

# ภาคผนวก จ

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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_FS0186	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	High Volume	RYG_FS0400	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	High Volume	RYG_FS0399	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	High Volume	BKK_FS0378	-	-	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	BKK_FS1059	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	BKK_FS1057	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	BKK_FS0365	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	RYG_FS0661	-	-	On site Calibration
Ambient	Total Suspended Particulate	Digital Balance	RYG_EN0001	20-Feb-25	20-Feb-26	12
Ambient	Nitrogen Dioxide	NO <sub>2</sub> Analyzer	RYG_FS0459	3-Jul-25	3-Jan-26	6
Ambient	Nitrogen Dioxide	NO <sub>2</sub> Analyzer	RYG_FS0533	3-Jul-25	3-Jan-26	6
Ambient	Nitrogen Dioxide	NO <sub>2</sub> Analyzer	RYG_FS0261	1-Jul-25	1-Jan-26	6
Ambient	Nitrogen Dioxide	NO <sub>2</sub> Analyzer	RYG_FS0272	2-Jul-25	2-Jan-26	6
Ambient	Sulfur Dioxide	SO <sub>2</sub> Analyzer	RYG_FS0458	2-Jul-25	2-Jan-26	6
Ambient	Sulfur Dioxide	SO <sub>2</sub> Analyzer	RYG_FS0730	3-Jul-25	3-Jan-26	6
Ambient	Sulfur Dioxide	SO <sub>2</sub> Analyzer	RYG_FS0260	2-Jul-25	2-Jan-26	6
Ambient	Sulfur Dioxide	SO <sub>2</sub> Analyzer	RYG_FS0271	1-Jul-25	1-Jan-26	6
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	RYG_FS0544	2-Apr-25	1-Oct-26	18
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	RYG_FS0545	2-Apr-25	1-Oct-26	18
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	RYG_FS0608	18-Jul-24	18-Jan-26	18
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	RYG_FS0609	18-Jul-24	18-Jan-26	18
Ambient	1,3-Butadiene	GC-MSD	RYG_EN0136	4-Jul-25	3-Jan-27	18
Ambient	Styrene	GC-MSD	RYG_EN0136	4-Jul-25	3-Jan-27	18
Ambient	Cyclohexane	GC-MSD	RYG_EN0136	4-Jul-25	3-Jan-27	18
Ambient	Toluene	GC-MSD	RYG_EN0136	4-Jul-25	3-Jan-27	18
Stack	Total Suspended Particulate	Console Control Unit	BKK_FS0527	10-Jul-25	10-Jan-26	6
Stack	Total Suspended Particulate	Pitot Tube	BKK_FS0552	22-Oct-25	23-Apr-26	6
Stack	Total Suspended Particulate	Fuel Gas Analyzer	RYG_FS0563	22-Jan-25	22-Jan-26	12
Stack	Total Suspended Particulate	Digital Balance	RYG_EN0003	20-Feb-25	20-Feb-26	12
Stack	Oxides of Nitrogen	Console Control Unit	BKK_FS0527	10-Jul-25	10-Jan-26	6
Stack	Oxides of Nitrogen	Pitot Tube	BKK_FS0552	22-Oct-25	23-Apr-26	6
Stack	Oxides of Nitrogen	Fuel Gas Analyzer	RYG_FS0563	22-Jan-25	22-Jan-26	12
Stack	Oxides of Nitrogen	Vacuum Gauge	BKK_FS0483	20-Aug-24	20-Feb-26	18
Stack	Oxides of Nitrogen	SPECTROPHOTOMETER	RYG_EN0179	18-Mar-25	18-Sep-26	18
Stack	Sulfur Dioxide	Console Control Unit	BKK_FS0527	10-Jul-25	10-Jan-26	6
Stack	Sulfur Dioxide	Pitot Tube	BKK_FS0552	22-Oct-25	23-Apr-26	6
Stack	Sulfur Dioxide	Fuel Gas Analyzer	RYG_FS0563	22-Jan-25	22-Jan-26	12
Stack	Sulfur Dioxide	Dry Gas	BKK_FS0534	10-Jul-25	10-Jan-26	6
Stack	Cyclohexane	Pitot Tube	BKK_FS0472	10-Jul-25	10-Jan-26	6
Stack	Cyclohexane	Fuel Gas Analyzer	RYG_FS0465	19-Feb-25	18-Feb-26	12
Stack	Cyclohexane	DRYCAL FLOWMETER	RYG_FS0208	27-Jan-25	26-Jan-26	12
Stack	Cyclohexane	DRYCAL FLOWMETER	BKK_FS0614	10-Sep-25	9-Sep-26	12
Stack	Cyclohexane	Air Sampling Pump	RYG_FS0135	7-Oct-25	7-Jan-26	3
Stack	Cyclohexane	Air Sampling Pump	RYG_FS0136	7-Oct-25	7-Jan-26	3
Stack	Cyclohexane	GC-FID	BKK_EN0126	22-Oct-24	22-Apr-26	18
Stack	1,3-Butadiene	Pitot Tube	BKK_FS0472	10-Jul-25	10-Jan-26	6
Stack	1,3-Butadiene	Fuel Gas Analyzer	RYG_FS0465	19-Feb-25	18-Feb-26	12
Stack	1,3-Butadiene	DRYCAL FLOWMETER	RYG_FS0208	27-Jan-25	26-Jan-26	12
Stack	1,3-Butadiene	DRYCAL FLOWMETER	BKK_FS0614	10-Sep-25	9-Sep-26	12
Stack	1,3-Butadiene	Air Sampling Pump	RYG_FS0135	7-Oct-25	7-Jan-26	3
Stack	1,3-Butadiene	Air Sampling Pump	RYG_FS0136	7-Oct-25	7-Jan-26	3
Stack	1,3-Butadiene	GC-MSD	BKK_EN0410	9-May-25	9-May-26	12
Noise	Leq 24 hrs	Sound Calibrator	RYG_FS0213	16-Jan-25	16-Jan-26	12
Noise	Leq 24 hrs	Sound Level Meter	RYG_FS0612	23-Dec-24	23-Dec-25	12
Noise	Leq 24 hrs	Sound Level Meter	RYG_FS0495	27-Jan-25	26-Jan-26	12
Noise	Leq 24 hrs	Sound Level Meter	RYG_FS0613	23-Dec-24	23-Dec-25	12



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Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Workplace	1,3-Butadiene	DRYCAL FLOWMETER	RYG_FS0208	27-Jan-25	26-Jan-26	12
Workplace	1,3-Butadiene	DRYCAL FLOWMETER	BKK_FS0614	9-Sep-24	9-Sep-25	12
Workplace	1,3-Butadiene	DRYCAL FLOWMETER	BKK_FS0614	10-Sep-25	9-Sep-26	12
Workplace	1,3-Butadiene	GC-MSD	BKK_EN0410	9-May-25	9-May-26	12
Workplace	Styrene	DRYCAL FLOWMETER	RYG_FS0208	27-Jan-25	26-Jan-26	12
Workplace	Styrene	DRYCAL FLOWMETER	BKK_FS0614	9-Sep-24	9-Sep-25	12
Workplace	Styrene	DRYCAL FLOWMETER	BKK_FS0614	10-Sep-25	9-Sep-26	12
Workplace	Styrene	GC-MSD	BKK_EN0410	9-May-25	9-May-26	12
Workplace	Cyclohexane	DRYCAL FLOWMETER	RYG_FS0208	27-Jan-25	26-Jan-26	12
Workplace	Cyclohexane	DRYCAL FLOWMETER	BKK_FS0614	9-Sep-24	9-Sep-25	12
Workplace	Cyclohexane	DRYCAL FLOWMETER	BKK_FS0614	10-Sep-25	9-Sep-26	12
Workplace	Cyclohexane	GC-FID	BKK_EN0126	22-Oct-24	22-Apr-26	18
Workplace	Toluene	DRYCAL FLOWMETER	RYG_FS0208	27-Jan-25	26-Jan-26	12
Workplace	Toluene	DRYCAL FLOWMETER	BKK_FS0614	9-Sep-24	9-Sep-25	12
Workplace	Toluene	DRYCAL FLOWMETER	BKK_FS0614	10-Sep-25	9-Sep-26	12
Workplace	Toluene	GC-MSD	BKK_EN0410	9-May-25	9-May-26	12
Workplace	Formaldehyde	DRYCAL FLOWMETER	RYG_FS0208	27-Jan-25	26-Jan-26	12
Workplace	Formaldehyde	DRYCAL FLOWMETER	BKK_FS0614	9-Sep-24	9-Sep-25	12
Workplace	Formaldehyde	DRYCAL FLOWMETER	BKK_FS0614	10-Sep-25	9-Sep-26	12
Workplace	Formaldehyde	GC-FID	BKK_EN0126	22-Oct-24	22-Apr-26	18



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รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Noise	Leq 12 hrs	Sound Calibrator	RYG_FS0213	16-Jan-25	16-Jan-26	12
Noise	Leq 12 hrs	Sound Level Meter	RYG_FS0439	9-Oct-24	9-Oct-25	12
Noise	Leq 12 hrs	Sound Level Meter	RYG_FS0493	27-Jan-25	26-Jan-26	12
Noise	Leq 12 hrs	Sound Level Meter	RYG_FS0492	27-Jan-25	26-Jan-26	12
Noise	Noise Dose, TWA	Dose Badge Reader	RYG_FS0211	2-Dec-24	2-Dec-25	12
Noise	Noise Dose, TWA	Dosimeter	RYG_FS0040	17-Sep-24	17-Sep-25	12
Noise	Noise Dose, TWA	Dosimeter	RYG_FS0036	17-Sep-24	17-Sep-25	12
Noise	Noise Dose, TWA	Dosimeter	RYG_FS0039	17-Sep-24	17-Sep-25	12
Noise	Noise Dose, TWA	Dosimeter	RYG_FS0041	17-Sep-24	17-Sep-25	12
Noise	Noise Dose, TWA	Dosimeter	RYG_FS0035	17-Sep-24	17-Sep-25	12
Noise	Noise Dose, TWA	Dosimeter	RYG_FS0038	17-Sep-24	17-Sep-25	12
Noise	Noise Dose, TWA	Dosimeter	RYG_FS0034	17-Sep-24	17-Sep-25	12
Noise	Noise Dose, TWA	Dosimeter	RYG_FS0037	17-Sep-24	17-Sep-25	12
Noise	Noise Dose, TWA	Dosimeter	RYG_FS0047	28-Apr-25	27-Apr-26	12
Noise	Noise Dose, TWA	Dosimeter	RYG_FS0042	17-Sep-24	17-Sep-25	12
Rayong Lab	pH at 25 °C	pH meter	RYG_EN0183	18-Jul-25	18-Jan-27	18
Rayong Lab	BOD	DO meter with Sensor	RYG_EN0032	20-Jan-25	20-Jul-26	18
Rayong Lab	BOD	Incubator	RYG_EN0154	1-Nov-24	1-May-26	18
Rayong Lab	BOD	Burette	RYG_EN0216	18-Sep-25	18-Sep-26	12
Rayong Lab	COD	Spectrophotometer	RYG_EN0037	18-Mar-25	18-Sep-26	18
Rayong Lab	Total Suspended Solids	Electronic Balance	RYG_EN0163	20-Feb-25	20-Feb-26	12
Rayong Lab	Total Suspended Solids	Chamber (Oven)	RYG_EN0012	10-Sep-25	10-Mar-27	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_EN0012	10-Sep-25	10-Mar-27	18
Rayong Lab	Oil & Grease	Electronic Balance	RYG_EN0003	20-Feb-25	20-Feb-26	12
Rayong Lab	Oil & Grease	Liquid Bath (Water)	RYG_EN0220	27-Nov-25	27-Nov-26	12
Rayong Lab	Temperature	Digital Thermometer	RYG_FS0568	5-May-25	5-May-26	12
Rayong Lab	Formaldehyde	SPECTROPHOTOMETER	RYG_EN0037	18-Mar-25	18-Sep-26	18
Rayong Lab	Total Kjeldahl Nitrogen	Block Digestion Unit	RYG_EN0188	10-Sep-25	10-Mar-27	18
Rayong Lab	Total Kjeldahl Nitrogen	pH Meter	RYG_EN0152	18-Jun-25	18-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	Methanol	Gas Chromatography	BKK_EN0041	3-Jan-25	3-Jul-26	18
Water Lab	Styrene	Gas Chromatography (MSD)	BKK_EN0059	25-Jun-25	25-Dec-26	18
Water Lab	Toluene	Gas Chromatography (MSD)	BKK_EN0059	25-Jun-25	25-Dec-26	18
Water Lab	1,3-Butadiene	Gas Chromatography (MSD)	BKK_EN0059	25-Jun-25	25-Dec-26	18
Soil	Zinc	ICP-OES	BKK_EL0037	23-Sep-24	23-Mar-26	18
Soil	Zinc	Hot Block	BKK_EL0054	4-Mar-25	4-Sep-26	18
Soil	Zinc	Chamber (Cooling Room)	BKK_EN0167	4-Jun-25	4-Dec-26	18
Soil	Methanol	Gas Chromatography	BKK_EN0041	3-Jan-25	3-Jul-26	18
Soil	Styrene	Gas Chromatography (MSD)	BKK_EN0059	25-Jun-25	25-Dec-26	18
Soil	Toluene	Gas Chromatography (MSD)	BKK_EN0059	25-Jun-25	25-Dec-26	18
Soil	1,3-Butadiene	Gas Chromatography (MSD)	BKK_EN0059	25-Jun-25	25-Dec-26	18
Soil	Formaldehyde	Spectrophotometer	BKK_EN0356	8-Oct-25	8-Oct-26	12

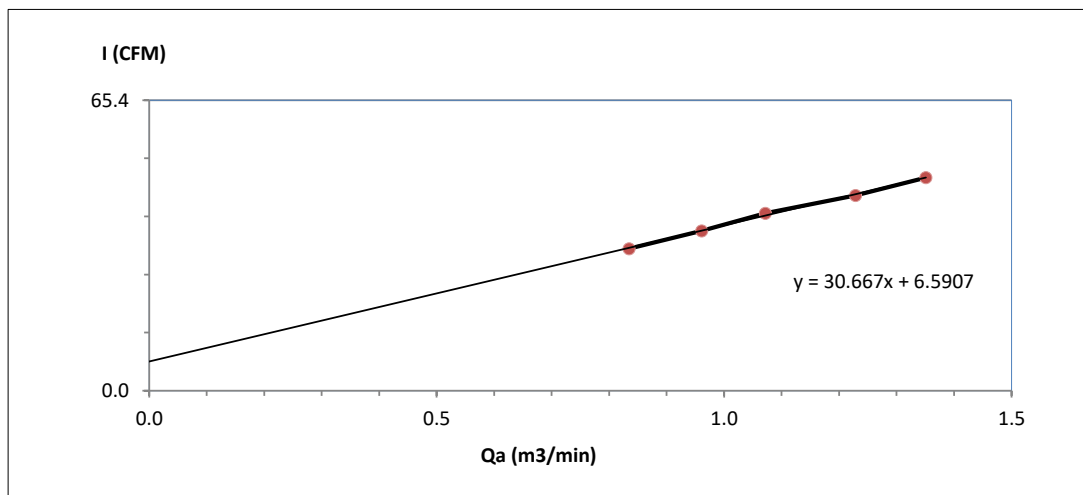




### High Volume Air Sampler Calibration Worksheet

Project Site :	Kuraray GC Advance Materials Co.,Ltd.	Barometric Pressure (mm Hg) :	756.2
Calibrate Location :	วัดมาบชลด	Temperature ( °C) :	30.5
Calibrate Date :	14-Nov-25	High Volume ID :	RYG_FS0186
CalibrationSheet No.:	C-141125-RYG_FS0186	High Volume Model :	TE-5009X
Calibrator ID:	RYG_FS0205	High Volume S/N :	4794
Calibrator Model :	TE-5028A	Calibrator Slope :	0.95091
Calibrator S/N :	1166	Calibrator Intercept :	-0.01856

Test No.	Delta H <sub>2</sub> O (inch)	Qa (m <sup>3</sup> /min)	I : Chart (CFM)	Linear Regression
1	1.5	0.835	32	Slope : 30.6673 Intercept : 6.5907 Correlation Coefficient : 0.9988
2	2.0	0.961	36	
3	2.5	1.072	40	
4	3.3	1.229	44	
5	4.0	1.351	48	



Calibrated by

( Mr. Norranon Tathongkham )  
RYG Field Services Scientist (2)

Approved by :

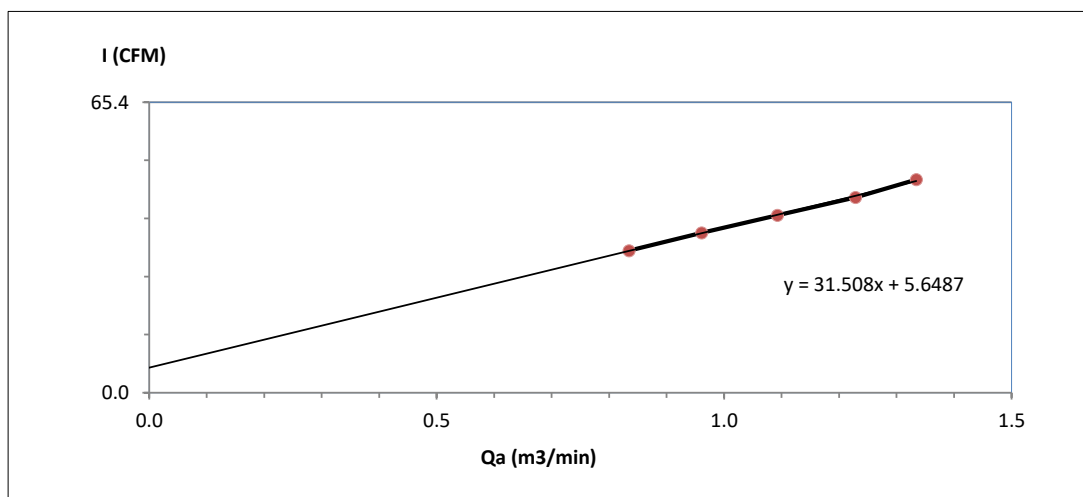
( Mr. Supot Salamteh )  
Field Services Section Head



### High Volume Air Sampler Calibration Worksheet

Project Site :	Kuraray GC Advance Materials Co.,Ltd.	Barometric Pressure (mm Hg) :	756.2
Calibrate Location :	ชุมชนหนองแฟบ	Temperature ( °C ) :	30.5
Calibrate Date :	14-Nov-25	High Volume ID :	RYG_FS0400
CalibrationSheet No.:	C-141125-RYG_FS0400	High Volume Model :	TE-5009X
Calibrator ID:	RYG_FS0205	High Volume S/N :	5691
Calibrator Model :	TE-5028A	Calibrator Slope :	0.95091
Calibrator S/N :	1166	Calibrator Intercept :	-0.01856

Test No.	Delta H <sub>2</sub> O (inch)	Qa (m <sup>3</sup> /min)	I : Chart (CFM)	Linear Regression
1	1.5	0.835	32	Slope : 31.5083 Intercept : 5.6487 Correlation Coefficient : 0.9992
2	2.0	0.961	36	
3	2.6	1.093	40	
4	3.3	1.229	44	
5	3.9	1.334	48	



Calibrated by

( Mr. Norranon Tathongkham )  
RYG Field Services Scientist (2)

Approved by :

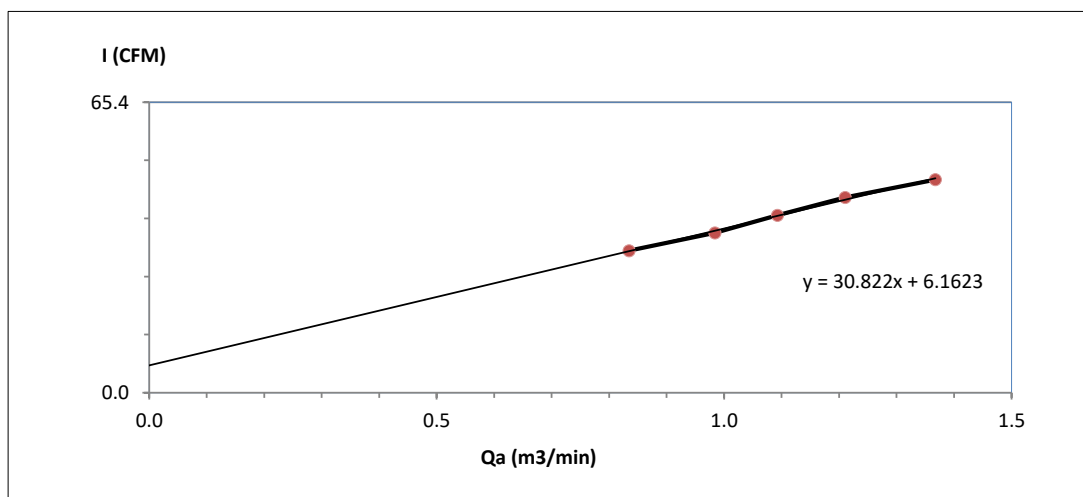
( Mr. Supot Salamteh )  
Field Services Section Head



### High Volume Air Sampler Calibration Worksheet

Project Site :	Kuraray GC Advance Materials Co.,Ltd.	Barometric Pressure (mm Hg) :	756.2
Calibrate Location :	วัดประทุมมิตรบำรุง	Temperature ( °C) :	30.5
Calibrate Date :	14-Nov-25	High Volume ID :	RYG_FS0399
CalibrationSheet No.:	C-141125-RYG_FS0399	High Volume Model :	TE-5009X
Calibrator ID:	RYG_FS0205	High Volume S/N :	5683
Calibrator Model :	TE-5028A	Calibrator Slope :	0.95091
Calibrator S/N :	1166	Calibrator Intercept :	-0.01856

Test No.	Delta H <sub>2</sub> O (inch)	Qa (m <sup>3</sup> /min)	I : Chart (CFM)	Linear Regression
1	1.5	0.835	32	Slope : 30.8217 Intercept : 6.1623 Correlation Coefficient : 0.9979
2	2.1	0.984	36	
3	2.6	1.093	40	
4	3.2	1.210	44	
5	4.1	1.368	48	



Calibrated by

( Mr. Norranon Tathongkham )  
RYG Field Services Scientist (2)

Approved by :

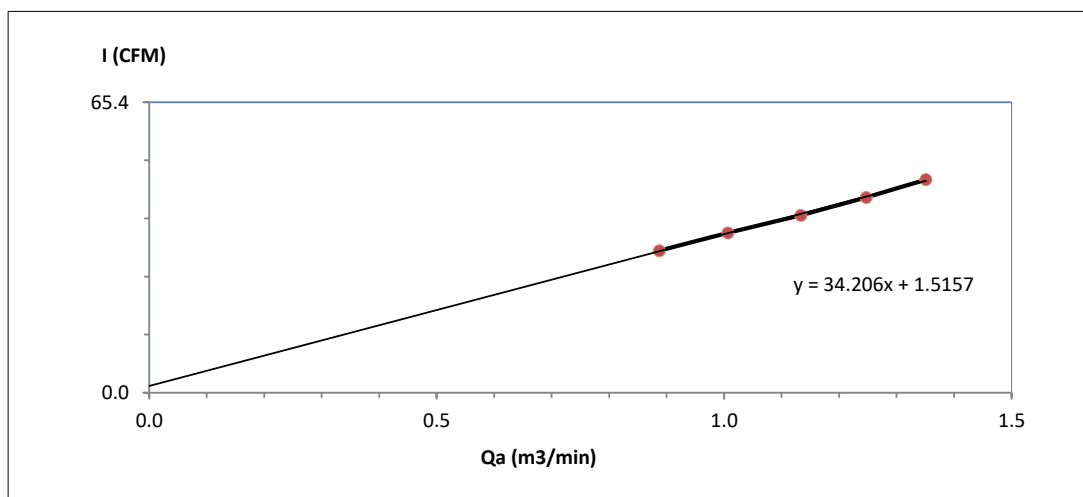
( Mr. Supot Salamteh )  
Field Services Section Head



### High Volume Air Sampler Calibration Worksheet

Project Site :	Kuraray GC Advance Materials Co.,Ltd.	Barometric Pressure (mm Hg) :	756.2
Calibrate Location :	ชุมชนบางพลู-ซากกลาง	Temperature ( °C) :	30.5
Calibrate Date :	14-Nov-25	High Volume ID :	BKK_FS0378
CalibrationSheet No.:	C-141125-BKK_FS0378	High Volume Model :	TE-5009X
Calibrator ID:	RYG_FS0205	High Volume S/N :	4155
Calibrator Model :	TE-5028A	Calibrator Slope :	0.95091
Calibrator S/N :	1166	Calibrator Intercept :	-0.01856

Test No.	Delta H <sub>2</sub> O (inch)	Qa (m <sup>3</sup> /min)	I : Chart (CFM)	Linear Regression
1	1.7	0.887	32	Slope : 34.2061 Intercept : 1.5157 Correlation Coefficient : 0.9994
2	2.2	1.007	36	
3	2.8	1.133	40	
4	3.4	1.247	44	
5	4.0	1.351	48	



Calibrated by

( Mr. Norranon Tathongkham )  
RYG Field Services Scientist (2)

Approved by :

( Mr. Supot Salamteh )  
Field Services Section Head

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 WI 08.
Serial   QM Ident. no.	25409664   RYG_EN0001	This certificate relate and apply this equipment only.
Customer	ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)	
	616/10 Moo 5 T.Maenam Khu, A.Pluak Daeng, Rayong 21140, Thailand.	
Order no.	2230	
Number of pages	4	
Date of calibration	20 Feb 2025	

REVIEW BY .....

Thanitak.

APPROVED BY .....

D. Khunon.

NEXT CAL DATE .....

20/02/26

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

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

Date 06 Mar 2025

Approval of the Calibration Certificate



Mr. Chonchai Inthana

Person in charge

Kachen Lalee

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. <i>T</i> <sub>weights</sub> - <i>T</i> <sub>place</sub>	24.5 °C   1.0 K
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	100 g		
1	10.0000 g	100.0000 g	Center	
2	9.9999 g	100.0000 g	Front left	
3	10.0000 g	99.9999 g	Back left	
4	10.0000 g	100.0000 g	Back right	
5	10.0000 g	99.9999 g	Front right	
6	9.9999 g	99.9999 g	Maximum deviation from centric loading indication	
7	10.0000 g	100.0000 g	Δ <sub>ecc</sub>   max = 0.0001 g	
8	10.0000 g	100.0000 g		
9	10.0000 g	100.0000 g		
10	10.0000 g	100.0000 g		
	<i>s</i> = 0.00004 g	<i>s</i> = 0.00005 g		

Error of indication

Testload	Indication	Error	Expansion factor	Uncertainty	Uncertainty relative
<i>L</i>	<i>I</i>	<i>E</i>	<i>k</i>	<i>U</i> ( <i>E</i> )	<i>U</i> <sub>rel</sub> ( <i>E</i> )
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		<i>E</i>   <sub>max</sub> = 0.0001 g			

*U*<sub>rel</sub>(*E*) is the quotient of *U*(*E*) and test load *L*. The uncertainty of measurement *U*(*E*) is valid only if error *E* is considered. You will find reference notes on the uncertainty of measurement in use under: Appendix to the calibration certificate | Interpretation of measurement results.  
Reference note: The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the documented Expansion factor, determined in accordance with the European Calibration 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

# Uncertainty of measurement in use

Device adjusted before measurement	Yes
Temperature deviation considered	1.5 K (isoCAL active)
Temperature coefficient considered	$1 \cdot 10^{-6}/\text{K}$

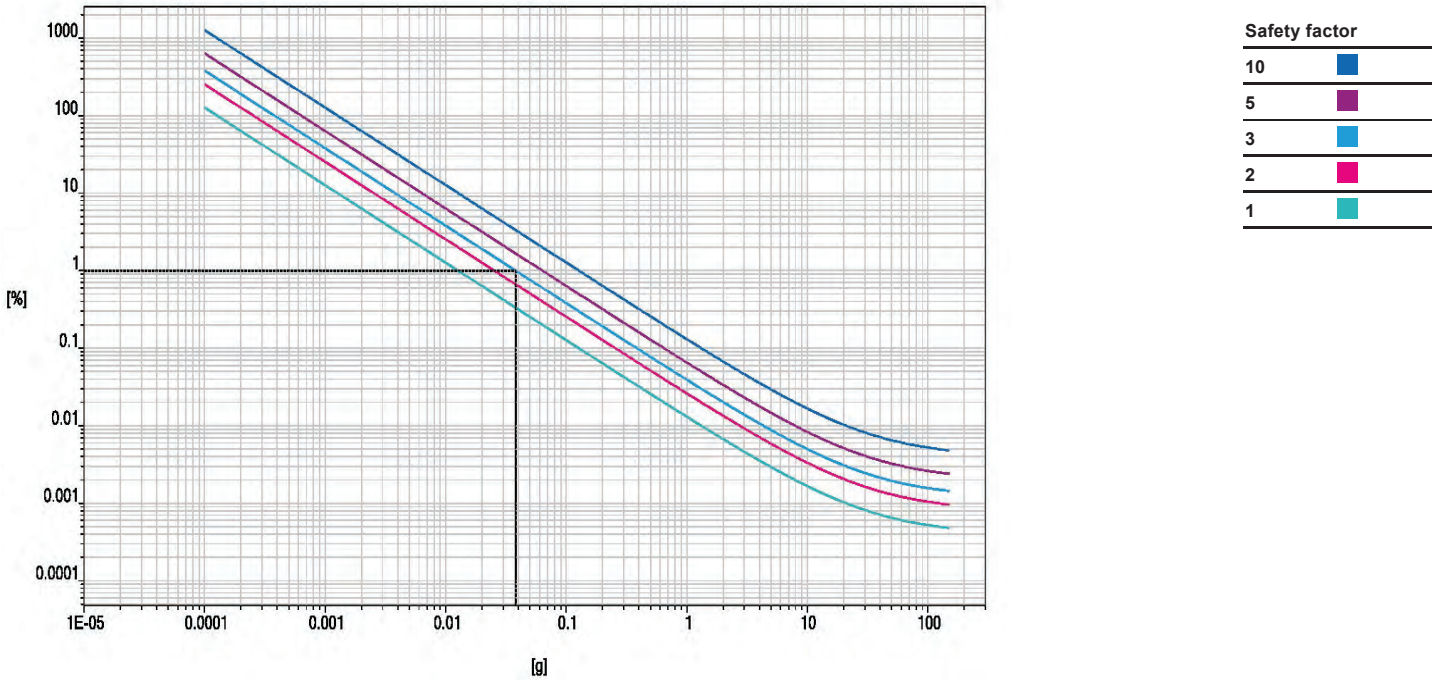
Uncertainty of the weighing result  $U_{gl}(W)$

$U_{gl}(W) = 0.00013 \text{ g} + 3.96 \cdot 10^{-6} \cdot R$

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

Indication in % from max load	Net indication $R$	Uncertainty $U_{gl}(W)$	Uncertainty relative $U_{gl}(W)_{rel}$
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

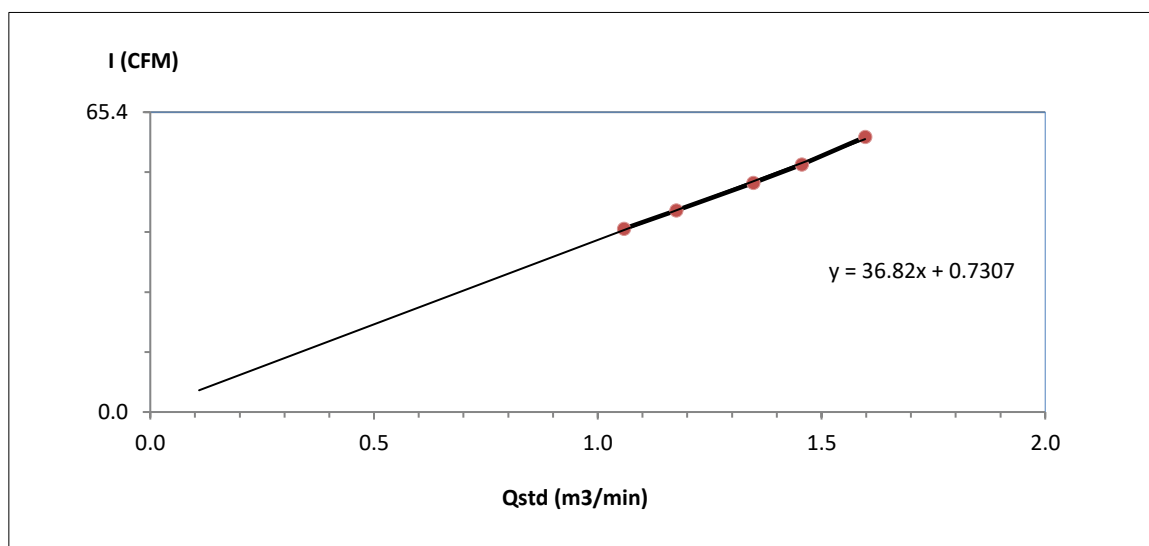




## High Volume Air Sampler Calibration Worksheet

Project Site :	Kuraray GC Advance Materials Co.,Ltd.	Barometric Pressure (mm Hg) :	756.2
Calibrate Location :	วัดมาบชลด	Temperature ( °C ) :	30.5
Calibrate Date :	14-Nov-25	High Volume ID :	BKK_FS1059
CalibrationSheet No.:	C-141125-BKK_FS1059	High Volume Model :	TE-5009X
Calibrator ID:	RYG_FS0205	High Volume S/N :	5693
Calibrator Model :	TE-5028A	Calibrator Slope :	1.51825
Calibrator S/N :	1166	Calibrator Intercept :	-0.02964

Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>std</sub> (m <sup>3</sup> /min)	I : Chart (CFM)	Linear Regression
1	2.5	1.0590	40	Slope : 36.8203 Intercept : 0.7307 Correlation Coefficient : 0.9990
2	3.1	1.1759	44	
3	4.1	1.3479	50	
4	4.8	1.4560	54	
5	5.8	1.5975	60	



Calibrated by

( Mr. Norranon Tathongkham )  
RYG Field Services Scientist (2)

Approved by :

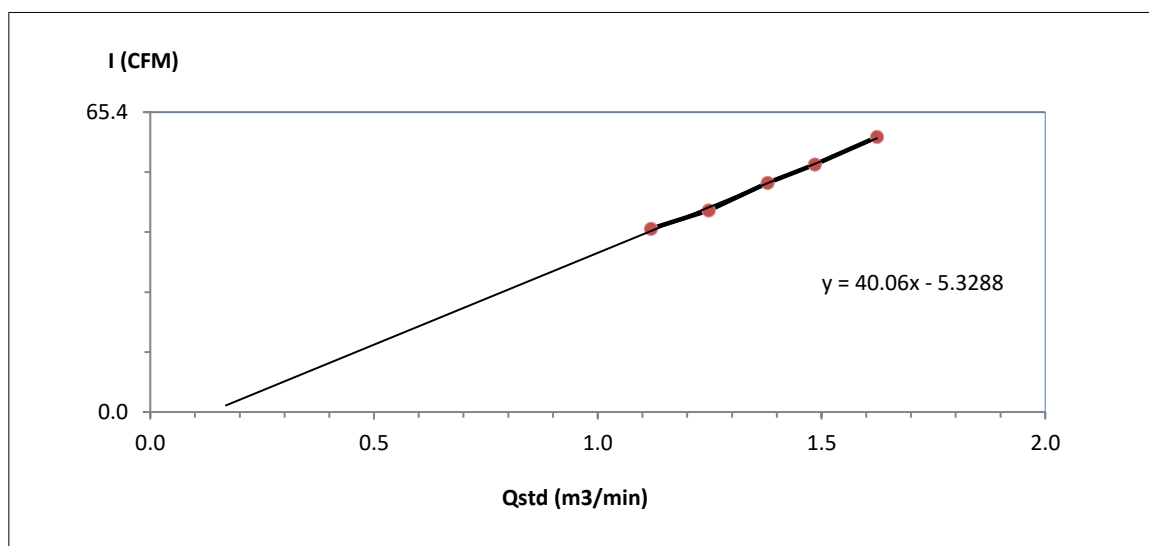
( Mr. Supot Salamteh )  
Field Services Section Head



## High Volume Air Sampler Calibration Worksheet

Project Site :	Kuraray GC Advance Materials Co.,Ltd.	Barometric Pressure (mm Hg) :	756.2
Calibrate Location :	ชุมชนหนองแฟบ	Temperature ( °C ) :	30.5
Calibrate Date :	14-Nov-25	High Volume ID :	BKK_FS1057
CalibrationSheet No.:	C-141125-BKK_FS1057	High Volume Model :	TE-5009X
Calibrator ID:	RYG_FS0205	High Volume S/N :	5500
Calibrator Model :	TE-5028A	Calibrator Slope :	1.51825
Calibrator S/N :	1166	Calibrator Intercept :	-0.02964

Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>std</sub> (m <sup>3</sup> /min)	I : Chart (CFM)	Linear Regression
1	2.8	1.1190	40	Slope : 40.0596 Intercept : -5.3288 Correlation Coefficient : 0.9985
2	3.5	1.2476	44	
3	4.3	1.3796	50	
4	5.0	1.4854	54	
5	6.0	1.6243	60	



Calibrated by

( Mr. Norranon Tathongkham )  
RYG Field Services Scientist (2)

Approved by :

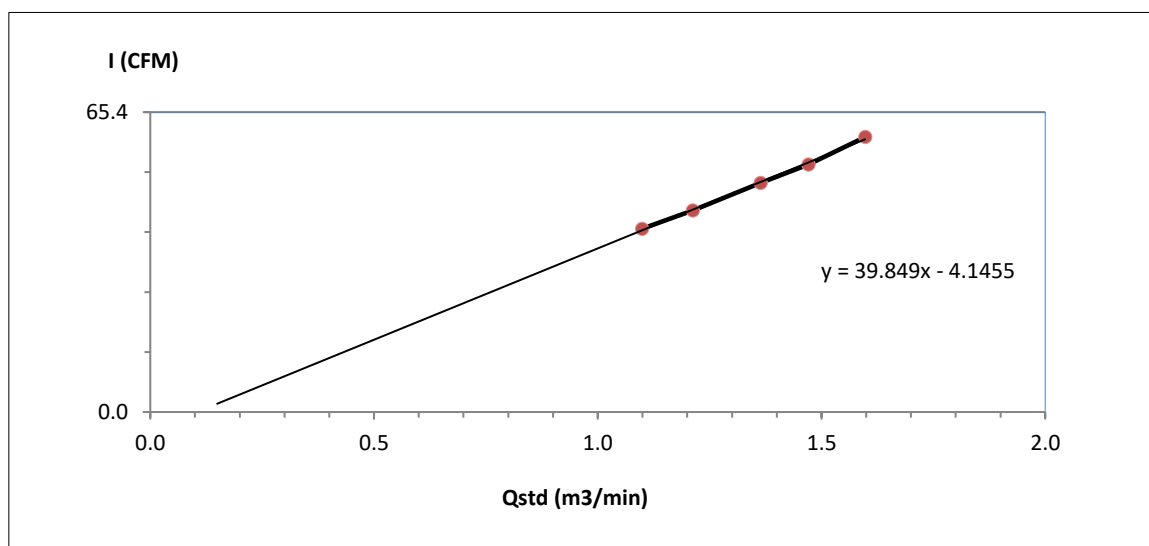
( Mr. Supot Salamteh )  
Field Services Section Head



## High Volume Air Sampler Calibration Worksheet

Project Site :	Kuraray GC Advance Materials Co.,Ltd.	Barometric Pressure (mm Hg) :	756.2
Calibrate Location :	วัดประชมมิตรบารุง	Temperature ( °C ) :	30.5
Calibrate Date :	14-Nov-25	High Volume ID :	BKK_FS0365
CalibrationSheet No.:	C-141125-BKK_FS0365	High Volume Model :	TE-5009X
Calibrator ID:	RYG_FS0205	High Volume S/N :	4164
Calibrator Model :	TE-5028A	Calibrator Slope :	1.51825
Calibrator S/N :	1166	Calibrator Intercept :	-0.02964

Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>std</sub> (m <sup>3</sup> /min)	I : Chart (CFM)	Linear Regression
1	2.7	1.0994	40	Slope : 39.8485 Intercept : -4.1455 Correlation Coefficient : 0.9987
2	3.3	1.2123	44	
3	4.2	1.3638	50	
4	4.9	1.4707	54	
5	5.8	1.5975	60	



Calibrated by

( Mr. Norranon Tathongkham )  
RYG Field Services Scientist (2)

Approved by :

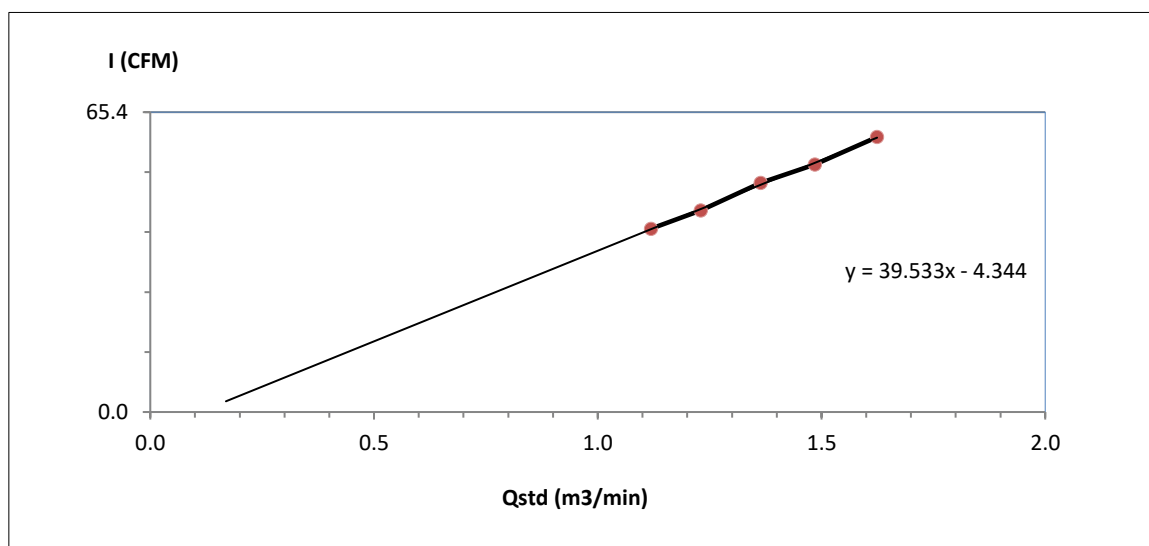
( Mr. Supot Salamteh )  
Field Services Section Head



## High Volume Air Sampler Calibration Worksheet

Project Site :	Kuraray GC Advance Materials Co.,Ltd.	Barometric Pressure (mm Hg) :	756.2
Calibrate Location :	ชุมชนบางพลู-ซากกลาง	Temperature ( °C ) :	30.5
Calibrate Date :	14-Nov-25	High Volume ID :	RYG_FS0661
CalibrationSheet No.:	C-141125-RYG_FS0661	High Volume Model :	TE-5009X
Calibrator ID:	RYG_FS0205	High Volume S/N :	6258
Calibrator Model :	TE-5028A	Calibrator Slope :	1.51825
Calibrator S/N :	1166	Calibrator Intercept :	-0.02964

Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>std</sub> (m <sup>3</sup> /min)	I : Chart (CFM)	Linear Regression
1	2.8	1.1190	40	Slope : 39.5335 Intercept : -4.3440 Correlation Coefficient : 0.9991
2	3.4	1.2301	44	
3	4.2	1.3638	50	
4	5.0	1.4854	54	
5	6.0	1.6243	60	



Calibrated by

( Mr. Norranon Tathongkham )  
RYG Field Services Scientist (2)

Approved by :

( Mr. Supot Salamteh )  
Field Services Section Head

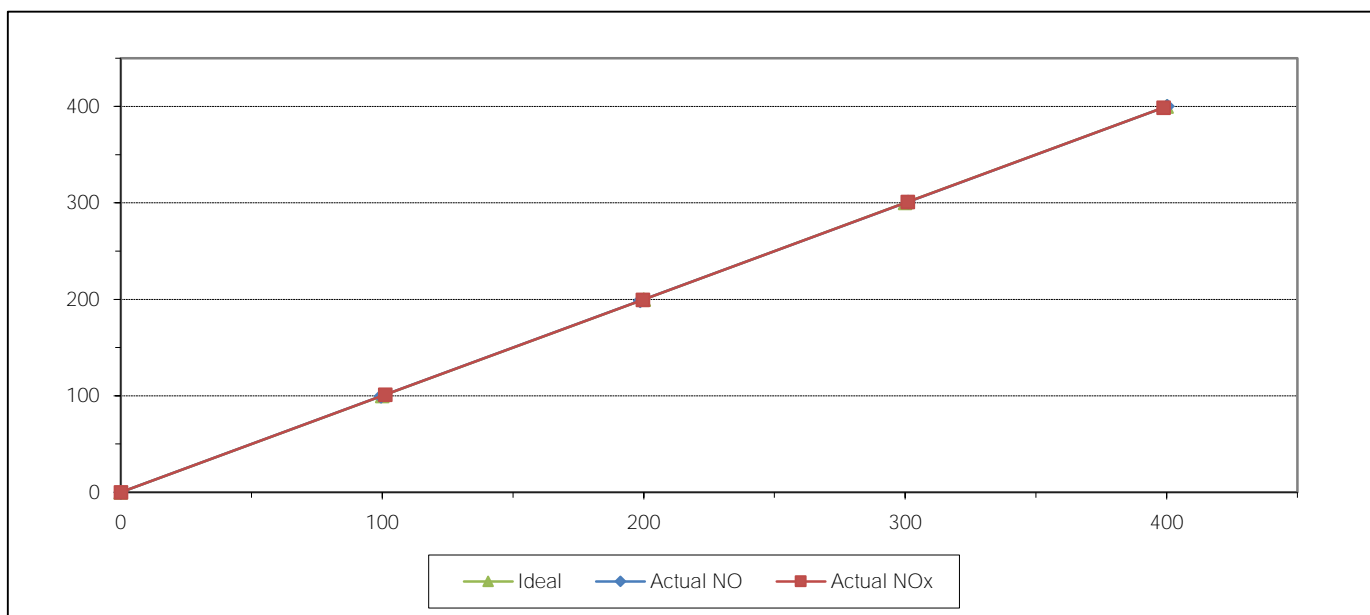


## MULTIPOINT CALIBRATION REPORT

Calibration Date 3-Jul-25  
Manufacturer HORIBA  
Serial No. NV0ER3YH  
Calibrator Manufacturer Teledyne API  
Serial No. 947  
Std. Gas Concentration (PPM) 55.88  
Cylinder Pressure (psi) 1800  
Certified Date 9-Feb-22

Equipment Name NOx Analyzer  
Model APNA-370  
Equipment ID RYG\_FS0459  
Model 700  
Cylinder No. GN0027222  
Certified By Airgas Inc.  
Expired Date 9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.05	0.05	0.05	0.10	0.10	0.10
1	100.00	99.50	-0.50	-0.50	101.20	1.20	1.20
2	200.00	198.70	-1.30	-0.65	199.70	-0.30	-0.15
3	300.00	301.10	1.10	0.37	301.00	1.00	0.33
4	400.00	400.30	0.30	0.08	398.80	-1.20	-0.30
AVERAGE (%)				-0.13			0.24



Calibrated By

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

Approved By

( Mr.Sarayuth Jittranont )  
Assistant General Manager

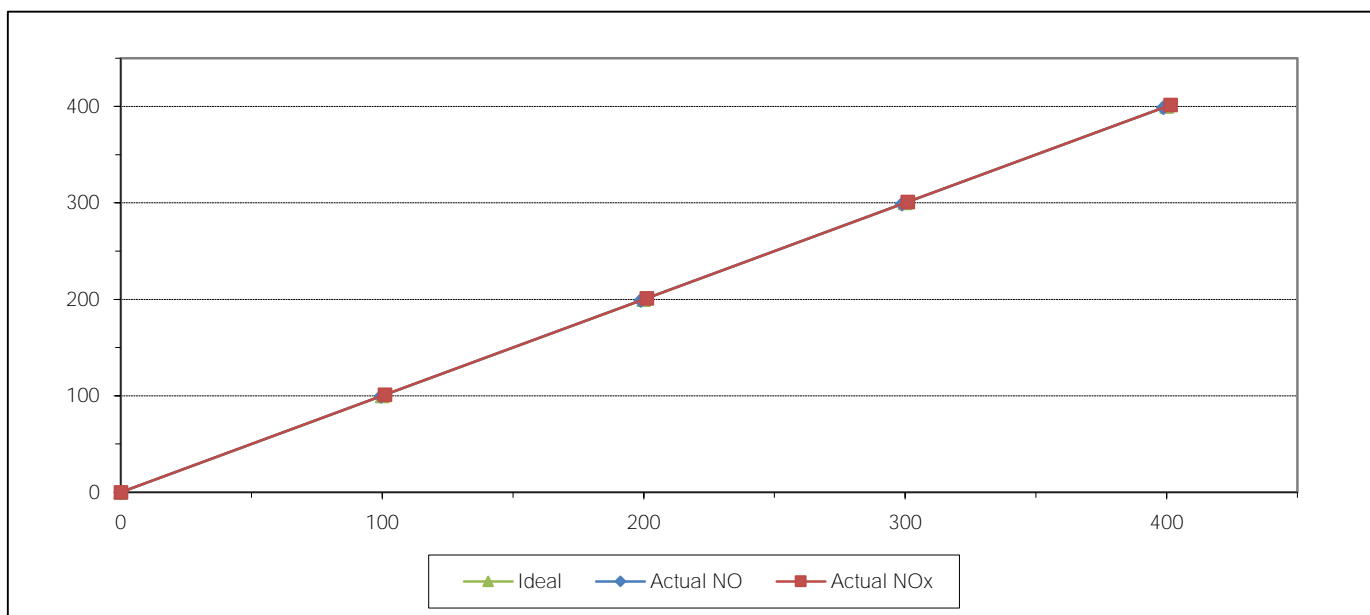


## MULTIPOINT CALIBRATION REPORT

Calibration Date 3-Jul-25  
Manufacturer Teledyne API  
Serial No. 7238  
Calibrator Manufacturer Teledyne API  
Serial No. 947  
Std. Gas Concentration (PPM) 55.88  
Cylinder Pressure (psi) 1800  
Certified Date 9-Feb-22

