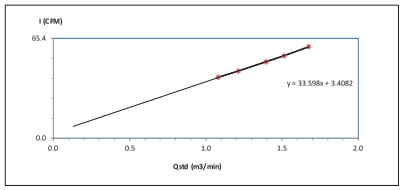
ภาคผนวก ง

ใบรับรองการสอบเทียบเครื่องมือ

High Volume Air Sampler Calibration Worksheet

Project Site:	Thai MMA Co., Ltd.	**Barometric Pressure (mm Hg) :**	756.2
Calibrate Location :	วัดหนองแห่น	**Temperature (°C) :**	30.8
Calibrate Date :	24-Mar-25	**High Volume ID :**	RYG_FS0179
CalibrationSheet No.:	**C-240325-RYG_FS0179**	**High Volume Model :**	TE-5170D
Calibrator ID:	RYG_FS0205	**High Volume S/N :**	4805
Calibrator Model :	TE-5028A	**Calibrator Slope :**	1.52567
Calibrator S/N :	1166	**Calibrator Intercept :**	-0.03613

Test No.	Delta H_2O (inch)	Q_{std} (m^3/min)	I : Chart (CFM)	Linear Regression
1	2.6	1.0802	40	Slope : 33.5985
2	3.3	1.2124	44	Intercept : 3.4082
3	4.4	1.3944	50	Correlation Coefficient : 0.9993
4	5.2	1.5127	54	
5	6.4	1.6743	60	



Calibrated by _____ Approved by : _____

(Mr.Santi Chaichana)
RYG-Field Services Scientist(2)

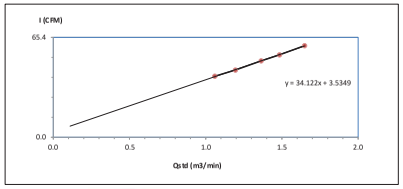
(Mr.Supot Salameh)
RYG-Field Services Section Head

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

High Volume Air Sampler Calibration Worksheet

Project Site :	Thai MMA Co., Ltd.	**Barometric Pressure (mm Hg) :**	756.2
Calibrate Location :	SCG site 3	**Temperature (°C) :**	30.8
Calibrate Date :	24-Mar-25	**High Volume ID :**	BKK_FS0365
CalibrationSheet No.:	**C-240325-BKK_FS0365**	**High Volume Model :**	TE-5009X
Calibrator ID:	RYG_FS0205	**High Volume S/N :**	4164
Calibrator Model :	TE-5028A	**Calibrator Slope :**	1.52567
Calibrator S/N :	1166	**Calibrator Intercept :**	-0.03613

Test No.	Delta H_2O (inch)	Q_{std} (m^3/min)	I : Chart (CFM)	Linear Regression
1	2.5	1.0600	40	Slope : 34.1215
2	3.2	1.1945	44	Intercept : 3.5349
3	4.2	1.3632	50	Correlation Coefficient : 0.9995
4	5.0	1.4841	54	
5	6.2	1.6485	60	



Calibrated by _____ Approved by : _____

(Mr.Santi Chaichana)
RYG-Field Services Scientist(2)

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

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

รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal.	Freq. Calibrate (Months)
Ambient	Total Suspended Particulate	High Volume	BKK_FS0365	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	RYG_FS0178	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	RYG_FS0179	-	-	On site Calibration
Ambient	Total Suspended Particulate	Digital Balance	RYG_EN0001	20-Feb-25	20-Feb-26	12
Ambient	Nitrogen Dioxide	NO_2 Analyzer	RYG_FS0252	4-Jan-25	4-Jul-25	6
Ambient	Nitrogen Dioxide	NO_2 Analyzer	RYG_FS0261	4-Jan-25	4-Jul-25	6
Ambient	Nitrogen Dioxide	NO_2 Analyzer	RYG_FS0461	4-Jan-25	4-Jul-25	6
Ambient	Total Hydrocarbon	DRYCAL FLOWMETER	RYG_FS0208	13-Feb-24	13-Aug-25	18
Ambient	Total Hydrocarbon	DRYCAL FLOWMETER	BKK_FS0614	21-May-24	21-May-25	12
Ambient	Total Hydrocarbon	Total Hydrocarbon Analyzer	RYG_EN0038	25-Jul-24	25-Jul-25	12
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	RYG_FS0611	26-Jun-24	26-Dec-25	18
Stack (CEMs)	Oxides of Nitrogen	Analyzer , System calibration, Stand				-
Stack (CEMs)	Oxygen	Analyzer , System calibration, Stand				-
Stack	Acrylic Acid	Console Control Unit	RYG_FS0315	6-Feb-25	6-Aug-25	6
Stack	Acrylic Acid	Pitot Tube	RYG_FS0321	6-Feb-25	9-Aug-25	6
Stack	Acrylic Acid	Flue gas Analyzer	RYG_FS0464	24-Mar-25	23-Mar-26	12
Stack	Acrylic Acid	DRYCAL FLOWMETER	RYG_FS0208	13-Feb-24	13-Aug-25	18
Stack	Acrylic Acid	DRYCAL FLOWMETER	BKK_FS0614	21-May-24	21-May-25	12
Stack	Acrylic Acid	Field Rotameter	RYG_FS0658	9-Jan-25	9-Apr-25	3
Stack	Acrylic Acid	BKK_FL0034	BKK_FL0034	6-Jan-25	6-Jan-26	12
Stack	Methyl Methacrylate	Console Control Unit	RYG_FS0315	6-Feb-25	6-Aug-25	6
Stack	Methyl Methacrylate	Pitot Tube	RYG_FS0321	6-Feb-25	9-Aug-25	6
Stack	Methyl Methacrylate	Flue gas Analyzer	RYG_FS0464	24-Mar-25	23-Mar-26	12
Stack	Methyl Methacrylate	DRYCAL FLOWMETER	RYG_FS0208	13-Feb-24	13-Aug-25	18
Stack	Methyl Methacrylate	DRYCAL FLOWMETER	BKK_FS0614	21-May-24	21-May-25	12
Stack	Methyl Methacrylate	Field Rotameter	RYG_FS0658	9-Jan-25	9-Apr-25	3
Stack	Methyl Methacrylate	GC-MSD	BKK_EN0410	10-May-24	10-Nov-25	18
Stack	Toluene	Console Control Unit	RYG_FS0315	6-Feb-25	6-Aug-25	6
Stack	Toluene	Pitot Tube	RYG_FS0321	6-Feb-25	9-Aug-25	6
Stack	Toluene	Flue gas Analyzer	RYG_FS0464	24-Mar-25	23-Mar-26	12
Stack	Toluene	DRYCAL FLOWMETER	RYG_FS0208	13-Feb-24	13-Aug-25	18
Stack	Toluene	DRYCAL FLOWMETER	BKK_FS0614	21-May-24	21-May-25	12
Stack	Toluene	Field Rotameter	RYG_FS0658	9-Jan-25	9-Apr-25	3
Stack	Toluene	GC-MSD	BKK_EN0410	10-May-24	10-Nov-25	18
Stack	Methanol	Console Control Unit	RYG_FS0315	6-Feb-25	6-Aug-25	6
Stack	Methanol	Pitot Tube	RYG_FS0321	6-Feb-25	9-Aug-25	6
Stack	Methanol	Flue gas Analyzer	RYG_FS0464	24-Mar-25	23-Mar-26	12
Stack	Methanol	DRYCAL FLOWMETER	RYG_FS0208	13-Feb-24	13-Aug-25	18
Stack	Methanol	DRYCAL FLOWMETER	BKK_FS0614	21-May-24	21-May-25	12
Stack	Methanol	Field Rotameter	RYG_FS0658	9-Jan-25	9-Apr-25	3
Stack	Methanol	GC-FID	BKK_EN0128	22-Oct-24	22-Apr-26	18
Stack	Total Suspended Particulate	Console Control Unit	RYG_FS0315	6-Feb-25	6-Aug-25	6
Stack	Total Suspended Particulate	Pitot Tube	RYG_FS0321	6-Feb-25	9-Aug-25	6
Stack	Total Suspended Particulate	Flue gas Analyzer	RYG_FS0464	24-Mar-25	23-Mar-26	12
Stack	Total Suspended Particulate	Digital Balance	RYG_EN0001	20-Feb-25	20-Feb-26	12
Workplace	Acrylic Acid	DRYCAL FLOWMETER	RYG_FS0208	13-Feb-24	13-Aug-25	18
Workplace	Acrylic Acid	DRYCAL FLOWMETER	BKK_FS0614	21-May-24	21-May-25	12
Workplace	Acrylic Acid	HPLC	BKK_FL0034	6-Jan-25	6-Jan-26	12
Workplace	Methyl Metacrylate	DRYCAL FLOWMETER	RYG_FS0208	13-Feb-24	13-Aug-25	18
Workplace	Methyl Metacrylate	DRYCAL FLOWMETER	BKK_FS0614	21-May-24	21-May-25	12
Workplace	Methyl Metacrylate	GC-MSD	BKK_EN0410	10-May-24	10-Nov-25	18
Workplace	Methanol	DRYCAL FLOWMETER	RYG_FS0208	13-Feb-24	13-Aug-25	18
Workplace	Methanol	DRYCAL FLOWMETER	BKK_FS0614	21-May-24	21-May-25	12
Workplace	Methanol	GC-FID	BKK_EN0128	22-Oct-24	22-Apr-26	18
Workplace	Total Hydrocarbon	DRYCAL FLOWMETER	RYG_FS0208	13-Feb-24	13-Aug-25	18
Workplace	Total Hydrocarbon	DRYCAL FLOWMETER	BKK_FS0614	21-May-24	21-May-25	12
Workplace	Total Hydrocarbon	Total Hydrocarbon Analyzer	RYG_EN0038	25-Jul-24	25-Jul-25	12

SARTORIUS

Accredited by

NSC-TISI-TIS 17025
Calibration 0426

Calibration certificate

Calibration Certificate No. 25BKL0001

Object	Electronic non-automatic weighing instrument
Manufacturer	Sartorius
Type	LA130S-F
Serial | QM Ident. no.	25409664 | RYG_EN0001
Customer	ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch) 616/10 Moo 5 T.Maenam Khu, A.Pluak Daeng, Rayong 21140, Thailand.
Order no.	2230
Number of pages	4
Date of calibration	20 Feb 2025

This calibration certificate documents the trace ability to national standards.

Uncertainties of measurements are taken into account when only statements of compliance are made.

This certificate was prepared by Sartorius Corporation in accordance to the current ISO/IEC 17025:2017 standard and Sartorius Work Instruction (Method) SOP WI 08.

This certificate relate and apply this equipment only.

REVIEW BY ……Thanitat……
APPROVED BY ……D.Kumar……
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.

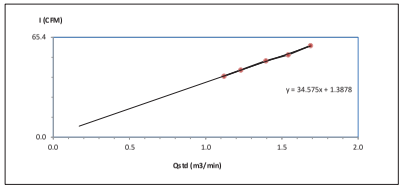
The user is obliged to have the object recalibrated at appropriate intervals.

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

High Volume Air Sampler Calibration Worksheet

Project Site :	Thai MMA Co., Ltd.	**Barometric Pressure (mm Hg) :**	756.2
Calibrate Location :	รม.ม่านมาบตาพุด	**Temperature (°C) :**	30.8
Calibrate Date :	24-Mar-25	**High Volume ID :**	RYG_FS0178
CalibrationSheet No.:	**C-240325-RYG_FS0178**	**High Volume Model :**	TE-5170D
Calibrator ID:	RYG_FS0205	**High Volume S/N :**	4804
Calibrator Model :	TE-5028A	**Calibrator Slope :**	1.52567
Calibrator S/N :	1166	**Calibrator Intercept :**	-0.03613

Test No.	Delta H_2O (inch)	Q_{std} (m^3/min)	I : Chart (CFM)	Linear Regression
1	2.8	1.1197	40	Slope : 34.5752
2	3.4	1.2301	44	Intercept : 1.3878
3	4.4	1.3944	50	Correlation Coefficient : 0.9986
4	5.4	1.5409	54	
5	6.5	1.6870	60	



Calibrated by _____ Approved by : _____

(Mr.Santi Chaichana)
RYG-Field Services Scientist(2)

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

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

รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal.	Freq. Calibrate (Months)
Workplace	Toluene	DRYCAL FLOWMETER	RYG_FS0208	13-Feb-24	13-Aug-25	18
Workplace	Toluene	DRYCAL FLOWMETER	BKK_FS0614	21-May-24	21-May-25	12
Workplace	Toluene	GC-MSD	BKK_EN0410	10-May-24	10-Nov-25	18
Noise	Leq 24 hrs	Sound Calibrator	RYG_FS0496	19-Mar-25	19-Mar-26	12
Noise	Leq 24 hrs	Sound Level Meter	RYG_FS0016	19-Sep-24	19-Sep-25	12
Noise	Leq 24 hrs	Sound Level Meter	RYG_FS0017	27-Jan-25	27-Jan-26	12
Noise	Leq 24 hrs	Sound Level Meter	RYG_FS0018	21-Jan-25	21-Jan-26	12
Noise	Leq 12 hrs	Sound Calibrator	RYG_FS0215	22-Oct-24	22-Oct-25	12
Noise	Leq 12 hrs	Sound Level Meter	RYG_FS0016	19-Sep-24	19-Sep-25	12
Noise	Leq 12 hrs	Sound Level Meter	RYG_FS0020	21-Jan-24	21-Jan-25	12
Noise	Leq 12 hrs	Sound Level Meter	RYG_FS0024	21-Jan-24	21-Jan-25	12
Noise	Leq 12 hrs	Sound Level Meter	RYG_FS0025	21-Jan-24	21-Jan-25	12
Noise	Leq 12 hrs	Sound Level Meter	RYG_FS0027	21-Jan-24	21-Jan-25	12
Noise	Leq 12 hrs	Sound Level Meter	RYG_FS0029	11-Jul-24	11-Jul-25	12
Noise	Leq 12 hrs	Sound Level Meter	RYG_FS0031	30-Aug-24	30-Aug-25	12
Noise	Leq 12 hrs	Sound Level Meter	RYG_FS0302	19-Sep-24	19-Sep-25	12
Noise	Leq 12 hrs	Sound Level Meter	RYG_FS0303	23-Aug-24	23-Aug-25	12
Noise	Leq 12 hrs	Sound Level Meter	RYG_FS0381	9-Oct-24	9-Oct-25	12
Noise	Leq 12 hrs	Sound Level Meter	RYG_FS0618	12-Jan-24	11-Jan-25	12
Noise	Leq 12 hrs	Sound Calibrator	RYG_FS0213	16-Jan-25	16-Jan-26	12
Noise	Leq 12 hrs	Sound Level Meter	RYG_FS0381	9-Oct-24	9-Oct-25	12
Noise	Leq 12 hrs	Sound Level Meter	RYG_FS0384	9-Oct-24	9-Oct-25	12
Noise	Noise Dose, TWA	Dose Badge Reader	RYG_FS0212	4-Sep-24	4-Sep-25	12
Noise	Noise Dose, TWA	Dosemeter	RYG_FS0183	16-Sep-24	16-Sep-25	12
Noise	Noise Dose, TWA	Dosemeter	RYG_FS0184	16-Sep-24	16-Sep-25	12
Noise	Noise Dose, TWA	Dosemeter	RYG_FS0185	16-Sep-24	16-Sep-25	12
Noise	Noise Dose, TWA	Dosemeter	RYG_FS0186	16-Sep-24	16-Sep-25	12
Noise	Noise Dose, TWA	Dosemeter	RYG_FS0187	16-Sep-24	16-Sep-25	12
Noise	Noise Dose, TWA	Dosemeter	RYG_FS0188	16-Sep-24	16-Sep-25	12
Noise	Noise Dose, TWA	Dosemeter	RYG_FS0189	16-Sep-24	16-Sep-25	12
Noise	Noise Dose, TWA	Dosemeter	RYG_FS0190	16-Sep-24	16-Sep-25	12
Noise	Noise Dose, TWA	Dose Badge Reader	RYG_FS0210	12-Feb-25	11-Feb-26	12
Noise	Noise Dose, TWA	Dosemeter	RYG_FS0043	17-Sep-24	17-Sep-25	12
Noise	Noise Dose, TWA	Dosemeter	RYG_FS0044	17-Sep-24	17-Sep-25	12
Noise	Noise Dose, TWA	Dosemeter	RYG_FS0045	11-Sep-24	11-Sep-25	12
Noise	Noise Dose, TWA	Dose Badge Reader	RYG_FS0210	12-Feb-25	11-Feb-26	12
Noise	Noise Dose, TWA	Dosemeter	RYG_FS0039	11-Sep-24	11-Sep-25	12
Raycong Lab	pH at 25 °C	pH Meter	RYG_EN0152	14-Dec-23	14-Jun-25	18
Raycong Lab	BOD	DO meter with Sensor	RYG_EN0132	20-Jan-25	20-Jul-26	18
Raycong Lab	BOD	Incubator	RYG_EN0194	1-Nov-24	1-May-26	18
Raycong Lab	COD	Spectrophotometer	RYG_EN0137	18-Mar-25	18-Sep-26	18
Raycong Lab	Total Suspended Solids	Electronic Balance	RYG_EN0002	20-Feb-25	20-Feb-26	12
Raycong Lab	Total Suspended Solids	Hot Air Oven	RYG_EN0010	21-Mar-24	21-Sep-25	18
Raycong Lab	Total Dissolved Solids 180°C	Electronic Balance	RYG_EN0002	20-Feb-25	20-Feb-26	12
Raycong Lab	Total Dissolved Solids 180°C	Hot Air Oven	RYG_EN0010	21-Mar-24	21-Sep-25	18
Raycong Lab	Oil & Grease	Electronic Balance	RYG_EN0002	20-Feb-25	20-Feb-26	12
Raycong Lab	Oil & Grease	Hot Air Oven	RYG_EN0213	19-Mar-25	19-Mar-26	12
Raycong Lab	Oil & Grease	Water Bath	RYG_EN0061	21-Mar-24	21-Sep-25	18
Raycong Lab	Temperature	pH meter	RYG_FS0994	1-Jul-24	1-Jul-25	12
Raycong Lab	Sulfate	Spectrophotometer	RYG_EN0137	18-Mar-25	18-Sep-26	18
Water Lab	Acetone	Gas Chromatography (MSD)	BKK_EN0059	13-Dec-23	13-Jun-25	18
Water Lab	Toluene	Gas Chromatography (MSD)	BKK_EN0059	13-Dec-23	13-Jun-25	18
Water Lab	Butanol	Gas Chromatography (MSD)	BKK_EN0059	13-Dec-23	13-Jun-25	18
Water Lab	Methanol	Gas Chromatography (MSD)	BKK_EN0059	13-Dec-23	13-Jun-25	18
Soil	Acetone	Gas Chromatography (MSD)	BKK_EN0059	13-Dec-23	13-Jun-25	18
Soil	Toluene	Gas Chromatography (MSD)	BKK_EN0059	13-Dec-23	13-Jun-25	18
Soil	Methanol	Gas Chromatography	BKK_EN0041	3-Jan-25	3-Jul-26	18
Soil	Butanol	Gas Chromatography (MSD)	BKK_EN0059	13-Dec-23	13-Jun-25	18

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. $T_{weights} - T_{place}$	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

Test load (nominal): 10 g | 100 g	10 g	100 g
1	10.0000 g	100.0000 g
2	9.9999 g	100.0000 g
3	10.0000 g	99.9999 g
4	10.0000 g	100.0000 g
5	10.0000 g	99.9999 g
6	9.9999 g	99.9999 g
7	10.0000 g	100.0000 g
8	10.0000 g	100.0000 g
9	10.0000 g	100.0000 g
10	10.0000 g	100.0000 g
	s = 0.00004 g	s = 0.00005 g

Eccentricity

Test load (nominal):	50 g
Center	50.0000 g
Front left	50.0001 g
Back left	50.0000 g
Back right	49.9999 g
Front right	50.0001 g
Maximum deviation from centric loading indication	
$\|\Delta I_{ecc}\|_{max}$ = 0.0001 g	

Error of indication

Testload L	Indication I	Error E	Expansion factor k	Uncertainty $U(E)$	Uncertainty relative $U_{rel}(E)$
0.0100 g	0.0100 g	0.0000 g	2.00	0.00012 g	1.2 %
0.0500 g	0.0500 g	0.0000 g	2.00	0.00013 g	0.25 %
0.1000 g	0.1000 g	0.0000 g	2.00	0.00013 g	0.13 %
0.5000 g	0.5000 g	0.0000 g	2.00	0.00013 g	0.026 %
1.0000 g	1.0000 g	0.0000 g	2.00	0.00013 g	0.013 %
2.0000 g	2.0000 g	0.0000 g	2.00	0.00013 g	0.0065 %
5.0000 g	5.0000 g	0.0000 g	2.00	0.00013 g	0.0026 %
10.0000 g	10.0000 g	0.0000 g	2.00	0.00013 g	0.0013 %
20.0000 g	20.0000 g	0.0000 g	2.00	0.00014 g	0.00069 %
100.0000 g	100.0000 g	0.0000 g	2.00	0.00021 g	0.00021 %
150.0000 g	149.9999 g	-0.0001 g	2.00	0.00028 g	0.00019 %
Maximum error of indication		$\|E\|_{max}$ = 0.0001 g			

