

## ภาคผนวก ง

เอกสารการสอบเทียบเครื่องมือตรวจวิเคราะห์





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รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Ambient	Particulate Matter (PM-10)	High Volume	BKK_FS0385	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	High Volume	BKK_FS1063	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	High Volume	BKK_FS1062	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	Digital Balance	BKK_EN0004	8-Feb-23	8-Feb-24	12
Ambient	Total Suspended Particulate	High Volume	BKK_FS0372	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	BKK_FS1059	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	BKK_FS1058	-	-	On site Calibration
Ambient	Total Suspended Particulate	Digital Balance	BKK_EN0004	8-Feb-23	8-Feb-24	12
Ambient	Iron as FeO <sub>2</sub>	High Volume	BKK_FS0372	-	-	On site Calibration
Ambient	Iron as FeO <sub>2</sub>	High Volume	BKK_FS1059	-	-	On site Calibration
Ambient	Iron as FeO <sub>2</sub>	High Volume	BKK_FS1058	-	-	On site Calibration
Ambient	Iron as FeO <sub>2</sub>	ICP-OES	BKK_EL0037	20-Mar-23	19-Sep-24	18
Ambient	Nitrogen Dioxide	NO <sub>2</sub> Analyzer	BKK_FS0779	1-Jul-23	1-Jan-24	6
Ambient	Nitrogen Dioxide	NO <sub>2</sub> Analyzer	BKK_FS1090	1-Jul-23	1-Jan-24	6
Ambient	Nitrogen Dioxide	NO <sub>2</sub> Analyzer	BKK_FS0785	1-Jul-23	1-Jan-24	6
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	BKK_FS0161	17-Mar-22	15-Sep-23	18
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_FS0159	23-Nov-22	23-May-24	18
Stack	Oxides of Nitrogen	Console Control Unit	BKK_FS0496	4-Jul-23	4-Jan-24	6
Stack	Oxides of Nitrogen	Flue gas Analyzer	BKK_FS1160	11-Jan-23	11-Jan-24	12
Stack	Oxides of Nitrogen	Vacuum Gauge	BKK_FS0894	21-Jul-22	19-Jan-24	18
Stack	Oxides of Nitrogen	Spectrophotometer	BKK_EN0018	16-Sep-22	16-Sep-23	12
Stack	Total Suspended Particulate	Console Control Unit	BKK_FS0496	4-Jul-23	4-Jan-24	6
Stack	Total Suspended Particulate	Console Control Unit	BKK_FS0485	4-Jul-23	3-Jan-24	6
Stack	Total Suspended Particulate	Flue gas Analyzer	BKK_FS1160	11-Jan-23	11-Jan-24	12
Stack	Total Suspended Particulate	Flue gas Analyzer	BKK_FS1095	25-Nov-22	25-Nov-23	12
Stack	Total Suspended Particulate	Digital Balance	BKK_EN0002	8-Feb-23	8-Feb-24	12
Stack	Triethanolamine	Console Control Unit	BKK_FS0496	4-Jul-23	4-Jan-24	6
Stack	Triethanolamine	Flue gas Analyzer	BKK_FS1160	11-Jan-23	11-Jan-24	12
Stack	Triethanolamine	Dry Gas	BKK_FS0505	3-Jul-23	3-Jan-24	6
Workplace	Total Dust	Field Rotameter	BKK_FS1028	1-Jul-23	1-Oct-23	3
Workplace	Total Dust	Field Rotameter	BKK_FS0591	3-Jul-23	3-Oct-23	3
Workplace	Total Dust	Field Rotameter	BKK_FS1202	2-Oct-23	2-Jan-24	3
Workplace	Total Dust	Digital Balance	BKK_EN0004	8-Feb-23	8-Feb-24	12
Workplace	Respirable Dust	Field Rotameter	BKK_FS1028	1-Jul-23	1-Oct-23	3
Workplace	Respirable Dust	Field Rotameter	BKK_FS0591	3-Jul-23	3-Oct-23	3
Workplace	Respirable Dust	Field Rotameter	BKK_FS1202	2-Oct-23	2-Jan-24	3
Workplace	Respirable Dust	Digital Balance	BKK_EN0004	8-Feb-23	8-Feb-24	12
Workplace	Chromium	Field Rotameter	BKK_FS1028	1-Jul-23	1-Oct-23	3
Workplace	Chromium	Field Rotameter	BKK_FS1202	2-Oct-23	2-Jan-24	3
Workplace	Chromium	ICP-OES	BKK_EL0037	20-Mar-23	19-Sep-24	18
Workplace	Silica (SiO <sub>2</sub> )	Field Rotameter	BKK_FS1028	1-Jul-23	1-Oct-23	3
Workplace	Silica (SiO <sub>2</sub> )	Field Rotameter	BKK_FS1202	2-Oct-23	2-Jan-24	3
Workplace	Silica (SiO <sub>2</sub> )	Spectrophotometer	BKK_EN0018	15-Sep-23	15-Sep-24	12
Workplace	Manganese	Field Rotameter	BKK_FS1028	1-Jul-23	1-Oct-23	3
Workplace	Manganese	Field Rotameter	BKK_FS1202	2-Oct-23	2-Jan-24	3
Workplace	Manganese	ICP-OES	BKK_EL0037	20-Mar-23	19-Sep-24	18
Workplace	Triethanolamine	Field Rotameter	BKK_FS1028	1-Jul-23	1-Oct-23	3
Workplace	Triethanolamine	Field Rotameter	BKK_FS1202	2-Oct-23	2-Jan-24	3





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รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Noise	Leq 24 hrs	Sound Calibrator	BKK_FS0618	7-Dec-22	7-Dec-23	12
Noise	Leq 24 hrs	Sound Level Meter	BKK_FS0101	29-May-23	29-May-24	12
Noise	Leq 24 hrs	Sound Level Meter	BKK_FS0969	19-Jan-23	19-Jan-24	12
Noise	Leq 24 hrs	Sound Level Meter	BKK_FS0107	2-Nov-22	2-Nov-23	12
Noise	Leq 24 hrs	Sound Level Meter	BKK_FS0968	19-Jan-23	19-Jan-24	12
Noise	Noise Annoyance	Sound Calibrator	BKK_FS0630	26-Apr-22	26-Apr-23	12
Noise	Noise Annoyance	Sound Level Meter	BKK_FS0100	11-Jul-22	11-Jul-23	12
Noise	Noise Annoyance	Sound Level Meter	BKK_FS0098	15-Aug-22	15-Aug-23	12
Noise	Noise Annoyance	Sound Calibrator	BKK_FS0630	26-Apr-22	26-Apr-23	12
Noise	Noise Annoyance	Sound Level Meter	BKK_FS0100	11-Jul-22	11-Jul-23	12
Noise	Noise Annoyance	Sound Level Meter	BKK_FS0098	15-Aug-22	15-Aug-23	12
Noise	Noise Annoyance	Sound Calibrator	BKK_FS0630	26-Apr-22	26-Apr-23	12
Noise	Noise Annoyance	Sound Level Meter	BKK_FS0106	2-Nov-22	2-Nov-23	12
Noise	Noise Annoyance	Sound Level Meter	BKK_FS0111	16-Dec-22	16-Dec-23	12
Noise	Noise Contour	Sound Calibrator	BKK_FS0631	20-Dec-22	20-Dec-23	18
Noise	Noise Contour	Sound Level Meter	BKK_FS0994	7-Sep-22	7-Sep-23	12
Noise	Noise Contour	Sound Level Meter	BKK_FS0993	25-Oct-22	25-Oct-23	12
Noise	Leq 8 hrs	Sound Calibrator	BKK_FS0630	25-May-23	25-May-24	12
Noise	Leq 8 hrs	Sound Level Meter	BKK_FS1214	12-Oct-22	12-Oct-23	12
Noise	Leq 8 hrs	Sound Level Meter	BKK_FS0111	16-Dec-22	16-Dec-23	12
Noise	Leq 8 hrs	Sound Level Meter	BKK_FS0110	3-Jan-23	3-Jan-24	12
Noise	Leq 8 hrs	Sound Calibrator	BKK_FS0630	25-May-23	25-May-24	12
Noise	Leq 8 hrs	Sound Level Meter	BKK_FS1223	4-Nov-22	4-Nov-23	12
Noise	Leq 8 hrs	Sound Level Meter	BKK_FS1222	8-Nov-22	8-Nov-23	12
Noise	Leq 8 hrs	Sound Level Meter	BKK_FS1224	4-Nov-22	4-Nov-23	12
Heat	Heat Stress	Heat Stress Monitor	BKK_FS0682	21-Nov-22	21-Nov-23	12
Heat	Heat Stress	Heat Stress Monitor	BKK_FS0681	21-Nov-22	21-Nov-23	12
Heat	Heat Stress	Heat Stress Monitor	BKK_FS0672	22-Feb-23	22-Feb-24	12
Heat	Heat Stress	Heat Stress Monitor	BKK_FS0680	7-Apr-23	7-Apr-24	12
Water Lab	pH at 25 °C	pH meter	BKK_EN0072	12-Sep-22	12-Mar-24	18
Water Lab	Total Suspended Solids	Electronic Top-Loading Balance	BKK_EN0002	8-Feb-23	8-Feb-24	12
Water Lab	Total Suspended Solids	Oven	BKK_EN0273	29-Nov-22	29-May-24	18
Water Lab	BOD	DO Meter	BKK_EN0205	3-Aug-22	3-Feb-24	18
Water Lab	BOD	Incubator	BKK_EN0304	5-Apr-23	5-Apr-24	12
Water Lab	COD	Hot Block	BKK_EN0222	25-Apr-23	25-Apr-24	12
Water Lab	COD	Spectrophotometer	BKK_EN0018	15-Sep-23	15-Sep-24	12
Water Lab	Dissolved Oxygen	Burette	BKK_EN0171	30-Aug-22	1-Mar-24	18
Water Lab	Dissolved Oxygen	Chamber (Cold Room)	BKK_EN0167	30-Jun-22	30-Dec-23	18
Water Lab	Oil & Grease	Electronic Top-Loading Balance	BKK_EN0002	8-Feb-23	8-Feb-24	12
Water Lab	Oil & Grease	Water Bath	BKK_EN0148	4-Jul-23	4-Jan-25	18
Water Lab	Total Kjeldahl Nitrogen	Digestion Unit	BKK_EN0366	17-May-23	17-May-24	12
Water Lab	Total Kjeldahl Nitrogen	Discrete analyzer	BKK_EN0037	12-Jul-23	12-Jul-24	12
Water Lab	Total Dissolved Solids 180°C	Electronic Top-Loading Balance	BKK_EN0002	8-Feb-23	8-Feb-24	12
Water Lab	Total Dissolved Solids 180°C	Oven	BKK_EN0273	29-Nov-22	29-May-24	18
Water Lab	Chromium	ICP-MS	BKK_EL0026	12-Jun-23	11-Jun-24	12
Water Lab	Chromium	Hot Block	BKK_EL0054	22-Sep-23	22-Mar-25	18
Water Lab	Chromium	Chamber (Cold Room)	BKK_EN0167	30-Jun-22	30-Dec-23	18
Water Lab	Iron	ICP-MS	BKK_EL0026	12-Jun-23	11-Jun-24	12
Water Lab	Iron	Hot Block	BKK_EL0054	22-Sep-23	22-Mar-25	18
Water Lab	Iron	Chamber (Cold Room)	BKK_EN0167	30-Jun-22	30-Dec-23	18
Water Lab	Manganese	ICP-MS	BKK_EL0026	12-Jun-23	11-Jun-24	12
Water Lab	Manganese	Hot Block	BKK_EL0054	22-Sep-23	22-Mar-25	18
Water Lab	Manganese	Chamber (Cold Room)	BKK_EN0167	30-Jun-22	30-Dec-23	18

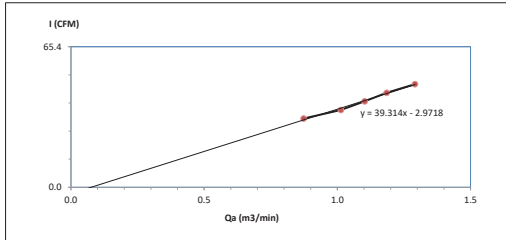




### High Volume Air Sampler Calibration Worksheet

Project Site : Magotteaux Co.,Ltd. Barometric Pressure (mm Hg) : 754  
Calibrate Location : กรุงเทพมหานคร (A1) Temperature (°C) : 33  
Calibrate Date : 14-Jul-23 High Volume ID : BKK\_FS0385  
CalibrationSheet No.: C-140723-BKK\_FS0385 High Volume Model : TE-5009X  
Calibrator ID: BKK\_FS0625 High Volume S/N: 4789  
Calibrator Model : TE-5028A Calibrator Slope : 1.04104  
Calibrator S/N : 2585 Calibrator Intercept : -0.00779

Test No.	Delta H <sub>2</sub> O (inch)	Qa (m <sup>3</sup> /min)	I: Chart (CFM)	Linear Regression
1	2.0	0.873	32	Slope : 39.3137 Intercept : -2.9718 Correlation Coefficient : 0.9953
2	2.7	1.013	36	
3	3.2	1.102	40	
4	3.7	1.185	44	
5	4.4	1.291	48	



Calibrated by : (Mr. Teeravut Sukdee) Field Scientist(2)  
Approved by : (Mr. Noppong Juntarupan) Enviro Field Coordinator Scientist (3)

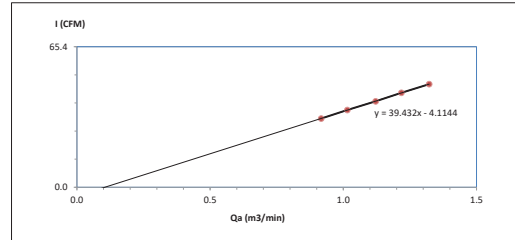
FORM NO.: F 06-074 REVISION NO.: ISSUE DATE: 14/03/16



### High Volume Air Sampler Calibration Worksheet

Project Site : Magotteaux Co.,Ltd. Barometric Pressure (mm Hg) : 754  
Calibrate Location : กรุงเทพมหานคร (A2) Temperature (°C) : 34  
Calibrate Date : 14-Jul-23 High Volume ID : BKK\_FS1063  
CalibrationSheet No.: C-140723-BKK\_FS1063 High Volume Model : TE-5009X  
Calibrator ID: BKK\_FS0625 High Volume S/N: 5685  
Calibrator Model : TE-5028A Calibrator Slope : 1.04104  
Calibrator S/N : 2585 Calibrator Intercept : -0.00779

Test No.	Delta H <sub>2</sub> O (inch)	Qa (m <sup>3</sup> /min)	I: Chart (CFM)	Linear Regression
1	2.2	0.917	32	Slope : 39.4319 Intercept : -4.1144 Correlation Coefficient : 0.9999
2	2.7	1.015	36	
3	3.3	1.121	40	
4	3.9	1.218	44	
5	4.6	1.322	48	



Calibrated by : (Mr. Teeravut Sukdee) Field Scientist(2)  
Approved by : (Mr. Noppong Juntarupan) Enviro Field Coordinator Scientist (3)

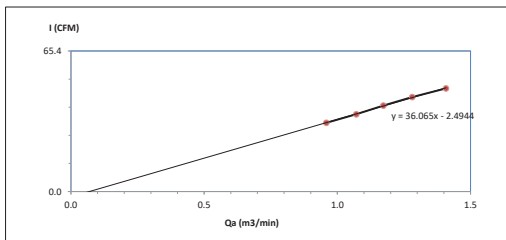
FORM NO.: F 06-074 REVISION NO.: ISSUE DATE: 14/03/16



### High Volume Air Sampler Calibration Worksheet

Project Site : Magotteaux Co.,Ltd. Barometric Pressure (mm Hg) : 754  
Calibrate Location : กรุงเทพมหานคร (A3) Temperature (°C) : 35  
Calibrate Date : 14-Jul-23 High Volume ID : BKK\_FS1062  
CalibrationSheet No.: C-140723-BKK\_FS1062 High Volume Model : TE-5009X  
Calibrator ID: BKK\_FS0625 High Volume S/N: 5686  
Calibrator Model : TE-5028A Calibrator Slope : 1.04104  
Calibrator S/N : 2585 Calibrator Intercept : -0.00779

Test No.	Delta H <sub>2</sub> O (inch)	Qa (m <sup>3</sup> /min)	I: Chart (CFM)	Linear Regression
1	2.4	0.959	32	Slope : 36.0651 Intercept : -2.4944 Correlation Coefficient : 0.9993
2	3.0	1.071	36	
3	3.6	1.173	40	
4	4.3	1.281	44	
5	5.2	1.408	48	



Calibrated by : (Mr. Teeravut Sukdee) Field Scientist(2)  
Approved by : (Mr. Noppong Juntarupan) Enviro Field Coordinator Scientist (3)

FORM NO.: F 06-074 REVISION NO.: ISSUE DATE: 14/03/16

Sartorius (Thailand) Co., Ltd.  
129 Rama 9 Road, Huaykwang, Huaykwang, Bangkok 10310  
Tel: +66 2643 9361-5, e-mail: sartorius.thailand@sartorius.com



SARTORIUS

Certificate of Calibration

Model Number : XP105DU  
Description : Semi-micro Balance  
Serial Number : 1123091884  
ID No. : BKK\_EN0004  
Manufacturer : Mettler Toledo

Certificate No. : 23BC10071  
Issued Date : Monday, February 13, 2023  
Reference No. : 203245  
Page No. : 1 of 3

Customer Name : ALS Laboratory Group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan, Khet Suan Luang, Bangkok 10250.  
Calibrated Place : Balance Room.

Calibrated By : Mr. Chonchai Inthana  
Calibration Date : Wednesday, February 08, 2023  
Calibration Procedure No. : This calibration was conducted by Using in-house calibration procedure number (WI-003) Based on UKAS LAB 14 : 2018

Metrological data : Capacity : 31/120 g Readability : 0.0001 g  
Ambients Conditions : Temperature : 21.0 °C ± 3.0 °C  
Humidity : 65.0 % RH ± 5.0 % RH  
Pressure : ±

Reasons for calibration : ☐ New Installation ☐ Service / Repair ☒ Recalibratory Maintenance  
Equipment Condition : ☒ Good Operate ☐ Fair

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

Traceability:  
Model Number : YCS011-522-00 Description : Sartorius weight set 1mg - 1kg E2 s/n 37629119 Traceability : SPC-RT Certificate No. : C02212585 Due Date : 14-Sep-2023  
MHB-382SD Humidity/Barometer/Temp. Lutron MHB-382SD Traceability : DKSH Certificate No. : C19220444 Due Date : 5-Sep-2023

This certificate relate and apply this equipment only.  
This certificate may not be reproduced other than in full except with the prior written approval of the Verification Operation Division Sartorius (Thailand) Co., Ltd.  
Mr. Chonchai Inthana (Technical Manager)



# Certificate of Calibration

Model Number : XP105DU  
Description : Semi-micro Balance  
Serial Number : 1123091884  
ID No. : BKK\_EN0004  
Manufacturer : Mettler Toledo

Certificate No. : 23BCI0071  
Issued Date : Monday, February 13, 2023  
Reference No. : 203245  
Page No. : 2 of 3

## Calibration Results : Without Adjustment

Repeatability			Eccentricity (Off-center loading error)		
The repeatability is the ability of a weighing instrument to display nearly identical readings under constant test conditions when the same load within a measurement series is placed repeatedly on the weighing pan in the same manner. The standard deviation is used to express repeatability quantitatively.			The off-center loading error is yielded by the difference between the readout of the load, i.e. 1/3 or 1/4 of maximum capacity, placed in the middle of the weighing pan and between each of four additional measurement points (positions defined according to OIML R111).		
Nominal Value : (Low Load)	2.00002	20.00002	Nominal value :	20	g
2 g	2.00001	20.00001	Tolerance	N/A	g
Tolerance	2.00002	20.00001	Difference		
N/A g	2.00002	20.00001	1		
	2.00002	20.00000	2		
Nominal Value : (High Load)	2.00002	20.00000	3		
20 g	2.00002	20.00001	4		
Tolerance	2.00002	20.00000	5		
N/A g	2.00001	20.00000	6		
	2.00001	20.00001			
Standard Deviation	0.000005	0.000007			

Linearity				
The linearity, also called linearity error. Describes the deviation of the characteristic curve of a weighing instrument from the linear slope.				
Tolerance	N/A	g		
Nominal Value	Conventional Mass Value	Displayed Value	Deviation	Uncertainty
(g)	(g)	(g)	(g)	(g)
0.1	0.10000	0.10000	0.00000	0.000023
0.5	0.50001	0.50000	-0.00001	0.000023
1	1.00000	1.00000	0.00000	0.000024
2	2.00002	2.00001	-0.00001	0.000026
5	5.00002	5.00002	0.00000	0.000030
10	10.00002	10.00002	0.00000	0.000035
15	15.00004	15.00004	0.00000	0.000053
20	20.00000	20.00000	0.00000	0.000053
25	25.00002	25.00002	0.00000	0.000069
30	30.00002	30.00004	0.00002	0.000069

SOP FM 33 03 February 2022

# Certificate of Calibration

Model Number : XS105DU  
Description : Semi-micro Balance  
Serial Number : 1123091884  
ID No. : BKK\_EN0004  
Manufacturer : Mettler Toledo

Certificate No. : 23BCI0071  
Issued Date : Monday, February 13, 2023  
Reference No. : 203245  
Page No. : 3 of 3

## Calibration Results : Without Adjustment

Repeatability			Eccentricity (Off-center loading error)		
The repeatability is the ability of a weighing instrument to display nearly identical readings under constant test conditions when the same load within a measurement series is placed repeatedly on the weighing pan in the same manner. The standard deviation is used to express repeatability quantitatively.			The off-center loading error is yielded by the difference between the readout of the load, i.e. 1/3 or 1/4 of maximum capacity, placed in the middle of the weighing pan and between each of four additional measurement points (positions defined according to OIML R111).		
Nominal Value : (Low Load)	100.0000	100.0000	Nominal value :	100	g
100 g	100.0000	100.0000	Tolerance	N/A	g
Tolerance	100.0000	100.0000	Difference		
N/A g	100.0000	100.0000	1		
	100.0000	100.0000	2		
Nominal Value : (High Load)	100.0000	100.0000	3		
100 g	99.9999	100.0000	4		
Tolerance	100.0000	100.0000	5		
N/A g	100.0000	100.0000	6		
	100.0000	100.0000			
Standard Deviation	0.00003				

Linearity				
The linearity, also called linearity error. Describes the deviation of the characteristic curve of a weighing instrument from the linear slope.				
Tolerance	N/A	g		
Nominal Value	Conventional Mass Value	Displayed Value	Deviation	Uncertainty
(g)	(g)	(g)	(g)	(g)
50	50.0000	50.0000	0.0000	0.00012
55	55.0000	55.0000	0.0000	0.00015
60	60.0000	60.0000	0.0000	0.00015
65	65.0001	65.0001	0.0000	0.00015
70	70.0000	70.0000	0.0000	0.00017
80	80.0000	80.0000	0.0000	0.00018
90	90.0001	90.0001	0.0000	0.00018
100	100.0000	100.0000	0.0000	0.00026
110	110.0000	110.0000	0.0000	0.00026
120	120.0000	120.0000	0.0000	0.00026

SOP FM 33 03 February 2022

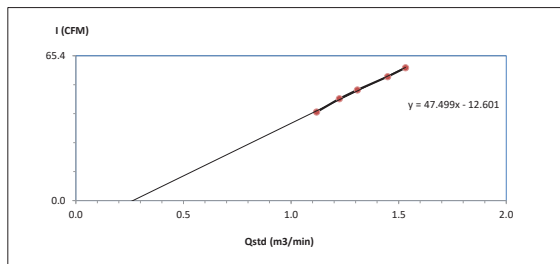


## High Volume Air Sampler Calibration Worksheet

Project Site : Magotteaux Co., Ltd.  
Calibrate Location : รังนกฟาร์ม (A1)  
Calibrate Date : 14-Jul-23  
CalibrationSheet No. : C-140723-BKK FS0372  
Calibrator ID : BKK FS0625  
Calibrator Model : TE-5028A  
Calibrator S/N : 2585

Barometric Pressure (mm Hg) : 754  
Temperature (°C) : 33  
High Volume ID : BKK FS0372  
High Volume Model : TE-5009X  
High Volume S/N : 5332  
Calibrator Slope : 1.66209  
Calibrator Intercept : -0.01241

Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>std</sub> (m <sup>3</sup> /min)	I : Chart (CFM)	Linear Regression
1	3.5	1.1188	40	Slope : 47.4988 Intercept : -12.6006 Correlation Coefficient : 0.9984
2	4.2	1.2244	46	
3	4.8	1.3081	50	
4	5.9	1.4489	56	
5	6.6	1.5317	60	



Calibrated by : (Mr. Teeravut Sukdee)  
Field Scientist(2)

Approved by : (Mr. Noppog Juntarup)  
Enviro Field Coordinator Scientist (3)

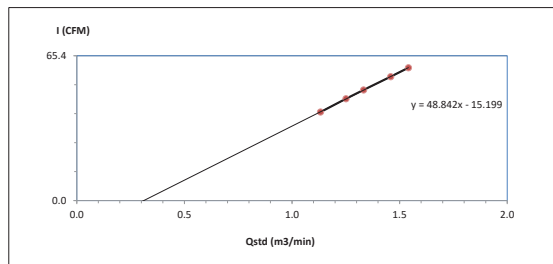


## High Volume Air Sampler Calibration Worksheet

Project Site : Magotteaux Co., Ltd.  
Calibrate Location : รังนกฟาร์ม (A2)  
Calibrate Date : 14-Jul-23  
CalibrationSheet No. : C-140723-BKK FS1059  
Calibrator ID : BKK FS0625  
Calibrator Model : TE-5028A  
Calibrator S/N : 2585

Barometric Pressure (mm Hg) : 754  
Temperature (°C) : 34  
High Volume ID : BKK FS1059  
High Volume Model : TE-5009X  
High Volume S/N : 5693  
Calibrator Slope : 1.66209  
Calibrator Intercept : -0.01241

Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>std</sub> (m <sup>3</sup> /min)	I : Chart (CFM)	Linear Regression
1	3.6	1.1327	40	Slope : 48.8416 Intercept : -15.1988 Correlation Coefficient : 0.9999
2	4.4	1.2509	46	
3	5.0	1.3326	50	
4	6.0	1.4586	56	
5	6.7	1.5407	60	



Calibrated by : (Mr. Teeravut Sukdee)  
Field Scientist(2)

Approved by : (Mr. Noppog Juntarup)  
Enviro Field Coordinator Scientist (3)

