

ภาคผนวก ง

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ใบรับรองการสอบเทียบเครื่องมือ



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รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Ambient	Particulate Matter (PM-10)	High Volume	RYG_F50188	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	High Volume	RYG_F50666	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	High Volume	RYG_F50665	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	High Volume	RYG_F50294	-	-	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_F50662	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	RYG_F50664	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	RYG_F50182	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	RYG_F50396	-	-	On site Calibration
Ambient	Total Suspended Particulate	Digital Balance	RYG_EN0001	20-Feb-25	20-Feb-26	12
Ambient	Sulfur Dioxide	SO <sub>2</sub> Analyzer	RYG_F50733	3-Jul-25	3-Jan-26	6
Ambient	Sulfur Dioxide	SO <sub>2</sub> Analyzer	BKK_F50796	1-Jul-25	1-Jan-26	6
Ambient	Sulfur Dioxide	SO <sub>2</sub> Analyzer	RYG_F50260	2-Jul-25	2-Jan-26	6
Ambient	Sulfur Dioxide	SO <sub>2</sub> Analyzer	RYG_F50730	3-Jul-25	3-Jan-26	6
Ambient	Nitrogen Dioxide	NO <sub>2</sub> Analyzer	RYG_F50732	3-Jul-25	3-Jan-26	6
Ambient	Nitrogen Dioxide	NO <sub>2</sub> Analyzer	BKK_F50797	2-Jul-25	2-Jan-26	6
Ambient	Nitrogen Dioxide	NO <sub>2</sub> Analyzer	RYG_F50261	1-Jul-25	1-Jan-26	6
Ambient	Nitrogen Dioxide	NO <sub>2</sub> Analyzer	RYG_F50731	3-Jul-25	3-Jan-26	6
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	RYG_F50412	29-Oct-24	29-Apr-26	18
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	RYG_F50087	7-Oct-24	7-Apr-26	18
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	RYG_F50611	26-Jun-24	26-Dec-25	18
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	RYG_F50544	2-Apr-25	1-Oct-26	18
Noise	Leq 24 hrs / Leq 5 min	Sound Calibrator	RYG_F50213	16-Jan-25	16-Jan-26	12
Noise	Leq 24 hrs / Leq 5 min	Sound Level Meter	RYG_F50616	23-Dec-24	23-Dec-25	12
Noise	Leq 24 hrs / Leq 5 min	Sound Level Meter	RYG_F50617	21-Jan-25	21-Jan-26	12
Noise	Leq 24 hrs / Leq 5 min	Sound Level Meter	RYG_F50615	23-Dec-24	23-Dec-25	12
Noise	Leq 24 hrs / Leq 5 min	Sound Level Meter	RYG_F50614	23-Dec-24	23-Dec-25	12
Noise	Leq 24 hrs / Leq 5 min	Sound Level Meter	RYG_F50613	23-Dec-24	23-Dec-25	12
Noise	Leq 24 hrs / Leq 5 min	Sound Level Meter	RYG_F50618	21-Jan-25	20-Jan-26	12
Noise	Noise Annoyance	Sound Calibrator	RYG_F50213	16-Jan-25	16-Jan-26	12
Noise	Noise Annoyance	Sound Level Meter	RYG_F50616	23-Dec-24	23-Dec-25	12
Noise	Noise Annoyance	Sound Level Meter	RYG_F50617	21-Jan-25	21-Jan-26	12
Noise	Noise Annoyance	Sound Level Meter	RYG_F50615	23-Dec-24	23-Dec-25	12
Noise	Noise Annoyance	Sound Level Meter	RYG_F50614	23-Dec-24	23-Dec-25	12
Noise	Noise Annoyance	Sound Level Meter	RYG_F50613	23-Dec-24	23-Dec-25	12
Noise	Noise Annoyance	Sound Level Meter	RYG_F50618	21-Jan-25	20-Jan-26	12
Noise	Leq 15 min	Sound Calibrator	RYG_F50213	16-Jan-25	16-Jan-26	12
Noise	Leq 15 min	Sound Level Meter	RYG_F50616	18-Aug-25	17-Aug-26	12
Noise	Leq 15 min	Sound Level Meter	RYG_F50601	27-Jan-25	26-Jan-26	12
Rayong Lab	Cyanide	SPECTROPHOTOMETER	RYG_EN0037	18-Mar-25	18-Sep-26	18
Rayong Lab	pH at 25 °C	pH meter	RYG_EN0037	18-Jul-25	18-Jan-27	18
Rayong Lab	Nitrate	SPECTROPHOTOMETER	RYG_EN0037	18-Mar-25	18-Sep-26	18
Rayong Lab	Ammonia Nitrogen	SPECTROPHOTOMETER	RYG_EN0037	18-Mar-25	18-Sep-26	18
Rayong Lab	Dissolved Oxygen	Chamber (Cold Room)	RYG_EN0036	11-Jun-24	11-Dec-25	18
Rayong Lab	BOD	DO meter with Sensor	RYG_EN0032	20-Jan-25	20-Jul-26	18
Rayong Lab	BOD	Incubator	RYG_EN0154	1-Nov-24	1-May-26	18
Rayong Lab	COO	SPECTROPHOTOMETER	RYG_EN0037	18-Mar-25	18-Sep-26	18
Rayong Lab	Formaldehyde	SPECTROPHOTOMETER	RYG_EN0037	18-Mar-25	18-Sep-26	18
Rayong Lab	Phenol	SPECTROPHOTOMETER	RYG_EN0037	18-Mar-25	18-Sep-26	18
Rayong Lab	Sulfide	Chamber (Cold Room)	RYG_EN0184	11-Jun-24	11-Dec-25	18
Rayong Lab	Temperature	pH meter	RYG_F50574	1-Apr-25	1-Apr-26	12
Rayong Lab	Total Suspended Solids	Electronic Balance	RYG_EN0163	20-Feb-25	20-Feb-26	12
Rayong Lab	Total Suspended Solids	Electronic Balance	RYG_EN0010	21-Mar-24	21-Mar-25	18
Rayong Lab	Total Dissolved Solids 180°C	Electronic Balance	RYG_EN0163	20-Feb-25	20-Feb-26	12
Rayong Lab	Total Dissolved Solids 180°C	Chamber (Oven)	RYG_EN0010	21-Mar-24	21-Sep-25	18
Rayong Lab	Total Kjeldahl Nitrogen	Block Digestion Unit	RYG_EN0188	11-Mar-24	11-Sep-25	18
Rayong Lab	Total Kjeldahl Nitrogen	pH Meter	RYG_EN0152	18-Jun-25	18-Dec-26	18

1

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Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Rayong Lab	Oil & Grease	Electronic Balance	RYG_EN0003	20-Feb-25	20-Feb-26	12
Rayong Lab	Oil & Grease	Liquid Bath (Water)	RYG_EN0061	21-Mar-24	21-Sep-25	18
Rayong Lab	Color	Chamber (Cold Room)	RYG_EN0188	11-Jun-24	11-Dec-25	18
Water Lab	Organophosphate Pesticide	GC MSMS	BKK_EN0256	21-Nov-24	21-May-26	18
Water Lab	Hexavalent Chromium	Spectrophotometer	BKK_EN0356	29-Oct-24	29-Oct-25	12
Water Lab	Trivalent Chromium	ICP-MS	BKK_EL0043	4-Oct-24	3-Apr-26	18
Water Lab	Trivalent Chromium	Hot Block	BKK_EL0054	4-Mar-25	4-Sep-26	18
Water Lab	Trivalent Chromium	Chamber (Cooling Room)	BKK_EN0167	4-Jun-25	4-Dec-26	18
Water Lab	Lead	ICP-MS	BKK_EL0043	4-Oct-24	3-Apr-26	18
Water Lab	Lead	Hot Block	BKK_EL0054	4-Mar-25	4-Sep-26	18
Water Lab	Lead	Chamber (Cooling Room)	BKK_EN0167	4-Jun-25	4-Dec-26	18
Water Lab	Iron	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	Manganese	ICP-MS	BKK_EL0043	4-Oct-24	3-Apr-26	18
Water Lab	Manganese	Hot Block	BKK_EL0054	4-Mar-25	4-Sep-26	18
Water Lab	Manganese	Chamber (Cooling Room)	BKK_EN0167	4-Jun-25	4-Dec-26	18
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
Water Lab	Nickel	ICP-MS	BKK_EL0043	4-Oct-24	3-Apr-26	18
Water Lab	Nickel	Hot Block	BKK_EL0054	4-Mar-25	4-Sep-26	18
Water Lab	Nickel	Chamber (Cooling Room)	BKK_EN0167	4-Jun-25	4-Dec-26	18
Water Lab	Arsenic	ICP-MS	BKK_EL0043	4-Oct-24	3-Apr-26	18
Water Lab	Arsenic	Hot Block	BKK_EL0054	4-Mar-25	4-Sep-26	18
Water Lab	Arsenic	Chamber (Cooling Room)	BKK_EN0167	4-Jun-25	4-Dec-26	18
Water Lab	Cadmium	ICP-MS	BKK_EL0043	4-Oct-24	3-Apr-26	18
Water Lab	Cadmium	Hot Block	BKK_EL0054	4-Mar-25	4-Sep-26	18
Water Lab	Cadmium	Chamber (Cooling Room)	BKK_EN0167	4-Jun-25	4-Dec-26	18
Water Lab	Silver	ICP-MS	BKK_EL0043	4-Oct-24	3-Apr-26	18
Water Lab	Silver	Hot Block	BKK_EL0054	4-Mar-25	4-Sep-26	18
Water Lab	Silver	Chamber (Cooling Room)	BKK_EN0167	4-Jun-25	4-Dec-26	18
Water Lab	Barium	ICP-MS	BKK_EL0043	4-Oct-24	3-Apr-26	18
Water Lab	Barium	Hot Block	BKK_EL0054	4-Mar-25	4-Sep-26	18
Water Lab	Barium	Chamber (Cooling Room)	BKK_EN0167	4-Jun-25	4-Dec-26	18
Water Lab	Selenium	ICP-MS	BKK_EL0043	4-Oct-24	3-Apr-26	18
Water Lab	Selenium	Hot Block	BKK_EL0054	4-Mar-25	4-Sep-26	18
Water Lab	Selenium	Chamber (Cooling Room)	BKK_EN0167	4-Jun-25	4-Dec-26	18
Water Lab	Zinc	ICP-MS	BKK_EL0043	4-Oct-24	3-Apr-26	18
Water Lab	Zinc	Hot Block	BKK_EL0054	4-Mar-25	4-Sep-26	18
Water Lab	Zinc	Chamber (Cooling Room)	BKK_EN0167	4-Jun-25	4-Dec-26	18
Water Lab	Mercury	DUO-CVAFS / CVAFS	BKK_EL0023	12-Dec-24	12-Jun-26	18
Water Lab	Total Coliform	Autoclave	BKK_ML0041	4-Mar-25	4-Sep-26	18
Water Lab	Total Coliform	Incubator	BKK_ML0231	21-Aug-25	21-Aug-26	12
Water Lab	Total Coliform	Hot Air Oven	BKK_ML0013	23-Apr-24	23-Oct-25	18
Water Lab	Fecal Coliform	Autoclave	BKK_ML0041	4-Mar-25	4-Sep-26	18
Water Lab	Fecal Coliform	Incubator	BKK_ML0231	21-Aug-25	21-Aug-26	12
Water Lab	Fecal Coliform	Hot Air Oven	BKK_ML0013	23-Apr-24	23-Oct-25	18
Water Lab	Fecal Coliform	Water Bath	BKK_ML0056	4-Mar-25	4-Mar-26	12

2

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Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Soil	Arsenic	ICP-OES	BKK_EL0037	23-Sep-24	23-Mar-26	18
Soil	Arsenic	Hot Block	BKK_EL0054	4-Mar-25	4-Sep-26	18
Soil	Arsenic	Chamber (Cold Room)	BKK_EN0167	4-Jun-25	4-Dec-26	18
Soil	Copper	ICP-OES	BKK_EL0037	23-Sep-24	23-Mar-26	18
Soil	Copper	Hot Block	BKK_EL0054	4-Mar-25	4-Sep-26	18
Soil	Copper	Chamber (Cold Room)	BKK_EN0167	4-Jun-25	4-Dec-26	18
Soil	Cadmium	ICP-OES	BKK_EL0037	23-Sep-24	23-Mar-26	18
Soil	Cadmium	Hot Block	BKK_EL0054	4-Mar-25	4-Sep-26	18
Soil	Cadmium	Chamber (Cold Room)	BKK_EN0167	4-Jun-25	4-Dec-26	18
Soil	Hexavalent Chromium	Spectrophotometer	BKK_EN0356	29-Oct-24	29-Oct-25	12
Soil	Lead	ICP-OES	BKK_EL0037	23-Sep-24	23-Mar-26	18
Soil	Lead	Hot Block	BKK_EL0054	4-Mar-25	4-Sep-26	18
Soil	Lead	Chamber (Cold Room)	BKK_EN0167	4-Jun-25	4-Dec-26	18
Soil	Manganese	ICP-OES	BKK_EL0037	23-Sep-24	23-Mar-26	18
Soil	Manganese	Hot Block	BKK_EL0054	4-Mar-25	4-Sep-26	18
Soil	Manganese	Chamber (Cold Room)	BKK_EN0167	4-Jun-25	4-Dec-26	18
Soil	Mercury	DUO-CVAFS / CVAFS	BKK_EL0023	12-Dec-24	12-Jun-26	18
Soil	Nickel	ICP-OES	BKK_EL0037	23-Sep-24	23-Mar-26	18
Soil	Nickel	Hot Block	BKK_EL0054	4-Mar-25	4-Sep-26	18
Soil	Nickel	Chamber (Cold Room)	BKK_EN0167	4-Jun-25	4-Dec-26	18
Soil	pH aqueous phase 50% (w/v)	pH meter	BKK_EN0342	17-Oct-24	17-Oct-25	12
Soil	Selenium	ICP-OES	BKK_EL0037	23-Sep-24	23-Mar-26	18
Soil	Selenium	Hot Block	BKK_EL0054	4-Mar-25	4-Sep-26	18
Soil	Selenium	Chamber (Cold Room)	BKK_EN0167	4-Jun-25	4-Dec-26	18
Sludge	Lead	ICP-OES	BKK_EL0037	23-Sep-24	23-Mar-26	18
Sludge	Lead	Hot Block	BKK_EL0054	4-Mar-25	4-Sep-26	18
Sludge	Lead	Chamber (Cooling Room)	BKK_EN0167	4-Jun-25	4-Dec-26	18
Sludge	Mercury	Mercury Analyzer	BKK_EL0226	6-Dec-24	6-Dec-25	12
Sludge	Copper	ICP-OES	BKK_EL0037	23-Sep-24	23-Mar-26	18
Sludge	Copper	Hot Block	BKK_EL0054	4-Mar-25	4-Sep-26	18
Sludge	Copper	Chamber (Cooling Room)	BKK_EN0167	4-Jun-25	4-Dec-26	18
Sludge	Nickel	ICP-OES	BKK_EL0037	23-Sep-24	23-Mar-26	18
Sludge	Nickel	Hot Block	BKK_EL0054	4-Mar-25	4-Sep-26	18
Sludge	Nickel	Chamber (Cooling Room)	BKK_EN0167	4-Jun-25	4-Dec-26	18
Sludge	Arsenic	ICP-OES	BKK_EL0037	23-Sep-24	23-Mar-26	18
Sludge	Arsenic	Hot Block	BKK_EL0054	4-Mar-25	4-Sep-26	18
Sludge	Arsenic	Chamber (Cooling Room)	BKK_EN0167	4-Jun-25	4-Dec-26	18
Sludge	Cadmium	ICP-OES	BKK_EL0037	23-Sep-24	23-Mar-26	18
Sludge	Cadmium	Hot Block	BKK_EL0054	4-Mar-25	4-Sep-26	18
Sludge	Cadmium	Chamber (Cooling Room)	BKK_EN0167	4-Jun-25	4-Dec-26	18
Sludge	Zinc	ICP-OES	BKK_EL0037	23-Sep-24	23-Mar-26	18
Sludge	Zinc	Hot Block	BKK_EL0054	4-Mar-25	4-Sep-26	18
Sludge	Zinc	Chamber (Cooling Room)	BKK_EN0167	4-Jun-25	4-Dec-26	18
Sludge	Hexavalent Chromium	Spectrophotometer	BKK_EN0356	8-Oct-25	8-Oct-26	12