Equipment Name NOx Analyzer  
Model T200  
Equipment ID RYG\_FS0533  
Model 700  
Cylinder No. GN0027222  
Certified By Airgas Inc.  
Expired Date 9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	99.50	-0.50	-0.50	101.10	1.10	1.10
2	200.00	198.90	-1.10	-0.55	201.20	1.20	0.60
3	300.00	298.80	-1.20	-0.40	301.00	1.00	0.33
4	400.00	398.70	-1.30	-0.33	401.50	1.50	0.38
AVERAGE (%)				-0.33			0.50



Calibrated By

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

Approved By

( Mr.Sarayuth Jittranont )  
Assistant General Manager

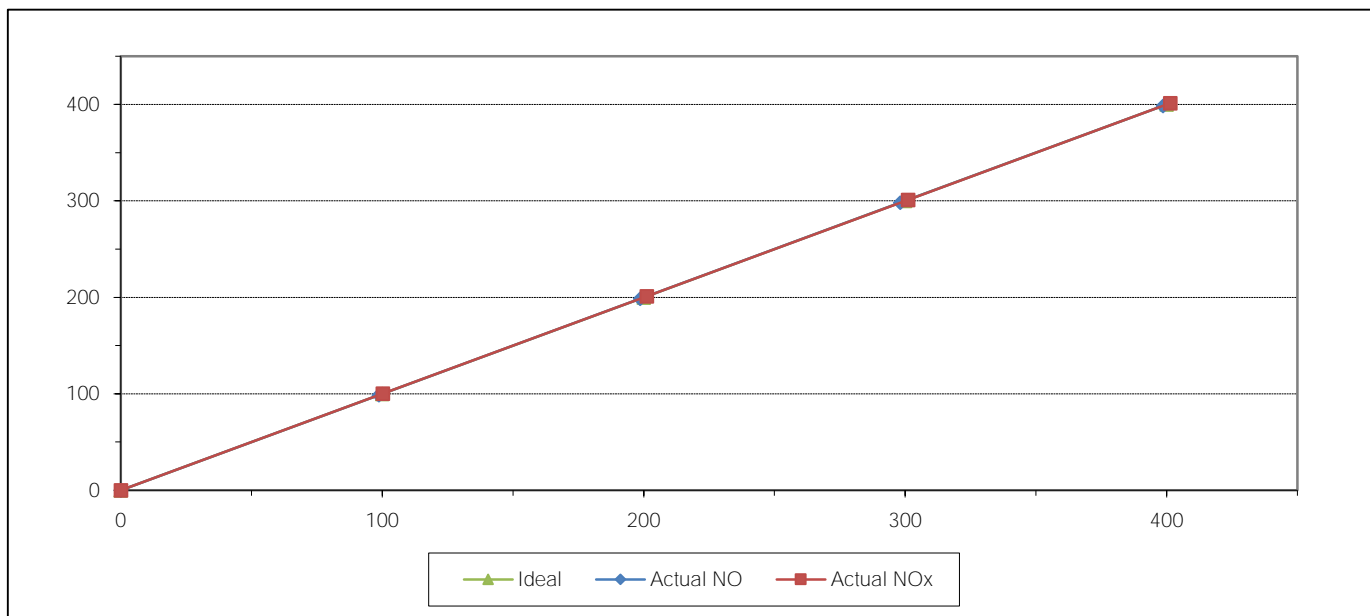


## MULTIPOINT CALIBRATION REPORT

Calibration Date 1-Jul-25  
Manufacturer HORIBA  
Serial No. SEEAW53E  
Calibrator Manufacturer Teledyne API  
Serial No. 947  
Std. Gas Concentration (PPM) 55.88  
Cylinder Pressure (psi) 1800  
Certified Date 9-Feb-22

Equipment Name NOx Analyzer  
Model APNA-370  
Equipment ID RYG\_FS0261  
Model 700  
Cylinder No. GN0027222  
Certified By Airgas Inc.  
Expired Date 9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	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 Sakarn )  
Field Environmental Scientist (3)

Approved By

( Mr.Sarayuth Jittranont )  
Assistant General Manager

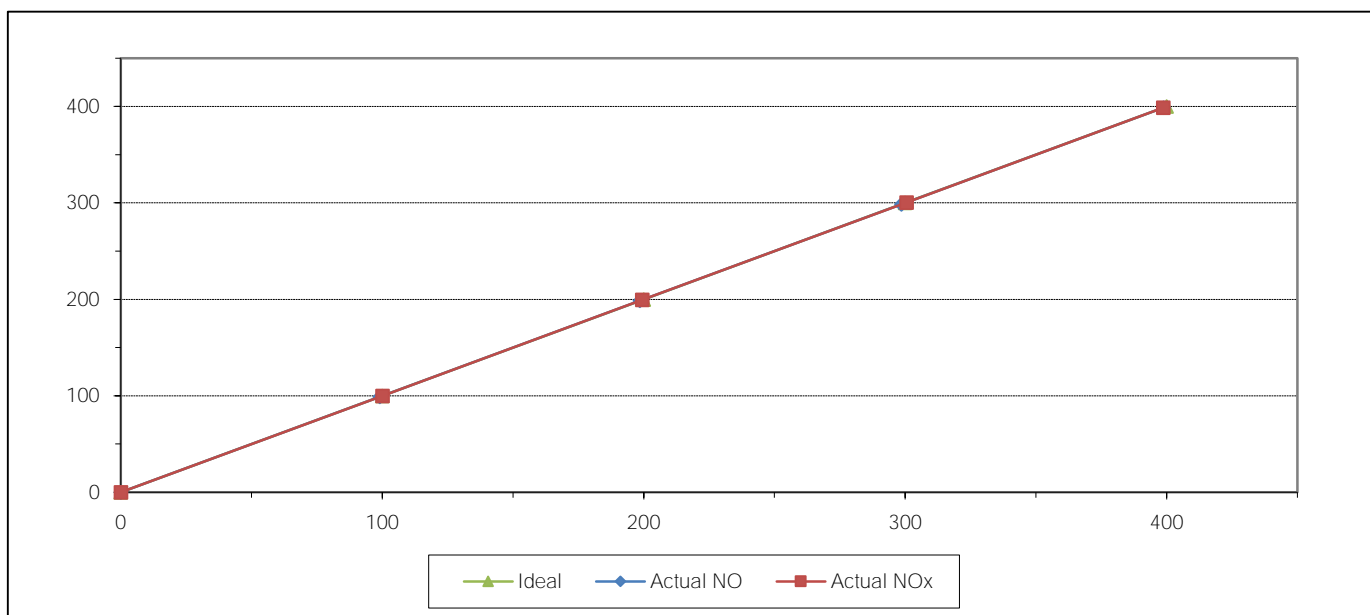


## MULTIPOINT CALIBRATION REPORT

Calibration Date 2-Jul-25  
Manufacturer HORIBA  
Serial No. 7AV89544  
Calibrator Manufacturer Teledyne API  
Serial No. 947  
Std. Gas Concentration (PPM) 55.88  
Cylinder Pressure (psi) 1800  
Certified Date 9-Feb-22

Equipment Name NOx Analyzer  
Model APNA-370  
Equipment ID RYG\_FS0272  
Model 700  
Cylinder No. GN0027222  
Certified By Airgas Inc.  
Expired Date 9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.05	0.05	0.05	0.10	0.10	0.10
1	100.00	99.10	-0.90	-0.90	100.10	0.10	0.10
2	200.00	198.50	-1.50	-0.75	199.50	-0.50	-0.25
3	300.00	298.60	-1.40	-0.47	300.50	0.50	0.17
4	400.00	398.90	-1.10	-0.28	398.70	-1.30	-0.33
AVERAGE (%)				-0.47			-0.04



Calibrated By

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

Approved By

( Mr.Sarayuth Jittranont )  
Assistant General Manager

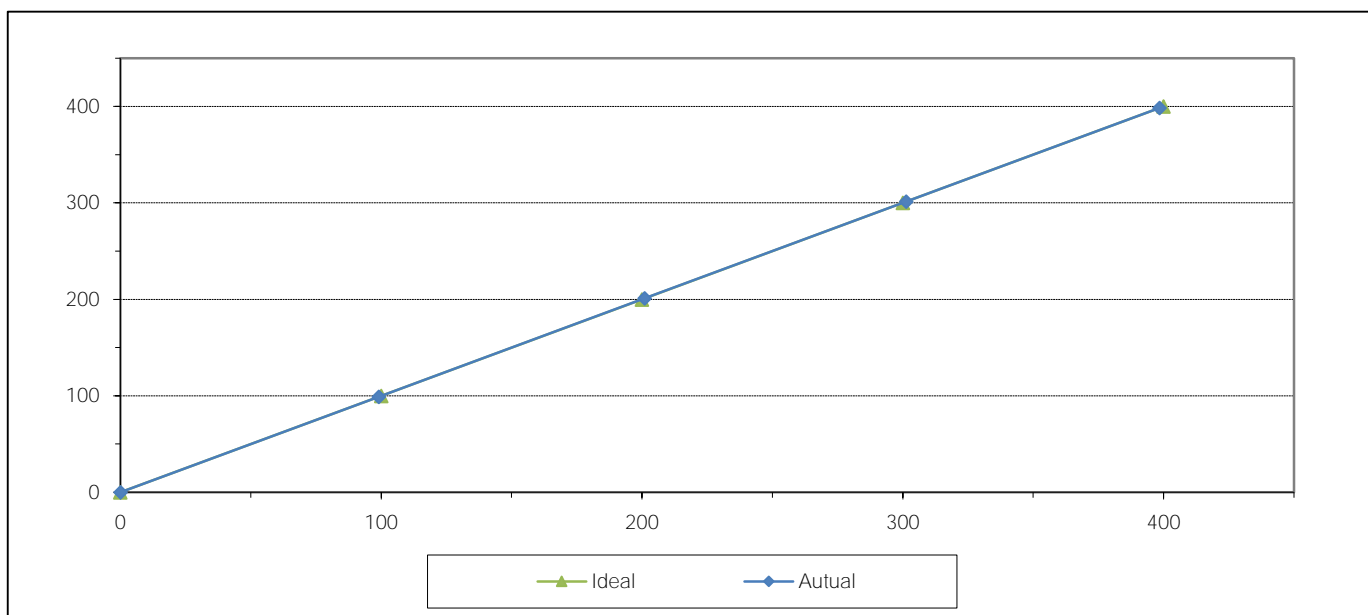




## MULTIPOINT CALIBRATION REPORT

Calibration Date	2-Jul-25	Equipment Name	SO2 Analyzer
Manufacturer	HORIBA	Model	APSA-370
Serial No.	PAUY0T7A	Equipment ID	RYG_FS0458
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	56.3	Cylinder No.	GN0027222
Cylinder Pressure (psi)	1800	Certified By	Airgas Inc.
Certified Date	9-Feb-22	Expired Date	9-Feb-30

Point	CALIBRATION RESULTS			
	Ideal	Actual	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	99.10	-0.90	-0.90
2	200.00	201.00	1.00	0.50
3	300.00	301.30	1.30	0.43
4	400.00	398.50	-1.50	-0.38
AVERAGE (%)				-0.05



Calibrated By

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

Approved By

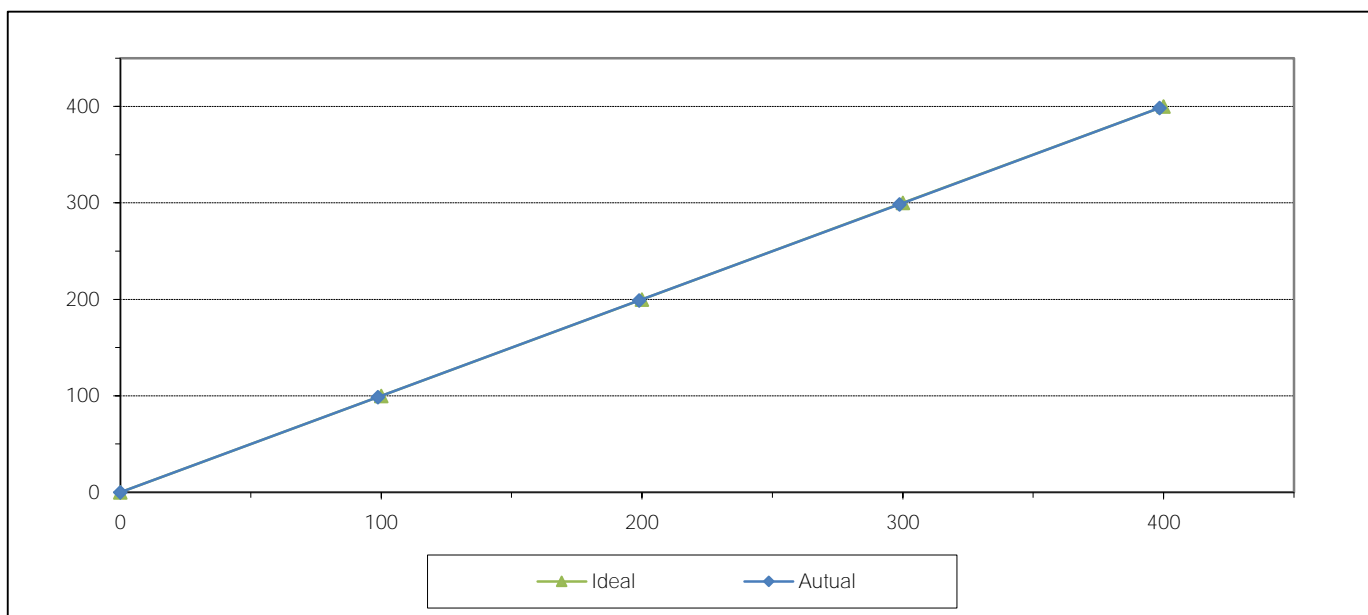
( Mr.Sarayuth Jittranont )  
Assistant General Manager



## 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 Sakarn )  
Field Environmental Scientist (3)

Approved By

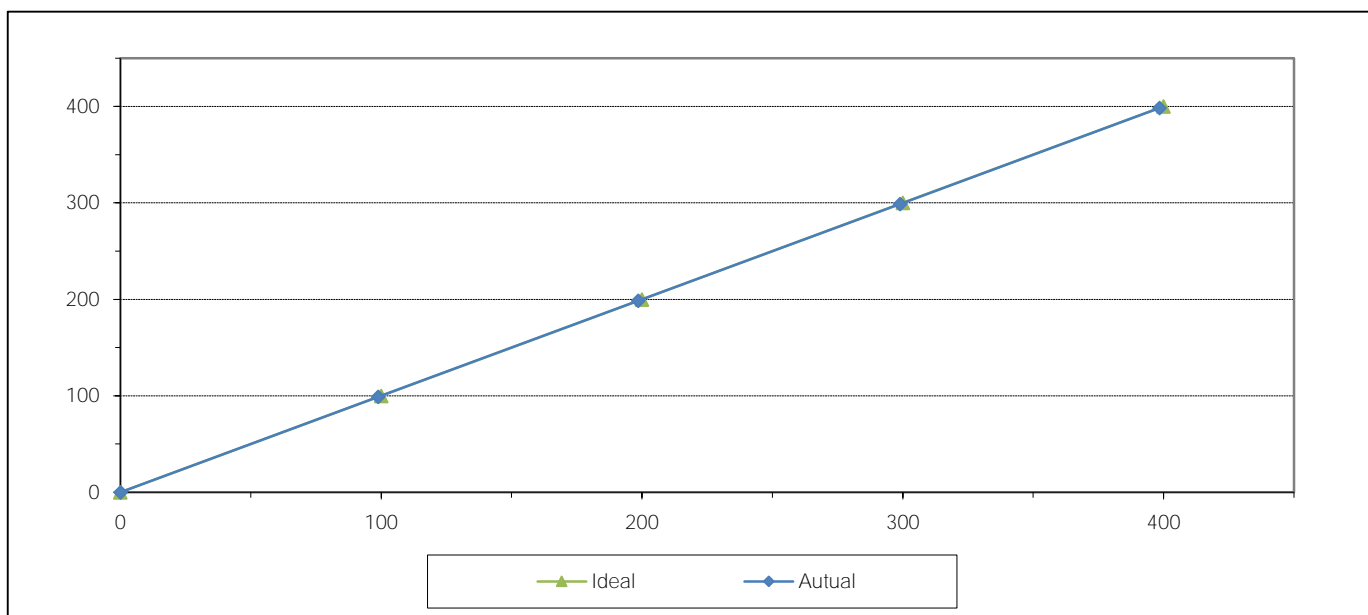
( Mr.Sarayuth Jittranont )  
Assistant General Manager



## 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	Autual	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 Sakarn )  
Field Environmental Scientist (3)

Approved By

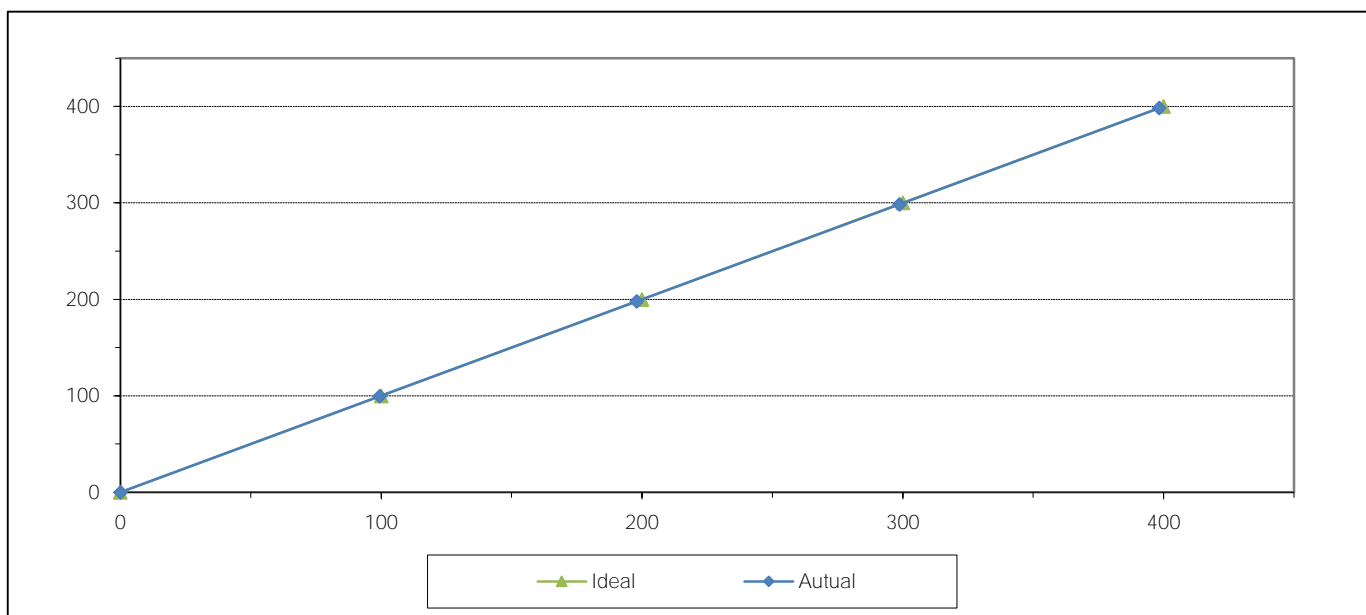
( Mr.Sarayuth Jittranont )  
Assistant General Manager



## MULTIPOINT CALIBRATION REPORT

Calibration Date	1-Jul-25	Equipment Name	SO2 Analyzer
Manufacturer	HORIBA	Model	APSA-370
Serial No.	1092NYKM	Equipment ID	RYG_FS0271
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	Autual	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	99.50	-0.50	-0.50
2	200.00	198.00	-2.00	-1.00
3	300.00	298.70	-1.30	-0.43
4	400.00	398.40	-1.60	-0.40
AVERAGE (%)				-0.45



Calibrated By

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

Approved By

( Mr.Sarayuth Jittranont )  
Assistant General Manager

Certificate Number

CWS-010-68

## CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

**MEASUREMENT ITEM** : Cup anemometer  
**MANUFACTURER** : Novalynx  
**MODEL/TYPE** : Sensor: WS-02F  
Data logger: 110-WS-25DL-D  
**SERIAL NUMBER** : Sensor: WSD-A5662  
Data logger: A5662  
**ID NUMBER** : RYG\_FS0544  
**CONDITION AS-RECEIVED** : Used item  
**CUSTOMER** : ALS laboratory group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang,  
Khet Suan Luang, Bangkok 10250 Thailand.

**RECEIVED DATE** : 14 Mar 2025  
**MEASUREMENT DATE** : 02 Apr 2025  
**ISSUE DATE** : 02 Apr 2025

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

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

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

**CALIBRATION CONDITIONS** : Wind tunnel cross-section area<sup>1</sup> 900 cm<sup>2</sup>  
Cup anemometer frontal area<sup>2</sup> 100 cm<sup>2</sup>  
Diameter of mounting pipe<sup>3</sup> - mm  
Blockage ratio of test object<sup>4</sup> 0.111 [-]

**Preconditioning** : 24 hours at ambient conditions.  
**Measurement Condition** : The average values during measurement are (24.5) °C, (45.8) %RH and (1011.4) hPa.

### TABULATION OF RESULTS:

The table on next page give the measured values.

### Calibrated by:

- ☒ Mr. Sorawit Thachalad  
☐ Miss Jitraporn Lertsomphol

### Remark:

- <sup>1</sup> Nozzle 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 <sup>2</sup> to <sup>1</sup>

### Calibration procedure:

The Cup anemometer was calibrated against Standard air velocity transducer model: 8455-12 and pitot tube with precision differential pressure meter model: DPM2500 in an close test-section of Eiffel-type wind tunnel with 900 cm<sup>2</sup> cross test section area. The WI-CL-007 based on IEC 61400-12-1, Wind energy generation systems – Part 12-1: Power performance measurements of electricity producing wind turbines, March 2017 was used as a calibration guideline.

### Traceability:

This certificate provides a traceability of The measurement to recognized the national standards, and to realization of the international system of units (SI) through the NIMT (National Metrology Institute of Thailand) via Certificate number: MW-0007-24 and MW-0065-24

### 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'



Approved signatory:

*Mr. Parinya Booncharoen*

Mr. Parinya Booncharoen  
Calibration Department Manager

REVIEW BY *Supt S.*

APPROVED BY *[Signature]*

NEXT CAL DATE: 01/ 10/ 2026



**MEASUREMENT RESULTS <sup>5</sup>**

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

$V_{std}^6$ (m/s)	Temp. wind tunnel (°C)	Temp. room (°C)	$V_{UUC}^7$ (m/s)	Error (m/s)	$U (k=2)$ (m/s)
1.014	24.70	24.50	0.8	-0.2	0.31
2.223	24.48	24.50	2.0	-0.2	0.31
3.042	24.64	24.50	2.9	-0.1	0.31
4.221	24.66	24.50	4.0	-0.2	0.31
4.95	24.52	24.50	4.9	-0.1	0.31
5.97	24.44	24.50	6.0	0.0	0.31
7.04	24.40	24.50	6.9	-0.1	0.31
7.96	24.50	24.50	7.9	0.0	0.31
9.02	24.50	24.50	9.0	-0.1	0.31
9.99	24.64	24.50	10.0	0.0	0.31
11.06	24.50	24.50	11.2	0.1	0.31
11.99	24.70	24.50	12.1	0.1	0.31
12.97	24.50	24.50	13.3	0.3	0.31
14.00	24.68	24.50	14.3	0.3	0.31
15.02	24.52	24.50	15.3	0.3	0.31
16.01	24.60	24.50	16.3	0.3	0.31

**Remark:**

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

<sup>6</sup> Velocity of standard

<sup>7</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.

Jiranatee Associates Co., Ltd  
63/14-15, 67/35-36  
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Accredited calibration laboratory  
ISO/IEC 17025:2017  
NSC-TISI-TIS 17025  
CALIBRATION 0367

Wind direction measurement laboratory  
Calibration services department.



Certificate Number

CWD-010-68

## CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

**MEASUREMENT ITEM** : Wind Direction Sensor  
**MANUFACTURER** : Novalynx  
**MODEL/TYPE** : Sensor: WS-02F  
Data logger: 110-WS-25DL-D  
**SERIAL NUMBER** : Sensor: WSD-A5662  
Data logger: A5662  
**ID NUMBER** : RYG\_FS0544  
**CONDITION AS-RECEIVED** : Used item  
**CUSTOMER** : ALS laboratory group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang,  
Khet Suan Luang, Bangkok 10250 Thailand.

**RECEIVED DATE** : 14 Mar 2025  
**MEASUREMENT DATE** : 02 Apr 2025  
**ISSUE DATE** : 02 Apr 2025

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

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

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

**CALIBRATION CONDITION** : Wind tunnel cross-section area<sup>1</sup> 900 cm<sup>2</sup>  
Wind direction frontal area<sup>2</sup> 129 cm<sup>2</sup>  
Diameter of mounting pipe<sup>3</sup> - mm  
Blockage ratio of test object<sup>4</sup> 0.143 [-]

**Preconditioning** : 24 hours at ambient conditions.  
**Measurement Condition** : The average values during measurement are (24.7)°C, (51.0) %RH and (1012.4) hPa.

### TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

- ☒ Mr. Sorawit Thachalad  
☐ Miss Jittraporn Lertsomphol



Approved signatory:

Mr. Parinya Booncharoen  
Calibration Department Manager

### Remark:

- <sup>1</sup> Nozzle 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 <sup>2</sup> to <sup>1</sup>

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	$D^{\circ}_{std}$	$D^{\circ}_{uuc}$	Error	$U (k=2)$
m/s	Degree (°)	Degree (°)	Degree (°)	Degree (°)
5.01	45.000	41	-4	0.80
	90.000	87	-3	0.80
	135.000	132	-3	0.80
	180.000	180	0	0.80
	225.000	228	3	0.80
	270.000	273	3	0.80
	315.000	318	3	0.80
	360.000	359	-1	0.80

## Remark:

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

<sup>6</sup> Direction of standard

<sup>7</sup> Direction of Unit Under Calibration

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







JIRANATEE ASSOCIATES CO.,LTD.

Jiranatee Associates Co.,Ltd  
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Web site: www.jiranatee.com

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

Temperature measurement laboratory  
Calibration services department.



## CERTIFICATE OF CALIBRATION

Certificate No. : CDT-075-68

Page 1 of 2 Pages

**MEASUREMENT ITEM** : Data Logger with Temperature sensor  
**MANUFACTURER** : Novalynx  
**MODEL/TYPE** : 110-WS-25DL-D  
**SERIAL NUMBER** : A5662  
**ID NUMBER** : RYG\_FS0544  
**CONDITION AS-RECEIVED** : Used item  
**CUSTOMER** : ALS laboratory group (thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd.,  
Khwaeng Suan Luang, Khet Suan Luang,  
Bangkok 10250 Thailand.

**RECEIVED DATE** : 14 Mar 2025  
**MEASUREMENT DATE** : 02 Apr 2025  
**ISSUE DATE** : 02 Apr 2025

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

Temperature :  $23.0 \pm 3.0$  °C  
Relative Humidity :  $55.0 \pm 15.0$  %RH

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

### TABULATION OF RESULTS:

The table on next page give the measured values.

### Calibration procedure:

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

### Traceability:

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

### Reference Used During Calibration:

1. Standard Temperature Probe  
Model: STS-100 A500, Serial No.: 667682-09
2. Digital Temperature Indicator  
Model: DTI-1000-A MK II, Serial No.: 671407-00591

### Uncertainty of Measurement:

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

### Calibrated by:

- ☐ Mr. Sorawit Thachalad  
☒ Miss Jittraporn Lertsomphol  
☐ Miss Ruangrumpai Phoommit



### Approved signatory:

Mr. Parinya Booncharoen  
Calibration Department Manager

**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.

<u>Immersion Depth</u> (mm)	<u>Standard Reading</u> (°C)	<u>UUC Reading</u> (°C)	<u>Error</u> (°C)	<u>Uncertainty</u> (°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\*\*\*







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NSC-TISI-TIS 17025  
CALIBRATION 0367



Relative humidity and Air Temperature measurement laboratory  
Calibration services department.

## CERTIFICATE OF CALIBRATION

Certificate No. : CRT-009-68

Page 1 of 2 Pages

**MEASUREMENT ITEM** : Relative humidity with data logger  
**MANUFACTURER** : Novalynx  
**MODEL/TYPE** : Data Logger: 110-WS-25DL-D  
Sensor: HMP60  
**SERIAL NUMBER** : Data Logger: A5662  
Sensor: T2320591  
**ID NUMBER** : RYG\_FS0544  
**CONDITION AS-RECEIVED** : Used item  
**CUSTOMER** : ALS laboratory group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang,  
Khet Suan Luang, Bangkok 10250 Thailand.

**RECEIVED DATE** : 14 Mar 2025  
**MEASUREMENT DATE** : 02 Apr 2025  
**ISSUE DATE** : 02 Apr 2025

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

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

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

### TABULATION OF RESULTS:

The table on next page give the measured values.

### Calibration procedure:

The Relative humidity and Air Temperature calibration was done by In-House calibration method as WI-CL-009 and WI-CL-010 according to comparison method with Standard Chilled Mirror hygrometer with Temperature sensor and standard Humidity generator chamber.

### Traceability:

The measurements are traceable to the international system of units (SI) through National Institute of Metrology Thailand (NIMT). Certificate number: TH-0146-24 and Jiranatee Associates Co., Ltd. Certificate number: CDT-026-68.

### Uncertainty of Measurement:

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



Calibrated by:

- ☐ Mr. Sorawit Thachalad  
☒ Miss Jittraporn Lertsomphol  
☐ Miss Ruangrumpai Phoommit

Approved signatory:

Mr. Parinya Booncharoen  
Calibration Department Manager

**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

<u>Air Temperature</u> (°C)	<u>Standard Reading</u> (%RH)	<u>UUC Reading</u> (%RH)	<u>Error</u> (%RH)	<u>Uncertainty</u> ±(%RH)
29.69	19.79	22.0	2.2	0.82
29.73	51.04	51.5	0.4	1.3
29.74	82.54	81.0	-1.5	2.3

**UUC\*:** Unit Under Calibration

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







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

Air speed measurement laboratory  
Calibration services department.



Certificate Number

CWS-011-68

## CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

**MEASUREMENT ITEM** : Cup anemometer  
**MANUFACTURER** : Novalynx  
**MODEL/TYPE** : Sensor: WS-02F  
Data logger: 110-WS-25DL-D  
**SERIAL NUMBER** : Sensor: WSD-A5816  
Data logger: AS816  
**ID NUMBER** : RYG\_FS0545  
**CONDITION AS-RECEIVED** : Used item  
**CUSTOMER** : ALS laboratory group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang,  
Khet Suan Luang, Bangkok 10250 Thailand.

**RECEIVED DATE** : 14 Mar 2025  
**MEASUREMENT DATE** : 02 Apr 2025  
**ISSUE DATE** : 02 Apr 2025

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

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

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

**CALIBRATION CONDITIONS** : Wind tunnel cross-section area<sup>1</sup> 900 cm<sup>2</sup>  
Cup anemometer frontal area<sup>2</sup> 100 cm<sup>2</sup>  
Diameter of mounting pipe<sup>3</sup> - mm  
Blockage ratio of test object<sup>4</sup> 0.111 [-]

**Preconditioning** : 24 hours at ambient conditions.  
**Measurement Condition** : The average values during measurement are (24.5) °C, (48.4) %RH and (1008.3) hPa.

### TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

- ☒ Mr. Sorawit Thachalad  
☐ Miss Jitraporn Lertsomphol

### Remark:

- <sup>1</sup> Nozzle 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 <sup>2</sup> to <sup>1</sup>

### Calibration procedure:

The Cup anemometer was calibrated against Standard air velocity transducer model: 8455-12 and pitot tube with precision differential pressure meter model: DPM2500 in an close test-section of Eiffel-type wind tunnel with 900 cm<sup>2</sup> cross test section area. The WI-CL-007 based on IEC 61400-12-1, Wind energy generation systems – Part 12-1: Power performance measurements of electricity producing wind turbines, March 2017 was used as a calibration guideline.

### Traceability:

This certificate provides a traceability of The measurement to recognized the national standards, and to realization of the international system of units (SI) through the NIMT (National Metrology Institute of Thailand) via Certificate number: MW-0007-24 and MW-0065-24

### 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'



Approved signatory:

Mr. Parinya Booncharoen  
Calibration Department Manager

REVIEW BY ..... .....

APPROVED BY ..... .....

NEXT CAL DATE..... 01/ 10/ 2026 .....

MEASUREMENT RESULTS <sup>5</sup>

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

$v_{std}$ <sup>6</sup> (m/s)	Temp. wind tunnel (°C)	Temp. room (°C)	$v_{uuc}$ <sup>7</sup> (m/s)	Error (m/s)	$U (k=2)$ (m/s)
1.014	24.68	24.50	0.9	-0.1	0.31
2.232	24.54	24.50	2.0	-0.2	0.31
3.042	24.66	24.50	2.9	-0.1	0.31
4.239	24.66	24.50	4.0	-0.2	0.31
4.96	24.44	24.50	5.0	0.0	0.31
5.96	24.60	24.50	5.9	-0.1	0.31
7.02	24.30	24.50	7.1	0.1	0.31
7.96	24.50	24.50	8.0	0.0	0.31
9.00	24.22	24.50	9.0	0.0	0.31
10.00	24.60	24.50	9.9	-0.1	0.31
11.00	24.30	24.50	11.1	0.1	0.31
11.97	24.60	24.50	12.0	0.0	0.31
12.95	24.40	24.50	13.1	0.1	0.31
14.00	24.60	24.50	14.0	0.0	0.39
15.01	24.40	24.50	15.0	0.0	0.39
15.99	24.48	24.50	16.2	0.2	0.32

## Remark:

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

<sup>6</sup> Velocity of standard

<sup>7</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\*\*\*







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

Wind direction measurement laboratory  
Calibration services department.



Certificate Number

CWD-011-68

## CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

**MEASUREMENT ITEM** : Wind Direction Sensor  
**MANUFACTURER** : Novalynx  
**MODEL/TYPE** : Sensor: WS-02F  
Data logger: 110-WS-25DL-D  
**SERIAL NUMBER** : Sensor: WSD-A5816  
Data logger: A5816  
**ID NUMBER** : RYG\_FS0545  
**CONDITION AS-RECEIVED** : Used item  
**CUSTOMER** : ALS laboratory group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang,  
Khet Suan Luang, Bangkok 10250 Thailand.

**RECEIVED DATE** : 14 Mar 2025  
**MEASUREMENT DATE** : 02 Apr 2025  
**ISSUE DATE** : 02 Apr 2025

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

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

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

**CALIBRATION CONDITION**

Wind tunnel cross-section area <sup>1</sup>	900	cm <sup>2</sup>
Wind direction frontal area <sup>2</sup>	129	cm <sup>2</sup>
Diameter of mounting pipe <sup>3</sup>	-	mm
Blockage ratio of test object <sup>4</sup>	0.143	[-]

**Preconditioning** : 24 hours at ambient conditions.  
**Measurement Condition** : The average values during measurement are (24.6)°C, (51.0) %RH and (1012.1) hPa.

### TABULATION OF RESULTS:

The table on next page give the measured values.

### Calibrated by:

- ☒ Mr. Sorawit Thachalad  
☐ Miss Jittraporn Lertsomphol



Approved signatory: .....

Mr. Parinya Booncharoen  
Calibration Department Manager

### Remark:

- <sup>1</sup> Nozzle 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 <sup>2</sup> to <sup>1</sup>

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 m/s	$D^{\circ}_{std}$ Degree (°)	$D^{\circ}_{uuc}$ Degree (°)	Error Degree (°)	$U (k=2)$ Degree (°)
4.99	45.000	41	-4	0.80
	90.000	87	-3	0.80
	135.000	133	-2	0.80
	180.000	181	1	0.80
	225.000	229	4	0.80
	270.000	273	3	0.80
	315.000	318	3	0.80
	360.000	359	-1	0.80

## Remark:

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

<sup>6</sup> Direction of standard

<sup>7</sup> Direction of Unit Under Calibration

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







JIRANATEE ASSOCIATES CO.,LTD.

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

Temperature measurement laboratory  
Calibration services department.



## CERTIFICATE OF CALIBRATION

Certificate No. : CDT-076-68

Page 1 of 2 Pages

**MEASUREMENT ITEM** : Data Logger with Temperature sensor  
**MANUFACTURER** : Novalynx  
**MODEL/TYPE** : 110-WS-25DL-D  
**SERIAL NUMBER** : A5816  
**ID NUMBER** : RYG\_FS0545  
**CONDITION AS-RECEIVED** : Used item  
**CUSTOMER** : ALS laboratory group (thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd.,  
Khwaeng Suan Luang, Khet Suan Luang,  
Bangkok 10250 Thailand.

**RECEIVED DATE** : 14 Mar 2025  
**MEASUREMENT DATE** : 02 Apr 2025  
**ISSUE DATE** : 02 Apr 2025

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

Temperature :  $23.0 \pm 3.0$  °C  
Relative Humidity :  $55.0 \pm 15.0$  %RH

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

### TABULATION OF RESULTS:

The table on next page give the measured values.

### Calibration procedure:

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

### Traceability:

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

### Reference Used During Calibration:

1. Standard Temperature Probe  
Model: STS-100 A500, Serial No.: 667682-09
2. Digital Temperature Indicator  
Model: DTI-1000-A MK II, Serial No.: 671407-00591

### Uncertainty of Measurement:

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

### Calibrated by:

- ☐ Mr. Sorawit Thachalad  
☒ Miss Jittrapornt Lertsomphol  
☐ Miss Ruangrumpai Phoommit



### Approved signatory:

Mr. Parinya Booncharoen  
Calibration Department Manager

**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: T2320595.  
Dimension: Diameter 12 mm. Length 80 mm.

<u>Immersion Depth</u> (mm)	<u>Standard Reading</u> (°C)	<u>UUC Reading</u> (°C)	<u>Error</u> (°C)	<u>Uncertainty</u> (°C)
80	20.074	19.6	-0.5	0.099
80	25.049	24.6	-0.4	0.099
80	30.035	29.6	-0.4	0.099
80	35.026	34.5	-0.5	0.099
80	40.014	39.5	-0.5	0.099

UUC\*: Unit Under Calibration

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







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NSC-TISI-TIS 17025  
CALIBRATION 0367



Relative humidity and Air Temperature measurement laboratory  
Calibration services department.

## CERTIFICATE OF CALIBRATION

Certificate No. : CRT-010-68

Page 1 of 2 Pages

**MEASUREMENT ITEM** : Relative humidity with data logger  
**MANUFACTURER** : Novalynx  
**MODEL/TYPE** : Data Logger: 110-WS-25DL-D  
Sensor: HMP60  
**SERIAL NUMBER** : Data Logger: A5816  
Sensor: T2320595  
**ID NUMBER** : RYG\_FS0545  
**CONDITION AS-RECEIVED** : Used item  
**CUSTOMER** : ALS laboratory group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang,  
Khet Suan Luang, Bangkok 10250 Thailand.

**RECEIVED DATE** : 14 Mar 2025  
**MEASUREMENT DATE** : 02 Apr 2025  
**ISSUE DATE** : 02 Apr 2025

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

Temperature :  $23.0 \pm 3.0$  °C  
Relative Humidity :  $55.0 \pm 15.0$  %RH

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

### TABULATION OF RESULTS:

The table on next page give the measured values.

### Calibration procedure:

The Relative humidity and Air Temperature calibration was done by In-House calibration method as WI-CL-009 and WI-CL-010 according to comparison method with Standard Chilled Mirror hygrometer with Temperature sensor and standard Humidity generator chamber.

### Traceability:

The measurements are traceable to the international system of units (SI) through National Institute of Metrology Thailand (NIMT). Certificate number: TH-0146-24 and Jiranatee Associates Co., Ltd. Certificate number: CDT-026-68.

### Uncertainty of Measurement:

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

Calibrated by:

- ☐ Mr. Sorawit Thachalad  
☒ Miss Jittraporn Lertsomphol  
☐ Miss Ruangrumpai Phoommit



Approved signatory:

Mr. Parinya Booncharoen  
Calibration Department Manager

**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

<u>Air Temperature</u> (°C)	<u>Standard Reading</u> (%RH)	<u>UUC Reading</u> (%RH)	<u>Error</u> (%RH)	<u>Uncertainty</u> ±(%RH)
29.69	19.79	21.6	1.8	0.82
29.73	51.04	50.8	-0.3	1.3
29.74	82.47	80.0	-2.5	2.3

UUC\*: Unit Under Calibration

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





Certificate Number

CWS-025-67

## CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

**MEASUREMENT ITEM** : Cup anemometer  
**MANUFACTURER** : Novalynx  
**MODEL/TYPE** : Sensor: WS-02F  
Data logger: 110-WS-25DL-D  
**SERIAL NUMBER** : Sensor: WSD-A5909  
Data logger: A5909  
**ID NUMBER** : RYG\_FS0608  
**CONDITION AS-RECEIVED** : Used item  
**CUSTOMER** : ALS laboratory group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang,  
Khet Suan Luang, Bangkok 10250 Thailand.

**RECEIVED DATE** : 08 Jul 2024  
**MEASUREMENT DATE** : 18 Jul 2024  
**ISSUE DATE** : 18 Jul 2024

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

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

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

**CALIBRATION CONDITIONS** : Wind tunnel cross-section area<sup>1</sup> 900 cm<sup>2</sup>  
Wind direction frontal area<sup>2</sup> 100 cm<sup>2</sup>  
Diameter of mounting pipe<sup>3</sup> - mm  
Blockage ratio of test object<sup>4</sup> 0.111 [-]

**Preconditioning** : 24 hours at ambient conditions.  
**Measurement Condition** : The average values during measurement are (24.5) °C, (43.4) %RH and (1006.7) hPa.

### TABULATION OF RESULTS:

The table on next page give the measured values.

### Calibrated by:

- ☒ Mr. Sorawit Thachalad  
☐ Miss Jittraporn Lertsomphol



### Remark:

- <sup>1</sup> Nozzle 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 <sup>2</sup> to <sup>1</sup>

### Calibration procedure:

The Cup anemometer was calibrated against Standard air velocity transducer model: 8455-12 and pitot tube with precision differential pressure meter model: DPM2500 in an close test-section of Eiffel-type wind tunnel with 900 cm<sup>2</sup> cross test section area. The WI-CL-007 based on IEC 61400-12-1, Wind energy generation systems – Part 12-1: Power performance measurements of electricity producing wind turbines, March 2017 was used as a calibration guideline.

### Traceability:

This certificate provides a traceability of The measurement to recognized the national standards, and to realization of the international system of units (SI) through the NIMT (National Metrology Institute of Thailand) via Certificate number: MW-0007-24 and MW-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'

REVIEW BY

Narakorn P.

APPROVED BY

Nichol

NEXT CAL. DATE

48/1/26

Approved signatory:

Mr. Parinya Booncharoen  
Calibration Department Manager

MEASUREMENT RESULTS <sup>5</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.

$v_{std}$ <sup>6</sup> (m/s)	Temp. wind tunnel (°C)	Temp. room (°C)	$v_{uuc}$ <sup>7</sup> (m/s)	Error (m/s)	$U (k=2)$ (m/s)
0.997	24.78	24.45	0.8	-0.2	0.31
2.014	24.20	24.45	1.8	-0.2	0.31
2.990	24.80	24.45	2.9	-0.1	0.31
4.102	24.80	24.45	3.8	-0.3	0.31
4.97	24.80	24.45	5.0	0.0	0.31
5.98	24.50	24.45	6.0	0.0	0.31
7.03	24.70	24.45	7.1	0.1	0.31
7.95	24.38	24.45	8.1	0.1	0.31
9.04	24.70	24.45	9.1	0.1	0.31
9.98	24.36	24.45	10.2	0.2	0.31
10.99	24.80	24.45	11.2	0.2	0.31
12.03	24.40	24.45	12.2	0.2	0.31
12.97	24.70	24.45	13.2	0.2	0.31
14.10	24.50	24.45	14.3	0.2	0.31
15.03	24.70	24.45	15.2	0.2	0.31
15.99	24.58	24.45	16.2	0.2	0.31

## Remark:

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

<sup>6</sup> Velocity of standard

<sup>7</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.





Certificate Number

CWD-025-67

## CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

**MEASUREMENT ITEM** : Wind Direction Sensor  
**MANUFACTURER** : Novalynx  
**MODEL/TYPE** : Sensor: WS-02F  
Data logger: 110-WS-25DL-D  
**SERIAL NUMBER** : Sensor: WSD-A5909  
Data logger: A5909  
**ID NUMBER** : RYG\_FS0608  
**CONDITION AS-RECEIVED** : Used item  
**CUSTOMER** : ALS laboratory group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang,  
Khet Suan Luang, Bangkok 10250 Thailand.

**RECEIVED DATE** : 08 Jul 2024  
**MEASUREMENT DATE** : 18 Jul 2024  
**ISSUE DATE** : 18 Jul 2024

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

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

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

<b>CALIBRATION CONDITION</b>	: Wind tunnel cross-section area <sup>1</sup>	900	cm <sup>2</sup>
	Wind direction frontal area <sup>2</sup>	129	cm <sup>2</sup>
	Diameter of mounting pipe <sup>3</sup>	-	mm
	Blockage ratio of test object <sup>4</sup>	0.143	[-]

**Preconditioning** : 24 hours at ambient conditions.  
**Measurement Condition** : The average values during measurement are (22.4)°C, (43.3) %RH and (1004.5) hPa.

### TABULATION OF RESULTS:

The table on next page give the measured values.

### Calibrated by:

- ☒ Mr. Sorawit Thachalad  
☐ Miss Jittraporn Lertsomphol



Approved signatory: .....

Mr. Parinya Booncharoen  
Calibration Department Manager

### Remark:

- <sup>1</sup> Nozzle 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 <sup>2</sup> to <sup>1</sup>

### Calibration procedure:

The wind direction sensor was calibrated against Standard Rotary Encoder model: AX4009TS-DM04-P3-S-U0 in an close test-section of Eiffel-type wind tunnel with 900 cm<sup>2</sup> cross test section area. The WI-CL-008 based on IEC 61400-12-1, Wind energy generation systems – Part 12-1: Power performance measurements of electricity producing wind turbines, March 2017 was used as a calibration guideline.

### Traceability:

This certificate provides a traceability of The measurement to recognized the national standards, and to realization of the international system of units (SI) through the NIMT (National Metrology Institute of Thailand) via Certificate number: DA-0036-23.

### 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'

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 m/s	$D^{\text{std}}$ Degree (°)	$D^{\text{uuc}}$ Degree (°)	Error Degree (°)	$U (k=2)$ Degree (°)
5.04	0.000	0	0	0.80
	45.000	41	-4	0.80
	90.000	87	-3	0.80
	135.000	132	-3	0.80
	180.000	178	-2	0.80
	225.000	225	0	0.80
	270.000	272	2	0.80
	315.000	319	4	0.80

## Remark:

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

<sup>6</sup> Direction of standard

<sup>7</sup> Direction of Unit Under Calibration

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







JIRANATEE ASSOCIATES CO.,LTD.

Jiranatee Associates Co.,Ltd  
63/14-15, 67/35-36  
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Bangkok 10600 (Thailand)  
Tel: +6608680812  
Mobile: +66863999453  
E-mail: jnac-calibration@jiranatee.com  
Web site: www.jiranatee.com

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

Temperature measurement laboratory  
Calibration services department.



NSC – TISI – TIS 17025  
CALIBRATION 0367

## CERTIFICATE OF CALIBRATION

Certificate No. : CDT-120-67

Page 1 of 2 Pages

MEASUREMENT ITEM : Data Logger with Temperature sensor  
MANUFACTURER : Novalynx  
MODEL/TYPE : 110-WS-25DL-D  
SERIAL NUMBER : A5909  
ID NUMBER : RYG\_FS0608  
CONDITION AS-RECEIVED : Used item  
CUSTOMER : ALS laboratory group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd.,  
Khwaeng Suan Luang, Khet Suan Luang,  
Bangkok 10250 Thailand.

RECEIVED DATE : 08 Jul 2024  
MEASUREMENT DATE : 18 Jul 2024  
ISSUE DATE : 18 Jul 2024

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

Temperature :  $23.0 \pm 3.0$  °C  
Relative Humidity :  $55.0 \pm 15.0$  %RH

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

### TABULATION OF RESULTS:

The table on next page give the measured values.

### Calibration procedure:

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

### Traceability:

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

### Reference Used During Calibration:

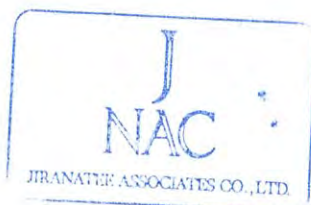
1. Standard Temperature Probe  
Model: STS-100 A500, Serial No.: 667682-09,  
Due date: 26 Mar 2025
2. Digital Temperature Indicator  
Model: DTI-1000-A MK II, Serial No.: 671407-00591 Due date: 14 Sep 2024

### Uncertainty of Measurement:

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

### Calibrated by:

- ☐ Mr. Sorawit Thachalad  
☒ Miss Jittraporn Lertsomphol  
☐ Miss Ruangrumpai Phoommit



Approved signatory: \_\_\_\_\_

Mr. Parinya Booncharoen  
Calibration Department Manager



JIRANATEE ASSOCIATES CO.,LTD.