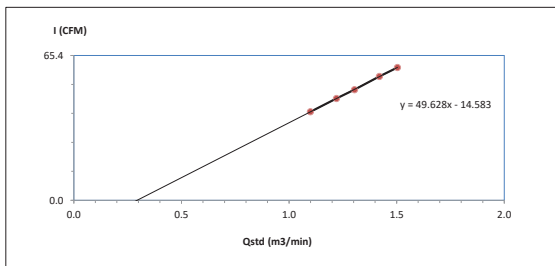






## High Volume Air Sampler Calibration Worksheet

Project Site :	Magotteaux Co., Ltd.	Barometric Pressure (mm Hg) :	754
Calibrate Location :	โรงงานอุตสาหกรรม (A3)	Temperature (°C) :	35
Calibrate Date :	14-Jul-23	High Volume ID :	BKK_FS1058
Calibration Sheet No.:	C-140723-BKK_FS1058	High Volume Model :	TE-5009X
Calibrator ID :	BKK_FS0625	High Volume S/N :	5689
Calibrator Model :	TE-5028A	Calibrator Slope :	1.66209
Calibrator S/N :	2585	Calibrator Intercept :	-0.01241

Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>std</sub> (m <sup>3</sup> /min)	I: Chart (CFM)	Linear Regression
1	3.4	1.0993	40	Slope : 49.6281 Intercept : -14.5828 Correlation Coefficient : 0.9999
2	4.2	1.2204	46	
3	4.8	1.3039	50	
4	5.7	1.4197	56	
5	6.4	1.5036	60	



Calibrated by   
(Mr. Teeravut Sukdee)  
Field Scientist(2)

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

FORM NO.: F 06-073 REVISION NO.: ISSUE DATE: 14/03/16



Agilent Technologies (Thailand) Limited  
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Bangkok 10500 Thailand  
Tel: +662 637 6363  
Fax: +662 632 4334  
Email: ccc-smt@agilent.com  
Website: www.agilent.com/th/en

### Customer Contact:

ALS Laboratory Group (Thailand) Co Ltd  
Head Office  
104 Phatthanakan 40 Phatthanakan Rd  
Khwaeng Phatthanakan Khet Suan  
TAX ID : 0105540004859  
Chanattagam.lmchom@alsglobal.com  
27603068

### Invoice To:

ALS Laboratory Group (Thailand) Co Ltd  
Head Office  
104 Phatthanakan 40 Phatthanakan Rd  
Khwaeng Phatthanakan Khet Suan

### SERVICE REPORT

Customer Purchase Order Number:	Customer Number: 70371013
Service Request:	Service Request Date:
Service Order: 6060033911	Service Confirmation: 6904800924



### Delivery Site:

ALS Laboratory Group (Thailand) Co Ltd  
Head Office  
104 Phatthanakan 40 Phatthanakan Rd  
Khwaeng Phatthanakan Khet Suan

### Location:

Room  
Bldg  
Lab  
Dept

### Direct Inquiries to:

Contact Name: Customer Contact Center  
Contact E-mail: ccc-smt@agilent.com  
Contact Telephone: +662 637 6363  
Contact Fax: +662 632 4334

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Tax ID : 0105540004859

Orbitbank N.A. Bangkok Branch  
399 Interchange 21 Building, Sukkumvit Road, Klongtoey New Sub-district, Wattana District, Bangkok 10110 Thailand  
Acc. No. 012-4452-007  
THB-Krung Thai Bank PCL  
Siam Square Bldg. 116/1-2 Rama 1 Rd. Pathumwan, BKK 10330 Thailand

ORIGINAL

Page 1 of 3

Service Confirmation Number: 6904800924  
Service Confirmation Date: 20.03.2023

Service Confirmation Number: 6904800924  
Service Confirmation Date: 20.03.2023

### Service Instrument:

Model Number	Model Description	Serial Number	System Handle	Parent Asset
SYS-ID-5100	ICP-OES 5100/5110 System			
G8018A	Agilent 5100 SVDV ICP-OES Spectrometer	MY1H010005	ICP OES 5100	SYS-ID-5100
G8418A	SPS 4 Autosampler	AU15A0784	ICP OES 5100	SYS-ID-5100

### Service Items:

Item	Service/Part #	Description	Qty	Entitlement	Service Start	Service End
1000	EQO	Enterprise Operational Qualification	1.00	Agreement Entitlement - 100 % covered	20.03.2023	20.03.2023

### Additional Information:

### Service Information:

Problem Description: WU-S-QG-ID-5100-5001143313		
Service Provided: Complete OOHV 5100ICPOES Equipment ID: BKK_FL0037, all tests passed		
Service Overview Code: Reason Code: Scheduled Service Diagnosis Code: Scheduled Service Resolution Code: Scheduled Service		
Reported Hours: 4.0	Travel Hours: 2.0	
Customer Field Service Representative Name: Kanyakorn Sukpharajaree	Customer Field Service Representative Signature: 	Date: 20 Mar 2023
Customer Name: Thitima Boonpeng	Customer Signature: 	Date: 20 Mar 2023
Additional Comments:		

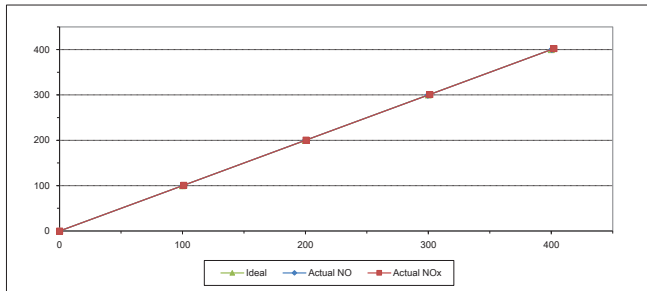




### MULTIPOINT CALIBRATION REPORT

Calibration Date	1-Jul-23	Equipment Name	NOx Analyzer
Manufacturer	HORIBA	Model	APNA-370
Serial No.	VJVGBEEP	Equipment ID	BKK_FS0779
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	100.10	0.10	0.10	101.00	1.00	1.00
2	200.00	199.80	-0.20	-0.10	200.50	0.50	0.25
3	300.00	299.60	-0.40	-0.13	301.20	1.20	0.40
4	400.00	400.50	0.50	0.13	402.20	2.20	0.55
AVERAGE (%)				0.02			0.46



Calibrated By

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

Approved By

(Mr.Sarayuth Jitranont)  
Assistant General Manager

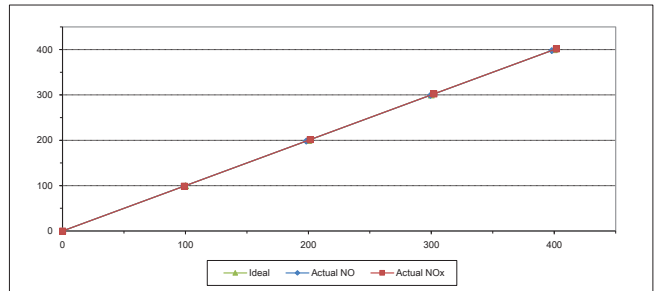
ALS Laboratory Group  
FORM NO.: F 06-056 REVISION NO.: ISSUE DATE: 02/04/12



### MULTIPOINT CALIBRATION REPORT

Calibration Date	1-Jul-23	Equipment Name	NOx Analyzer
Manufacturer	HORIBA	Model	APNA-370
Serial No.	SUDL58MU	Equipment ID	BKK_FS1090
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	98.70	-1.30	-1.30	99.10	-0.90	-0.90
2	200.00	198.30	-1.70	-0.85	201.50	1.50	0.75
3	300.00	299.30	-0.70	-0.23	302.20	2.20	0.73
4	400.00	398.00	-2.00	-0.50	401.70	1.70	0.42
AVERAGE (%)				-0.56			0.22



Calibrated By

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

Approved By

(Mr.Sarayuth Jitranont)  
Assistant General Manager

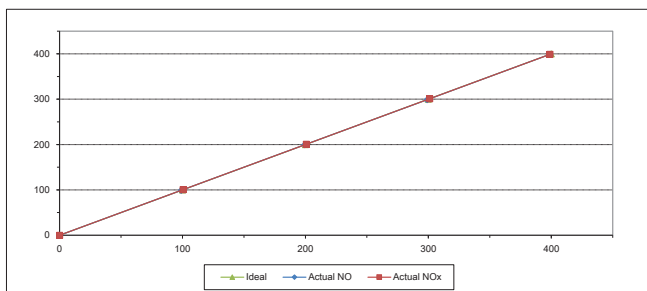
ALS Laboratory Group  
FORM NO.: F 06-056 REVISION NO.: ISSUE DATE: 02/04/12



### MULTIPOINT CALIBRATION REPORT

Calibration Date	1-Jul-23	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 Sakam)  
Field Environmental Scientist (3)

Approved By

(Mr.Sarayuth Jitranont)  
Assistant General Manager

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



63/14-15,67/35-36, Soi Petchkasem 7,7/1, Petchkasem Rd,  
Wathapra, Bangkokyai, Bangkok 10600 Thailand.  
Tel: (66) 02-8680812#13 Fax: (66) 02-8680860 www.jiranatee.com

### CERTIFICATE OF CALIBRATION

Certificate No: WS-02032022  
Page 1 of 2 pages

Measurement Item : Cup anemometer with data logger

Manufacturer : Data logger: Novatek

: Cup anemometer: Novatek

Model/Type : Data logger: 200-W9-20L8

: Cup anemometer: WS-02P

Serial Number : Data logger: A4916

: Cup anemometer: -

ID No : Data logger: BKK\_FS0161

: Cup anemometer: -

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

Test Conditions : Wind tunnel, cross test section area

: Anemometer frontal area

: Diameter of mounting pipe

: Blockage ratio of test object

Test Conditions : Air temperature

: Air pressure

: Relative air humidity

Calibration Procedure : Calibration was carried out base on:

: ISO 91403-12-1 (Q1): 2008-Performance Measurements of Electricity Producing Wind

Turbines

: MSA/NET Anemometer Calibration Procedure - Version 2: 2009

Traceability : This calibration documents the traceability 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 : MAR 17, 2022

Issued Date : MAR 21, 2022

Calibrated by : Mr. Sornchai Thachakud

: Miss Oranai Whaiyutayee



Approved Signatory: 25/6

Mr. Panyai Booncharoen

Calibration Department Manager

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Continuation of Certificate of Calibration Number

Certificate No: WS-02032022  
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 <sub>ref</sub> Reading m/s	V <sub>ref</sub> Reading m/s	Error (m/s)	Uncertainty (%)
2.090	1.9	-0.2	2.5
4.138	4.1	0.0	1.7
5.98	6.1	0.1	1.1
8.00	8.0	0.0	2.2
10.01	10.0	0.0	1.4
11.95	12.0	0.0	1.9
14.04	14.1	0.1	1.5
15.95	16.0	0.0	1.6
18.99	19.1	0.1	2.0
12.98	12.9	-0.1	0.85
10.98	11.0	0.0	1.1
9.01	9.0	0.0	0.85
7.00	7.0	0.0	0.94
5.204	5.1	-0.1	0.93
2.995	3.0	0.0	1.2
1.031	0.8	-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	Pilot static	TOPTO INC.	00352145	Aug. 07, 2021	MW-0034-21	5 ~ 30 m/s
2	Precision Differential Pressure Meter	Zagiab	DFM2500	Aug. 07, 2021	MW-0034-21	5 ~ 30 m/s
3	AI-velocity transducer (hot wire)	TSP INC.	8455-12	Aug. 08, 2021	MW-0035-21	0 ~ 5 m/s
4	Temperature	Zagiab	DSR-T1P	March 30, 2021	CL-077-64	-30 ~ 70°C
5	Relative humidity	Zagiab	DSR-T1P	March 30, 2021	PH-0303-2021	0 ~ 100 %RH
6	Atmospheric pressure	Zagiab	DSR-T1P	March 30, 2021	BP-01630-2021	800 ~ 1100 hPa
7	Wind tunnel	SRGM	MP3303	-	-	0 ~ 50 Hz

\*\*\*End of certificate of calibration\*\*\*



**CERTIFICATE OF CALIBRATION**

Certificate No: WD-02032022  
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-25L8  
Wind direction sensor: WS-02P

Serial Number : Data logger: A4916  
Wind direction sensor: -

ID No : Data logger: BKH\_PS0161  
Wind direction sensor: -

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

Environmental Condition:  
The measurement was carried out in an ambient temperature of (23±3) °C, and relative humidity of (40±10) %.

Measurement Method:

The wind direction sensor calibration according to comparison method with reference angle measurement electronic theodolite and the 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: 021065014, Certificate No: KWS64/0025.

Measurement Date : MAR 17, 2022.  
Issued Date : MAR 21, 2022.

Calibrated by  
☒ Mr. Sorawit Thachalad  
☐ Miss Orathai Whattabaiya



Approved Signatory:   
Mr. Parinya Booncharoen  
Calibration Department Manager

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Continuation of Certificate of Calibration Number

Certificate No: WO-02032022  
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	0	0	0	3.0
2		45	45	43	-2	3.0
3		90	90	87	-3	3.0
4		135	135	133	-2	3.0
5		180	180	180	0	3.0
6		225	225	228	3	3.0
7		270	270	274	4	3.0
8		315	315	319	4	3.0
9	Counter Clockwise	0/360	0	0	0	3.0
10		45	45	43	-2	3.0
11		90	90	87	-3	3.0
12		135	135	133	-2	3.0
13		180	180	180	0	3.0
14		225	225	228	3	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: WS-01052022  
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-25DL  
Cup anemometer: WS-02P

Serial Number : Data logger: A4940  
Cup anemometer: -

ID No : Data logger: BKH\_PS0165  
Cup anemometer: -

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

Test Conditions : Wind tunnel cross test section area 900 cm<sup>2</sup>  
Anemometer frontal area 100 cm<sup>2</sup>  
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 ED1: 2005-Power Performance Measurements of Electricity Producing Wind Turbines;  
MCSANCT 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 Thachalad  
☐ Miss Jitraporn Lerttongphol



Approved Signatory:   
Mr. Parinya Booncharoen  
Calibration Department Manager

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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 <sub>ind</sub> Reading m/s	V <sub>ind</sub> 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	10.2	0.2	0.68
11.99	12.2	0.2	0.72
14.02	14.3	0.3	0.47
16.00	16.3	0.3	0.43
18.02	18.3	0.3	0.65
12.99	13.1	0.1	0.61
11.01	11.2	0.2	0.63
9.01	9.1	0.1	0.69
7.00	7.0	0.0	0.90
5.165	5.1	-0.1	0.86
3.009	3.0	0.0	1.7
1.027	0.8	-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	Pilot static	TESCO INC.	0532145	Aug 07, 2021	MW-0034-21	5 ~ 30 m/s
2	Precision Differential Pressure Meter	Zorglab	DPM2000	Aug 07, 2021	MW-0034-21	5 ~ 30 m/s
3	Air velocity transducer (hot wire)	TSI INC.	8445-12	Aug 08, 2021	MW-0035-21	0 ~ 5 m/s
4	Temperature	Zorglab	DSR-THP	March 30, 2022	CL-027-65	-30 ~ 70°C
5	Relative humidity	Zorglab	DSR-THP	March 30, 2022	RH-03032022	0 ~ 100 %RH
6	Acoustic pressure	Zorglab	DSR-THP	March 30, 2022	SP-01032022	500 ~ 1100 IPa
7	Wind tunnel	ESBOM	MP300D	-	-	0 ~ 80 m/s

\*\*\*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: Novatym,  
Wind direction sensor: Novatym.

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

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

ID No : Data logger: BKH\_F80165  
Wind direction sensor: -

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

Environmental Condition:

The measurement was carried out in an ambient temperature of (23±3) °C, and relative humidity of (40±10) %.

Measurement Method:

The wind direction sensor calibration according to comparison method with reference angle measurement electronic theodolite and the 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: KWS04/0025.

Measurement Date : May 03, 2022.

Issued Date : May 04, 2022.

Calibrated by  
☒ Mr. Sorawit Thachalad  
☐ Miss Jitraporn Lertsomphol



Approved Signatory:   
Mr. Panyas Booncharoen,  
Calibration Department Manager

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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	Counter Clockwise	270	270	275	5	3.0
8		315	315	320	5	3.0
9		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	275	5	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\*\*\*



Jiranatee Associates Co., Ltd.  
63/14-15, 67/35-36,  
Petchkasem 7/71, Soi Petchkasem, Bangkok  
Bangkok 10600 Thailand  
Tel : +662-8680812  
Mobile : +668-1001515  
E-mail : jiranatee@jiranatee.com  
Website : www.jiranatee.com

Accredited calibration laboratory  
ISO/IEC 17025:2017  
MSC-TH-TH-17025  
CALIBRATION D367

Air speed measurement laboratory  
Calibration services department.

**CERTIFICATE OF CALIBRATION**

Page 1 of 2 Pages

MEASUREMENT ITEM : Cup anemometer  
MANUFACTURER : Novatym  
MODEL/TYPE : Sensor: WS-02P  
Data logger: 200-WS-25DL  
SERIAL NUMBER : Sensor :  
Data logger: A4903  
ID NUMBER : BKH\_F50159  
CONDITION AS RECEIVED : Used item  
CUSTOMER : ALS laboratory group (Thailand) co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang, Rhet Suan Luang, Bangkok 10250 Thailand.

RECEIVED DATE : 09 Nov 2022  
MEASUREMENT DATE : 23 Nov 2022  
ISSUE DATE : 25 Nov 2022

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follows:

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

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

CALIBRATION CONDITIONS : Wind tunnel cross-section area\* : 900 cm<sup>2</sup>  
Win direction frontal area\* : 100 cm<sup>2</sup>  
Diameter of mounting pipe\* : mm  
Blockage ratio of test object\* : 0.111 %

Preconditioning : 24 hours at ambient conditions.  
Measurement Condition : The average values during measurement are (24.2) °C, (45.0) %RH and (1007.3) hPa.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:  
☒ Mr. Sorawit Thachalad  
☐ Miss Jitraporn Lertsomphol



Approved Signatory:   
Mr. Panyas Booncharoen,  
Calibration Department Manager

Remark:  
\* Nozzle cross-section area of the wind tunnel  
\* Projected cross-section area of the tested object include mounting pipe.  
\* Diameter of mounting pipe  
\* Ratio %

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









### Stopwatch Calibration Test Report

Calibration Date : 4 Jul 23      Next Cal. Date : 3 Jan 24  
Barometric Pressure (mmHg) : 759      Temperature (°C) : 27.0  
Relative Humidity (%) : 58.0

#### 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\_FS0496  
Model : XC-572-V  
Serial No. : 1462087

Run No.	Time Actual (m:ss.ms)	Time Reading (m:ss)	Diff. (ms)	Diff. (min)
1	5:00:09	5:00	9	0.00015
2	5:00:10	5:00	10	0.00017
3	5:00:12	5:00	12	0.00020
4	5:00:11	5:00	11	0.00018
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	5:00:11	5:00	11	0.00018
9	5:00:09	5:00	9	0.00015
10	5:00:10	5:00	10	0.00017
			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 :	4 Jul 23	Ambient Temperature (°C)	30
Calibration sheet No. :	C-040723-BKK_FS0497	Relative Humidity (%) :	62
Digital Temperature ID :	BKK_FS0497	Reference Temperature ID	BKK_FS1144
Serial No. :	1412087	Serial No. :	201090006013
Model :	XC-572-V	Model :	Digicon-CC-VT-MS
		Next Calibrate :	14 Aug 24

Location	Reference Temperature °C	Digital Temperature °C	Error °C	MPE	Pass / Fail
Stack	0	0	0	±3	Pass
	25	25	0	±3	Pass
	50	50	0	±3	Pass
	100	100	0	±3	Pass
	150	150	0	±3	Pass
	200	199	-1	±3	Pass
Probe	250	249	-1	±3	Pass
	300	299	-1	±3	Pass
	500	499	-1	±3	Pass
	100	100	0	±3	Pass
	120	120	0	±3	Pass
	140	140	0	±3	Pass
Oven	100	100	0	±3	Pass
	120	120	0	±3	Pass
Filter	140	140	0	±3	Pass
	100	100	0	±3	Pass
	120	121	1	±3	Pass
Exit	140	141	1	±3	Pass
	0	2	2	±3	Pass
	10	12	2	±3	Pass
Meter	20	22	2	±3	Pass
	0	1	1	±3	Pass
	25	26	1	±3	Pass
AUX	50	51	1	±3	Pass
	0	0	0	±3	Pass
	25	25	0	±3	Pass
	50	50	0	±3	Pass

MPE : (Maximum permissible error of measurement) ค่าความผิดพลาดสูงสุดของการวัดที่อนุญาต

Calibrated by :

( Mr.Prasert Surakhan )

Field Scientist (3)

Approved by :

( Mr.Samart Roo-ngan )

Specialist (1)

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



### Pitot Tube Calibration Data

Pitot Tube Identification Number : BKK\_FS0500      Calibration Date : 4 Jul 23  
Lab test duct Number : 258-1-13-01      Standard Pitot ID : BKK\_FS0441  
Calibration Sheet No. : C-040723-BKK\_FS0500      Cp Standard : 0.99

Type S Pitot Tube Coefficient Data					
	Type s pitot tube Leg A,B	Standard pitot tube (ΔP, mm.H <sub>2</sub> O)	Type s pitot tube (ΔP, mm.H <sub>2</sub> O)	Cp (s) Leg A	Cp (s) Leg B
Test 1	A	12.00	17.00	0.840	-
	B	12.00	17.00	-	0.840
Test 2	A	12.00	17.00	0.840	-
	B	12.00	17.00	-	0.840
Test 3	A	12.00	16.80	0.845	-
	B	12.00	16.80	-	0.845
			C <sub>p</sub>	0.842	0.842

$$C_{P(S)} = C_{P_{std}} \sqrt{\frac{\Delta P_{(std)}}{\Delta P_{(s)}}}$$

$$\left[ \bar{C}_{P(A)} - \bar{C}_{P(B)} \right] \text{ must BE } \leq 0.01$$

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

Calibrated by :

( Mr. Worawich Tongpoom )

Field Scientist (2)

Approved by :

( Mr.Samart Roo-ngan )

Specialist (1)

FORM NO.: F 06-025 REVISION NO.: 1 ISSUE DATE: 30 Jun 22



### Pitot Tube Calibration Data

Pitot Tube Identification Number : BKK\_FS0501      Calibration Date : 4 Jul 23  
Lab test duct Number : 258-1-13-01      Standard Pitot ID : BKK\_FS0441  
Calibration Sheet No. : C-040723-BKK\_FS0501      Cp Standard : 0.99

Type S Pitot Tube Coefficient Data					
	Type s pitot tube Leg A,B	Standard pitot tube (ΔP, mm.H <sub>2</sub> O)	Type s pitot tube (ΔP, mm.H <sub>2</sub> O)	Cp (s) Leg A	Cp (s) Leg B
Test 1	A	12.00	17.00	0.840	-
	B	12.00	17.00	-	0.840
Test 2	A	12.00	17.00	0.840	-
	B	12.00	17.00	-	0.840
Test 3	A	12.00	16.80	0.845	-
	B	12.00	16.80	-	0.845
			C <sub>p</sub>	0.842	0.842

$$C_{P(S)} = C_{P_{std}} \sqrt{\frac{\Delta P_{(std)}}{\Delta P_{(s)}}}$$

$$\left[ \bar{C}_{P(A)} - \bar{C}_{P(B)} \right] \text{ must BE } \leq 0.01$$

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

Calibrated by :

( Mr. Worawich Tongpoom )

Field Scientist (2)

Approved by :

( Mr.Samart Roo-ngan )

Specialist (1)

FORM NO.: F 06-025 REVISION NO.: 1 ISSUE DATE: 30 Jun 22





PROBE NOZZLE DIAMETER  
CALIBRATION DATA SHEET

Calibration Date : 4 Jul 23 Nozzle Set ID. : BKK\_FS0502  
Calibration Sheet No. : C-040723-BKK\_FS0502 Vernier Caliper ID. : RYG\_FS0539

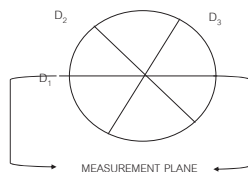
Nozzle ID #	Nozzle Diameter (cm.)			Hi - Lo $\Delta D$	$(D_1 + D_2 + D_3) / 3$ $D_{avg}$
	$D_1$	$D_2$	$D_3$		
1	0.315	0.315	0.315	0.000	0.315
2	0.475	0.475	0.475	0.000	0.475
3	0.530	0.530	0.530	0.000	0.530
4	0.635	0.635	0.635	0.000	0.635
5	0.790	0.790	0.790	0.000	0.790
6	0.950	0.950	0.950	0.000	0.950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

Where :

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

$\Delta D$  = Maximum distance between any two diameters, must be  $\leq 0.100$  mm.

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



Calibrated by :   
(Mr. Worawich Tongpoo)  
Field Scientist (2)

Approved by :   
(Mr. Samart Roo-ngan)  
Field Specialist (1)

FORM NO. 7-04-004 REVISION NO. 1 - ISSUE DATE 10-1-03



Calibration Certificate  
Certificate No: G 660016  
Date of issue : 12-Jan-23



Instrument description : Flue gas Analyzer  
Instrument model : Testo 340  
Instrument serial no. : 63119044  
ID no. or control no. : BKK\_FS1160  
Manufacturer : Testo SE & Co. KGAA  
Probe description : -  
Probe model : -  
Probe serial : -  
Customer name : ALS LABORATORY GROUP (THAILAND) CO.,LTD.  
Customer address : 104 Phatthanakan 40, Phatthanakan Road, Khwaeng Phatthanakan, Khet Suan Luang, Bangkok, 10250 Thailand  
Total pages of certificate : 2 Pages  
Receiving no. : L-230082  
Receiving date : 10-Jan-23  
Parameter of calibration : Gas Calibration (Oxygen 2.498, 10.04, 21.02 %vol, Carbon Monoxide 80.14, 309.9, 1003 ppm), Nitric Oxide 30.08, 150.9, 320.6 ppm, Sulphur Dioxide 50.04, 80.96, 601.1 ppm)  
Condition of UUC : Used  
Ambient condition : All of the Measurement were carried out the stabilized laboratory  
Temperature : 23  $\pm$  0.5  $^{\circ}$ C  
Humidity : 55  $\pm$  15 %RH  
Calibration place : 17/121 Soi Ngamwongwan 47 Yaek 48, Toongsonghong, Laksi, Bangkok 10210

Calibration procedure no. : WI-CL-28-C

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

Date of calibration : 11-Jan-23

Mr. Sattawat Nuesthong  
Calibration Technician

Mrs. Nangluk Wongkietee  
Technical Manager

FM-CL-09-C Rev.8

Page 1 of 2

Issued Date 21/02/16

Entech Industrial Solution Co.,Ltd.

