

# ภาคผนวก ง

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ใบรับรองการสอบเทียบเครื่องมือ



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รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Ambient	Particulate Matter (PM10)	High Volume	BKK_F50383	-	-	On site Calibration
Ambient	Particulate Matter (PM10)	High Volume	BKK_F51061	-	-	On site Calibration
Ambient	Particulate Matter (PM10)	High Volume	RYG_F50184	-	-	On site Calibration
Ambient	Particulate Matter (PM10)	High Volume	BKK_F51377	-	-	On site Calibration
Ambient	Particulate Matter (PM10)	Digital Balance	RYG_EN0001	20-Feb-25	20-Feb-26	12
Ambient	Total Suspended Particulate	High Volume	BKK_F51375	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	BKK_F50371	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	RYG_F50176	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	BKK_F50366	-	-	On site Calibration
Ambient	Total Suspended Particulate	Digital Balance	RYG_EN0001	20-Feb-25	20-Feb-26	12
Ambient	Nitrogen Dioxide	NO <sub>x</sub> Analyzer	BKK_F50782	3-Jan-25	3-Jul-25	6
Ambient	Nitrogen Dioxide	NO <sub>x</sub> Analyzer	RYG_F50261	4-Jan-25	4-Jul-25	6
Ambient	Nitrogen Dioxide	NO <sub>x</sub> Analyzer	RYG_F50453	4-Jan-25	4-Jul-25	6
Ambient	Nitrogen Dioxide	NO <sub>x</sub> Analyzer	BKK_F51088	3-Jan-25	3-Jul-25	6
Ambient	Sulfur Dioxide	SO <sub>2</sub> Analyzer	BKK_F50781	3-Jan-25	3-Jul-25	6
Ambient	Sulfur Dioxide	SO <sub>2</sub> Analyzer	RYG_F50257	4-Jan-25	4-Jul-25	6
Ambient	Sulfur Dioxide	SO <sub>2</sub> Analyzer	RYG_F50452	4-Jan-25	4-Jul-25	6
Ambient	Sulfur Dioxide	SO <sub>2</sub> Analyzer	BKK_F51087	3-Jan-25	3-Jul-25	6
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	BKK_F50909	28-Jun-24	28-Dec-25	18
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	BKK_F50974	26-Dec-24	26-Dec-25	12
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	RYG_F50650	7-Feb-25	7-Aug-26	18
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	BKK_F50975	17-Dec-24	17-Jun-26	18
Stack	Total Suspended Particulate	Console Control Unit	BKK_F50468	10-Jan-25	10-Jul-25	6
Stack	Total Suspended Particulate	Console Control Unit	BKK_F50556	10-Jan-25	10-Jul-25	6
Stack	Total Suspended Particulate	Phot. Tube	BKK_F50551	30-Nov-24	1-Jun-25	6
Stack	Total Suspended Particulate	Probe	BKK_F50552	30-Nov-24	1-Jun-25	6
Stack (CEMs)	Oxides of Nitrogen	Digital Balance	RYG_EN0003	20-Feb-25	20-Feb-26	12
Stack (CEMs)	Sulfur Dioxide	Analyzer, System calibration, Standard gas	-	-	-	-
Noise	Leq 24 hrs	Sound Calibrator	RYG_F50496	19-Mar-25	19-Mar-26	12
Noise	Leq 24 hrs	Sound Level Meter	RYG_F50029	11-Jul-24	11-Jul-25	12
Noise	Leq 24 hrs	Sound Level Meter	RYG_F50495	27-Jan-25	26-Jan-26	12
Noise	Leq 24 hrs	Sound Level Meter	RYG_F50614	23-Dec-24	23-Dec-25	12
Noise	Leq 8 hrs	Sound Calibrator	RYG_F50496	19-Mar-25	19-Mar-26	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_F50020	21-Jan-25	21-Jan-26	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_F50494	27-Jan-25	26-Jan-26	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_F50619	21-Jan-25	21-Jan-26	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_F50431	27-Jan-25	26-Jan-26	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_F50021	27-Jan-25	26-Jan-26	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_F50434	27-Jan-25	26-Jan-26	12
Noise	Leq 8 hrs	Sound Calibrator	RYG_F50496	19-Mar-25	19-Mar-26	12
Noise	Leq 8 hrs	Sound Level Meter	NKH_F50133	9-Jul-24	9-Jul-25	12
Noise	Leq 8 hrs	Sound Level Meter	NKH_F50001	9-May-25	9-May-26	12
Noise	Leq 8 hrs	Sound Level Meter	NKH_F50131	9-Jul-24	9-Jul-25	12
Noise	Leq 8 hrs	Sound Level Meter	NKH_F50132	9-Jul-24	9-Jul-25	12
Noise	Leq 8 hrs	Sound Level Meter	NKH_F50134	9-Jul-24	9-Jul-25	12
Noise	Leq 8 hrs	Sound Level Meter	NKH_F50129	9-Jul-24	9-Jul-25	12
Heat	Heat Stress	Heat Stress Monitor	RYG_F50020	20-Dec-24	20-Dec-25	12
Heat	Heat Stress	Heat Stress Monitor	RYG_F50218	27-Jan-25	26-Jan-26	12
Heat	Heat Stress	Heat Stress Monitor	RYG_F50217	20-Dec-24	20-Dec-25	12
Heat	Heat Stress	Heat Stress Monitor	RYG_F50221	20-Dec-24	20-Dec-25	12
Heat	Heat Stress	Heat Stress Monitor	RYG_F50523	18-Jan-25	16-Mar-26	12
Heat	Heat Stress	Heat Stress Monitor	RYG_F50524	18-Jan-25	17-Mar-26	12
Heat	Heat Stress	Heat Stress Monitor	RYG_F50226	27-Jan-25	26-Jan-26	12
Heat	Heat Stress	Heat Stress Monitor	RYG_F50521	17-Mar-25	16-Mar-26	12
Illuminance	Illuminance	Lux Meter	RYG_F50471	14-Mar-24	13-Mar-25	12
Illuminance	Illuminance	Lux Meter	RYG_F50536	20-Nov-24	20-Nov-25	12



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รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Rayong Lab	Temperature	pH meter	RYG_F50550	30-Jul-24	29-Jul-25	12
Rayong Lab	pH at 25 °C	pH meter	RYG_EN0152	14-Dec-23	14-Jun-25	18
Rayong Lab	Total Suspended Solids	Electronic Balance	RYG_EN0002	20-Feb-25	20-Feb-26	12
Rayong Lab	Total Suspended Solids	Hot Air Oven	RYG_EN0010	21-Mar-24	21-Sep-25	18
Rayong Lab	Total Dissolved Solids 180°C	Electronic Balance	RYG_EN0002	20-Feb-25	20-Feb-26	12
Rayong Lab	Total Dissolved Solids 180°C	Hot Air Oven	RYG_EN0010	21-Mar-24	21-Sep-25	18
Rayong Lab	BOD	DO meter with Sensor	RYG_EN0032	20-Jan-25	20-Jul-26	18
Rayong Lab	BOD	Incubator	RYG_EN0154	1-Nov-24	1-May-26	18
Rayong Lab	BOD	Buette	RYG_EN0216	24-Sep-24	24-Sep-25	12
Rayong Lab	Oil & Grease	Electronic Balance	RYG_EN0002	20-Feb-25	20-Feb-26	12
Rayong Lab	Oil & Grease	Hot Air Oven	RYG_EN0213	19-Mar-25	19-Mar-26	12
Rayong Lab	Oil & Grease	Water Bath	RYG_EN0061	21-Mar-24	21-Sep-25	18
Rayong Lab	Dissolved Oxygen	Chamber (Cold Room)	RYG_EN0184	11-Jun-24	11-Dec-25	18
Rayong Lab	Color (at Original pH)	Spectrophotometer	RYG_EN0037	18-Mar-25	18-Sep-26	18
Rayong Lab	Color (at pH 7.0)	Spectrophotometer	RYG_EN0037	18-Mar-25	18-Sep-26	18
Rayong Lab	COO	Spectrophotometer	RYG_EN0037	18-Mar-25	18-Sep-26	18
Rayong Lab	Chloride	pH ISE Meter	RYG_EN0152	14-Dec-23	14-Jun-25	18
Rayong Lab	Cyanide	Spectrophotometer	RYG_EN0037	18-Mar-25	18-Sep-26	18
Rayong Lab	Formaldehyde	Spectrophotometer	RYG_EN0037	18-Mar-25	18-Sep-26	18
Rayong Lab	Phenol	Spectrophotometer	RYG_EN0037	18-Mar-25	18-Sep-26	18
Rayong Lab	Sulfide	Chamber (Cold Room)	RYG_EN0184	11-Jun-24	11-Dec-25	18
Rayong Lab	Fluoride	pH ISE Meter	RYG_EN0152	14-Dec-23	14-Jun-25	18
Rayong Lab	Total Kjeldahl Nitrogen	Block Digestion Unit	RYG_EN0188	11-Mar-24	11-Sep-25	18
Rayong Lab	Total Kjeldahl Nitrogen	pH Meter	RYG_EN0152	14-Dec-23	14-Jun-25	18
Rayong Lab	Dissolved Oxygen (on site)	DO Meter	RYG_F50601	20-Sep-24	20-Sep-25	12
Water Lab	Calcium	ICP-OES	BKK_EL0037	22-Sep-24	23-Mar-26	18
Water Lab	Calcium	Hot Block	BKK_EL0054	4-Mar-25	4-Sep-26	18
Water Lab	Calcium	Chamber (Cooling Room)	BKK_EN0167	4-Jun-25	4-Dec-26	18
Water Lab	Magnesium	ICP-OES	BKK_EL0037	22-Sep-24	23-Mar-26	18
Water Lab	Magnesium	Hot Block	BKK_EL0054	4-Mar-25	4-Sep-26	18
Water Lab	Magnesium	Chamber (Cooling Room)	BKK_EN0167	4-Jun-25	4-Dec-26	18
Water Lab	Sodium	ICP-OES	BKK_EL0037	22-Sep-24	23-Mar-26	18
Water Lab	Sodium	Hot Block	BKK_EL0054	4-Mar-25	4-Sep-26	18
Water Lab	Sodium	Chamber (Cooling Room)	BKK_EN0167	4-Jun-25	4-Dec-26	18
Water Lab	SAR	ICP-OES	BKK_EL0037	22-Sep-24	23-Mar-26	18
Water Lab	SAR	Hot Block	BKK_EL0054	4-Mar-25	4-Sep-26	18
Water Lab	SAR	Chamber (Cooling Room)	BKK_EN0167	4-Jun-25	4-Dec-26	18
Water Lab	Chlorite	Ion Chromatography	BKK_EN0069	12-Jun-24	12-Jul-25	18
Water Lab	Organochlorine Pesticide	GC-MS/MS	BKK_EN0284	21-Nov-24	21-May-26	18
Water Lab	Anionic Surfactant	Spectrophotometer	BKK_EN0018	13-Sep-24	13-Sep-25	12
Water Lab	Anionic Surfactant	Chamber (Cooling Room)	BKK_EN0167	4-Jun-25	4-Dec-26	18
Water Lab	Hexavalent Chromium	Spectrophotometer	BKK_EN0018	13-Sep-24	13-Sep-25	12
Water Lab	Silver	CP-MS	BKK_EL0026	12-Dec-23	13-Jun-25	18
Water Lab	Silver	Hot Block	BKK_EL0054	4-Mar-25	4-Sep-26	18
Water Lab	Silver	Chamber (Cooling Room)	BKK_EN0167	4-Jun-25	4-Dec-26	18
Water Lab	Barium	CP-MS	BKK_EL0026	12-Dec-23	13-Jun-25	18
Water Lab	Barium	Hot Block	BKK_EL0054	4-Mar-25	4-Sep-26	18
Water Lab	Barium	Chamber (Cooling Room)	BKK_EN0167	4-Jun-25	4-Dec-26	18
Water Lab	Lead	CP-MS	BKK_EL0026	12-Dec-23	13-Jun-25	18
Water Lab	Lead	Hot Block	BKK_EL0054	4-Mar-25	4-Sep-26	18
Water Lab	Lead	Chamber (Cooling Room)	BKK_EN0167	4-Jun-25	4-Dec-26	18
Water Lab	Iron	CP-MS	BKK_EL0026	12-Dec-23	13-Jun-25	18
Water Lab	Iron	Hot Block	BKK_EL0054	4-Mar-25	4-Sep-26	18
Water Lab	Iron	Chamber (Cooling Room)	BKK_EN0167	4-Jun-25	4-Dec-26	18
Water Lab	Manganese	CP-MS	BKK_EL0026	12-Dec-23	13-Jun-25	18
Water Lab	Manganese	Hot Block	BKK_EL0054	4-Mar-25	4-Sep-26	18
Water Lab	Manganese	Chamber (Cooling Room)	BKK_EN0167	4-Jun-25	4-Dec-26	18



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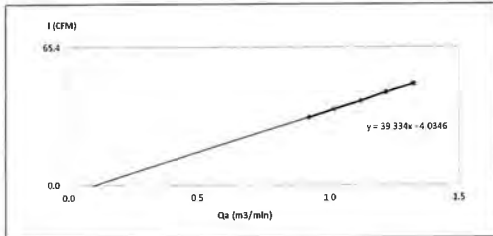
Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal.	Freq. Calibrate (Months)
Water Lab	Copper	CP-MS	BKK_EL0026	12-Dec-23	13-Jun-25	18
Water Lab	Copper	Hot Block	BKK_EL0054	4-Mar-25	4-Sep-26	18
Water Lab	Copper	Chamber (Cooling Room)	BKK_EN0167	4-Jun-25	4-Dec-26	18
Water Lab	Nickel	CP-MS	BKK_EL0026	12-Dec-23	13-Jun-25	18
Water Lab	Nickel	Hot Block	BKK_EL0054	4-Mar-25	4-Sep-26	18
Water Lab	Nickel	Chamber (Cooling Room)	BKK_EN0167	4-Jun-25	4-Dec-26	18
Water Lab	Arsenic	CP-MS	BKK_EL0026	12-Dec-23	13-Jun-25	18
Water Lab	Arsenic	Hot Block	BKK_EL0054	4-Mar-25	4-Sep-26	18
Water Lab	Arsenic	Chamber (Cooling Room)	BKK_EN0167	4-Jun-25	4-Dec-26	18
Water Lab	Selenium	CP-MS	BKK_EL0026	12-Dec-23	13-Jun-25	18
Water Lab	Selenium	Hot Block	BKK_EL0054	4-Mar-25	4-Sep-26	18
Water Lab	Selenium	Chamber (Cooling Room)	BKK_EN0167	4-Jun-25	4-Dec-26	18
Water Lab	Cadmium	CP-MS	BKK_EL0026	12-Dec-23	13-Jun-25	18
Water Lab	Cadmium	Hot Block	BKK_EL0054	4-Mar-25	4-Sep-26	18
Water Lab	Cadmium	Chamber (Cooling Room)	BKK_EN0167	4-Jun-25	4-Dec-26	18
Water Lab	Zinc	CP-MS	BKK_EL0026	12-Dec-23	13-Jun-25	18
Water Lab	Zinc	Hot Block	BKK_EL0054	4-Mar-25	4-Sep-26	18
Water Lab	Zinc	Chamber (Cooling Room)	BKK_EN0167	4-Jun-25	4-Dec-26	18
Water Lab	Trivalent Chromium	CP-MS	BKK_EL0026	12-Dec-23	13-Jun-25	18
Water Lab	Trivalent Chromium	Hot Block	BKK_EL0054	4-Mar-25	4-Sep-26	18
Water Lab	Trivalent Chromium	Chamber (Cooling Room)	BKK_EN0167	4-Jun-25	4-Dec-26	18
Water Lab	Mercury	Mercury Analyzer	BKK_EL0128	6-Dec-24	6-Dec-25	12



### High Volume Air Sampler Calibration Worksheet

Project Site : Gulf T54 Co., Ltd. Barometric Pressure (mm Hg) : 748.3  
Calibrate Location : โรงโม่หินบ้านฉาง Temperature (°C) : 32.2  
Calibrate Date : 2-May-25 High Volume ID : BKK-FS0383  
CalibrationSheet No : C-020525-BKK-FS0383 High Volume Model : TE-5009X  
Calibrator ID : RYG-FS0205 High Volume S/N : 4787  
Calibrator Model : TE-5028A Calibrator Slope : 0.95561  
Calibrator S/N : 1166 Calibrator Intercept : -0.02266

Test No.	Delta H <sub>2</sub> O (inch)	Qa (m <sup>3</sup> /min)	I : Chart (CFM)	Linear Regression
1	1.8	0.919	32	Slope: 39.3336 Intercept: -4.0346 Correlation Coefficient: 0.9998
2	2.2	1.014	36	
3	2.7	1.121	40	
4	3.2	1.218	44	
5	3.8	1.325	48	



Calibrated by : นางสาว นันทาวต  
( Mr. Nantawat Sarin )  
RYG Field Services Scientist (1)

Approved by : สมชาย  
( Mr. Supot Salamteh )  
RYG-Field Services Section Head

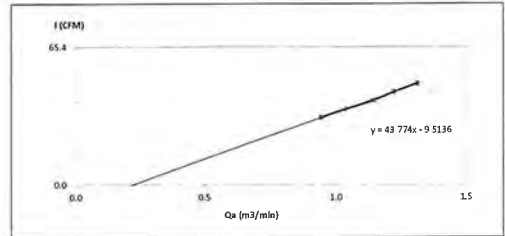
FORM NO. F 06-074 REVISION NO.2 ISSUE DATE 20/11/23



### High Volume Air Sampler Calibration Worksheet

Project Site : Gulf T54 Co., Ltd. Barometric Pressure (mm Hg) : 750.2  
Calibrate Location : โรงโม่หินบ้านฉาง Temperature (°C) : 34.1  
Calibrate Date : 2-May-25 High Volume ID : BKK-FS1061  
CalibrationSheet No : C-020525-BKK-FS1061 High Volume Model : TE-5009X  
Calibrator ID : RYG-FS0205 High Volume S/N : 5504  
Calibrator Model : TE-5028A Calibrator Slope : 0.95561  
Calibrator S/N : 1166 Calibrator Intercept : -0.02266

Test No.	Delta H <sub>2</sub> O (inch)	Qa (m <sup>3</sup> /min)	I : Chart (CFM)	Linear Regression
1	1.9	0.945	32	Slope: 43.7737 Intercept: -9.5136 Correlation Coefficient: 0.9990
2	2.3	1.038	36	
3	2.8	1.143	40	
4	3.2	1.220	44	
5	3.7	1.310	48	



Calibrated by : นางสาว นันทาวต  
( Mr. Nantawat Sarin )  
RYG Field Services Scientist (1)

Approved by : สมชาย  
( Mr. Supot Salamteh )  
RYG-Field Services Section Head

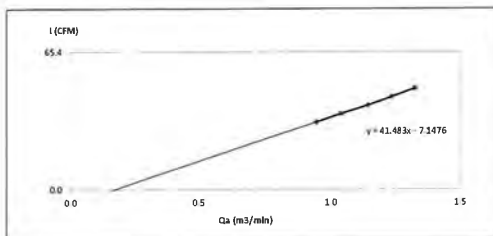
FORM NO. F 06-074 REVISION NO.2 ISSUE DATE 20/11/23



### High Volume Air Sampler Calibration Worksheet

Project Site : Gulf T54 Co., Ltd. Barometric Pressure (mm Hg) : 750.3  
Calibrate Location : โรงโม่หินบ้านฉาง Temperature (°C) : 32.9  
Calibrate Date : 2-May-25 High Volume ID : RYG-FS0184  
CalibrationSheet No : C-020525-RYG-FS0184 High Volume Model : TE-5009X  
Calibrator ID : RYG-FS0205 High Volume S/N : 4792  
Calibrator Model : TE-5028A Calibrator Slope : 0.95561  
Calibrator S/N : 1166 Calibrator Intercept : -0.02266

Test No.	Delta H <sub>2</sub> O (inch)	Qa (m <sup>3</sup> /min)	I : Chart (CFM)	Linear Regression
1	1.9	0.944	32	Slope: 41.4827 Intercept: -7.1476 Correlation Coefficient: 0.9997
2	2.3	1.036	36	
3	2.8	1.141	40	
4	3.3	1.237	44	
5	3.8	1.325	48	



Calibrated by : นางสาว นันทาวต  
( Mr. Nantawat Sarin )  
RYG Field Services Scientist (1)

Approved by : สมชาย  
( Mr. Supot Salamteh )  
RYG-Field Services Section Head

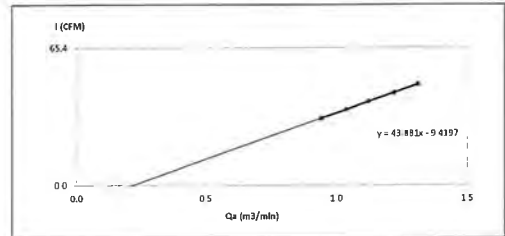
FORM NO. F 06-074 REVISION NO.2 ISSUE DATE 20/11/23



### High Volume Air Sampler Calibration Worksheet

Project Site : Gulf T54 Co., Ltd. Barometric Pressure (mm Hg) : 749.2  
Calibrate Location : โรงโม่หินบ้านฉาง Temperature (°C) : 33.0  
Calibrate Date : 2-May-25 High Volume ID : BKK-FS1377  
CalibrationSheet No : C-020525-BKK-FS1377 High Volume Model : TE-5009X  
Calibrator ID : RYG-FS0205 High Volume S/N : 6202  
Calibrator Model : TE-5028A Calibrator Slope : 0.95561  
Calibrator S/N : 1166 Calibrator Intercept : -0.02266

Test No.	Delta H <sub>2</sub> O (inch)	Qa (m <sup>3</sup> /min)	I : Chart (CFM)	Linear Regression
1	1.9	0.945	32	Slope: 43.9813 Intercept: -9.4197 Correlation Coefficient: 0.9998
2	2.3	1.037	36	
3	2.7	1.122	40	
4	3.2	1.219	44	
5	3.7	1.309	48	



Calibrated by : นางสาว นันทาวต  
( Mr. Nantawat Sarin )  
RYG Field Services Scientist (1)

Approved by : สมชาย  
( Mr. Supot Salamteh )  
RYG-Field Services Section Head

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



Accredited by

NSC-TISI-TIS 17025

Calibration 0426

## Calibration certificate

Calibration Certificate No 25BK.L0001

Object	Electronic non-automatic weighing instrument	This calibration certificate documents the traceability to national standards
Manufacturer	Sartorius	Uncertainties of measurements are taken into account when only statements of compliance are made
Type	LA130S-F	This certificate was prepared by Sartorius Corporation in accordance to the current ISO/IEC 17025:2017 standard and Sartorius Work Instruction (Method) SOP VM 05
Serial   QM Ident. no	25409664   RYG_EN0001	This certificate relate and apply this equipment only.
Customer	ALS Laboratory Group (Thailand) Co.,Ltd (Rayong Branch)	
	616/10 Moo 5 T Maenam Khu, A Pluak Daeng, Rayong 21140, Thailand	
Order no.	2230	
Number of pages	4	
Date of calibration	20 Feb 2025	



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

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

Date	06 Mar 2025	Approval of the Calibration Certificate	Person in charge
		Mr. Chonchai Inthana	Kachen Lalee

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

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Version 6.5

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Calibration certificate No : 25BK.L0001

Calibration Certificate

## Adjustment Status

The measuring device was internally adjusted before the calibration

## Environmental and measuring conditions

Date of calibration	20 Feb 2025
Temperature at place of calibration   Temp. diff	24.5 °C   1.0 K
Twilight - Tplace	
Measuring conditions	The installation site is suitable The device was levelled Balance was loaded up to Max before test.
Comments	Humidity 58.0 %RH

## Measurement results | Measurement uncertainties

Repeatability	Eccentricity
Test load (nominal): 10 g   100 g	Test load (nominal): 50 g
1 10.0000 g 100.0000 g	Center 50.0000 g
2 9.9999 g 100.0000 g	Front left 50.0001 g
3 10.0000 g 99.9999 g	Back left 50.0000 g
4 10.0000 g 100.0000 g	Back right 49.9999 g
5 10.0000 g 100.0000 g	Front right 50.0001 g
6 9.9999 g 99.9999 g	Maximum deviation from centric loading indication
7 10.0000 g 100.0000 g	Δ(ecc)max = 0.0001 g
8 10.0000 g 100.0000 g	
9 10.0000 g 100.0000 g	
10 10.0000 g 100.0000 g	
s = 0.00004 g s = 0.00005 g	

Testload	Indication	Error	Expansion factor	Uncertainty	Uncertainty relative
0.0100 g	0.0100 g	0.0000 g	2.00	0.00012 g	1.2 %
0.0500 g	0.0500 g	0.0000 g	2.00	0.00013 g	0.25 %
0.1000 g	0.1000 g	0.0000 g	2.00	0.00013 g	0.13 %
0.5000 g	0.5000 g	0.0000 g	2.00	0.00013 g	0.026 %
1.0000 g	1.0000 g	0.0000 g	2.00	0.00013 g	0.013 %
2.0000 g	2.0000 g	0.0000 g	2.00	0.00013 g	0.0065 %
5.0000 g	5.0000 g	0.0000 g	2.00	0.00013 g	0.0026 %
10.0000 g	10.0000 g	0.0000 g	2.00	0.00013 g	0.0013 %
20.0000 g	20.0000 g	0.0000 g	2.00	0.00014 g	0.00069 %
100.0000 g	100.0000 g	0.0000 g	2.00	0.00021 g	0.00021 %
150.0000 g	149.9999 g	-0.0001 g	2.00	0.00026 g	0.00019 %
Maximum error of indication	E  <sub>max</sub> = 0.0001 g				

Use(E) is the sum of Δ(E) and test load L. The uncertainty of measurement U(E) is valid only if error E is considered. You will find reference notes on the uncertainty of measurement in case under Appendix to the calibration certificate | Interpretation of measurement results.  
Reference note: The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the expansion factor. Determined in accordance with the European Calibration Guideline EURAMET cg-16, V4.0. There is a 95 % probability that the value of the measurand will be in the assigned value range.

End of calibration certificate

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10310 Bangkok

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Calibration certificate No : 25BK.L0001

Calibration Certificate

## Calibration object

Single range instrument

Model	LA130S-F
Serial Number	25409664
QM Ident. no   Inventory no	RYG_EN0001   —

Maximum capacity (Max. load)	150.0000 g
Measured range	150.0000 g
Scale interval	0.0001 g

## Place of calibration

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

## Calibration procedure

EURAMET cg-16, V4.0 - Guidelines on the Calibration of Non-Automatic Weighing Instruments

## Test equipment

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

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Interpretation of measurement results | Appendix to the calibration certificate

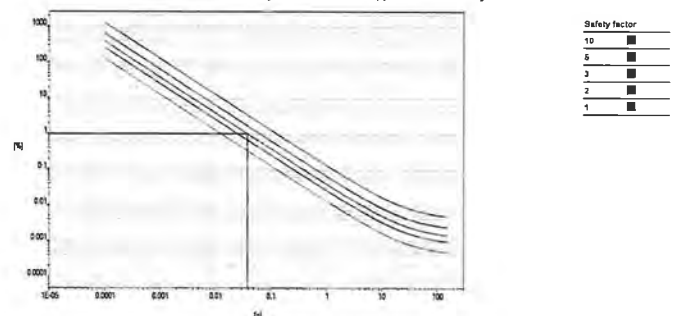
## Uncertainty of measurement in use

Device adjusted before measurement	Yes
Temperature deviation considered	1.5 K (isoCAL active)
Temperature coefficient considered	1 · 10 <sup>-4</sup> /K
Uncertainty of the weighing result U <sub>95</sub> (W)	U <sub>95</sub> (W) = 0.00013 g + 3.95 · 10 <sup>-4</sup> · R

Reference note: The current uncertainty of measurement is calculated by entering the reading R into this formula. In relation to this, there is no need for a correction of the indication error. The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied with an Expansion factor of 2, determined in accordance with the European Calibration Guideline EURAMET cg-16, V4.0. There is a 95 % probability that the value of the measurand will be in the assigned value range.

Indication in % from max load	Net indication R	Uncertainty U <sub>95</sub> (W)	Uncertainty relative U <sub>95</sub> (W) <sub>rel</sub>
1 %	1.5000 g	0.00014 g	0.0091 %
25 %	37.5000 g	0.00028 g	0.0074 %
50 %	75.0000 g	0.00043 g	0.0057 %
75 %	112.5000 g	0.00058 g	0.0051 %
100 %	150.0000 g	0.00072 g	0.0048 %

Graphic realization of the relative uncertainty of measurement | process accuracy



Displayed example

Process accuracy	1.00 %
Safety factor	3
Minimum sample weight	0.0380 g

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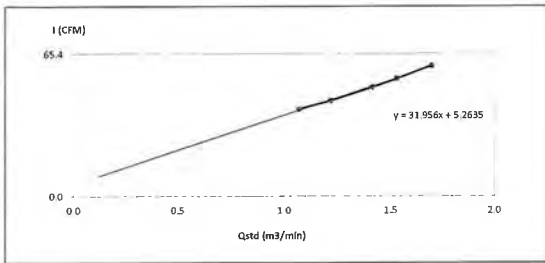




### High Volume Air Sampler Calibration Worksheet

Project Site :	Gulf TS4 Co.,Ltd.	Barometric Pressure (mm Hg) :	748.3
Calibrate Location :	โรงโม่หิน/เหมืองแร่ (หิน)	Temperature (°C) :	32.2
Calibrate Date :	2-May-25	High Volume ID :	BKK_FS1375
CalibrationSheet No.:	C-020525-BKK_FS1375	High Volume Model :	TE-5009X
Calibrator ID :	RYG_FS0205	High Volume S/N :	6256
Calibrator Model :	TE-5028A	Calibrator Slope :	1.52567
Calibrator S/N :	1166	Calibrator Intercept :	-0.03613

Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>std</sub> (m <sup>3</sup> /min)	I : Chart (CFM)	Linear Regression
1	2.6	1.0724	40	Slope: 31.9557 Intercept: 5.2635 Correlation Coefficient: 0.9986
2	3.4	1.2211	44	
3	4.6	1.4145	50	
4	5.4	1.5295	54	
5	6.7	1.6996	60	



Calibrated by

( Mr. Nantawat Sarin )  
RYG Field Services Scientist (1)

Approved by :

( Mr. Supot Salamteh )  
RYG-Field Services Section Head

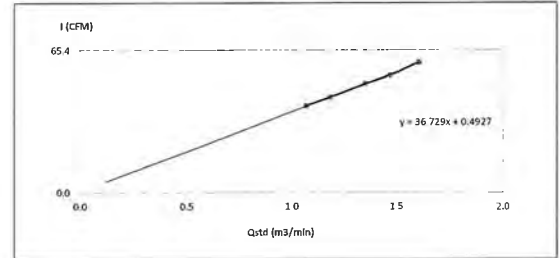
FORM NO.: F 06-073 REVISION NO.:2 ISSUE DATE: 20/11/23



### High Volume Air Sampler Calibration Worksheet

Project Site :	Gulf TS4 Co.,Ltd.	Barometric Pressure (mm Hg) :	750.7
Calibrate Location :	โรงโม่หิน/เหมืองแร่ (หิน)	Temperature (°C) :	34.1
Calibrate Date :	2-May-25	High Volume ID :	BKK_FS0371
CalibrationSheet No.:	C-020525-BKK_FS0371	High Volume Model :	G1051
Calibrator ID :	RYG_FS0205	High Volume S/N :	1324
Calibrator Model :	TE-5028A	Calibrator Slope :	1.52567
Calibrator S/N :	1166	Calibrator Intercept :	-0.03613

Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>std</sub> (m <sup>3</sup> /min)	I : Chart (CFM)	Linear Regression
1	2.6	1.0708	40	Slope: 36.7291 Intercept: 0.4927 Correlation Coefficient: 0.9990
2	3.2	1.1840	44	
3	4.2	1.3512	50	
4	5.0	1.4710	54	
5	6.0	1.6080	60	



Calibrated by

( Mr. Nantawat Sarin )  
RYG Field Services Scientist (1)

Approved by :

( Mr. Supot Salamteh )  
RYG-Field Services Section Head

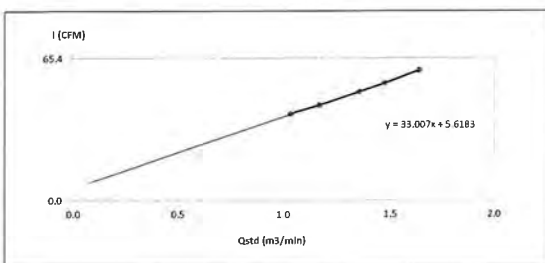
FORM NO.: F 06-073 REVISION NO.:2 ISSUE DATE: 20/11/23



### High Volume Air Sampler Calibration Worksheet

Project Site :	Gulf TS4 Co.,Ltd.	Barometric Pressure (mm Hg) :	750.1
Calibrate Location :	โรงโม่หิน/เหมืองแร่ (หิน)	Temperature (°C) :	32.9
Calibrate Date :	2-May-25	High Volume ID :	RYG_FS0176
CalibrationSheet No.:	C-020525-RYG_FS0176	High Volume Model :	TE-5170D
Calibrator ID :	RYG_FS0205	High Volume S/N :	4802
Calibrator Model :	TE-5028A	Calibrator Slope :	1.52567
Calibrator S/N :	1166	Calibrator Intercept :	-0.03613

Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>std</sub> (m <sup>3</sup> /min)	I : Chart (CFM)	Linear Regression
1	2.4	1.0318	40	Slope: 33.0071 Intercept: 5.6183 Correlation Coefficient: 0.9992
2	3.1	1.1677	44	
3	4.2	1.3533	50	
4	5.0	1.4732	54	
5	6.2	1.6364	60	



Calibrated by

( Mr. Nantawat Sarin )  
RYG Field Services Scientist (1)

Approved by :

( Mr. Supot Salamteh )  
RYG-Field Services Section Head

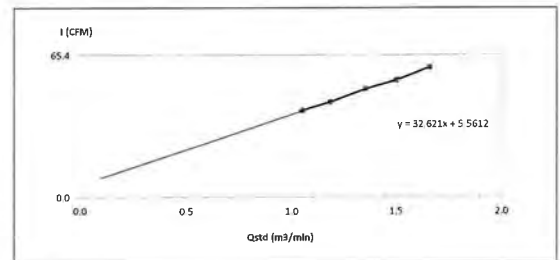
FORM NO.: F 06-073 REVISION NO.:2 ISSUE DATE: 20/11/23



### High Volume Air Sampler Calibration Worksheet

Project Site :	Gulf TS4 Co.,Ltd.	Barometric Pressure (mm Hg) :	749.2
Calibrate Location :	โรงโม่หิน/เหมืองแร่ (หิน)	Temperature (°C) :	33.0
Calibrate Date :	2-May-25	High Volume ID :	BKK_FS0366
CalibrationSheet No.:	C-020525-BKK_FS0366	High Volume Model :	TE-5009X
Calibrator ID :	RYG_FS0205	High Volume S/N :	4156
Calibrator Model :	TE-5028A	Calibrator Slope :	1.52567
Calibrator S/N :	1166	Calibrator Intercept :	-0.03613

Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>std</sub> (m <sup>3</sup> /min)	I : Chart (CFM)	Linear Regression
1	2.5	1.0516	40	Slope: 32.6206 Intercept: 5.5612 Correlation Coefficient: 0.9990
2	3.2	1.1849	44	
3	4.2	1.3523	50	
4	5.2	1.5006	54	
5	6.4	1.6608	60	



Calibrated by

( Mr. Nantawat Sarin )  
RYG Field Services Scientist (1)

Approved by :

( Mr. Supot Salamteh )  
RYG-Field Services Section Head

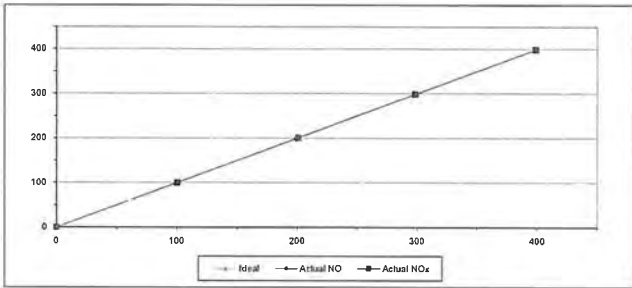
FORM NO.: F 06-073 REVISION NO.:2 ISSUE DATE: 20/11/23



## MULTIPOINT CALIBRATION REPORT

Calibration Date 3-Jan-25 Equipment Name NOx Analyzer  
 Manufacturer HORIBA Model APNA-370  
 Serial No. WPYQJMW Equipment ID BKK\_FS0782  
 Calibrator Manufacturer Teledyne API Model 700  
 Serial No. 947  
 Std. Gas Concentration (PPM) 55.88 Cylinder No. GN0027222  
 Cylinder Pressure (psi) 1800 Certified By 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	99.60	-0.40	-0.40	100.60	0.60	0.60
2	200.00	199.70	-0.30	-0.15	201.10	1.10	0.55
3	300.00	298.70	-1.30	-0.43	298.50	-1.50	-0.50
4	400.00	398.70	-1.30	-0.33	399.10	-0.90	-0.22
AVERAGE (%)				-0.24			0.10



Calibrated By

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

Approved By

(Mr. Sarayuth Jitranont)  
Assistant General Manager

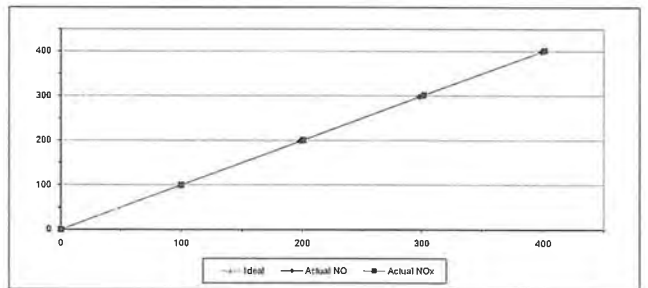
ALS Laboratory Group  
FORM NO : F 06-056 REVISION NO : - ISSUE DATE: 02/04/12



## MULTIPOINT CALIBRATION REPORT

Calibration Date 4-Jan-25 Equipment Name NOx Analyzer  
 Manufacturer HORIBA Model APNA-370  
 Serial No. SEEAW53E Equipment ID RYG\_FS0261  
 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	100.20	0.20	0.20
2	200.00	197.70	-2.30	-1.15	201.20	1.20	0.60
3	300.00	298.10	-1.90	-0.63	302.10	2.10	0.70
4	400.00	398.60	-1.40	-0.35	401.40	1.40	0.35
AVERAGE (%)				-0.87			0.39



Calibrated By

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

Approved By

(Mr. Sarayuth Jitranont)  
Assistant General Manager

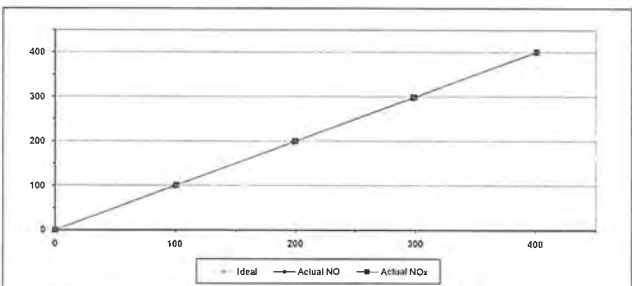
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FORM NO : F 06-056 REVISION NO : - ISSUE DATE: 02/04/12



## MULTIPOINT CALIBRATION REPORT

Calibration Date 4-Jan-25 Equipment Name NOx Analyzer  
 Manufacturer HORIBA Model APNA-370  
 Serial No. AWXG87CR Equipment ID RYG\_FS0453  
 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	99.60	-0.40	-0.40	101.10	1.10	1.10
2	200.00	198.60	-1.40	-0.70	198.60	-0.20	-0.10
3	300.00	299.00	-1.00	-0.33	298.60	-1.40	-0.47
4	400.00	401.20	1.20	0.30	401.10	1.10	0.28
AVERAGE (%)				-0.21			0.18