Continuation of Certificate of Calibration Number CDT-120-67

Page 2 of 2 Pages

**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: U3641220.  
Dimension: Diameter 12 mm. Length 80 mm.

<u>Immersion Depth</u> (mm)	<u>Standard Reading</u> (°C)	<u>UUC Reading</u> (°C)	<u>Error</u> (°C)	<u>Uncertainty</u> (°C)
80	20.047	19.8	-0.2	0.099
80	25.043	24.8	-0.2	0.099
80	30.034	29.8	-0.2	0.099
80	35.028	34.8	-0.2	0.099
80	40.018	39.7	-0.3	0.16

**UUC\*:** Unit Under Calibration

**Remark:** The reported uncertainty of measurement is 0.16, based on standard uncertainty multiplied by a coverage factor k=2.21 providing a level of confidence of approximately 95%.

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







JIRANATEE ASSOCIATES CO.,LTD.

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

Relative humidity and Air Temperature measurement laboratory  
Calibration services department.

## CERTIFICATE OF CALIBRATION

Certificate No. : CRT-022-67

Page 1 of 2 Pages

**MEASUREMENT ITEM** : Relative humidity with data logger  
**MANUFACTURER** : Novalynx  
**MODEL/TYPE** : Data Logger: 110-WS-25DL-D  
Sensor: HMP60  
**SERIAL NUMBER** : Data Logger: A5909  
Sensor: U3641220  
**ID NUMBER** : RYG\_FS0608  
**CONDITION AS-RECEIVED** : Used item  
**CUSTOMER** : ALS laboratory group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang,  
Khet Suan Luang, Bangkok 10250 Thailand.

**RECEIVED DATE** : 08 Jul 2024  
**MEASUREMENT DATE** : 18 Jul 2024  
**ISSUE DATE** : 18 Jul 2024

**Calibration procedure:**

The Relative humidity and Air Temperature calibration was done by In-House calibration method as WI-CL-009 and WI-CL-010 according to comparison method with Standard Chilled Mirror hygrometer with Temperature sensor and standard Humidity generator chamber.

**Traceability:**

The measurements are traceable to the international system of units (SI) through National Institute of Metrology Thailand (NIMT). Certificate number: TH-0079-23 and through Jiranatee 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'

**ENVIRONMENTAL CONDITIONS:**

Ambient condition in the laboratory are as follow:

Temperature	: $23.0 \pm 3.0$	°C
Relative Humidity	: $55.0 \pm 15.0$	%RH

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

**TABULATION OF RESULTS:**

The table on next page give the measured values.

**Calibrated by:**

- ☐ Mr. Sorawit Thachalad  
☒ Miss Jittraporn Lertsomphol  
☐ Miss Ruangrumpai Phoommit



**Approved signatory:**

Mr. Parinya Booncharoen  
Calibration Department Manager



JIRANATEE ASSOCIATES CO.,LTD.

Continuation of Certificate of Calibration Number: CRT-022-67

Page 2 of 2 Pages

**Measurement Results:**

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

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

**Table 1:** The results of calibration of relative humidity at 30 °C are reported in table below.

**Calibration Range:** 20%RH to 80%RH

<u>Air Temperature</u> (°C)	<u>Standard Reading</u> (%RH)	<u>UUC Reading</u> (%RH)	<u>Error</u> (%RH)	<u>Uncertainty</u> ± (%RH)
29.79	19.49	17.5	-1.9	0.83
29.82	50.54	47.3	-3.3	1.3
29.81	81.68	77.1	-4.6	2.3

UUC\*: Unit Under Calibration

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







JIRANATEE ASSOCIATES CO.,LTD.

Jirantee Associates Co.,Ltd  
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ISO/IEC 17025:2017  
NSC-TISI-TIS 17025  
CALIBRATION 0367

Air speed measurement laboratory  
Calibration services department.



NSC – TISI – TIS 17025  
CALIBRATION 0367

Certificate Number

CWS-026-67

## CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

**MEASUREMENT ITEM** : Cup anemometer  
**MANUFACTURER** : Novalynx  
**MODEL/TYPE** : Sensor: WS-02F  
Data logger: 110-WS-25DL-D  
**SERIAL NUMBER** : Sensor: WSD-A5910  
Data logger: A5910  
**ID NUMBER** : RYG\_FS0609  
**CONDITION AS-RECEIVED** : Used item  
**CUSTOMER** : ALS laboratory group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang,  
Khet Suan Luang, Bangkok 10250 Thailand.

**RECEIVED DATE** : 08 Jul 2024  
**MEASUREMENT DATE** : 18 Jul 2024  
**ISSUE DATE** : 18 Jul 2024

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

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

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

**CALIBRATION CONDITIONS** : Wind tunnel cross-section area<sup>1</sup> 900 cm<sup>2</sup>  
Wind direction frontal area<sup>2</sup> 100 cm<sup>2</sup>  
Diameter of mounting pipe<sup>3</sup> - mm  
Blockage ratio of test object<sup>4</sup> 0.111 [-]

**Preconditioning** : 24 hours at ambient conditions.  
**Measurement Condition** : The average values during measurement are (23.8) °C, (44.9) %RH and (1003.3) hPa.

### TABULATION OF RESULTS:

The table on next page give the measured values.

### Calibrated by:

- ☒ Mr. Sorawit Thachalad  
☐ Miss Jittraporn Lertsomphol



Approved signatory:

Mr. Parinya Booncharoen  
Calibration Department Manager

### Calibration procedure:

The Cup anemometer was calibrated against Standard air velocity transducer model: 8455-12 and pitot tube with precision differential pressure meter model: DPM2500 in an close test-section of Eiffel-type wind tunnel with 900 cm<sup>2</sup> cross test section area. The WI-CL-007 based on IEC 61400-12-1, Wind energy generation systems – Part 12-1: Power performance measurements of electricity producing wind turbines, March 2017 was used as a calibration guideline.

### Traceability:

This certificate provides a traceability of The measurement to recognized the national standards, and to realization of the international system of units (SI) through the NIMT (National Metrology Institute of Thailand) via Certificate number: MW-0007-24 and MW-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'

REVIEW BY *Maralorn P*

APPROVED BY *Wichit Ch*

NEXT CAL. DATE 18/1/26

### Remark:

- <sup>1</sup> Nozzle 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 <sup>2</sup> to <sup>1</sup>

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>5</sup>**

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

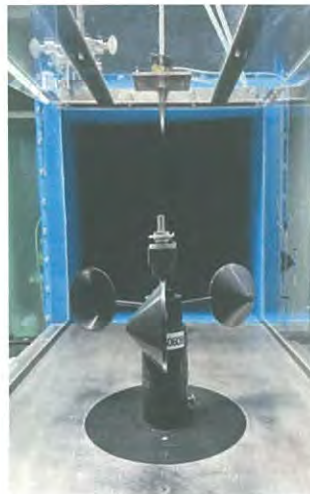
$v_{std}^6$ (m/s)	Temp. wind tunnel (°C)	Temp. room (°C)	$v_{uuc}^7$ (m/s)	Error (m/s)	$U (k=2)$ (m/s)
0.997	23.70	23.80	0.9	-0.1	0.31
2.021	23.90	23.80	1.8	-0.2	0.31
2.990	23.70	23.80	2.9	-0.1	0.31
4.094	23.70	23.80	3.8	-0.3	0.31
4.97	23.72	23.80	5.0	0.0	0.31
5.97	23.60	23.80	6.0	0.0	0.31
7.04	23.80	23.80	7.0	0.0	0.31
7.98	23.62	23.80	8.0	0.0	0.31
9.00	23.72	23.80	9.1	0.1	0.31
9.98	23.50	23.80	10.1	0.1	0.31
10.97	23.70	23.80	11.1	0.1	0.31
12.04	23.50	23.80	12.1	0.1	0.31
12.96	23.80	23.80	13.1	0.1	0.33
14.10	23.50	23.80	14.2	0.1	0.31
15.04	23.70	23.80	15.2	0.2	0.31
15.97	23.60	23.80	16.2	0.2	0.31

**Remark:**

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

<sup>6</sup> Velocity of standard

<sup>7</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\*\*\*

NAC

JIRANATEE ASSOCIATES CO., LTD.



Certificate Number

CWD-026-67

## CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

**MEASUREMENT ITEM** : Wind Direction Sensor  
**MANUFACTURER** : Novalynx  
**MODEL/TYPE** : Sensor: WS-02F  
Data logger: 110-WS-25DL-D  
**SERIAL NUMBER** : Sensor: WSD-A5910  
Data logger: A5910  
**ID NUMBER** : RYG\_FS0609  
**CONDITION AS-RECEIVED** : Used item  
**CUSTOMER** : ALS laboratory group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang,  
Khet Suan Luang, Bangkok 10250 Thailand.

**RECEIVED DATE** : 08 Jul 2024  
**MEASUREMENT DATE** : 18 Jul 2024  
**ISSUE DATE** : 18 Jul 2024

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

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

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

<b>CALIBRATION CONDITION</b>	: Wind tunnel cross-section area <sup>1</sup>	900	cm <sup>2</sup>
	Wind direction frontal area <sup>2</sup>	129	cm <sup>2</sup>
	Diameter of mounting pipe <sup>3</sup>	-	mm
	Blockage ratio of test object <sup>4</sup>	0.143	[-]

**Preconditioning** : 24 hours at ambient conditions.  
**Measurement Condition** : The average values during measurement are (22.2)°C, (47.5) %RH and (1001.7) hPa.

### TABULATION OF RESULTS:

The table on next page give the measured values.

### Calibrated by:

- ☒ Mr. Sorawit Thachalad  
☐ Miss Jittraporn Lertsomphol



Approved signatory: .....

Mr. Parinya Booncharoen  
Calibration Department Manager

### Remark:

- <sup>1</sup> Nozzle 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 <sup>2</sup> to <sup>1</sup>

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 m/s	$D^s_{std}$ Degree (°)	$D^7_{unc}$ Degree (°)	Error Degree (°)	$U (k=2)$ Degree (°)
5.04	0.000	0	0	0.80
	45.000	44	-1	0.80
	90.000	87	-3	0.80
	135.000	131	-4	0.80
	180.000	176	-4	0.80
	225.000	222	-3	0.80
	270.000	272	2	0.80
	315.000	320	5	0.80

## Remark:

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

<sup>6</sup> Direction of standard

<sup>7</sup> Direction of Unit Under Calibration

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







JIRANATEE ASSOCIATES CO.,LTD.

Jiranatee Associates Co.,Ltd  
63/14-15, 67/35-36  
Petchkasem 7,7/1, Rd.Watthapra, Bangkokyai,  
Bangkok 10600 (Thailand)  
Tel: +6608680812  
Mobile: +66863999453  
E-mail: jnac-calibration@jiranatee.com  
Web site: www.jiranatee.com

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

Temperature measurement laboratory  
Calibration services department.



## CERTIFICATE OF CALIBRATION

Certificate No. : CDT-121-67

Page 1 of 2 Pages

**MEASUREMENT ITEM** : Data Logger with Temperature sensor  
**MANUFACTURER** : Novalynx  
**MODEL/TYPE** : 110-WS-25DL-D  
**SERIAL NUMBER** : A5910  
**ID NUMBER** : RYG\_FS0609  
**CONDITION AS-RECEIVED** : Used item  
**CUSTOMER** : ALS laboratory group (thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd.,  
Khwaeng Suan Luang, Khet Suan Luang,  
Bangkok 10250 Thailand.

**RECEIVED DATE** : 08 Jul 2024  
**MEASUREMENT DATE** : 18 Jul 2024  
**ISSUE DATE** : 18 Jul 2024

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

Temperature :  $23.0 \pm 3.0$  °C  
Relative Humidity :  $55.0 \pm 15.0$  %RH

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

### TABULATION OF RESULTS:

The table on next page give the measured values.

### Calibration procedure:

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

### Traceability:

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

### Reference Used During Calibration:

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

### Uncertainty of Measurement:

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

### Calibrated by:

- ☐ Mr. Sorawit Thachalad  
☒ Miss Jittraporn Lertsomphol  
☐ Miss Ruangrumpai Phoommit



### Approved signatory:

Mr. Parinya Booncharoen  
Calibration Department Manager

**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: U3641223.  
Dimension: Diameter 12 mm. Length 80 mm.

<u>Immersion Depth</u> (mm)	<u>Standard Reading</u> (°C)	<u>UUC Reading</u> (°C)	<u>Error</u> (°C)	<u>Uncertainty</u> (°C)
80	20.047	19.6	-0.4	0.099
80	25.043	24.6	-0.4	0.099
80	30.034	29.7	-0.3	0.099
80	35.028	34.7	-0.3	0.099
80	40.018	39.5	-0.5	0.099

**UUC\*:** Unit Under Calibration

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







JIRANATEE ASSOCIATES CO.,LTD.

Jiranatee Associates Co.,Ltd  
63/14-15, 67/35-36  
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Web site: www.jiranatee.com

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

Relative humidity and Air Temperature measurement laboratory  
Calibration services department.

## CERTIFICATE OF CALIBRATION

Certificate No. : CRT-023-67

Page 1 of 2 Pages

**MEASUREMENT ITEM** : Relative humidity with data logger  
**MANUFACTURER** : Novalynx  
**MODEL/TYPE** : Data Logger: 110-WS-25DL-D  
Sensor: HMP60  
**SERIAL NUMBER** : Data Logger: A5910  
Sensor: U3641223  
**ID NUMBER** : RYG\_FS0609  
**CONDITION AS-RECEIVED** : Used item  
**CUSTOMER** : ALS laboratory group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang,  
Khet Suan Luang, Bangkok 10250 Thailand.

**RECEIVED DATE** : 08 Jul 2024  
**MEASUREMENT DATE** : 18 Jul 2024  
**ISSUE DATE** : 18 Jul 2024

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

Temperature :  $23.0 \pm 3.0$  °C  
Relative Humidity :  $55.0 \pm 15.0$  %RH

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

### TABULATION OF RESULTS:

The table on next page give the measured values.

### Calibration procedure:

The Relative humidity and Air Temperature calibration was done by In-House calibration method as WI-CL-009 and WI-CL-010 according to comparison method with Standard Chilled Mirror hygrometer with Temperature sensor and standard Humidity generator chamber.

### Traceability:

The measurements are traceable to the international system of units (SI) through National Institute of Metrology Thailand (NIMT). Certificate number: TH-0079-23 and through Jiranatee 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. Sorawit Thachalad  
☒ Miss Jittraporn Lertsomphol  
☐ Miss Ruangrumpai Phoommit



Approved signatory: .....

Mr. Parinya Booncharoen  
Calibration Department Manager



JIRANATEE ASSOCIATES CO.,LTD.

Continuation of Certificate of Calibration Number: CRT-023-67

Page 2 of 2 Pages

**Measurement Results:**

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

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

**Table 1:** The results of calibration of relative humidity at 30 °C are reported in table below.

**Calibration Range:** 20%RH to 80%RH

<u>Air Temperature</u> (°C)	<u>Standard Reading</u> (%RH)	<u>UUC Reading</u> (%RH)	<u>Error</u> (%RH)	<u>Uncertainty</u> ± (%RH)
29.79	19.50	17.7	-1.8	0.83
29.83	50.52	47.9	-2.7	1.3
29.80	81.80	78.0	-3.8	2.3

UUC\*: Unit Under Calibration

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



## Certificate of System Qualification

GC-OQ + GCMS-OQ

System ID: RYG\_EN0136  
Organization Name: ALS Laboratory Group (Thailand) Co.Ltd.  
Organization Location: 616/10, Moo 5, Tambol Mae Nam Khu, Pluak Daeng, Rayong, 21140, Thailand  
Date: July 4, 2025 10:49:05 AM  
EQP Name: AgilentRecommended , AgilentRecommended  
EQP Revision: GC.02.54, GCMS.02.54  
Overall Qualification Status: Pass



### CDS Logon Verification - GC

Logon: chonticha.khunkaew

### Overall CDS Logon Verification - GC Test Status

Pass

### System Inspection and Basic Safety and Operation

Name: 7890

Setpoint Status: Pass

### Overall System Inspection and Basic Safety and Operation Test Status

Pass

### Inlet Pressure Accuracy

Name: 7890

Front SSL

Setpoint Status: Pass

	Setpoint		Actual	
Inlet Pressure:	25.0	psi	24.9	psi
Accuracy:			0.1	psi
Agilent Recommended:			<= 1.2	

Date: July 4, 2025 10:49:05 AM  
System ID: RYG\_EN0136



**Overall Inlet Pressure Accuracy Test Status**

Pass

**GC Oven Temperature Accuracy**

Name: 7890

**Setpoint Status:** Pass

Zone: Oven

Setpoint/Actual

Temperature: 230.0 231 °C

Accuracy: 1.0 °C

Agilent Recommended:  $\geq -1.0$  % setpoint in K ( -5.0 °C ) $\leq 1.0$  % setpoint in K ( 5.0 °C )**Setpoint Status:** Pass

Zone: Oven

Setpoint/Actual

Temperature: 100.0 99.8 °C

Accuracy: -0.2 °C

Agilent Recommended:  $\geq -1.0$  % setpoint in K ( -3.7 °C ) $\leq 1.0$  % setpoint in K ( 3.7 °C )**Overall GC Oven Temperature Accuracy Test Status**

Pass

**GC Oven Temperature Stability**

Name: 7890

**Setpoint Status:** Pass

Setpoint/Average

Temperature: 100.0 99.81667 °C

Stability: 0.1 °C

Agilent Recommended:  $\leq 0.5$ **Overall GC Oven Temperature Stability Test Status**

Pass

**Log Amp**

Tested Combination1 Front SSL / External SQ

Name: 5977B

Setpoint Status: Pass

**Overall Log Amp Test Status**

Pass

**RFPA**

Tested Combination1 Front SSL / External SQ

Name: 5977B

Setpoint Status: Pass

Amu: 1050 m/z

Drift After Five Minutes:

RFPA Voltage:

7 mV

503 mV

Agilent Recommended:

&gt;= -100

and

&lt;= 100

&lt;= 1100

**Overall RFPA Test Status**

Pass

**Tune EI**

Tested Combination1 Front SSL / External SQ

Name: 5977B

Setpoint Status: Pass

Filament:

1

Setpoint Status: Pass

Filament:

2

**Overall Tune EI Test Status**

Pass

**Scouting Run**

Date: July 4, 2025 10:49:05 AM  
System ID: RYG\_EN0136

Tested Combination1 Front SSL / External SQ

Manual Injection

Name: Not applicable

Source: EI - Extractor

Setpoint Status: Completed

Injection Volume on Column: 1.0 uL

#### Overall Scouting Run Status

Completed

#### Signal to Noise EI

Tested Combination1 Front SSL / External SQ

Name: 5977B

Source: EI - Extractor Filament: 1

Setpoint Status: Pass

Signal to Noise: 1862

Agilent Recommended:  $\geq$  1200

Source: EI - Extractor Filament: 2

Setpoint Status: Pass

Signal to Noise: 1542

Agilent Recommended:  $\geq$  1200

#### Overall Signal to Noise EI Test Status

Pass



# Instrument Details

## Purpose

This section describes the as found system configuration..

## Details

### System

System ID	RYG_EN0136
Manufacturer	Agilent Technologies
Name	7890
Flow Data Input	Manual Data
Temperature Data Input	Manual Data or Other Data Logging

### Tested Combination1

Injection Technique	Manual Injection
Inlet	Front
Detector	External
LTM Included?	No

### Sampler 1

Manufacturer	Agilent Technologies
Type	Manual Injection
Usage	Sample Injection
Syringe Volume (µL)	10

### Mainframe 1

Manufacturer	Agilent Technologies
Name	7890
Model Number	G3442B
Serial Number	CN16463238
Firmware Revision	B.02.04.3
Component ID/Asset No.	081117000236
Oven Type	Standard

## Inlet 1

Manufacturer	Agilent Technologies
Name	7890
Type	SSL
Location	Front
Carrier Gas	Helium
Control Type	Electronic Pressure Control (EPC)
Purged Inlet	Yes

## Detector 1

Manufacturer	Agilent Technologies
Name	Mass Spectrometer
Type	Mass Spectrometer
Location	External

## Mass Spectrometer 1

Manufacturer	Agilent Technologies
Type	SQ
Name	5977B
Model Number	G7077B
Serial Number	US1701M008
Firmware Revision	5977 6.00.34
High Vacuum System	Turbo Pump
Scouting Run Standard	OFN Std
Component ID/Asset No.	081117000236

## MS EI Source 1

Manufacturer	Agilent Technologies
Source Type	EI - Extractor
Number of filaments	2

## Electronic Signature

### Purpose

This signature page was created and published because the ACE sign-off action was executed, which is valid for the entire document, including attachments. The ACE sign-off is an electronic signature that requires two distinct identification components: unique username and personal password. The Agilent representative who has delivered this service understands the meaning and legal status of an electronic signature. As a trained official operator, the Agilent representative has a unique password and logon to access ACE and electronically sign this document. (Other e-signatures can be applied to this document using a Document Content Management or other suitable method defined in your data access and control procedures.)

### Details

Full Name of Signer:	Eaknarin Puangsopa
Logged On User Name:	eaknarin_puangsopa@agilent.com
Signature Creation Date:	July 4, 2025
Reason for Signature:	Executed protocol and published this original version of document

### ACE Self Qualification Status

The installed version of ACE used to deliver this service passed qualification; the results conform with expected values. The self qualification summary report is available in the session folder location SDS\ClearStore\AceSelfQualification.

### Regulatory Disclaimer

This document provides a protocol to verify and record instrument configuration and evidence of proper operation. It has been prepared from our interpretation of applicable regulations as well as industry best practices. The document is designed to provide an important component of a complete compliance package. Validation depends upon many factors and use of this protocol alone does not assure compliance. Agilent Technologies makes no promises or representations as to its sufficiency for any specific regulatory program.

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User Name: eaknarin\_puangsoa

System Id: RYG\_EN0136

Report Generated by Hostname: AG-5CG22143KR

Print Date: July 4, 2025 10:49:07 AM

## ALS\_OQ\_RYG\_EN0136\_2025 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
July 3, 2025 12:07:42 PM	Audit	SessionCreated	Session	Host Name: AG-5CG22143KR, Drive Serial Number: 2A984E77
July 3, 2025 12:07:42 PM	start	Configuration	Session	None
July 3, 2025 12:07:42 PM	Audit	Entitlement	Licensing	User is FieldEngineer and does not require an unlock code
July 3, 2025 12:08:37 PM	Audit	EqpLoaded	Session	EQP details for primary technique [Gc] - File path: [ProtocolPacks/Gc/Configurat ions/02.54/Gc.02.54.eqp], EQP File Name: [Gc.02.54.eqp], EQP Name: [AgilentRecommended], Proto col Revision :[Gc.02.54] EQP details for hyphenated technique [GcMs] - File path: [ProtocolPacks/GcMs/Config urations/02.54/GcMs.02.54.e qp], EQP File Name: [GcMs.02.54.eqp], EQP Name: [AgilentRecommended]
July 3, 2025 12:08:41 PM	End	Configuration	Session	None
July 3, 2025 12:08:47 PM	start	Qualification	Session	OQ
July 3, 2025 12:08:48 PM	start	Execution	CDS Logon Verification - GC - 7890: - Qualitative test	None
July 3, 2025 12:12:14 PM	End	Execution	CDS Logon Verification - GC - 7890: - Qualitative test	Run Count.: 1

User Name: eaknarin\_puangsoa

System Id: RYG\_EN0136

Report Generated by Hostname: AG-5CG22143KR

Print Date: July 4, 2025 10:49:07 AM

## ALS\_OQ\_RYG\_EN0136\_2025 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
July 3, 2025 12:12:17 PM	start	Execution	System Inspection and Basic Safety and Operation - 7890: - Qualitative Test - No setpoints associated	None
July 3, 2025 12:12:35 PM	End	Execution	System Inspection and Basic Safety and Operation - 7890: - Qualitative Test - No setpoints associated	Run Count : 1
July 3, 2025 12:12:38 PM	start	Execution	Inlet Pressure Accuracy - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	None
July 3, 2025 12:17:02 PM	End	Execution	Inlet Pressure Accuracy - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	Run Count : 1
July 3, 2025 12:17:04 PM	start	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
July 3, 2025 12:21:01 PM	Audit	Data	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry
July 3, 2025 12:21:03 PM	End	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Run Count : 1
July 3, 2025 12:21:06 PM	start	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
July 3, 2025 12:21:22 PM	start	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None

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User Name: eaknarin\_puangsoa

System Id: RYG\_EN0136

Report Generated by Hostname: AG-SCG22143KR

Print Date: July 4, 2025 10:49:07 AM

## ALS\_OQ\_RYG\_EN0136\_2025 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
July 3, 2025 12:25:15 PM	Audit	Data	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry
July 3, 2025 12:25:17 PM	End	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Run Count : 1
July 3, 2025 12:25:19 PM	start	Execution	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	None
July 3, 2025 12:51:12 PM	Audit	Data	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Manual Data Entry
July 3, 2025 12:51:15 PM	End	Execution	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Run Count : 1
July 3, 2025 12:51:24 PM	start	Execution	Log Amp - 5977B SQ: - Source: EI - Extractor	None
July 3, 2025 1:40:17 PM	End	Execution	Log Amp - 5977B SQ: - Source: EI - Extractor	Run Count : 1
July 3, 2025 1:40:19 PM	start	Execution	RFPA - 5977B SQ: - Source: EI - Extractor	None
July 3, 2025 1:48:10 PM	End	Execution	RFPA - 5977B SQ: - Source: EI - Extractor	Run Count : 1
July 3, 2025 1:48:21 PM	start	Execution	Tune EI - 5977B SQ: - Source: - EI - Extractor Filament 1 (Qualitative - No setpoints associated)	None
July 3, 2025 2:00:38 PM	End	Execution	Tune EI - 5977B SQ: - Source: - EI - Extractor Filament 1 (Qualitative - No setpoints associated)	Run Count : 1

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User Name: eaknarin\_puangsopa

System ID: RYG\_EN0136

Report Generated by Hostname: AG-5CG22143KR

Print Date: July 4, 2025 10:49:07 AM

## ALS\_OQ\_RYG\_EN0136\_2025 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
July 3, 2025 2:00:41 PM	start	Execution	Tune EI - 5977B SQ: - Source: - None EI - Extractor Filament 2 (Qualitative - No setpoints associated)	
July 3, 2025 2:11:24 PM	End	Execution	Tune EI - 5977B SQ: - Source: - Run Count : 1 EI - Extractor Filament 2 (Qualitative - No setpoints associated)	
July 3, 2025 2:11:34 PM	start	Execution	Scouting Run - Manual Injection, Front SSL, SQ: - Source: - EI - Extractor- Part of GCMS System Preparation	None
July 3, 2025 2:11:57 PM	Audit	AceClosed	Session	None
July 4, 2025 9:11:18 AM	Audit	AceRestarted	Session	Host Name: AG-5CG22143KR, Drive Serial Number: 2A984E77
July 4, 2025 9:11:22 AM	Audit	SessionReloaded	Session	None
July 4, 2025 9:14:30 AM	start	Qualification	Session	OQ
July 4, 2025 9:14:30 AM	start	Execution	Scouting Run - Manual Injection, Front SSL, SQ: - Source: - EI - Extractor- Part of GCMS System Preparation	None
July 4, 2025 9:30:11 AM	Audit	AceRestarted	Session	Host Name: AG-5CG22143KR, Drive Serial Number: 2A984E77
July 4, 2025 9:30:13 AM	Audit	SessionReloaded	Session	None
July 4, 2025 9:33:02 AM	start	Qualification	Session	OQ
July 4, 2025 9:33:02 AM	start	Execution	Scouting Run - Manual Injection, Front SSL, SQ: - Source: - EI - Extractor- Part of GCMS System Preparation	None

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Date: July 4, 2025 10:49:05 AM  
System ID: RYG\_EN0136

User Name: eaknarin\_puangsoa

System Id: RYG\_EN0136

Report Generated by Hostname: AG-5CG22143KR

Print Date: July 4, 2025 10:49:07 AM

## ALS\_OQ\_RYG\_EN0136\_2025 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
July 4, 2025 10:06:33 AM	Audit	Data	Scouting Run - Manual Injection, Front SSL, SQ: - Source: - EI - Extractor- Part of GCMS System Preparation	Manual Data Entry
July 4, 2025 10:06:41 AM	End	Execution	Scouting Run - Manual Injection, Front SSL, SQ: - Source: - EI - Extractor- Part of GCMS System Preparation	Run Count : 1
July 4, 2025 10:06:44 AM	start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	None
July 4, 2025 10:09:12 AM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	Manual Data Entry
July 4, 2025 10:09:20 AM	End	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	Run Count : 1
July 4, 2025 10:09:25 AM	start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	None
July 4, 2025 10:11:28 AM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	Manual Data Entry
July 4, 2025 10:11:35 AM	End	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	Run Count : 1
July 4, 2025 10:11:38 AM	End	Qualification	Session	OQ

Page 5 / 6

User Name: eaknarin\_puangsoa

System Id: RYG\_EN0136

Report Generated by Hostname: AG-5CG22143KR

Print Date: July 4, 2025 10:49:07 AM

ALS\_OQ\_RYG\_EN0136\_2025 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
July 4, 2025 10:11:38 AM	start	Reporting	Session	None
July 4, 2025 10:34:26 AM	Audit	Reporting	Session	Report Generated : Certificate
July 4, 2025 10:36:02 AM	Audit	Reporting	Session	Report Generated : Report
July 4, 2025 10:39:06 AM	Audit	Reporting	Session	Report Generated : Certificate
July 4, 2025 10:40:07 AM	Audit	Reporting	Session	Report Generated : Report
July 4, 2025 10:47:04 AM	Audit	Reporting	Session	Report Generated : Certificate
July 4, 2025 10:47:40 AM	Audit	Reporting	Session	Report Generated : Report





## CONSOLE CONTROL UNIT CALIBRATION TEST REPORT

Calibration of Date : 10-Jul-25  
Next Cal. Date : 10-Jan-26

Barometric Pressure (mmHg) : 750  
Relative Humidity (%) : 40.0  
Temperature (C°) : 26.5

### Console Control Meter Data

Calibration No. : C-100125-BKK\_FS0527  
Dry Gas Meter ID : BKK\_FS0527  
Serial No. : 1508053  
Model No. : XC-572-V

### Reference Dry Gas Meter Data

Reference Dry Gas Meter ID : BKK\_FS1122  
Serial No. : A2003240  
Correction Factor (Y) : 1.0000  
Next Calibration Date : 25-Feb-26

$\Delta H$  (mm.H <sub>2</sub> O)	$\Theta$  Minutes	Reference Dry Gas Meter Calibration				Console Control ; Drygas Meter						Dry Gas Meter	Orifice
		Vr (Liters)			Tr  (°C)	Vm (Liters)			Ti  (°C)	To  (°C)	Avg.Tm  (°C)	Correction	Calibration
		Final	Initial	Total		Final	Initial	Total				Factor  (Y)	Factor  $\Delta H@$
15	12.22	150.10	0.00	150.10	29.0	967170.0	967023.0	147.00	28.0	28.0	28.0	1.0162	46.2310
25	9.25	150.10	0.00	150.10	29.0	967331.0	967184.0	147.00	28.0	28.0	28.0	1.0152	44.1493
50	6.55	150.10	0.00	150.10	28.0	967487.0	967340.0	147.00	27.0	27.0	27.0	1.0127	44.1283
80	5.11	150.10	0.00	150.10	28.0	967644.0	967498.0	146.00	28.0	28.0	28.0	1.0201	42.8303
120	4.16	149.80	0.00	149.80	28.0	967802.0	967656.0	146.00	28.0	28.0	28.0	1.0141	42.7489
											Avg.	1.0157	44.0176

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

$\Delta H@$  : Orifice pressure differential that equates to 21.24 lm of air @ 25 C and 760 mm of mercury , mmH<sub>2</sub>O ; tolerance for individual values  $\pm 5.08$  from average .

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

Calibrated by:

( Mr. Sutdamrong Chokpitinan)

RYG Field Services Scientist(2)

Approved by:

Nattapon Jiengwareewong

( Mr.Nattapol Jiengwareewong)

RYG Field Services Specialist(1)



## DIGITAL TEMPERATURE CALIBRATION DATA SHEET

Calibration Date :	10 Jul 25	Ambient Temperature (°C)	26.5
Calibration sheet No. :	C-100125-BKK_FS0527	Relative Humidity (%) :	40
Digital Temperature ID :	BKK_FS0527	Reference Temperature ID	BKK_FS1144
Serial No. :		Serial No. :	201090006013
Model :	C410FK07	Model :	Digicon-CC-VT-MS
		Next Calibrate :	5 Jan 26

Location	Reference Temperature °C	Digital Temperature °C	Error °C	MPE	Pass / Fail
Stack	0	0	0	±3	Pass
	25	25	0	±3	Pass
	50	51	1	±3	Pass
	100	102	2	±3	Pass
	150	151	1	±3	Pass
	200	200	0	±3	Pass
	250	250	0	±3	Pass
	300	300	0	±3	Pass
	500	501	1	±3	Pass
Probe	100	101	1	±3	Pass
	120	121	1	±3	Pass
	140	141	1	±3	Pass
Oven	100	101	-	±3	-
	120	121	-	±3	-
	140	141	-	±3	-
Filter	100	101	1	±3	Pass
	120	121	1	±3	Pass
	140	141	1	±3	Pass
Exit	0	-1	-1	±3	Pass
	10	8	-2	±3	Pass
	20	19	-1	±3	Pass
Meter	0	-1	-1	±3	Pass
	25	24	-1	±3	Pass
	50	48	-2	±3	Pass
AUX	0	0	0	±3	Pass
	25	25	0	±3	Pass
	50	50	0	±3	Pass

MPE : (Maximum permissible error of measurement) ค่าความผิดพลาดสูงสุดของการวัดที่ยอมรับได้

Calibrated by :

Mr. Sutdamrong Chokpitinan

RYG Field Services Scientist (2)

Approved by :

( Mr.Natthapol Jiengwareewong)

RYG Field Services Specialist (1)



## PROBE NOZZLE DIAMETER CALIBRATION DATA SHEET

Calibration Date : 10 Jul 25	Nozzle Set ID. : BKK_FS0533
Calibration Sheet No. : C-100725-BKK_FS0533	Vernier Caliper ID.: RYG_FS0539

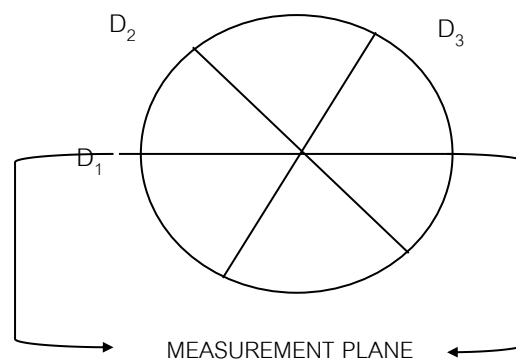
Nozzle ID #	Nozzle Diameter (cm.)			Hi - Lo	$(D_1 + D_2 + D_3) / 3$
	$D_1$	$D_2$	$D_3$	$\Delta D$	$D_{avg}$
1	0.316	0.312	0.310	0.006	0.313
2	0.480	0.475	0.474	0.006	0.476
3	0.536	0.535	0.540	0.005	0.537
4	0.631	0.622	0.635	0.013	0.629
5	0.787	0.792	0.789	0.005	0.789
6	0.948	0.949	0.951	0.003	0.949
7	1.084	1.080	1.089	0.009	1.084
8	1.268	1.266	1.264	0.004	1.266
9	1.600	1.592	1.598	0.008	1.597

Where :

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

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

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



Calibrated by : 

( Mr. Warawut Pubpa )

RYG Field Services Scientist (3)

Approved by : 

( Mr. Natthapol Jiengwareewong )

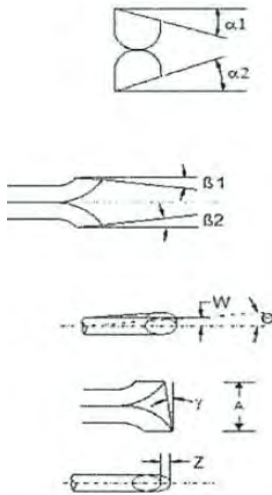
RYG Field Services Specialist (1)



## Type S Pitot Tube Calibration

**Date Calibration** 22-Oct-25  
**Pitot ID** BKK\_FS0552  
**Pitot SN** -

**Due Date** 23-Apr-26  
**Inclinometer ID** BKK\_FS1131  
**Vernier ID** BKK\_FS1405



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

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

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

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



**Certificate No:** G 680048

**Date of issue :** 27-Jan-25

**Instrument description :** Flue Gas Analyzer  
**Instrument model :** Testo 350 New  
**Instrument serial no. :** 62985047/1121  
**Control unit serial no. :** 03580098/1121  
**ID no. or control no. :** RYG\_FS0563  
**Manufacturer :** Testo SE & Co. KGaA  
**Probe description :** -  
**Probe model :** -  
**Probe serial no. :** -  
**Customer name :** ALS LABORATORY GROUP (THAILAND) CO.,LTD.  
**Customer address :** 104 Phatthanakan 40, Phatthanakan Road, Khwaeng Phatthanakan, Khet Suan Luang, Bangkok, 10250 Thailand  
**Total pages of certificate :** 2 Pages  
**Receiving no. :** L-250179  
**Receiving date. :** 22-Jan-25  
**Parameter of calibration :** Gas Calibration(Oxygen 2.50,9.984,21.02 %vol, Carbon Monoxide 80.45,302,1007 ppm) Nitrogen Dioxide 30.68,81.8,201.9 ppm, Nitric Oxide 30.0,151.5,322.5 ppm, Sulphur Dioxide 50.36,100.7,600.8 ppm)  
**Condition of UUC. :** Used  
**Ambient condition :** All of the Measurment ware caried out the stabilized labotary  
Temperature : 23 ±5 °C  
Humidity : 55 ± 15 %RH  
**Calibration place :** 17/121 Soi Ngamwongwan 47 Yaek 48, Toongsonghong, Laksi, Bangkok 10210  
**Calibration procedure no :** This instrument was calibrated by comparison with Standard gas mixture according to calibration Work Instruction no. WI-CL-28-C

REVIEW BY ..... *Supt. S.* .....

APPROVED BY ..... *[Signature]* .....

NEXT CAL DATE..... 22/ 01/ 2026 .....

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

**Date of calibration :** 22-Jan-25

*Kwanchai K.*

Mr. Kwanchai Khamdoung

**Calibration Technician**

*[Signature]*

Mrs. Nongluck Wongsettee

**Technical Manager**

**Certificate No.:** G 680048

**Standard References (Table 1)**

Standard	Certificate No.	Vendor	Due date
Oxygen ( O <sub>2</sub> ) 2.50 % Vol	2412/23	Linde	27-Aug-27
Oxygen ( O <sub>2</sub> ) 9.984 % Vol	CG-0113-24	Nimt	01-Aug-29
Oxygen ( O <sub>2</sub> ) 21.02 % Vol	CG-0041-22	Nimt	10-Feb-27
Carbon monoxide ( CO ) 80.45 ppm	CG-0132-24	Nimt	10-Sep-29
Carbon monoxide ( CO ) 302 ppm	1915/23	Linde	16-Jun-25
Carbon monoxide ( CO ) 1007 ppm	1870/24	Linde	17-Jun-26
Nitrogen Dioxide ( NO <sub>2</sub> ) 30.68 ppm	2832/24	Linde	08-Sep-26
Nitrogen Dioxide ( NO <sub>2</sub> ) 81.8 ppm	2330/24	Linde	01-Aug-26
Nitrogen Dioxide ( NO <sub>2</sub> ) 201.9 ppm	1975/23	Linde	17-Jul-25
Nitric Oxide ( NO ) 30.0 ppm	CG-0065-24	Nimt	06-May-26
Nitric Oxide ( NO ) 151.5 ppm	0161/23	Linde	22-Jan-25
Nitric Oxide ( NO ) 322.5 ppm	1974/23	Linde	17-Jul-25
Sulphur Dioxide ( SO <sub>2</sub> ) 50.36 ppm	2004/23	Linde	17-Jul-25
Sulphur Dioxide ( SO <sub>2</sub> ) 100.7 ppm	2662/24	Linde	25-Aug-26
Sulphur Dioxide ( SO <sub>2</sub> ) 600.8 ppm	2003/23	Linde	17-Jul-25

**Measured room conditions**

Temperature : 22.6 °C Humidity : 64.8 %RH Pressure : 1012.7 mbar

**Calibration conditions**

Gas Temperature : 23 °C Flow rate : 1,300 ml/min Gas pressure : 1016.3 mbar

**Calibration Results (Without adjustment) (Table 2)**

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty ( ± )
O <sub>2</sub> (%Vol)	2.50	2.47	-0.03	0.15
O <sub>2</sub> (%Vol)	9.984	9.92	-0.064	0.20
O <sub>2</sub> (%Vol)	21.02	21.12	0.10	0.30
CO (ppm)	80.45	82	1.55	3.0
CO (ppm)	302	305	3	6.0
CO (ppm)	1007	1011	4	12
NO <sub>2</sub> (ppm)	30.68	28.8	-1.88	8.0
NO <sub>2</sub> (ppm)	81.8	79.9	-1.9	8.0
NO <sub>2</sub> (ppm)	201.9	199.7	-2.2	12
NO (ppm)	30.0	31	1.0	8.0
NO (ppm)	151.5	153	1.5	8.0
NO (ppm)	322.5	324	1.5	12
SO <sub>2</sub> (ppm)	50.36	51	0.64	6.0
SO <sub>2</sub> (ppm)	100.7	102	1.3	6.0
SO <sub>2</sub> (ppm)	600.8	605	4.2	13

**Remark :** 1 cmol/mol = 1 %vol. 1 µmol/mol = 1 ppm.

**End of Report**

Accredited by

NSC-TISI-TIS 17025

Calibration 0426



## Calibration certificate

Calibration Certificate No. 25BKL0003

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

REVIEW BY

Thanitak.

APPROVED BY

D. Khunon.

NEXT CAL DATE

20/02/26

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

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

Date 06 Mar 2025

Approval of the Calibration Certificate



Mr. Chonchai Inthana

Person in charge

Kachen Lalee

Calibration object

Single range instrument

Model	MSU224S-100-DU
Serial Number	31709552
QM Ident. no   Inventory no.	RYG_EN0003   ---

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

Place of calibration

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

Calibration procedure

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

Test equipment

Test equipment type	Test equipment ID	Valid until
Thermometer	MHB-382SD s/nB011342 Traceable to SI unit through DKSH	21 Aug 2025
Test weight set OIML R111 E2	Certificate No.M2308197S ,E2(Traceable to SI unit through TCS)	23 Aug 2025



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. $T_{\text{weights}} - T_{\text{place}}$	24.7 °C   0.3 K
Measuring conditions	The installation site is suitable. The device was levelled. Balance was loaded up to Max before test.
Comments	Humidity 62.3 %RH.

Measurement results | Measurement uncertainties

Repeatability			Eccentricity	
Test load (nominal): 10 g   200 g			Test load (nominal): 100 g	
	10 g	200 g		
1	10.0000 g	200.0000 g	Center	
2	10.0000 g	200.0001 g	Front left	
3	9.9999 g	200.0000 g	Back left	
4	10.0000 g	200.0000 g	Back right	
5	10.0000 g	200.0001 g	Front right	
6	9.9999 g	200.0000 g	Maximum deviation from centric loading indication	
7	10.0000 g	200.0000 g	$ \Delta_{\text{ecc}} _{\text{max}} = 0.0001 \text{ g}$	
8	10.0000 g	200.0000 g		
9	10.0000 g	200.0000 g		
10	10.0000 g	200.0001 g		
	$s = 0.00004 \text{ g}$	$s = 0.00005 \text{ g}$		

Error of indication

Testload	Indication	Error	Expansion factor	Uncertainty	Uncertainty relative
$L$	$I$	$E$	$k$	$U(E)$	$U_{\text{rel}}(E)$
0.0100 g	0.0100 g	0.0000 g	2.00	0.00012 g	1.2 %
0.1000 g	0.1000 g	0.0000 g	2.00	0.00013 g	0.13 %
0.5000 g	0.5000 g	0.0000 g	2.00	0.00013 g	0.026 %
1.0000 g	1.0000 g	0.0000 g	2.00	0.00013 g	0.013 %
5.0000 g	5.0000 g	0.0000 g	2.00	0.00013 g	0.0026 %
10.0000 g	10.0000 g	0.0000 g	2.00	0.00013 g	0.0013 %
20.0000 g	20.0000 g	0.0000 g	2.00	0.00014 g	0.00068 %
50.0000 g	50.0000 g	0.0000 g	2.00	0.00015 g	0.00029 %
100.0000 g	100.0001 g	0.0001 g	2.00	0.00018 g	0.00018 %
200.0000 g	200.0000 g	0.0000 g	2.00	0.00028 g	0.00014 %
220.0000 g	220.0000 g	0.0000 g	2.00	0.00032 g	0.00015 %
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, V4.0. There is a 95 % probability that the value of the measurand will be in the assigned value range.

End of calibration certificate

# Uncertainty of measurement in use

Device adjusted before measurement	Yes
Temperature deviation considered	1.5 K (isoCAL active)
Temperature coefficient considered	$1 \cdot 10^{-6}/\text{K}$

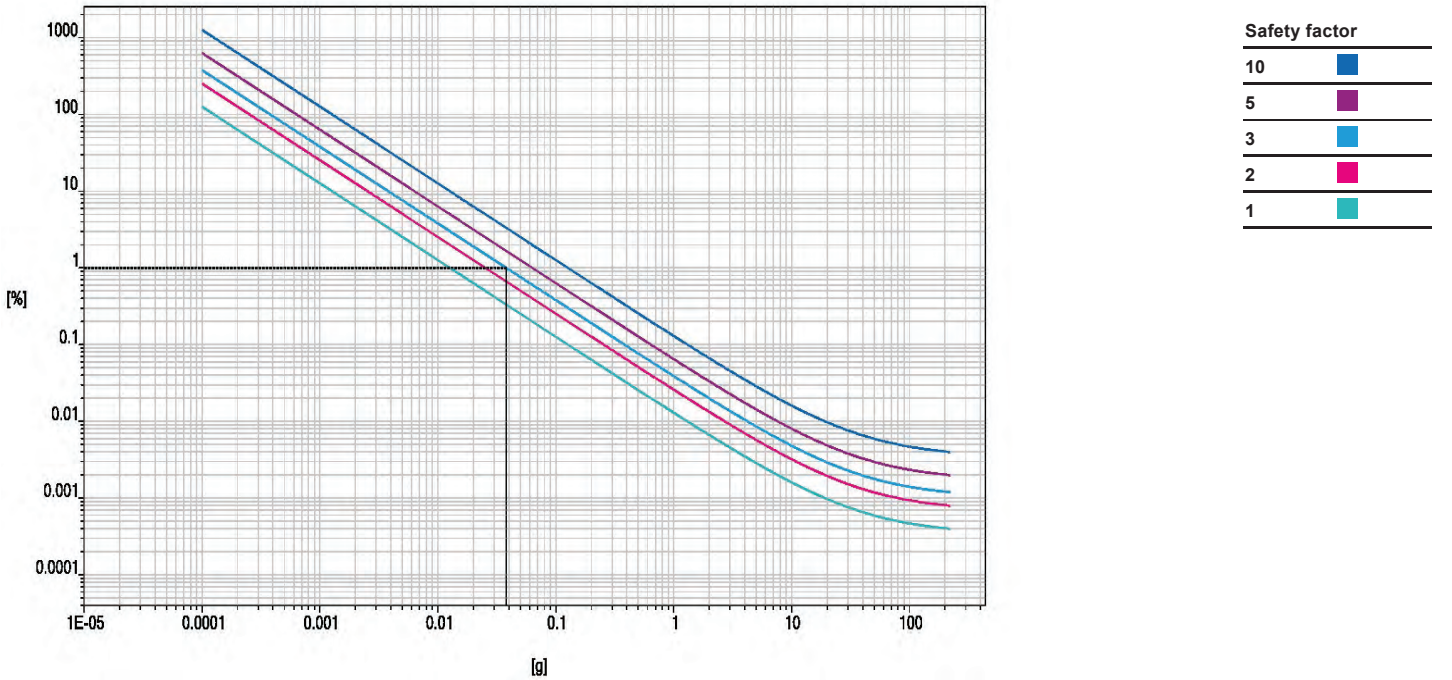
Uncertainty of the weighing result  $U_{gl}(W)$

$U_{gl}(W) = 0.00013 \text{ g} + 3.42 \cdot 10^{-6} \cdot R$

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

Indication in % from max load	Net indication $R$	Uncertainty $U_{gl}(W)$	Uncertainty relative $U_{gl}(W)_{rel}$
1 %	2.2000 g	0.00014 g	0.0063 %
25 %	55.0000 g	0.00032 g	0.00058 %
50 %	110.0000 g	0.00051 g	0.00046 %
75 %	165.0000 g	0.00069 g	0.00042 %
100 %	220.0000 g	0.00088 g	0.00040 %

Graphic realization of the relative uncertainty of measurement | process accuracy



Displayed example

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



# CALIBRATION LABORATORY Co., LTD.

2/10-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230  
Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



## CERTIFICATE OF CALIBRATION

### FOR

NOMENCLATURE : VACUUM GAUGE  
MANUFACTURER : DWYER  
MODEL / TYPE : DPGA-00  
SERIAL NO. : DVG08[BKK\_FS0483]  
CLID. NO. : 212300280  
JOB CONTROL NO. : 240819087097  
CALIBRATION SERVICE : ☒ IN-LABORATORY ☐ ON-SITE

REVIEW BY	<i>Norakorn P.</i>
APPROVED BY	<i>[Signature]</i>
NEXT CAL. DATE	20/2/26

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

DATE OF RECEIVED : 19 August 2024

DATE OF ISSUED : 22 August 2024

The report of calibration shall not be reproduced except in full without approval of the Calibration Laboratory Co., Ltd.