3

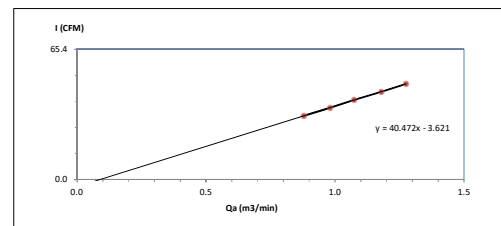
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High Volume Air Sampler Calibration Worksheet

Project Site :	Rojana Industrial Park Public Co., Ltd.	Barometric Pressure (mm Hg) :	751.8
Calibrate Location :	พาร์ทกรีน (สาขาต้นตี่) (A1)	Temperature (°C) :	30.2
Calibrate Date :	23-Sep-25	High Volume ID :	RYG_F50188
CalibrationSheet No.:	C-230925-RYG_F50188	High Volume Model :	TE-5009X
Calibrator ID:	RYG_F50206	High Volume S/N :	4796
Calibrator Model :	TE-5028A	Calibrator Slope :	0.92987
Calibrator S/N :	1543	Calibrator Intercept :	-0.01578

Test No.	Delta H <sub>2</sub> O (inch)	Qa (m <sup>3</sup> /min)	I: Chart (CFM)	Linear Regression
1	1.6	0.880	32	Slope : 40.4724
2	2.0	0.982	36	Intercept : -3.6210
3	2.4	1.074	40	Correlation Coefficient : 0.9999
4	2.9	1.179	44	
5	3.4	1.275	48	



Calibrated by

Adisak T.

( Mr. Adisak Tarisoorn )  
RYG Field Services Scientist (3)

Approved by

Suppt S.

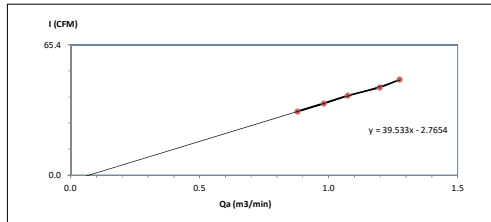
( Mr. Supot Salamthaj )  
Field Services Section Head



### High Volume Air Sampler Calibration Worksheet

Project Site : Rojana Industrial Park Public Co.,Ltd Barometric Pressure (mm Hg) : 751.8  
Calibrate Location : จังหวัดสุราษฎร์ธานีโซนบ่อ A16 (A2) Temperature (°C) : 30.2  
Calibrate Date : 23-Sep-25 High Volume ID : RYG\_FS0666  
CalibrationSheet No.: C-230925-RYG\_FS0666 High Volume Model : TE-5009X  
Calibrator ID : RYG\_FS0206 High Volume S/N : 6265  
Calibrator Model : TE-5028A Calibrator Slope : 0.92987  
Calibrator S/N : 1543 Calibrator Intercept : -0.01578

Test No.	Delta H <sub>2</sub> O (inch)	Qa (m <sup>3</sup> /min)	I: Chart (CFM)	Linear Regression
1	1.6	0.880	32	Slope : 39.5327 Intercept : -2.7654 Correlation Coefficient : 0.9981
2	2.0	0.982	36	
3	2.4	1.074	40	
4	3.0	1.199	44	
5	3.4	1.275	48	



Calibrated by Adisak T.  
(Mr. Adisak Tarisoon)  
RYG Field Services Scientist (3)

Approved by Suppt S.  
(Mr. Supot Salamteh)  
Field Services Section Head

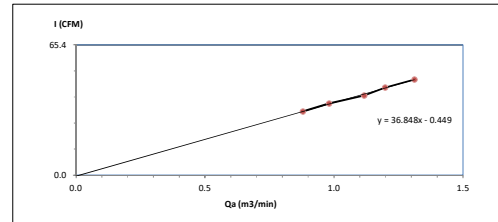
FORM NO.: F 06-074 REVISION NO.2 ISSUE DATE: 20/11/23



### High Volume Air Sampler Calibration Worksheet

Project Site : Rojana Industrial Park Public Co.,Ltd Barometric Pressure (mm Hg) : 751.8  
Calibrate Location : จังหวัดสุราษฎร์ธานีโซนบ่อ A06 (A3) Temperature (°C) : 30.2  
Calibrate Date : 23-Sep-25 High Volume ID : RYG\_FS0665  
CalibrationSheet No.: C-230925-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 <sub>2</sub> O (inch)	Qa (m <sup>3</sup> /min)	I: Chart (CFM)	Linear Regression
1	1.6	0.880	32	Slope : 36.8484 Intercept : -0.4490 Correlation Coefficient : 0.9979
2	2.0	0.982	36	
3	2.6	1.117	40	
4	3.0	1.199	44	
5	3.6	1.312	48	



Calibrated by Adisak T.  
(Mr. Adisak Tarisoon)  
RYG Field Services Scientist (3)

Approved by Suppt S.  
(Mr. Supot Salamteh)  
Field Services Section Head

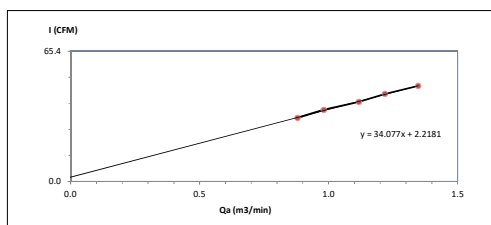
FORM NO.: F 06-074 REVISION NO.2 ISSUE DATE: 20/11/23



### High Volume Air Sampler Calibration Worksheet

Project Site : Rojana Industrial Park Public Co.,Ltd Barometric Pressure (mm Hg) : 751.8  
Calibrate Location : จังหวัดสุราษฎร์ธานีโซนบ่อ A17 (A4) Temperature (°C) : 30.2  
Calibrate Date : 23-Sep-25 High Volume ID : RYG\_FS0294  
CalibrationSheet No.: C-230925-RYG\_FS0294 High Volume Model : TE-5009X  
Calibrator ID : RYG\_FS0206 High Volume S/N : 5501  
Calibrator Model : TE-5028A Calibrator Slope : 0.92987  
Calibrator S/N : 1543 Calibrator Intercept : -0.01578

Test No.	Delta H <sub>2</sub> O (inch)	Qa (m <sup>3</sup> /min)	I: Chart (CFM)	Linear Regression
1	1.6	0.880	32	Slope : 34.0768 Intercept : 2.2181 Correlation Coefficient : 0.9990
2	2.0	0.982	36	
3	2.6	1.117	40	
4	3.1	1.218	44	
5	3.8	1.347	48	



Calibrated by Adisak T.  
(Mr. Adisak Tarisoon)  
RYG Field Services Scientist (3)

Approved by Suppt S.  
(Mr. Supot Salamteh)  
Field Services Section Head

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

# SARTORIUS



Accredited by  
NSC-TISI-TIS 17025  
Calibration 0426

### Calibration certificate

Calibration Certificate No. 25BKL0001

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 W108.
Serial   QM Ident. no.	25409664   RYG_EN0001	This certificate relate and apply this equipment only.
Customer	ALS Laboratory Group (Thailand) Co.,Ltd, (Rayong Branch)	
	618/10 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 Tharitat.  
APPROVED BY Dharmas.  
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  
Chonchai Inthana Kachen  
Mr. Chonchai Inthana Kachen Lalee

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

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Page 1 | 4

## 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

## 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
7-weights - T <sub>place</sub>	
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 g	Center
1	Front left
2	Back left
3	Back right
4	Front right
5	Maximum deviation from centric loading indication
6	$ \Delta_{ecc} _{max} = 0,0001 \text{ g}$
7	
8	
9	
10	
$s = 0,00004 \text{ g}$	$s = 0,00005 \text{ g}$

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 %
0,0500 g	0,0500 g	0,0000 g	2,00	0,00013 g	0,25 %
0,1000 g	0,1000 g	0,0000 g	2,00	0,00013 g	0,13 %
0,5000 g	0,5000 g	0,0000 g	2,00	0,00013 g	0,026 %
1,0000 g	1,0000 g	0,0000 g	2,00	0,00013 g	0,013 %
2,0000 g	2,0000 g	0,0000 g	2,00	0,00013 g	0,0065 %
5,0000 g	5,0000 g	0,0000 g	2,00	0,00013 g	0,0026 %
10,0000 g	10,0000 g	0,0000 g	2,00	0,00013 g	0,0013 %
20,0000 g	20,0000 g	0,0000 g	2,00	0,00014 g	0,00069 %
100,0000 g	100,0000 g	0,0000 g	2,00	0,00021 g	0,00021 %
150,0000 g	149,9999 g	-0,0001 g	2,00	0,00028 g	0,00019 %
Maximum error of indication		$ E _{max} = 0,0001 \text{ 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 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

## Interpretation of measurement results | Appendix to the calibration certificate

## Uncertainty of measurement in use

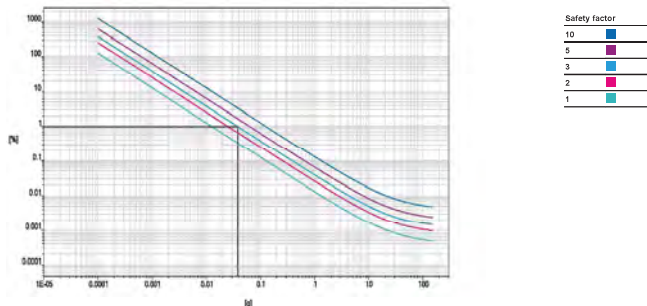
Device adjusted before measurement	Yes
Temperature deviation considered	1,5 K (isoCAL active)
Temperature coefficient considered	$1 \cdot 10^{-6}/\text{K}$

Uncertainty of the weighing result  $U_0(W)$   $U_0(W) = 0,00013 \text{ g} + 3,96 \cdot 10^{-6} \cdot R$

Reference note: The current uncertainty of measurement is calculated by entering the reading  $R$  into this formula. In relation to this, there is no need for a correction of the indication error. The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied with an Expansion factor of 2, determined in accordance with the European Calibration Guideline EURAMET cg-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	Uncertainty	Uncertainty relative
	$R$	$U_0(W)$	$U_0(W)_{rel}$
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

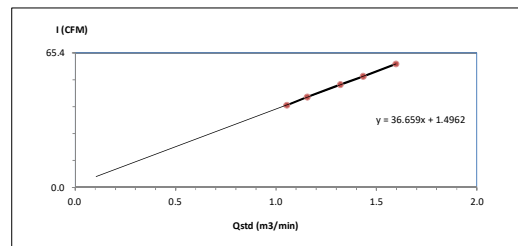
Process accuracy	1,00 %
Safety factor	3
Minimum sample weight	0,0380 g





## High Volume Air Sampler Calibration Worksheet

Project Site :	Rojana Industrial Park Public Co.,Ltd.	Barometric Pressure (mm Hg) :	751.8
Calibrate Location :	พารกกรรกรกร (สกรกรกรกร) (A1)	Temperature (°C) :	30.2
Calibrate Date :	23-Sep-25	High Volume ID :	RYG-FS0662
CalibrationSheet No.:	C-230925-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 <sub>2</sub> O (inch)	Q <sub>add</sub> (m <sup>3</sup> /min)	I: Chart (CFM)	Linear Regression
1	2.4	1.0541	40	Slope : 36.6588
2	2.9	1.1562	44	Intercept : 1.4962
3	3.8	1.3198	50	Correlation Coefficient : 0.9999
4	4.5	1.4340	54	
5	5.6	1.5968	60	



Calibrated by   
( Mr. Adisak Tarison )  
RYG Field Services Scientist (3)

