

ภาคผนวก ง

เอกสารการสอบเทียบเครื่องมือตรวจวิเคราะห์



right solutions.
right partner.

รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Ambient	Particulate Matter (PM-10)	High Volume	RYG_FS0397	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	High Volume	RYG_FS0186	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	High Volume	RYG_FS0184	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	High Volume	RYG_FS0295	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	High Volume	RYG_FS0189	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	High Volume	RYG_FS0665	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	Digital Balance	RYG_EN0001	20-Feb-25	20-Feb-26	12
Ambient	Total Suspended Particulate	High Volume	RYG_FS0175	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	RYG_FS0393	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	RYG_FS0182	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	RYG_FS0292	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	RYG_FS0396	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	RYG_FS0662	-	-	On site Calibration
Ambient	Total Suspended Particulate	Digital Balance	RYG_EN0001	20-Feb-25	20-Feb-26	12
Ambient	Nitrogen Dioxide	NO ₂ Analyzer	RYG_FS0252	4-Jan-25	4-Jul-25	6
Ambient	Nitrogen Dioxide	NO ₂ Analyzer	RYG_FS0461	4-Jan-25	4-Jul-25	6
Ambient	Nitrogen Dioxide	NO ₂ Analyzer	RYG_FS0261	4-Jan-25	4-Jul-25	6
Ambient	Nitrogen Dioxide	NO ₂ Analyzer	RYG_FS0863	4-Jan-25	4-Jul-25	6
Ambient	Nitrogen Dioxide	NO ₂ Analyzer	RYG_FS0533	4-Jan-25	4-Jul-25	6
Ambient	Nitrogen Dioxide	NO ₂ Analyzer	RYG_FS0559	4-Jan-25	4-Jul-25	6
Ambient	Sulfur Dioxide	SO ₂ Analyzer	RYG_FS0251	4-Jan-25	4-Jul-25	6
Ambient	Sulfur Dioxide	SO ₂ Analyzer	RYG_FS0460	4-Jan-25	4-Jul-25	6
Ambient	Sulfur Dioxide	SO ₂ Analyzer	RYG_FS0260	4-Jan-25	4-Jul-25	6
Ambient	Sulfur Dioxide	SO ₂ Analyzer	RYG_FS0462	4-Jan-25	4-Jul-25	6
Ambient	Sulfur Dioxide	SO ₂ Analyzer	RYG_FS0532	4-Jan-25	4-Jul-25	6
Ambient	Sulfur Dioxide	SO ₂ Analyzer	RYG_FS0458	4-Jan-25	4-Jul-25	6
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	RYG_FS0649	17-Jan-25	16-Jul-26	18
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	RYG_FS0081	4-Oct-24	4-Apr-26	18
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	RYG_FS0085	15-Jan-25	15-Jul-26	18
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	RYG_FS0550	7-Feb-25	7-Aug-26	18
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	RYG_FS0648	16-Jan-25	15-Jul-26	18
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	RYG_FS0412	29-Oct-24	29-Apr-26	18
Stack (CEM)	Carbon Monoxide	Analyzer , System calibration, Stand	-	-	-	-
Stack (CEM)	Oxides of Nitrogen	Analyzer , System calibration, Stand	-	-	-	-
Stack (CEM)	Sulfur Dioxide	Analyzer , System calibration, Stand	-	-	-	-
Stack (CEM)	Oxygen	Analyzer , System calibration, Stand	-	-	-	-
Stack	Total Suspended Particulate	Console Control Unit	BKK_FS0518	10-Jan-25	10-Jul-25	6
Stack	Total Suspended Particulate	Pilot Tube	BKK_FS0523	10-Jan-25	10-Jul-25	6
Stack	Total Suspended Particulate	Flux gas Analyzer	RYG_FS0564	25-Apr-25	24-Apr-26	12
Stack	Total Suspended Particulate	Digital Balance	RYG_EN0003	20-Feb-25	20-Feb-26	12
Stack	Flow Rate & Temperature	Console Control Unit	RYG_FS0515	6-Feb-25	6-Aug-25	6
Stack	Flow Rate & Temperature	Pilot Tube	BKK_FS0552	24-May-25	23-Nov-25	6
Stack	Flow Rate & Temperature	Flux gas Analyzer	RYG_FS0564	25-Apr-25	24-Apr-26	12
Noise	Leq 24 hrs	Sound Calibrator	RYG_FS0216	22-Oct-24	22-Oct-25	12
Noise	Leq 24 hrs	Sound Level Meter	RYG_FS0432	27-Jan-25	26-Jan-26	12
Noise	Leq 24 hrs	Sound Level Meter	RYG_FS0388	19-Mar-25	19-Mar-26	12
Noise	Leq 24 hrs	Sound Level Meter	RYG_FS0389	27-Jan-25	26-Jan-26	12
Noise	Leq 8 hrs	Sound Calibrator	RYG_FS0213	16-Jan-25	16-Jan-26	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0386	9-Oct-24	9-Oct-25	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0412	23-Dec-24	23-Dec-25	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0439	9-Oct-24	9-Oct-25	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0613	23-Dec-24	23-Dec-25	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0384	9-Oct-24	9-Oct-25	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0437	11-Dec-24	11-Dec-25	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0438	30-Oct-24	30-Oct-25	12
Noise	Leq 8 hrs	Sound Calibrator	RYG_FS0213	16-Jan-25	16-Jan-26	12

1

alsglobal.com



right solutions.
right partner.

รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0227	21-Jan-25	21-Jan-26	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0432	27-Jan-25	26-Jan-26	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0386	9-Oct-24	9-Oct-25	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0618	21-Jan-25	20-Jan-26	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0030	27-Jan-25	26-Jan-26	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0024	21-Jan-25	21-Jan-26	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0029	11-Jul-24	11-Jul-25	12
Heat	Heat Stress	Heat Stress Monitor	RYG_FS0230	23-Dec-24	23-Dec-25	12
Heat	Heat Stress	Heat Stress Monitor	RYG_FS0220	20-Dec-24	20-Dec-25	12
Heat	Heat Stress	Heat Stress Monitor	RYG_FS0228	20-Dec-24	20-Dec-25	12
Heat	Heat Stress	Heat Stress Monitor	RYG_FS0231	23-Dec-24	23-Dec-25	12
Heat	Heat Stress	Heat Stress Monitor	RYG_FS0217	20-Dec-24	20-Dec-25	12
Heat	Heat Stress	Heat Stress Monitor	RYG_FS0221	20-Dec-24	20-Dec-25	12
Heat	Heat Stress	Heat Stress Monitor	RYG_FS0223	7-Jan-25	7-Jan-26	12
Heat	Heat Stress	Heat Stress Monitor	RYG_FS0224	27-Jan-25	26-Jan-26	12
Heat	Heat Stress	Heat Stress Monitor	RYG_FS0226	27-Jan-25	26-Jan-26	12
Heat	Heat Stress	Heat Stress Monitor	RYG_FS0523	18-Mar-25	16-Mar-26	12
Heat	Heat Stress	Heat Stress Monitor	RYG_FS0524	18-Mar-25	17-Mar-26	12
Heat	Heat Stress	Heat Stress Monitor	RYG_FS0578	6-Aug-24	6-Aug-25	12
Illuminance	Illuminance	Lux Meter	RYG_FS0536	20-Nov-24	20-Nov-25	12
Illuminance	Illuminance	Lux Meter	RYG_FS0200	28-Jan-25	28-Jan-26	12
Rayong Lab	BOD	BOD 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	Burette	RYG_EN0216	28-Sep-24	24-Sep-25	12
Rayong Lab	COO	Spectrophotometer	RYG_EN0037	18-Mar-25	18-Sep-26	18
Rayong Lab	Nitrate	Spectrophotometer	RYG_EN0037	18-Mar-25	18-Sep-26	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	18-Jan-25	18-Dec-26	18
Water Lab	Iron	ICP-MS	BKK_EL0043	4-Oct-24	3-Apr-26	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	Copper	ICP-MS	BKK_EL0043	4-Oct-24	3-Apr-26	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
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
Water Lab	Chromic	Ion Chromatography	BKK_EN0027	21-Nov-24	21-Nov-25	12
Water Lab	Calcium	ICP-OES	BKK_EL0037	23-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	23-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	23-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	23-Sep-24	23-Mar-26	18
Water Lab	SAR	Hot Block	BKK_EL0054	4-Mar-25	4-Sep-26	18
Water Lab	Temperature	Chamber (Cooling Room)	BKK_EN0167	4-Jun-25	4-Dec-26	18
Rayong Lab	Temperature	pH meter	RYG_FS0594	30-Jul-24	29-Jul-25	12
Rayong Lab	pH at 25 °C	pH meter	RYG_EN0183	19-Jan-24	19-Jul-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	Dissolved Oxygen	Chamber (Cold Room)	RYG_EN0184	11-Jun-24	11-Dec-25	18

2

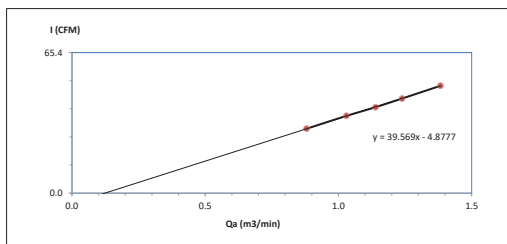
alsglobal.com



High Volume Air Sampler Calibration Worksheet

Project Site :	Gulf NC Co., Ltd.	Barometric Pressure (mm Hg) :	754.1
Calibrate Location :	วัดบางค้อ	Temperature (°C) :	31.7
Calibrate Date :	28-May-25	High Volume ID :	RYG_FS0397
CalibrationSheet No.:	C-280525-RYG_FS0397	High Volume Model :	TE-5009X
Calibrator ID:	RYG_FS0206	High Volume S/N :	5687
Calibrator Model :	TE-S028A	Calibrator Slope :	0.92987
Calibrator S/N :	1543	Calibrator Intercept :	-0.01578

Test No.	Delta H ₂ O (inch)	Qa (m ³ /min)	I: Chart (CFM)	Linear Regression
1	1.6	0.880	30	Slope: 39.5689
2	2.2	1.030	36	Intercept: -4.8777
3	2.7	1.139	40	Correlation Coefficient: 0.9998
4	3.2	1.239	44	
5	4.0	1.383	50	



Calibrated by (Mr. Khunakon Manchuan)
RYG Field Services Scientist (1)

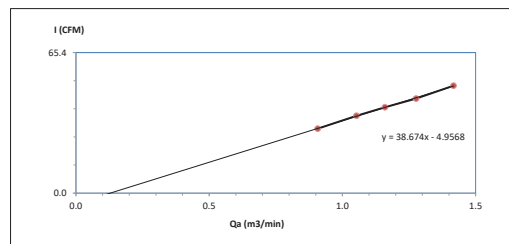
Approved by: (Mr. Supot Sameth)
RYG Field Services Section Head



High Volume Air Sampler Calibration Worksheet

Project Site :	Gulf NC Co., Ltd.	Barometric Pressure (mm Hg) :	754.1
Calibrate Location :	วัดสระตึกวัดบางค้อ	Temperature (°C) :	31.7
Calibrate Date :	28-May-25	High Volume ID :	RYG_FS0186
CalibrationSheet No.:	C-280525-RYG_FS0186	High Volume Model :	TE-5009X
Calibrator ID:	RYG_FS0206	High Volume S/N :	4794
Calibrator Model :	TE-S028A	Calibrator Slope :	0.92987
Calibrator S/N :	1543	Calibrator Intercept :	-0.01578

Test No.	Delta H ₂ O (inch)	Qa (m ³ /min)	I: Chart (CFM)	Linear Regression
1	1.7	0.907	30	Slope: 38.6742
2	2.3	1.053	36	Intercept: -4.9568
3	2.8	1.160	40	Correlation Coefficient: 0.9994
4	3.4	1.276	44	
5	4.2	1.417	50	



Calibrated by (Mr. Khunakon Manchuan)
RYG Field Services Scientist (1)

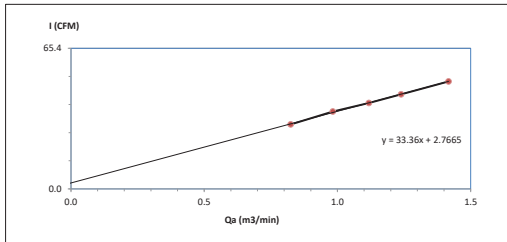
Approved by: (Mr. Supot Sameth)
RYG Field Services Section Head



High Volume Air Sampler Calibration Worksheet

Project Site : Gulf NC Co., Ltd. Barometric Pressure (mm Hg) : 754.1
Calibrate Location : ห้องปฏิบัติการ Temperature (°C) : 31.7
Calibrate Date : 28-May-25 High Volume ID : RYG_FS0184
CalibrationSheet No. : C-280525-RYG_FS0184 High Volume Model : TE-5009X
Calibrator ID : RYG_FS0206 High Volume S/N : 4792
Calibrator Model : TE-5028A Calibrator Slope : 0.92987
Calibrator S/N : 1543 Calibrator Intercept : -0.01578

Test No.	Delta H ₂ O (inch)	Qa (m ³ /min)	I: Chart (CFM)	Linear Regression
1	1.4	0.825	30	Slope : 33.3600 Intercept : 2.7665 Correlation Coefficient : 0.9994
2	2.0	0.983	36	
3	2.6	1.118	40	
4	3.2	1.239	44	
5	4.2	1.417	50	



Calibrated by [Signature]
(Mr.Khunakon Manchuan)
RYG Field Services Scientist (1)

Approved by [Signature]
(Mr. Supot Salamteh)
RYG Field Services Section Head

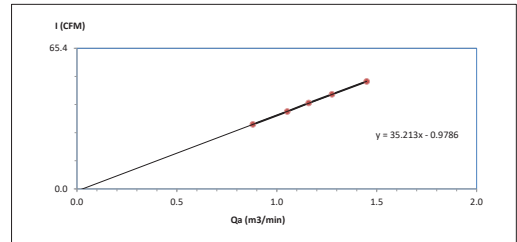
FORM NO.: F 06-074 REVISION NO.:2 ISSUE DATE: 20/11/23



High Volume Air Sampler Calibration Worksheet

Project Site : Gulf NC Co., Ltd. Barometric Pressure (mm Hg) : 754.1
Calibrate Location : ห้องปฏิบัติการ Temperature (°C) : 31.7
Calibrate Date : 28-May-25 High Volume ID : RYG_FS0295
CalibrationSheet No. : C-280525-RYG_FS0295 High Volume Model : TE-5009X
Calibrator ID : RYG_FS0206 High Volume S/N : 5502
Calibrator Model : TE-5028A Calibrator Slope : 0.92987
Calibrator S/N : 1543 Calibrator Intercept : -0.01578

Test No.	Delta H ₂ O (inch)	Qa (m ³ /min)	I: Chart (CFM)	Linear Regression
1	1.6	0.880	30	Slope : 35.2135 Intercept : -0.9786 Correlation Coefficient : 0.9999
2	2.3	1.053	36	
3	2.8	1.160	40	
4	3.4	1.276	44	
5	4.4	1.450	50	



Calibrated by [Signature]
(Mr.Khunakon Manchuan)
RYG Field Services Scientist (1)

Approved by [Signature]
(Mr. Supot Salamteh)
RYG Field Services Section Head

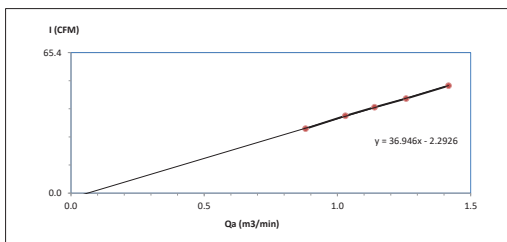
FORM NO.: F 06-074 REVISION NO.:2 ISSUE DATE: 20/11/23



High Volume Air Sampler Calibration Worksheet

Project Site : Gulf NC Co., Ltd. Barometric Pressure (mm Hg) : 754.1
Calibrate Location : พื้นที่โครงการ Temperature (°C) : 31.7
Calibrate Date : 28-May-25 High Volume ID : RYG_FS0189
CalibrationSheet No. : C-280525-RYG_FS0189 High Volume Model : TE-5009X
Calibrator ID : RYG_FS0206 High Volume S/N : 4797
Calibrator Model : TE-5028A Calibrator Slope : 0.92987
Calibrator S/N : 1543 Calibrator Intercept : -0.01578

Test No.	Delta H ₂ O (inch)	Qa (m ³ /min)	I: Chart (CFM)	Linear Regression
1	1.6	0.880	30	Slope : 36.9461 Intercept : -2.2926 Correlation Coefficient : 0.9996
2	2.2	1.030	36	
3	2.7	1.139	40	
4	3.3	1.258	44	
5	4.2	1.417	50	



Calibrated by [Signature]
(Mr.Khunakon Manchuan)
RYG Field Services Scientist (1)

Approved by [Signature]
(Mr. Supot Salamteh)
RYG Field Services Section Head

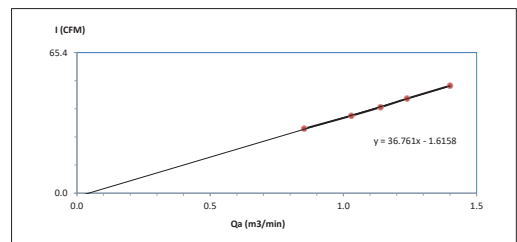
FORM NO.: F 06-074 REVISION NO.:2 ISSUE DATE: 20/11/23



High Volume Air Sampler Calibration Worksheet

Project Site : Gulf NC Co., Ltd. Barometric Pressure (mm Hg) : 754.1
Calibrate Location : ห้องปฏิบัติการ Temperature (°C) : 31.7
Calibrate Date : 28-May-25 High Volume ID : RYG_FS0665
CalibrationSheet No. : C-280525-RYG_FS0665 High Volume Model : TE-5009X
Calibrator ID : RYG_FS0206 High Volume S/N : 6264
Calibrator Model : TE-5028A Calibrator Slope : 0.92987
Calibrator S/N : 1543 Calibrator Intercept : -0.01578

Test No.	Delta H ₂ O (inch)	Qa (m ³ /min)	I: Chart (CFM)	Linear Regression
1	1.5	0.853	30	Slope : 36.7607 Intercept : -1.6158 Correlation Coefficient : 0.9995
2	2.2	1.030	36	
3	2.7	1.139	40	
4	3.2	1.239	44	
5	4.1	1.400	50	



Calibrated by [Signature]
(Mr.Khunakon Manchuan)
RYG Field Services Scientist (1)

Approved by [Signature]
(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. 25BK0001

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 WI 08.
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	

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

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

Page 1 | 4

Calibration certificate No.: 25BK0001
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-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

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

Page 2 | 4

Calibration certificate No.: 25BKL0001
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
Twights - 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
10 g100 g	Center50.0000 g
110.0000 g100.0000 g	Front left50.0001 g
29.9999 g100.0000 g	Back left50.0000 g
310.0000 g99.9999 g	Back right49.9999 g
410.0000 g100.0000 g	Front right50.0001 g
510.0000 g99.9999 g	Maximum deviation from centric loading indication
69.9999 g99.9999 g	Δf _{ecc} _{max} = 0.0001 g
710.0000 g100.0000 g	
810.0000 g100.0000 g	
910.0000 g100.0000 g	
1010.0000 g100.0000 g	
s = 0.00004 g s = 0.00005 g	

Error of indication	Expansion factor	Uncertainty	Uncertainty relative
Testload LIndication IError E	k	U(E)	U _{rel} (E)
0.0100 g0.0100 g0.0000 g	2.00	0.00012 g	1.2 %
0.0500 g0.0500 g0.0000 g	2.00	0.00013 g	0.25 %
0.1000 g0.1000 g0.0000 g	2.00	0.00013 g	0.13 %
0.5000 g0.5000 g0.0000 g	2.00	0.00013 g	0.026 %
1.0000 g1.0000 g0.0000 g	2.00	0.00013 g	0.013 %
2.0000 g2.0000 g0.0000 g	2.00	0.00013 g	0.0065 %
5.0000 g5.0000 g0.0000 g	2.00	0.00013 g	0.0026 %
10.0000 g10.0000 g0.0000 g	2.00	0.00013 g	0.0013 %
20.0000 g20.0000 g0.0000 g	2.00	0.00014 g	0.00069 %
100.0000 g100.0000 g0.0000 g	2.00	0.00021 g	0.00021 %
150.0000 g149.9999 g-0.0001 g	2.00	0.00028 g	0.00019 %
Maximum error of indication		E _{max} = 0.0001 g	

U_{rel}(E) is the quotient of U(E) and test load L. The uncertainty of measurement U(E) is valid only if error E is 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 Guideline EURAMET cg-18, V4.0. There is a 95 % probability that the value of the measurand will be in the assigned value range.

End of calibration certificate

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

Page 3 | 4

Interpretation of measurement results | Appendix to the calibration certificate

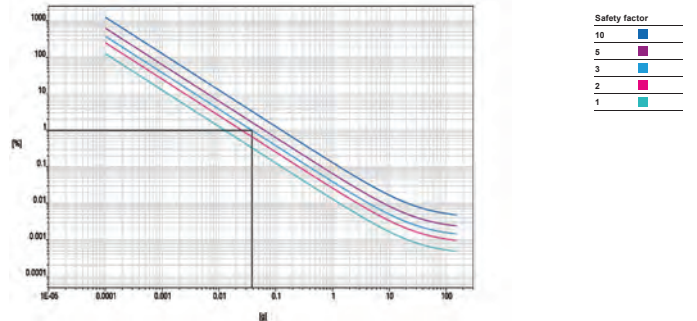
Uncertainty of measurement in use

Device adjusted before measurement	Yes
Temperature deviation considered	1.5 K (isoCAL active)
Temperature coefficient considered	1 · 10 ⁻⁴ /K
Uncertainty of the weighing result U _g (W)	U _g (W) = 0.00013 g + 3.96 · 10 ⁻⁶ · 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 measurand will be in the assigned value range.

Indication in % from max load	Net indication R	Uncertainty U _g (W)	Uncertainty relative U _g (W) _{rel}
1 %	1.5000 g	0.00014 g	0.0091 %
25 %	37.5000 g	0.00028 g	0.00074 %
50 %	75.0000 g	0.00043 g	0.00057 %
75 %	112.5000 g	0.00058 g	0.00051 %
100 %	150.0000 g	0.00072 g	0.00048 %

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

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

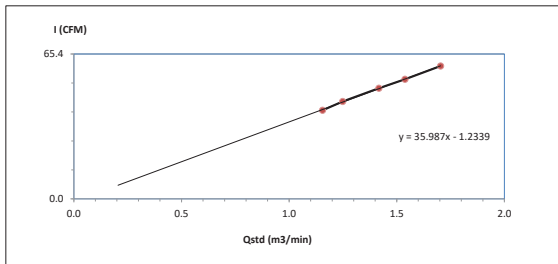
Page 4 | 4



High Volume Air Sampler Calibration Worksheet

Project Site :	Gulf NC Co., Ltd.	Barometric Pressure (mm Hg) :	754.1
Calibrate Location :	วัดบางศาลา	Temperature (°C) :	31.7
Calibrate Date :	28-May-25	High Volume ID :	RYG_FS0175
CalibrationSheet No.:	C-280525-RYG_FS0175	High Volume Model :	TE-5170D
Calibrator ID:	RYG_FS0206	High Volume S/N :	4801
Calibrator Model :	TE-5028A	Calibrator Slope :	1.48469
Calibrator S/N :	1543	Calibrator Intercept :	-0.02523

Test No.	Delta H ₂ O (inch)	Q _{std} (m ³ /min)	I: Chart (CFM)	Linear Regression
1	2.9	1.1551	40	Slope : 35.9871 Intercept : -1.2339 Correlation Coefficient : 0.9994
2	3.4	1.2487	44	
3	4.4	1.4170	50	
4	5.2	1.5382	54	
5	6.4	1.7038	60	



Calibrated by 
(Mr. Khunakon Manchuan)
RYG Field Services Scientist (1)

Approved by : 
(Mr. Supot Salameh)
RYG Field Services Section Head

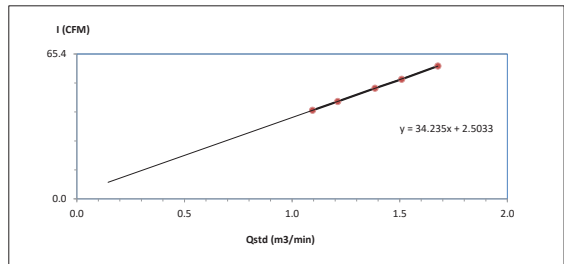
FORM NO.: F 06-073 REVISION NO.:2 ISSUE DATE: 20/11/23



High Volume Air Sampler Calibration Worksheet

Project Site :	Gulf NC Co., Ltd.	Barometric Pressure (mm Hg) :	754.1
Calibrate Location :	วัดสระศรีวัดราชท่า	Temperature (°C) :	31.7
Calibrate Date :	28-May-25	High Volume ID :	RYG_FS0393
CalibrationSheet No.:	C-280525-RYG_FS0393	High Volume Model :	TE-5170D
Calibrator ID:	RYG_FS0206	High Volume S/N :	5682
Calibrator Model :	TE-5028A	Calibrator Slope :	1.48469
Calibrator S/N :	1543	Calibrator Intercept :	-0.02523

Test No.	Delta H ₂ O (inch)	Q _{std} (m ³ /min)	I: Chart (CFM)	Linear Regression
1	2.6	1.0951	40	Slope : 34.2351 Intercept : 2.5033 Correlation Coefficient : 0.9999
2	3.2	1.2121	44	
3	4.2	1.3850	50	
4	5.0	1.5089	54	
5	6.2	1.6773	60	



Calibrated by 
(Mr. Khunakon Manchuan)
RYG Field Services Scientist (1)

Approved by : 
(Mr. Supot Salameh)
RYG Field Services Section Head

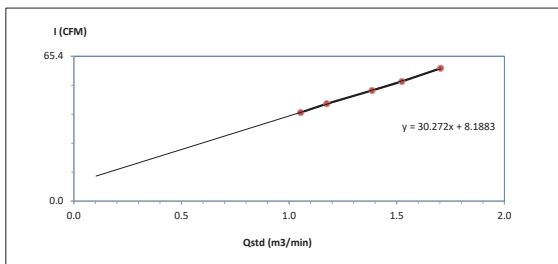
FORM NO.: F 06-073 REVISION NO.:2 ISSUE DATE: 20/11/23



High Volume Air Sampler Calibration Worksheet

Project Site :	Gulf NC Co., Ltd.	Barometric Pressure (mm Hg) :	754.1
Calibrate Location :	ชุมชนบ้านนาบะเขม	Temperature (°C) :	31.7
Calibrate Date :	28-May-25	High Volume ID :	RYG_FS0182
CalibrationSheet No.:	C-280525-RYG_FS0182	High Volume Model :	TE-5170D
Calibrator ID:	RYG_FS0206	High Volume S/N :	5335
Calibrator Model :	TE-5028A	Calibrator Slope :	1.48469
Calibrator S/N :	1543	Calibrator Intercept :	-0.02523

Test No.	Delta H ₂ O (inch)	Q _{std} (m ³ /min)	I: Chart (CFM)	Linear Regression
1	2.4	1.0531	40	Slope : 30.2719 Intercept : 8.1883 Correlation Coefficient : 0.9995
2	3.0	1.1744	44	
3	4.2	1.3850	50	
4	5.1	1.5236	54	
5	6.4	1.7038	60	



Calibrated by 
(Mr. Khunakon Manchuan)
RYG Field Services Scientist (1)

Approved by : 
(Mr. Supot Salameh)
RYG Field Services Section Head

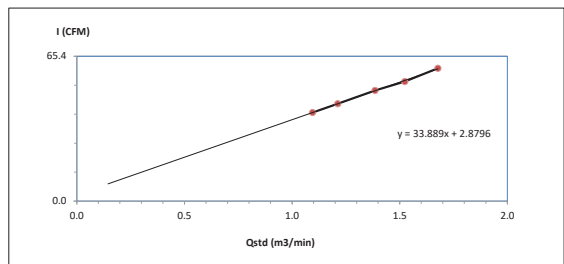
FORM NO.: F 06-073 REVISION NO.:2 ISSUE DATE: 20/11/23



High Volume Air Sampler Calibration Worksheet

Project Site :	Gulf NC Co., Ltd.	Barometric Pressure (mm Hg) :	754.1
Calibrate Location :	โรงเรียนบ้านโนนสะอาด	Temperature (°C) :	31.7
Calibrate Date :	28-May-25	High Volume ID :	RYG_FS0292
CalibrationSheet No.:	C-280525-RYG_FS0292	High Volume Model :	TE-5170D
Calibrator ID:	RYG_FS0206	High Volume S/N :	5497
Calibrator Model :	TE-5028A	Calibrator Slope :	1.48469
Calibrator S/N :	1543	Calibrator Intercept :	-0.02523

Test No.	Delta H ₂ O (inch)	Q _{std} (m ³ /min)	I: Chart (CFM)	Linear Regression
1	2.6	1.0951	40	Slope : 33.8888 Intercept : 2.8796 Correlation Coefficient : 0.9993
2	3.2	1.2121	44	
3	4.2	1.3850	50	
4	5.1	1.5236	54	
5	6.2	1.6773	60	



Calibrated by 
(Mr. Khunakon Manchuan)
RYG Field Services Scientist (1)

Approved by : 
(Mr. Supot Salameh)
RYG Field Services Section Head

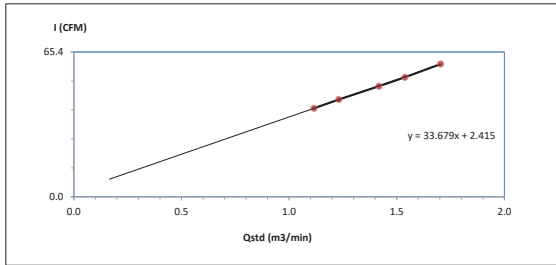
FORM NO.: F 06-073 REVISION NO.:2 ISSUE DATE: 20/11/23



High Volume Air Sampler Calibration Worksheet

Project Site : Gulf NC Co., Ltd. Barometric Pressure (mm Hg) : 754.1
Calibrate Location : พื้นที่โครงการ Temperature (°C) : 31.7
Calibrate Date : 28-May-25 High Volume ID : RYG_FS0396
CalibrationSheet No.: C-280525-RYG_FS0396 High Volume Model : TE-S170D
Calibrator ID: RYG_FS0206 High Volume S/N : 5688
Calibrator Model : TE-5028A Calibrator Slope : 1.48469
Calibrator S/N : 1543 Calibrator Intercept : -0.02523

Test No.	Delta H ₂ O (inch)	Q _{std} (m ³ /min)	I: Chart (CFM)	Linear Regression
1	2.7	1.1155	40	Slope : 33.6794 Intercept : 2.4150 Correlation Coefficient : 0.9997
2	3.3	1.2305	44	
3	4.4	1.4170	50	
4	5.2	1.5382	54	
5	6.4	1.7038	60	



Calibrated by : [Signature]
(Mr.Khunakon Manchuan)
RYG Field Services Scientist (1)

Approved by : [Signature]
(Mr. Supot Salameh)
RYG Field Services Section Head

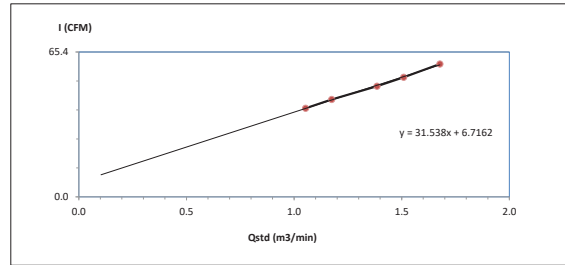
FORM NO.: F 06-073 REVISION NO.:2 ISSUE DATE: 20/11/23



High Volume Air Sampler Calibration Worksheet

Project Site : Gulf NC Co., Ltd. Barometric Pressure (mm Hg) : 754.1
Calibrate Location : พื้นที่โรงงาน Temperature (°C) : 31.7
Calibrate Date : 28-May-25 High Volume ID : RYG_FS0662
CalibrationSheet No.: C-280525-RYG_FS0662 High Volume Model : TE-5009X
Calibrator ID: RYG_FS0206 High Volume S/N : 6259
Calibrator Model : TE-5028A Calibrator Slope : 1.48469
Calibrator S/N : 1543 Calibrator Intercept : -0.02523

Test No.	Delta H ₂ O (inch)	Q _{std} (m ³ /min)	I: Chart (CFM)	Linear Regression
1	2.4	1.0531	40	Slope : 31.5380 Intercept : 6.7162 Correlation Coefficient : 0.9991
2	3.0	1.1744	44	
3	4.2	1.3850	50	
4	5.0	1.5089	54	
5	6.2	1.6773	60	



Calibrated by : [Signature]
(Mr.Khunakon Manchuan)
RYG Field Services Scientist (1)

Approved by : [Signature]
(Mr. Supot Salameh)
RYG Field Services Section Head

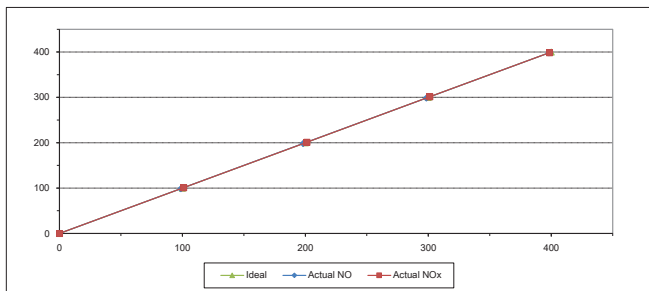
FORM NO.: F 06-073 REVISION NO.:2 ISSUE DATE: 20/11/23



MULTIPOINT CALIBRATION REPORT

Calibration Date : 4-Jan-25 Equipment Name : NOx Analyzer
Manufacturer : Teledyne API Model : T200
Serial No. : 2198 Equipment ID : RYG_FS0252
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	101.00	1.00	1.00
2	200.00	198.20	-1.80	-0.90	201.30	1.30	0.65
3	300.00	298.50	-1.50	-0.50	301.30	1.30	0.43
4	400.00	398.20	-1.80	-0.45	398.60	-1.40	-0.35
AVERAGE (%)				-0.61			0.37



Calibrated By : [Signature]
(Mr.Jirawut Sakam)
Field Environmental Scientist (3)

Approved By : [Signature]
(Mr.Sarayuth Jitranont)
Assistant General Manager

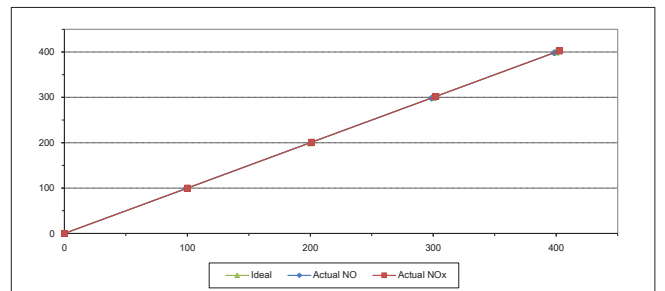
ALS Laboratory Group
FORM NO.: F 06-056 REVISION NO.: ISSUE DATE: 02/04/12