Calibrated By : Sittipong Pimdee  
Calibration Engineer

Approved By : Mongkol Yotsoontorn  
Authorized Signatory  
22 August 2024



This Calibration Certificate documents the traceability to national standards, which realize the units of measurement according to the International System of Units (SI)

Certificate No. Q24087097

F3-011-05/12-23

page 1 of 3



@clccalibration



## REPORT OF CALIBRATION

### FOR

NOMENCLATURE	:	VACUUM GAUGE
MANUFACTURER	:	DWYER
MODEL / TYPE	:	DPGA-00
SERIAL NO.	:	DVG08[BKK_FS0483]
DATE OF CALIBRATION	:	20 August 2024

---

#### ENVIRONMENT CONDITIONS :

Temperature :  $(23 \pm 2) ^\circ\text{C}$

Relative Humidity :  $(55 \pm 10) \% \text{RH}$

#### PROCEDURE USED :

This instrument was calibrated under procedure No. **CLC-CPPP-05** according to **DKD-R 6-1** as calibration guidelines.

The calibration was performed by direct measurement with Document Process Calibrator and Pressure Module which maintained by the Calibration Laboratory Co., Ltd.

#### REFERENCE STANDARD USED :

Document Process Calibrator, Fluke Model 741B S/N. 8295020 with Pressure Module Model 700PD5 S/N. 89404505.

#### TRACEABILITY :

The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand).  
Certificate No. MP-0040-24, Due Date 08 February 2025.

#### UNCERTAINTY :

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor of  $k = 2$ . It has been evaluated according to the "Calibration of Pressure Gauges (DKD-R 6-1)" which provides a level of confidence approximately 95%.

Certificate No. **Q24087097**

**F3-011-05/12-23**

page 2 of 3





## CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION

## MEASUREMENT RESULTS : ( X ) without adjustment ( ) adjustment

The DUC was exercised by applying a known pressure from its zero to full scale 1 times. Then 2 series of known gauge pressure were applied. The STD reading were recorded and the means value were reported in the table below.

### CALIBRATION DATA

#### CORRECTION OF PRESSURE

DUC Test point ( inHg )	STD Reading ( kPa )		Conversion to inHg		Correction ( inHg )	
	Up	Down	Up	Down	Up	Down
0.00	0.000	0.000	0.000	0.000	0.000	0.000
-10.00	-33.829	-33.833	-9.990	-9.991	+0.010	+0.009
-20.00	-67.679	-67.683	-19.986	-19.987	+0.014	+0.013
-26.00	-87.989	-87.992	-25.983	-25.984	+0.017	+0.016
-27.00	-91.381	-91.385	-26.985	-26.986	+0.015	+0.014
-28.00	-94.774	-94.774	-27.987	-27.987	+0.013	+0.013

Uncertainty of measurement  $\pm 0.053$  inHg

Transmitting fluid : Air.

Technical Note. Conversion factor 1 kPa ; 0.2953003 inHg

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 012 Page 43 of 67

**This report is valid for the above stated instrument/s only.**

### End of Certificate ###

Certificate No. Q24087097

F3-011-05/12-23

page 3 of 3





# Certificate of Calibration

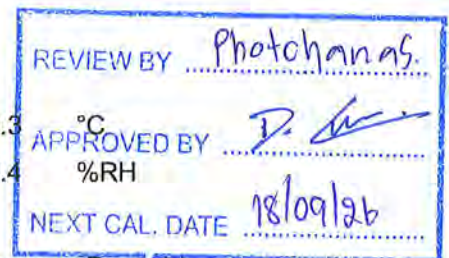
**Equipment:** SPECTROPHOTOMETER  
**Model:** DR3900  
**Serial No. (or ID.):** 2021761 (RYG\_EN0179)  
**Manufacturer:** HACH  
**Condition:** In Condition

**Certificate No.:** C06250109  
**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	24.3	°C	±	0.3	°C
Humidity	60.0	%RH	±	4.4	%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 Phooarsai

**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

The standard for Stray light Certificate No. 111585



(Mr. Preecha Phooarsai)

Person in charge



(Miss Kaewkan Suradech)

Authorized signatory

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

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

These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด

DKSH Technology Limited

2533 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพมหานคร 10260

2533 Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260

Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand



**Calibration Results:**
**Without Adjustment**

Wavelength Accuracy (nm), The spectral bandwidth of Std at 5 nm and UUC at 5 nm

Standard Wavelength	Unit Under Calibration	Correction	Uncertainty
418.40	418	0.40	0.59
537.00	536	1.00	0.59
638.00	638	0.00	0.59
747.61	748	-0.39	0.59
807.04	807	0.04	0.59

**Photometric Accuracy (Absorbance)**

Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
420 nm	0.0000	0.000	0.0000	0.0045
	0.2930	0.289	0.0040	0.0045
	0.5168	0.515	0.0018	0.0045
	1.0298	1.028	0.0018	0.0045
440 nm	0.0000	0.000	0.0000	0.0045
	0.2867	0.282	0.0047	0.0045
	0.5073	0.503	0.0043	0.0045
	1.0083	1.003	0.0053	0.0045
465 nm	0.0000	0.000	0.0000	0.0045
	0.2516	0.248	0.0036	0.0045
	0.4595	0.460	-0.0005	0.0045
	0.9334	0.935	-0.0016	0.0045
546.1 nm	0.0000	0.000	0.0000	0.0045
	0.2461	0.244	0.0021	0.0045
	0.4652	0.465	0.0002	0.0045
	0.9468	0.947	-0.0002	0.0045
590 nm	0.0000	0.000	0.0000	0.0045
	0.2594	0.257	0.0024	0.0045
	0.5040	0.503	0.0010	0.0045
	1.0032	1.001	0.0022	0.0045
635 nm	0.0000	0.000	0.0000	0.0045
	0.2579	0.256	0.0019	0.0045
	0.4971	0.496	0.0011	0.0045
	0.9720	0.971	0.0010	0.0045

**Calibration Results:****Without Adjustment****Stray light \***

Standard: cut-off	UUC: Wavelength (nm)	UUC: Transmission (%T)	Absorbance ( A)
391.44 +/- 0.11 nm	391	3.8	1.420

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

**The End of Certificate**



## ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: WO-00064379

ชนิดเครื่องมือ: SPECTROPHOTOMETER

รุ่น: DR3900

หมายเลขเครื่อง: 2021761

ตรวจสอบ (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
18 Mar 2025			18 Mar 2025		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
		General			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. ความสมบูรณ์เครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. ความสะอาด ( ช่องใส่ตัวอย่าง, ภายใน-นอกเครื่อง)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. สวิตช์ ปิด – เปิด เครื่อง (On-Off Swicth)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. ปุ่มกด (Keypad)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. หน้าจอ (Display, Screen Contrast)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
		Spectrophotometer			
<input type="checkbox"/>	<input type="checkbox"/>	6. แรงดันไฟฟ้า (Battery Backup) >= 2.5 VDC	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	7. ตัวหมุนเลือกความยาวคลื่น (Wavelength Control)	<input type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. ความยาวคลื่น (Wavelength Check)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	807nm=807.3nm
<input type="checkbox"/>	<input type="checkbox"/>	9. แหล่งกำเนิดแสง (UV < 3,000 hour)	<input type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	10. แหล่งกำเนิดแสง (Visible < 5,000 hour)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	11. ช่องวัดหลายตัวอย่าง (Carousel Module)	<input type="checkbox"/>	<input type="checkbox"/>	
		pH Meter and Conductivity Meter			
<input type="checkbox"/>	<input type="checkbox"/>	12. อิเล็กโทรด ( Electrode and Connection Cable )	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	13. ระดับสารละลายใน Electrode (Level KCl )	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	14. ฝาปิดกันปลาย Electrode (Dust Protection Hood)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	15. ขาจับอิเล็กโทรด (Stand)	<input type="checkbox"/>	<input type="checkbox"/>	
		Turbidimeter			
<input type="checkbox"/>	<input type="checkbox"/>	16. ค่าความขุ่นที่ต่ำสุด (No Sample)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	17. ระดับการส่องสว่างของแสง (>= 2.5 ไม่เกิน 3.0)	<input type="checkbox"/>	<input type="checkbox"/>	
		Automatic titrator			
<input type="checkbox"/>	<input type="checkbox"/>	18. สภาพ Piston Burettes	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	19. Function Rinsing and Dosing	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	20. ระบบท่อสายยางและอุปกรณ์ประกอบ	<input type="checkbox"/>	<input type="checkbox"/>	

เพิ่มเติม/ข้อแนะนำ :

Mr.Preecha Phooarsai

Service Engineer



## DRY GAS METER CALIBRATION TEST REPORT

Calibration of Date 10-Jul-25

Next Calibration Date 10-Jan-26

Barometric Pressure ( mm.Hg ) : 750

Relative Humidity (%) 40.0

Temperature (°C ) 26.5

### Dry Gas Meter Data

Calibration sheet No. : C-190225-BKK\_FS0534

Dry Gas Meter ID BKK\_FS0534

Serial No. 1606011

Model No. XC-62-CV

### Reference Dry Gas Meter Data

Reference Dry Gas Meter ID : BKK\_FS0629

Serial No. : 1607009

Correction Factor (Y) : 1.0000

Next Calibration Date : 10-Jan-26

Reference Dry Gas Meter Calibration				Dry Gas Meter						Dry Gas Meter
Vr (Liters)			Tr ( °C )	Vm (Liters)			Ti	To	Avg. Tm	Correction Factor ( Y )
Final	Initial	Total		Final	Initial	Total	( °C )	( °C )	( °C )	
30.00	0.00	30.00	27.0	29.19	0.00	29.19	26.0	27.0	26.5	1.0260
30.00	0.00	30.00	27.0	29.31	0.00	29.31	27.0	27.0	27.0	1.0235
60.01	0.00	60.01	27.0	58.19	0.00	58.19	27.0	27.0	27.0	1.0313
60.02	0.00	60.02	28.0	58.24	0.00	58.24	28.0	28.0	28.0	1.0306
90.00	0.00	90.00	29.0	87.42	0.00	87.42	29.0	29.0	29.0	1.0295
90.00	0.00	90.00	29.0	87.54	0.00	87.54	29.0	29.0	29.0	1.0281
									Avg.	1.0282

Y = Ratio of reading of reference dry gas meter to dry gas meter ; tolerance for individual  $\pm 0.05$  from average.

Calibrate by :

Mr. Warawut Pubpa  
RYG Field Service Scientist (3)

Approved by :

Mr.( Natthapol Jiengwareewong )  
RYG Field Service Specialist (1)



## DIGITAL TEMPERATURE CALIBRATION DATA SHEET

Calibration Date :	10 Jul 25	Ambient Temperature (°C)	26.5
Calibration sheet No. :	C-100725-BKK_FS0534	Relative Humidity (%) :	40.0

Digital Temperature ID :	BKK_FS0534	Reference Temperature ID	BKK_FS1144
Serial No. :	2251022	Serial No. :	201090006013
Model :	FM-5C	Model :	Digicon-CC-VT-MS
		Next Calibrate :	5 Jan 26

Location	Reference Temperature °C	Digital Temperature °C	Error °C	MPE	Pass / Fail
Stack	0	0	0	±3	Pass
	25	25	0	±3	Pass
	50	51	1	±3	Pass
	100	99	-1	±3	Pass
	150	148	-2	±3	Pass
	200	200	0	±3	Pass
	250	248	-2	±3	Pass
	300	298	-2	±3	Pass
	500	498	-2	±3	Pass
Probe	100	99	-1	±3	Pass
	120	120	0	±3	Pass
	140	138	-2	±3	Pass
Oven	100	-	-	-	-
	120	-	-	-	-
	140	-	-	-	-
Filter	100	99	-1	±3	Pass
	120	118	-2	±3	Pass
	140	138	-2	±3	Pass
Exit	0	0	0	±3	Pass
	10	10	0	±3	Pass
	20	20	0	±3	Pass
Meter	0	1	1	±3	Pass
	25	25	0	±3	Pass
	50	50	0	±3	Pass
AUX	0	0	0	±3	Pass
	25	25	0	±3	Pass
	50	50	0	±3	Pass

MPE : (Maximum permissible error of measurement) ค่าความผิดพลาดสูงสุดของการวัดที่ยอมรับได้

Calibrated by :

Mr. Warawut Pubpa

RYG Field Service Scientist (3)

Approved by :

( Mr.Natthapol Jiengwareewong)

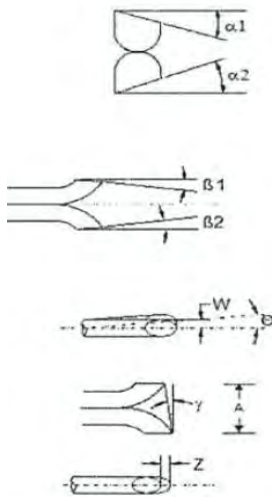
RYG Field Service Specialist (1)



## Type S Pitot Tube Calibration

**Date Calibration** 10-Jul-25  
**Pitot ID** BKK\_FS0472  
**Pitot SN**

**Due Date** 10-Jan-26  
**Inclinometer ID** BKK\_FS1131  
**Vernier ID** RYG\_FS0539



Parameter	Value	Allowable Range	Check
$\alpha 1$	0.9	$-10^{\circ} < \alpha 1 < +10^{\circ}$	OK
$\alpha 2$	3.2	$-10^{\circ} < \alpha 2 < +10^{\circ}$	OK
$\beta 1$	-2.3	$-5^{\circ} < \beta 1 < +5^{\circ}$	OK
$\beta 2$	-0.3	$-5^{\circ} < \beta 2 < +5^{\circ}$	OK
$\gamma$	1	-	-
$\theta$	1.9	-	-
$Z = A \tan \gamma$	0.016	$Z \leq 0.125"$	OK
$W = A \tan \theta$	0.030	$W \leq 0.031"$	OK
Dt	0.310	0.188" to 0.375"	OK
$A/2Dt$	1.452	$1.05 \leq PA/Dt \leq 1.5$	OK
A	0.9	$2.1Dt \leq A \leq 3Dt$	OK

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

Calibrated by :

( Mr. Warawut Pubpa )  
 RYG Field Services Scientist (3)

Approved By :

( Mr.Natthapol Jiengwareewong )  
 RYG Field Services Specialist (1)



**Certificate No:** G 680111

**Date of issue :** 19-Feb-25

**Instrument description :** Flue Gas Analyzer  
**Instrument model :** Testo 340  
**Control unit serial no. :** -  
**Instrument serial no. :** 62150585  
**ID no. or control no. :** RYG\_FS0465  
**Manufacturer :** Testo SE & Co. KGaA  
**Probe description :** -  
**Probe model :** -  
**Probe serial no. :** -  
**Customer name :** ALS LABORATORY GROUP (THAILAND) CO.,LTD.  
**Customer address :** 104 Phatthanakan 40, Phatthanakan Road, Khwaeng Phatthanakan, Khet Suan Luang, Bangkok, 10250 Thailand  
**Total pages of certificate :** 2 Pages  
**Receiving no. :** L-250514  
**Receiving date. :** 18-Feb-25  
**Parameter of calibration :** Gas Calibration(Oxygen 2.50,9.984,21.02 %vol, Carbon Monoxide 80.45,302,1007 ppm, Nitric Oxide 30.0,151.8,322.5 ppm, Sulphur Dioxide 50.36,100.7,600.8 ppm)  
**Condition of UUC. :** Used  
**Ambient condition :** All of the Measurment ware caried out the stabilized labotary  
Temperature : 23 ±5 °C  
Humidity : 55 ± 15 %RH  
**Calibration place :** 17/121 Soi Ngamwongwan 47 Yaek 48, Toongsonghong, Laksi, Bangkok 10210  
**Calibration procedure no :** This instrument was calibrated by comparison with Standard gas mixture according to calibration Work Instruction no. WI-CL-28-C

REVIEW BY *Supt S*

APPROVED BY *[Signature]*

NEXT CAL DATE...18/ 02/ 2026.....

*The calibration certificate expanded uncertainty of measurement is stated as the standard uncertainty of measurent Multiplied by coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.*

*This certificate is applied only to item under test Environmental condition.*

*This Calibration Certificate may not be reporduced other than in full except with the permission of the issuing laboratory. Calibration certificates without signature and seal not valid and The results relate only to the items tested/calibrated.*

*This calibration certificate documents are tracebility to national standards, which realize measurement according to the International System of Units (SI).*

**Date of calibration :** 19-Feb-25

*Kwanchai*

Mr. Kwanchai Khamdoug

**Calibration Technician**

*[Signature]*

Mrs. Nongluck Wongsettee

**Technical Manager**

**Certificate No.:** G 680111

**Standard References (Table 1)**

Standard	Certificate No.	Vendor	Due date
Oxygen ( O <sub>2</sub> ) 2.50 % Vol	2412/23	Linde	27-Aug-27
Oxygen ( O <sub>2</sub> ) 9.984 % Vol	CG-0113-24	Nimt	01-Aug-29
Oxygen ( O <sub>2</sub> ) 21.02 % Vol	CG-0041-22	Nimt	10-Feb-27
Carbon monoxide ( CO ) 80.45 ppm	CG-0132-24	Nimt	10-Sep-29
Carbon monoxide ( CO ) 302 ppm	1915/23	Linde	16-Jun-25
Carbon monoxide ( CO ) 1007 ppm	1870/24	Linde	17-Jun-26
Nitric Oxide ( NO ) 30.0 ppm	CG-0065-24	Nimt	06-May-26
Nitric Oxide ( NO ) 151.8 ppm	0404/25	Linde	09-Feb-27
Nitric Oxide ( NO ) 322.5 ppm	1974/23	Linde	17-Jul-25
Sulphur Dioxide ( SO <sub>2</sub> ) 50.36 ppm	2004/23	Linde	17-Jul-25
Sulphur Dioxide ( SO <sub>2</sub> ) 100.7 ppm	2662/24	Linde	25-Aug-26
Sulphur Dioxide ( SO <sub>2</sub> ) 600.8 ppm	2003/23	Linde	17-Jul-25

**Measured room conditions**

Temperature : 22.9 °C Humidity : 66.4 %RH Pressure : 1010.8 mbar

**Calibration conditions**

Gas Temperature : 23 °C Flow rate : 700 ml/min Gas pressure : 1014.5 mbar

**Calibration Results (Without adjustment) (Table 2)**

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty ( ± )
O <sub>2</sub> (%Vol)	2.50	2.44	-0.06	0.15
O <sub>2</sub> (%Vol)	9.984	9.91	-0.074	0.20
O <sub>2</sub> (%Vol)	21.02	21.13	0.11	0.30
CO (ppm)	80.45	81	0.55	3.0
CO (ppm)	302	301	-1	6.0
CO (ppm)	1007	1005	-2	12
NO (ppm)	30.0	32	2.0	8.0
NO (ppm)	151.8	154	2.2	8.0
NO (ppm)	322.5	323	0.5	12
SO <sub>2</sub> (ppm)	50.36	49	-1.36	6.0
SO <sub>2</sub> (ppm)	100.7	101	0.3	6.0
SO <sub>2</sub> (ppm)	600.8	603	2.2	13

**Remark :** 1 cmol/mol = 1 %vol, 1 µmol/mol = 1 ppm.

**End of Report**

## Certificate of Calibration

### Customer

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

Certificate No : 25-AFM-023

Request No : Req-2025-0169

### Unit Under Calibration Details

Measurement Item : Air Flow Meter

Manufacturer : Mesa Labs

Accuracy : 1% of Reading

Model : 200-510L

Sensor Model : -

Serial Number : 130027

Sensor Serial Number : -

ID : RYG\_FS0208

Instrument Status : Used

Location of Calibration : LAB 4 AIR VELOCITY METER

### Calibration Environment and Details

Temperature : 23 °C ± 3 °C

Humidity : 55 %RH ± 20 %RH

Barometric Pressure : 1013 hPa ± 10 hPa

Received Date : 21 January 2025

Calibration Date : 27 January 2025

Calibration Procedure : In-house method CP-AFM-01 by Comparison technique with Standard Primary Flow Calibrator

REVIEW BY 

APPROVED BY 

NEXT CAL DATE.....26/01/26.....

Reference Standard	Model	Serial Number	Traceble	Due Calibration
Air Flow Meter	Gilibrator 3 Low flow	18501010006	Sensidyne	6 August 2025
Air Flow Meter	Gilibrator 3 Standard flow	19031011003	Sensidyne	2 August 2025
Temperature meter	GT 11	08000057	Qreborn	1 March 2025
Pressure meter	CPG2400	41000KDU/651882	TPA	21 October 2025

### Traceability :

This Certificate is traceable to SI Unit through Sensidyne A2LA Accreditation No. 3943.01

### Note :

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

Calibration By :



Mr. Noppadon Luangart  
Service Calibration Engineer

Approved By :



Mr. Pacit Mathavorn  
Calibration Engineer Supervisor

Issue Date :

27 January 2025

Certificate No : 25-AFM-023

Request No : Req-2025-0169

**Result of Calibration : Without Adjustment**

Temperature (°C)	Pressure (kPa)	STD (cc/min)	UUC (cc/min)	Error (cc/min)	Uncertainty (cc/min)	MPE (cc/min)	Result
22.50	100.90	20	19.854	-0.1	1.3	0.2	Pass1
22.50	100.90	50	49.732	-0.3	3.3	0.5	Pass1
22.60	100.90	101	100.77	-0.2	2.8	1.0	Pass1
22.70	100.90	151	150.23	-0.8	4.2	1.5	Pass1
22.70	100.90	201	200.39	-0.6	5.6	2.0	Pass1
22.70	100.90	301	300.69	-0.3	8.4	3.0	Pass1
22.80	100.90	400	402.96	3.0	11	4.0	Pass1
23.10	100.90	500	504.62	4.6	7.2	5.0	Pass1

**Note**

STD : Standard UUC : Unit Under Calibration

- UUC Reference Condition : At atmospheric pressure and room temperature condition

- Flow Rate was corrected for non-standard operating condition by using equation :

$$Q_{\text{meas}} = Q_{\text{ref}} \times \frac{P_{\text{ref}}}{P_{\text{meas}}} \times \frac{T_{\text{meas}}}{T_{\text{ref}}}$$

where Q = Flow Rate P = Absolute Pressure T = Absolute Temperature  
 Meas = Measurement Condition ref = Standard Condition

\* Indicates non accredited

MPE = Maximum Permissible Error (Specified in Manufacturer's Specifications)

N/A = Not Available, Customer does not require a statement of conformity.



Certificate No : 25-AFM-023

Request No : Req-2025-0169

### Decision Rule for Statements of Conformity

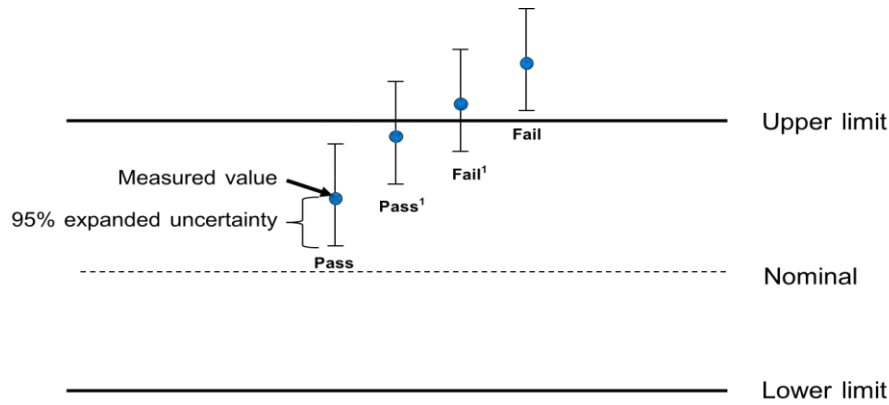
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09/2019; Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

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

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 Certificate



## Certificate of Calibration

### Customer

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

Certificate No : 25-AFM-208

Request No : Req-2025-1986

### Unit Under Calibration Details

Measurement Item : Air Flow Meter  
Manufacturer : Mesa Labs  
Model : 200-510M  
Serial Number : 151114  
ID : BKK\_FS0614  
Location of Calibration : LAB 4 AIR VELOCITY METER

Sensor Model : -  
Sensor Serial Number : -  
Instrument Status : Used

### Calibration Environment and Details

Temperature : 23 °C ± 3 °C  
Humidity : 55 %RH ± 20 %RH  
Barometric Pressure : 1013 hPa ± 10 hPa  
Received Date : 3 September 2025  
Calibration Date : 10 September 2025  
Calibration Procedure : In-house method CP-AFM-01 by Comparison technique with Standard Primary Flow Calibrator

REVIEW BY	<i>Narakon P.</i>
APPROVED BY	<i>[Signature]</i>
NEXT CAL DATE	09/09/26

Reference Standard	Model	Serial Number	Traceble	Due Calibration
Air Flow Meter	Gilibrator 3 Low flow	18501010006	Sensidyne	5 May 2026
Air Flow Meter	Gilibrator 3 Standard flow	19031011003	Sensidyne	6 May 2026
Temperature meter	GT 11	08000057	Qreborn	15 October 2025
Pressure meter	CPG2400	41000KDU/651882	TPA	21 October 2025

### Traceability :

This Certificate is traceable to SI Unit through Sensidyne A2LA Accreditation No. 3943.01 and MIT NSC-TISI-TIS Accreditation No. 0052

### Note :

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

Calibration By : *[Signature]*  
Mr. Noppadon Luangart  
Service Calibration Engineer

Approved By : *[Signature]*  
Mr. Pacit Mathavorn  
Calibration Engineer Supervisor

Issue Date : 10 September 2025

Certificate No : 25-AFM-208

Request No : Req-2025-1986

Result of Calibration : Without Adjustment

STD Reading			UUC Readingg			Error (cc/min)	Uncertainty		
Temperature (°C)	Pressure (kPa)	Flow (cc/min)	Temperature (°C)	Pressure (kPa)	Flow (cc/min)		(cc/min)	(°C)	(kPa)
25.5	100.98	100	-	-	100.02	0.0	3.6	1.0	0.50
25.7	100.97	503	-	-	500.81	-2.2	9.5	1.0	0.50
25.8	100.89	1003	-	-	1000.4	-3	19	1.0	0.50
26.1	100.88	2000	-	-	2001.9	2	38	1.0	0.50
26.5	100.85	3014	-	-	3002.2	-12	57	1.0	0.50
26.7	100.81	4027	-	-	4000.9	-26	76	1.0	0.50
27.0	100.74	5048	-	-	5001.8	-46	95	1.0	0.50

Note

STD : Standard UUC : Unit Under Calibration

- UUC Reference Condition : At atmospheric pressure and room temperature condition, Air ☐

- Flow Rate was corrected for non-standard operating condition by using equation :

$$Q_{meas} = Q_{ref} \times \frac{P_{ref}}{P_{meas}} \times \frac{T_{meas}}{T_{ref}}$$

where Q = Flow Rate P = Absolute Pressure T = Absolute Temperature

meas = Measurement Condition ref = Standard Condition

\* Indicates non accredited

End of Certificate



# Certificate of Calibration

Certificate No. C-071025-RYG\_FS0135

## Air Sampling Pump Detail

Equipment name : Personal Air Sampling Pump  
Brand : Gilian  
Model/Type : GilAir PlusEquipment ID : RYG\_FS0135  
Serial No. : 20150410011  
Calibration Date : 07-Oct-25  
Next calibration date : 07-Jan-26

## Reference Standard Low Flow Meter

Equipment name : Air Flow Meter  
Brand : MesaLabs  
Model/Type : Defender 510-LEquipment ID : RYG\_FS0208  
Serial No. : 130027  
Calibration Date : 27-Jan-25  
Due Date : 26-Jan-26

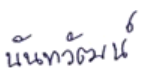
## Reference Standard High Flow Meter

Equipment name : Air Flow Meter  
Brand : MesaLabs  
Model/Type : Defender 510-MEquipment ID : BKK\_FS0614  
Serial No. : 151114  
Calibration Date : 10-Sep-25  
Due Date : 09-Sep-26

## Calibration Data

Air Sampling Pump setting (cc/min)	Reference Std. Flow Reading (cc/min)			Avg. (cc/min)	%Error acceptance	Acceptable range (cc/min)	Evaluation (Pass/ Fail)
	1	2	3				
Low Flow							
20	20.1	20.3	20.1	20.2	5%	19   -   21	Passed
50	50.5	49.8	50.7	50.3	5%	48   -   53	Passed
100	100.3	101.7	100.9	101.0	5%	95   -   105	Passed
200	203.3	204.8	204.1	204.1	5%	190   -   210	Passed
High Flow							
500	504.2	501.7	503.3	503.1	3%	485   -   515	Passed
1000	1009.7	1008.2	1005.4	1007.8	3%	970   -   1030	Passed
2000	2003.7	2001.6	2008.3	2004.5	3%	1940   -   2060	Passed
2500	2509.8	2511.3	2508.6	2509.9	3%	2425   -   2575	Passed

----- END OF REPORT -----

Calibrated By: 

( Mr. Nantawat Sarin )

RYG Field Services Scientist (1)

Issue date : 08-Oct-25

Approved By: 

( Mr. Supot Salamteh )

Field Services Section Head





# Certificate of Calibration

Certificate No. C-071025-RYG\_FS0136

## Air Sampling Pump Detail

Equipment name : Personal Air Sampling Pump  
Brand : Gilian  
Model/Type : GilAir PlusEquipment ID : RYG\_FS0136  
Serial No. : 20150410012  
Calibration Date : 07-Oct-25  
Next calibration date : 07-Jan-26

## Reference Standard Low Flow Meter

Equipment name : Air Flow Meter  
Brand : MesaLabs  
Model/Type : Defender 510-LEquipment ID : RYG\_FS0208  
Serial No. : 130027  
Calibration Date : 27-Jan-25  
Due Date : 26-Jan-26

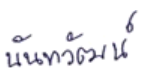
## Reference Standard High Flow Meter

Equipment name : Air Flow Meter  
Brand : MesaLabs  
Model/Type : Defender 510-MEquipment ID : BKK\_FS0614  
Serial No. : 151114  
Calibration Date : 10-Sep-25  
Due Date : 09-Sep-26

## Calibration Data

Air Sampling Pump setting (cc/min)	Reference Std. Flow Reading (cc/min)			Avg. (cc/min)	%Error acceptance	Acceptable range (cc/min)	Evaluation (Pass/ Fail)
	1	2	3				
Low Flow							
20	20.6	19.9	20.2	20.2	5%	19 - 21	Passed
50	51.2	51.7	51.5	51.5	5%	48 - 53	Passed
100	100.6	101.1	100.4	100.7	5%	95 - 105	Passed
200	201.7	201.4	202.3	201.8	5%	190 - 210	Passed
High Flow							
500	501.7	500.5	502.3	501.5	3%	485 - 515	Passed
1000	1000.1	1001.9	1002.5	1001.5	3%	970 - 1030	Passed
2000	2001.7	2004.9	2002.0	2002.9	3%	1940 - 2060	Passed
2500	2503.6	2508.3	2500.5	2504.1	3%	2425 - 2575	Passed

----- END OF REPORT -----

Calibrated By: 

( Mr. Nantawat Sarin )

RYG Field Services Scientist (1)

Issue date : 08-Oct-25

Approved By: 

( Mr. Supot Salamteh )

Field Services Section Head

Certificate of System Qualification

GC-OQ

System ID: GC-6\_CN11461066  
Organization Name: ALS Laboratory Group (Thailand) Co., Ltd.  
Organization Location: 104 Soi 40 Phatthanakan Rd,Khwang Suan Luang, Khet Suan Luang, Bangkok 10250  
Date: October 22, 2024 9:27:05 AM  
EQP Name: AgilentRecommended  
EQP Revision: GC.02.53  
Overall Qualification Status: Pass

REVIEW BY Jinda K.  
APPROVED BY Tamraton M.  
NEXT CAL. DATE 22 Apr 2026

CDS Logon Verification - GC

Logon: Saenguthai Tarak

Overall CDS Logon Verification - GC Test Status

Pass

System Inspection and Basic Safety and Operation

Name: 7890

Setpoint Status: Pass

Overall System Inspection and Basic Safety and Operation Test Status

Pass

Inlet Pressure Decay

Name: 7890  
Front                  SSL

Setpoint Status: Pass

Pressure: 25.0          psi

Pressure Change: 0.0          psi          /5 minutes

Agilent Recommended: >= -2.0          and          <= 0.5

## Overall Inlet Pressure Decay Test Status

Pass

## Inlet Pressure Accuracy

Name:

7890

Front

SSL

Setpoint Status:

Pass

Setpoint

Actual

Inlet Pressure:

25.0

psi

25.07

psi

Accuracy:

0.1

psi

Agilent Recommended:

&lt;=

1.2

## Overall Inlet Pressure Accuracy Test Status

Pass

## Inlet Pressure Decay

Name:

7890

Back

SSL

Setpoint Status:

Pass

Pressure:

25.0

psi

Pressure Change:

0.0

psi

/5 minutes

Agilent Recommended:

&gt;=

-2.0

and

&lt;=

0.5

## Overall Inlet Pressure Decay Test Status

Pass

## Inlet Pressure Accuracy

Name:

7890

Back

SSL

Date: October 22, 2024 9:27:05 AM

System ID: GC-6\_CN11461066

## Setpoint Status:

Pass

	Setpoint		Actual	
Inlet Pressure:	25.0	psi	25.06	psi
Accuracy:			0.1	psi
Agilent Recommended:		<=	1.2	

## Overall Inlet Pressure Accuracy Test Status

Pass

## Detector Flow Accuracy

Name:

7890

Front

FID

## Setpoint Status:

Pass

Flow Type:

Fuel

Setpoint:

30.0

mL/min

Measured Flow:

28.8

mL/min

Accuracy:

1.2

mL/min

Agilent Recommended:

&lt;=

10.0

% setpoint

( 3.0

ml/min

)

Limit is percentage of setpoint or 0.5 ml/minute, whichever is largest.

## Setpoint Status:

Pass

Flow Type:

Oxidizer

Setpoint:

400.0

mL/min

Measured Flow:

392

mL/min

Accuracy:

8.0

mL/min

Agilent Recommended:

&lt;=

10.0

% setpoint

( 40.0

ml/min

)

Limit is percentage of setpoint or 0.5 ml/minute, whichever is largest.

## Setpoint Status:

Pass

Flow Type:

Makeup

Setpoint:

25.0

mL/min

Measured Flow:

25.4

mL/min

Accuracy:

0.4

mL/min

Agilent Recommended:

&lt;=

10.0

% setpoint

( 2.5

ml/min

)

Limit is percentage of setpoint or 0.5 ml/minute, whichever is largest.

Date:

October 22, 2024 9:27:05 AM

System ID:

GC-6\_CN11461066



## Overall Detector Flow Accuracy Test Status

Pass

## Detector Flow Accuracy

Name:

7890

Back

FID

Setpoint Status:

Pass

Flow Type:

Fuel

Setpoint:

30.0

mL/min

Measured Flow:

30.8

mL/min

Accuracy:

0.8

mL/min

Agilent Recommended:

&lt;=

10.0

% setpoint

(

3.0

mL/min

)

Limit is percentage of setpoint or 0.5 ml/minute, whichever is largest.

Setpoint Status:

Pass

Flow Type:

Oxidizer

Setpoint:

400.0

mL/min

Measured Flow:

393

mL/min

Accuracy:

7.0

mL/min

Agilent Recommended:

&lt;=

10.0

% setpoint

(

40.0

mL/min

)

Limit is percentage of setpoint or 0.5 ml/minute, whichever is largest.

Setpoint Status:

Pass

Flow Type:

Makeup

Setpoint:

25.0

mL/min

Measured Flow:

25.2

mL/min

Accuracy:

0.2

mL/min

Agilent Recommended:

&lt;=

10.0

% setpoint

(

2.5

mL/min

)

Limit is percentage of setpoint or 0.5 ml/minute, whichever is largest.

## Overall Detector Flow Accuracy Test Status

Pass

## GC Oven Temperature Accuracy

Name:

7890

Date:

October 22, 2024 9:27:05 AM

System ID:

GC-6\_CN11461066

## Setpoint Status:

Pass

Zone:

Oven

Setpoint/Actual

Temperature:

230.0 230.3 °C

Accuracy:

0.3 °C

Agilent Recommended:

>=	-1.0	% setpoint in K	(	-5.0	°C	)
<=	1.0	% setpoint in K	(	5.0	°C	)

## Setpoint Status:

Pass

Zone:

Oven

Setpoint/Actual

Temperature:

100.0 100.0 °C

Accuracy:

0.0 °C

Agilent Recommended:

>=	-1.0	% setpoint in K	(	-3.7	°C	)
<=	1.0	% setpoint in K	(	3.7	°C	)

## Overall GC Oven Temperature Accuracy Test Status

Pass

## GC Oven Temperature Stability

Name:

7890

## Setpoint Status:

Pass

Setpoint/Average

Temperature:

100.0 100.0167 °C

Stability:

0.1 °C

Agilent Recommended:

<=	0.5
----	-----

## Overall GC Oven Temperature Stability Test Status

Pass

## Scouting Run

Tested Combination1

Front

SSL

/ Front

FID

Injection Tower

Name:

7693A

Date:

October 22, 2024 9:27:05 AM

System ID:

GC-6\_CN11461066

Setpoint Status:

Completed

Injection Volume on Column:

1.0

uL

Overall Scouting Run Status

Completed

## Noise and Drift

Tested Combination1

Front

SSL

/ Front

FID

Name:

7890

Setpoint Status:

Pass

Base Signal:

14.05

pA

ASTM Noise

pA

0.05

&lt;= 0.10

Drift

pA/Hr

0.03

&lt;= 2.50

Agilent Recommended:

Status:

Pass

Pass

## Overall Noise and Drift Test Status

Pass

## Injection Precision

Tested Combination1

Front

SSL

/ Front

FID

Name:

7693A

Setpoint Status:

Pass

Injection Volume on Column:

1.0

uL

Area RSD:

0.30

%

Retention Time RSD:

0.63

%

Agilent Recommended:

&lt;= 3.00

&lt;= 1.00

## Overall Injection Precision Test Status

Pass

## Signal to Noise

Date:

October 22, 2024 9:27:05 AM

System ID:

GC-6\_CN11461066

Tested Combination1	Front	SSL	/ Front	FID
Injection Tower				
Name:	7890			
Setpoint Status:	Pass			
Signal to Noise:	11078525			
Agilent Recommended:	>= 300000			

Overall Signal to Noise Test Status

Pass

Scouting Run

Tested Combination2	Back	SSL	/ Back	FID
Injection Tower				
Name:	7693A			
Setpoint Status:	Completed			
Injection Volume on Column:	1.0 uL			

Overall Scouting Run Status

Completed

Noise and Drift

Tested Combination2	Back	SSL	/ Back	FID
Name:	7890			
Setpoint Status:	Pass			
Base Signal:	13.79 pA			
Agilent Recommended:	ASTM Noise		Drift	
	pA		pA/Hr	
	0.05		0.01	
	<= 0.10		<= 2.50	
Status:	Pass		Pass	



## Overall Noise and Drift Test Status

Pass

## Injection Precision

Tested Combination2

Back

SSL

/ Back

FID

Name:

7693A

Setpoint Status:

Pass

Injection Volume on Column:

1.0

uL

Area RSD:

1.06

%

Retention Time RSD:

0.93

%

Agilent Recommended:

&lt;=

3.00

&lt;=

1.00

## Overall Injection Precision Test Status

Pass

## Signal to Noise

Tested Combination2

Back

SSL

/ Back

FID

Injection Tower

Name:

7890

Setpoint Status:

Pass

Signal to Noise:

1771221

Agilent Recommended:

&gt;=

300000

## Overall Signal to Noise Test Status

Pass

## Instrument Details

### Purpose

This section describes the as found system configuration.

### Details

#### System

System ID	GC-6_CN11461066
Manufacturer	Agilent Technologies
Name	7890
Flow Data Input	Manual Data
Temperature Data Input	Manual Data or Other Data Logging

#### Tested Combination1

Injection Technique	Injection Tower
Sampler Identifier	Sampler 1
Inlet	Front
Detector	Front
LTM Included?	No

#### Tested Combination2

Injection Technique	Injection Tower
Sampler Identifier	Sampler 2
Inlet	Back
Detector	Back
LTM Included?	No

#### Sampler 1

Manufacturer	Agilent Technologies
Type	Injection Tower
Name	7693A
Model Number	G4513A
Serial Number	CNCN10340103
Firmware Revision	A.11.06
Usage	Sample Injection
Location	Front
Syringe Volume (µL)	10

## Sampler 2

Manufacturer	Agilent Technologies
Type	Injection Tower
Name	7693A
Model Number	G4513A
Serial Number	CN16280128
Firmware Revision	A.11.06
Usage	Sample Injection
Location	Back
Syringe Volume (µL)	10

## Sampler 3

Manufacturer	Agilent Technologies
Type	Tray
Name	7693A
Model Number	G4514A
Serial Number	CN15380030
Firmware Revision	A.11.03
Vial Heater	Not installed

## Mainframe 1

Manufacturer	Agilent Technologies
Name	7890
Model Number	G3440A
Serial Number	CN11461066
Firmware Revision	A.01.16
Oven Type	Standard

## Inlet 1

Manufacturer	Agilent Technologies
Name	7890
Type	SSL
Location	Front
Carrier Gas	Helium
Control Type	Electronic Pressure Control (EPC)
Purged Inlet	Yes

## Inlet 2

Manufacturer	Agilent Technologies
Name	7890
Type	SSL
Location	Back
Carrier Gas	Helium
Control Type	Electronic Pressure Control (EPC)
Purged Inlet	Yes

## Detector 1

Manufacturer	Agilent Technologies
Name	7890
Type	FID
Adapter	Capillary
Control Type	Electronic Pressure Control (EPC)
Location	Front
Makeup Gas	Nitrogen

## Detector 2

Manufacturer	Agilent Technologies
Name	7890
Type	FID
Adapter	Capillary
Control Type	Electronic Pressure Control (EPC)
Location	Back
Makeup Gas	Nitrogen



# Electronic Signature

## Purpose

This signature page was created and published because the ACE sign-off action was executed, which is valid for the entire document, including attachments. The ACE sign-off is an electronic signature that requires two distinct identification components: unique username and personal password. The Agilent representative who has delivered this service understands the meaning and legal status of an electronic signature. As a trained official operator, the Agilent representative has a unique password and logon to access ACE and electronically sign this document. (Other e-signatures can be applied to this document using a Document Content Management or other suitable method defined in your data access and control procedures.)