Calibrated By

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

Approved By

(Mr. Sarayuth Jitranont)  
Assistant General Manager

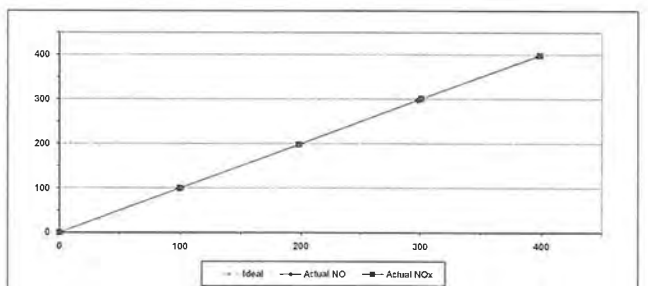
ALS Laboratory Group  
FORM NO : F 06-056 REVISION NO : - ISSUE DATE: 02/04/12



## MULTIPOINT CALIBRATION REPORT

Calibration Date 3-Jan-25 Equipment Name NOx Analyzer  
 Manufacturer HORIBA Model APNA-370  
 Serial No. PX13CWA0 Equipment ID BKK\_FS1088  
 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	99.10	-0.90	-0.90	100.20	0.20	0.20
2	200.00	198.30	-1.70	-0.85	198.10	-1.90	-0.95
3	300.00	298.40	-1.60	-0.53	301.30	1.30	0.43
4	400.00	396.90	-3.10	-0.78	398.70	-1.30	-0.33
AVERAGE (%)				-0.59			-0.11



Calibrated By

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

Approved By

(Mr. Sarayuth Jitranont)  
Assistant General Manager

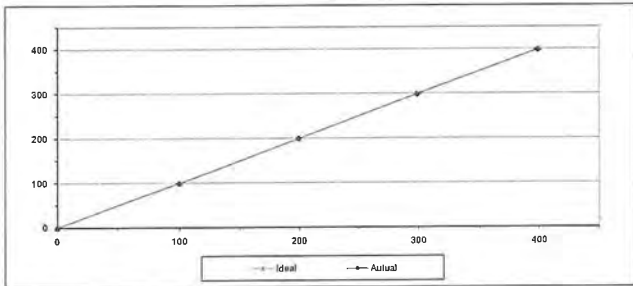
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FORM NO : F 06-056 REVISION NO : - ISSUE DATE: 02/04/12



## MULTIPOINT CALIBRATION REPORT

Calibration Date	3-Jan-25	Equipment Name	SO2 Analyzer
Manufacturer	HORIBA	Model	APSA-370
Serial No.	Y53SNSFB	Equipment ID	BKK_FS0761
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	56.3	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	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	99.70	-0.30	-0.30
2	200.00	199.20	-0.80	-0.40
3	300.00	298.50	-1.50	-0.50
4	400.00	398.50	-1.50	-0.38
AVERAGE (%)				-0.30



Calibrated By

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

Approved By

(Mr. Sarayuth Jittranont)  
Assistant General Manager

ALS Laboratory Group

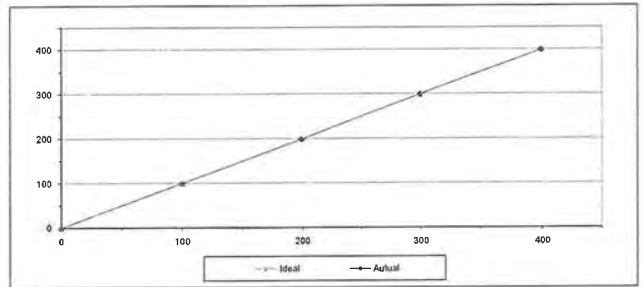
FORM NO.: F 06-056 REVISION NO.: ISSUE DATE: 02/04/12



## MULTIPOINT CALIBRATION REPORT

Calibration Date	4-Jan-25	Equipment Name	SO2 Analyzer
Manufacturer	HORIBA	Model	APSA-370
Serial No.	24PH0KNA	Equipment ID	RYG_FS0257
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	56.3	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	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	99.40	-0.60	-0.60
2	200.00	196.60	-1.40	-0.70
3	300.00	299.40	-0.60	-0.20
4	400.00	398.80	-1.20	-0.30
AVERAGE (%)				-0.34



Calibrated By

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

Approved By

(Mr. Sarayuth Jittranont)  
Assistant General Manager

ALS Laboratory Group

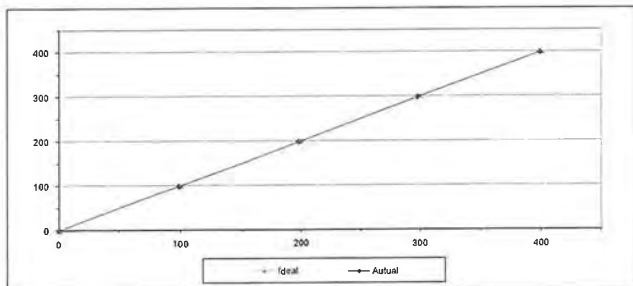
FORM NO.: F 06-056 REVISION NO.: ISSUE DATE: 02/04/12



## MULTIPOINT CALIBRATION REPORT

Calibration Date	4-Jan-25	Equipment Name	SO2 Analyzer
Manufacturer	HORIBA	Model	APSA-370
Serial No.	90U0XJ31	Equipment ID	RYG_FS0452
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	56.3	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	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	98.80	-1.20	-1.20
2	200.00	198.00	-2.00	-1.00
3	300.00	298.00	-2.00	-0.67
4	400.00	398.80	-1.20	-0.30
AVERAGE (%)				-0.61



Calibrated By

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

Approved By

(Mr. Sarayuth Jittranont)  
Assistant General Manager

ALS Laboratory Group

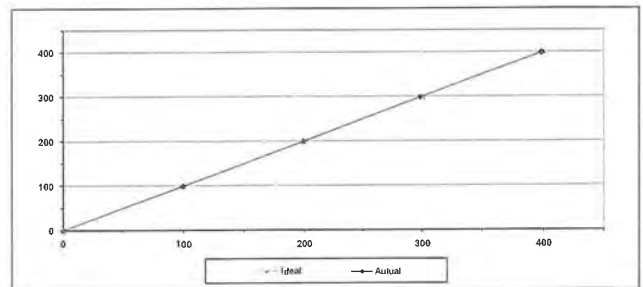
FORM NO.: F 06-056 REVISION NO.: ISSUE DATE: 02/04/12



## MULTIPOINT CALIBRATION REPORT

Calibration Date	3-Jan-25	Equipment Name	SO2 Analyzer
Manufacturer	HORIBA	Model	APSA-370
Serial No.	XHV1S59F	Equipment ID	BKK_FS1087
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	56.3	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	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	99.10	-0.90	-0.90
2	200.00	198.80	-1.20	-0.60
3	300.00	298.10	-1.90	-0.63
4	400.00	398.30	-1.70	-0.42
AVERAGE (%)				-0.49



Calibrated By

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

Approved By

(Mr. Sarayuth Jittranont)  
Assistant General Manager

ALS Laboratory Group

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



### MEASUREMENT RESULTS<sup>1</sup>

The Cup anemometer, Unit Under Calibration (UUC) was exercised at 0 m/s for 5 minutes prior to calibration being performed. The standard air velocity 3.5 m/s (ie 5 m/s was calculated by a standard air velocity transducer which was installed 50 mm away from wind tunnel nozzle and installed 40 mm away from top of the test section and the standard air velocity 5 m/s to 30 m/s was calculated by a pitot tube with precision differential pressure meter which was installed 50 mm away from wind tunnel nozzle and installed 40 mm away from top of the test section. UUC was mounted on a round vertical table of the lower plate at center of test section. The calibration was carried out under both rising and falling air velocity in the range of 1 m/s to 16 m/s at calibration interval of 2 m/s. The results of calibration and associated measurement uncertainties are reported in the table below.

$V_{ref}$ (m/s)	Temp. wind tunnel (°C)	Temp. room (°C)	$V_{UUC}$ (m/s)	Error (m/s)	U/(V+2) (m/s)
1.015	24.10	24.15	0.9	-0.1	0.31
2.038	24.24	24.15	1.8	-0.2	0.31
3.051	24.34	24.15	2.9	0.1	0.31
4.142	24.28	24.15	3.9	-0.2	0.31
4.98	24.10	24.15	5.0	0.0	0.31
6.04	24.16	24.15	6.1	0.0	0.31
7.05	24.10	24.15	7.1	0.0	0.31
7.08	24.30	24.15	8.1	0.1	0.31
9.05	24.12	24.15	9.1	0.0	0.31
9.98	24.12	24.15	10.7	0.2	0.31
11.01	24.20	24.15	11.1	0.1	0.31
11.99	24.10	24.15	12.2	0.2	0.31
13.01	24.14	24.15	13.2	0.2	0.31
14.06	24.10	24.15	14.2	0.2	0.31
15.06	24.20	24.15	15.2	0.2	0.31
15.99	24.10	24.15	15.3	0.3	0.31

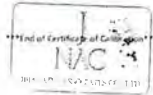
### Remark:

- Calibration results only count for the tested circumstances and environmental conditions during which calibration was done.
- Direction of standard.
- Direction of Unit Under Calibration.

### PHOTO OF CALIBRATION SET-UP



Calibration set up of the Cup anemometer calibration in the wind tunnel of Jiranatee Associates Co., Ltd. The Cup anemometer shown was for Unit Under Calibration (UUC). Remark: The orientation of the set-up is not true to scale due to imaging geometry.



## CERTIFICATE OF CALIBRATION

**MEASUREMENT ITEM** Cup anemometer  
**MANUFACTURER** Novatex  
**MODEL/TYPE** Sensor: WS-02F  
Data logger: 200-WS-25LB  
**SERIAL NUMBER** Sensor: WSD-A5262  
Data logger: A5262  
**ID NUMBER** NAC\_F50509  
**CONDITION AS RECEIVED** Used item  
**CUSTOMER** ALS Laboratory group (Thailand) Co., Ltd.  
104 Phatthanaburi Rd., Phatthanaburi Rd., Khwaeng Suan Luang,  
Khet Suan Luang, Bangkok 10250 Thailand

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

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:  
Temperature: 23.0 ± 0.5 °C  
Relative humidity: 55.0 ± 15.0 %RH  
Atmospheric Pressure: 1010.10 hPa

**PLACE OF CALIBRATION** 1) Pitot type wind tunnel of Jiranatee Associates Co., Ltd.

**CALIBRATION CONDITIONS**  
Wind tunnel cross section area<sup>1</sup> 500 cm<sup>2</sup>  
Wind direction frontal area<sup>2</sup> 100 cm<sup>2</sup>  
Diameter of mounting plate<sup>3</sup> - mm  
Blockage ratio of test object<sup>4</sup> 0.111 [-]

**Preconditioning** 24 hours at ambient conditions  
**Measurement Condition** The average values during measurement are (24.2) °C, (43.0) %RH and (1007.6) hPa

### TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:  
Mr. Sorawat Thirathach  
Miss Jiraporn Leetanachorn



Approved signature:

Mr. Panyia Booncharon  
Calibration Department Manager

**Remark:**  
1) Nozzle open section area of the wind tunnel.  
2) Projected cross-section area of the tested object include mounting plate.  
3) Diameter of mounting plate.  
4) Ratio:  $V_{ref}/V_{UUC}$

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

### MEASUREMENT RESULTS<sup>1</sup>

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

Air speed m/s	D <sub>ref</sub> Degree (°)	D <sub>UUC</sub> Degree (°)	Error Degree (°)	U/(V+2) Degree (°)
45.000	45	41	-4	0.80
90.000	87	83	-3	0.80
135.000	132	128	-3	0.80
180.000	181	181	0	0.80
225.000	228	228	0	0.80
270.000	275	275	0	0.80
315.000	320	320	0	0.80
360.000	359	359	-1	0.80

### Remark:

- Calibration results only count for the tested circumstances and environmental conditions during which calibration was done.
- Direction of standard.
- Direction of Unit Under Calibration.

## CERTIFICATE OF CALIBRATION

**MEASUREMENT ITEM** Wind Direction Sensor  
**MANUFACTURER** Novatex  
**MODEL/TYPE** Sensor: WS-02F  
Data logger: 200-WS-25LB  
**SERIAL NUMBER** Sensor: WSD-A5262  
Data logger: A5262  
**ID NUMBER** NAC\_F50509  
**CONDITION AS RECEIVED** Used item  
**CUSTOMER** ALS Laboratory group (Thailand) Co., Ltd.  
104 Phatthanaburi Rd., Phatthanaburi Rd., Khwaeng Suan Luang,  
Khet Suan Luang, Bangkok 10250 Thailand

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

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:  
Temperature: 23.0 ± 0.5 °C  
Relative humidity: 55.0 ± 15.0 %RH  
Atmospheric Pressure: 1010.10 hPa

**PLACE OF CALIBRATION** Pitot type wind tunnel of Jiranatee Associates Co., Ltd.

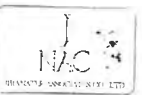
**CALIBRATION CONDITION**  
Wind tunnel cross section area 500 cm<sup>2</sup>  
Wind direction frontal area<sup>2</sup> 100 cm<sup>2</sup>  
Diameter of mounting plate<sup>3</sup> - mm  
Blockage ratio of test object<sup>4</sup> 0.143 [-]

**Preconditioning** 24 hours at ambient conditions  
**Measurement Condition** The average values during measurement are (23.0) °C, (53.3) %RH and (1007.6) hPa

### TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:  
Mr. Sorawat Thirathach  
Miss Jiraporn Leetanachorn



Approved signature:

Mr. Panyia Booncharon  
Calibration Department Manager

**Remark:**  
1) Nozzle open section area of the wind tunnel.  
2) Projected cross-section area of the tested object include mounting plate.  
3) Diameter of mounting plate.  
4) Ratio:  $V_{ref}/V_{UUC}$

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

## CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

Certificate No. : CDT-107-67

MEASUREMENT ITEM	: Data Logger with Temperature sensor
MANUFACTURER	: Navalyntx
MODEL/TYPE	: 200-W5-25LB
SERIAL NUMBER	: AS262
ID NUMBER	: BKK_F50909
CONDITION AS-RECEIVED	: Used item
CUSTOMER	: ALS laboratory group (thailand) Co., Ltd.

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

**ENVIRONMENTAL CONDITIONS:**  
Ambient condition in the laboratory are as follow:  
Temperature :  $23.0 \pm 3.0$  °C  
Relative Humidity :  $55.0 \pm 15.0$  %RH

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

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


**Calibration procedure:**  
The temperature calibration was done by in-house calibration method as ISO-11002 according to comparison method with standard digital temperature indicator and standard temperature probe. The temperature scale use was based on ITS 90.

**Traceability:**  
The measurement results are traceable to the international system of units (SI) through National Institute of Metrology Thailand (NIMT) Certificate number TT 0047-24, Certificate number: ER-0101-23

Reference Used During Calibration:  
 1. Standard Temperature Probe  
 Model: STS-100 A500, Serial No: 667682 09,  
 Due date: 26 Mar 2025  
 2. Digital Temperature Indicator  
 Model: DTI 1000-A MK II, Serial No: 671407-  
 00591 Due date: 14 Sep 2024

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

Calibrated by:  
☐ Mr. Sorawit Thachalad  
☒ Miss Kittaporn Lertsomphol  
☐ Miss Ruangrumpai Phoommit

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 OF CALIBRATION

Page 1 of 2 Pages

Certificate No. : CRT-019-62

MEASUREMENT ITEM	Relative humidity with data logger
MANUFACTURER	: Novalinx
MODEL/TYPE	: Data Logger: Z00-WS 251B Sensor: HMP60
SERIAL NUMBER	: Data Logger: AS262 Sensor: NO330785
ID NUMBER	: MKK_FS0909
CONDITION AS-RECEIVED	: Used Item
CUSTOMER	: ALS laboratory group (Thailand) Co., Ltd

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

**ENVIRONMENTAL CONDITIONS:**  
Ambient condition in the laboratory are as follow

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

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

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

**Calibration procedure:**  
The Relative humidity and Air Temperature calibration was done by In-House calibration method as WI-CL-005 and WI-CL-029 according to companion method as per Standard Laid Mirror hygrometer with Temperature sensor and standard Humidity generator chamber.

**Traceability:**  
The measurements are traceable to the international system of units (SI) through National Institute of Metrology Thailand (NIMT) Certificate number: TH-0079-23 and through Jipotee Associates Co., Ltd. Certificate number CDT 001 67.

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

Calibrated by  
 1. Mr. Soran Thachalad  
 2. Ms. Jittaporn Lertsomphol  
 3. Ms. Ruangrumai Phoomm

Approved signatory   
Mr. Parinya Buondiaroen

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IN WRITING FROM THE LABORATORY

Continuation of Certificate of Calibration Number: CRT-019-67

Page 2 of 2 Pages

### Measurement Results

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

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

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

Air Temperature (°C)	Standard Reading (%RH)	UUC Reading (%RH)	Error (%RH)	Uncertainty (%RH)
29.60	79.61	78.6	-1.0	0.69
29.80	50.49	49.8	-0.6	1.3
29.82	81.15	81.9	0.8	2.3

UUC\* Unit Under Calibration

\*\*\*End of Certificate of Calibration\*\*\*

Approved signatory   
Mr. Parinya Buondiaroen



Continuation of Certificate of Calibration Number COT-222-67

Page 2 of 2 Pages

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 70 °C to 40 °C

Function:

Table 1: This equipment was connected with temperature sensor Model: HMP605/N: R1131130  
Dimension: Diameter 1.2 mm, Length 80 mm

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.071	19.6	-0.5	0.069
80	25.067	24.6	-0.5	0.069
80	30.060	29.7	-0.4	0.069
80	35.047	34.4	-0.6	0.069
80	40.030	39.4	-0.6	0.069

UUC\*: Unit Under Calibration

\*\*\*End of Certificate of Calibration\*\*\*



## CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

Certificate No.: COT-222-67

MEASUREMENT ITEM: Data Logger with Temperature sensor  
MANUFACTURER: Novolyte  
MODEL/TYPE: 110-WS-25DL D  
SERIAL NUMBER: A5439  
ID NUMBER: BKK\_F50974  
CONDITION AS RECEIVED: Used Item  
CUSTOMER: ALS laboratory group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd.,  
Khwang Suan Luang, Khwaeng Suan Luang,  
Bangkok 10250 Thailand.

RECEIVED DATE: 24 Dec 2024  
MEASUREMENT DATE: 26 Dec 2024  
ISSUE DATE: 27 Dec 2024

### ENVIRONMENTAL CONDITIONS:

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

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

### TABULATION OF RESULTS:

The table on next page give the measured values

Calibration procedure:  
The temperature calibration was checked by 5-Point calibration method as WS-25DL D according to comparison findings with standard digital temperature sensors and standard temperature probe. The temperature scale was adjusted on ITS-90.

Traceability:  
The measurement results are traceable to the International System of units (SI) through National Institute of Metrology (Thailand) Certificate number: 11 0047 24. Certificate number: 11 0047 24. Certificate number: 11 0047 24.

Reference Used During Calibration:  
1. Standard Temperature Probe  
Model: STS 100 A500, Serial No.: 667682 03,  
Due date: 26 Mar 2025  
2. Digital Temperature Indicator  
Model: D11 1000 A MK II, Serial No.: 671407,  
Due date: 23 Oct 2025

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

Calibrated by:  
Mr. Pongchai Thongkham  
Mr. Pongchai Thongkham  
E-mail: pongchai.thongkham@jiranatee.com



Approved signatory:  
Mr. Pongchai Thongkham  
Calibration Manager

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Continuation of Certificate of Calibration Number CRT-063-67

Page 2 of 2 Pages

### Measurement Results:

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

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

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

Air Temperature (°C)	Standard Reading (%RH)	UUC Reading (%RH)	Error (%RH)	Uncertainty (%RH)
30.04	19.92	17.5	-2.3	0.78
30.03	67.67	66.7	-0.9	1.18
30.03	79.40	76.1	-3.4	2.1

UUC\*: Unit Under Calibration

\*\*\*End of Certificate of Calibration\*\*\*



## CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

Certificate No.: CRT-063-67

MEASUREMENT ITEM: Relative humidity with data logger  
MANUFACTURER: Novolyte  
MODEL/TYPE: Data Logger: 110-WS-25DL D  
Sensor: HMP60  
SERIAL NUMBER: Data Logger: A5439  
Sensor: R1131130  
ID NUMBER: BKK\_F50974  
CONDITION AS RECEIVED: Used Item  
CUSTOMER: ALS laboratory group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Suan Luang,  
Khwang Suan Luang, Bangkok 10250 Thailand.

RECEIVED DATE: 24 Dec 2024  
MEASUREMENT DATE: 26 Dec 2024  
ISSUE DATE: 27 Dec 2024

### ENVIRONMENTAL CONDITIONS:

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

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

### TABULATION OF RESULTS:

The table on next page give the measured values

Calibration procedure:  
The relative humidity calibration was checked by 5-Point calibration method as WS-25DL D according to comparison findings with standard digital temperature sensors and standard temperature probe. The temperature scale was adjusted on ITS-90.

Traceability:  
The measurement results are traceable to the International System of units (SI) through National Institute of Metrology (Thailand) Certificate number: 11 0047 24. Certificate number: 11 0047 24. Certificate number: 11 0047 24.

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

Calibrated by:  
Mr. Pongchai Thongkham  
Mr. Pongchai Thongkham  
E-mail: pongchai.thongkham@jiranatee.com



Approved signatory:  
Mr. Pongchai Thongkham  
Calibration Manager

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## CERTIFICATE OF CALIBRATION

Certificate No. CPN 036 07

Page 1 of 2 Pages

**MEASUREMENT ITEM**  
MANUFACTURER  
MODEL/TYPE  
SERIAL NUMBER  
ID NUMBER  
CONDITION AS RECEIVED  
CUSTOMER  
RECEIVED DATE  
MEASUREMENT DATE  
ISSUE DATE

Digital barometer  
: Novalyne  
Sensor 110 WS 25B1  
Data logger 110-WS 25DL-1  
Sensor BP AS430  
Data logger AS430  
: NIKK F50974  
: Used item  
: ALS laboratory group (Thailand) Co., Ltd.  
101 Phatthana Road, Phatthana Road,  
Khwaeng Suan Luang, Khwaeng Suan Luang,  
Bangkok 10250 Thailand

**Calibration procedure:**  
The Digital barometer was calibrated against  
Digital pressure calibration, TSI 17025  
was used as a reference gauge.

**Traceability:**  
The measurement results are traceable to  
the international system of units (SI) through  
the NIST National Metrology Institute of  
Thailand via Certificate number: MP-0009-24

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

### CONDITION OF THIS RESULT OF CALIBRATION:

1. Reference Standard Instrument

Instrument: Model: Serial No. Certificate No. Due Date  
Absolute Pressure Transducer: CPN03607 01001204 MP-0009-24 27 Dec 2024

2. Calibration effort for calibration equipment

3. The UUC\* was included in the calibration report and the order of UUC\* was used in the reference level

4. Calibration conditions

5. Conditions

Pressure transducer: 110 WS 25B1

110 WS 25DL-1

AS430

110 WS 25DL-1

AS430

6. The calibration is valid only for the item calibrated on date and place of calibration

Calibrated by:  
Mr. Sirakorn Thachasud  
Mr. Jiraporn Lertsompol



Approved signature:  
Mr. Jiraporn Lertsompol  
Calibration Department Manager

## CERTIFICATE OF CALIBRATION

Certificate No. C18-036 07

Page 1 of 2 Pages

**MEASUREMENT RESULTS**  
CALIBRATION IN THE RANGE OF  
The results of calibration and associated measurement uncertainties are reported in the table below

: Without adjustment  
: With adjustment  
: 950 mbar to 1050 mbar

STD (mbar)	UUC* (mbar)	Error (mbar)	Uncertainty (k=2) (mbar)
949.98	0.008	0.08	0.37
969.98	0.007	0.03	0.37
990.03	0.009	0.1	0.37
1010.03	0.009	0.1	0.37
1030.05	0.021	1.0	0.37
1050.03	0.025	1.0	0.37

Note: UUC\* Unit Under Calibration  
: To convert the result in report unit to Pa should be multiply by 100

\*End of certificate\*



63/14 16,67/35 36, Soi Petchkasem 7/7/1, Petchkasem Rd,  
Wattana, Bangkok 10600 Thailand  
Tel: (66) 02-8608060 Fax: (66) 02-8608060 www.jirantee.com

## CALIBRATION REPORT

Calibration Number RG 04122024  
Page 1 of 2 Pages

Measurement Item: Rain gauge with data logger

Manufacturer: Data logger: Novalyne  
Rain gauge: Novalyne

Model/Type: Data logger: 110 WS-25DL-1  
Rain gauge: 110 WS 25HG

Serial Number: Data logger: AS430  
Rain gauge: RG AS430

ID NO: BKK\_F50974

Customer: ALS laboratory group (Thailand) Co., Ltd.  
104 Phatthana Road, Phatthana Road, Khwaeng Suan Luang,  
Bangkok 10250 Thailand

### Environmental Conditions:

The measurement was carried out in an ambient temperature of (25±3)°C and relative humidity of (60±15)%

### Measurement Method:

The Rain gauge Unit Under Calibration (UUC) was calibrated by reference reference bottle with flow adjuster at low rate 0.6 ml per minute or 1 tipping every 20 seconds. The tipping interval was determined by procedures below.

1. Obtain rain gauge inlet area

Rain gauge precise diameter in cm = Diameter/2 x Pi (radial)

Rain gauge area =  $\pi R^2$  (mm<sup>2</sup>) UUC diameter = 25.5 cm UUC radius = 1025 cm

Rain gauge area = 330.1 cm<sup>2</sup>

2. Obtain theoretical correct rain gauge inlet area (number of tipping) using 330.1 cm<sup>2</sup> inlet area and 0.5 L of rain

a) 10000 mm<sup>2</sup> = 330.1 cm<sup>2</sup> inlet area = 33029 mm<sup>2</sup> Rain gauge area = 1/3029 of square meter

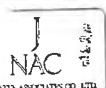
b) 3029 x 0.5 L volume = 1514.5 mm (mm of rain over 1 m<sup>2</sup> surface) 500 ml of rain volume (mm of rain) the rain

gauge area = 15.15 mm of rain

c) Number of tipping = 15.15 / 0.25 mm = 61 tipping

Note: Rain gauge is fully cleaned and leveled prior the calibration performed.

Measurement Date: Dec 26, 2024  
Issue Date: Dec 27, 2024



Approved signature:  
Mr. Jiraporn Lertsompol  
Calibration Department Manager

Performed by:  
☐ Mr. Sirakorn Thachasud  
☒ Mr. Jiraporn Lertsompol



63/14 16,67/35 36, Soi Petchkasem 7/7/1, Petchkasem Rd,  
Wattana, Bangkok 10600 Thailand  
Tel: (66) 02-8608060 Fax: (66) 02-8608060 www.jirantee.com

Continuation of Calibration of Calibration Number

Calibration Number: RG 04122024  
Page 2 of 2 Pages

Result of Calibration: ☒ Without Adjustment, ☐ With Adjustment  
The results of calibration are reported in table below

Quantity of H <sub>2</sub> O (ml)	Determined Tipping	Tipping count	Acceptable Tipping count
500	61	60	60 - 63
500	61	61	60 - 63
500	61	61	60 - 63
500	61	61	60 - 63
500	61	60	60 - 63

Remark: The procedure is made to verify the correct reading of the Unit under Calibration rain gauge when a precise volume of water is sent into its cover. We suggest that the number of tipping should be within ±2% different from the tipping count range 60-63 (typical) it means that the rain gauge meets the manufacturer acceptable limit.

\*End of calibration report\*







## CERTIFICATE OF CALIBRATION

Certificate No. : CDT-046-68

Page 1 of 2 Pages

**MEASUREMENT ITEM** : Data Logger with Temperature sensor  
**MANUFACTURER** : Novolynx  
**MODEL/TYPE** : 110-WS-25DL-D  
**SERIAL NUMBER** : AS918  
**ID NUMBER** : RYG\_F50650  
**CONDITION AS-RECEIVED** : Used Item  
**CUSTOMER** : ALS laboratory group (Thailand) Co., Ltd  
104 Phatthanakan 40, Phatthanakan Rd.,  
Khwaeng Suan Luang, Khet Suan Luang,  
Bangkok 10250 Thailand

**RECEIVED DATE** : 17 Jan 2025  
**MEASUREMENT DATE** : 07 Feb 2025  
**ISSUE DATE** : 07 Feb 2025

### ENVIRONMENTAL CONDITIONS:

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

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

### TABULATION OF RESULTS:

The table on next page give the measured values.

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

**Traceability:**  
The measurement results are traceable to the international system of units (SI) through National Institute of Metrology (NIMT) Certificate number: TT-0047-24, Certificate number: ER 0113-24

**Reference Used During Calibration:**  
1. Standard Temperature Probe  
Model: STS-100 AS500, Serial No.: 067682-05,  
Due date: 26 Mar 2025  
2. Digital Temperature Indicator  
Model: DTI-1000-A MK II, Serial No.: 673407-  
00591 Due date: 21 Oct 2025

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

Calibrated by:  
[X] Mr. Sornwit Thachalid  
[X] Ms. Jiraporn Terntamphol  
[X] Ms. Ruangsang Poommit



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 OF CALIBRATION

Certificate No. : CRT-006-68

Page 1 of 2 Pages

**MEASUREMENT ITEM** : Relative humidity with data logger  
**MANUFACTURER** : Novolynx  
**MODEL/TYPE** : Data Logger: 110-WS-25DL-D  
Sensor: HMP60  
**SERIAL NUMBER** : Data Logger: AS988  
Sensor: V1920215  
**ID NUMBER** : RYG\_F50650  
**CONDITION AS-RECEIVED** : Used Item  
**CUSTOMER** : ALS laboratory group (Thailand) Co., Ltd  
104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Suan Luang,  
Khet Suan Luang, Bangkok 10250 Thailand

**RECEIVED DATE** : 17 Jan 2025  
**MEASUREMENT DATE** : 07 Feb 2025  
**ISSUE DATE** : 07 Feb 2025

### ENVIRONMENTAL CONDITIONS:

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

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

### TABULATION OF RESULTS:

The table on next page give the measured values.

**Calibration procedure:**  
The relative humidity and Air Temperature calibration was done by in house calibration method as WJ-CL-001 and WJ-CL-010 according to comparison method with Standard, Class B Micro hygrometer with Temperature sensor and standard Humidity generator chamber.

**Traceability:**  
The measurements are traceable to the international system of units (SI) through National Institute of Metrology (NIMT) Certificate number: TH-0246-24 and Jiranatee Associates Co., Ltd. Certificate number: CRT-006-68.

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

Calibrated by:  
[X] Mr. Sornwit Thachalid  
[X] Ms. Jiraporn Terntamphol  
[X] Ms. Ruangsang Poommit



Approved signatory:  
Mr. Parinya Booncharoen  
Calibration Department Manager

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

Continuation of Certificate of Calibration Number CDT-046-68

Page 2 of 2 Pages

**Result of Calibration:** ☒ Without Adjustment ☐ With Adjustment

**Calibration Range:** 20 °C to 40 °C

### Function:

Table 1: This equipment was connected with temperature sensor Model: HMP605/N: V1920215  
Dimension: Diameter 12 mm, Length 80 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.080	19.8	-0.3	0.099
80	25.061	24.8	-0.1	0.099
80	30.043	29.7	-0.3	0.099
80	35.040	34.7	-0.3	0.099
80	40.021	39.7	-0.3	0.099

UUC\*: Unit Under Calibration

\*\*\*End of Certificate of Calibration\*\*\*













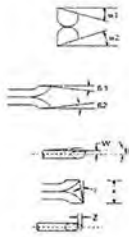




## Type S Pitot Tube Calibration

Date Calibration 30-Nov-24  
Pitot ID BKK\_FS0551  
Pitot SN -

Due Date 1-Jun-25  
Inclinometer ID BKK\_FS1131  
Vernier ID BKK\_FS1405



Parameter	Value	Allowable Range	Check
$\alpha 1$	2.4	$-10^\circ < \alpha 1 < +10^\circ$	OK
$\alpha 2$	-3.1	$-10^\circ < \alpha 2 < +10^\circ$	OK
$\beta 1$	-0.4	$-5^\circ < \beta 1 < +5^\circ$	OK
$\beta 2$	9.3	$-5^\circ < \beta 2 < +5^\circ$	OK
$\gamma$	1.3	-	-
$\theta$	1.4	-	-
$Z = A \tan \gamma$	0.020	$Z \leq 0.125''$	OK
$W = A \tan \theta$	0.021	$W \leq 0.031''$	OK
Dt	0.375	$0.188'' \text{ to } 0.375''$	OK
$A/2Dt$	1.160	$1.05 \leq PA/Dt \leq 1.5$	OK
A	0.87	$2.1Dt \leq A \leq 3Dt$	OK

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

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

Approved By:   
( Mr. Samart Roo-ngan )  
Enviro Field Services Specialist (1)

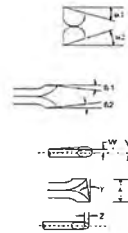
FORM NO : F 06-124 REVISION NO.: 0 ISSUE DATE: 25/12/23



## Type S Pitot Tube Calibration

Date Calibration 30-Nov-24  
Pitot ID BKK\_FS0552  
Pitot SN -

Due Date 1-Jun-25  
Inclinometer ID BKK\_FS1131  
Vernier ID BKK\_FS1405



Parameter	Value	Allowable Range	Check
$\alpha 1$	2.2	$-10^\circ < \alpha 1 < +10^\circ$	OK
$\alpha 2$	3	$-10^\circ < \alpha 2 < +10^\circ$	OK
$\beta 1$	-1.2	$-5^\circ < \beta 1 < +5^\circ$	OK
$\beta 2$	2.3	$-5^\circ < \beta 2 < +5^\circ$	OK
$\gamma$	1.4	-	-
$\theta$	1.2	-	-
$Z = A \tan \gamma$	0.022	$Z \leq 0.125''$	OK
$W = A \tan \theta$	0.018	$W \leq 0.031''$	OK
Dt	0.375	$0.188'' \text{ to } 0.375''$	OK
$A/2Dt$	1.173	$1.05 \leq PA/Dt \leq 1.5$	OK
A	0.88	$2.1Dt \leq A \leq 3Dt$	OK

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

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

Approved By:   
( Mr. Samart Roo-ngan )  
Enviro Field Services Specialist (1)

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

# SARTORIUS

Accredited by  
NSC-TISI-TIS 17025  
Calibration 0426



### Calibration certificate

Calibration Certificate No. 25BKL0003

Object	Electronic non-automatic weighing instrument	This calibration certificate documents the traceability to national standards
Manufacturer	Sartorius	Uncertainties of measurements are taken into account when only statements of compliance are made.
Type	MSU224S-100-DU	This certificate was prepared by Sartorius Corporation in accordance to the current ISO/IEC 17025:2017 standard and Sartorius Work Instruction (Method) SOP VM 08
Serial   QM Ident. no.	31709552   RYG_EN0003	This certificate relate and apply this equipment only.
Customer	ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch)	
	616/10 Moo 5 T. Maenam Khu. A. Pluak Daeng, Rayong 21140, Thailand	
Order no.	2230	
Number of pages	4	
Date of calibration	20 Feb 2025	

REVIEW BY   
APPROVED BY   
NEXT CAL DATE 20/02/26

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

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

Date 06 Mar 2025 Approval of the Calibration Certificate Person in charge  
  
Mr. Chonchai Inthana   
Kachen Lalee

Calibration certificate No : 25BKL0003  
Calibration Certificate

### Calibration object

#### Single range instrument

Model MSU224S-100-DU  
Serial Number 31709552  
QM Ident. no | Inventory no. RYG\_EN0003 | ---

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

### Place of calibration

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

### Calibration procedure

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

### Test equipment

Test equipment type	Test equipment ID	Valid until
Thermometer	MHB-382SD s/nB011342 Traceable to SI unit through DKSH	21 Aug 2025
Test weight set OIML R111 E2	Certificate No M2308197S_E2(Traceable to SI unit through TC5)	23 Aug 2025

## Adjustment Status

The measuring device was internally adjusted before the calibration.

## Environmental and measuring conditions

Date of calibration 20 Feb 2025

Temperature at place of calibration | Temp diff 24.7 °C | 0.3 K

Weights - 7 place

Measuring conditions

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

Comments

Humidity 62.3 %RH.

## Measurement results | Measurement uncertainties

## Repeatability

Test load (nominal): 10 g | 200 g

	10 g	200 g
1	10.0000 g	200.0000 g
2	10.0000 g	200.0001 g
3	9.9999 g	200.0000 g
4	10.0000 g	200.0000 g
5	10.0000 g	200.0001 g
6	9.9999 g	200.0000 g
7	10.0000 g	200.0000 g
8	10.0000 g	200.0000 g
9	10.0000 g	200.0000 g
10	10.0000 g	200.0001 g
s = 0.00004 g		s = 0.00005 g

## Eccentricity

Test load (nominal): 100 g

	100 g
Center	100.0000 g
Front left	100.0000 g
Back left	100.0001 g
Back right	99.9999 g
Front right	99.9999 g
Maximum deviation from certfic loading indication	
Δload  max = 0.0001 g	

## Error of indication

Testload	Indication	Error	Expansion factor	Uncertainty	Uncertainty relative
L	I	E	k	U(E)	U <sub>rel</sub> (E)
0.0100 g	0.0100 g	0.0000 g	2.00	0.00012 g	1.2 %
0.1000 g	0.1000 g	0.0000 g	2.00	0.00013 g	0.13 %
0.5000 g	0.5000 g	0.0000 g	2.00	0.00013 g	0.026 %
1.0000 g	1.0000 g	0.0000 g	2.00	0.00013 g	0.013 %
5.0000 g	5.0000 g	0.0000 g	2.00	0.00013 g	0.0026 %
10.0000 g	10.0000 g	0.0000 g	2.00	0.00013 g	0.0013 %
20.0000 g	20.0000 g	0.0000 g	2.00	0.00014 g	0.00068 %
50.0000 g	50.0000 g	0.0000 g	2.00	0.00015 g	0.00029 %
100.0000 g	100.0001 g	0.0001 g	2.00	0.00016 g	0.00016 %
200.0000 g	200.0000 g	0.0000 g	2.00	0.00026 g	0.00014 %
220.0000 g	220.0000 g	0.0000 g	2.00	0.00032 g	0.00015 %

Maximum error of indication

|E|<sub>max</sub> = 0.0001 g

U<sub>rel</sub>(E) is the quotient of U(E) and test load L. The uncertainty of measurement U(E) is valid only if error E is considered. You will find reference notes on the uncertainty of measurement in use within Appendix to the calibration certificate | Interpretation of measurement results  
Reference note: The result of expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the documented Expansion factor. Expansion factor is in accordance with the European Calibration Guideline EURAMET cg-18, V4.0. There is a 95 % probability that the value of the measured value lies in the assigned value range.