MULTIPOINT CALIBRATION REPORT

Calibration Date : 4-Jan-25 Equipment Name : NOx Analyzer
Manufacturer : HORIBA Model : APNA-370
Serial No. : T95HWM41 Equipment ID : RYG_FS0461
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	100.10	0.10	0.10
2	200.00	201.00	1.00	0.50	201.00	1.00	0.50
3	300.00	298.70	-1.30	-0.43	302.10	2.10	0.70
4	400.00	398.40	-1.60	-0.40	402.60	2.60	0.65
AVERAGE (%)				-0.31			0.41



Calibrated By : [Signature]
(Mr.Jirawut Sakam)
Field Environmental Scientist (3)

Approved By : [Signature]
(Mr.Sarayuth Jitranont)
Assistant General Manager

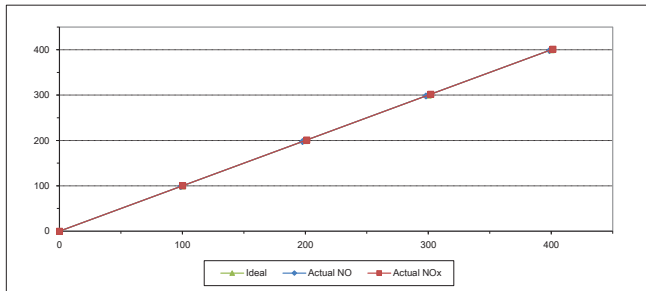
ALS Laboratory Group
FORM NO.: F 06-056 REVISION NO.: ISSUE DATE: 02/04/12



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 (%)				-0.67			0.39



Calibrated By

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

Approved By

(Mr.Sarayuth Jittranont)
Assistant General Manager

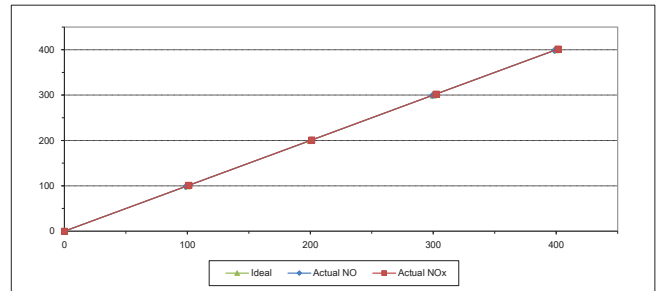
ALS Laboratory Group
FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



MULTIPOINT CALIBRATION REPORT

Calibration Date	4-Jan-25	Equipment Name	NOx Analyzer
Manufacturer	HORIBA	Model	APNA-370
Serial No.	R06K0177	Equipment ID	RYG_FS0463
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	98.80	-1.20	-1.20	101.30	1.30	1.30
2	200.00	201.30	1.30	0.65	201.20	1.20	0.60
3	300.00	299.40	-0.60	-0.20	302.30	2.30	0.77
4	400.00	398.70	-1.30	-0.33	401.50	1.50	0.38
AVERAGE (%)				-0.20			0.63



Calibrated By

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

Approved By

(Mr.Sarayuth Jittranont)
Assistant General Manager

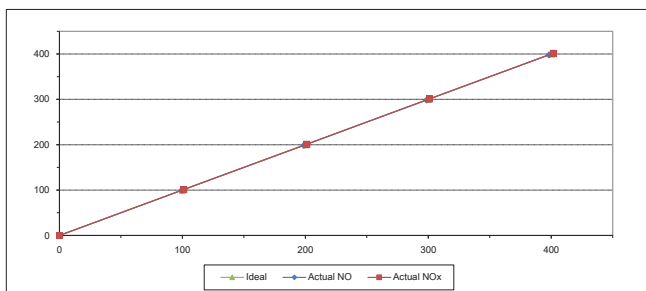
ALS Laboratory Group
FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



MULTIPOINT CALIBRATION REPORT

Calibration Date	4-Jan-25	Equipment Name	NOx Analyzer
Manufacturer	Teledyne API	Model	T200
Serial No.	7238	Equipment ID	RYG_FS0533
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	99.50	-0.50	-0.50	101.10	1.10	1.10
2	200.00	198.90	-1.10	-0.55	201.20	1.20	0.60
3	300.00	298.80	-1.20	-0.40	301.00	1.00	0.33
4	400.00	398.30	-1.70	-0.42	401.80	1.80	0.45
AVERAGE (%)				-0.35			0.52



Calibrated By

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

Approved By

(Mr.Sarayuth Jittranont)
Assistant General Manager

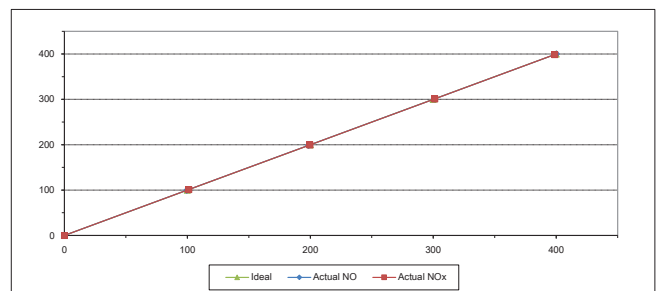
ALS Laboratory Group
FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



MULTIPOINT CALIBRATION REPORT

Calibration Date	4-Jan-25	Equipment Name	NOx Analyzer
Manufacturer	HORIBA	Model	APNA-370
Serial No.	NV0ER3YH	Equipment ID	RYG_FS0459
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	0.05	0.05	0.05	0.10	0.10	0.10
1	100.00	99.50	-0.50	-0.50	101.20	1.20	1.20
2	200.00	198.70	-1.30	-0.65	199.70	-0.30	-0.15
3	300.00	301.10	1.10	0.37	301.20	1.20	0.40
4	400.00	400.30	0.30	0.08	398.80	-1.20	-0.30
AVERAGE (%)				-0.13			0.25



Calibrated By

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

Approved By

(Mr.Sarayuth Jittranont)
Assistant General Manager

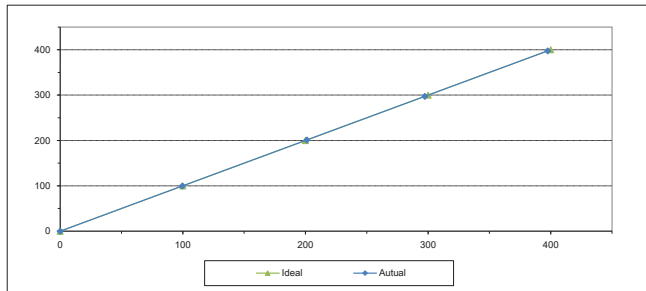
ALS Laboratory Group
FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



MULTIPOINT CALIBRATION REPORT

Calibration Date	4-Jan-25	Equipment Name	SO2 Analyzer
Manufacturer	Teledyne API	Model	T100
Serial No.	1773	Equipment ID	RYG_FS0251
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	99.60	-0.40	-0.40
2	200.00	201.10	1.10	0.55
3	300.00	297.30	-2.70	-0.90
4	400.00	397.50	-2.50	-0.63
AVERAGE (%)				-0.28



Calibrated By

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

Approved By

(Mr.Sarayuth Jitranont)
Assistant General Manager

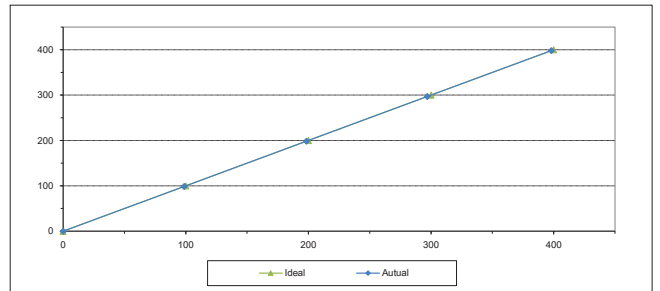
ALS Laboratory Group
FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



MULTIPOINT CALIBRATION REPORT

Calibration Date	4-Jan-25	Equipment Name	SO2 Analyzer
Manufacturer	HORIBA	Model	APSA-370
Serial No.	VABF9LSH	Equipment ID	RYG_FS0460
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	98.70	-1.30	-1.30
2	200.00	198.50	-1.50	-0.75
3	300.00	296.90	-3.10	-1.03
4	400.00	398.10	-1.90	-0.47
AVERAGE (%)				-0.69



Calibrated By

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

Approved By

(Mr.Sarayuth Jitranont)
Assistant General Manager

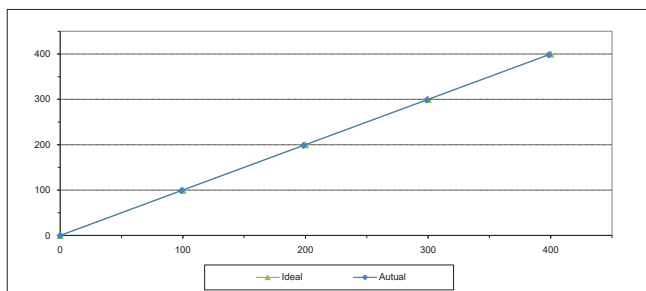
ALS Laboratory Group
FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



MULTIPOINT CALIBRATION REPORT

Calibration Date	4-Jan-25	Equipment Name	SO2 Analyzer
Manufacturer	HORIBA	Model	APSA-370
Serial No.	8HC0DGJF	Equipment ID	RYG_FS0260
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	98.90	-1.10	-1.10
2	200.00	198.50	-1.50	-0.75
3	300.00	299.00	-1.00	-0.33
4	400.00	398.50	-1.50	-0.38
AVERAGE (%)				-0.49



Calibrated By

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

Approved By

(Mr.Sarayuth Jitranont)
Assistant General Manager

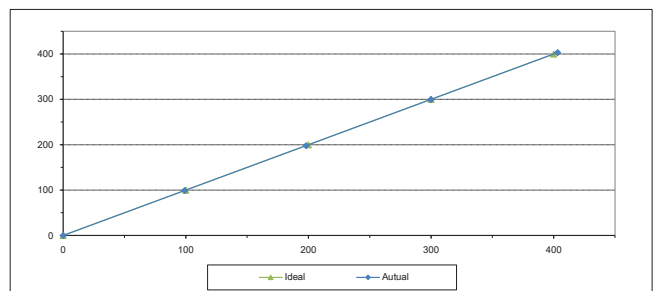
ALS Laboratory Group
FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



MULTIPOINT CALIBRATION REPORT

Calibration Date	4-Jan-25	Equipment Name	SO2 Analyzer
Manufacturer	HORIBA	Model	APSA-370
Serial No.	XL29Y85B	Equipment ID	RYG_FS0462
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	198.10	-1.90	-0.95
3	300.00	299.90	-0.10	-0.03
4	400.00	403.20	3.20	0.80
AVERAGE (%)				-0.20



Calibrated By

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

Approved By

(Mr.Sarayuth Jitranont)
Assistant General Manager

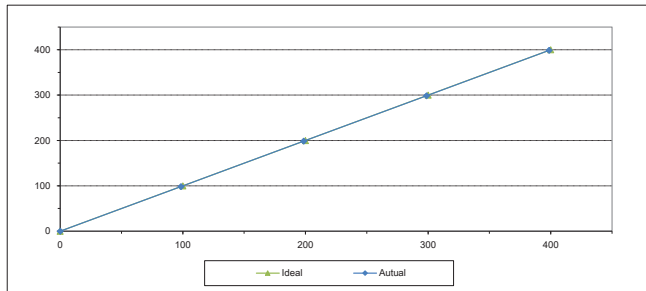
ALS Laboratory Group
FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



MULTIPOINT CALIBRATION REPORT

Calibration Date	4-Jan-25	Equipment Name	SO2 Analyzer
Manufacturer	Teledyne API	Model	T100
Serial No.	6060	Equipment ID	RYG_FS0532
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	98.50	-1.50	-1.50
2	200.00	198.60	-1.40	-0.70
3	300.00	298.70	-1.30	-0.43
4	400.00	398.70	-1.30	-0.33
AVERAGE (%)				-0.57



Calibrated By

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

Approved By

(Mr.Sareyuth Jitranont)
Assistant General Manager

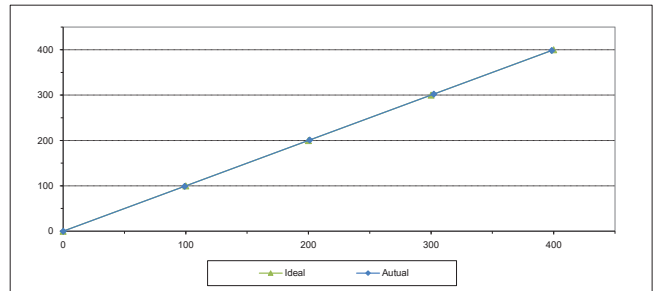
ALS Laboratory Group
FORM NO.: F 06-056 REVISION NO.: ISSUE DATE: 02/04/12



MULTIPOINT CALIBRATION REPORT

Calibration Date	4-Jan-25	Equipment Name	SO2 Analyzer
Manufacturer	HORIBA	Model	APSA-370
Serial No.	PAUY077A	Equipment ID	RYG_FS0458
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	201.00	1.00	0.50
3	300.00	302.30	2.30	0.77
4	400.00	398.50	-1.50	-0.38
AVERAGE (%)				0.02



Calibrated By

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

Approved By

(Mr.Sareyuth Jitranont)
Assistant General Manager

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



JIRANATEE ASSOCIATES CO., LTD.
Jirantee Associates Co., Ltd.
40/14 13, 6755-36
Pongkham 2, 171, Rd. Wattana, Bangkok
Bangkok 10000 (Thailand)
Tel: +6620880812
Mobile: +6620880815
E-mail: jirantee@jirantee.com
Website: www.jirantee.com

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



NSC - TIS - TIS 17025
CALIBRATION 0367

Certificate Number

CWS-006-68

CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM

MANUFACTURER

MODEL/TYPE

SERIAL NUMBER

ID NUMBER

CONDITION AS RECEIVED

CUSTOMER

Cup anemometer

Novalyne

Sensor: WS-03FA

Data logger: 110-WS-25DL-D

Sensor: WSD-A5980

Data logger: A5980

RYG_FS0649

Used item

ALS laboratory group (Thailand) Co., Ltd.

104 Phatthanakan Rd, Khwaeng Suan Luang,

Khet Suan Luang, Bangkok 10250 Thailand.

Calibration procedure:

The Cup anemometer was calibrated against Standard air velocity transducer model: B55V32 and pilot tube with precision differential pressure meter model: DPM7500 in air flow calibration of 0.001 type wind tunnel (gain 500 mm) over test section area. The WFL-002 based on IEC 61400-12-1, Wind energy generation systems - Part 12-1: Power performance measurements of electricity producing wind turbines, March 2017 was used as a reference guideline.

Traceability:

This certificate provides a traceability of the measurement to recognized the national standards and as evaluation of the international system of units (SI) through the IMPT (National Metrology Institute of Thailand) via Certificate number: MW-0001-24 and MW-0005-24

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 Guide to the Expression of Measurement Data - Guide on the expression of uncertainty in measurement.

RECEIVED DATE

10 Jan 2025

MEASUREMENT DATE

17 Jan 2025

ISSUE DATE

20 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

Atmospheric Pressure: 1010 ± 10 hPa

PLACE OF CALIBRATION

1: Effel-type wind tunnel of Jirantee Associates Co., Ltd.

CALIBRATION CONDITIONS

1: Wind tunnel cross-section area¹ 900 cm²

2: Wind direction frontal area² 100 cm²

3: Diameter of mounting pipe³ mm

4: Blockage ratio of test object⁴ 0.11% [-]

Preconditioning

1: 24 hours at ambient conditions.

Measurement Condition

2: The average values during measurement are (24.8) °C, (61.5) %RH and (1012.5) hPa.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

1: Mr. Sareyuth Jitranont

2: Miss Jirajanya Jiratanont

Approved signature:

(Signature)

(Signature)

REVIEW BY

(Signature)

APPROVED BY

(Signature)

NEXT CAL DATE: 16/ 07/ 26

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

Page 2 of 2 Pages

MEASUREMENT RESULTS⁵

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

U ² (m/s) ²	Temp. wind tunnel (°C)	Temp. room (°C)	U ² (m/s) ²	Error (m/s)	U (m/s)
1.023	24.66	24.75	0.9	0.1	0.31
2.246	24.88	24.75	2.0	0.2	0.31
3.076	24.44	24.75	3.0	0.1	0.31
4.204	24.50	24.75	4.0	0.2	0.31
4.96	24.30	24.75	4.9	0.0	0.31
5.97	24.70	24.75	5.9	0.0	0.31
7.03	24.30	24.75	7.0	0.0	0.31
7.97	24.62	24.75	8.1	0.1	0.31
9.23	24.20	24.75	9.1	0.1	0.31
9.98	24.30	24.75	10.1	0.1	0.31
11.09	24.16	24.75	11.2	0.1	0.31
12.00	24.10	24.75	12.2	0.2	0.31
13.05	24.20	24.75	13.2	0.2	0.31
13.98	24.12	24.75	14.3	0.1	0.31
15.03	24.36	24.75	15.3	0.2	0.31
15.97	24.22	24.75	16.3	0.3	0.31

Remark:

⁵ Calibration results only count for the tested circumstances and environmental conditions during which calibration took place

⁶ Velocity of standard

⁷ Velocity of Unit Under Calibration

PHOTO OF CALIBRATION SET-UP



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





JIRANATEE ASSOCIATES CO., LTD.

Jirantee Associates Co., Ltd.
80/14-15, 4/33-35
Ponkharn 1/1, Rd. Wattana, Bangkok
Bangkok 10000 (Thailand)
Tel: +6620088012
Mobile: +6620080653
E-mail: jirantee@jirantee.com
Web site: www.jirantee.com

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

Wind direction measurement laboratory
Calibration services department.



NSC - TIS - TIS 17025
CALIBRATION 0367

Certificate Number

CWD-006-68

CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM MANUFACTURER MODEL/TYPE

Wind Direction Sensor

Novallmx

Sensor: WS-02FA

Data logger: 110-WS-250L-D

Sensor: WSD-AS980

Data logger: AS980

RYG_F50649

Used item

CONDITION AS-RECEIVED CUSTOMER

ALS laboratory group (Thailand) Co., Ltd.

104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang,

Khet Suan Luang, Bangkok 10250 Thailand.

RECEIVED DATE

10 Jan 2025

MEASUREMENT DATE

17 Jan 2025

ISSUE DATE

20 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

Atmospheric Pressure: 1010 ± 10 hPa

PLACE OF CALIBRATION

Elliptical-type wind tunnel of Jirantee Associates Co., Ltd.

CALIBRATION CONDITION

Wind tunnel cross-section area¹

900 cm²

Wind direction typical area²

129 cm²

Diameter of mounting pipe³

mm

Blockage ratio of test object⁴

0.143 (-)

Preconditioning

24 hours at ambient conditions.

Measurement Condition

The average values during measurement are (24.4)°C, (52.4) %RH and (1017.3) hPa.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

Mr. Sorawit Thachalad

Miss Jittaporn Lertsomphol



Approved signatory:

Mr. Parinya Isoncharoen
Calibration Department Manager

Remarks:

¹ Elliptical cross-section area of the wind tunnel

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

³ Diameter of mounting pipe

⁴ Ratio (%)

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

Certificate Number

CWD-006-68

Page 2 of 2 Pages

MEASUREMENT RESULTS⁵

The wind direction sensor was calibrated against standard rotary encoder by comparison method. During calibration, the measurement was carried out at 45° intervals in clockwise and 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	D ₁₀₀	D ₁₀₀	Error	U (k=2)
m/s	Degree (°)	Degree (°)	Degree (°)	Degree (°)
0.000	0	0	0	0.80
45.000	41	41	-4	0.80
90.000	87	87	-3	0.80
135.000	133	133	-2	0.80
180.000	182	182	2	0.80
225.000	229	229	4	0.80
270.000	274	274	4	0.80
315.000	320	320	5	0.80

Remark:

⁵ Calibration results only count for the tested circumstances and environmental conditions during which calibration took place

⁶ Direction of standard

⁷ Direction of Unit Under Calibration

End of Certificate of Calibration



JIRANATEE ASSOCIATES CO., LTD.

Jirantee Associates Co., Ltd.
80/14-15, 4/33-35
Ponkharn 1/1, Rd. Wattana, Bangkok
Bangkok 10000 (Thailand)
Tel: +6620088012
Mobile: +6620080653
E-mail: jirantee@jirantee.com
Web site: www.jirantee.com

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

Temperature measurement laboratory
Calibration services department.



NSC - TIS - TIS 17025
CALIBRATION 0367

CERTIFICATE OF CALIBRATION

Certificate No.: CDT-030-68

Page 1 of 2 Pages

MEASUREMENT ITEM

Data Logger with Temperature sensor

MANUFACTURER

Novallmx

MODEL/TYPE

110-WS-250L-D

SERIAL NUMBER

AS980

ID NUMBER

RYG_F50649

CONDITION AS-RECEIVED

Used item

CUSTOMER

ALS laboratory group (Thailand) Co., Ltd.

104 Phatthanakan 40, Phatthanakan Rd.,

Khwaeng Suan Luang, Khet Suan Luang,

Bangkok 10250 Thailand.

RECEIVED DATE

10 Jan 2025

MEASUREMENT DATE

17 Jan 2025

ISSUE DATE

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

Traceability:

The measurement result are traceable to the International System of Units (SI) through National Institute of Metrology (NIMT). Certificate number: T1-0047-24, Certificate number: ER-0113-24.

Reference Used During Calibration:

1. Standard Temperature Probe

Model: STS-100 AS00, Serial No.: 667682-09,

Due date: 26 Mar 2025

2. Digital Temperature Indicator

Model: DTI-1000-A MK II, Serial No.: 671407,

DO581 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'.



JIRANATEE ASSOCIATES CO., LTD.

Continuation of Certificate of Calibration Number CDT-030-68

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: HMP60 S/N: V1920214. Dimension: Diameter 12 mm. Length 80 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.078	19.8	-0.3	0.095
80	25.067	24.8	-0.3	0.095
80	30.054	29.7	-0.4	0.095
80	35.035	34.7	-0.3	0.095
80	40.019	39.7	-0.3	0.095

UUC*: Unit Under Calibration

End of Certificate of Calibration



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-004-68

Page 1 of 2 Pages

MEASUREMENT ITEM

Relative humidity with data logger

MANUFACTURER

Novalyx

MODEL/TYPE

Data Logger: 110-W5-25DL-D

SERIAL NUMBER

Sensor: HAP60

ID NUMBER

Data Logger: A5980

CONDITION AS-RECEIVED

Sensor: V1920214

CUSTOMER

Used item

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

RECEIVED DATE

10 Jan 2025

MEASUREMENT DATE

17 Jan 2025

ISSUE DATE

20 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 Relative humidity and Air Temperature calibration was done by in-house calibration method as WI-CL-009 and WI-CL-010 according to comparison method with Standard, Calibrated 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: TH0445-24 and Jiranatee Associates Co., Ltd. Certificate number: CRT-036-68.

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:
☐ Mr. Sorawat Thairachud
☒ Ms. Bittaporn Terksomphol
☐ Ms. Ruangsri Prommet



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: CRT-004-68

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)
29.71	59.85	59.9	0.0	0.78
29.74	51.27	51.7	0.4	1.3
29.75	82.85	83.2	0.4	2.1

UUC*: Unit Under Calibration

End of Certificate of Calibration



Calibrated by:
☐ Mr. Sorawat Thairachud
☒ Ms. Bittaporn Terksomphol
☐ Ms. Ruangsri Prommet

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

Certificate No. : CPH-004-68

Page 1 of 2 Pages

MEASUREMENT ITEM

Digital barometer

MANUFACTURER

Novalyx

MODEL/TYPE

Sensor: 110-W5-25BP

SERIAL NUMBER

Data logger: 110-W5-25DL-D

ID NUMBER

Sensor: BP-A5980

CONDITION AS-RECEIVED

Data logger: A5980

CUSTOMER

Used item

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

RECEIVED DATE

10 Jan 2025

MEASUREMENT DATE

17 Jan 2025

ISSUE DATE

20 Jan 2025

CONDITION OF THIS RESULT OF CALIBRATION:

1. Calibration effort for calibration sequence C
2. The UUC* was installed in vertical orientation above reference standard instrument and center of UUC* was used as the reference level.

3. Calibration conditions:

4. Condition
Pressure transmitting medium : ☒ Normal ☐ Abnormal
Air : 1.19 kg/m³
T_{amb} : (542.46 ± 3) °C
T_{amb} : (22.910 ± 1) °C
P_{amb} : (1015.41 ± 1.7) mbar

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

Calibration procedure:

The Digital barometer was calibrated against Digital pressure calibrator, the WI-CL-001 was used as a calibration guideline.

Traceability:

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

Reference Used During Calibration:
1. Absolute Pressure Transducer:
Model: EP2000, Serial No.: A100316P

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. Sorawat Thairachud
☐ Ms. Bittaporn Terksomphol



Approved signatory:

Mr. Parinya Booncharoen
Calibration Department Manager

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

CERTIFICATE OF CALIBRATION

Certificate No. : CPH-004-68

Page 1 of 2 Pages

MEASUREMENT RESULTS

☐ Without adjustment ☒ With adjustment

CALIBRATION IN THE RANGE OF : 950 mbar to 1050 mbar

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

STD (mbar)	UUC* (mbar)	Error (mbar)	Uncertainty (k=2) (mbar)
950.06	951.4	1.3	0.37
970.07	970.9	0.8	0.38
990.10	990.6	0.5	0.38
1010.05	1010.1	0.0	0.38
1030.07	1029.5	-0.5	0.37
1050.05	1049.0	-1.1	0.37

Note: UUC* Unit Under Calibration

To convert the result in report unit to Pa should be multiply by 100

End of certificate



Calibrated by:
☒ Mr. Sorawat Thairachud
☐ Ms. Bittaporn Terksomphol

THIS CERTIFICATE REPORT 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

MEASUREMENT ITEM : Cup anemometer
MANUFACTURER : Novalyne
MODEL/TYPE : Sensor: WS-02E
Data logger: 110-WS-16N
SERIAL NUMBER : Sensor: WSD-1159
Data logger: 1159
ID NUMBER : RVG_FS0081
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 : 30 Sep 2024
MEASUREMENT DATE : 04 Oct 2024
ISSUE DATE : 07 Oct 2024

ENVIRONMENTAL CONDITIONS:
Ambient condition in the laboratory are as follows:
Temperature : 23.0 ± 3.0 °C
Relative Humidity : 55.0 ± 15.0 %RH
Atmospheric Pressure : 1010 ± 10 hPa

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

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

Preconditioning : 24 hours at ambient conditions.
Measurement Condition : The average values during measurement are (23.5) °C, (41.5) %RH and (100.4) hPa.

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

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



Approved signature:

REVIEW BY: *[Signature]*
APPROVED BY: *[Signature]*
NEXT CAL DATE: 4/4/26

Mr. Parinya Booncharoen
Calibration Department Manager

Remarks:
¹ Round type section area of the wind tunnel
² Projected cross-section area of the tested object include mounting pipe
³ Diameter of mounting pipe
⁴ Ratio "a" to "b"

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

Page 2 of 2 Pages

MEASUREMENT RESULTS¹

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

v_{std} (m/s)	Temp. wind tunnel (°C)	Temp. room (°C)	v_{std} (m/s)	Error (m/s)	U (k=2) (m/s)
1.011	23.30	23.50	0.9	-0.1	0.31
2.133	23.64	23.50	2.0	-0.1	0.31
3.084	23.30	23.50	3.0	-0.1	0.31
4.175	23.30	23.50	4.0	-0.2	0.31
5.02	23.02	23.50	5.0	0.0	0.31
5.96	23.42	23.50	5.9	-0.1	0.31
7.04	22.98	23.50	7.0	0.0	0.31
7.90	23.40	23.50	7.9	0.0	0.31
9.04	23.08	23.50	9.1	0.1	0.31
9.97	23.22	23.50	10.1	0.1	0.31
10.98	23.18	23.50	11.1	0.2	0.31
12.03	23.18	23.50	12.2	0.2	0.31
12.97	23.28	23.50	13.2	0.2	0.31
13.96	23.22	23.50	14.2	0.2	0.31
14.99	23.30	23.50	15.2	0.3	0.31
15.93	23.26	23.50	16.2	0.3	0.31

Remarks:

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

² Velocity of standard

³ Velocity of Unit Under Calibration

PHOTO OF CALIBRATION SET-UP



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



CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM : Wind Direction Sensor
MANUFACTURER : Novalyne
MODEL/TYPE : Sensor: WS-02E
Data logger: 110-WS-16N
SERIAL NUMBER : Sensor: WSD-1159
Data logger: 1159
ID NUMBER : RVG_FS0081
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 : 30 Sep 2024
MEASUREMENT DATE : 04 Oct 2024
ISSUE DATE : 07 Oct 2024

ENVIRONMENTAL CONDITIONS:
Ambient condition in the laboratory are as follows:
Temperature : 23.0 ± 3.0 °C
Relative Humidity : 55.0 ± 15.0 %RH
Atmospheric Pressure : 1010 ± 10 hPa

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

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

Preconditioning : 24 hours at ambient conditions.
Measurement Condition : The average values during measurement are (23.5) °C, (42.5) %RH and (1007.6) hPa.

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

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



Approved signature:

REVIEW BY: *[Signature]*
APPROVED BY: *[Signature]*
NEXT CAL DATE: 4/4/26

Mr. Parinya Booncharoen
Calibration Department Manager

Remarks:
¹ Round type section area of the wind tunnel
² Projected cross-section area of the tested object include mounting pipe
³ Diameter of mounting pipe
⁴ Ratio "a" to "b"

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

Page 2 of 2 Pages

MEASUREMENT RESULTS¹

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

Air speed m/s	D° _{std} Degree (°)	D° _{unc} Degree (°)	Error Degree (°)	U (k=2) Degree (°)
	0.000	0	0	0.80
	45.000	42	-3	0.80
	90.000	88	-2	0.80
	135.000	134	-1	0.80
	180.000	177	-3	0.80
	225.000	229	4	0.80
	270.000	273	3	0.80
	315.000	317	2	0.80

Remarks:

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

² Direction of standard

³ Direction of Unit Under Calibration

End of Certificate of Calibration





JIRANATEE ASSOCIATES CO., LTD.

Jiranatee Associates Co., Ltd.
6/17/15, 6/17/15-16
Pantaoon 7, 7/1, Rd Watthana, Bangkok,
Bangkok 10110 (Thailand)
Tel: +66(0)800812
Mobile: +66(0)990453
E-mail: jnc-calibration@jiranatee.com
Web site: www.jiranatee.com

Accredited calibration laboratory
ISO/IEC 17025:2017
NSC-TIS-15 17025
CALIBRATION 0367

Air speed measurement laboratory
Calibration services department.



NSC - TIS - TIS 17025
CALIBRATION 0367

Certificate Number

CWS-002-68

CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM
: Cup anemometer
MANUFACTURER
: Novalex
MODEL/TYPE
: Sensor: WS-02F
Data logger: 200-WS-250L
SERIAL NUMBER
: Sensor: WSD-A4985
Data logger: A4985
ID NUMBER
: RYG_F50085
CONDITION AS-RECEIVED
CUSTOMER
: AIS laboratory group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang,
Khet Suan Luang, Bangkok 10250 Thailand.

RECEIVED DATE
: 10 Jan 2025
MEASUREMENT DATE
: 15 Jan 2025
ISSUE DATE
: 16 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
Atmospheric Pressure : 1010 ± 10 hPa

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

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

Preconditioning
: 24 hours at ambient conditions.
Measurement Condition
: The average values during measurement are (24.4 °C, (59.8) 50RH and (1011.1) hPa.

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

Calibrated by:
[1] Mr. Sorawit Thongthai
[2] Miss Jiraporn Lertkarnjan

Remark:
¹ Nozzle cross-section area of the wind tunnel
² Projected cross-section area of the tested object include mounting pipe
³ Diameter of mounting pipe
⁴ Ratio "a/b"



Approved signatory

Mr. Parinya Boonwatan
Calibration Department Manager

REVIEW BY

APPROVED BY

NEXT CAL DATE 15/ 07/ 26

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

Page 2 of 2 Pages

MEASUREMENT RESULTS⁵

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

Vel ⁶ (m/s)	Temp. wind tunnel (°C)	Temp. room (°C)	Vel ⁷ (m/s)	Error (m/s)	U (k=2) (m/s)
0.986	24.50	24.40	0.9	-0.1	0.31
2.220	24.50	24.40	2.0	-0.2	0.31
3.010	24.40	24.40	3.0	0.0	0.45
4.224	24.42	24.40	4.0	-0.2	0.31
4.98	24.52	24.40	5.0	0.0	0.44
5.92	24.30	24.40	6.0	0.0	0.31
7.04	24.34	24.40	7.0	0.0	0.31
8.04	24.44	24.40	8.0	0.0	0.31
8.99	24.34	24.40	9.1	0.1	0.45
10.05	24.54	24.40	10.0	0.0	0.34
11.15	24.62	24.40	11.1	0.0	0.49
12.01	24.32	24.40	12.0	0.0	0.39
13.06	24.66	24.40	13.1	0.0	0.52
13.96	24.36	24.40	14.3	0.3	0.40
15.06	24.40	24.40	15.3	0.3	0.37
16.01	24.50	24.40	16.2	0.2	0.54

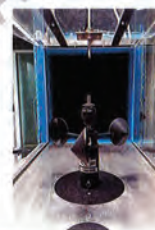
Remark:

⁵ Calibration results only count for the tested circumstances and environmental conditions during which calibration took place

⁶ Velocity of standard

⁷ Velocity 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 may differ from the calibrated one. Remark: The proportion of the set-up is not true to scale due to imaging geometry.



End of Certificate of Calibration



Jiranatee Associates Co., Ltd.
6/17/15, 6/17/15-16
Pantaoon 7, 7/1, Rd Watthana, Bangkok,
Bangkok 10110 (Thailand)
Tel: +66(0)800812
Mobile: +66(0)990453
E-mail: jnc-calibration@jiranatee.com
Web site: www.jiranatee.com

Accredited calibration laboratory
ISO/IEC 17025:2017
NSC-TIS-15 17025
CALIBRATION 0367

Wind direction measurement laboratory
Calibration services department.



NSC - TIS - TIS 17025
CALIBRATION 0367

Certificate Number

CWD-002-68

CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM
: Wind Direction Sensor
MANUFACTURER
: Novalex
MODEL/TYPE
: Sensor: WS-02F
Data logger: 200-WS-250L
SERIAL NUMBER
: Sensor: WSD-A4985
Data logger: A4985
ID NUMBER
: RYG_F50085
CONDITION AS-RECEIVED
CUSTOMER
: AIS laboratory group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang,
Khet Suan Luang, Bangkok 10250 Thailand.

RECEIVED DATE
: 10 Jan 2025
MEASUREMENT DATE
: 15 Jan 2025
ISSUE DATE
: 16 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
Atmospheric Pressure : 1010 ± 10 hPa

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

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

Preconditioning
: 24 hours at ambient conditions.
Measurement Condition
: The average values during measurement are (23.7°C, (54.5) 50RH and (1012.4) hPa.