## Details

Full Name of Signer:	Saenguthai Tarak
Logged On User Name:	saenguthai.tarak@non.agilent.com
Signature Creation Date:	October 22, 2024
Reason for Signature:	Executed protocol and published this original version of document

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User Name: saenguthai.tarak

System Id: GC-6\_CN11461066

Report Generated by Hostname: LAPTOP-CQ3SKOMV

Print Date: October 22, 2024 9:27:06 AM

## 2024\_ALS\_GC-6\_CN11461066\_OQHW Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 21, 2024 3:16:06 PM	Audit	SessionCreated	Session	None
October 21, 2024 3:16:07 PM	Start	Configuration	Session	None
October 21, 2024 3:16:07 PM	Audit	Entitlement	Licensing	User is Nonpaying and does not require an unlock code
October 21, 2024 3:22:40 PM	Audit	EqpLoaded	Session	EQP details for primary technique [Gc] - File path: [ProtocolPacks/Gc/Configurations/02.53/Gc.02.53.eqp], EQP File Name: [Gc.02.53.eqp], EQP Name: [AgilentRecommended], Protocol Revision :[Gc.02.53]
October 21, 2024 3:22:44 PM	End	Configuration	Session	None
October 21, 2024 3:22:47 PM	Start	Qualification	Session	OQ
October 21, 2024 3:22:48 PM	Start	Execution	CDS Logon Verification - GC - 7890: - Qualitative test	None
October 21, 2024 3:23:35 PM	End	Execution	CDS Logon Verification - GC - 7890: - Qualitative test	Run Count : 1
October 21, 2024 3:23:45 PM	Start	Execution	System Inspection and Basic Safety and Operation - 7890: - Qualitative Test - No setpoints associated	None
October 21, 2024 3:23:59 PM	End	Execution	System Inspection and Basic Safety and Operation - 7890: - Qualitative Test - No setpoints associated	Run Count : 1

User Name: saenguthai.tarak  
Report Generated by Hostname: LAPTOP-CO3SKOMV

System Id: GC-6\_CN11461066  
Print Date: October 22, 2024 9:27:06 AM

## 2024\_ALS\_GC-6\_CN11461066\_OQHW Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 21, 2024 3:24:01 PM	Start	Execution	Inlet Pressure Decay - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi	None
October 21, 2024 3:25:26 PM	End	Execution	Inlet Pressure Decay - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi	Run Count : 1
October 21, 2024 3:25:28 PM	Start	Execution	Inlet Pressure Accuracy - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	None
October 21, 2024 3:25:32 PM	End	Execution	Inlet Pressure Accuracy - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	Run Count : 1
October 21, 2024 3:25:50 PM	Start	Execution	Inlet Pressure Decay - Back SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi	None
October 21, 2024 3:26:01 PM	End	Execution	Inlet Pressure Decay - Back SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi	Run Count : 1
October 21, 2024 3:26:05 PM	Start	Execution	Inlet Pressure Accuracy - Back SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	None
October 21, 2024 3:26:10 PM	End	Execution	Inlet Pressure Accuracy - Back SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	Run Count : 1
October 21, 2024 3:26:12 PM	Start	Execution	Detector Flow Accuracy - Front FID: - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	None

User Name: saenguthai.tarak

System Id: GC-6\_CN11461066

Report Generated by Hostname: LAPTOP-CQ3SKOMV

Print Date: October 22, 2024 9:27:06 AM

## 2024\_ALS\_GC-6\_CN11461066\_OQHW Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 21, 2024 3:26:50 PM	Audit	Data	Detector Flow Accuracy - Front FID: - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
October 21, 2024 3:26:53 PM	End	Execution	Detector Flow Accuracy - Front FID: - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
October 21, 2024 3:26:54 PM	Start	Execution	Detector Flow Accuracy - Front FID: - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	None
October 21, 2024 3:27:10 PM	Audit	Data	Detector Flow Accuracy - Front FID: - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
October 21, 2024 3:27:13 PM	End	Execution	Detector Flow Accuracy - Front FID: - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
October 21, 2024 3:29:11 PM	Start	Execution	Detector Flow Accuracy - Front FID: - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	None
October 21, 2024 3:29:27 PM	Audit	Data	Detector Flow Accuracy - Front FID: - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
October 21, 2024 3:29:29 PM	End	Execution	Detector Flow Accuracy - Front FID: - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
October 21, 2024 3:29:30 PM	Start	Execution	Detector Flow Accuracy - Back FID: - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	None
October 21, 2024 3:29:47 PM	Audit	Data	Detector Flow Accuracy - Back FID: - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
October 21, 2024 3:29:52 PM	End	Execution	Detector Flow Accuracy - Back FID: - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	Run Count : 1

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User Name: saenguthai.tarak  
Report Generated by Hostname: LAPTOP-CQ3SKOMV

System Id: GC-6\_CN11461066  
Print Date: October 22, 2024 9:27:06 AM

## 2024\_ALS\_GC-6\_CN11461066\_OQHW Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 21, 2024 3:29:54 PM	Start	Execution	Detector Flow Accuracy - Back FID: - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	None
October 21, 2024 3:30:07 PM	Audit	Data	Detector Flow Accuracy - Back FID: - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
October 21, 2024 3:30:09 PM	End	Execution	Detector Flow Accuracy - Back FID: - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
October 21, 2024 3:30:11 PM	Start	Execution	Detector Flow Accuracy - Back FID: - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	None
October 21, 2024 3:30:34 PM	Audit	Data	Detector Flow Accuracy - Back FID: - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
October 21, 2024 3:30:37 PM	End	Execution	Detector Flow Accuracy - Back FID: - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
October 21, 2024 3:30:38 PM	Start	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
October 21, 2024 3:31:55 PM	Audit	Data	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry
October 21, 2024 3:31:57 PM	End	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Run Count : 1

User Name: saenguthai.tarak

System Id: GC-6\_CN11461066

Report Generated by Hostname: LAPTOP-CQ3SKOMV

Print Date: October 22, 2024 9:27:06 AM

## 2024\_ALS\_GC-6\_CN11461066\_OQHW Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 21, 2024 3:31:59 PM	Start	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
October 21, 2024 3:34:37 PM	Audit	Data	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry
October 21, 2024 3:34:39 PM	End	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Run Count : 1
October 21, 2024 3:34:42 PM	Start	Execution	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	None
October 21, 2024 3:39:05 PM	Audit	Data	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Manual Data Entry
October 21, 2024 3:39:07 PM	End	Execution	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Run Count : 1
October 21, 2024 3:39:33 PM	Start	Execution	GC Scouting Run - Injection Tower, Front SSL, Front FID: - Part of System Preparation - No limits associated	None
October 21, 2024 3:40:12 PM	Audit	AceClosed	Session	None
October 22, 2024 8:55:47 AM	Audit	AceRestarted	Session	None
October 22, 2024 8:55:50 AM	Audit	SessionReloaded	Session	None
October 22, 2024 8:56:02 AM	Start	Qualification	Session	OQ

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User Name: saenguthai.tarak

System Id: GC-6\_CN11461066

Report Generated by Hostname: LAPTOP-CQ3SKOMV

Print Date: October 22, 2024 9:27:06 AM

## 2024\_ALS\_GC-6\_CN11461066\_OQHW Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 22, 2024 8:56:02 AM	Start	Execution	GC Scouting Run - Injection Tower, Front SSL, Front FID: - Part of System Preparation - No limits associated	None
October 22, 2024 8:56:46 AM	Audit	Data	GC Scouting Run - Injection Tower, Front SSL, Front FID: - Part of System Preparation - No limits associated	Data files Path : G:\Data\Front\Front_SC10.D\ FID1A.ch
October 22, 2024 8:57:25 AM	End	Execution	GC Scouting Run - Injection Tower, Front SSL, Front FID: - Part of System Preparation - No limits associated	Run Count : 1
October 22, 2024 8:57:39 AM	Start	Execution	Noise and Drift - Front FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	None
October 22, 2024 8:58:03 AM	Audit	Data	Noise and Drift - Front FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	Data files Path : G:\Data\Front\Front_ND10.D\ FID1A.ch
October 22, 2024 8:58:37 AM	End	Execution	Noise and Drift - Front FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	Run Count : 1
October 22, 2024 8:58:40 AM	Start	Execution	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	None
October 22, 2024 8:59:06 AM	Audit	Data	DataManager	DataManager was in a data verification state but the user chose to start over

User Name: saenguthai.tarak

System Id: GC-6\_CN11461066

Report Generated by Hostname: LAPTOP-CQ3SKOMV

Print Date: October 22, 2024 9:27:06 AM

## 2024\_ALS\_GC-6\_CN11461066\_OQHW Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 22, 2024 9:01:43 AM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : G:\Data\Front\Front_IP0105.D\FID1A.ch
October 22, 2024 9:01:43 AM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : G:\Data\Front\Front_IP0106.D\FID1A.ch
October 22, 2024 9:01:43 AM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : G:\Data\Front\Front_IP0107.D\FID1A.ch
October 22, 2024 9:01:43 AM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : G:\Data\Front\Front_IP0108.D\FID1A.ch
October 22, 2024 9:01:43 AM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : G:\Data\Front\Front_IP0109.D\FID1A.ch
October 22, 2024 9:01:43 AM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : G:\Data\Front\Front_IP0110.D\FID1A.ch
October 22, 2024 9:02:11 AM	End	Execution	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Run Count : 1
October 22, 2024 9:02:16 AM	Start	Execution	Signal to Noise - Injection Tower, Front SSL, Front FID: - Detector FID - L: >= 300000	None
October 22, 2024 9:02:34 AM	Audit	Data	Signal to Noise - Injection Tower, Front SSL, Front FID: - Detector FID - L: >= 300000	Data files Path : G:\Data\Front\Front_SN01.D\FID1A.ch

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User Name: saenguthai.tarak

System Id: GC-6\_CN11461066

Report Generated by Hostname: LAPTOP-CQ3SKOMV

Print Date: October 22, 2024 9:27:06 AM

## 2024\_ALS\_GC-6\_CN11461066\_OQHW Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 22, 2024 9:02:54 AM	End	Execution	Signal to Noise - Injection Tower, Front SSL, Front FID: - Detector FID - L: $\geq 300000$	Run Count : 1
October 22, 2024 9:03:00 AM	Start	Execution	GC Scouting Run - Injection Tower, Back SSL, Back FID: - Part of System Preparation - No limits associated	None
October 22, 2024 9:03:31 AM	Audit	Data	GC Scouting Run - Injection Tower, Back SSL, Back FID: - Part of System Preparation - No limits associated	Data files Path : G:\Data\Back\Back_SC01.D\ FID2B.ch
October 22, 2024 9:04:03 AM	End	Execution	GC Scouting Run - Injection Tower, Back SSL, Back FID: - Part of System Preparation - No limits associated	Run Count : 1
October 22, 2024 9:04:06 AM	Start	Execution	Noise and Drift - Back FID: - Detector FID - L (Noise): $\leq$ 0.10 pA - L (Drift): $\leq 2.50$ pA/hour	None
October 22, 2024 9:08:56 AM	Audit	Data	Noise and Drift - Back FID: - Detector FID - L (Noise): $\leq$ 0.10 pA - L (Drift): $\leq 2.50$ pA/hour	Data files Path : G:\Data\Back\Back_ND013.D FID2B.ch
October 22, 2024 9:09:13 AM	End	Execution	Noise and Drift - Back FID: - Detector FID - L (Noise): $\leq$ 0.10 pA - L (Drift): $\leq 2.50$ pA/hour	Run Count : 1
October 22, 2024 9:09:26 AM	Start	Execution	Injection Precision - Injection Tower, Back SSL, Back FID: - GC - L (Area): $\leq 3.00\%$ - L (Ret. Time): $\leq 1.00\%$	None



User Name: saenguthai.tarak

System Id: GC-6\_CN11461066

Report Generated by Hostname: LAPTOP-CQ3SKOMV

Print Date: October 22, 2024 9:27:06 AM

## 2024\_ALS\_GC-6\_CN11461066\_OQHW Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 22, 2024 9:10:44 AM	Audit	Data	Injection Precision - Injection Tower, Back SSL, Back FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : G:\Data\Back\Back_IP0111.D \FID2B.ch
October 22, 2024 9:10:44 AM	Audit	Data	Injection Precision - Injection Tower, Back SSL, Back FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : G:\Data\Back\Back_IP0112.D \FID2B.ch
October 22, 2024 9:10:44 AM	Audit	Data	Injection Precision - Injection Tower, Back SSL, Back FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : G:\Data\Back\Back_IP0113.D \FID2B.ch
October 22, 2024 9:10:44 AM	Audit	Data	Injection Precision - Injection Tower, Back SSL, Back FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : G:\Data\Back\Back_IP0114.D \FID2B.ch
October 22, 2024 9:10:44 AM	Audit	Data	Injection Precision - Injection Tower, Back SSL, Back FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : G:\Data\Back\Back_IP0115.D \FID2B.ch
October 22, 2024 9:10:44 AM	Audit	Data	Injection Precision - Injection Tower, Back SSL, Back FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : G:\Data\Back\Back_IP0116.D \FID2B.ch
October 22, 2024 9:11:15 AM	End	Execution	Injection Precision - Injection Tower, Back SSL, Back FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Run Count : 1
October 22, 2024 9:11:23 AM	Start	Execution	Signal to Noise - Injection Tower, Back SSL, Back FID: - Detector FID - L: >= 300000	None
October 22, 2024 9:11:45 AM	Audit	Data	Signal to Noise - Injection Tower, Back SSL, Back FID: - Detector FID - L: >= 300000	Data files Path : G:\Data\Back\Back_SN01.D \FID2B.ch

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User Name: saenguthai.tarak

System Id: GC-6\_CN11461066

Report Generated by Hostname: LAPTOP-CQ3SKOMV

Print Date: October 22, 2024 9:27:06 AM

## 2024\_ALS\_GC-6\_CN11461066\_OQHW Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 22, 2024 9:12:08 AM	End	Execution	Signal to Noise - Injection Tower, Back SSL, Back FID: - Detector FID - L: >= 300000	Run Count : 1
October 22, 2024 9:12:15 AM	End	Qualification	Session	OQ
October 22, 2024 9:12:15 AM	Start	Reporting	Session	None
October 22, 2024 9:24:09 AM	Audit	Reporting	Session	Report Generated : Certificate
October 22, 2024 9:25:56 AM	Audit	Reporting	Session	Report Generated : Report

Certificate of System Qualification

GC-OQ + GCMS-OQ

System ID: GM-12  
Organization Name: ALS Laboratory Groups (Thailand) Co Ltd.  
Organization Location: 104 Phattanakan 40 Phattanakan Rd Bangkok 10250  
  
Date: May 9, 2025 3:29:14 PM  
EQP Name: AgilentRecommended , AgilentRecommended  
  
EQP Revision: GC.02.53, GCMS.02.54  
Overall Qualification Status: Pass

REVIEW BY Suchada T.  
APPROVED BY Tanyatorn M.  
NEXT CAL. DATE 9 May 26

CDS Logon Verification - GC

Logon: asbkk.env03

Overall CDS Logon Verification - GC Test Status

Pass

System Inspection and Basic Safety and Operation

Name: 8890  
Setpoint Status: Pass

Overall System Inspection and Basic Safety and Operation Test Status

Pass

Inlet Pressure Accuracy

Name: 8890  
Front                      SSL

Setpoint Status: Pass

	Setpoint		Actual	
Inlet Pressure:	25.0	psi	24.8	psi
Accuracy:			0.2	psi
Agilent Recommended:			<= 1.2	

Overall Inlet Pressure Accuracy Test Status

Pass

GC Oven Temperature Accuracy

Name: 8890

Setpoint Status: Pass

Zone: Oven

Setpoint/Actual

Temperature: 230.0 230.1 °C

Accuracy: 0.1 °C

Agilent Recommended: >= -1.0 % setpoint in K ( -5.0 °C )

<= 1.0 % setpoint in K ( 5.0 °C )

Setpoint Status: Pass

Zone: Oven

Setpoint/Actual

Temperature: 100.0 100.1 °C

Accuracy: 0.1 °C

Agilent Recommended: >= -1.0 % setpoint in K ( -3.7 °C )

<= 1.0 % setpoint in K ( 3.7 °C )

Overall GC Oven Temperature Accuracy Test Status

Pass

GC Oven Temperature Stability

Name: 8890

Setpoint Status: Pass

Setpoint/Average

Temperature: 100.0 100.1167 °C

Stability: 0.1 °C

Agilent Recommended: <= 0.5

Overall GC Oven Temperature Stability Test Status

Pass

**Log Amp**

Tested Combination1 Front SSL / External SQ

Name: 5977C

Setpoint Status: Pass

**Overall Log Amp Test Status**

Pass

**RFPA**

Tested Combination1 Front SSL / External SQ

Name: 5977C

Setpoint Status: Pass

Amu: 1050 m/z

Drift After Five Minutes:

RFPA Voltage:

Agilent Recommended:

1 mV

497 mV

&gt;= -100 and &lt;= 100

&lt;= 1100

**Overall RFPA Test Status**

Pass

**Tune EI**

Tested Combination1 Front SSL / External SQ

Name: 5977C

Setpoint Status: Pass

Filament: 1

Setpoint Status: Pass

Filament: 2

**Overall Tune EI Test Status**

Pass

**Scouting Run**

Date: May 9, 2025 3:29:14 PM  
System ID: GM-12



Tested Combination1	Front	SSL	/ External	SQ
	Injection Tower			
Name:	7693A			
Source:	EI - Extractor			
Setpoint Status:	Completed			
Injection Volume on Column:	1.0 uL			
Overall Scouting Run Status	Completed			

Instrument Detection Limit

Tested Combination1	Front	SSL	/ External	SQ
	Injection Tower			
Name:	7693A			
Source:	EI - Extractor			
Setpoint Status:	Pass			
Injection Volume on Column:	1.0 uL			
	Area		Retention Time	
Minimum RSD:	1.27 %		0.01 %	
Agilent Recommended:	<= 5.00		<= 1.00	
Status:	Pass		Pass	
Instrument Detection Limit:	4.28135 fg			
Agilent Recommended:	<= 16.82500			
Status:	Pass			
Overall Instrument Detection Limit Test Status	Pass			

Mass Ratio Precision

Tested Combination1	Front	SSL	/ External	SQ
	Injection Tower			
Name:	<input type="text" value="7693A"/>			
Source:	<input type="text" value="EI - Extractor"/>			
Setpoint Status:	<input type="text" value="Pass"/>			
Injection Volume on Column:	<input type="text" value="1.0"/>	uL		
	Area Mass 1		Mass Ratio	
	Abundance*s			
RSD:	<input type="text" value="2.17"/>	<input type="text" value="0.50"/>		%
Agilent Recommended:	<input type="text" value="&lt;= 5.00"/>	<input type="text" value="&lt;= 5.00"/>		%
	<input type="text" value="Pass"/>		<input type="text" value="Pass"/>	

Overall Mass Ratio Precision Test Status

NOTE: This test's 1 comment(s) and 0 deviation(s) are available in the Attachments section.

# Instrument Details

## Purpose

This section describes the as found system configuration.

## Details

Tested Combination1	
Injection Technique	Injection Tower
Inlet	Front
Detector	External
LTM Included?	No
Sampler 1	
Manufacturer	Agilent Technologies
Type	Injection Tower
Name	7693A
Model Number	G4513A
Serial Number	CN23125102
Firmware Revision	A.11.07
Usage	Sample Injection
Location	Front
Syringe Volume (µL)	10
Sampler 2	
Manufacturer	Agilent Technologies
Type	Tray
Name	7693A
Model Number	G4514A
Serial Number	CN23147049
Firmware Revision	A.12.03
Vial Heater	Not installed

## Mainframe 1

Manufacturer	Agilent Technologies
Name	8890
Model Number	G3540A
Serial Number	CN2303A031
Firmware Revision	2.8.1.6
Oven Type	Standard

## Inlet 1

Manufacturer	Agilent Technologies
Name	8890
Type	SSL
Location	Front
Carrier Gas	Helium
Control Type	Electronic Pressure Control (EPC)
Purged Inlet	Yes

## Mass Spectrometer 1

Manufacturer	Agilent Technologies
Type	SQ
Name	5977C
Model Number	G7077C
Serial Number	US2307MA35
Firmware Revision	6.00.35
Rough Pump	Wet Mechanical Vacuum Pump
High Vacuum System	Turbo Pump
Scouting Run Standard	OFN Std

## Electronic Signature

### Purpose

This signature page was created and published because the ACE sign-off action was executed, which is valid for the entire document, including attachments. The ACE sign-off is an electronic signature that requires two distinct identification components: unique username and personal password. The Agilent representative who has delivered this service understands the meaning and legal status of an electronic signature. As a trained official operator, the Agilent representative has a unique password and logon to access ACE and electronically sign this document. (Other e-signatures can be applied to this document using a Document Content Management or other suitable method defined in your data access and control procedures.)

### Details

Full Name of Signer:	Phuwanai Yoktragul
Logged On User Name:	phuwanai.yoktragul@agilent.com
Signature Creation Date:	May 9, 2025
Reason for Signature:	Executed protocol and published this original version of document

### ACE Self Qualification Status

The installed version of ACE used to deliver this service passed qualification; the results conform with expected values. The self qualification summary report is available in the session folder location SDS\ClearStore\AceSelfQualification.

### Regulatory Disclaimer

This document provides a protocol to verify and record instrument configuration and evidence of proper operation. It has been prepared from our interpretation of applicable regulations as well as industry best practices. The document is designed to provide an important component of a complete compliance package. Validation depends upon many factors and use of this protocol alone does not assure compliance. Agilent Technologies makes no promises or representations as to its sufficiency for any specific regulatory program.

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User Name: phuwanai.yoktragul  
Report Generated by Hostname: 5CG9217CJG

System Id: GM-12  
Print Date: May 9, 2025 3:29:17 PM

## OQ2025\_GM-12 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
May 8, 2025 2:38:52 PM	Audit	SessionCreated	Session	Host Name: 5CG9217CJG, Drive Serial Number: BC4F1A47
May 8, 2025 2:38:52 PM	start	Configuration	Session	None
May 8, 2025 2:38:52 PM	Audit	Entitlement	Licensing	User is FieldEngineer and does not require an unlock code
May 8, 2025 2:41:01 PM	Audit	EqpLoaded	Session	EQP details for primary technique [Gc] - File path: [ProtocolPacks/Gc/Configurat ions/02.53/Gc.02.53.eqp], EQP File Name: [Gc.02.53.eqp], EQP Name: [AgilentRecommended], Proto col Revision :[Gc.02.53] EQP details for hyphenated technique [GcMs] - File path: [ProtocolPacks/GcMs/Config urations/02.54/GcMs.02.54.e qp], EQP File Name: [GcMs.02.54.eqp], EQP Name: [AgilentRecommended]
May 8, 2025 2:41:05 PM	End	Configuration	Session	None
May 8, 2025 2:41:09 PM	start	Qualification	Session	OQ
May 8, 2025 2:41:10 PM	start	Execution	CDS Logon Verification - GC - 8890: - Qualitative test	None
May 8, 2025 2:42:42 PM	End	Execution	CDS Logon Verification - GC - 8890: - Qualitative test	Run Count : 1

User Name: phuwanai.yoktragul

System Id: GM-12

Report Generated by Hostname: 5CG9217CJG

Print Date: May 9, 2025 3:29:17 PM

OQ2025\_GM-12 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
May 8, 2025 2:43:00 PM	start	Execution	System Inspection and Basic Safety and Operation - 8890: - Qualitative Test - No setpoints associated	None
May 8, 2025 2:43:16 PM	End	Execution	System Inspection and Basic Safety and Operation - 8890: - Qualitative Test - No setpoints associated	Run Count : 1
May 8, 2025 2:43:21 PM	start	Execution	Inlet Pressure Accuracy - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	None
May 8, 2025 2:44:22 PM	End	Execution	Inlet Pressure Accuracy - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	Run Count : 1
May 8, 2025 2:44:28 PM	start	Execution	GC Oven Temperature Accuracy - 8890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
May 8, 2025 2:52:02 PM	Audit	Data	GC Oven Temperature Accuracy - 8890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry
May 8, 2025 2:52:05 PM	End	Execution	GC Oven Temperature Accuracy - 8890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Run Count : 1
May 8, 2025 2:52:13 PM	start	Execution	GC Oven Temperature Accuracy - 8890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
May 8, 2025 3:01:36 PM	Audit	Data	GC Oven Temperature Accuracy - 8890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry

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User Name: phuwanai.yoktragul  
Report Generated by Hostname: SCG9217CJG

System Id: GM-12  
Print Date: May 9, 2025 3:29:17 PM

## OQ2025\_GM-12 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
May 8, 2025 3:01:39 PM	End	Execution	GC Oven Temperature Accuracy - 8890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Run Count : 1
May 8, 2025 3:01:42 PM	start	Execution	GC Oven Temperature Stability - 8890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	None
May 8, 2025 3:20:17 PM	Audit	Data	GC Oven Temperature Stability - 8890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Manual Data Entry
May 8, 2025 3:20:19 PM	End	Execution	GC Oven Temperature Stability - 8890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Run Count : 1
May 8, 2025 3:20:42 PM	start	Execution	Log Amp - 5977C SQ: - Source: EI - Extractor	None
May 8, 2025 3:25:45 PM	End	Execution	Log Amp - 5977C SQ: - Source: EI - Extractor	Run Count : 1
May 8, 2025 3:25:48 PM	start	Execution	RFPD - 5977C SQ: - Source: EI - Extractor	None
May 8, 2025 3:36:10 PM	End	Execution	RFPD - 5977C SQ: - Source: EI - Extractor	Run Count : 1
May 8, 2025 3:36:50 PM	start	Execution	Tune EI - 5977C SQ: - Source: - EI - Extractor Filament 1 (Qualitative - No setpoints associated)	None
May 8, 2025 3:43:21 PM	End	Execution	Tune EI - 5977C SQ: - Source: - EI - Extractor Filament 1 (Qualitative - No setpoints associated)	Run Count : 1
May 8, 2025 3:43:27 PM	start	Execution	Tune EI - 5977C SQ: - Source: - EI - Extractor Filament 2 (Qualitative - No setpoints associated)	None

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User Name: phuwanai.yoktragul

System Id: GM-12

Report Generated by Hostname: 5CG9217CJG

Print Date: May 9, 2025 3:29:17 PM

## OQ2025\_GM-12 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
May 8, 2025 3:45:57 PM	End	Execution	Tune EI - 5977C SQ: - Source: - Run Count : 1 EI - Extractor Filament 2 (Qualitative - No setpoints associated)	
May 8, 2025 3:46:04 PM	Audit	AceClosed	Session	None
May 9, 2025 9:33:04 AM	Audit	AceRestarted	Session	Host Name: 5CG9217CJG, Drive Serial Number: BC4F1A47
May 9, 2025 9:33:06 AM	Audit	SessionReloaded	Session	None
May 9, 2025 9:33:59 AM	start	Qualification	Session	OQ
May 9, 2025 9:34:19 AM	start	Execution	Scouting Run - Injection Tower, Front SSL, SQ: - Source: - EI - Extractor- Part of GCMS System Preparation	None
May 9, 2025 9:35:36 AM	start	Execution	Instrument Detection Limit - Injection Tower, Front SSL, SQ: - Source: - EI - Extractor - RSD L (Area): <= 5.00% - RSD L (Ret. Time): <= 1.00%	None
May 9, 2025 9:39:00 AM	start	Execution	Scouting Run - Injection Tower, Front SSL, SQ: - Source: - EI - Extractor- Part of GCMS System Preparation	None
May 9, 2025 9:39:03 AM	start	Execution	Mass Ratio Precision - Injection Tower, Front SSL, SQ: - Source: EI - Extractor - L (RSD): <= 5.00%	None
May 9, 2025 9:43:57 AM	start	Execution	Scouting Run - Injection Tower, Front SSL, SQ: - Source: - EI - Extractor- Part of GCMS System Preparation	None

User Name: phuwanai.yoktragul  
Report Generated by Hostname: 5CG9217CJG

System Id: GM-12  
Print Date: May 9, 2025 3:29:17 PM

## OQ2025\_GM-12 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
May 9, 2025 10:04:26 AM	start	Execution	Instrument Detection Limit - Injection Tower, Front SSL, SQ: - Source: - EI - Extractor - RSD L (Area): <= 5.00% - RSD L (Ret. Time): <= 1.00%	None
May 9, 2025 10:04:28 AM	start	Execution	Scouting Run - Injection Tower, Front SSL, SQ: - Source: - EI - Extractor- Part of GCMS System Preparation	None
May 9, 2025 1:12:30 PM	start	Execution	Mass Ratio Precision - Injection Tower, Front SSL, SQ: - Source: EI - Extractor - L (RSD): <= 5.00%	None
May 9, 2025 3:02:09 PM	start	Execution	Scouting Run - Injection Tower, Front SSL, SQ: - Source: - EI - Extractor- Part of GCMS System Preparation	None
May 9, 2025 3:03:52 PM	Audit	Data	Scouting Run - Injection Tower, Front SSL, SQ: - Source: - EI - Extractor- Part of GCMS System Preparation	Data files Path : C:\Users\yoktragul\Downloads\ALS_OQ2025\OQ2025\SC_OFN.D
May 9, 2025 3:04:25 PM	Audit	Reporting	Reintegration	Reintegration Count: 1 -- [ Integration Type: Injection;Baseline Correction Mode: Advanced;Initial Slope Sensitivity: 10;Initial Peak Width: 0.01;Initial Area Reject: 0;Initial Height Reject: 150;Integration: Off at 0;Integration: On at 4 ]



User Name: phuwanai.yoktragul

System Id: GM-12

Report Generated by Hostname: 5CG9217CJG

Print Date: May 9, 2025 3:29:17 PM

## OQ2025\_GM-12 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
May 9, 2025 3:04:39 PM	Audit	Reporting	Reintegration	Reintegration Count: 2 -- [ Integration Type: Injection; Baseline Correction Mode: Advanced; Initial Slope Sensitivity: 10; Initial Peak Width: 0.01; Initial Area Reject: 0; Initial Height Reject: 100; Integration: Off at 0; Integration: On at 4 ]
May 9, 2025 3:04:46 PM	Audit	Reporting	Reintegration	Reintegration Count: 3 -- [ Integration Type: Injection; Baseline Correction Mode: Advanced; Initial Slope Sensitivity: 10; Initial Peak Width: 0.02; Initial Area Reject: 0; Initial Height Reject: 100; Integration: Off at 0; Integration: On at 4 ]
May 9, 2025 3:05:17 PM	End	Execution	Scouting Run - Injection Tower, Front SSL, SQ: - Source: - EI - Extractor- Part of GCMS System Preparation	Run Count : 1
May 9, 2025 3:05:21 PM	start	Execution	Instrument Detection Limit - Injection Tower, Front SSL, SQ: - Source: - EI - Extractor - RSD L (Area): <= 5.00% - RSD L (Ret. Time): <= 1.00%	None
May 9, 2025 3:07:51 PM	Audit	Data	Instrument Detection Limit - Injection Tower, Front SSL, SQ: - Source: - EI - Extractor - RSD L (Area): <= 5.00% - RSD L (Ret. Time): <= 1.00%	Data files Path : C:\Users\yoktragul\Downloads\ALS_OQ2025\OQ2025\IDL2.D

User Name: phuwanai.yoktragul

System Id: GM-12

Report Generated by Hostname: 5CG9217CJG

Print Date: May 9, 2025 3:29:17 PM

## OQ2025\_GM-12 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
May 9, 2025 3:07:51 PM	Audit	Data	Instrument Detection Limit - Injection Tower, Front SSL, SQ: - Source: - EI - Extractor - RSD L (Area): <= 5.00% - RSD L (Ret. Time): <= 1.00%	Data files Path : C:\Users\yoktragul\Downloads ALS_OQ2025\OQ2025\OQ2 025\IDL3.D
May 9, 2025 3:07:51 PM	Audit	Data	Instrument Detection Limit - Injection Tower, Front SSL, SQ: - Source: - EI - Extractor - RSD L (Area): <= 5.00% - RSD L (Ret. Time): <= 1.00%	Data files Path : C:\Users\yoktragul\Downloads ALS_OQ2025\OQ2025\OQ2 025\IDL4.D
May 9, 2025 3:07:51 PM	Audit	Data	Instrument Detection Limit - Injection Tower, Front SSL, SQ: - Source: - EI - Extractor - RSD L (Area): <= 5.00% - RSD L (Ret. Time): <= 1.00%	Data files Path : C:\Users\yoktragul\Downloads ALS_OQ2025\OQ2025\OQ2 025\IDL5.D
May 9, 2025 3:07:51 PM	Audit	Data	Instrument Detection Limit - Injection Tower, Front SSL, SQ: - Source: - EI - Extractor - RSD L (Area): <= 5.00% - RSD L (Ret. Time): <= 1.00%	Data files Path : C:\Users\yoktragul\Downloads ALS_OQ2025\OQ2025\OQ2 025\IDL6.D
May 9, 2025 3:07:51 PM	Audit	Data	Instrument Detection Limit - Injection Tower, Front SSL, SQ: - Source: - EI - Extractor - RSD L (Area): <= 5.00% - RSD L (Ret. Time): <= 1.00%	Data files Path : C:\Users\yoktragul\Downloads ALS_OQ2025\OQ2025\OQ2 025\IDL7.D
May 9, 2025 3:07:51 PM	Audit	Data	Instrument Detection Limit - Injection Tower, Front SSL, SQ: - Source: - EI - Extractor - RSD L (Area): <= 5.00% - RSD L (Ret. Time): <= 1.00%	Data files Path : C:\Users\yoktragul\Downloads ALS_OQ2025\OQ2025\OQ2 025\IDL8.D
May 9, 2025 3:07:51 PM	Audit	Data	Instrument Detection Limit - Injection Tower, Front SSL, SQ: - Source: - EI - Extractor - RSD L (Area): <= 5.00% - RSD L (Ret. Time): <= 1.00%	Data files Path : C:\Users\yoktragul\Downloads ALS_OQ2025\OQ2025\OQ2 025\IDL9.D

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User Name: phuwanai.yoktragul

System Id: GM-12

Report Generated by Hostname: 5CG9217C.JG

Print Date: May 9, 2025 3:29:17 PM

## OQ2025\_GM-12 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
May 9, 2025 3:07:51 PM	Audit	Data	Instrument Detection Limit - Injection Tower, Front SSL, SQ: - Source: - EI - Extractor - RSD L (Area): <= 5.00% - RSD L (Ret. Time): <= 1.00%	Data files Path : C:\Users\yoktragu\Downloads ALS_OQ2025\OQ2025\OQ2 025\IDL10.D
May 9, 2025 3:07:51 PM	Audit	Data	Instrument Detection Limit - Injection Tower, Front SSL, SQ: - Source: - EI - Extractor - RSD L (Area): <= 5.00% - RSD L (Ret. Time): <= 1.00%	Data files Path : C:\Users\yoktragu\Downloads ALS_OQ2025\OQ2025\OQ2 025\IDL11.D
May 9, 2025 3:08:43 PM	Audit	Reporting	Reintegration	Reintegration Count: 1 -- [ Integration Type: Injection;Baseline Correction Mode: Advanced;Initial Slope Sensitivity: 10;Initial Peak Width: 0.01;Initial Area Reject: 0;Initial Height Reject: 50;Integration: Off at 0;Integration: On at 4.6 ]
May 9, 2025 3:09:07 PM	Audit	Reporting	Reintegration	Reintegration Count: 2 -- [ Integration Type: Injection;Baseline Correction Mode: Advanced;Initial Slope Sensitivity: 10;Initial Peak Width: 0.01;Initial Area Reject: 0;Initial Height Reject: 200;Integration: Off at 0;Integration: On at 4.6 ]
May 9, 2025 3:10:29 PM	End	Execution	Instrument Detection Limit - Injection Tower, Front SSL, SQ: - Source: - EI - Extractor - RSD L (Area): <= 5.00% - RSD L (Ret. Time): <= 1.00%	Run Count : 1

User Name: phuwanai.yoktragul  
Report Generated by Hostname: 5CG9217CJG

System Id: GM-12  
Print Date: May 9, 2025 3:29:17 PM

OOQ2025\_GM-12 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
May 9, 2025 3:11:01 PM	start	Execution	Mass Ratio Precision - Injection Tower, Front SSL, SQ: - Source: EI - Extractor - L (RSD): ≤ 5.00%	None
May 9, 2025 3:12:51 PM	Audit	Data	Mass Ratio Precision - Injection Tower, Front SSL, SQ: - Source: EI - Extractor - L (RSD): ≤ 5.00%	Data files Path : C:\Users\yoktragul\Downloads VALS_OQ2025\OQ2025\OQ2025\MRP5.D
May 9, 2025 3:12:51 PM	Audit	Data	Mass Ratio Precision - Injection Tower, Front SSL, SQ: - Source: EI - Extractor - L (RSD): ≤ 5.00%	Data files Path : C:\Users\yoktragul\Downloads VALS_OQ2025\OQ2025\OQ2025\MRP6.D
May 9, 2025 3:12:51 PM	Audit	Data	Mass Ratio Precision - Injection Tower, Front SSL, SQ: - Source: EI - Extractor - L (RSD): ≤ 5.00%	Data files Path : C:\Users\yoktragul\Downloads VALS_OQ2025\OQ2025\OQ2025\MRP7.D
May 9, 2025 3:12:51 PM	Audit	Data	Mass Ratio Precision - Injection Tower, Front SSL, SQ: - Source: EI - Extractor - L (RSD): ≤ 5.00%	Data files Path : C:\Users\yoktragul\Downloads VALS_OQ2025\OQ2025\OQ2025\MRP8.D
May 9, 2025 3:12:51 PM	Audit	Data	Mass Ratio Precision - Injection Tower, Front SSL, SQ: - Source: EI - Extractor - L (RSD): ≤ 5.00%	Data files Path : C:\Users\yoktragul\Downloads VALS_OQ2025\OQ2025\OQ2025\MRP9.D
May 9, 2025 3:12:51 PM	Audit	Data	Mass Ratio Precision - Injection Tower, Front SSL, SQ: - Source: EI - Extractor - L (RSD): ≤ 5.00%	Data files Path : C:\Users\yoktragul\Downloads VALS_OQ2025\OQ2025\OQ2025\MRP10.D

User Name: phuwanai.yoktragul

System Id: GM-12

Report Generated by Hostname: 5CG9217CJG

Print Date: May 9, 2025 3:29:17 PM

## OQ2025\_GM-12 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
May 9, 2025 3:13:49 PM	Audit	Reporting	Reintegration	Reintegration Count: 1 -- [ Integration Type: Injection; Baseline Correction Mode: Advanced; Initial Slope Sensitivity: 10; Initial Peak Width: 0.01; Initial Area Reject: 0; Initial Height Reject: 50000; Integration: Off at 0; Integration: On at 2 ]
May 9, 2025 3:15:04 PM	End	Execution	Mass Ratio Precision - Injection Tower, Front SSL, SQ: - Source: EI - Extractor - L (RSD): <= 5.00%	Run Count : 1
May 9, 2025 3:16:15 PM	End	Qualification	Session	OQ
May 9, 2025 3:16:15 PM	start	Reporting	Session	None
May 9, 2025 3:26:19 PM	Audit	Reporting	Session	Report Generated : Certificate
May 9, 2025 3:27:20 PM	Audit	Reporting	Session	Report Generated : Report
May 9, 2025 3:28:25 PM	Audit	Reporting	Session	Report Generated : Report with Certificate



## Certificate of Calibration

### Customer



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

### Unit Under Calibration Details

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

### Calibration Environment and Details

Temperature : ( 23  $\pm$  2  $^{\circ}$ C )  
Humidity : ( 50  $\pm$  20 %RH )  
Barometric Pressure : ( 1013  $\pm$  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

REVIEW BY   
APPROVED BY   
NEXT CAL DATE 16/01/26


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

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

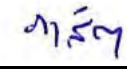
### Note

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

Calibrated By :

  
Mr. Noppadon Luangart  
Service Calibration Engineer

Approved By :

  
Mr. Pacit Mathavorn  
Calibration Engineer Supervisor

**Issue Date** : 16 January 2025

Certificate No : 25-ACT-010

Request No : Req-2025-0091

**Sound pressure level**

**Calibration Results : Without Adjustment**

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty (± dB)	Acceptance limit Class 1 (± dB)	Result
	Measured	Deviated value	Measured	Deviated value			
94 dB / 1000 Hz	94.11	0.11	-	-	0.13	0.25	Pass

**Frequency of Sound pressure level**

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

**Total Harmonic Distortion plus Noise of Sound pressure level (THD+N %)**

Calibration Range (Hz)	Without Adjustment	Adjustment	Uncertainty (± %)	Acceptance limit Class 1 (± %)	Result
	Measured (%)	Measured (%)			
94 dB / 1000 Hz	1.21	-	0.40	2.5	Pass

**Note :**

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

- Acceptance limit was IEC60942:2017 Class 1
- The calibration results exclude the calibrator pressure correction
- The calibration results exclude the microphone volume correction

Certificate No : 25-ACT-010

Request No : Req-2025-0091

### Decision Rule for Statements of Conformity

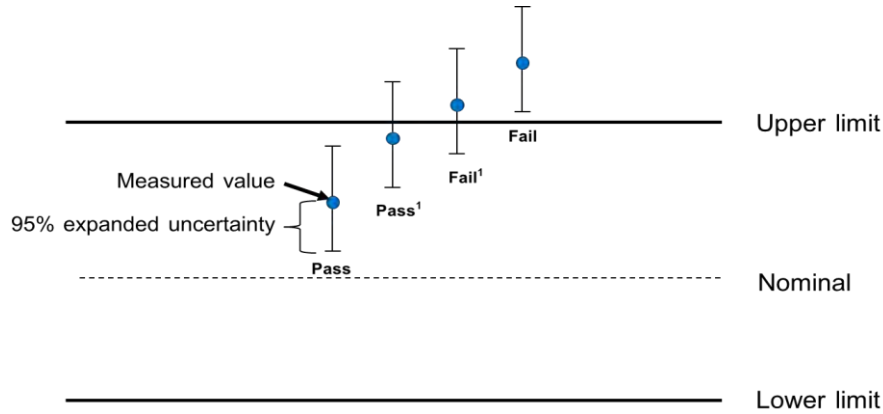
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09/2019; Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

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

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

Cert. No. : ACL24418  
Pages : 1 of 8

Calibration Certificate


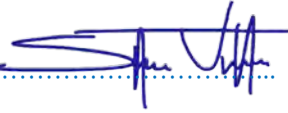
Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42A / Microphone UC-52 / Preamplifier NH-24  
Serial No.: 00623387 / 198634 / 26415  
ID No.: RYG\_FS0612

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
KHWAEANG 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 .....  .....  
APPROVED BY .....  .....  
NEXT CAL DATE..... 23/ 12/ 25 .....

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

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

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**Cert. No. : ACL24418**

**Job No. : VC68AC0051**

**Pages : 2 of 8**

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

### Calibration Method :

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

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

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

### Condition of this result of calibration :

#### 1. Reference Standard Instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
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).



# SITHIPORN ASSOCIATES CO., LTD.

## CALIBRATION LABORATORY

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

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Cert. No. : ACL24418  
Job No. : VC68AC0051  
Pages : 3 of 8

### Summary of Measurement Result :

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

*T. Ketchan*

**Cert. No. : ACL24418**

**Job No. : VC68AC0051**

**Page : 4 of 8**

**Result of calibration :**

**1. Absolute sensitivity**

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

**2. Self-generated noise**

**2.1 Normal test**

Measured Value ( dB )
14.6

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

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

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

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

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

*T. Petch.*

Cert. No. : ACL24418  
 Job No. : VC68AC0051  
 Pages : 5 of 8

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

Weighting network response with relative to 1 kHz.

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

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

##### 5.1 Frequency weightings at 1 kHz

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

##### 5.2 Time weighting at 1 kHz

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

#### 6. Long - term stability

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

*T. Ketch*

# SITHIPORN ASSOCIATES CO., LTD.

## CALIBRATION LABORATORY

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

SITHIPORN  
associates



Cert. No. : ACL24418

Job No. : VC68AC0051

Pages : 6 of 8

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

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

*T. Ketch*

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Cert. No. : ACL24418  
Job No. : VC68AC0051  
Pages : 7 of 8

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

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

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

### 9. Tone burst response

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

*T. Reith*



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

### 10. Peak C sound level

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

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

### 11. Overload indication

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

### 12. High level stability

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

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

End of Calibration Certificate

*S. Ketchan*

**Cert. No. : ACL25110**

**Pages : 1 of 8**

## Calibration Certificate

**Equipment :** SOUND LEVEL METER  
**Manufacturer :** RION  
**Model :** NL-42 / Microphone UC-52 / Preamplifier NH-24  
**Serial No.:** 00900074 / 188467 / 01736  
**ID No.:** RYG\_FS0495

**Condition As Found :** GOOD

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

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

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

REVIEW BY *Supt S.*

APPROVED BY *[Signature]*

NEXT CAL DATE 26/ 01/ 2026

**Calibrated by :**

Nathakorn Pisutpaisan

**Approved by :**

*[Signature]*  
( Thanakul Petchurai )

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

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

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

**Calibration Method :**

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

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

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

**Condition of this result of calibration :**

1. Reference Standard Instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
Waveform Generator	33210A	MY48017076	EF-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. : ACL25110**  
**Job No. : VC68AC0064**  
**Pages : 3 of 8**

**Summary of Measurement Result :**

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

*T. Petch.*

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

**Result of calibration :**

**1. Absolute sensitivity**

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

**2. Self-generated noise**

**2.1 Normal test**

Measured Value ( dB )
14.6

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

Frequency Weighting	Weighting ( dB )
A - weight	12.0
C - weight	17.7
Flat	23.2

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

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

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

*T. Reith.*



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

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

Weighting network response with relative to 1 kHz.

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

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

##### 5.1 Frequency weightings at 1 kHz

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

##### 5.2 Time weighting at 1 kHz

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

#### 6. Long - term stability

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

*T. Petch.*

Cert. No. : ACL25110  
Job No. : VC68AC0064  
Pages : 6 of 8

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

Anticipated Value ( dB )	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.1	0.1	± 1.1
134.0	134.1	0.1	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.1	0.1	± 1.1
114.0	114.1	0.1	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.1	0.1	± 1.1
99.0	99.1	0.1	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.1	0.1	± 1.1
28.0	28.1	0.1	± 1.1
27.0	27.1	0.1	± 1.1
26.0	26.2	0.2	± 1.1
25.0	25.2	0.2	± 1.1

*S. Petch.*

**Cert. No. : ACL25110**  
**Job No. : VC68AC0064**  
**Pages : 7 of 8**

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

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

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

**9. Tone burst response**

Time Weighting	Tone burst duration, 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	98.9	-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

*G. Petch.*

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

**10. Peak C sound level**

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

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

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CALIBRATION LABORATORY

451-451/1 Sirinthorn Road, Bangbumru, Bangplud, 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 : NL-42A / Microphone UC-52 / Preamplifier NH-24  
Serial No.: 00623388 / 198635 / 26416  
ID No.: RYG\_FS0613

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
KHWAEANG 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 ..... *Supt S.* .....  
APPROVED BY ..... *[Signature]* .....  
NEXT CAL DATE..23/ 12/ 25.....

Calibrated by : Nathakorn Pisutpaisan

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

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



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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 :

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

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

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

3.1 National Institute of Metrology (Thailand).

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

*T. Petch.*

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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)			Acceptance Limits
	Flat	C-weight	A-weight	
125	0.5	0.6	0.6	± 1.5
1000	0.1	0.1	0.2	± 1.0
8000	0.8	0.8	0.8	±5.0

*T. Petchu.*

**Cert. No. : ACL24419**  
**Job No. : VC68AC0051**  
**Pages : 5 of 8**

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

Weighting network response with relative to 1 kHz.

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

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

##### 5.1 Frequency weightings at 1 kHz

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

##### 5.2 Time weighting at 1 kHz

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

#### 6. Long - term stability

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

*T. Petch.*

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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	$\pm 1.1$
136.0	136.0	0.0	$\pm 1.1$
135.0	135.0	0.0	$\pm 1.1$
134.0	134.0	0.0	$\pm 1.1$
133.0	133.0	0.0	$\pm 1.1$
132.0	132.0	0.0	$\pm 1.1$
131.0	131.0	0.0	$\pm 1.1$
129.0	129.0	0.0	$\pm 1.1$
124.0	124.0	0.0	$\pm 1.1$
119.0	119.0	0.0	$\pm 1.1$
114.0	114.0	0.0	$\pm 1.1$
109.0	109.0	0.0	$\pm 1.1$
104.0	104.0	0.0	$\pm 1.1$
99.0	99.0	0.0	$\pm 1.1$
94.0	94.0	0.0	$\pm 1.1$
89.0	89.0	0.0	$\pm 1.1$
84.0	84.0	0.0	$\pm 1.1$
79.0	79.0	0.0	$\pm 1.1$
74.0	74.0	0.0	$\pm 1.1$
69.0	69.0	0.0	$\pm 1.1$
64.0	64.0	0.0	$\pm 1.1$
59.0	59.0	0.0	$\pm 1.1$
54.0	54.0	0.0	$\pm 1.1$
49.0	49.0	0.0	$\pm 1.1$
44.0	44.0	0.0	$\pm 1.1$
39.0	39.0	0.0	$\pm 1.1$
34.0	34.0	0.0	$\pm 1.1$
30.0	30.0	0.0	$\pm 1.1$
29.0	28.9	-0.1	$\pm 1.1$
28.0	28.0	0.0	$\pm 1.1$
27.0	26.9	-0.1	$\pm 1.1$
26.0	25.9	-0.1	$\pm 1.1$
25.0	24.9	-0.1	$\pm 1.1$

*T. Petch.*



# SITHIPORN ASSOCIATES CO., LTD.

## CALIBRATION LABORATORY

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

T. Petcha-

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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, Lcpeak ( 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

## Certificate of Calibration

### Customer

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

Certificate No : 24-AFM-179

Request No : Req-2024-1987

### Unit Under Calibration Details

Measurement Item : Air Flow Meter  
Manufacturer : MesaLabs Accuracy : 1% of Reading  
Model : Defender 510-M Sensor Model : -  
Serial Number : 151114 Sensor Serial Number : -  
ID : BKK\_FS0614 Instrument Status : Used  
Location of Calibration : LAB 4 AIR VELOCITY METER

### Calibration Environment and Details

Temperature : 23 °C ± 3 °C  
Humidity : 55 %RH ± 20 %RH  
Barometric Pressure : 1013 hPa ± 10 hPa  
Received Date : 30 August 2024  
Calibration Date : 9 September 2024  
Calibration Procedure : In-house method CP-AFM-01 by Comparison technique with Standard Primary Flow Calibrator



Reference Standard	Model	Serial Number	Traceble	Due Calibration
Air Flow Meter	Gilibrator 3 Low flow	18501010006	Sensidyne	6 August 2025
Air Flow Meter	Gilibrator 3 Standard flow	19031011003	Sensidyne	2 August 2025
Temperature meter	GT 11	08000057	Qreborn	1 March 2025
Pressure meter	CPG2400	41000KDU/651882	TPA	9 November 2024

### Traceability :

This Certificate is traceable to SI Unit through Sensidyne A2LA Accreditation No. 3943.01

### Note :

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

Calibration By : [Signature]  
Mr. Noppadon Luangart  
Service Calibration Engineer

Approved By : [Signature]  
Mr. Pacit Mathavorn  
Calibration Engineer Supervisor

Issue Date : 9 September 2024



Certificate No : 24-AFM-179

Request No : Req-2024-1987

**Result of Calibration : Without Adjustment**

Temperature (°C)	Pressure (kPa)	STD (cc/min)	UUC (cc/min)	Error (cc/min)	Uncertainty (cc/min)	MPE (cc/min)	Result
24.70	100.95	100	100.41	0.4	2.8	1.0	N/A
24.90	100.90	502	500.47	-1.5	7.1	5.0	N/A
24.90	100.97	1003	1001.3	-2	14	10.0	N/A
25.00	100.92	2014	2009.9	-4	29	20.1	N/A
25.20	101.03	3043	3058.3	15	44	30.4	N/A
25.30	101.10	4043	4005.1	-38	57	40.4	N/A
25.50	101.15	5052	5003.9	-48	74	50.5	N/A

**Note**

STD : Standard UUC : Unit Under Calibration

- UUC Reference Condition : At atmospheric pressure and room temperature condition

- Flow Rate was corrected for non-standard operating condition by using equation :

$$Q_{meas} = Q_{ref} \times \frac{P_{ref}}{P_{meas}} \times \frac{T_{meas}}{T_{ref}}$$

where Q = Flow Rate P = Absolute Pressure T = Absolute Temperature

Meas = Measurement Condition ref = Standard Condition

\* Indicates non accredited

MPE = Maximum Permissible Error (Specified in Manufacturer's Specifications)

N/A = Not Available, Customer does not require a statement of conformity.

Certificate No : 24-AFM-179

Request No : Req-2024-1987

### Decision Rule for Statements of Conformity

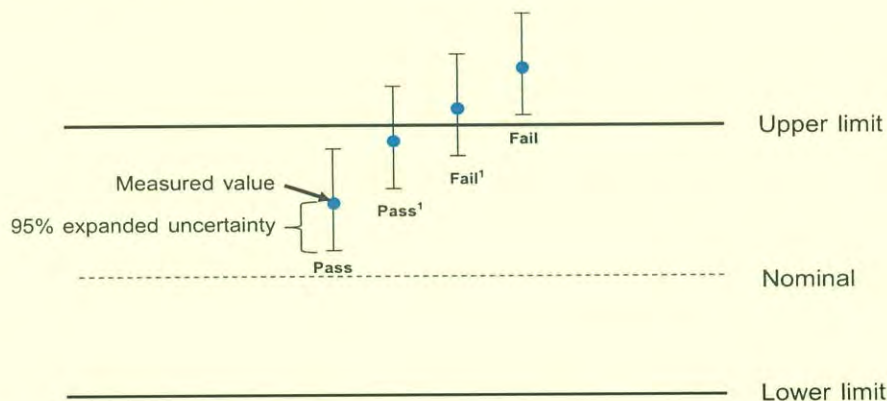
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09/2019; Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

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

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 Certificate



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

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Cert. No. : ACL24306  
Pages : 1 of 8

## Calibration Certificate

**Equipment :** SOUND LEVEL METER  
**Manufacturer :** RION  
**Model :** NL-42 / Microphone UC-52 / Preamplifier NH-24  
**Serial No.:** 00597169 / 158770 / 34370  
**ID No.:** RYG\_FS0439

**Condition As Found :** GOOD

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

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

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

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

**Calibrated by :** Nathakorn Pisutpaisan

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

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

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Calibration Procedure : CP-AC-01

Cert. No. : ACL24306  
Job No. : VC67AC0164  
Pages : 2 of 8

## 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 :

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

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.  
3. This certificate is traceable to the international system of unit maintained at :

3.1 National Institute of Metrology (Thailand).

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

*T. Petch.*



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Cert. No. : ACL24306  
Job No. : VC67AC0164  
Pages : 3 of 8

### Summary of Measurement Result :

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

*G. Petch.*

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Cert. No. : ACL24306

Job No. : VC67AC0164

Page : 4 of 8

### Result of calibration :

#### 1. Absolute sensitivity

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

#### 2. Self-generated noise

##### 2.1 Normal test

Measured Value ( dB )
13.4

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

Frequency Weighting	Weighting ( dB )
A - weight	10.8
C - weight	16.8
Flat	22.4

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

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

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

*S. Retch.*



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

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

Weighting network response with relative to 1 kHz.

