.0000

Review By :

(Mr. Wichan Choonharat)
Enviro Field Services Manager

Approved By :

(Mr. Sarayuth Jittranont)
Assistant General Manager

SITHIPORN ASSOCIATES CO.,LTD.

CALIBRATION LABORATORY



451-451/1 Sirinthorn Rd.,Bangbumru, Bangplud Bangkok 10700 THAILAND.
Tel.0-2435-8800 Fax.0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.com

NSC-TISI-TIS 17025
CALIBRATION 0394

Cert. No. : ACC22027

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,
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,
BANGKOK, 10250 THAILAND.

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

Received Date : 06 SEPTEMBER 2022
Calibration Date : 09 SEPTEMBER 2022
Date of Issue : 14 SEPTEMBER 2022

REVIEW BY	<i>Nathakorn P.</i>
APPROVED BY	<i>T. Petchurai</i>
NEXT CAL. DATE	9/9/23

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchurai
(Thanakul Petchurai)

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

Continuation of Calibration Certificate

Cert. No. : ACC22027

Job No. : VC65AC0081

Pages : 2 of 3

Calibration Procedure : CP-AC-03

Calibration Method :

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

The sound pressure level, frequency and total distortion of the sound calibrator 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-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL.BP. 04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0265	09-Feb-23
Digital Multimeter	33461A	MY60024273	EEL.BP. 05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23
Audio Analyzer	AVR-3360A	V744B6069	EF-0010-22	07-Feb-23

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).

Continuation of Calibration Certificate

Cert. No. : ACC22027
Job No. : VC65AC0081
Pages : 3 of 3

Result of calibration :

1. Sound pressure level

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

2. Frequency

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

3. Total distortion

Measured value (%)	Uncertainty (%)	Tolerance limit (%)
1.22	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

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

451-451/1 Sirinthorn Rd.,Bangbunru, Bangplud Bangkok 10700 THAILAND.
Tel.0-2435-8800 Fax.0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL21171

Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 00858525 / 158776 / 58777
ID No.: BKK_FS0115

Condition As Found : GOOD

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

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

Received Date : 09 DECEMBER 2021
Calibration Date : 14-15 DECEMBER 2021
Date of Issue : 16 DECEMBER 2021

REVIEW BY	<i>Nathakorn P.</i>
APPROVED BY	<i>[Signature]</i>
NEXT CAL DATE	14/12/22

Calibrated by : Nathakorn Pisutpaisan

Approved by :

[Signature]
(Thanakul Petchurai)

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

Continuation of Calibration Certificate

Cert. No. : ACL21171

Job No. : VC65AC0033

Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
Waveform Generator	33210A	MY48017076	EF-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL.BP. 05/0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0264	08-Feb-22
Digital Multimeter	8846A	1997025	EEL.BP. 06/0264	05-Feb-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KA1	34560495	AA-3003-21	16-Feb-22

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).

Continuation of Calibration Certificate

Cert. No. : ACL21171
Job No. : VC65AC0033
Pages : 3 of 8

Summary of Measurement Result :

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

Continuation of Calibration Certificate

Cert. No. : ACL21171
Job No. : VC65AC0033
Pages : 4 of 8

Result of calibration :**1. Absolute sensitivity**

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
13.4

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

Frequency Weighting	Measured value (dB)
A - weight	11.6
C - weight	17.8
Flat	23.2

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.4	0.4	0.5	± 1.5
1000	-0.1	-0.1	-0.1	± 1.0
8000	-2.8	-2.7	-2.7	±5.0

Continuation of Calibration Certificate

Cert. No. : ACL21171

Job No. : VC65AC0033

Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

Continuation of Calibration Certificate

Cert. No. : ACL21171

Job No. : VC65AC0033

Pages : 6 of 8

7. Level linearity on the reference level range

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

Continuation of Calibration Certificate

Cert. No. : ACL21171

Job No. : VC65AC0033

Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.3	-0.1	±3.0

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

Continuation of Calibration Certificate

Cert. No. : ACL21171

Job No. : VC65AC0033

Pages : 8 of 8

11. Overload indication

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

451-451/1 Sirinthorn Rd.,Bangumru, Bangplud Bangkok 10700 THAILAND.
Tel.0-2435-8800 Fax.0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL22039

Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 00572452 / 171618 / 72790
ID No.: BKK_FS0922

Condition As Found : GOOD

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

Location : -

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

Received Date : 05 JANUARY 2022
Calibration Date : 12-14 JANUARY 2022
Date of Issue : 17 JANUARY 2022

REVIEW BY	<i>Nathakorn P.</i>
APPROVED BY	<i>[Signature]</i>
NEXT CAL. DATE	12/1/23

Calibrated by : Nathakorn Pisutpaisan

Approved by :

[Signature]
(Thanakul Petchurai)

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Continuation of Calibration Certificate

Cert. No. : ACL22039

Job No. : VC65AC0041

Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

For tests results of each 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-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL.BP. 05/0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0264	08-Feb-22
Digital Multimeter	34461A	MY60024273	1-15180725251-1	15-Sep-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KA1	34560495	AA-3003-21	16-Feb-22

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).