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

Calibrated by:
[1] Mr. Sorawit Thongthai
[2] Miss Jiraporn Lertkarnjan

Remark:
¹ Nozzle cross-section area of the wind tunnel
² Projected cross-section area of the tested object include mounting pipe
³ Diameter of mounting pipe
⁴ Ratio "a/b"



Approved signatory

Mr. Parinya Boonwatan
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

Certificate Number

CWD-002-68

Page 2 of 2 Pages

MEASUREMENT RESULTS⁵

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

Air speed m/s	D ₁₀₀ Degree (°)	D ₁₀₀ Degree (°)	Error Degree (°)	U (k=2) Degree (°)
5.01	45.000	41	-4	0.80
	50.000	87	-3	0.80
	135.000	132	-3	0.80
	180.000	181	1	0.80
	225.000	229	4	0.80
	270.000	274	4	0.80
	315.000	318	3	0.80
	360.000	359	-1	0.80

Remark:

⁵ Calibration results only count for the tested circumstances and environmental conditions during which calibration took place

⁶ Direction of standard

⁷ Direction of Unit Under Calibration

End of Certificate of Calibration





JIRANATEE ASSOCIATES CO., LTD.

Jirantee Associates Co., Ltd.
60/27 35, 60/29-36
Ponhassan 7, 7/1, 164 Witthayu, Bangkok,
Bangkok 10250 (Thailand)
Tel: +662086817
Mobile: +662399043
E-mail: jnac.calibration@jiranatee.com
Web site: www.jiranatee.com

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

Air speed measurement laboratory
Calibration services department.



NSC-TIS-TIS 17025
CALIBRATION 0367

Certificate Number

CWS-007-68

CERTIFICATE OF CALIBRATION

Page 3 of 2 Pages

MEASUREMENT ITEM
: Cup anemometer
MANUFACTURER
: Novamys
MODEL/TYPE
: Sensor: WS-02FA
Data logger: 110-WS-250L-D
SERIAL NUMBER
: Sensor: WSD-A5988
Data logger: A5988
ID NUMBER
: RYIG_F50650
CONDITION AS-RECEIVED
: Used item
CUSTOMER
: ALS laboratory group (Thailand) Co., Ltd.
104 Phuthanakan 40, Phuthanakan 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 ± 3.0 °C
Relative Humidity : 55.0 ± 15.0 %RH
Atmospheric Pressure : 1010 ± 10 hPa

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

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

Preconditioning
: 24 hours at ambient conditions.
Measurement Condition
: The average values during measurement are 24.5 °C, 53.9 %RH and 1010.9 hPa.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:
[] Mr. Sorawit Thongthai
[] Miss Jitraporn Lertkarnphol



Approved signatory

Mr. Parinya Booncharoen
Calibration Department Manager

REVIEW BY: S.T.S.

APPROVED BY: S.T.S.

NEXT CAL DATE: 07/08/26

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

Calibration procedure:
The Cup anemometer was calibrated against Standard air velocity transducer model: B550B2 and pitot tube with precision differential pressure meter model: DPM2500 in on-chamber calibration of Effel-type wind tunnel with 900 cm² cross-section area. The W-CI-002 based on IEC 61400-12-1: Wind energy generation systems - Part 12-1: Power performance measurements of electricity producing wind turbines, March 2017 was used as a calibration guideline.
Traceability:
This certificate provides a traceability of the measurements to recognized the national standards and to realization of the international system of units [SI] through the NMIM (National Metrology Institute of Thailand) via Certificate number: IMV-0007-24 and IMV-0005-24.

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".

Page 2 of 2 Pages

MEASUREMENT RESULTS⁵

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

V_{ref} (m/s)	Temp. wind tunnel (°C)	Temp. room (°C)	V_{uuc} (m/s)	Error (m/s)	U (k=2) (m/s)
1.014	24.54	24.50	0.8	-0.2	0.31
2.235	24.62	24.50	2.0	-0.2	0.31
3.067	24.40	24.50	2.9	-0.1	0.31
4.272	24.44	24.50	3.9	-0.3	0.31
4.93	24.40	24.50	4.9	0.0	0.31
5.96	24.66	24.50	5.9	-0.1	0.31
7.03	24.22	24.50	6.9	-0.1	0.31
7.97	24.60	24.50	8.0	0.0	0.31
9.02	24.40	24.50	9.1	0.0	0.31
9.96	24.66	24.50	9.9	-0.1	0.31
11.02	24.12	24.50	11.1	0.1	0.31
12.01	24.60	24.50	12.1	0.1	0.31
13.00	24.10	24.50	13.1	0.1	0.31
14.00	24.42	24.50	14.0	0.1	0.37
15.05	24.18	24.50	15.3	0.2	0.31
15.99	24.28	24.50	16.2	0.2	0.31

Remark:

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

² Velocity of standard

³ Velocity of Unit Under Calibration

PHOTO OF CALIBRATION SET-UP



Calibration set-up of the Cup anemometer calibration in the wind tunnel of Jiranatee Associates Co., Ltd. The Cup anemometer shows very little from its calibrated one. Remark: The proportion of the set-up is not true to scale due to imaging geometry.



JIRANATEE ASSOCIATES CO., LTD.

Jirantee Associates Co., Ltd.
60/24 25, 60/29-36
Ponhassan 7, 7/1, 164 Witthayu, Bangkok,
Bangkok 10250 (Thailand)
Tel: +662086817
Mobile: +662399043
E-mail: jnac.calibration@jiranatee.com
Web site: www.jiranatee.com

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

Wind direction measurement laboratory
Calibration services department.



NSC-TIS-TIS 17025
CALIBRATION 0367

Certificate Number

CWD-007-68

CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM
: Wind Direction Sensor
MANUFACTURER
: Novamys
MODEL/TYPE
: Sensor: WS-02FA
Data logger: 110-WS-250L-D
SERIAL NUMBER
: Sensor: WSD-A5988
Data logger: A5988
ID NUMBER
: RYIG_F50650
CONDITION AS-RECEIVED
: Used item
CUSTOMER
: ALS laboratory group (Thailand) Co., Ltd.
104 Phuthanakan 40, Phuthanakan 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 ± 3.0 °C
Relative Humidity : 55.0 ± 15.0 %RH
Atmospheric Pressure : 1010 ± 10 hPa

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

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

Preconditioning
: 24 hours at ambient conditions.
Measurement Condition
: The average values during measurement are 24.3 °C, 55.5 %RH and 1007.1 hPa.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:
[] Mr. Sorawit Thongthai
[] Miss Jitraporn Lertkarnphol



Approved signatory

Mr. Parinya Booncharoen
Calibration Department Manager

Remark:
¹ Nozzle cross-section area of the wind tunnel
² Projected cross-section area of the tested object include mounting pipe
³ Diameter of mounting pipe
⁴ Ratio V_{uuc}/V_{std}

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

Calibration procedure:
The wind direction sensor was calibrated against Standard Rotary Encoder, model: AX-00750 DMM-F3-S-UD in on-chamber calibration of Effel-type wind tunnel with 900 cm² cross-section area. The W-CI-002 based on IEC 61400-12-1: Wind energy generation systems - Part 12-1: Power performance measurements of electricity producing wind turbines, March 2017 was used as a calibration guideline.
Traceability:
This certificate provides a traceability of the measurements to recognized the national standards and to realization of the international system of units [SI] through the NMIM (National Metrology Institute of Thailand) via Certificate number: DA-0027-24.

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".

Certificate Number

CWD-007-68

Page 2 of 2 Pages

MEASUREMENT RESULTS⁵

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

Air speed m/s	D^{CW} Degree (°)	D^{CCW} Degree (°)	Error Degree (°)	U (k=2) Degree (°)
4.98	45.000	41	-4	0.80
	90.000	86	-4	0.80
	135.000	132	-3	0.80
	180.000	180	0	0.80
	225.000	228	3	0.80
	270.000	274	4	0.80
	315.000	319	4	0.80
	360.000	359	-1	0.80

Remark:

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

² Direction of standard

³ Direction of Unit Under Calibration

End of Certificate of Calibration



CERTIFICATE OF CALIBRATION

Certificate No.: CDT-046-68

Page 1 of 2 Pages

MEASUREMENT ITEM: Data logger with Temperature sensor
MANUFACTURER: Novolyte
MODEL/TYPE: 110-WS-250L-D
SERIAL NUMBER: A5888
ID NUMBER: RVG_F50650
CONDITION AS-RECEIVED: Used Item
CUSTOMER: AIS laboratory group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khuang 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 ± 1.0 °C
Relative Humidity: 55.0 ± 15.0 %RH

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

TABULATION OF RESULTS:

The table on next page give the measured values.

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

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

Reference Used During Calibration:
1. Standard Temperature Probe
Model: STS-100 A506, Serial No.: 667682-05,
Due date: 26 Mar 2025
2. Digital Temperature Indicator
Model: DIT-1000-A MK II, Serial No.: 671407-
D0591 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:
☐ Mr. Sorawit Thachulad
☒ Miss Jittaporn Lertsomphol
☐ Miss Ruangsri Phoommit



Approved signatory: Mr. Pinyaa 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

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: HMP60 S/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	-0.3	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



CERTIFICATE OF CALIBRATION

Certificate No.: CRT-006-68

Page 1 of 2 Pages

MEASUREMENT ITEM: Relative humidity with data logger
MANUFACTURER: Novolyte
MODEL/TYPE: Data Logger: 110-WS-250L-D
Sensor: HMP60
SERIAL NUMBER: Data Logger: A5888
Sensor: V1920215
ID NUMBER: RVG_F50650
CONDITION AS-RECEIVED: Used Item
CUSTOMER: AIS laboratory group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd., Khuang 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 ± 1.0 °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 WCL-002 according to comparison method with Standard, Chilled 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: TH0146-24 and Jirantee Associates Co., Ltd. Certificate number: CDT-026-68.

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:
☐ Mr. Sorawit Thachulad
☒ Miss Jittaporn Lertsomphol
☐ Miss Ruangsri Phoommit



Approved signatory: Mr. Pinyaa 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 CRT-006-68

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)
29.20	20.51	22.0	1.5	0.78
29.22	52.54	54.8	2.3	1.3
29.25	84.48	87.9	3.4	2.3

UUC*: Unit Under Calibration

End of Certificate of Calibration



CERTIFICATE OF CALIBRATION

Certificate No. : CPR-005-68

Page 1 of 2 Pages

MEASUREMENT ITEM : Digital barometer
MANUFACTURER : Novalyne
MODEL/TYPE : Sensor: 110-WS-25DP
Data logger: 110-WS-25DL-D
SERIAL NUMBER : Sensor: BP-A5988
Data logger: AS988
ID NUMBER : RYG_F50650
CONDITION AS-RECEIVED : Used item
CUSTOMER : AIS laboratory group (Thailand) Co., Ltd.
104 Phattanakarn 40, Phattanakarn Rd,
Khaeng Suan Luang, Khet Suan Luang,
Bangkok 10250 Thailand.

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

Calibration procedure:
The Digital barometer was calibrated against Digital pressure calibrator. The W-C-0003 was used as a calibration guideline.

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

Reference Used During Calibration:
1. Absolute Pressure Transducer
Model: CPC200, Serial No.: 4100126P

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:

- Calibration effort for calibration sequence C
- The UUC* was installed in vertical orientation above reference standard instrument and center of UUC* was used as the reference level
- Calibration conditions:
 - Condition : ☒ Normal ☐ Abnormal
 - Pressure transmitting medium : Air
 - p_{ref} (20°C, 1 bar) : 1.19 kg/m³
 - H_{corr} : (63.1±1.9) %
 - t_{corr} : (23.140.3) °C
 - p_{corr} : (1008.711.7) mbar
- The certificate is valid only to the item calibrated on date and place of calibration

Calibrated by:
[] Mr. Somchai Thachalad
[] Miss. Jiraporn Lertkumthorn



Approved signature: Mr. Panyia Booncharoen
Calibration Department Manager

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

CERTIFICATE OF CALIBRATION

Certificate No. : CPR-005-68

Page 2 of 2 Pages

MEASUREMENT RESULTS : ☐ Without adjustment ☒ With adjustment
CALIBRATION IN THE RANGE OF : 950 mbar to 1050 mbar

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

STD (mbar)	UUC* (mbar)	Error (mbar)	Uncertainty (k=2) (mbar)
950.02	951.4	1.4	0.37
970.13	971.0	0.8	0.37
990.04	990.8	0.7	0.37
1010.11	1010.4	0.2	0.37
1030.08	1029.9	-0.2	0.37
1050.06	1049.5	-0.6	0.37

Note: UUC* Unit Under Calibration

To convert the result in report unit to Pa should be multiply by 100

End of certificate



CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM : Cup anemometer
MANUFACTURER : Novalyne
MODEL/TYPE : Sensor: WS-02F
Data logger: 110-WS-25DL-D
SERIAL NUMBER : Sensor: WSD-AS978
Data logger: AS978
ID NUMBER : RYG_F50648
CONDITION AS-RECEIVED : Used item
CUSTOMER : AIS laboratory group (Thailand) Co., Ltd.
104 Phattanakarn 40, Phattanakarn Rd, Khaeng Suan Luang,
Khet Suan Luang, Bangkok 10250 Thailand.

RECEIVED DATE : 10 Jan 2025
MEASUREMENT DATE : 16 Jan 2025
ISSUE DATE : 20 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
Atmospheric Pressure : (1010 ± 10) hPa

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

CALIBRATION CONDITIONS : Wind tunnel cross-section area^a : 900 cm²
Wind direction frontal area^a : 100 cm²
Diameter of mounting pipe^a : mm
Blockage ratio of test object^a : 0.111 %

Preconditioning : 24 hours at ambient conditions.
Measurement Condition : The average values during measurement are (24.3) °C, (61.9) %RH and (1011.9) hPa.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:
[] Mr. Somchai Thachalad
[] Miss. Jiraporn Lertkumthorn



Approved signature: Mr. Panyia Booncharoen
Calibration Department Manager

REVIEW BY: [Signature]
APPROVED BY: [Signature]
NEXT CAL DATE: 15/ 07/ 26

Remarks:
^a Accurate cross-section area of the wind tunnel
^b Freely placed cross-section area of the tested object include mounting pipe
^c Diameter of mounting pipe
^d Ratio V_{ref}/V_{std}

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

Certificate Number

CWS-005-68

Page 2 of 2 Pages

MEASUREMENT RESULTS^b

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

V_{std} (m/s)	Temp. wind tunnel (°C)	Temp. room (°C)	V_{UUC} (m/s)	Error (m/s)	U (k=2) (m/s)
0.998	24.10	24.25	0.9	-0.1	0.31
2.242	24.14	24.25	2.0	-0.2	0.31
3.112	24.14	24.25	3.0	-0.1	0.31
4.235	24.12	24.25	4.0	-0.2	0.31
4.94	24.12	24.25	5.0	0.0	0.31
5.98	24.30	24.25	6.0	0.0	0.31
7.03	24.10	24.25	7.2	0.1	0.31
7.97	24.22	24.25	8.2	0.2	0.31
9.03	24.10	24.25	9.3	0.2	0.31
9.95	24.10	24.25	10.2	0.2	0.31
11.02	24.16	24.25	11.2	0.2	0.31
11.99	24.26	24.25	12.3	0.3	0.31
13.04	24.32	24.25	13.4	0.4	0.31
13.98	24.12	24.25	14.4	0.4	0.31
15.01	24.26	24.25	15.4	0.4	0.31
15.97	24.10	24.25	16.4	0.4	0.31

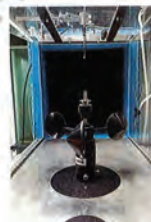
Remark:

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

^b Velocity of standard

^c Velocity 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 may differ from the calibrated one. Remark: The proportion of the set-up is not true to scale due to imaging geometry.



CERTIFICATE OF CALIBRATION

Certificate No. : CRT-003-68

Page 1 of 2 Pages

MEASUREMENT ITEM MANUFACTURER MODEL/TYPE

Relative humidity with data logger
: Novolyne
Data logger: 110-WS-25DL-D
Sensor: HMP60

SERIAL NUMBER

Data logger: A5978
Sensor: V1920213

ID NUMBER CONDITION AS-RECEIVED CUSTOMER

: RYG_F50648
Used item
ALS laboratory group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang,
Khet Suan Luang, Bangkok 10250 Thailand

RECEIVED DATE

: 10 Jan 2025

MEASUREMENT DATE

: 16 Jan 2025

ISSUE DATE

: 20 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 Relative humidity and Air Temperature calibration was done by Jirananatee Calibration method as WI-CL-009 and WI-CL-070 according to comparison method with Standard, Chilled 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: TH04546-24 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:
☐ Mr. Sorapong Thachulad
☒ Miss Bhanaporn Lertrachit
☐ Miss Bhanaporn Phasomrui



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: CRT-003-68

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 (NRH)	UUC Reading (NRH)	Error (NRH)	Uncertainty ± (NRH)
29.71	59.86	18.5	-1.4	0.78
29.75	51.21	49.0	-2.2	1.1
29.75	62.84	80.0	-2.9	2.1

UUC*: Unit Under Calibration

End of Certificate of Calibration



CERTIFICATE OF CALIBRATION

Certificate No. : CPR-003-68

Page 2 of 2 Pages

MEASUREMENT RESULTS

: ☐ Without adjustment ☒ With adjustment

CALIBRATION IN THE RANGE OF : 950 mbar to 1050 mbar

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

STD (mbar)	UUC* (mbar)	Error (mbar)	Uncertainty (k=2) (mbar)
950.13	951.7	1.6	0.38
970.13	971.1	1.0	0.37
990.09	990.6	0.5	0.37
1010.05	1010.0	0.0	0.37
1029.99	1029.5	-0.5	0.38
1050.07	1049.0	-1.1	0.37

Note: UUC* Unit Under Calibration

: To convert the result in report unit to Pa should be multiply by 100

End of certificate



CERTIFICATE OF CALIBRATION

Certificate No. : CPR-003-68

Page 1 of 2 Pages

MEASUREMENT ITEM MANUFACTURER MODEL/TYPE

Digital barometer
: Novolyne
Sensor: 110-WS-25BP
Data logger: 110-WS-25DL-D

SERIAL NUMBER

Sensor: BP-A5978
Data logger: A5978

ID NUMBER CONDITION AS-RECEIVED CUSTOMER

: RYG_F50648
Used item
ALS laboratory group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand.

RECEIVED DATE

: 10 Jan 2025

MEASUREMENT DATE

: 16 Jan 2025

ISSUE DATE

: 20 Jan 2025

CONDITION OF THIS RESULT OF CALIBRATION:

1. Calibration effort for calibration sequence C

2. The UUC* was installed in vertical orientation above reference standard instrument and center of UUC* was used as the reference level.

3. Calibration conditions:

4. Condition: ☒ Normal ☐ Abnormal

Pressure transmitting medium

At (20°C, 1 bar) : 1.19 kg/m^3

H_{max} : (55.142.3) %

t_{amb} : (23.140.3) °C

P_{amb} : (1013.240.7) mbar

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

Calibration procedure:

The Digital barometer was calibrated against Digital pressure calibrator. The WI-CL-003 was used as a calibration guideline.

Traceability:

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

Reference Used During Calibration:

1. Absolute Pressure Transducer
Mettler CP2200, Serial No.: 41001240

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. Sorapong Thachulad
☐ Miss Bhanaporn Lertrachit



Approved signatory:

Mr. Parinya Booncharoen
Calibration Department Manager

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



EMISSION TEST RESULT

Client		Gulf NC Co., Ltd.	Run #	1
Date		29 May 25	Location	Ulaa HRSG 11
Start Time		14:30	Test Operator	Saksit P.
SO ₂ Analyzer	Model	TELEDYNE API 100EH	Finish Time	14:50
NO _x /O ₂ Analyzer	Model	TELEDYNE API T200H	Serial No.	437
CO/CO ₂ Analyzer	Model	TELEDYNE API 300EM	Serial No.	482
			Serial No.	451

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
14:30	14.13	3.95	27.06	0.59	68.28	
14:31	14.13	3.95	26.94	0.58	68.21	
14:32	14.13	3.95	26.90	0.56	68.14	
14:33	14.13	3.95	26.91	0.57	68.05	
14:34	14.14	3.95	26.94	0.57	68.00	
14:35	14.13	3.95	26.96	0.58	67.75	
14:36	14.13	3.95	26.94	0.57	67.97	
14:37	14.14	3.95	26.89	0.57	68.15	
14:38	14.14	3.95	26.79	0.56	68.00	
14:39	14.13	3.95	26.70	0.56	68.04	
14:40	14.15	3.94	26.25	0.55	68.69	
14:41	14.16	3.93	25.48	0.54	68.65	
14:42	14.17	3.93	24.88	0.55	68.78	
14:43	14.17	3.94	24.96	0.54	68.77	
14:44	14.17	3.93	24.91	0.54	68.70	
14:45	14.17	3.93	25.00	0.54	68.22	
14:46	14.16	3.93	25.24	0.54	67.94	
14:47	14.16	3.94	25.51	0.53	67.82	
14:48	14.16	3.93	25.57	0.54	67.78	
14:49	14.15	3.95	25.59	0.53	67.36	
14:50	14.13	3.95	26.39	0.53	66.80	
Average	14.15	3.94	26.13	0.56	68.10	

Saksit P.

(Mr. Saksit Phaisanphisut)

Environmental Field Scientist (4)

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

ALS Laboratory Group

Page 3. of 5.



EMISSION TEST RESULT

Client		Gulf NC Co., Ltd.	Run #	2
Date		29 May 25	Location	Ulaa HRSG 11
Start Time		14:51	Test Operator	Saksit P.
SO ₂ Analyzer	Model	TELEDYNE API 100EH	Finish Time	15:11
NO _x /O ₂ Analyzer	Model	TELEDYNE API T200H	Serial No.	437
CO/CO ₂ Analyzer	Model	TELEDYNE API 300EM	Serial No.	482
			Serial No.	451

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
14:51	14.13	3.94	27.25	0.53	67.12	
14:52	14.13	3.95	27.67	0.53	67.20	
14:53	14.13	3.95	27.68	0.53	67.04	
14:54	14.13	3.95	27.65	0.52	67.20	
14:55	14.13	3.96	27.55	0.52	67.27	
14:56	14.14	3.95	27.39	0.51	67.37	
14:57	14.14	3.95	27.35	0.51	67.32	
14:58	14.14	3.94	27.25	0.60	67.45	
14:59	14.14	3.94	27.12	0.61	67.62	
15:00	14.15	3.95	26.92	0.59	67.45	
15:01	14.15	3.95	26.81	0.59	67.36	
15:02	14.15	3.95	26.76	0.59	67.34	
15:03	14.15	3.95	26.65	0.58	67.15	
15:04	14.15	3.94	26.49	0.58	67.18	
15:05	14.15	3.94	26.35	0.57	67.24	
15:06	14.15	3.95	26.35	0.57	67.15	
15:07	14.15	3.94	26.38	0.56	67.01	
15:08	14.15	3.94	26.39	0.56	66.91	
15:09	14.15	3.93	26.33	0.56	67.21	
15:10	14.16	3.94	26.25	0.56	66.89	
15:11	14.16	3.94	26.17	0.55	67.12	
Average	14.15	3.94	26.89	0.56	67.22	

Saksit P.

(Mr. Saksit Phaisanphisut)

Environmental Field Scientist (4)

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

ALS Laboratory Group

Page 4. of 5.



EMISSION TEST RESULT

Client		Gulf NC Co., Ltd.	Run #	3
Date		29 May 25	Location	Ulaa HRSG 11
Start Time		15:12	Test Operator	Saksit P.
SO ₂ Analyzer	Model	TELEDYNE API 100EH	Finish Time	15:32
NO _x /O ₂ Analyzer	Model	TELEDYNE API T200H	Serial No.	437
CO/CO ₂ Analyzer	Model	TELEDYNE API 300EM	Serial No.	482
			Serial No.	451

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
15:12	14.15	3.94	26.12	0.55	67.73	
15:13	14.15	3.94	25.96	0.54	67.86	
15:14	14.16	3.94	25.81	0.54	67.73	
15:15	14.14	3.94	25.67	0.54	67.82	
15:16	14.14	3.93	25.68	0.52	67.94	
15:17	14.15	3.95	25.60	0.52	67.95	
15:18	14.15	3.95	25.47	0.52	67.75	
15:19	14.15	3.95	25.37	0.52	67.82	
15:20	14.15	3.94	25.23	0.51	67.72	
15:21	14.14	3.94	25.09	0.51	67.93	
15:22	14.15	3.95	25.02	0.51	68.00	
15:23	14.14	3.95	25.02	0.50	67.95	
15:24	14.14	3.94	24.94	0.50	67.91	
15:25	14.14	3.94	24.88	0.49	67.91	
15:26	14.15	3.94	24.82	0.49	68.06	
15:27	14.14	3.96	24.75	0.49	67.86	
15:28	14.14	3.96	24.72	0.58	68.08	
15:29	14.14	3.96	24.76	0.57	67.94	
15:30	14.15	3.96	24.76	0.57	67.90	
15:31	14.15	3.96	24.70	0.56	68.02	
15:32	14.15	3.94	24.68	0.57	68.06	
Average	14.15	3.94	25.19	0.53	67.90	

Saksit P.

(Mr. Saksit Phaisanphisut)

Environmental Field Scientist (4)

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

ALS Laboratory Group

Page 5. of 5.



ANALYZER CALIBRATION DATA

Lot No. 2539570-1

Client	:	Gulf NC Co., Ltd.	Location	:	Ulaa HRSG 12
Date	:	30 May 25	Test Operator	:	Saksit P.

O ₂ ANALYZER	:	TELEDYNE API T200H	Serial No.	:	482
Model	:	25			
Span (%)	:				

	Cylinder Value (%)	Initial Analyzers Calibration Response (%)	Final Analyzers Calibration Response (%)	Difference (Percent of Span)
Zero Gas	0.00	-0.18	-0.10	0.32
Low-Level Gas	8.00	7.80	7.90	0.40
Span Gas	16.02	15.77	15.94	0.68

NO _x ANALYZER	:	TELEDYNE API T200H	Serial No.	:	482
Model	:				
Span (ppm)	:	100			

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	-0.25	-0.05	0.20
Low-Level Gas	55.17	55.87	56.09	0.22
Span Gas	82.39	82.00	82.24	0.24

SO ₂ ANALYZER	:	TELEDYNE API 100EH	Serial No.	:	437
Model	:				
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	0.01	0.02
Low-Level Gas	55.51	55.56	55.53	0.03
Span Gas	78.75	78.83	78.78	0.05

CO ANALYZER	:	TELEDYNE API 300EM	Serial No.	:	451
Model	:				
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	54.19	0.10
Span Gas	79.48	79.18	79.38	0.20

Calibrated by

Saksit P.

(Mr. Saksit Phaisanphisut)

Environmental Field Scientist (4)

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

ALS Laboratory Group

Page 1. of 5.



Lot No. 2539570-1

SYSTEM CALIBRATION BIAS AND DRIFT DATA

Client : Gulf NC Co., Ltd. Location : จั๊าะ HRSG 12
Date : 30 May 25 Test Operator : Saksit P.

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

	O ₂ 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	-0.18	-0.18	0.00	-0.10	0.32	0.32
Upscale Gas	15.77	15.77	0.00	15.34	0.68	0.68

NO_x ANALYZER : 82.39 Span (ppm) : 100
Cylinder Conc. (ppm)

	NO _x 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	-0.25	-0.25	0.00	-0.05	0.20	0.20
Upscale Gas	82.00	82.00	0.00	82.24	0.24	0.24

SO₂ ANALYZER : 78.75 Span (ppm) : 100
Cylinder Conc. (ppm)

	SO ₂ 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	0.03	0.03	0.00	0.01	0.02	0.02
Upscale Gas	78.83	78.83	0.00	78.78	0.05	0.05

CO ANALYZER : 79.48 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	-0.10	-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

(Mr. Saksit Phaisanphisut)

Environmental Field Scientist (4)

FORM NO.: F 06-063 REVISION NO.: 4 ISSUE DATE: 18/01/24

ALS Laboratory Group

Page 2. of 5.



EMISSION TEST RESULT

Client : Gulf NC Co., Ltd. Run # : 1
Date : 30 May 25 Location : จั๊าะ HRSG 12
Start Time : 10:20 Test Operator : Saksit P.
SO₂ Analyzer Model : TELEDYNE API 100EH Finish Time : 10:40
NO_x/O₂ Analyzer Model : TELEDYNE API T200H Serial No. : 437
CO/CO₂ Analyzer Model : TELEDYNE API 300EM Serial No. : 482
Serial No. : 451

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
10:20	14.83	3.78	16.84	0.15	36.52	
10:21	14.83	3.77	17.45	0.15	36.57	
10:22	14.81	3.78	17.97	0.14	36.60	
10:23	14.81	3.78	18.28	0.15	36.61	
10:24	14.79	3.78	18.56	0.14	36.57	
10:25	14.79	3.77	18.52	0.15	36.45	
10:26	14.78	3.79	18.59	0.14	36.41	
10:27	14.78	3.77	18.81	0.13	36.51	
10:28	14.79	3.77	18.78	0.13	36.47	
10:29	14.81	3.75	18.03	0.12	36.39	
10:30	14.84	3.74	16.81	0.12	36.28	
10:31	14.83	3.72	16.04	0.11	36.10	
10:32	14.82	3.73	15.92	0.10	36.00	
10:33	14.81	3.76	16.42	0.11	36.07	
10:34	14.82	3.76	16.71	0.11	36.04	
10:35	14.83	3.75	16.47	0.10	36.06	
10:36	14.83	3.74	16.09	0.10	36.03	
10:37	14.83	3.74	15.71	0.10	36.02	
10:38	14.80	3.75	16.02	0.09	35.91	
10:39	14.80	3.76	16.80	0.09	35.98	
10:40	14.81	3.76	17.01	0.08	35.93	
Average	14.81	3.76	17.23	0.12	36.26	

(Mr. Saksit Phaisanphisut)

Environmental Field Scientist (4)

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

ALS Laboratory Group

Page 3. of 5.



EMISSION TEST RESULT

Client : Gulf NC Co., Ltd. Run # : 2
Date : 30 May 25 Location : จั๊าะ HRSG 12
Start Time : 10:41 Test Operator : Saksit P.
SO₂ Analyzer Model : TELEDYNE API 100EH Finish Time : 11:01
NO_x/O₂ Analyzer Model : TELEDYNE API T200H Serial No. : 437
CO/CO₂ Analyzer Model : TELEDYNE API 300EM Serial No. : 482
Serial No. : 451

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
10:41	14.82	3.74	16.68	0.08	35.95	
10:42	14.85	3.72	15.66	0.07	35.93	
10:43	14.86	3.72	14.96	0.07	35.82	
10:44	14.85	3.72	14.38	0.13	35.80	
10:45	14.83	3.72	14.52	0.23	35.77	
10:46	14.82	3.75	15.15	0.23	35.78	
10:47	14.82	3.75	15.63	0.22	35.75	
10:48	14.84	3.74	15.40	0.21	35.71	
10:49	14.86	3.71	14.64	0.21	35.77	
10:50	14.87	3.71	13.73	0.20	35.72	
10:51	14.88	3.70	13.10	0.19	35.77	
10:52	14.88	3.70	12.83	0.20	35.68	
10:53	14.87	3.70	12.97	0.19	35.64	
10:54	14.87	3.71	13.23	0.20	35.59	
10:55	14.86	3.72	13.43	0.20	35.59	
10:56	14.84	3.73	13.73	0.20	35.49	
10:57	14.82	3.74	14.64	0.19	35.55	
10:58	14.80	3.74	15.47	0.19	35.51	
10:59	14.79	3.75	15.94	0.19	35.64	
11:00	14.81	3.74	15.73	0.19	35.60	
11:01	14.79	3.75	15.59	0.18	35.53	
Average	14.84	3.72	14.64	0.18	35.70	

(Mr. Saksit Phaisanphisut)

Environmental Field Scientist (4)

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

ALS Laboratory Group

Page 4. of 5.



EMISSION TEST RESULT

Client : Gulf NC Co., Ltd. Run # : 3
Date : 30 May 25 Location : จั๊าะ HRSG 12
Start Time : 11:02 Test Operator : Saksit P.
SO₂ Analyzer Model : TELEDYNE API 100EH Finish Time : 11:22
NO_x/O₂ Analyzer Model : TELEDYNE API T200H Serial No. : 437
CO/CO₂ Analyzer Model : TELEDYNE API 300EM Serial No. : 482
Serial No. : 451

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
11:02	14.79	3.75	15.69	0.18	35.42	
11:03	14.80	3.74	15.89	0.18	35.54	
11:04	14.84	3.71	15.19	0.15	35.63	
11:05	14.86	3.70	13.98	0.16	35.63	
11:06	14.85	3.71	13.03	0.15	35.46	
11:07	14.84	3.73	13.12	0.16	35.39	
11:08	14.81	3.74	13.71	0.15	35.35	
11:09	14.77	3.76	14.98	0.16	35.33	
11:10	14.75	3.77	16.55	0.16	35.41	
11:11	14.75	3.77	17.59	0.15	35.39	
11:12	14.77	3.76	17.57	0.14	35.35	
11:13	14.76	3.77	16.97	0.14	35.32	
11:14	14.74	3.77	17.13	0.17	35.39	
11:15	14.76	3.75	17.53	0.23	35.40	
11:16	14.81	3.74	16.65	0.22	35.24	
11:17	14.82	3.72	15.08	0.21	35.28	
11:18	14.82	3.73	14.06	0.22	35.24	
11:19	14.81	3.73	13.99	0.21	35.25	
11:20	14.79	3.75	14.60	0.22	35.09	
11:21	14.76	3.77	15.30	0.23	35.23	
11:22	14.73	3.78	17.14	0.22	35.30	
Average	14.79	3.74	15.51	0.18	35.36	

(Mr. Saksit Phaisanphisut)

Environmental Field Scientist (4)

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

ALS Laboratory Group

Page 5. of 5.



Lot No. 2539560-1

ANALYZER CALIBRATION DATA

Client : Gulf NC Co., Ltd. Location : Jāsa HRSG 12
Date : 30 May 25 Test Operator : Saksit P.

O₂ ANALYZER
Model : TELEDYNE API T803 Serial No. : 81
Span (%) : 25

	Cylinder Value (%)	Initial Analyzers Calibration Response (%)	Final Analyzers Calibration Response (%)	Difference (Percent of Span)
Zero Gas	0.00	-0.18	-0.10	0.32
Low-Level Gas	8.00	7.80	7.90	0.40
Span Gas	16.02	15.77	15.94	0.68

NO_x ANALYZER
Model : 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	-0.25	-0.05	0.20
Low-Level Gas	56.17	55.87	56.09	0.22
Span Gas	82.39	82.00	82.24	0.24

SO₂ ANALYZER
Model : 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	0.01	0.02
Low-Level Gas	55.51	55.56	55.53	0.03
Span Gas	78.75	78.83	78.78	0.05

CO ANALYZER
Model : TELEDYNE API 300EM Serial No. : 451
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	54.19	0.10
Span Gas	79.48	79.18	79.38	0.20

Calibrated by

(Mr. Saksit Phaisanphisut)

Environmental Field Scientist (4)

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

ALS Laboratory Group



Lot No. 2539560-1

SYSTEM CALIBRATION BIAS AND DRIFT DATA

Client : Gulf NC Co., Ltd. Location : Jāsa HRSG 12
Date : 30 May 25 Test Operator : Saksit P.