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

End of calibration certificate

Uncertainty of measurement in use

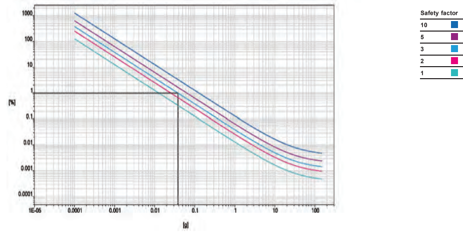
Device adjusted before measurement	Yes
Temperature deviation considered	1.5 K (isoCAL active)
Temperature coefficient considered	$1 \cdot 10^{-6}$/K

Uncertainty of the weighing result $U_{gl}(W)$ $U_{gl}(W) = 0.00013\ g + 3.96 \cdot 10^{-6} \cdot R$

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



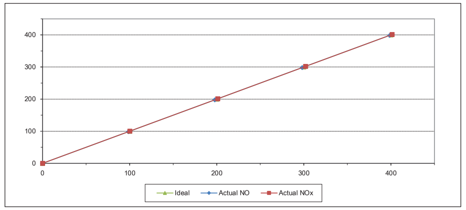
Displayed example

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

MULTIPOINT CALIBRATION REPORT

Calibration Date	4-Jan-25	Equipment Name	NOx Analyzer
Manufacturer	HORIBA	Model	APNA-370
Serial No.	SEEAW53E	Equipment ID	RYG_FS0261
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	55.88	Cylinder No.	GN0027222
Cylinder Pressure (psi)	1800	Certified By	Airgas Inc.
Certified Date	9-Feb-22	Expired Date	9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	98.70	-1.30	-1.30	100.20	0.20	0.20
2	200.00	197.70	-2.30	-1.15	201.20	1.20	0.60
3	300.00	298.10	-1.90	-0.63	302.10	2.10	0.70
4	400.00	398.60	-1.40	-0.35	401.40	1.40	0.35
	AVERAGE (%)			-0.67			0.39

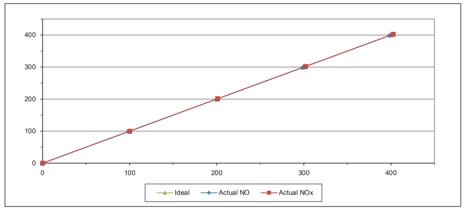


Calibrated By	Approved By
(Mr.Jirawut Sakam)	(Mr.Sarayuth Jittranont)
Field Environmental Scientist (3)	Assistant General Manager

MULTIPOINT CALIBRATION REPORT

Calibration Date	4-Jan-25	Equipment Name	NOx Analyzer
Manufacturer	HORIBA	Model	APNA-370
Serial No.	T95HWM41	Equipment ID	RYG_FS0461
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	55.88	Cylinder No.	GN0027222
Cylinder Pressure (psi)	1800	Certified By	Airgas Inc.
Certified Date	9-Feb-22	Expired Date	9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	98.70	-1.30	-1.30	100.10	0.10	0.10
2	200.00	201.00	1.00	0.50	201.00	1.00	0.50
3	300.00	298.70	-1.30	-0.43	302.10	2.10	0.70
4	400.00	398.40	-1.60	-0.40	402.60	2.60	0.65
	AVERAGE (%)			-0.31			0.41

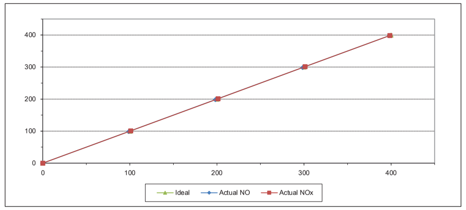


Calibrated By	Approved By
(Mr.Jirawut Sakam)	(Mr.Sarayuth Jittranont)
Field Environmental Scientist (3)	Assistant General Manager

MULTIPOINT CALIBRATION REPORT

Calibration Date	4-Jan-25	Equipment Name	NOx Analyzer
Manufacturer	Teledyne API	Model	T200
Serial No.	2198	Equipment ID	RYG_FS0252
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	55.88	Cylinder No.	GN0027222
Cylinder Pressure (psi)	1800	Certified By	Airgas Inc.
Certified Date	9-Feb-22	Expired Date	9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	98.70	-1.30	-1.30	101.00	1.00	1.00
2	200.00	198.20	-1.80	-0.90	201.30	1.30	0.65
3	300.00	298.50	-1.50	-0.50	301.30	1.30	0.43
4	400.00	398.20	-1.80	-0.45	398.60	-1.40	-0.35
	AVERAGE (%)			-0.61			0.37



Calibrated By	Approved By
(Mr.Jirawut Sakam)	(Mr.Sarayuth Jittranont)
Field Environmental Scientist (3)	Assistant General Manager

RYG_EN0038

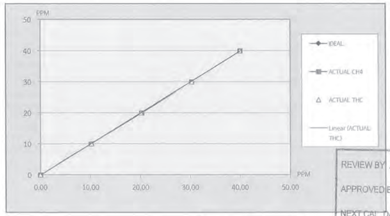
JNAC
JIRANATEE ASSOCIATES CO., LTD.

TEST REPORT

CUSTOMER NAME	: ALS Laboratory Group (Thailand) Co., Ltd. (บริษัท เอแอลเอส แลบอราทอรี่ กรุ๊ป (ประเทศไทย) จำกัด)		
EQRIPMENT NAME	: THC Analyzer		
MANUFACTURER	: HORIBA	MODEL : APHA-370	SERIAL NO : U430GTHB
STANDARD GAS CONCENTRATION (PPM) (CH4) :	506.1 PPM	CYLINDER NO	: CC734373
CYLINDER PRESSURE (psi(g)) :	1,600 PSI	CERTIFIED DATE	: 12/05/2020
CERTIFIED BY :	AIRGAS	EXPIRED DATE	: 12/05/2028

TEST RESULTS

POINT NO	TEST RESULTS						
	IDEAL	ACTUAL CH4	ERROR CH4	%ERROR CH4	ACTUAL THC	ERROR THC	%ERROR THC
ZERO	0.00	0.00	0.00	-	0.00	0.00	-
1	10.00	10.15	0.15	1.50	10.21	0.21	2.10
2	20.00	20.30	0.30	1.50	20.10	0.10	0.50
3	30.00	30.29	0.29	0.97	30.33	0.33	1.10
4	40.00	40.00	0.00	0.00	40.00	0.00	0.00
	AVERAGE (%)			0.99			0.93



REVIEW BY Thanita K.
APPROVED BY D.
NEXT CAL. DATE 25/07/2025

CALIBRATED BY : ทนง 25/7/67
CHECKED BY : สัญญา 25/7/67

JNAC JIRANATEE ASSOCIATES CO., LTD.

ต้องการข้อมูลทางด้านเทคนิคเพิ่มเติม : เจ้าหน้าที่ฝ่ายบริการหลังการขาย , โทร 02-868-0812 # 15,16 , E-Mail : Engineer@jiranatee.com
เลขที่ 63/14-15,67/35-36 ถนนเพชรเกษม 7,7/1 แขวงวัดท่าพระ เขตบางกอกใหญ่ กรุงเทพฯ 10600 โทร 02-8680812-13 โทรสาร 02-868-1889

FO-EN-206 R01/22-10-14

JNAC

CHECK LIST

CUSTOMER NAME	: ALS Laboratory Group (Thailand) Co., Ltd. (บริษัท เอแอลเอส แลบอราทอรี่ กรุ๊ป (ประเทศไทย) จำกัด)		
EQUIPMENT NAME	: THC Analyzer		
MANUFACTURER	: HORIBA	MODEL : APHA-370	SERIAL NO. : U430GTHB

TEST VALUES

NO.	THC Analyzer (APHA - 370)	UNIT	BEFORE	AFTER
1	Signal (CH4)	mV	35.60	35.80
2	Signal (THC)	mV	38.80	39.20
3	Detector	Temp ºC , Standard Value : Ambient temp+(5ºCto15ºC)	46.00	46.90
		Pressure kPa , Standard Value : (Ambient/1013x100-20)±4kPa	69.30	69.30
4	Ambient	kPa current atmospheric pressure	100.30	100.30
5	Purifire	ºC , Standard Value : 390 ºC to 430 ºC	420.00	420.50
		kPa , Normal value : 8 kPa to 25 kPa	9.80	9.80
6	NMHC	ºC , Standard Value : 230 ºC to 260 ºC	244.90	244.80
7	DC 24 V	V , Standard Value : 24 V ± 0.5 V	24.00	24.00
8	DC 5 V	V , Standard Value : 5 V ± 0.5 V	5.00	5.00
9	Bypass (Optional)	L/min, Normal value : 0.9 L/min ± 0.3 L/min	-	-
10	Over Flow (Optional)	L/min, Standard Value : 0.8 L/min or More	-	-
11	CH4 Samping Reading	PPM	2.93	2.03
12	NMHC Samping Reading	PPM	0.25	0.11
13	THC Samping Reading	PPM	3.18	2.13
14	Zero Gas CH4/THC	PPM	0.13/0.18	0.00/0.00
15	Span Gas	PPM	56.19/56.43	40.00/40.00
G	Gas H2 ...../......	20 PSI	20	20

Remark : Reference EX-EN-017-56 , Ambient HC Monitor APHA-370 Operetion Manual Page #81
Remark : (Ambeint temperature = 5ºC to 40ºC)

อาการที่ตรวจพบ
- Air Filter สกปรกและเสื่อมสภาพ , Filter Spoonge สกปรกและเสื่อมสภาพ

รายละเอียดการดำเนินการ
- ทำการ Service Maintenance ,เปลี่ยน Air Filter , 0.3 , เปลี่ยน Filter Spoonge , ทำ Calibration Zero/Span , Multipoint

ผลการดำเนินการ
- เรียบร้อย เครื่องสามารถดำเนินการตรวจวัดได้ตามปกติ

CALIBRATED BY : ทนง DATE : 25/7/67
CHECKED BY : สัญญา DATE : 25/7/67

JNAC JIRANATEE ASSOCIATES CO., LTD.

ต้องการข้อมูลทางด้านเทคนิคเพิ่มเติม : เจ้าหน้าที่ฝ่ายบริการหลังการขาย , โทร 02-868-0812 # 15-16 , E-Mail : Engineer@jiranatee.com
เลขที่ 63/14-15,67/35-36 ถนนเพชรเกษม 7,7/1 แขวงวัดท่าพระ เขตบางกอกใหญ่ กรุงเทพฯ 10600 โทร 02-868-0812-13 โทรสาร 02-868-1889

FO-EN-207 R00/01-08-13

MesaLabs

NVLAP Lab Code 200661-0 Calibration

Calibration Certificate

CertificateNo. 610563
Product 200-510M Defender 510 Medium Flow
Serial No. 151114
Cal. Date 21-May-2024

Sold To:

All calibrations are performedin accordance with ISO 17025 at Mesa Laboratories, Inc., 12100 W. 6th Ave, Lakewood, CO 80228, an ISO 17025:2017 accredited laboratory through NVLAP. This report shall not be reproduced except in full without the written approval of the laboratory. Results only relate to the items calibrated. This report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S. Government.

As Received Calibration Data

Technician: Derek Dellapa
Lab. Pressure: 614.2 mmHg
Lab. Temperature: 24.3 °C

Instrument Reading	Lab Standard Reading	Deviation	Allowable Deviation	As Received
0 ccm	4804.81 ccm	-100.0%	1.00%	Out of Tolerance
0 ccm	1000.98 ccm	-100.0%	1.00%	Out of Tolerance
0 ccm	249.55 ccm	-100.0%	1.00%	Out of Tolerance

Mesa Laboratories Standards Used

Description	Standard Serial Number	Calibration Date	Calibration Due Date
ML-800-24	117091	13-Nov-2023	13-Nov-2024

Nantam P. 21/1/25

Mesa Laboratories Inc. 12100 W. 6th Ave, Lakewood, CO 80228 USA
(303) 987-8000 www.mesalabs.com Symbol "MLAB" on the NASDAQ

1 of 2 FM-00226 Rev. B

MesaLabs

NVLAP Lab Code 200661-0 Calibration

As Shipped Calibration Data

Certificate No: 610563
Technician: Derek Dellapa
Lab. Pressure: 617 mmHg
Lab. Temperature: 24.6 °C

Instrument Reading	Lab Standard Reading	Deviation	Allowable Deviation	As Shipped
4482.47 ccm	4493.49 ccm	-0.25%	1.00%	In Tolerance
897.25 ccm	896.83 ccm	0.04%	1.00%	In Tolerance
248.51 ccm	248.67 ccm	-0.06%	1.00%	In Tolerance

Mesa Laboratories Standards Used

Description	Standard Serial Number	Calibration Date	Calibration Due Date
ML-800-24	211063	04-Oct-2023	04-Oct-2024

Calibration Notes

The expanded uncertainty of flow has a coverage factor of k = 2 for a confidence interval of approximately 95%.

Flow testing is in accordance with our test number MP-00672 with an expanded uncertainty of 0.27% using high-purity nitrogen or filtered laboratory air.

Traceability to the International System of Units (SI) is verified by accreditation to ISO/IEC 17025 by NVLAP under NVLAP Code 200661-0.

Technician Notes:

By: Derek Dellapa, Production Assembler II

Approved By: Troy Thacker, Quality Engineer

Mesa Laboratories, Inc. certifies that the above instrument meets or exceeds published specifications, and that the calibration results in this certificate were obtained using equipment capable of producing results that are traceable through NIST to the International System of Units (SI). Calibration results are in compliance with ISO/IEC 17025:2017. Calibrations process has a Test Uncertainty Ration (TUR) of 4:1 or greater. Any Pass/Fail determination is made without taking measurement uncertainty into account and is based on UUT performance against required tolerance only.

Mesa Laboratories Inc. 12100 W. 6th Ave, Lakewood, CO 80228 USA
(303) 987-8000 www.mesalabs.com Symbol "MLAB" on the NASDAQ

2 of 2 FM-00226 Rev. B

INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7/139 MOO 13, SOI SUNTINAKORN 11 TAMBON BANG KAEO,
AMPHOE BANG PHLI SAMUT PRAKAN PROVINCE 10540 THAILAND
TEL: (66)0-2116-5860-1 FAX: (66)0-2116-7140

INNOVATIVE INSTRUMENT CO., LTD. บริษัท อินโนเวทีฟ อินสทรูเมนท์ จำกัด — ANAB ACCREDITED CALIBRATION LABORATORY AC-2961

Page 1/2

Certificate of Calibration

Certificate No : 24-AFM-033
Request No : Req-2024-0241

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

Unit Under Calibration Details
Measurement Item : Primary Flow Calibrator
Manufacturer : Bios
Model : Defender 510-L — Sensor Model : -
Serial Number : 130027 — Sensor Serial Number : -
ID : RYG_FS0208
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 : 31 January 2024
Calibration Date : 13 February 2024
Calibration Procedure : In-house method CP-AFM-01 by Comparison technique with Standard Primary Flow Calibrator

REVIEW BY Nantam P.
APPROVED BY
NEXT CAL. DATE 13/8/25

Reference Standard	Model	Serial Number	Traceble	Due Calibration
Air Flow Meter	Gilibrator 3 Low flow	18501010006	Sensidyne	12 July 2024
Air Flow Meter	Gilibrator 3 Standard flow	19031011003	Sensidyne	12 July 2024
Temperature meter	GT 11	08000057	Qrebom	27 February 2024
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 : Mr. Noppadon Luangart, Service Calibration Engineer
Approved By : Mr. Pacit Mathavorn, Calibration Engineer Supervisor
Issue Date : 13 February 2024

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

FM-708-AFM-01 Rev.01 Issue date 25/01/24

INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7/139 MOO 13, SOI SUNTINAKORN 11 TAMBON BANG KAEO,
AMPHOE BANG PHLI SAMUT PRAKAN PROVINCE 10540 THAILAND
TEL: (66)0-2116-5860-1 FAX: (66)0-2116-7140

Page 2/2

Certificate No : 24-AFM-033
Request No : Req-2024-0241

Result of Calibration : Without Adjustment

Temperature (°C)	Pressure (kPa)	STD (cc/min)	UUC (cc/min)	Error (cc/min)	Uncertainty (cc/min)
24.50	101.26	20	19.965	0.0	1.3
24.20	101.25	101	100.50	-0.5	2.8
24.00	101.31	200	199.13	-0.9	5.6
23.90	101.42	301	303.56	2.6	8.4
24.10	101.41	401	404.57	4	11
24.10	101.49	480	483.81	3.8	7.0

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 :

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

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

* Indicates non accredited

End of Certificate

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

FM-708-AFM-01 Rev.01 Issue date 25/01/24

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

Pressure measurement laboratory
Calibration services department.

NSC - TISI - TIS 17025
CALIBRATION 0367

CERTIFICATE OF CALIBRATION

Certificate No. : CPR-007-67

MEASUREMENT ITEM	: Digital barometer
MANUFACTURER	: Novalynx
MODEL/TYPE	: Sensor: 110-WS-25BP Data logger: 110-WS-25DL-D
SERIAL NUMBER	: Sensor: BP-A5912 Data logger: A5912
ID NUMBER	: RYG_FS0611
CONDITION AS-RECEIVED	: Used item
CUSTOMER	: ALS laboratory group (Thailand) Co., Ltd. 104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand.
RECEIVED DATE	: 10 Jun 2024
MEASUREMENT DATE	: 26 Jun 2024
ISSUE DATE	: 26 Jun 2024

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

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

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

CONDITION OF THIS RESULT OF CALIBRATION:
1. Reference Standard Instrument:

Instrument	Model	Serial No.	Certificate No.	Due Date
Absolute Pressure Transducer	CPG2500	4100126P	MP-0009-24	27 Dec 2024

1. Calibration effort for calibration sequence B
2. The UUC* was installed in vertical orientation above reference standard instrument and center of UUC* was used as the reference level.
3. Calibration conditions:
4. Condition : ☑ Normal ☐ Abnormal
   - Pressure transmitting medium : Air
   - ρ_l (20°C, 1 bar) : 1.19 kg/m³
   - H_{amb} : (55±15) %
   - t_{amb} : (23±3) °C
   - p_{amb} : (1010±10) mbar
5. The certificate is valid only to the item calibrated on date and place of calibration

Calibrated by:
☑ Mr. Sorawit Thachalad
☐ Miss Jittraporn Lertsomphol

JNAC JIRANATEE ASSOCIATES CO., LTD.

Approved signatory: ....
Mr. Parinya Booncharoen
Calibration Department Manager

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

Jiranatee Associates Co., Ltd.

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

Pressure measurement laboratory
Calibration services department.

NSC - TISI - TIS 17025
CALIBRATION 0367

CERTIFICATE OF CALIBRATION

Certificate No. : CPR-007-67

MEASUREMENT RESULTS : ☐ Without adjustment ☑ With adjustment

CALIBRATION IN THE RANGE OF : 950 mbar to 1050 mbar

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

STD	UUC*	Error	Uncertainty (k=2)
(mbar)	(mbar)	(mbar)	(mbar)
950.11	951.9	1.8	0.37
970.08	971.3	1.2	0.37
990.08	991.0	0.9	0.37
1010.09	1010.4	0.3	0.37
1030.05	1029.9	-0.2	0.37
1050.08	1049.3	-0.8	0.37

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

End of certificate

JNAC JIRANATEE ASSOCIATES CO., LTD.

Jiranatee Associates Co., Ltd.

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

Wind direction measurement laboratory
Calibration services department.

NSC – TISI – TIS 17025
CALIBRATION 0367

Certificate Number
CWD-017-67

CERTIFICATE OF CALIBRATION

MEASUREMENT ITEM	: Wind Direction Sensor
MANUFACTURER	: Novalynx
MODEL/TYPE	: Sensor: WS-02F Data logger: 110-WS-25DL-D
SERIAL NUMBER	: Sensor: WSD-A5912 Data logger: A5912
ID NUMBER	: RYG_FS0611
CONDITION AS-RECEIVED	: Used item
CUSTOMER	: ALS laboratory group (Thailand) Co., Ltd. 104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand.
RECEIVED DATE	: 10 Jun 2024
MEASUREMENT DATE	: 26 Jun 2024
ISSUE DATE	: 26 Jun 2024

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

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

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

CALIBRATION CONDITION

: Wind tunnel cross-section area[1]	900	cm²
Wind direction frontal area[2]	129	cm²
Diameter of mounting pipe[3]	-	mm
Blockage ratio of test object[4]	0.143	[-]

Preconditioning : 24 hours at ambient conditions.
Measurement Condition : The average values during measurement are (23.9)°C, (52.6) %RH and (1005.3) hPa.