Continuation of Calibration Certificate

Cert. No. : ACL22039
Job No. : VC65AC0041
Pages : 3 of 8

Summary of Measurement Result :

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

Continuation of Calibration Certificate

Cert. No. : ACL22039

Job No. : VC65AC0041

Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.6

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

Frequency Weighting	Measured value (dB)
A - weight	12.0
C - weight	18.8
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)			Acceptance Limits
	Flat	C-weight	A-weight	
125	0.2	0.2	0.2	± 1.5
1000	-0.1	-0.1	-0.1	± 1.0
8000	-0.5	-0.5	-0.4	±5.0

Continuation of Calibration Certificate

Cert. No. : ACL22039

Job No. : VC65AC0041

Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	-0.1	0.0	0.0	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	-0.1	±1.5
500	0.0	0.0	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±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	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	0.0	-
C - weight	94.0	0.0	± 0.2
Flat	94.0	0.0	± 0.2

5.2 Time weighting at 1 kHz

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

Continuation of Calibration Certificate

Cert. No. : ACL22039

Job No. : VC65AC0041

Pages : 6 of 8

7. Level linearity on the reference level range

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

Continuation of Calibration Certificate

 Cert. No. : ACL22039
 Job No. : VC65AC0041
 Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

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

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

Continuation of Calibration Certificate

Cert. No. : ACL22039
 Job No. : VC65AC0041
 Pages : 8 of 8

11. Overload indication

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

12. High level stability

Frequency Weighting	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

SITHIPHORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

451-451/1 Sirinthorn Rd.,Bangbunru, Bangplud Bangkok 10700 THAILAND.
Tel.0-2435-8800 Fax.0-2433-1679 e-mail:cal-center@sithiphorn.com http://www.sithiphorn.com



NSC-TISI-TIS 17025
CALIBRATION 0394

Cert. No. : ACL22043

Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 00873053 / 171587 / 73329
ID No.: BKK_FS0930

Condition As Found : GOOD

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

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

Received Date : 05 JANUARY 2022
Calibration Date : 12-14 JANUARY 2022
Date of Issue : 17 JANUARY 2022

REVIEW BY	<i>Nathakorn P.</i>
APPROVED BY	<i>[Signature]</i>
NEXT CAL DATE	12/1/23

Calibrated by :

Nathakorn Pisutpaisan

Approved by :

[Signature]
(Thanakul Petchurai)

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Continuation of Calibration Certificate

Cert. No. : ACL22043
Job No. : VC65AC0041
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

For tests results of each 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-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL.BP. 05/0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0264	08-Feb-22
Digital Multimeter	34461A	MY60024273	I-15180725251-1	15-Sep-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KA1	34560495	AA-3003-21	16-Feb-22

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).

Continuation of Calibration Certificate

 Cert. No. : ACL22043
 Job No. : VC65AC0041
 Pages : 3 of 8

Summary of Measurement Result :

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

Continuation of Calibration Certificate

Cert. No. : ACL22043

Job No. : VC65AC0041

Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.6

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

Frequency Weighting	Measured value (dB)
A - weight	13.1
C - weight	19.4
Flat	24.7

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)			Acceptance Limits
	Flat	C-weight	A-weight	
125	0.2	0.2	0.2	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-0.3	-0.3	-0.2	±5.0

Continuation of Calibration Certificate

Cert. No. : ACL22043
 Job No. : VC65AC0041
 Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	-0.1	0.0	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.0	-0.1	±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	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	0.0	-
C - weight	94.0	0.0	± 0.2
Flat	94.0	0.0	± 0.2

5.2 Time weighting at 1 kHz

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

Continuation of Calibration Certificate

Cert. No. : ACL22043

Job No. : VC65AC0041

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	84.1	0.1	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.1	0.1	± 1.1
69.0	69.1	0.1	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.1	0.1	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.0	0.0	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	25.0	0.0	± 1.1

Continuation of Calibration Certificate

Cert. No. : ACL22043

Job No. : VC65AC0041

Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	93.9	-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

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	-
One	136.4	136.3	-0.1	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

Continuation of Calibration Certificate

Cert. No. : ACL22043
Job No. : VC65AC0041
Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

SITHIPHORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

451-451/1 Sirinthorn Rd.,Bangbunru, Bangplud Bangkok 10700 THAILAND.
Tel.0-2435-8800 Fax.0-2433-1679 e-mail:cal-center@sithiphorn.com http://www.sithiphorn.com



Cert. No. : ACL22191

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,
KHWANG 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 : 06 SEPTEMBER 2022
Calibration Date : 07-09 SEPTEMBER 2022
Date of Issue : 14 SEPTEMBER 2022

REVIEW BY	<i>Nathakorn P.</i>
APPROVED BY	<i>[Signature]</i>
NEXT CAL. DATE	4/9/23

Calibrated by :

Nathakorn Pisutpaisan

Approved by :

T. Petchurai
(Thanakul Petchurai)

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Continuation of Calibration Certificate

Cert. No. : ACL22191
Job No. : VC65AC0081
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

For tests results of each 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-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL.BP. 04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL.BP. 05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

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).

Continuation of Calibration Certificate

Cert. No. : ACL22191

Job No. : VC65AC0081

Pages : 3 of 8

Summary of Measurement Result :

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

Continuation of Calibration Certificate

Cert. No. : ACL22191
Job No. : VC65AC0081
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.95)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.3

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

Frequency Weighting	Measured value (dB)
A - weight	11.6
C - weight	18.0
Flat	23.5

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			Acceptance Limits
	Flat	C-weight	A-weight	
125	0.6	0.7	0.7	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-2.7	-2.7	-2.6	±5.0

Continuation of Calibration Certificate

Cert. No. : ACL22191
Job No. : VC65AC0081
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

Continuation of Calibration Certificate

Cert. No. : ACL22191

Job No. : VC65AC0081

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	104.1	0.1	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	26.0	0.0	± 1.1
25.0	24.9	-0.1	± 1.1

Continuation of Calibration Certificate

Cert. No. : ACL22191
Job No. : VC65AC0081
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	116.9	-0.1	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	107.9	-0.1	1.5 ; -5.0
	200	800	127.6	127.5	-0.1	±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

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	-
One	136.4	136.4	0.0	±3.0

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

Continuation of Calibration Certificate

Cert. No. : ACL22191
Job No. : VC65AC0081
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.5	89.5	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	137.1	137.0	0.1	±0.3

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

End of Calibration Certificate

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

451-451/1 Sirinthorn Rd.,Bangbunru, Bangplud Bangkok 10700 THAILAND.
Tel.0-2435-8800 Fax.0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL22176

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 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KHWANG 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 : 25 JULY 2022
Calibration Date : 15-18 AUGUST 2022
Date of Issue : 19 AUGUST 2022

REVIEW BY	<i>Nathakorn P.</i>
APPROVED BY	<i>T. Petchurai</i>
NEXT CAL. DATE	16/8/23

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchurai
(Thanakul Petchurai)

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Continuation of Calibration Certificate

Cert. No. : ACL22176
Job No. : VC65AC0071
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL.BP. 04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL.BP. 05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

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).