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

	O ₂ 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	-0.18	-0.18	0.00	-0.10	0.32	0.32
Upscale Gas	15.77	15.77	0.00	15.94	0.68	0.68

NO_x ANALYZER
Cylinder Conc. (ppm) : 82.39 Span (ppm) : 100

	NO _x 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	-0.25	-0.25	0.00	-0.05	0.20	0.20
Upscale Gas	82.00	82.00	0.00	82.24	0.24	0.24

SO₂ ANALYZER
Cylinder Conc. (ppm) : 78.75 Span (ppm) : 100

	SO ₂ 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	0.03	0.03	0.00	0.01	0.02	0.02
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	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	-0.10	-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

(Mr. Saksit Phaisanphisut)

Environmental Field Scientist (4)

FORM NO.: F-06-063 REVISION NO.: 4 ISSUE DATE: 18/01/24

ALS Laboratory Group



Client Name : Gulf NC Co., Ltd. Date : 30 May 25
Plant Name : Jāsa HRSG 12

Run No: 1 Time Base: 21 min							Run No: 2 Time Base: 21 min						
Date	Time	SO ₂	NO _x	CO	O ₂	Load	Date	Time	SO ₂	NO _x	CO	O ₂	Load
		ppm	ppm	ppm	%Vol	MW			ppm	ppm	ppm	%Vol	MW
30 May 25	10:20	0.02	19.83	35.61	14.90	40.15	30 May 25	10:41	0.02	14.89	38.28	14.98	38.07
30 May 25	10:21	0.06	20.29	35.61	14.89	40.26	30 May 25	10:42	0.04	15.46	38.27	14.91	38.38
30 May 25	10:22	0.04	20.73	35.63	14.90	39.94	30 May 25	10:43	0.13	16.54	38.28	14.98	38.78
30 May 25	10:23	0.00	13.95	15.25	5.05	40.24	30 May 25	10:44	0.12	17.01	38.26	14.95	38.58
30 May 25	10:24	0.04	17.87	35.38	14.34	40.32	30 May 25	10:45	0.05	17.39	38.30	14.98	38.11
30 May 25	10:25	0.08	20.01	35.68	14.87	40.15	30 May 25	10:46	0.02	16.05	35.37	14.99	37.63
30 May 25	10:26	0.16	19.74	35.60	14.90	39.49	30 May 25	10:47	0.01	15.18	38.23	15.01	37.13
30 May 25	10:27	0.11	18.20	35.53	14.93	39.92	30 May 25	10:48	0.02	14.68	38.30	15.00	37.62
30 May 25	10:28	0.10	16.68	35.34	14.95	38.80	30 May 25	10:49	0.00	13.50	35.29	15.03	37.04
30 May 25	10:29	0.12	16.27	35.22	14.94	38.15	30 May 25	10:50	0.03	13.57	35.10	15.01	37.27
30 May 25	10:30	0.13	17.00	35.22	14.92	39.40	30 May 25	10:51	0.03	14.06	38.24	15.01	37.27
30 May 25	10:31	0.09	17.83	35.30	14.91	39.31	30 May 25	10:52	0.02	14.77	38.25	15.00	37.48
30 May 25	10:32	0.10	17.83	35.32	14.93	39.30	30 May 25	10:53	0.08	15.55	38.21	14.98	37.04
30 May 25	10:33	0.09	17.49	35.34	14.94	38.73	30 May 25	10:54	0.08	16.28	38.05	14.97	38.30
30 May 25	10:34	0.16	17.57	35.29	14.94	38.78	30 May 25	10:55	0.03	17.20	38.21	14.95	38.76
30 May 25	10:35	0.05	17.80	35.21	14.94	38.35	30 May 25	10:56	0.02	17.34	38.24	14.94	38.85
30 May 25	10:36	0.05	18.75	35.37	14.91	39.22	30 May 25	10:57	0.01	17.07	38.26	14.95	38.23
30 May 25	10:37	0.00	17.81	35.34	14.92	38.28	30 May 25	10:58	0.00	15.49	38.21	14.97	38.28
30 May 25	10:38	0.02	16.87	35.25	14.93	38.19	30 May 25	10:59	0.00	15.98	38.19	14.99	38.73
30 May 25	10:39	0.01	16.16	35.35	14.95	38.30	30 May 25	11:00	0.02	15.89	38.14	14.95	38.69
30 May 25	10:40	0.05	16.47	35.23	14.96	37.95	30 May 25	11:01	0.05	15.74	38.31	14.97	37.94
Max		0.19	20.72	36.60	14.86	40.61	Max		0.13	17.01	38.26	14.95	38.58
Avg		0.19	17.76	34.29	14.43	39.34	Avg		0.04	15.73	38.24	14.98	38.01

Run No: 3							Time Base : 21 min							Run No: 4							Time Base : 21 min						
Date	Time	SO ₂	NO _x	CO	O ₂	Load	Date	Time	SO ₂	NO _x	CO	O ₂	Load	Date	Time	SO ₂	NO _x	CO	O ₂	Load							
		ppm	ppm	ppm	%Vol	MW			ppm	ppm	ppm	%Vol	MW			ppm	ppm	ppm	%Vol	MW							
30 May 25	11:00	0.00	14.74	35.38	15.01	37.03	30 May 25	11:23	0.02	15.98	38.51	14.98	38.37	30 May 25	11:08	0.00	14.74	35.38	15.01	37.03							
30 May 25	11:03	0.02	14.87	35.37	15.03	37.07	30 May 25	11:24	0.01	19.20	35.45	14.90	38.52	30 May 25	11:10	0.00	14.74	35.38	15.01	37.03							
30 May 25	11:04	0.03	15.34	35.30	15.01	37.49	30 May 25	11:25	0.00	19.01	35.33	14.88	38.96	30 May 25	11:13	0.00	20.80	35.13	14.64	40.81							
30 May 25	11:05	0.04	16.31	35.22	15.00	38.03	30 May 25	11:26	0.02	19.22	35.37	14.88	38.84	30 May 25	11:16	0.00	14.74	35.38	15.01	37.03							
30 May 25	11:06	0.00	16.30	35.14	14.96	36.99	30 May 25	11:27	0.07	17.87	35.56	14.90	38.60	30 May 25	11:19	0.00	14.74	35.38	15.01	37.03							
30 May 25	11:07	0.00	17.43	35.15	14.90	36.98	30 May 25	11:28	0.00	15.82	35.33	14.88	38.99	30 May 25	11:22	0.00	14.74	35.38	15.01	37.03							
30 May 25	11:08	0.00	16.30	35.16	14.90	36.98	30 May 25	11:29	0.00	15.82	35.33	14.88	38.99	30 May 25	11:25	0.00	14.74	35.38	15.01	37.03							
30 May 25	11:09	0.00	17.21	35.27	14.92	36.98	30 May 25	11:30	0.04	16.72	35.32	14.86	37.24	30 May 25	11:28	0.00	14.74	35.38	15.01	37.03							
30 May 25	11:10	0.04	16.89	35.25	14.93	36.98	30 May 25	11:31	0.00	15.06	35.39	14.91	36.78	30 May 25	11:31	0.00	14.74	35.38	15.01	37.03							
30 May 25	11:11	0.04	16.93	35.22	14.91	36.98	30 May 25	11:32	0.00	15.06	35.39	14.91	36.78	30 May 25	11:34	0.00	14.74	35.38	15.01	37.03							
30 May 25	11:12	0.01	16.82	35.29	14.91	36.22	30 May 25	11:33	0.01	16.47	35.32	14.91	36.78	30 May 25	11:37	0.00	14.74	35.38	15.01	37.03							
30 May 25	11:13	0.01	16.80	35.27	14.90	36.01	30 May 25	11:34	0.02	15.30	35.30	14.90	37.28	30 May 25	11:40	0.00	14.74	35.38	15.01	37.03							
30 May 25	11:14	0.00	16.79	35.23	14.90	36.01	30 May 25	11:35	0.02	14.82	35.30	14.90	37.28	30 May 25	11:43	0.00	14.74	35.38	15.01	37.03							
30 May 25	11:15	0.01	16.15	35.18	14.90	36.00	30 May 25	11:36	0.02	14.46	35.23	14.90	37.08	30 May 25	11:46	0.00	14.74	35.38	15.01	37.03							
30 May 25	11:16	0.00	15.43	35.25	14.93	36.00	30 May 25	11:37	0.00	14.46	35.11	14.98	36.48	30 May 25	11:49	0.00	14.74	35.38	15.01	37.03							
30 May 25	11:17	0.00	15.43	35.25	14.93	36.00	30 May 25	11:38	0.00	14.46	35.11	14.98	36.48	30 May 25	11:52	0.00	14.74	35.38	15.01	37.03							
30 May 25	11:18	0.00	15.40	34.98	14.96	36.80	30 May 25	11:39	0.00	14.94	35.44	14.80	36.03	30 May 25	11:55	0.00	14.74	35.38	15.01	37.03							
30 May 25	11:19	0.01	14.74	35.10	14.90	36.49	30 May 25	11:40	0.01	19.15	35.30	14.88	40.06	30 May 25	11:58	0.00	14.74	35.38	15.01	37.03							
30 May 25	11:20	0.00	14.74	35.29	14.90	36.49	30 May 25	11:41	0.00	19.15	35.30	14.88	40.06	30 May 25	12:01	0.00	14.74	35.38	15.01	37.03							
30 May 25	11:21	0.02	19.39	35.26	14.89	40.04	30 May 25	11:42	0.03	22.79	35.20	14.81	40.44	30 May 25	12:04	0.00	14.74	35.38	15.01	37.03							
30 May 25	11:22	0.01	20.21	35.48	14.87	39.74	30 May 25	11:43	0.00	22.79	35.20	14.81	40.44	30 May 25	12:07	0.00	14.74	35.38	15.01	37.03							
Max	0.04	20.21	35.48	14.87	40.04		Max	0.05	22.79	35.20	14.81	40.46		Max	0.04	20.21	35.48	14.87	40.04								
Avg	0.007	15.61	35.68	14.90	37.03		Avg	0.02	17.62	35.30	14.89	37.03		Avg	0.007	15.61	35.68	14.90	37.03								



Reference Method Data

Client Name		GNC NC Co., Ltd.		Date		30 May 25							
Plant Name		GNC		Location		SMA2 HRSG 12							
Run No. 1		Time Base : 21 min		Run No. 2		Time Base : 21 min							
Date	Time	SO2 ppm	NOx ppm	CO ppm	CO2 Vol%	SO2 ppm	NOx ppm	CO ppm	CO2 Vol%				
30 May 25	10:20	0.16	16.84	36.52	14.83	3.78	30 May 25	10:41	0.08	16.88	35.95	14.82	3.74
30 May 25	10:21	0.15	17.40	35.57	14.83	3.77	30 May 25	10:42	0.07	15.86	35.83	14.85	3.72
30 May 25	10:22	0.14	17.97	36.60	14.81	3.76	30 May 25	10:43	0.07	14.86	35.82	14.86	3.72
30 May 25	10:23	0.15	18.28	36.61	14.81	3.76	30 May 25	10:44	0.13	14.38	35.80	14.80	3.72
30 May 25	10:24	0.14	18.58	35.57	14.79	3.76	30 May 25	10:45	0.23	14.52	35.77	14.83	3.72
30 May 25	10:25	0.15	18.82	36.45	14.79	3.77	30 May 25	10:46	0.23	15.15	35.78	14.82	3.75
30 May 25	10:26	0.14	18.59	36.41	14.78	3.76	30 May 25	10:47	0.22	15.83	35.75	14.82	3.75
30 May 25	10:27	0.13	18.11	36.51	14.79	3.77	30 May 25	10:48	0.21	15.40	35.71	14.84	3.74
30 May 25	10:28	0.13	18.78	36.47	14.79	3.77	30 May 25	10:49	0.21	14.64	35.77	14.86	3.71
30 May 25	10:29	0.12	16.03	36.39	14.81	3.75	30 May 25	10:50	0.20	13.73	35.72	14.87	3.71
30 May 25	10:30	0.12	16.51	36.28	14.84	3.74	30 May 25	10:51	0.17	13.10	35.77	14.86	3.70
30 May 25	10:31	0.11	16.04	36.10	14.83	3.72	30 May 25	10:52	0.20	12.83	35.68	14.88	3.70
30 May 25	10:32	0.10	15.92	36.00	14.82	3.73	30 May 25	10:53	0.19	12.57	35.64	14.87	3.70
30 May 25	10:33	0.11	16.42	35.97	14.81	3.76	30 May 25	10:54	0.20	12.22	35.60	14.87	3.71
30 May 25	10:34	0.11	16.71	35.94	14.82	3.76	30 May 25	10:55	0.20	13.43	35.59	14.86	3.72
30 May 25	10:35	0.10	16.47	35.95	14.83	3.75	30 May 25	10:56	0.20	13.73	35.49	14.84	3.73
30 May 25	10:36	0.10	16.09	36.03	14.83	3.74	30 May 25	10:57	0.19	14.64	35.55	14.82	3.74
30 May 25	10:37	0.10	15.71	36.02	14.83	3.74	30 May 25	10:58	0.19	15.47	35.51	14.80	3.74
30 May 25	10:38	0.09	16.02	35.91	14.80	3.75	30 May 25	10:59	0.19	15.84	35.44	14.79	3.75
30 May 25	10:39	0.09	16.80	35.98	14.80	3.76	30 May 25	11:00	0.19	15.73	35.60	14.81	3.74
30 May 25	10:40	0.09	17.01	35.93	14.81	3.76	30 May 25	11:01	0.18	15.59	35.53	14.79	3.75
Max		0.15	18.81	36.61	14.84	3.76	Max		0.23	16.88	35.95	14.86	3.75
Avg		0.12	17.23	36.26	14.81	3.76	Avg		0.18	14.64	35.70	14.84	3.72

Run No. 3						Time Base : 21 min						Run No. 4						Time Base : 21 min					
Date	Time	SO2 ppm	NOx ppm	CO ppm	CO2 Vol%	Date	Time	SO2 ppm	NOx ppm	CO ppm	CO2 Vol%	Date	Time	SO2 ppm	NOx ppm	CO ppm	CO2 Vol%						
30 May 25	11:02	0.18	16.89	35.42	14.79	3.75	30 May 25	11:23	0.22	18.23	35.25	14.73	3.79	30 May 25	11:23	0.22	18.23	35.25	14.73	3.79			
30 May 25	11:03	0.20	17.31	35.40	14.79	3.74	30 May 25	11:24	0.21	18.31	35.26	14.74	3.81	30 May 25	11:24	0.21	18.31	35.26	14.74	3.81			
30 May 25	11:04	0.15	15.19	35.63	14.84	3.71	30 May 25	11:25	0.22	18.89	35.44	14.73	3.79	30 May 25	11:25	0.22	18.89	35.44	14.73	3.79			
30 May 25	11:05	0.16	15.98	35.63	14.86	3.70	30 May 25	11:26	0.21	18.73	35.36	14.74	3.76	30 May 25	11:26	0.21	18.73	35.36	14.74	3.76			
30 May 25	11:06	0.16	16.03	35.61	14.86	3.71	30 May 25	11:27	0.20	18.23	35.33	14.72	3.79	30 May 25	11:27	0.20	18.23	35.33	14.72	3.79			
30 May 25	11:07	0.16	15.12	35.39	14.84	3.73	30 May 25	11:28	0.22	18.52	35.29	14.71	3.79	30 May 25	11:28	0.22	18.52	35.29	14.71	3.79			
30 May 25	11:08	0.15	15.71	35.39	14.81	3.74	30 May 25	11:29	0.20	18.89	35.41	14.72	3.76	30 May 25	11:29	0.20	18.89	35.41	14.72	3.76			
30 May 25	11:09	0.16	14.88	35.35	14.77	3.76	30 May 25	11:30	0.19	18.41	35.28	14.77	3.77	30 May 25	11:30	0.19	18.41	35.28	14.77	3.77			
30 May 25	11:10	0.16	16.55	35.41	14.75	3.77	30 May 25	11:31	0.19	16.73	35.16	14.79	3.75	30 May 25	11:31	0.19	16.73	35.16	14.79	3.75			
30 May 25	11:11	0.16	17.59	35.39	14.76	3.77	30 May 25	11:32	0.19	15.82	35.20	14.79	3.75	30 May 25	11:32	0.19	15.82	35.20	14.79	3.75			
30 May 25	11:12	0.14	17.07	35.35	14.77	3.76	30 May 25	11:33	0.17	15.15	35.31	14.83	3.72	30 May 25	11:33	0.17	15.15	35.31	14.83	3.72			
30 May 25	11:13	0.14	16.37	35.32	14.76	3.77	30 May 25	11:34	0.17	14.10	35.19	14.84	3.71	30 May 25	11:34	0.17	14.10	35.19	14.84	3.71			
30 May 25	11:14	0.17	17.13	35.39	14.74	3.77	30 May 25	11:35	0.17	13.18	35.18	14.81	3.72	30 May 25	11:35	0.17	13.18	35.18	14.81	3.72			
30 May 25	11:15	0.23	17.53	35.40	14.76	3.75	30 May 25	11:36	0.16	13.82	35.20	14.83	3.72	30 May 25	11:36	0.16	13.82	35.20	14.83	3.72			
30 May 25	11:16	0.22	14.86	35.24	14.81	3.74	30 May 25	11:37	0.16	14.10	35.12	14.85	3.72	30 May 25	11:37	0.16	14.10	35.12	14.85	3.72			
30 May 25	11:17	0.21	16.08	35.26	14.82	3.72	30 May 25	11:38	0.16	14.32	35.11	14.82	3.72	30 May 25	11:38	0.16	14.32	35.11	14.82	3.72			
30 May 25	11:18	0.22	14.86	35.24	14.82	3.73	30 May 25	11:39	0.15	14.05	35.04	14.82	3.74	30 May 25	11:39	0.15	14.05	35.04	14.82	3.74			
30 May 25	11:19	0.21	15.30	35.25	14.81	3.73	30 May 25	11:40	0.16	14.81	35.04	14.77	3.76	30 May 25	11:40	0.16	14.81	35.04	14.77	3.76			
30 May 25	11:20	0.22	14.80	35.09	14.79	3.75	30 May 25	11:41	0.16	16.87	35.23	14.79	3.79	30 May 25	11:41	0.16	16.87	35.23	14.79	3.79			
30 May 25	11:21	0.23	15.30	35.23	14.76	3.77	30 May 25	11:42	0.16	15.10	35.14	14.74	3.76	30 May 25	11:42	0.16	15.10	35.14	14.74	3.76			
30 May 25	11:22	0.25	17.14	35.39	14.72	3.76	30 May 25	11:43	0.17	15.07	35.25	14.89	3.81	30 May 25	11:43	0.17	15.07	35.25	14.89	3.81			
Max		0.23	17.59	35.63	14.86	3.76	Max		0.22	19.07	35.46	14.84	3.81	Max		0.22	19.07	35.46	14.84	3.81			
Avg		0.18	15.51	35.36	14.79	3.74	Avg		0.18	16.62	35.24	14.77	3.81	Avg		0.18	16.62	35.24	14.77	3.81			

Run No. 5						Time Base : 21 min						Run No. 6						Time Base : 21 min					
Date	Time	SO2	NOx	CO	CO2	Date	Time	SO2	NOx	CO	CO2	Date	Time	SO2	NOx	CO	CO2	Date	Time	SO2	NOx	CO	CO2
		ppm	ppm	ppm	Vol%			ppm	ppm	ppm	Vol%			ppm	ppm	ppm	Vol%			ppm	ppm	ppm	Vol%
30 May 25	11:44	0.19	20.19	35.35	14.86	3.82	30 May 25	12:05	0.15	11.35	34.31	15.09	3.56										
30 May 25	11:45	0.20	20.52	35.67	14.87	3.82	30 May 25	12:06	0.14	10.90	34.31	15.08	3.56										
30 May 25	11:46	0.24	21.88	35.49	14.87	3.83	30 May 25	12:07	0.15	10.87	33.89	15.07	3.56										
30 May 25	11:47	0.24	21.50	35.47	14.87	3.83	30 May 25	12:08	0.15	10.84	34.40	15.10	3.54										
30 May 25	11:48	0.24	21.82	35.51	14.85	3.82	30 May 25	12:09	0.14	10.96	34.47	15.13	3.52										
30 May 25	11:49	0.24	22.37	35.58	14.84	3.83	30 May 25	12:10	0.15	10.88	34.75	15.14	3.50										
30 May 25	11:50	0.23	21.84	35.58	14.84	3.83	30 May 25	12:11	0.15	10.96	34.41	15.12	3.53										
30 May 25	11:51	0.24	20.31	35.62	14.84	3.83	30 May 25	12:12	0.14	10.99	34.19	15.12	3.52										
30 May 25	11:52	0.23	20.36	35.86	14.83	3.84	30 May 25	12:13	0.15	11.09	34.42	15.12	3.53										
30 May 25	11:53	0.23	20.31	35.67	14.85	3.84	30 May 25	12:14	0.15	11.15	34.33	15.13	3.53										
30 May 25	11:54	0.23	20.32	35.62	14.85	3.83	30 May 25	12:15	0.22	10.87	34.04	15.16	3.52										
30 May 25	11:55	0.23	20.30	35.62	14.85	3.83	30 May 25	12:16	0.21	10.75	34.82	15.16	3.52										
30 May 25	11:56	0.23	20.37	35.67	14.85	3.83	30 May 25	12:17	0.21	10.88	34.90	15.16	3.48										
30 May 25	11:57	0.22	20.36	35.69	14.84	3.83	30 May 25	12:18	0.21	10.33	35.11	15.19	3.48										
30 May 25	11:58	0.21	20.31	35.74	14.84	3.83	30 May 25	12:19	0.21	10.15	34.81	15.18	3.48										
30 May 25	11:59	0.21	20.19	35.75	14.85	3.83	30 May 25	12:20	0.21	10.29	33.98	15.18	3.52										
30 May 25	12:00	0.21	20.14	35.63	14.86	3.81	30 May 25	12:21	0.21	10.79	33.57	15.10	3.55										
30 May 25	12:01	0.18	17.03	35.27	14.79	3.74	30 May 25	12:22	0.22	11.26	33.30	15.09	3.54										
30 May 25	12:02	0.16	12.86	34.76	14.92	3.66	30 May 25	12:23	0.20	11.48	33.25	15.09	3.55										
30 May 25	12:03	0.16	10.90	34.28	15.03	3.60	30 May 25	12:24	0.20	11.50	33.20	15.09	3.55										
30 May 25	12:04	0.15	10.85	34.25	15.02	3.59	30 May 25	12:25	0.20	11.46	33.24	15.09	3.55										
Max		0.25	23.36	35.74	15.07	3.84	Max		0.22	11.50	35.11	15.19	3.56										
Avg		0.22	20.88	35.42	14.71	3.79	Avg		0.18	10.52	34.24	15.13	3.53										



Reference Method Data

Client Name		Gulf NC Co., Ltd.				Date		30 May 25					
Plant Name		GNC				Location		SMA2 HRSG 12					
Run No. 7		Time Base : 21 min				Run No. 8		Time Base : 21 min					
Date	Time	SO2 ppm	NOx ppm	CO ppm	CO2 Vol%	Date	Time	SO2 ppm	NOx ppm	CO ppm	CO2 Vol%		
30 May 25	12:26	0.20	11.41	33.14	15.08	3.55	30 May 25	12:47	0.21	10.80	33.29	15.10	3.54
30 May 25	12:27	0.20	11.40	33.31	15.10	3.55	30 May 25	12:48	0.21	10.85	33.47	15.11	3.54
30 May 25	12:28	0.19	11.27	33.51	15.12	3.53	30 May 25	12:49	0.20	10.87	33.68	15.13	3.53
30 May 25	12:29	0.19	10.95	34.02	15.14	3.52	30 May 25	12:50	0.20	10.46	34.15	15.18	3.49
30 May 25	12:30	0.19	10.50	34.57	15.17	3.51	30 May 25	12:51	0.20	10.80	34.78	15.19	3.46
30 May 25	12:31	0.18	10.28	34.32	15.16	3.51	30 May 25	12:52	0.19	9.75	34.84	15.22	3.46
30 May 25	12:32	0.18	10.21	34.59	15.18	3.49	30 May 25	12:53	0.19	9.31	35.93	15.25	3.45
30 May 25	12:33	0.15	10.86	35.25	15.21	3.50	30 May 25	12:54	0.18	9.05	35.24	15.29	3.44
30 May 25	12:34	0.18	8.75	35.40	15.20	3.48	30 May 25	12:55	0.18	9.02	35.15	15.29	3.44
30 May 25	12:35	0.18	8.50	35.18	15.21	3.51	30 May 25	12:56	0.17	8.58	35.22	15.29	3.44
30 May 25	12:36	0.17	10.04	34.13	15.25	3.52	30 May 25	12:57	0.17	9.36	35.42	15.22	3.48
30 May 25	12:37	0.17	10.38	33.75	15.33	3.53	30 May 25	12:58	0.17	9.44	35.35	15.21	3.49
30 May 25	12:38	0.14	10.51	34.14	15.32	3.52	30 May 25	12:59	0.17	9.76	35.15	15.25	3.48
30 May 25	12:39	0.16	10.46	34.41	15.17	3.50	30 May 25	13:00	0.17	10.43	33.57	15.06	3.58
30 May 25	12:40	0.17	10.22	34.04	15.16	3.50	30 May 25	13:01	0.17	12.25	33.24	14.93	3.64
30 May 25	12:41	0.16	10.52	34.24	15.24	3.54	30 May 25	13:02	0.17	12.74	32.69	14.68	3.74
30 May 25	12:42	0.16	10.82	33.20	15.10	3.55	30 May 25	13:03	0.17	21.31	19.97	14.65	3.79
30 May 25	12:43	0.16	11.11	33.37	15.13	3.54	30 May 25	13:04	0.21	20.04	14.69	14.64	3.82
30 May 25	12:44	0.16	10.88	34.44	15.21	3.51	30 May 25	13:05	0.21	19.85	14.69	14.64	3.82
30 May 25	12:45	0.22	10.38	34.30	15.17	3.50	30 May 25	13:06	0.20	22.36	14.94	14.62	3.83
30 May 25	12:46	0.21	10.25	33.37	15.14	3.52	30 May 25	13:07	0.22	22.05	14.94	14.62	3.83
Max	0.22	11.41	35.76	15.21	3.55	Max	0.22	22.05	24.34	15.26	14.83	3.83	
Avg	0.18	10.52	34.14	15.22	3.52	Avg	0.19	10.71	15.02	35.29	15.17	3.48	



CEMs Data

Client Name Plant Name				Gulf NC Co., Ltd. GNC				Location สถานี HRSG 11			
Run No: 1				Run No: 2				Run No: 3			
Date	Time	Flowrate kg/hr	Temperature °C	Date	Time	Flowrate kg/hr	Temperature °C	Date	Time	Flowrate kg/hr	Temperature °C
29-May-25	11:40	375,819	113.5	29-May-25	12:01	377,707	110.1	29-May-25	12:22	368,013	108.0
29-May-25	11:41	373,256	113.1	29-May-25	12:02	286,163	109.3	29-May-25	12:23	305,501	108.0
29-May-25	11:42	373,256	113.0	29-May-25	12:03	294,237	108.3	29-May-25	12:24	307,208	108.0
29-May-25	11:43	381,277	113.0	29-May-25	12:04	298,456	107.3	29-May-25	12:25	308,013	108.0
29-May-25	11:44	380,131	113.0	29-May-25	12:05	299,187	108.5	29-May-25	12:26	307,720	108.0
29-May-25	11:45	387,819	113.0	29-May-25	12:06	300,381	105.0	29-May-25	12:27	306,887	108.2
29-May-25	11:46	376,840	113.5	29-May-25	12:07	299,357	105.5	29-May-25	12:28	306,355	108.5
29-May-25	11:47	376,987	113.5	29-May-25	12:08	305,531	105.5	29-May-25	12:29	307,037	108.5
29-May-25	11:48	374,451	113.3	29-May-25	12:09	307,208	105.5	29-May-25	12:30	307,208	108.5
29-May-25	11:49	377,352	113.0	29-May-25	12:10	307,208	105.5	29-May-25	12:31	307,379	108.5
29-May-25	11:50	380,424	112.8	29-May-25	12:11	307,891	105.5	29-May-25	12:32	306,696	108.5
29-May-25	11:51	384,348	112.5	29-May-25	12:12	305,501	105.7	29-May-25	12:33	305,845	108.5
29-May-25	11:52	386,588	112.5	29-May-25	12:13	306,887	108.2	29-May-25	12:34	306,555	108.6
29-May-25	11:53	386,544	112.5	29-May-25	12:14	306,184	108.7	29-May-25	12:35	307,891	107.0
29-May-25	11:54	383,185	112.5	29-May-25	12:15	305,501	107.0	29-May-25	12:36	308,696	107.0
29-May-25	11:55	387,277	112.5	29-May-25	12:16	305,875	107.0	29-May-25	12:37	305,891	107.0
29-May-25	11:56	379,741	112.4	29-May-25	12:17	304,648	108.8	29-May-25	12:38	308,696	107.0
29-May-25	11:57	378,205	112.0	29-May-25	12:18	304,648	108.5	29-May-25	12:39	306,184	107.0
29-May-25	11:58	383,699	111.9	29-May-25	12:19	305,160	108.5	29-May-25	12:40	307,208	107.0
29-May-25	11:59	345,095	111.4	29-May-25	12:20	307,208	108.5	29-May-25	12:41	308,672	107.0
29-May-25	12:00	382,298	110.8	29-May-25	12:21	307,037	108.0	29-May-25	12:42	305,845	107.0
Max		386,588	113.5	Max		317,707	110.1	Max		307,891	107.0
Avg		374,873	112.8	Avg		304,323	108.6	Avg		306,574	108.6



CEMs Data

Client Name Plant Name				Gulf NC Co., Ltd. GNC				Location สถานี HRSG 11			
Run No: 5				Run No: 6				Run No: 7			
Date	Time	Flowrate kg/hr	Temperature °C	Date	Time	Flowrate kg/hr	Temperature °C	Date	Time	Flowrate kg/hr	Temperature °C
29-May-25	13:04	411,315	112.1	29-May-25	13:25	410,120	115.0	29-May-25	13:46	411,656	113.9
29-May-25	13:05	410,973	112.8	29-May-25	13:26	410,291	114.0	29-May-25	13:47	410,973	113.6
29-May-25	13:06	410,291	113.5	29-May-25	13:27	412,509	114.5	29-May-25	13:48	413,704	114.0
29-May-25	13:07	408,755	114.0	29-May-25	13:28	408,243	114.3	29-May-25	13:49	414,387	114.0
29-May-25	13:08	408,413	114.3	29-May-25	13:29	410,461	114.0	29-May-25	13:50	413,702	114.0
29-May-25	13:09	408,243	114.6	29-May-25	13:30	412,509	114.0	29-May-25	13:51	413,875	114.4
29-May-25	13:10	408,584	115.0	29-May-25	13:31	410,461	113.0	29-May-25	13:52	414,276	114.5
29-May-25	13:11	410,120	115.0	29-May-25	13:32	408,677	113.5	29-May-25	13:53	411,827	114.5
29-May-25	13:12	408,584	115.0	29-May-25	13:33	409,006	113.3	29-May-25	13:54	412,851	114.5
29-May-25	13:13	407,219	115.0	29-May-25	13:34	415,752	113.0	29-May-25	13:55	413,702	114.5
29-May-25	13:14	410,461	115.4	29-May-25	13:35	408,608	113.0	29-May-25	13:56	415,240	114.5
29-May-25	13:15	400,095	115.5	29-May-25	13:36	412,359	112.6	29-May-25	13:57	414,045	114.5
29-May-25	13:16	410,291	116.0	29-May-25	13:37	403,437	112.5	29-May-25	13:58	413,051	114.5
29-May-25	13:17	411,485	116.0	29-May-25	13:38	410,120	112.5	29-May-25	13:59	412,851	114.5
29-May-25	13:18	410,291	116.0	29-May-25	13:39	408,925	112.5	29-May-25	14:00	411,485	114.5
29-May-25	13:19	403,437	116.0	29-May-25	13:40	413,702	112.5	29-May-25	14:01	411,827	114.5
29-May-25	13:20	410,973	116.0	29-May-25	13:41	410,120	112.5	29-May-25	14:02	411,827	114.5
29-May-25	13:21	408,413	116.0	29-May-25	13:42	411,827	113.0	29-May-25	14:03	409,267	114.5
29-May-25	13:22	407,580	115.9	29-May-25	13:43	412,339	113.0	29-May-25	14:04	410,632	114.0
29-May-25	13:23	410,291	115.5	29-May-25	13:44	413,051	113.0	29-May-25	14:05	414,276	114.0
29-May-25	13:24	411,827	115.5	29-May-25	13:45	408,805	113.5	29-May-25	14:06	414,387	114.0
Max		411,827	116.0	Max		415,752	115.0	Max		415,240	114.5
Avg		400,649	115.0	Avg		410,770	113.4	Avg		412,794	114.3



CEMs Data

Client Name Plant Name				Gulf NC Co., Ltd. GNC				Location สถานี HRSG 11			
Run No: 9				Run No: 10				Run No: 11			
Date	Time	Flowrate kg/hr	Temperature °C	Date	Time	Flowrate kg/hr	Temperature °C	Date	Time	Flowrate kg/hr	Temperature °C
29-May-25	14:28	415,069	114.0	29-May-25	14:49	414,557	114.0	29-May-25	15:10	413,383	114.0
29-May-25	14:29	414,557	114.0	29-May-25	14:50	414,216	114.0	29-May-25	15:11	418,204	114.0
29-May-25	14:30	412,188	114.0	29-May-25	14:51	413,180	114.0	29-May-25	15:12	414,216	114.0
29-May-25	14:31	414,557	114.0	29-May-25	14:52	413,875	114.0	29-May-25	15:13	410,120	114.0
29-May-25	14:32	412,339	114.1	29-May-25	14:53	414,216	114.0	29-May-25	15:14	411,827	114.0
29-May-25	14:33	411,997	114.0	29-May-25	14:54	413,875	113.5	29-May-25	15:15	412,680	114.0
29-May-25	14:34	413,704	114.0	29-May-25	14:55	413,704	113.5	29-May-25	15:16	414,889	114.0
29-May-25	14:35	411,827	114.0	29-May-25	14:56	411,485	113.5	29-May-25	15:17	415,891	114.0
29-May-25	14:36	414,216	114.0	29-May-25	14:57	411,827	113.5	29-May-25	15:18	413,383	114.0
29-May-25	14:37	411,997	114.0	29-May-25	14:58	414,557	113.5	29-May-25	15:19	414,387	114.0
29-May-25	14:38	411,895	114.0	29-May-25	14:59	414,557	113.5	29-May-25	15:20	413,051	114.0
29-May-25	14:39	412,680	114.0	29-May-25	15:00	412,851	113.5	29-May-25	15:21	414,728	114.0
29-May-25	14:40	413,192	114.0	29-May-25	15:01	412,680	113.5	29-May-25	15:22	414,045	114.0
29-May-25	14:41	414,557	114.0	29-May-25	15:02	415,752	113.5	29-May-25	15:23	415,752	114.0
29-May-25	14:42	411,997	114.0	29-May-25	15:03	415,411	113.5	29-May-25	15:24	416,093	114.0
29-May-25	14:43	410,973	114.0	29-May-25	15:04	415,080	113.5	29-May-25	15:25	414,216	114.0
29-May-25	14:44	411,895	113.5	29-May-25	15:05	416,436	113.5	29-May-25	15:26	412,509	114.0
29-May-25	14:45	413,192	113.5	29-May-25	15:06	413,875	113.5	29-May-25	15:27	411,997	114.0
29-May-25	14:46	411,485	113.5	29-May-25	15:07	414,728	114.0	29-May-25	15:28	411,895	114.0
29-May-25	14:47	413,383	114.0	29-May-25	15:08	415,891	114.0	29-May-25	15:29	413,192	114.0
29-May-25	14:48	412,188	114.0	29-May-25	15:09	414,728	114.0	29-May-25	15:30	413,383	114.0
Max		415,069	114.1	Max		416,436	114.0	Max		418,204	114.0
Avg		412,818	113.9	Avg		414,151	113.7	Avg		413,880	114.0