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 cm² 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'

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

Calibrated by:
☑ Mr. Sorawit Thachalad
☐ Miss Jittraporn Lertsomphol

JNAC JIRANATEE ASSOCIATES CO., LTD.

Approved signatory: ....
Mr. Parinya Booncharoen
Calibration Department Manager

Remark:
[1] Nozzle cross-section area of the wind tunnel
[2] Projected cross-section area of the tested object include mounting pipe
[3] Diameter of mounting pipe
[4] Ratio [2] to [1]

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

Jiranatee Associates Co., Ltd.

Certificate Number
CWD-017-67

MEASUREMENT RESULTS [5]

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'_{std}	D'_{uuc}	Error	U (k=2)
m/s	Degree (°)	Degree (°)	Degree (°)	Degree (°)
	0.000	0	0	0.80
	45.000	43	-2	0.80
	90.000	87	-3	0.80
5.01	135.000	131	-4	0.80
	180.000	177	-3	0.80
	225.000	225	0	0.80
	270.000	271	1	0.80
	315.000	318	3	0.80

Remark:
[5] Calibration results only count for the tested circumstances and environmental conditions during which calibration took place
[6] Direction of standard
[7] Direction of Unit Under Calibration

End of Certificate of Calibration

JNAC JIRANATEE ASSOCIATES CO., LTD.

Jiranatee Associates Co., Ltd.

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

Air speed measurement laboratory
Calibration services department.

NSC – TISI – TIS 17025
CALIBRATION 0367

Certificate Number
CWS-017-67

CERTIFICATE OF CALIBRATION

MEASUREMENT ITEM	: Cup anemometer
MANUFACTURER	: Novalynx
MODEL/TYPE	: Sensor: WS-02F Data logger: 110-WS-25DL-D
SERIAL NUMBER	: Sensor: WSD-A5912 Data logger: A5912
ID NUMBER	: RYG_FS0611
CONDITION AS-RECEIVED	: Used item
CUSTOMER	: ALS laboratory group (Thailand) Co., Ltd. 104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand.
RECEIVED DATE	: 10 Jun 2024
MEASUREMENT DATE	: 26 Jun 2024
ISSUE DATE	: 26 Jun 2024

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

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

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

CALIBRATION CONDITIONS

: Wind tunnel cross-section area[1]	900	cm²
Wind direction frontal area[2]	100	cm²
Diameter of mounting pipe[3]	-	mm
Blockage ratio of test object[4]	0.111	[-]

Preconditioning : 24 hours at ambient conditions.
Measurement Condition : The average values during measurement are (24.0) °C, (44.0) %RH and (1003.0) hPa.

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 cm² 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 ..... Marlum P
APPROVED BY .....
26/12/25

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

Calibrated by:
☑ Mr. Sorawit Thachalad
☐ Miss Jittraporn Lertsomphol

JNAC JIRANATEE ASSOCIATES CO., LTD.

Approved signatory: ....
Mr. Parinya Booncharoen
Calibration Department Manager

Remark:
[1] Nozzle cross-section area of the wind tunnel
[2] Projected cross-section area of the tested object include mounting pipe
[3] Diameter of mounting pipe
[4] Ratio [2] to [1]

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

Jiranatee Associates Co., Ltd.

Certificate Number
CWS-017-67

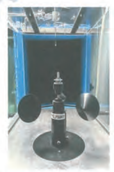
MEASUREMENT RESULTS [5]

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]	Temp. wind tunnel	Temp. room	V_{uuc} [7]	Error	U (k=2)
(m/s)	(°C)	(°C)	(m/s)	(m/s)	(m/s)
1.000	24.00	24.00	0.8	-0.2	0.31
1.993	24.08	24.00	1.7	-0.3	0.31
2.971	24.00	24.00	2.8	-0.2	0.31
4.094	24.00	24.00	3.8	-0.3	0.31
4.99	23.82	24.00	5.0	0.0	0.31
6.03	24.22	24.00	6.0	0.0	0.31
7.04	23.80	24.00	7.0	0.0	0.31
7.97	24.18	24.00	8.0	0.0	0.31
8.99	23.54	24.00	9.1	0.1	0.31
9.99	23.98	24.00	10.1	0.1	0.31
11.00	23.80	24.00	11.2	0.2	0.31
11.99	23.92	24.00	12.2	0.2	0.31
13.00	23.80	24.00	13.3	0.3	0.31
14.06	23.82	24.00	14.4	0.4	0.31
15.04	23.80	24.00	15.4	0.4	0.31
15.99	23.80	24.00	16.4	0.4	0.31

Remark:
[5] Calibration results only count for the tested circumstances and environmental conditions during which calibration took place
[6] Velocity of standard
[7] Velocity of Unit Under Calibration

PHOTO OF CALIBRATION SET-UP



Calibration set-up of the Cup anemometer calibration in the wind tunnel of 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

JNAC JIRANATEE ASSOCIATES CO., LTD.

Jiranatee Associates Co., Ltd.

Lot No. 2515862-1

ANALYZER CALIBRATION DATA

Client	: THAI MMA Co., Ltd.	**Location**	: ปล่อง Z-6210		
Date	: 28 Mar 25	**Test Operator**	: Sathaporn T.		

O_2 ANALYZER
Model : TELEDYNE API 200EH **Serial No.** : 735
Span (%) : 25

	Cylinder Value (%)	Initial Analyzers Calibration Response (%)	Final Analyzers Calibration Response (%)	Difference (Percent of Span)
Zero Gas	0.00	0.10	0.11	0.04
Low-Level Gas	8.19	8.29	8.30	0.04
Span Gas	16.07	16.18	16.18	0.00

NO_X ANALYZER
Model : TELEDYNE API 200EH **Serial No.** : 735
Span (ppm) : 100

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.15	0.17	0.02
Low-Level Gas	55.91	55.80	55.81	0.01
Span Gas	82.51	82.32	82.30	0.02

Calibrated by

Sathaporn.T

(Mr. Sathaporn Thakaew)
Environmental Field Scientist (3)

Lot No. 2515862-1

SYSTEM CALIBRATION BIAS AND DRIFT DATA

Client	: THAI MMA Co., Ltd.	**Location**	: ปล่อง Z-6210
Date	: 28 Mar 25	**Test Operator**	: Sathaporn T.

O_2 ANALYZER
Cylinder Conc. (%) : 16.07 **Span (%)** : 25

	O_2 Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
		System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	
Zero Gas	0.10	0.13	0.12	0.15	0.20	0.08
Upscale Gas	16.18	16.25	0.28	16.25	0.28	0.00

NO_X ANALYZER
Cylinder Conc. (ppm) : 82.51 **Span (ppm)** : 100

	NO_X Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
		System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	
Zero Gas	0.15	0.24	0.09	0.27	0.12	0.03
Upscale Gas	82.32	82.14	0.18	82.12	0.20	0.02

Calibrated by

Sathaporn.T

(Mr. Sathaporn Thakaew)
Environmental Field Scientist (3)

JNAC
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

Relative humidity and Air Temperature measurement laboratory
Calibration services department.

CERTIFICATE OF CALIBRATION

Certificate No. : CRT-016-67

MEASUREMENT ITEM : Relative humidity with data logger
MANUFACTURER : Novalynx
MODEL/TYPE : Data Logger: 110-WS-25DL-D
Sensor: HMP60
SERIAL NUMBER : Data Logger: A5912
Sensor: U3911247
ID NUMBER : RYG_FS0611
CONDITION AS-RECEIVED : Used item
CUSTOMER : ALS laboratory group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand.

RECEIVED DATE : 10 Jun 2024
MEASUREMENT DATE : 26 Jun 2024
ISSUE DATE : 26 Jun 2024

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

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

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

Calibration procedure:
The Relative humidity and Air Temperature calibration was done by In-House calibration method as WI-CL-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

JNAC JIRANATEE ASSOCIATES CO., LTD.

Approved signatory:
Mr. Parinya Booncharoen
Calibration Department Manager

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

Jiranatee Associates Co.,Ltd.

JNAC
JIRANATEE ASSOCIATES CO.,LTD.

Continuation of Certificate of Calibration Number: CRT-016-67

Measurement Results:

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

Result of Calibration: ☑ Without Adjustment ☐ With Adjustment

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

Air Temperature (°C)	Standard Reading (%RH)	UUC Reading (%RH)	Error (%RH)	Uncertainty ±(%RH)
29.80	19.60	18.6	-1.0	0.83
29.80	50.55	48.0	-2.6	1.3
29.81	81.61	77.8	-3.8	2.3

UUC*: Unit Under Calibration

End of Certificate of Calibration

JNAC JIRANATEE ASSOCIATES CO., LTD.

Jiranatee Associates Co.,Ltd.

JNAC
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.

ilac-MRA
NSC – TISI – TIS 17025
CALIBRATION 0367

CERTIFICATE OF CALIBRATION

Certificate No. : CDT-104-67

MEASUREMENT ITEM : Data Logger with Temperature sensor
MANUFACTURER : Novalynx
MODEL/TYPE : 110-WS-25DL-D
SERIAL NUMBER : A5912
ID NUMBER : RYG_FS0611
CONDITION AS-RECEIVED : Used item
CUSTOMER : ALS laboratory group (thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khwaeng Suan Luang, Khet Suan Luang,
Bangkok 10250 Thailand.

RECEIVED DATE : 10 Jun 2024
MEASUREMENT DATE : 26 Jun 2024
ISSUE DATE : 26 Jun 2024

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

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

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

Calibration procedure:
The 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

JNAC JIRANATEE ASSOCIATES CO., LTD.

Approved signatory:
Mr. Parinya Booncharoen
Calibration Department Manager

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

Jiranatee Associates Co.,Ltd.

JNAC
JIRANATEE ASSOCIATES CO.,LTD.

Continuation of Certificate of Calibration Number CDT-104-67

Result of Calibration: ☑ Without Adjustment ☐ With Adjustment

Calibration Range: 20 °C to 40 °C

Function:
Table 3: This equipment was connected with temperature sensor Model: HMP60 S/N: U3911247.
Dimension: Diameter 12 mm. Length 80 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.065	19.6	-0.5	0.099
80	25.058	24.6	-0.5	0.099
80	30.048	29.7	-0.3	0.099
80	35.033	34.7	-0.4	0.14
80	40.045	39.5	-0.5	0.099

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

End of Certificate of Calibration

JNAC JIRANATEE ASSOCIATES CO., LTD.

Jiranatee Associates Co.,Ltd.

Lot No. 2515864-1

SYSTEM CALIBRATION BIAS AND DRIFT DATA

Client : THAI MMA Co., Ltd.
Date : 27 Mar 25
Location : เม็ดละ ZZ-6210
Test Operator : Sathaporn T.

O_2 ANALYZER
Cylinder Conc. (%) : 16.07
Span (%) : 25

	O_2 Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
		System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	
Zero Gas	0.10	0.19	0.36	0.22	0.48	0.12
Upscale Gas	16.17	16.25	0.32	16.29	0.48	0.16

NO_x ANALYZER
Cylinder Conc. (ppm) : 82.51
Span (ppm) : 100

	NO_x Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
		System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	
Zero Gas	0.35	0.44	0.09	0.47	0.12	0.03
Upscale Gas	82.22	82.04	0.18	82.02	0.20	0.02

Calibrated by

Sathaporn.T

(Mr.Sathaporn Thakaew)

Environmental Field Scientist (3)

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

ALS Laboratory Group

EMISSION TEST RESULT

Client	THAI MMA Co., Ltd.	Run #	3
Date	28 Mar 25	Location	เม็ดละ Z-6210
Start Time	11:27	Test Operator	Sathaporn T.
SO_2 Analyzer Model	-	Finish Time	11:47
NO_x/O_2 Analyzer Model	TELEDYNE API 200EH	Serial No.	-
CO/CO_2 Analyzer Model	-	Serial No.	735
		Serial No.	-

Time (min)	O_2 (%)	CO_2 (%)	NOx (ppm)	SO_2 (ppm)	CO (ppm)	Remark
11:27	5.25	8.20	14.85	-	-	
11:28	5.24	8.11	14.88	-	-	
11:29	5.16	8.21	14.88	-	-	
11:30	5.35	8.25	14.88	-	-	
11:31	5.17	8.30	14.83	-	-	
11:32	5.24	8.25	14.97	-	-	
11:33	5.24	8.21	15.00	-	-	
11:34	5.24	8.26	14.89	-	-	
11:35	5.22	8.27	15.00	-	-	
11:36	5.21	8.20	15.03	-	-	
11:37	5.22	8.21	14.99	-	-	
11:38	5.20	8.23	15.06	-	-	
11:39	5.19	8.28	15.13	-	-	
11:40	5.18	8.28	15.11	-	-	
11:41	5.21	8.30	15.06	-	-	
11:42	5.24	8.22	15.14	-	-	
11:43	5.25	8.21	15.12	-	-	
11:44	5.27	8.17	14.97	-	-	
11:45	5.27	8.13	15.01	-	-	
11:46	5.25	8.27	15.08	-	-	
11:47	5.23	8.24	15.07	-	-	
Average	**5.22**	**8.23**	**15.00**	**-**	**-**	

Sathaporn.T

(Mr. Sathaporn Thakaew)

Environmental Field Scientist (3)

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

ALS Laboratory Group

EMISSION TEST RESULT

Client	THAI MMA Co., Ltd.	Run #	1
Date	28 Mar 25	Location	เม็ดละ Z-6210
Start Time	10:45	Test Operator	Sathaporn T.
SO_2 Analyzer Model	-	Finish Time	11:05
NO_x/O_2 Analyzer Model	TELEDYNE API 200EH	Serial No.	-
CO/CO_2 Analyzer Model	-	Serial No.	735
		Serial No.	-

Time (min)	O_2 (%)	CO_2 (%)	NOx (ppm)	SO_2 (ppm)	CO (ppm)	Remark
10:45	5.31	8.21	14.77	-	-	
10:46	5.32	8.12	14.76	-	-	
10:47	5.28	8.23	14.80	-	-	
10:48	5.25	8.16	14.81	-	-	
10:49	5.22	8.17	14.73	-	-	
10:50	5.24	8.21	14.75	-	-	
10:51	5.24	8.21	14.72	-	-	
10:52	5.24	8.20	14.73	-	-	
10:53	5.24	8.15	14.81	-	-	
10:54	5.22	8.21	14.81	-	-	
10:55	5.21	8.12	14.76	-	-	
10:56	5.21	8.23	14.73	-	-	
10:57	5.22	8.25	14.75	-	-	
10:58	5.27	8.21	14.75	-	-	
10:59	5.26	8.24	14.81	-	-	
11:00	5.23	8.14	15.00	-	-	
11:01	5.22	8.24	15.23	-	-	
11:02	5.21	8.20	15.27	-	-	
11:03	5.17	8.19	15.32	-	-	
11:04	5.20	8.15	15.39	-	-	
11:05	5.24	8.20	15.28	-	-	
Average	**5.24**	**8.19**	**14.90**	**-**	**-**	

Sathaporn.T

(Mr. Sathaporn Thakaew)

Environmental Field Scientist (3)

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

ALS Laboratory Group

EMISSION TEST RESULT

Client	THAI MMA Co., Ltd.	Run #	1
Date	27 Mar 25	Location	เม็ดละ ZZ-6210
Start Time	10:30	Test Operator	Sathaporn T.
SO_2 Analyzer Model	-	Finish Time	10:50
NO_x/O_2 Analyzer Model	TELEDYNE API 200EH	Serial No.	-
CO/CO_2 Analyzer Model	-	Serial No.	735
		Serial No.	-

Time (min)	O_2 (%)	CO_2 (%)	NOx (ppm)	SO_2 (ppm)	CO (ppm)	Remark
10:30	5.71	8.14	8.01	-	-	
10:31	5.65	8.14	7.83	-	-	
10:32	5.56	8.18	7.82	-	-	
10:33	5.64	8.09	7.93	-	-	
10:34	5.67	8.18	8.05	-	-	
10:35	5.76	8.10	8.08	-	-	
10:36	5.73	8.10	8.04	-	-	
10:37	5.82	8.06	8.21	-	-	
10:38	5.78	8.04	8.28	-	-	
10:39	5.81	8.13	8.27	-	-	
10:40	5.63	8.11	8.34	-	-	
10:41	5.69	8.07	8.30	-	-	
10:42	5.70	8.24	8.22	-	-	
10:43	5.75	8.07	8.31	-	-	
10:44	5.75	8.13	8.30	-	-	
10:45	5.86	8.11	8.27	-	-	
10:46	5.80	8.07	8.22	-	-	
10:47	5.79	8.12	8.27	-	-	
10:48	5.74	8.10	8.33	-	-	
10:49	5.79	8.13	8.31	-	-	
10:50	5.13	8.18	8.47	-	-	
Average	**5.75**	**8.12**	**8.18**	**-**	**-**	

Sathaporn.T

(Mr.Sathaporn Thakaew)

Environmental Field Scientist (3)

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

ALS Laboratory Group

Lot No. 25158 64-1

ANALYZER CALIBRATION DATA

Client : THAI MMA Co., Ltd.
Date : 27 Mar 25
Location : เม็ดละ ZZ-6210
Test Operator : Sathaporn T.

O_2 ANALYZER
Model : TELEDYNE API 200EH
Span (%) : 25
Serial No. : 735

	Cylinder Value (%)	Initial Analyzers Calibration Response (%)	Final Analyzers Calibration Response (%)	Difference (Percent of Span)
Zero Gas	0.00	0.10	0.11	0.04
Low-Level Gas	8.19	8.29	8.30	0.04
Span Gas	16.07	16.17	16.18	0.04

NO_x ANALYZER
Model : TELEDYNE API 200EH
Span (ppm) : 100
Serial No. : 735

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.35	0.37	0.02
Low-Level Gas	55.91	55.70	55.71	0.01
Span Gas	82.51	82.22	82.20	0.02

Calibrated by

Sathaporn.T

(Mr.Sathaporn Thakaew)

Environmental Field Scientist (3)

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

ALS Laboratory Group

EMISSION TEST RESULT

Client	THAI MMA Co., Ltd.	Run #	2
Date	28 Mar 25	Location	เม็ดละ Z-6210
Start Time	11:06	Test Operator	Sathaporn T.
SO_2 Analyzer Model	-	Finish Time	11:26
NO_x/O_2 Analyzer Model	TELEDYNE API 200EH	Serial No.	-
CO/CO_2 Analyzer Model	-	Serial No.	735
		Serial No.	-

Time (min)	O_2 (%)	CO_2 (%)	NOx (ppm)	SO_2 (ppm)	CO (ppm)	Remark
11:06	5.24	8.21	15.10	-	-	
11:07	5.20	8.26	15.08	-	-	
11:08	5.23	8.29	15.20	-	-	
11:09	5.23	8.30	15.39	-	-	
11:10	5.24	8.23	15.38	-	-	
11:11	5.20	8.21	15.71	-	-	
11:12	5.17	8.27	15.86	-	-	
11:13	5.20	8.25	15.64	-	-	
11:14	5.21	8.21	15.35	-	-	
11:15	5.23	8.23	15.25	-	-	
11:16	5.22	8.23	15.23	-	-	
11:17	5.26	8.24	15.33	-	-	
11:18	5.26	8.19	15.44	-	-	
11:19	5.21	8.16	15.39	-	-	
11:20	5.17	8.28	15.26	-	-	
11:21	5.14	8.29	15.26	-	-	
11:22	5.17	8.24	15.18	-	-	
11:23	5.21	8.24	14.99	-	-	
11:24	5.21	8.20	15.06	-	-	
11:25	5.22	8.23	14.98	-	-	
11:26	5.22	8.19	14.84	-	-	
Average	**5.21**	**8.23**	**15.28**	**-**	**-**	

Sathaporn.T

(Mr. Sathaporn Thakaew)

Environmental Field Scientist (3)

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

ALS Laboratory Group

EMISSION TEST RESULT

Client	THAI MMA Co., Ltd.	Run #	2
Date	27 Mar 25	Location	ปล่อง 2Z-6210
Start Time	10:51	Test Operator	Sathaporn T.
SO_2 Analyzer Model	-	Finish Time	11:11
NO_x/O_2 Analyzer Model	TELEDYNE API 200EH	Serial No.	-
CO/CO_2 Analyzer Model	-	Serial No.	735
		Serial No.	-