End of calibration certificate

## Uncertainty of measurement in use

Device adjusted before measurement

Yes

Temperature deviation considered

1.5 K (isoCAL active)

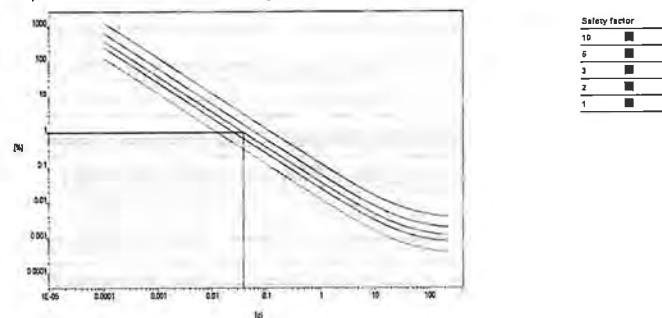
Temperature coefficient considered

1 · 10<sup>-4</sup> /KUncertainty of the weighing result U<sub>g1</sub>(W)U<sub>g1</sub>(W) = 0.00013 g + 3.42 · 10<sup>-4</sup> · R

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

Indication in % from max load	Net indication R	Uncertainty U <sub>g1</sub> (W)	Uncertainty relative U <sub>g1</sub> (W)/W <sub>net</sub>
1 %	2.2000 g	0.00014 g	0.0063 %
25 %	55.0000 g	0.00032 g	0.00058 %
50 %	110.0000 g	0.00051 g	0.00046 %
75 %	165.0000 g	0.00069 g	0.00042 %
100 %	220.0000 g	0.00086 g	0.00040 %

## Graphic realization of the relative uncertainty of measurement | process accuracy



## Displayed example

Process accuracy

1 00 %

Safety factor

3

Minimum sample weight

0.0360 g

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Version 6.5

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Version 6.5

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Lot No 2540440-1

## ANALYZER CALIBRATION DATA

Client : Gulf T54 Co., Ltd. Location : Jais HRSG 11  
Date : 09 May 25 Test Operator : Sakitt P.O<sub>2</sub> ANALYZERModel : HORIBA PG-350 Serial No : TDBARGKP  
Span (%) : 25

	Cylinder Value (%)	Initial Analyzers Calibration Response (%)	Final Analyzers Calibration Response (%)	Difference (Percent of Span)
Zero Gas	0.00	0.15	0.05	0.40
Low-Level Gas	9.00	9.16	8.10	0.32
Span Gas	10.02	10.22	10.17	0.20

NO<sub>2</sub> ANALYZERModel : TELEDYNE API T200H Serial No : 482  
Span (ppm) : 100

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.30	0.20	0.10
Low-Level Gas	56.17	56.67	56.47	0.20
Span Gas	62.39	62.99	62.79	0.20

SO<sub>2</sub> ANALYZERModel : TELEDYNE API 100EH Serial No : 437  
Span (ppm) : 100

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.03	0.02	0.01
Low-Level Gas	55.51	55.57	55.54	0.03
Span Gas	78.75	78.63	78.78	0.05

## CO ANALYZER

Model : HORIBA PG-350 Serial No : VKNVUGU  
Span (ppm) : 100

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	-0.10	-0.02	0.08
Low-Level Gas	54.24	54.09	54.10	0.10
Span Gas	79.48	79.18	79.38	0.20

Calibrated by

Sakitt P.

(Mr.Sakitt Phalanphitui)

Environmental Field Scientist (4)



Lot No 2540440-1

## SYSTEM CALIBRATION BIAS AND DRIFT DATA

Client : Gulf T54 Co., Ltd. Location : Jais HRSG 11  
Date : 09 May 25 Test Operator : Sakitt P.O<sub>2</sub> ANALYZER

Cylinder Conc (%) : 16.02 Span (%) : 25

	O <sub>2</sub> Analyzer Calibration Response	System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.15	0.15	0.00	0.05	0.40	0.40
Upscale Gas	16.22	16.22	0.00	16.17	0.20	0.20

NO<sub>2</sub> ANALYZER

Cylinder Conc (ppm) : 82.39 Span (ppm) : 100

	NO <sub>2</sub> Analyzer Calibration Response	System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.30	0.30	0.00	0.20	0.10	0.10
Upscale Gas	82.99	82.99	0.00	82.79	0.20	0.20

SO<sub>2</sub> ANALYZER

Cylinder Conc (ppm) : 78.75 Span (ppm) : 100

	SO <sub>2</sub> Analyzer Calibration Response	System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.03	0.03	0.00	0.02	0.01	0.01
Upscale Gas	78.83	78.83	0.00	78.78	0.05	0.05

## CO ANALYZER

Cylinder Conc (ppm) : 79.48 Span (ppm) : 100

	CO Analyzer Calibration Response	System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	-0.10	-0.10	0.00	-0.02	0.08	0.08
Upscale Gas	79.18	79.18	0.00	79.38	0.20	0.20

Calibrated by

Sakitt P.

(Mr.Sakitt Phalanphitui)

Environmental Field Scientist (4)





## EMISSION TEST RESULT

Client	Gulf T54 Co., Ltd.	Run #	1
Date	09 May 25	Location	Jaboa HRSG 11
Start Time	10:20	Test Operator	Sakait P.
SO <sub>2</sub> Analyzer Model	TELEDYNE API 100EH	Finish Time	10:48
NO <sub>x</sub> /O <sub>2</sub> Analyzer Model	TELEDYNE API T200H	Serial No.	437
CO/CO <sub>2</sub> Analyzer Model	HORIBA PG-350	Serial No.	482
		Serial No.	VKNVUGU8

Time (min)	O <sub>2</sub> (%)	CO <sub>2</sub> (%)	NO <sub>x</sub> (ppm)	SO <sub>2</sub> (ppm)	CO (ppm)	Remark
10:20	14.30	3.85	13.73	0.30	2.13	
10:21	14.26	3.79	14.48	0.28	1.95	
10:22	14.28	3.77	15.10	0.26	1.95	
10:23	14.30	3.82	15.11	0.30	2.39	
10:24	14.25	3.78	15.14	0.28	1.82	
10:25	14.31	3.78	15.17	0.28	2.40	
10:26	14.30	3.78	14.50	0.28	2.27	
10:27	14.31	3.77	14.17	0.28	1.96	
10:28	14.32	3.77	14.09	0.28	2.14	
10:29	14.31	3.79	13.56	0.28	1.82	
10:30	14.29	3.78	13.91	0.28	2.50	
10:31	14.29	3.77	14.30	0.28	1.82	
10:32	14.29	3.78	14.16	0.27	1.83	
10:33	14.28	3.79	14.12	0.30	0.67	
10:34	14.27	3.79	14.06	0.29	0.60	
10:35	14.26	3.79	13.83	0.29	1.83	
10:36	14.26	3.78	13.80	0.29	1.83	
10:37	14.28	3.78	13.90	0.29	1.96	
10:38	14.29	3.77	14.26	0.29	1.51	
10:39	14.28	3.78	14.23	0.29	1.51	
10:40	14.28	3.77	14.13	0.28	1.83	
Average	14.29	3.78	14.28	0.28	1.85	

Sakait P.

(Mr. Sakait Phaisanphit)

Environmental Field Scientist (4)

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

ALS Laboratory Group



## EMISSION TEST RESULT

Client	Gulf T54 Co., Ltd.	Run #	2
Date	09 May 25	Location	Jaboa HRSG 11
Start Time	10:41	Test Operator	Sakait P.
SO <sub>2</sub> Analyzer Model	TELEDYNE API 100EH	Finish Time	11:01
NO <sub>x</sub> /O <sub>2</sub> Analyzer Model	TELEDYNE API T200H	Serial No.	437
CO/CO <sub>2</sub> Analyzer Model	HORIBA PG-350	Serial No.	482
		Serial No.	VKNVUGU8

Time (min)	O <sub>2</sub> (%)	CO <sub>2</sub> (%)	NO <sub>x</sub> (ppm)	SO <sub>2</sub> (ppm)	CO (ppm)	Remark
10:41	14.20	3.78	14.38	0.29	2.50	
10:42	14.31	3.78	14.29	0.29	0.24	
10:43	14.38	3.79	14.25	0.27	0.23	
10:44	14.26	3.82	14.53	0.29	1.83	
10:45	14.20	3.82	15.23	0.29	1.71	
10:46	14.24	3.78	15.75	0.26	1.92	
10:47	14.26	3.79	15.30	0.27	1.82	
10:48	14.38	3.78	14.53	0.27	1.87	
10:49	14.29	3.79	14.65	0.27	1.71	
10:50	14.26	3.78	13.66	0.28	1.52	
10:51	14.28	3.75	14.11	0.28	1.51	
10:52	14.28	3.77	12.85	0.30	1.42	
10:53	14.26	3.76	13.64	0.29	1.39	
10:54	14.24	3.74	13.77	0.29	1.14	
10:55	14.27	3.78	14.11	0.29	1.52	
10:56	14.27	3.75	13.64	0.23	1.72	
10:57	14.27	3.76	13.74	0.28	3.91	
10:58	14.27	3.75	13.58	0.20	1.72	
10:59	14.28	3.76	13.51	0.29	1.40	
11:00	14.29	3.75	13.87	0.30	1.40	
11:01	14.31	3.75	14.03	0.28	1.40	
Average	14.27	3.77	14.22	0.28	1.77	

Sakait P.

(Mr. Sakait Phaisanphit)

Environmental Field Scientist (4)

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

ALS Laboratory Group



## EMISSION TEST RESULT

Client	Gulf T54 Co., Ltd.	Run #	3
Date	09 May 25	Location	Jaboa HRSG 11
Start Time	11:02	Test Operator	Sakait P.
SO <sub>2</sub> Analyzer Model	TELEDYNE API 100EH	Finish Time	11:22
NO <sub>x</sub> /O <sub>2</sub> Analyzer Model	TELEDYNE API T200H	Serial No.	437
CO/CO <sub>2</sub> Analyzer Model	HORIBA PG-350	Serial No.	482
		Serial No.	VKNVUGU8

Time (min)	O <sub>2</sub> (%)	CO <sub>2</sub> (%)	NO <sub>x</sub> (ppm)	SO <sub>2</sub> (ppm)	CO (ppm)	Remark
11:02	14.28	3.75	13.90	0.27	1.72	
11:03	14.26	3.75	13.99	0.29	1.72	
11:04	14.27	3.75	14.02	0.27	1.72	
11:05	14.25	3.79	13.97	0.27	1.91	
11:06	14.22	3.77	14.57	0.27	1.72	
11:07	14.26	3.77	14.45	0.29	1.72	
11:08	14.27	3.73	14.24	0.29	1.40	
11:09	14.28	3.75	13.94	0.29	1.26	
11:10	14.27	3.73	14.11	0.30	1.59	
11:11	14.29	3.76	14.05	0.29	1.26	
11:12	14.27	3.75	13.95	0.29	1.59	
11:13	14.27	3.75	13.60	0.30	1.72	
11:14	14.26	3.76	13.64	0.30	1.26	
11:15	14.26	3.77	13.58	0.30	1.26	
11:16	14.24	3.77	13.37	0.29	1.59	
11:17	14.24	3.78	13.15	0.29	1.59	
11:18	14.24	3.76	13.26	0.25	1.59	
11:19	14.25	3.76	13.50	0.29	1.63	
11:20	14.26	3.76	13.75	0.31	1.46	
11:21	14.23	3.76	13.55	0.30	2.10	
11:22	14.21	3.79	13.29	0.30	1.33	
Average	14.26	3.76	13.60	0.29	1.57	

Sakait P.

(Mr. Sakait Phaisanphit)

Environmental Field Scientist (4)

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

ALS Laboratory Group



## ANALYZER CALIBRATION DATA

Lot No. 2540442-1

Client	Gulf T54 Co., Ltd.	Location	Jaboa HRSG 12
Date	09 May 25	Test Operator	Naratip T.
O <sub>2</sub> ANALYZER Model	TELEDYNE API 200EH	Serial No.	735
Span (%)	25		

	Cylinder Value (%)	Initial Analyzers Calibration Response (%)	Final Analyzers Calibration Response (%)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.00	0.20
Low-Level Gas	8.19	8.11	8.17	0.24
Span Gas	16.07	16.04	16.10	0.24

NO <sub>2</sub> ANALYZER Model	TELEDYNE API 200EH	Serial No.	735
Span (ppm)	100		

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.00	-0.08	0.08
Low-Level Gas	55.91	56.20	56.10	0.10
Span Gas	82.51	82.60	81.70	0.90

SO <sub>2</sub> ANALYZER Model	TELEDYNE API 100EH	Serial No.	410
Span (ppm)	100		

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.00	0.00
Low-Level Gas	56.28	56.20	56.10	0.10
Span Gas	79.76	79.80	79.20	0.60

CO ANALYZER Model	TELEDYNE API 300EM	Serial No.	425
Span (ppm)	100		

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.80	0.80
Low-Level Gas	55.20	56.00	57.50	1.00
Span Gas	79.74	80.00	81.00	1.00

Calibrated by

Naratip T.

(Mr. Naratip Thueakchalam)

Environmental Field Scientist (1)

FORM NO. F-06-062 REVISION NO. 4 ISSUE DATE 18/01/24

ALS Laboratory Group





Lot No 2540442-1

## SYSTEM CALIBRATION BIAS AND DRIFT DATA

Client : Gulf T&S Co., Ltd. Location : Ulae HRSO 12  
Date : 09 May 25 Test Operator : Naratip T.O<sub>2</sub> ANALYZER : 16.07 Span (%) : 25  
Cylinder Conc. (%)

	O <sub>2</sub> Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
		System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	
Zero Gas	0.00	0.00	0.28	0.04	0.16	0.12
Upscale Gas	16.04	16.00	0.16	15.97	0.08	0.52

NO<sub>x</sub> ANALYZER : 82.51 Span (ppm) : 100  
Cylinder Conc. (ppm)

	NO <sub>x</sub> Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
		System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	
Zero Gas	0.00	0.00	0.08	0.08	0.08	0.08
Upscale Gas	82.60	82.00	0.60	81.79	0.80	0.30

SO<sub>2</sub> ANALYZER : 79.76 Span (ppm) : 100  
Cylinder Conc. (ppm)

	SO <sub>2</sub> Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
		System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	
Zero Gas	0.00	0.00	0.00	0.01	0.01	0.01
Upscale Gas	79.80	79.20	0.60	79.30	0.50	0.10

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

	CO Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
		System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	
Zero Gas	0.00	0.00	0.00	0.00	0.00	0.00
Upscale Gas	80.00	80.00	0.00	79.90	1.00	1.00

Calibrated by

Naratip T.

( Mr. Naratip Thuekchakam )

Environmental Field Scientist (1)

FORM NO F06-002 REVISION NO 4 ISSUE DATE 18/01/24

ALS Laboratory Group



## EMISSION TEST RESULT

Client : Gulf T&S Co., Ltd. Run # 1  
Date : 09 May 25 Location : Ulae HRSO 12  
Start Time : 10:00 Test Operator : Naratip T.  
SO<sub>2</sub> Analyzer Model : TELEDYNE API 100EH Finish Time : 10:20  
NO<sub>x</sub>/O<sub>2</sub> Analyzer Model : TELEDYNE API 200EH Serial No : 410  
CO/CO<sub>2</sub> Analyzer Model : TELEDYNE API 300EM Serial No : 735  
Serial No : 425

Time (min)	O <sub>2</sub> (%)	CO <sub>2</sub> (%)	NO <sub>x</sub> (ppm)	SO <sub>2</sub> (ppm)	CO (ppm)	Remark
10:00	14.70	3.63	12.55	0.73	4.19	
10:01	14.71	3.63	12.86	0.73	4.15	
10:02	14.67	3.63	13.36	0.72	4.11	
10:03	14.65	3.65	13.28	0.79	4.05	
10:04	14.69	3.66	14.53	0.83	4.05	
10:05	14.67	3.63	14.15	0.86	3.95	
10:06	14.67	3.68	14.25	0.87	3.64	
10:07	14.19	3.62	15.06	0.85	3.76	
10:08	14.74	3.67	15.08	0.92	3.68	
10:09	14.76	3.67	14.32	0.89	3.62	
10:10	14.76	3.63	13.83	0.15	2.51	
10:11	14.75	3.65	13.74	0.92	3.53	
10:12	14.75	3.65	13.71	0.92	3.45	
10:13	14.75	3.63	13.18	0.92	3.41	
10:14	14.75	3.63	13.82	0.92	3.39	
10:15	14.74	3.52	14.01	0.95	3.34	
10:16	14.70	3.61	14.71	0.95	3.33	
10:17	14.74	3.59	15.05	0.92	3.15	
10:18	14.69	3.59	14.95	0.94	3.15	
10:19	14.73	3.60	14.99	0.93	3.11	
10:20	14.76	3.64	14.97	0.95	3.00	
Average	14.72	3.64	14.18	0.88	3.61	

Naratip T.

( Mr. Naratip Thuekchakam )

Environmental Field Scientist (1)

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

ALS Laboratory Group



## EMISSION TEST RESULT

Client : Gulf T&S Co., Ltd. Run # 2  
Date : 09 May 25 Location : Ulae HRSO 12  
Start Time : 10:21 Test Operator : Naratip T.  
SO<sub>2</sub> Analyzer Model : TELEDYNE API 100EH Finish Time : 10:41  
NO<sub>x</sub>/O<sub>2</sub> Analyzer Model : TELEDYNE API 200EH Serial No : 419  
CO/CO<sub>2</sub> Analyzer Model : TELEDYNE API 300EM Serial No : 735  
Serial No : 425

Time (min)	O <sub>2</sub> (%)	CO <sub>2</sub> (%)	NO <sub>x</sub> (ppm)	SO <sub>2</sub> (ppm)	CO (ppm)	Remark
10:21	14.76	3.64	14.32	0.97	2.97	
10:22	14.76	3.66	14.03	0.14	2.64	
10:23	14.76	3.61	14.07	0.95	2.57	
10:24	14.78	3.60	14.50	0.96	2.92	
10:25	14.76	3.62	14.03	0.97	2.69	
10:26	14.80	3.62	14.11	0.14	2.81	
10:27	14.80	3.60	14.16	0.98	2.63	
10:28	14.79	3.61	14.13	0.97	2.81	
10:29	14.77	3.57	14.18	0.95	2.80	
10:30	14.77	3.59	14.03	0.97	2.74	
10:31	14.78	3.58	13.85	0.98	2.65	
10:32	14.80	3.59	14.08	0.96	2.70	
10:33	14.80	3.60	14.26	0.94	2.61	
10:34	14.80	3.59	14.22	0.96	2.74	
10:35	14.78	3.59	14.06	0.94	2.57	
10:36	14.78	3.58	14.20	0.14	2.66	
10:37	14.78	3.59	14.20	0.94	2.63	
10:38	14.78	3.60	14.23	0.95	2.50	
10:39	14.71	3.59	14.56	0.92	2.46	
10:40	14.19	3.58	15.27	0.92	2.45	
10:41	14.73	3.58	15.48	0.91	2.47	
Average	14.77	3.60	14.26	0.93	2.71	

Naratip T.

( Mr. Naratip Thuekchakam )

Environmental Field Scientist (1)

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

ALS Laboratory Group



## EMISSION TEST RESULT

Client : Gulf T&S Co., Ltd. Run # 3  
Date : 09 May 25 Location : Ulae HRSO 12  
Start Time : 10:42 Test Operator : Naratip T.  
SO<sub>2</sub> Analyzer Model : TELEDYNE API 100EH Finish Time : 11:02  
NO<sub>x</sub>/O<sub>2</sub> Analyzer Model : TELEDYNE API 200EH Serial No : 410  
CO/CO<sub>2</sub> Analyzer Model : TELEDYNE API 300EM Serial No : 735  
Serial No : 425

Time (min)	O <sub>2</sub> (%)	CO <sub>2</sub> (%)	NO <sub>x</sub> (ppm)	SO <sub>2</sub> (ppm)	CO (ppm)	Remark
10:42	14.76	3.61	15.00	0.91	2.31	
10:43	14.79	3.62	14.25	0.92	2.37	
10:44	14.78	3.64	14.07	0.14	2.35	
10:45	14.77	3.63	13.99	0.95	2.38	
10:46	14.78	3.62	14.04	0.91	2.30	
10:47	14.76	3.61	14.07	0.92	2.28	
10:48	14.74	3.61	14.34	0.93	2.30	
10:49	14.77	3.61	14.63	0.90	2.32	
10:50	14.76	3.59	14.64	0.91	2.26	
10:51	14.79	3.58	14.18	0.92	2.30	
10:52	14.77	3.58	14.00	0.18	2.22	
10:53	14.77	3.62	13.98	0.91	2.17	
10:54	14.75	3.59	14.10	0.92	2.13	
10:55	14.77	3.61	14.45	0.91	2.17	
10:56	14.79	3.61	14.45	0.91	2.12	
10:57	14.77	3.61	14.19	0.93	2.12	
10:58	14.78	3.62	14.23	0.91	2.13	
10:59	14.78	3.63	14.19	0.16	2.00	
11:00	14.72	3.57	14.25	0.91	1.93	
11:01	14.73	3.60	14.59	0.87	1.93	
11:02	14.77	3.62	14.48	0.88	1.95	
Average	14.77	3.61	14.30	0.91	2.20	

Naratip T.

( Mr. Naratip Thuekchakam )

Environmental Field Scientist (1)

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

ALS Laboratory Group

## CERTIFICATE OF ANALYSIS

### Grade of Product: EPA PROTOCOL STANDARD

Customer: AIR LIQUIDE (THAILAND) LTD  
Part Number: E04N199E3HA0002  
Cylinder Number: GNO027210  
Laboratory: 124 - Plumsteadville - PA  
PGVP Number: A12022  
Gas Code: CO,NO,NOX,SO2,BALN

Reference Number: 160-402340013-1  
Cylinder Volume: 247.2 CF  
Cylinder Pressure: 2215 PSIG  
Valve Outlet: 660  
Certification Date: Feb 11, 2022

Expiration Date: Feb 11, 2030

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 820R-12-051, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 6.7 megapascals.

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	80.00 PPM	82.38 PPM	G1	+/- 1.0% NIST Traceable	02/04/2022, 02/11/22
CARBON MONOXIDE	80.00 PPM	79.48 PPM	G1	+/- 0.6% NIST Traceable	02/04/2022, 02/11/22
NITRIC OXIDE	80.00 PPM	82.38 PPM	G1	+/- 1.0% NIST Traceable	02/04/2022, 02/11/22
SULFUR DIOXIDE	80.00 PPM	78.75 PPM	G1	+/- 0.5% NIST Traceable	02/04/2022, 02/11/22
NITROGEN	Balance				

CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	09010212	KAL004777	98.48 PPM CARBON MONOXIDE/NITROGEN	+/- 0.5%	Oct 15, 2024
NTRM	200610-15	CC733106	98.61 PPM NITRIC OXIDE/NITROGEN	+/- 0.5%	Oct 06, 2026
NTRM	200610-04	CC708044	98.61 PPM NITRIC OXIDE/NITROGEN	+/- 0.5%	Oct 06, 2026
GMIS	12420888139	CC323707	4.087 PPM NITROGEN DIOXIDE/NITROGEN	+/- 0.2%	Sep 03, 2024
NTRM	11010415	KAL004813	99.6 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.5%	Jul 28, 2023

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

Triad Data Available Upon Request

NOTES: Gross Weight: 48.5 Kg

Net Weight: 8.1 Kg



## CERTIFICATE OF ANALYSIS

### Grade of Product: EPA PROTOCOL STANDARD

Customer: AIR LIQUIDE (THAILAND) LTD  
Part Number: E04N199E3HA0066  
Cylinder Number: GNO027216  
Laboratory: 124 - Plumsteadville - PA  
PGVP Number: A12022  
Gas Code: CO,NO,NOX,SO2,BALN

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

Expiration Date: Feb 09, 2030

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 820R-12-051, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 6.7 megapascals.

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	80.00 PPM	82.38 PPM	G1	+/- 1.0% NIST Traceable	02/02/2022, 02/08/2022
CARBON MONOXIDE	80.00 PPM	82.38 PPM	G1	+/- 0.6% NIST Traceable	02/02/2022, 02/08/2022
NITRIC OXIDE	80.00 PPM	82.38 PPM	G1	+/- 0.9% NIST Traceable	02/02/2022, 02/08/2022
SULFUR DIOXIDE	80.00 PPM	82.38 PPM	G1	+/- 0.6% NIST Traceable	02/02/2022, 02/08/2022
NITROGEN	Balance				

CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	09010212	KAL004777	98.48 PPM CARBON MONOXIDE/NITROGEN	+/- 0.5%	Oct 15, 2024
NTRM	200610-15	CC733106	98.61 PPM NITRIC OXIDE/NITROGEN	+/- 0.5%	Oct 06, 2026
GMIS	12420888139	CC323707	4.087 PPM NITROGEN DIOXIDE/NITROGEN	+/- 0.2%	Sep 03, 2024
NTRM	11010415	KAL004813	99.6 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.5%	Jul 28, 2023

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

Triad Data Available Upon Request

NOTES: Gross Weight: 49.4 Kg

Net Weight: 8.4 Kg



*Michael A. Taylor*  
Approved for Release

Page 1 of 160-402340012-1

## CERTIFICATE OF ANALYSIS

### Grade of Product: EPA Protocol

Part Number: E04N199E3HA0066  
Cylinder Number: ND11223  
Laboratory: 124 - Plumsteadville - PA  
PGVP Number: A12021  
Gas Code: CO,NO,NOX,SO2,BALN

Reference Number: 160-402138464-1  
Cylinder Volume: 247.2 CF  
Cylinder Pressure: 2215 PSIG  
Valve Outlet: 660  
Certification Date: Jul 15, 2025

Expiration Date: Jul 15, 2025

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 820R-12-051, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 6.7 megapascals.

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	80.00 PPM	86.17 PPM	G1	+/- 1.4% NIST Traceable	07/08/2021, 07/15/2021
CARBON MONOXIDE	80.00 PPM	86.17 PPM	G1	+/- 0.5% NIST Traceable	07/08/2021, 07/15/2021
NITRIC OXIDE	80.00 PPM	86.17 PPM	G1	+/- 1.0% NIST Traceable	07/08/2021, 07/15/2021
SULFUR DIOXIDE	80.00 PPM	86.17 PPM	G1	+/- 1.1% NIST Traceable	07/08/2021, 07/15/2021
NITROGEN	Balance				

CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	11010130	KAL004536	97.31 PPM CARBON MONOXIDE/NITROGEN	+/- 0.4%	Oct 04, 2022
PRM	12386	D855025	9.91 PPM AIR/NITROGEN DIOXIDE	2.0%	Feb 20, 2020
NTRM	200610-50	CC733426	98.61 PPM NITRIC OXIDE/NITROGEN	+/- 0.5%	Oct 06, 2026
GMIS	124208889	CC323707	4.028 PPM NITROGEN DIOXIDE/NITROGEN	2.1%	Aug 15, 2021
NTRM	15010224	KAL003638	97.69 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Dec 23, 2021

ANALYTICAL EQUIPMENT			
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration	
Nicolet iSSO FTIR AUP2010245 CO	FTIR	Jun 24, 2021	
Nicolet iSSO FTIR AUP2010245 NO	FTIR	Jul 01, 2021	
Nicolet iSSO FTIR AUP2010245 NO2	FTIR	Jun 30, 2021	
Nicolet iSSO FTIR AUP2010245 SO2	FTIR	Jul 08, 2021	

Triad Data Available Upon Request

NOTES:

Gross Weight: 47.9 Kg

Net Weight: 7.8 Kg



*Michael A. Taylor*  
Approved for Release

Page 1 of 160-402138464-1

## CERTIFICATE OF ANALYSIS

### Grade of Product: EPA Protocol

Part Number: E04N199E3HA0002  
Cylinder Number: ND11222  
Laboratory: 124 - Plumsteadville - PA  
PGVP Number: A12021  
Gas Code: CO,NO,NOX,SO2,BALN

Reference Number: 160-402138465-1  
Cylinder Volume: 247.2 Cubic Feet  
Cylinder Pressure: 2215 PSIG  
Valve Outlet: 660  
Certification Date: Jul 15, 2025

Expiration Date: Jul 15, 2025

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 820R-12-051, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 6.7 megapascals.

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	80.00 PPM	86.17 PPM	G1	+/- 1.4% NIST Traceable	07/08/2021, 07/15/2021
CARBON MONOXIDE	80.00 PPM	86.17 PPM	G1	+/- 0.5% NIST Traceable	07/08/2021, 07/15/2021
NITRIC OXIDE	80.00 PPM	86.17 PPM	G1	+/- 1.4% NIST Traceable	07/08/2021, 07/15/2021
SULFUR DIOXIDE	80.00 PPM	86.17 PPM	G1	+/- 1.1% NIST Traceable	07/08/2021, 07/15/2021
NITROGEN	Balance				

CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	11010130	KAL004536	97.31 PPM CARBON MONOXIDE/NITROGEN	+/- 0.4%	Oct 04, 2022
PRM	12386	D855025	9.91 PPM AIR/NITROGEN DIOXIDE	2.0%	Feb 20, 2020
NTRM	200610-50	CC733426	98.61 PPM NITRIC OXIDE/NITROGEN	+/- 0.5%	Oct 06, 2026
GMIS	124208889	CC323707	4.028 PPM NITROGEN DIOXIDE/NITROGEN	2.1%	Aug 15, 2021
NTRM	15010224	KAL003638	97.69 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Dec 23, 2021

ANALYTICAL EQUIPMENT			
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration	
Nicolet iSSO FTIR AUP2010245 CO	FTIR	Jun 24, 2021	
Nicolet iSSO FTIR AUP2010245 NO	FTIR	Jul 01, 2021	
Nicolet iSSO FTIR AUP2010245 NO2	FTIR	Jun 30, 2021	
Nicolet iSSO FTIR AUP2010245 SO2	FTIR	Jul 08, 2021	

Triad Data Available Upon Request

NOTES:

Gross Weight: 48.0 Kg

Net Weight: 7.8 Kg



*Michael A. Taylor*  
Approved for Release

Page 1 of 160-402138465-1

## CERTIFICATE OF ANALYSIS

### Grade of Product: EPA Protocol

Part Number: E02N192E3HA0000 Reference Number: 82-401018725-1  
Cylinder Number: ND60018 Cylinder Volume: 248.4 CF  
Laboratory: 124 - Riverton (SAP) - NJ Cylinder Pressure: 2214 PSIG  
PGVP Number: E52017 Valve Outlet: 590  
Gas Code: O2,BALN Certification Date: Oct 23, 2017  
Expiration Date: Oct 23, 2025

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/031, using the assay procedures listed. Analytical methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.  
Do Not Use This Cylinder below 100 psig (i.e. 0.7 megapascals).

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
OXYGEN	8.000 %	8.003 %	G1	+/- 0.4% NIST Traceable	10/23/2017
NITROGEN	Balance				
CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	0606208	CC262337	8.001 % OXYGEN/NITROGEN	+/- 0.3%	Nov 08, 2018
ANALYTICAL EQUIPMENT					
Instrument/Make/Model			Analytical Principle	Last Multipoint Calibration	
Heraeus MPA 510-Q2-TVM041			Paramagnetic	Sep 28, 2017	

Triad Data Available Upon Request

NOTES:  
This calibration std. has been certified in accordance with the May 2012 EPA Traceability Protocol, Document EPA-600/R-12/031. All testing processes and measurements conform to the requirements of ISO/IEC 17025 and to Airgas ISO 9001:2000 and relate only to items identified on this certificate. All values are certified to be NIST Traceable with total uncertainty as detailed under Analytical Uncertainty. This document shall not be reproduced in full without written approval of the issuer.



TESTING CERT No. 2000.02

*[Signature]*  
Approved for Release

Page 1 of 82-401018725-1

## CERTIFICATE OF ANALYSIS

### Grade of Product: EPA PROTOCOL STANDARD

Customer: AIR LIQUIDE (THAILAND) LTD Reference Number: 160-402340010-1  
Part Number: E02N194E3HA0001 Cylinder Volume: 249.8 CF  
Cylinder Number: GN0027197 Cylinder Pressure: 2214 PSIG  
Laboratory: 124 - Plumsteadville - PA Valve Outlet: 590  
PGVP Number: A12022 Certification Date: Feb 02, 2022  
Gas Code: O2,BALN Expiration Date: Feb 02, 2030

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/031, using the assay procedures listed. Analytical methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.  
Do Not Use This Cylinder below 100 psig (i.e. 0.7 megapascals).

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
OXYGEN	15.00 %	15.02 %	G1	+/- 0.4% NIST Traceable	02/02/2022
NITROGEN	Balance				
CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	08010230	K055228	15.26 % OXYGEN/NITROGEN	+/- 0.4%	Jun 01, 2022
ANALYTICAL EQUIPMENT					
Instrument/Make/Model			Analytical Principle	Last Multipoint Calibration	
SIEMENS OXYMAT 6 - N1-WS-951 - O2			PARAMAGNETIC	Jun 27, 2022	

Triad Data Available Upon Request

NOTES: Gross Weight: 48.8 Kg  
Net Weight: 6.2 Kg



Page 1 of 160-402340010-1

## CERTIFICATE OF ANALYSIS

### Grade of Product: EPA PROTOCOL STANDARD

Customer: AIR LIQUIDE (THAILAND) LTD Reference Number: 160-402830555-1  
Part Number: E02N194E3HA0001 Cylinder Volume: 250.0 CF  
Cylinder Number: GN0028535 Cylinder Pressure: 2214 PSIG  
Laboratory: 124 - Plumsteadville - PA Valve Outlet: 590  
PGVP Number: A12023 Certification Date: Sep 05, 2023  
Gas Code: O2,BALN Expiration Date: Sep 05, 2031

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/031, using the assay procedures listed. Analytical methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.  
Do Not Use This Cylinder below 100 psig (i.e. 0.7 megapascals).

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
OXYGEN	15.00 %	15.07 %	G1	+/- 0.4% NIST Traceable	09/05/2023
NITROGEN	Balance				
CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	08010205	K001516	15.22 % OXYGEN/NITROGEN	+/- 0.4%	Jun 01, 2024
ANALYTICAL EQUIPMENT					
Instrument/Make/Model			Analytical Principle	Last Multipoint Calibration	
SIEMENS OXYMAT 6 - N1-WS-951 - O2			PARAMAGNETIC	Aug 16, 2020	

Triad Data Available Upon Request

NOTES: Gross Weight: 58.0 Kg  
Net Weight: 5.4 Kg



*[Signature]*  
Approved for Release

Page 1 of 1

## CERTIFICATE OF ANALYSIS

### Grade of Product: EPA Protocol

Part Number: E02N192E3HA0000 Reference Number: 160-401984144-1  
Cylinder Number: GN0025085 Cylinder Volume: 248.4 CF  
Laboratory: 124 - Plumsteadville - PA Cylinder Pressure: 2214 PSIG  
PGVP Number: A12020 Valve Outlet: 590  
Gas Code: O2,BALN Certification Date: Nov 11, 2020  
Expiration Date: Nov 11, 2028

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/031, using the assay procedures listed. Analytical methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.  
Do Not Use This Cylinder below 100 psig (i.e. 0.7 megapascals).

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
OXYGEN	8.000 %	8.186 %	G1	+/- 0.4% NIST Traceable	11/11/20
NITROGEN	Balance				
CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	10010602	K036055	8.987 % OXYGEN/NITROGEN	+/- 0.3%	Apr 18, 2022
ANALYTICAL EQUIPMENT					
Instrument/Make/Model			Analytical Principle	Last Multipoint Calibration	
SIEMENS OXYMAT 6 - N1-WS-951 - O2			PARAMAGNETIC	Oct 26, 2020	

Triad Data Available Upon Request

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



*[Signature]*  
Approved for Release

Page 1 of 160-401984144-1

### Certificate of Calibration

#### Customer

Name : ALS Laboratory Group Thailand Co., Ltd. Certificate No : 25-AC1-042  
Address : 104 Soi Phatthanakan 40, Phatthanakan Road, Suan Luang, Request No : Req-2025-0604  
Bangkok 10250

#### Unit Under Calibration Details

Measurement item : Acoustic Calibrator Class : 1  
Manufacturer : RJON Range : 94 dB / 1000 Hz  
Model : NC-75 Instrument Status : Used  
Serial Number : 35002736  
ID : RYG JS0496

#### Calibration Environment and Details

Temperature : (23 ± 2 °C)  
Humidity : (50 ± 20 %RH)  
Barometric Pressure : (1013 ± 10.0 hPa)  
Received Date : 6 March 2025  
Calibration Date : 19 March 2025  
Location of Calibration : 1 AB 1 Acoustic  
Calibration Procedure : In-house method CIP-ACT-02 based on IEC 60942:2017 Electroacoustics - Sound calibrators

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

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

#### Note

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

Calibrated By :  Approved By :   
Mr. Noppadon Tuangrat Mr. Paei Mathavorn  
Service Calibration Engineer Calibration Engineer Supervisor  
Issue Date : 19 March 2025

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

FM 708 ACT-02 Rev 03 Issue date 5/6/24

Certificate No : 25-AC1-042

Request No : Req-2025-0604

#### Decision Rule for Statements of Conformity

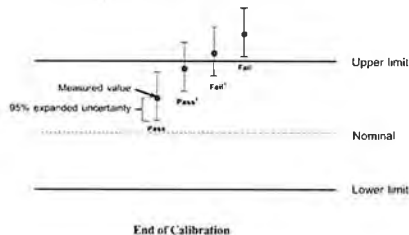
The standard decision rule employed for the statements of conformity in each calibration result will be applied using ILAC-GS 09:2019, Guidelines on the Reporting of Compliance with Specification as follows: **Pass** and **Fail** statements.

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

**Pass** - The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.

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

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



Certificate No : 25-AC1-042

Request No : Req-2025-0604

#### Sound pressure level

#### Calibration Results : Without Adjustment

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty (± dB)	Acceptance limit Class 1 (± dB)	Result
	Measured	Deviated value	Measured	Deviated value			
94 dB / 1000 Hz	94.06	0.06	-	-	0.13	± 0.25	Pass

#### Frequency of Sound pressure level

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

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

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)	Acceptance limit Class 1 (± %)	Result
	Measured (%)	Deviated (%)	Measured (%)	Deviated (%)			
94 dB / 1000 Hz	0.98	-	-	-	0.40	± 2.5	Pass

#### Note :

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

- Acceptance limit of IEC 60942:2017 Class 1

- The calibration results exclude the calibration pressure correction

- The calibration results exclude the microphone volume correction

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

FM 708 ACT-02 Rev 03 Issue date 5/6/24

### SITHIPORN ASSOCIATES CO., LTD. CALIBRATION LABORATORY

451-451/1 Sirinthon Road, Banggumai, Bangkai, Bangkok 10700 Thailand  
Tel : +66 2-433 8331 E-mail : calibration@sithiporn.com

Cert. No : ACL24228

Pages : 1 of 8


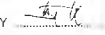
## Calibration Certificate

**Equipment :** SOUND LEVEL METER  
**Manufacturer :** RJON  
**Model :** NL-42 / Microphone UC-52 / Preamplifier NII-24  
**Serial No.:** 00734223 / 169439 / 72460  
**ID No :** RYG JS0029

**Condition As Found :** GOOD

**Customer :** ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
KHUWAENG 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 :** 10 JULY 2024  
**Calibration Date :** 11 JULY 2024  
**Date of Issue :** 15 JULY 2024

REVIEW BY :   
APPROVED BY :   
NEXT CAL DATE : 11/3/25

Calibrated by : Nathakorn Pisuipaisan

Approved by :   
( 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.

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

FM 708 ACT-02 Rev 03 Issue date 5/6/24

**SITHIPORN ASSOCIATES CO., LTD.**  
**CALIBRATION LABORATORY**

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



Cert. No. : ACL24228  
Job No. : VC67AC0127  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

**Calibration Method :**

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

**Condition of this result of calibration :**

**1. Reference Standard Instruments :**

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-24	05-FEB-25
Waveform Generator	33511B	MY52302742	EF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	FEL_BP 21/0267	13-FEB-25
Digital Multimeter	33461A	MY53220076	FEL_BP 20/0267	15-FEB-25
Digital Multimeter	34461A	MY60024273	FEL_BP 22/0267	15-FEB-25
Programmable Attenuator	MAT-1070	62100114	EF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KA1	34560495	AA-3001-24	05-FEB-25

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

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

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

*T. Petchu-*

**SITHIPORN ASSOCIATES CO., LTD.**  
**CALIBRATION LABORATORY**

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



Cert. No. : ACL24228  
Job No. : VC67AC0127  
Pages : 3 of 8

**Summary of Measurement Result :**

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

*T. Petchu-*

**SITHIPORN ASSOCIATES CO., LTD.**  
**CALIBRATION LABORATORY**

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



Cert. No. : ACL24228  
Job No. : VC67AC0127  
Page : 4 of 8

**Result of calibration :**

**1. Absolute sensitivity**

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

**2. Self-generated noise**

**2.1 Normal test**

Measured Value (dB)
14.6

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

Frequency Weighting	Weighting (dB)
A-weight	9.9
C-weight	16.7
Flat	22.4

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

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.4	0.4	0.4	±1.5
1000	-0.1	-0.1	-0.1	±1.0
8000	-1.7	-1.6	-1.6	+5.0

*T. Petchu-*

**SITHIPORN ASSOCIATES CO., LTD.**  
**CALIBRATION LABORATORY**

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



Cert. No. : ACL24228  
Job No. : VC67AC0127  
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	-0.1	±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	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	94.0	0.0	±0.2
C-weight	94.0	94.0	0.0	±0.2
Flat	94.0	94.0	0.0	±0.2

**5.2 Time weighting at 1 kHz**

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

**6. Long-term stability**

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

*T. Petchu-*



Cert. No. : ACL24228  
Job No. : VC67AC0127  
Pages : 6 of 8

**7. Level linearity on the reference level range**

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.1	0.1	±1.1
136.0	136.1	0.1	±1.1
135.0	135.1	0.1	±1.1
134.0	134.1	0.1	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.1	0.1	±1.1
124.0	124.0	0.0	±1.1
119.0	119.1	0.1	±1.1
114.0	114.1	0.1	±1.1
109.0	109.1	0.1	±1.1
104.0	104.1	0.1	±1.1
99.0	99.1	0.1	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	34.0	0.0	±1.1
30.0	30.0	0.0	±1.1
29.0	29.0	0.0	±1.1
28.0	28.1	0.1	±1.1
27.0	27.0	0.0	±1.1
26.0	26.1	0.1	±1.1
25.0	25.1	0.1	±1.1

*T. Petchur*

Cert. No. : ACL24228  
Job No. : VC67AC0127  
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, 1b (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, 1.openk (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
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	±2.0
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±2.0

*T. Petchur*

Cert. No. : ACL24228  
Job No. : VC67AC0127  
Pages : 8 of 8

**11. Overload indication**

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

**12. High level stability**

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

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

End of Calibration Certificate

*T. Petchur*

Cert. No. : ACL25110  
Pages : 1 of 8

**Calibration Certificate**

**Equipment :** SOUND LEVEL METER  
**Manufacturer :** RION  
**Model :** NL-42 / Microphone UC-52 / Preamplifier NH-24  
**Serial No.:** 00900074 / 18467 / 01736  
**ID No.:** RYG\_FS0495

**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 ± 1.3 ) °C  
**Pressure :** ( 101.3 ± 3 ) kPa  
**Relative Humidity :** ( 50.0 ± 20 ) %

**Received Date :** 14 JANUARY 2025  
**Calibration Date :** 27-29 JANUARY 2025  
**Date of Issue :** 30 JANUARY 2025

Calibrated by :

Nathakorn Pisutpraisan

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.