17/121 Soi Ngamwongwan 47, Yaek 48, Toongsonghong, Laksi, Bangkok, 10210 THAILAND. Tel: 0-2779-8888 Calibration@entech.co.th  
Tax ID : 010553635591 www.entech.co.th



Calibration Certificate  
Certificate No.: G 660016



Standard References (Table 1)

Standard	Certificate No.	Vendor	Due date
Oxygen ( O2 ) 2.498 % Vol	4219/21	Linde	30-Sep-25
Oxygen ( O2 ) 10.04 % Vol	CG-0153-21	Nimet	18-Nov-26
Oxygen ( O2 ) 21.02 % Vol	CG-0041-22	Nimet	10-Feb-27
Carbon monoxide ( CO ) 80.14 ppm	CG-0040-22	Nimet	14-Feb-27
Carbon monoxide ( CO ) 309.9 ppm	2803/21	Linde	22-Jun-23
Carbon monoxide ( CO ) 1003 ppm	2583/22	Linde	09-Aug-24
Nitric Oxide ( NO ) 30.08 ppm	SGS10068	Nimet	13-Jun-24
Nitric Oxide ( NO ) 150.9 ppm	2657/21	Linde	27-Jun-23
Nitric Oxide ( NO ) 320.6 ppm	2944/21	Linde	02-Jul-23
Sulphur Dioxide ( SO2 ) 50.04 ppm	3205/21	Linde	25-Jul-23
Sulphur Dioxide ( SO2 ) 100.8 ppm	3507/22	Linde	09-Nov-24
Sulphur Dioxide ( SO2 ) 601.1 ppm	3204/21	Linde	20-Jul-23

Measured room conditions

Temperature : 23.1  $^{\circ}$ C Humidity : 61.1 %RH Pressure : 1012.6 mbar

Calibration conditions

Gas Temperature : 23  $^{\circ}$ C Flow rate : 600 ml/min Gas pressure : 1015.1 mbar

Calibration Results (before adjustment) (Table 2)

Parameter of Standard	Values	Mean of UUC	Error	Uncertainty
O2 (%Vol)	2.498	2.45	-0.048	0.20
O2 (%Vol)	10.04	9.93	-0.11	0.40
O2 (%Vol)	21.02	21.17	0.15	0.80
CO (ppm)	80.14	81	0.86	3.0
CO (ppm)	309.9	314	4.1	6.0
CO (ppm)	1003	1010	7	12
NO (ppm)	30.08	29	-1.08	8.0
NO (ppm)	150.9	143	-7.9	8.0
NO (ppm)	320.6	292	-28.6	12
SO2 (ppm)	50.04	45	-5.04	6.0
SO2 (ppm)	100.8	95	-5.8	6.0
SO2 (ppm)	601.1	582	-19.1	13

Calibration Results (after adjustment) (Table 3)

Parameter of Standard	Values	Mean of UUC	Error	Uncertainty
O2 (%Vol)	2.498	2.45	-0.048	0.20
O2 (%Vol)	10.04	9.93	-0.11	0.40
O2 (%Vol)	21.02	21.17	0.15	0.80
CO (ppm)	80.14	81	0.86	3.0
CO (ppm)	309.9	314	4.1	6.0
CO (ppm)	1003	1010	7	12
NO (ppm)	30.08	31	0.92	8.0
NO (ppm)	150.9	153	2.1	8.0
NO (ppm)	320.6	321	0.4	12
SO2 (ppm)	50.04	53	2.96	6.0
SO2 (ppm)	100.8	101	0.2	6.0
SO2 (ppm)	601.1	602	0.9	13

Remark : 1 cmol/mol = 1 %vol ; 1  $\mu$ mol/mol = 1 ppm

End of Report

Entech Industrial Solution Co.,Ltd.

17/121 Soi Ngamwongwan 47 Yaek 48, Toongsonghong, Laksi, Bangkok 10210 THAILAND. Tel: 0-2779-8888 Calibration@entech.co.th  
Tax ID : 010553635591 www.entech.co.th



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)  
Mechanical Engineering Standards Laboratory Soi 1, Bangpoo Industrial Estate, Muang, Samutprakan 10280, Thailand.

Request No. 23-65/0497-02

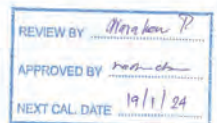
MTC.No. 23-65/0497-02

Number of Pages(S) 2

CALIBRATION CERTIFICATE

Nomenclature : " P " VACUUM GAUGE

Model : F221AVD  
Serial No. : VG04 ID. BKK\_FS0894  
Range : -30 in Hg to 0 in Hg  
Scale Interval : 0.5 in Hg



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

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

Calibration method : Normal

Received date : 7 June 2022

Calibration date : 21 July 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).

CALIBRATED BY :   
(Mr. Uthai Chaipapatt)

APPROVED BY :   
(Ms. Krana Luanghirun)

Director  
Mechanical Engineering Standards Laboratory

Ref. 2013265060702513002

Issued Date : 22 July 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.

Head Office

35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,  
Changwat Pathumthani 12120, Thailand.  
Tel: (66) 0 2577 9000  
Fax: (66) 0 2577 9009  
E-mail : jump@tistr.or.th Website: www.tistr.or.th

Office/Laboratory

Soi 1C, Bangpoo Industrial Estate, Sathuwit Road,  
Amphoe Muang, Changwat Samutprakan 10280, Thailand.  
Tel: (66) 0 2523 1672-89 ext. 115, 116  
Fax: (66) 0 2523 9165  
E-mail : mtg@tistr.or.th

Office

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

FM&LJATC.002 Rev.4





THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)  
Mechanical Engineering Standards Laboratory Soi 1, Bangpoo Industrial Estate, Muang, Samutprakan 10280, Thailand.

Reques 23-65/0497-02

2 / 2

MTC.No. 23-65/0497-02

Calibration range : -27 in Hg to 0 in Hg

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

Calibration condition : Temperature  $(23.4 \pm 2) ^\circ\text{C}$  ; Relative Humidity  $(66 \pm 10) \%$   
Atmospheric pressure  $(1001 \pm 10) \text{ hPa}$ .  
Local gravity  $(9.783003 \pm 0.000050) \text{ m/s}^2$

#### Measurement Data :

Gauge position : Vertical

Medium : Air

Reference level : Gauge inlet

Unit : in Hg

UUC Reading	Gauge Pressure	Error	( $\pm$ ) Uncertainty
0	0.00	0.00	0.12
-10	-9.82	-0.18	0.21
-20	-20.09	0.09	0.23
-26	-26.33	0.33	0.13
-27	-27.27	0.27	0.18
-28	-28.34	0.34	0.12

Note : 1. The reading taken after the gauge is lightly tapped.

2. Conversion factor : in Hg = 3.386384 kPa

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

*Signature*

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.

Head Office  
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,  
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E-mail : humpat@tistr.or.th Website: www.tistr.or.th

Office/Laboratory  
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Amphoe Muang Chongwatthani 30380, Thailand  
Tel. (66) 0 2323 1672-80 ext. 115, 116  
Fax. (66) 0 2323 9165  
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Fax. (66) 0 2579 8592  
E-mail : samet@tistr.or.th

FM.BLMTC.002 Rev.4



Bara Scientific Co., Ltd.  
968 U Chu Liang Building Floor7 Rama4 Road  
Siam Bangkok Bangkok Thailand 10500  
Tel : 02-6324300 Fax : 02-6375496-7  
www.barascientific.com



## Certificate of Calibration

Number of Page(s) 1 of 3

Certificate No. BSCC-UV-307/22  
Equipment UVVis Spectrophotometer  
Model UV-1800  
Manufacturer Shimadzu  
Serial No. A11454908533CD  
ID No. BOK\_EN0018  
Date of receipt 16 September 2022  
Date of calibration 16 September 2022  
Date of issue 23 September 2022

REVIEW BY *Signature*  
APPROVED BY *Signature*  
NEXT CAL. DATE 16/9/23

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 Stama Scientific Ltd.  
(UKAS accredited calibration laboratory NO. 0659)

Calibrated by Mr.Waruth Jangphung

Approved by

*Signature*

Mr.Kanchit Choothep  
Technical Manager

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.

FM-UV-708-02 Rev.01 (23/01/63)



Bara Scientific Co., Ltd.  
968 U Chu Liang Building Floor7 Rama4 Road  
Siam Bangkok Bangkok Thailand 10500  
Tel : 02-6324300 Fax : 02-6375496-7  
www.barascientific.com



## Certificate of Calibration

Certificate No. BSCC-UV-307/22

Number of Page(s) 2 of 3

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#### 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 0.7467	0.0000 0.7461	0.0000 -0.0006	0.0075 0.0075
257	0.0000 0.8662	0.0000 0.8647	0.0000 -0.0015	0.0075 0.0075
313	0.0000 0.2904	0.0000 0.2911	0.0000 0.0007	0.0075 0.0075
350	0.0000 0.6429	0.0000 0.6426	0.0000 -0.0003	0.0075 0.0075

\*CNR = Customer not request

The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate.  
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FM-UV-708-02 Rev.01 (23/01/63)



Bara Scientific Co., Ltd.  
968 U Chu Liang Building Floor7 Rama4 Road  
Siam Bangkok Bangkok Thailand 10500  
Tel : 02-6324300 Fax : 02-6375496-7  
www.barascientific.com



## Certificate of Calibration

Certificate No. BSCC-UV-307/22

Number of Page(s) 3 of 3

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 0.5783 0.7628 1.0206	0.0000 0.5777 0.7635 1.0230	0.0000 -0.0006 0.0007 0.0024	0.0042 0.0042 0.0046 0.0042
440.0	0.0000 0.5621 0.7455 0.9685	0.0000 0.5618 0.7460 1.0005	0.0000 -0.0003 0.0005 0.0020	0.0042 0.0042 0.0048 0.0042
465.0	0.0000 0.5227 0.6880 0.9487	0.0000 0.5219 0.6884 0.9503	0.0000 -0.0008 0.0004 0.0016	0.0042 0.0042 0.0051 0.0042
545.1	0.0000 0.5207 0.6973 0.9959	0.0000 0.5199 0.6971 0.9964	0.0000 -0.0008 -0.0002 0.0005	0.0042 0.0042 0.0049 0.0042
590.0	0.0000 0.5544 0.7233 1.0942	0.0000 0.5534 0.7242 1.0943	0.0000 -0.0010 -0.0011 0.0001	0.0042 0.0042 0.0050 0.0042
635.0	0.0000 0.5616 0.6927 1.0881	0.0000 0.5606 0.6921 1.0885	0.0000 -0.0010 -0.0006 0.0004	0.0042 0.0042 0.0053 0.0042

\*CNR = Customer not request

##### 4.Stray Light\*

Standard cut-off wavelength (nm)	Unit Under Calibration(UUC) Wavelength (nm)	Transmission (%T)	Absorbance (A)
200.85 $\pm$ 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 base 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 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.

FM-UV-708-02 Rev.01 (23/01/63)



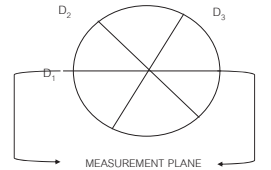


# PROBE NOZZLE DIAMETER CALIBRATION DATA SHEET

Calibration Date :	4 Jul 23	Nozzle Set ID. :	BKK_FS0485
Calibration Sheet No. :	C-040723-BKK_FS0485	Vernier Caliper ID.:	RYG_FS0539

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

Where :  
 $D_1, D_2, D_3$  = There different nozzle diameters at 60 degrees to each other, each measured the nearest 0.025 mm.  
 $\Delta D$  = Maximum distance between any two diameters, must be  $\leq 0.100$  mm.  
 $D_{avg}$  =  $(D_1 + D_2 + D_3) / 3$



Calibrated by : Worawich Tongpoom  
( Mr. Worawich Tongpoom )  
Field Scientist (2)

Approved by : S.P.  
( Mr.Smart Roo-ngan )  
Field Specialist (1)

FORM NO. F 06-027 REVISION NO. 2 ISSUE DATE: 16-1-2023

## CONSOLE CONTROL UNIT CALIBRATION TEST REPORT

Calibration of Date : 4 Jul 23  
Next Cal. Date : 3 Jan 24

### Console Control Meter Data

Calibration No. : C-040723-BKK\_FS0485  
Dry Gas Meter ID : BKK\_FS0485  
Serial No. : 1310055  
Model No. : XC-572-V

### Reference Dry Gas Meter Data

Reference Dry Gas Meter ID : BKK\_FS0629  
Serial No. : 1607009  
Correction Factor (V) : 1.0000  
Next Calibration Date : 9 Dec 23

AH (mm H <sub>2</sub> O)	Θ Mmides	Reference Dry Gas Meter Calibration				Console Control : Drygas Meter						Dry Gas Meter Correction		Office Calibration Factor
		Vr (Liters)		Tr	Vtr (Liters)		Ti		To		Avg Tri	Factor		
		Final	Initial		Total	Final	Initial	Total	(°C)	(°C)	(°C)	(°C)	(V)	
15	12.67	150.05	0.00	150.05	31.0	88794.10	88780.0	141.00	31.0	31.0	31.0	1.0026	48.3037	
25	9.85	150.10	0.00	150.10	32.0	888176.0	88800.0	146.00	32.0	32.0	32.0	1.0046	46.6079	
50	6.65	150.00	0.00	150.00	33.0	888348.6	88820.0	148.60	33.0	33.0	33.0	1.0046	45.6022	
100	4.57	150.00	0.00	150.00	34.0	888529.6	88838.0	148.60	34.0	34.0	34.0	0.9931	43.2137	
150	3.73	150.03	0.00	150.03	34.0	888692.2	88850.0	149.20	34.0	34.0	34.5	0.9895	43.3054	
												Avg	1.0151	45.6466

Y : Ratio of reading of reference to dry gas meter ; tolerance for individual values  $\pm 0.02$  from average.  
 $\Delta H_{\Theta}$  : Office pressure differential that equates to 21.24 in of air @ 25°C and 760 mm of mercury ; mmH<sub>2</sub>O ; tolerance for individual values  $\pm 5.08$  from average.

Procedure: 40 CFR 60.APP AMETH, SEC 5.3 & 7  
Calibrated by : Chonlath  
( Mr. Chonlath Wongphan )  
Field Scientist(2)

Approved by : S.P.  
( Mr.Smart Roo-ngan )  
Field Specialist(1)  
FORM NO. F 06-027 REVISION NO. 2 ISSUE DATE: 30-Jan-22



## Stopwatch Calibration Test Report

Calibration Date : 4 Jul 23  
Barometric Pressure (mmHg) : 759  
Relative Humidity (%) : 58.0  
Next Cal. Date : 3 Jan 24  
Temperature (°C) : 27.0

### 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\_FS0485  
Model : XC-572-V  
Serial No. : 1310055

Run No.	Time Actual (m:ss.ms)	Time Reading (m:ss)	Diff. (ms)	Diff. (min)
1	5:00:09	5:00	9	0.00015
2	5:00:11	5:00	11	0.00018
3	5:00:09	5:00	9	0.00015
4	5:00:11	5:00	11	0.00018
5	5:00:10	5:00	10	0.00017
6	5:00:08	5:00	8	0.00013
7	5:00:08	5:00	8	0.00013
8	5:00:11	5:00	11	0.00018
9	5:00:10	5:00	10	0.00017
10	5:00:11	5:00	11	0.00018
Average				0.00016
SD				0.00002

Calibrate by : Prasert S.  
Mr.Prasert Surakhan  
Field Scientist (3)

Approved by : S.P.  
Mr. Smart Roo-ngan  
Specialist (1)



## DIGITAL TEMPERATURE CALIBRATION DATA SHEET

Calibration Date :	4 Jul 23	Ambient Temperature (°C)	30
Calibration sheet No. :	C-040723-BKK_FS0486	Relative Humidity (%) :	62
Digital Temperature ID :	BKK_FS0486	Reference Temperature ID	BKK_FS1144
Serial No. :	1310055	Serial No. :	20109006013
Model :	XC-572-V	Model :	Digicon-CC-VT-MS
		Next Calibrate :	14 Aug 24

Location	Reference Temperature °C	Digital Temperature °C	Error °C	MPE	Pass / Fail
Stack	0	0	0	$\pm 3$	Pass
	25	25	0	$\pm 3$	Pass
	50	50	0	$\pm 3$	Pass
	100	100	0	$\pm 3$	Pass
	150	149	-1	$\pm 3$	Pass
	200	199	-1	$\pm 3$	Pass
Probe	250	248	-2	$\pm 3$	Pass
	300	298	-2	$\pm 3$	Pass
	500	498	-2	$\pm 3$	Pass
	100	99	-1	$\pm 3$	Pass
	120	119	-1	$\pm 3$	Pass
	140	139	-1	$\pm 3$	Pass
Oven	100	100	0	$\pm 3$	Pass
	120	120	0	$\pm 3$	Pass
	140	140	0	$\pm 3$	Pass
Filter	100	100	0	$\pm 3$	Pass
	120	120	0	$\pm 3$	Pass
	140	139	-1	$\pm 3$	Pass
Exit	0	1	1	$\pm 3$	Pass
	10	10	0	$\pm 3$	Pass
Meter	20	20	0	$\pm 3$	Pass
	0	0	0	$\pm 3$	Pass
	25	25	0	$\pm 3$	Pass
AUX	50	50	0	$\pm 3$	Pass
	0	0	0	$\pm 3$	Pass
	25	25	0	$\pm 3$	Pass
	50	50	0	$\pm 3$	Pass

MPE : (Maximum permissible error of measurement) ค่าความผิดพลาดสูงสุดของภาวที่ออกมาได้

Calibrated by : Prasert S.  
( Mr.Prasert Surakhan )  
Field Scientist (3)

Approved by : S.P.  
( Mr.Smart Roo-ngan )  
Specialist (1)

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





### Pitot Tube Calibration Data

Pitot Tube Identification Number : BKK\_FS0489 Calibration Date : 4 Jul 23  
Lab test duct Number : 258-1-13-01 Standard Pitot ID : BKK\_FS0441  
Calibration Sheet No. : C-040723-BKK\_FS0489 Cp Standard : 0.99

Type S Pitot Tube Coefficient Data					
	Type s pitot tube Leg A,B	Standard pitot tube ( $\Delta P$ , mm.H <sub>2</sub> O)	Type s pitot tube ( $\Delta P$ , mm.H <sub>2</sub> O)	Cp (s) Leg A	Cp (s) Leg B
Test 1	A	12.00	17.00	0.840	-
	B	12.00	17.00	-	0.840
Test 2	A	12.00	17.00	0.840	-
	B	12.00	17.00	-	0.840
Test 3	A	12.00	16.80	0.845	-
	B	12.00	16.80	-	0.845
$\bar{C}_p$				0.842	0.842

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

$$[Cp_{(A)} - Cp_{(B)}] \text{ must BE } \leq 0.01$$

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

Calibrated by :

(Mr. Worawich Tongpoom)  
Field Scientist (2)

Approved by :

(Mr. Samart Roo-ngan)  
Specialist (1)

FORM NO.: F 06-025 REVISION NO.: 1 ISSUE DATE: 30 Jun 22



### Pitot Tube Calibration Data

Pitot Tube Identification Number : BKK\_FS0490 Calibration Date : 4 Jul 23  
Lab test duct Number : 258-1-13-01 Standard Pitot ID : BKK\_FS0441  
Calibration Sheet No. : C-040723-BKK\_FS0490 Cp Standard : 0.99

Type S Pitot Tube Coefficient Data					
	Type s pitot tube Leg A,B	Standard pitot tube ( $\Delta P$ , mm.H <sub>2</sub> O)	Type s pitot tube ( $\Delta P$ , mm.H <sub>2</sub> O)	Cp (s) Leg A	Cp (s) Leg B
Test 1	A	12.00	17.00	0.840	-
	B	12.00	17.00	-	0.840
Test 2	A	12.00	17.00	0.840	-
	B	12.00	17.00	-	0.840
Test 3	A	12.00	16.80	0.845	-
	B	12.00	16.80	-	0.845
$\bar{C}_p$				0.842	0.842

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

$$[Cp_{(A)} - Cp_{(B)}] \text{ must BE } \leq 0.01$$

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

Calibrated by :

(Mr. Worawich Tongpoom)  
Field Scientist (2)

Approved by :

(Mr. Samart Roo-ngan)  
Specialist (1)

FORM NO.: F 06-025 REVISION NO.: 1 ISSUE DATE: 30 Jun 22



### Calibration Certificate



Certificate No: G 650808  
Date of issue : 29-Nov-22

Instrument description : Flue gas Analyzer  
Instrument model : Testo 350 New  
Instrument serial no. : 62087398  
ID no. or control no. : BKK\_FS1095  
Manufacturer : Testo SE & Co. KGaA  
Probe description : --  
Probe model : --  
Probe serial : --  
Customer name : ALS LABORATORY GROUP (THAILAND) CO.,LTD.  
Customer address : 104 Phatthanakan 40, Phatthanakan Road, Khwaeng Phatthanakan, Khet Suai Luang, Bangkok, 10250 Thailand  
Total pages of certificate : 3 Pages  
Receiving no. : L-224152  
Receiving date : 25-Nov-22  
Parameter of calibration : Gas Calibration(Oxygen 2.498,10.04,21.02 %Vol, Carbon Monoxide 80.14,309.9,1003 ppm, Nitrogen Dioxide 30.34,80.96,202.2 ppm, Nitric Oxide 30.08,150.9,320.6 ppm, Sulphur Dioxide 50.04,100.8,601.1 ppm)  
Condition of UUC : Used  
Ambient condition : All of the Measurement were carried out the stabilized laboratory  
Temperature :  $23 \pm 0.5$  °C  
Humidity :  $55 \pm 15$  %RH  
Calibration place : 17/121 Soi Ngamwongwan 47 Yaek 48, Toongsongkhon, Lakki, Bangkok 10210  
Calibration procedure no. : WI-CL-28-C

REVIEW BY :   
APPROVED BY :   
NEXT CAL. DATE : 25/11/23

The calibration certificate expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by coverage factor  $k=2$ , which for a normal distribution corresponds to a coverage probability of approximately 95%.  
This certificate is applied only to item under test Environmental condition.  
This Calibration Certificate may not be reproduced other than in full except with the permission of the issuing laboratory.  
Calibration certificates without signature and seal not valid.  
This calibration certificate documents are traceability to national standards, which realize measurement according to the International System of Units (SI).  
Date of calibration : 28-Nov-22

Mr. Sedrauw Huesithong  
Calibration Technician

Mrs. Nongluck Wongpetee  
Technical Manager

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Issued Date 26/02/16



### Calibration Certificate



Certificate No: G 650808

#### Standard References (Table 1)

Standard	Certificate No.	Vendor	Due date
Oxygen ( O2 ) 2.498 % Vol	4219/21	Linde	30-Sep-25
Oxygen ( O2 ) 10.04 % Vol	CG-0153-21	Nimitt	18-Nov-26
Oxygen ( O2 ) 21.02 % Vol	CG-0041-22	Nimitt	10-Feb-27
Carbon monoxide ( CO ) 80.14 ppm	CG-0040-22	Nimitt	14-Feb-27
Carbon monoxide ( CO ) 309.9 ppm	2803/21	Linde	22-Jun-23
Carbon monoxide ( CO ) 1003 ppm	2583/22	Linde	09-Aug-24
Nitrogen Dioxide ( NO2 ) 30.34 ppm	2703/22	Linde	22-Aug-24
Nitrogen Dioxide ( NO2 ) 80.96 ppm	2041/22	Linde	26-Jun-24
Nitrogen Dioxide ( NO2 ) 202.2 ppm	3239/21	Linde	20-Jul-23
Nitric Oxide ( NO ) 30.08 ppm	CG-0089-22	Nimitt	13-Jun-24
Nitric Oxide ( NO ) 150.9 ppm	2857/21	Linde	27-Jun-23
Nitric Oxide ( NO ) 320.6 ppm	2944/21	Linde	02-Jul-23
Sulphur Dioxide ( SO2 ) 50.04 ppm	3205/21	Linde	25-Jul-23
Sulphur Dioxide ( SO2 ) 100.8 ppm	3507/22	Linde	09-Nov-24
Sulphur Dioxide ( SO2 ) 601.1 ppm	3204/21	Linde	20-Jul-23

#### Measured room conditions

Temperature : 23.4 °C Humidity : 54.1 %RH Pressure : 1015.6 mbar

#### Calibration conditions

Gas Temperature : 23 °C Flow rate : 1,200 ml/min Gas pressure : 1021.8 mbar

#### Calibration Results Before Adjustment (Table 2)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (±)
O2 (%Vol)	2.498	2.53	0.032	0.20
O2 (%Vol)	10.04	10.09	0.05	0.40
O2 (%Vol)	21.02	21.10	0.08	0.80
CO (ppm)	80.14	80	-0.14	3.0
CO (ppm)	309.9	307	-2.9	6.0
CO (ppm)	1003	995	-8	12
NO2 (ppm)	30.34	27.3	-3.04	8.0
NO2 (ppm)	80.96	76.5	-4.46	8.0
NO2 (ppm)	202.2	199.8	-2.4	12
NO (ppm)	30.08	28	-2.08	8.0
NO (ppm)	150.9	148	-2.9	8.0
NO (ppm)	320.6	311	-9.6	12
SO2 (ppm)	50.04	49	-1.04	6.0
SO2 (ppm)	100.8	99	-1.8	6.0
SO2 (ppm)	601.1	599	-2.1	13

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Issued Date 26/02/16









### DIGITAL TEMPERATURE CALIBRATION DATA SHEET

Calibration Date :	3 Jul 23	Ambient Temperature (°C)	32
Calibration sheet No. :	C-030723-BKK_FS0505	Relative Humidity (%) :	58
Digital Temperature ID :	BKK_FS0505	Reference Temperature ID	BKK_FS1144
Serial No. :	1503004	Serial No. :	201090006013
Model :	XC-62-CV	Model :	Digicon-CC-VT-MS
		Next Calibrate :	31 Jan 23