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

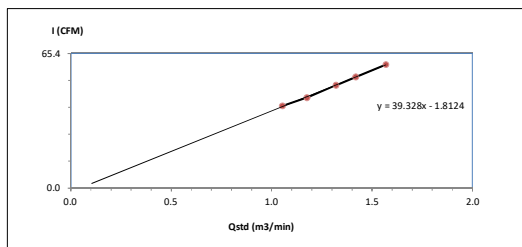




### High Volume Air Sampler Calibration Worksheet

Project Site : Rojana Industrial Park Public Co.,Ltd Barometric Pressure (mm Hg) : 751.8  
 Calibrate Location : พื้นที่ภาคใต้ของแปลง A16 (A2) Temperature (°C) : 30.2  
 Calibrate Date : 23-Sep-25 High Volume ID : RYG\_FS0664  
 CalibrationSheet No.: C-230925-RYG\_FS0664 High Volume Model : TE-5009X  
 Calibrator ID: RYG\_FS0206 High Volume S/N : 6261  
 Calibrator Model : TE-5028A Calibrator Slope : 1.48469  
 Calibrator S/N : 1543 Calibrator Intercept : -0.02523

Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>std</sub> (m <sup>3</sup> /min)	I: Chart (CFM)	Linear Regression
1	2.4	1.0541	40	Slope : 39.3285 Intercept : -1.8124 Correlation Coefficient : 0.9993
2	3.0	1.1755	44	
3	3.8	1.3198	50	
4	4.4	1.4183	54	
5	5.4	1.5685	60	



Calibrated by Adisak T.  
 ( Mr. Adisak Tarisoon )  
 RYG Field Services Scientist (3)

Approved by Supot S.  
 ( Mr. Supot Salamteh )  
 Field Services Section Head

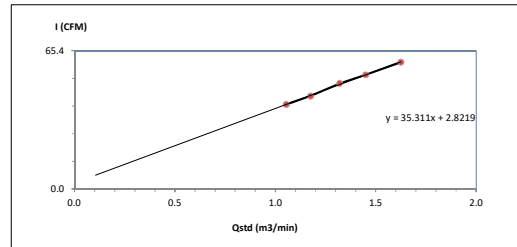
FORM NO.: F 06-073 REVISION NO.:2 ISSUE DATE: 20/11/23



### High Volume Air Sampler Calibration Worksheet

Project Site : Rojana Industrial Park Public Co.,Ltd Barometric Pressure (mm Hg) : 751.8  
 Calibrate Location : พื้นที่ภาคใต้ของแปลง A06 (A3) Temperature (°C) : 30.2  
 Calibrate Date : 23-Sep-25 High Volume ID : RYG\_FS0182  
 CalibrationSheet No.: C-230925-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 <sub>2</sub> O (inch)	Q <sub>std</sub> (m <sup>3</sup> /min)	I: Chart (CFM)	Linear Regression
1	2.4	1.0541	40	Slope : 35.3110 Intercept : 2.8219 Correlation Coefficient : 0.9991
2	3.0	1.1755	44	
3	3.8	1.3198	50	
4	4.6	1.4496	54	
5	5.8	1.6247	60	



Calibrated by Adisak T.  
 ( Mr. Adisak Tarisoon )  
 RYG Field Services Scientist (3)

Approved by Supot S.  
 ( Mr. Supot Salamteh )  
 Field Services Section Head

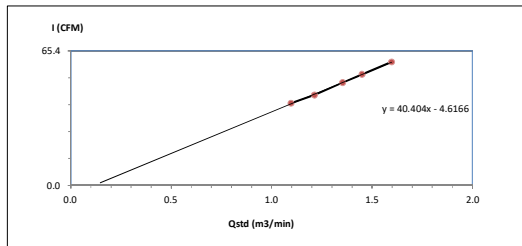
FORM NO.: F 06-073 REVISION NO.:2 ISSUE DATE: 20/11/23



### High Volume Air Sampler Calibration Worksheet

Project Site : Rojana Industrial Park Public Co.,Ltd Barometric Pressure (mm Hg) : 751.8  
 Calibrate Location : พื้นที่ภาคใต้ของแปลง A17 (A4) Temperature (°C) : 30.2  
 Calibrate Date : 23-Sep-25 High Volume ID : RYG\_FS0396  
 CalibrationSheet No.: C-230925-RYG\_FS0396 High Volume Model : TE-5170D  
 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 <sub>2</sub> O (inch)	Q <sub>std</sub> (m <sup>3</sup> /min)	I: Chart (CFM)	Linear Regression
1	2.6	1.0961	40	Slope : 40.4042 Intercept : -4.6166 Correlation Coefficient : 0.9994
2	3.2	1.2133	44	
3	4.0	1.3535	50	
4	4.6	1.4496	54	
5	5.6	1.5968	60	



Calibrated by Adisak T.  
 ( Mr. Adisak Tarisoon )  
 RYG Field Services Scientist (3)

Approved by Supot S.  
 ( Mr. Supot Salamteh )  
 Field Services Section Head

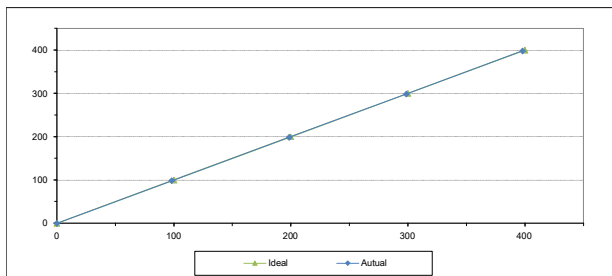
FORM NO.: F 06-073 REVISION NO.:2 ISSUE DATE: 20/11/23



### MULTIPOINT CALIBRATION REPORT

Calibration Date : 3-Jul-25 Equipment Name : SO2 Analyzer  
 Manufacturer : Teledyne API Model : N100  
 Serial No. : 115 Equipment ID : RYG\_FS0733  
 Calibrator Manufacturer : Teledyne API Model : 700  
 Serial No. : 947  
 Std. Gas Concentration (PPM) : 58.3 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	98.30	-1.70	-1.70
2	200.00	198.50	-1.50	-0.75
3	300.00	298.50	-1.50	-0.50
4	400.00	398.00	-2.00	-0.50
AVERAGE (%)				-0.67



Calibrated By

Approved By

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

( Mr. Sarayuth Jitranont )  
 Assistant General Manager

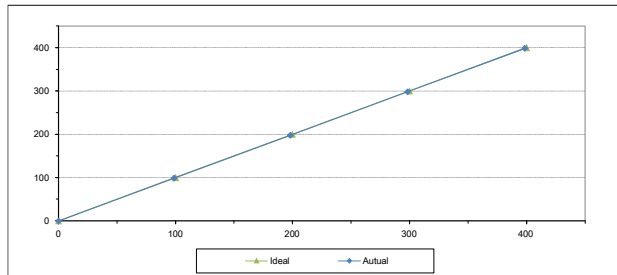
ALS Laboratory Group  
 FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



### MULTIPOINT CALIBRATION REPORT

Calibration Date	1-Jul-25	Equipment Name	SO2 Analyzer
Manufacturer	HORIBA	Model	APSA-370
Serial No.	G2CH436B	Equipment ID	BKK_FS0796
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	0.05	0.05	0.05
1	100.00	98.70	-1.30	-1.30
2	200.00	198.10	-1.90	-0.95
3	300.00	298.30	-1.70	-0.57
4	400.00	398.50	-1.50	-0.38
AVERAGE (%)				-0.63



Calibrated By

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

Approved By

(Mr.Sarayuth Jittrantont)  
Assistant General Manager

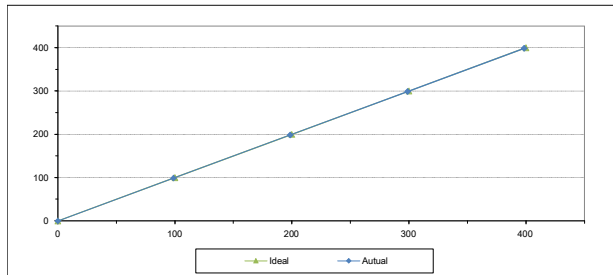
ALS Laboratory Group  
FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



### MULTIPOINT CALIBRATION REPORT

Calibration Date	2-Jul-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	198.60	-1.40	-0.70
3	300.00	299.00	-1.00	-0.33
4	400.00	398.50	-1.50	-0.38
AVERAGE (%)				-0.48



Calibrated By

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

Approved By

(Mr.Sarayuth Jittrantont)  
Assistant General Manager

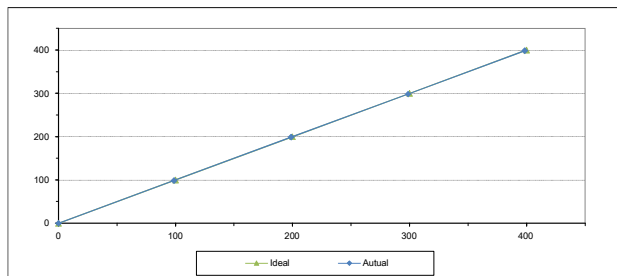
ALS Laboratory Group  
FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



### MULTIPOINT CALIBRATION REPORT

Calibration Date	3-Jul-25	Equipment Name	SO2 Analyzer
Manufacturer	Teledyne API	Model	N100
Serial No.	114	Equipment ID	RYG_FS0730
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	0.00	0.00	0.00
1	100.00	98.80	-1.20	-1.20
2	200.00	198.90	-1.10	-0.55
3	300.00	298.70	-1.30	-0.43
4	400.00	398.50	-1.50	-0.38
AVERAGE (%)				-0.51



Calibrated By

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

Approved By

(Mr.Sarayuth Jittrantont)  
Assistant General Manager

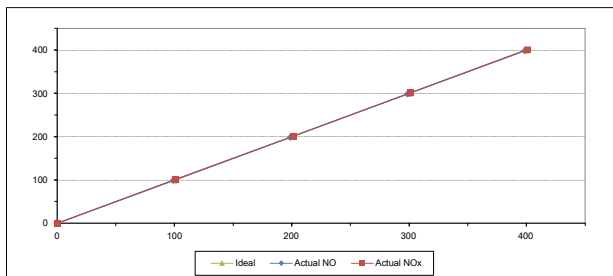
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FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



### MULTIPOINT CALIBRATION REPORT

Calibration Date	3-Jul-25	Equipment Name	NOx Analyzer
Manufacturer	Teledyne API	Model	N200
Serial No.	122	Equipment ID	RYG_FS0732
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	99.20	-0.80	-0.80	101.30	1.30	1.30
2	200.00	198.70	-1.30	-0.65	201.30	1.30	0.65
3	300.00	298.80	-1.20	-0.40	301.30	1.30	0.43
4	400.00	398.50	-1.50	-0.38	401.00	1.00	0.25
AVERAGE (%)				-0.43			0.55



Calibrated By

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

Approved By

(Mr.Sarayuth Jittrantont)  
Assistant General Manager

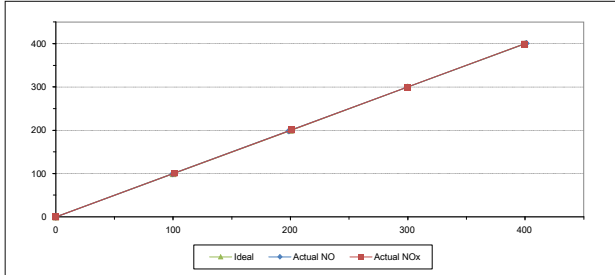
ALS Laboratory Group  
FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



### MULTIPOINT CALIBRATION REPORT

Calibration Date	2-Jul-25	Equipment Name	NOx Analyzer
Manufacturer	HORIBA	Model	APNA-370
Serial No.	H73KYD1M	Equipment ID	BKK_FS0797
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	99.70	-0.30	-0.30	101.00	1.00	1.00
2	200.00	198.60	-1.40	-0.70	201.10	1.10	0.55
3	300.00	299.10	-0.90	-0.30	299.70	-0.30	-0.10
4	400.00	401.10	1.10	0.28	399.50	-0.50	-0.13
AVERAGE (%)				-0.18			0.28



Calibrated By

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

Approved By

(Mr.Sarayuth Jitranont)  
Assistant General Manager

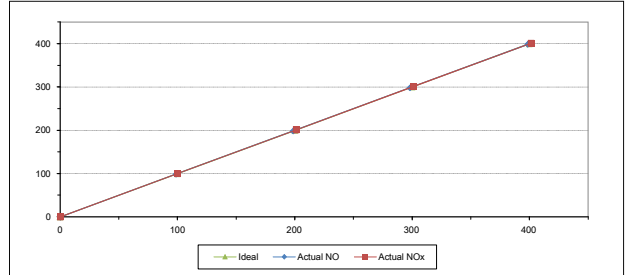
ALS Laboratory Group  
FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



### MULTIPOINT CALIBRATION REPORT

Calibration Date	1-Jul-25	Equipment Name	NOx Analyzer
Manufacturer	HORIBA	Model	APNA-370
Serial No.	SEEAW53E	Equipment ID	RYG_FS0281
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	198.70	-1.30	-0.65	201.20	1.20	0.60
3	300.00	298.10	-1.90	-0.63	301.10	1.10	0.37
4	400.00	398.60	-1.40	-0.35	401.40	1.40	0.35
AVERAGE (%)				-0.57			0.32



Calibrated By

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

Approved By

(Mr.Sarayuth Jitranont)  
Assistant General Manager

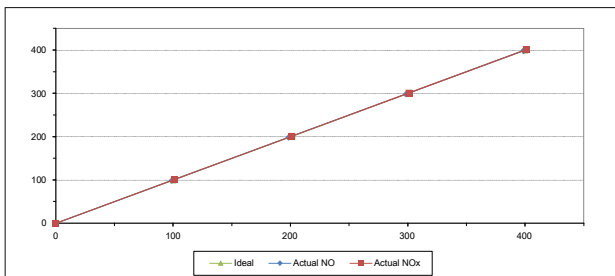
ALS Laboratory Group  
FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