REVIEW BY: *Spt S*

APPROVED BY: *[Signature]*

NEXT CAL DATE: 28/01/2026

Cert. No. : ACL25110  
Job No. : VC68AC0064  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

**Calibration Method :**

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

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

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

**Condition of this result of calibration :**

## 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-24	05-FEB-25
Waveform Generator	33511B	MY52302742	EF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	EEL-BP 21/0267	13-FEB-25
Digital Multimeter	33461A	MY53220076	EEL-BP 20/0267	15-FEB-25
Digital Multimeter	34461A	MY60024273	EEL-BP 22/0267	15-FEB-25
Programmable Attenuator	MAT-1070	62100114	EF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KA1	34560495	AA-3001-24	05-FEB-25

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

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

3.1 National Institute of Metrology (Thailand),

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

T. Petch.

Cert. No. : ACL25110  
Job No. : VC68AC0064  
Page : 4 of 8**Result of calibration :**

## 1. Absolute sensitivity

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

## 2. Self-generated noise

## 2.1 Normal test

Measured Value ( dB )
14.6

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

Frequency Weighting	Weighting ( dB )
A - weight	12.0
C - weight	17.7
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	0.3	0.3	0.3	± 5.0

T. Petch.

Cert. No. : ACL25110  
Job No. : VC68AC0064  
Pages : 3 of 8**Summary of Measurement Result :**

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

T. Petch.

Cert. No. : ACL25110  
Job No. : VC68AC0064  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

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

## 5.2 Time weighting at 1 kHz

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

## 6. Long - term stability

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

T. Petch.

Cert. No. : ACL25110  
Job No. : VC68AC0064  
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	99.1	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	29.1	0.1	±1.1
28.0	28.1	0.1	±1.1
27.0	27.1	0.1	±1.1
26.0	26.2	0.2	±1.1
25.0	25.2	0.2	±1.1

T. Petchum

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Job No. : VC68AC0064  
Pages : 7 of 8

## 8. Level linearity including the level range control

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

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	29.0	29.1	0.1	±1.1

## 9. Tone burst response

Time Weighting	Tone burst duration, Th (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	116.9	-0.1	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

T. Petchum

Cert. No. : ACL25110  
Job No. : VC68AC0064  
Pages : 8 of 8

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, T <sub>peak</sub> (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	130.0	130.0	0.0	±3.0
One	133.4	133.4	0.0	±3.0

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

## 11. Overload indication

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

## 12. High level stability

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

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

End of Calibration Certificate

T. Petchum

451-451/1 Srintham Road, Bangkhumru, Bangkok, 10700 Thailand  
Tel : +66 2433 8331 Email : calibrations@sithiporn.comCert. No. : ACL24420  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42A / Microphone UC-52 / Preamplifier NH-24  
Serial No. : 00623389 / 198636 / 26417  
ID No. : RYG\_FS0614

Condition As Found : GOOD

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

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

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

Calibrated by :

Nathakorn Pisutpaisan

Approved by :

T. Petchum  
( Thanakul Petchum )

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

**SITHIPORN ASSOCIATES CO., LTD.**  
**CALIBRATION LABORATORY**

459-45/1 Sirinthorn Road, Bangbunru, Bangkok, 10700 Thailand  
Tel +66 2433 8331 Email: calibration@sithiporn.com

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Cert. No. : ACL24420  
Job No. : VC68AC0051  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

**Calibration Method :**

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

**Condition of this result of calibration :**

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-24	05-FEB-25
Waveform Generator	33511B	MY52302742	EF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	EEL-BP 21/0267	13-FEB-25
Digital Multimeter	33461A	MY53220076	EEL-BP 20/0267	15-FEB-25
Digital Multimeter	34461A	MY60024273	EEL-BP 22/0267	15-FEB-25
Programmable Attenuator	MA1-1070	62100114	EF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KAI	34560495	AA-3001-24	05-FEB-25

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

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

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

T. Reichen

**SITHIPORN ASSOCIATES CO., LTD.**  
**CALIBRATION LABORATORY**

459-45/1 Sirinthorn Road, Bangbunru, Bangkok, 10700 Thailand  
Tel +66 2433 8331 Email: calibration@sithiporn.com

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Cert. No. : ACL24420  
Job No. : VC68AC0051  
Page : 4 of 8

**Result of calibration :**

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
13.8

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

Frequency Weighting	Weighting (dB)
A-weight	9.9
C-weight	16.8
Flat	22.7

3. Acoustical signal tests of frequency weightings

Meier 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	0.4	0.4	±1.5
1000	0.2	0.2	0.2	±1.0
8000	0.4	0.5	0.5	±5.0

T. Reichen

**SITHIPORN ASSOCIATES CO., LTD.**  
**CALIBRATION LABORATORY**

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Cert. No. : ACL24420  
Job No. : VC68AC0051  
Pages : 3 of 8

**Summary of Measurement Result :**

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

T. Reichen

**SITHIPORN ASSOCIATES CO., LTD.**  
**CALIBRATION LABORATORY**

459-45/1 Sirinthorn Road, Bangbunru, Bangkok, 10700 Thailand  
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Cert. No. : ACL24420  
Job No. : VC68AC0051  
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	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	94.0	0.0	±0.2
C-weight	94.0	94.0	0.0	±0.2
Flat	94.0	94.0	0.0	±0.2

5.2 Time weighting at 1 kHz

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

6. Long-term stability

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

T. Reichen



Cert. No. : ACL24420  
Job No. : VC68AC0051  
Pages : 6 of 8

Cert. No. : ACL24420  
Job No. : VC68AC0051  
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**7. Level linearity on the reference level range**

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

*T. Petch*

**8. Level linearity including the level range control**

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

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

**9. Tone burst response**

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

*T. Petch*



Cert. No. : ACL24420  
Job No. : VC68AC0051  
Pages : 8 of 8

Cert. No. : ACL25073  
Pages : 1 of 8

**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	130.0	130.0	0.0	±3.0
One	133.4	133.4	0.0	±3.0

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

**11. Overload indication**

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

**12. High level stability**

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

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

End of Calibration Certificate

*T. Petch*

**Calibration Certificate**

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL 42 / Microphone UC 52 / Preamplifier NH-24  
Serial No.: 01222716 / 143832 / 22763  
ID No.: RYG\_FS0020

Condition As Found : GOOD

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

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

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

Calibrated by :

Nathakorn Pisutpaisan

Approved by :

*T. Petch*  
( Thanakul Peichurai )

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Cert. No. : ACL25073  
Job No. : VC68AC0059  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

**Calibration Method :**

This equipment was calibrated by follow on IEC-61672-3 (2013) Standard for sound level meter (SLM).  
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

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

**Condition of this result of calibration :**

## 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-24	05-FEB-25
Waveform Generator	33511B	MY52302742	EL-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	EEL-BP 21/0267	13-FEB-25
Digital Multimeter	33461A	MY53220076	EEL-BP 20/0267	15-FEB-25
Digital Multimeter	34461A	MY60024273	EEL-BP 22/0267	15-FEB-25
Programmable Attenuator	MAT-1070	62100114	EF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KAJ	34560495	AA-3001-24	05-FEB-25

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

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

3.1 National Institute of Metrology (Thailand).

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

T. Petch

Cert. No. : ACL25073  
Job No. : VC68AC0059  
Page : 4 of 8**Result of calibration :**

## 1. Absolute sensitivity

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

## 2. Self-generated noise

## 2.1 Normal test

Measured Value ( dB )
13.4

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

Frequency Weighting	Weighting ( dB )
A - weight	10.8
C - weight	16.7
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	-0.2	-0.2	± 1.5
1000	-0.6	-0.6	-0.6	± 1.0
8000	-1.0	-1.0	-1.0	± 5.0

T. Petch

Cert. No. : ACL25073  
Job No. : VC68AC0059  
Pages : 3 of 8**Summary of Measurement Result :**

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

T. Petch

Cert. No. : ACL25073  
Job No. : VC68AC0059  
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	0.2	0.2	0.3	±2.0
125	0.2	0.2	0.2	±1.5
250	0.1	0.1	0.1	±1.5
500	0.1	0.1	0.1	±1.5
1000	0.0	0.0	0.1	±1.0
2000	0.0	0.0	0.0	±2.0
4000	-0.1	-0.1	0.0	±3.0
8000	-0.1	0.0	0.0	±5.0

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

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

## 5.2 Time weighting at 1 kHz

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

## 6. Long - term stability

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

T. Petch

Cert. No. : ACL25073  
Job No. : VC68AC0059  
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	140.0	3.0	$\pm 1.1$
136.0	140.0	4.0	$\pm 1.1$
135.0	140.0	5.0	$\pm 1.1$
134.0	140.0	6.0	$\pm 1.1$
133.0	133.1	0.1	$\pm 1.1$
132.0	132.1	0.1	$\pm 1.1$
131.0	131.1	0.1	$\pm 1.1$
129.0	129.1	0.1	$\pm 1.1$
124.0	124.0	0.0	$\pm 1.1$
119.0	119.1	0.1	$\pm 1.1$
114.0	114.1	0.1	$\pm 1.1$
109.0	109.0	0.0	$\pm 1.1$
104.0	104.1	0.1	$\pm 1.1$
99.0	99.1	0.1	$\pm 1.1$
94.0	94.0	0.0	$\pm 1.1$
89.0	89.0	0.0	$\pm 1.1$
84.0	84.0	0.0	$\pm 1.1$
79.0	79.0	0.0	$\pm 1.1$
74.0	74.0	0.0	$\pm 1.1$
69.0	69.0	0.0	$\pm 1.1$
64.0	64.0	0.0	$\pm 1.1$
59.0	59.0	0.0	$\pm 1.1$
54.0	54.0	0.0	$\pm 1.1$
49.0	49.0	0.0	$\pm 1.1$
44.0	44.0	0.0	$\pm 1.1$
39.0	39.0	0.0	$\pm 1.1$
34.0	34.0	0.0	$\pm 1.1$
30.0	30.1	0.1	$\pm 1.1$
29.0	29.1	0.1	$\pm 1.1$
28.0	28.2	0.2	$\pm 1.1$
27.0	27.1	0.1	$\pm 1.1$
26.0	26.2	0.2	$\pm 1.1$
25.0	25.3	0.3	$\pm 1.1$

T. Petchur

Cert. No. : ACL25073  
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## 8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	94.0	94.0	0.0	$\pm 1.1$

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	29.0	29.2	0.2	$\pm 1.1$

## 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	$\pm 1.0$
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	$\pm 1.0$
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	$\pm 1.0$

T. Petchur

Cert. No. : ACL25073  
Job No. : VC68AC0059  
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## 10. Peak C sound level

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

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	$\pm 2.0$
Positive half cycle	135.4	135.1	-0.3	$\pm 2.0$
Negative half cycle	135.4	135.1	-0.3	$\pm 2.0$

## 11. Overload indication

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

## 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	$\pm 0.3$

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

End of Calibration Certificate

T. Petchur

451-451/1 Srinthorn Road, Bangkum, Bangkok, 10700 Thailand  
Tel. +66 2433 8331 Email : calibrating@sithiporn.comCert. No. : ACL25109  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24  
Serial No. : 00900073 / 188466 / 01735  
ID No. : RYG\_FS0494

Condition As Found : GOOD

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

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

Received Date : 14 JANUARY 2025  
Calibration Date : 27-29 JANUARY 2025  
Date of Issue : 30 JANUARY 2025

Calibrated by :

Nathakorn Pisutpaisan

Approved by :

T. Petchur  
( Thanakul Petchur )

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

Cert. No. : ACL25109  
Job No. : VC68AC0064  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

**Calibration Method :**

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

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

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

**Condition of this result of calibration :****1. Reference Standard Instruments :**

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-24	05-FEB-25
Waveform Generator	33511B	MY52302742	EF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	EEL_BP 21/0267	13-FEB-25
Digital Multimeter	33461A	MY53220076	EEL_BP 20/0267	15-FEB-25
Digital Multimeter	34461A	MY60024273	EEL_BP 22/0267	15-FEB-25
Programmable Attenuator	MAT-1070	62100114	EF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KAI	34560495	AA-3001-24	05-FEB-25

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

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

3.1 National Institute of Metrology (Thailand).

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

T. Petch

Cert. No. : ACL25109  
Job No. : VC68AC0064  
Page : 4 of 8**Result of calibration :****1. Absolute sensitivity**

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

**2. Self-generated noise****2.1 Normal test**

Measured Value ( dB )
15.1

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

Frequency Weighting	Weighting ( dB )
A - weight	12.0
C - weight	18.3
Flat	24.1

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

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

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

T. Petch

Cert. No. : ACL25109  
Job No. : VC68AC0064  
Pages : 3 of 8**Summary of Measurement Result :**

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

T. Petch

Cert. No. : ACL25109  
Job No. : VC68AC0064  
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	0.1	0.1	±1.5
250	0.0	0.1	0.0	±1.5
500	0.0	0.1	0.0	±1.5
1000	0.0	0.0	0.1	±1.0
2000	-0.1	0.1	0.0	±2.0
4000	-0.1	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	Anticipated Value ( dB )	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
A - weight	94.0	94.0	0.0	± 0.2
C - weight	94.0	94.0	0.0	± 0.2
Flat	94.0	94.0	0.0	± 0.2

5.2 Time weighting at 1 kHz

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

**6. Long - term stability**

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

T. Petch

Cert. No. : ACL25109  
Job No. : VC68AC0064  
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	30.1	0.1	±1.1
29.0	29.1	0.1	±1.1
28.0	28.1	0.1	±1.1
27.0	27.1	0.1	±1.1
26.0	26.2	0.2	±1.1
25.0	25.2	0.2	±1.1

T. Petch

Cert. No. : ACL25109  
Job No. : VC68AC0064  
Pages : 7 of 8

## 8. Level linearity including the level range control

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

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

## 9. Tone burst response

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

T. Petch

Cert. No. : ACL25109  
Job No. : VC68AC0064  
Pages : 8 of 8

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

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

## 11. Overload indication

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

## 12. High level stability

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

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

End of Calibration Certificate

T. Petch

451-451/1 Samthorn Road, Bangbunru, Bangkok, Thailand 10700 Thailand  
Tel : 06 2432 0331 Email : calibration@sithiporn.comCert. No. : ACL25079  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42A/ Microphone UC-52 / Preamplifier NH-24  
Serial No. : 00623394 / 198641 / 26422  
ID No : RYG\_FS0619

Condition As Found : GOOD

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

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

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

REVIEW BY :

APPROVED BY :

NEXT CAL. DATE : 21/01/2026

Calibrated by :

Nathakorn Pisutpaiban

Approved by :

T. Petch  
( Thanakul Peitchurai )

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

Cert. No. : ACL25079  
Job No. : VC68AC0059  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

**Calibration Method :**

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

**Condition of this result of calibration :**

## 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EJ-0009-24	05-FEB-25
Waveform Generator	33511B	MY52302742	EF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	EEL-BP 21/0267	13-FEB-25
Digital Multimeter	33461A	MY53220076	EEL-BP 20/0267	15-FEB-25
Digital Multimeter	34461A	MY60024273	EEL-BP 22/0267	15-FEB-25
Programmable Attenuator	MAT-1070	62100114	EF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KA1	34560495	AA-3001-24	05-FEB-25

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

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

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

*T. Petch*Cert. No. : ACL25079  
Job No. : VC68AC0059  
Page : 4 of 8**Result of calibration :**

## 1. Absolute sensitivity

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

## 2. Self-generated noise

## 2.1 Normal test

Measured Value ( dB )
14.6

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

Frequency Weighting	Weighting ( dB )
A - weight	12.6
C - weight	19.1
Flat	24.5

## 3. Acoustical signal tests of frequency weightings

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

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

*T. Petch*Cert. No. : ACL25079  
Job No. : VC68AC0059  
Pages : 3 of 8**Summary of Measurement Result :**

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

*T. Petch*Cert. No. : ACL25079  
Job No. : VC68AC0059  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

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

## 5.2 Time weighting at 1 kHz

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

## 6. Long - term stability

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

*T. Petch*



Cert. No. : ACL25079  
Job No. : VC68AC0059  
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	34.1	0.1	±1.1
30.0	30.1	0.1	±1.1
29.0	29.1	0.1	±1.1
28.0	28.1	0.1	±1.1
27.0	27.1	0.1	±1.1
26.0	26.1	0.1	±1.1
25.0	25.1	0.1	±1.1

T. Petchur

Cert. No. : ACL25079  
Job No. : VC68AC0059  
Pages : 7 of 8

## 8. Level linearity including the level range control

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

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

## 9. Tone burst response

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

T. Petchur

Cert. No. : ACL25079  
Job No. : VC68AC0059  
Pages : 8 of 8

## 10. Peak C sound level

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

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

## 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	S.L.M Display at initial (dB)	S.L.M Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	137.0	137.0	0.0	±0.3

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

End of Calibration Certificate

T. Petchur

451-451/1 Sirinthorn Road, Bangbunma, Bangkapi, Bangkok, 10700 Thailand  
Tel : +66 2433 8931 Email : calibration@sithiporn.comCert. No. : ACL25075  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24  
Serial No.: 00233184 / 144837 / 23232  
ID No.: RYG\_FS0025

Condition As Found : GOOD

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

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

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

Calibrated by :

Nuthakorn Pisutpaisan

Approved by :

T. Petchur  
( Thamkul 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.

Cert. No. : ACL25075  
Job No. : VC68AC0059  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

**Calibration Method :**

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

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

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

**Condition of this result of calibration :**

## 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-24	05-FEB-25
Waveform Generator	33511B	MY52302742	FF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	EEL-BP 21/0267	13-FEB-25
Digital Multimeter	33461A	MY53220076	EEL-BP 20/0267	15-FEB-25
Digital Multimeter	34461A	MY60024273	EEL-BP 22/0267	15-FEB-25
Programmable Attenuator	MAT-1070	62100114	EF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KAI	34560495	AA-3001-24	05-FEB-25

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

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

3.1 National Institute of Metrology (Thailand).

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

T. Petch

Cert. No. : ACL25075  
Job No. : VC68AC0059  
Page : 4 of 8**Result of calibration :**

## 1. Absolute sensitivity

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

## 2. Self-generated noise

## 2.1 Normal test

Measured Value ( dB )
18.2

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

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

## 3. Acoustical signal tests of frequency weightings

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

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

T. Petch

Cert. No. : ACL25075  
Job No. : VC68AC0059  
Pages : 3 of 8**Summary of Measurement Result :**

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

T. Petch

Cert. No. : ACL25075  
Job No. : VC68AC0059  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz

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

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

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

## 5.2 Time weighting at 1 kHz

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

## 6. Long - term stability

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

T. Petch

Cert. No. : ACL25075  
Job No. : VC68AC0059  
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

T. Petchurai

Cert. No. : ACL25075  
Job No. : VC68AC0059  
Pages : 7 of 8

## 8. Level linearity including the level range control

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

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

## 9. Tone burst response

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

T. Petchurai

Cert. No. : ACL25075  
Job No. : VC68AC0059  
Pages : 8 of 8

## 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	130.0	130.0	0.0	±3.0
One	133.4	133.4	0.0	±3.0

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

## 11. Overload indication

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

T. Petchurai

451-451/1 Srinom Road, Bangbunmu, Bangpluek, Bangkok, 10700 Thailand  
Tel : +66 2433 8331 Email : calibration@sithiporn.comCert. No. : ACL25105  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24  
Serial No. : 00296518 / 66239 / 34375  
ID No. : RYG-FS0431

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 JANUARY 2025  
Calibration Date : 27-29 JANUARY 2025  
Date of Issue : 30 JANUARY 2025

Calibrated by :

Nathakorn Pisutpisan

Approved by :

T. Petchurai  
( Thanakul Petchurai )

REVIEW BY	Spt S
APPROVED BY	T. Petchurai
NEXT CAL DATE	26/01/2026

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

Cert. No. : ACL25105  
Job No. : VC68AC0064  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

**Calibration Method :**

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

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

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

**Condition of this result of calibration :**

## 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-24	05-FEB-25
Waveform Generator	33511B	MY52302742	EF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	EELBP 21/0267	13-FEB-25
Digital Multimeter	33461A	MY53220076	EELBP 20/0267	15-FEB-25
Digital Multimeter	34461A	MY60024275	EELBP 22/0267	15-FEB-25
Programmable Attenuator	MAT-1070	62100114	EL-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-12KAI	34560495	AA-3001-24	05-FEB-25

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

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

3.1 National Institute of Metrology (Thailand).

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

*T. Petch*Cert. No. : ACL25105  
Job No. : VC68AC0064  
Page : 4 of 8**Result of calibration :**

## 1. Absolute sensitivity

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

## 2. Self-generated noise

## 2.1 Normal test

Measured Value (dB)
22.0

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

Frequency Weighting	Weighting (dB)
A-weight	14.2
C-weight	20.1
Flat	25.8

## 3. Acoustical signal tests of frequency weightings

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

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

*T. Petch*Cert. No. : ACL25105  
Job No. : VC68AC0064  
Pages : 3 of 8**Summary of Measurement Result :**

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

*T. Petch*Cert. No. : ACL25105  
Job No. : VC68AC0064  
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	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

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

## 5.2 Time weighting at 1 kHz

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

## 6. Long-term stability

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

*T. Petch*

Cert. No. : ACL25105  
Job No. : VC68AC0064  
Pages : 6 of 8

## 7. Level linearity on the reference level range

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

T. Petch

Cert. No. : ACL25105  
Job No. : VC68AC0064  
Pages : 7 of 8

## 8. Level linearity including the level range control

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

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

## 9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	7	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

T. Petch

Cert. No. : ACL25105  
Job No. : VC68AC0064  
Pages : 8 of 8

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

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

## 11. Overload indication

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

## 12. High level stability

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

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

End of Calibration Certificate

T. Petch

451-451/1 Srinthorn Road, Bangchuan, Bangkok, 10700 Thailand  
Tel : +66 2433 8331 Email : calibr@longsithiporn.comCert. No. : ACL25104  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42 / Microphone UC-52 / Pre-amplifier NH-24  
Serial No. : 00296517 / 135220 / 87527  
ID No. : RYG-PS0434

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
KHWAENG PHATTHANAKAN, KJ11:1 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 JANUARY 2025  
Calibration Date : 27-29 JANUARY 2025  
Date of Issue : 30 JANUARY 2025

Calibrated by :

Nathakorn Pisutpaisan

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.



Cert. No. : ACL25104  
Job No. : VC68AC0064  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

**Calibration Method :**

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

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

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

**Condition of this result of calibration :**

## 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-24	05-FEB-25
Waveform Generator	33511B	MY52302742	EF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	EEL-BP 21/0267	13-FEB-25
Digital Multimeter	33461A	MY53220076	EEL-BP 20/0267	15-FEB-25
Digital Multimeter	34461A	MY60024273	EEL-BP 22/0267	15-FEB-25
Programmable Attenuator	MAT-1070	62100114	EF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KAI	34560495	AA-3001-24	05-FEB-25

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

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

3.1 National Institute of Metrology (Thailand)

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

*T. Petch*Cert. No. : ACL25104  
Job No. : VC68AC0064  
Page : 4 of 8**Result of calibration :**

## 1. Absolute sensitivity

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

## 2. Self-generated noise

## 2.1 Normal test

Measured Value ( dB )
17.2

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

Frequency Weighting	Weighting ( dB )
A - weight	14.6
C - weight	20.5
Flat	26.1

## 3. Acoustical signal tests of frequency weightings

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

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

*T. Petch*Cert. No. : ACL25104  
Job No. : VC68AC0064  
Pages : 3 of 8**Summary of Measurement Result :**

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

*T. Petch*Cert. No. : ACL25104  
Job No. : VC68AC0064  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

## 5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

## 6. Long - term stability

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

*T. Petch*

Cert. No. : ACL25104  
Job No. : VC68AC0064  
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	24.8	-0.2	± 1.1

T. Petchur

Cert. No. : ACL25104  
Job No. : VC68AC0064  
Pages : 7 of 8

## 8. Level linearity including the level range control

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

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

## 9. Tone burst response

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

T. Petchur

Cert. No. : ACL25104  
Job No. : VC68AC0064  
Pages : 8 of 8

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, 1 cycle (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	130.0	130.0	0.0	±3.0
One	133.4	133.3	-0.1	±3.0

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

## 11. Overload indication

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

## 12. High level stability

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

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

End of Calibration Certificate

T. Petchur

Cert. No. : ACL24222  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NI-52A / Microphone UC-59 / Preamplifier NI-25  
Serial No.: 00531297 / 23200 / 32973  
ID No.: NKH PS0133

Condition As Found : GOOD

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

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

Received Date : 02 JULY 2024  
Calibration Date : 09-10 JULY 2024  
Date of Issue : 12 JULY 2024

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.

**SITHIPORN ASSOCIATES CO., LTD.**  
**CALIBRATION LABORATORY**

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



Cert. No. : ACL24222  
Job No. : VC67AC0118  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

**Calibration Method :**

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

**Condition of this result of calibration :**

**1. Reference Standard Instruments :**

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-24	05-FEB-25
Waveform Generator	33511B	MY52302742	EF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	EEL-BP 21/0267	13-FEB-25
Digital Multimeter	33461A	MY53220076	EEL-BP 20/0267	15-FEB-25
Digital Multimeter	34461A	MY60024273	EEL-BP 22/0267	15-FEB-25
Programmable Attenuator	MAT-1070	62100114	1-F-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KA1	34560495	AA-3001-24	05-FEB-25

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

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

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

*T. Petch.*

**SITHIPORN ASSOCIATES CO., LTD.**  
**CALIBRATION LABORATORY**

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



Cert. No. : ACL24222  
Job No. : VC67AC0118  
Pages : 3 of 8

**Summary of Measurement Result :**

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

*T. Petch.*

**SITHIPORN ASSOCIATES CO., LTD.**  
**CALIBRATION LABORATORY**

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



Cert. No. : ACL24222  
Job No. : VC67AC0118  
Page : 4 of 8

**Result of calibration :**

**1. Absolute sensitivity**

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.94)	94.0	0.0	±0.3

**2. Self-generated noise**

**2.1 Normal test**

Measured Value (dB)
13.6

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

Frequency Weighting	Weighting (dB)
A-weight	8.7
C-weight	14.6
Flat	20.2

**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	± 1.0
1000	0.1	0.1	0.1	± 0.7
8000	0.0	0.1	0.1	± 1.5, -2.5

*T. Petch.*

**SITHIPORN ASSOCIATES CO., LTD.**  
**CALIBRATION LABORATORY**

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



Cert. No. : ACL24222  
Job No. : VC67AC0118  
Pages : 5 of 8

**4. Electrical signal tests of frequency weightings**

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	-0.1	0.0	±1.0
125	0.0	0.0	0.0	±1.0
250	0.0	0.0	0.0	±1.0
500	0.0	0.1	0.0	±1.0
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	0.0	±1.0
4000	0.0	0.0	0.0	±1.0
8000	0.0	0.1	0.1	+ 1.5, - 2.5
16000	0.0	-1.2	-1.1	+ 2.5, -16.0

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

**5.1 Frequency weightings at 1 kHz**

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

**5.2 Time weighting at 1 kHz**

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

**6. Long-term stability**

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

*T. Petch.*

Cert. No. : ACL24222  
Job No. : VC67AC0118  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±0.8
136.0	136.0	0.0	±0.8
135.0	135.0	0.0	±0.8
134.0	134.0	0.0	±0.8
133.0	133.0	0.0	±0.8
132.0	132.0	0.0	±0.8
131.0	131.0	0.0	±0.8
129.0	129.0	0.0	±0.8
124.0	124.0	0.0	±0.8
119.0	119.0	0.0	±0.8
114.0	114.0	0.0	±0.8
109.0	109.0	0.0	±0.8
104.0	104.0	0.0	±0.8
99.0	99.0	0.0	±0.8
94.0	94.0	0.0	±0.8
89.0	89.0	0.0	±0.8
84.0	84.0	0.0	±0.8
79.0	79.0	0.0	±0.8
74.0	74.0	0.0	±0.8
69.0	69.0	0.0	±0.8
64.0	64.0	0.0	±0.8
59.0	59.0	0.0	±0.8
54.0	54.0	0.0	±0.8
49.0	49.0	0.0	±0.8
44.0	44.0	0.0	±0.8
39.0	39.0	0.0	±0.8
34.0	34.0	0.0	±0.8
30.0	30.0	0.0	±0.8
29.0	29.0	0.0	±0.8
28.0	28.0	0.0	±0.8
27.0	27.0	0.0	±0.8
26.0	26.0	0.0	±0.8
25.0	25.0	0.0	±0.8

T. Petchur

Cert. No. : ACL24222  
Job No. : VC67AC0118  
Pages : 7 of 8

## 8. Level linearity including the level range control

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

## 9. Tone burst response

Time Weighting	Tone burst duration, 1/b (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.0 ; -3.0
	2	8	117.0	117.0	0.0	1.0 ; -1.5
	200	800	134.0	134.1	0.1	±0.5
Slow	2	8	108.0	108.0	0.0	1.0 ; -3.0
	200	800	127.6	127.6	0.0	±0.5
	0.25	1	99.0	98.9	-0.1	1.0 ; -3.0
SEL	2	8	108.0	108.0	0.0	1.0 ; -1.5
	200	800	128.0	128.1	0.1	±0.5

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, 1 peak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±2.0
One	136.4	136.3	-0.1	±2.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.1	0.1	±1.0
Positive half cycle	135.4	135.2	-0.2	±1.0
Negative half cycle	135.4	135.2	-0.2	±1.0

T. Petchur

Cert. No. : ACL24222  
Job No. : VC67AC0118  
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	±0.1

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

End of Calibration Certificate

T. Petchur

Cert. No. : ACL25184  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42 / Microphone UC-52 / Preamplifier NH 24  
Serial No.: 00371914 / 169110 / 72255  
ID No.: NK111-S0001

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 : 23 APRIL 2025  
Calibration Date : 09 MAY 2025  
Date of Issue : 13 MAY 2025

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.

Cert. No. : ACL25184  
Job No. : VC68AC0092  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

**Calibration Method :**

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

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

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

**Condition of this result of calibration :**

## 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0011-25	11-FEB-26
Waveform Generator	33511B	MY52302742	EF-0012-25	11-FEB-26
Digital Multimeter	34461A	MY60024273	CA2025120EA	18-MAR-26
Programmable Attenuator	MAT-1070	62100114	EF-0006-25	11-FEB-26
Condenser Microphone	4180	2977900	AA-1002-25	19-FEB-26
Measuring Amplifier	NA-42KAI	34560495	AA-3002-25	19-FEB-26

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

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

- 3.1. National Institute of Metrology (Thailand).
- 3.2. Electrical And Electronics Institute (EEI).

*T. Petch.*Cert. No. : ACL25184  
Job No. : VC68AC0092  
Page : 4 of 8**Result of calibration :**

## 1. Absolute sensitivity

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

## 2. Self-generated noise

## 2.1 Normal test

Measured Value ( dB )
13.4

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

Frequency Weighting	Weighting ( dB )
A - weight	9.9
C - weight	16.2
Flat	21.8

## 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	0.4	0.4	±1.5
1000	0.0	0.0	0.0	±1.0
8000	-1.0	-0.9	-0.9	±5.0

*T. Petch.*Cert. No. : ACL25184  
Job No. : VC68AC0092  
Pages : 3 of 8**Summary of Measurement Result :**

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

*T. Petch.*Cert. No. : ACL25184  
Job No. : VC68AC0092  
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	-0.1	0.0	±1.5
250	0.1	-0.1	0.0	±1.5
500	0.0	0.0	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.1	0.0	0.1	±2.0
4000	0.1	0.0	0.1	±3.0
8000	0.1	0.0	0.1	±5.0

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

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

## 5.2 Time weighting at 1 kHz

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

## 6. Long - term stability

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

*T. Petch.*



Cert. No. : ACL25184  
Job No. : VC68AC0092  
Pages : 6 of 8

## 7. Level linearity on the reference level range

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

T. Petchum

Cert. No. : ACL25184  
Job No. : VC68AC0092  
Pages : 7 of 8

## 8. Level linearity including the level range control

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

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

## 9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	108.0	0.0	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.1	0.1	±1.0
Slow	2	8	108.0	108.1	0.1	1.0 ; -5.0
	200	800	127.6	127.7	0.1	±1.0
	0.25	1	99.0	99.0	0.0	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

T. Petchum

Cert. No. : ACL25184  
Job No. : VC68AC0092  
Pages : 8 of 8

## 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	130.0	130.0	0.0	±3.0
One	133.4	133.4	0.0	±3.0

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

## 11. Overload indication

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

## 12. High level stability

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

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

End of Calibration Certificate

T. Petchum

451-45/11 Sirinoh Road Bangbunru Bangkok, 10720 Thailand  
Tel : +66 2432 833 Email : cal@bangsithiporn.comCert. No. : ACL24220  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-52A / Microphone UC-59 / Preamplifier NH-25  
Serial No.: 00531295 / 23094 / 32971  
ID No.: NKH\_1 S0131

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 JULY 2024  
Calibration Date : 09-10 JULY 2024  
Date of Issue : 12 JULY 2024

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchum  
( Thanakul Petchum )

REVIEW BY	<i>Nathakorn</i>
APPROVED BY	<i>T. Petchum</i>
NEXT CAL DATE	9/5/25

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

**SITHIPORN ASSOCIATES CO., LTD.**  
**CALIBRATION LABORATORY**

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

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Cert. No. : ACL24220  
Job No. : VC67AC0118  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

**Calibration Method :**

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

**Condition of this result of calibration :**

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-24	05-1 FEB-25
Waveform Generator	33511B	MY52302742	EF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	EEL-BP 21/0267	13-FF-B-25
Digital Multimeter	33461A	MY53220076	FEL-BP 20/0267	15-FEB-25
Digital Multimeter	33461A	MY60024273	EEL-BP 22/0267	15-FEB-25
Programmable Attenuator	MAT-1070	62100114	EF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KAI	34560495	AA-3001-24	05-FEB-25

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

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

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

*T. Petch*

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Cert. No. : ACL24220  
Job No. : VC67AC0118  
Pages : 3 of 8

**Summary of Measurement Result :**

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

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Cert. No. : ACL24220  
Job No. : VC67AC0118  
Page : 4 of 8

**Result of calibration :**

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.94)	94.0	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
13.4

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

Frequency Weighting	Weighting (dB)
A-weight	8.7
C-weight	13.4
Flat	19.1

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.1	0.1	0.1	± 1.0
1000	0.0	0.0	0.0	± 0.7
8000	-0.2	-0.1	-0.1	-1.5, -2.5

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Cert. No. : ACL24220  
Job No. : VC67AC0118  
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	-0.1	0.0	-0.1	±1.0
125	0.0	0.0	-0.1	±1.0
250	0.0	0.0	-0.1	±1.0
500	0.0	0.0	-0.1	±1.0
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±1.0
4000	0.0	0.0	0.0	±1.0
8000	0.0	0.0	0.0	+1.5, -2.5
16000	0.0	-1.2	-1.2	+2.5, -16.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long-term stability

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

*T. Petch*

Cert. No. : ACL24220  
Job No. : VC67AC0118  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.1	0.1	±0.8
136.0	136.1	0.1	±0.8
135.0	135.1	0.1	±0.8
134.0	134.1	0.1	±0.8
133.0	133.0	0.0	±0.8
132.0	132.0	0.0	±0.8
131.0	131.0	0.0	±0.8
129.0	129.1	0.1	±0.8
124.0	124.0	0.0	±0.8
119.0	119.1	0.1	±0.8
114.0	114.1	0.1	±0.8
109.0	109.1	0.1	±0.8
104.0	104.1	0.1	±0.8
99.0	99.1	0.1	±0.8
94.0	94.0	0.0	±0.8
89.0	89.0	0.0	±0.8
84.0	84.0	0.0	±0.8
79.0	79.0	0.0	±0.8
74.0	74.0	0.0	±0.8
69.0	69.0	0.0	±0.8
64.0	64.0	0.0	±0.8
59.0	59.0	0.0	±0.8
54.0	54.0	0.0	±0.8
49.0	49.0	0.0	±0.8
44.0	44.0	0.0	±0.8
39.0	39.0	0.0	±0.8
34.0	34.0	0.0	±0.8
30.0	30.0	0.0	±0.8
29.0	29.0	0.0	±0.8
28.0	28.0	0.0	±0.8
27.0	27.0	0.0	±0.8
26.0	26.0	0.0	±0.8
25.0	24.9	-0.1	±0.8

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Cert. No. : ACL24220  
Job No. : VC67AC0118  
Pages : 7 of 8

## 8. Level linearity including the level range control

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

## 9. Tone burst response

Time	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.0 : -3.0
	2	8	117.0	117.0	0.0	1.0 : -1.5
	200	800	134.0	134.0	0.0	±0.5
Slow	2	8	108.0	108.0	0.0	1.0 : -3.0
	200	800	127.6	127.6	0.0	±0.5
SEL	0.25	1	99.0	98.9	-0.1	1.0 : -3.0
	2	8	108.0	108.0	0.0	1.0 : -1.5
	200	800	128.0	128.0	0.0	±0.5

## 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	±2.0
One	136.4	135.4	-1.0	±2.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±1.0
Positive half cycle	135.4	135.1	-0.3	±1.0
Negative half cycle	135.4	135.1	-0.3	±1.0

T. Petchur

Cert. No. : ACL24220  
Job No. : VC67AC0118  
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	±0.1

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

End of Calibration Certificate

T. Petchur

Cert. No. : ACL24221  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-52A / Microphone UC-59 / Pre-amplifier NH-25  
Serial No. : 00531296 / 23161 / 32972  
ID No. : NKH FS0132

Condition As Found : GOOD

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

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

Received Date : 02 JULY 2024  
Calibration Date : 09-10 JULY 2024  
Date of Issue : 12 JULY 2024

Calibrated by : Nathakorn Pisutpaisan

Approved by : T. Petchur  
( Thanakul Petchurai )

REVIEW BY	Nathakorn P
APPROVED BY	T. Petchur
NEXT CAL DATE	9/3/25

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Cert. No. : ACL24221  
Job No. : VC67AC0118  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

**Calibration Method :**

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

**Condition of this result of calibration :**

**1. Reference Standard Instruments :**

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	ET-0009-24	05-FEB-25
Waveform Generator	33511B	MY52302742	EF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	FEL-BP 21/0267	13-FEB-25
Digital Multimeter	33461A	MY53220076	FEL-BP 20/0267	15-FEB-25
Digital Multimeter	33461A	MY60024273	EEL-BP 22/0267	15-FEB-25
Programmable Attenuator	MAT-1070	62100114	EF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KAI	34560495	AA-3001-24	05-FEB-25

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.  
3. This certificate is traceable to the international system of unit maintained at :  
3.1 National Institute of Metrology (Thailand).  
3.2 Thailand Institute of Scientific and Technological Research (TISTR)

*T. Petch.*

**SITHIPORN ASSOCIATES CO., LTD.**  
**CALIBRATION LABORATORY**

45/45/1 Srinthorn Road Bangumnu Bangkok 10700 Thailand  
Tel : +66 2433 8331 Email : calibration@sithiporn.com

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Cert. No. : ACL24221  
Job No. : VC67AC0118  
Page : 4 of 8

**Result of calibration :**

**1. Absolute sensitivity**

Reference Acoustic Signal ( dB )	Measured Value ( dB )	Deviation ( dB )	Acceptance Limit ( dB )
93.9 (93.94)	94.0	0.0	±0.3

**2. Self-generated noise**

**2.1 Normal test**

Measured Value ( dB )
13.8

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

Frequency Weighting	Weighting ( dB )
A - weight	9.9
C - weight	15.3
Flat	21.0

**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	0.1	0.1	0.1	± 1.0
1000	0.1	0.1	0.1	± 0.7
8000	0.4	0.4	0.4	+ 1.5, - 2.5

*T. Petch.*

**SITHIPORN ASSOCIATES CO., LTD.**  
**CALIBRATION LABORATORY**

45/45/1 Srinthorn Road Bangumnu Bangkok 10700 Thailand  
Tel : +66 2433 8331 Email : calibration@sithiporn.com

SITHIPORN  
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Cert. No. : ACL24221  
Job No. : VC67AC0118  
Pages : 3 of 8

**Summary of Measurement Result :**

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

*T. Petch.*

**SITHIPORN ASSOCIATES CO., LTD.**  
**CALIBRATION LABORATORY**

45/45/1 Srinthorn Road Bangumnu Bangkok 10700 Thailand  
Tel : +66 2433 8331 Email : calibration@sithiporn.com

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Cert. No. : ACL24221  
Job No. : VC67AC0118  
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	±1.0
125	0.0	0.0	0.0	±1.0
250	0.0	0.0	0.0	±1.0
500	0.0	0.0	0.0	±1.0
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±1.0
4000	0.0	0.0	0.0	±1.0
8000	0.0	0.1	0.1	+ 1.5, - 2.5
16000	0.0	-1.2	-1.2	+ 2.5, -16.0

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

**5.1 Frequency weightings at 1 kHz**

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

**5.2 Time weighting at 1 kHz**

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

**6. Long - term stability**

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

*T. Petch.*

Cert. No. : ACL24221  
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## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±0.8
136.0	136.0	0.0	±0.8
135.0	135.0	0.0	±0.8
134.0	134.0	0.0	±0.8
133.0	133.0	0.0	±0.8
132.0	132.0	0.0	±0.8
131.0	131.0	0.0	±0.8
129.0	129.0	0.0	±0.8
124.0	124.0	0.0	±0.8
119.0	119.0	0.0	±0.8
114.0	114.0	0.0	±0.8
109.0	109.0	0.0	±0.8
104.0	104.0	0.0	±0.8
99.0	99.0	0.0	±0.8
94.0	94.0	0.0	±0.8
89.0	89.0	0.0	±0.8
84.0	84.0	0.0	±0.8
79.0	79.0	0.0	±0.8
74.0	74.0	0.0	±0.8
69.0	69.0	0.0	±0.8
64.0	64.0	0.0	±0.8
59.0	59.0	0.0	±0.8
54.0	53.9	-0.1	±0.8
49.0	49.0	0.0	±0.8
44.0	44.0	0.0	±0.8
39.0	38.9	-0.1	±0.8
34.0	33.9	-0.1	±0.8
30.0	29.9	-0.1	±0.8
29.0	28.9	-0.1	±0.8
28.0	27.9	-0.1	±0.8
27.0	27.0	0.0	±0.8
26.0	26.0	0.0	±0.8
25.0	25.0	0.0	±0.8

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Cert. No. : ACL24221  
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## 8. Level linearity including the level range control

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

## 9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.0 ; -3.0
	2	8	117.0	117.0	0.0	1.0 ; -1.5
	200	800	134.0	134.0	0.0	±0.5
Slow	2	8	108.0	108.0	0.0	1.0 ; -3.0
	200	800	127.6	127.6	0.0	±0.5
SEL	0.25	1	99.0	98.9	-0.1	1.0 ; -3.0
	2	8	108.0	108.0	0.0	1.0 ; -1.5
	200	800	128.0	128.1	0.1	±0.5

## 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	±2.0
One	136.4	136.3	-0.1	±2.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±1.0
Positive half cycle	135.4	135.2	-0.2	±1.0
Negative half cycle	135.4	135.2	-0.2	±1.0

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## 11. Overload indication

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

## 12. High level stability

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

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

End of Calibration Certificate

Cert. No. : ACL24223  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-52A / Microphone UC-59 / Preamplifier NH-25  
Serial No. : 00531298 / 23203 / 32974  
ID No. : NKH\_FS0134

Condition As Found : GOOD

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

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

Received Date : 02 JULY 2024  
Calibration Date : 09-10 JULY 2024  
Date of Issue : 12 JULY 2024

Calibrated by : Nathakorn Pisutpaisan

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.