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

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

**5.1 Frequency weightings at 1 kHz**

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

**5.2 Time weighting at 1 kHz**

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

**6. Long - term stability**

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

*G. Petch*



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Job No. : VC67AC0164  
Pages : 6 of 8

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

Anticipated Value ( dB )	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
137.0	137.0	0.0	$\pm 1.1$
136.0	136.0	0.0	$\pm 1.1$
135.0	135.0	0.0	$\pm 1.1$
134.0	134.0	0.0	$\pm 1.1$
133.0	133.0	0.0	$\pm 1.1$
132.0	132.0	0.0	$\pm 1.1$
131.0	131.0	0.0	$\pm 1.1$
129.0	129.0	0.0	$\pm 1.1$
124.0	124.0	0.0	$\pm 1.1$
119.0	119.0	0.0	$\pm 1.1$
114.0	114.0	0.0	$\pm 1.1$
109.0	109.0	0.0	$\pm 1.1$
104.0	104.0	0.0	$\pm 1.1$
99.0	99.0	0.0	$\pm 1.1$
94.0	94.0	0.0	$\pm 1.1$
89.0	89.0	0.0	$\pm 1.1$
84.0	84.0	0.0	$\pm 1.1$
79.0	79.0	0.0	$\pm 1.1$
74.0	74.0	0.0	$\pm 1.1$
69.0	69.0	0.0	$\pm 1.1$
64.0	64.0	0.0	$\pm 1.1$
59.0	59.0	0.0	$\pm 1.1$
54.0	54.0	0.0	$\pm 1.1$
49.0	49.0	0.0	$\pm 1.1$
44.0	44.0	0.0	$\pm 1.1$
39.0	38.9	-0.1	$\pm 1.1$
34.0	34.0	0.0	$\pm 1.1$
30.0	30.0	0.0	$\pm 1.1$
29.0	29.1	0.1	$\pm 1.1$
28.0	28.1	0.1	$\pm 1.1$
27.0	27.1	0.1	$\pm 1.1$
26.0	26.2	0.2	$\pm 1.1$
25.0	25.3	0.3	$\pm 1.1$

*Signature*

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

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

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

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

### 9. Tone burst response

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

*T. Petch*



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Cert. No. : ACL24306

Job No. : VC67AC0164

Pages : 8 of 8

### 10. Peak C sound level

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

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

### 11. Overload indication

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

### 12. High level stability

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

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

End of Calibration Certificate

**Cert. No. : ACL25108**

**Pages : 1 of 8**

## Calibration Certificate

**Equipment :** SOUND LEVEL METER  
**Manufacturer :** RION  
**Model :** NL-42 / Microphone UC-52 / Preamplifier NH-24  
**Serial No.:** 00900072 / 188465 / 01734  
**ID No.:** RYG\_FS0493

**Condition As Found :** GOOD

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

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

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

REVIEW BY ..... *Sypt S* .....

APPROVED BY ..... *[Signature]* .....

NEXT CAL DATE..... 26/ 01/ 2026 .....

**Calibrated by :**

Nathakorn Pisutpaisan

**Approved by :**

*[Signature]*  
( Thanakul Petchurai )

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**Cert. No. : ACL25108**  
**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 :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
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).

*S. Petch...*



**Cert. No. : ACL25108**  
**Job No. : VC68AC0064**  
**Pages : 3 of 8**

**Summary of Measurement Result :**

<b>Parameter</b>	<b>Uncertainty (dB)</b>	<b>Maximum-permitted uncertainty of measurement (dB)</b>
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

*S. Petcha*

**Cert. No. : ACL25108**  
**Job No. : VC68AC0064**  
**Page : 4 of 8**

**Result of calibration :**

**1. Absolute sensitivity**

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

**2. Self-generated noise**

**2.1 Normal test**

Measured Value ( dB )
14.2

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

Frequency Weighting	Weighting ( dB )
A - weight	10.8
C - weight	17.0
Flat	22.9

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

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

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

*G. Petcha.*

Cert. No. : ACL25108  
Job No. : VC68AC0064  
Pages : 5 of 8

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

Weighting network response with relative to 1 kHz.

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

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

##### 5.1 Frequency weightings at 1 kHz

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

##### 5.2 Time weighting at 1 kHz

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

#### 6. Long - term stability

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

*G. Petchu.*

Cert. No. : ACL25108  
Job No. : VC68AC0064  
Pages : 6 of 8

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

Anticipated Value ( dB )	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	78.9	-0.1	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	53.9	-0.1	± 1.1
49.0	48.9	-0.1	± 1.1
44.0	43.9	-0.1	± 1.1
39.0	38.9	-0.1	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.0	0.0	± 1.1
26.0	26.1	0.1	± 1.1
25.0	25.0	0.0	± 1.1

*S. Petch*

**Cert. No. : ACL25108**  
**Job No. : VC68AC0064**  
**Pages : 7 of 8**

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

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

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

**9. Tone burst response**

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

*R. Petch.*



Cert. No. : ACL25108  
Job No. : VC68AC0064  
Pages : 8 of 8

**10. Peak C sound level**

Number of cycle in test signal	Anticipated Value ( dB )	Measured Value, Lcpeak ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Continuous	130.0	130.0	0.0	±3.0
One	133.4	133.1	-0.3	±3.0

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

*Retch.*

**Cert. No. : ACL25107**

**Pages : 1 of 8**

## Calibration Certificate

**Equipment :** SOUND LEVEL METER  
**Manufacturer :** RION  
**Model :** NL-42 / Microphone UC-52 / Preamplifier NH-24  
**Serial No.:** 00900071 / 188464 / 01733  
**ID No.:** RYG\_FS0492

**Condition As Found :** GOOD

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

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

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

REVIEW BY ..... *Supt S* .....

APPROVED BY ..... *[Signature]* .....

NEXT CAL DATE..... 26/ 01/ 2026 .....

**Calibrated by :**

Nathakorn Pisutpaisan

**Approved by :**

*[Signature]*  
( Thanakul Petchurai )

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

**Cert. No. : ACL25107**  
**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 :

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

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

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

3.1 National Institute of Metrology (Thailand).

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

*T. Ketch.*

**Cert. No. : ACL25107**  
**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

*G. Petch.*

**Cert. No. : ACL25107**  
**Job No. : VC68AC0064**  
**Page : 4 of 8**

**Result of calibration :**

**1. Absolute sensitivity**

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

**2. Self-generated noise**

**2.1 Normal test**

Measured Value ( dB )
15.1

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

Frequency Weighting	Weighting ( dB )
A - weight	12.0
C - weight	18.4
Flat	24.1

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

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

Frequency ( Hz )	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.2	0.2	0.2	± 1.5
1000	0.1	0.1	0.1	± 1.0
8000	0.9	0.9	0.9	±5.0

*G. Petch.*



**Cert. No. : ACL25107**  
**Job No. : VC68AC0064**  
**Pages : 5 of 8**

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

Weighting network response with relative to 1 kHz.

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

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

##### 5.1 Frequency weightings at 1 kHz

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

##### 5.2 Time weighting at 1 kHz

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

#### 6. Long - term stability

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

*T. Ketch.*

Cert. No. : ACL25107

Job No. : VC68AC0064

Pages : 6 of 8

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

Anticipated Value ( dB )	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	78.9	-0.1	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	63.9	-0.1	± 1.1
59.0	59.0	0.0	± 1.1
54.0	53.9	-0.1	± 1.1
49.0	48.9	-0.1	± 1.1
44.0	43.9	-0.1	± 1.1
39.0	38.9	-0.1	± 1.1
34.0	33.9	-0.1	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.1	0.1	± 1.1
26.0	26.1	0.1	± 1.1
25.0	25.2	0.2	± 1.1

*T. Petch.*

Cert. No. : ACL25107  
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	29.2	0.2	±1.1

**9. Tone burst response**

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

*T. Petcha*

Cert. No. : ACL25107  
Job No. : VC68AC0064  
Pages : 8 of 8

**10. Peak C sound level**

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

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

**11. Overload indication**

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

**12. High level stability**

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

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

**End of Calibration Certificate**

*R. Petch.*



# CERTIFICATE OF CALIBRATION

ISSUED BY Cirrus Research plc

DATE OF ISSUE 02 December 2024

CERTIFICATE NUMBER 228072



Cirrus Research plc  
Acoustic House  
Bridlington Road  
Hunmanby  
North Yorkshire  
YO14 0PH  
United Kingdom

Page 1 of 2

Approved signatory

N.Smith

Electronically signed:

## doseBadge Reader : IEC 60942:2003

### Instrument information

**Manufacturer:** Cirrus Research plc

**Notes:**

**Model:** RC:110A

**Serial number:** 75996

**Class:** 2

### Test summary

**Date of calibration:** 02 December 2024

The doseBadge reader detailed above has been calibrated to the published data as described in the operating manual and in the half-inch configuration. The procedures and techniques used are as described in IEC60942\_2003 Annex B – Periodic Tests and three determinations of the sound pressure level, frequency and total distortion were made.

The sound pressure level was measured using a WS2F condenser microphone type MK:224 manufactured by Cirrus Research plc.

The results have been corrected to the reference pressure of 101.33 kPa using the manufacturer's data.

The doseBadge Reader has been shown to conform to the Class 2 requirements for periodic testing, described in Annex B of IEC 60942:2003 for the sound pressure level(s) and frequency(ies) stated, for the environmental conditions under which the tests were performed.

However, as public evidence was not available, from a testing organisation responsible for pattern approval, to demonstrate that the model of doseBadge Reader conformed to the requirements for pattern evaluation described in Annex A of IEC 60942:2003, no general statement or conclusion can be made about conformance of the doseBadge Reader to the requirements of IEC 60942:2003.

**Notes:**

REVIEW BY

APPROVED BY

NEXT CAL DATE 02/12/25

This certificate provides traceability of measurement to the SI system of units and/or to units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory. The results within this certificate relate only to the items calibrated. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor  $k=2$ , providing a coverage probability of approximately 95%.



# CERTIFICATE OF CALIBRATION

Certificate Number:  
**228072**

Page 2 of 2

## Environmental conditions

The following conditions were recorded at the time of the test:

<b>Before</b>	Pressure: 100.23 kPa	Temperature: 23.0 °C	Humidity: 39.1 %
<b>After</b>	Pressure: 100.24 kPa	Temperature: 23.0 °C	Humidity: 41.3 %

## Test equipment

Equipment	Manufacturer	Model	Serial number
Distortion Meter	Keithley	2015	1053426
Acoustic Calibrator	Bruel and Kjaer	4231	2610257
Environmental Monitor	Comet	T7510	21962628

## Initial Acoustic Results

	Expected	Sample 1	Sample 2	Sample 3	Average	Deviation	Tolerance	Uncertainty
Level (dB)	114.00	113.20	113.19	113.19	113.19	-0.81	±0.75	0.11 dB
Distortion (%)	< 4.00	0.23	0.21	1.39	0.61	0.61	+4.00	0.13 %
Frequency (Hz)	1000.0	1004.1	1004.1	1004.1	1004.1	4.1	±200.0	0.1 Hz

The measured quantities or deviations (as applicable), extended by the expanded combined uncertainty of measurement, must not exceed the corresponding tolerance.

## Adjusted Acoustic Results

	Expected	Sample 1	Sample 2	Sample 3	Average	Deviation	Tolerance	Uncertainty
Level (dB)	114.00	113.98	113.99	113.99	113.99	-0.01	±0.75	0.11 dB
Distortion (%)	< 4.00	0.23	0.25	0.23	0.24	0.24	+4.00	0.13 %
Frequency (Hz)	1000.0	1004.0	1004.1	1004.1	1004.1	4.1	±200.0	0.1 Hz

## Functionality Results

Function	Result
Keypad	Pass
Battery Power	Pass
Display	Pass
Communication	Pass
2 way IR link	Pass
Clock	Pass

End of results

Calibration report Number

CDM-111-67

## CALIBRATION REPORT

Page 1 of 1 Pages

**MEASUREMENT ITEM** : Dose meter  
**MANUFACTURER** : Cirrus Research plc  
**MODEL/TYPE** : CR:110AIS  
**SERIAL NUMBER** : YF479  
**ID NUMBER** : RYG\_FS0040  
**CONDITION AS-RECEIVED** : Used item  
**CUSTOMER** : ALS laboratory group (thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang,  
Khet Suan Luang, Bangkok 10250 Thailand.

**RECEIVED DATE** : 16 Sep 2024  
**MEASUREMENT DATE** : 17 Sep 2024  
**ISSUE DATE** : 18 Sep 2024

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

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

**PRECONDITIONING** : The dose meter (Unit Under Calibration) was preconditioning 24 hours at ambient conditions prior to calibration being performed.

### Calibration procedure:

The Noise dosimeter (Unit Under Calibration) was calibrated against Standard dosebadge reader model: RC-110A which the calibration was performed respecting the requirements of ISO/IEC 17025:2017 and carried out in accordance with the requirements of IEC 60942:2003 where applicable.

### 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 Cirrus research plc via Certificate number: 218610

### STANDARD USED DURING CALIBRATION:

**Instrument name:** doseBadge Reader **Manufacturer:** Cirrus Research plc. **Model:** RC:110A **Serial number:** 81051

**Remark:** doseBadge Reader Unit with Internal Acoustic Calibrator to IEC 60942: 2003 Class 2.

### CALIBRATION RESULTS:

Table 1: The results of dose meter calibration are reported in the table below.

DoseBadge Reader Level <sup>1</sup> (dB)	Noise Dosimeter reading <sup>2</sup> (dB)	Error (dB)	Status
114.0	114.0	0.0	✓

### Calibrated by:

- ☒ Mr. Sorawit Thachalad  
☐ Miss Jittraporn Lertsomphol



### Approved signatory:

*[Signature]*

Mr. Parinya Booncharoen  
Calibration Department Manager

### Remark:

<sup>1</sup> The decibel level of standard doseBadge reader that supplied to Unit Under Calibration.

<sup>2</sup> The measurement reading of Unit Under Calibration.





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Web site: www.jiranatee.com

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

Acoustic calibration laboratory  
Calibration services department.

REVIEW BY	<i>Manakorn R</i>
APPROVED BY	<i>[Signature]</i>
NEXT CAL. DATE	17/9/25

Calibration report Number

CDM-107-67

## CALIBRATION REPORT

Page 1 of 1 Pages

MEASUREMENT ITEM : Dose meter  
MANUFACTURER : Cirrus Research plc  
MODEL/TYPE : RC:110AIS  
SERIAL NUMBER : YF475  
ID NUMBER : RYG\_FS0036  
CONDITION AS-RECEIVED : Used item  
CUSTOMER : ALS laboratory group (thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang,  
Khet Suan Luang, Bangkok 10250 Thailand.

RECEIVED DATE : 16 Sep 2024  
MEASUREMENT DATE : 17 Sep 2024  
ISSUE DATE : 18 Sep 2024

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

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

PRECONDITIONING : The dose meter (Unit Under Calibration) was preconditioning 24 hours at ambient conditions prior to calibration being performed.

### Calibration procedure:

The Noise dosimeter (Unit Under Calibration) was calibrated against Standard dosebadge reader model: RC-110A which the calibration was performed respecting the requirements of ISO/IEC 17025:2017 and carried out in accordance with the requirements of IEC 60942:2003 where applicable.

### 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 Cirrus research plc via Certificate number: 218610

### STANDARD USED DURING CALIBRATION:

Instrument name: doseBadge Reader Manufacturer: Cirrus Research plc. Model: RC:110A Serial number: 81051

Remark: doseBadge Reader Unit with Internal Acoustic Calibrator to IEC 60942: 2003 Class 2.

### CALIBRATION RESULTS:

Table 1: The results of dose meter calibration are reported in the table below.

DoseBadge Reader Level <sup>1</sup> (dB)	Noise Dosimeter reading <sup>2</sup> (dB)	Error (dB)	Status
114.0	114.0	0.0	✓

### Calibrated by:

- ☒ Mr. Sorawit Thachalad  
☐ Miss Jitraporn Lertsomphol



Approved signatory: .....

*[Signature]*  
Mr. Parinya Booncharoen  
Calibration Department Manager

### Remark:

<sup>1</sup> The decibel level of standard doseBadge reader that supplied to Unit Under Calibration.

<sup>2</sup> The measurement reading of Unit Under Calibration.

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

Calibration report Number

CDM-110-67

## CALIBRATION REPORT

Page 1 of 1 Pages

MEASUREMENT ITEM : Dose meter  
MANUFACTURER : Cirrus Research plc  
MODEL/TYPE : CR:110AIS  
SERIAL NUMBER : YF478  
ID NUMBER : RYG\_FS0039  
CONDITION AS-RECEIVED : Used item  
CUSTOMER : ALS laboratory group (thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang,  
Khet Suan Luang, Bangkok 10250 Thailand.

RECEIVED DATE : 16 Sep 2024  
MEASUREMENT DATE : 17 Sep 2024  
ISSUE DATE : 18 Sep 2024

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

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

### PRECONDITIONING

: The dose meter (Unit Under Calibration) was preconditioning 24 hours at ambient conditions prior to calibration being performed.

### Calibration procedure:

The Noise dosimeter (Unit Under Calibration) was calibrated against Standard dosebadge reader model: RC-110A which the calibration was performed respecting the requirements of ISO/IEC 17025:2017 and carried out in accordance with the requirements of IEC 60942:2003 where applicable.

### 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 Cirrus research plc via Certificate number: 218610

### STANDARD USED DURING CALIBRATION:

Instrument name: doseBadge Reader Manufacturer: Cirrus Research plc. Model: RC:110A Serial number: 81051

Remark: doseBadge Reader Unit with Internal Acoustic Calibrator to IEC 60942: 2003 Class 2.

### CALIBRATION RESULTS:

Table 1: The results of dose meter calibration are reported in the table below.

DoseBadge Reader Level <sup>1</sup> (dB)	Noise Dosimeter reading <sup>2</sup> (dB)	Error (dB)	Status
114.0	114.0	0.0	✓

### Calibrated by:

- ☒ Mr. Sorawit Thachalad  
☐ Miss Jitraporn Lertsomphol



### Approved signatory:

*[Signature]*

Mr. Parinya Booncharoen  
Calibration Department Manager

### Remark:

<sup>1</sup> The decibel level of standard doseBadge reader that supplied to Unit Under Calibration.

<sup>2</sup> The measurement reading of Unit Under Calibration.

Calibration report Number

CDM-112-67

## CALIBRATION REPORT

Page 1 of 1 Pages

**MEASUREMENT ITEM** : Dose meter  
**MANUFACTURER** : Cirrus Research plc  
**MODEL/TYPE** : CR:110AIS  
**SERIAL NUMBER** : YF480  
**ID NUMBER** : RYG\_FS0041  
**CONDITION AS-RECEIVED** : Used item  
**CUSTOMER** : ALS laboratory group (thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang,  
Khet Suan Luang, Bangkok 10250 Thailand.

**RECEIVED DATE** : 16 Sep 2024  
**MEASUREMENT DATE** : 17 Sep 2024  
**ISSUE DATE** : 18 Sep 2024

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

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

**PRECONDITIONING** : The dose meter (Unit Under Calibration) was preconditioning 24 hours at ambient conditions prior to calibration being performed.

### Calibration procedure:

The Noise dosimeter (Unit Under Calibration) was calibrated against Standard dosebadge reader model: RC-110A which the calibration was performed respecting the requirements of ISO/IEC 17025:2017 and carried out in accordance with the requirements of IEC 60942:2003 where applicable.

### 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 Cirrus research plc via Certificate number: 218610

### STANDARD USED DURING CALIBRATION:

Instrument name: doseBadge Reader Manufacturer: Cirrus Research plc. Model: RC:110A Serial number: 81051

Remark: doseBadge Reader Unit with Internal Acoustic Calibrator to IEC 60942: 2003 Class 2.

### CALIBRATION RESULTS:

Table 1: The results of dose meter calibration are reported in the table below.

DoseBadge Reader Level <sup>1</sup> (dB)	Noise Dosimeter reading <sup>2</sup> (dB)	Error (dB)	Status
114.0	114.0	0.0	✓

### Calibrated by:

- ☒ Mr. Sorawit Thachalad  
☐ Miss Jittraporn Lertsomphol



### Approved signatory:

*[Signature]*  
Mr. Parinya Booncharoen  
Calibration Department Manager

### Remark:

<sup>1</sup> The decibel level of standard doseBadge reader that supplied to Unit Under Calibration.

<sup>2</sup> The measurement reading of Unit Under Calibration.





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NSC-TISI-TIS 17025  
CALIBRATION 0367

Acoustic calibration laboratory  
Calibration services department.

REVIEW BY	Warakorn P.
APPROVED BY	[Signature]
NEXT CAL. DATE	17/9/25

Calibration report Number

CDM-106-67

## CALIBRATION REPORT

Page 1 of 1 Pages

MEASUREMENT ITEM : Dose meter  
MANUFACTURER : Cirrus Research plc  
MODEL/TYPE : RC:110AIS  
SERIAL NUMBER : YF474  
ID NUMBER : RYG\_FS0035  
CONDITION AS-RECEIVED : Used item  
CUSTOMER : ALS laboratory group (thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang,  
Khet Suan Luang, Bangkok 10250 Thailand.

RECEIVED DATE : 16 Sep 2024  
MEASUREMENT DATE : 17 Sep 2024  
ISSUE DATE : 18 Sep 2024

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

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

### Calibration procedure:

The Noise dosimeter (Unit Under Calibration) was calibrated against Standard dosebadge reader model: RC-110A which the calibration was performed respecting the requirements of ISO/IEC 17025:2017 and carried out in accordance with the requirements of IEC 60942:2003 where applicable.

### 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 Cirrus research plc via Certificate number: 218610

PRECONDITIONING : The dose meter (Unit Under Calibration) was preconditioning 24 hours at ambient conditions prior to calibration being performed.

### STANDARD USED DURING CALIBRATION:

Instrument name: doseBadge Reader Manufacturer: Cirrus Research plc. Model: RC:110A Serial number: 81051

Remark: doseBadge Reader Unit with Internal Acoustic Calibrator to IEC 60942: 2003 Class 2.

### CALIBRATION RESULTS:

Table 1: The results of dose meter calibration are reported in the table below.

DoseBadge Reader Level <sup>1</sup> (dB)	Noise Dosimeter reading <sup>2</sup> (dB)	Error (dB)	Status
114.0	114.0	0.0	✓

### Calibrated by:

- ☒ Mr. Sorawit Thachalad  
☐ Miss Jittraporn Lertsomphol



Approved signatory:

[Signature]

Mr. Parinya Booncharoen  
Calibration Department Manager

### Remark:

<sup>1</sup> The decibel level of standard doseBadge reader that supplied to Unit Under Calibration.

<sup>2</sup> The measurement reading of Unit Under Calibration.

THIS CALIBRATION REPORT MAY NOT BE REPRODUCED EXCEPT IN FULL UNLESS PERMISSION FOR REPRODUCTION HAS BEEN OBTAINED  
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Web site: www.jiranatee.com

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

Acoustic calibration laboratory  
Calibration services department.

REVIEW BY *Nirakorn P*  
APPROVED BY *[Signature]*  
NEXT CAL. DATE *17/9/25*

Calibration report Number

CDM-109-67

## CALIBRATION REPORT

Page 1 of 1 Pages

MEASUREMENT ITEM : Dose meter  
MANUFACTURER : Cirrus Research plc  
MODEL/TYPE : CR:110AIS  
SERIAL NUMBER : YF477  
ID NUMBER : RYG\_FS0038  
CONDITION AS-RECEIVED : Used item  
CUSTOMER : ALS laboratory group (thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang,  
Khet Suan Luang, Bangkok 10250 Thailand.

RECEIVED DATE : 16 Sep 2024  
MEASUREMENT DATE : 17 Sep 2024  
ISSUE DATE : 18 Sep 2024

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

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

PRECONDITIONING : The dose meter (Unit Under Calibration) was preconditioning 24 hours at ambient conditions prior to calibration being performed.

### Calibration procedure:

The Noise dosimeter (Unit Under Calibration) was calibrated against Standard dosebadge reader model: RC-110A which the calibration was performed respecting the requirements of ISO/IEC 17025:2017 and carried out in accordance with the requirements of IEC 60942:2003 where applicable.

### 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 Cirrus research plc via Certificate number: 218610

### STANDARD USED DURING CALIBRATION:

Instrument name: doseBadge Reader Manufacturer: Cirrus Research plc. Model: RC:110A Serial number: 81051

Remark: doseBadge Reader Unit with Internal Acoustic Calibrator to IEC 60942: 2003 Class 2.

### CALIBRATION RESULTS:

Table 1: The results of dose meter calibration are reported in the table below.

DoseBadge Reader Level <sup>1</sup> (dB)	Noise Dosimeter reading <sup>2</sup> (dB)	Error (dB)	Status
114.0	114.0	0.0	✓

### Calibrated by:

- ☒ Mr. Sorawit Thachalad  
☐ Miss Jittraporn Lertsomphol



Approved signatory: *[Signature]*

Mr. Parinya Booncharoen  
Calibration Department Manager

### Remark:

<sup>1</sup> The decibel level of standard doseBadge reader that supplied to Unit Under Calibration.

<sup>2</sup> The measurement reading of Unit Under Calibration.

THIS CALIBRATION REPORT MAY NOT BE REPRODUCED EXCEPT IN FULL UNLESS PERMISSION FOR REPRODUCTION HAS BEEN OBTAINED  
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Web site: www.jiranatee.com

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

Acoustic calibration laboratory  
Calibration services department.

REVIEW BY

*Narakorn P.*

APPROVED BY

*[Signature]*

NEXT CAL. DATE

17/9/25

Calibration report Number

CDM-105-67

## CALIBRATION REPORT

Page 1 of 1 Pages

MEASUREMENT ITEM : Dose meter  
MANUFACTURER : Cirrus Research plc  
MODEL/TYPE : CR:110AIS  
SERIAL NUMBER : YF473  
ID NUMBER : RYG\_FS0034  
CONDITION AS-RECEIVED : Used item  
CUSTOMER : ALS laboratory group (thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang,  
Khet Suan Luang, Bangkok 10250 Thailand.

### Calibration procedure:

The Noise dosimeter (Unit Under Calibration) was calibrated against Standard dosebadge reader model: RC-110A which the calibration was performed respecting the requirements of ISO/IEC 17025:2017 and carried out in accordance with the requirements of IEC 60942:2003 where applicable.

### 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 Cirrus research plc via Certificate number: 218610

RECEIVED DATE : 16 Sep 2024  
MEASUREMENT DATE : 17 Sep 2024  
ISSUE DATE : 18 Sep 2024

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

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

PRECONDITIONING : The dose meter (Unit Under Calibration) was preconditioning 24 hours at ambient conditions prior to calibration being performed.

### STANDARD USED DURING CALIBRATION:

Instrument name: doseBadge Reader Manufacturer: Cirrus Research plc. Model: RC:110A Serial number: 81051

Remark: doseBadge Reader Unit with Internal Acoustic Calibrator to IEC 60942: 2003 Class 2.

### CALIBRATION RESULTS:

Table 1: The results of dose meter calibration are reported in the table below.

DoseBadge Reader Level <sup>1</sup> (dB)	Noise Dosimeter reading <sup>2</sup> (dB)	Error (dB)	Status
114.0	114.0	0.0	✓

### Calibrated by:

- ☒ Mr. Sorawit Thachalad  
☐ Miss Jitraporn Lertsomphol



### Approved signatory:

*[Signature]*

Mr. Parinya Booncharoen  
Calibration Department Manager

### Remark:

<sup>1</sup> The decibel level of standard doseBadge reader that supplied to Unit Under Calibration.

<sup>2</sup> The measurement reading of Unit Under Calibration.

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

Calibration report Number

CDM-108-67

## CALIBRATION REPORT

Page 1 of 1 Pages

MEASUREMENT ITEM : Dose meter  
MANUFACTURER : Cirrus Research plc  
MODEL/TYPE : CR:110AIS  
SERIAL NUMBER : YF476  
ID NUMBER : RYG\_FS0037  
CONDITION AS-RECEIVED : Used item  
CUSTOMER : ALS laboratory group (thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang,  
Khet Suan Luang, Bangkok 10250 Thailand.

RECEIVED DATE : 16 Sep 2024  
MEASUREMENT DATE : 17 Sep 2024  
ISSUE DATE : 18 Sep 2024

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

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

PRECONDITIONING : The dose meter (Unit Under Calibration) was preconditioning 24 hours at ambient conditions prior to calibration being performed.

### Calibration procedure:

The Noise dosimeter (Unit Under Calibration) was calibrated against Standard dosebadge reader model: RC-110A which the calibration was performed respecting the requirements of ISO/IEC 17025:2017 and carried out in accordance with the requirements of IEC 60942:2003 where applicable.

### 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 Cirrus research plc via Certificate number: 218610

### STANDARD USED DURING CALIBRATION:

Instrument name: doseBadge Reader Manufacturer: Cirrus Research plc. Model: RC:110A Serial number: 81051

Remark: doseBadge Reader Unit with Internal Acoustic Calibrator to IEC 60942: 2003 Class 2.

### CALIBRATION RESULTS:

Table 1: The results of dose meter calibration are reported in the table below.

DoseBadge Reader Level <sup>1</sup> (dB)	Noise Dosimeter reading <sup>2</sup> (dB)	Error (dB)	Status
114.0	114.0	0.0	✓

### Calibrated by:

- ☒ Mr. Sorawit Thachalad  
☐ Miss Jittraporn Lertsomphol



### Approved signatory:

*[Signature]*

Mr. Parinya Booncharoen  
Calibration Department Manager

### Remark:

<sup>1</sup> The decibel level of standard doseBadge reader that supplied to Unit Under Calibration.

<sup>2</sup> The measurement reading of Unit Under Calibration.

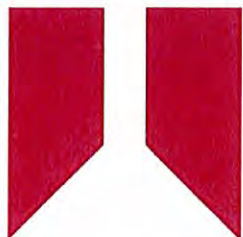


# CERTIFICATE OF CALIBRATION

ISSUED BY **Cirrus Research plc**

DATE OF ISSUE **29 April 2025**

CERTIFICATE NUMBER **239325**



**Cirrus Research plc**  
**Acoustic House**  
**Bridlington Road**  
**Hunmanby**  
**North Yorkshire**  
**YO14 0PH**  
**United Kingdom**

Page 1 of 6

Approved signatory

N.Smith

Electronically signed:

## Dosemeter : IEC 61252-1993+A1:2000

### Instrument information

Manufacturer: Cirrus Research plc  
Model: CR:110AIS  
Serial number: YF565  
Firmware version: 5.4

Notes:

REVIEW BY *Supt S*

APPROVED BY *[Signature]*

NEXT CAL DATE 27/ 04/ 2026

### Test summary

Date of calibration: 28 April 2025

The calibration was performed respecting the requirements of ISO/IEC 17025:2017.

The dosimeter submitted for testing successfully completed the periodic tests of IEC 61252-1993+A1:2000.

The dosimeter submitted for testing conforms to the specifications in IEC 61252-1993+A1:2000.

### Test equipment

Equipment	Manufacturer	Model	Serial number
Signal Generator	SIGLENT	SDG1032X	SDG1XDEX6R4732
Attenuator	Cirrus Research	ZE:952	64370
Environmental Monitor	Comet	T7510	16966334
doseBadge Reader	Cirrus Research plc	RC:110A	100498

### Notes

This certificate provides traceability of measurement to the SI system of units and/or to units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory. The results within this certificate relate only to the items calibrated. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor  $k=2$ , providing a coverage probability of approximately 95%.



# CERTIFICATE OF CALIBRATION

Certificate Number:  
**239325**

Page 2 of 6

## Environmental conditions

The following conditions were recorded at the time of the test:

<b>Before</b>	Pressure: 101.98 kPa	Temperature: 20.8 °C	Humidity: 52.7 %
<b>After</b>	Pressure: 101.99 kPa	Temperature: 21.2 °C	Humidity: 51.6 %

## Test results summary

Test	Result
Absolute Acoustic Sensitivity	Complies
Linearity	Complies
Short Duration	Complies
Overload Latching	Complies
Frequency weighting	Complies

# CERTIFICATE OF CALIBRATION

Certificate Number:

**239325**

Page 3 of 6

## Laboratory uncertainties

Requirement	Value
Absolute acoustic sensitivity	0.2 dB
Level linearity	0.15 dB
Short duration signals	0.2 dB
Overload latching indication	0.2 dB
Electrical freq. weighting 125 Hz	0.15 dB
Electrical freq. weighting 8 kHz	0.15 dB

# CERTIFICATE OF CALIBRATION

Certificate Number:

239325

Page 4 of 6

## B1: Absolute Acoustical Sensitivity

Result: **Passed**

Frequency: 1000 Hz

Uncertainty: 0.2 dB

Name	Input Level (dB)	Reading (dB)	Deviation (dB)	Limits (dB)
Initial	114	114.30	-0.3	113 / 115
Adjusted	114	114.00	0	113 / 115

## B2: Linearity Of Response To Steady Signals

Result: **Passed**

Frequency: 1000 Hz

Uncertainty: 0.2 dB

Range: 80 – 130 dB

Input Level (dB)	Expected Exposure (Pa <sup>2</sup> h)	Exposure (Pa <sup>2</sup> h)	Duration (s)	Deviation (Pa <sup>2</sup> h)	Limits (Pa <sup>2</sup> h)	Deviation (%)	Limits (%)
80	0.000222	0.000273	20	-0.000051	0.000175 / 0.000280	23	-21 / +26
90	0.002222	0.002172	20	0.000050	0.001755 / 0.002800	-2	-21 / +26
100	0.022222	0.020739	20	0.001483	0.017555 / 0.028000	-7	-21 / +26
110	0.222222	0.202669	20	0.019553	0.175555 / 0.280000	-9	-21 / +26
120	2.222222	2.171638	20	0.050584	1.755555 / 2.800000	-2	-21 / +26
130	22.222223	23.269524	20	-1.047301	17.555556 / 28.000001	5	-21 / +26



# CERTIFICATE OF CALIBRATION

Certificate Number:

**239325**

Page 5 of 6

## B3: Frequency Weightings

Result: **Passed**

Reference Frequency: 1000 Hz

Reference Exposure: 5.6984599601109

Reference Input Level: 127 dB

Duration: 10 Seconds

Frequency (Hz)	Exposure (Pa <sup>2</sup> h)	Exposure Ratio	Ratio Limit	Uncertainty
125	0.130544	0.0229	0.0174 / 0.0347	0.15
8000	2.375513	0.4169	0.246 / 2.455	0.15

## B4: Short-Duration Signals

Result: **Passed**

Uncertainty: 0.2 dB

Frequency: 4000 Hz

Input Level (dB)	Burst Level (dB)	Ratio	Duration (s)	Burst Duration (ms)	Duration Between Bursts (ms)	Expected Exposure (Pa <sup>2</sup> h)	Exposure (Pa <sup>2</sup> h)	Deviation (%)	Limits (%)
114	95	1:100	10	10	990	0.003434	0.003853	12	-21 / +26
129	100	1:1000	10	1	999	0.010858	0.010858	0	-29 / +41

# CERTIFICATE OF CALIBRATION

Certificate Number:

**239325**

Page 6 of 6

## B6: Latching Overload Indicator

Result: **Passed**

Frequency: 1000 Hz

Uncertainty: 0.2 dB

Level (dB)	Expected To Overload	Overloaded
130	No	No
133	Yes	Yes

End of results





JIRANATEE ASSOCIATES CO., LTD.

Jiranatee Associates Co., Ltd  
63/14-15, 67/35-36  
Petchkasem 7, 7/1, Rd. Watthapra, Bangkokyai,  
Bangkok 10600 (Thailand)  
Tel: +6608680812  
Mobile: +66863999453  
E-mail: jnac-calibration@jiranatee.com  
Web site: www.jiranatee.com

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

Acoustic calibration laboratory  
Calibration services department.

REVIEW BY

Narakorn P.

APPROVED BY

Gus

NEXT CAL. DATE

14/9/25

Calibration report Number

CDM-113-67

## CALIBRATION REPORT

Page 1 of 1 Pages

MEASUREMENT ITEM : Dose meter  
MANUFACTURER : Cirrus Research plc  
MODEL/TYPE : CR:110AIS  
SERIAL NUMBER : YF481  
ID NUMBER : RYG\_FS0042  
CONDITION AS-RECEIVED : Used item  
CUSTOMER : ALS laboratory group (thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang,  
Khet Suan Luang, Bangkok 10250 Thailand.

RECEIVED DATE : 16 Sep 2024  
MEASUREMENT DATE : 17 Sep 2024  
ISSUE DATE : 18 Sep 2024

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

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

### PRECONDITIONING

: The dose meter (Unit Under Calibration) was preconditioning 24 hours at ambient conditions prior to calibration being performed.

### Calibration procedure:

The Noise dosimeter (Unit Under Calibration) was calibrated against Standard dosebadge reader model: RC-110A which the calibration was performed respecting the requirements of ISO/IEC 17025:2017 and carried out in accordance with the requirements of IEC 60942:2003 where applicable.

### 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 Cirrus research plc via Certificate number: 218610

### STANDARD USED DURING CALIBRATION:

Instrument name: doseBadge Reader Manufacturer: Cirrus Research plc. Model: RC:110A Serial number: 81051

Remark: doseBadge Reader Unit with Internal Acoustic Calibrator to IEC 60942: 2003 Class 2.

### CALIBRATION RESULTS:

Table 1: The results of dose meter calibration are reported in the table below.

DoseBadge Reader Level <sup>1</sup> (dB)	Noise Dosimeter reading <sup>2</sup> (dB)	Error (dB)	Status
114.0	114.0	0.0	✓

### Calibrated by:

- ☒ Mr. Sorawit Thachalad  
☐ Miss Jittraporn Lertsomphol



Approved signatory:

Mr. Parinya Booncharoen

Calibration Department Manager

### Remark:

<sup>1</sup> The decibel level of standard doseBadge reader that supplied to Unit Under Calibration.

<sup>2</sup> The measurement reading of Unit Under Calibration.



## 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 : 2507-0561DSC-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 :  $(25 \pm 2.5) ^\circ\text{C}$   
Relative Humidity :  $(50 \pm 15) \%$   
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 Sirithean

Approved by :

Saithip

Approved Signatory

- ( ) Chakrit Waewwanjua  
( ) Ponpan Paipim  
(✓) Saithip Meangmai

Issue Date : 21 July 2025

**The Uncertainties are for a confidence probability of approximately 95%**

This certificate may not be reproduced other than in full, except with the prior written  
Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.



Cert.No.: 25CH847

Page.: 2 of 3

**Condition of this calibration result**

1. Reference Standard Instrument

<u>Instrument</u>	<u>Serial No.</u>	<u>ID No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
1) Document Process Calibrator	54030049	130RC116	24E2759	25 Aug 2025
2) Ref. Standard Thermometer	3240076	60RC033	25I394	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

<u>Buffer Solution</u>	<u>Manufacturer</u>	<u>Lot No.</u>	<u>Exp. date</u>
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 <i>k</i>
	pH	mV	mV	pH		
pH Meter S/N.: C104059460	4.000	177.48	177.3	4.000	0.058	2.00
	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 ( $\pm$ )	Coverage factor $k$
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 ( $\pm$ °C)	Coverage factor $k$
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 %.

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
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TEL. 0-2717-3000-24 FAX. 0-2719-9484



## 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 ) %

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except with the prior written approval of the head of  
Corporate Services 3: Equipment Calibration and Testing Services.

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

616/10 Moo 5, T.Maenam Khu, A.Pluakdaeng,  
Rayong 21140, Thailand

**Procedure used:** Calibration were conducted using calibration procedure No. CP-E17 according to EURAMET cg-15.

### Condition of this result of calibration

1.Reference standards instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
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 Prasomsoosiri  
**Issue Date :** 23 July 2025

**Approved Signatory :** \_\_\_\_\_

[ ] Phalinee Prabpaipal

[ ] Nuntawat Khamchai

[✓] Pongsagorn Boonyaporn





Cert. No.: 25E2372

Page.: 2 of 2

**Result of calibration :-** (\*) Without adjustment ( ) After adjustment

**Function:** DC voltage measurement

**Range:**

2000

mV

<u>Standard Value</u>	<u>UUC* Reading</u>	<u>Error</u>	<u>Uncertainty</u>
( mV )	( mV )	( mV )	( $\pm$ $\mu$ V )
-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.**

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



## Certificate of Calibration

Cert. No.: 25LM10

Page.: 1 of 2

Equipment : DO Meter with Sensor

Manufacturer : YSI

Model : 5000-115V

Serial No. : 15E102796

ID No. : RYG\_EN0032

Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.  
(Rayong Branch)  
616/10 Moo 5 T. Maenam Khu, A. Pluakdaeng,  
Rayong 21140 Thailand

Location : TPA On Site Calibration Laboratory

Received Order : 17 January 2025

Calibrated Date : 20 January 2025

Ambient Temperature : (  $26 \pm 10$  ) °C

Relative Humidity : (  $50 \pm 30$  ) %

AC Line Voltage : (  $220 \pm 22$  ) V

Calibrated by : Warakorn Lerngagtrakul

Approved by :

Approved Signatory

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

REVIEW BY ..... Photchanas.

APPROVED BY .....

NEXT CAL DATE..... 20/07/26



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

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

**Procedure Used :-**

Calibration were conducted using in-house calibration procedure CP-OT01 according to comparison with Industrial Platinum Resistance Thermometer ( IPRT ) into Temperature Bath.

The temperature scale used was based on ITS-90.

**Condition of this result of calibration**

1. Reference standard instrument:-

<u>Instrument</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Traceable</u>	<u>Due Date</u>
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

<u>Calibration Point</u> ( °C )	<u>Immersion Depth</u> ( mm )	<u>Standard Temperature</u> ( °C )	<u>UUC* Reading</u> ( °C )	<u>Error</u> ( °C )	<u>Uncertainty</u> ( ± °C )	<u>Coverage Factor</u> <i>k</i>
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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TEL. 0-2717-3000 FAX. 0-2719-9484

## Certificate of Testing

**Cert.No.:** 25TW15

**Page.:** 1 of 2

**Equipment :** DO Meter

**Manufacturer :** YSI

**Model :** 5000-115V

**Serial No. :** 15E102796

**ID No. :** RYG\_EN0032

**Received Date :** 17 January 2025

**Test Date :** 20 January 2025


**Reference :** 2501-0600DSC-1

**Submitted by :** ALS Laboratory Group (Thailand) Co.,Ltd.  
(Rayong Branch)  
616/10 Moo 5, T.Maenam Khu, A.Pluakdaeng,  
Rayong 21140, Thailand

**Laboratory Condition :** Temperature (  $25 \pm 5$  ) °C  
Humidity (  $50 \pm 20$  ) %

**Test Procedure :** In - house method : CP-CH9  
by Comparison Technique with Azide Modification Method

**Tested by :** Walalak Sirithean

**Approved by :**   
Approved Signatory

( ) Pornthippa Tameyakul  
( ) Ponpan Paipim  
(✓) Saithip Meangmai

**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).

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

2. Standard Material :-

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

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

Dissolved Oxygen Probe No.: 15E100464

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

This report was certified only for the instrument we tested. It is allowable to use for study  
Intend to use for advertising and referral purpose is prohibited. This report may not be reproduced  
other in full, without written approval of the laboratory

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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 :

*Kunchit*

Approved Signatory

( ) Ponpan Paipim

( ) Suwit Imjai

(✓) Kunchit Promprat

Issue Date : 07 November 2024

REVIEW BY ..... *Thanitak* .....

APPROVED BY ..... *D. Khun* .....

NEXT CAL DATE..... 01/05/26 .....

**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:-

<u>Instrument</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Traceable</u>	<u>Due Date</u>
1 ) Data Acquisition	MY44073381	24LM73	TPA	18 May 2025

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

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

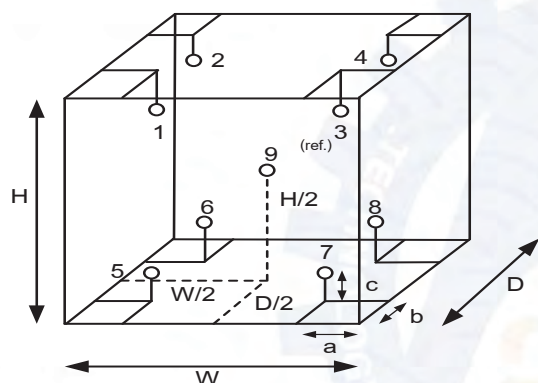
**Remark :** TPA : Technology Promotion Association ( Thailand - Japan )

**Result of Calibration :-** ( \* ) Without Adjustment

**Function of UUC\* :** Temperature Source

**Fresh air setting :** Close

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

**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>



**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 <i>k</i>
20.0	20.0	20.0	0.026	0.26	0.53	2

Calibration Point ( °C )	Measured Temperature ( °C )									Uncertainty  ( ±°C )
	Position									
	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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## Certificate of Calibration

Cert.No.: 25CG3668

Page.: 1 of 2

Equipment :	Burette
Capacity :	50 mL
Serial No. :	-
ID. No. :	RYG_EN0216
Manufacturer :	Witeg
Made in :	Germany
Submitted by :	ALS Laboratory Group (Thailand) Co.,Ltd. Rayong Branch 616/10 Moo 5 T.MaenamKoo, A.Plukdaeng Rayong 21140, Thailand
Ambient Temperature :	(20 ± 2.5) °C
Relative Humidity :	(50 ± 10) %
Barometric Pressure :	753 mmHg
Calibration Procedure :	ASTM E 542 - 01
Calibrated by :	Srisuda Khamtha
Approved by :	 Approved Signatory
( ) Ponpan Paipim	
(✓) Chakrit Waewwanjua	

REVIEW BY *Thanitak*

APPROVED BY *D. Khamtha*

NEXT CAL DATE **18/09/26**

**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 :** Burette  
**Received Date :** 16 September 2025  
**Condition As-Received :** Used Item  
**Calibration Date :** 18 September 2025  
**Reference :** 2509-0564DSC-3

**Cert.No.:** 25CG3668

**Page.:** 2 of 2

**Condition of this result of calibration**

1. Reference Standard Instruments :

<u>Instruments</u>	<u>Model</u>	<u>Serial No.</u>	<u>ID. No.</u>	<u>Certificate No.</u>	<u>Traceability</u>	<u>Due date</u>
1) Balance	XP205	B134206712	140RC007	25MM296	TPA	16 July 2026
2) Humidity/Baro/Temp	MHB-382SD	AM.42259	140EC016	25H1616	TPA	14 Aug 2026
3) Digital Thermometer	HH376	230806555	140EC013	25I1740	TPA	17 Jan 2026

This measurement result is traceable to SI Unit

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

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

**Calibration result :**

<b>Nominal capacity ( mL )</b>	<b>Reading ( mL )</b>	<b>Uncertainty ( ± mL )</b>	<b>k Factor</b>
10	10.0264	0.0082	2.00
25	25.0141	0.0087	2.00
50	49.9952	0.010	2.00

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

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

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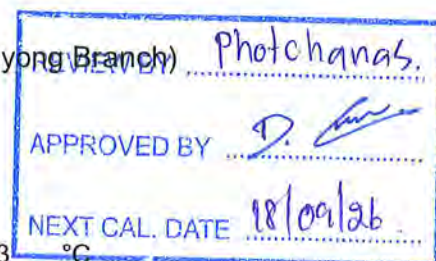


# Certificate of Calibration

**Equipment:** SPECTROPHOTOMETER  
**Model:** DR6000  
**Serial No. (or ID.):** 1627845 (RYG\_EN0037)  
**Manufacturer:** HACH  
**Condition:** In Condition

**Certificate No.:** C06250108  
**Issued Date:** 18 March 2025  
**Job No.:** WO-00064379  
**Page:** 1 of 3

**Customer:** ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)  
616/10 Moo 5 T.Maenam Khu,  
A.Pluakdaeng, Rayong 21140, Thailand.



**Environment Condition:**

Temperature	24.4	°C	±	0.3	°C
Humidity	60.8	%RH	±	3.5	%RH

**Calibration Place:** ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)  
( Wet Chemistry Lab )  
616/10 Moo 5 T.Maenam Khu, A.Pluakdaeng, Rayong 21140, Thailand.