CEMs Data

Client Name Plant Name				Gulf NC Co., Ltd. GNC				Location สถานี HRSG 12							
Run No: 1				Run No: 2				Run No: 3				Run No: 4			
Date	Time	Flowrate kg/hr	Temperature °C	Date	Time	Flowrate kg/hr	Temperature °C	Date	Time	Flowrate kg/hr	Temperature °C	Date	Time	Flowrate kg/hr	Temperature °C
29-May-25	15:30	393,629	112.5	30-May-25	15:01	342,196	112.5	30-May-25	11:12	393,629	112.5	30-May-25	11:33	342,877	112.0
29-May-25	15:31	393,971	112.5	30-May-25	15:02	345,437	112.5	30-May-25	11:13	348,632	112.0	30-May-25	11:34	343,371	112.0
29-May-25	15:32	393,728	112.5	30-May-25	15:03	344,072	112.5	30-May-25	11:14	343,389	112.0	30-May-25	11:35	341,240	112.0
29-May-25	15:33	391,240	112.5	30-May-25	15:04	346,509	112.5	30-May-25	11:15	344,755	107.1	30-May-25	11:36	341,341	112.0
29-May-25	15:34	346,632	112.5	30-May-25	15:05	348,675	112.5	30-May-25	11:16	342,877	111.4	30-May-25	11:37	343,731	112.0
29-May-25	15:35	390,728	112.5	30-May-25	15:06	350,045	112.5	30-May-25	11:17	348,291	112.5	30-May-25	11:38	343,632	112.0
29-May-25	15:36	392,435	110.3	30-May-25	15:07	347,997	112.5	30-May-25	11:18	345,437	112.5	30-May-25	11:39	346,609	112.0
29-May-25	15:37	390,728	108.2	30-May-25	15:08	346,509	112.5	30-May-25	11:19	350,216	112.5	30-May-25	11:40	352,264	112.0
29-May-25	15:38	390,657	112.5	30-May-25	15:09	347,997	112.5	30-May-25	11:20	350,216	112.5	30-May-25	11:41	350,492	095.0
29-May-25	15:39	390,728	112.5	30-May-25	15:10	350,045	112.5	30-May-25	11:21	353,117	112.5	30-May-25	11:42	350,728	112.0
29-May-25	15:40	346,893	112.5	30-May-25	15:11	347,315	112.8	30-May-25	11:22	352,435	112.5	30-May-25	11:43	356,531	110.0
29-May-25	15:41	347,666	112.5	30-May-25	15:12	338,605	107.0	30-May-25	11:23	352,726	112.0	30-May-25	11:44	356,831	113.0
29-May-25	15:42	347,877	112.5	30-May-25	15:13	342,195	111.4	30-May-25	11:24	360,490	112.0	30-May-25	11:45	356,672	113.0
29-May-25	15:43	390,728	112.5	30-May-25	15:14	345,437	112.5	30-May-25	11:25	360,629	112.0	30-May-25	11:46	356,672	113.0
29-May-25	15:44	347,666	112.5	30-May-25	15:15	335,115	112.5	30-May-25	11:26	358,609	112.0	30-May-25	11:47	356,848	113.2
29-May-25	15:45	346,893	112.5	30-May-25	15:16	347,485	112.5	30-May-25	11:27	349,363	112.0	30-May-25	11:48	356,139	113.0
29-May-25	15:46	344,072	112.5	30-May-25	15:17	351,752	112.5	30-May-25	11:28	348,461	098.0	30-May-25	11:49	356,672	113.0
29-May-25	15:47	390,728	112.5	30-May-25	15:18	348,675	112.5	30-May-25	11:29	348,291	112.5	30-May-25	11:50	356,672	113.0
29-May-25	15:48	340,688	112.5	30-May-25	15:19	353,288	112.0	30-May-25	11:30	344,072	112.5	30-May-25	11:51	359,391	110.0
29-May-25	15:49	339,676	107.1	30-May-25	15:20	350,045	112.7	30-May-25	11:31	340,147	112.0	30-May-25	11:52	360,761	113.0
30-May-25	15:00	342,195	111.4	30-May-25	15:21	352,947	112.0	30-May-25	11:32	342,365	112.0	30-May-25	11:53	351,240	113.0
30-May-25	15:01	350,728	112.5	30-May-25	15:22	346,632	112.0	30-May-25	11:33	342,365	112.0	30-May-25	11:54	360,761	113.0
Aug 148,119 111.6				Aug 147,884 112.2				Aug 148,201 111.9				Aug 152,896 112.0			



CEMs Data

Client Name Gulf NC Co., Ltd. Location 0402 HRSG 12
Plant Name GNC

Run No: 5				Run No: 6				Run No: 7				Run No: 8			
Date	Time	Flowrate kg/hr	Temperature °C	Date	Time	Flowrate kg/hr	Temperature °C	Date	Time	Flowrate kg/hr	Temperature °C	Date	Time	Flowrate kg/hr	Temperature °C
30-May-25	11:54	352.264	112.7	30-May-25	12:15	275.659	107.5	30-May-25	12:36	275.576	104.5	30-May-25	12:57	300.211	105.9
30-May-25	11:55	352.847	112.5	30-May-25	12:16	275.978	107.5	30-May-25	12:37	275.464	104.5	30-May-25	12:58	317.789	106.6
30-May-25	11:56	355.336	112.3	30-May-25	12:17	277.683	107.2	30-May-25	12:38	280.243	104.5	30-May-25	12:59	331.272	107.5
30-May-25	11:57	359.699	112.2	30-May-25	12:18	284.651	106.3	30-May-25	12:39	282.832	99.8	30-May-25	13:00	346.126	108.5
30-May-25	11:58	347.853	111.8	30-May-25	12:19	282.373	105.6	30-May-25	12:40	281.267	104.0	30-May-25	13:01	350.387	109.6
30-May-25	11:59	359.738	111.2	30-May-25	12:20	284.339	105.6	30-May-25	12:41	278.195	105.5	30-May-25	13:02	352.605	110.4
30-May-25	12:00	316.253	107.3	30-May-25	12:21	281.608	106.3	30-May-25	12:42	275.464	105.5	30-May-25	13:03	353.459	111.0
30-May-25	12:01	302.771	106.3	30-May-25	12:22	283.907	107.1	30-May-25	12:43	275.203	105.5	30-May-25	13:04	355.507	111.6
30-May-25	12:02	283.144	106.4	30-May-25	12:23	283.315	107.8	30-May-25	12:44	281.437	105.9	30-May-25	13:05	356.189	107.9
30-May-25	12:03	273.757	107.3	30-May-25	12:24	283.627	108.0	30-May-25	12:45	280.925	106.1	30-May-25	13:06	351.480	110.5
30-May-25	12:04	275.123	106.3	30-May-25	12:25	283.144	107.8	30-May-25	12:46	280.584	106.5	30-May-25	13:07	356.088	113.3
30-May-25	12:05	277.853	105.8	30-May-25	12:26	279.580	104.0	30-May-25	12:47	276.488	106.5	30-May-25	13:08	357.112	113.9
30-May-25	12:06	267.770	105.1	30-May-25	12:27	276.639	103.4	30-May-25	12:48	273.245	106.5	30-May-25	13:09	359.351	114.2
30-May-25	12:07	266.387	98.4	30-May-25	12:28	274.611	106.0	30-May-25	12:49	269.681	106.5	30-May-25	13:10	369.501	114.5
30-May-25	12:08	266.216	104.5	30-May-25	12:29	275.464	106.6	30-May-25	12:50	268.760	106.0	30-May-25	13:11	366.771	114.5
30-May-25	12:09	266.557	104.5	30-May-25	12:30	273.757	105.3	30-May-25	12:51	268.807	106.0	30-May-25	13:12	352.456	114.5
30-May-25	12:10	266.869	104.5	30-May-25	12:31	272.904	105.0	30-May-25	12:52	265.365	107.4	30-May-25	13:13	343.801	114.0
30-May-25	12:11	266.704	106.0	30-May-25	12:32	272.563	104.8	30-May-25	12:53	273.245	103.4	30-May-25	13:14	348.339	113.3
30-May-25	12:12	260.803	105.3	30-May-25	12:33	275.464	104.5	30-May-25	12:54	273.731	105.5	30-May-25	13:15	345.437	112.7
30-May-25	12:13	273.731	104.1	30-May-25	12:34	276.024	104.5	30-May-25	12:55	273.058	105.5	30-May-25	13:16	348.651	112.9
30-May-25	12:14	273.731	102.7	30-May-25	12:35	276.604	104.5	30-May-25	12:56	284.851	105.5	30-May-25	13:17	351.623	112.9
Max		355.336	112.7	Max		284.651	108.0	Max		284.851	106.5	Max		359.501	114.5
Avg		303.226	107.0	Avg		278.837	105.0	Avg		278.277	105.0	Avg		350.224	111.3



CEMs Data

Client Name Gulf NC Co., Ltd. Location 0402 HRSG 12
Plant Name GNC

Run No: 9				Run No: 10				Run No: 11				Run No: 12			
Date	Time	Flowrate kg/hr	Temperature °C	Date	Time	Flowrate kg/hr	Temperature °C	Date	Time	Flowrate kg/hr	Temperature °C	Date	Time	Flowrate kg/hr	Temperature °C
30-May-25	13:18	352.850	107.8	30-May-25	13:39	356.304	113.0	30-May-25	14:00	354.141	112.0	30-May-25	14:21	349.363	112.4
30-May-25	13:19	353.809	109.4	30-May-25	13:40	342.707	113.0	30-May-25	14:01	346.291	112.0	30-May-25	14:22	348.680	112.0
30-May-25	13:20	353.117	111.0	30-May-25	13:41	338.269	113.0	30-May-25	14:02	341.000	111.0	30-May-25	14:23	350.216	105.5
30-May-25	13:21	355.709	111.0	30-May-25	13:42	348.126	113.0	30-May-25	14:03	336.904	111.5	30-May-25	14:24	345.192	112.0
30-May-25	13:22	354.853	111.0	30-May-25	13:43	347.456	113.0	30-May-25	14:04	337.416	111.3	30-May-25	14:25	350.216	111.5
30-May-25	13:23	344.243	111.0	30-May-25	13:44	349.704	106.5	30-May-25	14:05	338.099	111.0	30-May-25	14:26	352.605	111.5
30-May-25	13:24	340.488	111.0	30-May-25	13:45	351.923	113.0	30-May-25	14:06	340.147	111.0	30-May-25	14:27	352.605	111.5
30-May-25	13:25	340.488	105.8	30-May-25	13:46	347.698	112.8	30-May-25	14:07	339.025	111.0	30-May-25	14:28	351.752	111.5
30-May-25	13:26	338.099	111.0	30-May-25	13:47	350.728	112.5	30-May-25	14:08	338.052	111.0	30-May-25	14:29	351.581	111.4
30-May-25	13:27	340.317	111.0	30-May-25	13:48	348.168	112.5	30-May-25	14:09	344.072	111.0	30-May-25	14:30	352.093	111.0
30-May-25	13:28	342.707	111.5	30-May-25	13:49	347.315	112.5	30-May-25	14:10	342.707	111.3	30-May-25	14:31	349.192	111.0
30-May-25	13:29	350.293	112.0	30-May-25	13:50	347.704	112.0	30-May-25	14:11	346.073	111.5	30-May-25	14:32	350.776	111.0
30-May-25	13:30	341.171	112.4	30-May-25	13:51	347.315	112.0	30-May-25	14:12	354.693	111.5	30-May-25	14:33	351.752	111.0
30-May-25	13:31	345.608	106.5	30-May-25	13:52	350.216	112.0	30-May-25	14:13	354.624	112.0	30-May-25	14:34	352.947	111.0
30-May-25	13:32	352.637	113.0	30-May-25	13:53	350.216	112.0	30-May-25	14:14	354.141	112.0	30-May-25	14:35	354.312	111.0
30-May-25	13:33	358.005	113.0	30-May-25	13:54	346.365	112.0	30-May-25	14:15	350.877	112.0	30-May-25	14:36	356.019	111.1
30-May-25	13:34	334.173	113.1	30-May-25	13:55	351.260	112.0	30-May-25	14:16	353.288	112.0	30-May-25	14:37	356.019	111.5
30-May-25	13:35	344.413	113.5	30-May-25	13:56	351.411	112.0	30-May-25	14:17	353.409	112.5	30-May-25	14:38	352.605	111.5
30-May-25	13:36	351.955	114.0	30-May-25	13:57	353.288	106.5	30-May-25	14:18	353.629	112.5	30-May-25	14:39	354.312	111.5
30-May-25	13:37	355.025	113.5	30-May-25	13:58	350.557	112.0	30-May-25	14:19	353.117	112.5	30-May-25	14:40	352.944	111.5
30-May-25	13:38	359.738	113.4	30-May-25	13:59	350.557	112.0	30-May-25	14:20	353.871	112.5	30-May-25	14:41	351.340	111.5
Max		355.336	114.0	Max		353.288	113.0	Max		355.677	112.5	Max		356.019	112.4
Avg		341.471	111.2	Avg		348.136	111.8	Avg		347.290	111.7	Avg		351.988	111.1



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

CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

Customer: AIR LIQUIDE
Part Number: E04N189E3HA0002
Cylinder Number: GNO027210
Laboratory: 124 - Plumsteadville - PA
PGVP Number: A12022
Gas Code: CO,NO,NOX,SO2,BALN
Reference Number: 180-402340013-1
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 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 in mole/mole basis unless otherwise noted.
Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	80.00 PPM	82.39 PPM	G1	+/- 1.0% NIST Traceable	02/04/2022, 02/11/2022
CARBON MONOXIDE	80.00 PPM	79.48 PPM	G1	+/- 0.8% NIST Traceable	02/04/2022
NITRIC OXIDE	80.00 PPM	82.38 PPM	G1	+/- 1.0% NIST Traceable	02/04/2022, 02/11/2022
SULFUR DIOXIDE	80.00 PPM	78.75 PPM	G1	+/- 0.9% NIST Traceable	02/04/2022, 02/11/2022
NITROGEN	Balance				

CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	06010212	KAL004777	36.48 PPM CARBON MONOXIDE/NITROGEN	+/- 0.5%	Oct 18, 2024
NTRM	200810-15	CC731106	98.81 PPM NITRIC OXIDE/NITROGEN	+/- 0.9%	Oct 06, 2026
NTRM	200810-04	CC708044	98.61 PPM NITRIC OXIDE/NITROGEN	+/- 0.9%	Oct 06, 2026
GMS	124X06889138	CC323707	4.097 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.0%	Sep 03, 2024
NTRM	11010148	KAL004813	99.9 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Jul 26, 2023

ANALYTICAL EQUIPMENT		
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet iS50 FTIR AUP2010245 CO	FTIR	Feb 03, 2022
Nicolet iS50 FTIR AUP2010245 NO	FTIR	Feb 10, 2022
Nicolet iS50 FTIR AUP2010245 NO2	FTIR	Jan 27, 2022
Nicolet iS50 FTIR AUP2010245 SO2	FTIR	Jan 20, 2022

Triad Data Available Upon Request

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



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

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E04N189E3HA0005
Cylinder Number: ND11223
Laboratory: 124 - Plumsteadville - PA
PGVP Number: A12021
Gas Code: CO,NO,NOX,SO2,BALN
Reference Number: 180-402138464-1
Cylinder Volume: 247.2 CF
Cylinder Pressure: 2215 PSIG
Valve Outlet: 660
Certification Date: Jul 15, 2021
Expiration Date: Jul 15, 2029

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/031, 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 in mole/mole basis unless otherwise noted.
Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	80.00 PPM	85.17 PPM	G1	+/- 1.4% NIST Traceable	07/08/2021, 07/15/2021
CARBON MONOXIDE	80.00 PPM	84.24 PPM	G1	+/- 0.5% NIST Traceable	07/08/2021
NITRIC OXIDE	80.00 PPM	85.17 PPM	G1	+/- 1.0% NIST Traceable	07/08/2021, 07/15/2021
SULFUR DIOXIDE	80.00 PPM	85.51 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	D656025	9.81 PPM AIR/NITROGEN DIOXIDE	2.0%	Feb 20, 2020
NTRM	200810-50	CC733428	98.91 PPM NITRIC OXIDE/NITROGEN	+/- 0.9%	Oct 06, 2026
GMS	124X08889	KAL038707	4.058 PPM NITROGEN DIOXIDE/NITROGEN	2.1%	Aug 15, 2021
NTRM	60102024	KAL038363	97.89 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Dec 23, 2021

CERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

Part Number: E02N162E3HA0000 Reference Number: 62-401018725-1
Cylinder Number: ND60018 Cylinder Volume: 249.4 CF
Laboratory: 124 - Riverton (SAP) - NJ Cylinder Pressure: 2214 PSIG
PGVP Number: B62017 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 procedure listed. Analytical Metrology 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 specifications are on a volumetric basis unless otherwise noted.
Do Not Use This Cylinder before 100 gals. (i.e. 3.7 megagrams).

ANALYTICAL RESULTS				
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty
OXYGEN	8.000 %	8.003 %	G1	+/- 0.4% NIST Traceable
NITROGEN	Balance			
CALIBRATION STANDARDS				
Type	Lot ID	Cylinder No	Concentration	Uncertainty
NTRMplus	09050208	C120337	8.951 % OXYGEN/NITROGEN	+/- 0.3% Nov 08, 2018
ANALYTICAL EQUIPMENT				
Instrument/Make/Model			Analytical Principle	Last Multipoint Calibration
Horiba MPA 510-C2-77VM-041			Paramagnetic	Sep 25, 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 procedures 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

Approved for Release

Page 1 of 62-401018725-1

CERTIFICATE OF ANALYSIS
Grade of Product: EPA PROTOCOL STANDARD

Customer: AIR LIQUIDE (THAILAND) LTD.
Part Number: E02N164E2HA0001 Reference Number: 160-402340010-1
Cylinder Number: GN0027197 Cylinder Volume: 249.8 CF
Laboratory: 124 - Plumsteadville - PA Cylinder Pressure: 2214 PSIG
PGVP Number: A12022 Valve Outlet: 590
Gas Code: O2,BALN Certification Date: Feb 02, 2022

Expiration Date: Feb 02, 2030

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/031, using the assay procedure listed. Analytical Metrology 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 specifications are on a volumetric basis unless otherwise noted.
Do Not Use This Cylinder before 100 gals. (i.e. 3.7 megagrams).

ANALYTICAL RESULTS				
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty
OXYGEN	16.50 %	16.02 %	G1	+/- 0.4% NIST Traceable
NITROGEN	Balance			
CALIBRATION STANDARDS				
Type	Lot ID	Cylinder No	Concentration	Uncertainty
NTRM	09010730	R005226	23.20 % OXYGEN/NITROGEN	+/- 0.4% Jun 01, 2022
ANALYTICAL EQUIPMENT				
Instrument/Make/Model			Analytical Principle	Last Multipoint Calibration
SIEMENS OXYMAT 6 - N1-W5-361 - 02			PARAMAGNETIC	Jun 17, 2022

Triad Data Available Upon Request

NOTES: Gross Weight: 48.8 Kg

Net Weight: 9.2 Kg



Approved for Release

Page 1 of 160-402340010-1

CONSOLE CONTROL UNIT CALIBRATION TEST REPORT

Calibration of Date : 10-Jan-25 Barometric Pressure (mmHg) : 755.6
Next Cal. Date : 10-Jul-25 Relative Humidity (%) : 56.5
Temperature (°C) : 28.8

Console Control Meter Data

Calibration No. : C-100125-BKK_FS0518
Dry Gas Meter ID : BKK_FS0518
Serial No. : 1504025
Model No. : XC-572-V

Reference Dry Gas Meter Data

Reference Dry Gas Meter ID : BKK_FS1122
Serial No. : A2003240
Correction Factor (Y) : 1.0000
Next Calibration Date : 25-Feb-26

AH	θ	Reference Dry Gas Meter Calibration				Console Control Dry Gas Meter						Dry Gas Meter Correction Factor	Orifice Calibration Factor
		Final	Initial	Total	°C	Final	Initial	Total	°C	°C	Avg. Temp. (°C)		
15	12.02	150.00	0.00	150.00	31.0	830810.0	830808.0	150.00	30.0	30.0	0.9757	44.7913	
25	9.47	150.00	0.00	150.00	31.0	833251.0	833098.0	150.00	31.0	31.0	0.9780	46.1439	
50	6.61	150.00	0.00	150.00	31.0	833431.0	833277.0	150.00	32.0	32.0	0.9725	44.8148	
80	5.18	150.00	0.00	150.00	31.0	833602.0	833447.0	150.00	32.0	32.0	0.9634	44.0300	
120	4.19	150.00	0.00	150.00	32.0	833766.0	833613.0	150.00	32.0	32.0	0.9691	43.5021	
											Avg.	0.9718	44.6494

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

Avg : Orifice pressure differential that equates to 21.24 in of air @ 25°C and 760 mm of mercury, mmH2O; tolerance for individual values ± 5.08 from average.

Procedure: 40 CFR 60 APP A METH SEC 5.3 & 7

Calibrated by:

(Mr. Warawut. Pubpa)

RYG Field Service Scientist(3)

Approved by:

(Mr. Natthapol. Jengwareewong)

RYG Field Service Specialist(1)

FORM NO.: 1-06-04 REVISION NO.: 2 ISSUE DATE: 30 Jan 22



DIGITAL TEMPERATURE CALIBRATION DATA SHEET

Calibration Date :	10 Jan 25	Ambient Temperature (°C)	28.8
Calibration sheet No. :	C-100125-BKK_FS0519	Relative Humidity (%) :	56.5
Digital Temperature ID :	BKK_FS0519	Reference Temperature ID	RYG_FS0681
Serial No. :	1504025	Serial No. :	201090014918
Model :	XC-572-V	Model :	Digicon-CC-VT-MS
		Next Calibrate :	13 May 25

Location	Reference Temperature °C	Digital Temperature °C	Error °C	MPE	Pass / Fail
Stack	0	0	0	±3	Pass
	25	25	0	±3	Pass
	50	50	0	±3	Pass
	100	100	0	±3	Pass
	150	150	0	±3	Pass
Probe	200	201	1	±3	Pass
	250	251	1	±3	Pass
	300	301	1	±3	Pass
	500	501	1	±3	Pass
	100	100	0	±3	Pass
Oven	120	121	1	±3	Pass
	140	141	1	±3	Pass
	100	100	0	±3	Pass
	120	121	1	±3	Pass
	140	141	1	±3	Pass
Filter	100	100	0	±3	Pass
	120	121	1	±3	Pass
	140	141	1	±3	Pass
	10	9	-1	±3	Pass
	20	19	-1	±3	Pass
Meter	0	0	0	±3	Pass
	25	25	0	±3	Pass
	50	51	1	±3	Pass
	0	0	0	±3	Pass
	25	25	0	±3	Pass
AUX	0	0	0	±3	Pass
	50	51	1	±3	Pass

MPE : (Maximum permissible error of measurement) ค่าความผิดพลาดสูงสุดของวิธีการที่อนุญาต

Calibrated by :

Mr. Warawut. Pubpa

RYG Field Service Scientist (3)

Approved by :

Mr. Natthapol. Jengwareewong

RYG Field Service Specialist (1)

FORM NO.: F-06-022 REVISION NO.: 2 ISSUE DATE: 9 Feb 23



PROBE NOZZLE DIAMETER
CALIBRATION DATA SHEET

Calibration Date : 10 Jan 25	Nozzle Set ID. : BKK_FS0524
Calibration Sheet No. : C-100125-BKK_FS0524	Vernier Caliper ID.: BKK_FS1123

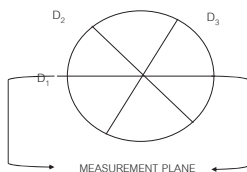
Nozzle ID #	Nozzle Diameter (cm.)			Hi - Lo ΔD	$(D_1 + D_2 + D_3) / 3$ D_{avg}
	D_1	D_2	D_3		
1	0.318	0.318	0.318	0.000	0.318
2	0.472	0.474	0.475	0.003	0.474
3	0.545	0.540	0.540	0.005	0.542
4	0.632	0.635	0.634	0.003	0.634
5	0.792	0.792	0.792	0.000	0.792
6	0.952	0.952	0.952	0.000	0.952
7	1.091	1.110	1.092	0.019	1.098
8	1.256	1.262	1.262	0.006	1.260
9	1.601	1.598	1.600	0.003	1.600

Where :

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

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

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



Calibrated by :
(Mr.Warawut Pubpa)
RYG Field Service Scientist (3)

Approved by :
(Mr.Natthapol Jengwarewong)
RYG Field Service Specialist (1)

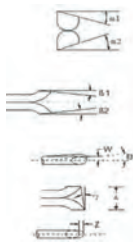
FORM NO.: F-06-124 REVISION NO.: 0 ISSUE DATE: 25/12/23



Type S Pitot Tube Calibration

Date Calibration 10-Jan-25
Pitot ID BKK_FS0523
Pitot SN -

Due Date 10-Jul-25
Inclinometer ID BKK_FS1131
Vernier ID RYG_FS0539



Parameter	Value	Allowable Range	Check
$\alpha 1$	-0.2	$-10^\circ < \alpha 1 < +10^\circ$	OK
$\alpha 2$	2.4	$-10^\circ < \alpha 2 < +10^\circ$	OK
$\beta 1$	-1.2	$-5^\circ < \beta 1 < +5^\circ$	OK
$\beta 2$	-1.6	$-5^\circ < \beta 2 < +5^\circ$	OK
γ	-1.1	-	-
θ	0.2	-	-
$Z = A \tan \gamma$	-0.018	$Z \leq 0.125"$	OK
$W = A \tan \theta$	0.003	$W \leq 0.031"$	OK
Dt	0.308	0.188" to 0.375"	OK
A/2Dt	1.494	$1.05 \leq PA/Dt \leq 1.5$	OK
A	0.92	$2.1Dt \leq A \leq 3Dt$	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. Warawut Pubpa)
RYG Field Services Scientist (3)

Approved By :
(Mr.Natthapol Jengwarewong)
RYG Field Services Specialist (1)

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



Calibration Certificate

Certificate No: G 680274
Date of issue : 28-Apr-25

Instrument description : Flue Gas Analyzer
Instrument model : Testo 350 New
Instrument serial no. : 62985049/1121
Control unit serial no. : 03580182/1121
ID no. or control no. : RYG_FS0564
Manufacturer : Testo SE & Co. KGaA
Probe description : -
Probe model : -
Probe serial no. : -
Customer name : ALS LABORATORY GROUP (THAILAND) CO.,LTD.
Customer address : 104 Phatthanakan 40, Phatthanakan Road, Khwaeng Phatthanakan, Khet Suan Luang, Bangkok, 10250 Thailand

Total pages of certificate : 2 Pages
Receiving no. : L-251464
Receiving date. : 24-Apr-25
Parameter of calibration : Gas Calibration(Oxygen 2.50,9.984,21.01 %vol, Carbon Monoxide 80.45,302,1007 ppm)
Nitrogen Dioxide 30.68,81.8,202.6 ppm, Nitric Oxide 30.0,151.8,322.5 ppm,
Sulphur Dioxide 50.36,100.7,600.8 ppm)

Condition of UUC. : Used
Ambient condition : All of the Measurement were carried out the stabilized laboratory
Temperature : $23 \pm 5^\circ C$
Humidity : $55 \pm 15\% RH$

Calibration place : 17/121 Soi Ngiamwongwan 47 Yaek 48, Toongsonghong, Laksi, Bangkok 10210

Calibration procedure no : This instrument was calibrated by comparison with Standard gas mixture according to calibration Work Instruction no. WI-CL-28-C

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

Date of calibration : 25-Apr-25

Mr. Kwanchai Khamboung
Calibration Technician

Mrs. Nongluk Wongsettee
Technical Manager

FM-CL-09-C Rev.0

Page 1 of 2

Issued Date 26/02/16

Entech Industrial Solution Co.,Ltd.

17/121 Soi Ngiamwongwan 47 Yaek 48, Toongsonghong, Laksi, Bangkok 10210 THAILAND Tel. 0-2779-8888 Calibration@entech.co.th
Tax ID : 0105536035591 www.entech.co.th



Calibration Certificate

Certificate No.: G 680274

Standard References (Table 1)

Standard	Certificate No.	Vendor	Due date
Oxygen (O2) 2.50 % Vol	2412/23	Linde	27-Aug-27
Oxygen (O2) 9.984 % Vol	CG-0113-24	Nimt	01-Aug-29
Oxygen (O2) 21.01 % Vol	CG-0112-24	Nimt	01-Aug-29
Carbon monoxide (CO) 80.45 ppm	CG-0132-24	Nimt	10-Sep-29
Carbon monoxide (CO) 302 ppm	1815/23	Linde	16-Jun-25
Carbon monoxide (CO) 1007 ppm	1870/24	Linde	17-Jun-26
Nitrogen Dioxide (NO2) 30.68 ppm	2832/24	Linde	08-Sep-26
Nitrogen Dioxide (NO2) 81.8 ppm	2330/24	Linde	01-Aug-26
Nitrogen Dioxide (NO2) 202.6 ppm	3794/24	Linde	23-Dec-26
Nitric Oxide (NO) 30.0 ppm	CG-0065-24	Nimt	06-May-26
Nitric Oxide (NO) 151.8 ppm	0404/25	Linde	09-Feb-27
Nitric Oxide (NO) 322.5 ppm	1974/23	Linde	17-Jul-25
Sulphur Dioxide (SO2) 50.36 ppm	2004/23	Linde	17-Jul-25
Sulphur Dioxide (SO2) 100.7 ppm	2662/24	Linde	25-Aug-26
Sulphur Dioxide (SO2) 600.8 ppm	2003/23	Linde	17-Jul-25

Measured room conditions

Temperature : 22.6 °C Humidity : 59.8 %RH Pressure : 1010.3 mbar
Calibration conditions
Gas Temperature : 23 °C Flow rate : 1,300 ml/min Gas pressure : 1016.2 mbar

Calibration Results (Without adjustment) (Table 2)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (±)
O2 (%Vol)	2.50	2.44	-0.06	0.15
O2 (%Vol)	9.984	9.89	-0.094	0.20
O2 (%Vol)	21.01	21.11	0.10	0.30
CO (ppm)	80.45	81	0.55	3.0
CO (ppm)	302	303	1	6.0
CO (ppm)	1007	1006	-1	12
NO2 (ppm)	30.68	29.4	-1.28	8.0
NO2 (ppm)	81.8	79.9	-1.9	8.0
NO2 (ppm)	202.6	199.8	-2.8	12
NO (ppm)	30.0	31	1.0	8.0
NO (ppm)	151.8	154	2.2	8.0
NO (ppm)	322.5	322	-0.5	12
SO2 (ppm)	50.36	49	-1.36	6.0
SO2 (ppm)	100.7	100	-0.7	6.0
SO2 (ppm)	600.8	602	1.2	13

Remark : 1 cmoI/mol = 1 %vol, 1 µmol/mol = 1 ppm, Sensor (NO2,NO,SO2) New.

End of Report

FM-CL-09-C Rev.0

Page 2 of 2

Issued Date 26/02/16

Entech Industrial Solution Co.,Ltd.

17/121 Soi Ngiamwongwan 47 Yaek 48, Toongsonghong, Laksi, Bangkok 10210 THAILAND Tel. 0-2779-8888 Calibration@entech.co.th
Tax ID : 0105536035591 www.entech.co.th

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 WI 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 *Tharitak*

APPROVED BY *D. J. Jansen*

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
		<i>Chonchai Inthana</i>	<i>Kachen Lalee</i>
		Mr. Chonchai Inthana	Kachen Lalee

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

Page 1 | 4

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 TCS)	23 Aug 2025

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

Page 2 | 4

Calibration certificate No.: 25BKL0003
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.	24.7 °C 0.3 K
Twights - Tplace	
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	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 100.0000 g
2 10.0000 g 200.0001 g	Back left 100.0001 g
3 9.9999 g 200.0000 g	Back right 99.9999 g
4 10.0000 g 200.0000 g	Front right 99.9999 g
5 10.0000 g 200.0001 g	Maximum deviation from centric loading indication
6 9.9999 g 200.0000 g	Δf _{ecc} max = 0.0001 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	

Error of indication					
Testload	Indication	Error	Expansion factor	Uncertainty	Uncertainty relative
L	I	E	k	$U(E)$	$U_{rel}(E)$
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	0.00018 g	0.00018 %
200.0000 g	200.0000 g	0.0000 g	2.00	0.00028 g	0.00014 %
220.0000 g	220.0000 g	0.0000 g	2.00	0.00032 g	0.00015 %

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

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

End of calibration certificate

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

Page 3 | 4

Interpretation of measurement results | Appendix to the calibration certificate

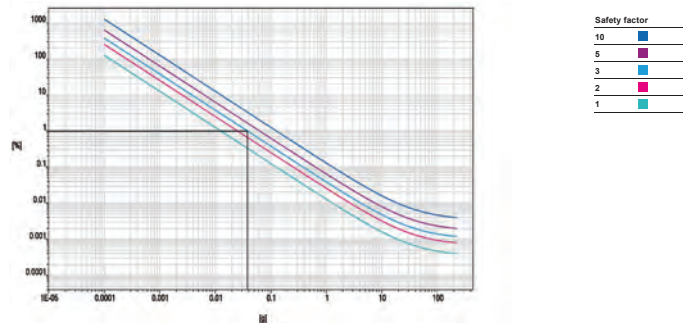
Uncertainty of measurement in use

Device adjusted before measurement	Yes
Temperature deviation considered	1.5 K (isoCAL active)
Temperature coefficient considered	1 · 10 ⁻⁴ /K
Uncertainty of the weighing result U _g (W)	U _g (W) = 0.00013 g + 3.42 · 10 ⁻⁶ · 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 measurand will be in the assigned value range.