Time (min)	O_2 (%)	CO_2 (%)	NOx (ppm)	SO_2 (ppm)	CO (ppm)	Remark
10:51	5.71	8.13	8.59	-	-	
10:52	5.67	8.12	8.60	-	-	
10:53	5.77	8.07	8.70	-	-	
10:54	5.79	8.06	8.80	-	-	
10:55	5.81	8.03	8.81	-	-	
10:56	5.79	8.14	8.90	-	-	
10:57	5.82	8.09	9.01	-	-	
10:58	5.81	8.05	9.10	-	-	
10:59	5.77	8.07	9.14	-	-	
11:00	5.70	8.14	9.18	-	-	
11:01	5.68	8.15	9.23	-	-	
11:02	5.71	8.10	9.03	-	-	
11:03	5.70	8.14	8.84	-	-	
11:04	5.65	8.07	8.83	-	-	
11:05	5.65	8.05	8.78	-	-	
11:06	5.67	8.11	8.75	-	-	
11:07	5.73	8.15	8.74	-	-	
11:08	5.79	8.09	8.80	-	-	
11:09	5.77	8.14	8.78	-	-	
11:10	5.79	8.11	8.74	-	-	
11:11	6.17	8.11	8.81	-	-	
Average	**5.76**	**8.10**	**8.87**	**-**	**-**	

Sathaporn.T

(Mr.Sathaporn Thakaew)

Environmental Field Scientist (3)

EMISSION TEST RESULT

Client	THAI MMA Co., Ltd.	Run #	3
Date	27 Mar 25	Location	ปล่อง 2Z-6210
Start Time	11:12	Test Operator	Sathaporn T.
SO_2 Analyzer Model	-	Finish Time	11:32
NO_x/O_2 Analyzer Model	TELEDYNE API 200EH	Serial No.	-
CO/CO_2 Analyzer Model	-	Serial No.	735
		Serial No.	-

Time (min)	O_2 (%)	CO_2 (%)	NOx (ppm)	SO_2 (ppm)	CO (ppm)	Remark
11:12	5.81	8.09	8.81	-	-	
11:13	5.71	8.11	8.78	-	-	
11:14	6.04	8.20	8.88	-	-	
11:15	5.59	8.17	8.92	-	-	
11:16	5.65	8.12	8.93	-	-	
11:17	5.64	8.15	8.97	-	-	
11:18	5.70	8.12	8.96	-	-	
11:19	5.65	8.11	8.98	-	-	
11:20	5.70	8.21	9.02	-	-	
11:21	5.68	8.16	9.11	-	-	
11:22	5.79	8.11	9.15	-	-	
11:23	5.77	8.19	9.09	-	-	
11:24	5.84	8.13	9.10	-	-	
11:25	5.75	8.11	9.10	-	-	
11:26	5.71	8.07	8.97	-	-	
11:27	5.66	8.13	8.96	-	-	
11:28	5.71	8.11	8.95	-	-	
11:29	5.63	8.15	8.93	-	-	
11:30	5.61	8.11	8.99	-	-	
11:31	5.63	8.18	9.08	-	-	
11:32	5.77	8.13	9.07	-	-	
Average	**5.71**	**8.13**	**8.99**	**-**	**-**	

Sathaporn.T

(Mr.Sathaporn Thakaew)

Environmental Field Scientist (3)

Lot No. 2515856-1

ANALYZER CALIBRATION DATA

Client : THAI MMA Co., Ltd. Location : ปล่อง Z-6210
Date : 28 Mar 25 Test Operator : Sathaporn T.

O_2 ANALYZER
Model : TELEDYNE API 200EH Serial No. : 735
Span (%) : 25

	Cylinder Value (%)	Initial Analyzers Calibration Response (%)	Final Analyzers Calibration Response (%)	Difference (Percent of Span)
Zero Gas	0.00	0.10	0.11	0.04
Low-Level Gas	8.19	8.29	8.30	0.04
Span Gas	16.07	16.18	16.18	0.00

NO_X ANALYZER
Model : TELEDYNE API 200EH Serial No. : 735
Span (ppm) : 100

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.15	0.17	0.02
Low-Level Gas	55.91	55.80	55.81	0.01
Span Gas	82.51	82.32	82.30	0.02

Calibrated by

Sathaporn.T

(Mr.Sathaporn Thakaew)

Environmental Field Scientist (3)

Lot No. 2515856-1

SYSTEM CALIBRATION BIAS AND DRIFT DATA

Client : THAI MMA Co., Ltd. Location : ปล่อง Z-6210
Date : 28 Mar 25 Test Operator : Sathaporn T.

O_2 ANALYZER
Cylinder Conc. (%) : 16.07 Span (%) : 25

	O_2 Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
		System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	
Zero Gas	0.10	0.13	0.12	0.15	0.20	0.08
Upscale Gas	16.18	16.25	0.28	16.25	0.28	0.00

NO_X ANALYZER
Cylinder Conc. (ppm) : 82.51 Span (ppm) : 100

	NO_X Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
		System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	
Zero Gas	0.15	0.24	0.09	0.27	0.12	0.03
Upscale Gas	82.32	82.14	0.18	82.12	0.20	0.02

Calibrated by

Sathaporn.T

(Mr.Sathaporn Thakaew)

Environmental Field Scientist (3)

CEMs Data

Client Name: THAI MMA Co., Ltd. Date: 28 Mar 25
Plant Name: MMA Site 3 Location: ปล่อง Z-6210

Run No: 1 Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
28 Mar 25	10:45	-	13.63	-	5.26	-
28 Mar 25	10:46	-	13.69	-	5.22	-
28 Mar 25	10:47	-	13.69	-	5.21	-
28 Mar 25	10:48	-	13.86	-	5.24	-
28 Mar 25	10:49	-	13.65	-	5.17	-
28 Mar 25	10:50	-	13.73	-	5.13	-
28 Mar 25	10:51	-	13.84	-	5.16	-
28 Mar 25	10:52	-	13.72	-	5.17	-
28 Mar 25	10:53	-	13.65	-	5.15	-
28 Mar 25	10:54	-	13.79	-	5.19	-
28 Mar 25	10:55	-	13.61	-	5.15	-
28 Mar 25	10:56	-	13.54	-	5.15	-
28 Mar 25	10:57	-	13.59	-	5.17	-
28 Mar 25	10:58	-	13.55	-	5.15	-
28 Mar 25	10:59	-	13.65	-	5.15	-
28 Mar 25	11:00	-	13.82	-	5.18	-
28 Mar 25	11:01	-	13.86	-	5.15	-
28 Mar 25	11:02	-	13.74	-	5.13	-
28 Mar 25	11:03	-	13.91	-	5.14	-
28 Mar 25	11:04	-	14.03	-	5.16	-
28 Mar 25	11:05	-	14.18	-	5.10	-
Max		-	14.18	-	5.26	-
Avg		-	13.75	-	5.17	-

Run No: 2 Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
28 Mar 25	11:06	-	14.15	-	5.12	-
28 Mar 25	11:07	-	13.94	-	5.15	-
28 Mar 25	11:08	-	13.83	-	5.16	-
28 Mar 25	11:09	-	13.82	-	5.16	-
28 Mar 25	11:10	-	13.93	-	5.19	-
28 Mar 25	11:11	-	13.94	-	5.16	-
28 Mar 25	11:12	-	14.10	-	5.19	-
28 Mar 25	11:13	-	14.55	-	5.12	-
28 Mar 25	11:14	-	14.56	-	5.14	-
28 Mar 25	11:15	-	14.09	-	5.10	-
28 Mar 25	11:16	-	14.00	-	5.11	-
28 Mar 25	11:17	-	14.15	-	5.14	-
28 Mar 25	11:18	-	14.05	-	5.15	-
28 Mar 25	11:19	-	14.07	-	5.22	-
28 Mar 25	11:20	-	14.02	-	5.15	-
28 Mar 25	11:21	-	14.06	-	5.15	-
28 Mar 25	11:22	-	13.84	-	5.09	-
28 Mar 25	11:23	-	14.01	-	5.07	-
28 Mar 25	11:24	-	13.91	-	5.10	-
28 Mar 25	11:25	-	13.69	-	5.11	-
28 Mar 25	11:26	-	13.48	-	5.16	-
Max		-	14.56	-	5.22	-
Avg		-	14.01	-	5.14	-

Run No: 3 Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
28 Mar 25	11:27	-	13.50	-	5.11	-
28 Mar 25	11:28	-	13.53	-	5.12	-
28 Mar 25	11:29	-	13.48	-	5.16	-
28 Mar 25	11:30	-	13.39	-	5.10	-
28 Mar 25	11:31	-	13.54	-	5.11	-
28 Mar 25	11:32	-	13.42	-	5.09	-
28 Mar 25	11:33	-	13.46	-	5.11	-
28 Mar 25	11:34	-	13.48	-	5.14	-
28 Mar 25	11:35	-	13.59	-	5.15	-
28 Mar 25	11:36	-	13.48	-	5.15	-
28 Mar 25	11:37	-	13.46	-	5.17	-
28 Mar 25	11:38	-	13.45	-	5.14	-
28 Mar 25	11:39	-	13.53	-	5.10	-
28 Mar 25	11:40	-	13.53	-	5.15	-
28 Mar 25	11:41	-	13.47	-	5.10	-
28 Mar 25	11:42	-	13.49	-	5.15	-
28 Mar 25	11:43	-	13.53	-	5.11	-
28 Mar 25	11:44	-	13.56	-	5.17	-
28 Mar 25	11:45	-	13.52	-	5.19	-
28 Mar 25	11:46	-	13.33	-	5.19	-
28 Mar 25	11:47	-	13.36	-	5.22	-
Max		-	13.59	-	5.22	-
Avg		-	13.48	-	5.14	-

Run No: 4 Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
28 Mar 25	11:48	-	13.30	-	5.18	-
28 Mar 25	11:49	-	13.46	-	5.16	-
28 Mar 25	11:50	-	13.57	-	5.14	-
28 Mar 25	11:51	-	13.65	-	5.09	-
28 Mar 25	11:52	-	13.65	-	5.08	-
28 Mar 25	11:53	-	13.71	-	5.09	-
28 Mar 25	11:54	-	13.69	-	5.12	-
28 Mar 25	11:55	-	13.68	-	5.17	-
28 Mar 25	11:56	-	13.46	-	5.13	-
28 Mar 25	11:57	-	13.49	-	5.14	-
28 Mar 25	11:58	-	13.55	-	5.15	-
28 Mar 25	11:59	-	13.57	-	5.16	-
28 Mar 25	12:00	-	13.30	-	5.21	-
28 Mar 25	12:01	-	13.14	-	5.17	-
28 Mar 25	12:02	-	13.12	-	5.14	-
28 Mar 25	12:03	-	13.11	-	5.10	-
28 Mar 25	12:04	-	13.15	-	5.08	-
28 Mar 25	12:05	-	13.15	-	5.05	-
28 Mar 25	12:06	-	13.12	-	5.04	-
28 Mar 25	12:07	-	12.96	-	5.10	-
28 Mar 25	12:08	-	12.89	-	5.17	-
Max		-	13.71	-	5.21	-
Avg		-	13.37	-	5.13	-

Run No: 5 Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
28 Mar 25	12:09	-	12.90	-	5.19	-
28 Mar 25	12:10	-	12.98	-	5.23	-
28 Mar 25	12:11	-	13.03	-	5.15	-
28 Mar 25	12:12	-	12.91	-	5.11	-
28 Mar 25	12:13	-	12.91	-	5.09	-
28 Mar 25	12:14	-	12.88	-	5.15	-
28 Mar 25	12:15	-	12.87	-	5.06	-
28 Mar 25	12:16	-	12.91	-	5.07	-
28 Mar 25	12:17	-	12.87	-	5.09	-
28 Mar 25	12:18	-	12.94	-	5.10	-
28 Mar 25	12:19	-	12.88	-	5.10	-
28 Mar 25	12:20	-	13.03	-	5.07	-
28 Mar 25	12:21	-	13.25	-	5.04	-
28 Mar 25	12:22	-	13.34	-	5.09	-
28 Mar 25	12:23	-	13.35	-	5.08	-
28 Mar 25	12:24	-	13.35	-	5.11	-
28 Mar 25	12:25	-	13.36	-	5.22	-
28 Mar 25	12:26	-	13.28	-	5.16	-
28 Mar 25	12:27	-	13.37	-	5.13	-
28 Mar 25	12:28	-	13.28	-	5.13	-
28 Mar 25	12:29	-	13.14	-	5.11	-
Max		-	13.37	-	5.23	-
Avg		-	13.09	-	5.12	-

Run No: 6 Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
28 Mar 25	12:30	-	13.20	-	5.11	-
28 Mar 25	12:31	-	13.10	-	5.11	-
28 Mar 25	12:32	-	13.14	-	5.14	-
28 Mar 25	12:33	-	13.06	-	5.12	-
28 Mar 25	12:34	-	13.15	-	5.08	-
28 Mar 25	12:35	-	13.13	-	5.12	-
28 Mar 25	12:36	-	12.96	-	5.13	-
28 Mar 25	12:37	-	12.87	-	5.10	-
28 Mar 25	12:38	-	12.84	-	5.12	-
28 Mar 25	12:39	-	12.78	-	5.09	-
28 Mar 25	12:40	-	12.81	-	5.08	-
28 Mar 25	12:41	-	12.80	-	5.17	-
28 Mar 25	12:42	-	12.69	-	5.16	-
28 Mar 25	12:43	-	12.66	-	5.20	-
28 Mar 25	12:44	-	12.55	-	5.15	-
28 Mar 25	12:45	-	12.47	-	5.11	-
28 Mar 25	12:46	-	12.48	-	5.12	-
28 Mar 25	12:47	-	12.56	-	5.08	-
28 Mar 25	12:48	-	12.47	-	5.11	-
28 Mar 25	12:49	-	12.25	-	5.17	-
28 Mar 25	12:50	-	12.41	-	5.17	-
Max		-	13.20	-	5.20	-
Avg		-	12.78	-	5.13	-

CEMs Data

Client Name: THAI MMA Co., Ltd. Date: 28 Mar 25
Plant Name: MMA Site 3 Location: ปล่อง Z-6210

Run No: 7 Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
28 Mar 25	12:51	-	12.40	-	5.19	-
28 Mar 25	12:52	-	12.40	-	5.14	-
28 Mar 25	12:53	-	12.39	-	5.15	-
28 Mar 25	12:54	-	12.49	-	5.14	-
28 Mar 25	12:55	-	12.52	-	5.12	-
28 Mar 25	12:56	-	12.56	-	5.12	-
28 Mar 25	12:57	-	12.65	-	5.14	-
28 Mar 25	12:58	-	12.66	-	5.18	-
28 Mar 25	12:59	-	12.55	-	5.19	-
28 Mar 25	13:00	-	12.71	-	5.21	-
28 Mar 25	13:01	-	12.71	-	5.22	-
28 Mar 25	13:02	-	12.70	-	5.20	-
28 Mar 25	13:03	-	12.35	-	5.20	-
28 Mar 25	13:04	-	12.45	-	5.18	-
28 Mar 25	13:05	-	12.51	-	5.12	-
28 Mar 25	13:06	-	12.50	-	5.10	-
28 Mar 25	13:07	-	12.43	-	5.10	-
28 Mar 25	13:08	-	12.44	-	5.12	-
28 Mar 25	13:09	-	12.59	-	5.14	-
28 Mar 25	13:10	-	12.60	-	5.11	-
28 Mar 25	13:11	-	12.38	-	5.19	-
Max		-	12.71	-	5.22	-
Avg		-	12.52	-	5.15	-

Run No: 8 Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
28 Mar 25	13:12	-	12.41	-	5.15	-
28 Mar 25	13:13	-	12.40	-	5.19	-
28 Mar 25	13:14	-	12.34	-	5.16	-
28 Mar 25	13:15	-	12.38	-	5.11	-
28 Mar 25	13:16	-	12.44	-	5.13	-
28 Mar 25	13:17	-	12.38	-	5.14	-
28 Mar 25	13:18	-	12.20	-	5.23	-
28 Mar 25	13:19	-	12.22	-	5.20	-
28 Mar 25	13:20	-	12.00	-	5.23	-
28 Mar 25	13:21	-	11.93	-	5.24	-
28 Mar 25	13:22	-	12.02	-	5.25	-
28 Mar 25	13:23	-	11.91	-	5.24	-
28 Mar 25	13:24	-	11.92	-	5.21	-
28 Mar 25	13:25	-	11.95	-	5.19	-
28 Mar 25	13:26	-	12.07	-	5.19	-
28 Mar 25	13:27	-	12.26	-	5.19	-
28 Mar 25	13:28	-	12.14	-	5.21	-
28 Mar 25	13:29	-	12.14	-	5.21	-
28 Mar 25	13:30	-	12.09	-	5.18	-
28 Mar 25	13:31	-	12.17	-	5.13	-
28 Mar 25	13:32	-	12.13	-	5.09	-
Max		-	12.44	-	5.25	-
Avg		-	12.17	-	5.18	-

Run No: 9 Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
28 Mar 25	13:33	-	12.41	-	5.09	-
28 Mar 25	13:34	-	12.28	-	5.12	-
28 Mar 25	13:35	-	12.25	-	5.15	-
28 Mar 25	13:36	-	12.22	-	5.21	-
28 Mar 25	13:37	-	12.08	-	5.19	-
28 Mar 25	13:38	-	12.03	-	5.15	-
28 Mar 25	13:39	-	12.01	-	5.15	-
28 Mar 25	13:40	-	11.92	-	5.16	-
28 Mar 25	13:41	-	12.05	-	5.19	-
28 Mar 25	13:42	-	12.11	-	5.20	-
28 Mar 25	13:43	-	12.10	-	5.19	-
28 Mar 25	13:44	-	11.96	-	5.15	-
28 Mar 25	13:45	-	11.97	-	5.15	-
28 Mar 25	13:46	-	11.90	-	5.19	-
28 Mar 25	13:47	-	11.84	-	5.17	-
28 Mar 25	13:48	-	11.69	-	5.21	-
28 Mar 25	13:49	-	11.75	-	5.23	-
28 Mar 25	13:50	-	11.82	-	5.23	-
28 Mar 25	13:51	-	11.83	-	5.20	-
28 Mar 25	13:52	-	11.68	-	5.13	-
28 Mar 25	13:53	-	11.70	-	5.13	-
Max		-	12.41	-	5.23	-
Avg		-	11.98	-	5.17	-

Run No: 10 Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
28 Mar 25	13:54	-	11.71	-	5.07	-
28 Mar 25	13:55	-	11.66	-	5.09	-
28 Mar 25	13:56	-	11.50	-	5.08	-
28 Mar 25	13:57	-	11.45	-	5.13	-
28 Mar 25	13:58	-	11.41	-	5.15	-
28 Mar 25	13:59	-	11.45	-	5.16	-
28 Mar 25	14:00	-	11.35	-	5.13	-
28 Mar 25	14:01	-	11.44	-	5.20	-
28 Mar 25	14:02	-	11.48	-	5.20	-
28 Mar 25	14:03	-	11.40	-	5.21	-
28 Mar 25	14:04	-	11.48	-	5.22	-
28 Mar 25	14:05	-	11.41	-	5.24	-
28 Mar 25	14:06	-	11.50	-	5.25	-
28 Mar 25	14:07	-	11.54	-	5.21	-
28 Mar 25	14:08	-	11.51	-	5.19	-
28 Mar 25	14:09	-	11.62	-	5.16	-
28 Mar 25	14:10	-	11.64	-	5.13	-
28 Mar 25	14:11	-	11.63	-	5.09	-
28 Mar 25	14:12	-	11.67	-	5.07	-
28 Mar 25	14:13	-	11.89	-	5.11	-
28 Mar 25	14:14	-	11.81	-	5.10	-
Max		-	11.89	-	5.25	-
Avg		-	11.55	-	5.15	-

Run No: 11 Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
28 Mar 25	14:15	-	11.78	-	5.12	-
28 Mar 25	14:16	-	11.86	-	5.15	-
28 Mar 25	14:17	-	11.94	-	5.20	-
28 Mar 25	14:18	-	12.13	-	5.22	-
28 Mar 25	14:19	-	12.12	-	5.18	-
28 Mar 25	14:20	-	12.21	-	5.19	-
28 Mar 25	14:21	-	12.21	-	5.15	-
28 Mar 25	14:22	-	12.09	-	5.17	-
28 Mar 25	14:23	-	12.10	-	5.15	-
28 Mar 25	14:24	-	11.98	-	5.17	-
28 Mar 25	14:25	-	11.97	-	5.12	-
28 Mar 25	14:26	-	11.93	-	5.15	-
28 Mar 25	14:27	-	11.78	-	5.11	-
28 Mar 25	14:28	-	11.57	-	5.12	-
28 Mar 25	14:29	-	11.45	-	5.16	-
28 Mar 25	14:30	-	11.51	-	5.14	-
28 Mar 25	14:31	-	11.50	-	5.18	-
28 Mar 25	14:32	-	11.46	-	5.13	-
28 Mar 25	14:33	-	11.35	-	5.15	-
28 Mar 25	14:34	-	11.55	-	5.12	-
28 Mar 25	14:35	-	11.59	-	5.12	-
Max		-	12.21	-	5.22	-
Avg		-	11.81	-	5.15	-