Location	Reference Temperature °C	Digital Temperature °C	Error °C	MPE	Pass / Fail
Stack	0	-1	-1	±3	Pass
	25	23	-2	±3	Pass
	50	48	-2	±3	Pass
	100	99	-1	±3	Pass
	150	149	-1	±3	Pass
	200	198	-2	±3	Pass
Probe	250	247	-3	±3	Pass
	300	297	-3	±3	Pass
	500	498	-2	±3	Pass
	100	100	0	±3	Pass
	120	120	0	±3	Pass
	140	140	0	±3	Pass
Oven	100	-	-	±3	-
	120	-	-	±3	-
	140	-	-	±3	-
Filter	100	98	-2	±3	Pass
	120	119	-1	±3	Pass
	140	138	-2	±3	Pass
Exit	0	0	0	±3	Pass
	10	8	-2	±3	Pass
	20	18	-2	±3	Pass
Meter	0	0	0	±3	Pass
	25	24	-1	±3	Pass
	50	48	-2	±3	Pass
AUX	0	-1	-1	±3	Pass
	25	23	-2	±3	Pass
	50	48	-2	±3	Pass

MPE : (Maximum permissible error of measurement) ค่าความผิดพลาดสูงสุดของการวัดที่อนุญาต

Calibrated by :

( Mr.Prasert Surakhan )

Field Scientist (3)

Approved by :

( Mr.Samart Roo-ngan )

Specialist (1)

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



### ROTA METER CALIBRATION RESULT JULY 2023

Rotameter ID.	Calibration Date	Regression Result	Coefficient (R <sup>2</sup> )
BKK_FS0577	03 Jul 23	$Y = 1.2484x - 0.6741$	0.9931
BKK_FS0579	03 Jul 23	$Y = 1.0997x - 0.4918$	1.0000
BKK_FS0583	01 Jul 23	$Y = 1.0068x + 1.6459$	0.9998
BKK_FS0584	01 Jul 23	$Y = 0.9804x + 9.469$	0.9999
BKK_FS0585	07 Jul 23	$Y = 1.0248x - 0.8333$	0.9996
BKK_FS0586	01 Jul 23	$Y = 0.9907x + 11.074$	1.0000
BKK_FS0587	07 Jul 23	$Y = 0.986x + 17.77$	0.9993
BKK_FS0588	01 Jul 23	$Y = 0.9751x + 9.8452$	0.9999
BKK_FS0589	03 Jul 23	$Y = 1.0174x + 0.0381$	1.0000
BKK_FS0590	01 Jul 23	$Y = 1.0127x - 3.4333$	1.0000
BKK_FS0591	03 Jul 23	$Y = 1.0452x - 51.824$	0.9998
BKK_FS0592	07 Jul 23	$Y = 1.0003x + 14.344$	1.0000
BKK_FS0593	01 Jul 23	$Y = 1.0386x - 41.415$	0.9997
BKK_FS0594	07 Jul 23	$Y = 1.0025x + 6.32$	0.9999
BKK_FS0595	01 Jul 23	$Y = 1.0871x - 114.97$	0.9985
BKK_FS0596	03 Jul 23	$Y = 1.038x - 51.974$	0.9993
BKK_FS0597	01 Jul 23	$Y = 1.0059x - 9.9086$	1.0000
BKK_FS1004	01 Jul 23	$Y = 1.0186x + 6.731$	0.9998
BKK_FS1005	01 Jul 23	$Y = 0.9922x + 13.993$	0.9970
BKK_FS1006	01 Jul 23	$Y = 1.1747x - 3.1235$	0.9991
BKK_FS1007	07 Jul 23	$Y = 1.0737x + 0.8677$	0.9997
BKK_FS1008	07 Jul 23	$Y = 1.0446x + 1.2156$	0.9999
BKK_FS1009	01 Jul 23	$Y = 1.1044x - 0.8245$	1.0000
BKK_FS1010	03 Jul 23	$Y = 1.2271x - 2.0139$	1.0000
BKK_FS1011	03 Jul 23	$Y = 1.261x - 1.7003$	1.0000
BKK_FS1012	03 Jul 23	$Y = 0.9978x - 3.7238$	0.9990
BKK_FS1013	03 Jul 23	$Y = 1.0245x - 28.65$	0.9999
BKK_FS1014	01 Jul 23	$Y = 1.3135x - 7.0966$	0.9961
BKK_FS1015	01 Jul 23	$Y = 0.9802x + 3.8214$	0.9999
BKK_FS1016	01 Jul 23	$Y = 1.0726x - 85.581$	0.9995
BKK_FS1020	01 Jul 23	$Y = 1.1161x - 1.1986$	1.0000
BKK_FS1021	01 Jul 23	$Y = 0.9566x + 16.524$	0.9987
BKK_FS1022	01 Jul 23	$Y = 1.0712x - 89.51$	0.9990
BKK_FS1023	01 Jul 23	$Y = 1.3791x - 8.8721$	0.9944
BKK_FS1024	01 Jul 23	$Y = 0.9449x + 11.421$	0.9993
BKK_FS1025	01 Jul 23	$Y = 1.0477x - 41.116$	1.0000
BKK_FS1026	01 Jul 23	$Y = 1.3389x - 4.918$	1.0000
BKK_FS1027	01 Jul 23	$Y = 0.9852x + 1.5238$	1.0000
BKK_FS1028	01 Jul 23	$Y = 1.0281x - 19.897$	0.9996

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ALS Laboratory Group



### ROTA METER CALIBRATION RESULT JULY 2023

Rotameter ID.	Calibration Date	Regression Result	Coefficient (R <sup>2</sup> )
BKK_FS1029	01 Jul 23	$Y = 1.3382x - 8.9776$	0.9941
BKK_FS1030	01 Jul 23	$Y = 0.9818x + 2.3476$	0.9995
BKK_FS1031	01 Jul 23	$Y = 1.0526x - 64.415$	0.9997
BKK_FS1039	01 Jul 23	$Y = 0.998x + 14.823$	0.9997
BKK_FS1040	01 Jul 23	$Y = 1.0041x - 2.7552$	0.9999
BKK_FS1041	01 Jul 23	$Y = 1.116x - 1.0078$	0.9999
BKK_FS1042	01 Jul 23	$Y = 1.0209x + 3.56$	0.9980
BKK_FS1043	01 Jul 23	$Y = 1.0039x - 5.0143$	0.9999
BKK_FS1044	01 Jul 23	$Y = 1.0807x + 0.9837$	0.9998
BKK_FS1164	03 Jul 23	$Y = 1.0589x + 4.6061$	0.9996
BKK_FS1165	03 Jul 23	$Y = 0.9809x + 7.5262$	0.9981
BKK_FS1166	03 Jul 23	$Y = 1.0567x - 50.446$	0.9999
BKK_FS1200	03 Jul 23	$Y = 1.3634x - 1.3816$	0.9991
BKK_FS1201	03 Jul 23	$Y = 1.0388x - 7.0524$	0.9999
BKK_FS1202	03 Jul 23	$Y = 1.0518x - 59.531$	0.9998
RYG_FS0197	01 Jul 23	$Y = 1.0087x - 3.2838$	0.9999
RYG_FS0198	01 Jul 23	$Y = 0.9877x + 36.487$	0.9999
RYG_FS0199	01 Jul 23	$Y = 1.0299x - 0.367$	0.9992
PHK_FS0027	13 Jul 23	$Y = 1.1219x - 2.2432$	0.9984
PHK_FS0028	13 Jul 23	$Y = 1.0341x - 6.7967$	0.9999
PHK_FS0029	13 Jul 23	$Y = 0.9977x + 8.7829$	0.9999
SGK_FS0135	14 Jul 23	$Y = 0.9877x + 11.513$	0.9974
SGK_FS0138	13 Jul 23	$Y = 1.0571x - 1.1565$	0.9991
SGK_FS0139	13 Jul 23	$Y = 0.9801x + 8.6267$	0.9997
SGK_FS0140	13 Jul 23	$Y = 0.9978x + 11.644$	1.0000
SGK_FS0141	13 Jul 23	$Y = 1.1349x - 2.2867$	0.9990
SGK_FS0142	13 Jul 23	$Y = 0.9915x + 11.403$	0.9994
SGK_FS0143	13 Jul 23	$Y = 1.0054x - 4.0648$	1.0000

Review By :

(Mr. Wichan Choonharat)

Enviro Field Services Manager

Approved By :

(Mr. Sarayuth Jitranont)

Assistant General Manager

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ALS Laboratory Group



### ROTA METER CALIBRATION RESULT OCTOBER 2023

Rotameter ID.	Calibration Date	Regression Result	Coefficient (R <sup>2</sup> )
BKK_FS0577	02 Oct 23	$Y = 1.2862x - 1.2952$	0.9963
BKK_FS0579	02 Oct 23	$Y = 1.2546x + 0.0065$	0.9946
BKK_FS0583	03 Oct 23	$Y = 1.0773x - 2.4138$	0.9989
BKK_FS0584	02 Oct 23	$Y = 0.9787x + 12.569$	0.9999
BKK_FS0585	18 Oct 23	$Y = 1.0322x + 3.7767$	0.9998
BKK_FS0586	02 Oct 23	$Y = 0.9777x + 15.405$	0.9997
BKK_FS0587	18 Oct 23	$Y = 1.0175x + 14.717$	0.9997
BKK_FS0589	03 Oct 23	$Y = 1.0148x + 2.4143$	1.0000
BKK_FS0590	03 Oct 23	$Y = 1.0088x + 0.8429$	1.0000
BKK_FS0591	02 Oct 23	$Y = 1.0733x - 88.805$	0.9989
BKK_FS0592	18 Oct 23	$Y = 1.0037x + 10.388$	1.0000
BKK_FS0593	02 Oct 23	$Y = 1.0538x - 60.63$	0.9996
BKK_FS0594	18 Oct 23	$Y = 1.0052x + 5.3238$	0.9999
BKK_FS0596	03 Oct 23	$Y = 1.0449x - 48.241$	0.9996
BKK_FS0597	03 Oct 23	$Y = 1.0697x - 83.62$	0.9994
BKK_FS1004	02 Oct 23	$Y = 0.9855x + 14.75$	0.9992
BKK_FS1005	02 Oct 23	$Y = 1.02x + 1.7167$	0.9996
BKK_FS1006	02 Oct 23	$Y = 1.1762x - 3.5619$	0.9999
BKK_FS1007	18 Oct 23	$Y = 1.1405x + 2.6044$	0.9993
BKK_FS1008	18 Oct 23	$Y = 1.1267x + 4.8333$	0.9991
BKK_FS1010	03 Oct 23	$Y = 1.0027x + 2.5832$	0.9986
BKK_FS1011	02 Oct 23	$Y = 1.3811x - 6.2068$	0.9998
BKK_FS1012	02 Oct 23	$Y = 1.0017x + 0.9$	1.0000
BKK_FS1013	02 Oct 23	$Y = 1.0593x - 46.02$	0.9994
BKK_FS1014	03 Oct 23	$Y = 1.0961x - 1.6895$	0.9983
BKK_FS1015	03 Oct 23	$Y = 0.9979x + 6.2595$	0.9993
BKK_FS1016	03 Oct 23	$Y = 1.0683x - 82.491$	0.9995
BKK_FS1017	06 Oct 23	$Y = 0.9981x - 2.2235$	0.9998
BKK_FS1018	06 Oct 23	$Y = 0.9817x - 20.653$	0.9999
BKK_FS1019	06 Oct 23	$Y = 1.0152x - 64.485$	0.9998
BKK_FS1020	02 Oct 23	$Y = 1.2691x - 2.4721$	0.9983
BKK_FS1021	02 Oct 23	$Y = 1.0036x + 2.3286$	0.9999
BKK_FS1022	02 Oct 23	$Y = 1.0633x - 73.266$	0.9990
BKK_FS1023	03 Oct 23	$Y = 1.0879x - 1.0694$	0.9984
BKK_FS1024	02 Oct 23	$Y = 1.0035x + 1.4857$	1.0000
BKK_FS1025	03 Oct 23	$Y = 1.0556x - 58.597$	0.9999
BKK_FS1026	02 Oct 23	$Y = 1.2894x - 1.497$	0.9970
BKK_FS1027	02 Oct 23	$Y = 1.0032x + 1.5167$	1.0000
BKK_FS1028	02 Oct 23	$Y = 1.0433x - 30.012$	0.9994

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ALS Laboratory Group





## ROTA METER CALIBRATION RESULT OCTOBER 2023

Rotameter ID.	Calibration Date	Regression Result	Coefficient (R <sup>2</sup> )
BKK_FS1029	02 Oct 23	Y = 1.3494x - 3.5078	0.9981
BKK_FS1030	02 Oct 23	Y = 1.0015x + 1.2214	1.0000
BKK_FS1031	02 Oct 23	Y = 1.0516x - 56.996	0.9994
BKK_FS1039	02 Oct 23	Y = 0.9991x + 14.527	0.9994
BKK_FS1040	02 Oct 23	Y = 1.0049x - 2.4324	1.0000
BKK_FS1041	02 Oct 23	Y = 1.1682x - 2.1293	1.0000
BKK_FS1042	02 Oct 23	Y = 1.0051x + 6.2533	0.9989
BKK_FS1043	02 Oct 23	Y = 1.0022x + 3.96	1.0000
BKK_FS1044	02 Oct 23	Y = 1.0796x + 2.9806	0.9993
BKK_FS1164	02 Oct 23	Y = 1.2714x + 0.234	0.9945
BKK_FS1165	02 Oct 23	Y = 1.0029x + 3.3571	0.9994
BKK_FS1166	02 Oct 23	Y = 1.061x - 56.83	1.0000
BKK_FS1200	02 Oct 23	Y = 1.2803x - 1.4599	0.9962
BKK_FS1201	02 Oct 23	Y = 1.0374x - 6.1952	1.0000
BKK_FS1202	02 Oct 23	Y = 1.0486x - 44.05	0.9997
PHK_FS0027	09 Oct 23	Y = 1.1052x + 1.0293	1.0000
PHK_FS0028	09 Oct 23	Y = 1.0377x - 1.9833	1.0000
PHK_FS0029	09 Oct 23	Y = 1.0021x + 7.5248	1.0000
RYG_FS0197	02 Oct 23	Y = 1.0036x + 9.0133	1.0000
RYG_FS0198	02 Oct 23	Y = 0.9991x + 17.568	1.0000
RYG_FS0199	02 Oct 23	Y = 1.0814x - 1.2993	0.9997
RYG_FS0654	02 Oct 23	Y = 1.1168x - 2.1207	1.0000
RYG_FS0655	02 Oct 23	Y = 1.0086x + 6.2733	0.9991
RYG_FS0656	02 Oct 23	Y = 1.0009x + 8.48	1.0000
RYG_FS0657	02 Oct 23	Y = 1.0435x + 2.6459	0.9999
RYG_FS0658	02 Oct 23	Y = 0.9788x + 10.283	0.9992
RYG_FS0659	02 Oct 23	Y = 1.0074x - 6.621	1.0000
SGK_FS0135	18 Oct 23	Y = 0.9831x + 14.843	0.9994
SGK_FS0138	06 Oct 23	Y = 1.0831x - 0.8401	0.9998
SGK_FS0139	06 Oct 23	Y = 0.9826x + 8.6567	1.0000
SGK_FS0140	06 Oct 23	Y = 1.0011x + 7.8095	1.0000
SGK_FS0141	06 Oct 23	Y = 1.125x - 1.2259	0.9998
SGK_FS0142	06 Oct 23	Y = 0.9956x + 10.257	0.9997
SGK_FS0143	06 Oct 23	Y = 1.004x + 3.3105	1.0000

Review By : Wichan Choonharat  
(Mr. Wichan Choonharat)

Enviro Field Services Manager

Approved By : Mr. Sarayuth Jittrantont  
(Mr. Sarayuth Jittrantont)

Assistant General Manager

Page 2 of 2

ALS Laboratory Group

Bara Scientific Co., Ltd.  
968 U Chu Liang Building Floor7 Rama4 Road  
Silom Bangkok Bangkok Thailand 10500  
Tel : 02-6324300 Fax : 02-6375496-7  
www.barascientific.com

## Certificate of Calibration

Certificate No. BSCC-UV-367/23  
Equipment UV/Vis Spectrophotometer  
Model UV-1800  
Manufacturer Shimadzu  
Serial No. A11454908533CD  
ID No. BKK\_EN0018  
Date of receipt 15 September 2023  
Date of calibration 15 September 2023  
Date of issue 22 September 2023

Number of Page(s) 1 of 3

REVIEW BY: Sirak P.  
APPROVED BY: LL AL  
NEXT CAL DATE: 15/9/2024Customer name ALS Laboratory Group (Thailand) Co., Ltd.  
Address 104 Soi Phattanakarn 40, Phattanakarn Road, Phattanakarn, Suan Luang, Bangkok 10250Temperature (23.4 - 24.7) °C (On site)  
Humidity (55.5 - 61.2) %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. 95937 and 95924  
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. Wanchana Janiwey

Approved by

Mr. Kanchit Choothep  
Technical ManagerThe 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.

FMAU-708-02 Rev.01 (2301/83)

Bara Scientific Co., Ltd.  
968 U Chu Liang Building Floor7 Rama4 Road  
Silom Bangkok Bangkok Thailand 10500  
Tel : 02-6324300 Fax : 02-6375496-7  
www.barascientific.com

## Certificate of Calibration

Certificate No. BSCC-UV-367/23 Number of Page(s) 2 of 3

Calibration Results:

## 1. Wavelength Accuracy

Certified Wavelength (nm)	UUC (nm)	Error (nm)	Uncertainty (±nm)
241.70	241.67	-0.03	0.18
334.02	334.03	0.01	0.18
418.53	418.59	0.06	0.18
572.99	573.14	0.15	0.18
879.41	879.21	-0.20	0.18

## 2. Photometric Accuracy (UV)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty (±A)
235	0.0000	0.0000	0.0000	0.0075
	0.7467	0.7460	-0.0007	0.0075
257	0.0000	0.0000	0.0000	0.0075
	0.8662	0.8646	-0.0016	0.0075
313	0.0000	0.0000	0.0000	0.0075
	0.2904	0.2908	0.0004	0.0075
350	0.0000	0.0001	0.0001	0.0075
	0.6429	0.6415	-0.0014	0.0075

\*CNR = Customer not request

The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate.  
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FMAU-708-02 Rev.01 (2301/83)

Bara Scientific Co., Ltd.  
968 U Chu Liang Building Floor7 Rama4 Road  
Silom Bangkok Bangkok Thailand 10500  
Tel : 02-6324300 Fax : 02-6375496-7  
www.barascientific.com

## Certificate of Calibration

Certificate No. BSCC-UV-367/23 Number of Page(s) 3 of 3

Calibration Results:

## 3. Photometric Accuracy (Visible)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty (±A)
420.0	0.0000	0.0000	0.0000	0.0042
	0.5783	0.5793	0.0010	0.0042
	0.7628	0.7624	-0.0004	0.0042
	1.0206	1.0216	0.0010	0.0042
440.0	0.0000	0.0000	0.0000	0.0042
	0.5621	0.5625	0.0004	0.0042
	0.7455	0.7452	-0.0003	0.0042
	0.9985	0.9989	0.0004	0.0042
465.0	0.0000	0.0000	0.0000	0.0042
	0.5227	0.5229	0.0002	0.0042
	0.6880	0.6873	-0.0007	0.0042
	0.9487	0.9486	-0.0001	0.0042
546.1	0.0000	0.0000	0.0000	0.0042
	0.5207	0.5211	0.0004	0.0042
	0.6973	0.6960	-0.0013	0.0042
	0.9959	0.9944	-0.0015	0.0042
590.0	0.0000	0.0000	0.0000	0.0042
	0.5544	0.5538	-0.0006	0.0042
	0.7253	0.7236	-0.0017	0.0042
	1.0942	1.0925	-0.0017	0.0042
635.0	0.0000	0.0000	0.0000	0.0042
	0.5616	0.5612	-0.0004	0.0042
	0.6927	0.6909	-0.0018	0.0042
	1.0881	1.0866	-0.0015	0.0042

\*CNR = Customer not request

## 4. Stray Light\*

Standard cut-off wavelength (nm)	Wavelength (nm)	Transmission (%)	Absorbance (A)
200.96±0.11nm	200.55	0.9770	2.0104

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 base 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 mention in this report / certificate.  
Advertising the report / Certificate and publicity of the results are prohibited and also shall not be reproduced  
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FMAU-708-02 Rev.01 (2301/83)



# 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. : ACC22042  
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 ± 3 ) °C  
Pressure : ( 101.3 ± 3 ) kPa  
Relative Humidity : ( 50.0 ± 20 ) %

Received Date : 30 NOVEMBER 2022  
Calibration Date : 07 DECEMBER 2022  
Date of Issue : 12 DECEMBER 2022

Calibrated by : Nathakorn Pisutpaisan

Approved by :

*T. Petchum*  
( Thanakul Petchum )

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

QP-TS12-04-04-020664

# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACC22042  
Job No. : VC66AC0015  
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).

QP-TS12-04-04-020664

# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACC22042  
Job No. : VC66AC0015  
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	94.05	0.05	0.15	0.40

2. Frequency

Specified Frequency (Hz)	Measured value (Hz)	Deviated value (%)	Uncertainty (%)	Tolerance limit (%)
1000	1003.7	0.4	0.1	1.0

3. Total distortion

Measured value (%)	Uncertainty (%)	Tolerance limit (%)
1.70	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

QP-TS12-04-04-020664

# 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. : ACL23173  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24  
Serial No.: 00658244 / 158766 / 58768  
ID No.: BKK\_FS0101

Condition As Found : GOOD

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

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

Received Date : 29 MAY 2023  
Calibration Date : 29-30 MAY 2023  
Date of Issue : 31 MAY 2023

Calibrated by : Nathakorn Pisutpaisan

Approved by :

*T. Petchum*  
( Thanakul Petchum )

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

QP-TS12-04-04-020664



## Continuation of Calibration Certificate

Cert. No. : ACL23173  
Job No. : VC66AC0060  
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-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL_BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL_BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL_BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAI	34560495	AA-3002-23	14-FEB-24

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

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

3.1 National Institute of Metrology (Thailand).

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

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL23173  
Job No. : VC66AC0060  
Pages : 3 of 8

## Summary of Measurement Result :

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

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

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL23173  
Job No. : VC66AC0060  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

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

## 2. Self-generated noise

## 2.1 Normal test

Measured Value (dB)
16.8

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

Frequency Weighting	Measured value (dB)
A - weight	12.0
C - weight	18.3
Flat	24.2

## 3. Acoustical signal tests of frequency weightings

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

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

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL23173  
Job No. : VC66AC0060  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

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

## 5.2 Time weighting at 1 kHz

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

## 6. Long - term stability

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

QF-TS12-04-04-020664



## Continuation of Calibration Certificate

Cert. No. : ACL23173  
Job No. : VC66AC0060  
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	38.9	-0.1	±1.1
34.0	33.9	-0.1	±1.1
30.0	29.9	-0.1	±1.1
29.0	28.9	-0.1	±1.1
28.0	27.9	-0.1	±1.1
27.0	26.9	-0.1	±1.1
26.0	25.9	-0.1	±1.1
25.0	24.9	-0.1	±1.1

QF-TS12-04-04-020664

T. Petchurui

## Continuation of Calibration Certificate

Cert. No. : ACL23173  
Job No. : VC66AC0060  
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	128.1	0.1	±1.0

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L <sub>peak</sub> (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	135.7	-0.7	±3.0

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

QF-TS12-04-04-020664

T. Petchurui

## Continuation of Calibration Certificate

Cert. No. : ACL23173  
Job No. : VC66AC0060  
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

QF-TS12-04-04-020664

T. Petchurui

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.comCert. No. : ACL23050  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No.: 00296512 / 179113 / 87521  
ID No.: BKK\_FS0969

Condition As Found : GOOD

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

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

Received Date : 17 JANUARY 2023  
Calibration Date : 19-20 JANUARY 2023  
Date of Issue : 23 JANUARY 2023

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchurui  
( Thanakul Petchurui )

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.

QF-TS12-04-04-020664



## Continuation of Calibration Certificate

Cert. No. : ACL23050  
Job No. : VC66AC0026  
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).

QF-TS12-04-04-020664

P.T.N.

## Continuation of Calibration Certificate

Cert. No. : ACL23050  
Job No. : VC66AC0026  
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

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P.T.N.

## Continuation of Calibration Certificate

Cert. No. : ACL23050  
Job No. : VC66AC0026  
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)
14.2

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

Frequency Weighting	Measured value (dB)
A - weight	10.8
C - weight	17.1
Flat	22.8

## 3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.1	0.2	0.2	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-0.5	-0.4	-0.4	±5.0

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P.T.N.

## Continuation of Calibration Certificate

Cert. No. : ACL23050  
Job No. : VC66AC0026  
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	0.0	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	94.0	94.0	0.0	± 0.3

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P.T.N.



Cert. No. : ACL23050  
Job No. : VC66AC0026  
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	109.0	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	27.1	0.1	± 1.1
26.0	26.0	0.0	± 1.1
25.0	25.0	0.0	± 1.1

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Cert. No. : ACL23050  
Job No. : VC66AC0026  
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	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 <sub>peak</sub> (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

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Cert. No. : ACL23050  
Job No. : VC66AC0026  
Pages : 8 of 8

## 11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle	0.3	±1.5
89.5	89.8		

## 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

451-451/1 Sidinthorn Rd., Bangbunru, Bangkok Bangkok 10700 THAILAND.  
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACL22252  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No. : 00858517 / 157784 / 48099  
ID No. : BKK\_FS0107

Condition As Found : GOOD

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

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

Received Date : 01 NOVEMBER 2022  
Calibration Date : 02-03 NOVEMBER 2022  
Date of Issue : 04 NOVEMBER 2022

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchurani  
( Thanakul Petchurani )

REVIEW BY : *Nathakorn P.*  
APPROVED BY : *[Signature]*  
NEXT CAL. DATE : 2/11/23

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## Continuation of Calibration Certificate

Cert. No. : ACL22252  
Job No. : VC66AC0004  
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 test 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).

QF-TS12-04-04-020664

T. Petch.

## Continuation of Calibration Certificate

Cert. No. : ACL22252  
Job No. : VC66AC0004  
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

QF-TS12-04-04-020664

T. Petch.

## Continuation of Calibration Certificate

Cert. No. : ACL22252  
Job No. : VC66AC0004  
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)
16.3

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

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

## 3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
125	0.3	0.3	0.3	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-1.2	-1.1	-1.1	±5.0

QF-TS12-04-04-020664

T. Petch.

## Continuation of Calibration Certificate

Cert. No. : ACL22252  
Job No. : VC66AC0004  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	0.0	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	-0.1	±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

QF-TS12-04-04-020664

T. Petch.



Continuation of Calibration Certificate

Cert. No. : ACL22252  
Job No. : VC66AC0004  
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	63.9	-0.1	± 1.1
59.0	59.0	0.0	± 1.1
54.0	53.9	-0.1	± 1.1
49.0	48.9	-0.1	± 1.1
44.0	43.9	-0.1	± 1.1
39.0	38.9	-0.1	± 1.1
34.0	33.9	-0.1	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.9	-0.1	± 1.1

QF-TS12-04-04-020664

T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL22252  
Job No. : VC66AC0004  
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, Lcpeak (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

QF-TS12-04-04-020664

T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL22252  
Job No. : VC66AC0004  
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

QF-TS12-04-04-020664

T. Petchur

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



Cert. No. : ACL23049  
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No.: 00296511 / 179112 / 87520  
ID No.: BKK\_FS0968

Condition As Found : GOOD

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

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

Received Date : 17 JANUARY 2023  
Calibration Date : 19-20 JANUARY 2023  
Date of Issue : 23 JANUARY 2023

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchur  
( Thanakul Petchurai )

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QF-TS12-04-04-020664



Continuation of Calibration Certificate

Cert. No. : ACL23049  
Job No. : VC66AC0026  
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).