T. Petch



Calibration Procedure : CP-AC-01

**Calibration Method :**

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

**Condition of this result of calibration :**

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-24	05-FEB-25
Waveform Generator	33511B	MY52302742	EF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	EEL-BP 21/0267	13-FEB-25
Digital Multimeter	33461A	MY53220076	EEL-BP 20/0267	15-FEB-25
Digital Multimeter	34461A	MY60024273	EEL-BP 22/0267	15-FEB-25
Programmable Attenuator	MA1-1070	62100114	EF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KA1	34560495	AA-3001-24	05-FEB-25

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

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

3.1 National Institute of Metrology (Thailand)

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

*T. Petch*

**Result of calibration :**

1. Absolute sensitivity

Reference Acoustic Signal ( dB )	Measured Value ( dB )	Deviation ( dB )	Acceptance Limit ( dB )
93.9 (93.94)	94.0	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value ( dB )
13.8

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

Frequency Weighting	Weighting ( dB )
A - weight	9.9
C - weight	15.0
Flat	20.6

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	-0.1	-0.1	-0.1	± 1.0
1000	-0.1	-0.1	-0.1	± 0.7
8000	0.0	0.1	0.1	- 1.5, - 2.5

*T. Petch*

**Summary of Measurement Result :**

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

*T. Petch*

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency ( Hz )	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	0.0	0.0	±1.0
125	0.0	0.1	0.0	±1.0
250	0.0	0.0	0.0	±1.0
500	0.0	0.1	0.0	±1.0
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	0.0	±1.0
4000	0.0	0.0	0.0	±1.0
8000	0.0	0.1	0.1	+ 1.5, - 2.5
16000	0.0	-1.2	-1.1	+ 2.5, -16.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

*T. Petch*

Cert. No. : ACL24223  
Job No. : VC67AC0118  
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## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±0.8
136.0	136.0	0.0	±0.8
135.0	135.0	0.0	±0.8
134.0	134.0	0.0	±0.8
133.0	133.0	0.0	±0.8
132.0	132.0	0.0	±0.8
131.0	131.0	0.0	±0.8
129.0	129.0	0.0	±0.8
124.0	124.0	0.0	±0.8
119.0	119.0	0.0	±0.8
114.0	114.0	0.0	±0.8
109.0	109.0	0.0	±0.8
104.0	104.0	0.0	±0.8
99.0	99.0	0.0	±0.8
94.0	94.0	0.0	±0.8
89.0	89.0	0.0	±0.8
84.0	84.0	0.0	±0.8
79.0	79.0	0.0	±0.8
74.0	74.0	0.0	±0.8
69.0	69.0	0.0	±0.8
64.0	64.0	0.0	±0.8
59.0	59.0	0.0	±0.8
54.0	54.0	0.0	±0.8
49.0	49.0	0.0	±0.8
44.0	44.0	0.0	±0.8
39.0	39.0	0.0	±0.8
34.0	33.9	-0.1	±0.8
30.0	29.9	-0.1	±0.8
29.0	28.9	-0.1	±0.8
28.0	27.9	-0.1	±0.8
27.0	26.9	-0.1	±0.8
26.0	25.9	-0.1	±0.8
25.0	24.9	-0.1	±0.8

T. Petchu-

Cert. No. : ACL24223  
Job No. : VC67AC0118  
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## 8. Level linearity including the level range control

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

## 9. Tone burst response

Time	Tone burst duration, T <sub>b</sub> (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	108.0	0.0	1.0 ; -3.0
	2	8	117.0	117.0	0.0	1.0 ; -1.5
	200	800	134.0	134.1	0.1	±0.5
Slow	2	8	108.0	108.0	0.0	1.0 ; -3.0
	200	800	127.6	127.6	0.0	±0.5
SEL	0.25	1	99.0	98.9	-0.1	1.0 ; -3.0
	2	8	108.0	108.0	0.0	1.0 ; -1.5
	200	800	128.0	128.1	0.1	±0.5

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L <sub>peak</sub> (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±2.0
One	136.4	135.9	-0.5	±2.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	132.9	-0.1	±1.0
Positive half cycle	135.4	135.1	-0.3	±1.0
Negative half cycle	135.4	135.1	-0.3	±1.0

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## 11. Overload indication

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

## 12. High level stability

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

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

End of Calibration Certificate

T. Petchu-

Cert. No. : ACL24218  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-52A / Microphone UC-59 / Preamplifier NH-25  
Serial No. : 00531293 / 23025 / 32969  
ID No. : NKJ1 FS0129

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PIATTHANAKAN 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 JULY 2024  
Calibration Date : 09-10 JULY 2024  
Date of Issue : 12 JULY 2024

Calibrated by : Nonthakorn Pisutpaisan

Approved by :

T. Petchu-  
( 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.

**SITHIPORN ASSOCIATES CO., LTD.**  
**CALIBRATION LABORATORY**

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



Cert. No. : ACL24218  
Job No. : VC67AC0118  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

**Calibration Method :**

This equipment was calibrated by follow on IEC-61672-3 (2013) Standard for sound level meter (SLM).  
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

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

**Condition of this result of calibration :**

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-24	05-FEB-25
Waveform Generator	33511B	MY52302742	EF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	EEL-BP 21/0267	13-11-25
Digital Multimeter	33461A	MY53220076	EEL-BP 20/0267	15-FEB-25
Digital Multimeter	34461A	MY60024273	EEL-BP 22/0267	15-FEB-25
Programmable Attenuator	MAT-1070	62100114	EF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KAI	34560495	AA-3001-24	05-FEB-25

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

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

3.1 National Institute of Metrology (Thailand).

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

*T. Reth...*

**SITHIPORN ASSOCIATES CO., LTD.**  
**CALIBRATION LABORATORY**

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



Cert. No. : ACL24218  
Job No. : VC67AC0118  
Pages : 3 of 8

**Summary of Measurement Result :**

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

*T. Reth...*

**SITHIPORN ASSOCIATES CO., LTD.**  
**CALIBRATION LABORATORY**

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



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**Result of calibration :**

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.94)	94.0	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
13.4

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

Frequency Weighting	Weighting (dB)
A - weight	8.7
C - weight	14.5
Flat	20.3

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	0.0	0.0	0.0	± 1.0
1000	0.0	0.0	0.0	± 0.7
8000	0.5	0.5	0.5	+ 1.5, - 2.5

*T. Reth...*

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



Cert. No. : ACL24218  
Job No. : VC67AC0118  
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	-0.1	0.0	±1.0
125	0.0	0.0	0.0	±1.0
250	0.0	0.0	0.0	±1.0
500	0.0	0.0	0.0	±1.0
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±1.0
4000	0.0	0.0	0.0	±1.0
8000	0.0	0.1	0.1	+ 1.5, - 2.5
16000	0.0	-1.2	-1.2	+ 2.5, -16.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

*T. Reth...*

CerL No. : ACL24218  
Job No. : VC67AC0118  
Pages : 6 of 8

### 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±0.8
136.0	136.0	0.0	±0.8
135.0	135.0	0.0	±0.8
134.0	134.0	0.0	±0.8
133.0	133.0	0.0	±0.8
132.0	132.0	0.0	±0.8
131.0	131.0	0.0	±0.8
129.0	129.0	0.0	±0.8
124.0	124.0	0.0	±0.8
119.0	119.0	0.0	±0.8
114.0	114.0	0.0	±0.8
109.0	109.0	0.0	±0.8
104.0	104.0	0.0	±0.8
99.0	99.0	0.0	±0.8
94.0	94.0	0.0	±0.8
89.0	89.0	0.0	±0.8
84.0	84.0	0.0	±0.8
79.0	79.0	0.0	±0.8
74.0	74.0	0.0	±0.8
69.0	69.0	0.0	±0.8
64.0	64.0	0.0	±0.8
59.0	59.0	0.0	±0.8
54.0	54.0	0.0	±0.8
49.0	49.0	0.0	±0.8
44.0	44.0	0.0	±0.8
39.0	39.0	0.0	±0.8
34.0	34.0	0.0	±0.8
30.0	30.0	0.0	±0.8
29.0	29.0	0.0	±0.8
28.0	28.0	0.0	±0.8
27.0	27.0	0.0	±0.8
26.0	26.0	0.0	±0.8
25.0	25.0	0.0	±0.8

J. Petrich

Cert. No. : ACL24218  
Job No. : VC67AC0118  
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 )
Audio	94.0	94.0	0.0	±0.8

### 9. Tone burst response

Time Weighting	Tone burst duration, Tb ( ms )	Cycle	Anticipated Value ( dB )	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Fast	0.25	1	108.0	107.9	-0.1	1.0 ; -3.0
	2	8	117.0	117.0	0.0	1.0 ; +1.5
	200	800	134.0	134.0	0.0	±0.5
Slow	2	8	108.0	108.0	0.0	1.0 ; -3.0
	200	800	127.6	127.6	0.0	±0.5
SEL	0.25	1	99.0	98.9	-0.1	1.0 ; -3.0
	2	8	108.0	108.0	0.0	1.0 ; +1.5
	200	800	128.0	128.0	0.0	±0.5

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value ( dB )	Measured Value, $L_{peak}$ ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Continuous	133.0	133.0	0.0	$\pm 2.0$
One	136.4	135.5	-0.9	$\pm 2.0$

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	132.9	-0.1	±1.0
Positive half cycle	135.4	135.1	-0.3	±1.0
Negative half cycle	135.4	135.1	-0.3	±1.0

G. Petch.

Cert. No. : ACL24218  
Job No. : VC67AC0118  
Pages : 8 of 8

## 11. Overload indication

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

## 12. High level stability

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

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

End of Calibration Certificate

## CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

Certificate No. : CDT-217-67

MEASUREMENT ITEM  
MANUFACTURER  
MODEL/TYPE  
SERIAL NUMBER  
ID NUMBER  
CONDITION AS-RECEIVED  
CUSTOMER

- Heat Stress Monitor
- Delta OIM
- HD32.2
- 1500G715
- RYG\_FS0220
- Used item

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

RECEIVED DATE	11 Dec 2024
MEASUREMENT DATE	: 20 Dec 2024
ISSUE DATE	23 Dec 2024


**ENVIRONMENTAL CONDITIONS:**  
Ambient condition in the laboratory  
Temperature  
Relative Humidity

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

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

REVIEW BY: Sgt. S.  
APPROVED BY: [Signature]  
NEXT CAL DATE: 2012.05

Calibrated by:  
 T. S. S. & H. H. H.  
 T. S. S. & H. H. H.  
 T. S. S. & H. H. H.

Approved signatory:   
Mr. Pannya Inouchi  
Chairman, Board of Directors

T. Letch

Continuation of Certificate of Calibration Number COT-217-67

Page 1 of 2 Pages

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 °C to 40 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2, S/N: 17022563.  
Dimension: Diameter 3.3 mm, Length 170 mm

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.067	20.0	-0.1	0.090
80	25.054	25.0	-0.1	0.090
80	30.054	30.0	-0.1	0.090
80	35.043	35.0	-0.1	0.090
80	40.034	40.0	-0.1	0.090

Table 2: This equipment was connected with Globe thermometer probe Model: TP3207.2, S/N: 20019632  
Dimension: Diameter 14 mm, Length 205 mm

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.057	20.0	-0.1	0.090
110	25.051	25.0	-0.1	0.090
110	30.054	30.0	-0.1	0.090
110	35.043	35.0	-0.1	0.090
110	40.033	40.0	-0.1	0.090

Table 3: This equipment was connected with temperature probe Model: TP3207.2, S/N: 15015507  
Dimension: Diameter 14 mm, Length 150 mm

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
75	20.057	20.0	-0.1	0.090
75	25.050	25.0	-0.1	0.090
75	30.054	30.0	-0.1	0.090
75	35.043	35.0	-0.1	0.090
75	40.034	40.0	-0.1	0.090

UUC: Under Calibration

\*\*\*End of Certificate of Calibration\*\*\*



Certificate No.: COT-033-68

Page 1 of 2 Pages

MEASUREMENT ITEM: Heat Stress Monitor  
MANUFACTURER: Delta OHM  
MODEL/TYPE: HD32.2  
SERIAL NUMBER: 15006713  
ID NUMBER: RYG\_F50219  
CONDITION AS-RECEIVED: Used Item  
CUSTOMER: ALS laboratory group (Thailand) Co., Ltd.  
104 Phatthanakan Rd, Phatthanakan Rd,  
Khwaeng Suan Luang, Khet Suan Luang,  
Bangkok 10250 Thailand.

RECEIVED DATE: 17 Jan 2025  
MEASUREMENT DATE: 27 Jan 2025  
ISSUE DATE: 29 Jan 2025

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

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

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

Calibration procedure:  
The temperature calibration was done by  
to trace calibration against the 1994-001  
according to comparison method with standard  
digital temperature indicator and standard  
temperature probe. The temperature value was  
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: 11-0347-26, Certificate  
number: 10-0113-24

Reference Used During Calibration:  
3. Standard Temperature Probe  
Model: SITS 100 AS00, Serial No.: 647682-09,  
Due date: 16 Mar 2025  
2. Digital Temperature Indicator  
Model: DTI 1000 A MK II, Serial No.: 671407-  
00591 Due date: 21 Oct 2025

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

REVIEW BY: S.T.S.  
APPROVED BY: [Signature]  
NEXT CAL DATE: 26 Oct 2026



Approved signature: Mr. Parinya Ratanachorn  
Calibration Department Manager

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

Continuation of Certificate of Calibration Number COT-033-68

Page 2 of 2 Pages

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 °C to 40 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2, S/N: 22035270.  
Dimension: Diameter 3.3 mm, Length 170 mm

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.068	20.1	0.0	0.090
80	25.059	25.1	0.0	0.090
80	30.050	30.1	0.1	0.090
80	35.042	35.1	0.1	0.090
80	40.036	40.1	0.1	0.090

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276.2, S/N: 22035462.  
Dimension: Diameter 3.3 mm, Length 205 mm

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.067	20.1	0.0	0.090
110	25.059	25.1	0.1	0.16
110	30.050	30.2	0.1	0.090
110	35.042	35.2	0.2	0.090
110	40.036	40.2	0.2	0.090

Table 3: This equipment was connected with temperature probe Model: TP3207.2, S/N: 15015499.  
Dimension: Diameter 14 mm, Length 150 mm

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
75	20.057	20.1	0.2	0.090
75	25.059	25.2	0.1	0.090
75	30.070	30.1	0.1	0.090
75	35.042	35.1	0.1	0.090
75	40.036	40.0	0.0	0.090

UUC: Under Calibration

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

\*\*\*End of Certificate of Calibration\*\*\*



Certificate No.: COT-216-67

Page 1 of 2 Pages

MEASUREMENT ITEM: Heat Stress Monitor  
MANUFACTURER: Delta OHM  
MODEL/TYPE: HD32.2  
SERIAL NUMBER: 15006711  
ID NUMBER: RYG\_F50217  
CONDITION AS-RECEIVED: Used Item  
CUSTOMER: ALS laboratory group (Thailand) Co., Ltd.  
104 Phatthanakan Rd, Phatthanakan Rd,  
Khwaeng Suan Luang, Khet Suan Luang,  
Bangkok 10250 Thailand

RECEIVED DATE: 11 Dec 2024  
MEASUREMENT DATE: 20 Dec 2024  
ISSUE DATE: 23 Dec 2024

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

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

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

Calibration procedure:  
The temperature calibration was done by  
to trace calibration against the 1994-001  
according to comparison method with standard  
digital temperature indicator and standard  
temperature probe. The temperature value was  
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: 11-0347-26, Certificate  
number: 10-0113-24

Reference Used During Calibration:  
3. Standard Temperature Probe  
Model: SITS 100 AS00, Serial No.: 647682-09,  
Due date: 16 Mar 2025  
2. Digital Temperature Indicator  
Model: DTI 1000 A MK II, Serial No.: 671407-  
00591 Due date: 21 Oct 2022

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

REVIEW BY: S.T.S.  
APPROVED BY: [Signature]  
NEXT CAL DATE: 26 Oct 2026



Approved signature: Mr. Parinya Ratanachorn  
Calibration Department Manager

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

Continuation of Certificate of Calibration Number CDT-216-67

Page 2 of 2 Pages

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Ranges: 20 °C to 40 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3701 2, S/N: 16008706  
Dimension: Diameter 3.3 mm, Length 170 mm

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.012	20.2	0.1	0.039
80	25.061	25.2	0.1	0.039
80	30.012	30.2	0.1	0.039
80	35.015	35.2	0.2	0.039
80	40.015	40.1	0.1	0.039

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276 2, S/N: 17015321  
Dimension: Diameter 3.3 mm, Length 205 mm

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.057	20.2	0.1	0.039
110	25.061	25.2	0.1	0.039
110	30.012	30.2	0.1	0.039
110	35.015	35.2	0.2	0.039
110	40.015	40.1	0.2	0.039

Table 3: This equipment was connected with temperature probe Model: TP3207 2, S/N: 17003350  
Dimension: Diameter 3.3 mm, Length 150 mm

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
75	20.062	20.3	0.2	0.039
75	25.061	25.1	0.0	0.039
75	30.012	30.0	0.1	0.039
75	35.015	35.0	0.1	0.039
75	40.015	40.1	0.1	0.039

UUC: Dry-Bulb Calibration

\*\*\*End of Certificate of Calibration\*\*\*



Accredited calibration laboratory  
ISO/IEC 17025:2017  
MSC 17017:2015  
CALIBRATION 0367

Temperature measurement laboratory  
Calibration services department

## CERTIFICATE OF CALIBRATION

Certificate No. : CDT-216-67

Page 1 of 2 Pages

MEASUREMENT ITEM  
MANUFACTURER  
MODEL/TYPE  
SERIAL NUMBER  
ID NUMBER  
CONDITION AS-RECEIVED  
CUSTOMER

: Heat Stress Monitor  
: Delta OHM  
: HD32 2  
: 15005716  
: RYG, F50521  
: Used Item  
: ALS laboratory group (Thailand) Co., Ltd  
104 Phatthanakan 40, Phatthanakan Rd.,  
Khaeng Suan Luang, Khet Suan Luang,  
Bangkok 10250 Thailand

RECEIVED DATE  
MEASUREMENT DATE  
ISSUE DATE

: 11 Dec 2024  
: 20 Dec 2024  
: 23 Dec 2024

ENVIRONMENTAL CONDITIONS:

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

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

TABULATION OF RESULTS:

The table on next page give the measured values

REVIEW BY: *S/S*  
APPROVED BY: *[Signature]*  
NEXT CAL DATE: 20 Dec 2025



Approved signature:

*[Signature]*  
Mr. Porinya Booncharoen  
Calibration Department Manager

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

Continuation of Certificate of Calibration Number CDT-216-67

Page 2 of 2 Pages

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Ranges: 20 °C to 40 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3701 2, S/N: 18009587  
Dimension: Diameter 3.3 mm, Length 170 mm

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.066	20.1	0.0	0.039
80	25.061	25.1	0.0	0.039
80	30.012	30.1	0.0	0.039
80	35.015	35.0	0.0	0.039
80	40.015	40.0	0.0	0.039

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276 2, S/N: 15015567  
Dimension: Diameter 3.3 mm, Length 205 mm

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.056	20.0	-0.1	0.039
110	25.061	25.0	0.1	0.039
110	30.012	30.1	0.0	0.039
110	35.015	35.0	0.0	0.039
110	40.015	40.0	0.0	0.039

Table 3: This equipment was connected with temperature probe Model: TP3207 2, S/N: 15015402  
Dimension: Diameter 3.3 mm, Length 150 mm

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
75	20.055	20.3	0.2	0.039
75	25.061	25.2	0.1	0.039
75	30.012	30.1	0.0	0.039
75	35.015	35.1	-0.1	0.039
75	40.015	40.0	0.1	0.039

UUC: Dry-Bulb Calibration

\*\*\*End of Certificate of Calibration\*\*\*



Accredited calibration laboratory  
ISO/IEC 17025:2017  
MSC 17017:2015  
CALIBRATION 0367

Temperature measurement laboratory  
Calibration services department

## CERTIFICATE OF CALIBRATION

Certificate No. : CDT-068-68

Page 1 of 2 Pages

MEASUREMENT ITEM  
MANUFACTURER  
MODEL/TYPE  
SERIAL NUMBER  
ID NUMBER  
CONDITION AS-RECEIVED  
CUSTOMER

: Heat Stress Monitor  
: Delta OHM  
: HD32 2  
: 20032243  
: RYG, F50523  
: Used Item  
: ALS laboratory group (Thailand) Co., Ltd  
104 Phatthanakan 40, Phatthanakan Rd.,  
Khaeng Suan Luang, Khet Suan Luang,  
Bangkok 10250 Thailand

RECEIVED DATE  
MEASUREMENT DATE  
ISSUE DATE

: 03 Mar 2025  
: 18 Mar 2025  
: 20 Mar 2025

ENVIRONMENTAL CONDITIONS:

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

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

TABULATION OF RESULTS:

The table on next page give the measured values

REVIEW BY: *S/S*  
APPROVED BY: *[Signature]*  
NEXT CAL DATE: 18 Mar 2026



Approved signature:

*[Signature]*  
Mr. Porinya Booncharoen  
Calibration Department Manager

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



Continuation of Certificate of Calibration Number CDT-068-68

Page 2 of 2 Pages

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 °C to 40 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2, S/N: 21001219.  
Dimension: Diameter 3.3 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.056	19.9	-0.2	0.099
80	25.050	25.0	0.0	0.099
80	30.032	30.0	0.0	0.099
80	35.019	35.0	0.0	0.099
80	39.996	40.0	0.0	0.099

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276.2, S/N: 22023935.  
Dimension: Diameter 3.3 mm. Length 205 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.056	20.1	0.0	0.099
110	25.050	25.1	0.0	0.099
110	30.032	30.0	0.0	0.099
110	35.019	35.0	0.0	0.099
110	39.996	40.0	0.0	0.099

Table 3: This equipment was connected with temperature probe Model: TP3207.2, S/N: 21001786.  
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
75	20.056	20.1	0.0	0.099
75	25.050	25.1	0.1	0.099
75	30.032	30.0	0.0	0.099
75	35.019	35.0	0.0	0.099
75	39.996	40.0	0.0	0.099

UUC\*: Unit Under Calibration

\*\*\*End of Certificate of Calibration\*\*\*



Certificate No. : CDT-069-68

Page 1 of 2 Pages

MEASUREMENT ITEM : Heat Stress Monitor  
MANUFACTURER : Delta OHM  
MODEL/TYPE : HD32.2  
SERIAL NUMBER : 20032249  
ID NUMBER : RYG\_F50524  
CONDITION AS-RECEIVED : Used item  
CUSTOMER : ALS laboratory group (thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd.,  
Khwaeng Sun Luang, Khet Sun Luang,  
Bangkok 10250 Thailand

RECEIVED DATE : 03 Mar 2025  
MEASUREMENT DATE : 18 Mar 2025  
ISSUE DATE : 20 Mar 2025

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

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

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

REVIEW BY: *S.T.S.*  
APPROVED BY: *[Signature]*  
NEXT CAL DATE: 17/03/2026



Calibrated by:  
☐ Mr. Soravut Thachalad  
☒ Miss Nitraporn Lertsomphol  
☐ Miss Ruangrui Poommitt

Approved signatory: *[Signature]*  
Mr. Pariny Booncharoen  
Calibration Department Manager

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

Continuation of Certificate of Calibration Number CDT-069-68

Page 2 of 2 Pages

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 °C to 40 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2, S/N: 21001215.  
Dimension: Diameter 3.3 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.056	20.2	0.1	0.099
80	25.050	25.2	0.2	0.099
80	30.034	30.2	0.2	0.099
80	35.018	35.2	0.2	0.099
80	39.996	40.1	0.1	0.099

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276.2, S/N: 21001244.  
Dimension: Diameter 3.3 mm. Length 205 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.056	20.0	-0.1	0.099
110	25.050	25.0	0.0	0.099
110	30.034	30.0	0.0	0.099
110	35.018	35.0	0.0	0.099
110	39.996	40.0	0.0	0.099

Table 3: This equipment was connected with temperature probe Model: TP3207.2, S/N: 21001790.  
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
75	20.056	20.1	0.0	0.099
75	25.050	25.0	0.0	0.099
75	30.034	29.9	-0.1	0.099
75	35.018	34.9	-0.1	0.099
75	39.996	39.8	-0.2	0.099

UUC\*: Unit Under Calibration

\*\*\*End of Certificate of Calibration\*\*\*



Certificate No. : CDT-035-68

Page 1 of 2 Pages

MEASUREMENT ITEM : Heat Stress Monitor  
MANUFACTURER : Delta OHM  
MODEL/TYPE : HD32.2  
SERIAL NUMBER : 15006726  
ID NUMBER : RYG\_F50226  
CONDITION AS-RECEIVED : Used item  
CUSTOMER : ALS laboratory group (thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd.,  
Khwaeng Sun Luang, Khet Sun Luang,  
Bangkok 10250 Thailand

RECEIVED DATE : 17 Jan 2025  
MEASUREMENT DATE : 27 Jan 2025  
ISSUE DATE : 25 Jan 2025

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

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

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

REVIEW BY: *S.T.S.*  
APPROVED BY: *[Signature]*  
NEXT CAL DATE: 05/01/2026



Calibrated by:  
☐ Mr. Soravut Thachalad  
☒ Miss Nitraporn Lertsomphol  
☐ Miss Ruangrui Poommitt

Approved signatory: *[Signature]*  
Mr. Pariny Booncharoen  
Calibration Department Manager

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

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 °C to 40 °C

**Function:**

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2, S/N: 15015841.  
Dimension: Diameter 3.3 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.057	20.1	0.0	0.09
80	25.050	25.0	-0.1	0.09
80	30.050	30.0	-0.1	0.09
80	35.041	35.0	0.0	0.09
80	40.026	40.0	0.0	0.09

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276.2, S/N: 20008282.  
Dimension: Diameter 3.3 mm. Length 205 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.067	20.1	0.0	0.09
110	25.060	25.1	0.0	0.09
110	30.051	30.1	0.0	0.16
110	35.041	35.1	0.1	0.09
110	40.028	40.0	0.0	0.09

Table 3: This equipment was connected with temperature probe Model: TP3207.2, S/N: 15015494.  
Dimension: Diameter 3.4 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
75	20.057	20.2	0.1	0.09
75	25.050	25.0	0.1	0.09
75	30.051	29.9	0.2	0.09
75	35.041	34.9	0.1	0.09
75	40.026	39.8	0.2	0.09

UUC\*: Unit Under Calibration  
Remark: The reported uncertainty of measurement is 0.16, based on standard uncertainty multiplied by a coverage factor k=2.71 providing a level of confidence of approximately 95%.

\*\*\*End of Certificate of Calibration\*\*\*



**CERTIFICATE OF CALIBRATION**

Certificate No. : CDT-066-68

Page 1 of 2 Pages

MEASUREMENT ITEM : Heat Stress Monitor  
MANUFACTURER : Delta OHM  
MODEL/TYPE : H032.2  
SERIAL NUMBER : 20032241  
ID NUMBER : RYG\_FS0521  
CONDITION AS-RECEIVED : Used Item  
CUSTOMER : ALS Laboratory group (Thailand) Co., Ltd.  
104 Phatthana Road 10/10, Khet Pra, Bangkok 10600 (Thailand)

RECEIVED DATE : 03 Mar 2025  
MEASUREMENT DATE : 17 Mar 2025  
ISSUE DATE : 20 Mar 2025

**ENVIRONMENTAL CONDITIONS:**

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

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

**TABULATION OF RESULTS:**

The table on next page give the measured values.

REVIEW BY: *S/S*  
APPROVED BY: *[Signature]*  
NEXT CAL DATE: 16/02/2026



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

Approved signatory: *[Signature]*  
Mr. Parinya Booncharoen  
Calibration Department Manager

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

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 °C to 40 °C

**Function:**

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2, S/N: 21001217.  
Dimension: Diameter 3.3 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.067	20.1	0.0	0.09
80	25.052	25.1	0.0	0.09
80	30.045	30.1	0.1	0.09
80	35.025	35.1	0.1	0.09
80	40.009	40.1	0.1	0.09

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276.2, S/N: 21001242.  
Dimension: Diameter 3.3 mm. Length 205 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.067	20.0	-0.1	0.09
110	25.052	25.0	-0.1	0.09
110	30.045	30.0	0.0	0.09
110	35.025	35.0	0.0	0.09
110	40.009	40.0	0.0	0.09

Table 3: This equipment was connected with temperature probe Model: TP3207.2, S/N: 21001783.  
Dimension: Diameter 3.4 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
75	20.067	20.2	0.1	0.09
75	25.052	25.1	0.0	0.09
75	30.045	30.0	0.0	0.09
75	35.025	35.0	0.0	0.09
75	40.008	39.9	-0.1	0.09

UUC\*: Unit Under Calibration

\*\*\*End of Certificate of Calibration\*\*\*



**Certificate of Calibration**

Certificate No. : 24PH145  
Page : 1 of 2

Equipment : Lux Meter  
Manufacturer : Tominars  
Model : TM-201L  
Serial No. : 180702490  
ID No. : RYG\_FS0471

Condition As-Received: Used Item

Received Date: 12 March 2024

Calibration Date: 14 March 2024

Reference: 2403-0392WSC

Ambient Temperature: ( 23 ± 2 ) °C

Relative Humidity: ( 50 ± 15 ) %

**Procedure used:**

Calibration were conducted using calibration procedure No. CP-PH01 based on inverse square law technique

**Condition of this result of calibration**

1 Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Photometry & Encorder	LMGuide 9.5 m	120RC003	DL-0064-22	20 Jul 2025
2) Luminous intensity standard lamp	CEL FEL-U	F-1543	TP-1030-23	06 Jun 2024

2 This result of calibration was made on requested at the point specified by customer

3 Test Equipment : Programmable Voltage/Current Source ( Model : OL83A S/N : 18221394 )

4 Test Equipment : Illuminance Meter ( Model : 51002 S/N : 080129 )

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

6 This Certification is traceable to the International System of Unit maintained through:

- National Institute of Metrology Thailand (NIMT)
- National Institute of Metrology (Thailand), NSC-ONSC Accredited No. Calibration 0144

Calibrated by : Nivai Nitas  
Issue Date : 18 March 2024

Approved Signatory :

☐ Phalinee Prabpaipal  
☐ Wanlop Lampkorn  
☐ Nuntawit Khanchai



Cert. No.: 24PH145  
Page: 2 of 2

**Result of calibration:**

( \* ) Without adjustment ( ) After adjustment

Function : Illuminance Measurement	Standard Value	UUC* Reading	Range : 200 lx	Error	Uncertainty
	( lx )	( lx )		( lx )	( ± lx )
	0	0.0		0.0	-
	20	20.1		0.1	0.26
	50	50.0		0.0	0.65
	100	100.0		0.0	1.3
	150	150.0		0.0	2.0
	190	190.0		0.0	2.5

Function : Illuminance Measurement	Standard Value	UUC* Reading	Range : 2000 lx	Error	Uncertainty
	( lx )	( lx )		( lx )	( ± lx )
	200	199		-1	2.6
	500	499		-1	6.6
	1000	1000		0	13
	1500	1501		1	20
	1900	1901		1	25

Function : Illuminance Measurement	Standard Value	UUC* Reading	Range : 20000 lx	Error	Uncertainty
	( lx )	( lx )		( lx )	( ± lx )
	2000	1990		-10	26
	3000	3000		0	39
	4000	4000		0	52
	5000	5000		0	65

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

UUC\* = Unit Under Calibration.

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
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534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250  
TEL. 0-2717-3000-24 FAX 0-2719-9484



**Certificate of Calibration**

Certificate No.: 24PH1577  
Page: 1 of 2

Equipment : Lux Meter  
Manufacturer : PEAK METER  
Model : PM6612L  
Serial No.: H12A-D16324  
ID No.: RYG\_FS0536  
Condition As-Received: Used Item  
Received Date: 11 November 2024  
Calibration Date: 20 November 2024  
Reference: 2411-0341WSC  
Ambient Temperature: ( 23 ± 2 ) °C  
Relative Humidity: ( 50 ± 15 ) %  
Submitted by: ALS Laboratory Group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd.,  
Khwaeng Phatthanakan, Khet Suan Luang,  
Bangkok 10250 Thailand  
Procedure used: Calibration was conducted using calibration procedure No. CP-FH01 based on inverse square law technique.

**Condition of this result of calibration**

1. Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Photometry & Encoder	LMguide 9,6 m	120RC003	DL-0064-22	20 Jul 2025
2) STANDARD LAMP	OL FEL-U	F-1783	TP-1008-24	08 Jan 2025

2. This result of calibration was made on requested at the point specified by customer.

3. Test Equipment : Programmable Voltage/Current Source ( Model : CLB3A, SN : 15221284 ).

4. Test Equipment : Illuminance Meter ( Model : 51002, SN : 080129 )

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

6. This Certification is traceable to the International System of Unit maintained through:-

- National Institute of Metrology Thailand (NIMT)

- National Institute of Metrology (Thailand), NSC-ONSC Accredited No. Calibration 0144

REVIEW BY:	Sgt S
APPROVED BY:	Sgt S
NEXT CAL DATE:	20/11/25

Calibrated by : Nival Nilas  
Issue Date : 20 November 2024

Approved Signatory :  
[ ] Phalinee Prabpaipal  
[ ] Chatchawan Khunpluek  
[✓] Nuntawat Khamsai



Cert. No.: 24PH1577  
Page: 2 of 2

**Result of calibration:**

( ) Without adjustment ( \* ) After adjustment

Function : Illuminance Measurement	Before Adjust	After Adjust	Range : Autorange	Error	Uncertainty
	Standard Value	UUC* Reading	UUC* Reading		
	( lx )	( lx )	( lx )	( lx )	( ± lx )
	0	0.00	0.00	0.00	-
	15	-	14.7	-0.3	0.20
	100	-	99.2	-0.8	1.3
	500	-	499	-1	6.5
	1000	951	1000	0	13
	2000	-	1989	-11	26
	3000	-	2980	-20	39
	4000	-	3980	-20	52
	5000	4730	4980	-20	65

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

Before adjustment light source factor setting mode : L0 = 1.209

After adjustment light source factor setting mode : L0 = 1.271

UUC\* = Unit Under Calibration.