Indication in % from max load	Net indication R	Uncertainty U _g (W)	Uncertainty relative U _g (W) _{rel}
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	0.00088 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	0.0380 g

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

Page 4 | 4



Console Control Meter Data

Reference Dry Gas Meter Data

y : Ratio of reading of reference to dry gas meter : tolerance for individual values + 0.02 from average

AHQ : Orifice pressure differential that equates to 21.24 mm of air @ 25 °C and 760 mm of mercury. mmH₂O : tolerance for individual values + 5.08 from average

Procedure: 40 CFR 60 APP A METH. SEC 5.3 & 7

Approved by: Nattaporn Jengwareswong
(Mr.Nattaporn Jengwareswong)
BMC Field Center, Specialist(3)

FORM NO. 5-06-024 DIVISION NO. 3 ISSUE DATE: 30 Jun 78



Digital Temperature ID :	RYG_FS0315	Reference Temperature ID	RYG_FS0681
Serial No. :	1706091	Serial No. :	201090014918
Model :	XC-572-V	Model :	Digicon-CC-VT-MS
		Next Calibrate :	13 May 25

MPE : (Maximum permissible error of measurement) ค่าความผิดพลาดสูงสุดของการวัดที่ยอมรับได้

Calibrated by :

(Mr. Saksit Phaisanphisut)

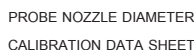
RYG Field Service Scientist (4)

Approved by :

(Mr.Natthapol Jienwareewong)

RYG Field Service Specialist (1)

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



Nozzle ID #	Nozzle Diameter (cm.)			Hi - Lo ΔD	$(D_1 + D_2 + D_3) / 3$ D_{avg}
	D_1	D_2	D_3		
1	0.298	0.300	0.305	0.007	0.301
2	0.465	0.475	0.465	0.010	0.468
3	0.605	0.605	0.605	0.000	0.605
4	0.540	0.540	0.540	0.000	0.540
5	0.770	0.760	0.765	0.010	0.765
6	0.930	0.928	0.930	0.002	0.929
7	1.082	1.080	1.085	0.005	1.082
8	1.240	1.230	1.235	0.010	1.235
9	1.594	1.558	1.551	0.043	1.568

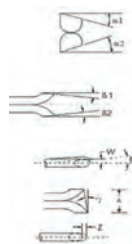
Where :

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

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

$$D_{\text{mean}} = (D_s + D_o + D_n) / 3$$


Calibrated by : _____ Approved by : _____
(Mr. Saksit Phaisanprisut) (Mr. Natthapol Jiewwareewong)
RYG Field Service Scientist (4) RYG Field Service Specialist (1)



Parameter	Value	Allowable Range	Check
α_1	2.2	$-10^\circ < \alpha_1 < +10^\circ$	OK
α_2	3	$-10^\circ < \alpha_2 < +10^\circ$	OK
β_1	-1.2	$-5^\circ < \beta_1 < +5^\circ$	OK
β_2	2.3	$-5^\circ < \beta_2 < +5^\circ$	OK
γ	1.4	-	-
θ	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	$0.188''$ to $0.375''$	OK
$A/2Dt$	1.173	$1.05 \leq A/2Dt \leq 1.5$	OK
A	0.88	$2.1Dt \leq A \leq 3Dt$	OK

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

Calibrated by :

(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: 25/12/22

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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



Cert. No. : ACC24055
Pages : 1 of 3

Calibration Certificate

Equipment : SOUND CALIBRATOR
Manufacturer : RION
Model : NC-74
Serial No.: 34178124
ID No.: RYG_FS0216

REVIEW BY *S.T.S*
APPROVED BY *[Signature]*
NEXT CAL DATE: 22-Oct-25

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 : 18 OCTOBER 2024
Calibration Date : 22 OCTOBER 2024
Date of Issue : 24 OCTOBER 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

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



Cert. No. : ACC24055
Job No. : VC68AC0015
Pages : 2 of 3

Calibration Procedure : CP-AC-03

Calibration Method :

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

The sound pressure level, frequency and total distortion of the sound calibrator was measured using the reference microphone.

Condition of this result of calibration :

1. Reference Standard Instruments :

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

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

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

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

T. Petchur

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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



Cert. No. : ACC24055
Job No. : VC68AC0015
Pages : 3 of 3

Result of calibration :

1. Sound pressure level

Specified sound pressure level (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (dB)	Acceptance limit (dB)
94	94.19	0.19	0.14	0.40

2. Frequency

Specified Frequency (Hz)	Measured value (Hz)	Deviated value (%)	Uncertainty (%)	Acceptance limit (%)
1000	1001.3	0.1	0.1	1.0

3. Total distortion

Measured value (%)	Uncertainty (%)	Acceptance limit (%)
1.82	0.10	3.0

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

End of Calibration Certificate

T. Petchur

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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



Cert. No. : ACL25102
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00296515 / 179119 / 87526
ID No.: RYG_FS0432

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

REVIEW BY *S.T.S*
APPROVED BY *[Signature]*
NEXT CAL DATE: 26/ 01/ 2026

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. : ACL25102
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. : ACL25102
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. : ACL25102
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)
14.2

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

Frequency Weighting	Weighting (dB)
A - weight	10.8
C - weight	17.3
Flat	23.0

3. Acoustical signal tests of frequency weightings

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

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

T. Petch.

Cert. No. : ACL25102
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	-0.1	-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. : ACL25102
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	53.9	-0.1	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	38.9	-0.1	± 1.1
34.0	33.9	-0.1	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.9	-0.1	± 1.1

S. Petch.

Cert. No. : ACL25102
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	28.8	-0.2	±1.1

9. Tone burst response

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

S. Petch.

Cert. No. : ACL25102
Job No. : VC68AC0064
Pages : 8 of 8

10. Peak C sound level

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

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

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

S. Petch.

Certificate of Calibration

Customer

Name : ALS Laboratory Group Thailand Co., Ltd.

Address : 104 Soi Phantumnan 40, Phantumnan Road, Sino Luang, Bangkok 10250

Certificate No. : 25-SLM-113

Request No. : Req-2025-0603

Unit Under Calibration Details

Measurement item	Sound Level Meter	Microphone Class : 2
Manufacturer	RION	Microphone Model : UC-52
Model	NI-42	Microphone S/N : 172170
Serial Number	01173609	Preamplifier Model : NH-24
ID	RYG-F50358	Preamplifier S/N : 74021
Resolution	0.1 dB	Instrument Status : Used


Calibration Environment and Details

Temperature	23 °C ± 2 °C
Humidity	50 %RH ± 20 %RH
Barometric Pressure	1013 hPa ± 10 hPa
Received Date	6 March 2025
Calibrated Date	19 March 2025
Calibration Procedure	In-house method CP-SLM-01, based on IEC 61672-3:2013 Electroacoustics - Sound level meters - Part 3: Periodic tests
Location of Calibration	Lab Acoustic

Reference Standard

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

Note

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor $k = 2$, providing a level of confidence approximately 95 %.Calibrated By : 
Mr. Noppadol Liumgatt
Service Calibration EngineerApproved By : 
Mr. Pichit Mathaveen
Calibration Engineer Supervisor
Issue Date : 19 March 2025

Certificate No : 25-SLM-113
Request No : Req2025-0603

1. Indication at the calibration check frequency

UUC Setting	Nominal Level	Before Adjust	After Adjust	UNCERTAINTY	Acceptance Limit	Result
UUC Level	(dB)	(dB)	(dB)	(\pm dB)	(\pm dB)	
Calibrator Setting	(dB)	(dB)	(dB)	(\pm dB)	(\pm dB)	
1000 Hz 94 dB	94.06	94.0	-0.06	0.20	0.30	Pass

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

2. Self-generated noise, Microphone installed

UUC Setting	Measured	UNCERTAINTY
FAST / 30-130	(dB)	(\pm dB)
UUC Weighting	(dB)	(\pm dB)
A	15.8	0.10

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

UUC Setting	Measured	UNCERTAINTY
FAST / 30-130	(dB)	(\pm dB)
UUC Weighting	(dB)	(\pm dB)
A	12.4	0.10
C	16.7	0.10
Z	20.7	0.10

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

UUC Setting	Deviation from various Frequency Weighting Response curve	UNCERTAINTY	Acceptance Limit	Result
FAST / 30-130	A C Z	(\pm dB)	(\pm dB)	
STD Setting	(dB) (dB) (dB)	(\pm dB)	(\pm dB)	
125 Hz	0.2 0.4 0.4	0.60	1.5	Pass
1000 Hz	0.0 0.0 0.0	0.60	1.0	Pass
4000 Hz	-0.1 -0.1 -0.1	0.60	5.0	Pass
8000 Hz	-1.4 -1.4 -1.3	0.70	5.0	Pass

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

FM-30-SLM-60 Rev.01 Issue date 7/6/21

Certificate No : 25-SLM-113
Request No : Req2025-0603

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

UUC Setting	Deviation from various Frequency Weighting Response curve	UNCERTAINTY	Acceptance Limit	Result
FAST / 30-130	A (dB) C (dB) Z (dB)	(\pm dB)	(\pm dB)	
STD Setting	(dB) (dB) (dB)	(\pm dB)	(\pm dB)	
63 Hz	-0.2 -0.1 0.0	0.20	2.0	Pass
125 Hz	-0.1 0.0 0.0	0.20	1.5	Pass
250 Hz	-0.1 0.0 0.0	0.20	1.5	Pass
500 Hz	0.0 0.0 0.0	0.20	1.5	Pass
1000 Hz	0.0 0.0 0.0	0.20	1.0	Pass
2000 Hz	0.0 0.1 0.0	0.20	2.0	Pass
4000 Hz	0.0 0.0 0.0	0.20	3.0	Pass
8000 Hz	0.1 0.1 0.0	0.20	5.0	Pass
16000 Hz	-1.3 -1.4 0.0	0.20	>5. -INF	Pass

6. Frequency and time weightings at 1kHz

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

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

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

FM-30-SLM-60 Rev.01 Issue date 7/6/21

Certificate No : 25-SLM-113
Request No : Req2025-0603

7. Long Term Stability

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

8. Level linearity on the reference level range

UUC Setting	Anticipated REF	Deviation UUC ERR	UNCERTAINTY	Acceptance Limit	Result
FAST / A / 30-130	(dB)	(dB) (dB)	(\pm dB)	(\pm dB)	
STD dB	(dB)	(dB) (dB)	(\pm dB)	(\pm dB)	
136.00	136	137.9 -0.1	0.30	1.1	Pass
134.00	134	134.0 0.0	0.30	1.1	Pass
129.00	129	128.9 -0.1	0.30	1.1	Pass
124.00	124	124.0 0.0	0.30	1.1	Pass
119.00	119	119.0 0.0	0.30	1.1	Pass
114.00	114	114.0 0.0	0.30	1.1	Pass
109.00	109	109.0 0.0	0.30	1.1	Pass
104.00	104	104.0 0.0	0.30	1.1	Pass
99.00	99	99.0 0.0	0.30	1.1	Pass
94.00	94	94.0 0.0	0.30	1.1	Pass
89.00	89	89.0 0.0	0.30	1.1	Pass
84.00	84	84.0 0.0	0.30	1.1	Pass
79.00	79	79.0 0.0	0.30	1.1	Pass
74.00	74	74.0 0.0	0.30	1.1	Pass
69.00	69	69.0 0.0	0.30	1.1	Pass
64.00	64	64.0 0.0	0.30	1.1	Pass
59.00	59	59.0 0.0	0.30	1.1	Pass
54.00	54	54.0 0.0	0.30	1.1	Pass
49.00	49	49.0 0.0	0.30	1.1	Pass
44.00	44	44.0 0.0	0.30	1.1	Pass
39.00	39	39.0 0.0	0.30	1.1	Pass
34.00	34	34.0 0.0	0.30	1.1	Pass
29.00	29	29.0 0.0	0.30	1.1	Pass
24.00	24	24.1 0.1	0.30	1.1	Pass

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

FM-30-SLM-60 Rev.01 Issue date 7/6/21

Certificate No : 25-SLM-113
Request No : Req2025-0603

9. Level linearity including the level range control

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

10. Tone burst response

UUC Setting	STD Toneburst	Anticipated Ref	Measured UUC ERR	UNCERTAINTY	Acceptance Limit	Result
A / 30-130	(ms)	(dB)	(dB) (dB)	(\pm dB)	(\pm dB)	
UUC Time Response	(ms)	(dB)	(dB) (dB)	(\pm dB)	(\pm dB)	
Fast	200	126.0	126.0 0.0	0.20	1.0	Pass
	2	109.0	109.0 0.0	0.20	+1.0, -2.5	Pass
	0.25	100.0	99.9 -0.1	0.20	+1.5, -5.0	Pass
Slow	200	119.6	119.6 0.0	0.20	1.0	Pass
	2	100.0	100.0 0.0	0.20	+1.0, -5.0	Pass
SIL	200	120.0	120.0 0.0	0.20	1.0	Pass
	2	100.0	100.0 0.0	0.20	+1.0, -2.5	Pass
	0.25	91.0	90.9 -0.1	0.20	+1.5, -5.0	Pass

11. Peak C Sound level

UUC Setting	Anticipated REF	Measured UUC ERR	UNCERTAINTY	Acceptance Limit	Result
FAST / C / 55-141	(dB)	(dB) (dB)	(\pm dB)	(\pm dB)	
STD Setting	(dB)	(dB) (dB)	(\pm dB)	(\pm dB)	
Complete cycle	136.4	136.4 0.00	0.20	3.0	Pass
Positive half cycle	135.4	135.2 -0.20	0.20	2.0	Pass
Negative half cycle	135.4	135.2 -0.20	0.20	2.0	Pass

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

FM-30-SLM-60 Rev.01 Issue date 7/6/21



Certificate No : 25-SLM-113
Request No : Req2025-0603

Page 6/7

12. Overload indication

UUC Setting	Measured	UNCERTAINTY	Acceptance Limit	Result
FAST / A /30-130	UUC	(± dB)	(± dB)	
STD Setting	(dB)			
Positive one-half cycle	139.5			
Negative one-half cycle	139.4			
Deviated	0.1	0.20	1.5	Pass

13. High Level Stability

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

Note :

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

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

The 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-308-SLM-01 Rev.03 Issue date 19/01



Certificate No : 25-SLM-113
Request No : Req2025-0603

Page 7/7

Decision Rule for Statements of Conformity

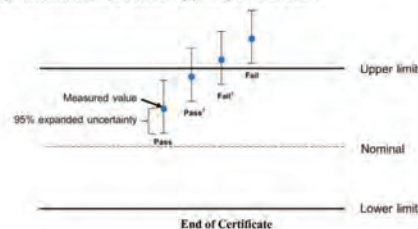
The standard decision rule employed for the statements of conformity in each calibration result will be applied using IEC-6109:2019; Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

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

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

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

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



The 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-308-SLM-01 Rev.03 Issue date 19/01

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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



Cert. No. : ACL25101
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No. : 01173610 / 143485 / 22619
ID No. : RYG_FS0389

Condition As Found : GOOD

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

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

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

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchurai
(Thanakul Petchurai)

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

SITHIPORN
associatesSITHIPORN ASSOCIATES
CALIBRATION LABORATORY

Cert. No. : ACL25101
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. Petchurai

Cert. No. : ACL25101
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

Z. Petch.

Cert. No. : ACL25101
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)
18.8

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

Frequency Weighting (dB)	Weighting (dB)
A - weight	16.3
C - weight	22.1
Flat	28.0

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	0.4	0.4	0.4	± 1.5
1000	0.1	0.1	0.1	± 1.0
8000	-0.2	-0.2	-0.2	±5.0

Z. Petch.

Cert. No. : ACL25101
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	0.0	±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	0.1	±2.0
4000	0.0	0.1	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	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

Z. Petch.

Cert. No. : ACL25101
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	119.1	0.1	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	26.0	0.0	± 1.1
25.0	24.9	-0.1	± 1.1

Z. Petch.

Cert. No. : ACL25101
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	108.0	0.0	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.1	0.1	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

Cert. No. : ACL25101
Job No. : VC68AC0064
Pages : 8 of 8

10. Peak C sound level

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

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

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle	0.0	±1.5
89.6	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	137.1	137.0	0.1	±0.3

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

End of Calibration Certificate

INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7/139 MOO 13, SOI SUTINAKORN 11 TAMBON BANG KAE0,
AMPHOE BANG PHI SAMUT PRAKAN PROVINCE 10540 THAILAND
TEL: (660-2116-5800-1 FAX: (660-2116-7140)

Page 1 of 3

Certificate of Calibration

Customer

Name : ALS Laboratory Group Thailand Co., Ltd. Certificate No : 25-ACT-010
Address : 104 Soi Phatthanakan 40, Phatthanakan Road, Suan Luang, Request No : Req-2025-0091
Bangkok 10250

Unit Under Calibration Details

Measurement item : Acoustic Calibrator Class : 1
Manufacturer : RION Range : 94 dB / 1000 Hz
Model : NC-74 Instrument Status : Used
Serial Number : 34178121
ID : RYG_FS0213

Calibration Environment and Details

Temperature : (23 ±2 °C)
Humidity : (50 ± 20 %RH)
Barometric Pressure : (1013 ±10.0 hPa)
Received Date : 15 January 2025
Calibration Date : 16 January 2025
Location of Calibration : LAB 1 Acoustic
Calibration Procedure : In-house method CP-ACT-02 based on IEC 60942:2017 Electroacoustics - Sound calibrators

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

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

Note

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

Calibrated By :
Mr. Noppadon Luangart
Service Calibration Engineer

Approved By :
Mr. Pacit Mathavorn
Calibration Engineer Supervisor
Issue Date : 16 January 2025

INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7/139 MOO 13, SOI SUTINAKORN 11 TAMBON BANG KAE0,
AMPHOE BANG PHI SAMUT PRAKAN PROVINCE 10540 THAILAND
TEL: (660-2116-5800-1 FAX: (660-2116-7140)

Page 2 of 3

Certificate No : 25-ACT-010

Request No : Req-2025-0091

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	94.11	0.11	-	-	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 (%)	Measured (%)			
94 dB / 1000 Hz	1.21	-	0.40	2.5	Pass

Note :

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

- Acceptance limit was IEC60942:2017 Class 1

- The calibration results exclude the calibrator pressure correction

- The calibration results exclude the microphone volume correction



Certificate No : 25-ACT-010

Request No : Req-2025-0091

Decision Rule for Statements of Conformity

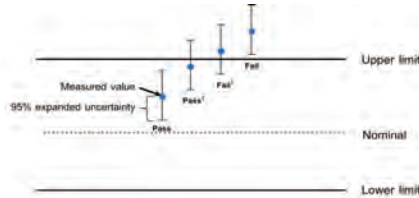
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09/2019; Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

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

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

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

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



End of Calibration

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

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

SITHIPORN ASSOCIATES CO., LTD. CALIBRATION LABORATORY

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

SITHIPORN
associates



Cert. No. : ACL24307

Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 01073423 / 169513 / 73684
ID No.: RYG_FS0386

Condition As Found : GOOD

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

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

Received Date : 23 SEPTEMBER 2024
Calibration Date : 09 OCTOBER 2024
Date of Issue : 09 OCTOBER 2024

REVIEW BY	<i>Nathakorn P.</i>
APPROVED BY	<i>[Signature]</i>
NEXT CAL. DATE	9/10/25

Calibrated by : Nathakorn Pisutpaisan

Approved by : *[Signature]*
(Thanakul Petchurai)

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

SITHIPORN ASSOCIATES CO., LTD. CALIBRATION LABORATORY

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

SITHIPORN
associates



Cert. No. : ACL24307
Job No. : VC67AC0164
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

Condition of this result of calibration :

I. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-24	05-FEB-25
Waveform Generator	33511B	MY52302742	EF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	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).

[Signature]

SITHIPORN ASSOCIATES CO., LTD. CALIBRATION LABORATORY

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

SITHIPORN
associates



Cert. No. : ACL24307
Job No. : VC67AC0164
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

[Signature]

Cert. No. : ACL24307
Job No. : VC67AC0164
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)
15.7

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

Frequency Weighting	Weighting (dB)
A - weight	14.8
C - weight	21.2
Flat	26.6

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	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	0.3	0.4	0.4	±5.0

z. Petch.

Cert. No. : ACL24307
Job No. : VC67AC0164
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

z. Petch.

Cert. No. : ACL24307
Job No. : VC67AC0164
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	30.0	0.0	± 1.1
29.0	29.1	0.1	± 1.1
28.0	28.1	0.1	± 1.1
27.0	27.2	0.2	± 1.1
26.0	26.2	0.2	± 1.1
25.0	25.3	0.3	± 1.1

z. Petch.

Cert. No. : ACL24307
Job No. : VC67AC0164
Pages : 7 of 8

8. Level linearity including the level range control

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

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	30.0	29.9	-0.1	±1.1

9. Tone burst response

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

z. Petch.

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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



Cert. No. : ACL24307
Job No. : VC67AC0164
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	133.0	133.0	0.0	±3.0
One	136.4	136.3	-0.1	±3.0

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

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

T. Petchur

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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



Cert. No. : ACL24418
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42A / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00623387 / 198634 / 26415
ID No.: RYG_FS0612

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



Cert. No. : ACL24418
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 to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference
Standard Instruments.
For tests results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

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

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

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

3.1 National Institute of Metrology (Thailand).

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

T. Petchur

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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



Cert. No. : ACL24418
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. Petchur

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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

SITHIPORN
associates



Cert. No. : ACL24418
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)
14.6

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

Frequency Weighting	Weighting (dB)
A - weight	11.6
C - weight	18.0
Flat	24.0

3. Acoustical signal tests of frequency weightings

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

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

T. Ketch

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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

SITHIPORN
associates



Cert. No. : ACL24418
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	-0.1	-0.1	0.0	±2.0
125	0.0	0.1	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.0	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. Ketch

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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

SITHIPORN
associates



Cert. No. : ACL24418
Job No. : VC68AC0051
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	53.9	-0.1	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	38.9	-0.1	± 1.1
34.0	33.9	-0.1	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.0	0.0	± 1.1
26.0	26.0	0.0	± 1.1
25.0	25.1	0.1	± 1.1

T. Ketch

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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

SITHIPORN
associates



Cert. No. : ACL24418
Job No. : VC68AC0051
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	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.1	0.1	±1.0

T. Ketch

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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

SITHIPORN
associates



Cert. No. : ACL24418
Job No. : VC68AC0051
Pages : 8 of 8

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lopeak (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. Petchur

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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

SITHIPORN
associates



Cert. No. : ACL24306
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No. : 00597169 / 158770 / 34370
ID No. : RYG_FS0439

Condition As Found : GOOD

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

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

Received Date : 23 SEPTEMBER 2024
Calibration Date : 09 OCTOBER 2024
Date of Issue : 09 OCTOBER 2024

REVIEW BY	<i>Nathakorn P.</i>
APPROVED BY	<i>T. Petchur</i>
NEXT CAL. DATE	9/10/25

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

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

SITHIPORN
associates



Cert. No. : ACL24306
Job No. : VC67AC0164
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. Petchur

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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

SITHIPORN
associates



Cert. No. : ACL24306
Job No. : VC67AC0164
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. Petchur

Cert. No. : ACL24306
Job No. : VC67AC0164
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	16.8
Flat	22.4

3. Acoustical signal tests of frequency weightings

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

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

z. Retch.

Cert. No. : ACL24306
Job No. : VC67AC0164
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

z. Retch.

Cert. No. : ACL24306
Job No. : VC67AC0164
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	38.9	-0.1	± 1.1
34.0	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	25.3	0.3	± 1.1

z. Retch.

Cert. No. : ACL24306
Job No. : VC67AC0164
Pages : 7 of 8

8. Level linearity including the level range control

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

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	30.0	30.1	0.1	±1.1

9. Tone burst response

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

z. Retch.

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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

SITHIPORN
associates



Cert. No. : ACL24306
Job No. : VC67AC0164
Pages : 8 of 8

10. Peak C sound level

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

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	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	89.6	0.0	±1.5

12. High level stability

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

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

End of Calibration Certificate

T. Petch.

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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

SITHIPORN
associates



Cert. No. : ACL24419
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42A / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00623388 / 198635 / 26416
ID No.: RYG_FS0613

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KHWANG PHATTHANAKAN, KHET SUAN I UANG,
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. 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.

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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

SITHIPORN
associates



Cert. No. : ACL24419
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 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.

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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

SITHIPORN
associates



Cert. No. : ACL24419
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. Petch.

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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

SITHIPORN
associates



Cert. No. : ACL24419
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)
14.2

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

Frequency Weighting	Weighting (dB)
A - weight	
C - weight	19.1
Flat	24.6

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.5	0.6	0.6	± 1.5
1000	0.1	0.1	0.2	± 1.0
8000	0.8	0.8	0.8	±5.0

T. Petch.

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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

SITHIPORN
associates



Cert. No. : ACL24419
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	-0.1	0.0	±2.0
125	0.0	0.1	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.1	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

T. Petch.

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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

SITHIPORN
associates



Cert. No. : ACL24419
Job No. : VC68AC0051
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	28.9	-0.1	± 1.1
28.0	28.0	0.0	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.9	-0.1	± 1.1

T. Petch.

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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

SITHIPORN
associates



Cert. No. : ACL24419
Job No. : VC68AC0051
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	134.1	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.

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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

SITHIPORN
associates



Cert. No. : ACL24419
Job No. : VC68AC0051
Pages : 8 of 8

10. Peak C sound level

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

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.1	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.

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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

SITHIPORN
associates



Cert. No. : ACL24305
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00873109 / 171842 / 73485
ID No.: RYG_FS0384

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 SEPTEMBER 2024
Calibration Date : 09 OCTOBER 2024
Date of Issue : 09 OCTOBER 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.

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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

SITHIPORN
associates



Cert. No. : ACL24305
Job No. : VC67AC0164
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.

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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

SITHIPORN
associates



Cert. No. : ACL24305
Job No. : VC67AC0164
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. : ACL24305
Job No. : VC67AC0164
Page : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
16.1

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

Frequency Weighting	Weighting (dB)
A - weight	13.1
C - weight	19.8
Flat	25.1

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.4	0.5	0.5	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-1.4	-1.3	-1.3	±5.0

T. Petch.

Cert. No. : ACL24305
Job No. : VC67AC0164
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	0.1	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. : ACL24305
Job No. : VC67AC0164
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	28.1	0.1	± 1.1
27.0	27.2	0.2	± 1.1
26.0	26.2	0.2	± 1.1
25.0	25.2	0.2	± 1.1

T. Petch.

Cert. No. : ACL24305
Job No. : VC67AC0164
Pages : 7 of 8

8. Level linearity including the level range control

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

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	30.0	30.1	0.1	±1.1

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.1	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. : ACL24305
Job No. : VC67AC0164
Pages : 8 of 8

10. Peak C sound level

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

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

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

T. Petch.

Cert. No. : ACL24392
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00597167 / 179118 / 87525
ID No.: RYG_FS0437

Condition As Found : GOOD

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

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

Received Date : 21 NOVEMBER 2024
Calibration Date : 11 DECEMBER 2024
Date of Issue : 11 DECEMBER 2024

REVIEW BY *S.T.S.*
APPROVED BY *[Signature]*
NEXT CAL DATE: 11 / 12 / 25

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. : ACL24392
Job No. : VC67AC0168
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 weightings with Anechoic chamber and Reference
Standard Instruments.
For tests results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

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

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

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

3.1 National Institute of Metrology (Thailand).

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

T. Petch.

Cert. No. : ACL24392
Job No. : VC67AC0168
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

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

SITHIPORN
associates



Cert. No. : ACL24392
Job No. : VC67AC0168
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	11.6
C - weight	17.8
Flat	23.6

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.4	0.5	0.4	± 1.5
1000	0.2	0.2	0.2	± 1.0
8000	1.3	1.4	1.4	±5.0

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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

SITHIPORN
associates



Cert. No. : ACL24392
Job No. : VC67AC0168
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

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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

SITHIPORN
associates



Cert. No. : ACL24392
Job No. : VC67AC0168
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	53.9	-0.1	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	38.9	-0.1	± 1.1
34.0	34.0	0.0	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	27.0	0.0	± 1.1
26.0	26.0	0.0	± 1.1
25.0	24.9	-0.1	± 1.1

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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

SITHIPORN
associates



Cert. No. : ACL24392
Job No. : VC67AC0168
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
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

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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

SITHIPORN
associates



Cert. No. : ACL24392
Job No. : VC67AC0168
Pages : 8 of 8

10. Peak C sound level

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

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

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

T. Petchurai

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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

SITHIPORN
associates



Cert. No. : ACL24339
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00597168 / 180411 / 88181
ID No.: RYG_FS0438

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 : 18 OCTOBER 2024
Calibration Date : 30 OCTOBER 2024
Date of Issue : 31 OCTOBER 2024

REVIEW BY *S.T.S*
APPROVED BY *T. Petchurai*
NEXT CAL DATE: 30 Oct 2025

Calibrated by : Nathakorn Pisutpaisan

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

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

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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

SITHIPORN
associates



Cert. No. : ACL24339
Job No. : VC67AC0168
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. Petchurai

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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

SITHIPORN
associates



Cert. No. : ACL24339
Job No. : VC67AC0168
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. Petchurai

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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



Cert. No. : ACL24339
Job No. : VC67AC0168
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	11.6
C - weight	17.8
Flat	23.4

3. Acoustical signal tests of frequency weightings

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

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

T. Petch

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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



Cert. No. : ACL24339
Job No. : VC67AC0168
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	-0.2	-0.1	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	-0.1	±1.5
500	0.0	0.0	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

T. Petch

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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



Cert. No. : ACL24339
Job No. : VC67AC0168
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	132.9	-0.1	± 1.1
132.0	131.9	-0.1	± 1.1
131.0	130.9	-0.1	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.1	0.1	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.1	0.1	± 1.1
26.0	26.0	0.0	± 1.1
25.0	25.1	0.1	± 1.1

T. Petch

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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



Cert. No. : ACL24339
Job No. : VC67AC0168
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	134.0	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. Petch

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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

SITHIPORN
associates



Cert. No. : ACL24339
Job No. : VC67AC0168
Pages : 8 of 8

10. Peak C sound level

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

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

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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

SITHIPORN
associates



Cert. No. : ACL25076
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00734221 / 187363 / 23230
ID No.: RYG_FS0027

Condition As Found : GOOD

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

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

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

REVIEW BY *S.T.S.*

APPROVED BY *T. Petchur*

NEXT CAL DATE... 21/01/2026

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

SITHIPORN ASSOCIATES
CALIBRATION LABORATORY

Cert. No. : ACL25076
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	EF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY33220104	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. Petchur

SITHIPORN
associates

SITHIPORN ASSOCIATES
CALIBRATION LABORATORY

Cert. No. : ACL25076
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. Petchur

Cert. No. : ACL25076
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)
15.4

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	17.9
Flat	23.8

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.4	0.4	0.4	± 1.5
1000	0.1	0.1	0.1	± 1.0
8000	2.1	2.1	2.1	±5.0

T. Petch

Cert. No. : ACL25076
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	0.0	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz**5.1 Frequency weightings at 1 kHz**

Frequency Weighting	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. : ACL25076
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	53.9	-0.1	± 1.1
49.0	49.0	0.0	± 1.1
44.0	43.9	-0.1	± 1.1
39.0	38.9	-0.1	± 1.1
34.0	33.9	-0.1	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.9	-0.1	± 1.1

T. Petch

Cert. No. : ACL25076
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	134.1	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. : ACL25076
Job No. : VC68AC0059
Pages : 8 of 8

10. Peak C sound level

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

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±2.0
Positive half cycle	135.4	135.2	-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. : ACL25078
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42A/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 00623393 / 198640 / 26421
ID No.: RYG_FS0618

Condition As Found : GOOD

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

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

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

REVIEW BY : S.T.S.
APPROVED BY : T. Petchur.
NEXT CAL DATE : 20/ 01/ 2026

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. : ACL25078
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	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. Petchur.

Cert. No. : ACL25078
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. Petchur.

Cert. No. : ACL25078
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)
16.6

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

Frequency Weighting	Weighting (dB)
A - weight	13.1
C - weight	17.9
Flat	24.4

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.5	0.5	0.5	± 1.5
1000	0.1	0.1	0.1	± 1.0
8000	2.3	2.2	2.3	±5.0

Cert. No. : ACL25078
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	-0.1	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	-0.1	±1.5
500	0.0	0.0	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

Cert. No. : ACL25078
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	26.9	-0.1	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.9	-0.1	± 1.1

Cert. No. : ACL25078
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
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.1	0.1	±1.0

Cert. No. : ACL25078
Job No. : VC68AC0059
Pages : 8 of 8

10. Peak C sound level

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

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

11. Overload indication

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

12. High level stability

Frequency	SLM Display at initial	SLM Display at final	Deviated Value (dB)	Acceptance Limits (dB)
Weighting	(dB)	(dB)	(dB)	(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

Cert. No. : ACL25099
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No. : 00734225 / 179117 / 87524
ID No. : RYG_FS0030

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

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

Calibrated by : Nathakorn Pisutpaisan

Approved by : T. Petchurai
(Thanakul Petchurai)

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

Cert. No. : ACL25099
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	MY48017078	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. Petchurai

Cert. No. : ACL25099
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. Petchurai

Cert. No. : ACL25099
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)
14.8

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

Frequency Weighting (dB)	Weighting (dB)
A - weight	12.0
C - weight	18.2
Flat	23.8

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.3	0.3	0.3	± 1.5
1000	0.1	0.1	0.1	± 1.0
8000	2.2	2.2	2.2	±5.0

Cert. No. : ACL25099
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	-0.1	0.0	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.1	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	0.0	±2.0
4000	0.0	0.1	0.0	±3.0
8000	0.0	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 weightings 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

*Petch**Petch*

Cert. No. : ACL25099
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	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	25.8	-0.2	± 1.1
25.0	24.9	-0.1	± 1.1

Petch

Cert. No. : ACL25099
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	28.8	-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	128.1	0.1	±1.0

Petch

Cert. No. : ACL25099
Job No. : VC68AC0064
Pages : 8 of 8

10. Peak C sound level

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

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

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

T. Petchur.

Cert. No. : ACL25074
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00233187 / 157777 / 22053
ID No.: RYG_FS0024

Condition As Found : GOOD

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

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

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

REVIEW BY : *S. S.*
APPROVED BY : *T. Petchur.*
NEXT CAL DATE : 21/01/2026

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. : ACL25074
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	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. Petchur.

Cert. No. : ACL25074
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		0.25
12. High level stability	0.1	0.1

T. Petchur.

Cert. No. : ACL25074
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	13.1
C - weight	19.2
Flat	24.9

3. Acoustical signal tests of frequency weightings

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

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

Cert. No. : ACL25074
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	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz**5.1 Frequency weightings at 1 kHz**

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

Cert. No. : ACL25074
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	132.9	-0.1	± 1.1
132.0	131.9	-0.1	± 1.1
131.0	130.9	-0.1	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.1	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	26.2	0.2	± 1.1
25.0	25.2	0.2	± 1.1

Cert. No. : ACL25074
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	29.1	0.1	±1.1

9. Tone burst response

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

Cert. No. : ACL25074
Job No. : VC68AC0059
Pages : 8 of 8

10. Peak C sound level

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

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

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

T. Petchur

Cert. No. : ACL24228
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No. : 00734223 / 169439 / 72460
ID No. : RYQ_FS0029

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 : 10 JULY 2024
Calibration Date : 11 JULY 2024
Date of Issue : 15 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.

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 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. Petchur

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. Petchur

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

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	-1.7	-1.6	-1.6	±5.0

T. Petch.

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. Petch.

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. Petch.

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

10. Peak C sound level

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

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

491-491/ Sirinthon Road, Bangbunru, Bangplad, Bangkok, 10700 Thailand
Tel: +66 2433 8331 Email: calibration@sithiporn.com



Cert. No. : ACL24228
Job No. : YC67AC0127
Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

T. Petch



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

Temperature measurement laboratory
Calibration services department.