### MULTIPOINT CALIBRATION REPORT

Calibration Date	3-Jul-25	Equipment Name	NOx Analyzer
Manufacturer	Teledyne API	Model	N200
Serial No.	107	Equipment ID	RYG_FS0731
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	55.88	Cylinder No.	GN0027222
Cylinder Pressure (psi)	1800	Certified By	Airgas Inc.
Certified Date	9-Feb-22	Expired Date	9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	99.00	-1.00	-1.00	101.30	1.30	1.30
2	200.00	198.50	-1.50	-0.75	201.30	1.30	0.65
3	300.00	298.70	-1.30	-0.43	301.00	1.00	0.33
4	400.00	398.80	-1.20	-0.30	401.30	1.30	0.33
AVERAGE (%)				-0.48			0.54



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



Accredited calibration laboratory  
ISO/IEC 17025:2017  
NSC-F01-TS 17025  
CALIBRATION 0367

Accredited calibration laboratory  
ISO/IEC 17025:2017  
NSC-F01-TS 17025  
CALIBRATION 0367



Certificate Number

CWS-056-07

### CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

#### MEASUREMENT ITEM

MANUFACTURER

MODEL/TYPE

SERIAL NUMBER

ID NUMBER

CONDITION AS RECEIVED

CUSTOMER

RECEIVED DATE

MEASUREMENT DATE

ISSUE DATE

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follows:

Temperature

Relative Humidity

Atmospheric Pressure

PLACE OF CALIBRATION

CALIBRATION CONDITIONS

Preconditioning

Measurement Condition

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

10 Mr. Sarawut Thachalad

11 Miss Jiraporn Lertsuphachol

Remarks:

12 Actual cross-section area of the wind tunnel

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

14 Diameter of mounting pipe

15 Ratio "a"

16

17

18

19

20

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

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

$V_{std}$ (m/s)	Temp. wind tunnel (°C)	Temp. room (°C)	$V_{UUC}$ (m/s)	Error (m/s)	$U/(V \pm 2)$ (m/s)
0.998	23.04	23.20	0.8	-0.2	0.31
1.215	23.30	23.20	1.6	-0.2	0.31
1.002	22.96	23.20	1.0	-0.2	0.31
4.226	22.96	23.20	4.0	-0.2	0.31
4.94	23.04	23.20	4.8	-0.4	0.31
5.66	22.90	23.20	6.0	-0.1	0.31
5.62	22.74	23.20	7.2	-0.1	0.31
7.37	22.14	23.20	8.0	-0.6	0.31
8.97	22.70	23.20	9.0	-0.0	0.31
9.96	22.84	23.20	10.1	0.1	0.34
11.08	22.80	23.20	11.0	-0.1	0.31
12.02	22.50	23.20	12.0	0.0	0.30
12.93	22.88	23.20	13.1	0.1	0.40
13.94	22.90	23.20	14.0	0.0	0.44
15.07	22.90	23.20	15.2	0.2	0.53
15.97	23.00	23.20	16.2	0.3	0.48

### Remarks:

<sup>1</sup> Calibration results only valid for the tested circumstances and environmental conditions during which calibration took place.

<sup>2</sup> Velocity of standard

<sup>3</sup> 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.

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

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

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

### Certificate Number

CWS-052-67

## CERTIFICATE OF CALIBRATION

### MEASUREMENT ITEM

Manufacturer

Model/Type

Serial Number

ID Number

Condition as-received

Customer

Cup anemometer

Manufacturer

Model/Type

Serial Number

ID Number

Condition as-received

Customer

### Calibration procedure:

The Cup anemometer was calibrated against a standard air velocity transducer model 445PQ2 and pitot tube with precision differential pressure meter model 2742502 in an open calibration cell. 620-type wind tunnel with 900 mm cross-section area. The W1-C00 based on IEC 61400-12-1, Wind energy generation systems - Part 12-1: Power performance measurement of electricity producing wind turbines, March 2017 was used as a calibration guideline.

### Traceability:

The certificate provides a traceability of the measurement to recognized national standards and to realization of the International System of Units (SI) through the National Metrology Institute of Thailand via Certificate Number: NM-0027-24 and NM-0055-23.

### Uncertainty of Measurement:

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

### RECEIVED DATE

30 Sep 2024

### MEASUREMENT DATE

17 Oct 2024

### ISSUE DATE

17 Oct 2024

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follows:

Temperature 23.0 ± 0.5 °C

Relative Humidity 55.0 ± 3.0 %RH

Atmospheric Pressure 1010.10 kPa

### PLACE OF CALIBRATION

620-type wind tunnel of Jiranatee Associates Co., Ltd.

### CALIBRATION CONDITIONS

Wind tunnel cross-section area 900 mm<sup>2</sup>

Wind direction frontal area 100 mm<sup>2</sup>

Diameter of mounting pipe 1 mm

Blockage ratio of test object 0.111 [-]

### Preconditioning

24 hours at ambient condition

### Measurement Condition

The average values during measurement are 23.0 °C, 56.0 %RH and 1010.1 kPa.

### TABULATION OF RESULTS:

The table on next page give the measured values.

### Calibrated by:

Dr. Mr. Sorawit Thirakul

Mr. Mitthiraporn Lertthongphol



### Approved signature:

Mr. Pinyas Booncharoen

Calibration Department Manager

### Remarks:

<sup>1</sup> Nominally cross-section area of the wind tunnel

<sup>2</sup> Projected cross-section area of the tested object include mounting pipe

<sup>3</sup> Diameter of mounting pipe

<sup>4</sup> Ratio  $A_0/A$

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

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

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

$V_{std}$ (m/s)	Temp. wind tunnel (°C)	Temp. room (°C)	$V_{UUC}$ (m/s)	Error (m/s)	$U/(V \pm 2)$ (m/s)
1.013	23.26	23.30	0.8	-0.2	0.31
2.237	23.24	23.30	1.0	-0.2	0.31
3.053	23.20	23.30	3.0	-0.1	0.31
4.304	23.26	23.30	4.0	-0.2	0.31
4.86	23.32	23.30	5.0	-0.0	0.31
5.58	22.70	23.30	6.0	0.0	0.31
5.66	23.44	23.30	7.0	-0.0	0.31
7.38	22.58	23.30	8.0	-0.0	0.31
8.97	23.00	23.30	9.0	-0.0	0.31
9.97	23.26	23.30	10.1	0.1	0.31
11.01	23.10	23.30	11.1	0.1	0.31
12.02	22.94	23.30	12.1	0.1	0.33
12.95	23.20	23.30	13.1	0.2	0.32
13.93	23.04	23.30	14.1	0.1	0.34
14.98	23.20	23.30	15.1	0.2	0.37
15.91	23.14	23.30	16.1	0.3	0.41

### Remarks:

<sup>1</sup> Calibration results only valid for the tested circumstances and environmental conditions during which calibration took place.

<sup>2</sup> Velocity of standard

<sup>3</sup> 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.

Accredited calibration laboratory  
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NSC-TSI-TIS 17025  
CALIBRATION 0367

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

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

### Certificate Number

CWS-052-67

## CERTIFICATE OF CALIBRATION

### MEASUREMENT ITEM

Manufacturer

Model/Type

Serial Number

ID Number

Condition as-received

Customer

Wind Direction Sensor

Manufacturer

Model/Type

Serial Number

ID Number

Condition as-received

Customer

### Calibration procedure:

The wind direction sensor was calibrated against a standard Rotary Encoder model AV40275-0002-000-000 in an open calibration cell. 620-type wind tunnel with 900 mm cross-section area. The W1-C00 based on IEC 61400-12-1, Wind energy generation systems - Part 12-1: Power performance measurement of electricity producing wind turbines, March 2017 was used as a calibration guideline.

### Traceability:

The certificate provides a traceability of the measurement to recognized national standards and to realization of the International System of Units (SI) through the National Metrology Institute of Thailand via Certificate Number: NM-0027-24 and NM-0055-23.

### Uncertainty of Measurement:

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

### RECEIVED DATE

30 Sep 2024

### MEASUREMENT DATE

17 Oct 2024

### ISSUE DATE

17 Oct 2024

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follows:

Temperature 23.0 ± 0.5 °C

Relative Humidity 55.0 ± 3.0 %RH

Atmospheric Pressure 1010.10 kPa

### PLACE OF CALIBRATION

620-type wind tunnel of Jiranatee Associates Co., Ltd.

### CALIBRATION CONDITIONS

Wind tunnel cross-section area 900 mm<sup>2</sup>

Wind direction frontal area 128 mm<sup>2</sup>

Diameter of mounting pipe 1 mm

Blockage ratio of test object 0.141 [-]

### Preconditioning

24 hours at ambient condition

### Measurement Condition

The average values during measurement are 23.3 °C, 147.3 %RH and 1010.1 kPa.

### TABULATION OF RESULTS:

The table on next page give the measured values.

### Calibrated by:

Dr. Mr. Sorawit Thirakul

Mr. Mitthiraporn Lertthongphol



### Approved signature:

Mr. Pinyas Booncharoen

Calibration Department Manager

### Remarks:

<sup>1</sup> Nominally cross-section area of the wind tunnel

<sup>2</sup> Projected cross-section area of the tested object include mounting pipe

<sup>3</sup> Diameter of mounting pipe

<sup>4</sup> Ratio  $A_0/A$

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



MEASUREMENT RESULTS<sup>1</sup>

The wind direction sensor was calibrated against standard rotary encoder by comparison method. During calibration, the measurement was carried out at 45 intervals 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 m/s	$\theta^{\circ}_{\text{ref}}$ Degree (°)	$\theta^{\circ}_{\text{me}}$ Degree (°)	Error Degree (°)	$U(95\%)$ Degree (°)
0.00	0.00	0	0	0.65
45.000	45	47	-3	0.65
90.000	90	87	-3	0.65
135.000	135	133	-2	0.65
180.000	180	178	-2	0.65
225.000	225	224	-1	0.65
270.000	270	271	1	0.65
315.000	315	318	3	0.65

## Remarks:

<sup>1</sup> Calibration results only count for the stated circumstances and environmental conditions during which calibration took place.

<sup>2</sup> Direction of standard

<sup>3</sup> Direction of Unit Under Calibration

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



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CALIBRATION 0367

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

Anemometer measurement laboratory  
Calibration services department



NSC - TIS - TIS 17025  
CALIBRATION 0367

Certificate Number

FWA-01-001

## CERTIFICATE OF CALIBRATION

## MEASUREMENT ITEM

## MANUFACTURER

## MODEL/TYPE

## SERIAL NUMBER

## ID NUMBER

## CONDITION AS-RECEIVED

## CUSTOMER

Cup anemometer  
Novatek  
Sensor: WS-02F  
Data logger: L10-W5-230L-V1  
Serial: WSD-43812  
Data logger: A5912  
RVC\_130613  
Used item

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

Received Date: 10 Jun 2024  
Measurement Date: 26 Jun 2024  
Issue Date: 26 Jun 2024

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

Place of Calibration: J101 type wind tunnel of Jiranatee Associates Co., Ltd.

Calibration Conditions:  
Wind tunnel cross-section area: 800 cm<sup>2</sup>  
Wind direction frontal area: 100 cm<sup>2</sup>  
Diameter of mounting pipe: 10 mm  
Blockage ratio of test object: 0.111 %

Preconditioning:  
Measurement Condition: 24 hours at ambient conditions.  
The average values during measurement are (24.0) °C, (44.0) %RH and (1005.0) hPa.

Tabulation of Results:  
The table on next page give the measured values.

Calibrated by: Mr. Parinya Booncharoen  
Mr. Jiraporn Lertkarnphol

Approved signature: Mr. Parinya Booncharoen  
Calibration Department Manager

Remarks:  
<sup>1</sup> Nominal cross-section area of the wind tunnel  
<sup>2</sup> Projected cross-section area of the tested object include mounting pipe  
<sup>3</sup> Diameter of mounting pipe  
<sup>4</sup> Ratio %

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 855022 and gage tube with precision differential pressure meter model DM2500 in anemometer calibration cell. The wind tunnel with 800 cm<sup>2</sup> cross section area. The WSD-43812 based on IEC 61409-12-1, wind energy generation system - Part 12-1, power performance measurement of electricity producing wind turbines, March 2017 was used as a calibration reference.

## Traceability:

This certificate provides a traceability of the measurement to recognized the national standards and to realization of the international system of units (SI) through the NMV (National Metrology Institute of Thailand) via Certificate number: MW-0017-24 and MW-005-23.

## Uncertainty of Measurement:

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

Signature: Mr. Parinya Booncharoen  
Date: 26/12/24

Approved 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

MEASUREMENT RESULTS<sup>1</sup>

The Cup anemometer, Unit Under Calibration (UUC) was exercised at 10 m/s for 5 minutes prior to calibration being performed. This 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 10 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 power plate at center of test section. The calibration was carried out under both rising and falling air velocity in the range of 1 m/s to 16 m/s at calibration interval of 1 m/s. The results of calibration and associated measurement uncertainties are reported in the table below.

$V_{ref}$ (m/s)	Temp. wind tunnel (°C)	Temp. room (°C)	$V_{me}$ (m/s)	Error (m/s)	$U(95\%)$ (m/s)
1.000	24.00	24.00	0.8	-0.2	0.31
1.400	24.00	24.00	1.2	-0.2	0.31
2.000	24.00	24.00	1.8	-0.2	0.31
2.800	24.00	24.00	2.6	-0.2	0.31
3.800	24.00	24.00	3.6	-0.2	0.31
5.000	24.00	24.00	5.0	0.0	0.31
6.500	24.00	24.00	6.0	-0.5	0.31
8.500	24.00	24.00	7.0	-1.5	0.31
11.000	24.00	24.00	8.0	-3.0	0.31
14.000	24.00	24.00	9.1	-4.9	0.31
17.000	24.00	24.00	10.1	-6.9	0.31
20.000	24.00	24.00	11.2	-8.8	0.31
23.000	24.00	24.00	12.2	-10.8	0.31
26.000	24.00	24.00	13.2	-12.8	0.31
29.000	24.00	24.00	14.2	-14.8	0.31
32.000	24.00	24.00	15.2	-16.8	0.31

## Remarks:

<sup>1</sup> Calibration results only count for the stated circumstances and environmental conditions during which calibration took place.