Continuation of Calibration Certificate

Cert. No. : ACL22176

Job No. : VC65AC0071

Pages : 3 of 8

Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.5	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long - term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

Continuation of Calibration Certificate

Cert. No. : ACL22176

Job No. : VC65AC0071

Pages : 4 of 8

Result of calibration :**1. Absolute sensitivity**

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.95)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
15.5

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

Frequency Weighting	Measured value (dB)
A - weight	11.6
C - weight	17.8
Flat	23.5

3. Acoustical signal tests of frequency weightings

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

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

Continuation of Calibration Certificate

Cert. No. : ACL22176
 Job No. : VC65AC0071
 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	0.0	-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	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	0.0	-
C - weight	94.0	0.0	± 0.2
Flat	94.0	0.0	± 0.2

5.2 Time weighting at 1 kHz

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

Continuation of Calibration Certificate

Cert. No. : ACL22176

Job No. : VC65AC0071

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	84.1	0.1	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.1	0.1	± 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	34.1	0.1	± 1.1
30.0	30.2	0.2	± 1.1
29.0	29.2	0.2	± 1.1
28.0	28.3	0.3	± 1.1
27.0	27.3	0.3	± 1.1
26.0	26.4	0.4	± 1.1
25.0	25.5	0.5	± 1.1

Continuation of Calibration Certificate

 Cert. No. : ACL22176
 Job No. : VC65AC0071
 Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

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

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

Continuation of Calibration Certificate

Cert. No. : ACL22176
Job No. : VC65AC0071
Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

SITHIPHORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

451-451/1 Sirinthorn Rd.,Bangbumru, Bangplud Bangkok 10700 THAILAND.
Tel.0-2435-8800 Fax.0-2433-1679 e-mail:cal-center@sithiphorn.com http://www.sithiphorn.com



Cert. No. : ACL22040

Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 00597162 / 180405 / 88175
ID No.: BKK_FS0997

Condition As Found : GOOD

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

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

Received Date : 05 JANUARY 2022
Calibration Date : 12-14 JANUARY 2022
Date of Issue : 17 JANUARY 2022

REVIEW BY	<i>Nathakorn P.</i>
APPROVED BY	<i>[Signature]</i>
NEXT CAL DATE	12/11/23

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchurai
(Thanakul Petchurai)

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

Continuation of Calibration Certificate

Cert. No. : ACL22040

Job No. : VC65AC0041

Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

For tests results of each 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-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL.BP. 05/0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0264	08-Feb-22
Digital Multimeter	34461A	MY60024273	1-15180725251-1	15-Sep-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KAI	34560495	AA-3003-21	16-Feb-22

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).

Continuation of Calibration Certificate

Cert. No. : ACL22040

Job No. : VC65AC0041

Pages : 3 of 8

Summary of Measurement Result :

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

Continuation of Calibration Certificate

Cert. No. : ACL22040

Job No. : VC65AC0041

Pages : 4 of 8

Result of calibration :**1. Absolute sensitivity**

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
16.6

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

Frequency Weighting	Measured value (dB)
A - weight	13.6
C - weight	20.2
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)			Acceptance Limits
	Flat	C-weight	A-weight	
125	0.1	0.1	0.1	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	0.3	0.4	0.4	±5.0

Continuation of Calibration Certificate

Cert. No. : ACL22040

Job No. : VC65AC0041

Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	-0.1	-0.1	-0.1	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	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	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	0.0	-
C - weight	94.0	0.0	± 0.2
Flat	94.0	0.0	± 0.2

5.2 Time weighting at 1 kHz

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

Continuation of Calibration Certificate

Cert. No. : ACL22040

Job No. : VC65AC0041

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	131.9	-0.1	± 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	27.9	-0.1	± 1.1
27.0	27.0	0.0	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.9	-0.1	± 1.1

Continuation of Calibration Certificate

 Cert. No. : ACL22040
 Job No. : VC65AC0041
 Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.3	-0.1	±3.0

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

Continuation of Calibration Certificate

Cert. No. : ACL22040

Job No. : VC65AC0041

Pages : 8 of 8

11. Overload indication

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

SITHIPHORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY



451-451/1 Sirinthorn Rd., Bangbunru, Bangplud Bangkok 10700 THAILAND.
Tel.0-2435-8800 Fax.0-2433-1679 e-mail:cal-center@sithiphorn.com http://www.sithiphorn.com

Cert. No. : ACC21020

Pages : 1 of 3

Calibration Certificate

Equipment : SOUND CALIBRATOR
Manufacturer : RION
Model : NC-74
Serial No.: 34425567
ID No.: BKK_FS0618

Condition As Found : GOOD

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

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

Received Date : 06 OCTOBER 2021
Calibration Date : 18 OCTOBER 2021
Date of Issue : 19 OCTOBER 2021

REVIEW BY	<i>Nathakorn P.</i>
APPROVED BY	<i>[Signature]</i>
NEXT CAL. DATE	18/10/22

Calibrated by : Nathakorn Pisutpaisan

Approved by :

[Signature]
(Thanakul Petchurai)

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

Continuation of Calibration Certificate

Cert. No. : ACC21020

Job No. : VC65AC0002

Pages : 2 of 3

Calibration Procedure : CP-AC-03

Calibration Method :

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

The sound pressure level, frequency and total distortion of the sound calibrator 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-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL.BP. 05/0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0264	08-Feb-22
Digital Multimeter	8846A	1997025	EEL.BP. 06/0264	05-Feb-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KA1	34560495	AA-3003-21	16-Feb-22
Audio Analyzer	AVR-3360A	V744B6069	EF-0010-21	10-Feb-22

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).