QF-TS12-04-04-020664

T. R. R.

Continuation of Calibration Certificate

Cert. No. : ACL23049  
Job No. : VC66AC0026  
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

QF-TS12-04-04-020664

T. R. R.

Continuation of Calibration Certificate

Cert. No. : ACL23049  
Job No. : VC66AC0026  
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)
13.8

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

Frequency Weighting	Measured value (dB)
A - weight	9.9
C - weight	16.6
Flat	22.5

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	0.3	0.3	0.3	± 1.5
1000	-0.1	-0.1	-0.1	± 1.0
8000	-1.5	-1.5	-1.4	±5.0

QF-TS12-04-04-020664

T. R. R.

Continuation of Calibration Certificate

Cert. No. : ACL23049  
Job No. : VC66AC0026  
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	0.0	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

QF-TS12-04-04-020664

T. R. R.



## Continuation of Calibration Certificate

Cert. No. : ACL23049  
Job No. : VC66AC0026  
Pages : 6 of 8

## 7. Level linearity on the reference level range

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

QF-TS12-04-04-020664

T. Petchur

## Continuation of Calibration Certificate

Cert. No. : ACL23049  
Job No. : VC66AC0026  
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, Lcpeak (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

QF-TS12-04-04-020664

T. Petchur

## Continuation of Calibration Certificate

Cert. No. : ACL23049  
Job No. : VC66AC0026  
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

QF-TS12-04-04-020664

T. Petchur

451-451/1 Sirinthorn Rd., Bangbunru, Bangplud Bangkok 10700 THAILAND.  
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiphom.com http://www.sithiphom.comCert. No. : ACC22012  
Pages : 1 of 3

## Calibration Certificate

Equipment : SOUND CALIBRATOR  
Manufacturer : RION  
Model : NC-74  
Serial No.: 34178117  
ID No.: BKK\_FS0630

Condition As Found : GOOD

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

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

Received Date : 22 APRIL 2022  
Calibration Date : 26 APRIL 2022  
Date of Issue : 29 APRIL 2022

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchur  
( Thanakul Petchurai )

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Continuation of Calibration Certificate

Cert. No. : ACC22012  
Job No. : VC65AC0055  
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).

QF-TS12-04-04-020664

T. Petch.

Continuation of Calibration Certificate

Cert. No. : ACC22012  
Job No. : VC65AC0055  
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	94.13	0.13	0.14	0.40

2. Frequency

Specified Frequency (Hz)	Measured value (Hz)	Deviated value (%)	Uncertainty (%)	Tolerance limit (%)
1000	1001.7	0.2	0.1	1.0

3. Total distortion

Measured value (%)	Uncertainty (%)	Tolerance limit (%)
1.73	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

QF-TS12-04-04-020664

T. Petch.

SITHIPORN ASSOCIATES CO.,LTD.  
CALIBRATION LABORATORY

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



Cert. No. : ACL22168  
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preampifier NH-24  
Serial No.: 00658243 / 157783 / 48098  
ID No.: BKK\_FS0100

Condition As Found : GOOD

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

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

Received Date : 06 JULY 2022  
Calibration Date : 11-18 JULY 2022  
Date of Issue : 19 JULY 2022

Calibrated by : Nathakorn Pitutpaisan

Approved by : T. Petch.  
( 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.

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Continuation of Calibration Certificate

Cert. No. : ACL22168  
Job No. : VC65AC0069  
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	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

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).

QF-TS12-04-04-020664

T. Petch.



## Continuation of Calibration Certificate

Cert. No. : ACL22168  
Job No. : VC65AC0069  
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

QF-TS12-04-04-020664

7. Peth.

## Continuation of Calibration Certificate

Cert. No. : ACL22168  
Job No. : VC65AC0069  
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)
15.7

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	19.1
Flat	25.0

## 3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.2	0.2	0.3	± 1.5
1000	0.0	-0.1	0.0	± 1.0
8000	-1.4	-1.4	-1.4	±5.0

QF-TS12-04-04-020664

7. Peth.

## Continuation of Calibration Certificate

Cert. No. : ACL22168  
Job No. : VC65AC0069  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

Frequency Weighting	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

QF-TS12-04-04-020664

7. Peth.

## Continuation of Calibration Certificate

Cert. No. : ACL22168  
Job No. : VC65AC0069  
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	128.9	-0.1	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.1	0.1	± 1.1
29.0	29.1	0.1	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.1	0.1	± 1.1
26.0	26.2	0.2	± 1.1
25.0	25.2	0.2	± 1.1

QF-TS12-04-04-020664

7. Peth.



Continuation of Calibration Certificate

Cert. No. : ACL22168  
Job No. : VC65AC0069  
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
	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
SEL	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L <sub>peak</sub> (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

QF-TS12-04-04-020664

T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL22168  
Job No. : VC65AC0069  
Pages : 8 of 8

11. Overload indication

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

QF-TS12-04-04-020664

T. Petchur

SITHIPORN ASSOCIATES CO.,LTD.  
CALIBRATION LABORATORY

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



Cert. No. : ACL22177  
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone U/C-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 PHATTANAKAN 40, PHATTANAKAN ROAD,  
KHWAENG PHATTANAKAN, KHET SUAN LUANG,  
BANGKOK, 10250 THAILAND.

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

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

REVIEW BY: *Nathakorn P.*  
APPROVED BY: *T. Petchur*  
NEXT CAL. DATE: 15/8/23

Calibrated by : Nathakorn Pisutpaisan

Approved by : *T. Petchur*  
( 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.

QF-TS12-04-04-020664

SITHIPORN SITHIPORN ASSOCIATES CO.,LTD.  
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).

QF-TS12-04-04-020664

T. Petchur



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

QF-TS12-04-04-020664

T. Petch.

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

QF-TS12-04-04-020664

T. Petch.

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

QF-TS12-04-04-020664

T. Petch.

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	119.0	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

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T. Petch.



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
	0.25	1	99.0	98.8	-0.2	1.5 ; -5.0
SEL	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 <sub>peak</sub> (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

QF-TS12-04-04-020664

T. Petchu.

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

QF-TS12-04-04-020664

T. Petchu.

SITHIPORN ASSOCIATES CO.,LTD.  
CALIBRATION LABORATORY

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Cert. No. : ACL22251  
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No. : 00858516 / 158777 / 58778  
ID No. : BKK\_FS0106

Condition As Found : GOOD

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

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

Received Date : 01 NOVEMBER 2022  
Calibration Date : 02-03 NOVEMBER 2022  
Date of Issue : 04 NOVEMBER 2022

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchu.  
( Thanakul Petchumai )

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QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22251  
Job No. : VC66AC0004  
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).

QF-TS12-04-04-020664

T. Petchu.



## Continuation of Calibration Certificate

Cert. No. : ACL22251  
Job No. : VC66AC0004  
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

QF-TS12-04-04-020664

T. Petch.

## Continuation of Calibration Certificate

Cert. No. : ACL22251  
Job No. : VC66AC0004  
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)
16.8

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

Frequency Weighting	Measured value (dB)
A - weight	9.9
C - weight	16.6
Flat	22.5

## 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	0.8	0.8	0.8	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-2.6	-2.5	-2.5	±5.0

QF-TS12-04-04-020664

T. Petch.

## Continuation of Calibration Certificate

Cert. No. : ACL22251  
Job No. : VC66AC0004  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

QF-TS12-04-04-020664

T. Petch.

## Continuation of Calibration Certificate

Cert. No. : ACL22251  
Job No. : VC66AC0004  
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	25.0	0.0	± 1.1

QF-TS12-04-04-020664

T. Petch.



Continuation of Calibration Certificate

Cert. No. : ACL22251  
Job No. : VC66AC0004  
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 <sub>peak</sub> (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

QF-TS12-04-04-020664

T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL22251  
Job No. : VC66AC0004  
Pages : 8 of 8

11. Overload indication

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

QF-TS12-04-04-020664

T. Petch

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. : ACL22302  
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No.: 00858521 / 158765 / 58767  
ID No.: BKK\_FS0111

Condition As Found : GOOD

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

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

Received Date : 07 DECEMBER 2022  
Calibration Date : 16-20 DECEMBER 2022  
Date of Issue : 21 DECEMBER 2022

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petch  
( Thanakul Petchurai )

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QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22302  
Job No. : VC66AC0016  
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).

QF-TS12-04-04-020664

T. Petch



## Continuation of Calibration Certificate

Cert. No. : ACL22302  
Job No. : VC66AC0016  
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

QF-TS12-04-04-020664

T. Reth...

## Continuation of Calibration Certificate

Cert. No. : ACL22302  
Job No. : VC66AC0016  
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)
14.8

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	18.1
Flat	23.8

## 3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.3	0.3	0.4	± 1.5
1000	0.1	0.0	0.0	± 1.0
8000	-1.9	-1.8	-1.8	±5.0

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T. Reth...

## Continuation of Calibration Certificate

Cert. No. : ACL22302  
Job No. : VC66AC0016  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

QF-TS12-04-04-020664

T. Reth...

## Continuation of Calibration Certificate

Cert. No. : ACL22302  
Job No. : VC66AC0016  
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	59.1	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	26.9	-0.1	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.9	-0.1	± 1.1

QF-TS12-04-04-020664

T. Reth...



Cert. No. : ACL22302  
Job No. : VC66AC0016  
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
	2	8	108.0	108.0	0.0	1.0 ; -2.5
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 <sub>peak</sub> (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	135.4	-1.0	±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	135.2	-0.2	±2.0

QF-TS12-04-04-020664

T. Petchurai

Cert. No. : ACL22302  
Job No. : VC66AC0016  
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

QF-TS12-04-04-020664

T. Petchurai

SITHIPORN ASSOCIATES CO.,LTD.  
CALIBRATION LABORATORY

451-451/1 Sirinthorn Rd.,Bangbunru, Bangplud Bangkok 10700 THAILAND.  
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Cert. No. : ACC22043  
Pages : 1 of 3

Calibration Certificate

Equipment : SOUND CALIBRATOR  
Manufacturer : RION  
Model : NC-74  
Serial No. : 34178118  
ID No. : BKK\_FS0631

Condition As Found : GOOD

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

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

Received Date : 07 DECEMBER 2022  
Calibration Date : 20 DECEMBER 2022  
Date of Issue : 21 DECEMBER 2022

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchurai  
( Thanakul Petchurai )

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QF-TS12-04-04-020664

Cert. No. : ACC22043  
Job No. : VC66AC0016  
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	3351TB	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).

QF-TS12-04-04-020664

T. Petchurai



Cert. No. : ACC22043  
Job No. : VC66AC0016  
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	94.13	0.13	0.14	0.40

2. Frequency

Specified Frequency (Hz)	Measured value (Hz)	Deviated value (%)	Uncertainty (%)	Tolerance limit (%)
1000	1001.7	0.2	0.1	1.0

3. Total distortion

Measured value (%)	Uncertainty (%)	Tolerance limit (%)
2.13	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

QF-TS12-04-04-020664

T. Petchum

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

Location : -  
Ambient Temperature : ( 23.0 ± 3 ) °C  
Pressure : ( 101.3 ± 3 ) kPa  
Relative Humidity : ( 50.0 ± 2.0 ) %  
Received Date : 06 SEPTEMBER 2022  
Calibration Date : 07-09 SEPTEMBER 2022  
Date of Issue : 14 SEPTEMBER 2022

REVIEW BY : *Nathakorn P*  
APPROVED BY : *T. Petchum*  
NEXT CAL. DATE : 4/9/23

Calibrated by : Nathakorn Pisutpaisan

Approved by :

*T. Petchum*  
( Thanakul Petchum )

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QF-TS12-04-04-020664

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).

QF-TS12-04-04-020664

T. Petchum

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

QF-TS12-04-04-020664

T. Petchum



## 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)			
	Flat	C-weight	A-weight	Acceptance Limits
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

QF-TS12-04-04-020664

T. Petch...

## 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

QF-TS12-04-04-020664

T. Petch...

## 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

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T. Petch...

## 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 <sub>peak</sub> ( 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

QF-TS12-04-04-020664

T. Petch...



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

QF-TS12-04-04-020664

T. Petchur

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. : ACL22246  
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No.: 00597155 / 180398 / 88168  
ID No.: BKK\_FS0993

Condition As Found : GOOD

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

Location :  
Ambient Temperature : ( 23.0 ± 3 ) °C  
Pressure : ( 101.3 ± 3 ) kPa  
Relative Humidity : ( 50.0 ± 20 ) %  
Received Date : 11 OCTOBER 2022  
Calibration Date : 25-26 OCTOBER 2022  
Date of Issue : 27 OCTOBER 2022

VIEW BY: Nathakorn P.  
PROVED BY: [Signature]  
EXT. CAL. DATE: 26/10/25

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchur  
( Thanakul Petchurai )

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QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22246  
Job No. : VC65AC0090  
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).

QF-TS12-04-04-020664

T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL22246  
Job No. : VC65AC0090  
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

QF-TS12-04-04-020664

T. Petchur



## Continuation of Calibration Certificate

Cert. No. : ACL22246  
Job No. : VC65AC0090  
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 )
16.4

## 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	17.6
Flat	23.2

## 3. Acoustical signal tests of frequency weightings

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

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

QF-TS12-04-04-020664

P. P. P. P.

## Continuation of Calibration Certificate

Cert. No. : ACL22246  
Job No. : VC65AC0090  
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	0.1	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

Frequency Weighting	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

QF-TS12-04-04-020664

P. P. P. P.

## Continuation of Calibration Certificate

Cert. No. : ACL22246  
Job No. : VC65AC0090  
Pages : 6 of 8

## 7. Level linearity on the reference level range

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

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P. P. P. P.

## Continuation of Calibration Certificate

Cert. No. : ACL22246  
Job No. : VC65AC0090  
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 <sub>peak</sub> ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Continuous	133.0	133.0	0.0	-
One	136.4	135.9	-0.5	±3.0

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

QF-TS12-04-04-020664

P. P. P. P.



Continuation of Calibration Certificate

Cert. No. : ACL22246  
Job No. : VC65AC0090  
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

QF-TS12-04-04-020664



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. : ACC23014  
Pages : 1 of 3

Calibration Certificate

Equipment : SOUND CALIBRATOR  
Manufacturer : RION  
Model : NC-74  
Serial No. : 34178117  
ID No. : BKK\_FS0630

Condition As Found : GOOD

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

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

Received Date : 22 MAY 2023  
Calibration Date : 24 MAY 2023  
Date of Issue : 25 MAY 2023



Calibrated by : Nathakorn Pisutpaisan

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

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Continuation of Calibration Certificate

Cert. No. : ACC23014  
Job No. : VC66AC0059  
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-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL_BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL_BP 30/0267	13-FEB-24
Digital Multimeter	33461A	MY60024273	EEL_BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAI	34560495	AA-3002-23	14-FEB-24
Audio Analyzer	AVR-3360A	V744B6069	EF-0012-23	10-FEB-24

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

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

3.1 National Institute of Metrology (Thailand).

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACC23014  
Job No. : VC66AC0059  
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	94.16	0.16	0.14	0.40

2. Frequency

Specified Frequency (Hz)	Measured value (Hz)	Deviated value ( % )	Uncertainty ( % )	Tolerance limit ( % )
1000	1001.7	0.2	0.1	1.0

3. Total distortion

Measured value ( % )	Uncertainty ( % )	Tolerance limit ( % )
1.69	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

QF-TS12-04-04-020664



# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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



Cert. No. : ACL22221  
Pages : 1 of 8

## Calibration Certificate

**Equipment :** SOUND LEVEL METER  
**Manufacturer :** RION  
**Model :** NL-42A/ Microphone UC-52 / Preamplifier NH-24  
**Serial No.:** 00623381 / 198627 / 26409  
**ID No.:** -

**Condition As Found :** GOOD

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

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

**Received Date :** 28 SEPTEMBER 2022  
**Calibration Date :** 12-17 OCTOBER 2022  
**Date of Issue :** 18 OCTOBER 2022



**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.

QF-TS12-04-04-020664

# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

## Continuation of Calibration Certificate

Cert. No. : ACL22221  
Job No. : VC65AC0086  
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).

QF-TS12-04-04-020664

# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

## Continuation of Calibration Certificate

Cert. No. : ACL22221  
Job No. : VC65AC0086  
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

QF-TS12-04-04-020664

# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

## Continuation of Calibration Certificate

Cert. No. : ACL22221  
Job No. : VC65AC0086  
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)
14.8

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

Frequency Weighting	Measured value (dB)
A - weight	11.2
C - weight	17.2
Flat	22.8

#### 3. Acoustical signal tests of frequency weightings

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

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

QF-TS12-04-04-020664



## Continuation of Calibration Certificate

Cert. No. : ACL22221  
Job No. : VC65AC0086  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighing network response with relative to 1 kHz.

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

## 5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	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

QF-TS12-04-04-020664

T. Petch.

## Continuation of Calibration Certificate

Cert. No. : ACL22221  
Job No. : VC65AC0086  
Pages : 6 of 8

## 7. Level linearity on the reference level range

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

QF-TS12-04-04-020664

T. Petch.

## Continuation of Calibration Certificate

Cert. No. : ACL22221  
Job No. : VC65AC0086  
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	128.1	0.1	±1.0

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value ( dB )	Measured Value, L <sub>peak</sub> ( 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	133.1	0.1	-
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

QF-TS12-04-04-020664

T. Petch.

## Continuation of Calibration Certificate

Cert. No. : ACL22221  
Job No. : VC65AC0086  
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

QF-TS12-04-04-020664

T. Petch.



# 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. : ACL22302  
Pages : 1 of 8

## Calibration Certificate

**Equipment :** SOUND LEVEL METER  
**Manufacturer :** RION  
**Model :** NL-42/ Microphone UC-52 / Preamplifier NH-24  
**Serial No.:** 00838521 / 158765 / 58767  
**ID No.:** BKK\_FS0111

**Condition As Found :** GOOD

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

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

**Received Date :** 07 DECEMBER 2022  
**Calibration Date :** 16-20 DECEMBER 2022  
**Date of Issue :** 21 DECEMBER 2022

**Calibrated by :** Nathakorn Pisutpaisan

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

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.

QF-TS12-04-04-020664

# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

## Continuation of Calibration Certificate

Cert. No. : ACL22302  
Job No. : VC66AC0016  
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).

QF-TS12-04-04-020664

# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

## Continuation of Calibration Certificate

Cert. No. : ACL22302  
Job No. : VC66AC0016  
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

QF-TS12-04-04-020664

# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

## Continuation of Calibration Certificate

Cert. No. : ACL22302  
Job No. : VC66AC0016  
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)
14.8

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	18.1
Flat	23.8

#### 3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.3	0.3	0.4	± 1.5
1000	0.1	0.0	0.0	± 1.0
8000	-1.9	-1.8	-1.8	±5.0

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## Continuation of Calibration Certificate

Cert. No. : ACL22302  
Job No. : VC66AC0016  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

QF-TS12-04-04-020664

T. Petch...

## Continuation of Calibration Certificate

Cert. No. : ACL22302  
Job No. : VC66AC0016  
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	59.1	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	26.9	-0.1	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.9	-0.1	± 1.1

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T. Petch...

## Continuation of Calibration Certificate

Cert. No. : ACL22302  
Job No. : VC66AC0016  
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
	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
SEL	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value ( dB )	Measured Value, L <sub>peak</sub> ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Continuous	133.0	133.0	0.0	-
One	136.4	135.4	-1.0	±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	135.2	-0.2	±2.0

QF-TS12-04-04-020664

T. Petch...

## Continuation of Calibration Certificate

Cert. No. : ACL22302  
Job No. : VC66AC0016  
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

QF-TS12-04-04-020664

T. Petch...



# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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Cert. No. : ACL23004  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No.: 00858520 / 158771 / 58772  
ID No.: BKK\_FS0110

Condition As Found : GOOD

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

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

Received Date : 14 DECEMBER 2022  
Calibration Date : 03-05 JANUARY 2023  
Date of Issue : 06 JANUARY 2023

Calibrated by : Nathakorn Pisutpaisan

Approved by :

*T. Petchur*  
( Thanakul Petchurai )

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# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

## Continuation of Calibration Certificate

Cert. No. : ACL23004  
Job No. : VC66AC0021  
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).

QF-TS12-04-04-020664

# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

## Continuation of Calibration Certificate

Cert. No. : ACL23004  
Job No. : VC66AC0021  
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

QF-TS12-04-04-020664

# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

## Continuation of Calibration Certificate

Cert. No. : ACL23004  
Job No. : VC66AC0021  
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	12.5
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)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.3	0.3	0.4	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-1.4	-1.4	-1.4	±5.0

QF-TS12-04-04-020664



## Continuation of Calibration Certificate

Cert. No. : ACL23004  
Job No. : VC66AC0021  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

Frequency Weighting	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

QF-TS12-04-04-020664

T. Petcha

## Continuation of Calibration Certificate

Cert. No. : ACL23004  
Job No. : VC66AC0021  
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	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

QF-TS12-04-04-020664

T. Petcha

## Continuation of Calibration Certificate

Cert. No. : ACL23004  
Job No. : VC66AC0021  
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	128.1	0.1	±1.0

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value ( dB )	Measured Value, Lcpeak ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Continuous	133.0	133.0	0.0	-
One	136.4	135.3	-1.1	±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

QF-TS12-04-04-020664

T. Petcha

## Continuation of Calibration Certificate

Cert. No. : ACL23004  
Job No. : VC66AC0021  
Pages : 8 of 8

## 11. Overload indication

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

## 12. High level stability

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

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

QF-TS12-04-04-020664

T. Petcha



# 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. : ACL22255  
Pages : 1 of 8

## Calibration Certificate

**Equipment :** SOUND LEVEL METER  
**Manufacturer :** RION  
**Model :** NL-42A/ Microphone UC-52 / Preamplifier NH-24  
**Serial No.:** 00222500 / 195809 / 15331  
**ID No.:** -

**Condition As Found :** GOOD

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

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

**Received Date :** 02 NOVEMBER 2022  
**Calibration Date :** 04-07 NOVEMBER 2022  
**Date of Issue :** 08 NOVEMBER 2022



**Calibrated by :** Nathakorn Pisutpaisan

**Approved by :**

*T. Petchum*  
( Thanakul Petchum )

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

QF-TS12-04-04-020664

# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

## Continuation of Calibration Certificate

Cert. No. : ACL22255  
Job No. : VC66AC0005  
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, 04/0263	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL-BP, 03/0263	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL-BP, 05/0263	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).

QF-TS12-04-04-020664

# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

## Continuation of Calibration Certificate

Cert. No. : ACL22255  
Job No. : VC66AC0005  
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

QF-TS12-04-04-020664

# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

## Continuation of Calibration Certificate

Cert. No. : ACL22255  
Job No. : VC66AC0005  
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)
14.2

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

Frequency Weighting	Measured value (dB)
A-weight	9.9
C-weight	16.5
Flat	22.4

#### 3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.2	0.2	0.2	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	0.7	0.8	0.8	±5.0

QF-TS12-04-04-020664



Cert. No. : ACL22255  
Job No. : VC66AC0005  
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	-0.1	-0.1	-0.1	±1.5
500	-0.1	0.0	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.0	0.0	±5.0

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

Frequency Weighting	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	93.9	0.0	± 0.1
Leq	93.9	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	94.1	94.1	0.0	± 0.3

QF-TS12-04-04-020664

T. Retch

Cert. No. : ACL22255  
Job No. : VC66AC0005  
Pages : 6 of 8

## 7. Level linearity on the reference level range

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

QF-TS12-04-04-020664

T. Retch

Cert. No. : ACL22255  
Job No. : VC66AC0005  
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
	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
SEL	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value ( dB )	Measured Value, L <sub>peak</sub> ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Continuous	133.0	133.0	0.0	-
One	136.4	135.5	-0.9	±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

QF-TS12-04-04-020664

T. Retch

Cert. No. : ACL22255  
Job No. : VC66AC0005  
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

QF-TS12-04-04-020664

T. Retch



# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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Cert. No. : ACL22263  
Pages : 1 of 8

## Calibration Certificate

**Equipment :** SOUND LEVEL METER  
**Manufacturer :** RION  
**Model :** NL-42A/ Microphone UC-52 / Preamplifier NH-24  
**Serial No.:** 00222486 / 198967 / 15317  
**ID No.:** - RYK/3 1212

**Condition As Found :** GOOD

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

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

**Received Date :** 02 NOVEMBER 2022  
**Calibration Date :** 08-10 NOVEMBER 2022  
**Date of Issue :** 11 NOVEMBER 2022

**Calibrated by :** Nathakorn Pisutpaisan

**Approved by :**

*T. Petchurai*  
( Thanakul Petchurai )

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QF-TS12-04-04-020664

# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

## Continuation of Calibration Certificate

Cert. No. : ACL22263  
Job No. : VC66AC0005  
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).

QF-TS12-04-04-020664

# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

## Continuation of Calibration Certificate

Cert. No. : ACL22263  
Job No. : VC66AC0005  
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

QF-TS12-04-04-020664

# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

## Continuation of Calibration Certificate

Cert. No. : ACL22263  
Job No. : VC66AC0005  
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)
14.4

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

Frequency Weighting	Measured value (dB)
A - weight	11.2
C - weight	17.6
Flat	23.4

#### 3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.5	0.5	0.5	± 1.5
1000	0.0	0.1	0.1	± 1.0
8000	-0.4	-0.3	-0.2	± 5.0

QF-TS12-04-04-020664



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	-0.2	-0.1	±2.0
125	-0.1	0.0	-0.1	±1.5
250	0.0	0.0	-0.1	±1.5
500	0.0	0.0	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.0	0.0	±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	94.0	94.0	0.0	± 0.3

QF-TS12-04-04-020664

T. R. R. R.

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	99.1	0.1	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.9	-0.1	± 1.1

QF-TS12-04-04-020664

T. R. R. R.

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
	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
SEL	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value ( dB )	Measured Value, Lepeak ( 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

QF-TS12-04-04-020664

T. R. R. R.

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

QF-TS12-04-04-020664

T. R. R. R.



# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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



Cert. No. : ACL22256  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42A/ Microphone UC-52 / Preamplifier NH-24  
Serial No.: 00222501 / 195810 / 15332  
ID No.: - 5597 191011

Condition As Found : GOOD

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

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

Received Date : 02 NOVEMBER 2022  
Calibration Date : 04-07 NOVEMBER 2022  
Date of Issue : 08 NOVEMBER 2022



Calibrated by : Nathakorn Pisutpaisan

Approved by :

*T. Petchum*  
( Thanakul Petchum )

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

QF-TS12-04-04-020664

# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

## Continuation of Calibration Certificate

Cert. No. : ACL22256  
Job No. : VC66AC0005  
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	MY32302742	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).