Run No: 12 Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
28 Mar 25	14:36	-	11.56	-	5.11	-
28 Mar 25	14:37	-	11.66	-	5.17	-
28 Mar 25	14:38	-	11.65	-	5.15	-
28 Mar 25	14:39	-	11.67	-	5.19	-
28 Mar 25	14:40	-	11.46	-	5.24	-
28 Mar 25	14:41	-	11.52	-	5.24	-
28 Mar 25	14:42	-	11.51	-	5.21	-
28 Mar 25	14:43	-	11.61	-	5.16	-
28 Mar 25	14:44	-	11.55	-	5.11	-
28 Mar 25	14:45	-	11.57	-	5.11	-
28 Mar 25	14:46	-	11.36	-	5.12	-
28 Mar 25	14:47	-	11.47	-	5.10	-
28 Mar 25	14:48	-	11.72	-	5.16	-
28 Mar 25	14:49	-	11.74	-	5.19	-
28 Mar 25	14:50	-	11.90	-	5.19	-
28 Mar 25	14:51	-	11.95	-	5.22	-
28 Mar 25	14:52	-	12.02	-	5.19	-
28 Mar 25	14:53	-	12.09	-	5.15	-
28 Mar 25	14:54	-	12.07	-	5.14	-
28 Mar 25	14:55	-	11.98	-	5.11	-
28 Mar 25	14:56	-	11.98	-	5.09	-
Max		-	12.09	-	5.24	-
Avg		-	11.72	-	5.16	-

CEMs Data

Client Name: THAI MMA Co., Ltd. | Date: 27 Mar 25
Plant Name: MMA Site 3 | Location: ปล่อง 2Z-6210

Run No: 1 — Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
27 Mar 25	10:30	-	8.28	-	5.58	-
27 Mar 25	10:31	-	8.18	-	5.59	-
27 Mar 25	10:32	-	8.36	-	5.60	-
27 Mar 25	10:33	-	9.04	-	5.56	-
27 Mar 25	10:34	-	8.38	-	5.50	-
27 Mar 25	10:35	-	8.51	-	5.46	-
27 Mar 25	10:36	-	7.78	-	5.46	-
27 Mar 25	10:37	-	8.37	-	5.48	-
27 Mar 25	10:38	-	8.31	-	5.50	-
27 Mar 25	10:39	-	8.63	-	5.51	-
27 Mar 25	10:40	-	8.52	-	5.54	-
27 Mar 25	10:41	-	9.24	-	5.56	-
27 Mar 25	10:42	-	9.13	-	5.58	-
27 Mar 25	10:43	-	8.09	-	5.54	-
27 Mar 25	10:44	-	8.73	-	5.51	-
27 Mar 25	10:45	-	7.90	-	5.51	-
27 Mar 25	10:46	-	8.57	-	5.53	-
27 Mar 25	10:47	-	8.46	-	5.54	-
27 Mar 25	10:48	-	8.02	-	5.57	-
27 Mar 25	10:49	-	8.18	-	5.57	-
27 Mar 25	10:50	-	7.93	-	5.57	-
Max		-	9.24	-	5.60	-
Avg		-	8.41	-	5.53	-

Run No: 2 — Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
27 Mar 25	10:51	-	8.72	-	5.54	-
27 Mar 25	10:52	-	8.36	-	5.56	-
27 Mar 25	10:53	-	8.31	-	5.54	-
27 Mar 25	10:54	-	8.57	-	5.52	-
27 Mar 25	10:55	-	8.19	-	5.49	-
27 Mar 25	10:56	-	9.35	-	5.51	-
27 Mar 25	10:57	-	8.26	-	5.54	-
27 Mar 25	10:58	-	9.41	-	5.57	-
27 Mar 25	10:59	-	8.53	-	5.57	-
27 Mar 25	11:00	-	8.57	-	5.58	-
27 Mar 25	11:01	-	9.54	-	5.58	-
27 Mar 25	11:02	-	8.69	-	5.57	-
27 Mar 25	11:03	-	9.05	-	5.51	-
27 Mar 25	11:04	-	9.17	-	5.49	-
27 Mar 25	11:05	-	8.29	-	5.49	-
27 Mar 25	11:06	-	8.26	-	5.49	-
27 Mar 25	11:07	-	8.25	-	5.46	-
27 Mar 25	11:08	-	9.31	-	5.45	-
27 Mar 25	11:09	-	8.89	-	5.46	-
27 Mar 25	11:10	-	8.03	-	5.48	-
27 Mar 25	11:11	-	8.82	-	5.50	-
Max		-	9.54	-	5.58	-
Avg		-	8.69	-	5.52	-

Run No: 3 — Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
27 Mar 25	11:12	-	8.94	-	5.51	-
27 Mar 25	11:13	-	8.93	-	5.52	-
27 Mar 25	11:14	-	9.26	-	5.52	-
27 Mar 25	11:15	-	8.67	-	5.54	-
27 Mar 25	11:16	-	8.89	-	5.49	-
27 Mar 25	11:17	-	8.91	-	5.45	-
27 Mar 25	11:18	-	9.89	-	5.41	-
27 Mar 25	11:19	-	8.74	-	5.40	-
27 Mar 25	11:20	-	9.20	-	5.41	-
27 Mar 25	11:21	-	8.49	-	5.43	-
27 Mar 25	11:22	-	9.89	-	5.43	-
27 Mar 25	11:23	-	9.21	-	5.44	-
27 Mar 25	11:24	-	8.37	-	5.44	-
27 Mar 25	11:25	-	9.47	-	5.47	-
27 Mar 25	11:26	-	8.75	-	5.49	-
27 Mar 25	11:27	-	8.71	-	5.52	-
27 Mar 25	11:28	-	8.84	-	5.51	-
27 Mar 25	11:29	-	8.46	-	5.49	-
27 Mar 25	11:30	-	8.93	-	5.47	-
27 Mar 25	11:31	-	8.67	-	5.47	-
27 Mar 25	11:32	-	8.35	-	5.45	-
Max		-	9.89	-	5.54	-
Avg		-	8.93	-	5.47	-

Run No: 4 — Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
27 Mar 25	11:33	-	9.71	-	5.42	-
27 Mar 25	11:34	-	8.92	-	5.42	-
27 Mar 25	11:35	-	8.84	-	5.45	-
27 Mar 25	11:36	-	8.89	-	5.48	-
27 Mar 25	11:37	-	8.99	-	5.49	-
27 Mar 25	11:38	-	9.35	-	5.49	-
27 Mar 25	11:39	-	8.68	-	5.48	-
27 Mar 25	11:40	-	8.54	-	5.46	-
27 Mar 25	11:41	-	8.55	-	5.46	-
27 Mar 25	11:42	-	8.36	-	5.47	-
27 Mar 25	11:43	-	9.00	-	5.49	-
27 Mar 25	11:44	-	8.50	-	5.50	-
27 Mar 25	11:45	-	8.71	-	5.51	-
27 Mar 25	11:46	-	8.92	-	5.52	-
27 Mar 25	11:47	-	8.94	-	5.51	-
27 Mar 25	11:48	-	9.17	-	5.46	-
27 Mar 25	11:49	-	8.46	-	5.47	-
27 Mar 25	11:50	-	8.22	-	5.47	-
27 Mar 25	11:51	-	9.04	-	5.50	-
27 Mar 25	11:52	-	8.86	-	5.49	-
27 Mar 25	11:53	-	9.16	-	5.48	-
Max		-	9.71	-	5.52	-
Avg		-	8.85	-	5.47	-

Run No: 5 — Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
27 Mar 25	11:54	-	8.72	-	5.46	-
27 Mar 25	11:55	-	8.77	-	5.49	-
27 Mar 25	11:56	-	8.74	-	5.49	-
27 Mar 25	11:57	-	8.72	-	5.51	-
27 Mar 25	11:58	-	8.87	-	5.49	-
27 Mar 25	11:59	-	8.49	-	5.49	-
27 Mar 25	12:00	-	9.00	-	5.50	-
27 Mar 25	12:01	-	8.71	-	5.54	-
27 Mar 25	12:02	-	9.01	-	5.52	-
27 Mar 25	12:03	-	8.97	-	5.50	-
27 Mar 25	12:04	-	9.56	-	5.45	-
27 Mar 25	12:05	-	9.03	-	5.44	-
27 Mar 25	12:06	-	8.86	-	5.45	-
27 Mar 25	12:07	-	8.95	-	5.49	-
27 Mar 25	12:08	-	9.77	-	5.48	-
27 Mar 25	12:09	-	8.70	-	5.47	-
27 Mar 25	12:10	-	8.83	-	5.44	-
27 Mar 25	12:11	-	8.82	-	5.44	-
27 Mar 25	12:12	-	9.16	-	5.43	-
27 Mar 25	12:13	-	8.89	-	5.40	-
27 Mar 25	12:14	-	9.00	-	5.40	-
Max		-	9.77	-	5.54	-
Avg		-	8.93	-	5.47	-

Run No: 6 — Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
27 Mar 25	12:15	-	8.53	-	5.42	-
27 Mar 25	12:16	-	8.66	-	5.43	-
27 Mar 25	12:17	-	9.47	-	5.43	-
27 Mar 25	12:18	-	8.92	-	5.44	-
27 Mar 25	12:19	-	9.28	-	5.46	-
27 Mar 25	12:20	-	9.01	-	5.48	-
27 Mar 25	12:21	-	9.05	-	5.47	-
27 Mar 25	12:22	-	10.10	-	5.43	-
27 Mar 25	12:23	-	8.93	-	5.43	-
27 Mar 25	12:24	-	9.11	-	5.43	-
27 Mar 25	12:25	-	9.20	-	5.43	-
27 Mar 25	12:26	-	7.93	-	5.45	-
27 Mar 25	12:27	-	8.76	-	5.45	-
27 Mar 25	12:28	-	8.80	-	5.48	-
27 Mar 25	12:29	-	8.55	-	5.51	-
27 Mar 25	12:30	-	8.55	-	5.57	-
27 Mar 25	12:31	-	8.70	-	5.54	-
27 Mar 25	12:32	-	8.64	-	5.51	-
27 Mar 25	12:33	-	8.44	-	5.47	-
27 Mar 25	12:34	-	8.80	-	5.47	-
27 Mar 25	12:35	-	8.91	-	5.45	-
Max		-	10.10	-	5.57	-
Avg		-	8.87	-	5.46	-

Lot No. 2515860-1

ANALYZER CALIBRATION DATA

Client : **THAI MMA Co., Ltd.** **Location** : **ปล่อง 2Z-6210**
Date : **27 Mar 25** **Test Operator** : **Sathaporn T.**

O_2 ANALYZER
Model : **TELEDYNE API 200EH** **Serial No.** : **735**
Span (%) : **25**

	Cylinder Value (%)	Initial Analyzers Calibration Response (%)	Final Analyzers Calibration Response (%)	Difference (Percent of Span)
Zero Gas	0.00	0.10	0.11	0.04
Low-Level Gas	8.19	8.29	8.30	0.04
Span Gas	16.07	16.17	16.18	0.04

NO_X ANALYZER
Model : **TELEDYNE API 200EH** **Serial No.** : **735**
Span (ppm) : **100**

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.35	0.37	0.02
Low-Level Gas	55.91	55.70	55.71	0.01
Span Gas	82.51	82.22	82.20	0.02

Calibrated by

Sathaporn.T

(Mr.Sathaporn Thakaew)
Environmental Field Scientist (3)

Reference Method Data

Client Name: THAI MMA Co., Ltd. | Date: 28 Mar 25
Plant Name: MMA Site 3 | Location: ปล่อง Z-6210

Run No: 1 — Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
28 Mar 25	10:45	-	14.77	-	5.31	-
28 Mar 25	10:46	-	14.76	-	5.32	-
28 Mar 25	10:47	-	14.80	-	5.28	-
28 Mar 25	10:48	-	14.81	-	5.25	-
28 Mar 25	10:49	-	14.73	-	5.22	-
28 Mar 25	10:50	-	14.75	-	5.24	-
28 Mar 25	10:51	-	14.72	-	5.24	-
28 Mar 25	10:52	-	14.73	-	5.24	-
28 Mar 25	10:53	-	14.81	-	5.24	-
28 Mar 25	10:54	-	14.81	-	5.22	-
28 Mar 25	10:55	-	14.76	-	5.21	-
28 Mar 25	10:56	-	14.73	-	5.21	-
28 Mar 25	10:57	-	14.75	-	5.22	-
28 Mar 25	10:58	-	14.75	-	5.27	-
28 Mar 25	10:59	-	14.81	-	5.26	-
28 Mar 25	11:00	-	15.00	-	5.23	-
28 Mar 25	11:01	-	15.23	-	5.22	-
28 Mar 25	11:02	-	15.27	-	5.21	-
28 Mar 25	11:03	-	15.32	-	5.17	-
28 Mar 25	11:04	-	15.39	-	5.20	-
28 Mar 25	11:05	-	15.28	-	5.24	-
Max		-	15.39	-	5.32	-
Avg		-	14.90	-	5.24	-

Run No: 2 — Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
28 Mar 25	11:06	-	15.10	-	5.24	-
28 Mar 25	11:07	-	15.08	-	5.20	-
28 Mar 25	11:08	-	15.20	-	5.23	-
28 Mar 25	11:09	-	15.39	-	5.23	-
28 Mar 25	11:10	-	15.38	-	5.24	-
28 Mar 25	11:11	-	15.71	-	5.20	-
28 Mar 25	11:12	-	15.86	-	5.17	-
28 Mar 25	11:13	-	15.64	-	5.20	-
28 Mar 25	11:14	-	15.35	-	5.21	-
28 Mar 25	11:15	-	15.25	-	5.23	-
28 Mar 25	11:16	-	15.23	-	5.22	-
28 Mar 25	11:17	-	15.33	-	5.26	-
28 Mar 25	11:18	-	15.44	-	5.26	-
28 Mar 25	11:19	-	15.39	-	5.21	-
28 Mar 25	11:20	-	15.26	-	5.17	-
28 Mar 25	11:21	-	15.26	-	5.14	-
28 Mar 25	11:22	-	15.18	-	5.17	-
28 Mar 25	11:23	-	14.99	-	5.21	-
28 Mar 25	11:24	-	15.06	-	5.21	-
28 Mar 25	11:25	-	14.98	-	5.22	-
28 Mar 25	11:26	-	14.84	-	5.22	-
Max		-	15.86	-	5.26	-
Avg		-	15.28	-	5.21	-

Run No: 3 — Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
28 Mar 25	11:27	-	14.85	-	5.25	-
28 Mar 25	11:28	-	14.88	-	5.24	-
28 Mar 25	11:29	-	14.88	-	5.16	-
28 Mar 25	11:30	-	14.88	-	5.15	-
28 Mar 25	11:31	-	14.83	-	5.17	-
28 Mar 25	11:32	-	14.97	-	5.24	-
28 Mar 25	11:33	-	15.00	-	5.24	-
28 Mar 25	11:34	-	14.89	-	5.24	-
28 Mar 25	11:35	-	15.00	-	5.22	-
28 Mar 25	11:36	-	15.03	-	5.21	-
28 Mar 25	11:37	-	14.99	-	5.22	-
28 Mar 25	11:38	-	15.06	-	5.20	-
28 Mar 25	11:39	-	15.13	-	5.19	-
28 Mar 25	11:40	-	15.11	-	5.18	-
28 Mar 25	11:41	-	15.06	-	5.21	-
28 Mar 25	11:42	-	15.14	-	5.24	-
28 Mar 25	11:43	-	15.12	-	5.25	-
28 Mar 25	11:44	-	14.97	-	5.27	-
28 Mar 25	11:45	-	15.01	-	5.27	-
28 Mar 25	11:46	-	15.08	-	5.25	-
28 Mar 25	11:47	-	15.07	-	5.23	-
Max		-	15.14	-	5.27	-
Avg		-	15.00	-	5.22	-

Run No: 4 — Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
28 Mar 25	11:48	-	15.27	-	5.21	-
28 Mar 25	11:49	-	15.35	-	5.18	-
28 Mar 25	11:50	-	15.35	-	5.16	-
28 Mar 25	11:51	-	15.39	-	5.14	-
28 Mar 25	11:52	-	15.41	-	5.19	-
28 Mar 25	11:53	-	15.40	-	5.23	-
28 Mar 25	11:54	-	15.26	-	5.24	-
28 Mar 25	11:55	-	15.20	-	5.19	-
28 Mar 25	11:56	-	15.21	-	5.22	-
28 Mar 25	11:57	-	15.13	-	5.28	-
28 Mar 25	11:58	-	15.18	-	5.28	-
28 Mar 25	11:59	-	15.07	-	5.24	-
28 Mar 25	12:00	-	14.87	-	5.20	-
28 Mar 25	12:01	-	14.91	-	5.18	-
28 Mar 25	12:02	-	14.94	-	5.15	-
28 Mar 25	12:03	-	14.85	-	5.12	-
28 Mar 25	12:04	-	14.85	-	5.15	-
28 Mar 25	12:05	-	14.84	-	5.20	-
28 Mar 25	12:06	-	14.75	-	5.24	-
28 Mar 25	12:07	-	14.70	-	5.26	-
28 Mar 25	12:08	-	14.77	-	5.25	-
Max		-	15.41	-	5.28	-
Avg		-	15.08	-	5.20	-

Run No: 5 — Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
28 Mar 25	12:09	-	14.85	-	5.23	-
28 Mar 25	12:10	-	14.76	-	5.20	-
28 Mar 25	12:11	-	14.82	-	5.19	-
28 Mar 25	12:12	-	14.74	-	5.18	-
28 Mar 25	12:13	-	14.66	-	5.18	-
28 Mar 25	12:14	-	14.79	-	5.17	-
28 Mar 25	12:15	-	14.81	-	5.15	-
28 Mar 25	12:16	-	14.81	-	5.58	-
28 Mar 25	12:17	-	14.83	-	5.16	-
28 Mar 25	12:18	-	14.83	-	5.15	-
28 Mar 25	12:19	-	15.03	-	5.55	-
28 Mar 25	12:20	-	15.25	-	5.16	-
28 Mar 25	12:21	-	15.34	-	5.19	-
28 Mar 25	12:22	-	15.28	-	5.64	-
28 Mar 25	12:23	-	15.10	-	5.26	-
28 Mar 25	12:24	-	15.21	-	5.22	-
28 Mar 25	12:25	-	15.18	-	5.20	-
28 Mar 25	12:26	-	15.10	-	5.19	-
28 Mar 25	12:27	-	15.12	-	5.20	-
28 Mar 25	12:28	-	15.09	-	5.19	-
28 Mar 25	12:29	-	14.99	-	5.19	-
Max		-	15.34	-	5.64	-
Avg		-	14.98	-	5.24	-

Run No: 6 — Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
28 Mar 25	12:30	-	15.08	-	5.20	-
28 Mar 25	12:31	-	15.05	-	5.18	-
28 Mar 25	12:32	-	15.10	-	5.17	-
28 Mar 25	12:33	-	15.07	-	5.18	-
28 Mar 25	12:34	-	14.97	-	5.21	-
28 Mar 25	12:35	-	14.92	-	5.17	-
28 Mar 25	12:36	-	14.89	-	5.15	-
28 Mar 25	12:37	-	14.92	-	5.17	-
28 Mar 25	12:38	-	14.92	-	5.18	-
28 Mar 25	12:39	-	14.87	-	5.19	-
28 Mar 25	12:40	-	14.91	-	5.24	-
28 Mar 25	12:41	-	14.71	-	5.24	-
28 Mar 25	12:42	-	14.65	-	5.19	-
28 Mar 25	12:43	-	14.72	-	5.16	-
28 Mar 25	12:44	-	14.80	-	5.14	-
28 Mar 25	12:45	-	14.82	-	5.20	-
28 Mar 25	12:46	-	14.77	-	5.21	-
28 Mar 25	12:47	-	14.63	-	5.24	-
28 Mar 25	12:48	-	14.58	-	5.24	-
28 Mar 25	12:49	-	14.53	-	5.25	-
28 Mar 25	12:50	-	14.61	-	5.23	-
Max		-	15.10	-	5.25	-
Avg		-	14.83	-	5.19	-

CEMs Data

Client Name: THAI MMA Co., Ltd. | Date: 27 Mar 25
Plant Name: MMA Site 3 | Location: ปล่อง 2Z-6210