Continuation of Calibration Certificate

Cert. No. : ACC21020

Job No. : VC65AC0002

Pages : 3 of 3

Result of calibration :

1. Sound pressure level

Specified sound pressure level (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit (dB)
94	94.1	0.10	0.14	0.40

2. Frequency

Specified Frequency (Hz)	Measured value (Hz)	Deviated value (%)	Uncertainty (%)	Tolerance limit (%)
1000	1002.4	0.2	0.1	1.0

3. Total distortion

Measured value (%)	Uncertainty (%)	Tolerance limit (%)
1.57	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 —————

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

451-451/1 Sirinthorn Rd.,Bangbunru, Bangplud Bangkok 10700 THAILAND.
Tel.0-2435-8800 Fax.0-2433-1679 e-mail:cal-center@sithiphorn.com http://www.sithiphorn.com



Cert. No. : ACL22137

Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 00710641 / 136960 / 10642
ID No.: BKK_FS0025

Condition As Found : GOOD

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

Location : -

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

Received Date : 26 MAY 2022
Calibration Date : 09-10 JUNE 2022
Date of Issue : 14 JUNE 2022

REVIEW BY	<i>Nathakorn P</i>
APPROVED BY	<i>[Signature]</i>
NEXT CAL. DATE	9/6/23

Calibrated by : Nathakorn Pisutpaisan

Approved by :

[Signature]
(Thanakul Petchurai)

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Continuation of Calibration Certificate

Cert. No. : ACL22137

Job No. : VC65AC0063

Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

For tests results of each 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-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL.BP. 04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL.BP. 05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KA1	34560495	AA-3005-22	22-Feb-23

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).

Continuation of Calibration Certificate

Cert. No. : ACL22137

Job No. : VC65AC0063

Pages : 3 of 8

Summary of Measurement Result :

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

Continuation of Calibration Certificate

Cert. No. : ACL22137

Job No. : VC65AC0063

Pages : 4 of 8

Result of calibration :**1. Absolute sensitivity**

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.95)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
23.2

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

Frequency Weighting	Measured value (dB)
A - weight	15.0
C - weight	20.9
Flat	26.7

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)			Acceptance Limits
	Flat	C-weight	A-weight	
125	0.0	0.0	0.1	± 1.5
1000	-0.1	-0.1	-0.1	± 1.0
8000	0.2	0.3	0.3	±5.0

Continuation of Calibration Certificate

Cert. No. : ACL22137
Job No. : VC65AC0063
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	-0.1	-0.1	±2.0
125	-0.1	0.0	0.0	±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	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	0.0	-
C - weight	94.0	0.0	± 0.2
Flat	94.0	0.0	± 0.2

5.2 Time weighting at 1 kHz

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

Continuation of Calibration Certificate

Cert. No. : ACL22137

Job No. : VC65AC0063

Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	132.9	-0.1	± 1.1
132.0	131.9	-0.1	± 1.1
131.0	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	27.0	0.0	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.9	-0.1	± 1.1

Continuation of Calibration Certificate

Cert. No. : ACL22137

Job No. : VC65AC0063

Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

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

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

Continuation of Calibration Certificate

Cert. No. : ACL22137

Job No. : VC65AC0063

Pages : 8 of 8

11. Overload indication

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

12. High level stability

Frequency Weighting	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

SITHIPHORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

451-451/1 Sirinthorn Rd, Bangbumru, Bangplud Bangkok 10700 THAILAND.
Tel.0-2435-8800 Fax.0-2433-1679 e-mail:cal-center@sithiphorn.com http://www.sithiphorn.com



Cert. No. : ACL21149

Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-S2 / Preamplifier NH-24
Serial No.: 00658240 / 157780 / 48095
ID No.: BKK_FS0097

Condition As Found : GOOD

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

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

Received Date : 08 NOVEMBER 2021
Calibration Date : 09-10 NOVEMBER 2021
Date of Issue : 12 NOVEMBER 2021

REVIEW BY	Nathakorn P.
APPROVED BY	[Signature]
NEXT CAL. DATE	9/11/22

Calibrated by :

Nathakorn Pisutpaisan

Approved by :

[Signature]
(Thanakul Petchurai)

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

Continuation of Calibration Certificate

Cert. No. : ACL21149

Job No. : VC65AC0015

Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

For tests results of each 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-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL.BP. 05/0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0264	08-Feb-22
Digital Multimeter	8846A	1997025	EEL.BP. 06/0264	05-Feb-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KAI	34560495	AA-3003-21	16-Feb-22

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).