<sup>2</sup> Velocity of standard

<sup>3</sup> 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\*\*\*



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

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

Wind direction measurement laboratory  
Calibration services department



NSC - TIS - TIS 17025  
CALIBRATION 0367

Certificate Number

CWD-017-67

## CERTIFICATE OF CALIBRATION

## MEASUREMENT ITEM

## MANUFACTURER

## MODEL/TYPE

## SERIAL NUMBER

## ID NUMBER

## CONDITION AS-RECEIVED

## CUSTOMER

Wind direction sensor  
Novatek  
Sensor: WS-02F  
Data logger: L10-W5-230L-V1  
Serial: WSD-43812  
Data logger: A5912  
RVC\_130613  
Used item

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

Received Date: 10 Jun 2024  
Measurement Date: 26 Jun 2024  
Issue Date: 26 Jun 2024

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

Place of Calibration: J101 type wind tunnel of Jiranatee Associates Co., Ltd.

Calibration Condition:  
Wind tunnel cross-section area: 800 cm<sup>2</sup>  
Wind direction frontal area: 100 cm<sup>2</sup>  
Diameter of mounting pipe: 10 mm  
Blockage ratio of test object: 0.111 %

Preconditioning:  
Measurement Condition: 24 hours at ambient conditions.  
The average values during measurement are (23.9) °C, (52.4) %RH and (1005.3) hPa.

Tabulation of Results:  
The table on next page give the measured values.

Calibrated by: Mr. Parinya Booncharoen  
Mr. Jiraporn Lertkarnphol

Approved signature: Mr. Parinya Booncharoen  
Calibration Department Manager

Remarks:  
<sup>1</sup> Velocity cross-section area of the wind tunnel  
<sup>2</sup> Projected cross-section area of the tested object include mounting pipe  
<sup>3</sup> Diameter of mounting pipe  
<sup>4</sup> Ratio %

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## Calibration procedure:

The wind direction sensor was calibrated against Standard air velocity transducer model 855022 and gage tube with precision differential pressure meter model DM2500 in anemometer calibration cell. The wind tunnel with 800 cm<sup>2</sup> cross section area. The WSD-43812 based on IEC 61409-12-1, wind energy generation system - Part 12-1, power performance measurement of electricity producing wind turbines, March 2017 was used as a calibration reference.

## Traceability:

This certificate provides a traceability of the measurement to recognized the national standards and to realization of the international system of units (SI) through the NMV (National Metrology Institute of Thailand) via Certificate number: MW-0017-24 and MW-005-23.

## Uncertainty of Measurement:

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

Signature: Mr. Parinya Booncharoen  
Date: 26/12/24

Approved 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

### MEASUREMENT RESULTS

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	$\theta^\circ$ (°)	$\theta^\circ$ (°)	Error	$U_{95\%}$
m/s	Degree (°)	Degree (°)	Degree (°)	Degree (°)
3.01	0.000	0	0	0.40
	45.000	44	-3	0.40
	89.900	87	-3	0.40
	135.800	134	-4	0.40
	180.000	177	-3	0.40
	225.000	226	0	0.40
	270.000	271	1	0.40
	315.000	316	1	0.40

#### Remarks:

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

\* Direction of standard.

\* Division of Unit Under Calibration.

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



JIRANATEE ASSOCIATES CO., LTD.

8/14-15, 8/17-18,  
Pattana 7/7, 8/18 Wattana, Bangkok  
Bangkok 10000 (Thailand)  
Tel: +662-000012  
Mobile: +662-0000433  
E-mail: jnc@jiranatee.com  
Web site: www.jiranatee.com

Accredited calibration laboratory

ISO/IEC 17025:2017  
NSC-TIS-TIS 17025  
CALIBRATION 0367

Pressure measurement laboratory  
Calibration services department.



## CERTIFICATE OF CALIBRATION

Certificate No.: CPB-007-67

Page 1 of 2 Pages

### MEASUREMENT ITEM

#### MANUFACTURER

#### MODEL/TYPE

#### SERIAL NUMBER

#### ID NUMBER

#### CONDITION AS-RECEIVED

#### CUSTOMER

Digital transmitter  
Novamix  
Sensor: 110-W5-250P  
Data logger: 110-W5-250L-U  
Sensor: BP-A5912  
Data logger: AS917  
RYE, F30611  
Used item  
AAS laboratory group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd.  
Khwaeng Suan Luang, Khet Suan Luang,  
Bangkok 10250 Thailand.

#### Calibration procedure:

The Digital transmitter was calibrated against digital pressure calibrator. The WP-CE-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) Certificate number: MP-0009-24

#### Uncertainty of Measurement:

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

RECEIVED DATE  
MEASUREMENT DATE  
ISSUE DATE

: 10 Jun 2024  
: 26 Jun 2024  
: 26 Jun 2024

### CONDITION OF THIS RESULT OF CALIBRATION:

#### 1. Reference Standard Instrument:

#### Instrument

#### Model

#### Serial No.

#### Certificate No.

#### Due Date

Absolute Pressure Transducer  
CPG2500  
41010128P  
MP-0009-24  
27 Dec 2024

#### 2. Calibration effort for calibration sequence 8

#### 3. 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. Conditions:

#### Pressure transmitting medium

#### Atm.

#### 1.13 kg/m<sup>3</sup>

#### Hum.

#### (50±10) %

#### Temp.

#### (23±0.5) °C

#### Press.

#### (1010±10) mbar

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

#### Calibrated by:

#### Mr. Sorawit Thachalad

#### Mr. Jiraporn Lertsomphol



#### Approved signature:

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



JIRANATEE ASSOCIATES CO., LTD.

8/14-15, 8/17-18,  
Pattana 7/7, 8/18 Wattana, Bangkok  
Bangkok 10000 (Thailand)  
Tel: +662-000012  
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Accredited calibration laboratory

ISO/IEC 17025:2017  
NSC-TIS-TIS 17025  
CALIBRATION 0367

Pressure measurement laboratory

Calibration services department.



JIRANATEE ASSOCIATES CO., LTD.

8/14-15, 8/17-18,  
Pattana 7/7, 8/18 Wattana, Bangkok  
Bangkok 10000 (Thailand)  
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Web site: 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.: COT-104-67

Page 1 of 2 Pages

Certificate No.: CPB-007-67

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	UUC*	Error	Uncertainty (k=2)
(mbar)	(mbar)	(mbar)	(mbar)
950.11	951.9	1.8	0.37
970.08	971.3	1.2	0.37
990.08	991.0	0.9	0.37
1010.89	1010.4	-0.5	0.47
1030.05	1029.9	-0.2	0.37
1050.08	1049.3	-0.8	0.37

Note: UUC\* Unit Under Calibration

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

\*\*End of certificate\*\*



### MEASUREMENT ITEM

#### MANUFACTURER

#### MODEL/TYPE

#### SERIAL NUMBER

#### ID NUMBER

#### CONDITION AS-RECEIVED

#### CUSTOMER

Data Logger with Temperature sensor  
Novamix  
110-W5-250L-D  
AS912  
RYE, F30611  
Used item  
AAS laboratory group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd.  
Khwaeng Suan Luang, Khet Suan Luang,  
Bangkok 10250 Thailand.

#### Calibration procedure:

The temperature calibration was done by in-house calibration method as WP-4-003 according to comparison method with standard digital thermometer, indicating and standard temperature probe. The temperature scale was based on ITS-90.

#### Traceability:

The measurement results are traceable to the international system of units (SI) through National Metrology of Thailand (NIMT) Certificate number: TT-0043-24, Certificate number: ET-0103-23

#### Reference Used During Calibration:

1. Standard Temperature Probe

Model: STS-100 AS500, Serial No.: 667682-03

Due date: 26 Nov 2023

2. Digital Temperature Indicator

Model: DTI-1000-A-MR-R, Serial No.: 675407-00001

Due date: 14 Sep 2024

#### Uncertainty of Measurement:

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

#### RECEIVED DATE

#### MEASUREMENT DATE

#### ISSUE DATE

: 10 Jun 2024  
: 26 Jun 2024  
: 26 Jun 2024

#### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follows:

Temperature : 23.0 ± 3.0 °C

Relative Humidity : 55.0 ± 15.0 %RH

NOTES: 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.

#### Calibrated by:

#### Mr. Sorawit Thachalad

#### Mr. Jiraporn Lertsomphol

#### Mr. Jiraporn Lertsomphol



#### Approved signature:

Mr. Parinya Booncharoen

Calibration Department Manager

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Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 °C to 40 °C

Function:

Table 3: This equipment was connected with temperature sensor Model: HMP60 S/N: U3911247.  
Dimension: Diameter 12 mm, Length 60 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
90	20.060	19.6	-0.5	0.090
80	25.058	24.6	-0.5	0.089
80	30.048	29.7	-0.4	0.089
80	35.031	34.7	-0.4	0.14
80	40.045	39.5	-0.5	0.089

UUC: Limit Under Calibration

Remark: The reported uncertainty of measurement is 0.14, based on standard uncertainty multiplied by a coverage factor k=2.14 providing a level of confidence of approximately 95%.

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



Certificate No.: CDT-016-67

Page 2 of 2 Pages

MEASUREMENT ITEM

MANUFACTURER

MODEL/TYPE

SERIAL NUMBER

ID NUMBER

CONDITION AS RECEIVED

CUSTOMER

RECEIVED DATE

MEASUREMENT DATE

ISSUE DATE

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

Temperature: 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.

Relative humidity with data logger

Humidity

Data logger: 330-100-250L-D

Sensor: HUM60

Data logger: AS912

Sensor: U3911247

HW: J20611

Used item:

ALS laboratory group (Thailand) Co., Ltd.

104 Phuthanukan 40, Phuthanukan Rd, Khwaeng Suan Luang,

Khwaeng Suan Luang, Bangkok 10250 Thailand.

Calibration procedure:

For Relative humidity and Air Temperature calibration, were done by the device (calibration) certified as WI-CL-020 and WI-CL-030 according to comparison method with Standard, China Metrology Institute with Temperature sensor and Standard Humidity generation chamber.

Traceability:

The measurements were traceable to the international system of units (SI) through National Institute of Metrology (Thailand) (NIMT), Calibration number: TH079-21 and through Jirantee Associates Co., Ltd. Certificate number: CDT-001-67.

Uncertainty of Measurement:

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

Calibrated by:

☒ Mr. Sorasit Thaisakul  
☒ Miss Jiraporn Lertsitornol  
☒ Miss Wangrungrat Phomsri



Approved signatory

Mr. Parinya Booncharoen  
Calibration Department Manager

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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 50 °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)
29.89	19.60	18.5	-1.0	0.83
29.89	10.55	8.0	-2.6	1.3
29.81	61.61	77.8	+1.6	2.3

UUC: Limit Under Calibration

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



Page 1 of 2 Pages

MEASUREMENT ITEM

MANUFACTURER

MODEL/TYPE

SERIAL NUMBER

ID NUMBER

CONDITION AS RECEIVED

CUSTOMER

RECEIVED DATE

MEASUREMENT DATE

ISSUE DATE

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

Temperature: 23.0 ± 1.0 °C

Relative humidity: 55.0 ± 15.0 %RH

Atmospheric Pressure: 1010 ± 10 hPa

PLACE OF CALIBRATION

CALIBRATION CONDITIONS

Preconditioning

Measurement Condition

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

☒ Mr. Sorasit Thaisakul  
☒ Miss Jiraporn Lertsitornol  
☒ Miss Wangrungrat Phomsri

Remark:

\* Reported cross-section area of the wind tunnel

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

\* Diameter of mounting pipe

\* Ratio: 1:1

Cup anemometer

Humidity

Sensor: AS-028

Data logger: 330-100-250L-D

Sensor: WDA-0602

Data logger: AS662

HW: J20611

Used item:

ALS laboratory group (Thailand) Co., Ltd.

104 Phuthanukan 40, Phuthanukan Rd, Khwaeng Suan Luang,

Khwaeng Suan Luang, Bangkok 10250 Thailand.

Calibration procedure:

The Cup anemometer was calibrated against Standard air velocity according to ISO 9906 and used with automatic data logger of anemometer model: WDA-0602 in anemometer calibration of 1990 new unit (with unit: m/s) and used with anemometer. The WI-CL-020 (new) of IEC 61400-12.1. Used average anemometer system - Part 1: 1. Power performance measurements of electricity producing wind turbines, March 2017 was used for comparison purposes.

Traceability:

The certificate provides a traceability of the measurement to national system of units (SI) through National Institute of Metrology (Thailand) (NIMT), Calibration number: TH079-21 and through Jirantee Associates Co., Ltd. Certificate number: CDT-001-67.