**Calibration By:** Mr.Preecha Phooarsai  
**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

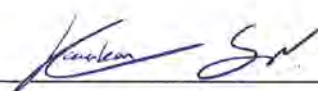
The standard for Stray light Certificate No. 111586 and 111585

The standard for Spectral resolution Certificate No. 111587



(Mr. Preecha Phooarsai)

Person in charge



(Miss Kaewkan Suradech)  
Authorized signatory

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

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

These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด

DKSH Technology Limited

2533 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพมหานคร 10260

2533 Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260

Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

**Calibration Results:**
**Without Adjustment**

Wavelength Accuracy (nm), The spectral bandwidth of Std at 2 nm and UUC at 2 nm

Standard Wavelength	Unit Under Calibration	Correction	Uncertainty
418.61	418.5	0.11	0.13
536.66	536.7	-0.04	0.13
637.98	638.3	-0.32	0.13
748.48	748.8	-0.32	0.13
807.03	807.5	-0.47	0.13

Photometric Accuracy (Absorbance)

Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
420 nm	0.0000	0.000	0.0000	0.0045
	0.2930	0.291	0.0020	0.0045
	0.5168	0.518	-0.0012	0.0045
	1.0298	1.031	-0.0012	0.0045
440 nm	0.0000	0.000	0.0000	0.0045
	0.2867	0.285	0.0017	0.0045
	0.5073	0.508	-0.0007	0.0045
	1.0083	1.009	-0.0007	0.0045
465 nm	0.0000	0.000	0.0000	0.0045
	0.2516	0.250	0.0016	0.0045
	0.4595	0.461	-0.0015	0.0045
	0.9334	0.935	-0.0016	0.0045
546.1 nm	0.0000	0.000	0.0000	0.0045
	0.2461	0.246	0.0001	0.0045
	0.4652	0.466	-0.0008	0.0045
	0.9468	0.948	-0.0012	0.0045
590 nm	0.0000	0.000	0.0000	0.0045
	0.2594	0.259	0.0004	0.0045
	0.5040	0.505	-0.0010	0.0045
	1.0032	1.004	-0.0008	0.0045
635 nm	0.0000	0.000	0.0000	0.0045
	0.2579	0.258	-0.0001	0.0045
	0.4971	0.497	0.0001	0.0045
	0.9720	0.973	-0.0010	0.0045

**Calibration Results:**
**Without Adjustment**
**Photometric Accuracy (Absorbance)**

Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
235 nm	0.0000	0.000	0.0000	0.0080
	0.7355	0.738	-0.0025	0.0080
257 nm	0.0000	0.000	0.0000	0.0080
	0.8574	0.857	0.0004	0.0080
313 nm	0.0000	0.000	0.0000	0.0080
	0.2864	0.290	-0.0036	0.0080
350 nm	0.0000	0.000	0.0000	0.0080
	0.6374	0.637	0.0004	0.0080

**Stray light \***

Standard: cut-off	UUC: Wavelength (nm)	UUC: Transmission (%T)	Absorbance ( A)
260.62 +/- 0.11 nm	260.6	1.7	1.770
391.44 +/- 0.11 nm	391.4	1.4	1.854

**Spectral Resolution \***

Nominal Concentration 0.02 % v/v	Peak	Trough	Ratio	SBW
Standard Wavelength ( nm )	268.66	266.69	1.38	2.00
UUC: Wavelength (nm)	268.2	266.2		
Std Absorbance ( A)	0.4566	0.2780		
UUC: Absorbance ( A)	0.413	0.299		

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

**The End of Certificate**



## ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: WO-00064379

ชนิดเครื่องมือ: SPECTROPHOTOMETER

รุ่น: DR6000

หมายเลขเครื่อง: 1627845

ตรวจสอบ (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
18 Mar 2025			18 Mar 2025		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
		General			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. ความสมบูรณ์เครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. ความสะอาด ( ช่องใส่ตัวอย่าง, ภายใน-นอกเครื่อง)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. สวิตช์ ปิด – เปิด เครื่อง (On-Off Swicth)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. ปุ่มกด (Keypad)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. หน้าจอ (Display, Screen Contrast)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
		Spectrophotometer			
<input type="checkbox"/>	<input type="checkbox"/>	6. แรงดันไฟฟ้า (Battery Backup) >= 2.5 VDC	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	7. ตัวหมุนเลือกความยาวคลื่น (Wavelength Control)	<input type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. ความยาวคลื่น (Wavelength Check)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	*
<input checked="" type="checkbox"/>	<input type="checkbox"/>	9. แหล่งกำเนิดแสง (UV < 3,000 hour)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	13.5 Hours
<input checked="" type="checkbox"/>	<input type="checkbox"/>	10. แหล่งกำเนิดแสง (Visible < 5,000 hour)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	893.0 Hours
<input checked="" type="checkbox"/>	<input type="checkbox"/>	11. ช่องวัดหลายตัวอย่าง (Carousel Module)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
		pH Meter and Conductivity Meter			
<input type="checkbox"/>	<input type="checkbox"/>	12. อิเล็กโทรด ( Electrode and Connection Cable )	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	13. ระดับสารละลายใน Electrode (Level KCl )	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	14. ฝาปิดกันปลาย Electrode (Dust Protection Hood)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	15. ขาจับอิเล็กโทรด (Stand)	<input type="checkbox"/>	<input type="checkbox"/>	
		Turbidimeter			
<input type="checkbox"/>	<input type="checkbox"/>	16. ค่าความขุ่นที่ต่ำสุด (No Sample)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	17. ระดับการส่องสว่างของแสง (>= 2.5 ไม่เกิน 3.0)	<input type="checkbox"/>	<input type="checkbox"/>	
		Automatic titrator			
<input type="checkbox"/>	<input type="checkbox"/>	18. สภาพ Piston Burettes	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	19. Function Rinsing and Dosing	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	20. ระบบท่อสายยางและอุปกรณ์ประกอบ	<input type="checkbox"/>	<input type="checkbox"/>	

เพิ่มเติม/ข้อแนะนำ : \* 656.1nm = 656.1nm

\* 486.0nm = 485.7nm

Mr.Preecha Phooarsai

Service Engineer

Accredited by

NSC-TISI-TIS 17025

Calibration 0426



## Calibration certificate

Calibration Certificate No. 25BKL0002

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	MCE224S-2S00-U	This certificate was prepared by Sartorius Corporation in accordance to the current ISO/IEC 17025:2017 standard and Sartorius Work Instruction (Method) SOP WI 08.
Serial   QM Ident. no.	38101399   RYG_EN0163	This certificate relate and apply this equipment only.
Customer	ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)	
	616/10 Moo 5 T.Maenam Khu, A.Pluak Daeng, Rayong 21140, Thailand.	
Order no.	2230	
Number of pages	4	
Date of calibration	20 Feb 2025	

REVIEW BY *Thanitak.*APPROVED BY *D. Khunon.*NEXT CAL DATE *20/02/26*

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

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

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



Calibration object

Single range instrument

Model	MCE224S-2S00-U
Serial Number	38101399
QM Ident. no   Inventory no.	RYG_EN0163   ---

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

Place of calibration

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

Calibration procedure

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

Test equipment

Test equipment type	Test equipment ID	Valid until
Thermometer	MHB-382SD s/nB011342 Traceable to SI unit through DKSH	21 Aug 2025
Test weight set OIML R111 E2	Certificate No.M2308197S ,E2(Traceable to SI unit through TCS)	23 Aug 2025

Adjustment Status

The measuring device was internally adjusted before the calibration.

Environmental and measuring conditions

Date of calibration	20 Feb 2025
Temperature at place of calibration   Temp. diff. <i>T</i> <sub>weights</sub> - <i>T</i> <sub>place</sub>	24.4 °C   0.6 K
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

Test load (nominal): 10 g   200 g		
	10 g	200 g
1	10.0000 g	200.0000 g
2	10.0000 g	200.0000 g
3	10.0000 g	200.0001 g
4	9.9999 g	200.0000 g
5	9.9999 g	200.0000 g
6	10.0000 g	200.0001 g
7	10.0000 g	200.0000 g
8	10.0000 g	200.0000 g
9	9.9999 g	200.0001 g
10	10.0000 g	200.0000 g
	<i>s</i> = 0.00005 g	<i>s</i> = 0.00005 g

Eccentricity

Test load (nominal): 100 g	
Center	100.0000 g
Front left	100.0000 g
Back left	100.0000 g
Back right	100.0000 g
Front right	99.9999 g
Maximum deviation from centric loading indication $ \Delta_{ecc} _{max} = 0.0001\text{ g}$	

Error of indication

Testload	Indication	Error	Expansion factor	Uncertainty	Uncertainty relative
<i>L</i>	<i>I</i>	<i>E</i>	<i>k</i>	<i>U</i> ( <i>E</i> )	<i>U</i> <sub>rel</sub> ( <i>E</i> )
0.0100 g	0.0100 g	0.0000 g	2.00	0.00013 g	1.3 %
0.1000 g	0.1000 g	0.0000 g	2.00	0.00013 g	0.13 %
0.5000 g	0.5000 g	0.0000 g	2.00	0.00013 g	0.026 %
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 _{max} = 0.0001\text{ g}$			

*U*<sub>rel</sub>(*E*) is the quotient of *U*(*E*) and test load *L*. The uncertainty of measurement *U*(*E*) is valid only if error *E* is considered. You will find reference notes on the uncertainty of measurement in use under: Appendix to the calibration certificate | Interpretation of measurement results.  
Reference note: The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the documented Expansion factor, determined in accordance with the European Calibration 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

# Uncertainty of measurement in use

Device adjusted before measurement	Yes
Temperature deviation considered	1.5 K (isoCAL active)
Temperature coefficient considered	$1 \cdot 10^{-6}/\text{K}$

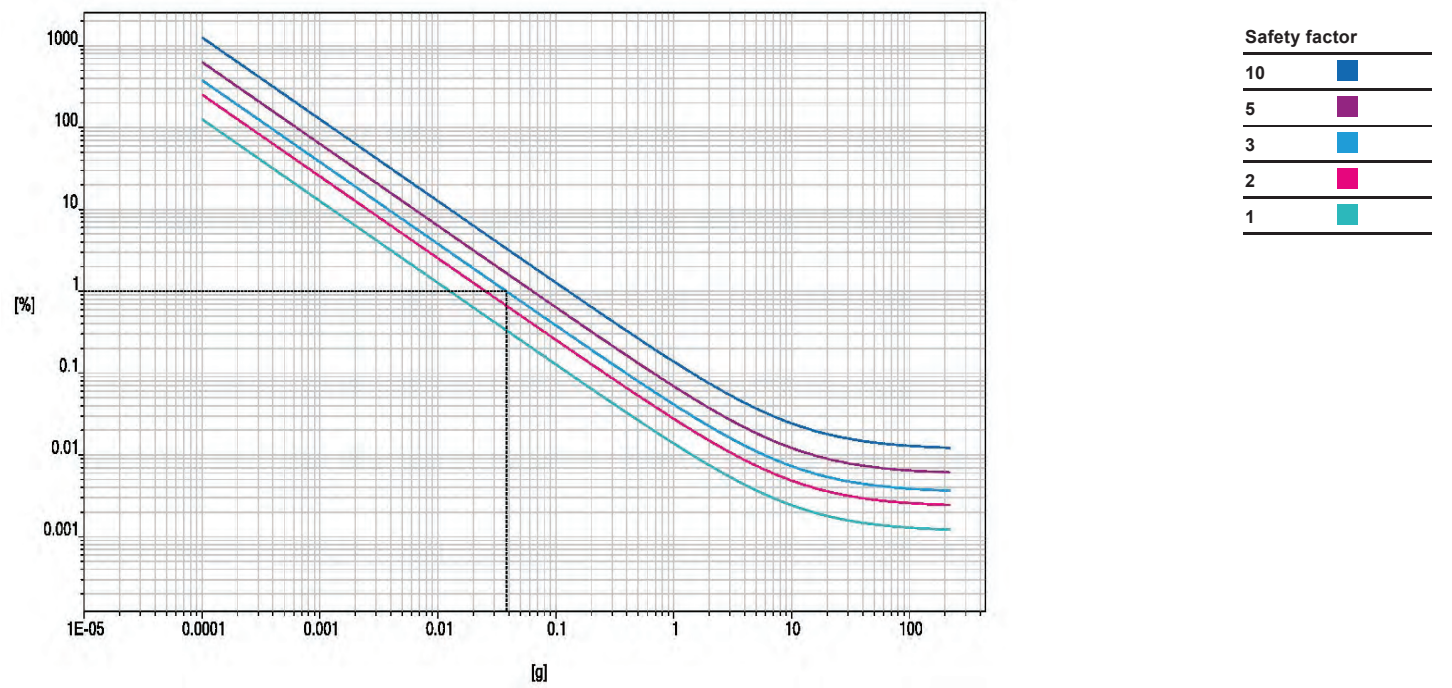
Uncertainty of the weighing result  $U_{gl}(W)$

$U_{gl}(W) = 0.00013 \text{ g} + 1.16 \cdot 10^{-5} \cdot R$

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

Indication in % from max load	Net indication $R$	Uncertainty $U_{gl}(W)$	Uncertainty relative $U_{gl}(W)_{rel}$
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

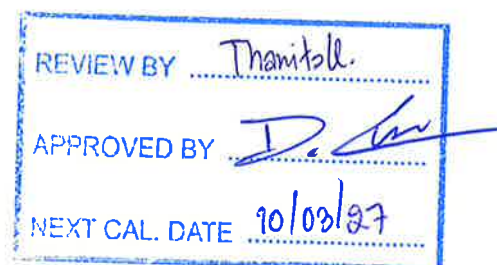
Certificate No. T251530

Page 1 of 3

**Certificate of Calibration****Equipment** : Chamber ( Oven )**Manufacturer** : MEMMERT**Model** : UF 110**Serial No.** : B416.2420**Customer Code** : RYG\_EN0012**ID No.** : T6444A5**Customer** : ALS Laboratory Group (Thailand) Co.,Ltd. ( Rayong Branch)

616/10 Moo 5 T.Maenamkoo,

A.Pluakdaeng, Rayong 21140

**Customer Location** : ENVIRONMENT LABORATORY**Date of Receipt** : 3 September 2025**Calibrated By** : Sujjar Naknakred ( Site Calibration Manager )**Approved By** :  Boonchai Suriyawong (Site Calibration Manager)**Date of Issue** : 17 SEP 2025**The uncertainties are for a confidence probability of approximately 95%.**

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



Certificate No. T251530

Page 2 of 3

## Calibration Report

**Equipment** : Chamber ( Oven )  
**Date of Calibration** : 10 September 2025  
**Environment** : Temperature : 35.7-36.6 °C  
Line Voltage : 226.8-233.7 V  
Relative Humidity : 55 - 65 %RH

### Condition of this results of calibration :

1. This equipment was calibrated by insert nine resistance thermometer detectors into its chamber , the other one resistance thermometer detector use for ambient temperature measurement . The calibration was done in according to WI-T20 ( based on ASTM E145-94 ( Reapproved 2019) and AS2853-1986 ).

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

2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
RTD	100 ohm	30-(CH1-10)	T242203	9 November 2025
DATA LOGGER	34970A	T47	T242203	9 November 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 29 Minute At 104 °C

Fresh Air Damper ☒ Open ☒ Min ☐ Medium ☐ Max

☐ Close

☐ Not Available

5. Adjustment :

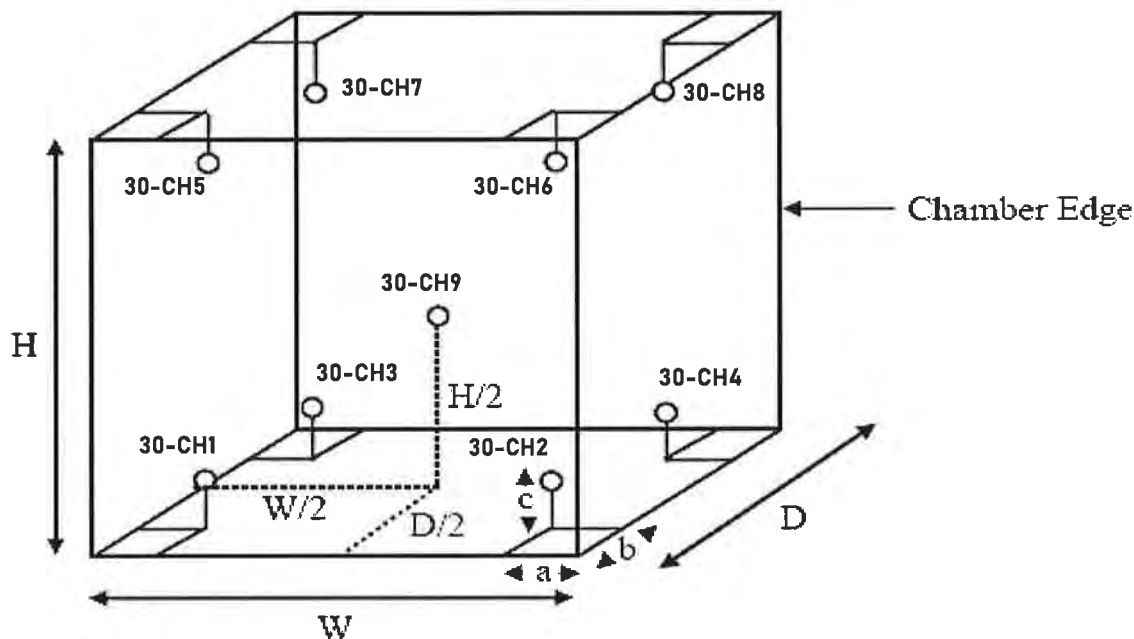
( ) without adjustment

( X ) after adjustment

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



## Calibration Report



**Remark :** Internal Dimensions of Chamber : W (Width) = 56 cm. , H (Height) = 48 cm. and D (Depth) = 40 cm.  
Size of Installed Standard sensor number 30-CH1 to number 30-CH8 : a = 5 cm. ,b = 5 cm. and c = 5 cm.  
Size of Installed Standard sensor number 30-CH9 : W/2 = 56 cm./2 , H/2 = 48 cm./2 and D/2 = 40cm./2

### Measurement Results

Average Standard Reading at each position (°C)									
Calibration Point	30-CH1	30-CH2	30-CH3	30-CH4	30-CH5	30-CH6	30-CH7	30-CH8	30-CH9
104	104.02	103.70	104.01	104.16	104.11	104.08	104.01	104.33	103.61
180	180.67	178.78	180.38	179.85	179.16	180.27	180.98	181.04	179.49

Chamber ( Oven )			Temperature Distribution				
Setting °C	Reading (°C )		Average ( °C )	Stability (± °C )	Uniformity ( °C )	Uncertainty (± °C )	Coverage Factor k
	Min , Max	Average					
104.0	103.9 , 104.1	104.0	104.00	0.08	0.61	0.42	2.00
180.0	179.9 , 180.1	180.0	180.07	0.21	1.51	0.52	2.00

\* The quoted uncertainty exclude "uniformity"

The calibration result apply only the above calibrated item.

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

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

End of Certificate.

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





# Metrology

SCI ECO Services Company Limited

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

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

Bangkok Tel : +668 9205 6851 , +669 8247 2360  
Website : www.scieco.co.th E-Mail : calibrate@scg.com



Certificate No. T242075

Page 1 of 3

## Certificate of Calibration

<b>Equipment</b>	: Liquid Bath ( Water )	<div style="border: 1px solid blue; padding: 10px;"><p>REVIEW BY <i>Thanitak.</i></p><p>APPROVED BY <i>D. Khunon.</i></p><p>NEXT CAL DATE. 19/12/25</p></div>
<b>Manufacturer</b>	: Memmert	
<b>Model</b>	: WNE29	
<b>Serial No.</b>	: L623.0105	
<b>Customer Code</b>	: RYG_EN0220	
<b>ID No.</b>	: T5650A5	
<b>Customer</b>	: ALS Laboratory Group (Thailand) Co.,Ltd. ( Rayong Branch)  616/10 Moo 5 T.Maenam Khu,  A.Pluakdaeng, Rayong 21140	
<b>Customer Location</b>	: Wet Chemistry Lab	
<b>Date of Receipt</b>	: 11 December 2024	
<b>Calibrated By</b>	: Atiphong Rongrat ( Technician )	
<b>Approved By</b>	: <i>Boonchai</i> / Boonchai Suriyawong (Site Calibration Manager)	
<b>Date of Issue</b>	: 20 DEC 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** : Liquid Bath ( Water )  
**Date of Calibration** : 19 December 2024  
**Environment** : Temperature : 25.3-25.9 °C  
: Line Voltage : 221.4-225.4 V  
: Relative Humidity : 55 - 65 %RH

### Condition of this results of calibration :

1. This equipment was calibrated by insert five resistance thermometer detectors into its water bath , the other one thermocouple type T use for ambient temperature measurement . The calibration was done in according to WI-T36 ( based on ASTM E715-80 ( Reapproved 2001 ) ).  
All data show below were final values and the initial data from customer request . The temperature scale used, was based on ITS - 90.

2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
RTD	100 OHM	M34 (CH1-CH5)	T240400	16 March 2025
DATA LOGGER	34970A	T193	T240400	16 March 2025

3. This certificate is traceable to :

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

4. Condition of calibrated item : good


Equipment Description :

Time Const. 1 Hour 30 Minute At 63 °C

5. Adjustment :

( X ) without adjustment

( ) after adjustment

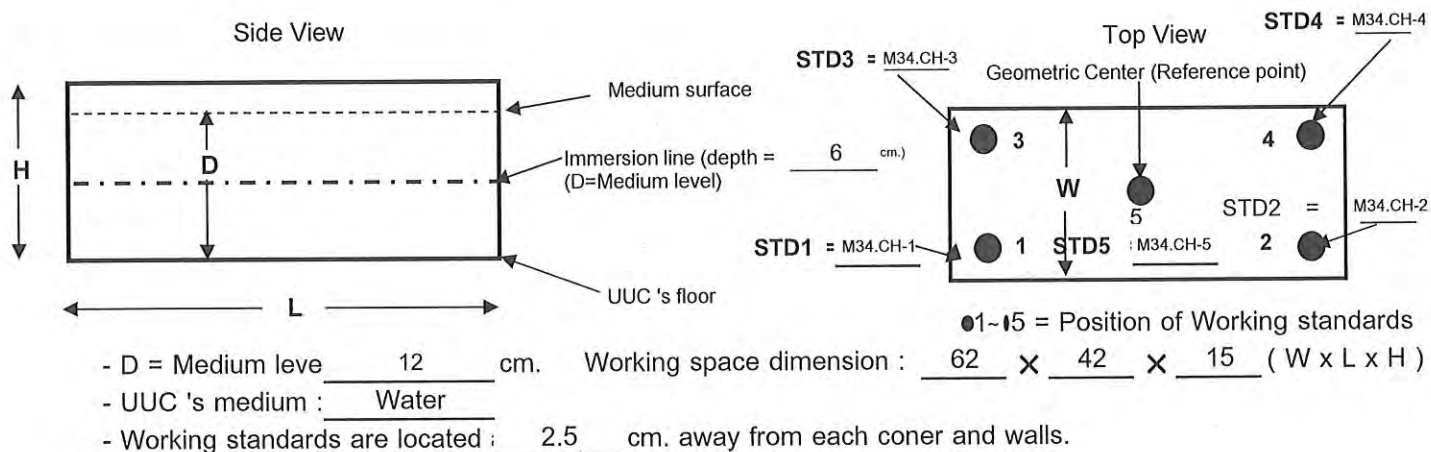
Approved By. 



Certificate No. T242075

Page 3 of 3

## Calibration Report



### Measurement Results:

Calibration Point	Average Standard Reading at each position (°C)				
	M34.CH-1	M34.CH-2	M34.CH-3	M34.CH-4	M34.CH-5
63	62.87	63.00	62.88	62.98	63.22
85	84.76	85.14	84.89	85.07	85.24

Liquid Bath ( Water )			Temperature Distribution				
Setting (°C)	Reading (°C)		Average (°C)	Stability (±°C)	Uniformity (±°C)	Uncertainty (±°C)	Coverage Factor k
	Min , Max	Average					
63.0	-	63.0	62.99	0.07	0.25	0.23	2.00
85.0	-	85.0	85.02	0.13	0.35	0.26	2.00

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. 



**Metrology Center**  
**SCI ECO Services Company Limited**

51 Moo 8, Tubkwang, Kaeng Khoi, Saraburi, Thailand 18260

Bangkok Tel : +668 9205 6851 , +669 81924 0059

Saraburi Tel : +669 8247 2360

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



Certificate No. T252169

Page 1 of 3

## Certificate of Calibration

**Equipment** : Liquid Bath ( Water )

**Manufacturer** : Memmert

**Model** : WNE29

**Serial No.** : L623.0105

**Customer Code** : RYG\_EN0220

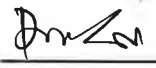
**ID No.** : T5650A5

**Customer** : ALS Laboratory Group (Thailand) Co.,Ltd. ( Rayong Branch)  
616/10 Moo 5 T.Maenamkoo,  
A.Pluakdaeng, Rayong 21140

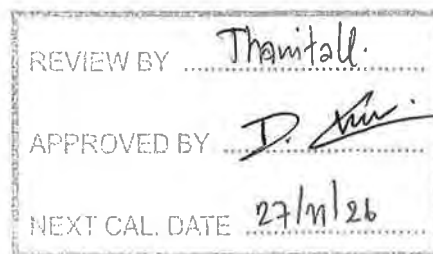
**Customer Location** : Wet Chemistry Lab

**Date of Receipt** : 19 November 2025

**Calibrated By** : Sujjar Naknakred ( Site Calibration Manager )

**Approved By** :  / Boonchai Suriyawong (Site Calibration Manager)

**Date of Issue** : 01 DEC 2025



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

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

Certificate No. T252169

Page 2 of 3

## Calibration Report

**Equipment** : Liquid Bath ( Water )  
**Date of Calibration** : 27 November 2025  
**Environment** : Temperature : 25.5-25.7 °C  
Line Voltage : 221.8-225.5 V  
Relative Humidity : 55 - 65 %RH

### Condition of this results of calibration :

1. This equipment was calibrated by insert five resistance thermometer detectors into its water bath , the other one thermocouple type T use for ambient temperature measurement . The calibration was done in according to WI-T36 ( based on ASTM E715-80 ( Reapproved 2022 ) ).

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

2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
RTD	100 OHM	M18 (CH1-CH5)	T251758	17 October 2026
DATA LOGGER	34970A	T261	T251758	17 October 2026

3. This certificate is traceable to :

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

4. Condition of calibrated item : good

Equipment Description :

Time Constant 1 Hour 3 Minute At 63 °C

5. Adjustment :

( X ) without adjustment

( ) after adjustment

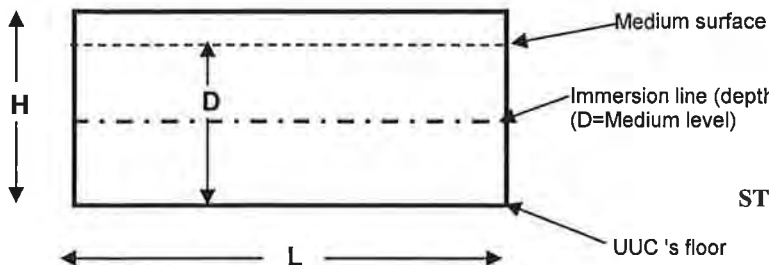
Approved By. \_\_\_\_\_

Certificate No. T252169

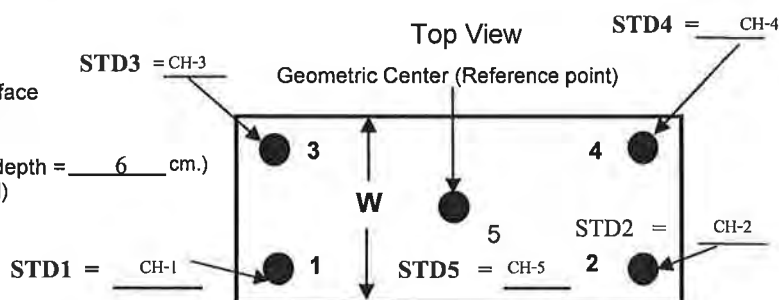
Page 3 of 3

## Calibration Report

Side View



Top View



● 1 ~ ● 5 = Position of Working standards

- D = Medium level : 12 cm.

Working space dimension : 59 × 35 × 14 (W×L×H)

- UUC 's medium : Water

- Working standards are located at 2.5 cm. away from each corner and walls.

### Measurement Results:

Calibration Point	Average Standard Reading at each position (°C)				
	CH-1	CH-2	CH-3	CH-4	CH-5
63	62.93	63.13	62.94	63.10	63.09
85	85.15	85.33	85.21	85.43	85.20

Liquid Bath ( Water )			Temperature Distribution				
Setting (°C)	Reading (°C)		Average (°C)	Stability (±°C)	Uniformity (±°C)	Uncertainty (±°C)	Coverage Factor <i>k</i>
	Min , Max	Average					
63.0	62.9 , 63.1	63.0	63.04	0.08	0.17	0.27	2.06
85.0	84.8 , 85.2	85.0	85.26	0.13	0.24	0.43	2.23

\* The quoted uncertainty exclude "uniformity"

The calibration result apply only the above calibrated item.

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

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

End of Certificate.

Approved By. 





TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250  
TEL. 0-2717-3000-24 FAX. 0-2719-9484



## Certificate of Calibration

Certificate No. : 25T679

Page : 1 of 2

Equipment : Digital Thermometer

Manufacturer: Testo

Model : 106

Serial No.: 83461616/0721

ID No.: RYG\_FS0568

Condition As-Received: Used Item

Received Date: 25 April 2025

Calibration Date: 05 May 2025  
to 06 May 2025

Reference: 2504-0660DSC

Ambient Temperature: ( 25 ± 3 ) °C

Relative Humidity: ( 50 ± 20 ) %

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except with the prior written approval of the head of  
Corporate Services 3: Equipment Calibration and Testing Services.

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

616/10 Moo 5, T.Maenam Khu, A.Pluakdaeng,  
Rayong 21140, Thailand

Procedure used: Calibration were conducted using in-house calibration procedure CP-T01 according to comparison with  
Industrial Platinum Resistance Thermometer (IPRT) into liquid bath temperature controller.  
The temperature scale used was based on ITS-90.

### Condition of this result of calibration

1.Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Digital Thermometer	1529	A7A609	2411182	25 Oct 2025
2) Industrial Platinum Resistance Thermometer	5627-12	571975	2411182	25 Oct 2025

2.The 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 maintained through-

-Technology Promotion Association (Thailand-Japan), NSC-ONSC Accredited No. Calibration 0008

REVIEW BY ..... Pitthaya T.

APPROVED BY ..... Supt. S.

NEXT CAL DATE..... 05/05/26

Calibrated by : Yossapon Poljorn  
Issue Date : 08 May 2025

Approved Signatory : \_\_\_\_\_

[ ] Phalinee Prabpaipal

[✓] Chatchawan Khunpiluek

[ ] Wanlop Larpkern



Cert. No.: 25T679

Page.: 2 of 2

**Result of Calibration:-**

Without Adjustment

**Function:**

Temperature measurement

Dimension of probe : Diameter 3 mm., Length 55 mm. Sheath material : Stainless Steel

<b>Immersion</b>	<b>Standard</b>	<b>UUC*</b>		<b>Uncertainty</b>
<b>Depth</b>	<b>Temperature</b>	<b>Reading</b>	<b>Error</b>	<b>of Measurement</b>
( mm.)	( °C )	( °C )	( °C )	( ±°C )
50	25.0023	24.9	-0.1023	0.12
50	45.0037	45.0	-0.0037	0.12

**UUC\*** : Unit Under Calibration

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

-o0o-





# Metrology Center

## SCI ECO Services Company Limited

51 Moo 8, Tubkwang, Kaeng Khoi, Saraburi, Thailand 18260

Bangkok Tel : +668 9205 6851 , +669 81924 0059

Saraburi Tel : +669 8247 2360

Website : [www.scieco.co.th](http://www.scieco.co.th) E-Mail : [calibrate@scg.co.th](mailto:calibrate@scg.co.th)

Certificate No. T251529

Page 1 of 3

## Certificate of Calibration

Equipment : DIGESTION UNIT

Manufacturer : Gerhardt, Germany

Model : KT - 20S

Serial No. : 572021009

Customer Code : RYG\_EN0188

ID No. : T6452A5

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

616/10 Moo 5 T.Maenamkoo,

A.Pluakdaeng, Rayong 21140

Customer Location : ENVIRONMENT LABORATORY


Date of Receipt : 3 September 2025

Calibrated By : Sujjar Naknakred ( Site Calibration Manager )

Approved By :  / Boonchai Suriyawong (Site Calibration Manager)

Date of Issue : 17 SEP 2025

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

REVIEW BY	Thanitall.
APPROVED BY	
NEXT CAL. DATE	10/03/27

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

## Calibration Report

Equipment : DIGESTION UNIT  
Date of Calibration : 10 September 2025  
Environment : Temperature : 21.7 - 24.3 °C  
Line Voltage : 226.9 - 232.1 V  
Relative Humidity : 55 - 65 %RH

### Condition of this results of calibration :

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

2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	Type S	M20A1-(CH1-CH4)	T250750	14 May 2026
DATA LOGGER	34970A	T261	T250750	14 May 2026

3. This certificate is traceable to :

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

4. Condition of calibrated item : good

Equipment Description :

Time Constant 1 Hour 46 Minute At 380 °C  
Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max  
☐ Close  
☒ Not Available

5. Adjustment :

( X ) without adjustment

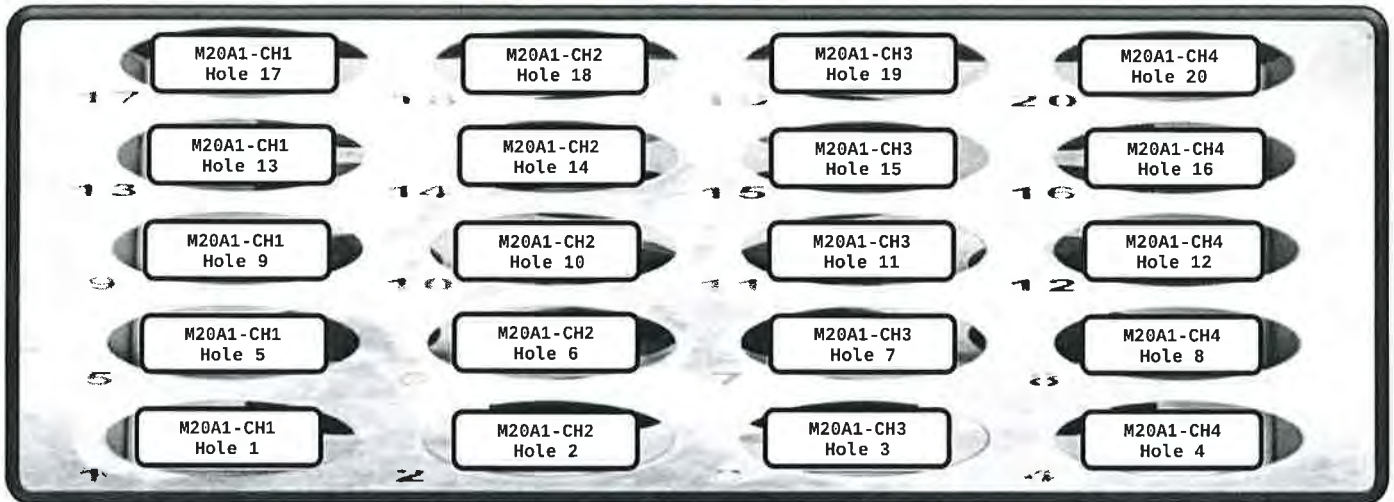
( ) after adjustment

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





## Calibration Report



DISPLAY CONTROL (FRONT)

### Measurement Results

Cal.Point	Setting	Reading	STD.	Position of Standards at Block									
( °C )	( °C )	( °C )	Reading	M20A1-CH1 Hole 1	M20A1-CH2 Hole 2	M20A1-CH3 Hole 3	M20A1-CH4 Hole 4	M20A1-CH1 Hole 5	M20A1-CH2 Hole 6	M20A1-CH3 Hole 7	M20A1-CH4 Hole 8	M20A1-CH1 Hole 9	M20A1-CH2 Hole 10
380	360	360	Max °C	381.2	380.5	381.0	381.0	379.2	380.8	381.3	377.7	382.8	381.5
			Min °C	380.7	380.0	380.4	380.5	378.6	380.1	380.9	377.2	381.9	380.9
			Average °C	381.0	380.3	380.7	380.8	378.9	380.4	381.1	377.5	382.4	381.2
			Stability ±°C	0.3	0.3	0.3	0.2	0.3	0.3	0.2	0.2	0.5	0.3

Cal.Point	Setting	Reading	STD.	Position of Standards at Block									
( °C )	( °C )	( °C )	Reading	M20A1-CH3 Hole 11	M20A1-CH4 Hole 12	M20A1-CH1 Hole 13	M20A1-CH2 Hole 14	M20A1-CH3 Hole 15	M20A1-CH4 Hole 16	M20A1-CH1 Hole 17	M20A1-CH2 Hole 18	M20A1-CH3 Hole 19	M20A1-CH4 Hole 20
380	360	360	Max °C	382.5	377.2	378.7	378.8	378.5	379.9	383.3	381.0	382.4	381.1
			Min °C	381.7	376.5	378.5	378.5	378.1	379.5	382.7	380.6	381.6	380.4
			Average °C	382.1	376.8	378.6	378.7	378.3	379.7	383.0	380.8	382.0	380.8
			Stability ±°C	0.4	0.4	0.1	0.2	0.2	0.2	0.3	0.2	0.4	0.4

The expanded uncertainty of temperature measurement was  $\pm 1.8$  °C

The calibration result apply only the above calibrated item.

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

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

End of Certificate.

Approved By. 



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



## Certificate of Calibration

Cert.No.: 25CH709/1

Page.: 1 of 3

This Certificate was issued to replace the Certificate No.25CH709

**Equipment :** pH Meter  
**Manufacturer :** Mettler Toledo  
**Model :** SevenExcellence  
**Serial No. :** B834291445  
**ID No. :** RYG\_EN0152  
**Condition As-Received:** Used Item  
**Received Date :** 12 June 2025  
**Calibration Date :** 18 June 2025  
**Reference :** 2506-0407DSC-2  
**Submitted by :**

**ALS Laboratory Group (Thailand) Co.,Ltd.**  
**Rayong Branch**  
**616/10 Moo 5, T.Maenam Khu,**  
**A.Pluakdaeng, Rayong 21140, Thailand**

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

**Calibrated by :** Walalak Sirithean

**Approved by :**

*Saithip*

Approved Signatory

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

**Issue Date :**

1 July 2025

**The Uncertainties are for a confidence probability of approximately 95%**

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Cert.No.: 25CH709/1

Page.: 2 of 3

**Condition of this calibration result**

1. Reference Standard Instrument

<u>Instrument</u>	<u>Serial No.</u>	<u>ID No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
1) Document Process Calibrator	54030049	130RC116	24E2759	25 Aug 2025
2) Ref. Standard Thermometer	4982054	110RC044	24I757	14 July 2025

- 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 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

<u>Buffer Solution</u>	<u>Manufacturer</u>	<u>Lot No.</u>	<u>Exp. date</u>
pH 4.007	CPA chem	1066665	18 Jan 2027
pH 7.000	Hach Lenge GmbH	C03232	02 Dec 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 <i>k</i>
	pH	mV	mV	pH		
pH Meter S/N.: B834291445	4.000	177.48	177.3	4.000	0.058	2.00
	7.000	0.00	-0.1	7.000	0.058	2.00
	10.000	-177.48	-177.5	10.000	0.058	2.00





Cert.No.: 25CH709/1

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.: 5211504	4.007	4.006	181.1	0.0044	2.00
	7.000	7.000	4.9	0.0084	2.00
	10.010	10.007	-170.6	0.0066	2.00

#### Function : Temperature Measurement

##### (\*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : InLabEXpert Pro-ISM

- Serial No. : 5211504

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 ( $\pm$ °C)	Coverage factor $k$
25.0	25.001	25.1	0.099	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-





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TEL. 0-2717-3000-24 FAX. 0-2719-9484



## Certificate of Calibration

Certificate No. : 25E1979/1

Page : 1 of 2

This Certificate was issued to replace to the Certificate No. 25E1979

**Equipment :** pH Meter  
**Manufacturer:** Mettler Toledo  
**Model :** SevenExcellence  
**Serial No.:** B834291445  
**ID No.:** RYG\_EN0152  
**Condition As-Received:** Used Item  
**Received Date:** 12 June 2025  
**Calibration Date:** 16 June 2025  
**Reference:** 2506-0407DSC  
**Ambient Temperature:** ( 23 ± 2 ) °C  
**Relative Humidity:** ( 50 ± 10 ) %

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except with the prior written approval of the head of  
Corporate Services 3: Equipment Calibration and Testing  
Services.

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

*616/10 Moo 5, T.Maenam Khu, A.Pluakdaeng,  
Rayong 21140, Thailand*

**Procedure used:** Calibration were conducted using calibration procedure No. CP-E17 According to EURAMET cg-15.

### Condition of this result of calibration

1.Reference standards instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
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 :** Wutchareeporn Peethong  
**Issue Date :** 01 July 2025

**Approved Signatory :** \_\_\_\_\_

[ ] Phalinee Prabpaipal

[✓] Nuntawat Khamchai

[ ] Pongsagorn Boonyaporn



Cert. No.: 25E1979/1

Page.: 2 of 2

**Result of calibration :-** (\*) Without adjustment ( ) After adjustment

**Function:** DC voltage measurement

**Range:** 2000 mV

<u>Standard Value</u>	<u>UUC* Reading</u>	<u>Error</u>	<u>Uncertainty</u>
( mV )	( mV )	( mV )	( $\pm$ $\mu$ V )
-200.0000	-199.9	0.1	68
-150.0000	-150.0	0.0	65
-100.0000	-100.0	0.0	63
-50.0000	-50.0	0.0	61
0.0000	0.0	0.0	58
50.0000	50.0	0.0	61
100.0000	100.0	0.0	63
150.0000	149.9	-0.1	65
200.0000	199.9	-0.1	68

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

**UUC\* = Unit Under Calibration.**

-o0o-



## Agilent Technologies

Agilent Technologies (Thailand) Limited  
U CHU LIANG BLDG. 22/F UNIT A,D  
968 RAMA 4 ROAD, SILOM, BANGRAK  
Bangkok 10500 Thailand

Tel: +662 637 6363  
Fax: +662 632 4334  
Email: [ccc-smt@agilent.com](mailto:ccc-smt@agilent.com)  
Website: [www.agilent.com/chem](http://www.agilent.com/chem)

### Customer Contact:

ALS Laboratory Group (Thailand) Co  
Ltd Head Office

104 Phatthanakan 40 Phatthanakan Rd  
Khwaeng Phatthanakan Khet Suan

TAX ID : 0105540004859

[chanattagarn.imchom@alsglobal.com](mailto:chanattagarn.imchom@alsglobal.com)  
227158760

### Invoice To:

ALS Laboratory Group (Thailand) Co  
Ltd Head Office

104 Phatthanakan 40 Phatthanakan Rd  
Khwaeng Phatthanakan Khet Suan

### Delivery Site:

ALS Laboratory Group (Thailand) Co  
Ltd Head Office

104 Phatthanakan 40 Phatthanakan Rd  
Khwaeng Phatthanakan Khet Suan

### Location:

Room  
Bldg  
Lab  
Dept

## SERVICE REPORT

<b>Customer Purchase Order Number:</b>	<b>Customer Number:</b> 70371013
<b>Service Request:</b>	<b>Service Request Date:</b>
<b>Service Order:</b> 6006676060	<b>Service Confirmation:</b> 6905905441

REVIEW BY <u>Tattaporn C.</u>
APPROVED BY <u>Samita N.</u>
NEXT CAL. DATE <u>3/4/2026</u>

### Direct Inquiries to:

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

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Bangkok 10500 Thailand  
Tax ID : 0105542068218

Citibank N.A. Bangkok Branch  
399 Interchange 21 Building, Sukhumvit Road, Klongtoey Nau  
Sub-district, Wattana District, Bangkok 10110 Thailand  
Acc. No: 012-4452-007 ,  
THB:Krung Thai Bank PCL  
Siam Square Br.,416/1-2 Rama I Rd.,Pathumwan, BKK 10330  
Thailand

ORIGINAL

**Service Confirmation Number:** 6905905441

**Service Confirmation Date:** 08.10.2024

**Service Instrument:**

Model Number	Model Description	Serial Number	System Handle	Parent Asset
SYS-IM-7900	ICPMS 7900 System			
G8410A	SPS 4 Autosampler	AU15430722	ICP MS 7900	SYS-IM-7900
G8411A	ISIS 3 for Agilent 7850/7900/8900	JP15510227	ICP MS 7900	SYS-IM-7900
G3292A	PSC 6106T Chiller	2U15A1948	ICP MS 7900	SYS-IM-7900
G8403A	Agilent 7900 ICP-MS	JP15471169	ICP MS 7900	SYS-IM-7900

**Service Items:**

Item	Service/Part #	Description	Qty	Entitlement	Service Start	Service End
1000	EOQ	Enterprise Operational Qualification	1.00	Agreement Entitlement - 100 % covered	04.10.2024	04.10.2024
1010	5185-5850	ICP-MS Checkout Solutions	1.00	Agreement Entitlement - 100 % covered		



**Additional Information:**



Service Confirmation Number: 6905905441

Service Confirmation Date: 08.10.2024

**Service Information:**

<b>Problem Description:</b> *WU-EQQ-IM-7900-5001253655		
<b>Service Provided:</b> Perform OQ Hardware. Test CDS logon, auto sampler, Auto tune, BG and 20 Min stability. I calibrate the instrument No BKK_EL0043 test all pass.		
<b>Service Overview Code:</b> Reason Code: Scheduled Service Diagnosis Code: Scheduled Service Resolution Code: Scheduled Service		
<b>Reported Hours:</b> 7.0	<b>Travel Hours:</b> 2.0	
<b>Customer Field Service Representative Name:</b> Panthep Kurasathain	<b>Customer Field Service Representative Signature:</b> 	<b>Date:</b> 08 Oct 2024
<b>Customer Name:</b> Supakwan Mak	<b>Customer Signature:</b> 	<b>Date:</b> 08 Oct 2024
<b>Additional Comments:</b>		

Certificate No. T250355

Page 1 of 6

## Certificate of Calibration

**Equipment** : HEATING BLOCK

**Manufacturer** : Environmental Express

**Model** : SC 196

**Serial No.** : 6974CECW3285

**Customer Code** : BKK\_EL0054

**ID No.** : T5306A3

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

**Customer Location** : Acid Digestion Lab

**Date of Receipt** : 26 February 2025

**Calibrated By** : Atiphong Rongrat ( Technician )

**Approved By** :  / Boonchai Suriyawong (Site Calibration Manager)

**Date of Issue** : 7 MAR 2025

REVIEW BY	Tattaporn C.
APPROVED BY	Samit N.
NEXT CAL. DATE	04/09/26

Samit N.  
บวช น.ร.