Continuation of Calibration Certificate

Cert. No. : ACL21149
Job No. : VC65AC0015
Pages : 3 of 8

Summary of Measurement Result :

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

Continuation of Calibration Certificate

Cert. No. : ACL21149
Job No. : VC65AC0015
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
19.4

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

Frequency Weighting	Measured value (dB)
A - weight	13.1
C - weight	18.8
Flat	24.3

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.2	0.4	0.3	± 1.5
1000	-0.1	-0.1	-0.1	± 1.0
8000	-0.7	-0.6	-0.6	±5.0

Continuation of Calibration Certificate

Cert. No. : ACL21149
Job No. : VC65AC0015
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

Continuation of Calibration Certificate

Cert. No. : ACL21149
Job No. : VC65AC0015
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	131.9	-0.1	± 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	30.1	0.1	± 1.1
29.0	29.1	0.1	± 1.1
28.0	28.1	0.1	± 1.1
27.0	27.1	0.1	± 1.1
26.0	26.2	0.2	± 1.1
25.0	25.2	0.2	± 1.1

Continuation of Calibration Certificate

 Cert. No. : ACL21149
 Job No. : VC65AC0015
 Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

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

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

Continuation of Calibration Certificate

Cert. No. : ACL21149

Job No. : VC65AC0015

Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

451-451/1 Sirinthorn Rd.,Bangbumru, Bangplud Bangkok 10700 THAILAND.
Tel.0-2435-8800 Fax.0-2433-1679 e-mail:cal-center@sithiphorn.com http://www.sithiphorn.com



Cert. No. : ACL22177

Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 00658241 / 158767 / 58769
ID No.: BKK_FS0098

Condition As Found : GOOD

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

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

Received Date : 25 JULY 2022
Calibration Date : 15-18 AUGUST 2022
Date of Issue : 19 AUGUST 2022

REVIEW BY	<i>Nathakorn P.</i>
APPROVED BY	<i>[Signature]</i>
NEXT CAL. DATE	15/8/23

Calibrated by : Nathakorn Pisutpaisan

Approved by :

[Signature]
(Thanakul Petchurai)

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

Continuation of Calibration Certificate

Cert. No. : ACL22177

Job No. : VC65AC0071

Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

For tests results of each 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-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL.BP. 04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL.BP. 05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

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).

Continuation of Calibration Certificate

Cert. No. : ACL22177
Job No. : VC65AC0071
Pages : 3 of 8

Summary of Measurement Result :

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

Continuation of Calibration Certificate

Cert. No. : ACL22177
Job No. : VC65AC0071
Pages : 4 of 8

Result of calibration :**1. Absolute sensitivity**

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.95)	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	Measured value (dB)
A - weight	11.6
C - weight	18.0
Flat	23.7

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)			Acceptance Limits
	Flat	C-weight	A-weight	
125	0.5	0.5	0.6	± 1.5
1000	0.1	0.1	0.1	± 1.0
8000	-1.7	-1.7	-1.7	±5.0

Continuation of Calibration Certificate

Cert. No. : ACL22177

Job No. : VC65AC0071

Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	0.0	0.0	±2.0
125	0.0	0.1	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.1	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	0.0	±2.0
4000	0.0	0.1	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	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	0.0	-
C - weight	94.0	0.0	± 0.2
Flat	94.0	0.0	± 0.2

5.2 Time weighting at 1 kHz

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

Continuation of Calibration Certificate

Cert. No. : ACL22177

Job No. : VC65AC0071

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	119.1	0.1	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.1	0.1	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.9	-0.1	± 1.1

Continuation of Calibration Certificate

Cert. No. : ACL22177
Job No. : VC65AC0071
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	116.9	-0.1	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	107.9	-0.1	1.5 ; -5.0
	200	800	127.6	127.5	-0.1	±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

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	-
One	136.4	136.3	-0.1	±3.0

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

Continuation of Calibration Certificate

Cert. No. : ACL22177

Job No. : VC65AC0071

Pages : 8 of 8

11. Overload indication

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

SITHIPHORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

451-451/1 Sirinthorn Rd.,Bangbunru, Bangplud Bangkok 10700 THAILAND.
Tel.0-2435-8800 Fax.0-2433-1679 e-mail:cal-center@sithiphorn.com http://www.sithiphorn.com



NSC-TISI-TIS 17025
CALIBRATION 0394

Cert. No. : ACL21150

Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 00858513 / 158763 / 58765
ID No.: BKK_FS0103

Condition As Found : GOOD

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

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

Received Date : 08 NOVEMBER 2021
Calibration Date : 09-10 NOVEMBER 2021
Date of Issue : 12 NOVEMBER 2021

Calibrated by : Nathakorn Pisutpaisan

Approved by :


(Thanakul Petchurai)

REVIEW BY	
APPROVED BY	
NEXT CAL. DATE	9/11/22

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.

Continuation of Calibration Certificate

Cert. No. : ACL21150

Job No. : VC65AC0015

Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

For tests results of each 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-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL.BP. 05/0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0264	08-Feb-22
Digital Multimeter	8846A	1997025	EEL.BP. 06/0264	05-Feb-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KAI	34560495	AA-3003-21	16-Feb-22

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).

Continuation of Calibration Certificate

 Cert. No. : ACL21150
 Job No. : VC65AC0015
 Pages : 3 of 8

Summary of Measurement Result :

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

Continuation of Calibration Certificate

Cert. No. : ACL21150
Job No. : VC65AC0015
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.6

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

Frequency Weighting	Measured value (dB)
A - weight	11.6
C - weight	17.8
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)			Acceptance Limits
	Flat	C-weight	A-weight	
125	0.4	0.5	0.5	± 1.5
1000	-0.1	-0.1	0.0	± 1.0
8000	-2.6	-2.6	-2.6	±5.0

Continuation of Calibration Certificate

 Cert. No. : ACL21150
 Job No. : VC65AC0015
 Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	0.0	0.0	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.0	-0.1	±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	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	0.0	-
C - weight	94.0	0.0	± 0.2
Flat	94.0	0.0	± 0.2