Run No: 7 — Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
27 Mar 25	12:36	-	9.15	-	5.45	-
27 Mar 25	12:37	-	9.33	-	5.43	-
27 Mar 25	12:38	-	9.40	-	5.46	-
27 Mar 25	12:39	-	9.32	-	5.48	-
27 Mar 25	12:40	-	8.86	-	5.51	-
27 Mar 25	12:41	-	9.73	-	5.50	-
27 Mar 25	12:42	-	9.66	-	5.51	-
27 Mar 25	12:43	-	9.52	-	5.52	-
27 Mar 25	12:44	-	9.43	-	5.54	-
27 Mar 25	12:45	-	9.62	-	5.50	-
27 Mar 25	12:46	-	9.89	-	5.47	-
27 Mar 25	12:47	-	10.14	-	5.45	-
27 Mar 25	12:48	-	10.01	-	5.48	-
27 Mar 25	12:49	-	9.98	-	5.50	-
27 Mar 25	12:50	-	10.00	-	5.53	-
27 Mar 25	12:51	-	10.32	-	5.50	-
27 Mar 25	12:52	-	10.05	-	5.50	-
27 Mar 25	12:53	-	10.06	-	5.50	-
27 Mar 25	12:54	-	10.10	-	5.49	-
27 Mar 25	12:55	-	9.69	-	5.47	-
27 Mar 25	12:56	-	10.04	-	5.45	-
Max		-	10.32	-	5.54	-
Avg		-	9.73	-	5.48	-

Run No: 8 — Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
27 Mar 25	12:57	-	9.80	-	5.43	-
27 Mar 25	12:58	-	9.98	-	5.45	-
27 Mar 25	12:59	-	10.23	-	5.48	-
27 Mar 25	13:00	-	10.15	-	5.53	-
27 Mar 25	13:01	-	9.54	-	5.55	-
27 Mar 25	13:02	-	9.95	-	5.54	-
27 Mar 25	13:03	-	9.83	-	5.54	-
27 Mar 25	13:04	-	9.89	-	5.53	-
27 Mar 25	13:05	-	10.33	-	5.51	-
27 Mar 25	13:06	-	10.30	-	5.47	-
27 Mar 25	13:07	-	9.74	-	5.42	-
27 Mar 25	13:08	-	9.94	-	5.39	-
27 Mar 25	13:09	-	9.97	-	5.40	-
27 Mar 25	13:10	-	10.01	-	5.41	-
27 Mar 25	13:11	-	10.19	-	5.42	-
27 Mar 25	13:12	-	9.88	-	5.42	-
27 Mar 25	13:13	-	9.62	-	5.40	-
27 Mar 25	13:14	-	9.77	-	5.43	-
27 Mar 25	13:15	-	9.82	-	5.46	-
27 Mar 25	13:16	-	10.25	-	5.49	-
27 Mar 25	13:17	-	10.21	-	5.52	-
Max		-	10.33	-	5.55	-
Avg		-	9.97	-	5.47	-

Run No: 9 — Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
27 Mar 25	13:18	-	10.09	-	5.52	-
27 Mar 25	13:19	-	10.07	-	5.49	-
27 Mar 25	13:20	-	9.87	-	5.47	-
27 Mar 25	13:21	-	9.93	-	5.48	-
27 Mar 25	13:22	-	10.42	-	5.48	-
27 Mar 25	13:23	-	9.59	-	5.47	-
27 Mar 25	13:24	-	9.80	-	5.43	-
27 Mar 25	13:25	-	9.64	-	5.42	-
27 Mar 25	13:26	-	9.64	-	5.42	-
27 Mar 25	13:27	-	9.84	-	5.45	-
27 Mar 25	13:28	-	9.58	-	5.47	-
27 Mar 25	13:29	-	10.22	-	5.48	-
27 Mar 25	13:30	-	9.46	-	5.49	-
27 Mar 25	13:31	-	9.69	-	5.53	-
27 Mar 25	13:32	-	9.57	-	5.55	-
27 Mar 25	13:33	-	9.01	-	5.57	-
27 Mar 25	13:34	-	10.28	-	5.54	-
27 Mar 25	13:35	-	9.69	-	5.49	-
27 Mar 25	13:36	-	9.23	-	5.45	-
27 Mar 25	13:37	-	9.58	-	5.48	-
27 Mar 25	13:38	-	9.50	-	5.45	-
Max		-	10.42	-	5.57	-
Avg		-	9.75	-	5.48	-

Run No: 10 — Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
27 Mar 25	13:39	-	9.51	-	5.45	-
27 Mar 25	13:40	-	9.43	-	5.43	-
27 Mar 25	13:41	-	9.38	-	5.45	-
27 Mar 25	13:42	-	9.82	-	5.47	-
27 Mar 25	13:43	-	8.75	-	5.51	-
27 Mar 25	13:44	-	9.34	-	5.48	-
27 Mar 25	13:45	-	9.32	-	5.47	-
27 Mar 25	13:46	-	9.42	-	5.44	-
27 Mar 25	13:47	-	9.47	-	5.47	-
27 Mar 25	13:48	-	9.73	-	5.49	-
27 Mar 25	13:49	-	8.94	-	5.53	-
27 Mar 25	13:50	-	9.50	-	5.50	-
27 Mar 25	13:51	-	9.07	-	5.49	-
27 Mar 25	13:52	-	8.90	-	5.46	-
27 Mar 25	13:53	-	9.16	-	5.44	-
27 Mar 25	13:54	-	8.63	-	5.44	-
27 Mar 25	13:55	-	9.64	-	5.45	-
27 Mar 25	13:56	-	10.03	-	5.41	-
27 Mar 25	13:57	-	9.57	-	5.42	-
27 Mar 25	13:58	-	9.82	-	5.44	-
27 Mar 25	13:59	-	9.66	-	5.48	-
Max		-	10.03	-	5.53	-
Avg		-	9.39	-	5.46	-

Run No: 11 — Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
27 Mar 25	14:00	-	9.41	-	5.43	-
27 Mar 25	14:01	-	9.05	-	5.38	-
27 Mar 25	14:02	-	9.42	-	5.36	-
27 Mar 25	14:03	-	8.85	-	5.39	-
27 Mar 25	14:04	-	8.93	-	5.38	-
27 Mar 25	14:05	-	9.22	-	5.39	-
27 Mar 25	14:06	-	9.13	-	5.43	-
27 Mar 25	14:07	-	9.34	-	5.48	-
27 Mar 25	14:08	-	8.94	-	5.48	-
27 Mar 25	14:09	-	8.83	-	5.46	-
27 Mar 25	14:10	-	9.49	-	5.43	-
27 Mar 25	14:11	-	10.15	-	5.44	-
27 Mar 25	14:12	-	9.25	-	5.44	-
27 Mar 25	14:13	-	9.54	-	5.44	-
27 Mar 25	14:14	-	9.29	-	5.45	-
27 Mar 25	14:15	-	8.98	-	5.45	-
27 Mar 25	14:16	-	9.11	-	5.43	-
27 Mar 25	14:17	-	9.41	-	5.41	-
27 Mar 25	14:18	-	9.15	-	5.43	-
27 Mar 25	14:19	-	9.59	-	5.46	-
27 Mar 25	14:20	-	9.07	-	5.50	-
Max		-	10.15	-	5.50	-
Avg		-	9.24	-	5.43	-

Run No: 12 — Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
27 Mar 25	14:21	-	9.19	-	5.48	-
27 Mar 25	14:22	-	9.41	-	5.47	-
27 Mar 25	14:23	-	9.74	-	5.46	-
27 Mar 25	14:24	-	9.78	-	5.48	-
27 Mar 25	14:25	-	9.21	-	5.44	-
27 Mar 25	14:26	-	9.82	-	5.42	-
27 Mar 25	14:27	-	9.27	-	5.41	-
27 Mar 25	14:28	-	8.72	-	5.45	-
27 Mar 25	14:29	-	9.35	-	5.46	-
27 Mar 25	14:30	-	8.55	-	5.48	-
27 Mar 25	14:31	-	9.07	-	5.46	-
27 Mar 25	14:32	-	9.43	-	5.47	-
27 Mar 25	14:33	-	9.56	-	5.48	-
27 Mar 25	14:34	-	8.89	-	5.51	-
27 Mar 25	14:35	-	9.78	-	5.48	-
27 Mar 25	14:36	-	9.06	-	5.48	-
27 Mar 25	14:37	-	8.91	-	5.49	-
27 Mar 25	14:38	-	8.89	-	5.53	-
27 Mar 25	14:39	-	9.33	-	5.50	-
27 Mar 25	14:40	-	9.35	-	5.49	-
27 Mar 25	14:41	-	9.86	-	5.48	-
Max		-	9.86	-	5.53	-
Avg		-	9.29	-	5.47	-

Lot No. 2515860-1

SYSTEM CALIBRATION BIAS AND DRIFT DATA

Client : **THAI MMA Co., Ltd.** **Location** : **ปล่อง 2Z-6210**
Date : **27 Mar 25** **Test Operator** : **Sathaporn T.**

O_2 ANALYZER
Cylinder Conc. (%) : **16.07** **Span (%)** : **25**

	O_2 Analyzer Calibration Response	Initial Values: System Calibration Response	Initial Values: System Cal Bias (% of Span)	Final Values: System Calibration Response	Final Values: System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.10	0.19	0.36	0.22	0.48	0.12
Upscale Gas	16.17	16.25	0.32	16.29	0.48	0.16

NO_X ANALYZER
Cylinder Conc. (ppm) : **82.51** **Span (ppm)** : **100**

	NO_X Analyzer Calibration Response	Initial Values: System Calibration Response	Initial Values: System Cal Bias (% of Span)	Final Values: System Calibration Response	Final Values: System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.35	0.44	0.09	0.47	0.12	0.03
Upscale Gas	82.22	82.04	0.18	82.02	0.20	0.02

Calibrated by

Sathaporn.T

(Mr.Sathaporn Thakaew)
Environmental Field Scientist (3)

Reference Method Data

Client Name: THAI MMA Co., Ltd. | Date: 28 Mar 25
Plant Name: MMA Site 3 | Location: ปล่อง Z-6210

Run No: 7 — Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
28 Mar 25	12:51	-	14.64	-	5.20	-
28 Mar 25	12:52	-	14.60	-	5.18	-
28 Mar 25	12:53	-	14.76	-	5.19	-
28 Mar 25	12:54	-	14.83	-	5.20	-
28 Mar 25	12:55	-	14.81	-	5.20	-
28 Mar 25	12:56	-	14.95	-	5.22	-
28 Mar 25	12:57	-	14.90	-	5.25	-
28 Mar 25	12:58	-	14.82	-	5.30	-
28 Mar 25	12:59	-	14.89	-	5.28	-
28 Mar 25	13:00	-	14.94	-	5.26	-
28 Mar 25	13:01	-	14.98	-	5.65	-
28 Mar 25	13:02	-	14.80	-	5.22	-
28 Mar 25	13:03	-	14.71	-	5.19	-
28 Mar 25	13:04	-	14.66	-	5.16	-
28 Mar 25	13:05	-	14.64	-	5.17	-
28 Mar 25	13:06	-	14.64	-	5.18	-
28 Mar 25	13:07	-	14.73	-	5.19	-
28 Mar 25	13:08	-	14.77	-	5.22	-
28 Mar 25	13:09	-	14.70	-	5.25	-
28 Mar 25	13:10	-	14.63	-	5.25	-
28 Mar 25	13:11	-	14.63	-	5.24	-
Max		-	14.98	-	5.65	-
Avg		-	14.76	-	5.24	-

Run No: 8 — Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
28 Mar 25	13:12	-	14.53	-	5.22	-
28 Mar 25	13:13	-	14.38	-	5.20	-
28 Mar 25	13:14	-	14.48	-	5.19	-
28 Mar 25	13:15	-	14.49	-	5.20	-
28 Mar 25	13:16	-	14.31	-	5.27	-
28 Mar 25	13:17	-	14.31	-	5.27	-
28 Mar 25	13:18	-	14.26	-	5.29	-
28 Mar 25	13:19	-	14.17	-	5.31	-
28 Mar 25	13:20	-	14.10	-	5.31	-
28 Mar 25	13:21	-	14.12	-	5.30	-
28 Mar 25	13:22	-	14.13	-	5.26	-
28 Mar 25	13:23	-	14.12	-	5.24	-
28 Mar 25	13:24	-	14.21	-	5.23	-
28 Mar 25	13:25	-	14.27	-	5.24	-
28 Mar 25	13:26	-	14.18	-	5.28	-
28 Mar 25	13:27	-	14.26	-	5.26	-
28 Mar 25	13:28	-	14.25	-	5.23	-
28 Mar 25	13:29	-	14.22	-	5.18	-
28 Mar 25	13:30	-	14.28	-	5.14	-
28 Mar 25	13:31	-	14.37	-	5.15	-
28 Mar 25	13:32	-	14.46	-	5.18	-
Max		-	14.53	-	5.31	-
Avg		-	14.28	-	5.23	-

Run No: 9 — Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
28 Mar 25	13:33	-	14.41	-	5.68	-
28 Mar 25	13:34	-	14.24	-	5.27	-
28 Mar 25	13:35	-	14.26	-	5.23	-
28 Mar 25	13:36	-	14.23	-	5.21	-
28 Mar 25	13:37	-	14.05	-	5.20	-
28 Mar 25	13:38	-	14.04	-	5.23	-
28 Mar 25	13:39	-	14.05	-	5.24	-
28 Mar 25	13:40	-	13.98	-	5.23	-
28 Mar 25	13:41	-	14.10	-	5.23	-
28 Mar 25	13:42	-	14.15	-	5.24	-
28 Mar 25	13:43	-	14.04	-	5.23	-
28 Mar 25	13:44	-	13.94	-	5.22	-
28 Mar 25	13:45	-	14.00	-	5.23	-
28 Mar 25	13:46	-	13.95	-	5.26	-
28 Mar 25	13:47	-	13.86	-	5.28	-
28 Mar 25	13:48	-	13.95	-	5.28	-
28 Mar 25	13:49	-	13.99	-	5.25	-
28 Mar 25	13:50	-	13.90	-	5.20	-
28 Mar 25	13:51	-	13.94	-	5.16	-
28 Mar 25	13:52	-	13.88	-	5.14	-
28 Mar 25	13:53	-	13.87	-	5.14	-
Max		-	14.41	-	5.68	-
Avg		-	14.04	-	5.24	-

Run No: 10 — Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
28 Mar 25	13:54	-	13.86	-	5.15	-
28 Mar 25	13:55	-	13.75	-	5.18	-
28 Mar 25	13:56	-	13.75	-	5.21	-
28 Mar 25	13:57	-	13.76	-	5.21	-
28 Mar 25	13:58	-	13.77	-	5.25	-
28 Mar 25	13:59	-	13.72	-	5.23	-
28 Mar 25	14:00	-	13.60	-	5.25	-
28 Mar 25	14:01	-	13.64	-	5.26	-
28 Mar 25	14:02	-	13.68	-	5.28	-
28 Mar 25	14:03	-	13.66	-	5.28	-
28 Mar 25	14:04	-	13.82	-	5.26	-
28 Mar 25	14:05	-	13.85	-	5.26	-
28 Mar 25	14:06	-	13.81	-	5.23	-
28 Mar 25	14:07	-	13.89	-	5.21	-
28 Mar 25	14:08	-	14.02	-	5.15	-
28 Mar 25	14:09	-	13.98	-	5.12	-
28 Mar 25	14:10	-	13.98	-	5.12	-
28 Mar 25	14:11	-	14.15	-	5.16	-
28 Mar 25	14:12	-	14.26	-	5.16	-
28 Mar 25	14:13	-	14.19	-	5.19	-
28 Mar 25	14:14	-	14.35	-	5.19	-
Max		-	14.35	-	5.28	-
Avg		-	13.88	-	5.20	-

Run No: 11 — Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
28 Mar 25	14:15	-	14.47	-	5.21	-
28 Mar 25	14:16	-	14.54	-	5.23	-
28 Mar 25	14:17	-	14.61	-	5.23	-
28 Mar 25	14:18	-	14.69	-	5.23	-
28 Mar 25	14:19	-	14.69	-	5.24	-
28 Mar 25	14:20	-	14.62	-	5.20	-
28 Mar 25	14:21	-	14.58	-	5.21	-
28 Mar 25	14:22	-	14.60	-	5.22	-
28 Mar 25	14:23	-	14.57	-	5.20	-
28 Mar 25	14:24	-	14.40	-	5.18	-
28 Mar 25	14:25	-	14.17	-	5.14	-
28 Mar 25	14:26	-	14.05	-	5.16	-
28 Mar 25	14:27	-	13.95	-	5.20	-
28 Mar 25	14:28	-	14.00	-	5.22	-
28 Mar 25	14:29	-	14.08	-	5.22	-
28 Mar 25	14:30	-	14.03	-	5.20	-
28 Mar 25	14:31	-	14.01	-	5.20	-
28 Mar 25	14:32	-	14.10	-	5.18	-
28 Mar 25	14:33	-	14.14	-	5.18	-
28 Mar 25	14:34	-	14.12	-	5.19	-
28 Mar 25	14:35	-	14.20	-	5.20	-
Max		-	14.69	-	5.24	-
Avg		-	14.32	-	5.20	-

Run No: 12 — Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
28 Mar 25	14:36	-	14.21	-	5.21	-
28 Mar 25	14:37	-	14.08	-	5.27	-
28 Mar 25	14:38	-	14.21	-	5.29	-
28 Mar 25	14:39	-	14.21	-	5.30	-
28 Mar 25	14:40	-	14.16	-	5.24	-
28 Mar 25	14:41	-	14.22	-	5.18	-
28 Mar 25	14:42	-	14.30	-	5.14	-
28 Mar 25	14:43	-	14.30	-	5.14	-
28 Mar 25	14:44	-	14.22	-	5.15	-
28 Mar 25	14:45	-	14.20	-	5.14	-
28 Mar 25	14:46	-	14.34	-	5.19	-
28 Mar 25	14:47	-	14.36	-	5.24	-
28 Mar 25	14:48	-	14.56	-	5.25	-
28 Mar 25	14:49	-	14.70	-	5.24	-
28 Mar 25	14:50	-	14.71	-	5.20	-
28 Mar 25	14:51	-	14.82	-	5.19	-
28 Mar 25	14:52	-	14.77	-	5.20	-
28 Mar 25	14:53	-	14.64	-	5.18	-
28 Mar 25	14:54	-	14.68	-	5.13	-
28 Mar 25	14:55	-	14.73	-	5.11	-
28 Mar 25	14:56	-	14.70	-	5.12	-
Max		-	14.82	-	5.30	-
Avg		-	14.43	-	5.19	-

Airgas. an Air Liquide company

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

CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

Customer: AIR LIQUIDE (THAILAND) LTD

Part Number:	E02NI84E3HA0001	Reference Number:	160-402830555-1
Cylinder Number:	GN0029535	Cylinder Volume:	250.0 CF
Laboratory:	124 - Plumsteadville - PA	Cylinder Pressure:	2214 PSIG
PGVP Number:	A12023	Valve Outlet:	590
Gas Code:	O2,BALN	Certification Date:	Sep 05, 2023

Expiration Date: Sep 05, 2031

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted. The results relate only to the items tested. The report shall not be reproduced except in full without approval of the laboratory. Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
OXYGEN	16.00 %	16.07 %	G1	+/- 0.4% NIST Traceable	09/05/2023
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	08010205	K001516	23.2 % OXYGEN/NITROGEN	+/- 0.4%	Jun 01, 2024

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
SIEMENS OXYMAT 6 - N1-W5-951 - O2	PARAMAGNETIC	Aug 16, 2023

Triad Data Available Upon Request

NOTES: Gross Weight: 50.0 Kg
Net Weight: 8.4 Kg

Approved for Release

Airgas. an Air Liquide company

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

CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

Customer: AIR LIQUIDE (THAILAND) LTD

Part Number:	E04NI99E3HA0066	Reference Number:	160-402340012-1
Cylinder Number:	GN0027216	Cylinder Volume:	247.2 CF
Laboratory:	124 - Plumsteadville - PA	Cylinder Pressure:	2215 PSIG
PGVP Number:	A12022	Valve Outlet:	660
Gas Code:	CO,NO,NOX,SO2,BALN	Certification Date:	Feb 09, 2022