04/09/26

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

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

Certificate No. T250355

Page 2 of 6

## Calibration Report

**Equipment** : HEATING BLOCK  
**Date of Calibration** : 4 March 2025  
**Environment** : Temperature : 24.4-24.9 °C  
Line Voltage : 221.6-226.3 V  
Relative Humidity : 55 - 65 %RH

### Condition of this results of calibration :

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

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

2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	TYPE T	TN221-TN230	T240712	19 April 2025
TC	TYPE T	TN231-TN240	T240712	19 April 2025
TC	TYPE T	TN241-TN250	T240401	16 March 2025
TC	TYPE T	TN251-TN260	T240401	16 March 2025
DATA LOGGER	34970A	T193	T240401	16 March 2025

3. This certificate is traceable to :

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

4. Condition of calibrated item : good

Equipment Description :

Time Constant 2 Hour 40 Minute At 95 °C

Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max

☐ Close

☒ Not Available

5. Adjustment :

( ) without adjustment

( X ) after adjustment

Approved By. Pon Loh





# Metrological Center

## SCI ECO Services Company Limited

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

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

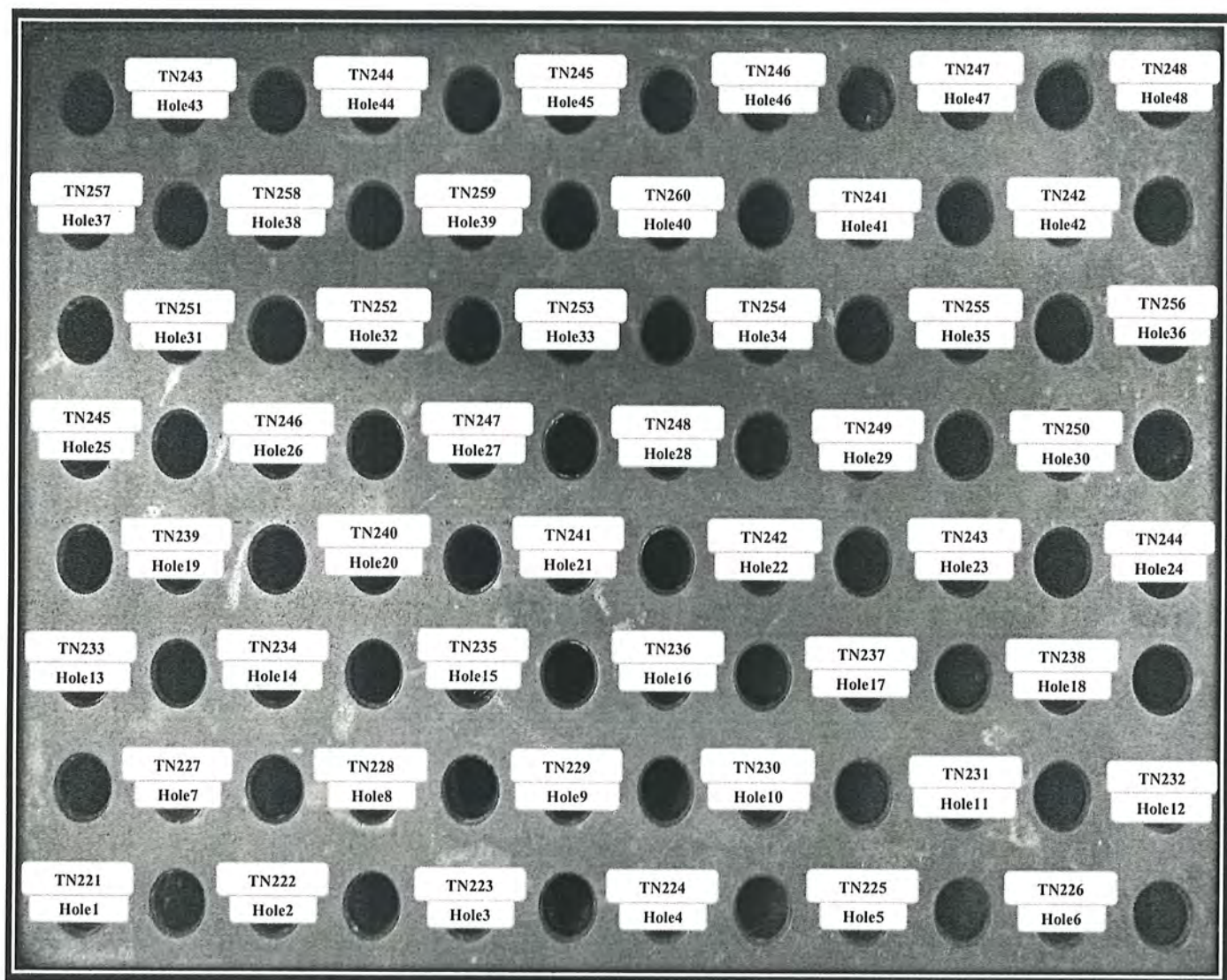
Website : www.scieco.co.th

E-Mail : calibrate@scg.co.th

Certificate No. T250355

Page 3 of 6

## Calibration Report



### FRONT CONTROL

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

*Don Lai*



Certificate No. T250355

Page 4 of 6

## Calibration Report

### Measurement Results

Calibration Point		Average Standard Reading at each position (°C)					
<b>R1 Hole1-Hole6</b>		<b>TN221</b>	<b>TN222</b>	<b>TN223</b>	<b>TN224</b>	<b>TN225</b>	<b>TN226</b>
<b>CAL POINT</b>	Max	94.85	95.37	95.03	95.25	95.52	94.75
<b>95</b>	Min	94.17	94.66	94.38	94.63	94.87	94.12
	Average	94.51	95.02	94.70	94.94	95.20	94.43
<b>R2 Hole7-Hole12</b>		<b>TN227</b>	<b>TN228</b>	<b>TN229</b>	<b>TN230</b>	<b>TN231</b>	<b>TN232</b>
	Max	94.71	94.56	94.79	95.32	95.44	95.06
	Min	94.05	93.88	94.10	94.65	94.90	94.65
	Average	94.38	94.22	94.44	94.99	95.17	94.85
<b>R3 Hole13-Hole18</b>		<b>TN233</b>	<b>TN234</b>	<b>TN235</b>	<b>TN236</b>	<b>TN237</b>	<b>TN238</b>
	Max	95.26	95.43	95.40	95.71	95.41	95.06
	Min	94.54	94.64	94.71	95.10	94.86	94.42
	Average	94.90	95.03	95.06	95.41	95.13	94.74
<b>R4 Hole19-Hole24</b>		<b>TN239</b>	<b>TN240</b>	<b>TN241</b>	<b>TN242</b>	<b>TN243</b>	<b>TN244</b>
	Max	95.13	95.06	95.68	96.16	95.35	95.80
	Min	94.39	94.43	94.86	95.51	94.88	95.12
	Average	94.76	94.75	95.27	95.83	95.12	95.46
<b>R5 Hole25-Hole30</b>		<b>TN245</b>	<b>TN246</b>	<b>TN247</b>	<b>TN248</b>	<b>TN249</b>	<b>TN250</b>
	Max	94.95	95.81	95.39	95.82	95.66	95.66
	Min	94.47	95.03	94.67	94.99	94.84	94.87
	Average	94.71	95.42	95.03	95.41	95.25	95.27
<b>R6 Hole31-Hole36</b>		<b>TN251</b>	<b>TN252</b>	<b>TN253</b>	<b>TN254</b>	<b>TN255</b>	<b>TN256</b>
	Max	96.07	95.34	96.28	95.39	94.95	95.12
	Min	95.28	94.55	95.51	94.62	94.13	94.35
	Average	95.67	94.95	95.90	95.00	94.54	94.73
<b>R7 Hole37-Hole42</b>		<b>TN257</b>	<b>TN258</b>	<b>TN259</b>	<b>TN260</b>	<b>TN241</b>	<b>TN242</b>
	Max	95.15	95.63	96.11	95.09	95.34	95.51
	Min	94.38	94.88	95.32	94.28	94.54	94.72
	Average	94.76	95.25	95.71	94.69	94.94	95.11
<b>R8 Hole43-Hole48</b>		<b>TN243</b>	<b>TN244</b>	<b>TN245</b>	<b>TN246</b>	<b>TN247</b>	<b>TN248</b>
	Max	95.84	95.87	95.44	95.72	95.65	95.75
	Min	95.06	95.10	94.60	94.95	94.87	94.98
	Average	95.45	95.48	95.02	95.34	95.26	95.36

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



Certificate No. T250355

Page 5 of 6

## Calibration Report

### Measurement Results

Calibration Point		Average Standard Reading at each position ( ° C )					
<b>R1 Hole1-Hole6</b>		<b>TN221</b>	<b>TN222</b>	<b>TN223</b>	<b>TN224</b>	<b>TN225</b>	<b>TN226</b>
<b>CAL POINT</b>	Max	104.48	104.40	104.60	105.27	105.24	105.19
<b>105</b>	Min	104.15	104.02	104.25	104.94	104.91	104.93
	Average	104.32	104.21	104.42	105.10	105.08	105.06
<b>R2 Hole7-Hole12</b>		<b>TN227</b>	<b>TN228</b>	<b>TN229</b>	<b>TN230</b>	<b>TN231</b>	<b>TN232</b>
	Max	105.20	105.45	105.58	105.96	105.81	106.03
	Min	104.92	105.14	105.29	105.64	105.53	105.79
	Average	105.06	105.29	105.43	105.80	105.67	105.91
<b>R3 Hole13-Hole18</b>		<b>TN233</b>	<b>TN234</b>	<b>TN235</b>	<b>TN236</b>	<b>TN237</b>	<b>TN238</b>
	Max	106.09	106.14	105.83	106.25	105.97	105.88
	Min	105.80	105.89	105.57	106.00	105.69	105.65
	Average	105.94	106.01	105.70	106.13	105.83	105.77
<b>R4 Hole19-Hole24</b>		<b>TN239</b>	<b>TN240</b>	<b>TN241</b>	<b>TN242</b>	<b>TN243</b>	<b>TN244</b>
	Max	105.87	105.75	105.30	105.07	105.22	105.66
	Min	105.62	105.52	105.13	104.90	105.05	105.49
	Average	105.74	105.63	105.21	104.98	105.14	105.57
<b>R5 Hole25-Hole30</b>		<b>TN245</b>	<b>TN246</b>	<b>TN247</b>	<b>TN248</b>	<b>TN249</b>	<b>TN250</b>
	Max	105.62	105.54	105.52	105.75	105.97	105.69
	Min	105.45	105.35	105.31	105.57	105.81	105.49
	Average	105.53	105.44	105.41	105.66	105.89	105.59
<b>R6 Hole31-Hole36</b>		<b>TN251</b>	<b>TN252</b>	<b>TN253</b>	<b>TN254</b>	<b>TN255</b>	<b>TN256</b>
	Max	106.19	106.34	106.47	105.96	105.76	105.35
	Min	106.02	106.16	106.31	105.77	105.58	105.18
	Average	106.10	106.25	106.39	105.87	105.67	105.27
<b>R7 Hole37-Hole42</b>		<b>TN257</b>	<b>TN258</b>	<b>TN259</b>	<b>TN260</b>	<b>TN241</b>	<b>TN242</b>
	Max	106.21	105.59	105.45	105.36	106.08	106.09
	Min	106.04	105.42	105.28	105.20	105.90	105.92
	Average	106.12	105.51	105.37	105.28	105.99	106.00
<b>R8 Hole43-Hole48</b>		<b>TN243</b>	<b>TN244</b>	<b>TN245</b>	<b>TN246</b>	<b>TN247</b>	<b>TN248</b>
	Max	106.54	106.33	105.78	105.38	105.42	105.69
	Min	106.38	106.16	105.60	105.20	105.25	105.52
	Average	106.46	106.25	105.69	105.29	105.33	105.61

Approved By.





## Calibration Report

### Measurement Results:

HEATING BLOCK			Temperature Distribution	
Setting (°C)	Reading (°C)		Stability ( $\pm$ °C)	Uncertainty ( $\pm$ °C)
	Min , Max	Average		
102.0	-	102.0	0.43	0.83
107.0	-	107.0	0.20	0.70

\* The quoted uncertainty exclude " uniformity "

The calibration result apply only the above calibrated item.

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

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

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




Certificate No. T250873

Page 1 of 4

**Certificate of Calibration****Equipment** : Chamber ( Cooling Room )**Manufacturer** : KOLDTECH**Model** : KM 320**Serial No.** : TBN-1012061/05**Customer Code** : BKK\_EN0167**ID No.** : T2463A3**Customer** : ALS Laboratory Group (Thailand) Co.,Ltd.

104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,

Khet Suan Luang, Bangkok 10250

**Customer Location** : Laboratory Room**Date of Receipt** : 28 May 2025**Calibrated By** : Atiphong Rongrat ( Technician )**Approved By** :  / Boonchai Suriyawong (Site Calibration Manager)**Date of Issue** : 19 JUN 2025

REVIEW BY



APPROVED BY



NEXT CAL DATE.....04/12/26

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

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



Certificate No. T250873

Page 2 of 4

## Calibration Report

**Equipment** : Chamber ( Cooling Room )  
**Date of Calibration** : 4 June 2025  
**Environment** : Temperature : 23.4-24.9 °C  
Line Voltage : 221.4-230.2 V  
Relative Humidity : 55 - 65 %RH

### Condition of this results of calibration :

1. This equipment was calibrated by insert 16 standard thermocouples type T into its chamber , the other one standard thermocouples type T use for ambient temperature measurement . The calibration was done in according to WI-T20 ( based on ASTM E145-94 ( Reapproved 2001) and AS2853-1986 ).  
All data show below were final values and the initial data from customer request . The temperature scale used was based on ITS - 90 .

#### 2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	TYPE T	TN91-TN100	T242036	3 December 2025
TC	TYPE T	TN101-TN110	T242036	3 December 2025
DATA LOGGER	34970A	T121	T242036	3 December 2025

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

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

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


Equipment Description :

Time Constant 2 Hour 20 Minute At 3 °C  
Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max  
☐ Close  
☒ Not Available

#### 5. Adjustment :

( X ) without adjustment

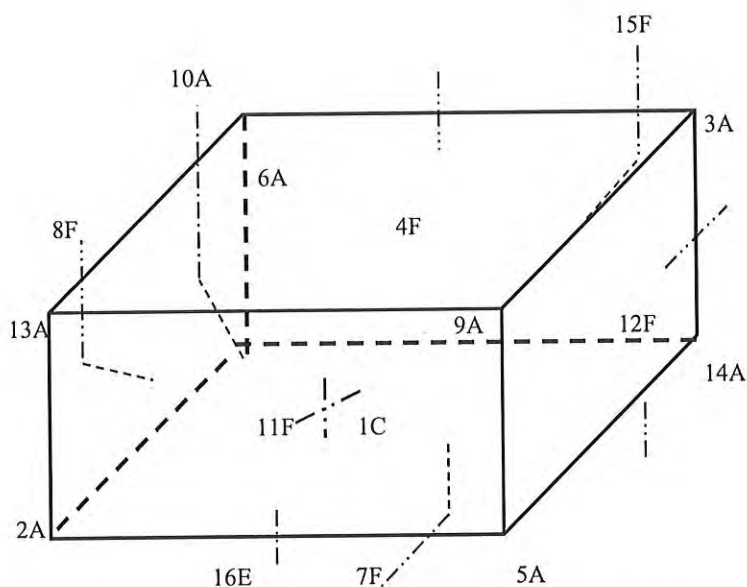
( ) after adjustment

Approved By. 

Certificate No. T250873

Page 3 of 4

## Calibration Report



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

1C = TN91	12F = TN102
2A = TN92	13A = TN103
3A = TN93	14A = TN104
4F = TN94	15F = TN105
5A = TN95	16E = TN106
6A = TN96	
7F = TN97	
8F = TN98	
9A = TN99	
10A = TN100	
11F = TN101	

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



Certificate No. T250873

Page 4 of 4

## Calibration Report

### Measurement Results

Calibration Point	Average Standard Reading at each position (°C)											
	TN91	TN92	TN93	TN94	TN95	TN96	TN97	TN98	TN99	TN100	TN101	TN102
3.0	2.95	2.92	3.09	2.92	3.16	3.50	3.40	3.03	3.14	2.98	3.44	3.13
	TN103	TN104	TN105	TN106								
	3.19	3.06	3.46	2.92								

Chamber ( Cooling Room )			Temperature Distribution				
Setting (°C)	Reading (°C)		Average (°C)	Stability (± °C)	Uniformity (°C)	Uncertainty (± °C)	Coverage Factor <i>k</i>
	Min , Max	Average					
3.0	2.8 , 3.9	3.4	3.14	1.20	1.30	1.90	2.04

The calibration result apply only the above calibrated item.

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

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

Approved By. 

## Certificate of System Qualification

GC-OQ + GCMS-OQ

REVIEW BY	Tanyatorn M.
APPROVED BY	KL AL
NEXT CAL. DATE	3 Jul 26

System ID: GM-6  
Organization Name: ALS Laboratory Group (Thailand) Co., Ltd.  
Organization Location: 104 Phatthanakan 40, Phatthanakan Rd., Suan Luang, Bangkok 10250

Date: January 3, 2025 9:06:38 AM  
EQP Name: AgilentRecommended , AgilentRecommended  
EQP Revision: GC.02.53, GCMS.02.54  
Overall Qualification Status: Pass

### CDS Logon Verification - GC

Logon: asbkk.evv02

### Overall CDS Logon Verification - GC Test Status

Pass

### System Inspection and Basic Safety and Operation

Name: 7890

Setpoint Status: Pass

### Overall System Inspection and Basic Safety and Operation Test Status

Pass

### Inlet Pressure Accuracy

Name: 7890

Front SSL

Setpoint Status: Pass

	Setpoint		Actual
Inlet Pressure:	25.0	psi	24.9
			psi
Accuracy:			0.1
			psi
Agilent Recommended:			<= 1.2

Date: January 3, 2025 9:06:38 AM  
System ID: GM-6



Cj YfU``b`YhDfYggi fY'5 VVW fUWHiHYghiGHUi g

Pass

< YUXgdUWV' @U\_

Name: 7697A with Tray

Sampler 1

GYfrc]bhiGHUi g. DUgg

Cj YfU``< YUXgdUWV' @U\_`HYghiGHUi g

Pass

< YUXgdUWV'< YUHYX`NcbYg`HYa dYfUi fY'5 VVW fUWm

Name: 7697A with Tray

Sampler 1

GYfrc]bhiGHUi g. DUgg

Zone: Transferline

Temperature:

Setpoint 115.0 °C

Actual 115.4

Accuracy: 0.4 °C

Agilent Recommended: >= -1.8 % setpoint ( -2.1 °C )

<= 5.2 % setpoint ( 6.0 °C )

GYfrc]bhiGHUi g. DUgg

Zone: Sample Loop

Temperature:

Setpoint 110.0 °C

Actual 110.2

Accuracy: 0.2 °C

Agilent Recommended: >= -4.0

<= 4.0

GYrdc]bhiGHUli g.

DUgg

Zone:

Oven

Temperature:

Setpoint 100.0 °C

Actual 100.3

Accuracy:

0.3 °C

Agilent Recommended:

>= -4.0

<= 4.0

Cj YfU``< YUXgdUWV< YUH'X'NcbYg'HYa dYfUli fY'5 VVW fUWmiHYgh

Pass

; 7 °Cj Yb'HYa dYfUli fY'5 VVW fUWm

Name:

7890

GYrdc]bhiGHUli g.

DUgg

Zone:

Oven

Setpoint/Actual

Temperature:

230.0 230.4 °C

Accuracy:

0.4 °C

Agilent Recommended:

>= -1.0 % setpoint in K

( -5.0 °C )

<= 1.0 % setpoint in K

( 5.0 °C )

GYrdc]bhiGHUli g.

DUgg

Zone:

Oven

Setpoint/Actual

Temperature:

100.0 100.1 °C

Accuracy:

0.1 °C

Agilent Recommended:

>= -1.0 % setpoint in K

( -3.7 °C )

<= 1.0 % setpoint in K

( 3.7 °C )

Cj YfU``; 7 °Cj Yb'HYa dYfUli fY'5 VVW fUWmiHYghGHUli g

Pass

; 7 °Cj Yb'HYa dYfUli fY'GHUWJ]lm

Name:

7890

GYrdc]bhiGHUi g.

DUgg

Setpoint/Average

Temperature:

100.0 100.1333 °C

Stability:

0.1 °C

Agilent Recommended:

<= 0.5

Cj YfU``; 7`Cj Yb`HYa dYfUi fY`GHUJ]JmiHYghiGHUi g

Pass

@[ `5a d

Tested Combination1

Front

SSL

/ External

SQ

Name:

5975C inert XL with TAD

GYrdc]bhiGHUi g.

DUgg

Cj YfU``@[ `5a d`HYghiGHUi g

Pass

F: D5

Tested Combination1

Front

SSL

/ External

SQ

Name:

5975C inert XL with TAD

GYrdc]bhiGHUi g.

DUgg

Amu: 1050 m/z

Drift After Five Minutes:

RFPA Voltage:

37 mV

566 mV

Agilent Recommended:

>= -100 and <= 100

<= 1100

Cj YfU``F: D5`HYghiGHUi g

Pass

Hi bY9=

Tested Combination1

Front

SSL

/ External

SQ

Name:

5975C inert XL with TAD

GYrdc]bhiGHUi g.

DUgg

Filament:

1

GYrdc]bhiGHU g.

Filament:

Cj YfU`'Hi bY9=HYghiGHU g

## GWëi h]b[ 'Fi b

Tested Combination1	Front	SSL	/ External	SQ
Headspace				
Name:	<input type="text" value="7697A with Tray"/>			
Source:	<input type="text" value="EI - Inert"/>			

GYrdc]bhiGHU g.

Injection Volume on Column:  uL

Cj YfU`'GWëi h]b[ 'Fi b'GHU g

## ≡YW]cb'DfYW]g]cb

Tested Combination1	Front	SSL	/ External	SQ
Name:	<input type="text" value="7697A with Tray"/>			
Source:	<input type="text" value="EI - Inert"/>			

GYrdc]bhiGHU g.

Injection Volume on Column:  uL

Area RSD:  % Retention Time RSD:  %

Agilent Recommended:

Cj YfU`'≡YW]cb'DfYW]g]cb'HYghiGHU g

## A Ugg'FU]c'DfYW]g]cb



Tested Combination1	Front	SSL	/ External	SQ
Headspace				
Name:	7697A with Tray			
Source:	EI - Inert			
<b>GYfrc]bhiGHU g.</b>	<b>DUgg</b>			
Injection Volume on Column:	1000	uL		
	Area Mass 1		Mass Ratio	
	Abundance*s			
RSD:	1.77			%
Agilent Recommended:	<=	5.00		
	Pass			
			0.29	%
			<=	5.00
			Pass	

**Cj YfU`A Ugg`F Ujc`DfYVg]cb`HYghiGHU g**

Pass

**↵YV]cb`7 UfmiCj Yf**

Tested Combination1	Front	SSL	/ External	SQ
Name:	7697A with Tray			
Source:	EI - Inert			
<b>GYfrc]bhiGHU g.</b>	<b>DUgg</b>			
Injection Volume on Column:	1000	uL		
Area Carry Over:		0.01	%	
Agilent Recommended:	<=	1.00		

**Cj YfU`↵YV]cb`7 UfmiCj Yf`HYghiGHU g**

Pass

## bgfi a Ybh8 YhJ`g

### Di fdcgY

This section describes the as found system configuration.

### 8 YhJ`g

#### System

System ID	GM-6
Manufacturer	Agilent Technologies
Name	7890
Flow Data Input	Manual Data
Temperature Data Input	Manual Data or Other Data Logging

#### Tested Combination1

Injection Technique	Headspace
Inlet	Front
Detector	External
LTM Included?	No

#### Sampler 1

Manufacturer	Agilent Technologies
Type	Headspace
Name	7697A with Tray
Model Number	G4557A
Serial Number	CN13020009
Firmware Revision	A.01.05.1
Sampling System	Loop fill
Location	Front
Injection Volume (µL)	1000
Headspace to GC Connection	EPC Headspace

## Mainframe 1

Manufacturer	Agilent Technologies
Name	7890
Model Number	G3440A
Serial Number	CN12511186
Firmware Revision	A.01.14
Oven Type	Standard

## Inlet 1

Manufacturer	Agilent Technologies
Name	7890
Type	SSL
Location	Front
Carrier Gas	Helium
Control Type	Electronic Pressure Control (EPC)
Purged Inlet	Yes

## Detector 1

Manufacturer	Agilent Technologies
Name	Mass Spectrometer
Type	Mass Spectrometer
Location	External

## Mass Spectrometer 1

Manufacturer	Agilent Technologies
Type	SQ
Name	5975C inert XL with TAD
Model Number	G3172A
Serial Number	US13023A30
Firmware Revision	7.02.09
High Vacuum System	Turbo Pump
Scouting Run Standard	MRP Std

MS EI Source 1

Manufacturer	Agilent Technologies
Source Type	EI - Inert
Number of filaments	2



## 9`YWfcbJWGJ[ bUhi fY

### Di fdcgY

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### 8 YHJ'g

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Logged On User Name:	sulkifli.mama@agilent.com
Signature Creation Date:	January 3, 2025
Reason for Signature:	Executed protocol and published this original version of document

### FY[ i`Uc fmi8 JgWUJa Yf

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GmghYa 7X.; A!\*  
Df]bh8 UH. >Ubi Uf m' ž&\$&) '-.\$\*.) +`5 A

[illegible]

January 2, 2025 10:51:32 AM	Audit	SessionCreated	Session	None
January 2, 2025 10:51:32 AM	Start	Configuration	Session	None
January 2, 2025 10:51:32 AM	Audit	Entitlement	Licensing	User is FieldEngineer and does not require an unlock code
January 2, 2025 11:01:24 AM	Audit	EqpLoaded	Session	EQP details for primary technique [Gc] - File path: [ProtocolPacks/Gc/Configurations/02.53/Gc.02.53.eqp], EQP File Name: [Gc.02.53.eqp], EQP Name: [AgilentRecommended], Protocol Revision :[Gc.02.53] EQP details for hyphenated technique [GcMs] - File path: [ProtocolPacks/GcMs/Configurations/02.54/GcMs.02.54.eqp], EQP File Name: [GcMs.02.54.eqp], EQP Name: [AgilentRecommended]
January 2, 2025 11:01:53 AM	End	Configuration	Session	None
January 2, 2025 11:02:05 AM	Start	Qualification	Session	OQ
January 2, 2025 11:02:05 AM	Start	Execution	CDS Logon Verification - GC - 7890: - Qualitative test	None
January 2, 2025 11:08:09 AM	End	Execution	CDS Logon Verification - GC - 7890: - Qualitative test	Run Count : 1

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Time	Event	Phase	Injection Precision - 7697A with Tray Headspace, Front SSL, SQ: - Source: - EI - Inert L (Area): <= 5.00% - L (Ret. Time): <= 1.00%	Run Count : 1
January 2, 2025 4:08:28 PM	End	Execution	Injection Precision - 7697A with Tray Headspace, Front SSL, SQ: - Source: - EI - Inert L (Area): <= 5.00% - L (Ret. Time): <= 1.00%	Run Count : 1
January 2, 2025 4:08:39 PM	Start	Execution	Mass Ratio Precision - 7697A with Tray Headspace, Front SSL, SQ: - Source: EI - Inert - L (RSD): <= 5.00%	None
January 2, 2025 4:10:31 PM	Audit	Data	DataManager	DataManager was in a data verification state but the user chose to start over
January 2, 2025 4:10:58 PM	Audit	Data	Mass Ratio Precision - 7697A with Tray Headspace, Front SSL, SQ: - Source: EI - Inert - L (RSD): <= 5.00%	Data files Path : F:\OQ2025\ALS\OQ2025\IP_01.D
January 2, 2025 4:10:58 PM	Audit	Data	Mass Ratio Precision - 7697A with Tray Headspace, Front SSL, SQ: - Source: EI - Inert - L (RSD): <= 5.00%	Data files Path : F:\OQ2025\ALS\OQ2025\IP_02.D
January 2, 2025 4:10:58 PM	Audit	Data	Mass Ratio Precision - 7697A with Tray Headspace, Front SSL, SQ: - Source: EI - Inert - L (RSD): <= 5.00%	Data files Path : F:\OQ2025\ALS\OQ2025\IP_03.D
January 2, 2025 4:10:58 PM	Audit	Data	Mass Ratio Precision - 7697A with Tray Headspace, Front SSL, SQ: - Source: EI - Inert - L (RSD): <= 5.00%	Data files Path : F:\OQ2025\ALS\OQ2025\IP_04.D
January 2, 2025 4:10:58 PM	Audit	Data	Mass Ratio Precision - 7697A with Tray Headspace, Front SSL, SQ: - Source: EI - Inert - L (RSD): <= 5.00%	Data files Path : F:\OQ2025\ALS\OQ2025\IP_05.D

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Certificate of System Qualification

GC-OQ + GCMS-OQ

System ID:	BKK_EN0059(GM-7)
Organization Name:	ALS Laboratory Group (Thailand) Co., Ltd.
Organization Location:	104 Patthanakarn 40, Patthanakarn Rd., Khwang Suan Luang, Khet Suan Luang, Bangkok
Date:	June 25, 2025 8:40:18 PM
EQP Name:	AgilentRecommended , AgilentRecommended
EQP Revision:	GC.02.50, GCMS.02.50
Overall Qualification Status:	Pass

REVIEW BY *Nant Samr*

APPROVED BY *KL Ad*

NEXT CAL. DATE *25-Dec-26*

System Inspection and Basic Safety and Operation

Name:	7890
Setpoint Status:	Pass

Overall System Inspection and Basic Safety and Operation Test Status

Pass
------

Inlet Pressure Accuracy

Name:	7890			
	Front	SSL		
Setpoint Status:	Pass			
	Setpoint		Actual	
Inlet Pressure:	25.0	psi	25.2	psi
Accuracy:			0.2	psi
Agilent Recommended:			<= 1.2	

Overall Inlet Pressure Accuracy Test Status

Pass
------

GC Oven Temperature Accuracy

Name:

7890

Setpoint Status:

Pass

Zone:

Oven

Setpoint/Actual

Temperature:

230.0

228.8

°C

Accuracy:

-1.2

°C

Agilent Recommended:

>=

-1.0

% setpoint in K

<=

1.0

% setpoint in K

(

-5.0

°C

)

(

5.0

°C

)

Setpoint Status:

Pass

Zone:

Oven

Setpoint/Actual

Temperature:

100.0

100.8

°C

Accuracy:

0.8

°C

Agilent Recommended:

>=

-1.0

% setpoint in K

<=

1.0

% setpoint in K

(

-3.7

°C

)

(

3.7

°C

)

Overall GC Oven Temperature Accuracy Test Status

Pass

GC Oven Temperature Stability

Name:

7890

Setpoint Status:

Pass

Setpoint/Average

Temperature:

100.0

101.0

°C

Stability:

0.0

°C

Agilent Recommended:

<=

0.5

Overall GC Oven Temperature Stability Test Status

Pass

Log Amp

Tested Combination1

Front

SSL

/ External

SQ

Name:

5977A

Date:

June 25, 2025 8:40:18 PM

System ID:

BKK\_EN0059(GM-7)

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Setpoint Status:

Pass

Overall Log Amp Test Status

Pass

RFPA

Tested Combination1	Front	SSL	/ External	SQ
Name:	5977A			
Setpoint Status:	Pass			
Amu:	1050	m/z	Drift After Five Minutes:	RFPA Voltage:
			2	462
			mV	mV
Agilent Recommended:	>=	-100	and	<= 100
				<= 1100

Overall RFPA Test Status

Pass

Tune EI

Tested Combination1	Front	SSL	/ External	SQ
Name:	5977A			
Setpoint Status:	Pass			
Filament:	1			
Setpoint Status:	Pass			
Filament:	2			

Overall Tune EI Test Status

Pass

Signal to Noise EI

Tested Combination1	Front	SSL	/ External	SQ
Name:	5977A			

Source:	El - Extractor	Filament:	1
Setpoint Status:	Pass		
Signal to Noise:	35794093956		
Agilent Recommended:	>=	1200	

Source:	El - Extractor	Filament:	2
Setpoint Status:	Pass		
Signal to Noise:	32894968229		
Agilent Recommended:	>=	1200	

Overall Signal to Noise EI Test Status

Pass
------

NOTE: This test's 0 comment(s) and 3 deviation(s) are available in the Attachments section.



# Instrument Details

## Purpose

This section describes the as found system configuration.

## Details

### System

System ID	BKK_EN0059(GM-7)
Manufacturer	Agilent Technologies
Name	7890

### Tested Combination1

Injection Technique	Manual Injection
Inlet	Front
Detector	External
LTM Included?	No

### Sampler 1

Manufacturer	Agilent Technologies
Type	Manual Injection
Usage	Sample Injection
Syringe Volume (µL)	10

### Mainframe 1

Manufacturer	Agilent Technologies
Name	7890
Model Number	G3442B
Serial Number	CN14133181
Firmware Revision	B.02.03
Oven Type	Standard

Inlet 1

Manufacturer	Agilent Technologies
Name	7890
Type	SSL
Location	Front
Carrier Gas	Helium
Control Type	Electronic Pressure Control (EPC)
Purged Inlet	Yes

Detector 1

Manufacturer	Agilent Technologies
Name	Mass Spectrometer
Type	Mass Spectrometer
Location	External

Mass Spectrometer 1

Manufacturer	Agilent Technologies
Type	SQ
Name	5977A
Serial Number	US1415M209
Firmware Revision	5977 6.00.21
High Vacuum System	Turbo Pump
Scouting Run Standard	OFN Std

MS EI Source 1

Manufacturer	Agilent Technologies
Source Type	EI - Extractor
Number of filaments	2

# Electronic Signature

## Purpose

This signature page was created and published because the ACE sign-off action was executed, which is valid for the entire document, including attachments. The ACE sign-off is an electronic signature that requires two distinct identification components: unique username and personal password. The Agilent representative who has delivered this service understands the meaning and legal status of an electronic signature. As a trained official operator, the Agilent representative has a unique password and logon to access ACE and electronically sign this document. (Other e-signatures can be applied to this document using a Document Content Management or other suitable method defined in your data access and control procedures.)

## Details

Full Name of Signer:	Supasak Nimsongtham
Logged On User Name:	supasak.nimsongtham@agilent.com
Signature Creation Date:	June 25, 2025
Reason for Signature:	Executed protocol and published this original version of document

## ACE Self Qualification Status

The installed version of ACE used to deliver this service passed qualification; the results conform with expected values. The self qualification summary report is available in the session folder location SDS\ClearStore\AceSelfQualification.

## Regulatory Disclaimer

This document provides a protocol to verify and record instrument configuration and evidence of proper operation. It has been prepared from our interpretation of applicable regulations as well as industry best practices. The document is designed to provide an important component of a complete compliance package. Validation depends upon many factors and use of this protocol alone does not assure compliance. Agilent Technologies makes no promises or representations as to its sufficiency for any specific regulatory program.

## Warranty

Agilent Technologies makes no warranty of any kind to this material, including but not limited to, the implied warranties or merchantability and fitness for a particular purpose. Agilent Technologies shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material.

User Name: supasak.nimsongtham  
Report Generated by Hostname: 5CG1115HKC

System Id: BKK\_EN0059(GM-7)  
Print Date: June 25, 2025 8:40:20 PM

GM-7-2025 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
June 13, 2025 10:01:23 AM	Audit	SessionCreated	Session	Host Name: 5CG1115HKC, Drive Serial Number: C2031778
June 13, 2025 10:01:24 AM	start	Configuration	Session	None
June 13, 2025 10:01:24 AM	Audit	Entitlement	Licensing	User is FieldEngineer and does not require an unlock code
June 13, 2025 10:04:40 AM	Audit	EqpLoaded	Session	EQP details for primary technique [Gc] - File path: [ProtocolPacks/Gc/Configurat ions/02.50/Gc.02.50.eqp], EQP File Name: [Gc.02.50.eqp], EQP Name: [AgilentRecommended], Proto col Revision :[Gc.02.50] EQP details for hyphenated technique [GcMs] - File path: [ProtocolPacks/GcMs/Config urations/02.50/GcMs.02.50.e qp], EQP File Name: [GcMs.02.50.eqp], EQP Name: [AgilentRecommended]
June 13, 2025 10:04:51 AM	End	Configuration	Session	None
June 13, 2025 10:05:03 AM	start	Qualification	Session	OQ
June 13, 2025 10:05:05 AM	start	Execution	System Inspection and Basic Safety and Operation - 7890: - Qualitative Test - No setpoints associated	None
June 13, 2025 10:05:35 AM	End	Execution	System Inspection and Basic Safety and Operation - 7890: - Qualitative Test - No setpoints associated	Run Count : 1

User Name: supasak.nimsongtham  
Report Generated by Hostname: 5CG1115HKC

System Id: BKK\_EN0059(GM-7)  
Print Date: June 25, 2025 8:40:20 PM

GM-7-2025 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
June 13, 2025 10:06:49 AM	start	Execution	Inlet Pressure Accuracy - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	None
June 13, 2025 10:06:58 AM	End	Execution	Inlet Pressure Accuracy - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	Run Count : 1
June 13, 2025 10:07:00 AM	start	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
June 13, 2025 10:07:30 AM	Audit	Data	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry
June 13, 2025 10:07:35 AM	End	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Run Count : 1
June 13, 2025 10:07:59 AM	start	Execution	RFPA - 5977A SQ: - Source: EI - Extractor	None
June 13, 2025 10:11:14 AM	start	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
June 13, 2025 10:12:12 AM	Audit	Data	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry
June 13, 2025 10:12:17 AM	End	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Run Count : 1



User Name: supasak.nimsongtham  
Report Generated by Hostname: 5CG1115HKC

System Id: BKK\_EN0059(GM-7)  
Print Date: June 25, 2025 8:40:20 PM

## GM-7-2025 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
June 13, 2025 10:12:19 AM	start	Execution	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	None
June 13, 2025 10:30:39 AM	Audit	Data	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Manual Data Entry
June 13, 2025 10:30:45 AM	End	Execution	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Run Count : 1
June 13, 2025 10:30:56 AM	start	Execution	Log Amp - 5977A SQ: - Source: EI - Extractor	None
June 13, 2025 10:31:15 AM	End	Execution	Log Amp - 5977A SQ: - Source: EI - Extractor	Run Count : 1
June 13, 2025 10:34:14 AM	Audit	AceClosed	Session	None
June 16, 2025 11:55:53 AM	Audit	AceRestarted	Session	Host Name: DESKTOP-6PKI2AL, Drive Serial Number: 9494EA83
June 16, 2025 11:55:55 AM	Audit	SessionReloaded	Session	None
June 16, 2025 11:58:07 AM	start	Qualification	Session	OQ
June 16, 2025 5:47:31 PM	Audit	AceClosed	Session	None
June 17, 2025 1:34:47 PM	Audit	AceRestarted	Session	Host Name: DESKTOP-6PKI2AL, Drive Serial Number: 9494EA83
June 17, 2025 1:39:58 PM	Audit	AceClosed	Session	None
June 17, 2025 1:52:55 PM	Audit	AceRestarted	Session	Host Name: DESKTOP-6PKI2AL, Drive Serial Number: 9494EA83
June 17, 2025 2:03:56 PM	Audit	SessionReloaded	Session	None
June 17, 2025 2:03:58 PM	start	Qualification	Session	OQ
June 17, 2025 2:04:08 PM	Audit	AceClosed	Session	None

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User Name: supasak.nimsongtham  
Report Generated by Hostname: 5CG1115HKC

System Id: BKK\_EN0059(GM-7)  
Print Date: June 25, 2025 8:40:20 PM

## GM-7-2025 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
June 25, 2025 3:07:51 PM	Audit	AceRestarted	Session	Host Name: 5CG1115HKC, Drive Serial Number: C2031778
June 25, 2025 3:07:54 PM	Audit	SessionReloaded	Session	None
June 25, 2025 3:09:13 PM	start	Qualification	Session	OQ
June 25, 2025 3:09:36 PM	start	Execution	RFPA - 5977A SQ: - Source: EI - Extractor	None
June 25, 2025 3:10:29 PM	End	Execution	RFPA - 5977A SQ: - Source: EI - Extractor	Run Count : 1
June 25, 2025 3:10:35 PM	start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	None
June 25, 2025 3:10:40 PM	start	Execution	Tune EI - 5977A SQ: - Source: - EI - Extractor Filament 1 (Qualitative - No setpoints associated)	None
June 25, 2025 4:10:20 PM	start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	None
June 25, 2025 4:10:23 PM	start	Execution	Tune EI - 5977A SQ: - Source: - EI - Extractor Filament 1 (Qualitative - No setpoints associated)	None
June 25, 2025 4:10:43 PM	End	Execution	Tune EI - 5977A SQ: - Source: - EI - Extractor Filament 1 (Qualitative - No setpoints associated)	Run Count : 1
June 25, 2025 4:10:45 PM	start	Execution	Tune EI - 5977A SQ: - Source: - EI - Extractor Filament 2 (Qualitative - No setpoints associated)	None

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Date: June 25, 2025 8:40:18 PM  
System ID: BKK\_EN0059(GM-7)

User Name: supasak.nimsongtham  
Report Generated by Hostname: 5CG1115HKC

System Id: BKK\_EN0059(GM-7)  
Print Date: June 25, 2025 8:40:20 PM

## GM-7-2025 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
June 25, 2025 4:11:08 PM	End	Execution	Tune EI - 5977A SQ: - Source: - EI - Extractor Filament 2 (Qualitative - No setpoints associated)	Run Count : 1
June 25, 2025 4:11:11 PM	start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	None
June 25, 2025 4:30:52 PM	start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	None
June 25, 2025 5:23:59 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	Data files Path : C:\Users\lmsongth\Download s\OQ data\OQ data\OQ_SN_F1_001.D
June 25, 2025 5:24:19 PM	Audit	Data	DataManager	DataManager was in a data verification state but the user chose to start over
June 25, 2025 5:26:41 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	Data files Path : C:\Users\lmsongth\Download s\OQ data\OQ data\OQ_SN_F1_001.D
June 25, 2025 5:27:29 PM	Audit	Reporting	Reintegration	Reintegration Count: 1 -- [ Integration Type: Injection; Baseline Correction Mode: Advanced; Initial Slope Sensitivity: 10; Initial Peak Width: 0.01; Initial Area Reject: 0; Initial Height Reject: 20000; Integration: Off at 0; Integration: On at 4 ]

User Name: supasak.nimsongtham  
Report Generated by Hostname: 5CG1115HKC

System Id: BKK\_EN0059(GM-7)  
Print Date: June 25, 2025 8:40:20 PM

## GM-7-2025 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
June 25, 2025 5:29:45 PM	End	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	Run Count : 1
June 25, 2025 5:31:32 PM	Audit	TestUnlocked	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	Deviation filed for Run Count : 1
June 25, 2025 5:31:32 PM	start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	None
June 25, 2025 5:34:18 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	Data files Path : C:\Users\lmsongth\Download s\OQ data\OQ data\OQ_SN_F1_001.D
June 25, 2025 5:35:03 PM	Audit	Data	DataManager	DataManager was in a data verification state but the user chose to start over
June 25, 2025 5:37:01 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	Data files Path : C:\Users\lmsongth\Download s\OQ data\OQ data\OQ_SN_F1_001.D
June 25, 2025 5:37:47 PM	Audit	Reporting	Reintegration	Reintegration Count: 1 -- [ Integration Type: Injection; Baseline Correction Mode: Advanced; Initial Slope Sensitivity: 10; Initial Peak Width: 0.01; Initial Area Reject: 0; Initial Height Reject: 25000; Integration: OFF at 0; Integration: ON at 4 ]

User Name: supasak.nimsongtham  
Report Generated by Hostname: 5CG1115HKC

System Id: BKK\_EN0059(GM-7)  
Print Date: June 25, 2025 8:40:20 PM

## GM-7-2025 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
June 25, 2025 5:40:08 PM	End	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	Run Count : 2
June 25, 2025 5:41:09 PM	start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	None
June 25, 2025 5:44:37 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	Data files Path : C:\Users\lmsongth\Download s\OQ data\OQ data\OQ_SN_F2_001.D
June 25, 2025 5:48:28 PM	End	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	Run Count : 1
June 25, 2025 5:49:39 PM	Audit	TestUnlocked	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	Deviation filed for Run Count : 1
June 25, 2025 5:49:40 PM	start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	None
June 25, 2025 5:57:10 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	Data files Path : C:\Users\lmsongth\Download s\OQ data\OQ data\OQ_SN_F2_001.D
June 25, 2025 5:57:46 PM	Audit	Data	DataManager	DataManager was in a data verification state but the user chose to start over



User Name: supasak.nimsongtham  
Report Generated by Hostname: 5CG1115HKC

System Id: BKK\_EN0059(GM-7)  
Print Date: June 25, 2025 8:40:20 PM

## GM-7-2025 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
June 25, 2025 5:59:51 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	Data files Path : C:\Users\lmsongth\Download s\OQ data\OQ data\OQ_SN_F2_001.D
June 25, 2025 6:00:02 PM	Audit	Data	DataManager	DataManager was in a data verification state but the user chose to start over
June 25, 2025 6:02:07 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	Data files Path : C:\Users\lmsongth\Download s\OQ data\OQ data\OQ_SN_F2_001.D
June 25, 2025 6:02:24 PM	Audit	Data	DataManager	DataManager was in a data verification state but the user chose to start over
June 25, 2025 6:19:36 PM	Audit	Data	DataManager	DataManager was in a data verification state but the user chose to start over
June 25, 2025 6:27:38 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	Data files Path : C:\Users\lmsongth\Download s\OQ data\OQ data\OQ_SN_F2_002.D
June 25, 2025 6:33:07 PM	End	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	Run Count : 2
June 25, 2025 6:34:17 PM	Audit	TestUnlocked	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	Deviation filed for Run Count : 2
June 25, 2025 6:34:17 PM	start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	None

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User Name: supasak.nimsongtham  
Report Generated by Hostname: 5CG1115HKC

System Id: BKK\_EN0059(GM-7)  
Print Date: June 25, 2025 8:40:20 PM

## GM-7-2025 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
June 25, 2025 6:35:07 PM	Audit	AceClosed	Session	None
June 25, 2025 6:35:57 PM	Audit	AceRestarted	Session	Host Name: 5CG1115HKC, Drive Serial Number: C2031778
June 25, 2025 6:35:59 PM	Audit	SessionReloaded	Session	None
June 25, 2025 6:36:12 PM	start	Qualification	Session	OQ
June 25, 2025 6:36:13 PM	start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	None
June 25, 2025 6:39:41 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	Data files Path : C:\Users\lmsongth\Download s\OQ data\OQ data\OQ_SN_F2_002.D
June 25, 2025 6:42:57 PM	End	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	Run Count : 3
June 25, 2025 6:43:11 PM	End	Qualification	Session	OQ
June 25, 2025 6:43:11 PM	start	Reporting	Session	None
June 25, 2025 8:04:02 PM	Audit	Reporting	Session	Report Generated : Certificate
June 25, 2025 8:32:04 PM	Audit	Reporting	Session	Report Generated : Report



## Agilent Technologies

Agilent Technologies (Thailand) Limited  
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Email: [ccc-smt@agilent.com](mailto:ccc-smt@agilent.com)  
Website: [www.agilent.com/chem](http://www.agilent.com/chem)

### Customer Contact:

ALS Laboratory Group (Thailand) Co  
Ltd Head Office

104 Phatthanakan 40 Phatthanakan Rd  
Khwaeng Phatthanakan Khet Suan

TAX ID : 0105540004859

[Chanattagarn.lmchom@alsglobal.com](mailto:Chanattagarn.lmchom@alsglobal.com)  
27603068

### Invoice To:

ALS Laboratory Group (Thailand) Co  
Ltd Head Office

104 Phatthanakan 40 Phatthanakan Rd  
Khwaeng Phatthanakan Khet Suan

## SERVICE REPORT

<b>Customer Purchase Order Number:</b>	<b>Customer Number:</b> 70371013
<b>Service Request:</b>	<b>Service Request Date:</b>
<b>Service Order:</b> 6006676091	<b>Service Confirmation:</b> 6905876103

REVIEW BY <u>Pronphen C.</u>
APPROVED BY <u>Savitri N.</u>
NEXT CAL. DATE <u>23 Mar 2026</u>

### Delivery Site:

ALS Laboratory Group (Thailand) Co  
Ltd Head Office

104 Phatthanakan 40 Phatthanakan Rd  
Khwaeng Phatthanakan Khet Suan

### Location:

Room  
Bldg  
Lab  
Dept

### Direct Inquiries to:

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

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Sub-district, Wattana District, Bangkok 10110 Thailand  
Acc. No: 012-4452-007,  
THB:Krung Thai Bank PCL  
Siam Square Br.,416/1-2 Rama I Rd.,Pathumwan, BKK 10330  
Thailand

ORIGINAL

Service Confirmation Number: 6905876103

Service Confirmation Date: 23.09.2024

**Service Instrument:**

Model Number	Model Description	Serial Number	System Handle	Parent Asset
SYS-IO-5100	ICP-OES 5100/5110 System			
G8010A	Agilent 5100 SVDV ICP-OES Spectrometer	MY16010005	ICP OES 5100	SYS-IO-5100
G8410A	SPS 4 Autosampler	AU15440764	ICP OES 5100	SYS-IO-5100

**Service Items:**

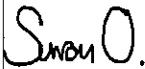

Item	Service/Part #	Description	Qty	Entitlement	Service Start	Service End
1000	EOQ	Enterprise Operational Qualification	1.00	Agreement Entitlement 100 % covered	22.09.2024	23.09.2024
1010	6610030100	Bottle ICP-OES Wavecal soln 500mL 5 ppm	1.00	Agreement Entitlement 100 % covered		
1020	5190-7001	Calibration blank solution 5pct HNO3	1.00	Agreement Entitlement 100 % covered		

**Additional Information:**

**Service Confirmation Number:** 6905876103

**Service Confirmation Date:** 23.09.2024

**Service Information:**

<b>Problem Description:</b> WU-OQ-IO-5100-5001253655		
<b>Service Provided:</b> Complete OQHW 5100ICPOES Equipment ID: BKK_EL0037, all test passed		
<b>Service Overview Code:</b> Reason Code: Scheduled Service Diagnosis Code: Scheduled Service Resolution Code: Scheduled Service		
<b>Reported Hours:</b> 4.0	<b>Travel Hours:</b> 2.0	
<b>Customer Field Service Representative Name:</b> Suwan Onkhom	<b>Customer Field Service Representative Signature:</b> 	<b>Date:</b> 23 Sep 2024
<b>Customer Name:</b> CHANATTAGARN IMCHOM	<b>Customer Signature:</b> 	<b>Date:</b> 23 Sep 2024
<b>Additional Comments:</b>		





TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL.0-2717-3000-29 FAX.0-2719-9484



## Certificate of Calibration

Cert.No.: 25CHO537

Page.: 1 of 3

Equipment :	Spectrophotometer
Manufacturer :	HACH
Model :	DR3900
Serial No. :	2021559
ID No. :	BKK_EN0356
Condition As-Received:	Used Item
Received Date :	08 October 2025
Calibration Date :	08 October 2025
Reference :	2510-0042OC-11
Submitted by :	ALS Laboratory Group (Thailand) Co.,Ltd. 104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan, Khet Suan Luang, Bangkok 10250 Thailand
Calibration Place :	Wet Chemistry Lab 2
Ambient Temperature :	( 21.9 to 21.9 ) °C (On-Site)
Relative Humidity :	( 62 to 65 ) % (On-Site)
Calibration Procedure :	In - house method : CP-OCH4 based on ASTM E 275-08
Calibrated by :	Uthen Kankawi
Approved by :	 Approved Signatory
( ) Chakrit Waewwanjua	
( ) Ponpan Paipim	
(✓) Saithip Meangmai	
Issue Date :	9 October 2025

REVIEW BY 

APPROVED BY 

NEXT CAL DATE...08/10/26

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written  
Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.



Cert. No. : 25CHO537

Page : 2 of 3

**Condition of calibration result**

1. Reference Standard Material :

<u>Material</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due date</u>
1. Absorbance Standard set	44487	122584	31 May 2026
2. Wavelength Standard set	36730	118120	15 Jan 2026
3. Wavelength Standard set	36730	118121	15 Jan 2026

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

3. This certificate is traceable to the International System of Unit maintained through :

- Starna Scientific Ltd.

4. Spectral BandWidth : 5 nm  
Scan Speed : - nm/min

**Calibration Results : without adjustment**

**Wavelength Accuracy**

<b>Certified Values of Reference Material ( nm )</b>	<b>UUC Reading ( nm )</b>	<b>Uncertainty of Measurement ( <math>\pm</math> nm )</b>	<b>Coverage Factor <i>k</i></b>
418.40	418	0.59	2.00
479.88	480	0.59	2.00
513.75	513	0.59	2.00
537.00	536	0.59	2.00
638.00	638	0.59	2.00
747.61	748	0.59	2.00
807.04	807	0.59	2.00



Cert. No. : 25CHO537

Page : 3 of 3

**Calibration Results : without adjustment**

**Photometric Accuracy**

Wavelength (nm)	Certified Values of Reference Material ( Abs )	UUC Reading ( Abs )	Uncertainty of Measurement ( $\pm$ Abs )	Coverage Factor <i>k</i>
420.0	Zero	0.000	0.0028	2.00
	0.5750	0.573	0.0028	2.00
	0.7156	0.713	0.0028	2.00
	1.0176	1.014	0.0028	2.00
440.0	Zero	0.000	0.0028	2.00
	0.5598	0.557	0.0028	2.00
	0.7037	0.700	0.0028	2.00
	1.0013	0.997	0.0028	2.00
465.0	Zero	0.000	0.0028	2.00
	0.5222	0.522	0.0028	2.00
	0.6646	0.664	0.0028	2.00
	0.9444	0.945	0.0028	2.00
546.1	Zero	0.000	0.0028	2.00
	0.5234	0.523	0.0028	2.00
	0.7007	0.700	0.0028	2.00
	0.9992	0.999	0.0028	2.00
590.0	Zero	0.000	0.0028	2.00
	0.5573	0.556	0.0028	2.00
	0.7760	0.773	0.0028	2.00
	1.1104	1.108	0.0028	2.00
635.0	Zero	0.000	0.0028	2.00
	0.5648	0.565	0.0028	2.00
	0.7654	0.765	0.0028	2.00
	1.0961	1.096	0.0028	2.00

**Remark**

- Each individual filter is measured against the empty filter holder (blank) used to zero the spectrophotometer
- 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 %.