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**Certificate of Calibration**

Cert. No.: 24CH890  
Page: 1 of 2

Equipment : pH Meter  
Manufacturer : Mettler Toledo  
Model : Seven2Go S2  
Serial No. : C219171496  
ID No. : RYG\_FS0550  
Condition As-Received: Used Item  
Received Date: 26 July 2024  
Calibration Date : 30 July 2024  
Reference : 2407-0932DSC-2  
Submitted by : ALS Laboratory Group (Thailand) Co., Ltd. Rayong Branch  
616/10 Moo 5, T. Maenam Khu,  
A. Pluakdaeng, Rayong 21140, Thailand

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

Calibrated by : Warakorn Lamagagrakul  
Approved by :  
Sailthip  
Approved Signatory

( ) Unnoppol Harachai  
( ) Ponpan Paipim  
(✓) Sailthip Meangmai

Issue Date : 30 July 2024

REVIEW BY:	P. Haya T
APPROVED BY:	Sgt S
NEXT CAL DATE:	29/7/25

The Uncertainties are for a confidence probability of approximately 95%

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Cert.No.: 24CH890  
Page: 2 of 2

#### Condition of this calibration result

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC116	23E2802	27 Aug 2024

- This Certification is traceable to SI Through Technology Promotion Association (Thailand - Japan)

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

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	970851	25 Apr 2026
pH 6.986	CPA chem	970852	25 Apr 2025
pH 9.997	CPA chem	970853	25 Apr 2025

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

#### Calibration Results

Function : mV Measurement

Performing standard curve by Document Process Calibrator at pH (4,7,10)

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement ( $\pm$ mV)	Coverage factor k
	pH	mV	mV	pH		
pH Meter S/N: C219171496	4.00	177.48	178	4.00	0.58	2.00
	7.00	0.00	0	7.00	0.58	2.00
	10.00	-177.48	-177	10.00	0.58	2.00

Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH Measurement ( $\pm$ )	Coverage factor k
pH Electrode S/N: 3293237	4.008	4.01	177	0.0071	2.00
	6.986	6.99	2	0.011	2.00
	9.997	10.00	-173	0.0092	2.00

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

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TEL: 0-2717-3000-29 FAX: 0-2719-9484



## Certificate of Calibration

Cert. No.: 24LM121  
Page: 1 of 2

Equipment : pH Meter with Sensor  
Manufacturer : Mettler Toledo  
Model : Seve2Go S2  
Serial No. : C129171496  
ID No. : RYG\_FS0550  
Submitted by : ALS Laboratory Group (Thailand) Co., Ltd. Rayong Branch  
616/10 Moo 5, T. Maenam Khu,  
A. Pluakdaeng, Rayong 21140, Thailand  
Location : TPA On Site Calibration Laboratory  
Received Order : 26 July 2024  
Calibrated Date : 30 July 2024  
Ambient Temperature : ( $26 \pm 10$ ) °C  
Relative Humidity : ( $50 \pm 30$ ) %  
AC Line Voltage : ( $220 \pm 22$ ) V

Calibrated by : Warakorn Lemgagrakul

Approved by :

( ) Porpan Paipim  
( ) Suwit Imjai  
(✓) Kunchit Promprat

Issue Date : 01 August 2024

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written approval of the head of Corporate Services 3: Equipment Calibration and Testing Services.



Equipment : pH Meter with Sensor  
Condition As-Received : Used Item  
Reference : 2407-0932DSC-4

Cert. No.: 24LM121  
Page: 2 of 2

#### Procedure Used :-

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

#### Condition of this result of calibration

1. Reference standard instrument:-  

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Digital Thermometer	3240076	24J317	TPA	21 Mar 2025

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

3. This certification is traceable to the International System of Unit.

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

Result of Calibration :- ( ) Without Adjustment

Function : Temperature measurement.

This instrument was connected with temperature sensor, S/N: 3184175

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty ( $\pm$ °C)	Coverage Factor k
25.0	100	25.004	25.3	0.296	0.16	2.00
30.0	100	30.001	30.4	0.399	0.16	2.00
40.0	100	40.004	40.4	0.396	0.16	2.00
50.0	100	50.004	50.4	0.396	0.16	2.00

UUC\* : Unit Under Calibration

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

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
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TEL: 0-2717-3000-29 FAX: 0-2719-9484



## Certificate of Calibration

Certificate No.: 23E3924  
Page: 1 of 2

Equipment : pH Meter  
Manufacturer : Mettler Toledo  
Model : SevenExcellence  
Serial No. : B634291445  
ID No. : RYG\_EN0152  
Condition As-Received : Used Item  
Received Date : 08 December 2023  
Calibration Date : 14 December 2023  
Reference : 2312-0151DSC  
Ambient Temperature : ( $23 \pm 2$ ) °C  
Relative Humidity : ( $50 \pm 10$ ) %  
Submitted by : ALS Laboratory Group (Thailand) Co., Ltd. Rayong Branch  
616/10 Moo 5, T. Maenam Khu, A. Pluakdaeng  
Rayong 21140, Thailand  
Procedure used : Calibration were conducted using calibration procedure No. CP-E17 according to EURAMET cg-15

#### Condition of this result of calibration

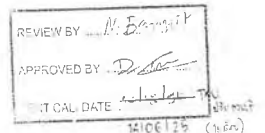
1. Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Multi-Product Calibrator	5502A	2435802	EE-0041-23	26 Apr 2024

2. This result of calibration was made on requested at the point specified by customer

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

4. This Certification is traceable to the International System of Unit maintained through National Institute of Metrology Thailand (NIMT)



Calibrated by : Natchanon Prasomsosin  
Issue Date : 15 December 2023

Approved Signatory :

( ) Phalinee Prasomsin  
(✓) Nuntawat Khanchai  
( ) Pongsaporn Boonysaporn

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Cert. No : 23E3924  
Page.: 2 of 2



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
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TEL 0 2712 5408 19 FAX 0 2719 9100



Cert.No.: 23CH1574  
Page: 1 of 3

Result of calibration :- (\*) Without adjustment ( ) After adjustment

Function: DC voltage measurement		Range: 2000 mV		
Standard Value	UUC* Reading	Error	Uncertainty	
( mV )	( mV )	( mV )	( ± μV )	
-200.0000	-199.9	0.1	68	
-150.0000	-150.0	0.0	65	
-100.0000	-100.0	0.0	63	
-50.0000	-50.0	0.0	61	
0.0000	0.0	0.0	58	
50.0000	50.0	0.0	61	
100.0000	100.0	0.0	63	
150.0000	150.0	0.0	65	
200.0000	199.9	-0.1	68	

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

UUC\*= Unit Under Calibration.

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## Certificate of Calibration

Equipment : pH Meter  
Manufacturer : Mettler Toledo  
Model : SevenExcellence  
Serial No. : B834291445  
ID No. : RYG\_EN0152  
Condition As-Received: Used Item  
Received Date : 08 December 2023  
Calibration Date : 15 December 2023  
Reference : 2312-0151DSC-3  
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd. Rayong Branch  
616/10 Moo 5, T.Maenam Khu, A Pluakdaeng,  
Rayong 21140, Thailand  
Ambient Temperature : (25 ± 2.5) °C  
Relative Humidity : (50 ± 15) %  
Calibration Procedure : In-house method  
- CP-CH5 by direct measurement with standard voltage calibrator and direct measurement with certified reference material (CRM)  
- CP-CH8 by comparison with standard thermometer

Calibrated by : Warakorn Lengragrakul

Approved by :   
Approved Signatory

( ) Sathip Meangmai  
( ) Warakorn Lengragrakul  
(x) Ponpan Palpim

Issue Date : 19 December 2023

The Uncertainties are for a confidence probability of approximately 95 %

The certificate is valid only for the equipment described in the title of this certificate.  
Approved by : Head of Corporate Services / Equipment Calibration and Testing Services

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Cert.No : 23CH1574  
Page.: 2 of 3



Cert.No : 23CH1574  
Page: 3 of 3

### Condition of this calibration result

1. Reference Standard Instrument :-
- | Instrument                     | Serial No. | ID No.   | Cert. No. | Due Date     |
|--------------------------------|------------|----------|-----------|--------------|
| 1) Document Process Calibrator | 54030049   | 130RC116 | 23E2802   | 27 Aug 2024  |
| 2) Ref. Standard Thermometer   | 4982054    | 110RC044 | 231908    | 26 July 2024 |
- This certification is traceable to the International System of Unit maintained through:-  
- Technology Promotion Association (Thailand-Japan)
2. Certified Reference Materials : The measurement results are traceable to SI through CPA chem Ltd.,  
ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	913598	14 July 2025
pH 6.986	CPA chem	931959	01 Oct 2024
pH 9.997	CPA chem	940106	02 Nov 2024

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

### Calibration Results

Function : mV Measurement

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

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement ( ± mV )	Coverage factor k
	pH	mV	mV	pH		
pH Meter S/N : B834291445	4.000	177.48	177.3	4.000	0.058	2.00
	7.000	0.00	-0.1	7.000	0.058	2.00
	10.000	-177.48	-177.5	10.000	0.058	2.00

### Calibration Results

Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading ( mV )	Uncertainty of pH measurement ( ± )	Coverage factor k
pH Electrode S/N : 3225368	4.008	4.013	184.1	0.0045	2.00
	6.986	6.998	8.7	0.0084	2.00
	9.997	10.002	-164.7	0.0088	2.11

### Function : Temperature Measurement

(\*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : InLab®Expert Pro-ISM

- Serial No : 3225368

Dimension of probe;

- Length : 120 mm

- Diameter : 12 mm

- Immersion Depth : 100 mm

Calibration Point ( °C )	Standard Temperature ( °C )	UUC* Reading ( °C )	Error ( °C )	Uncertainty of measurement ( ± °C )	Coverage factor k
25.0	25.003	24.3	-0.703	0.13	2.00

Remark : - UUC\* = Unit Under Calibration

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

-o0o-

a 1193852

a 1193851



# Certificate of Calibration

REVIEW BY *Tharitak*  
APPROVED BY *D. Chonchai*  
NEXT CAL DATE 02/02/2025

Model Number : MSE224S-100-DU  
Description : Analytical Balance  
Serial Number : 0026207038  
ID No : RYG\_EN0002  
Manufacturer : Sartorius  
Certificate No : 24BC0059  
Issued Date : Friday, February 23, 2024  
Reference No : 229196  
Page No : 1 of 2

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

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

Calibrated By : Mr. Chonchai Inthana  
Calibration Date : Thursday, February 22, 2024

Metrological data :  
Capacity : 220 g Readability : 0.0001 g  
Reasons for calibration  
☐ New Installation ☐ Service / Repair ☒ Re-calibration/ Maintenance  
Ambient Conditions:  
Temperature : 24.2 °C ± 5.0 °C  
Humidity : 57.0 % RH ± 10.0 % RH  
Pressure : ±  
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 the unit of measurement according to the International Standard System of Units (SI). Report of Tolerance came from list of Sartorius Metrological Specifications.

## Traceability:

Model Number	Description	Traceability	Certificate No.	Due Date
YCS011-522-00	Sartorius weight set 1mg - 5000g E2 YCS011-522-00	TCS	M2308197S	23-Aug-2025
MHB-382SD	Humidity/Barometer/Temp. Lutron MHB-382SD	DKSH	C18231845	23-Aug-2024

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

Mr. Chonchai Inthana (Technical Manager)  
SARTORIUS  
CALIBRATION 0426

SOP FM 33 03 February 2022

Accredited by

NSC-TISI-TIS 17025  
Calibration 0426

## Calibration certificate

Calibration Certificate No 25BK0004

Object	Electronic non-automatic weighing instrument	This calibration certificate documents the traceability to national standards
Manufacturer	Sartorius	Uncertainties of measurements are taken into account when only statements of compliance are made
Type	MSE224S-100-DU	This certificate was prepared by Sartorius Corporation in accordance to the current ISO/IEC 17025:2017 standard and Sartorius Work Instruction (Method) SOP FM 08
Serial   QM Ident. no	26207038   RYG_EN0002	This certificate relate and apply this equipment only
Customer	ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch)	
Order no	2230	
Number of pages	4	
Date of calibration	20 Feb 2025	

REVIEW BY *Tharitak*  
APPROVED BY *D. Chonchai*  
NEXT CAL DATE 20/02/26

This calibration certificate may not be reproduced other than in full except with the permission of NSC-TISI-TIS-17025 and the issuing laboratory. Calibration certificates without signature are not valid.  
The user is obliged to have the object recalibrated at appropriate intervals

Date 06 Mar 2025 Approval of the Calibration Certificate  
Mr. Chonchai Inthana  
Person in charge  
Kachen Lalee

# Certificate of Calibration

Model Number : MSE224S-100-DU  
Description : Analytical Balance  
Serial Number : 0026207038  
ID No : RYG\_EN0002  
Manufacturer : Sartorius  
Certificate No : 24BC0059  
Issued Date : Friday, February 23, 2024  
Reference No : 229196  
Page No : 2 of 2

## Calibration Results : Without Adjustment

<b>Repeatability</b> The repeatability is the ability of a weighing instrument to display nearly identical results 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 reproducibility qualitatively.	<b>Eccentricity (Off-center loading error)</b> The off-center loading error is yielded by the difference between the result 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 R113).
Nominal Value : (Low Load) 20 g Tolerance 0.0001 g Nominal Value : (High Load) 200 g Tolerance 0.0001 g Standard Deviation 0.00007 0.00006	Nominal value : 100 g Tolerance 0.0004 g Difference 1 - 2 -0.0001 3 -0.0001 4 0.0000 5 -0.0001 6 -

## Linearity

The linearity, also called linearity error, describes the deviation of the characteristic curve of a weighing instrument from the linear slope.

Tolerance 0.0002 g				
Nominal Value (g)	Conventional Mass Value (g)	Displayed Value (g)	Deviation (g)	Uncertainty (g)
0.01	0.0100	0.0100	0.0000	0.00018
0.05	0.0500	0.0500	0.0000	0.00018
0.1	0.1000	0.1000	0.0000	0.00018
0.5	0.5000	0.5000	0.0000	0.00018
1	1.0000	1.0000	0.0000	0.00018
5	5.0000	5.0000	0.0000	0.00018
10	10.0000	10.0000	0.0000	0.00018
20	20.0000	20.0000	0.0000	0.00018
50	50.0000	49.9999	-0.0001	0.00019
100	100.0000	100.0000	0.0000	0.00023
200	200.0000	199.9999	-0.0001	0.00032

End of Report.

SOP FM 33 03 February 2022

Calibration certificate No : 25BK0004

Calibration Certificate

## Calibration object

Single range instrument

Model MSE224S-100-DU  
Serial Number 26207038  
QM Ident. no | Inventory no RYG\_EN0002 | --

Maximum capacity (Max. load) 220 0000 g  
Measured range 220 0000 g  
Scale interval 0.0001 g

## Place of calibration

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

## Calibration procedure

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

## Test equipment

Test equipment type	Test equipment ID	Valid until
Thermometer	MHB-382SD s/nB011342 Traceable to SI unit through DKSH	21 Aug 2025
Test weight set OIML R111 E2	Certificate No M2308197S, E2 (Traceable to SI unit through TCS)	23 Aug 2025



Adjustment Status

The measuring device was internally adjusted before the calibration.

Environmental and measuring conditions

Date of calibration 20 Feb 2025  
Temperature at place of calibration | Temp. diff. 24.4 °C | 0.6 K  
Weights - Tplace  
Measuring conditions The installation site is suitable The device was levelled Balance was loaded up to Max before test  
Comments Humidity 50.2 %RH.

Measurement results | Measurement uncertainties

Repeatability		Eccentricity	
Test load (nominal): 10 g   200 g		Test load (nominal): 100 g	
10 g	200 g	Center	100.0000 g
1 10.0000 g	200.0000 g	Front left	99.9998 g
2 10.0000 g	200.0001 g	Back left	100.0000 g
3 10.0001 g	200.0001 g	Back right	100.0000 g
4 10.0000 g	200.0000 g	Front right	100.0000 g
5 10.0001 g	200.0000 g	Maximum deviation from centric loading indication	
6 10.0001 g	200.0001 g	Δf <sub>cent</sub>   <sub>max</sub> = 0.0002 g	
7 10.0000 g	200.0000 g		
8 10.0000 g	200.0001 g		
9 10.0001 g	200.0000 g		
10 10.0000 g	200.0000 g		
s = 0.00005 g		s = 0.00005 g	

Testload	Indication	Error	Expansion factor	Uncertainty	Uncertainty relative
L	I	E	k	U(E)	U <sub>rel</sub> (E)
0.0100 g	0.0100 g	0.0000 g	2.00	0.00013 g	1.3 %
0.1000 g	0.1000 g	0.0000 g	2.00	0.00013 g	0.13 %
0.5000 g	0.5000 g	0.0000 g	2.00	0.00013 g	0.027 %
1.0000 g	1.0000 g	0.0000 g	2.00	0.00013 g	0.013 %
5.0000 g	5.0000 g	0.0000 g	2.00	0.00014 g	0.0027 %
10.0000 g	10.0000 g	0.0000 g	2.00	0.00014 g	0.0014 %
20.0000 g	20.0000 g	0.0000 g	2.00	0.00014 g	0.00072 %
50.0000 g	50.0000 g	0.0000 g	2.00	0.00016 g	0.00032 %
100.0000 g	100.0001 g	0.0001 g	2.00	0.00021 g	0.00021 %
200.0000 g	200.0000 g	0.0000 g	2.00	0.00034 g	0.00017 %
220.0000 g	220.0000 g	0.0000 g	2.00	0.00039 g	0.00018 %
Maximum error of indication		E  <sub>max</sub> = 0.0001 g			

U<sub>rel</sub>(E) is the quotient of U(E) and test load L. The uncertainty of measurement U(E) is valid only if error E is considered. You will find reference notes on the uncertainty of measurement in use under Appendix to the calibration certificate Interpretation of measurement results.  
Reference note: The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the documented expansion factor, determined in accordance with the European Calibration Guide EURLAMET 09-18, V4.0. There is a 95 % probability that the value of the measurand will be in the assigned value range.

End of calibration certificate

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

Verical®  
Version 6.5

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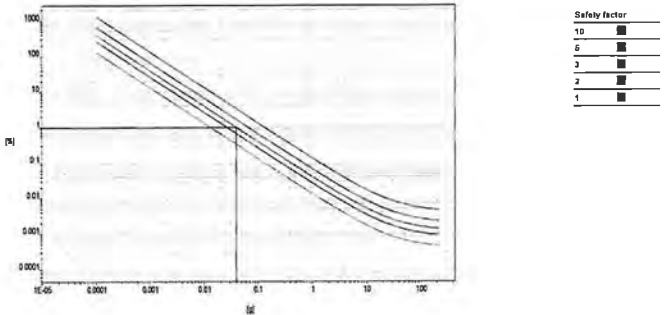
Uncertainty of measurement in use

Device adjusted before measurement Yes  
Temperature deviation considered 1.5 K (isoCAL active)  
Temperature coefficient considered 1 · 10<sup>-4</sup> /K  
Uncertainty of the weighing result U<sub>95</sub>(W) U<sub>95</sub>(W) = 0.00013 g + 3.95 · 10<sup>-4</sup> · R

Reference note: The current uncertainty of measurement is calculated by entering the reading R into the formula. In relation to this, there is no need for a correction of the indication error. The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied with an expansion factor of 2, determined in accordance with the European Calibration Guide EURLAMET 09-18, V4.0. There is a 95 % probability that the value of the measurand will be in the assigned value range.

Indication In % from max load	Net indication R	Uncertainty U <sub>95</sub> (W)	Uncertainty relative U <sub>95</sub> (W)/W
1 %	2.2000 g	0.00014 g	0.0063 %
25 %	55.0000 g	0.00035 g	0.00063 %
50 %	110.0000 g	0.00056 g	0.00051 %
75 %	165.0000 g	0.00078 g	0.00047 %
100 %	220.0000 g	0.00100 g	0.00045 %

Graphic realization of the relative uncertainty of measurement | process accuracy



Displayed example

Process accuracy 1.00 %  
Safety factor 3  
Minimum sample weight 0.0395 g

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

Verical®  
Version 6.5

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
S34/4 PATTANAKARN ROAD SOI 16, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL 0-2717-3000-29 FAX 0-2719-9484



Certificate of Calibration

Cert. No.: 24TM632  
Page : 1 of 3

Equipment : Hot Air Oven  
Manufacturer : Memmert  
Model : UFE 500  
Serial No.: G511.1572  
ID No.: RYG\_EN0010

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

Received Order : 21 March 2024  
Calibration Date : 21 March 2024  
Ambient Temperature : ( 26 ± 10 ) °C  
Relative Humidity : ( 50 ± 30 ) %

Calibrated by : Man Pattanapongpalboon

Approved by :  
( ) Pornthipha Tameyakul  
( ) Unnopphol Harachai  
(x) Suwit Imjai

Issue Date : 22 March 2024

REVIEW BY: *Thanitak*  
APPROVED BY: *D. J. J.*  
NEXT CAL DATE: 21/09/25



Equipment : Hot Air Oven  
Condition As-Received : Used Item  
Reference : 2403-0563OC-1  
Procedure Used :-

Cert. No.: 24TM632  
Page : 2 of 3

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector ( RTD ) and Thermocouple Type T.

The temperature scale used was based on ITS-90.

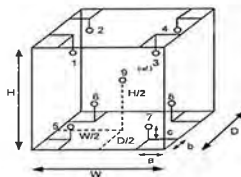
Condition of this result of calibration

- Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1 ) Data Acquisition	MY57013711	23LM115	TPA	11 Jul 2024
- This certificate is valid only to the item calibrated on date and place of calibration.
- This certification is traceable to the International System of Unit.

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

Result of Calibration : ( ° ) Without Adjustment  
Function of UUC : Temperature Source  
Fresh air setting : Close



Probe Installation Details :  
a = 5.0 cm  
b = 5.0 cm  
c = 5.0 cm  
Dimension of Chamber :  
D = 0.40 m  
W = 0.56 m  
H = 0.48 m  
Capacity = 0.11 m³

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	27	27
REL.Humid. ( % )	57	59
AC Supply ( Volt )	222	224

Ref. Std. ID No.: @ Calibration Point		
Position :	( 180 ) °C	( 104 ) °C
1	18-18TC-01	18-18RTD-01
2	18-18TC-02	18-18RTD-02
3	18-18TC-03	18-18RTD-03
4	18-18TC-04	18-18RTD-04
5	18-18TC-05	18-18RTD-05
6	18-18TC-06	23-18RTD-06
7	18-18TC-07	18-18RTD-07
8	18-18TC-08	22-18RTD-08
9 (ref.)	18-18TC-09	18-18RTD-09

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written approval of the head of Corporate Services 3: Equipment Calibration and Testing Services



Equipment : Hot Air Oven  
 Condition As-Received : Used Item  
 Reference : 2403-0563OC-1  
 Result of Calibration : ( \* ) Without Adjustment  
 Function of UUC\* : Temperature Source  
 Fresh air setting : Close

Cert. No.: 24TM632  
 Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
104.0	104.0	104.0	0.051	0.59	0.62	2
180.0	180.0	180.0	0.15	1.3	1.7	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	Position									
	1	2	3	4	5	6	7	8	9 (ref.)	
104.0	103.921	103.786	103.757	103.759	103.950	103.617	104.213	103.672	103.673	0.42
180.0	179.614	179.270	179.145	179.599	180.001	180.423	180.293	180.629	179.429	1.1

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

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

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

UUC\* : Unit Under Calibration

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

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

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
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 TEL 0-2717-3000 FAX 0-2719-9484

Cert.No.: 23TW168  
 Page.: 1 of 2

## Certificate of Testing

Equipment : DO Meter  
 Manufacturer : YSI  
 Model : 5000-115V  
 Serial No. : 15E102796  
 ID No. : RYG\_EN0032  
 Received Date : 21 July 2023  
 Test Date : 24 July 2023  
 Reference : 2307-0713DSC-1  
 Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd  
 Rayong Branch  
 616/10 Moo 5, T.Maenam Khu, A.Pluakdaeng,  
 Rayong 21140, Thailand  
 Laboratory Condition : Temperature ( 25 ± 5 ) °C  
 Humidity ( 50 ± 20 ) %  
 Test Procedure : In - house method : CP-CH9  
 by Comparison Technique with Azide Modification Method  
 Tested by : Walalak Sirilhean  
 Approved by :   
 Approved Signatory  
 ( ) Malee Bulkrua  
 (✓) Sailthip Meangmai  
 ( ) Warakorn Lemgaglakul

Issue Date : 26 July 2023

H 0320211



Cert.No.: 23TW168  
 Page.: 2 of 2

### Condition of this result of calibration

#### 1. Reference Standard Instruments :

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

Instruments	Serial No.	ID No.	Certificate No.	Due Date
1) Burette	-	130BU10	23CG1172	22 Mar 2025
2) Balance	1126143764	140RC004	22MM50	20 Sep 2023

#### 2. Standard Material :-

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

Result : Dissolved Oxygen Meter Adjustment With Air 100 %

Dissolved Oxygen Probe No : 15E100464

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.18	8.17	0.0055

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

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 TEL 0-2717-3000 FAX 0-2719-9484



Cert. No : 23LM125  
 Page.: 1 of 2

## Certificate of Calibration

Equipment : DO Meter with Sensor  
 Manufacturer : YSI  
 Model : 5000-115V  
 Serial No. : 15E102796  
 ID No. : RYG\_EN0032  
 Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd  
 Rayong Branch  
 616/10 Moo 5 T. Maenam Khu, A. Pluakdaeng,  
 Rayong 21140 Thailand  
 Location : TPA On Site Calibration Laboratory  
 Received Order : 25 July 2023  
 Calibrated Date : 27 July 2023  
 Ambient Temperature : ( 26 ± 10 ) °C  
 Relative Humidity : ( 50 ± 30 ) %  
 AC Line Voltage : ( 220 ± 22 ) V  
 Calibrated by : Preecha Hlaib  
 Approved by :   
 Approved Signatory  
 ( ) Ponthippa Tameyakul  
 ( ) Malee Bulkrua  
 (✓) Suwit Imjai  
 Issue Date : 31 July 2023

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced or altered in any way without the prior written approval of the Technology Promotion Association (Thailand-Japan) Calibration and Testing Services.

a 1172155

A 0053616



Equipment : DO Meter with Sensor  
 Condition As-Received : Used Item  
 Reference : 2307-0713DSC-2

Cert. No.: 23LM125  
 Page: 2 of 2

#### Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-OT01 according to comparison with Industrial Platinum Resistance Thermometer (IPRT) into Temperature Bath.

The temperature scale used was based on ITS-90.

#### Condition of this result of calibration

##### 1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Digital Thermometer	2188080	221285	TPA	21 Oct 2023

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

3. This certification is traceable to the International System of Unit.

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

Result of Calibration :- ( \* ) Without Adjustment

Function : Temperature measurement.

This instrument was connected with temperature sensor, S/N: 1228475367

Calibration Point ( °C )	Immersion Depth ( mm )	Standard Temperature ( °C )	UUC* Reading ( °C )	Error ( °C )	Uncertainty ( ± °C )	Coverage Factor k
20.00	100	20.011	19.91	-0.101	0.15	2.00

UUC\* : Unit Under Calibration

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

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a 1159515



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
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## Certificate of Calibration

Cert. No.: 25LM10  
 Page: 1 of 2

Equipment : DO Meter with Sensor

Manufacturer : YSI

Model : 5000-115V

Serial No : 15E102796

ID No : RYG\_EN0032

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

Location : TPA On Site Calibration Laboratory

Received Order : 17 January 2025

Calibrated Date : 20 January 2025

Ambient Temperature : ( 28 ± 10 ) °C

Relative Humidity : ( 50 ± 30 ) %

AC Line Voltage : ( 220 ± 22 ) V

Calibrated by : Warakorn Lemgagtrakul

Approved by :

( ) Chakrit Waewwanjua  
 (✓) Suwit Imjai  
 ( ) Kunchit Prompral

Issue Date : 23 January 2025

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written  
 Approval of the head of Corporate Services 3: Equipment Calibration and Testing Services.

REVIEW BY	Photchanas
APPROVED BY	<i>[Signature]</i>
NEXT CAL DATE	20/07/26



Equipment : DO Meter with Sensor  
 Condition As-Received : Used Item  
 Reference : 2501-0600DSC-2

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

#### Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-OT01 according to comparison with Industrial Platinum Resistance Thermometer (IPRT) into Temperature Bath.

The temperature scale used was based on ITS-90.

#### Condition of this result of calibration

##### 1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Digital Thermometer	2188080	241022	TPA	17 Sep 2025

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

3. This certification is traceable to the International System of Unit.

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

Result of Calibration :- ( \* ) Without Adjustment

Function : Temperature measurement.

This instrument was connected with temperature sensor, S/N: 15E100464

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

UUC\* : Unit Under Calibration

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

-o0o-



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
 CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
 534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
 TEL 0-2717-3000 FAX 0-2719-9484

## Certificate of Testing

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

Equipment : DO Meter

Manufacturer : YSI

Model : 5000-115V

Serial No : 15E102796

ID No : RYG\_EN0032

Received Date : 17 January 2025

Test Date : 20 January 2025

Reference : 2501-0600DSC-1

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

Laboratory Condition : Temperature ( 25 ± 5 ) °C

Humidity ( 50 ± 20 ) %

In - house method : CP-CH9

by Comparison Technique with Azide Modification Method

Tested by :

Walalak Sirinhean

Approved by :

*[Signature]*  
 Approved Signatory

( ) Pornthippa Tameyakul  
 ( ) Ponpan Palpin  
 (✓) Sathip Meangmal

Issue Date : 21 January 2025





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

#### Condition of this result of calibration

##### 1. Reference Standard Instruments :

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

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

##### 2. Standard Material :-

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

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

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

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

-o0o-



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL 0-2717-3000-29 FAX 0-2719-9484



## Certificate of Calibration

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

Equipment : Low Temp. Incubator

Manufacturer : Memmert

Model : IPP750

Serial No. : V818.0084

ID No. : RYG\_EN0154

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

Location : BOD Room

Received Order : 01 November 2024

Calibration Date : 01 November 2024

Ambient Temperature : ( 26 ± 10 ) °C

Relative Humidity : ( 50 ± 30 ) %

AC Line Voltage : ( 220 ± 22 ) V

Calibrated by : Krisda Malee

Approved by :

( ) Ponpan Paipim  
( ) Suwit Imjai  
(✓) Kunchit Promprai

Issue Date : 07 November 2024

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written  
Approval of the head of Corporate Services 3: Equipment Calibration and Testing Services



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

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

#### Procedure Used :-

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

#### Condition of this result of calibration

##### 1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1 ) Data Acquisition	MY44073381	24LM73	TPA	18 May 2025

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

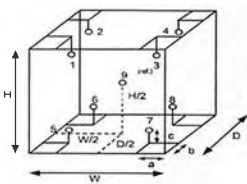
3. This certification is traceable to the International System of Unit.

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

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Close



#### Probe Installation Details :

#### Dimension of Chamber :

a = 10 cm  
b = 10 cm  
c = 10 cm  
D = 0.60 m  
W = 1.0 m  
H = 1.2 m  
Capacity = 0.72 m<sup>3</sup>

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

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



Equipment : Low Temp. Incubator  
Condition As-Received : Used Item  
Reference : 2411-0002OC-1  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Close

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

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

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

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

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

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

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

UUC\* : Unit Under Calibration

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

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

-o0o-





Equipment : Hot Air Oven  
 Condition As-Received : Used Item  
 Reference : 2403-0563OC-3  
 Result of Calibration :- ( ) Without Adjustment  
 Function of UUC\* : Temperature Source  
 Fresh air setting : Close

Cert. No.: 24TM634  
 Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
104.0	104.0	104.0	0.065	0.52	0.90	2
180.0	180.0	180.0	0.20	1.2	2.0	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	1	2	3	4	5	6	7	8	9 (ref.)	
104.0	104.169	103.506	103.898	103.712	103.772	103.730	104.289	103.805	103.798	0.42
180.0	180.701	179.239	179.935	179.999	180.127	180.138	180.895	179.313	180.211	1.1

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

Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.  
 Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.  
 Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.  
 UUC\* : Unit Under Calibration

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

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

-000-



**Metrology**  
 SCI ECO Services Company Limited  
 33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110, Thailand.  
 Saraburi Tel : +66 3627 3096 Fax : +66 3627 3100  
 Bangkok Tel : +668 9205 6851, +668 8247 2360  
 Website : www.scieco.co.th E-Mail : calibrate@scg.com

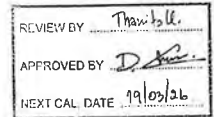


Certificate No. T250454

Page 1 of 3

## Certificate of Calibration

Equipment : Chamber ( Oven )  
 Manufacturer : MEMMERT  
 Model : UF 110  
 Serial No. : B423.0853  
 Customer Code : RYG\_EN0213  
 ID No. : T5884A5  
 Customer : ALS Laboratory Group (Thailand) Co.,Ltd. ( Rayong Branch)



616/10 Moo 5 T.Maenam Khu,

A.Pluakdaeng, Rayong 21140

Customer Location : ENVIRONMENT LABORATORY

Date of Receipt : 12 March 2025

Calibrated By : Sujjar Naknakred ( Site Calibration Manager )

Approved By : Boonchai Suriyawong (Site Calibration Manager)

Date of Issue : 21 MAR 2025

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

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

FM-L1411918-08-66



**Metrology**  
 SCI ECO Services Company Limited  
 33/2 Moo 3, T. Banpa, A. Kaengkhoi, Saraburi 18110, Thailand.



Certificate No. T250454

Page 2 of 3

## Calibration Report

Equipment : Chamber ( Oven )  
 Date of Calibration : 19 March 2025  
 Environment : Temperature : 26.5-26.9 °C  
 Line Voltage : 223.9-231.3 V  
 Relative Humidity : 55 - 65 %RH

### Condition of this results of calibration :

1. This equipment was calibrated by insert nine resistance thermometer detectors into its chamber , the other one resistance thermometer detector use for ambient temperature measurement . The calibration was done in accordance to WI-120 ( based on ASTM E145-94 ( Reapproved 2019 ) and AS2853-1986 ).  
 All data show below were final values and the initial data from customer request . The temperature scale used was based on ITS - 90 .

### 2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
RTD	100 ohm	27-(CH1-10)	T240709	19 April 2025
DATA LOGGER	34970A	T149	T240709	19 April 2025

### 3. This certificate is traceable to :

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

### 4. Condition of calibrated item : good

#### Equipment Description :

Time Constant : 1 Hour 44 Minute At 104 °C  
 Fresh Air Damper : ☐ Open ☐ Min ☐ Medium ☐ Max  
☒ Close  
☐ Not Available

### 5. Adjustment :

( ) without adjustment ( X ) after adjustment

Approved By

*[Signature]*



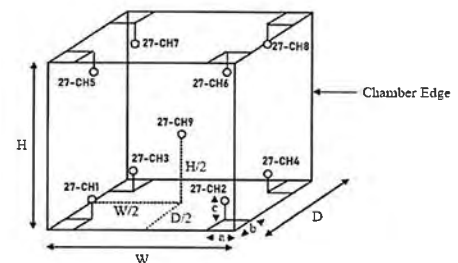
**Metrology**  
 SCI ECO Services Company Limited  
 33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110, Thailand.



Certificate No. T250454

Page 3 of 3

## Calibration Report



Remark : Internal Dimensions of Chamber : W (Width) = 56 cm , H (Height) = 48 cm and D (Depth) = 40 cm  
 Size of Installed Standard sensor number 27-CH1 to number 27-CH8 : a = 5 cm , b = 5 cm and c = 5 cm  
 Size of Installed Standard sensor number 27-CH9 : W/2 = 56 cm /2 , H/2 = 48 cm /2 and D/2 = 40 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	27-CH9
104	103.84	104.10	104.10	104.48	103.73	104.14	103.95	103.57	104.22
180	179.41	179.92	180.80	181.37	179.54	179.52	179.82	179.41	180.31

Chamber ( Oven )			Temperature Distribution				
Setting °C	Reading (°C)		Average (°C)	Stability (± °C)	Uniformity (°C)	Uncertainty (± °C)	Coverage Factor k
	Min	Max					
104.0	103.9	104.1	104.0	0.08	0.65	0.42	2.00
180.0	-	180.0	180.01	0.17	1.26	0.49	2.00

\* The quoted uncertainty exclude 'uniformity'

The calibration result apply only the above calibrated item.

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

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

End of Certificate.

Approved By

*[Signature]*

FM-L15 11818-08-66

FM-L15 11818-08-66





## Calibration Report

Equipment : Chamber ( Cold Room )  
Date of Calibration : 11 June 2024  
Environment : Temperature : 23.1-24.1 °C  
Line Voltage : 222.3-226.3 V  
Relative Humidity : 55 - 65 %RH

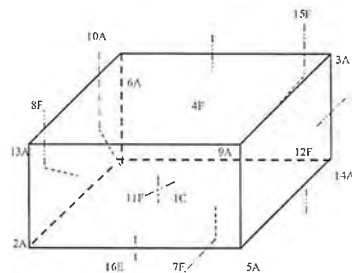
## Condition of this results of calibration :

1. This equipment was calibrated by insert nine standard thermocouples type T into its chamber , the other one standard thermocouples type T use for ambient temperature measurement . The calibration was done in according to WI-T20 ( based on ASTM E145-94 ( Recapproved 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 F | TN161-TN170   | T240713        | 19 April 2025 |
| TC          | TYPE T | TN171-TN180   | T240713        | 19 April 2025 |
| DATA LOGGER | 34970A | TJ49          | T240713        | 19 April 2025 |
3. This certificate is traceable to :  
National Institute of Metrology ( Thailand ) through Metrological Center ( NSC-TIS-17025 CALIBRATION 0244 )
4. Condition of calibrated item : good  
Equipment Description :  
Time Constant : 3 Hour 30 Minute At 3 °C  
Fresh Air Damper : ☐ Open ☐ Min ☐ Medium ☐ Max  
☐ Close  
☒ Not Available
5. Adjustment :  
( ) without adjustment ( X ) after adjustment

Approved By: 


FM-L15111-18-08-60

## 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-L15111-18-08-60

## Calibration Report

## Measurement Results:

Calibration Point	Average Standard Reading at each position (°C)									
	TN161	TN162	TN163	TN164	TN165	TN166	TN167	TN168	TN169	TN170
3	2.73	2.70	2.77	2.78	2.99	2.35	3.09	3.21	3.08	2.90
	TN171	TN172	TN173	TN174	TN175	TN176				
	3.39	3.01	2.92	2.81	2.42	3.42				


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 , 4.4	3.7	2.97	1.32	1.13	2.02	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: 



## Certificate of Calibration

Equipment: SPECTROPHOTOMETER  
Model: DR6000  
Serial No. (or ID.): 1627845 (RYG\_EN0037)  
Manufacturer: HACH  
Condition: In Condition

Certificate No.: C06230441  
Issued Date: 19 September 2023  
Job No.: WO-0005382  
Page: 1 of 3

Customer: ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)  
616/100 Moo 5 T.Maenam Khu,  
A.Pluakdaeng, Rayong 21140, Thailand.

Environment Condition: Temperature 23.9 °C ± 0.2  
Humidity 65.3 %RH ± 1.4

REVIEW BY:   
APPROVED BY:   
NEXT CAL DATE: 18/12/25

Calibration Place: ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch) (Wet Chemistry)  
616/100 Moo 5 T.Maenam Khu,  
A.Pluakdaeng, Rayong 21140, Thailand.

Calibration By: Mr.Nattapat Rungueang  
Calibration Date: 18 September 2023  
The Method used: In house method, CAL-WI-24, based on ASTM E 275-08 and ASTM E 367-04  
Traceability: This certificate is traceable to the CRM maintained by National Institute of Standards and Technology (NIST) through Starna Scientific Limited.