Uncertainty of Measurement:

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



Approved signatory

Mr. Parinya Booncharoen  
Calibration Department Manager

REVIEW BY

APPROVED BY

NEXT CAL DATE: 01/10/2026

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Certificate Number

CWS-010-68

Page 2 of 2 Pages

MEASUREMENT RESULTS<sup>5</sup>

The Cup anemometer, Unit Under Calibration (UUC) was exposed at 10 m/s for 5 minutes prior to calibration being performed. The standard air velocity 0.5 m/s to 5 m/s was calculated by a standard air velocity transducer which was installed 50 mm away from wind tunnel nozzle and installed 40 mm away from top of the test section and the standard air velocity 5 m/s to 10 m/s was calculated by a pitot tube with pressure 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 (100mm) plus an offset of test section. The calibration was carried out under both rising and falling air velocity in the range of 1 m/s to 10 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)	$V_{meas}$ (m/s)	Error (m/s)	$U$ (k=2) (m/s)
0.5	24.70	24.50	0.8	0.2	0.31
1.0	24.48	24.50	2.0	-0.2	0.31
1.5	24.64	24.50	2.9	-0.1	0.31
2.0	24.66	24.50	4.0	-0.2	0.31
2.5	24.52	24.50	4.9	-0.4	0.31
3.0	24.44	24.50	6.0	0.0	0.31
3.5	24.40	24.50	6.9	-0.2	0.31
4.0	24.56	24.50	7.9	-0.0	0.31
4.5	24.50	24.50	9.0	0.0	0.31
5.0	24.64	24.50	10.0	0.0	0.31
5.5	24.56	24.50	11.1	0.1	0.31
6.0	24.70	24.50	12.1	0.1	0.31
6.5	24.30	24.50	13.1	0.0	0.31
7.0	24.68	24.50	14.1	0.3	0.31
7.5	24.52	24.50	15.1	0.0	0.31
8.0	24.60	24.50	16.2	0.0	0.31

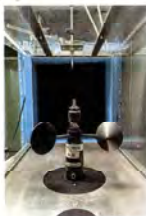
## Remarks:

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

<sup>2</sup> Uncertainty of standard

<sup>3</sup> Uncertainty of Unit Under Calibration

## PHOTO OF CALIBRATION SET-UP



Calibration setup 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\*\*\*

Certificate Number

CWO-010-68

Page 2 of 2 Pages

MEASUREMENT RESULTS<sup>5</sup>

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 $v_{ref}$ (m/s)	$D'_{ref}$ Degree (°)	$D'_{meas}$ Degree (°)	Error Degree (°)	$U$ (k=2) Degree (°)
45.000	45	41	-4	0.89
90.000	47	43	-4	0.89
135.000	142	137	-5	0.89
180.000	140	135	-5	0.89
225.000	228	223	-5	0.89
270.000	273	268	-5	0.89
315.000	318	313	-5	0.89
360.000	359	354	-5	0.89

## Remarks:

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

<sup>2</sup> Uncertainty of standard

<sup>3</sup> Uncertainty of Unit Under Calibration



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



Certificate Number

CWO-010-68

## CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

## MEASUREMENT ITEM

Wind Direction Sensor

Manufacturer

Model/Type

Serial Number

ID Number

Condition as-received

Customer

Received Date

Measurement Date

Issue Date

Environmental Conditions

Place of Calibration

Calibration Condition

Preconditioning

Measurement Condition

Tabulation of Results

Calibration by

Checked by

Issued by

Remarks

Notes

References

Uncertainty of Measurement

Stability

Repeatability

Reproducibility

Reference Used During Calibration

Standard Temperature Probe

Model: STS-100 AS20, Serial No.: 567682-09

Model: DTI-1000-6 MK II, Serial No.: 673407-00002

Uncertainty of Measurement

Stability

Repeatability

Reproducibility

Reference Used During Calibration

Standard Temperature Probe

Model: STS-100 AS20, Serial No.: 567682-09

Model: DTI-1000-6 MK II, Serial No.: 673407-00002

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Uncertainty of Measurement

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Reproducibility

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Model: STS-100 AS20, Serial No.: 567682-09

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Uncertainty of Measurement

Stability

Repeatability

Reproducibility

Reference Used During Calibration

Standard Temperature Probe

Model: STS-100 AS20, Serial No.: 567682-09

Model: DTI-1000-6 MK II, Serial No.: 673407-00002

Uncertainty of Measurement

Stability



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: T2320591.  
Dimension: Diameter 12 mm, Length 80 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.074	19.6	-0.5	0.099
80	25.049	24.6	-0.4	0.099
80	30.035	29.7	-0.3	0.099
80	35.026	34.6	-0.4	0.099
80	40.014	39.5	-0.5	0.099

UUC\*: Unit Under Calibration

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



## CERTIFICATE OF CALIBRATION

Certificate No.: CRT-009-86

Page 1 of 3 Pages

MEASUREMENT ITEM: Relative Humidity with data logger  
MANUFACTURER: Naisyline  
MODEL/TYPE: Data Logger: 110-W5-250L-D  
SERIAL NUMBER: Sensor: T2320591  
ID NUMBER: RVL\_130144  
CONDITION AS RECEIVED: Used item  
CUSTOMER: AEC Laboratory Group (Thailand) Co., Ltd.  
204 Phatthanakan 40, Phatthanakan Road, Suwan Luang, Khoson Luang, Bangkok 10250 Thailand.

RECEIVED DATE: 15 May 2025  
MEASUREMENT DATE: 02 Apr 2025  
ISSUE DATE: 02 Apr 2025

### ENVIRONMENTAL CONDITIONS:

Ambient condition in (in-laboratory) air as follows:  
Temperature: 25.0 ± 0.5 °C  
Relative Humidity: 35.0 ± 15.0 %RH

NOTED: The certificate is valid only in 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-0-099 and WI-0-078 following an comparison method with Standard, Calibrated Air-hygrometer with Temperature sensor and standard Humidity generator chamber.

Traceability: The measurements were traceable to the International System of Units (SI) through National Institute of Metrology (Thailand) (NIMT). Certificate number: NIMT-13 and standard uncertainty: 0.05 and Certificate number: CDT-036-06.

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 as accordance with the Guide to the Expression of Uncertainty in Measurement.



Calibrated by:  
☐ Mr. Sorapong Thairat  
☒ Mr. Nopadon Lertsuangphol  
☐ Mr. Wangrumpal Phommit

Approved signature: Mr. Parinya Booncharoen  
Calibration Department Manager

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### 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)
29.69	33.09	44.0	10.9	0.6
29.73	33.04	51.5	18.4	1.1
29.74	32.54	61.0	28.5	2.3

UUC\*: Unit Under Calibration

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



## Certificate of Calibration

### Customer

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

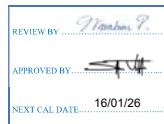
Certificate No.: 25-ACT-010  
Request No.: Req-2025-0091

### Unit Under Calibration Details

Measurement item: Acoustic Calibrator  
Manufacturer: RION  
Model: NC-74  
Serial Number: 34178121  
ID: RYG\_FS0213  
Class: 1  
Range: 94 dB / 1000 Hz  
Instrument Status: Used

### Calibration Environment and Details

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



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

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

### Note

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

Calibrated By: Mr. Nopadon Luangart  
Service Calibration Engineer

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

Certificate No : 25-ACT-010

Request No : Req-2025-0091

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

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

Certificate No : 25-ACT-010

Request No : Req-2025-0091

Decision Rule for Statements of Conformity

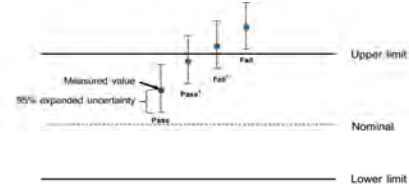
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8/99/2019; Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

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

Pass<sup>1</sup> = The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.

Fail<sup>1</sup> = 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

458-459/1 Sirinthorn Road, Bangbunru, Bangplad, Bangkok, 10700 Thailand  
Tel. +66 2433 8331 Email : calibration@sithiporn.com



Cert. No. : ACL24422

Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42A / Microphone UC-52 / Preamplifier NH-24  
Serial No.: 00623391 / 198638 / 26419  
ID No.: RYG\_FS0616

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 :   
( 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

458-459/1 Sirinthorn Road, Bangbunru, Bangplad, Bangkok, 10700 Thailand  
Tel. +66 2433 8331 Email : calibration@sithiporn.com



Cert. No. : ACL24422

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).



Cert. No. : ACL24422  
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*

Cert. No. : ACL24422  
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	0.0	-0.1	±1.5
250	0.0	0.0	-0.1	±1.5
500	0.0	0.0	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

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

**5.1 Frequency weightings at 1 kHz**

Frequency Weighting	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. : ACL24422  
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)
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	21.3
Flat	26.9

**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	0.6	0.6	0.6	±1.5
1000	0.2	0.2	0.2	±1.0
8000	-0.7	-0.6	-0.6	±5.0

*T. Petch*

Cert. No. : ACL24422  
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	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	24.9	0.1	±1.1

*T. Petch*

# SITHIPORN ASSOCIATES CO., LTD. CALIBRATION LABORATORY

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



Cert. No. : ACL24422  
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	29.4	0.4	±1.1

## 9. Tone burst response

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

*T. Petchur*

# SITHIPORN ASSOCIATES CO., LTD. CALIBRATION LABORATORY

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



Cert. No. : ACL24422  
Job No. : VC68AC0051  
Pages : 8 of 8

## 10. Peak C sound level

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

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

## 11. Overload indication

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

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



Cert. No. : ACL25077  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42A/ Microphone UC-52 / Preamplifier NH-24  
Serial No.: 00623392 / 198639 / 26420  
ID No.: RYG\_FS0617

Condition As Found : GOOD

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

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

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

Calibrated by : Nathakorn Pisutpaisan

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

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

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

# SITHIPORN associates

# SITHIPORN ASSOCIATES CALIBRATION LABORATORY

Cert. No. : ACL25077  
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-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 :

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

*T. Petchur*



Cert. No. : ACL25077  
Job No. : VC68AC0059  
Pages : 3 of 8

## Summary of Measurement Result :

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

T. Petch

Cert. No. : ACL25077  
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	-0.1	-0.1	-0.1	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	-0.1	±1.5
500	0.0	0.0	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.0	0.0	±5.0

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

Frequency Weighting	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	93.9	-0.1	± 0.1
Leq	94.0	94.0	0.0	± 0.1

## 6. Long-term stability

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

T. Petch

Cert. No. : ACL25077  
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	12.6
C - weight	18.7
Flat	24.4

## 3. Acoustical signal tests of frequency weightings

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

Frequency ( Hz )	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	1.2	1.2	1.2	±5.0

T. Petch

Cert. No. : ACL25077  
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	135.1	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	109.0	0.0	± 1.1
104.0	104.1	0.1	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	27.0	0.0	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	25.0	0.0	± 1.1

T. Petch

Cert. No. : ACL25077  
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	116.9	-0.1	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.8	-0.2	1.5 ; -5.0
	2	8	108.0	107.9	-0.1	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

Cert. No. : ACL25077  
Job No. : VC68AC0059  
Pages : 8 of 8

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value ( dB )	Measured Value, Lepeak ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Continuous	130.0	130.0	0.0	±3.0
One	133.4	133.4	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
89.5	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

SITHIPORN ASSOCIATES CO., LTD.  
CALIBRATION LABORATORY451-451/1 Sirinthorn Road, Bangbunmu, Bangkok, 10700 Thailand  
Tel. +66 2433 8331 Email: calibration@sithiporn.comSITHIPORN  
associatesCert. No. : ACL24421  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42A / Microphone UC-52 / Preamplifier NH-24  
Serial No.: 00623390 / 198637 / 26418  
ID No.: RYG\_FS0615

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 :   
( 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 LABORATORY451-451/1 Sirinthorn Road, Bangbunmu, Bangkok, 10700 Thailand  
Tel. +66 2433 8331 Email: calibration@sithiporn.comSITHIPORN  
associatesCert. No. : ACL24421  
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 test results of each items were made by observation of each Instruments display and also with SLM's display.

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-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-42KAJ	34560495	AA-3001-24	05-FEB-25

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

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

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

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Cert. No. : ACL24421  
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

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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	0.1	±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	0.1	0.1	±5.0

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

**5.1 Frequency weightings at 1 kHz**

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

**5.2 Time weighting at 1 kHz**

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

**6. Long-term stability**

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

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Cert. No. : ACL24421  
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 (dB)	Weighting (dB)
A-weight	13.1
C-weight	19.5
Flat	24.8

**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	0.5	0.5	0.5	± 1.5
1000	0.2	0.2	0.2	± 1.0
8000	0.0	0.0	0.0	± 5.0

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Cert. No. : ACL24421  
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	132.9	-0.1	± 1.1
132.0	131.9	-0.1	± 1.1
131.0	130.9	-0.1	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	27.0	0.0	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.9	-0.1	± 1.1

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Cert. No. : ACL24421  
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
	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
SEL	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

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Cert. No. : ACL24421  
Job No. : VC68AC0051  
Pages : 8 of 8

**10. Peak C sound level**

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lepeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	130.0	130.0	0.0	±3.0
One	133.4	133.4	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	89.6	0.0	±1.5

**12. High level stability**

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

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

End of Calibration Certificate

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Cert. No. : ACL24420  
Pages : 1 of 8

**Calibration Certificate**

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

**Condition As Found :** GOOD

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

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

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

REVIEW BY *S.T.S.*

APPROVED BY *[Signature]*

NEXT CAL DATE: 23/12/25

Calibrated by : Nathakorn Pisutpaisan

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

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

**Calibration Procedure :** CP-AC-01

**Calibration Method :**

This equipment was calibrated by follow on IEC-61672-3 (2013) Standard for sound level meter (SLM). The SLM had tests 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-42KAJ	34560495	AA-3001-24	05-FEB-25

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

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

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



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

**Summary of Measurement Result :**

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

*T. Petch*

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Job No. : VC68AC0051  
Pages : 5 of 8

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

Weighting network response with relative to 1 kHz.

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

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

**5.1 Frequency weightings at 1 kHz**

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

**5.2 Time weighting at 1 kHz**

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

**6. Long-term stability**

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

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

**Result of calibration :**

**1. Absolute sensitivity**

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

**2. Self-generated noise**

**2.1 Normal test**

Measured Value (dB)
13.8

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

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

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

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

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

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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	29.0	0.0	±1.1
28.0	28.0	0.0	±1.1
27.0	27.0	0.0	±1.1
26.0	25.9	-0.1	±1.1
25.0	25.0	0.0	±1.1

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Cert. No. : ACL24420  
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	28.8	-0.2	±1.1

**9. Tone burst response**

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

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Job No. : VC68AC0051  
Pages : 8 of 8

**10. Peak C sound level**

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

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.1	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	0.1	±1.5
89.6	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

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

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



Cert. No. : ACL24419  
Pages : 1 of 8

**Calibration Certificate**

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NI-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,  
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.