Expiration Date: Feb 09, 2030

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.
Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	55.00 PPM	55.91 PPM	G1	+/- 1.0% NIST Traceable	02/02/2022, 02/09/2022
CARBON MONOXIDE	55.00 PPM	55.20 PPM	G1	+/- 0.6% NIST Traceable	02/02/2022
NITRIC OXIDE	55.00 PPM	55.91 PPM	G1	+/- 0.9% NIST Traceable	02/02/2022, 02/09/2022
SULFUR DIOXIDE	55.00 PPM	56.28 PPM	G1	+/- 0.8% NIST Traceable	02/02/2022, 02/09/2022
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	09010212	KAL004777	98.48 PPM CARBON MONOXIDE/NITROGEN	+/- 0.5%	Oct 16, 2024
NTRM	200610-15	CC733106	98.61 PPM NITRIC OXIDE/NITROGEN	+/- 0.9%	Oct 06, 2026
GMIS	124206889139	CC323707	4,097 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.0%	Sep 03, 2024
NTRM	11010419	KAL004813	99.6 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Jul 28, 2023

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet iS50 FTIR AUP2010245 CO	FTIR	Jan 06, 2022
Nicolet iS50 FTIR AUP2010245 NO	FTIR	Jan 12, 2022
Nicolet iS50 FTIR AUP2010245 NO2	FTIR	Jan 27, 2022
Nicolet iS50 FTIR AUP2010245 SO2	FTIR	Jan 20, 2022

Triad Data Available Upon Request

NOTES: Gross Weight: 49.4 Kg
Net Weight: 8.4 Kg

Approved for Release

Reference Method Data

Client Name	THAI MMA Co., Ltd.	Date	27 Mar 25
Plant Name	MMA Site 3	Location	ปล่อง ZZ-6210

Run No: 1 — Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
27 Mar 25	10:30	-	8.01	-	5.71	-
27 Mar 25	10:31	-	7.83	-	5.65	-
27 Mar 25	10:32	-	7.82	-	5.56	-
27 Mar 25	10:33	-	7.93	-	5.64	-
27 Mar 25	10:34	-	8.05	-	5.67	-
27 Mar 25	10:35	-	8.08	-	5.76	-
27 Mar 25	10:36	-	8.04	-	5.73	-
27 Mar 25	10:37	-	8.21	-	5.82	-
27 Mar 25	10:38	-	8.28	-	5.78	-
27 Mar 25	10:39	-	8.27	-	5.81	-
27 Mar 25	10:40	-	8.34	-	5.63	-
27 Mar 25	10:41	-	8.30	-	5.69	-
27 Mar 25	10:42	-	8.22	-	5.70	-
27 Mar 25	10:43	-	8.31	-	5.75	-
27 Mar 25	10:44	-	8.30	-	5.75	-
27 Mar 25	10:45	-	8.27	-	5.86	-
27 Mar 25	10:46	-	8.22	-	5.80	-
27 Mar 25	10:47	-	8.27	-	5.79	-
27 Mar 25	10:48	-	8.33	-	5.74	-
27 Mar 25	10:49	-	8.31	-	5.79	-
27 Mar 25	10:50	-	8.47	-	6.13	-
Max		-	8.47	-	6.13	-
Avg		-	8.18	-	5.75	-

Run No: 2 — Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
27 Mar 25	10:51	-	8.59	-	5.71	-
27 Mar 25	10:52	-	8.60	-	5.67	-
27 Mar 25	10:53	-	8.70	-	5.77	-
27 Mar 25	10:54	-	8.80	-	5.79	-
27 Mar 25	10:55	-	8.81	-	5.81	-
27 Mar 25	10:56	-	8.90	-	5.79	-
27 Mar 25	10:57	-	9.01	-	5.82	-
27 Mar 25	10:58	-	9.10	-	5.81	-
27 Mar 25	10:59	-	9.14	-	5.77	-
27 Mar 25	11:00	-	9.18	-	5.70	-
27 Mar 25	11:01	-	9.23	-	5.68	-
27 Mar 25	11:02	-	9.03	-	5.71	-
27 Mar 25	11:03	-	8.84	-	5.70	-
27 Mar 25	11:04	-	8.83	-	5.65	-
27 Mar 25	11:05	-	8.78	-	5.65	-
27 Mar 25	11:06	-	8.75	-	5.67	-
27 Mar 25	11:07	-	8.74	-	5.73	-
27 Mar 25	11:08	-	8.80	-	5.79	-
27 Mar 25	11:09	-	8.78	-	5.77	-
27 Mar 25	11:10	-	8.74	-	5.79	-
27 Mar 25	11:11	-	8.81	-	6.17	-
Max		-	9.23	-	6.17	-
Avg		-	8.87	-	5.76	-

Run No: 3 — Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
27 Mar 25	11:12	-	8.81	-	5.81	-
27 Mar 25	11:13	-	8.78	-	5.71	-
27 Mar 25	11:14	-	8.88	-	6.04	-
27 Mar 25	11:15	-	8.92	-	5.59	-
27 Mar 25	11:16	-	8.93	-	5.65	-
27 Mar 25	11:17	-	8.97	-	5.64	-
27 Mar 25	11:18	-	8.96	-	5.70	-
27 Mar 25	11:19	-	8.98	-	5.65	-
27 Mar 25	11:20	-	9.02	-	5.70	-
27 Mar 25	11:21	-	9.11	-	5.68	-
27 Mar 25	11:22	-	9.15	-	5.79	-
27 Mar 25	11:23	-	9.09	-	5.77	-
27 Mar 25	11:24	-	9.10	-	5.84	-
27 Mar 25	11:25	-	9.10	-	5.75	-
27 Mar 25	11:26	-	8.97	-	5.71	-
27 Mar 25	11:27	-	8.96	-	5.66	-
27 Mar 25	11:28	-	8.95	-	5.71	-
27 Mar 25	11:29	-	8.93	-	5.63	-
27 Mar 25	11:30	-	8.99	-	5.61	-
27 Mar 25	11:31	-	9.08	-	5.63	-
27 Mar 25	11:32	-	9.07	-	5.77	-
Max		-	9.15	-	6.04	-
Avg		-	8.99	-	5.71	-

Run No: 4 — Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
27 Mar 25	11:33	-	8.99	-	5.77	-
27 Mar 25	11:34	-	9.03	-	5.80	-
27 Mar 25	11:35	-	9.12	-	5.74	-
27 Mar 25	11:36	-	9.09	-	5.71	-
27 Mar 25	11:37	-	9.10	-	5.66	-
27 Mar 25	11:38	-	9.00	-	5.70	-
27 Mar 25	11:39	-	8.92	-	5.72	-
27 Mar 25	11:40	-	9.01	-	5.76	-
27 Mar 25	11:41	-	9.03	-	5.75	-
27 Mar 25	11:42	-	9.05	-	5.81	-
27 Mar 25	11:43	-	9.06	-	5.77	-
27 Mar 25	11:44	-	9.07	-	5.76	-
27 Mar 25	11:45	-	9.05	-	5.64	-
27 Mar 25	11:46	-	9.02	-	6.12	-
27 Mar 25	11:47	-	9.04	-	5.70	-
27 Mar 25	11:48	-	9.04	-	5.79	-
27 Mar 25	11:49	-	8.95	-	5.71	-
27 Mar 25	11:50	-	9.04	-	5.71	-
27 Mar 25	11:51	-	9.10	-	5.68	-
27 Mar 25	11:52	-	9.10	-	5.75	-
27 Mar 25	11:53	-	9.17	-	5.75	-
Max		-	9.17	-	6.12	-
Avg		-	9.04	-	5.75	-

Run No: 5 — Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
27 Mar 25	11:54	-	9.12	-	5.78	-
27 Mar 25	11:55	-	9.06	-	5.69	-
27 Mar 25	11:56	-	9.14	-	5.74	-
27 Mar 25	11:57	-	9.25	-	5.77	-
27 Mar 25	11:58	-	9.24	-	5.83	-
27 Mar 25	11:59	-	9.20	-	5.76	-
27 Mar 25	12:00	-	9.28	-	5.72	-
27 Mar 25	12:01	-	9.26	-	5.59	-
27 Mar 25	12:02	-	9.18	-	5.64	-
27 Mar 25	12:03	-	9.28	-	6.16	-
27 Mar 25	12:04	-	9.32	-	5.79	-
27 Mar 25	12:05	-	9.28	-	5.72	-
27 Mar 25	12:06	-	9.34	-	6.03	-
27 Mar 25	12:07	-	9.24	-	5.62	-
27 Mar 25	12:08	-	9.18	-	5.63	-
27 Mar 25	12:09	-	9.17	-	6.06	-
27 Mar 25	12:10	-	9.17	-	5.60	-
27 Mar 25	12:11	-	9.24	-	5.70	-
27 Mar 25	12:12	-	9.31	-	5.69	-
27 Mar 25	12:13	-	9.37	-	5.69	-
27 Mar 25	12:14	-	9.36	-	5.63	-
Max		-	9.37	-	6.16	-
Avg		-	9.24	-	5.75	-

Run No: 6 — Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
27 Mar 25	12:15	-	9.17	-	5.70	-
27 Mar 25	12:16	-	9.17	-	5.73	-
27 Mar 25	12:17	-	9.12	-	5.77	-
27 Mar 25	12:18	-	9.08	-	5.70	-
27 Mar 25	12:19	-	9.13	-	5.65	-
27 Mar 25	12:20	-	9.08	-	5.64	-
27 Mar 25	12:21	-	8.97	-	5.69	-
27 Mar 25	12:22	-	9.02	-	5.67	-
27 Mar 25	12:23	-	9.05	-	5.70	-
27 Mar 25	12:24	-	9.00	-	5.66	-
27 Mar 25	12:25	-	8.95	-	5.76	-
27 Mar 25	12:26	-	9.02	-	5.82	-
27 Mar 25	12:27	-	9.03	-	5.87	-
27 Mar 25	12:28	-	8.96	-	5.78	-
27 Mar 25	12:29	-	9.01	-	5.70	-
27 Mar 25	12:30	-	9.06	-	5.65	-
27 Mar 25	12:31	-	9.06	-	5.69	-
27 Mar 25	12:32	-	9.19	-	5.66	-
27 Mar 25	12:33	-	9.45	-	5.68	-
27 Mar 25	12:34	-	9.57	-	5.63	-
27 Mar 25	12:35	-	9.79	-	5.72	-
Max		-	9.79	-	5.87	-
Avg		-	9.14	-	5.70	-

Airgas. an Air Liquide company

Airgas Specialty Gases
Airgas USA, LLC
6141 Easton Road
Bldg 1
Plumsteadville, PA 18949
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number:	E02NI92E3HA0000	Reference Number:	160-401948144-1
Cylinder Number:	GN0025086	Cylinder Volume:	248.4 CF
Laboratory:	124 - Plumsteadville - PA	Cylinder Pressure:	2214 PSIG
PGVP Number:	A12020	Valve Outlet:	590
Gas Code:	O2,BALN	Certification Date:	Nov 11, 2020

Expiration Date: Nov 11, 2028

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.
Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
OXYGEN	8.000 %	8.186 %	G1	+/- 0.3% NIST Traceable	11/11/20
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	10010602	1D38055	9.967 % OXYGEN/NITROGEN	+/- 0.3%	Apr 19, 2022

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
SIEMENS OXYMAT 6 - N1-W5-951 - O2	PARAMAGNETIC	Oct 26, 2020

Triad Data Available Upon Request

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

Approved for Release

Airgas. an Air Liquide company

Airgas Specialty Gases
Airgas USA, LLC
6141 Easton Road
Bldg 2
Plumsteadville, PA 18949
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number:	E04NI99E3HA0002	Reference Number:	160-402138465-1
Cylinder Number:	ND11222	Cylinder Volume:	247.2 Cubic Feet
Laboratory:	124 - Plumsteadville - PA	Cylinder Pressure:	2215 PSIG
PGVP Number:	A12021	Valve Outlet:	660
Gas Code:	CO,NO,NOX,SO2,BALN	Certification Date:	Jul 15, 2021

Expiration Date: Jul 15, 2029

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.
Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	80.00 PPM	82.51 PPM	G1	+/- 1.4% NIST Traceable	07/08/2021, 07/15/2021
CARBON MONOXIDE	80.00 PPM	79.74 PPM	G1	+/- 0.5% NIST Traceable	07/08/2021
NITRIC OXIDE	80.00 PPM	82.51 PPM	G1	+/- 1.4% NIST Traceable	07/08/2021, 07/15/2021
SULFUR DIOXIDE	80.00 PPM	79.76 PPM	G1	+/- 1.0% NIST Traceable	07/08/2021, 07/15/2021
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	11010130	KAL004536	97.31 PPM CARBON MONOXIDE/NITROGEN	+/- 0.4%	Oct 04, 2022
PRM	12386	D685025	9.91 PPM AIR/NITROGEN DIOXIDE	2.0%	Feb 20, 2020
NTRM	200610-50	CC733426	98.61 PPM NITRIC OXIDE/NITROGEN	+/- 0.9%	Oct 06, 2026
GMIS	124206889	CC323707	4.028 PPM NITROGEN DIOXIDE/NITROGEN	2.1%	Aug 15, 2021
NTRM	16010224	KAL003838	97.89 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Dec 23, 2021

The SRM, PRM or RGM noted above is only in reference to the GMIS used in the assay and not part of the analysis.

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet iS50 FTIR AUP2010245 CO	FTIR	Jun 24, 2021
Nicolet iS50 FTIR AUP2010245 NO	FTIR	Jul 01, 2021
Nicolet iS50 FTIR AUP2010245 NO2	FTIR	Jun 30, 2021
Nicolet iS50 FTIR AUP2010245 SO2	FTIR	Jul 09, 2021

Triad Data Available Upon Request

NOTES:
Gross Weight: 48.0 Kg
Net Weight: 7.8 Kg

Approved for Release

Reference Method Data

Client Name	THAI MMA Co., Ltd.	Date	27 Mar 25
Plant Name	MMA Site 3	Location	ปล่อง ZZ-6210

Run No: 7 — Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
27 Mar 25	12:36	-	9.87	-	5.76	-
27 Mar 25	12:37	-	10.05	-	5.79	-
27 Mar 25	12:38	-	10.08	-	6.18	-
27 Mar 25	12:39	-	9.96	-	5.77	-
27 Mar 25	12:40	-	9.94	-	5.76	-
27 Mar 25	12:41	-	9.91	-	5.79	-
27 Mar 25	12:42	-	9.90	-	5.68	-
27 Mar 25	12:43	-	10.25	-	5.58	-
27 Mar 25	12:44	-	10.54	-	5.64	-
27 Mar 25	12:45	-	10.45	-	5.73	-
27 Mar 25	12:46	-	10.34	-	5.78	-
27 Mar 25	12:47	-	10.43	-	5.78	-
27 Mar 25	12:48	-	10.43	-	5.71	-
27 Mar 25	12:49	-	10.36	-	5.73	-
27 Mar 25	12:50	-	10.42	-	5.73	-
27 Mar 25	12:51	-	10.45	-	5.71	-
27 Mar 25	12:52	-	10.43	-	5.65	-
27 Mar 25	12:53	-	10.60	-	6.00	-
27 Mar 25	12:54	-	10.56	-	5.62	-
27 Mar 25	12:55	-	10.50	-	5.67	-
27 Mar 25	12:56	-	10.47	-	5.75	-
Max		-	10.60	-	6.18	-
Avg		-	10.28	-	5.75	-

Run No: 8 — Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
27 Mar 25	12:57	-	10.43	-	5.84	-
27 Mar 25	12:58	-	10.43	-	5.84	-
27 Mar 25	12:59	-	10.45	-	5.79	-
27 Mar 25	13:00	-	10.41	-	5.80	-
27 Mar 25	13:01	-	10.36	-	5.76	-
27 Mar 25	13:02	-	10.26	-	5.72	-
27 Mar 25	13:03	-	10.27	-	5.65	-
27 Mar 25	13:04	-	10.47	-	5.56	-
27 Mar 25	13:05	-	10.47	-	5.55	-
27 Mar 25	13:06	-	10.31	-	5.61	-
27 Mar 25	13:07	-	10.21	-	5.64	-
27 Mar 25	13:08	-	10.23	-	5.66	-
27 Mar 25	13:09	-	10.23	-	5.64	-
27 Mar 25	13:10	-	10.15	-	5.62	-
27 Mar 25	13:11	-	10.20	-	5.69	-
27 Mar 25	13:12	-	10.21	-	5.76	-
27 Mar 25	13:13	-	10.17	-	5.80	-
27 Mar 25	13:14	-	10.34	-	5.80	-
27 Mar 25	13:15	-	10.39	-	5.75	-
27 Mar 25	13:16	-	10.28	-	5.69	-
27 Mar 25	13:17	-	10.27	-	5.67	-
Max		-	10.47	-	5.84	-
Avg		-	10.31	-	5.70	-

Run No: 9 — Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
27 Mar 25	13:18	-	10.28	-	5.73	-
27 Mar 25	13:19	-	10.26	-	6.06	-
27 Mar 25	13:20	-	10.25	-	5.65	-
27 Mar 25	13:21	-	10.24	-	5.59	-
27 Mar 25	13:22	-	10.32	-	6.03	-
27 Mar 25	13:23	-	10.33	-	5.63	-
27 Mar 25	13:24	-	10.37	-	5.77	-
27 Mar 25	13:25	-	10.36	-	6.08	-
27 Mar 25	13:26	-	10.20	-	5.74	-
27 Mar 25	13:27	-	10.12	-	5.72	-
27 Mar 25	13:28	-	10.01	-	5.82	-
27 Mar 25	13:29	-	9.92	-	5.81	-
27 Mar 25	13:30	-	9.97	-	5.85	-
27 Mar 25	13:31	-	9.94	-	5.71	-
27 Mar 25	13:32	-	9.94	-	5.66	-
27 Mar 25	13:33	-	10.02	-	5.61	-
27 Mar 25	13:34	-	10.02	-	5.74	-
27 Mar 25	13:35	-	10.09	-	5.64	-
27 Mar 25	13:36	-	10.06	-	5.66	-
27 Mar 25	13:37	-	9.98	-	5.60	-
27 Mar 25	13:38	-	9.97	-	5.72	-
Max		-	10.37	-	6.08	-
Avg		-	10.13	-	5.75	-

Run No: 10 — Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
27 Mar 25	13:39	-	9.94	-	5.71	-
27 Mar 25	13:40	-	9.88	-	5.76	-
27 Mar 25	13:41	-	9.91	-	5.67	-
27 Mar 25	13:42	-	9.90	-	5.68	-
27 Mar 25	13:43	-	10.00	-	5.62	-
27 Mar 25	13:44	-	10.04	-	5.73	-
27 Mar 25	13:45	-	9.99	-	5.78	-
27 Mar 25	13:46	-	10.07	-	5.80	-
27 Mar 25	13:47	-	10.10	-	5.69	-
27 Mar 25	13:48	-	10.04	-	5.68	-
27 Mar 25	13:49	-	10.04	-	5.62	-
27 Mar 25	13:50	-	9.67	-	5.62	-
27 Mar 25	13:51	-	9.54	-	5.64	-
27 Mar 25	13:52	-	9.72	-	5.68	-
27 Mar 25	13:53	-	10.08	-	5.59	-
27 Mar 25	13:54	-	10.13	-	5.63	-
27 Mar 25	13:55	-	10.03	-	5.73	-
27 Mar 25	13:56	-	10.02	-	5.76	-
27 Mar 25	13:57	-	10.00	-	5.58	-
27 Mar 25	13:58	-	9.94	-	5.51	-
27 Mar 25	13:59	-	10.06	-	5.54	-
Max		-	10.13	-	5.80	-
Avg		-	9.96	-	5.66	-

Run No: 11 — Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
27 Mar 25	14:00	-	10.00	-	5.64	-
27 Mar 25	14:01	-	9.94	-	5.58	-
27 Mar 25	14:02	-	9.93	-	5.62	-
27 Mar 25	14:03	-	9.97	-	5.71	-
27 Mar 25	14:04	-	10.02	-	6.14	-
27 Mar 25	14:05	-	10.01	-	5.74	-
27 Mar 25	14:06	-	10.03	-	5.63	-
27 Mar 25	14:07	-	10.08	-	5.64	-
27 Mar 25	14:08	-	9.98	-	5.67	-
27 Mar 25	14:09	-	10.00	-	5.66	-
27 Mar 25	14:10	-	10.01	-	5.64	-
27 Mar 25	14:11	-	9.92	-	5.70	-
27 Mar 25	14:12	-	9.96	-	5.99	-
27 Mar 25	14:13	-	9.94	-	5.62	-
27 Mar 25	14:14	-	9.93	-	5.58	-
27 Mar 25	14:15	-	10.00	-	6.14	-
27 Mar 25	14:16	-	10.01	-	5.73	-
27 Mar 25	14:17	-	10.01	-	5.77	-
27 Mar 25	14:18	-	9.95	-	5.68	-
27 Mar 25	14:19	-	10.02	-	5.70	-
27 Mar 25	14:20	-	10.00	-	5.67	-
Max		-	10.08	-	6.14	-
Avg		-	9.98	-	5.72	-

Run No: 12 — Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
27 Mar 25	14:21	-	9.89	-	5.72	-
27 Mar 25	14:22	-	9.91	-	5.59	-
27 Mar 25	14:23	-	9.87	-	5.60	-
27 Mar 25	14:24	-	9.77	-	5.59	-
27 Mar 25	14:25	-	9.86	-	5.70	-
27 Mar 25	14:26	-	9.75	-	5.69	-
27 Mar 25	14:27	-	9.55	-	6.04	-
27 Mar 25	14:28	-	9.61	-	5.62	-
27 Mar 25	14:29	-	9.75	-	5.66	-
27 Mar 25	14:30	-	9.81	-	6.12	-
27 Mar 25	14:31	-	9.67	-	5.72	-
27 Mar 25	14:32	-	9.67	-	5.62	-
27 Mar 25	14:33	-	9.75	-	5.65	-
27 Mar 25	14:34	-	9.78	-	5.71	-
27 Mar 25	14:35	-	9.76	-	5.73	-
27 Mar 25	14:36	-	9.80	-	6.09	-
27 Mar 25	14:37	-	9.83	-	5.64	-
27 Mar 25	14:38	-	9.78	-	5.64	-
27 Mar 25	14:39	-	9.66	-	5.67	-
27 Mar 25	14:40	-	9.73	-	5.67	-
27 Mar 25	14:41	-	9.81	-	5.68	-
Max		-	9.91	-	6.12	-
Avg		-	9.76	-	5.72	-

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Calibration Certificate

Certificate No: G 680210
Date of issue : 25-Mar-25

REVIEW BY .... APPROVED BY .... NEXT CAL DATE ... 23/ 03/ 2026 ....