The standard for Wavelength Certificate No. 111583 and 111584  
The standard for Photometric Certificate No. 9114984 and 111588  
The standard for Stray Light Certificate No. 111586 and 111585  
The standard for Spectral resolution Certificate No. 111587

(Mr. Nattapat Rungueang)  
Person in Charge

(Mr. Nitinun Srihawan)  
Authorized signatory

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

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

These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

DKSH Technology Limited  
2533 Sukhumvit Road, Bangkok, Prachinburi, Bangkok 10260  
Phone: +66 2034 1020 Email: info.calibration@dksh.com Website: www.dksh.com/thailand

Delivering Growth - in Asia and Beyond

CAL-FM-C06-15: 12 Sep 2022

Calibration Results:  
Without Adjustment

Wavelength Accuracy (nm), The spectral bandwidth of Std at 2 nm and UUC at 2 nm				
Standard Wavelength	Unit Under Calibration	Correction	Uncertainty	
418.61	418.3	0.31	0.13	
536.66	536.6	0.06	0.13	
637.98	638.3	-0.32	0.13	
748.48	748.7	-0.22	0.13	
807.03	807.4	-0.37	0.13	
Photometric Accuracy (Absorbance)				
Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
420 nm	0.0000	0.000	0.0000	0.0045
	0.2930	0.289	0.0040	0.0045
	0.5168	0.519	-0.0022	0.0045
	1.0298	1.028	0.0008	0.0045
440 nm	0.0000	0.000	0.0000	0.0045
	0.2867	0.283	0.0037	0.0045
	0.5073	0.509	-0.0017	0.0045
	1.0083	1.007	0.0013	0.0045
465 nm	0.0000	0.000	0.0000	0.0045
	0.2516	0.250	0.0016	0.0045
	0.4595	0.462	-0.0025	0.0045
	0.9334	0.933	0.0004	0.0045
546.1 nm	0.0000	0.000	0.0000	0.0045
	0.2481	0.245	0.0011	0.0045
	0.4652	0.466	-0.0008	0.0045
	0.9468	0.946	0.0008	0.0045
590 nm	0.0000	0.000	0.0000	0.0045
	0.2594	0.259	0.0004	0.0045
	0.5040	0.505	-0.0010	0.0045
	1.0032	1.002	0.0012	0.0045
635 nm	0.0000	0.000	0.0000	0.0045
	0.2579	0.257	0.0009	0.0045
	0.4971	0.497	0.0001	0.0045
	0.9720	0.971	0.0010	0.0045

บริษัท ดีเคเอส อีเซีย จำกัด  
DKSH Technology Limited  
2533 สุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260  
2533 Sukhumvit Road, Bangkok, Prachinburi, Bangkok 10260  
Phone: +66 2659 7000 Email: info.calibration@dksh.com Website: www.dksh.com/calibration-thailand

Delivering Growth - In Asia and Beyond

CAL-FM-C06-15: 12 Sep 2022

Calibration Results:  
Without Adjustment

Photometric Accuracy (Absorbance)					
Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty	
235 nm	0.0000	0.000	0.0000	0.0080	
	0.7355	0.737	-0.0015	0.0080	
257 nm	0.0000	0.000	0.0000	0.0080	
	0.8574	0.857	0.0004	0.0080	
313 nm	0.0000	0.000	0.0000	0.0080	
	0.2884	0.280	-0.0038	0.0080	
350 nm	0.0000	0.000	0.0000	0.0080	
	0.6374	0.637	0.0004	0.0080	
Stray light *					
Standard: cut-off		UUC: Wavelength (nm)	UUC: Transmission (%T)	Absorbance ( A)	
280.62 +/- 0.11 nm		280.8	1.3	1.886	
391.44 +/- 0.11 nm		381.4	1.3	1.886	
Spectral Resolution *					
Nominal Concentration 0.02 % w/v		Peak	Trough	Ratio	SBW
Standard Wavelength ( nm )		268.65	266.69	1.38	2.00
UUC: Wavelength (nm)		268.2	266.1		
Std Absorbance ( A)		0.4566	0.2780		
Absorbance ( A)		0.413	0.300		

\* Calibration Marked \* Not TSI Accredited \* in this Certificate have been included for completeness

The End of Certificate

บริษัท ดีเคเอส อีเซีย จำกัด  
DKSH Technology Limited  
2533 สุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260  
2533 Sukhumvit Road, Bangkok, Prachinburi, Bangkok 10260  
Phone: +66 2659 7000 Email: info.calibration@dksh.com Website: www.dksh.com/calibration-thailand

Delivering Growth - In Asia and Beyond

CAL-FM-C06-15: 12 Sep 2022

## ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: WO-00005382

ชนิดเครื่องมือ: SPECTROPHOTOMETER รุ่น: DR6000

หมายเลขเครื่อง: 1627845

ตรวจสอบ (วัน)		ตรวจสอบ (ส่ง)		หมายเหตุ
18 Sep 2023		18 Sep 2023		
ปกติ	ไม่ปกติ	ปกติ	ไม่ปกติ	
General				
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. ความสมบูรณ์เครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. ความสะอาด (ช่องใส่ตัวอย่าง, ภายใน-นอกเครื่อง)	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. สวิตช์ ปิด - เปิด เครื่อง (On-Off Switch)	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. ปุ่มกด (Keypad)	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. หน้าจอ (Display, Screen Contrast)	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Spectrophotometer				
<input type="checkbox"/>	<input type="checkbox"/>	6. แรงดันไฟฟ้า (Battery Backup) >= 2.5 VDC	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	7. ตัวหมุนเลือกความยาวคลื่น (Wavelength Control)	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. ความยาวคลื่น (Wavelength Check)	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	9. แหล่งกำเนิดแสง (UV < 3,000 hour)	<input checked="" type="checkbox"/>	9.2 Hours
<input checked="" type="checkbox"/>	<input type="checkbox"/>	10. แหล่งกำเนิดแสง (Visible < 5,000 hour)	<input checked="" type="checkbox"/>	741.5 Hours
<input checked="" type="checkbox"/>	<input type="checkbox"/>	11. ช่องวัดหลายตัวอย่าง (Carousel Module)	<input checked="" type="checkbox"/>	<input type="checkbox"/>
pH Meter and Conductivity Meter				
<input type="checkbox"/>	<input type="checkbox"/>	12. อิเล็กโทรด (Electrode and Connection Cable)	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	13. ระดับสารละลายใน Electrode (Level KCl)	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	14. ฝาปิดกันลาย Electrode (Dust Protection Hood)	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	15. ยารับอิเล็กทรอนิกส์ (Stand)	<input type="checkbox"/>	<input type="checkbox"/>
Turbidimeter				
<input type="checkbox"/>	<input type="checkbox"/>	16. ค่าความขุ่นที่สุด (No Sample)	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	17. ระยะการส่องสว่างของแสง (>= 2.5 ไม่นเกิน 3.0)	<input type="checkbox"/>	<input type="checkbox"/>
Automatic titrator				
<input type="checkbox"/>	<input type="checkbox"/>	18. สภาพ Piston Burettes	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	19. Function Rinsing and Dosing	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	20. ระบบท่อส่งยาและอุปกรณ์ประกอบ	<input type="checkbox"/>	<input type="checkbox"/>

เห็นด้วย/ข้อแนะนำ: \*656.1nm=656.1nm

\*486.0nm=485.5nm

Mr.Nattapat Rungueang

Service Engineer


บริษัท ดีเคเอส อีเซีย จำกัด  
DKSH Technology Limited  
2533 สุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260  
2533 Sukhumvit Road, Bangkok, Prachinburi, Bangkok 10260  
Phone: +66 2659 7000 Email: info.calibration@dksh.com Website: www.dksh.com/calibration-thailand

Delivering Growth - In Asia and Beyond

CAL-FM-R31-03: 20 Jul 2022



## Certificate of Calibration

Equipment:	SPECTROPHOTOMETER		Certificate No.:	C06250108
Model:	DR6000		Issued Date:	18 March 2025
Serial No. (or ID):	1627845 (RYG_EN0037)		Job No.:	WO-00064379
Manufacturer:	HACH		Page:	1 of 3
Condition:	In Condition			
Customer:	ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch), Photchanas 616/10 Moo 5 T.Maenam Khu, A.Pluakdaeng, Rayong 21140, Thailand.			
Environment Condition:	Temperature	24.4 °C	± 0.3 °C	APPROVED BY  NEXT CAL DATE 18/04/25
	Humidity	60.6 %RH	± 3.5 %RH	
Calibration Place:	ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch) ( Wet Chemistry Lab ) 616/10 Moo 5 T.Maenam Khu, A.Pluakdaeng, Rayong 21140, Thailand			
Calibration By:	Mr.Preecha Phoosai			
Calibration Date:	18 March 2025			
The Method used:	In house method, CAL-WI-24, base on ASTM E 275-08 and ASTM E 387-04			
Traceability:	This certificate is traceable to the CRM maintained by National Institute of Standards and Technology (NIST) through Siama Scientific Limited.			
	The standard for Wavelength Certificate No. 111583 and 111584			
	The standard for Photometric Certificate No. 9114984 and 111588			
	The standard for Stray light Certificate No. 111586 and 111585			
	The standard for Spectral resolution Certificate No. 111587			

(Mr. Preecha Phoosai)  
Person in charge(Miss Kaewkan Suradech)  
Authorized signatory

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

The measurement uncertainty stated is the expanded uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is contained in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).

These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

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2533 Sukhumvit Road, Bangkok, Prachinburi, Bangkok 10260  
Phone: +66 2659 7000 Email: info.calibration@dksh.com Website: www.dksh.com/calibration-thailand

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CAL-FM-C06-15: 11 Mar 2024

Calibration Results:  
Without Adjustment

Wavelength Accuracy (nm), The spectral bandwidth of Std at 2 nm and UUC at 2 nm				
Standard Wavelength	Unit Under Calibration	Correction	Uncertainty	
418.61	418.5	0.11	0.13	
536.66	536.7	-0.04	0.13	
637.98	638.3	-0.32	0.13	
748.48	748.8	-0.32	0.13	
807.03	807.5	-0.47	0.13	
Photometric Accuracy (Absorbance)				
Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
420 nm	0.0000	0.000	0.0000	0.0045
	0.2930	0.291	0.0020	0.0045
	0.5168	0.518	-0.0012	0.0045
	1.0298	1.031	-0.0012	0.0045
440 nm	0.0000	0.000	0.0000	0.0045
	0.2867	0.285	0.0017	0.0045
	0.5073	0.508	-0.0007	0.0045
	1.0083	1.009	-0.0007	0.0045
465 nm	0.0000	0.000	0.0000	0.0045
	0.2516	0.250	0.0016	0.0045
	0.4595	0.461	-0.0015	0.0045
	0.9334	0.935	-0.0016	0.0045
546.1 nm	0.0000	0.000	0.0000	0.0045
	0.2461	0.246	0.0001	0.0045
	0.4852	0.486	-0.0008	0.0045
	0.9468	0.948	-0.0012	0.0045
590 nm	0.0000	0.000	0.0000	0.0045
	0.2594	0.259	0.0004	0.0045
	0.5040	0.505	-0.0010	0.0045
	1.0032	1.004	-0.0008	0.0045
635 nm	0.0000	0.000	0.0000	0.0045
	0.2579	0.258	-0.0001	0.0045
	0.4971	0.497	0.0001	0.0045
	0.9720	0.973	-0.0010	0.0045

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2533 สุขุมวิท ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพฯ 10110  
2533 Sukhumvit Road Bangkok, Phraklang, Bangkok 10110  
Phone +66 2639 7000 Email info@calibration@dksh.com Website: www.dksh.com/calibration-thailand  
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CAL-FM-C06-16 11 Mar 2024

Calibration Results:  
Without Adjustment

Photometric Accuracy (Absorbance)				
Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
235 nm	0.0000	0.000	0.0000	0.0080
	0.7355	0.738	-0.0025	0.0080
257 nm	0.0000	0.000	0.0000	0.0080
	0.8574	0.857	0.0004	0.0080
313 nm	0.0000	0.000	0.0000	0.0080
	0.2864	0.290	-0.0036	0.0080
350 nm	0.0000	0.000	0.0000	0.0080
	0.6374	0.637	0.0004	0.0080
Stray light *				
Standard: cut-off		UUC: Wavelength (nm)	UUC: Transmission (%)	Absorbance (A)
260.62 +/- 0.11 nm		260.6	1.7	1.770
391.44 +/- 0.11 nm		391.4	1.4	1.854
Spectral Resolution *				
Nominal Concentration 0.02 % v/v	Peak	Trough	Ratio	SBW
Standard Wavelength (nm)	268.65	266.69	1.38	2.00
UUC: Wavelength (nm)	268.2	266.2		
Std Absorbance (A)	0.4566	0.2780		
UUC: Absorbance (A)	0.413	0.299		

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

The End of Certificate

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CAL-FM C06-16 11 Mar 2024

## ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: WO-00064379

## Certificate of Calibration

Represent to Certificate of Calibration No. C29240007

ชนิดเครื่องมือ: SPECTROPHOTOMETER รุ่น DR6000		หมายเลขเครื่อง: 1627845	
ตรวจสอบ (วัน)	รายการตรวจสอบ		หมายเหตุ
18 Mar 2025	18 Mar 2025		
ปกติ	ไม่ปกติ	ปกติ	ไม่ปกติ
General			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. ความสมบูรณ์เครื่อง	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. ความสะอาด (ช่องใส่ตัวอย่าง, ภายใน-นอกเครื่อง)	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. สวิทช์ ปิด - เปิด เครื่อง (On-Off Switch)	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. ปุ่มกด (Keypad)	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. หน้าจอ (Display, Screen Contrast)	<input checked="" type="checkbox"/>
Spectrophotometer			
<input type="checkbox"/>	<input type="checkbox"/>	6. แบตเตอรี่ (Battery Backup) >= 2.5 VDC	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	7. ตัวหมุนเลือกความยาวคลื่น (Wavelength Control)	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	8. ความยาวคลื่น (Wavelength Check)	<input checked="" type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	9. แหล่งกำเนิดแสง (UV < 3,000 hour)	<input checked="" type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	10. แหล่งกำเนิดแสง (Visible < 5,000 hour)	<input checked="" type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	11. ช่องวัดหลายตัวอย่าง (Carousel Module)	<input checked="" type="checkbox"/>
pH Meter and Conductivity Meter			
<input type="checkbox"/>	<input type="checkbox"/>	12. อิเล็กโทรด (Electrode and Connection Cable)	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	13. ระดับสารละลายใน Electrode (Level KCl)	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	14. ฝาปิดกันปลาย Electrode (Dust Protection Hood)	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	15. ขาตั้งอิเล็กโทรด (Stand)	<input type="checkbox"/>
Turbidimeter			
<input type="checkbox"/>	<input type="checkbox"/>	16. ค่าความขุ่นตัวอย่าง (No Sample)	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	17. ระดับการส่องสว่างของแสง (>= 2.5 ไม่นเกิน 3.0)	<input type="checkbox"/>
Automatic titrator			
<input type="checkbox"/>	<input type="checkbox"/>	18. หัวฉีด Piston Burettes	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	19. Function Rinsing and Dosing	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	20. ระบบท่อสายยางและอุปกรณ์ประกอบ	<input type="checkbox"/>

เงื่อนไขระบบแนะนำ: \* 656.1nm = 656.1nm  
\* 486.0nm = 485.7nm

Mr.Preecha Phooasai  
Service Engineer

Equipment:	Block Digestion Unit	Certificate No.	C29240011
Model:	KT-20s	Issued Date:	22 March 2024
Serial No. (or ID )	5720210009/5770203073	Job No.:	WO-00020429
Manufacturer:	Gerhardt	Page:	1 of 4
Condition:	In Condition	Digestion Block	20 holes

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

Environment Condition:	Temperature:	25 °C ± 0.7 °C
	Humidity:	54 %RH ± 4.1 %RH
	Voltage:	225 VAC ± 1.7 VAC

REVIEW BY	
APPROVED BY	
NEXT CAL DATE	11 Mar 25

Calibration Place: ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)  
( Wei Chemistry Lab )  
616/10 Moo 5 T Maenam Khu, A Pluakdaeng, Rayong 21140, Thailand.

Calibration By: Mr. Thanathorn Phunook  
Calibration Date: 11 March 2024  
The Method used: In house method base on by comparison with standard  
Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through N.M. Technical Center Laboratory (NTL)  
Certificate No.: TC22/0060

(Mr. Thanathorn Phunook)  
Person in charge

(Mr. Udon Sirichana)  
Authorized signatory

"This certificate is issued by the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international standards or other recognized national standards of laboratories.  
The measurement uncertainty stated in the expanded uncertainty with coverage factor k=2 (95%) is provided in accordance with the Guide to the Expression of Uncertainty in Measurement (GUM).  
These results may be affected by deviations in compliance conditions. The results refer to the items under calibration as indicated. The report shall not be reproduced except by the authorized approval of DKSH Technology Limited.

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2533 Sukhumvit Road Bangkok, Phraklang, Bangkok 10110  
Phone +66 2639 7000 Email info@calibration@dksh.com Website: www.dksh.com/calibration-thailand  
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CAL-FM-R31-03 20 Jul 2022

CAL-FM C29 07 20 Jul 2022

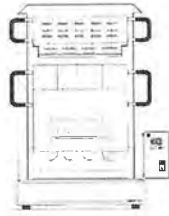
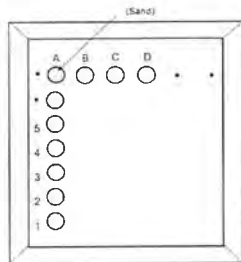


Fig 1 Front view



Location of standard

Fig 2 Digestion block

### Definitions

**Indicating Temperature:** The average reading of indicating device which forms the integral part of the Digestion block

**Measured Temperature:** The average reading of working standard at any positions or location

### Calibration Results:

#### Pre Calibration

Locations	Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature (°C)	Correction of UUC (°C)	Uncertainty (± °C)
A1	380	380	380	401.5	21.5	1.5
A2				401.2	21.2	1.5
A3				399.1	19.1	1.5
A4				397.8	17.8	1.5
A5				395.1	15.1	1.5
B1				396.6	16.6	1.5
B2				396.1	16.1	1.5
B3				397.9	12.9	1.5
B4				391.6	11.6	1.5
B5				390.7	10.7	1.5
C1				395.3	15.3	1.5
C2				395.6	15.6	1.5
C3				392.8	12.8	1.5
C4				391.7	11.7	1.5
C5				390.3	10.3	1.5
D1				397.6	17.6	1.5
D2				396.6	16.6	1.5
D3				395.0	15.0	1.5
D4				394.2	14.2	1.5
D5				393.6	13.6	1.5

### Calibration Results:

#### Without adjustment

Locations	Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature (°C)	Correction of UUC (°C)	Uncertainty (± °C)
A1	380	365	365	382.5	17.5	1.5
A2				382.4	17.4	1.5
A3				382.1	17.1	1.5
A4				379.7	14.7	1.5
A5				376.3	13.3	1.5
B1				380.1	15.1	1.5
B2				380.1	15.1	1.5
B3				378.5	13.5	1.5
B4				378.3	13.3	1.5
B5				378.1	14.1	1.5
C1				380.1	15.1	1.5
C2				380.1	15.1	1.5
C3				378.8	13.8	1.5
C4				378.2	13.2	1.5
C5				377.3	12.3	1.5
D1				380.5	15.5	1.5
D2				380.6	15.6	1.5
D3				378.1	13.1	1.5
D4				378.7	13.7	1.5
D5				377.7	12.7	1.5

The End of Certificate

### ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

เลขที่ใบงาน WO-00020429

ชนิดเครื่องมือ: Block Digestion Unit

รุ่น: KT-20s

หมายเลขเครื่อง: 5720210009/5770200073

ตรวจสอบ (วัน)	รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
		11 Mar 2024	11 Mar 2024	
ปกติ	ไม่ปกติ	ปกติ	ไม่ปกติ	
<b>General</b>				
<input type="checkbox"/>	<input type="checkbox"/>	1. สายไฟ	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	2. การทำงาน Main Switch	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	3. การทำงาน Selector Key	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	4. การแสดงผล Display	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	5. สภาพ Hole	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	6. สภาพฝาปิด	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	7. สภาพตัวเครื่อง	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	8. สภาพแวดล้อม สถานที่ตั้งเครื่อง	<input type="checkbox"/>	<input type="checkbox"/>


ข้อแนะนำ

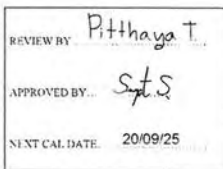
Mr. Thanathorn Phunook  
Service Engineer



## Certificate of Testing

Cert.No.: 24TW201  
Page.: 1 of 2

Equipment : DO Meter  
Manufacturer : Mettler Toledo  
Model : Seven2GO S9  
Serial No. : C231550464  
ID No. : RYG\_FS0601  
Received Date : 19 September 2024  
Test Date : 20 September 2024  
Reference : 2409-0756DSC-4  
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd, Rayong Branch  
616/10 Moo 5, T.Maenam Khu, A.Pluakdaeng,  
Rayong 21140, Thailand  
Laboratory Condition : Temperature (25 ± 5) °C  
Humidity (50 ± 5) %  
Test Procedure : In - house method : CP-CH9  
by Comparison Technique with Azide Modification Method  
Tested by : Walalak Sirithean  
Approved by :   
Approved Signatory  
( ) Unnophol Harachai  
( ) Ponpan Palpim  
(✓) Saitip Meangmai  
Issue Date : 23 September 2024



Cert.No.: 24TW201  
Page.: 2 of 2

### Condition of this result of calibration

1. Reference Standard Instruments :  
This certification is traceable to the International System of Unit through the reference standards  
laboratory of Industrial Calibration Center, Technology Promotion Association (Thailand-Japan).
- | Instruments | Serial No. | ID No.   | Certificate No. | Due Date     |
|-------------|------------|----------|-----------------|--------------|
| 1. Burette  | -          | 130BU10  | 23CG1172        | 22 Mar 2025  |
| 2. Balance  | 14233821   | 110RC001 | 24MM131         | 04 July 2025 |
2. Standard Material :-
- | Material                        | Manufacturer | Lot.No.    | Assay |
|---------------------------------|--------------|------------|-------|
| Sodium Thiosulfate 5-Hydrate AR | KEMAUS       | 2203162447 | 99.6% |

Result : Dissolved Oxygen Meter Adjustment With Air 100 %  
Dissolved Oxygen Probe No.: 940132

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.18	8.16	0.0045


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

-o0o-



## Certificate of Calibration

Cert. No.: 24LM155  
Page.: 1 of 2

Equipment : DO Meter with Sensor  
Manufacturer : Mettler Toledo  
Model : Seven2GO S9  
Serial No. : C231550464  
ID No. : RYG\_FS0601  
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd, Rayong Branch  
616/10 Moo 5, T.Maenam Khu,  
A.Pluakdaeng,  
Rayong 21140, Thailand  
Location : TPA On Site Calibration Laboratory  
Received Order : 19 September 2024  
Calibrated Date : 23 September 2024  
Ambient Temperature : (26 ± 10) °C  
Relative Humidity : (50 ± 30) %  
AC Line Voltage : (220 ± 22) V  
Calibrated by : Warakorn Lemgagrakul  
Approved by :   
Approved Signatory  
( ) Ponpan Palpim  
( ) Suwit Imjai  
(✓) Kunchit Promprat  
Issue Date : 25 September 2024



Equipment : DO Meter with Sensor  
Condition As-Received : Used Item  
Reference : 2409-0756DSC-6  
Cert. No.: 24LM155  
Page.: 2 of 2

### Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-OT01 according to comparison with  
Industrial Platinum Resistance Thermometer (IPRT) into Temperature Bath.

The temperature scale used was based on ITS-90.

### Condition of this result of calibration

1. Reference standard instrument:-
- | Instrument             | Serial No. | Cert. No. | Traceable | Due Date    |
|------------------------|------------|-----------|-----------|-------------|
| 1) Digital Thermometer | 2188080    | 2311216   | TPA       | 11 Oct 2024 |
2. This certificate is valid only to the item calibrated on date and place of calibration.  
3. This certification is traceable to the International System of Unit.

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

Result of Calibration :- ( ) Without Adjustment

Function : Temperature measurement.

This instrument was connected with temperature sensor, S/N.: 940132

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty (± °C)	Coverage Factor k
20.0	80	20.002	20.1	0.098	0.16	2.00

UUC\* : Unit Under Calibration

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

-o0o-

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written  
Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.



## Customer Contact:

ALS Laboratory Group (Thailand) Co  
Ltd Head Office104 Phatthanakan 40 Phatthanakan Rd  
Khwaeng Phatthanakan Khet Suan

TAX ID : 910540004859

Chanatagarn Imchom@alsglobal.com  
27683068

## Invoice To:

ALS Laboratory Group (Thailand) Co  
Ltd Head Office104 Phatthanakan 40 Phatthanakan Rd  
Khwaeng Phatthanakan Khet Suan

## Delivery Site:

ALS Laboratory Group (Thailand) Co  
Ltd Head Office104 Phatthanakan 40 Phatthanakan Rd  
Khwaeng Phatthanakan Khet Suan

## Location:

Room  
Bldg  
Lab  
Dept

## SERVICE REPORT

## Customer Purchase

Order Number:

## Customer Number:

170371013

## Service Request:

## Service Request Date:

## Service Order:

600667E091

## Service Confirmation:

6905876103

REVIEW BY: *Phongph C*APPROVED BY: *Savit N*

NEXT CAL DATE: 23 May 2025

## Direct Inquiries to:

Contact Name:

Contact E-mail:

Contact Telephone:

Contact Fax:

## Customer Contact Center:

ccc-smi@agilent.com

+662 637 6363

+662 637 4334

## Service Instrument:

Model Number	Model Description	Serial Number	System Handle	Parent Asset
SYS-ID: 5100	ICP-OES 5100/5110 System			
68010A	Agilent 5100 SVDV ICP-OES Spectrometer	MY18010005	ICP OES 5100	SYS-ID-5100
68110A	SPS 4 Autosampler	AI115440764	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	22.09.2024	23.09.2024
1010	6610030100	Bottle ICP-OES Wavecal soln 500mL 5 ppm	1.00	Agreement Entitlement 100 % covered		
1020	5190-7001	Calibration blank solution Spect HVD3	1.00	Agreement Entitlement 100 % covered		

## Additional Information:

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U Chulalongkorn Rd 22/F Unit A/D  
101 Rama 4 Road Silom Bangkok  
Bangkok 10250 Thailand  
Tax ID 910540004859Tatjana K. Hengkl Bunch  
315 Interchange 21 Building Sukhumvit Road Klongtoey Nua  
Sub District Wattana District Bangkok 10110 Thailand  
Acc No: 012 4452 007  
TMB Krung Thai Bank PCL  
Sam Sathu Bldg 415/1-2 Rama 1 Rd Pathumwan 50C 10330  
Thailand

ORIGINAL

Page 1 of 3

Page 2 of 3

Service Confirmation Number: 6905876103  
Service Confirmation Date: 23.09.2024

## 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](http://www.scieco.co.th) E-Mail : [calibrate@scg.co.th](mailto:calibrate@scg.co.th)

## Service Information:

<b>Problem Description:</b> WU-IG-IO-5100-5801263655		
<b>Service Provided:</b> Complete OOHV 5100ICPOES Equipment ID: BKK_EL0037, all test passed		
<b>Service Overview Code:</b> Reason Code: Scheduled Service Diagnosis Code: Scheduled Service Resolution Code: Scheduled Service		
<b>Reported Hours:</b> A.D	<b>Travel Hours:</b> Z.D	
<b>Customer Field Service Representative Name:</b> Suwan Onkhom	<b>Customer Field Service Representative Signature:</b> <i>Suwan O.</i>	<b>Date:</b> 23 Sep 2024
<b>Customer Name:</b> CHANATTAGARN IMCHOM	<b>Customer Signature:</b> <i>Phongph C</i>	<b>Date:</b> 23 Sep 2024
<b>Additional Comments:</b>		

Page 3 of 3

Certificate No. T231676

Page 1 of 6

## Certificate of Calibration

Equipment : HEATING BLOCK

Manufacturer : Environmental Express

Model : SC 196

Serial No. : 6974CECW3285

Customer Code : BKK\_EL0054

ID No. : 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 : Sanee Musikawan (Site Calibration Manager)

Approved By : *[Signature]* / Sujjar Naknakred (Site Calibration Manager)

Date of Issue : 26 SEP 2023

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

REVIEW BY: <i>Tattaporn C</i>
APPROVED BY: <i>Savit N</i>
NEXT CAL DATE: 02/03/25

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



## Metrological Center

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

Page 2 of 6

### 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 WI-T20.

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

#### 2. Reference Standard Instrument :

Instrument	Model	Instrument No	Certificate No.	Due Date
TC	TYPE T	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.

FM-L13 108 30-05-57



## Metrological Center

SCI ECO Services Company Limited

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

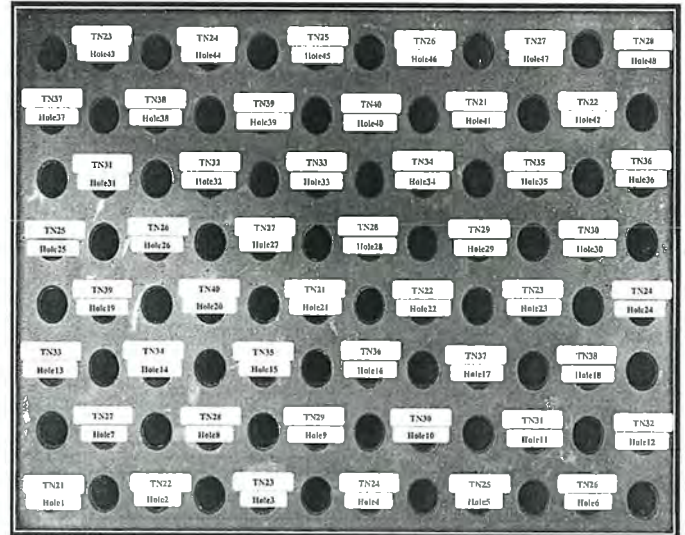
Telephone : +66 2 586 5792-4 Fax : +66 2 586 5109

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

Certificate No. T231676

Page 3 of 6

### Calibration Report



#### FRONT CONTROL

Approved By.

FM-L13 108 30-05-57



## Metrological Center

SCI ECO Services Company Limited

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

Certificate No T231676

Page 4 of 6

### 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 95.17
95	Min 94.57 93.95 94.75 94.92 94.80 94.72
Average	94.79 94.18 94.98 95.17 94.26 94.95
R2 Hole7-Hole12	TN27 TN28 TN29 TN30 TN31 TN32
Max	95.36 95.43 95.19 95.16 95.35 94.97
Min	94.94 94.95 94.72 94.71 94.90 94.57
Average	95.15 95.19 94.96 94.94 95.13 94.77
R3 Hole13-Hole18	TN33 TN34 TN35 TN36 TN37 TN38
Max	95.37 95.50 95.22 95.21 95.33 95.31
Min	94.99 95.09 94.78 94.82 94.88 94.96
Average	95.18 95.30 95.00 95.02 95.11 95.13
R4 Hole19-Hole24	TN39 TN40 TN21 TN22 TN23 TN24
Max	95.59 94.42 94.52 94.24 94.63 94.67
Min	95.21 94.06 94.13 93.88 94.28 94.27
Average	95.40 94.24 94.33 94.06 94.45 94.47
R5 Hole25-Hole30	TN25 TN26 TN27 TN28 TN29 TN30
Max	95.19 95.38 92.93 95.30 95.14 95.03
Min	94.83 95.03 92.56 94.95 94.79 94.70
Average	95.01 95.20 92.75 95.12 94.96 94.87
R6 Hole31-Hole36	TN31 TN32 TN33 TN34 TN35 TN36
Max	94.63 94.90 94.77 94.31 94.24 93.87
Min	94.24 94.55 94.44 93.98 93.92 93.56
Average	94.43 94.72 94.60 94.14 94.08 93.71
R7 Hole37-Hole42	TN37 TN38 TN39 TN40 TN21 TN22
Max	94.30 94.44 94.04 93.81 94.89 95.35
Min	93.95 94.05 93.67 93.48 94.39 94.90
Average	94.12 94.24 93.86 93.65 94.64 95.12
R8 Hole43-Hole48	TN23 TN24 TN25 TN26 TN27 TN28
Max	95.99 95.63 95.28 95.29 95.45 94.87
Min	95.57 95.15 94.82 94.84 94.99 94.48
Average	95.78 95.39 95.05 95.07 95.22 94.68

Approved By.

FM-L13 108 30-05-57



## 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

Page 5 of 6

### 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 105.23 104.32 105.43 105.25 104.44 105.27
105	Min 104.94 103.93 105.15 105.04 104.11 104.96
Average	105.09 104.13 105.29 105.15 104.28 105.12
R2 Hole7-Hole12	TN27 TN28 TN29 TN30 TN31 TN32
Max	105.30 105.12 105.18 105.32 105.12 105.16
Min	105.11 104.92 104.96 105.00 104.92 104.97
Average	105.20 105.02 105.07 105.11 105.02 105.06
R3 Hole13-Hole18	TN33 TN34 TN35 TN36 TN37 TN38
Max	105.37 105.63 105.02 104.80 104.69 105.19
Min	105.17 105.37 104.75 104.59 104.50 105.00
Average	105.27 105.50 104.88 104.69 104.60 105.09
R4 Hole19-Hole24	TN39 TN40 TN21 TN22 TN23 TN24
Max	105.31 104.43 106.41 104.71 105.63 105.82
Min	105.08 104.22 106.15 104.41 105.37 105.56
Average	105.19 104.33 106.28 104.56 105.50 105.69
R5 Hole25-Hole30	TN25 TN26 TN27 TN28 TN29 TN30
Max	104.95 106.26 103.34 105.78 105.59 105.87
Min	104.67 105.96 103.08 105.56 105.36 105.68
Average	104.81 106.11 103.21 105.67 105.48 105.77
R6 Hole31-Hole36	TN31 TN32 TN33 TN34 TN35 TN36
Max	104.75 104.86 104.80 105.20 104.50 104.39
Min	104.54 104.63 104.59 105.00 104.32 104.18
Average	104.65 104.75 104.69 105.10 104.41 104.28
R7 Hole37-Hole42	TN37 TN38 TN39 TN40 TN21 TN22
Max	104.30 104.90 104.85 104.65 104.88 104.85
Min	104.09 104.72 104.66 104.49 104.63 104.52
Average	104.19 104.81 104.75 104.57 104.76 104.68
R8 Hole43-Hole48	TN23 TN24 TN25 TN26 TN27 TN28
Max	105.71 105.85 105.39 105.61 105.42 105.19
Min	105.45 105.61 105.14 105.27 105.18 104.94
Average	105.58 105.73 105.27 105.44 105.30 105.07

Approved By.

FM-L13 108 30-05-57



Certificate No. T231676

Page 6 of 6

## Calibration Report

### Measurement Results:

HEATING BLOCK			Temperature Distribution	
Setting (°C)	Reading (°C)		Stability (± °C)	Uncertainty (± °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 %

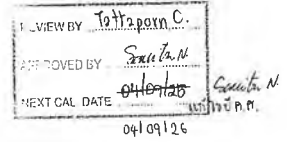
Approved By: \_\_\_\_\_

FM-L12 108/30-05-57

Page 1 of 6

## Certificate of Calibration

**Equipment** : HEATING BLOCK  
**Manufacturer** : Environmental Express  
**Model** : SC 196  
**Serial No.** : 6974CECW3285  
**Customer Code** : BKK\_EL0054  
**ID No.** : TS306A3  
**Customer** : ALS Laboratory Group (Thailand) Co.,Ltd.  
104 Phatthanakan 40, Phatthanakan Rd.,  
Khwaeng Phatthanakan, Khet Suan Luang, Bangkok 10250  
**Customer Location** : Acid Digestion Lab  
**Date of Receipt** : 26 February 2025  
**Calibrated By** : Atiphong Rongrat ( Technician )  
**Approved By** : Boonchai Suriyawong (Site Calibration Manager)  
**Date of Issue** : 17 MAR 2025



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

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

FM-L12 108/30-05-57



Certificate No. T250355

Page 2 of 6

## Calibration Report

**Equipment** : HEATING BLOCK  
**Date of Calibration** : 4 March 2025  
**Environment** : Temperature : 24.4-24.9 °C  
Line Voltage : 221.6-226.3 V  
Relative Humidity : 55 - 65 %RH

### Condition of this results of calibration :

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

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

### 2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	TYPE T	TN221-TN230	T240712	19 April 2025
TC	TYPE T	TN231-TN240	T240712	19 April 2025
TC	TYPE T	TN241-TN250	T240401	16 March 2025
TC	TYPE T	TN251-TN260	T240401	16 March 2025
DATA LOGGER	34970A	T193	T240401	16 March 2025

### 3. This certificate is traceable to :

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

### 4. Condition of calibrated item : good

#### Equipment Description :

Time Constant : 2 Hour 40 Minute At 95 °C  
Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max  
☐ Close  
☒ Not Available

### 5. Adjustment :

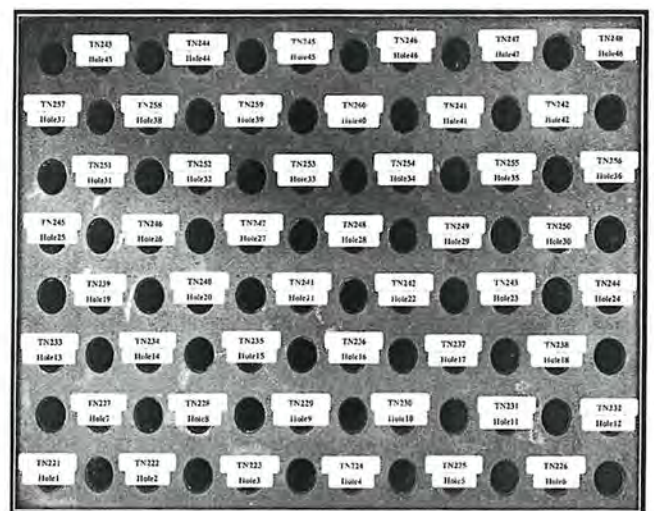
( ) without adjustment ( X ) after adjustment

Approved By: \_\_\_\_\_

FM-L13 108/30-05-57

Page 3 of 6

## Calibration Report



FRONT CONTROL

Approved By: \_\_\_\_\_

FM-L13 108/30-05-57

## Calibration Report

### Measurement Results

Calibration Point	Average Standard Reading at each position (°C)					
R1 Hole1-Hole6	TN221	TN222	TN223	TN224	TN225	TN226
CAL POINT	Max	94.85	95.37	95.03	95.25	95.52
	Min	94.17	94.66	94.38	94.63	94.87
	Average	94.51	95.02	94.70	94.94	95.20
R2 Hole7-Hole12	TN227	TN228	TN229	TN230	TN231	TN232
	Max	94.71	94.56	94.79	95.32	95.44
	Min	94.03	93.88	94.10	94.65	94.90
	Average	94.38	94.22	94.44	94.99	95.17
R3 Hole13-Hole18	TN233	TN234	TN235	TN236	TN237	TN238
	Max	95.26	95.43	95.40	95.71	95.41
	Min	94.54	94.64	94.71	95.10	94.86
	Average	94.90	95.03	95.06	95.41	95.13
R4 Hole19-Hole24	TN239	TN240	TN241	TN242	TN243	TN244
	Max	95.13	95.06	95.68	96.16	95.35
	Min	94.39	94.43	94.86	95.51	94.88
	Average	94.76	94.75	95.27	95.83	95.12
R5 Hole25-Hole30	TN245	TN246	TN247	TN248	TN249	TN250
	Max	94.95	95.81	95.39	95.82	95.66
	Min	94.47	95.03	94.67	94.99	94.84
	Average	94.71	95.42	95.03	95.41	95.25
R6 Hole31-Hole36	TN251	TN252	TN253	TN254	TN255	TN256
	Max	96.07	95.34	96.28	95.39	94.95
	Min	95.28	94.55	95.51	94.62	94.13
	Average	95.67	94.95	95.90	95.00	94.54
R7 Hole37-Hole42	TN257	TN258	TN259	TN260	TN261	TN262
	Max	95.15	95.63	96.11	95.09	95.34
	Min	94.38	94.88	95.32	94.28	94.54
	Average	94.76	95.25	95.71	94.69	94.94
R8 Hole43-Hole48	TN263	TN264	TN265	TN266	TN267	TN268
	Max	95.84	95.87	95.44	95.72	95.65
	Min	95.06	95.10	94.60	94.95	94.87
	Average	95.45	95.48	95.02	95.34	95.26


Approved By: 

FM-L13 108/30-05-57

## Calibration Report

### Measurement Results

Calibration Point	Average Standard Reading at each position (°C)					
R1 Hole1-Hole6	TN221	TN222	TN223	TN224	TN225	TN226
CAL POINT	Max	104.48	104.40	104.60	105.27	105.24
	Min	104.15	104.02	104.25	104.94	104.91
	Average	104.32	104.21	104.42	105.10	105.08
R2 Hole7-Hole12	TN227	TN228	TN229	TN230	TN231	TN232
	Max	105.20	105.45	105.58	105.96	105.81
	Min	104.92	105.14	105.29	105.64	105.53
	Average	105.06	105.29	105.43	105.80	105.67
R3 Hole13-Hole18	TN233	TN234	TN235	TN236	TN237	TN238
	Max	106.09	106.14	105.83	106.25	105.97
	Min	105.80	105.89	105.57	106.00	105.69
	Average	105.94	106.01	105.70	106.13	105.83
R4 Hole19-Hole24	TN239	TN240	TN241	TN242	TN243	TN244
	Max	105.87	105.75	105.30	105.07	105.22
	Min	105.62	105.52	105.13	104.90	105.05
	Average	105.74	105.63	105.21	104.98	105.14
R5 Hole25-Hole30	TN245	TN246	TN247	TN248	TN249	TN250
	Max	105.62	105.54	105.52	105.75	105.97
	Min	105.45	105.35	105.31	105.57	105.81
	Average	105.53	105.44	105.41	105.66	105.89
R6 Hole31-Hole36	TN251	TN252	TN253	TN254	TN255	TN256
	Max	106.19	106.34	106.47	105.96	105.76
	Min	106.02	106.16	106.31	105.77	105.58
	Average	106.10	106.25	106.39	105.87	105.67
R7 Hole37-Hole42	TN257	TN258	TN259	TN260	TN261	TN262
	Max	106.21	105.59	105.45	105.36	106.08
	Min	106.04	105.42	105.28	105.20	105.90
	Average	106.12	105.51	105.37	105.28	105.99
R8 Hole43-Hole48	TN263	TN264	TN265	TN266	TN267	TN268
	Max	106.54	106.33	105.78	105.38	105.42
	Min	106.38	106.16	105.60	105.20	105.25
	Average	106.46	106.25	105.69	105.29	105.33

Approved By: 

FM-L13 108/30-05-57

## Calibration Report

### Measurement Results:

Setting (°C)	HEATING BLOCK		Temperature Distribution	
	Min, Max	Average	Stability (±°C)	Uncertainty (±°C)
102.0	-	102.0	0.43	0.83
107.0	-	107.0	0.20	0.70

\* The quoted uncertainty exclude " uniformity "

The calibration result apply only the above calibrated item.