QF-TS12-04-04-020664

# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

## Continuation of Calibration Certificate

Cert. No. : ACL22256  
Job No. : VC66AC0005  
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

QF-TS12-04-04-020664

# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

## Continuation of Calibration Certificate

Cert. No. : ACL22256  
Job No. : VC66AC0005  
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)
14.2

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

Frequency Weighting	Measured value (dB)
A - weight	9.9
C - weight	16.7
Flat	22.6

#### 3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.2	0.3	0.2	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	0.8	0.9	0.9	±5.0

QF-TS12-04-04-020664



Cert. No. : ACL22256  
Job No. : VC66AC0005  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

QF-TS12-04-04-020664

T. R. T. H.

Cert. No. : ACL22256  
Job No. : VC66AC0005  
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	84.0	0.0	± 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	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	27.0	0.0	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.9	-0.1	± 1.1

QF-TS12-04-04-020664

T. R. T. H.

Cert. No. : ACL22256  
Job No. : VC66AC0005  
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
	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
SEL	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.1	0.1	±1.0

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value ( dB )	Measured Value, L <sub>peak</sub> ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Continuous	133.0	133.1	0.1	-
One	136.4	135.5	-0.9	±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

QF-TS12-04-04-020664

T. R. T. H.

Cert. No. : ACL22256  
Job No. : VC66AC0005  
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

QF-TS12-04-04-020664

T. R. T. H.





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## CERTIFICATE OF CALIBRATION

Certificate No.: CL-165-65  
Page 1 of 2

Equipment Name: Heat Stress Monitor  
Manufacturer: Delta OHM  
Model: HD32.2  
Serial No: 16002005  
ID No: BKK\_FS0682

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: 15 Nov 2022  
Calibration date: 21 Nov 2022  
Issue date: 23 Nov 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: 22 July 2023

### 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-0092-  
22



### Calibrated by

☒ Mr. Sorawit Thachalad  
☐ Miss Jitraporn Lertsomphol



### Approved Signatory:

Mr. Parinya Booncharoen  
Calibration Department Manager

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



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Certificate No.: CL-165-65  
Page 2 of 2

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: 16008205.  
Dimension: Diameter 14 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
30	20.065	20.0	-0.1	0.14
30	25.050	24.9	-0.2	0.099
30	30.042	29.9	-0.1	0.099
30	35.040	34.9	-0.1	0.099
30	40.033	39.9	-0.1	0.099

Table 2: This equipment was connected with temperature probe Model: TP3207.2 S/N: 16010559.  
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
70	20.066	20.1	0.0	0.099
70	25.052	24.8	-0.3	0.099
70	30.042	29.7	-0.3	0.099
70	35.038	34.6	-0.4	0.099
70	40.034	39.5	-0.5	0.099

Table 3: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 16008195.  
Dimension: Diameter 8 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.065	20.1	0.0	0.099
110	25.052	25.1	0.0	0.099
110	30.042	30.1	0.1	0.099
110	35.039	35.1	0.1	0.099
110	40.034	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 ★



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## CERTIFICATE OF CALIBRATION

Certificate No.: CL-164-65  
Page 1 of 2

Equipment Name: Heat Stress Monitor  
Manufacturer: Delta OHM  
Model: HD32.2  
Serial No: 16002004  
ID No: BKK\_FS0681

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: 15 Nov 2022  
Calibration date: 21 Nov 2022  
Issue date: 23 Nov 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: 22 July 2023

### Calibration Condition

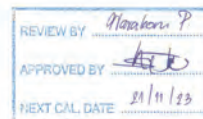
Temperature: (23±3) °C  
Relative Humidity: (55±15)%

### 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-0092-  
22



### Calibrated by

☒ Mr. Sorawit Thachalad  
☐ Miss Jitraporn Lertsomphol



### Approved Signatory:

Mr. Parinya Booncharoen  
Calibration Department Manager

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



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Wathapra, Bangkokhyai, Bangkok 10600 Thailand.  
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Certificate No.: CL-164-65  
Page 2 of 2

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: 16008207.  
Dimension: Diameter 14 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
30	20.066	20.0	-0.1	0.099
30	25.049	25.0	0.0	0.099
30	30.042	30.0	0.0	0.099
30	35.037	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: 16010559.  
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
70	20.066	20.1	0.0	0.099
70	25.049	25.0	0.0	0.099
70	30.042	29.9	-0.1	0.099
70	35.034	34.8	-0.2	0.099
70	40.031	39.8	-0.2	0.099

Table 3: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 16006594.  
Dimension: Diameter 8 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.066	20.1	0.0	0.099
110	25.049	25.0	0.0	0.099
110	30.042	30.0	0.0	0.099
110	35.035	35.0	0.0	0.099
110	40.031	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-040-66  
Page 1 of 2

Equipment Name: Heat Stress Monitor  
Manufacturer: Delta OHM  
Model: HD32.2  
Serial No: 15006710  
ID No: BKK\_FS0672

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: 15 Feb 2023  
Calibration date: 22 Feb 2023  
Issue date: 23 Feb 2023

### 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: 22 July 2023

### 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-0092-  
22



Calibrated by  
☐ Mr. Sorawit Thachalad  
☒ Miss Jitraporn Lertsomphol



Approved Signatory:   
Mr. Parinya Booncharoen  
Calibration Department Manager

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

Certificate No. : CL-040-66  
Page 2 of 2

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: 15015852.  
Dimension: Diameter 14 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
60	20.065	20.0	-0.1	0.099
60	25.060	25.0	-0.1	0.099
60	30.053	30.0	-0.1	0.099
60	35.047	35.0	0.0	0.099
60	40.044	40.0	0.0	0.099

Table 2: This equipment was connected with temperature probe Model: TP3207.2 S/N: 14036714.  
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
70	20.065	20.1	0.0	0.099
70	25.061	24.9	-0.2	0.099
70	30.053	29.8	-0.3	0.099
70	35.047	34.7	-0.3	0.099
70	40.043	39.6	-0.4	0.099

Table 3: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 15021832.  
Dimension: Diameter 8 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.065	20.1	0.0	0.099
110	25.060	25.1	0.0	0.099
110	30.053	30.1	0.0	0.099
110	35.047	35.1	0.1	0.099
110	40.043	40.1	0.1	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-058-66  
Page 1 of 2

Equipment Name: Heat Stress Monitor  
Manufacturer: Delta OHM  
Model: HD32.2  
Serial No: 15036132  
ID No: BKK\_FS0680

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: 01 Mar 2023  
Calibration date: 07 Apr 2023  
Issue date: 07 Apr 2023

### Reference Used During Calibration

1. Standard Temperature Probe Model: STS-100 A500,  
Serial No.: 667682-09, Due date: 28 Mar 2024  
2. Digital Temperature Indicator Model: DTI-1000-A MK  
II, Serial No.: 671407-00591 Due date: 22 July 2023

### 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-0038-23, Certificate number: ER-0092-  
22



Calibrated by  
☐ Mr. Sorawit Thachalad  
☒ Miss Jitraporn Lertsomphol



Approved Signatory:   
Mr. Parinya Booncharoen  
Calibration Department Manager

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

Certificate No. : CL-058-66  
Page 2 of 2

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: 15015846.  
Dimension: Diameter 14 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
60	20.068	20.1	0.0	0.099
60	25.060	25.1	0.0	0.099
60	30.050	30.1	0.1	0.099
60	35.041	35.1	0.1	0.099
60	40.046	40.1	0.1	0.099

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 15015972.  
Dimension: Diameter 8 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.068	20.0	-0.1	0.099
110	25.060	25.0	-0.1	0.099
110	30.050	30.0	-0.1	0.099
110	35.041	35.0	0.0	0.099
110	40.046	40.0	0.0	0.099

Table 3: This equipment was connected with temperature probe Model: TP3207.2 S/N: 14032362.  
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
70	20.068	20.2	0.1	0.099
70	25.060	25.1	0.0	0.099
70	30.050	29.9	-0.1	0.099
70	35.042	34.8	-0.2	0.099
70	40.046	39.7	-0.3	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 ★







TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES  
53/4 PATTANAKARN ROAD SOI 19, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL. 0-2317-0000-01 FAX. 0-2319-0444



Cert. No.: 22CH1222  
Page.: 1 of 2

## Certificate of Calibration

Equipment : pH Meter  
Manufacturer : Mettler Toledo  
Model : Seven Compact S220  
Serial No. : B520948426  
ID No. : BKK\_EN0072  
Condition As-Received : Used Item  
Received Date : 09 September 2022  
Calibration Date : 12 September 2022  
Reference : 2209-0312DSC-1  
Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd.,  
Khwang Phatthanakan, Khet Suan Luang,  
Bangkok 10250 Thailand

Ambient Temperature : (25 ± 2.5) °C  
Relative Humidity : (50 ± 15) %  
Calibration Procedure : In-house method :  
- CP-CH5 by direct measurement with standard  
voltage calibrator and direct measurement  
with certified reference material (CRM)

Calibrated by : Warakorn Lemgagtrakul

Approved by :   
Approved Signatory

( ) Malee Butkrua  
( ) Sathip Moangmai  
( ) Warakorn Lemgagtrakul

Issue Date : 15 September 2022

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written  
approval of the Association of Corporate Services & Equipment Calibration and Testing Services.



Cert. No.: 22CH1222  
Page.: 2 of 2

### Condition of this calibration result

1. Reference Standard Instrument :-

Instrument	Serial No.	ID No.	Cert. No.	Due Date
Document Process Calibrator	54030049	130RC116	22E2789	24 Aug 2023

This certification is traceable to the International System of Unit maintained at:-  
- Traceable to National Institute of Metrology (Thailand), NIMT

2. Certified Reference Materials :- The measurement results are traceable to SI through CPA chem Ltd.,  
ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	823320	20 June 2024
pH 6.985	CPA chem	794122	14 Feb 2023
pH 10.008	CPA chem	823323	20 June 2023

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

### Calibration Results

Function : mV Measurement

Performing standard curve by Fluke at pH (4,7,10)

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (mV)	Coverage factor k
			mV	pH		
pH Meter S/N: B520948426	4.000	177.48	177.4	4.000	0.058	2.00
	7.000	0.00	0.0	7.000	0.058	2.00
	10.000	-177.48	-177.5	10.000	0.058	2.00

### Function : pH Measurement

Performing three buffers standard curve by using buffer nominal pH (4,7,10)

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH measurement (±)	Coverage factor k
pH Electrode S/N: PCE-66-EX1001	4.008	3.999	153.9	0.0055	2.00
	6.985	7.017	-13.7	0.0084	2.00
	10.008	9.996	-179.0	0.0078	2.00

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

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## Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoh, Saraburi 18110, Thailand.  
Saraburi Tel : +66 3627 3096 Fax : +66 3627 3100  
Bangkok Tel : +668 9205 6851 , +668 8247 2380  
Website : www.scieco.co.th E-Mail : calibrate@scg.com



NSC-TIS-TIS 17025  
CALIBRATION 0244

Certificate No. T222502

Page 1 of 4

## Certificate of Calibration

Equipment : Chamber ( Oven )  
Manufacturer : Memmert  
Model : UF 450  
Serial No. : B7170531  
Customer Code : BKK\_EN0273  
ID No. : T8042A4  
Customer : ALS Laboratory Group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,  
Khet Suan Luang, Bangkok 10250  
Customer Location : Oven Room  
Date of Receipt : 23 November 2022  
Calibrated By : Sujjar Naknakred ( Site Calibration Manager )  
Approved By : /Boonchai Suriyawong (Site Calibration Manager)  
Date of Issue : 09 DEC 2022

REVIEW BY :   
APPROVED BY :   
NEXT CAL. DATE : 09/05/24

The uncertainties are for a confidence probability of approximately 95%.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrological Center.

FM-L14115/31-08-64



## Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoh, Saraburi 18110, Thailand.



NSC-TIS-TIS 17025  
CALIBRATION 0244

Certificate No. T222502

Page 2 of 4

## Calibration Report

Equipment : Chamber ( Oven )  
Date of Calibration : 29 November 2022  
Environment : Temperature : 29.1-29.6 °C  
Line Voltage : 221.3-223.2 V  
Relative Humidity : 55-65 %RH

### Condition of this results of calibration :

1. This equipment was calibrated by insert nine resistance thermometer detectors and nine standard thermocouples type T into its chamber, the other one resistance thermometer detector use for ambient temperature measurement.  
The calibration was done in according to WI-T20 ( based on ASTM E145-94 ( Reapproved 2001 ) and AS2853-1986 ).  
All data show below were final values and the initial data from customer request. The temperature scale used was based on ITS - 90.

### 2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
RTD	100 ohm	27-(CH1-10)	T210004	30 December 2022
TC	TYPE T	TN261-TN270	T210010	30 December 2022
DATA LOGGER	34970A	T149	T210004	30 December 2022

### 3. This certificate is traceable to :-

National Institute of Metrology ( Thailand ) through Metrological Center ( NSC-TIS-TIS 17025 CALIBRATION 0244 )

### 4. Condition of calibrated item : good

Equipment Description :

Time Constant : 1 Hour 49 Minute At 104 °C  
Fresh Air Damper : ☒ Open ☐ Min ☐ Medium ☒ Max  
☐ Close  
☐ Not Available

### 5. Adjustment :

( ) without adjustment ( X ) after adjustment

Approved By :

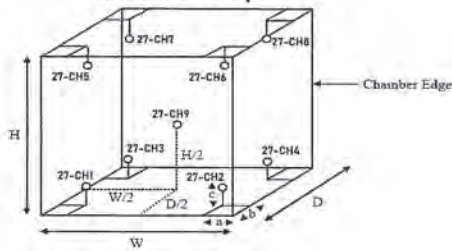
FM-L15117/35-05-60



Certificate No. T222502

Page 3 of 4

### Calibration Report



**Remark :**

Internal Dimensions of Chamber : W (Width) = 104 cm., H (Height) = 72 cm. and D (Depth) = 60 cm.  
Size of Installed Standard sensor number 27-CH1 to number 27-CH9 :  $\phi = 5$  cm.,  $h = 5$  cm. and  $e = 5$  cm.  
Size of Installed Standard sensor number 27-CH9 : W/2 = 104 cm/2, H/2 = 72 cm/2 and D/2 = 60 cm/2

**Measurement Results**

Average Standard Reading at each position (°C)								
Calibration Point	27-CH1	27-CH2	27-CH3	27-CH4	27-CH5	27-CH6	27-CH7	27-CH8
104	104.97	103.63	103.45	104.02	104.41	103.57	104.59	103.78

Chamber ( Oven )		Temperature Distribution					
Setting (°C)	Reading (°C)		Average (°C)	Stability (±°C)	Uniformity (°C)	Uncertainty (±°C)	Coverage Factor k
	Min.	Max					
104.0	-	104.0	103.97	0.07	0.70	0.42	2.00

\* The quoted uncertainty exclude "uniformity"

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on date and place of test only.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k which for a distribution, providing a level of confidence of approximately 95 %.

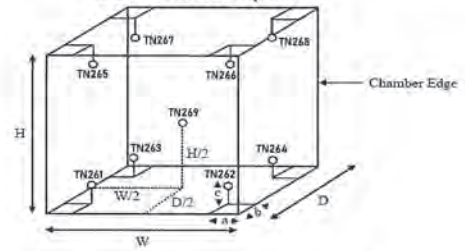
Approved By:

PM-E15 11/7/15-05-63

Certificate No. T222502

Page 4 of 4

### Calibration Report



**Remark :**

Internal Dimensions of Chamber : W (Width) = 104 cm., H (Height) = 72 cm. and D (Depth) = 60 cm.  
Size of Installed Standard sensor number TN261 to number TN269 :  $\phi = 5$  cm.,  $h = 5$  cm. and  $e = 5$  cm.  
Size of Installed Standard sensor number TN269 : W/2 = 104 cm/2, H/2 = 72 cm/2 and D/2 = 60 cm/2

**Measurement Results**

Average Standard Reading at each position (°C)								
Calibration Point	TN261	TN262	TN263	TN264	TN265	TN266	TN267	TN268
180	179.14	179.17	179.65	179.26	180.41	179.64	181.18	180.99

Chamber ( Oven )		Temperature Distribution					
Setting (°C)	Reading (°C)		Average (°C)	Stability (±°C)	Uniformity (°C)	Uncertainty (±°C)	Coverage Factor k
	Min.	Max					
180.0	-	180.0	179.98	0.38	1.78	1.10	2.00

\* The quoted uncertainty exclude "uniformity"

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on date and place of test only.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k which for a distribution, providing a level of confidence of approximately 95 %.

Approved By:

PM-L15 11/7/15-05-63



**TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)**  
CORPORATE SERVICES 3 : EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL. 0-2711-0100 FAX. 0-2719-9484

Cert.No.: 22TW178  
Page.: 1 of 2

### Certificate of Testing

**Equipment :** DQ Meter  
**Manufacturer :** YSI  
**Model :** 5100  
**Serial No. :** 15L103204  
**ID No. :** BKK\_EN0205  
**Received Date :** 02 August 2022  
**Test Date :** 03 August 2022  
**Reference :** 2206-0060DSC-1  
**Submitted by :** ALS Laboratory Group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd.,  
Khaeng Phatthanakan, Khwaeng Suan Luang,  
Bangkok 10250 Thailand  
**Laboratory Condition :** Temperature (25 ± 5) °C  
Humidity (50 ± 20) %  
**Test Procedure :** In - house method : CP-CH9  
by Comparison Technique with Azide Modification Method.  
**Tested by :** Walalak Sinithean  
**Approved by :**   
Approved Signatory  
( ) Malee Butkrus  
( ) Sathip Meangmai  
( ) Warakorn Lemgatrakul

REVIEW BY:

APPROVED BY:

NEXT CAL. DATE: 03/02/24

**Issue Date :** 4 August 2022

R 0293758



Cert.No.: 22TW178  
Page.: 2 of 2

#### Condition of this result of calibration

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

Instruments	Serial No.	ID No.	Certificate No.	Due Date
1) Burette	-	130BU10	21CG1389	25 Mar 2023
2) Balance	1126143764	140RC004	21MM430	21 Sep 2022

#### 2. Standard Material :-

Material	Manufacturer	Lot.No.	Assay
Sodium Thiosulfate pentahydrate	Merck	AM1763316	100.2%

**Result :** Dissolved Oxygen Meter Adjustment With Air 100 %

Dissolved Oxygen Probe No.: 17A100064

Titration Method (Azide Modification Method)	DO Meter Reading	Standard Deviation
(mg/L)	(mg/L)	(mg/L)
8.06	8.07	0.0045

This report was certified only for the instrument we tested. It is allowable to use for study the system efficiency. The environmental impact control and present to organization it may concerned. Inferred to use for advertising and referral purpose is prohibited. This report may not be reproduced other in full without written approval of the laboratory.

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
334/2 PATTANAKARN ROAD SOI 18, SUKHUMVIT, SUKHUMVIT 10250  
TEL: 0-2717-3009-27 FAX: 0-2719-9444



Cert. No.: 22LM107  
Page: 1 of 2

## Certificate of Calibration

Equipment : DO Meter with Sensor  
Manufacturer : YSI  
Model : 5100  
Serial No. : 15L103204  
ID No. : BKK\_EN0205  
Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd.,  
Khuwaeng Phatthanakan, Khet Suan Luang,  
Bangkok 10250 Thailand  
Location : TPA On Site Calibration Laboratory  
Received Order : 2 August 2022  
Calibrated Date : 4 August 2022  
Ambient Temperature : ( 26 ± 10 ) °C  
Relative Humidity : ( 50 ± 30 ) %  
AC Line Voltage : ( 220 ± 22 ) V  
Calibrated by : Man Pattanapongpaiboon

Approved by :   
Approved Signatory

( ) Ponthippa Tameyakul  
( ) Manee Butkruen  
( ) Suwit Imjai

Issue Date : 9 August 2022

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced without prior written approval of the Metrological Center (NSC-TIS-TIS 17025 CALIBRATION 0244)

A 0044131



Equipment : DO Meter with Sensor  
Condition As Received : Used Item  
Reference : 2208-0060DSC-2  
Procedure Used :-

Cert. No.: 22LM107  
Page: 2 of 2

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

### Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Digital Thermometer	1502A	AS2847	2111144	20 Oct 2022

2. This certificate is valid only to the item calibrated on date and place of calibration.  
3. This certification is traceable to the International System of Unit.

Result of Calibration :- ( \* ) Without Adjustment  
Function : Temperature measurement.

This instrument was connected with temperature sensor, S/N: 16C100772.

Calibration Point ( °C )	Immersion Depth ( mm )	Standard Temperature ( °C )	UUC* Reading ( °C )	Error ( °C )	Uncertainty ( ± °C )	Coverage Factor k
20.00	80	20.002	19.99	-0.072	0.15	2.00

UUC\* : Until Under Calibration

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

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## Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhloi, Saraburi 18110, Thailand.  
Saraburi Tel : +66 3627 3096 Fax : +66 3627 3100  
Bangkok Tel : +668 9205 6851, +669 8247 2360  
Website : www.sci-eco.co.th E-Mail : calibrate@sci-eco.com

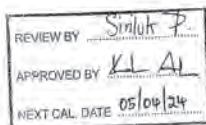


Certificate No. T230682

Page 1 of 4

## Certificate of Calibration

Equipment : Chamber ( Incubator )  
Manufacturer : MEMMERT  
Model : ICP 750  
Serial No. : F819.0021  
Customer Code : BKK\_EN0304  
ID No. : T9572A4  
Customer : ALS Laboratory Group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd., Khuwaeng Phatthanakan,  
Khet Suan Luang, Bangkok 10250  
Customer Location : Wet Chemistry Lab 2  
Date of Receipt : 30 March 2023  
Calibrated By : Sujjar Nakhred ( Site Calibration Manager )  
Approved By : Boonchai Suriyawong ( Assistant Calibration Manager )  
Date of Issue : 19 APR 2023



The uncertainties are for a confidence probability of approximately 95%.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of this laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrological Center.

FM-L141831-08-44



## Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhloi, Saraburi 18110, Thailand.



Certificate No. T230682

Page 2 of 4

## Calibration Report

Equipment : Chamber ( Incubator )  
Date of Calibration : 5 April 2023 ( Finished Time 4:30 PM )  
Environment : Temperature 22.9-28.6 °C  
Line Voltage 221.7-225.5 V

### Condition of this results of test :

1. This instrument was calibrated by insert 12 standard resistance thermometer into its chamber and test according to WI-T20 ( based on ASTM E145-94 ( Reapproved 2001 ) and AS2853-1986 )

All data show below were final values and the initial data may be obtained upon request.

The temperature scale used was based on ITS - 90.

2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
RTD	100 ohm	37-(CH1-10)	T222493	28 November 2023
RTD	100 ohm	36-(CH1-10)	T222493	28 November 2023
DATA LOGGER	34970A	T193	T222493	28 November 2023

3. This certificate is traceable to :

National Institute of Metrology ( Thailand ) through Metrological Center ( NSC-TIS-TIS 17025 CALIBRATION 0244 )

4. Condition of calibrated item : good

UUC Description :

Time Constant : 1 Hour 37 Minute At 20 °C  
Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max  
☐ Close  
☒ Not Available

5. Result of test :

( ) without adjustment

( X ) after adjustment

Approved By :

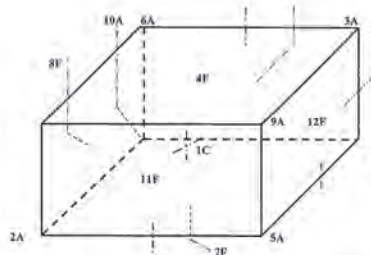
FM-L141831-05-63



Certificate No T230682

## Calibration Report

Page 3 of 4



C = Centre, F = Centre of Face, A = Corner, E = Centre of Edge

1C	=	37CH1
2A	=	37CH2
3A	=	37CH3
4F	=	37CH4
5A	=	37CH5
6A	=	37CH6
7F	=	37CH7
8F	=	37CH8
9A	=	37CH9
10A	=	37CH10

11F	=	36CH1
12F	=	36CH2

Approved By:

FM-L15/17/15-05-03

Certificate No. T230682

## Calibration Report

Page 4 of 4

### Measurement Results

Calibration Point	Average Standard Reading at each position (°C)									
	37CH1	37CH2	37CH3	37CH4	37CH5	37CH6	37CH7	37CH8	37CH9	37CH10
20.0	20.26	20.17	20.10	20.15	20.12	19.96	20.14	19.69	20.20	19.82
	36CH1	36CH2								
	20.03	20.04								

Chamber ( Incubator )		Temperature Distribution					
Setting (°C)	Reading (°C)		Average (°C)	Stability (±°C)	Uniformity (°C)	Uncertainty (±°C)	Coverage Factor k
	Min, Max	Average					
20.0	19.9, 20.1	20.0	19.98	0.19	0.53	0.38	2.00

\* The quoted uncertainty exclude "uniformity"

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on date and place of test only.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k which for a t-distribution, providing a level of confidence of approximately 95 %.

Approved By:

FM-L15/17/15-05-03

Certificate No. T230760

Page 1 of 5

## Certificate of Calibration

Equipment : HOT BLOCK

Manufacturer : Environmental Express

Model : B3000-240

Serial No. : 2017CODW116

Customer Code : BKK\_EN0222

ID No. : T6769A4

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

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

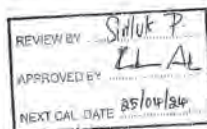
Customer Location : Wet Chemistry Lab2

Date of Receipt : 21 April 2023

Calibrated By : Watcharak Puttarat (Technician)

Approved By : / Sujjar Nakhakred (Site Calibration Manager)

Date of Issue : 12 MAY 2023



The uncertainties are for a confidence probability of approximately 95%.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrological Center.