5.2 Time weighting at 1 kHz

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

Continuation of Calibration Certificate

Cert. No. : ACL21150

Job No. : VC65AC0015

Pages : 6 of 8

7. Level linearity on the reference level range

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

Continuation of Calibration Certificate

Cert. No. : ACL21150

Job No. : VC65AC0015

Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.0	-0.4	±3.0

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

Continuation of Calibration Certificate

Cert. No. : ACL21150
Job No. : VC65AC0015
Pages : 8 of 8

11. Overload indication

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

451-451/1 Sirinthorn Rd.,Bangbunru, Bangplud Bangkok 10700 THAILAND.
Tel.0-2435-8800 Fax.0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.com



NSC-TISI-TIS 17025
CALIBRATION 0394

Cert. No. : ACL21172

Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 00858526 / 175176 / 85721
ID No.: BKK_FS0116

Condition As Found : GOOD

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

Location : -

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

Received Date : 09 DECEMBER 2021
Calibration Date : 14-15 DECEMBER 2021
Date of Issue : 16 DECEMBER 2021

REVIEW BY	<i>Nathakorn P.</i>
APPROVED BY	<i>[Signature]</i>
NEXT CAL. DATE	14/12/22

Calibrated by :

Nathakorn Pisutpaisan

Approved by :

[Signature]
(Thanakul Petchurai)

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Continuation of Calibration Certificate

Cert. No. : ACL21172

Job No. : VC65AC0033

Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
Waveform Generator	33210A	MY48017076	EF-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL.BP. 05/0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0264	08-Feb-22
Digital Multimeter	8846A	1997025	EEL.BP. 06/0264	05-Feb-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KA1	34560495	AA-3003-21	16-Feb-22

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).

Continuation of Calibration Certificate

 Cert. No. : ACL21172
 Job No. : VC65AC0033
 Pages : 3 of 8

Summary of Measurement Result :

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

Continuation of Calibration Certificate

Cert. No. : ACL21172
Job No. : VC65AC0033
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.96)	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	Measured value (dB)
A - weight	13.4
C - weight	19.7
Flat	25.1

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	0.2	0.2	0.2	± 1.5
1000	0.1	0.0	0.0	± 1.0
8000	1.9	2.0	2.0	±5.0

Continuation of Calibration Certificate

Cert. No. : ACL21172
Job No. : VC65AC0033
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	-0.2	-0.1	±2.0
125	0.0	0.0	-0.1	±1.5
250	0.0	0.0	-0.1	±1.5
500	0.0	0.0	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.1	0.0	0.0	±3.0
8000	0.1	0.0	0.0	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	0.0	-
Slow	94.0	0.0	± 0.1
Leq	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	93.9	94.0	0.1	± 0.3

Continuation of Calibration Certificate

Cert. No. : ACL21172

Job No. : VC65AC0033

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	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.1	0.1	± 1.1
114.0	114.1	0.1	± 1.1
109.0	109.1	0.1	± 1.1
104.0	104.1	0.1	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.9	-0.1	± 1.1

Continuation of Calibration Certificate

Cert. No. : ACL21172

Job No. : VC65AC0033

Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	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

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	-
One	136.4	136.4	0.0	±3.0

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

Continuation of Calibration Certificate

Cert. No. : ACL21172

Job No. : VC65AC0033

Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

451-451/1 Sirinthorn Rd.,Bangbunru, Bangplud Bangkok 10700 THAILAND.
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.com



NSC-TIS1-TIS 17025
CALIBRATION 0394

Cert. No. : ACL21134

Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 00572564 / 170401 / 72902
ID No.: BKK_FS0880

Condition As Found : GOOD

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

Location : -

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

Received Date : 18 OCTOBER 2021
Calibration Date : 25-26 OCTOBER 2021
Date of Issue : 28 OCTOBER 2021

REVIEW BY	<i>Nathakorn P.</i>
APPROVED BY	<i>Nathakorn P.</i>
NEXT CAL. DATE	25/10/22

Calibrated by :

Nathakorn Pisutpaisan

Approved by :

T. Petchurai
(Thanakul Petchurai)

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Continuation of Calibration Certificate

Cert. No. : ACL21134
Job No. : VC65AC0005
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

For tests results of each 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
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Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL.BP. 05/0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0264	08-Feb-22
Digital Multimeter	8846A	1997025	EEL.BP. 06/0264	05-Feb-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KA1	34560495	AA-3003-21	16-Feb-22

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).

Continuation of Calibration Certificate

Cert. No. : ACL21134
Job No. : VC65AC0005
Pages : 3 of 8

Summary of Measurement Result :

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

Continuation of Calibration Certificate

Cert. No. : ACL21134
Job No. : VC65AC0005
Pages : 4 of 8

Result of calibration :**1. Absolute sensitivity**

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.8

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

Frequency Weighting	Measured value (dB)
A - weight	10.9
C - weight	17.3
Flat	22.9

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.2	0.2	0.2	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-0.6	-0.5	-0.5	±5.0

Continuation of Calibration Certificate

Cert. No. : ACL21134
Job No. : VC65AC0005
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

Continuation of Calibration Certificate

Cert. No. : ACL21134

Job No. : VC65AC0005

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	104.1	0.1	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.0	0.0	± 1.1
26.0	26.1	0.1	± 1.1
25.0	25.1	0.1	± 1.1

Continuation of Calibration Certificate

Cert. No. : ACL21134

Job No. : VC65AC0005

Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	116.9	-0.1	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	107.9	-0.1	1.5 ; -5.0
	200	800	127.6	127.5	-0.1	±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

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	-
One	136.4	136.0	-0.4	±3.0

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

Continuation of Calibration Certificate

Cert. No. : ACL21134

Job No. : VC65AC0005

Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

451-451/1 Sirinthorn Rd., Bangbunru, Bangplud Bangkok 10700 THAILAND.
Tel.0-2435-8800 Fax.0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL21135

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,
KHWANG 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 : 18 OCTOBER 2021
Calibration Date : 25-26 OCTOBER 2021
Date of Issue : 28 OCTOBER 2021

VIEW BY *Nathakorn P.*
APPROVED BY *Nathakorn P.*
NEXT CAL. DATE *25/10/22*

Calibrated by :

Nathakorn Pisutpaisan

Approved by :

T. Petchurai
(Thanakul Petchurai)

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

Continuation of Calibration Certificate

Cert. No. : ACL21135

Job No. : VC65AC0005

Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
Waveform Generator	33210A	MY48017076	EF-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL.BP, 05/0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL.BP, 03/0264	08-Feb-22
Digital Multimeter	8846A	1997025	EEL.BP, 06/0264	05-Feb-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KAI	34560495	AA-3003-21	16-Feb-22

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).