CERTIFICATE OF CALIBRATION

Certificate No. : CDT-220-67

Page 1 of 2 Pages

MEASUREMENT ITEM : Heat Stress Monitor
MANUFACTURER : Delta OHM
MODEL/TYPE : HD32.2
SERIAL NUMBER : 15020734
ID NUMBER : RYG_F50230
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 : 11 Dec 2024
MEASUREMENT DATE : 23 Dec 2024
ISSUE DATE : 23 Dec 2024

ENVIRONMENTAL CONDITIONS:

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

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

TABULATION OF RESULTS:

The table on next page give the measured values.

REVIEW BY : *S.T.S*
APPROVED BY : *[Signature]*
NEXT CAL DATE : 23/12/25

Calibrated by:
Mr. Sirinorn Thuchalad
11 Mile, Sirinorn Thuchalad
11 Mile, Sirinorn Thuchalad



Approved signatory: Mr. Panyai 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-220-67

Page 2 of 2 Pages

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 °C to 40 °C

Functions:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2, S/N: 17015132.
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	0.099
80	25.060	25.0	-0.1	0.099
80	30.054	29.9	-0.2	0.099
80	35.044	34.9	-0.1	0.099
80	40.034	40.0	0.0	0.099

Table 2: This equipment was connected with Globe thermometer probe Model: TP3207.2, S/N: 15020482.
Dimension: Diameter 3.3 mm, Length 205 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.066	20.1	0.0	0.099
110	25.061	25.1	0.0	0.099
110	30.054	30.0	0.0	0.16
110	35.043	35.0	0.0	0.099
110	40.034	40.0	0.0	0.099

Table 3: This equipment was connected with temperature probe Model: TP3207.2, S/N: 15033222.
Dimension: Diameter 14 mm, Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
75	20.067	20.1	0.0	0.099
75	25.061	25.0	-0.1	0.099
75	30.055	29.9	-0.2	0.099
75	35.044	34.8	-0.2	0.099
75	40.034	39.7	-0.3	0.099

UUC: Unit Under Calibration
Remark: The reported uncertainty of measurement is 0.16, based on standard uncertainty multiplied by a coverage factor $k=2.23$ providing a level of confidence of approximately 95%.

End of Certificate of Calibration



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

Temperature measurement laboratory
Calibration services department.



CERTIFICATE OF CALIBRATION

Certificate No. : CDT-217-67

Page 1 of 2 Pages

MEASUREMENT ITEM : Heat Stress Monitor
MANUFACTURER : Delta OHM
MODEL/TYPE : HD32.2
SERIAL NUMBER : 15006715
ID NUMBER : RYG_F50220
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 : 11 Dec 2024
MEASUREMENT DATE : 20 Dec 2024
ISSUE DATE : 23 Dec 2024

ENVIRONMENTAL CONDITIONS:

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

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

TABULATION OF RESULTS:

The table on next page give the measured values.

REVIEW BY : *S.T.S*
APPROVED BY : *[Signature]*
NEXT CAL DATE : 20/12/25

Calibrated by:
Mr. Sirinorn Thuchalad
11 Mile, Sirinorn Thuchalad
11 Mile, Sirinorn Thuchalad



Approved signatory: Mr. Panyai 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

Functions:

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	0.099
80	25.060	25.0	-0.1	0.099
80	30.054	30.0	-0.1	0.099
80	35.043	35.0	0.0	0.099
80	40.034	40.0	0.0	0.099

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276-2, S/N: 20019632.
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	0.099
110	25.061	25.0	-0.1	0.099
110	30.054	30.0	-0.1	0.099
110	35.043	35.1	0.1	0.099
110	40.033	40.1	0.1	0.099

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	20.067	20.2	0.1	0.099
75	25.060	25.2	0.1	0.099
75	30.054	30.1	0.0	0.099
75	35.044	35.1	0.1	0.099
75	40.034	40.0	0.0	0.099

UUC*: Unit Under Calibration.

End of Certificate of Calibration



Thailand Association Co., Ltd.
64/14-15, 6/27/9-10
Pondokwan 1, 7/1, 6/1, Watthana, Bangkok 10330, Thailand
Tel: +6620880112
Mobile: +6620880113
E-mail: jnc-calibration@iranatee.com
Website: www.jiranatee.com

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

Temperature measurement laboratory
Calibration services department.

CERTIFICATE OF CALIBRATION

Certificate No. : CDT-219-67

Page 1 of 2 Pages

MEASUREMENT ITEM
MANUFACTURER : Heat Stress Monitor
MODEL/TYPE : Delta OHM
SERIAL NUMBER : HD32.2
ID NUMBER : 15020724
CONDITION AS-RECEIVED : RYG, F50228
CUSTOMER : Used Item
ALS laboratory group (thailand) Co., Ltd.
104 Phatthanakan Rd.,
Khwaeng 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.T.S.
APPROVED BY : S.T.S.
NEXT CAL DATE : 20/12/25



Approved signatory: Mr. Panyai Booncharon
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

Functions:

Table 1: This equipment was connected with wet bulb probe Model: HP3201-2, S/N: 15003776.
Dimension: Diameter 3.3 mm, Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.066	20.3	0.2	0.099
80	25.061	25.2	0.1	0.099
80	30.053	30.1	0.0	0.099
80	35.045	35.0	0.0	0.099
80	40.034	39.9	-0.1	0.099

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276-2, S/N: 15038490.
Dimension: Diameter 3.3 mm, Length 205 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.066	19.9	-0.2	0.099
110	25.062	24.9	-0.2	0.099
110	30.053	29.9	-0.2	0.099
110	35.045	34.9	-0.1	0.099
110	40.034	39.8	-0.2	0.099

Table 3: This equipment was connected with temperature probe Model: TP3207-2, S/N: 15031951.
Dimension: Diameter 14 mm, Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
75	20.066	20.3	0.2	0.099
75	25.061	25.2	0.1	0.099
75	30.053	30.1	0.0	0.099
75	35.045	35.0	0.0	0.099
75	40.034	39.9	-0.1	0.099

UUC*: Unit Under Calibration.

End of Certificate of Calibration



Thailand Association Co., Ltd.
64/14-15, 6/27/9-10
Pondokwan 1, 7/1, 6/1, Watthana, Bangkok 10330, Thailand
Tel: +6620880112
Mobile: +6620880113
E-mail: jnc-calibration@iranatee.com
Website: www.jiranatee.com

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

Temperature measurement laboratory
Calibration services department.

CERTIFICATE OF CALIBRATION

Certificate No. : CDT-221-67

Page 1 of 2 Pages

MEASUREMENT ITEM
MANUFACTURER : Heat Stress Monitor
MODEL/TYPE : Delta OHM
SERIAL NUMBER : HD32.2
ID NUMBER : 15020735
CONDITION AS-RECEIVED : RYG, F50231
CUSTOMER : Used Item
ALS laboratory group (thailand) Co., Ltd.
104 Phatthanakan Rd.,
Khwaeng Suan Luang, Khet Suan Luang,
Bangkok 10250 Thailand.

RECEIVED DATE
MEASUREMENT DATE
ISSUE DATE

: 11 Dec 2024
: 23 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.T.S.
APPROVED BY : S.T.S.
NEXT CAL DATE : 23/12/25



Approved signatory: Mr. Panyai Booncharon
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

Functions:

Table 1: This equipment was connected with wet bulb probe Model: HP3201-2, S/N: 15035050.
Dimension: Diameter 3.3 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.064	20.1	0.0	0.099
80	25.063	25.1	0.0	0.099
80	30.047	30.1	0.1	0.099
80	35.037	35.0	0.0	0.099
80	40.024	40.0	0.0	0.099

Table 2: This equipment was connected with Globe thermometer probe Model: TP3207-2, S/N: 17023218.
Dimension: Diameter 3.3 mm. Length 205 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.064	20.1	0.0	0.099
110	25.063	25.1	0.0	0.099
110	30.047	30.1	0.1	0.099
110	35.037	35.1	0.1	0.099
110	40.024	40.1	0.1	0.099

Table 3: This equipment was connected with temperature probe Model: TP3207-2, S/N: 15033221.
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
75	20.064	20.1	0.0	0.099
75	25.063	25.0	-0.1	0.099
75	30.047	30.0	0.0	0.099
75	35.037	35.0	0.0	0.099
75	40.024	40.0	0.0	0.099

UUC* Under Calibration

End of Certificate of Calibration



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

Temperature measurement laboratory
Calibration services department.



CERTIFICATE OF CALIBRATION

Certificate No. : CDT-216-67

Page 1 of 2 Pages

MEASUREMENT ITEM : Heat Stress Monitor
MANUFACTURER : Delta OHM
MODEL/TYPE : HD32.2
SERIAL NUMBER : 15006711
ID NUMBER : RVG_F50217
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 : 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.

REVIEW BY: *[Signature]*
APPROVED BY: *[Signature]*
NEXT CAL DATE: 20/12/25



Approved signatory: *[Signature]*
Mr. Panyia 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

Functions:

Table 1: This equipment was connected with wet bulb probe Model: HP3201-2, S/N: 16008205.
Dimension: Diameter 3.3 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.052	20.2	0.1	0.099
80	25.061	25.2	0.1	0.099
80	30.052	30.2	0.1	0.099
80	35.045	35.2	0.2	0.099
80	40.034	40.1	0.1	0.099

Table 2: This equipment was connected with Globe thermometer probe Model: TP3207-2, S/N: 17015123.
Dimension: Diameter 3.3 mm. Length 205 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.052	20.2	0.1	0.099
110	25.061	25.2	0.1	0.099
110	30.052	30.2	0.1	0.099
110	35.045	35.2	0.2	0.099
110	40.034	40.2	0.2	0.099

Table 3: This equipment was connected with temperature probe Model: TP3207-2, S/N: 17003390.
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
75	20.052	20.3	0.2	0.099
75	25.061	25.1	-0.0	0.099
75	30.052	30.0	-0.1	0.099
75	35.044	34.9	-0.1	0.099
75	40.034	39.8	-0.2	0.099

UUC* Under Calibration

End of Certificate of Calibration



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

Temperature measurement laboratory
Calibration services department.



CERTIFICATE OF CALIBRATION

Certificate No. : CDT-218-67

Page 1 of 2 Pages

MEASUREMENT ITEM : Heat Stress Monitor
MANUFACTURER : Delta OHM
MODEL/TYPE : HD32.2
SERIAL NUMBER : 15006716
ID NUMBER : RVG_F50221
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 : 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.

REVIEW BY: *[Signature]*
APPROVED BY: *[Signature]*
NEXT CAL DATE: 20/12/25



Approved signatory: *[Signature]*
Mr. Panyia 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: 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	0.099
80	25.061	25.1	0.0	0.099
80	30.053	30.1	0.0	0.099
80	35.045	35.0	0.0	0.099
80	40.034	40.0	0.0	0.099

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276.2, S/N: 15015967.
Dimension: Diameter 3.3 mm. Length 205 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.066	20.0	-0.1	0.099
110	25.061	25.0	-0.1	0.099
110	30.052	30.1	0.0	0.099
110	35.045	35.0	0.0	0.099
110	40.034	40.0	0.0	0.099

Table 3: This equipment was connected with temperature probe Model: TP3207.2, S/N: 15015492.
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
75	20.066	20.3	0.2	0.099
75	25.061	25.2	0.1	0.099
75	30.053	30.1	0.0	0.099
75	35.045	34.9	-0.1	0.099
75	40.034	39.9	-0.1	0.099

UUC: Unit Under Calibration

End of Certificate of Calibration



CERTIFICATE OF CALIBRATION

Certificate No. : CDT-005-68

Page 1 of 2 Pages

MEASUREMENT ITEM
MANUFACTURER : Heat Stress Monitor
MODEL/TYPE : Delta OHM
SERIAL NUMBER : HD32.2
ID NUMBER : 15006718
CONDITION AS-RECEIVED : RYG_F50223
CUSTOMER : Used item
ALS laboratory group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khwaeng Suan Luang, Khet Suan Luang,
Bangkok 10250 Thailand.

RECEIVED DATE : 27 Dec 2024
MEASUREMENT DATE : 07 Jan 2025
ISSUE DATE : 08 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/S*
APPROVED BY: *S/S*
NEXT CAL DATE: 07/01/26



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: 18009586.
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	0.099
80	25.061	25.1	0.0	0.099
80	30.053	30.1	0.0	0.099
80	35.043	35.1	0.1	0.099
80	40.035	40.0	0.0	0.099

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276.2, S/N: 20019638.
Dimension: Diameter 3.3 mm. Length 205 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.068	20.2	0.1	0.099
110	25.061	25.2	0.1	0.099
110	30.053	30.2	0.1	0.099
110	35.043	35.2	0.2	0.099
110	40.035	40.2	0.2	0.099

Table 3: This equipment was connected with temperature probe Model: TP3207.2, S/N: 15015496.
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
75	20.068	20.3	0.2	0.099
75	25.061	25.2	0.1	0.099
75	30.053	30.1	0.0	0.099
75	35.043	35.0	0.0	0.099
75	40.035	39.9	-0.1	0.099

UUC: Unit Under Calibration

End of Certificate of Calibration



CERTIFICATE OF CALIBRATION

Certificate No. : CDT-034-68

Page 1 of 2 Pages

MEASUREMENT ITEM
MANUFACTURER : Heat Stress Monitor
MODEL/TYPE : Delta OHM
SERIAL NUMBER : HD32.2
ID NUMBER : 15006720
CONDITION AS-RECEIVED : RYG_F50224
CUSTOMER : Used item
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 : 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 In House calibration method as per ISO 17025 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 (NIMT) Certificate number: T1-0047-24, Certificate number: EN 0113-24

Reference Used During Calibration:
1. Standard Temperature Probe
Model: STS-100 A500, Serial No.: 667082-09,
Due date: 26 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/S*
APPROVED BY: *S/S*
NEXT CAL DATE: 26/01/2026



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: 15015854.
Dimension: Diameter 3.3 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.067	19.7	-0.4	0.099
80	25.060	24.7	-0.4	0.099
80	30.051	29.7	-0.4	0.099
80	35.041	34.7	-0.3	0.099
80	40.028	39.6	-0.4	0.099

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276.2, S/N: 20008275.
Dimension: Diameter 3.3 mm. Length 205 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.068	20.1	0.0	0.099
110	25.060	25.1	0.0	0.099
110	30.051	30.1	0.0	0.099
110	35.040	35.1	0.1	0.099
110	40.028	40.2	0.1	0.16

Table 3: This equipment was connected with temperature probe Model: TP3207.2, S/N: 15015498.
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
75	20.068	20.3	0.2	0.099
75	25.060	25.2	0.1	0.099
75	30.051	30.1	0.0	0.099
75	35.040	35.1	0.1	0.099
75	40.028	40.0	0.0	0.099

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

End of Certificate of Calibration



Hiranatee Associates Co.,Ltd
6/314-15, 6/315-36
Pattanakarn 1,7/1, Rd. Wattana, Bangkok,
Bangkok 10000(Thailand)
Tel : +66(0)800012
Mobile : +66(0)809951
E-mail : jnac-calibration@jiranatee.com
Web site : www.jiranatee.com

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 Phattanakarn 40, Phattanakarn 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.

REVIEW BY: S.T.S
APPROVED BY: [Signature]
NEXT CAL DATE: 28/01/2026



Approved signature:

[Signature]
Mr. Parinya Booncharom
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	20.067	20.1	0.0	0.16
80	25.060	25.0	-0.1	0.099
80	30.050	30.0	-0.1	0.099
80	35.041	35.0	0.0	0.099
80	40.028	40.0	0.0	0.099

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	0.099
110	25.060	25.1	0.0	0.099
110	30.051	30.1	0.0	0.16
110	35.041	35.1	0.1	0.099
110	40.028	40.0	0.0	0.099

Table 3: This equipment was connected with temperature probe Model: TP3207.2, S/N: 15015494.
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
75	20.067	20.2	0.1	0.099
75	25.060	25.0	-0.1	0.099
75	30.051	29.9	-0.2	0.099
75	35.041	34.9	-0.1	0.099
75	40.028	39.8	-0.2	0.099

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

End of Certificate of Calibration



Hiranatee Associates Co.,Ltd
6/314-15, 6/315-36
Pattanakarn 1,7/1, Rd. Wattana, Bangkok,
Bangkok 10000(Thailand)
Tel : +66(0)800012
Mobile : +66(0)809951
E-mail : jnac-calibration@jiranatee.com
Web site : www.jiranatee.com

CERTIFICATE OF CALIBRATION

Certificate No. : CDT-068-68

Page 1 of 2 Pages

MEASUREMENT ITEM : Heat Stress Monitor
MANUFACTURER : Delta OHM
MODEL/TYPE : HD32.2
SERIAL NUMBER : 20052243
ID NUMBER : RYG_F50523
CONDITION AS-RECEIVED : Used item
CUSTOMER : ALS laboratory group (thailand) Co., Ltd.
104 Phattanakarn 40, Phattanakarn Rd.,
Khwaeng Suan Luang, Khet Suan 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: 16/ 03/ 2026



Approved signature:

[Signature]
Mr. Parinya Booncharom
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: 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 OF CALIBRATION

Certificate No. : CDT-069-68

Page 1 of 2 Pages

MEASUREMENT ITEM : Heat Stress Monitor
MANUFACTURER : Delta DHM
MODEL/TYPE : HD32.2
SERIAL NUMBER : 20032249
ID NUMBER : RYG_FS0524
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 : 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: *[Signature]*
APPROVED BY: *[Signature]*
NEXT CAL DATE: 17/03/2026



Calibrated by:
☐ Mr. Sorawit Thachalad
☒ Miss Jittaporn Lertsomphol
☐ Miss Ruangrumpai 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: 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 OF CALIBRATION

Certificate No. : CDT-142-67

Page 1 of 2 Pages

MEASUREMENT ITEM : Heat Stress Monitor
MANUFACTURER : Delta DHM
MODEL/TYPE : HD32.2
SERIAL NUMBER : 22016388
ID NUMBER : RYG_FS0578
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 : 19 Jul 2024
MEASUREMENT DATE : 06 Aug 2024
ISSUE DATE : 07 Aug 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: *[Signature]*
APPROVED BY: *[Signature]*
NEXT CAL DATE: 6/8/25



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

Approved signatory: *[Signature]*
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

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: 22015694.
Dimension: Diameter 3.3 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.059	19.9	-0.2	0.099
80	25.054	24.9	-0.2	0.099
80	30.047	29.9	-0.1	0.099
80	35.036	34.9	-0.1	0.099
80	40.029	39.8	-0.2	0.099

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 22023956.
Dimension: Diameter 3.3 mm. Length 205 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.060	20.1	0.0	0.099
110	25.054	25.1	0.0	0.099
110	30.047	30.1	0.1	0.099
110	35.036	35.1	0.1	0.099
110	40.029	40.1	0.1	0.099

Table 3: This equipment was connected with temperature probe Model: TP3207.2 S/N: 22025031.
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
75	20.059	20.2	0.1	0.099
75	25.053	25.1	0.0	0.099
75	30.047	30.0	-0.1	0.16
75	35.036	34.9	-0.1	0.099
75	40.029	39.8	-0.2	0.099

UUC: Unit Under Calibration

Remark: The reported uncertainty of measurement is 0.16, based on standard uncertainty multiplied by a coverage factor $k=2.11$ providing a level of confidence of approximately 95%.

End of Certificate of Calibration



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
334/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250
TEL: 0-2717-3000-24 FAX: 0-2719-9484



Certificate of Calibration

Certificate No.: 24PH577
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

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.

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 were conducted using calibration procedure No. GP-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 & Encoder	LMguide 9.6 m	120RC003	DL-0064-22	20 Jul 2025
2) STANDARD LAMP	OL FEL-U	F-1783	TP-1009-24	09 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: OL83A, S/N: 16221394).

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

REVIEW BY: S/S
APPROVED BY: [Signature]
NEXT CAL DATE: 20/11/25

Calibrated by: Nivat Nitas
Issue Date: 20 November 2024

Approved Signatory: [Signature]
[] Phalinee Prabpaipal
[] Chatchawan Khunpluek
[✓] Nuntawat Khamchai



Cert. No.: 24PH577
Page: 2 of 2

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

Function: Illuminance Measurement Range: Autorange

Standard Value (lx)	Before Adjust UUC* Reading (lx)	After Adjust UUC* Reading (lx)	Error (lx)	Uncertainty (± 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.

-000-



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
334/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250
TEL: 0-2717-3000-24 FAX: 0-2719-9484



Certificate of Calibration

Certificate No.: 25PH415
Page: 1 of 2

Equipment: Lux Meter
Manufacturer: Delta CHM
Model: HD2102.2
Serial No.: 16002032
ID No.: RYG_FS0200
Condition As-Received: Used Item

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.

Received Date: 21 January 2025
Calibration Date: 28 January 2025

Reference: 2501-0720WSC
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 were conducted using calibration procedure No. GP-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 & Encoder	LMguide 9.6 m	120RC003	DL-0064-22	20 Jul 2025
2) STANDARD LAMP	OL FEL-U	F-1784	TP-1007-24	02 Mar 2025

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: 16221394).

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

REVIEW BY: S/S
APPROVED BY: [Signature]
NEXT CAL DATE: 28/01/2026

Calibrated by: Nivat Nitas
Issue Date: 28 January 2025

Approved Signatory: [Signature]
[] Phalinee Prabpaipal
[] Chatchawan Khunpluek
[✓] Nuntawat Khamchai



Cert. No.: 25PH46
Page.: 2 of 2

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

Function : Illuminance Measurement

Range : Autorange

Standard Value	UUC* Reading	Error	Uncertainty
(lx)	(lx)	(lx)	(± lx)
0	0.00	0.00	±
15	14.88	-0.12	0.20
100	98.16	-1.84	1.3
500	494.7	-5.3	6.5
1000	994.1	-5.9	13
2000	1994.5	-5.5	26
3000	3000	0	39
4000	3985	-15	52
5000	4970	-30	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 %

Calibration with probe sensor s/n. 22038597
UUC* = Unit Under Calibration.

-00-



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.: 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. Pluakdaeng,
Rayong 21140 Thailand

Location : TPA On Site Calibration Laboratory

Received Order : 17 January 2025

Calibrated Date : 20 January 2025

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 30) %

AC Line Voltage : (220 ± 22) V

Calibrated by : Warakorn Lemgagrakul

Approved by :

- () Chakrit Waewwanjua
(✓) Suwit Imjai
() Kunchit Promprat

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	Phatchanna S.
APPROVED BY	D. Imjai
NEXT CAL DATE	20/07/26



Equipment : DO Meter with Sensor

Condition As-Received : Used Item

Reference : 2501-0600DSC-2

Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-OT01 according to comparison with Industrial Platinum Resistance Thermometer (IPT) 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	2411022	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	Immersion Depth	Standard Temperature	UUC* Reading	Error	Uncertainty	Coverage Factor
(°C)	(mm)	(°C)	(°C)	(°C)	(± °C)	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 %.

-00-



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.Pluaekdaeng,
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 Sirithean

Approved by :

- () Pornthippa Tameyakul
() Ponpan Paipim
(✓) Saithip Meangmai

Issue Date : 21 January 2025

Saithip
Approved Signatory



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 Promprat

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.

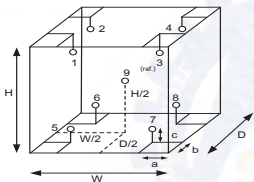
3. This certification is traceable to the International System of Unit.

Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration : (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close



Probe Installation Details :

a = 10 cm
b = 10 cm
c = 10 cm

Dimension of Chamber :

D = 0.60 m
W = 1.0 m
H = 1.2 m
Capacity = 0.72 m³

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-



Certificate of Calibration

Cert.No.: 24CG3711
Page.: 1 of 2

Equipment : Burette
Capacity : 50 mL
Serial No. : -
ID. No. : RYG_EN0216
Manufacturer : Witeg
Made in : Germany
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.
Rayong Branch
616/10 Moo 5, T.Maenam Khu, A.Pluakdaeng
Rayong 21140, Thailand

Ambient Temperature : (20 ± 2.5) °C
Relative Humidity : (50 ± 10) %
Barometric Pressure : 756 mmHg
Calibration Procedure : ASTM E 542 - 01

Calibrated by : Sa-ngeunkam Wongsa

Approved by :

(✓) Srisuda Khamtha
() Ponpan Paipim
() Unnopphol Harachai

Issue Date : 24 September 2024

REVIEW BY *Tharitat*
APPROVED BY *D. Srisuda*
NEXT CAL DATE 24/09/25

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 : Burette
Received Date : 19 September 2024
Condition As-Received : Used Item
Calibration Date : 24 September 2024
Reference : 2409-0756DSC-3

Cert.No.: 24CG3711
Page.: 2 of 2

Condition of this result of calibration

1. Reference Standard Instruments :

Instruments	Model	Serial No.	ID. No.	Certificate No.	Traceability	Due date
1) Balance	XP205	B134206712	140RC007	24MM316	TPA	15 July 2025
2) Data Logger	HL-20D	20683159	140EC012	23H2174	TPA	10 Oct 2024
3) Thermometer	-	1594592	140EC010	24I175	TPA	20 Feb 2025

This certification is traceable to SI Unit

2. The certificate is valid only to the item calibrated on date and place of calibration.
3. True value is converted to true volume at the standard temperature of 20 °C

Calibration result :

Nominal capacity (mL)	Reading (mL)	Uncertainty (± mL)	k Factor
10	10.0259	0.0082	2.00
20	20.0214	0.0085	2.00
30	30.0006	0.0089	2.00
40	40.0003	0.0094	2.00
50	49.9988	0.011	2.00

Remark mL = cm³

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-



Certificate of Calibration

Equipment: SPECTROPHOTOMETER
Model: DR6000
Serial No. (or ID.): 1627845 (RYG_EN0037)
Manufacturer: HACH
Condition: In Condition

Certificate No.: C06250108
Issued Date: 18 March 2025
Job No.: WO-00064379
Page: 1 of 3

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

Environment Condition: Temperature 24.4 °C ± 0.3 °C
Humidity 60.8 %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 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. Preecha Phoosai)
Person in charge

(Miss Kaewkan Suradech)
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, Thailand 10260
2533 Sukhumvit Road, Bangkok, Thailand 10260
Phone: +66 2558 7500 Email: info@dksh.com Website: www.dksh.com

Delivering Growth - in Asia and Beyond.

CAL-FM-C06-16 | 11 Mar 2024



Certificate No.: C06250108 Page 2 of 3

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
	0.2667	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	0.248	0.0001	0.0045
	0.4652	0.466	-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

DKSH Technology Limited
2533 Sukhumvit Road, Bangkok, Thailand 10260
2533 Sukhumvit Road, Bangkok, Thailand 10260
Phone: +66 2558 7500 Email: info@dksh.com Website: www.dksh.com

Delivering Growth - in Asia and Beyond.

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 (%T)	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)	268.66	266.69	1.38	2.00
UUC: Wavelength (nm)	268.2	266.2		
Std Absorbance (A)	0.4565	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

DKSH Technology Limited
2533 Sukhumvit Road, Bangkok, Thailand 10260
Phone: +66 2028 7000 Email: info@dksh.com Website: www.dksh.com

Delivering Growth - In Asia and Beyond.

CAL-FM-C06-18-11 Mar 2024

ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: WO-00064379

ชนิดเครื่องวัด: SPECTROPHOTOMETER รุ่น: DR8000

หมายเลขเครื่อง: 1627845

ตรวจสอบ (รับ)		รายการตรวจวัด		ตรวจสอบ (ส่ง)		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 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. แบตเตอรี่ (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 type="checkbox"/>	<input type="checkbox"/>	*
<input checked="" type="checkbox"/>	<input type="checkbox"/>	9. แสงยูวีแสง (UV < 3,000 hour)		<input checked="" type="checkbox"/>	<input type="checkbox"/>	13.5 Hours
<input checked="" type="checkbox"/>	<input type="checkbox"/>	10. แสงที่มองเห็นแสง (Visible < 5,000 hour)		<input checked="" type="checkbox"/>	<input type="checkbox"/>	893.0 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. ฝาปิดกันปลาย Electrode (Dust Protection Hood)		<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	15. ขาตั้งอิเล็กโทรด (Stand)		<input type="checkbox"/>	<input type="checkbox"/>	
Turbidimeter						
<input type="checkbox"/>	<input type="checkbox"/>	16. ค่าความทึบที่ต่ำสุด (No Sample)		<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	17. ระดับการส่องสว่างของแสง (>= 2.5 ไม่น้อย 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. ระบบท่อสายยางและอุปกรณ์ประกอบ		<input type="checkbox"/>	<input type="checkbox"/>	

เพิ่มเป็นข้อแนะนำ: * 656.1nm = 656.1nm

* 486.0nm = 485.7nm

Mr.Preecha Phooansai
Service Engineer

DKSH Technology Limited
2533 Sukhumvit Road, Bangkok, Thailand 10260
Phone: +66 2028 7000 Email: info@dksh.com Website: www.dksh.com

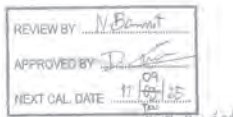
Delivering Growth - In Asia and Beyond.

CAL-FMR31-03 20 Jul 2022

Certificate of Calibration

Represent to Certificate of Calibration No. C29240011

Equipment:	Block Digestion Unit	Certificate No.:	C29240011
Model:	KT-20s	Issued Date:	22 March 2024
Serial No. (or ID):	5720210008/5770200073	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 VACCalibration 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. 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.: TC22/0080

Signature of Mr. Thanathorn Phunook
(Mr. Thanathorn Phunook)
Person in charge

Signature of Mr. Udon Srichana
(Mr. Udon Srichana)
Authorized signatory

This certificate is issued in full without approval of DKSH Technology Limited.
The measurement uncertainty stated in this certificate is based on the expanded uncertainty (k=2) as required from the standard uncertainty (k=1) by the coverage factor (k=2).
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, Thailand 10260
Phone: +66 2028 7000 Email: info@dksh.com Website: www.dksh.com

Delivering Growth - In Asia and Beyond.

CAL-FM-C29-01 23 Jul 2022

Certificate No.: C29240011

Page: 2 of 4



Fig. 1: Front view

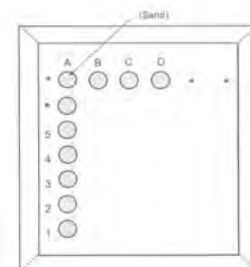


Fig. 2: Digestion block

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 position or location.

DKSH Technology Limited
2533 Sukhumvit Road, Bangkok, Thailand 10260
Phone: +66 2028 7000 Email: info@dksh.com Website: www.dksh.com

Delivering Growth - In Asia and Beyond.

CAL-FM-C29-01 23 Jul 2022

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				392.9	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	385	385	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				378.3	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				379.1	14.1	1.5
C1				380.1	15.1	1.5
C2				380.1	15.1	1.5
C3				378.9	13.9	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

ชนิดเครื่อง: Block Digestion Unit

รุ่น: KT-20s

หมายเลขเครื่อง: 5720210009/5770200073

ตรวจสอบ (วัน)	รายการตรวจเช็ค		ตรวจสอบ (ผู้)	หมายเหตุ	
11 Mar 2024			11 Mar 2024		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
General					
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. สายไฟ	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. การทำงาน Main Switch	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. การทำงาน Selector Key	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. การแสดงผล Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. สลัก Hole	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	6. สลักฝาปิด	<input type="checkbox"/>	<input type="checkbox"/>	ไม่มี
<input checked="" type="checkbox"/>	<input type="checkbox"/>	7. สลักตัวเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. สลักแฉกคั่น ณ สถานที่ตั้งเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

ชื่อคนตรวจ

Mr. Trianathorn Phonook
Service EngineerTECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
1344 PATTANAKARN ROAD, 3/F, 18, SUANLUANG, SUANLUANG, BANGKOK 10250
TEL: 0-2317-5300-24 FAX: 0-2719-9484

Certificate of Calibration

Certificate No.: Z3E3924

Page: 1 of 2

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: 14 December 2023
Reference: Z312-01510SC
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 10) %This certificate may not be reproduced other than in full,
except with the prior written approval of the head of
Corporate Services & Equipment Calibration and Testing Services.

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

818/10 Moo 5, T. Maewon Ki, A. Phraekiang,
Rayong 21140, Thailand

Procedure used: Calibration were conducted using calibration procedure No. CP-E17 according to EURAMET-cp-19.

Condition of this result of calibration

1. Reference standards (instruments):

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Multi-Product Calibrator	5502A	2435602	EE-0041-23	28 Apr 2024

2. This result of calibration was made on request at the point specified by customer.

3. The 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)

REVIEW BY: *M. Bannai*
APPROVED BY: *D. S.*
NEXT CAL DATE: 14 Dec 2024 (1 ปี)
14 Dec 2024 (1 ปี)Calibrated by: Napachon Prasoongkarn
Issue Date: 15 December 2023Approved Signatory:
/ / Phisone Prasoongkarn
/ / Nitsawat Khanchai
/ / Pongnagorn Boonyaporn



Cert. No.: 23E3924

Page: 2 of 2

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

Function: DC voltage measurement	Range: 2000 mV		
Standard Value	UUC* Reading	Error	Uncertainty
(mV)	(mV)	(mV)	(± μ V)
-200.0000	-199.9	0.1	66
-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.

-000-

A 1193422



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
Unit 811 PHANASARU BUILDING 13-13/14 UNIT 811, 100 MAHAJULAKULON RD.
TEL: 02-017-000-09 FAX: 02-017-0488



Cert.No.: 23CH1574

Page: 1 of 3

Certificate of Calibration

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 :	15 December 2023
Reference :	2312-0151DSC-3
Submitted by :	ALS Laboratory Group (Thailand) Co., Ltd. Rayong Branch 618/10 Moo 5, T.Maenam Khu, A.Piuaaklaeng, 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 Lemgagrakul

Approved by :
Approved Signatory

() Sathip Meangmai
() Warakorn Lemgagrakul
() Ponpan Palpin

Issue Date : 19 December 2023

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

This certificate may only be reproduced, stored, distributed, or used with the prior written permission of Technology Promotion Association (Thailand-Japan) Calibration and Testing Services.

A 10061696



Cert.No.: 23CH1574

Page: 2 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	23I908	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-1635

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	913596	14 July 2025
pH 6.968	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		
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	



Cert.No.: 23CH1574

Page: 3 of 3

Calibration Results

Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH measurement (±)	Coverage factor k
pH Electrode S/N: 3225368	4.008	4.013	184.1	0.0045	2.00
	6.966	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 %.

-000-

A 1193852

A 1193851



Certificate of Calibration

Cert.No.: 25CH709/1
Page.: 1 of 3

This Certificate was issued to replace the Certificate No.25CH709

Equipment : pH Meter
Manufacturer : Mettler Toledo
Model : SevenExcellence
Serial No. : B834291445
ID No. : RYG_EN0152
Condition As-Received: Used Item
Received Date : 12 June 2025
Calibration Date : 18 June 2025
Reference : 2506-0407DSC-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) %
Calibration Procedure : In - house method :
- CP-CH5 by direct measurement with DC voltage
standard and direct measurement with
certified reference material (CRM)
- CP-CH8 by comparison with temperature standard

Calibrated by : Walalak Sirirthean
Approved by :
Approved Signatory

() Chakrit Waewwanjua
() Ponpan Paipim
(✓) Saithip Meangmai
Issue Date : 1 July 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.



Certificate of Calibration

Certificate No.: 25E1979/1
Page : 1 of 2

This Certificate was issued to replace the Certificate No. 25E1979

Equipment : pH Meter
Manufacturer: Mettler Toledo
Model : SevenExcellence
Serial No.: B834291445
ID No.: RYG_EN0152
Condition As-Received: Used Item
Received Date: 12 June 2025
Calibration Date: 16 June 2025
Reference: 2506-0407DSC
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 10) %

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.