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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-42KA1	34560495	AA-3001-24	05-FEB-25

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

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

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

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Cert. No. : 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*

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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	12.6
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

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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	S.L.M Display at initial (dB)	S.L.M Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	94.0	0.0	±0.3

*T. Petch*

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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*

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

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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 <sub>peak</sub> (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	130.0	130.0	0.0	±3.0
One	133.4	133.3	-0.1	±3.0

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

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



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,  
KHUWAFENG 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 *[Signature]*  
NEXT CAL DATE: 20/01/2026

Calibrated by : Nathakorn Pisutpaisan

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

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**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	MY60034273	EEL_BP 22/0267	15-FEB-25
Programmable Attenuator	MAT-1070	62100114	EF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KAJ	34560495	AA-3001-24	05-FEB-25

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

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

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

*T. Petch*

Cert. No. : 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

*Reth*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

*Reth*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

*Reth*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

*Reth*



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 <sub>peak</sub> (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	130.0	130.0	0.0	±3.0
One	133.4	133.4	0.0	±3.0

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

## 11. Overload indication

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

SITHIPORN ASSOCIATES CO., LTD.  
CALIBRATION LABORATORY451-451/ Sirinthorn Road, Bangjaumnu, Bangkok, 10700 Thailand  
Tel. +66 2433 8331 Email: calibration@sithiporn.comSITHIPORN  
associatesCert. No. : ACL25315  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24  
Serial No. : 00734218 / 146937 / 34368  
ID No. : RYG\_FS0031

Condition As Found : GOOD

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

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

Received Date : 04 AUGUST 2025  
Calibration Date : 18-19 AUGUST 2025  
Date of Issue : 20 AUGUST 2025

Calibrated by : Nathakorn Pisutpaisan

Approved by : *Wichok E.*  
( Wichok Ekpongpradit )

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. : ACL25315  
Job No. : VC68AC0162  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

## Calibration Method :

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

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0011-25	11-FEB-26
Waveform Generator	33511B	MY52302742	EF-0012-25	11-FEB-26
Digital Multimeter	33461A	MY53220104	EEL_BP 24/0268	22-APR-26
Digital Multimeter	33461A	MY53220076	EEL_BP 23/0268	22-APR-26
Digital Multimeter	34461A	MY60024273	CA2025120EA	18-MAR-26
Programmable Attenuator	MAT-1070	62100114	EF-0006-25	11-FEB-26
Condenser Microphone	4180	2977900	AA-1002-25	19-FEB-26
Measuring Amplifier	NA-42KAI	34560495	AA-3002-25	19-FEB-26

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

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

3.1 National Institute of Metrology (Thailand).

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

3.3 Electrical And Electronics Institute (EEI).

Cert. No. : ACL25315  
Job No. : VC68AC0162  
Pages : 3 of 8

**Summary of Measurement Result :**

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

Cert. No. : ACL25315  
Job No. : VC68AC0162  
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 )
21.6

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

Frequency Weighting	Weighting ( dB )
A - weight	12.0
C - weight	18.0
Flat	23.7

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

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

Frequency ( Hz )	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.8	0.8	0.8	± 1.5
1000	0.1	0.1	0.1	± 1.0
8000	-1.1	-1.1	-1.1	±5.0

Cert. No. : ACL25315  
Job No. : VC68AC0162  
Pages : 5 of 8

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

Weighting network response with relative to 1 kHz.

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

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

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

**5.2 Time weighting at 1 kHz**

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

**6. Long - term stability**

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

Cert. No. : ACL25315  
Job No. : VC68AC0162  
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

Cert. No. : ACL25315  
Job No. : VC68AC0162  
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	1.0 ; -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. : ACL25315  
Job No. : VC68AC0162  
Pages : 8 of 8

## 10. Peak C sound level

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

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.6	133.1	-0.5	±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

SITHIPORN ASSOCIATES CO., LTD.  
CALIBRATION LABORATORY451/451/1 Sirinthorn Road, Bangbunmu, Bangkok, 10700 Thailand  
Tel. +66 2433 8331 Email : calibration@sithiporn.comSITHIPORN  
associatesCert. No. : ACL25100  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24  
Serial No.: 00472126 / 158778 / 88180  
ID No.: RYG\_FS0301

Condition As Found : GOOD

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

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

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

Calibrated by : Nathakorn Pisutpaisan

Approved by :   
( Thanakul Petchurai )

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

Cert. No. : ACL25100  
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).



Cert. No. : ACL25100  
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. : ACL25100  
Job No. : VC68AC0064  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	-0.1	0.0	0.0	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	-0.1	±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. : ACL25100  
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)
13.6

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	16.4
Flat	22.2

## 3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			Acceptance Limits
	Flat	C-weight	A-weight	
125	0.7	0.8	0.9	± 1.5
1000	0.1	0.1	0.1	± 1.0
8000	-3.2	-3.2	-3.8	±5.0

T. Petch.

Cert. No. : ACL25100  
Job No. : VC68AC0064  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.1	0.1	± 1.1
134.0	134.1	0.1	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.1	0.1	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.1	0.1	± 1.1
114.0	114.1	0.1	± 1.1
109.0	109.1	0.1	± 1.1
104.0	104.1	0.1	± 1.1
99.0	99.1	0.1	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.0	0.0	± 1.1
26.0	26.0	0.0	± 1.1
25.0	25.0	0.0	± 1.1

T. Petch.

Cert. No. : ACL25100  
Job No. : VC68AC0064  
Pages : 7 of 8

## 8. Level linearity including the level range control

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

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

## 9. Tone burst response

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

P. Petch.

Cert. No. : ACL25100  
Job No. : VC68AC0064  
Pages : 8 of 8

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L <sub>peak</sub> (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	130.0	130.0	0.0	±3.0
One	133.4	133.4	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
89.5	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

P. Petch.



## Certificate of Calibration

Equipment: SPECTROPHOTOMETER  
Model: DR6000  
Serial No. (or ID.): 1627845 (RYC\_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 to the units of measurement, according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.

The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor ( $k=2$ ) i.e. provides 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.

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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	
740.40	740.0	-0.32	0.13	
807.03	807.5	-0.47	0.13	

Photometric Accuracy (Absorbance)				
Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
420 nm	0.0000	0.000	0.0000	0.0045
	0.2930	0.291	0.0020	0.0045
	0.5168	0.518	-0.0012	0.0045
	1.0298	1.031	-0.0012	0.0045
440 nm	0.0000	0.000	0.0000	0.0045
	0.2867	0.285	0.0017	0.0045
	0.5073	0.508	-0.0007	0.0045
	1.0003	1.009	-0.0007	0.0045
465 nm	0.0000	0.000	0.0000	0.0045
	0.2516	0.250	0.0016	0.0045
	0.4595	0.461	-0.0015	0.0045
	0.9334	0.935	-0.0016	0.0045
546.1 nm	0.0000	0.000	0.0000	0.0045
	0.2461	0.246	0.0001	0.0045
	0.4652	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
	0.5049	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  
Phone: +66 2059 7000 Email: info@dksh.com Website: www.dksh.com/scientific

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CAL-FM-C06-16: 11 Mar 2024

Calibration Results:  
Without Adjustment

Photometric Accuracy (Absorbance)				
Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
235 nm	0.0000	0.000	0.0000	0.0080
	0.7355	0.738	-0.0025	0.0080
257 nm	0.0000	0.000	0.0000	0.0080
	0.8574	0.857	0.0004	0.0080
313 nm	0.0000	0.000	0.0000	0.0080
	0.2864	0.290	-0.0036	0.0080
350 nm	0.0000	0.000	0.0000	0.0080
	0.6374	0.637	0.0004	0.0080
Stray light *				
Standard: cut-off	UUC: Wavelength (nm)	UUC: Transmission (%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 )	268.65	266.69	1.38	2.00
UUC: Wavelength (nm)	268.2	266.2		
Std Absorbance ( A )	0.4556	0.2780		
UUC: Absorbance (A)	0.413	0.299		

\* Calibration Marked \* Not TISI Accredited \* in this Certificate have been included for completeness.

The End of Certificate

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CAL-FM-C06-10: 11 Mar 2024

## ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: WO-00064379

ชนิดเครื่องมือ: SPECTROPHOTOMETER รุ่น: DR6000

หมายเลขเครื่อง: 1627845

ตรวจสอบ (วัน)		ตรวจสอบ (ชื่อ)	
18 Mar 2025		18 Mar 2025	
ปกติ	ไม่ปกติ	ปกติ	ไม่ปกติ
General			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. ความสมบูรณ์เครื่อง	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. ความสะอาด (ช่องใส่ตัวอย่าง, ภายในแยกเครื่อง)	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. สวิตช์ ยืด - ปิด เครื่อง (On-Off Switch)	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. ปุ่มกด (Keypad)	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. หน้าจอ (Display, Screen Contrast)	<input checked="" type="checkbox"/>
Spectrophotometer			
<input type="checkbox"/>	<input type="checkbox"/>	6. แรงดันไฟฟ้า (Battery Backup) >= 2.5 VDC	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	7. ตัวควบคุมความยาวคลื่น (Wavelength Control)	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. ความยาวคลื่น (Wavelength Check)	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	9. แสงยูวี (UV < 3,000 hour)	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	10. แสงอินฟราเรด (Visible < 6,000 hour)	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	11. ช่องวัดหลายตัวอย่าง (Carousel Module)	<input checked="" type="checkbox"/>
pH Meter and Conductivity Meter			
<input type="checkbox"/>	<input type="checkbox"/>	12. อิเล็กโทรด (Electrode and Connection Cable)	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	13. ระดับสารละลายใน Electrode (Level KCl)	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	14. ฝาปิดป้องกัน Electrode (Dust Protection Hood)	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	15. ขาจับอิเล็กโทรด (Stand)	<input type="checkbox"/>
Turbidimeter			
<input type="checkbox"/>	<input type="checkbox"/>	16. ค่าความขุ่นที่ต่ำสุด (No Sample)	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	17. ระดับการล้างตัวของแสง (>= 2.5 ไม่นาน 3.0)	<input type="checkbox"/>
Automatic titrator			
<input type="checkbox"/>	<input type="checkbox"/>	18. สภาวะ Piston Burette	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	19. Function Rinsing and Dosing	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	20. ระบบจ่ายยาและอุปกรณ์ประกอบ	<input type="checkbox"/>

เพิ่มเติม: \* 656.1nm = 656.1nm

\* 488.0nm = 485.7nm

Mr. Preecha Phooarsai  
Service Engineer

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Phone: +66 2022 7000 Email: info@dksh.com Website: www.dksh.com/thailand

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CAL-FM-R31-03: 20 Jul 2022



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TEL. 0-2717-3000-29 FAX 0-2719-9484



## Certificate of Calibration

Cert.No.: 25CH847  
Page: 1 of 3

Equipment : pH Meter  
Manufacturer : Mettler Toledo  
Model : SevenCompact S220  
Serial No. : C104059460  
ID No. : RYG\_EN0183  
Condition As-Received: Used Item  
Received Date : 17 July 2025  
Calibration Date : 18 July 2025  
Reference : 2507-0561 DSC-3  
Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.  
Rayong Branch  
616/10 Moo 5, T. Maenam Khu,  
A. Pluakdaeng, Rayong 21140, Thailand

Ambient Temperature : (25 ± 2.5) °C  
Relative Humidity : (50 ± 15) %  
Calibration Procedure : In-house method :  
- CP-CH5 by direct measurement with DC voltage standard and direct measurement with certified reference material (CRM)  
- CP-CH8 by comparison with temperature standard

Calibrated by : Walalak Sinthean

Approved by : Approved Signatory

( ) Chakrit Waewwanjua  
( ) Ponpan Paipim  
(✓) Sathip Meangmai

Issue Date : 21 July 2025

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

Cert.No.: 25CH847  
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	24E2759	25 Aug 2025
2) Ref. Standard Thermometer	3240076	60RC033	251394	01 Apr 2026

- This measurement result is traceable to SI through Technology Promotion Association (Thailand - Japan)

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

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.007	CPA chem	1066665	18 Jan 2027
pH 6.965	CPA chem	1066667	18 Jan 2026
pH 10.010	CPA chem	1114385	08 June 2026

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 (±mV)	Coverage factor k
			pH	mV		
pH Meter	4.000	177.48	177.3	4.000	0.058	2.00
S/N: C104059460	7.000	0.00	-0.2	7.000	0.058	2.00
	10.000	-177.48	-177.6	10.000	0.058	2.00





Cert.No.: 25CH847  
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 <i>k</i>
pH Electrode S/N.: 5240606	4.007	4.008	184.6	0.0044	2.00
	6.965	6.966	10.2	0.0084	2.00
	10.010	10.009	-164.9	0.0065	2.00

#### Function : Temperature Measurement

(\*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : InLabExpert Pro-ISM

- Serial No. : 5240606

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 <i>k</i>
25.0	25.001	25.0	-0.001	0.13	2.00

Remark : - UUC\* = Unit Under Calibration

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

-o0o-



Cert. No.: 25E2372  
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	49.9	-0.1	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.

-o0o-



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## Certificate of Calibration

Certificate No. : 25E2372  
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: 17 July 2025

Calibration Date: 22 July 2025

Reference: 2507-0561DSC

Ambient Temperature: ( 23 ± 2 ) °C

Relative Humidity: ( 50 ± 10 ) %

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

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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 : Napachanok Prasomsosiri  
Issue Date : 23 July 2025

Approved Signatory :  
[ ] Phalinee Pratsapaipal  
[ ] Nuntawat Khamchai  
[x] Pongsagom Boonyaporn



Metrology  
SCI ECO Services Company Limited  
33/2 Moo 3, T.Banpa, A.Kaengkhloi, Saraburi 18110, Thailand.  
Saraburi Tel : +66 3627 3096 Fax : +66 3627 3100  
Bangkok Tel : +668 9205 6851, +669 8247 2360  
Website : www.scieco.co.th E-Mail : calibrate@scg.com



Certificate No. T241120

Page 1 of 4

## Certificate of Calibration

Equipment : Chamber ( Cold Room )

Manufacturer : MODULAR

Model : IREVOHCOO

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 Pissasutthikul (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.