Continuation of Calibration Certificate

Cert. No. : ACL21135
Job No. : VC65AC0005
Pages : 3 of 8

Summary of Measurement Result :

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

Continuation of Calibration Certificate

Cert. No. : ACL21135

Job No. : VC65AC0005

Pages : 4 of 8

Result of calibration :**1. Absolute sensitivity**

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
16.7

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

Frequency Weighting	Measured value (dB)
A - weight	14.6
C - weight	20.2
Flat	25.5

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.4	0.5	0.5	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-1.0	-0.9	-0.9	±5.0

Continuation of Calibration Certificate

Cert. No. : ACL21135
Job No. : VC65AC0005
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	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

Continuation of Calibration Certificate

Cert. No. : ACL21135

Job No. : VC65AC0005

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	89.1	0.1	± 1.1
84.0	84.1	0.1	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.1	0.1	± 1.1
69.0	69.1	0.1	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.1	0.1	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.1	0.1	± 1.1
29.0	29.1	0.1	± 1.1
28.0	28.1	0.1	± 1.1
27.0	27.2	0.2	± 1.1
26.0	26.3	0.3	± 1.1
25.0	25.3	0.3	± 1.1

Continuation of Calibration Certificate

Cert. No. : ACL21135

Job No. : VC65AC0005

Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

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

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

Continuation of Calibration Certificate

Cert. No. : ACL21135

Job No. : VC65AC0005

Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

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

————— End of Calibration Certificate —————

CERTIFICATE OF CALIBRATION

Certificate No. : CL-078-65

Page 1 of 2

Equipment Name: Heat Stress Monitor

Manufacturer.: DeltaOHM

Model: HD32.2

Serial No: 13021779

ID No: BKK_FS0640

Customer

Name: ALS laboratory group (thailand) Co.,Ltd.

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

Received date: 25 May 2022

Calibration date: 26 May 2022

Issue date: 02 Jun 2022

Reference Used During Calibration

1.Standard Temperature Probe Model: STS-100 A500,
Serial No.: 667682-09, Due date: 23 Mar 2023

2.Digital Temperature Indicator Model: DTI-1000-A MK
II, Serial No.: 671407-00591 Due date: 04 June 2022

Calibration Condition

Temperature: $(23 \pm 3)^{\circ}\text{C}$

Relative Humidity: $(55 \pm 15)\%$

Calibration Procedure

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

Traceability

The measurement results are traceable to the
international system of units (SI) through National
Institute of Metrology Thailand (NIMT) Certificate
number: TT-0034-22, Certificate number: ER-0032-
21

REVIEW BY

Parinya B.

APPROVED BY

[Signature]

NEXT CAL. DATE

26/5/23

Calibrated by

☐ Mr. Sorawit Thachalad

☒ Miss Jitraporn Lertsomphol



Approved Signatory:

[Signature]
Mr. Parinya Booncharoen
Calibration Department Manager

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 – 40 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 13030281.
Dimension: Diameter 14 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
30	20.042	20.0	0.0	0.099
30	25.046	25.0	0.0	0.099
30	30.045	30.0	0.0	0.099
30	35.034	35.0	0.0	0.099
30	40.030	40.0	0.0	0.099

Table 2: This equipment was connected with temperature probe Model: TP3207.2 S/N: 13013672.
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
70	20.041	20.2	0.2	0.099
70	25.046	24.9	-0.1	0.099
70	30.045	29.8	-0.2	0.099
70	35.034	34.7	-0.3	0.099
70	40.030	39.6	-0.4	0.099

Table 3: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 13030461.
Dimension: Diameter 8 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.042	20.0	0.0	0.099
110	25.046	25.0	0.0	0.099
110	30.045	30.0	0.0	0.099
110	35.034	35.0	0.0	0.099
110	40.030	40.0	0.0	0.099

UUC* : Unit Under Calibration

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

★ End of Certificate ★

CERTIFICATE OF CALIBRATION

Certificate No.: CL-079-65
Page 1 of 2

Equipment Name: Heat Stress Monitor
Manufacturer.: DeltaOHM
Model: HD32.2
Serial No: 13024785
ID No: BKK_FS0641

Customer

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

Received date: 25 May 2022
Calibration date: 26 May 2022
Issue date: 02 Jun 2022

Reference Used During Calibration

1.Standard Temperature Probe Model: STS-100 A500,
Serial No.: 667682-09, Due date: 23 Mar 2023
2.Digital Temperature Indicator Model: DTI-1000-A MK
II, Serial No.: 671407-00591 Due date: 04 June 2022

Calibration Condition

Temperature: (23±3)°C
Relative Humidity: (55±15)%

Calibration Procedure

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

Traceability

The measurement results are traceable to the
international system of units (SI) through National
Institute of Metrology Thailand (NIMT) Certificate
number: TT-0034-22, Certificate number: ER-0032-
21

REVIEW BY	<i>Minakorn P.</i>
APPROVED BY	<i>[Signature]</i>
NEXT CAL DATE	26/5/23

Calibrated by

- ☐ Mr. Sorawit Thachalad
☒ Miss Jitraporn Lertsomphol



Approved Signatory:

[Signature]
Mr. Parinya Booncharoen
Calibration Department Manager

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 – 40 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 13030282.