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

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

Approved By: 

## Certificate of Calibration

Equipment : Chamber ( Cooling Room )

Manufacturer : KOLDTECH

Model : KM 320

Serial No. : TBN-1012061/05

Customer Code : BKK\_EN0167

ID No. : T2463A3

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


104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,

Khet Suan Luang, Bangkok 10250

Customer Location : Laboratory

Date of Receipt : 29 November 2023

Calibrated By : Adiphong Rongrat ( Technician )

Approved By :  / Boonchai Suriyawong (Site Calibration Manager)

Date of Issue : 09 JAN 2024

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

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



Certificate No. T232160

Page 2 of 4

## Calibration Report

Equipment : Chamber ( Cooling Room )  
Date of Calibration : 6 December 2023  
Environment : Temperature : 23.4-24.9 °C  
Line Voltage : 221.4-230.2 V  
Relative Humidity : 55 - 65 %RH

## Condition of this results of calibration :

1. This equipment was calibrated by insert 16 standard thermocouples type T into its chamber , the other one standard thermocouples type T use for ambient temperature measurement . The calibration was done in according to WI-T20 ( based on ASTM E145-94 ( Reapproved 2001 ) and AS2853-1986 ).  
All data show below were final values and the initial data from customer request . The temperature scale used was based on ITS - 90 .
2. Reference Standard Instrument :
- | Instrument  | Model  | Instrument No. | Certificate No. | Due Date      |
|-------------|--------|----------------|-----------------|---------------|
| TC          | TYPE T | TN161-TN170    | T230773         | 10 April 2024 |
| TC          | TYPE T | TN171-TN180    | T230773         | 10 April 2024 |
| DATA LOGGER | 34970A | TJ49           | T230773         | 10 April 2024 |
3. This certificate is traceable to :  
National Institute of Metrology ( Thailand ) through Metrological Center ( NSC-TIS-TIS 17025 CALIBRATION 0244 )
4. Condition of calibrated item : good  
Equipment Description :  
Time Constant 1 Hour 30 Minute At 3 °C  
Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max  
☐ Close  
☒ Not Available
5. Adjustment :  
( X ) without adjustment ( ) after adjustment

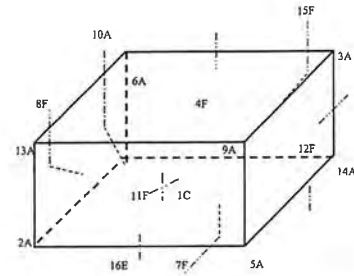
Approved By.

FM-L15 118/18-08-66

Certificate No. T232160

Page 3 of 4

## Calibration Report



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

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

Approved By.

FM-L15 118/18-08-66

Certificate No. T232160

Page 4 of 4

## Calibration Report

## Measurement Results

Calibration Point	Average Standard Reading at each position (°C)											
	TN161	TN162	TN163	TN164	TN165	TN166	TN167	TN168	TN169	TN170	TN171	TN172
3.0	2.83	3.34	2.95	3.46	3.45	3.76	3.25	3.46	3.39	3.50	3.58	3.42
	TN173	TN174	TN175	TN176								
	3.33	3.39	3.15	3.43								

Chamber ( Cooling Room )			Temperature Distribution					
Setting (°C)	Reading (°C)		Average (°C)	Stability (± °C)	Uniformity (°C)	Uncertainty (± °C)	Coverage Factor k	
	Min	Max						
3.0	2.8	4.1	3.5	3.36	1.10	2.00	1.90	2.09

The calibration result apply only the above calibrated item.  
The result of test was found accurate as shown on date and place of test only.  
The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k which for a t-distribution, providing a level of confidence of approximately 95 % .

Approved By.

FM-L15 118/18-08-66

Certificate No. T250873

Page 1 of 4

## Certificate of Calibration

Equipment : Chamber ( Cooling Room )

Manufacturer : KOLDTECH

Model : KM 320

Serial No. : TBN-1012061/05

Customer Code : BKK\_EN0167

ID No. : T2463A3

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

Customer Location : Laboratory Room

Date of Receipt : 28 May 2025

Calibrated By : Atiphong Rongrat ( Technician )

Approved By : / Boonchai Suriyawong (Site Calibration Manager)

Date of Issue : 19 JUN 2025

REVIEW BY :

APPROVED BY :

NEXT CAL DATE : 04/12/26

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

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

FM-L15 118/18-08-66

Certificate No. T250873

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## Calibration Report

Equipment : Chamber (Cooling Room)  
Date of Calibration : 4 June 2025  
Environment : Temperature : 23.4-24.9 °C  
Line Voltage : 221.4-230.2 V  
Relative Humidity : 55 - 65 %RH

## Condition of this results of calibration :

1. This equipment was calibrated by insert 16 standard thermocouples type T into its chamber, the other one standard thermocouples type T use for ambient temperature measurement. The calibration was done in according to WI-T20 (based on ASTM E145-94 (Reapproved 2001) and AS2853-1986)  
All data show below were final values and the initial data from customer request. The temperature scale used was based on ITS - 90

## 2. Reference Standard Instrument :

Instrument	Model	Instrument No	Certificate No	Due Date
TC	TYPE T	TN91-TN100	T242036	3 December 2025
TC	TYPE T	TN101-TN110	T242036	3 December 2025
DATA LOGGER	34970A	TJ21	T242036	3 December 2025

## 3. This certificate is traceable to :

National Institute of Metrology (Thailand) through Metrological Center (NSC-TIS-115 17025 CALIBRATION 0244).

## 4. Condition of calibrated item : good

## Equipment Description :

Time Constant : 2 Hour 20 Minute At 3 °C  
Fresh Air Damper : ☐ Open ☐ Min ☐ Medium ☐ Max  
☐ Close  
☒ Not Available

## 5. Adjustment :

( X ) without adjustment ( ) after adjustment

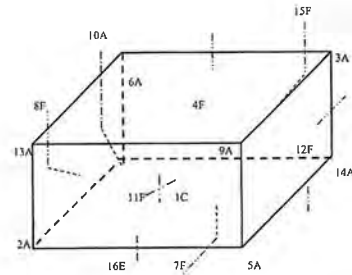
Approved By: 

FM-TL07 102/27-03-68

Certificate No. T250873

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## Calibration Report



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

1C = TN91	12F = TN102
2A = TN92	13A = TN103
3A = TN93	14A = TN104
4F = TN94	15F = TN105
5A = TN95	16E = TN106
6A = TN96	
7F = TN97	
8F = TN98	
9A = TN99	
10A = TN100	
11F = TN101	

Approved By: 

FM-TL07 102/27-03 68

Certificate No. T250873

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## Calibration Report

## Measurement Results


Calibration Point	Average Standard Reading at each position (°C)										
	TN91	TN92	TN93	TN94	TN95	TN96	TN97	TN98	TN99	TN100	TN101
3.0	2.95	2.92	3.09	2.92	3.16	3.50	3.40	3.03	3.14	2.98	3.44
	TN102	TN103	TN104	TN105	TN106						
	3.19	3.06	3.46	2.92							

Chamber (Cooling Room)		Temperature Distribution					Coverage Factor k
Setting (°C)		Reading (°C)		Average (°C)	Stability (± °C)	Uniformity (°C)	
Min	Max	Average					
3.0	2.8 - 3.9	3.4		3.14	1.20	1.30	2.04

The calibration result apply only the above calibrated item.  
The result of test was found accurate as shown on date and place of test only.  
The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k which for a t-distribution, providing a level of confidence of approximately 95 %.

Approved By: 

FM-TL 07 102/27-03-68



REVIEW BY: Autcharawan S

APPROVED BY: Tanawat m

NEXT CAL DATE: 12 Jul 2025

### Certificate of Calibration

#### ICS-2100: Anion (ID#659)

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

**ICS-2100 S/N: 15010977**  
**AS-HV S/N: 5450A36659**

For  
**ALS Laboratory Group (Thailand) Co., Ltd.**

Operator Signature: Nutdanai

Date: Jan 12, 2024

(Mr. Nutdanai Laekhwan)  
Application Chemist



## Certificate of System Qualification

GC-OQ + GCMS-OQ

System ID: GM-10  
Organization Name: ALS Laboratory Group (Thailand) Co., Ltd.  
Organization Location: 104 Pathanakarn Rd., Kwang Suan Luang, Khet Suan Luang, Bangkok 10250

Date: November 21, 2024 2:12:44 PM  
EQP Name: AgilentRecommended, AgilentRecommended

EQP Revision: GC.02.55, GCMS.02.55  
Overall Qualification Status: Pass

REVIEW BY: Suchada T.  
APPROVED BY: Nanti Sorn  
NEXT CAL DATE: 21-May-21

## CDS Logon Verification - GC

Logon: asbkk.emv03

## Overall CDS Logon Verification Test Status

Pass

## System Inspection and Basic Safety and Operation

Name: 7890

Setpoint Status: Pass

## Overall System Inspection and Basic Safety and Operation Test Status

Pass

## Inlet Pressure Accuracy

Name: 7890

Front MMI

## Setpoint Status: Pass

Setpoint: 25.0 psi Actual: 25.2 psi

Accuracy: 0.2 psi

Agilent Recommended: &lt;= 1.2

Date: November 21, 2024 2:12:44 PM

System ID: GM-10

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## Overall Inlet Pressure Accuracy Test Status

Pass

## GC Oven Temperature Accuracy

Name: 7890

Setpoint Status: Pass

Zone: Oven

Setpoint/Actual

Temperature: 230.0 228.2 °C

Accuracy: -1.8 °C

Agilent Recommended: &gt;= -1.0 % setpoint in K &lt;= 1.0 % setpoint in K

(-5.0 °C) (5.0 °C)

Setpoint Status: Pass

Zone: Oven

Setpoint/Actual

Temperature: 100.0 100.7 °C

Accuracy: 0.7 °C

Agilent Recommended: &gt;= -1.0 % setpoint in K &lt;= 1.0 % setpoint in K

(-3.7 °C) (3.7 °C)

## Overall GC Oven Temperature Accuracy Test Status

Pass

NOTE: This test's 2 comment(s) and 0 deviation(s) are available in the Attachments section.

## GC Oven Temperature Stability

Name: 7890

Setpoint Status: Pass

Setpoint/Average

Temperature: 100.0 100.7333 °C

Stability: 0.1 °C

Agilent Recommended: &lt;= 0.5

Date: November 21, 2024 2:12:44 PM

System ID: GM-10

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## Overall GC Oven Temperature Stability Test Status

Pass

NOTE: This test's 1 comment(s) and 0 deviation(s) are available in the Attachments section.

## Tune EI

Tested Combination1 Front MMI / External TQ

Name: 7000D

Setpoint Status: Pass

Filament: 1

Setpoint Status: Pass

Filament: 2

## Overall Tune EI Test Status

Pass

## Scouting Run

Tested Combination1 Front MMI / External TQ

Name: 7693A

Source: EI - Extractor

Setpoint Status: Completed

Injection Volume on Column: 1.0 uL

## Overall Scouting Run Status

Completed

## Instrument Detection Limit

Tested Combination1 Front MMI / External TQ

Name: 7693A

Source: EI - Extractor

## Setpoint Status: Pass

Injection Volume on Column: 1.0 uL

Area: 4.58 %

Agilent Recommended: &lt;= 12.00

Status: Pass

Instrument Detection Limit: 1.54238 fg

Agilent Recommended: &lt;= 4.03800

Status: Pass

Overall Instrument Detection Limit Test Status

Pass

Retention Time: 0.01 %

Agilent Recommended: &lt;= 1.00

Status: Pass

Mass Ratio Precision

Tested Combination1 Front MMI / External TQ

Name: 7693A

Source: EI - Extractor

Setpoint Status: Pass

Injection Volume on Column: 0.5 uL

Area Mass 1: 2.23 %

Abundance's: 5.00 %

Agilent Recommended: &lt;= 5.00

Status: Pass

Overall Mass Ratio Precision Test Status

Pass

Mass Ratio: 0.10 %

Agilent Recommended: &lt;= 5.00

Status: Pass

Date: November 21, 2024 2:12:44 PM

System ID: GM-10

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Date: November 21, 2024 2:12:44 PM

System ID: GM-10

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Instrument Details

Purpose  
This section describes the as found system configuration

Details

System	
System ID	GM-10
Manufacturer	Agilent Technologies
Name	7890
Flow Data Input	Manual Data
Temperature Data Input	Manual Data or Other Data Logging

Tested Combination1	
Injection Technique	Injection Tower
Inlet	Front
Detector	External
LTM Included?	No

Sampler 1	
Manufacturer	Agilent Technologies
Type	Injection Tower
Name	7693A
Model Number	G4513A
Serial Number	CN18180003
Firmware Revision	A.11.02
Usage	Sample Injection
Location	Front
Syringe Volume (µL)	10

Date: November 21, 2024 2:12:44 PM  
System ID: GM-10

Sampler 2	
Manufacturer	Agilent Technologies
Type	Tray
Name	7693A
Model Number	G4514A
Serial Number	CN18170137
Firmware Revision	A.11.03
Vial Heater	Not Installed
Mainframe 1	
Manufacturer	Agilent Technologies
Name	7890
Model Number	G3442B
Serial Number	CN18153080
Firmware Revision	B.02.05
Oven Type	Standard
Inlet 1	
Manufacturer	Agilent Technologies
Name	7890
Type	MMI
Location	Front
Carrier Gas	Helium
Control Type	Electronic Pressure Control (EPC)
Purged Inlet	Yes
Inlet 2	
Manufacturer	Agilent Technologies
Name	7890
Type	SSL
Location	Back
Carrier Gas	Helium
Control Type	Electronic Pressure Control (EPC)
Purged Inlet	Yes

Date: November 21, 2024 2:12:44 PM  
System ID: GM-10

Detector 1	
Manufacturer	Agilent Technologies
Name	Mass Spectrometer
Type	Mass Spectrometer
Location	External
Mass Spectrometer 1	
Manufacturer	Agilent Technologies
Type	TQ
Name	7000D
Model Number	G7000D
Serial Number	US1826U108
Firmware Revision	G 7000.085A
High Vacuum System	Turbo Pump
Liquid Injection Scouting Run Standard	OFN Std

MS EI Source 1	
Manufacturer	Agilent Technologies
Source Type	EI - Extractor
Number of filaments	2

Date: November 21, 2024 2:12:44 PM  
System ID: GM-10

Electronic Signature

Purpose  
This signature page was created and published because the ACE sign-off action was executed, which is valid for the entire document, including attachments. The ACE sign-off is an electronic signature that requires two distinct identification components: unique username and personal password. The Agilent representative who has delivered this service understands the meaning and legal status of an electronic signature. As a trained official operator, the Agilent representative has a unique password and login to access ACE and electronically sign this document. (Other e-signatures can be applied to this document using a Document Content Management or other suitable method defined in your data access and control procedures.)

Details	
Full Name of Signer:	Supasak Nimsongtham
Logged On User Name:	supasak.nimsongtham@agilent.com
Signature Creation Date:	November 21, 2024
Reason for Signature:	Executed protocol and published this original version of document

ACE Self Qualification Status  
The installed version of ACE used to deliver this service passed qualification; the results conform with expected values. The self qualification summary report is available in the session folder location SDS\ClearStore\AceSelfQualification.

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Date: November 21, 2024 2:12:44 PM  
System ID: GM-10

User Name: supasak.nimsongtham  
Report Generated by Hostname: SCD1115HKC  
Print Date: November 21, 2024 2:12:48 PM  
System ID: GM-10

GM-10 2024 Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
November 21, 2024 11:58:17 AM	Audit	Session Created	Session	Host Name: SCD1115HKC, Drive Serial Number: C2031778
November 21, 2024 11:58:17 AM	start	Configuration	Session	None
November 21, 2024 11:58:17 AM	Audit	Entitlement	Licensing	User is Field Engineer and does not require an unlock code
November 21, 2024 12:01:59 PM	Audit	Equipped	Session	EOP details for primary technique (GC) - File path: [Protocol\Pack\GC\Config\user02.55\GC.02.55.eop], EOP File Name: [GC.02.55.eop], EOP Name: [AgilentRecommended], Protocol Revision: [GC.02.55.eop], EOP details for hyphenated technique (GCMS) - File path: [Protocol\Pack\GCMS\Config\user02.56\GCMS.02.56.eop], EOP File Name: [GCMS.02.56.eop], EOP Name: [AgilentRecommended]
November 21, 2024 12:02:04 PM	End	Configuration	Session	None
November 21, 2024 12:02:12 PM	start	Qualification	Session	GC
November 21, 2024 12:02:12 PM	start	Execution	GC Logon Verification - GC - 7890 - Qualitative test	None
November 21, 2024 12:03:09 PM	End	Execution	GC Logon Verification - GC - 7890 - Qualitative test	Run Count: 1

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Date: November 21, 2024 2:12:44 PM  
System ID: GM-10

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User Name: supasak.nimsongtham  
Report Generated by Hostname: SCD1115HKC  
Print Date: November 21, 2024 2:12:48 PM  
System ID: GM-10

GM-10 2024 Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
November 21, 2024 12:03:11 PM	start	Execution	System Inspection and Basic Safety and Operation - 7890 - Qualitative Test - No setpoints associated	None
November 21, 2024 12:03:20 PM	End	Execution	System Inspection and Basic Safety and Operation - 7890 - Qualitative Test - No setpoints associated	Run Count: 1
November 21, 2024 12:03:23 PM	start	Execution	Inlet Pressure Accuracy - Front MM - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	None
November 21, 2024 12:03:28 PM	End	Execution	Inlet Pressure Accuracy - Front MM - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	Run Count: 1
November 21, 2024 12:03:30 PM	start	Execution	GC Oven Temperature Accuracy - 7890 - Temperature Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
November 21, 2024 12:06:02 PM	Audit	Data	GC Oven Temperature Accuracy - 7890 - Temperature Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Date Entry
November 21, 2024 12:06:05 PM	End	Execution	GC Oven Temperature Accuracy - 7890 - Temperature Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Run Count: 1
November 21, 2024 12:06:07 PM	start	Execution	GC Oven Temperature Accuracy - 7890 - Temperature Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
November 21, 2024 12:06:20 PM	Audit	Data	GC Oven Temperature Accuracy - 7890 - Temperature Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Date Entry

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Date: November 21, 2024 2:12:44 PM  
System ID: GM-10

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User Name: supasak.nimsongtham  
Report Generated by Hostname: SCD1115HKC  
Print Date: November 21, 2024 2:12:46 PM  
System ID: GM-10

GM-10 2024 Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
November 21, 2024 12:06:23 PM	End	Execution	GC Oven Temperature Accuracy - 7890 - Temperature Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Run Count: 1
November 21, 2024 12:06:26 PM	start	Execution	GC Oven Temperature Stability - 7890 - Temperature Oven - S: 100.0°C - L: <= 0.5°C	None
November 21, 2024 12:07:10 PM	Audit	Data	GC Oven Temperature Stability - 7890 - Temperature Oven - S: 100.0°C - L: <= 0.5°C	Manual Date Entry
November 21, 2024 12:07:14 PM	End	Execution	GC Oven Temperature Stability - 7890 - Temperature Oven - S: 100.0°C - L: <= 0.5°C	Run Count: 1
November 21, 2024 12:07:16 PM	start	Execution	Tune EI - 70000 TQ - Source - EI - Extractor Flamed 1 (Qualitative - No setpoints associated)	None
November 21, 2024 12:07:26 PM	End	Execution	Tune EI - 70000 TQ - Source - EI - Extractor Flamed 1 (Qualitative - No setpoints associated)	Run Count: 1
November 21, 2024 12:07:28 PM	start	Execution	Tune EI - 70000 TQ - Source - EI - Extractor Flamed 2 (Qualitative - No setpoints associated)	None
November 21, 2024 12:07:39 PM	End	Execution	Tune EI - 70000 TQ - Source - EI - Extractor Flamed 2 (Qualitative - No setpoints associated)	Run Count: 1
November 21, 2024 12:07:41 PM	start	Execution	Scouting Run - Injection Tower, Front MM, TQ - Source - EI - Extractor - Part of GCMS System Preparation	None

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Date: November 21, 2024 2:12:44 PM  
System ID: GM-10

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User Name: supasak.nimsongtham  
Report Generated by Hostname: SCD1115HKC  
Print Date: November 21, 2024 2:12:46 PM  
System ID: GM-10

GM-10 2024 Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
November 21, 2024 12:08:53 PM	Audit	Data	Scouting Run - Injection Tower, Front MM, TQ - Source - EI - Extractor - Part of GCMS System Preparation	Data File Path: C:\GM-10\002046\SC001.D
November 21, 2024 12:09:23 PM	Audit	Reporting	Reintegration Count: 1 - [Integration Type: Integration/Reintegration Mode: Advanced/Initial Slope Sensitivity: 10 Initial Peak Width: 0.01 Initial Area Rejected: Control Height Rejected: 50 Integration: Off at 0 Integration: On at 4]	None
November 21, 2024 12:09:30 PM	End	Execution	Scouting Run - Injection Tower, Front MM, TQ - Source - EI - Extractor - Part of GCMS System Preparation	Run Count: 1
November 21, 2024 12:09:53 PM	start	Execution	Instrument Detection Limit - Injection Tower, Front MM, TQ - Source - EI - Extractor - RSD L (Area) <= 12.00% - RSD L (Ret. Time) <= 1.00%	None
November 21, 2024 12:16:46 PM	Audit	Data	Instrument Detection Limit - Injection Tower, Front MM, TQ - Source - EI - Extractor - RSD L (Area) <= 12.00% - RSD L (Ret. Time) <= 1.00%	Data File Path: C:\GM-10\002046\DC001.D
November 21, 2024 12:16:46 PM	Audit	Data	Instrument Detection Limit - Injection Tower, Front MM, TQ - Source - EI - Extractor - RSD L (Area) <= 12.00% - RSD L (Ret. Time) <= 1.00%	Data File Path: C:\GM-10\002046\DC002.D

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Date: November 21, 2024 2:12:44 PM  
System ID: GM-10

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User Name: supachak.sirachathum  
Report Generated by Hostname: SCD1115HKC  
Print Date: November 21, 2024 2:12:46 PM  
System ID: GM-10

GM-10 2024 Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
November 21, 2024 12:10:40 PM	Audit	Data	Instrument Detection Limit - Injection Tower, Front MM, TQ - Source: EI - Extractor - RSD L (Area) <= 12.00% - RSD L (Rel. Time) <= 1.00%	Data file Path: C:\GM-10 002024V01003.D
November 21, 2024 12:16:46 PM	Audit	Data	Instrument Detection Limit - Injection Tower, Front MM, TQ - Source: EI - Extractor - RSD L (Area) <= 12.00% - RSD L (Rel. Time) <= 1.00%	Data file Path: C:\GM-10 002024V01004.D
November 21, 2024 12:16:47 PM	Audit	Data	Instrument Detection Limit - Injection Tower, Front MM, TQ - Source: EI - Extractor - RSD L (Area) <= 12.00% - RSD L (Rel. Time) <= 1.00%	Data file Path: C:\GM-10 002024V01005.D
November 21, 2024 12:18:47 PM	Audit	Data	Instrument Detection Limit - Injection Tower, Front MM, TQ - Source: EI - Extractor - RSD L (Area) <= 12.00% - RSD L (Rel. Time) <= 1.00%	Data file Path: C:\GM-10 002024V01006.D
November 21, 2024 12:18:47 PM	Audit	Data	Instrument Detection Limit - Injection Tower, Front MM, TQ - Source: EI - Extractor - RSD L (Area) <= 12.00% - RSD L (Rel. Time) <= 1.00%	Data file Path: C:\GM-10 002024V01007.D
November 21, 2024 12:18:47 PM	Audit	Data	Instrument Detection Limit - Injection Tower, Front MM, TQ - Source: EI - Extractor - RSD L (Area) <= 12.00% - RSD L (Rel. Time) <= 1.00%	Data file Path: C:\GM-10 002024V01008.D
November 21, 2024 12:18:47 PM	Audit	Data	Instrument Detection Limit - Injection Tower, Front MM, TQ - Source: EI - Extractor - RSD L (Area) <= 12.00% - RSD L (Rel. Time) <= 1.00%	Data file Path: C:\GM-10 002024V01009.D

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Date: November 21, 2024 2:12:44 PM  
System ID: GM-10

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User Name: supachak.sirachathum  
Report Generated by Hostname: SCD1115HKC  
Print Date: November 21, 2024 2:12:46 PM  
System ID: GM-10

GM-10 2024 Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
November 21, 2024 12:10:47 PM	Audit	Data	Instrument Detection Limit - Injection Tower, Front MM, TQ - Source: EI - Extractor - RSD L (Area) <= 12.00% - RSD L (Rel. Time) <= 1.00%	Data file Path: C:\GM-10 002024V01010.D
November 21, 2024 12:18:15 PM	Audit	Reporting	Reintegration	Reintegration Count: 1 - [ Integration Type: Injection, Baseline Correction Mode: Advanced, Initial Slope Sensitivity: 10, Initial Peak Width: 0.01, Initial Area Reject: 0.01, Initial Height Reject: 0.01, Integration On at 4 ]
November 21, 2024 12:22:42 PM	End	Execution	Instrument Detection Limit - Injection Tower, Front MM, TQ - Source: EI - Extractor - RSD L (Area) <= 12.00% - RSD L (Rel. Time) <= 1.00%	Run Count: 1
November 21, 2024 12:22:52 PM	Start	Execution	Mass Ratio Precision - Injection Tower, Front MM, TQ - Source: EI - Extractor - L (RSD) <= 5.00%	
November 21, 2024 12:27:38 PM	Audit	Data	Mass Ratio Precision - Injection Tower, Front MM, TQ - Source: EI - Extractor - L (RSD) <= 5.00%	Data file Path: C:\GM-10 002024MRP001.D
November 21, 2024 12:27:38 PM	Audit	Data	Mass Ratio Precision - Injection Tower, Front MM, TQ - Source: EI - Extractor - L (RSD) <= 5.00%	Data file Path: C:\GM-10 002024MRP002.D
November 21, 2024 12:27:38 PM	Audit	Data	Mass Ratio Precision - Injection Tower, Front MM, TQ - Source: EI - Extractor - L (RSD) <= 5.00%	Data file Path: C:\GM-10 002024MRP003.D
November 21, 2024 12:27:38 PM	Audit	Data	Mass Ratio Precision - Injection Tower, Front MM, TQ - Source: EI - Extractor - L (RSD) <= 5.00%	Data file Path: C:\GM-10 002024MRP004.D

Page 6 / 7

Date: November 21, 2024 2:12:44 PM  
System ID: GM-10

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User Name: supachak.sirachathum  
Report Generated by Hostname: SCD1115HKC  
Print Date: November 21, 2024 2:12:46 PM  
System ID: GM-10

GM-10 2024 Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
November 21, 2024 12:27:38 PM	Audit	Data	Mass Ratio Precision - Injection Tower, Front MM, TQ - Source: EI - Extractor - L (RSD) <= 5.00%	Data file Path: C:\GM-10 002024MRP005.D
November 21, 2024 12:27:38 PM	Audit	Data	Mass Ratio Precision - Injection Tower, Front MM, TQ - Source: EI - Extractor - L (RSD) <= 5.00%	Data file Path: C:\GM-10 002024MRP006.D
November 21, 2024 12:27:39 PM	Audit	Data	Mass Ratio Precision - Injection Tower, Front MM, TQ - Source: EI - Extractor - L (RSD) <= 5.00%	Data file Path: C:\GM-10 002024MRP007.D
November 21, 2024 12:30:20 PM	Audit	Reporting	Reintegration	Reintegration Count: 1 - [ Integration Type: Injection, Baseline Correction Mode: Advanced, Initial Slope Sensitivity: 10, Initial Peak Width: 0.01, Initial Area Reject: 0.01, Initial Height Reject: 0.01, Integration On at 4 ]
November 21, 2024 12:36:42 PM	End	Execution	Mass Ratio Precision - Injection Tower, Front MM, TQ - Source: EI - Extractor - L (RSD) <= 5.00%	Run Count: 1
November 21, 2024 12:37:11 PM	End	Qualification	Session	OK
November 21, 2024 12:37:11 PM	Start	Reporting	Session	None
November 21, 2024 1:11:02 PM	Audit	Reporting	Session	Report Generated
November 21, 2024 1:17:20 PM	Audit	Reporting	Session	Report Generated - Report

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Date: November 21, 2024 2:12:44 PM  
System ID: GM-10

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Bara Scientific Co., Ltd.  
988 U Chu Liang Building Floor 7 Ramad Road  
Silom Bangkok Bangkok Thailand 10500  
Tel: 02-6324300 Fax: 02-6375490-7  
www.barscientific.com



## Certificate of Calibration

Number of Page(s) 1 of 3

Certificate No. BSCC-UV-374/24  
Equipment UV/Vis Spectrophotometer  
Model UV-1800  
Manufacturer Shimadzu  
Serial No. A11454908533 CD  
ID No. BKK\_EN0018  
Date of receipt 13 September 2024  
Date of calibration 13 September 2024  
Date of issue 13 SEP 2024

Customer name ALS Laboratory Group (Thailand) Co., Ltd.  
Address 104 Soi Phattanakarn 40 Phattanakarn Road Phattanakarn Suan Luang, Bangkok 10250

Temperature (25.3 - 26.7) °C (On site)  
Humidity (50.4 - 55.9) %RH (On site)

Equipment condition Good Operation

Calibration Location Organic Preparation Lab

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

Traceability Wavelength Accuracy is traceable to certificate No 106372 and 106371  
Photometric Accuracy is traceable to certificate No 106364 and 111398  
Stray Light is traceable to certificate No 106377  
The above certificate are traceable to SI unit through NIST Standard Ltd  
(UKAS accredited calibration laboratory NO 0659)

Calibrated by Mr Wanchana Jaritloy

Approved by

Mr. Sorinthi Temboonsakdi  
Service Manager

The above results are valid exclusively for the calibrated item(s) as mentioned in this report / certificate.  
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Bara Scientific Co., Ltd.  
888 U Chu Liang Building Floor 7 Rama4 Road  
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## Certificate of Calibration

Certificate No. BSCC-UV-374/24

Number of Page(s) 2 of 3

### Calibration Results:

#### 1. Wavelength Accuracy

Certified Wavelength (nm)	UUC (nm)	Error (nm)	Uncertainty (nm)
241.70	241.55	-0.15	0.18
334.02	333.85	-0.17	0.18
418.53	418.57	0.04	0.18
572.99	572.97	-0.02	0.18
679.41	679.17	-0.24	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
	0.7171	0.7169	-0.0002	0.0075
257	0.0000	0.0000	0.0000	0.0075
	0.8354	0.8345	-0.0009	0.0075
313	0.0000	0.0000	0.0000	0.0075
	0.2786	0.2781	-0.0005	0.0075
350	0.0000	0.0000	0.0000	0.0075
	0.6199	0.6194	-0.0005	0.0075

\*CNR = Customer not request

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FM-UV-706-02 Rev.01 (23/01/23)



Bara Scientific Co., Ltd.  
888 U Chu Liang Building Floor 7 Rama4 Road  
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Tel : 02-6374300 Fax : 02-6374987  
www.barscientific.com



## Certificate of Calibration

Certificate No. BSCC-UV-374/24

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
	0.5761	0.5765	0.0004	0.0042
	0.7119	0.7105	-0.0014	0.0042
	1.0189	1.0174	-0.0015	0.0042
440.0	0.0000	0.0000	0.0000	0.0042
	0.6610	0.6613	0.0003	0.0042
	0.7001	0.6984	-0.0017	0.0042
	1.0026	1.0011	-0.0015	0.0042
465.0	0.0000	0.0000	0.0000	0.0042
	0.5235	0.5232	-0.0003	0.0042
	0.6814	0.6968	-0.0016	0.0042
	0.9456	0.9444	-0.0012	0.0042
546.1	0.0000	0.0000	0.0000	0.0042
	0.5249	0.5245	-0.0004	0.0042
	0.6975	0.6966	-0.0019	0.0042
	1.0009	0.9994	-0.0015	0.0042
590.0	0.0000	0.0000	0.0000	0.0042
	0.5590	0.5586	-0.0004	0.0042
	0.7725	0.7708	-0.0017	0.0042
	1.1125	1.1114	-0.0011	0.0042
635.0	0.0000	0.0000	0.0000	0.0042
	0.5666	0.5666	0.0000	0.0042
	0.7620	0.7604	-0.0016	0.0042
	1.0962	1.0971	-0.0011	0.0042

\*CNR = Customer not request

#### 4. Stray Light\*

Standard cut-off wavelength (nm)	Wavelength (nm)	Transmission (%)	Absorbance (A)
200.85±0.11nm	199.58	0.9520	2.0217

The Stray light transmission reference is less than 1.0% and Stray light absorbance reference is greater than 2.00A  
\*Stray Light not NSC-ONSC Accredited.

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

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

The above results are valid exclusively for the calibrated item(s) as 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-706-02 Rev.01 (23/01/23)

BKK\_EL0026

### Agilent Technologies

Agilent Technologies (Thailand) Limited  
110 CHU LING BLDG 7/F UNIT A/D  
SUKHUMVIT ROAD SILEM BANGKOK  
Bangkok 10500 Thailand

Tel: 66 2 67 8452  
Fax: 66 2 67 4134  
Email: ccc-smi@agilent.com  
Website: www.agilent.com/thai

Service Confirmation Number: E905338201  
Service Confirmation Date: 12.12.2023

### Customer Contact:

All Laboratory Group (Thailand) Co., Ltd.  
Head Office:  
104/1 Phatthanakan Rd Phatthanakan Rd  
Phatthanakan Bangkok 10110  
TAX ID 0105540004959  
Chanattapan Inchoon@agilent.com  
27603088

### Invoice To:

All Laboratory Group (Thailand) Co., Ltd.  
Head Office:  
104/1 Phatthanakan Rd Phatthanakan Rd  
Phatthanakan Bangkok 10110

### Delivery Site:

All Laboratory Group (Thailand) Co., Ltd.  
Head Office:  
104/1 Phatthanakan Rd Phatthanakan Rd  
Phatthanakan Bangkok 10110

### Location:

Room  
Bldg  
Lab  
Dept

### SERVICE REPORT

Customer Purchase Order Number: 70371013  
Customer Number: 70371013  
Service Request: Service Request Date:  
Service Order: 6006041263 Service Confirmation: 6905338201

REVIEW BY *Sudhakar H.*  
APPROVED BY *Sudhakar H.*  
NEXT CAL DATE 12/06/2025

### Direct Inquiries to:

Contact Name: ccc-smi@agilent.com  
Contact E-mail: 662 637 6363  
Contact Phone: 662 632 4334

Customer Contact Center  
Contact E-mail: ccc-smi@agilent.com  
Contact Phone: 662 637 6363  
Contact Fax: 662 632 4334

### Service Instrument:

Model Number	Model Description	Serial Number	System Handle	Parent Asset
SYS-IM-7700-E	ICPMS 7700 System Enhanced		ICP MS 7700 (HPLC)	
G1316A	1260 Thermostatted Column Compartment	DEACN12300	ICP MS 7700 (HPLC)	SYS-IM-7700-E
G1329B	1260 Standard Autosampler	DEACN11098	ICP MS 7700 (HPLC)	SYS-IM-7700-E
G1311B	1260 Quaternary Pump	DEAB704380	ICP MS 7700 (HPLC)	SYS-IM-7700-E
G3281A	Agilent 7700x ICP-MS	JP12081612	ICP MS 7700 (HPLC)	SYS-IM-7700-E

### Service Items:

Item	Service/Part #	Description	Qty	Entitlement	Service Start	Service End
1000	EQ0	Enterprise Operational Qualification	1.00	Agreement Entitlement 100 % covered	12.12.2023	12.12.2023
1010	S185-5850	ICP-MS Checkout Solutions	1.00	Agreement Entitlement 100 % covered		

### Additional Information:

Agilent Technologies (Thailand) Limited Head Office  
110 Chu Ling Bldg 7/F Unit A/D  
Sukhumvit Road Silem Bangkok  
Bangkok 10500 Thailand  
Tel: 02-6374300  
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Branch Office Bangkok Branch  
110 Interchange 21 Bldg Sukhumvit Road Silem Bangkok  
Sukhumvit Road Silem Bangkok 10110 Thailand  
Tel: 02-4452 807  
Fax: 02-4452 807  
THB Krueng Thien Bank PCL  
Siam Square Bldg 416/1-2 Rama 1 Rd. Pathumwan BKK 10330  
Thailand

ORIGINAL

Service Confirmation Number: 6905338201  
Service Confirmation Date: 12.12.2023



REVIEW BY	Q. J. J.
APPROVED BY	Sawitri N.
REVIEW DATE	06/10/25

## Performance Verification Certificate for Mercury Analyzer

### Service Information:

<b>Problem Description:</b> WU-DQ-IM/HPLC-7700-5001143313		
<b>Service Provided:</b> Perform OQ Hardware control test CSD logon, Autosample, ISIS, Auto tune, BG and Stability. After done the instrument BKK_EL0028 calibrated pass all		
<b>Service Overview Code:</b> Reason Code: Scheduled Service Diagnosis Code: Scheduled Service Resolution Code: Scheduled Service		
Reported Hours: 8.0	Travel Hours: 1.0	
Customer Field Service Representative Name: Panthep Kuraasathai	Customer Field Service Representative Signature: 	Date: 12 Dec 2023
Customer Name: Supakwan Mak	Customer Signature: 	Date: 12 Dec 2023
<b>Additional Comments:</b>		

**PRODUCT ID** Quicktrace M-8000 , Teledyne Leeman Labs  
**Equipment ID** BKK\_EL0128 Mercury Analyzer  
S/N: US22133002  
BKK\_EL0129 Autosampler  
S/N: 052222A560

**Customer Name** ALS Laboratory Group (Thailand) Co., Ltd.  
**Address** 104 Soi Pattana 40, Pattana Rd. Suan Luang, Suan Luang  
Bangkok 10250 Thailand

**Date of Qualified** December 6, 2024  
**Next Due date** December 6, 2025

This certifies for products which was performed in acceptable criteria specifications

<b>Autosampler &amp; Sample Introduction</b>	<b>PASSED</b>
<b>Analyzer</b>	<b>PASSED</b>
<b>Gas Liquid Separator &amp; Dryer</b>	<b>PASSED</b>
<b>CVAFS Detector</b>	<b>PASSED</b>
<b>Electronics/Mechanical</b>	<b>PASSED</b>
<b>Data station/PC</b>	<b>PASSED</b>
<b>Analytical test</b>	<b>PASSED</b>

**Provided by**  
**Scientist Instrument Co., Ltd.**  
113 Soi Ekachai 44, Ekachai Road  
Khlong Bang Phran, Bangbon  
Bangkok 10150 Thailand

**Certified by**   
**Thunraphol Sakdayos**  
**Service Engineer**