FM-L12/10/20-05-57

Certificate No. T230760

## Calibration Report

Page 2 of 5

Equipment : HOT BLOCK

Date of Calibration : 25 April 2023

Environment : Temperature : 22.9-24.4 °C

Line Voltage : 212.7-227.8 V

Relative Humidity : 55 - 65 %RH

### Condition of this results of calibration :

1. This equipment was calibrated by insert 20 standard thermocouples type T into its chamber, the other one standard thermocouples type T use for ambient temperature measurement. The calibration was done in according to WI-T20 ( based on ASTM E145-94 ( Reapproved 2001) and AS2853-1986 ). All data show below were final values and the initial data from customer request. The temperature scale used was based on ITS - 90.

### 2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	TYPE T	TN121-TN130	T222122	5 October 2023
TC	TYPE T	TN131-TN140	T222122	5 October 2023
DATA LOGGER	34970A	T150	T222122	5 October 2023

### 3. This certificate is traceable to :

National Institute of Metrology (Thailand) through Metrological Center ( NSC-TIS-TIS 17025 CALIBRATION 0244 ).

### 4. Condition of calibrated item : good

#### Equipment Description :

Time Constant : 1 Hour 32 Minute At 150 °C  
Fresh Air Damper : ☐ Open ☐ Min ☐ Medium ☐ Max  
☐ Close  
☒ Not Available

### 5. Adjustment :

( X ) without adjustment

( ) after adjustment

Approved By:

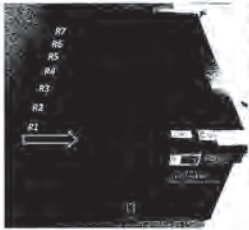
FM-L13/10/20-05-57



Certificate No. T230760

Page 3 of 5

## Calibration Report



R/W	Hole															
R7	H49	H50	H51	H52	H53	H54	H55	H56								
R6	H41	H42	H43	H44	H45	H46	H47	H48								
R5	H33	H34	H35	H36	H37	H38	H39	H40								
R4	H25	H26	H27	H28	H29	H30	H31	H32								
R3	H17	H18	H19	H20	H21	H22	H23	H24								
R2	H9	H10	H11	H12	H13	H14	H15	H16								
R1	H1	H2	H3	H4	H5	H6	H7	H8								

H: STANDARD THERMOCOUPLE TYPE T

H1	=	TN121	H9	=	TN129	H17	=	TN137	H25	=	TN125	H33	=	TN133	H41	=	TN121	H49	=	TN129
H2	=	TN122	H10	=	TN130	H18	=	TN138	H26	=	TN126	H34	=	TN134	H42	=	TN122	H50	=	TN130
H3	=	TN123	H11	=	TN131	H19	=	TN139	H27	=	TN127	H35	=	TN135	H43	=	TN123	H51	=	TN131
H4	=	TN124	H12	=	TN132	H20	=	TN140	H28	=	TN128	H36	=	TN136	H44	=	TN124	H52	=	TN132
H5	=	TN125	H13	=	TN133	H21	=	TN121	H29	=	TN129	H37	=	TN137	H45	=	TN125	H53	=	TN133
H6	=	TN126	H14	=	TN134	H22	=	TN132	H30	=	TN130	H38	=	TN138	H46	=	TN126	H54	=	TN134
H7	=	TN127	H15	=	TN135	H23	=	TN123	H31	=	TN131	H39	=	TN139	H47	=	TN127	H55	=	TN135
H8	=	TN128	H16	=	TN136	H24	=	TN124	H32	=	TN132	H40	=	TN140	H48	=	TN128	H56	=	TN136

Approved By: 

FM-L13 10830-05-57

Certificate No. T230760

Page 4 of 5

## Calibration Report

### Measurement Results

		Average Standard Reading at each position (°C)															
Calibration Point		TN121	TN122	TN123	TN124	TN125	TN126	TN127	TN128	TN129	TN130						
Point	Setting	Max	149.31	149.49	149.73	148.49	149.26	149.81	149.42	148.86	148.78	149.19					
150	150.0	Min	149.14	149.31	149.54	148.36	149.08	149.65	149.22	148.65	149.07	149.07					
	Average		149.23	149.40	149.64	148.43	149.16	149.73	149.33	148.76	148.71	149.13					
		TN131	TN132	TN133	TN134	TN135	TN136	TN137	TN138	TN139	TN140						
	Max	149.90	150.15	150.18	149.16	148.89	149.72	149.28	149.50	150.01	149.32						
	Min	149.78	150.06	149.69	149.03	148.76	149.49	149.12	149.37	149.90	149.23						
	Average	149.84	150.12	149.76	149.09	148.81	149.62	149.19	149.43	149.95	149.27						
		TN121	TN122	TN123	TN124	TN125	TN126	TN127	TN128	TN129	TN130						
	Max	149.88	149.14	149.20	150.02	148.75	149.57	149.21	149.18	150.13	148.91						
	Min	149.67	148.94	148.98	149.83	148.58	149.43	149.06	149.01	149.91	148.72						
	Average	149.78	149.05	149.11	149.94	148.67	149.51	149.13	149.10	150.01	148.81						
		TN131	TN132	TN133	TN134	TN135	TN136	TN137	TN138	TN139	TN140						
	Max	149.42	149.57	149.13	148.94	148.84	150.16	149.42	149.54	149.66	150.08						
	Min	149.27	149.36	148.99	148.81	148.70	149.99	149.27	149.39	149.52	149.97						
	Average	149.36	149.45	149.06	148.88	148.76	150.08	149.36	149.48	149.60	150.03						
		TN121	TN122	TN123	TN124	TN125	TN126	TN127	TN128	TN129	TN130						
	Max	149.21	149.16	149.50	148.88	148.58	149.81	149.06	150.40	148.46	149.24						
	Min	149.03	148.93	149.27	148.48	148.42	149.62	148.78	150.26	148.14	149.04						
	Average	149.12	149.04	149.39	148.57	148.51	149.72	148.93	150.33	148.29	149.14						
		TN131	TN132	TN133	TN134	TN135	TN136										
	Max	148.79	148.23	149.03	149.09	148.46	149.25										
	Min	148.49	147.98	148.88	148.94	148.29	149.12										
	Average	148.61	148.06	148.94	149.02	148.35	149.19										

Approved By: 

FM-L13 10830-05-57

Certificate No. T230760

Page 5 of 5

## Calibration Report

### Measurement Results

HOT BLOCK			Temperature Distribution	
Setting (°C)	Reading (°C)		Stability (± °C)	Uncertainty (± °C)
	Min	Max		
150.0	150.1	150.0	0.20	0.82

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on date and place of test only.

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

Approved By: 

FM-L13 10830-05-57







TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES  
334/9 PATTANAKARN ROAD 5TH FLOOR, SUKUMVIT ROAD BANGKOK 10250  
TEL: 0-2777-3000-27 FAX: 0-2777-3000-28



Cert.No.: 22CG3154  
Page: 1 of 2

## Certificate of Calibration

Equipment :	Burette	<div> REVIEW BY   APPROVED BY   NEXT CAL DATE  03/03/2024 </div>
Capacity :	50 mL	
Serial No. :	-	
ID. No. :	BKK_END171	
Manufacturer :	Witeg	
Made in :	Germany	
Submitted by :	ALS Laboratory Group (Thailand) Co., Ltd. 104 Phatthanakan 40, Phatthanakan Rd. Khwaeng Phatthanakan, Khol Suan Luang Bangkok 10250 Thailand	
Ambient Temperature :	(20 ± 2.5) °C	
Relative Humidity :	(50 ± 10) %	
Barometric Pressure :	758 mmHg	
Calibration Procedure :	ASTM E 542 - 01	
Calibrated by :	Panward Pramkiam	
Approved by :	 Approved Signatory	
	( ) Pornthippa Tameyakul ( ) Malee Butkruea (x) Panpan Paipim ( ) Srisuda Khamthia	
Issue Date :	31 August 2022	

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written approval of the head of Corporate Services & Equipment Calibration and Testing Services

A 0044607





Equipment : Burette  
 Received Date : 26 August 2022  
 Condition As-Received : Used Item  
 Calibration Date : 30 August 2022  
 Reference : 2208-0918DSC-2

Cert.No.: 22CG3154  
 Page: 2 of 2

#### Condition of this result of calibration

#### 1. Reference Standard Instruments :

Instruments	Model	Serial No.	ID No.	Certificate No.	Traceability	Due date
1) Balance	AE200S	N03679	140RC001	21MM429	NIMT	22 Sep 2022
2) Thermo-Hygrograph	THDX-CE	00016540	140EC001	22H1243	NIST,NIMT	09 June 2023
3) Thermometer	-	1594592	140EC010	221181	NIMT	10 Feb 2023

This certification is traceable to SI Unit.

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

3. True value is converted to true volume at the standard temperature of 20 °C.

#### Calibration result :

Nominal capacity ( mL )	Reading ( mL )	Uncertainty ( ± mL )	k Factor
50	49.9959	0.010	2.00

Remark mL = cm<sup>3</sup>

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

-000-

PR

a 1123908



## Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhloi, Saraburi 18110, Thailand.

Saraburi Tel : +66 3627 3096 Fax : +66 3627 3100

Bangkok Tel : +668 9205 6851 , +669 8247 2360

Website : www.scieco.co.th

E-Mail : calibrate@scg.co.th



Certificate No. T221644

Page 1 of 4

## Certificate of Calibration

Equipment : Chamber ( Cold Room )

Manufacturer : KOLDTECH

Model : KM 320

Serial No. : TBN-1012061/05

Customer Code : BKK\_EN0167

ID No. : T2463A3

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

104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,

Khet Suan Luang, Bangkok 10250

Customer Location : Environmental Laboratory

Date of Receipt : 27 June 2022

Calibrated By : Sujjar Nakhakred ( Site Calibration Manager )

Approved By : / Boonchai Suriyawong (Site Calibration Manager)

Date of Issue : 8 JUL 2022

The uncertainties are for a confidence probability of approximately 95%.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrological Center.

FM-L14 117/01-02-04



## Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhloi, Saraburi 18110, Thailand.



Certificate No. T221644

Page 2 of 4

## Calibration Report

Equipment : Chamber ( Cold Room )  
 Date of Calibration : 30 June - 1 July 2022  
 Environment : Temperature : 18.9-23.7 °C  
 Line Voltage : 222.9-226.5 V  
 Relative Humidity : 55 - 65 %RH

#### Condition of this results of calibration :

1. This equipment was calibrated by insert nine standard thermocouples type T into its chamber , the other one standard thermocouples type T use for ambient temperature measurement . The calibration was done in according to WI-T20 ( based on ASTM E145-94 ( Reapproved 2001 ) and AS2853-1986 ).

All data show below were final values and the initial data from customer request . The temperature scale used was based on ITS - 90 .

#### 2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	TYPE T	TN161-TN170	T210009	30 July 2022
TC	TYPE T	TN171-TN180	T210009	30 July 2022
DATA LOGGER	34970A	TJ49	T210009	30 July 2022

#### 3. This certificate is traceable to :

National Institute of Metrology ( Thailand ) through Metrological Center ( NSC-TISI-TIS 17025 CALIBRATION 0244 )

#### 4. Condition of calibrated item : good

##### Equipment Description :

Time Constant : 3 Hour - Minute At 3 °C  
 Fresh Air Damper : ☐ Open ☐ Min ☐ Medium ☐ Max  
☐ Close  
☒ Not Available

#### 5. Adjustment :

( ) without adjustment ( X ) after adjustment

Approved By

FM-L15117/18-05-63



## Metrological Center

SCI ECO Services Company Limited

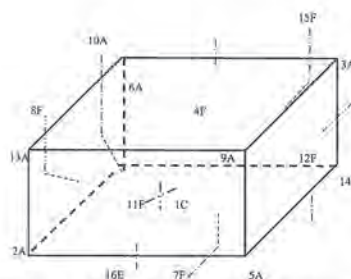
33/2 Moo 3, T.Banpa, A.Kaengkhloi, Saraburi 18110, Thailand.



Certificate No. T221644

Page 3 of 4

## Calibration Report



C = Centre, F = Centre of Face, A = Corner, E = Centre of Edge

1C = TN161	11F = TN171
2A = TN162	12F = TN172
3A = TN163	13A = TN173
4F = TN164	14A = TN174
5A = TN165	15F = TN175
6A = TN166	16E = TN176
7F = TN167	
8F = TN168	
9A = TN169	
10A = TN170	

Approved By

FM-L15 117/18-05-63



Certificate No. T221644

Page 4 of 4

## Calibration Report

## Measurement Results:

Calibration Point	Average Standard Reading at each position (°C)									
	TN161	TN162	TN163	TN164	TN165	TN166	TN167	TN168	TN169	TN170
3	2.71	2.82	2.75	2.89	2.95	3.68	3.02	2.96	3.03	2.85
	TN171	TN172	TN173	TN174	TN175	TN176				
	2.97	3.02	2.89	3.04	2.97	3.33				

Chamber ( Cold Room )			Temperature Distribution				
Setting (°C)	Reading (°C)		Average (°C)	Stability (± °C)	Uniformity (°C)	Uncertainty (± °C)	Coverage Factor k
	Min , Max	Average					
3.0	2.9 , 4.0	3.2	2.99	1.05	1.50	1.66	2.00

\* The quoted uncertainty exclude " uniformity "

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on date and place of test only.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k which for a t-distribution, providing a level of confidence of approximately 95 %.

Approved By: 

FM-L15 117/15-05-63

Certificate No. T231303

Page 1 of 3

## Certificate of Calibration

Equipment : Liquid Bath ( Water )

Manufacturer : MEMMERT

Model : WNB29

Serial No. : L611.0135

Customer Code : BKK\_EN0148

ID No. : T6455A4

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

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

Customer Location : ORGANIC PREPARATION LAB

Date of Receipt : 27 June 2023

Calibrated By : Sujjar Naknakred ( Site Calibration Manager )

Approved By :  / Boonchai Suriyawong (Site Calibration Manager)

Date of Issue : 11 JUL 2023

The uncertainties are for a confidence probability of approximately 95%.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrological Center.

FM-L14/15/01-08-64

Certificate No. T231303

Page 2 of 3

## Calibration Report

Equipment : Liquid Bath ( Water )  
Date of Calibration : 4 July 2023  
Environment : Temperature : 22.2-22.5 °C  
Line Voltage : 221.6-224.8 V  
Relative Humidity : 55 - 65 %RH

## Condition of this results of calibration :

1. This equipment was calibrated by insert five resistance thermometer detectors into its water bath , the other one thermocouple type T use for ambient temperature measurement . The calibration was done in according to WI-T36 ( based on ASTM E715-80 ( Reapproved 2001 ) ).

All data show below were final values and the initial data from customer request . The temperature scale used was based on ITS - 90 .

## 2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
RTD	100 OHM	M18 (CH1,CH6-CH7,CH9-CH10)	T230545	10 April 2024
DATA LOGGER	34970A	T149	T230545	10 April 2024

## 3. This certificate is traceable to :

National Institute of Metrology ( Thailand ) through Metrological Center ( NSC-TIS-TIS 17025 CALIBRATION 0244 )

## 4. Condition of calibrated item : good

Equipment Description :

Time Constant 3 Hour 45 Minute At 60 °C

## 5. Adjustment :

( X ) without adjustment ( ) after adjustment

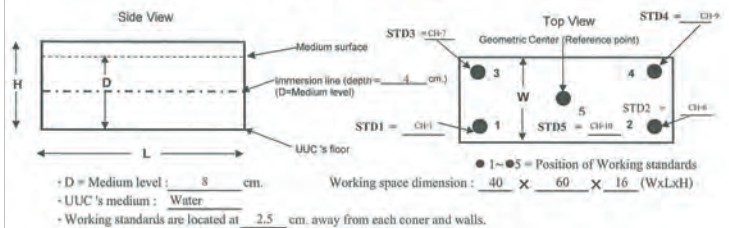
Approved By: 

FM-L15 117/15-05-63

Certificate No. T231303

Page 3 of 3

## Calibration Report



## Measurement Results:

Calibration Point	Average Standard Reading at each position (°C)				
	CH-1	CH-6	CH-7	CH-9	CH-10
60	60.03	60.06	60.24	60.11	60.18
85	84.79	84.83	85.42	85.05	85.20
95	93.71	93.83	94.62	94.15	94.42

Liquid Bath ( Water )			Temperature Distribution				
Setting (°C)	Reading (°C)		Average (°C)	Stability (± °C)	Uniformity (°C)	Uncertainty (± °C)	Coverage Factor k
	Min , Max	Average					
61.0	60.9 , 61.1	61.0	60.12	0.13	0.19	0.29	2.04
86.0	85.8 , 86.2	86.0	85.06	0.19	0.47	0.44	2.17
95.0	94.6 , 95	94.9	94.15	0.32	0.65	0.55	2.13

\* The quoted uncertainty exclude "uniformity"

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on date and place of test only.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k which for a t-distribution, providing a level of confidence of approximately 95 %.

Approved By: 

FM-L15 117/15-05-63





Certificate No. T230902

Page 1 of 5

## Certificate of Calibration

Equipment : Digestion Unit  
Manufacturer : SCP Science  
Model : DigiPRER HT  
Serial No. : HTC1120480658  
Customer Code : BKK\_EN0366  
ID No. : T2635A5  
Customer : ALS Laboratory Group (Thailand) Co.,Ltd.  
104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,  
Khet Suan Luang, Bangkok 10250  
Customer Location : Wet Chemistry Lab 1  
Date of Receipt : 10 May 2023  
Calibrated By : Sujjar Naknakred ( Site Calibration Manager )  
Approved By : [Signature] / Boonchai Suriyawong ( Site Calibration Manager )  
Date of Issue : 29 MAY 2023

The uncertainties are for a confidence probability of approximately 95%.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrological Center.

FM-L12 108/50-05-57



Certificate No. T230902

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## Calibration Report

Equipment : Digestion Unit  
Date of Calibration : 17 May 2023  
Environment : Temperature : 23.9 - 26.3 °C  
Line Voltage : 221.8 - 225.9 V  
Relative Humidity : 55 - 65 %RH

### Condition of this results of calibration :

- This equipment was calibrated by insert four standard thermocouples type S into its chamber , the other one thermocouple type T use for ambient temperature measurement . The calibration was done in according to WI-T10.
- Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	Type S	M20A1-(CH17-CH20)	T230547	18 April 2024
DATA LOGGER	34970A	T149	T230547	18 April 2024
- This certificate is traceable to :  
National Institute of Metrology ( Thailand ) through Metrological Center ( NSC-TISI-TIS 17025 CALIBRATION 0244 )
- Condition of calibrated item : good  
Equipment Description :  
Time Constant : 1 Hour 54 Minute At 380 °C  
Fresh Air Damper : ☐ Open ☐ Min ☐ Medium ☐ Max  
☐ Close  
☒ Not Available
- Adjustment :  
( X ) without adjustment ( ) after adjustment

Approved By : [Signature]

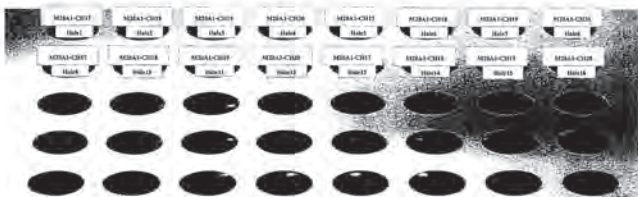
FM-L13 108/50-05-57



Certificate No. T230902

Page 3 of 5

## Calibration Report



FRONT

### Measurement Results

Cal. Point	Setting	Reading	STD.	Position of Standards at Block							
°C	°C	°C	Reading	Hole1	Hole2	Hole3	Hole4	Hole5	Hole6	Hole7	Hole8
380.0	380.0	379.4 - 380.7	Max °C	377.3	379.0	379.2	380.2	377.5	376.5	380.7	380.1
			Min °C	376.8	378.6	378.9	379.9	377.0	379.0	380.2	379.6
			Average °C	377.6	378.8	379.1	380.0	377.3	379.2	380.4	379.9
			Stability ± °C	0.2	0.2	0.2	0.2	0.3	0.3	0.2	0.2

Cal. Point	Setting	Reading	STD.	Position of Standards at Block							
°C	°C	°C	Reading	Hole9	Hole10	Hole11	Hole12	Hole13	Hole14	Hole15	Hole16
380.0	380.0	379.4 - 380.7	Max °C	377.1	378.9	379.7	379.9	379.3	379.6	379.5	377.4
			Min °C	376.7	378.5	379.3	379.5	378.9	379.1	379.0	377.0
			Average °C	376.9	378.7	379.5	379.7	379.1	379.4	379.3	377.2
			Stability ± °C	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.2

Approved By : [Signature]

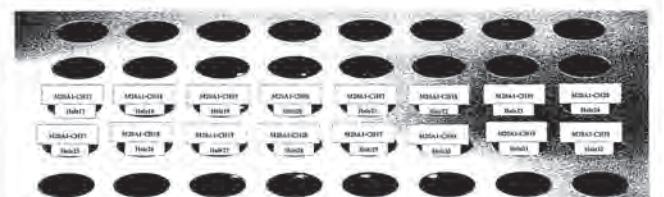
FM-L13 108/50-05-57



Certificate No. T230902

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## Calibration Report



FRONT

### Measurement Results

Cal. Point	Setting	Reading	STD.	Position of Standards at Block							
°C	°C	°C	Reading	Hole17	Hole18	Hole19	Hole20	Hole21	Hole22	Hole23	Hole24
380.0	380.0	379.4 - 380.7	Max °C	378.4	380.1	380.1	380.6	379.1	379.8	379.6	377.8
			Min °C	377.8	379.6	379.7	379.3	378.6	379.2	379.2	377.3
			Average °C	378.1	379.9	379.9	379.7	378.9	379.5	379.4	377.5
			Stability ± °C	0.3	0.3	0.2	0.3	0.3	0.3	0.2	0.2

Cal. Point	Setting	Reading	STD.	Position of Standards at Block							
°C	°C	°C	Reading	Hole25	Hole26	Hole27	Hole28	Hole29	Hole30	Hole31	Hole32
380.0	380.0	379.4 - 380.7	Max °C	377.9	379.4	380.1	380.1	379.3	379.6	378.9	377.3
			Min °C	377.4	378.9	379.7	379.7	378.8	378.9	378.4	376.7
			Average °C	377.7	379.2	379.9	379.9	379.0	379.3	378.6	377.0
			Stability ± °C	0.3	0.3	0.2	0.2	0.3	0.4	0.3	0.3

Approved By : [Signature]

FM-L13 108/50-05-57





## Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhon, Saraburi 18110

Telephone : +66 2 586 5792-4 Fax : +66 2 586 5109

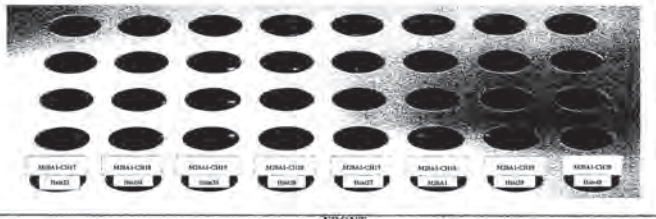
Website : www.sci-eco.co.th

E-Mail : calibrate@scg.co.th

Certificate No. T230902

Page 5 of 5

### Calibration Report



FRONT

#### Measurement Results

Cal. Point	Setting	Reading	STD.	Position of Standards at Block							
°C	°C	°C	Reading	Hole33	Hole34	Hole35	Hole36	Hole37	Hole38	Hole39	Hole40
				MDA1-CH1	MDA1-CH2	MDA1-CH3	MDA1-CH4	MDA1-CH5	MDA1-CH6	MDA1-CH7	MDA1-CH8
			Max °C	377.7	378.0	378.3	379.0	378.2	378.5	378.3	377.4
			Min °C	377.3	377.6	377.9	378.6	377.7	378.1	376.9	377.6
			Average °C	377.5	377.8	378.1	378.8	377.9	378.3	377.1	377.2
			Stability ± °C	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2

The expanded uncertainty of temperature measurement was  $\pm 1.85$  °C

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on date and place of test only.

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

Approved By

FM-L13108/30-05-57



บริษัท ดับเบิล เอส ไดแอกโนสติกส์ จำกัด  
DOUBLE S DIAGNOSTICS CO., LTD.