Dimension: Diameter 14 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
30	20.056	20.8	0.7	0.099
30	25.049	25.8	0.8	0.099
30	30.040	30.8	0.8	0.099
30	35.035	35.8	0.8	0.099
30	40.029	40.9	0.9	0.099

Table 2: This equipment was connected with temperature probe Model: TP3207.2 S/N: 13023259.

Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
70	20.056	20.4	0.3	0.099
70	25.049	25.3	0.3	0.099
70	30.040	30.4	0.4	0.099
70	35.035	35.3	0.3	0.099
70	40.029	40.1	0.1	0.099

Table 3: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 13044157.

Dimension: Diameter 8 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.056	20.7	0.6	0.099
110	25.049	25.8	0.8	0.099
110	30.040	30.8	0.8	0.099
110	35.035	35.8	0.8	0.099
110	40.029	40.8	0.8	0.099

UUC* : Unit Under Calibration

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

★ End of Certificate ★

CERTIFICATE OF CALIBRATION

Certificate No. : CL-012-65

Page 1 of 2

Equipment Name: Heat Stress Monitor with Sensor
Manufacturer.: DeltaOHM
Model: HD32.2
Serial No: 13024797
ID No: BKK_FS0642

Customer

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

Received date: 10 JAN 2022

Calibration date: 14 FEB 2022

Issue date: 17 FEB 2022

Reference Used During Calibration

1.Standard Temperature Probe Model: STS-100 A500,
Serial No.: 667682-09, Due date: 25 Mar 2022
2.Digital Temperature Indicator Model: DTI-1000-A MK
II, Serial No.: 671407-00591 Due date: 04 June 2022

Calibration Condition

Temperature: (23±3)°C
Relative Humidity: (55±15)%

Calibration Procedure

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

Traceability

The measurement results are traceable to the
international system of units (SI) through National
Institute of Metrology Thailand (NIMT) Certificate
number: TT-0036-21, Certificate number: ER-0032-
21

REVIEW BY

APPROVED BY

NEXT CAL. DATE

14/2/23

Calibrated by

- ☐ Mr. Sorawit Thachalad
☒ Miss Orathai Wiwatwittaya



Approved Signatory:

Mr. Parinya Booncharoen
Calibration Department Manager

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 – 40 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 13035038.
Dimension: Diameter 14 mm, Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
30	20.055	20.0	-0.1	0.099
30	25.037	25.0	0.0	0.099
30	30.019	30.0	0.0	0.099
30	35.006	35.0	0.0	0.099
30	40.002	40.0	0.0	0.099

Table 2: This equipment was connected with temperature probe Model: TP3207.2 S/N: 13033291.
Dimension: Diameter 14 mm, Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
70	20.051	20.0	-0.1	0.099
70	24.990	24.7	-0.3	0.099
70	29.917	29.5	-0.4	0.099
70	34.873	34.4	-0.5	0.099
70	39.864	39.4	-0.5	0.099

Table 3: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 13042466.
Dimension: Diameter 8 mm, Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.053	20.1	0.0	0.099
110	25.035	25.1	0.1	0.099
110	30.026	30.1	0.1	0.099
110	35.020	35.0	0.0	0.099
110	40.009	40.0	0.0	0.099

UUC* : Unit Under Calibration

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

★ End of Certificate ★



CERTIFICATE OF CALIBRATION

Certificate No. : CL-084-65
Page 1 of 2

Equipment Name: Heat Stress Monitor
Manufacturer.: DeltaOHM
Model: HD32.2
Serial No: 13024907
ID No: BKK_FSD644

Customer

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

Received date: 25 May 2022
Calibration date: 31 May 2022
Issue date: 02 Jun 2022

Reference Used During Calibration

1.Standard Temperature Probe Model: STS-100 A500,
Serial No.: 667682-09, Due date: 23 Mar 2023
2.Digital Temperature Indicator Model: DTI-1000-A MK
II, Serial No.: 671407-00591 Due date: 04 June 2022

Calibration Condition

Temperature: (23±3)°C
Relative Humidity: (55±15)%

Calibration Procedure

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

Traceability

The measurement results are traceable to the
international system of units (SI) through National
Institute of Metrology Thailand (NIMT) Certificate
number: TT-0034-22, Certificate number: ER-0032-
21

REVIEW BY

Amakorn P.

APPROVED BY

[Signature]

NEXT CAL DATE

31/5/23

Calibrated by

- ☐ Mr. Sorawit Thachalad
☒ Miss Jitraporn Lertsomphol

Approved Signatory:

[Signature]

Mr. Parinya Booncharoen
Calibration Department Manager



Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 - 40 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 13030283.
Dimension: Diameter 14 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
30	20.048	20.1	0.1	0.099
30	25.050	25.1	0.1	0.099
30	30.041	30.1	0.1	0.099
30	35.038	35.1	0.1	0.099
30	40.038	40.1	0.1	0.099

Table 2: This equipment was connected with temperature probe Model: TP3207.2 S/N: 13013675.
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
70	20.047	20.1	0.1	0.099
70	25.050	24.9	-0.1	0.099
70	30.042	29.8	-0.2	0.099
70	35.039	34.7	-0.3	0.099
70	40.038	39.6	-0.4	0.099

Table 3: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 13030457.
Dimension: Diameter 8 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.047	20.6	0.6	0.099
110	25.050	25.6	0.6	0.099
110	30.042	30.6	0.6	0.099
110	35.039	35.6	0.6	0.099
110	40.038	40.6	0.6	0.099

UUC* : Unit Under Calibration

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

★ End of Certificate ★