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	5500A	6315011	25E1627	19 May 2026
2.This result of calibration was made on requested at the point specified by customer.				
3.The certificate is valid only to the item calibrated on date and place of calibration.				
4.This measurement result is traceable to the International System of Unit maintained through:-				
-Technology Promotion Association (Thailand-Japan), NSC-ONSC Accredited No. Calibration 0008				

Calibrated by : Wutchareepom Peethong
Issue Date : 01 July 2025

Approved Signatory :
[] Phalinee Prabpaipal
[✓] Nuntawat Khamchai
[] Pongsagom Boonyaporn



Cert. No.: 25E1979/1
Page.: 2 of 2

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	149.9	-0.1	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.

-000-



Agilent Technologies (Thailand) Limited
U Chu Liang Bldg. 22/F UNIT A.D.
988 Rama 4 Road, Silom, Bangkok
Bangkok 10500 Thailand

Tel: +662 637 6363
Fax: +662 637 4334
Email: ccc-smt@agilent.com
Website: www.agilent.com/chem

Customer Contact:

ALS Laboratory Group (Thailand) Co.
Ltd Head Office
104 Phatthanakan 40 Phatthanakan Rd
Khwaeng Phatthanakan Khet Suan
TAX ID : 0105540004859
chanattagarnimichom@alsglobal.com
227158760

Invoice To:

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

SERVICE REPORT

Customer Purchase Order Number:	Customer Number: 70371013
Service Request:	Service Request Date:
Service Order: 6006676960	Service Confirmation: 6905905441

REVIEW BY Tattaporn C.
APPROVED BY Samut M.
NEXT CAL DATE 31/1/2024

Delivery Site:

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

Location:

Room
Bldg
Lab
Dept

Direct Inquiries to:

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

products | applications | software | services

Learn more about Agilent's Special Offers, Products, Services and our full range of laboratory productivity solutions optimized for your applications and workflows. Visit us at www.agilent.com/chem

Agilent Technologies (Thailand) Limited, Head Office
U Chu Liang Bldg. 22/F Unit A.D.
988 Rama 4 Road, Silom, Bangkok,
Bangkok 10500 Thailand
Tax ID : 0105542080218

DBank N.A. Bangkok Branch
395 Interchange 21 Building, Sukhumvit Road, Klongroey New
Sub-district, Wattana District, Bangkok 10110 Thailand
Acc. No: 912-4402-007
THB-Krung Thai Bank PCL
Siam Square Bx. 416/1-2 Rama 1 Rd, Pathumwan, BKK 10330
Thailand

ORIGINAL

Page 1 of 3

Service Confirmation Number: 6905905441
Service Confirmation Date: 06.10.2024

Service Confirmation Number: 6905905441
Service Confirmation Date: 06.10.2024

Service Instrument:

Model Number	Model Description	Serial Number	System Handle	Parent Asset
SYS-IM-7900	ICPMS 7900 System			
G8410A	SPS 4 Autosampler	AU15430722	ICP MS 7900	SYS-IM-7900
G8411A	ISIS 3 for Agilent 7850/7900/8900	JP15510227	ICP MS 7900	SYS-IM-7900
G3292A	PSC 8106T Chiller	ZU15A1949	ICP MS 7900	SYS-IM-7900
G8403A	Agilent 7900 ICP-MS	JP15471169	ICP MS 7900	SYS-IM-7900

Service Items:

Item	Service/Part #	Description	Qty	Entitlement	Service Start	Service End
1008	EQO	Enterprise Operational Qualification	1.00	Agreement Entitlement: 100 % covered	04.10.2024	04.10.2024
1010	5185-5950	ICP-MS Checkout Solutions	1.00	Agreement Entitlement: 100 % covered		

Additional Information:

Service Information:

Problem Description: *WU-EQO-IM-7900-6001253055		
Service Provided: Perform OQ Hardware, Test CDS login, auto sampler, Auto tune, BG and 20 Min stability, I calibrate the instrument No BKK_EL0043 test all pass.		
Service Overview Code: Reason Code: Scheduled Service Diagnosis Code: Scheduled Service Resolution Code: Scheduled Service		
Reported Hours: 7.0	Travel Hours: 2.0	
Customer Field Service Representative Name: Pantkeap Kuranathain	Customer Field Service Representative Signature:	Date: 09 Oct 2024
Customer Name: Supakwan Mah	Customer Signature:	Date: 08 Oct 2024
Additional Comments: 		



Certificate No. T250355

Page 1 of 6

Certificate of Calibration

Equipment : HEATING BLOCK
Manufacturer : Environmental Express
Model : SC 196
Serial No. : 6974CECW3285
Customer Code : BKK_EL0054
ID No. : TS306A3
Customer : ALS Laboratory Group (Thailand) Co.,Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khwaeng Phatthanakan, Khet Suan Luang, Bangkok 10250
Customer Location : Acid Digestion Lab
Date of Receipt : 26 February 2025
Calibrated By : Atiphong Rongrat (Technician)
Approved By : Boonchai Suriyawong / Boonchai Suriyawong (Site Calibration Manager)
Date of Issue : 7 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 109/30-05-57



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 : Boonchai Suriyawong

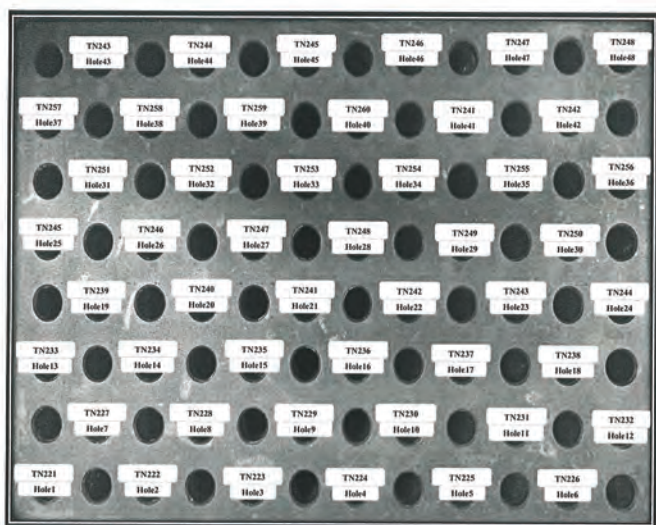
FM-L13 108/30-05-57



Certificate No. T250355

Page 3 of 6

Calibration Report



FRONT CONTROL

Approved By : Boonchai Suriyawong

FM-L13 108/30-05-57



Certificate No. T250355

Page 4 of 6

Calibration Report

Measurement Results

Calibration Point	Average Standard Reading at each position (°C)					
R1 Hole1-Hole6	TN221	TN222	TN223	TN224	TN225	TN226
CAL POINT	Max	94.85	95.37	95.03	95.25	95.52
95	Min	94.17	94.66	94.38	94.63	94.87
	Average	94.51	95.02	94.70	94.94	95.20
R2 Hole7-Hole12	TN227	TN228	TN229	TN230	TN231	TN232
	Max	94.71	94.56	94.79	95.32	95.44
	Min	94.05	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	94.36	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	TN241	TN242
	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	TN243	TN244	TN245	TN246	TN247	TN248
	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 : Boonchai Suriyawong

FM-L13 108/30-05-57



Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110
Telephone : +66 2 586 5792-4 Fax : +66 2 586 5109
Website : www.scieco.co.th E-Mail : calibrate@scg.co.th

Certificate No. T250355

Page 5 of 6

Calibration Report

Measurement Results

Calibration Point	Average Standard Reading at each position (°C)					
R1 Hole1-Hole6	TN221	TN222	TN223	TN224	TN225	TN226
CAL POINT	Max	104.48	104.40	104.60	105.27	105.24
	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	TN243	TN244	TN245	TN246	TN247	TN248
	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:

[Signature]

FM-L13 108/30-05-S1



Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110
Telephone : +66 2 586 5792-4 Fax : +66 2 586 5109
Website : www.scieco.co.th E-Mail : calibrate@scg.co.th

Certificate No. T250355

Page 6 of 6

Calibration Report

Measurement Results:

Setting (°C)	HEATING BLOCK		Temperature Distribution	
	Reading (°C)		Stability (±°C)	Uncertainty (±°C)
	Min, Max	Average		
102.0	-	102.0	0.43	0.83
107.8	-	107.8	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:

[Signature]

FM-L13 108/30-05-S1



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. T232160

Page 1 of 4

Certificate of Calibration

Equipment : Chamber (Cooling Room)
Manufacturer : KOLDTECH
Model : KM 320
Serial No. : TBN-1012061/05
Customer Code : BKK_EN0167
ID No. : T2463A3
Customer : ALS Laboratory Group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,
Khet Suan Luang, Bangkok 10250
Customer Location : Laboratory
Date of Receipt : 29 November 2023
Calibrated By : Atiphong Rongrat (Technician)
Approved By : *[Signature]* / Boonchai Suriyawong (Site Calibration Manager)
Date of Issue : 09 JAN 2024

REVIEW BY	<i>[Signature]</i>
APPROVED BY	<i>[Signature]</i>
NEXT CAL DATE	06/06/25

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

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

FM-L14 119/16-08-60



Metrology

SCI ECO Services Company Limited

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



Certificate No. T232160

Page 2 of 4

Calibration Report

Equipment : Chamber (Cooling Room)
Date of Calibration : 6 December 2023
Environment : Temperature : 23.4-24.9 °C
Line Voltage : 221.4-230.2 V
Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

- 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 accordance 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.
- Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	TYPE T	TN161-TN170	T230773	10 April 2024
TC	TYPE T	TN171-TN180	T230773	10 April 2024
DATA LOGGER	34970A	T149	T230773	10 April 2024
- This certificate is traceable to : National Institute of Metrology (Thailand) through Metrological Center (NSC-TISI-TIS 17025 CALIBRATION 0244).
- Condition of calibrated item : good
Equipment Description :

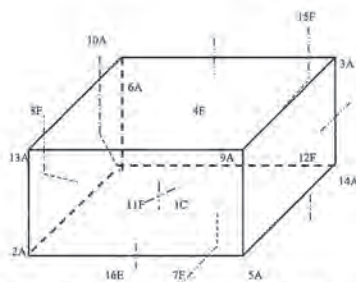
Time Constant	1 Hour	30 Minute	At 3 °C
Fresh Air Damper	<input type="checkbox"/> Open	<input type="checkbox"/> Min	<input type="checkbox"/> Medium
	<input type="checkbox"/> Close		<input type="checkbox"/> Max
	<input checked="" type="checkbox"/> Not Available		
- Adjustment :
(X) without adjustment () after adjustment

Approved By:

[Signature]

FM-L14 119/16-08-60

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
4E = 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

Calibration Report

Measurement Results

Calibration Point	Average Standard Reading at each position (°C)									
	TN161	TN162	TN163	TN164	TN165	TN166	TN167	TN168	TN169	TN170
3.0	2.83	3.34	2.95	3.46	3.45	3.76	3.25	3.46	3.39	3.50
	TN171	TN172	TN173	TN174	TN175	TN176				
	3.33	3.39	3.15	3.43						

Setting (°C)	Reading (°C)		Temperature Distribution					Coverage Factor k
	Min	Max	Average	Average (°C)	Stability (± °C)	Uniformity (°C)	Uncertainty (± °C)	
3.0	2.8	4.1	3.5	3.36	1.10	2.00	1.50	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 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

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

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

FM-TL06.102/27-03-68

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 :

- 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 E1145-94 (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.
- Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	TYPE T	TN91-TN100	T242036	3 December 2025
TC	TYPE T	TN101-TN110	T242036	3 December 2025
DATA LOGGER	34970A	T121	T242036	3 December 2025
- This certificate is traceable to : National Institute of Metrology (Thailand) through Metrological Center (NSC-TIS-115 17025 CALIBRATION 9244).
- 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
- Adjustment :
(X) without adjustment () after adjustment

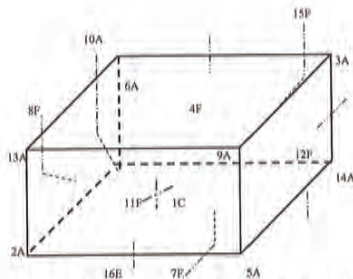
Approved By:

FM-TL07.102/27-03-68

Certificate No. T250873

Page 3 of 4

Calibration Report



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

1C = TN91	12E = TN102
2A = TN92	13A = TN103
3A = TN93	14A = TN104
4F = TN94	15E = TN105
5A = TN95	16E = TN106
6A = TN96	
7E = TN97	
8E = TN98	
9A = TN99	
10A = TN100	
11E = TN101	

Approved By:

FM-TL07 02/27-03-68

Certificate No. T250873

Page 4 of 4

Calibration Report

Measurement Results

Calibration Point	Average Standard Reading at each position (°C)											
	TN91	TN92	TN93	TN94	TN95	TN96	TN97	TN98	TN99	TN100	TN101	TN102
3.0	2.95	2.92	3.09	2.92	3.16	3.50	3.40	3.03	3.14	2.98	3.44	3.13
	TN103	TN104	TN105	TN106								
	3.19	3.06	3.46	2.92								

Chamber (Cooling Room)		Temperature Distribution				
Setting (°C)	Reading (°C)		Average (°C)	Stability (±°C)	Uniformity (°C)	Uncertainty (±°C)
	Min	Max				
3.0	2.8	3.9	3.4	3.14	1.20	1.30

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-TL07 02/27-03-68

SARTORIUS

Accredited by
NSC-TISI-TIS 17025
Calibration 0426

Calibration certificate

Calibration Certificate No. 25BKL0004

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 WI 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)	
	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.: 25BKL0004

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 - T place

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

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	10.0001 g	200.0001 g
4	10.0000 g	200.0000 g
5	10.0001 g	200.0000 g
6	10.0001 g	200.0001 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

Eccentricity

Test load (nominal): 100 g

Center	100.0000 g
Front left	99.9998 g
Back left	100.0000 g
Back right	100.0000 g
Front right	100.0000 g
Maximum deviation from centric loading indication Δecc max = 0.0002 g	

Error of indication

Testload <i>L</i>	Indication <i>I</i>	Error <i>E</i>	Expansion factor <i>k</i>	Uncertainty <i>U(E)</i>	Uncertainty relative <i>U_{rel}(E)</i>
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|_{max} = 0.0001 g

U_{rel}(E) is the quotient of *U(E)* and test load *L*. The uncertainty of measurement *U(E)* is valid only if error *E* is 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 Guideline EURAMET cg-18, V4.0. There is a 95 % probability that the value of the measurand will be in the assigned value range.

End of calibration certificate

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

Verical®
Version 6.5

Page 3 | 4

Uncertainty of measurement in use

Device adjusted before measurement

Yes

Temperature deviation considered

1.5 K (isoCAL active)

Temperature coefficient considered

1 · 10⁻⁴ /K

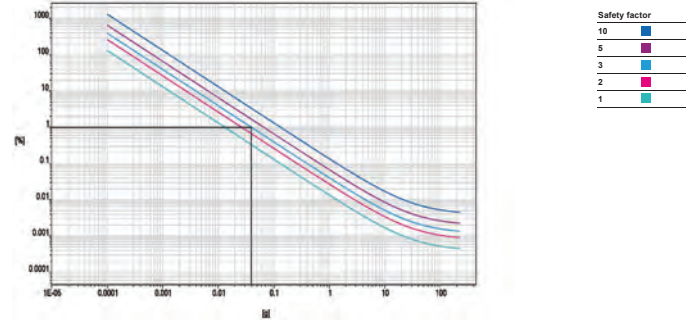
Uncertainty of the weighing result *U_g(W)*

U_g(W) = 0.00013 g + 3.95 · 10⁻⁴ · *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 measurand will be in the assigned value range.

Indication in % from max load	Net indication <i>R</i>	Uncertainty <i>U_g(W)</i>	Uncertainty relative <i>U_g(W)_{rel}</i>
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

Page 4 | 4



Metrology

SCI ECO Services Company Limited

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

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

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

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



Certificate No. 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.



Metrology

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhohi, 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

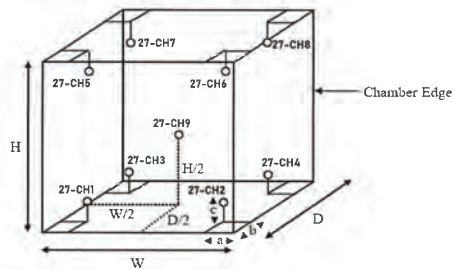
Condition of this results of calibration :

- This equipment was calibrated by insert nine resistance thermometer detectors into its chamber , the other one resistance thermometer detector use for ambient temperature measurement . The calibration was done in according to WI-T20 (based on ASTM E145-94 (Reapproved 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 .
- 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
- This certificate is traceable to :
National Institute of Metrology (Thailand) through Metrological Center (NSC-TISI-TIS 17025 CALIBRATION 0244.)
- Condition of calibrated item : good
Equipment Description :
Time Constant : 1 Hour 44 Minute At 104 °C
Fresh Air Damper : ☐ Open ☐ Min ☐ Medium ☐ Max
☒ Close
☐ Not Available
- Adjustment :
() without adjustment (X) after adjustment

Approved By:

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 = 40cm./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	Average					
104.0	103.9 , 104.1	104.0	104.01	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

FM-L15 I18/18-08-66

Certificate of Calibration

Cert. No.: 24TM635
Page : 1 of 3

Equipment : Water Bath
Manufacturer : Memmert
Model : WNB22
Serial No. : L513.0648
ID No. : RYG_EN0081

Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)
616/10 Moo 5, T. Maenam Khu,
A. Pluakdaeng,
Rayong 21140, Thailand
Location : Wet Chemistry Lab

Received Order : 21 March 2024
Calibration Date : 21 March 2024
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %

Calibrated by : Man Pattanapongpaiboon

Approved by :

() Pornthippa Tameyakul
() Unnopphol Harachai
(✓) Suwit Imjai

Approved Signatory

Issue Date : 23 March 2024

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written approval of the head of Corporate Services 3: Equipment Calibration and Testing Services.



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2403-0563OC-4
Procedure Used :-

Cert. No.: 24TM635
Page : 2 of 3

Calibration were conducted using in-house calibration procedure CP-OT04 Based on ASTM E715 according to direct measurement method with Data Acquisition which connected with Industrial Platinum Resistance Thermometer (IPRT).

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY57013711	23LM115	TPA	11 Jul 2024

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

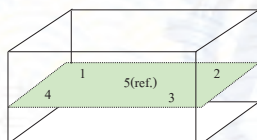
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Heat transfer medium used : Water

	Environmental		AC Voltage Supply
	(°C)	(%R.H.)	(Volt)
Beginning of Calibration	25	55	222
Finished of Calibration	25	57	223



Front

Position :	Ref. Std. ID No.:
1	4803988-001
2	4803988-002
3	4803988-003
4	4803988-004
5(ref.)	4803988-005



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2403-0563OC-4
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source

Cert. No.: 24TM635
Page : 3 of 3

Calibration point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Average* Standard Reading (°C)					Uncertainty (± °C)
			1	2	3	4	5 (ref.)	
85.0	85.0	85.0	84.428	84.424	84.489	84.507	84.477	0.18

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Coverage Factor k
85.0	0.19	0.11	2

Average* : The average of 30 values in each position.

Uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

Stability : One-half of the greatest maximum difference of measured temperature at any one probe.

UUC* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity.

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

-00-

REVIEW BY Thawatchai T.
APPROVED BY KL AL
NEXT CAL. DATE 21 Nov 25



Bara Scientific

Certificate of Calibration

Shimadzu LC-HIC

This certificate is to verify that instrument below are calibrated

by Bara Scientific Co., Ltd

Instrument	Serial No.
DGU-403	L22166050657
SIL-20AC	L20176012374
CTO-40S	L22236003442
LC-20ADSP	L20106096217
SPD-40	L22256002616
CDD-10Avp	C21346004484
CBM-40lite	L22126103139

For

ALS Laboratory Group (Thailand) Co., Ltd.

Operator Signature: Thawatchai T. Date: 21 November 2024

(Mr.Thawatchai Toros)

Service Engineer



Bara Scientific Co., Ltd
11 Chu Liny Building, Floor 7, 168 Rama 4 Road, Siam Respark Bangkok 10200
Thailand Tel: (+66) 63743601 (auto 10 lines) Fax: (+66) 637436067 www.barascientific.com

equiREC-4 3 Rev001 2553

FM-SG-13 Rev 00

Agilent Technologies

Agilent Technologies (Thailand) Limited
11 CHULIANG BLDG. 22/F UNIT A.D
968 RAMA 4 ROAD, SIAM, BANGKOK
Bangkok 10500 Thailand
Tel: +662 637 4363
Fax: +662 637 4334
Email: ccc-asi@agilent.com
Website: www.agilent.com/chem

Customer Contact:

ALS Laboratory Group (Thailand) Co
Ltd Head Office104 Phatthanakan 40 Phatthanakan Rd
Khwaeng Phatthanakan Khet Suan
TAX ID : 0105540004859Chanattagarn.imchom@alsglobal.com
27803088

Invoice To:

ALS Laboratory Group (Thailand) Co
Ltd Head Office104 Phatthanakan 40 Phatthanakan Rd
Khwaeng Phatthanakan Khet Suan

SERVICE REPORT

Customer Purchase Order Number:	Customer Number: 703771013
Service Request:	Service Request Date:
Service Order: 6006676091	Service Confirmation: 6905876103

REVIEW BY Penphen C.
APPROVED BY Sawat S.
NEXT CAL. DATE 31 Mar 2026

Delivery Site:

ALS Laboratory Group (Thailand) Co
Ltd Head Office104 Phatthanakan 40 Phatthanakan Rd
Khwaeng Phatthanakan Khet Suan

Location:

Room
Bldg
Lab
Dept

Direct Inquiries to:

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

products | applications | software | services

Learn more about Agilent's Special Offers, Products, Services and our
full range of laboratory productivity solutions optimized for your
applications and workflows. Visit us at www.agilent.com/chem

Agilent Technologies (Thailand) Limited, Head Office:
11 Chu Liny Bldg. 22/F Unit A.D
968 Rama 4 Road, Siam, Bangkok
Bangkok 10500 Thailand
Tax ID: 0105540004859

Citibank NA, Bangkok Branch:
399 Interchange 21 Building, Sukhumvit Road, Klongtoey Nuea
Sub-district, Watana District, Bangkok 10110 Thailand
Acc. No: 912-4452-097
THB-Klong Thai Bank PLC
Siam Square Br., 418/1-2 Rama 1 Rd., Pathumwan, BKK 10330
Thailand

ORIGINAL

Page 1 of 3

Service Confirmation Number: 6905876103
Service Confirmation Date: 23.09.2024

Service Confirmation Number: 6905876103
Service Confirmation Date: 23.09.2024

Service Instrument:

Model Number	Model Description	Serial Number	System Handle	Parent Asset
SYS-ID-5100	ICP-OES 5100/5110 System			
G8010A	Agilent 5100 SVDV ICP-OES Spectrometer	MY18010005	ICP OES 5100	SYS-ID-5100
G8410A	SPS 4 Autosampler	AU18440764	ICP OES 5100	SYS-ID-5100

Service Items:

Item	Service/Part #	Description	Qty	Entitlement	Service Start	Service End
1000	EDQ	Enterprise Operational Qualification	1.00	Agreement Entitlement - 100 % covered	22.09.2024	23.09.2024
1010	8010030100	Bottle ICP-OES Wavecal soln 50/1ml, 5 ppm	1.00	Agreement Entitlement - 100 % covered		
1020	5190-7001	Calibration blank solution Spect HNO3	1.00	Agreement Entitlement - 100 % covered		

Additional Information:

Page 2 of 3

Service Information:

Problem Description: WU-DG-10-5100-5501253655		
Service Provided: Complete OQ/PV 5100/ICP-OES Equipment ID: BKK_EL0037, all test passed		
Service Overview Code: Renewal Code: Scheduled Service Diagnosis Code: Scheduled Service Resolution Code: Scheduled Service		
Reported Hours: 4.0	Travel Hours: 2.0	
Customer Field Service Representative Name: Sowan Onkum	Customer Field Service Representative Signature: <u>Sawat S.</u>	Date: 23 Sep 2024
Customer Name: CHANATTAGARN IMCHOM	Customer Signature: <u>Penphen C.</u>	Date: 23 Sep 2024
Additional Comments:		

Page 3 of 3



Certificate of Calibration

Cert.No.: 24CH889
Page.: 1 of 2

Equipment : pH Meter
Manufacturer : Mettler Toledo
Model : SevenGo S2
Serial No. : C222171779
ID No. : RYG_FS0594
Condition As-Received: Used Item
Received Date : 26 July 2024
Calibration Date : 30 July 2024
Reference : 2407-0932DSC-1
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd. Rayong Branch
616/10 Moo 5, T.Maenam Khu,
A.Pluaekdaeng, Rayong 21140, Thailand

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

Calibrated by : Warakorn Lerngagrakul

Approved by :
Approved Signatory

() Unnopphol Harachai
() Ponpan Paipim
(✓) Salthip Meangmai

Issue Date : 30 July 2024

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written
Approval of the head of Corporate Services 3: Equipment Calibration and Testing Services.



Cert.No.: 24CH889
Page.: 2 of 2

Condition of this calibration result

1. Reference Standard Instrument

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC116	23E2802	27 Aug 2024

- This Certification is traceable to SI Through Technology Promotion Association (Thailand - Japan)

2. Certified Reference Materials : The measurement results are traceable to SI through CPA chem Ltd.,
ANSI-ASQ National Accreditation Board, Accredited No. AR-1635

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	970851	25 Apr 2026
pH 6.986	CPA chem	970852	25 Apr 2025
pH 9.997	CPA chem	970853	25 Apr 2025

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

Calibration Results

Function : mV Measurement

Performing standard curve by Document Process Calibrator at pH (4,7,10)

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement	Coverage factor
	pH	mV	mV	pH	(±mV)	k
pH Meter S/N.: C222171779	4.00	177.48	177	4.00	0.58	2.00
	7.00	0.00	0	7.00	0.58	2.00
	10.00	-177.48	-178	10.00	0.58	2.00

Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH Measurement (±)	Coverage factor k
pH Electrode S/N.: 3184175	4.008	4.01	172	0.0071	2.00
	6.986	6.99	-2	0.0099	2.00
	9.997	10.00	-174	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 %.

-000-



Certificate of Calibration

Cert. No.: 24LM120
Page.: 1 of 2

Equipment : pH Meter with Sensor
Manufacturer : Mettler Toledo
Model : Seve2Go S2
Serial No. : C222171779
ID No. : RYG_FS0594
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd. Rayong Branch
616/10 Moo 5, T.Maenam Khu,
A.Pluaekdaeng, Rayong 21140, Thailand

Location : TPA On Site Calibration Laboratory

Received Order : 26 July 2024
Calibrated Date : 30 July 2024
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
AC Line Voltage : (220 ± 22) V

Calibrated by : Warakorn Lerngagrakul

Approved by :
Approved Signatory

() Ponpan 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-3

Cert. No.: 24LM120
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	24I317	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.: 3293237

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty (± °C)	Coverage Factor k
25.0	100	25.003	25.1	0.097	0.16	2.00
30.0	100	30.004	30.2	0.196	0.16	2.00
40.0	100	40.001	40.2	0.199	0.16	2.00
50.0	100	50.003	50.2	0.197	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 %.

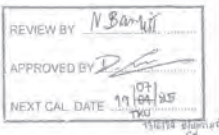
-000-



Cert.No.: 24CH96
Page.: 1 of 3

Certificate of Calibration

Equipment : pH Meter
Manufacturer : Mettler Toledo
Model : SevenCompact S220
Serial No. : C104059460
ID No. : RYG_EN0183
Condition As-Received: Used Item
Received Date : 18 January 2024
Calibration Date : 19 January 2024
Reference : 2401-0579DSC-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 : $(25 \pm 2.5) ^\circ\text{C}$
Relative Humidity : $(50 \pm 15) \%$
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 temperature standard

Calibrated by : Warakorn Lemgagrakul

Approved by :

(☒) Sallhip Maangmai
(☐) Warakorn Lemgagrakul
(☐) Porpan Palpim

Issue Date : 24 January 2024

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

This document may not be reproduced other than in full without the prior written approval of the head of Corporate Services & Equipment Calibration and Testing Services.

A 0062854



Cert.No.: 24CH96
Page.: 2 of 3

Condition of this calibration result

- Reference Standard Instrument
- Instrument

Serial No.	ID No.	Cert. No.	Due Date
54030049	130RC116	23E2802	27 Aug 2024
4982054	110RC044	23I908	26 July 2024

This certification is traceable to the International System of Unit maintained through:-
- Technology Promotion Association (Thailand-Japan)

- 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	840102	27 Nov 2025
pH 6.986	CPA chem	840104	02 Nov 2024
pH 9.997	CPA chem	840106	02 Nov 2024

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

Calibration Results

Function : mV Measurement

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

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (±mV)	Coverage factor k
			mV	pH		
pH Meter S/N : C104059460	4.000	177.48	177.4	4.000	0.058	2.00
	7.000	0.00	0.0	7.000	0.058	2.00
	10.000	-177.48	-177.5	10.000	0.058	2.00

A 1198287



Cert.No.: 24CH96
Page.: 3 of 3

Calibration Results

Function : pH Measurement

Performing three buffers standard curve by using buffer nominal pH (4.01,7.00,10.01)

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 : 3225367	4.008	4.013	176.0	0.0054	2.07
	6.986	6.983	2.2	0.0084	2.00
	9.997	9.995	-174.1	0.0065	2.00

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe:

- Model : InLab®Expert Pro-ISM

- Serial No. : 3225367

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	25.001	25.2	0.199	0.13	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 %.

-060-

A 1198286



Certificate of Calibration

Certificate No.: 24E289
Page : 1 of 2

Equipment : pH Meter
Manufacturer : Mettler Toledo
Model : SevenCompact S220
Serial No. : C104059460
ID No. : RYG_EN0183

Condition As-Received: Used Item
Received Date : 18 January 2024
Calibration Date : 23 January 2024

Reference : 2401-0579DSC
Ambient Temperature : $(23 \pm 2) ^\circ\text{C}$
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-16.

Condition of this result of calibration

- Reference standards instruments:

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Multi-Product Calibrator	5500A	6315011	E209300035	29 May 2024

- This result of calibration was made on request at the point specified by customer.

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

- This Certification is traceable to the International System of Unit maintained through:-

-NA Caltechologies Co., Ltd., ANAB Accredited No. Calibration AC-2838

Calibrated by : Wudkarnworn Wongchabkum
Issue Date : 24 January 2024

Approved Signatory :

(☒) Piyasinee Pitsatnapan
(☒) Nuntawat Khunthaisai
(☐) Pongasam Boonyadorn

A 0333296



Cert. No.: 24E289

Page: 2 of 2

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	-200.0	0.0	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	99.9	-0.1	63
150.0000	149.9	-0.1	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.

-000-



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.: 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 Pattanapongpaiboon

Approved by :

() Ponthippa Tameyakul
() Unnopphol Harachai
(x) Suwit Imjai

Issue Date : 22 March 2024

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written
Approval of the head of Corporate Services 3: Equipment Calibration and Testing Services.



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2403-0563OC-1

Cert. No.: 24TM632

Page : 2 of 3

Procedure Used :-

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD) and Thermocouple Type T.

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY57013711	23LM115	TPA	11 Jul 2024

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

3. This certification is traceable to the International System of Unit.

Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

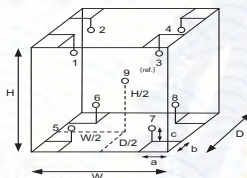
Function of UUC* : Temperature Source

Fresh air setting : Close

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



Probe Installation Details : Dimension of Chamber :

a = 5.0 cm D = 0.40 m
b = 5.0 cm W = 0.56 m
c = 5.0 cm H = 0.48 m
Capacity = 0.11 m³



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)
	1	2	3	4	5	6	7	8	9 (ref.)	
104.0	103.921	103.786	103.757	103.759	103.950	103.817	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 %.

-000-



Metrology

SCI ECO Services Company Limited
33/2 Moo 3, T.Banpa, A.Kaengkhoh, Saraburi 18110, Thailand.
Saraburi Tel : +66 3627 3096 Fax : +66 3627 3100
Bangkok Tel : +668 9205 6851 , +669 8247 2360
Website : www.scieco.co.th E-Mail : calibrate@scg.com



Certificate No. T241120

Page 1 of 4

Certificate of Calibration

Equipment : Chamber (Cold Room)
Manufacturer : MODULAR
Model : IREVCOHCOO
Serial No. : C00351459
Customer Code : RYG_EN0184
ID No. : T1939A5
Customer : ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)
616/10 Moo 5 T.Maenam Khu,
A.Pluakdaeng, Rayong 21140

Customer Location : Laboratory

Date of Receipt : 5 June 2024

Calibrated By : Sujjar Naknakred (Site Calibration Manager)

Approved By : Preecha Phisassutthikul (Temperature Calibration Manager)

Date of Issue : 12 JUN 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.

TM-4-14110-18-08-00



Metrology

SCI ECO Services Company Limited
33/2 Moo 3, T.Banpa, A.Kaengkhoh, Saraburi 18110, Thailand.



Certificate No. T241120

Page 2 of 4

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 :

- 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 accordance 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 .
- Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	TYPE T	TN161-TN170	T240713	19 April 2025
TC	TYPE T	TN171-TN180	T240713	19 April 2025
DATA LOGGER	34970A	T149	T240713	19 April 2025
- This certificate is traceable to :
National Institute of Metrology (Thailand) through Metrological Center (NSC-TIS-TIS (7025 CALIBRATION 6244)
- 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

Adjustment : () without adjustment (X) after adjustment

Approved By : Preecha Phisassutthikul

TM-4-14110-18-08-00



Metrology

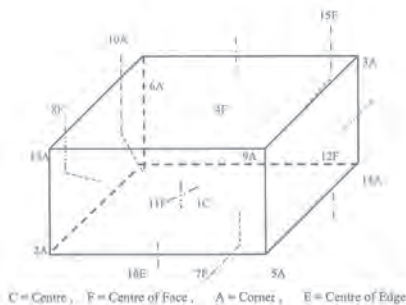
SCI ECO Services Company Limited
33/2 Moo 3, T.Banpa, A.Kaengkhoh, Saraburi 18110, Thailand.



Certificate No. T241120

Page 3 of 4

Calibration Report



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

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

Approved By : Preecha Phisassutthikul

TM-4-14110-18-08-00



Metrology

SCI ECO Services Company Limited
33/2 Moo 3, T.Banpa, A.Kaengkhoh, Saraburi 18110, Thailand.



Certificate No. T241120

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
3	2.73	2.70	2.77	2.78	2.99	2.35	3.09	3.21	3.08
	TN171	TN172	TN173	TN174	TN175	TN176			
	3.39	3.01	3.92	2.81	3.42	3.42			

Setting (°C)	Reading (°C)		Temperature Distribution				
	Min	Max	Average (°C)	Stability (±°C)	Uniformity (°C)	Uncertainty (±°C)	Coverage Factor k
3.0	2.9	4.4	3.7	2.97	1.52	1.13	2.02

* 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 : Preecha Phisassutthikul

TM-4-14110-18-08-00