1. ซอยสุขุมวิท 31, แขวงคลองเตย, เขตคลองเตย, กรุงเทพฯ 10110 โทร: 02-747-7888 โทรสาร: 02-747-7889

2. ซอยสุขุมวิท 31, แขวงคลองเตย, เขตคลองเตย, กรุงเทพฯ 10110 โทร: 02-747-7888 โทรสาร: 02-747-7889

Maintenance Plan YEAR : 2023

เดือน	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec.
YAU							UP	OK				

#### Periodical maintenance check list for Konelab

	6M	12M	Note
1.Diluent-wash tubing change	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
2.ISE tubing change	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	15044
3.Syringe check/change		<input checked="" type="checkbox"/>	
4.Dispensing check/ change		<input checked="" type="checkbox"/>	
5.Waste tubing change when necessary		<input checked="" type="checkbox"/>	
6.Lamp check/change	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
7.Mixer paddle/paddle change(not Konelab20)		<input checked="" type="checkbox"/>	
8.ISE needles check/change		<input checked="" type="checkbox"/>	15044
9.Pump tubing check/ change	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
10.Broken/worn out part check /change		<input checked="" type="checkbox"/>	
11.Peristaltic pump check /cleaning/ lubrication	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
12.Heating check		<input checked="" type="checkbox"/>	
13.Cooling check		<input checked="" type="checkbox"/>	
14.Dispenser mechanic check/adjustment	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
15.Cuvette transfer mechanic check/adjustment	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
16.Dispenser movement check/adjustment	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
17.Sample/reagent register check/adjustment	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
18.Dispensing tubing tightness check	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
19.Photometer and optics cleaning/check/adjustment	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
20.Workstation PC cleaning if necessary	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
21.Mechanic cleaning/lubrication	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
22.Instrument cleaning if necessary	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
23.Complete analyzer testing with waterblank/QC or sample	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
24.Test parameters/Adjustment/config. Save to USB key	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
25.UPS Test	<input type="checkbox"/>	<input checked="" type="checkbox"/>	

Place: DLS LAB Instrument: K80 Aquakem  
Date/Time: 12/7/66 Serial no: 87931  
Service done by: S. J. E. Install date: 12/1/66  
Signature of customer: S. J. E. Date/Time: 12/1/66

Accuracy results Aquakem 7.2.AQ2 Page: 1  
Laboratory Analyzer User

7/12/2023 21:21

Performed 7/12/2023  
Lot #166

#### ACCEPTANCE CRITERIA

	Result	Limit	Warning
Temperature (7C)	37.7	37.0 +/- 1.0	
Dispensing ratio	16.4	14.8 - 17.2	
CV%	1.17	<1.7	
Photometric noise			
Max SD L340_2 (mA)	0.19	<2.0	
Max SD L340_4 (mA)	1.06	<3.0	
Linearity of photometer			
Slope	1.0188	0.94 - 1.06	
Curvature	0.0035	+/- 0.02	
Max bias from linear fit (mA)	3.2	<15.0	
Max delta %	-2.0	+/- 6.0	
Linearity of sample dispensing			
Proport. volume XDISP2 (71)	2.06	1.96 - 2.16	
Proport. volume XDISP4 (71)	4.13	3.85 - 4.40	
XDISP2 CV%	0.58	<2.0	
XDISP4 CV%	0.70	<2.0	
XDISP10 CV%	0.59	<2.0	
Needle 0.71 volume			
Average (A)	0.009	<0.050	
Standard deviation (A)	0.002	<0.005	
Volume (71)	0.06	<0.32	

#### OTHER INFORMATION

Dispensing ratio	Photom. noise: SD (mA)
Posit Result (A)	Posit L340_2 L340_4
1 0.1592	0.09 0.63
2 0.1624	0.09 1.06
3 0.1631	0.14 0.50
4 0.1631	0.13 0.33
5 0.1625	0.19 0.38
6 0.1650	0.02 0.64

Accuracy results Aquakem 7.2.AQ2 Page: 2  
Laboratory Analyzer User

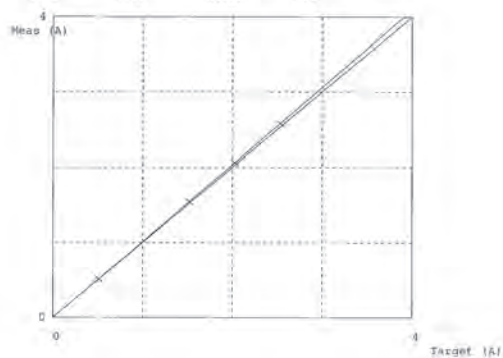
7/12/2023 21:21

#### Linearity of sample dispensing

Test	Absorbance (A)
XDISP2	0.313
XDISP4	0.616
XDISP10	1.478

#### Linearity of photometer

L340_	Target (A)	Meas (A)	Delta (A)	Delta %
1	0.001	0.005	-0.004	-394.7
2	0.512	0.519	-0.007	-1.5
3	1.523	1.550	-0.027	-1.8
4	2.027	2.066	-0.039	-1.9
5	2.532	2.582	-0.050	-2.0





7700 Series ICP-MS  
Preventive Maintenance Checklist – Standard



Agilent Preventive Maintenance provides factory recommended service for your analytical systems to assure reliable operation and the accuracy of your results. Delivered by highly-trained and certified service engineers using genuine Agilent parts and supplies, Agilent Preventive Maintenance provides everything you need to reduce unplanned downtime and keep your systems operating at their peak.

For more information about Agilent Technologies services please visit our web site using the following URL: <http://www.chem.agilent.com/en-us/products/services/pages/default.aspx>

### Customer Information

- Customers should provide all necessary operating supplies upon request of the engineer.
- A customer representative should be available to the engineer while performing the preventive maintenance procedures.
- Any parts, not included in the Parts Lists section of this document, are not part of the recommended Preventive Maintenance service, nor are they included in the price of this service.
- If a system requires the use of additional or special procedures and/or parts for the instrument service, then these must be ordered separately and charged as a repair, which may incur additional costs.

### Service Engineer's Responsibilities

- Only complete/printout pages that relate to the system or module being serviced.
- Complete empty fields with the relevant information.
- Complete the relevant checkboxes in the checklist using a "X" or tick mark "✓" in the checkbox.
- Complete Not Applicable check boxes to indicate services not delivered, as needed.
- Complete the PM service in the order of the tasks listed.
- Complete the Service Review section together with the customer.

REVIEW BY: Supawan N.  
APPROVED BY: Supawan N.  
NEXT CAL. DATE: 11/06/2024

Issued: 7-Feb-2014, Revision: 1.2

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7700 Series ICP-MS  
Preventive Maintenance Checklist – Standard



### System Information

Instrument system name and ID	7700X ICP-MS
Instrument system site and location	ALS Laboratory Group (Thailand) Ltd
List system component product numbers	List the serial numbers of each component
1. G3281A	1. 7812091612
2. G3292A	2. 4N4220700
3. ASX 500	3. US 021293A5LC
4.	4.
5.	5.
6.	6.
7.	7.

ICP-MS configuration table	Circle the type or write in the type if other
Nebulizer	MicroMist   Micro Flow   <u>Mira Mist</u>   other
Spray Chamber	<u>Quartz</u>   PFA   other
Torch	<u>Quartz</u>   Demountable   other
Sampling Cone	<u>Su</u>   Pt   other
Skimmer Cone	<u>Su</u>   Pt   Ni plated   other

### Preparation

- Discuss any specific issues with the customer prior to starting.
- Review the instrument logbook.
- Save instrument control settings before starting the procedure.
- Perform general inspection of system for cleanliness.
- Check for proper installation of safety-related parts, assemblies, sensors etc.
- Check for required firmware updates and verify with customers if they would like it installed.
- Begin system vent.

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7700 Series ICP-MS  
Preventive Maintenance Checklist – Standard



### Inspect and clean system while venting

- Perform a general inspection of the system.
- Look for any obvious external damage or problems.
- Check mechanical pumps for evidence of excessive fluid leaks.
- Inspect vacuum hoses, pump exhaust tubes and power cord for excessive wear.
- Inspect Shield plate contacts. Clean if needed.
- Inspect the tape lining on the peristaltic pump clamp; replace the tape if worn (5043-0030).
- Check electronics for dust accumulation, clean if necessary.

### Mechanical vacuum pumps

- Drain and replace mechanical pump fluid.
- Verify proper oil recycling function of mechanical pumps, the gas ballast valve must be open.
- Replace the oil mist filter.
- Inspect and clean or replace the inlet filter (P/N 5190-0145 for E2M18, P/N SR03700237 for DS402).
- Verify proper oil recycling function of mechanical pumps, the gas ballast valve must be open when connected to an Edwards E2M18.

### Cooling water system

- Drain cooling fluid
- Remove, clean and reinstall metal mesh filter.
- Re fill Polyclear cooling fluid (G3292-80010)
- Clean the Air filter and the Condenser by compressed air or vacuum cleaner

### Ion lens cleaning

- Remove extraction/omega lenses and clean all lenses.
- Remove ORS cell, plate bias and defiect lens, clean all lenses.
- Replace octopole. Reinstall all lenses and the ORS cell and close analyzer.

### Auto Sampler ASX500 Series

- Clean external surfaces of the Autosampler, this will protect the service technician from potential chemical burns
- Z-Axis Inspection Inspect the Z-axis PEEK drive cable for kinks or slight bends. Power off the autosampler and manually move the Z-drive up and down using the rotor on the rear of the instrument. Inspect the Z-axis drive cable for kinks or slight bends o If the movement is rough and hard to move then replace Z-axis drive cable (P/N G3286-80331) or Z-axis drive assembly (P/N G3286-80330)

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Preventive Maintenance Checklist – Standard



- Pump Tubing Replacement  
Replace peristaltic pump tubing. Replace all tubing that goes from the rinse station to the pump and from the pump to the waste/rinse bottles
- QC Testing  
Using customer's racks and the Agilent software move the sample probe to the 4 outermost corners and ensure that the probe is centered in the vial
- Final Inspection  
Check that all components are tight

### Auto Sampler I-AS

- Clean external surfaces of the Autosampler, this will protect the service technician from potential chemical burns
- Pump Tubing Replacement  
Replace peristaltic pump tubing. Replace all tubing that goes from the rinse station to the pump and from the pump to the waste/rinse bottles.
- QC Testing  
Using customer's tray and move the sample probe to the sample vial 1, wash vial and rinse port and ensure that the probe is centered in the vial.

### ISIS

- Replace ISIS valve seal (P/N G3138-05117)
- Inspect the tape lining on the peristaltic pump clamp; replace the tape if worn (5043-0030).
- QC test  
Verify the function of valve and Peripump. Make sure that there is no leak from the valve and pump tubing connections.

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# 7700 Series ICP-MS Preventive Maintenance Checklist - Standard



## Restore Instrument

- ☒ Pump system down.
- ☒ Perform the system post check.
  - ☒ Check quadrupole matching.
  - ☒ Perform octopole matching.
  - ☒ Verify good gas control function by changing the flow and observing the meter readings, perform an automatic offset adjustment for the MPC's.
  - ☒ Verify in Tune (using the customer's last tune) that changes in lens voltage result in the expected sensitivity change.
  - ☒ Perform Startup including performance report and an Autotune. Print the Autotune report and attach it to this checklist.
  - ☒ Check the instrument status and record the measurements in the status table. (Use "Record Log" in "Maintenance LogBook" with G7200B software, Use Performance report with G7201A/B software)
  - ☒ Record the EM and discriminator Voltages in the results table.
  - ☒ Run 10 minute stability test with tune solution. Check the result of RSD is below 4%.

## Guidance

If the PM service is performed prior to a qualification service, then use the qualification procedure as a guide for final instrument set up and checkout.

## Service Review

- ☒ Attach available reports/printouts of all tests to this documentation.
- ☒ Make an entry in the MassHunter Maintenance Log Book recording the PM activities.
- ☒ Update/reset instrument maintenance counters as appropriate
- ☒ Affix the PM sticker to the system or instrument logbook based on the customer's request.
- ☒ Complete the Service Engineer Comments section below if there are additional comments
- ☒ Review the service and any test results with the customer.
- ☒ If the Instrument firmware was updated, record the details of the change in the Service Engineer's Comments box below or if necessary, in the customer's IQ records.

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# 7700 Series ICP-MS Preventive Maintenance Checklist - Standard



## 7700 Series ICP-MS Status Results Table

- ☐ Check this box if you have run a performance report to record the meter readings. Print out the report and attach it to this checklist, instead of completing the table.

Measurement	Standby Mode	Analysis Mode No Gas Mode	Analysis Mode H <sub>2</sub> Gas @ 4ml/min	Analysis Mode He Gas @ 4ml/min
IP/BK Press	2.65 Pa	2.62 Pa	- Pa	2.62 Pa
TMP Revolution	100 %	100 %	- %	100 %
Analyzer Press	8.54x10 <sup>-5</sup> Pa	2.95x10 <sup>-5</sup> Pa	- Pa	8.15x10 <sup>-5</sup> Pa
Water RF/WC/IF	0	1.50 L/min		
Water Temperature		22.1 °C		
Inlet Temp	15.0 °C	29.9 °C		
Internal Temp	15.0 °C	46.0 °C		
RF Power		15.91 Watts		
RF Reflect		5 Watts		
Plasma Freq.		26.74 MHz		
Carrier Gas (BP)		4.41 kPaG		
Ar Gas Tank Press		5.19 kPaG		
Carrier Gas		1.00 L/min		
MU/Dil. Gas		0.10 L/min		
Plasma Gas		15.00 L/min		
Aux Gas		0.90 L/min		
S/C Temperature		2.0 °C		
OP Gas Tank Press <sup>1</sup>	- kPaG	- kPaG		
Optional Gas *1		- %		

Do not fill in the shaded cells in the table. There are no measurements for these combinations.

Notes:

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# 7700 Series ICP-MS Preventive Maintenance Checklist - Standard



## 7700 Series ICP-MS Test Results Table

Test Description	Expected Test Result	Actual Test Result
Analog HV Voltage	Not applicable	1761 V
Pulse HV Voltage	Not applicable	1486 V
Discriminator Voltage	Not applicable	4.5 mV

## 7700 Series ICP-MS Parts List Table

Part Description	Part Number	Product/Model # where used	Quantity Consumed
1L Rough Pump Oil	6040-0834	7700 ICP-MS	2
Oil Mist Filter Kit for E2M18	3162-1056	7700 ICP-MS	1
Oil Mist Filter for DS402	9466342M002	7700 ICP-MS	-
Graphite Gasket for Sample Cone (3pk)	G3280-07009	7700 ICP-MS	1
7700 Octopole	G3280-07045	7700 ICP-MS	1
Polyclear cooling fluid	G3292-80010	G1879B/G3292A	1
Rinse / Drain tubing	G3286-80117	ASX-500	1
Tubing / connection kit for drain	G3286-80118	ASX-500	1
Peristaltic pump tubing set	G3160-65326	I-AS	-
Drain tubing to rinse bottle and drain bottle	G3160-65328	I-AS	-
Rotor seal for Valve (ISIS)	G3138-65117	ISIS	1
<b>Additional parts may be required from engineers stock:</b>			
Inlet Filter E2M18	5190-0145	7700 ICP-MS	-
Inlet Filter DS402	SR03700237	7700 ICP-MS	-
Peristaltic pump tape (30m roll)	5043-0030	7700 ICP-MS	-
Polishing Paper Kit (#400/#1200, 5 sheets each)	G1833-65404	7700 ICP-MS	-
Cotton Swabs, ultra-fine conical bud shape at both ends (100/pk)	9300-2574	7700 ICP-MS	-
Alumina Powder	8660-0701	7700 ICP-MS	-
lint-free-paper	05980-60051	7700 ICP-MS	-
Z-Axis Drive PEEK Cable (Anti-Kink)	G3286-80331	ASX-500	-
Z-Axis Drive Assembly (PEEK, Anti-Kink)	G3286-80330	ASX-500	-

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# 7700 Series ICP-MS Preventive Maintenance Checklist - Standard



## Service Engineer Comments (optional)

If there are any specific points you wish to note as part of performing the service or other items of interest for the customer, please write in this box.

## Other Important Customer Web Links

- ☐ How to get information on your product: Literature Library - <http://www.agilent.com/chem/library>
- ☐ Need to know more? - [www.agilent.com/chem/education](http://www.agilent.com/chem/education)
- ☐ Need technical support, FAQs? - [www.agilent.com/chem/techsupp](http://www.agilent.com/chem/techsupp)
- ☐ Need supplies? - [www.agilent.com/chem/supplies](http://www.agilent.com/chem/supplies)

## Service Completion

Service request number 600 614263 Date service completed 12 June 2023

Agilent signature [Signature] Customer signature Supakwan N.

Document part number: G3280-90078

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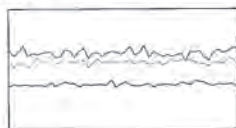


## Tune Report

Operator Name Sugakorn Mak  
Acq/Data Batch C:\Agilent\NCPM\11\User Tune 1  
Acq. Date/Time 8/12/2023 4:05:12 PM  
Report Comment PM 12 June 2023  
Instrument Name GC328 (A-IP12051612)

(No Gas)

Sensitivity



Mass	Range	Count	RSD%	Background
7	10000	6240	4.494	2.190
89	50000	27817	3.328	3.800
205	50000	18565	3.537	9.800

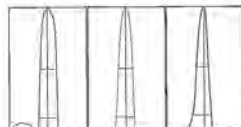
Sampling Period [sec] 0.311

Integration Time [sec] 0.1

Oxide/Doubly Charged Ratio

Oxide 156 / 140 1.482 %  
Doubly Charged 70 / 140 1.508 %

Resolution/Axis



Mass	Peak Height	Axis	W-50%	W-15%
7	8337.66	7.00	0.64	0.730
89	27591.94	85.00	0.55	0.716
205	18018.73	205.00	0.46	0.726

Integration Time [sec] 0.1

Acquisition Time [sec] 22.74

V Axis Linear

Tune Parameters

Plasma Parameters

Plasma Mode — Nebulizer Gas 1.00 L/min Makeup Gas 0.10 L/min  
RF Power 1550 W Option Gas — Auxiliary Gas 0.80 L/min  
RF Matching 1.80 V Nebulizer Pump 0.10 rps Plasma Gas 15.0 L/min  
Sample Depth 8.0 mm S/C Temp 2 °C

Lens Parameters

Extract 1 0.0 V Omega Lens 6.4 V Deflect 11.8 V  
Extract 2 -145.0 V Cell Entrance -30 V Plate Bias -40 V  
Omega Bias -90 V Cell Exit -50 V

Cell Parameters

Use Gas No 3rd Gas Flow — Energy Discrimination 5.0 V  
He Flow 9.0 mL/min OctP Bias -8.0 V

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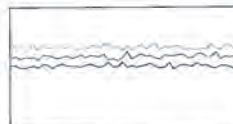
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## Tune Report

H2 Flow — OctP RF 190 V  
QP Parameters  
Mass Gain 145 Axis Gain 1.0021 QP Bias -3.0 V  
Mass Offset 124 Axis Offset 0.12  
Hardware Settings  
Torch  
Torch H -0.4 mm Torch V 0.0 mm  
EM  
Discriminator 4.5 mV Analog HV 1748 V Pulse HV 1466 V

(He)

Sensitivity



Mass	Range	Count	RSD%	Background
59	20000	11826	2.752	7.200
89	20000	12367	2.527	5.800
205	50000	25671	2.768	13.300

Sampling Period [sec] 0.31

Integration Time [sec] 0.1

Oxide/Doubly Charged Ratio

Oxide 156 / 140 1.366 %  
Doubly Charged 70 / 140 1.566 %

Tune Parameters

Plasma Parameters

Plasma Mode — Nebulizer Gas 1.00 L/min Makeup Gas 0.10 L/min  
RF Power 1550 W Option Gas — Auxiliary Gas 0.80 L/min  
RF Matching 1.80 V Nebulizer Pump 0.10 rps Plasma Gas 15.0 L/min  
Sample Depth 8.0 mm S/C Temp 2 °C

Lens Parameters

Extract 1 0.0 V Omega Lens 7.4 V Deflect 3.8 V  
Extract 2 -200.0 V Cell Entrance -90 V Plate Bias -115 V  
Omega Bias -90 V Cell Exit -70 V

Cell Parameters

Use Gas Yes 3rd Gas Flow — Energy Discrimination 3.0 V  
He Flow 4.5 mL/min OctP Bias -21.0 V  
H2 Flow — OctP RF 200 V

QP Parameters

Mass Gain 145 Axis Gain 1.0021 QP Bias -18.0 V  
Mass Offset 124 Axis Offset 0.12

Hardware Settings

Torch  
Torch H -0.4 mm Torch V 0.0 mm

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8/12/2023 4:05 PM

## Tune Report

EM  
Discriminator 4.5 mV Analog HV 1748 V Pulse HV 1466 V



## Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoh, Saraburi 18110

Telephone : +66 2 586 5792-4 Fax : +66 2 586 5109

Website : www.scieco.co.th E-Mail : calibrate@scg.co.th

Certificate No. T231676

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## Certificate of Calibration

Equipment : HEATING BLOCK

Manufacturer : Environmental Express

Model : SC 196

Serial No. : 6974CECW3285

Customer Code : BKK\_EL0054

ID No. : T5306A3

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

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

Customer Location : Acid Digestion Lab

Date of Receipt : 13 September 2023

Calibrated By : Saneek Musikanan (Site Calibration Manager)

Approved By :  / Sujjar Nakhakred (Site Calibration Manager)

Date of Issue : 26 SEP 2023

The uncertainties are for a confidence probability of approximately 95%.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrological Center.

PM-L12 (09/30-05-57)





Certificate No. T231676

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### Calibration Report

Equipment : HEATING BLOCK  
Date of Calibration : 22 September 2023  
Environment : Temperature : 21.8-23.1 °C  
Line Voltage : 221.6-226.3 V  
Relative Humidity : 55 - 65 %RH

#### Condition of this results of calibration :

1. This equipment was calibrated by insert 20 standard thermocouples type T into its chamber , the other one standard thermocouples type T use for ambient temperature measurement . The calibration was done in according to W1-T20.

All data show below were final values and the initial data from customer request . The temperature scale used was based on ITS - 90 .

#### 2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	TYPE T	TN21-TN30	T230014	17 January 2024
TC	TYPE T	TN31-TN40	T230014	17 January 2024
DATA LOGGER	34970A	T151	T230014	17 January 2024

#### 3. This certificate is traceable to :

National Institute of Metrology ( Thailand ) through Metrological Center ( NSC-TISI-TIS 17025 CALIBRATION 0244.)

#### 4. Condition of calibrated item : good

##### Equipment Description :

Time Constant 2 Hour 20 Minute At 95 °C  
Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max  
☐ Close  
☒ Not Available

#### 5. Adjustment :

( ) without adjustment ( X ) after adjustment

Approved By.

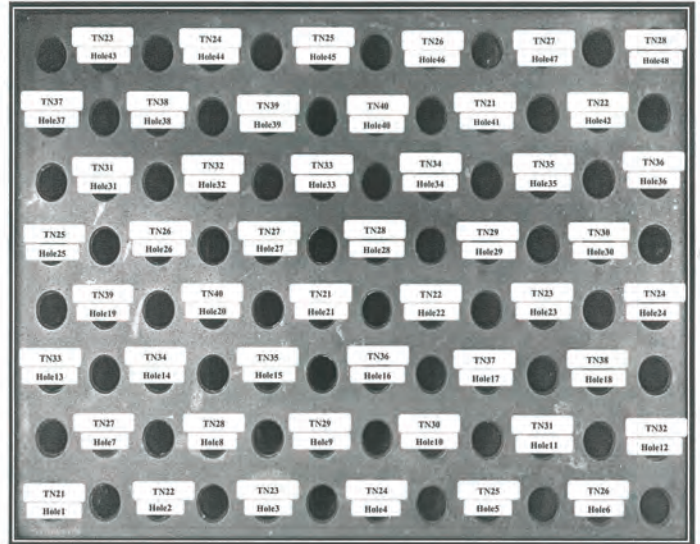
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### Calibration Report



#### FRONT CONTROL

Approved By.

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### Calibration Report

#### Measurement Results

Calibration Point	Average Standard Reading at each position ( °C )					
R1 Hole1-Hole6	TN21	TN22	TN23	TN24	TN25	TN26
CAL POINT	Max	95.01	94.41	95.20	95.41	94.51
	Min	94.57	93.95	94.75	94.92	94.00
	Average	94.79	94.18	94.98	95.17	94.26
R2 Hole7-Hole12	TN27	TN28	TN29	TN30	TN31	TN32
	Max	95.36	95.43	95.19	95.16	95.35
	Min	94.94	94.95	94.72	94.71	94.90
	Average	95.15	95.19	94.96	94.94	95.13
R3 Hole13-Hole18	TN33	TN34	TN35	TN36	TN37	TN38
	Max	95.37	95.50	95.22	95.21	95.33
	Min	94.99	95.09	94.78	94.82	94.88
	Average	95.18	95.30	95.00	95.02	95.11
R4 Hole19-Hole24	TN39	TN40	TN21	TN22	TN23	TN24
	Max	95.59	94.42	94.52	94.24	94.63
	Min	95.21	94.06	94.13	93.88	94.28
	Average	95.40	94.24	94.33	94.06	94.45
R5 Hole25-Hole30	TN25	TN26	TN27	TN28	TN29	TN30
	Max	95.19	95.38	92.93	95.30	95.14
	Min	94.83	95.03	92.56	94.95	94.79
	Average	95.01	95.20	92.75	95.12	94.96
R6 Hole31-Hole36	TN31	TN32	TN33	TN34	TN35	TN36
	Max	94.63	94.90	94.77	94.21	94.24
	Min	94.24	94.55	94.44	93.98	93.92
	Average	94.43	94.72	94.60	94.14	94.08
R7 Hole37-Hole42	TN37	TN38	TN39	TN40	TN21	TN22
	Max	94.30	94.44	94.04	93.81	94.89
	Min	93.95	94.05	93.67	93.48	94.39
	Average	94.13	94.24	93.86	93.65	94.64
R8 Hole43-Hole48	TN23	TN24	TN25	TN26	TN27	TN28
	Max	95.99	95.63	95.28	95.29	95.45
	Min	95.57	95.15	94.82	94.84	94.99
	Average	95.78	95.39	95.05	95.07	94.68

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Certificate No T231676

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### Calibration Report

#### Measurement Results

Calibration Point	Average Standard Reading at each position ( °C )					
R1 Hole1-Hole6	TN21	TN22	TN23	TN24	TN25	TN26
CAL POINT	Max	105.23	104.32	105.43	105.25	104.44
	Min	104.94	103.95	105.15	105.04	104.11
	Average	105.09	104.13	105.29	105.15	104.28
R2 Hole7-Hole12	TN27	TN28	TN29	TN30	TN31	TN32
	Max	105.30	105.12	105.18	105.22	105.12
	Min	105.11	104.92	104.96	105.00	104.92
	Average	105.20	105.02	105.07	105.11	105.02
R3 Hole13-Hole18	TN33	TN34	TN35	TN36	TN37	TN38
	Max	105.37	105.63	105.02	104.80	104.69
	Min	105.17	105.37	104.75	104.59	104.50
	Average	105.27	105.50	104.88	104.69	104.60
R4 Hole19-Hole24	TN39	TN40	TN21	TN22	TN23	TN24
	Max	105.31	104.43	106.41	104.71	105.63
	Min	105.08	104.22	106.15	104.41	105.37
	Average	105.19	104.33	106.28	104.56	105.50
R5 Hole25-Hole30	TN25	TN26	TN27	TN28	TN29	TN30
	Max	104.95	106.26	103.34	105.78	105.59
	Min	104.67	105.96	103.08	105.56	105.36
	Average	104.81	106.11	103.21	105.67	105.48
R6 Hole31-Hole36	TN31	TN32	TN33	TN34	TN35	TN36
	Max	104.75	104.86	104.80	105.20	104.50
	Min	104.54	104.63	104.59	105.00	104.32
	Average	104.65	104.75	104.69	105.10	104.41
R7 Hole37-Hole42	TN37	TN38	TN39	TN40	TN21	TN22
	Max	104.30	104.90	104.85	104.65	104.88
	Min	104.09	104.72	104.66	104.49	104.63
	Average	104.19	104.81	104.75	104.57	104.76
R8 Hole43-Hole48	TN23	TN24	TN25	TN26	TN27	TN28
	Max	105.71	105.85	105.39	105.61	105.42
	Min	105.45	105.61	105.14	105.27	105.18
	Average	105.58	105.73	105.27	105.44	105.30

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## Calibration Report

### Measurement Results:

HEATING BLOCK			Temperature Distribution	
Setting (°C)	Reading (°C)		Stability ( $\pm$ °C)	Uncertainty ( $\pm$ °C)
	Min , Max	Average		
100.0	100.3 , 100.5	100.4	0.26	0.81
107.0	107.0 , 107.1	107.1	0.19	0.78

\* The quoted uncertainty exclude " uniformity "

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on date and place of test only.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor  $k$  which for a t-distribution, providing a level of confidence of approximately 95 %.

Approved By. \_\_\_\_\_