## Calibration Report

Equipment : Chamber ( Cold Room )  
Date of Calibration : 11 June 2024  
Environment : Temperature : 23.1-24.1 °C  
Line Voltage : 222.3-226.3 V  
Relative Humidity : 55 - 65 %RH

### Condition of this results of calibration :

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

### 2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	TYPE T	TN161-TN170	T240713	19 April 2025
TC	TYPE T	TN171-TN180	T240713	19 April 2025
DATA LOGGER	34970A	T149	T240713	19 April 2025

### 3. This certificate is traceable to :

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

### 4. Condition of calibrated item : good

#### Equipment Description :

Time Constant 3 Hour 30 Minute At 3 °C  
Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max  
☐ Close  
☒ Not Available

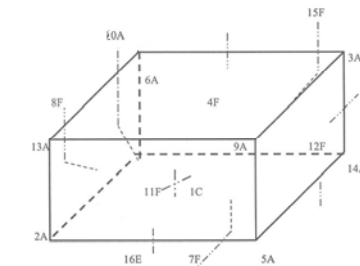
### 5. Adjustment :

( ) without adjustment ( X ) after adjustment

Approved By:

FM-L15 I18/18-08-66

## Calibration Report



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

1C	=	TN161
2A	=	TN162
3A	=	TN163
4F	=	TN164
5A	=	TN165
6A	=	TN166
7F	=	TN167
8F	=	TN168
9A	=	TN169
10A	=	TN170

11F	=	TN171
12F	=	TN172
13A	=	TN173
14A	=	TN174
15F	=	TN175
16E	=	TN176

Approved By:

FM-L15 I18/18-08-66

## Calibration Report

### Measurement Results:

Calibration Point	Average Standard Reading at each position (°C)									
	TN161	TN162	TN163	TN164	TN165	TN166	TN167	TN168	TN169	TN170
3	2.73	2.70	2.77	2.78	2.99	2.35	3.09	3.21	3.08	2.90
	TN171	TN172	TN173	TN174	TN175	TN176				
	3.39	3.01	2.92	2.81	3.42	3.42				

Chamber ( Cold Room )			Temperature Distribution				
Setting (°C)	Reading (°C)		Average (°C)	Stability (±°C)	Uniformity (°C)	Uncertainty (±°C)	Coverage Factor k
	Min , Max	Average					
3.0	2.9 , 4.4	3.7	2.97	1.32	1.13	2.02	2.00

\* The quoted uncertainty exclude " uniformity "

The calibration result apply only the above calibrated item.

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

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

Approved By:

FM-L15 I18/18-08-66

## 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 Lemragtrakul

Approved by :

( ) Chakrit Waewwanjua  
(✓) Suwit Imjai  
( ) Kunchit Promprat

Issue Date : 23 January 2025

The Uncertainties are for a confidence probability of approximately 95%

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REVIEW BY:

APPROVED BY:

NEXT CAL DATE: 20/07/26





Equipment : DO Meter with Sensor  
Condition As-Received : Used Item  
Reference : 2501-0600DSC-2  
Procedure Used :-

Cert. No.: 25LM10  
Page.: 2 of 2

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

#### Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Digital Thermometer	2188080	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 ( °C )	Immersion Depth ( mm )	Standard Temperature ( °C )	UUC* Reading ( °C )	Error ( °C )	Uncertainty ( ± °C )	Coverage Factor %
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 %.

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## 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.Pluakdaeng,  
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 :

Approved Signatory

( ) Ponthippa Tameyakul  
( ) Ponpan Paipim  
(✓) Salthip Meangmal

Issue Date : 21 January 2025



Cert.No.: 25TW15  
Page.: 2 of 2

#### Condition of this result of calibration

1. Reference Standard Instruments :

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

Instruments	Serial No.	ID No.	Certificate No.	Due Date
1. Burette	-	130BU10	23CG1172	22 Mar 2025
2. Balance	14233821	110RC001	24MM131	04 July 2025

2. Standard Material :-

Material	Manufacturer	Lot.No.	Assay
Sodium Thiosulfate 5-Hydrate AR	KEMAUS	2203162447	99.6%

Result : Dissolved Oxygen Meter Adjustment With Air 100 %  
Dissolved Oxygen Probe No.: 15E100464

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.20	8.20	0.0084

This report was certified only for the instrument we tested. It is allowable to use for study  
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other in full, without written approval of the laboratory

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## 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 :

Approved Signatory

( ) Ponpan Paipim  
( ) Suwit Imjai  
(✓) Kunchit Promprat

Issue Date : 07 November 2024

The Uncertainties are for a confidence probability of approximately 95%

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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	MY44073361	24LM73	TPA	18 May 2025

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

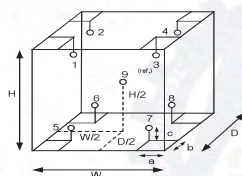
3. This certification is traceable to the International System of Unit.

**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 m<sup>3</sup>

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	24	25
REL.Humid. ( % )	55	53
AC Supply ( Volt )	220	221

Position :	Ref. Std. ID No.:
1	1RTD-2/1
2	1RTD-2/2
3	22-01RTD-03
4	1RTD-2/4
5	1RTD-2/5
6	1RTD-2/6
7	23-01RTD-07
8	1RTD-2/8
9 (ref.)	23-01RTD-09



Equipment : Low Temp. Incubator  
Condition As-Received : Used Item  
Reference : 2411-0002OC-1  
**Result of Calibration :-** ( \* ) Without Adjustment  
**Function of UUC\* :** Temperature Source  
**Fresh air setting :** Close

Cert. No.: 24TM1663  
Page : 3 of 3

Calibration Point ( °C )	UUC* Setting ( °C )	UUC* Reading ( °C )	Temperature stability ( ± °C )	Temperature uniformity ( °C )	Overall Variation ( °C )	Coverage Factor k
20.0	20.0	20.0	0.026	0.26	0.53	2

Calibration Point ( °C )	Measured Temperature ( °C )									Uncertainty ( ± °C )
	1	2	3	4	5	6	7	8	9 (ref.)	
20.0	20.071	19.915	20.273	20.179	19.977	19.782	20.056	20.026	20.033	0.30

**Average\* :** The average of 30 values in each position.

**Temperature stability :** One-half of the greatest maximum difference of measured temperature at any one sensor.

**Temperature uniformity :** The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

**Overall Variation :** The Difference of the maximum and minimum measured temperatures throughout observation.

**UUC\* :** Unit Under Calibration

**Note :** The reported uncertainty of measurement was included stability and excluded uniformity .

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

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TEL.0-2717-3000-29 FAX.0-2719-9484



**Certificate of Calibration**

Cert.No.: 25CH393  
Page: 1 of 3

Equipment : pH Meter  
Manufacturer : Mettler Toledo  
Model : SevenGoTM pH/mV S2  
Serial No. : C202355606  
ID No. : RYG\_FS0574  
Condition As-Received: Used Item  
Received Date : 31 March 2025  
Calibration Date : 01 April 2025  
Reference : 2503-0981DSC-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 Sirinthean  
Approved by :   
( ) Chakrit Waewwanjua  
( ) Ponpan Paipim  
(✓) Saithip Meangmai  
Issue Date : 2 April 2025

REVIEW BY   
APPROVED BY   
NEXT CAL DATE: 01/04/26



Cert.No.: 25CH393  
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	24E2759	25 Aug 2025
2) Ref. Standard Thermometer	4982054	110RC044	24I757	14 July 2025

- This Certification is traceable to SI Through Technology Promotion Association (Thailand - Japan)

2. Certified Reference Materials

:The measurement results are traceable to SI through Hach Lenge GmbH Ltd.,  
Deutsche Akkreditierungsstelle, Accredited No.D-RM-15184-01-00  
:The measurement results are traceable to SI through CPA chem Ltd.,  
ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.007	CPA chem	1066665	18 Jan 2027
pH 6.999	Hach Lenge GmbH	C03220	29 Oct 2026
pH 10.010	CPA chem	1066669	18 Jan 2026

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 ( ±mV )	Coverage factor k
			mV	pH		
pH Meter	4.00	177.48	177	4.00	0.58	2.00
S/N.: C202355606	7.00	0.00	0	7.00	0.58	2.00
	10.00	-177.48	-178	10.00	0.58	2.00

The Uncertainties are for a confidence probability of approximately 95%

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Cert.No.: 25CH393  
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 ( $\pm$ )	Coverage factor $k$
pH Electrode S/N.: 2015870	4.007	4.01	175	0.0085	2.05
	6.999	7.01	1	0.0095	2.00
	10.010	10.02	-164	0.0096	2.00

Function : Temperature Measurement

(\*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : InlabExpert Go-ISM

- Serial No. : 2015870

Dimension of probe

- Length : 120 mm.

- Diameter : 12 mm.

- Immersion Depth : 100 mm.

Calibration Point ( $^{\circ}\text{C}$ )	Standard Temperature ( $^{\circ}\text{C}$ )	UUC* Reading ( $^{\circ}\text{C}$ )	Error ( $^{\circ}\text{C}$ )	Uncertainty of measurement ( $\pm$ $^{\circ}\text{C}$ )	Coverage factor $k$
25.0	25.002	25.0	-0.002	0.13	2.00
45.0	45.000	45.1	0.100	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 %.

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SARTORIUS



Accredited by

NSC-TISI-TIS 17025

Calibration 0426

#### Calibration certificate

Calibration Certificate No. 25BK0002

Object	Electronic non-automatic weighing instrument	This calibration certificate documents the traceability to national standards. Uncertainties of measurements are taken into account when only statements of compliance are made. This certificate was prepared by Sartorius Corporation in accordance to the current ISO/IEC 17025:2017 standard and Sartorius Work Instruction (Method) SOP WI08. This certificate relate and apply this equipment only.
Manufacturer	Sartorius	
Type	MCE224S-2S00-U	
Serial   QM Ident. no.	38101399   RYG_EN0163	
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. Lalee*  
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

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10310 Bangkok

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Page 1 | 4

Calibration certificate No.: 25BK0002

Calibration Certificate

#### Calibration object

##### Single range instrument

Model	MCE224S-2S00-U
Serial Number	38101399
QM Ident. no   Inventory no.	RYG_EN0163   --
Maximum capacity (Max. load)	220,000 g
Measured range	220,000 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-362SD 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

Calibration certificate No.: 25BK0002

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.	24,4 $^{\circ}\text{C}$   0,6 K
Weights - $T_{\text{place}}$	
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   200 g		Test load (nominal): 100 g	
10 g	200 g	Center	100,0000 g
1	10,0000 g	Front left	100,0000 g
2	10,0000 g	Back left	100,0000 g
3	10,0000 g	Back right	100,0000 g
4	9,9999 g	Front right	99,9999 g
5	9,9999 g	Maximum deviation from centric loading indication	
6	10,0000 g	$ \Delta_{\text{ecc}} _{\text{max}} = 0,0001 \text{ g}$	
7	10,0000 g		
8	10,0000 g		
9	9,9999 g		
10	10,0000 g		
$s = 0,00005 \text{ g}$ $s = 0,00005 \text{ g}$			

Testload $L$	Indication $I$	Error $E$	Expansion factor $k$	Uncertainty $U(E)$	Uncertainty relative $U_{\text{rel}}(E)$
0,0100 g	0,0100 g	0,0000 g	2,00	0,00013 g	1,3 %
0,1000 g	0,1000 g	0,0000 g	2,00	0,00013 g	0,13 %
0,5000 g	0,5000 g	0,0000 g	2,00	0,00013 g	0,026 %
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	9,9999 g	-0,0001 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	50,0001 g	0,0001 g	2,00	0,00015 g	0,00029 %
100,0000 g	100,0000 g	0,0000 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 %
Maximum error of indication		$ E _{\text{max}} = 0,0001 \text{ g}$			

$U_{\text{rel}}(E)$  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, V4.2. There is a 95 % probability that the value of the measurand will be in the assigned value range.

End of calibration certificate

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Page 3 | 4

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Page 2 | 4



## Uncertainty of measurement in use

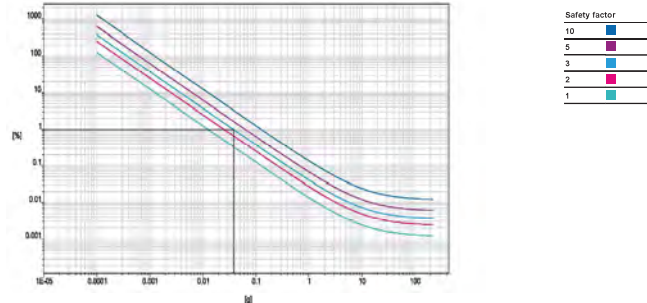
Device adjusted before measurement Yes  
 Temperature deviation considered 1,5 K (isoCAL active)  
 Temperature coefficient considered  $1 \cdot 10^{-4}/K$

Uncertainty of the weighing result  $U_{g(W)}$   $U_{g(W)} = 0.00013 \text{ g} + 1.16 \cdot 10^{-4} \cdot R$

Reference note: The current uncertainty of measurement is calculated by entering the reading  $R$  into this formula. In relation to this, there is no need for a correction of the indication error. The reported expanded uncertainty of measurement is stated as the standard uncertainty 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	0,00016 g	0,0071 %
25 %	55,0000 g	0,00077 g	0,0014 %
50 %	110,0000 g	0,0014 g	0,0013 %
75 %	165,0000 g	0,0020 g	0,0012 %
100 %	220,0000 g	0,0027 g	0,0012 %

Graphic realization of the relative uncertainty of measurement | process accuracy



Displayed example

Process accuracy 1,00 %  
 Safety factor 3  
 Minimum sample weight 0,0381 g

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Page 4 | 4



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## 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 :  $(26 \pm 10) ^\circ C$   
 Relative Humidity :  $(50 \pm 30) \%$   
 Calibrated by : Man Pattanapongpaiboon  
 Approved by :   
 Approved Signatory  
 ( ) Ponthippa Tameyakul  
 ( ) Unnopphol Harachai  
 (x) Suwit Imjai  
 Issue Date : 22 March 2024

The Uncertainties are for a confidence probability of approximately 95%

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 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

- Reference standard instrument-  

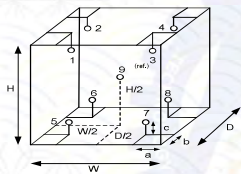
Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY57013711	23LM115	TPA	11 Jul 2024
- This certificate is valid only to the item calibrated on date and place of calibration.
- This certification is traceable to the International System of Unit.

Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- ( ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Close



Probe Installation Details : 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

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



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 %.

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