Instrument description	:	Flue Gas Analyzer
Instrument model	:	Testo 350 New
Instrument serial no.	:	62087344/1119
Control unit serial no.	:	03401649/1119
ID no. or control no.	:	RYG_FS0464
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	:	3 Pages
Receiving no.	:	L-250946
Receiving date.	:	18-Mar-25
Parameter of calibration	:	Gas Calibration(Oxygen 2.50,9.984,21.02 %vol, Carbon Monoxide 80.45,302,1007 ppm, Nitrogen Dioxide 30.68,81.8,202.6 ppm, Nitric Oxide 30.0,151.8,322.5 ppm, Sulphur Dioxide 50.36,100.7,600.8 ppm)
Condition of UUC.	:	Used
Ambient condition	:	All of the Measurment ware caried out the stablized labotary Temperature : 23 ±5 °C Humidity : 55 ± 15 %RH
Calibration place	:	17/121 Soi Ngamwongwan 47 Yaek 48, Toongsonghong, Laksi, Bangkok 10210 THAILAND
Calibration procedure no :	:	This instrument was calibrated by comparison with Standard gas mixture according to calibration Work Instruction no. WI-CL-28-C

The calibration certificate expanded uncertainty of measurement is stated as the standard uncertainty of 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 reproduced other than in full except with the permission of the issuing laboratory. Calibration certificates without signature and seal not valid and The results relate only to the items tested/calibrated. This calibration certificate documents are tracebility to national standards, which realize measurement according to the International System of Units (SI).

Date of calibration : 24-Mar-25

Mr. Kwanchai Khamdoung
Calibration Technician

Mrs. Nongluck Wongsettee
Technical Manager

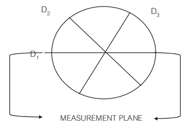
Entech Industrial Solution Co.,Ltd.
17/121 Soi Ngamwongwan 47 Yaek 48, Toongsonghong, Laksi, Bangkok 10210 THAILAND Tel. 0-2779-8888 Calibration@entech.co.th
Tax ID : 0105536035591 www.entech.co.th

PROBE NOZZLE DIAMETER
CALIBRATION DATA SHEET

Calibration Date :	6 Feb 25	Nozzle Set ID. :	RYG_FS0319
Calibration Sheet No. :	C-060225-RYG_FS0319	Vernier Caliper ID.:	BKK_FS1123

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

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



Calibrated by : (Mr. Saksit Phaisanphisut) RYG Field Service Scientist (4)

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

FORM NO.: F 06-026 REVISION NO.: - ISSUE DATE: 9/1/03

CONSOLE CONTROL UNIT CALIBRATION TEST REPORT

Calibration of Date	: 6-Feb-25		Barometric Pressure (mmHg) :	752	
Next Cal. Date	: 6-Aug-25		Relative Humidity (%)	:	45.5
			Temperature (C°)	:	31.5
Console Control Meter Data			***Reference Dry Gas Meter Data***		
Calibration No.	: C-060225-RYG_FS0315		Reference Dry Gas Meter ID	:	BKK_FS1122
Dry Gas Meter ID	: RYG_FS0315		Serial No.	:	A2003240
Serial No.	: 1706091		Correction Factor (Y)	:	1.0000
Model No.	: XC-572-V		Next Calibration Date	:	25 Feb 26

ΔH	Θ	Reference Dry Gas Meter Calibration				Console Control ; Drygas Meter						Dry Gas Meter Correction Factor	Orifice Calibration Factor
		Vr (Liters)			Tr	Vm (Liters)			Ti	To	Avg.Tm		
(mm.H_2O)	Minutes	Final	Initial	Total	(°C)	Final	Initial	Total	(°C)	(°C)	(°C)	(Y)	ΔH@
15	12.07	150.18	0.00	150.18	29.0	1164.4	1013.0	151.40	30.0	30.0	30.0	0.9938	44.6386
25	9.32	150.04	0.00	150.04	29.0	1380.6	1230.0	150.60	30.0	30.0	30.0	0.9971	44.4413
50	6.55	150.10	0.00	150.10	29.0	1550.8	1400.0	150.80	30.0	30.0	30.0	0.9938	43.8652
80	5.10	150.33	0.00	150.33	29.0	1720.8	1570.0	150.80	30.0	30.0	30.0	0.9924	42.4197
120	4.17	150.38	0.00	150.38	29.0	1900.9	1750.0	150.90	30.0	30.0	30.0	0.9883	42.5111
											Avg.	0.9931	43.5752

Y Ratio of reading of reference to dry gas meter ; tolerance for individual values ± 0.02 from average .
ΔH@ : Orifice pressure differential that equates to 21.24 lm of air @ 25 C and 760 mm of mercury , mmH2O ; tolerance for individual values ± 5.08 from average .
Procedure; 40 CFR 60,APP A,METH ,SEC 5.3 & 7

Calibrated by: (Mr. Saksit Phaisanphisut) RYG Field Service Scientist(4)

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

FORM NO.: F 06-024 REVISION NO.: 2 ISSUE DATE: 30 Jun 22

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Calibration Certificate

Certificate No.: G 680210

Standard References (Table 1)

Standard	Certificate No.	Vendor	Due date
Oxygen (O2) 2.50 % Vol	2412/23	Linde	27-Aug-27
Oxygen (O2) 9.984 % Vol	CG-0113-24	Nimt	01-Aug-29
Oxygen (O2) 21.02 % 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 (NO2) 30.68 ppm	2832/24	Linde	08-Sep-26
Nitrogen Dioxide (NO2) 81.8 ppm	2330/24	Linde	01-Aug-26
Nitrogen Dioxide (NO2) 202.6 ppm	3794/24	Linde	23-Dec-26
Nitric Oxide (NO) 30.0 ppm	CG-0065-24	Nimt	06-May-26
Nitric Oxide (NO) 151.8 ppm	0404/25	Linde	09-Feb-27
Nitric Oxide (NO) 322.5 ppm	1974/23	Linde	17-Jul-25
Sulphur Dioxide (SO2) 50.36 ppm	2004/23	Linde	17-Jul-25
Sulphur Dioxide (SO2) 100.7 ppm	2662/24	Linde	25-Aug-26
Sulphur Dioxide (SO2) 600.8 ppm	2003/23	Linde	17-Jul-25

Measured room conditions
Temperature : 22.7 °C Humidity : 62.6 %RH Pressure : 1010.5 mbar

Calibration conditions
Gas Temperature : 23 °C Flow rate : 1,300 ml/min Gas pressure : 1016.2 mbar

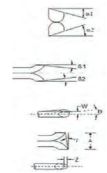
Calibration Results (Befor adjustment) (Table 2)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (±)
O2 (%Vol)	2.50	2.46	-0.04	0.15
O2 (%Vol)	9.984	9.95	-0.034	0.20
O2 (%Vol)	21.02	21.08	0.06	0.30
CO (ppm)	80.45	81	0.55	3.0
CO (ppm)	302	302	0	6.0
CO (ppm)	1007	1010	3	12
NO2 (ppm)	30.68	26.9	-3.78	8.0
NO2 (ppm)	81.8	67.1	-14.7	8.0
NO2 (ppm)	202.6	181.3	-21.3	12
NO (ppm)	30.0	24	-6.0	8.0
NO (ppm)	151.8	145	-6.8	8.0
NO (ppm)	322.5	302	-20.5	12
SO2 (ppm)	50.36	48	-2.36	6.0
SO2 (ppm)	100.7	97	-3.7	6.0
SO2 (ppm)	600.8	589	-11.8	13

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

Type S Pitot Tube Calibration

Date Calibration	6-Feb-25	**Due Date**	9-Aug-25
Pitot ID	RYG_FS0321	**Inclinometer ID**	BKK_FS1131
Pitot SN	-	**Vernier ID**	RYG_FS0539



Parameter	Value	Allowable Range	Check
α1	-1.4	-10° < α1 < +10°	OK
α2	-0.2	-10° < α2 < +10°	OK
β1	0.8	-5° < β1 < +5°	OK
β2	-0.4	-5° < β2 < +5°	OK
γ	0.8	-	-
θ	0.5	-	-
Z = A tan γ	0.013	Z ≤ 0.125"	OK
W = A tan θ	0.008	W ≤ 0.031"	OK
Dt	0.310	0.188" to 0.375"	OK
A/2Dt	1.484	1.05 ≤ PA/Dt ≤ 1.5	OK
A	0.92	2.1Dt ≤ A ≤ 3Dt	OK

Certify that pitot tube/porbe meets or exceeds all specifications, crieria 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. Saksit Phaisanphisut) RYG Field Services Scientist (4)

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

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

DIGITAL TEMPERATURE CALIBRATION DATA SHEET

Calibration Date :	2 Jun 25	Ambient Temperature (°C)	31.5
Calibration sheet No. :	C-060225-RYG_FS0315	Relative Humidity (%) :	45.5
Digital Temperature ID :	RYG_FS0315	Reference Temperature ID	RYG_FS0681
Serial No. :	1706091	Serial No. :	201090014918
Model :	XC-572-V	Model :	Digicon-CC-VT-MS
		Next Calibrate :	13 May 25

Location	Reference Temperature °C	Digital Temperature °C	Error °C	MPE	Pass / Fail
Stack	0	0	0	±3	Pass
	25	25	0	±3	Pass
	50	50	0	±3	Pass
	100	101	1	±3	Pass
	150	151	1	±3	Pass
	200	200	0	±3	Pass
	250	250	0	±3	Pass
	300	301	1	±3	Pass
	500	501	1	±3	Pass
Probe	100	102	2	±3	Pass
	120	121	1	±3	Pass
	140	141	1	±3	Pass
Oven	100	101	1	±3	Pass
	120	120	0	±3	Pass
	140	141	1	±3	Pass
Filter	100	101	1	±3	Pass
	120	121	1	±3	Pass
	140	140	0	±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	24	-1	±3	Pass
	50	49	-1	±3	Pass
AUX	0	0	0	±3	Pass
	25	25	0	±3	Pass
	50	50	0	±3	Pass

MPE : (Maximum permissible error of measurement) **ค่าความผิดพลาดสูงสุดของการวัดที่ยอมได้**

Calibrated by : (Mr. Saksit Phaisanphisut) RYG Field Service Scientist (4)

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

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

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Certificate of System Qualification

GC-OQ + GCMS-OQ

System ID:	GM-12
Organization Name:	ALS Laboratory Group (Thailand) Co Ltd.
Organization Location:	104 Phattanakan 40 Phatthanakan Rd Bangkok 10250
Date:	May 10, 2024 2:18:55 PM
EQP Name:	AgilentRecommended , AgilentRecommended
EQP Revision:	GC.02.53, GCMS.02.54
Overall Qualification Status:	Pass

REVIEW BY Suchada T.
APPROVED BY Tonnyloorn
NEXT CAL. DATE 10 Nov 25

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	25.0	psi
Accuracy:			0.0	psi
Agilent Recommended:			<= 1.2	

Date: May 10, 2024 2:18:55 PM
System ID: GM-12

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Overall Inlet Pressure Accuracy Test Status

Pass

GC Oven Temperature Accuracy

Name: 8890

Setpoint Status: **Pass**

Zone: Oven

	Setpoint/Actual				
Temperature:	230.0	229.1	°C		
Accuracy:		-0.9	°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	101.1	°C		
Accuracy:		1.1	°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	100.9	°C
Stability:		0.0	°C
Agilent Recommended:	<= 0.5		

Overall GC Oven Temperature Stability Test Status

Pass

Date: May 10, 2024 2:18:55 PM
System ID: GM-12

ROTA METER CALIBRATION RESULT JANUARY 2025

Rotameter ID.	Calibration Date	Regression Result	Coefficient (R^2)
SGK_FS0135	10 Jan 25	Y = 1.0205x + 4.58	0.9999
SGK_FS0136	10 Jan 25	Y = 1.0299x + 1.5233	0.9999
SGK_FS0138	10 Jan 25	Y = 1.0865x + 3.4633	1.0000
SGK_FS0139	10 Jan 25	Y = 1.0186x + 4.9267	0.9996
SGK_FS0140	10 Jan 25	Y = 0.9997x + 15.3	1.0000
SGK_FS0141	10 Jan 25	Y = 1.1165x + 2.6633	0.9999
SGK_FS0142	10 Jan 25	Y = 1.0162x + 4.9767	0.9999
SGK_FS0143	10 Jan 25	Y = 1.0025x + 10.838	1.0000

Review By : (Mr. Wichan Choonharat)
Enviro Field Services Manager

Approved By : (Mr.Sarayuth Jittranont)
Assistant General Manager

 ALS Laboratory Group

ENTECH Where Quality Starts Again

Calibration Certificate

Certificate No.: G 680210

Calibration Results (After adjustment) (Table 3)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (±)
O2 (%Vol)	2.50	2.46	-0.04	0.15
O2 (%Vol)	9.984	9.95	-0.034	0.20
O2 (%Vol)	21.02	21.08	0.06	0.30
CO (ppm)	80.45	81	0.55	3.0
CO (ppm)	302	302	0	6.0
CO (ppm)	1007	1010	3	12
NO2 (ppm)	30.68	29.4	-1.28	8.0
NO2 (ppm)	81.8	79.7	-2.1	8.0
NO2 (ppm)	202.6	199.2	-3.4	12
NO (ppm)	30.0	30	0.0	8.0
NO (ppm)	151.8	153	1.2	8.0
NO (ppm)	322.5	324	1.5	12
SO2 (ppm)	50.36	50	-0.36	6.0
SO2 (ppm)	100.7	101	0.3	6.0
SO2 (ppm)	600.8	599	-1.8	13

Remark : 1 cmol/mol = 1 %vol. 1 µmol/mol = 1 ppm., Sensor CO New.

End of Report

FM-CL-09-C Rev.8 Page 3 of 3 Issued Date 26/02/16

Entech Industrial Solution Co.,Ltd.
17-121 Soi Nipamwongwan 47 Yaek 48, Toonsongkhong, Laksi, Bangkok 10210 THAILAND Tel 0-2779-8888 Calibration@entech.co.th
Tax ID : 0105536035551 www.entech.co.th

ARCHEMICA

Certificate of Calibration

REVIEW BY Pardy Bun
APPROVED BY S. Ou
NEXT CAL DATE 6-Jan-26

HPLC_U-3000 ID#690 (BKK_FL0034)

This certificate is to verify that instrument below are calibrated by *Archemica Lab Co.,Ltd.*

DGP-3600SD	S/N : 8105093
WPS-3000TSL	S/N : 8107446
TCC-3000SD	S/N : 6006552
DAD-3000	S/N : 8107298

For

ALS Laboratory Group (Thailand) Co.,Ltd

ARCHEMICA LAB
บริษัท อาร์เคม่ิก้า แลบ จำกัด
ARCHEMICA LAB CO.,LTD.

Operator Signature: Naphat Srinarongkul Date: 6-7/Jan/2025

(Mr.Naphat Srinarongkul)

Application Chemist

ROTA METER CALIBRATION RESULT JANUARY 2025

Rotameter ID.	Calibration Date	Regression Result	Coefficient (R^2)
BKK_FS0573	09 Jan 25	Y = 1.0442x + 3.4629	0.9998
BKK_FS0577	10 Jan 25	Y = 1.101x + 2.2422	0.9995
BKK_FS0584	10 Jan 25	Y = 1.0176x + 3.74	0.9995
BKK_FS0585	10 Jan 25	Y = 1.0344x + 0.9767	0.9999
BKK_FS0587	10 Jan 25	Y = 1.0176x + 6.3433	0.9998
BKK_FS0591	10 Jan 25	Y = 0.9994x + 18.562	1.0000
BKK_FS0592	10 Jan 25	Y = 0.9996x + 12.927	1.0000
BKK_FS0594	10 Jan 25	Y = 1.0023x + 10.499	1.0000
BKK_FS1006	09 Jan 25	Y = 1.0547x + 3.8765	0.9995
BKK_FS1007	10 Jan 25	Y = 1.112x + 1.4085	0.9996
BKK_FS1008	10 Jan 25	Y = 1.1369x + 0.3976	0.9988
BKK_FS1009	09 Jan 25	Y = 0.9987x + 12.063	0.9996
BKK_FS1017	10 Jan 25	Y = 1.0649x + 4.4133	0.9994
BKK_FS1018	10 Jan 25	Y = 1.0108x + 4.3333	0.9999
BKK_FS1019	10 Jan 25	Y = 0.9996x + 12.746	1.0000
BKK_FS1026	10 Jan 25	Y = 1.0808x + 2.8537	0.9990
BKK_FS1027	10 Jan 25	Y = 1.0223x + 4.84	0.9999
BKK_FS1028	10 Jan 25	Y = 1.0011x + 15.808	1.0000
BKK_FS1039	09 Jan 25	Y = 0.9987x + 12.063	0.9996
BKK_FS1040	09 Jan 25	Y = 1.0013x + 3.9257	1.0000
BKK_FS1041	09 Jan 25	Y = 1.0299x + 3.5058	0.9999
BKK_FS1042	09 Jan 25	Y = 1.0058x + 10.903	0.9993
BKK_FS1044	09 Jan 25	Y = 1.1297x + 1.8599	0.9994
PHK_FS0027	10 Jan 25	Y = 1.0823x + 3.8912	1.0000
PHK_FS0028	10 Jan 25	Y = 1.0056x + 8.4067	0.9998
PHK_FS0029	10 Jan 25	Y = 1x + 14.547	1.0000
RYG_FS0195	09 Jan 25	Y = 1.0041x + 8.7581	1.0000
RYG_FS0196	09 Jan 25	Y = 0.9994x + 16.56	1.0000
RYG_FS0197	09 Jan 25	Y = 1.0021x + 13.837	1.0000
RYG_FS0198	09 Jan 25	Y = 0.9975x + 17.805	0.9999
RYG_FS0199	09 Jan 25	Y = 1.0294x + 4.9105	0.9997
RYG_FS0627	09 Jan 25	Y = 1.0235x + 4.83	1.0000
RYG_FS0628	09 Jan 25	Y = 1.0222x + 3.63	0.9999
RYG_FS0654	09 Jan 25	Y = 1.0857x - 0.0238	1.0000
RYG_FS0655	09 Jan 25	Y = 0.9928x + 10.99	1.0000
RYG_FS0656	09 Jan 25	Y = 1.003x + 9.5419	1.0000
RYG_FS0657	09 Jan 25	Y = 1.026x + 3.483	0.9998
RYG_FS0658	09 Jan 25	Y = 1.0173x + 3.57	0.9999
RYG_FS0659	09 Jan 25	Y = 1.0003x + 11.785	1.0000

 ALS Laboratory Group

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

Detector 1

Manufacturer	Agilent Technologies
Name	Mass Spectrometer
Type	Mass Spectrometer
Location	External

Mass Spectrometer 1

Manufacturer	Agilent Technologies
Type	SQ
Name	5977C
Model Number	G7077C
Serial Number	US2307MA35
Firmware Revision	6.00.35
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

Tested Combination1 Front SSL / External SQ
Injection Tower
Name: 7693A
Source: EI - Extractor

Setpoint Status: Pass

Injection Volume on Column: 1.0 uL

	Area Mass 1 Abundance*s	Mass Ratio
RSD:	0.71 %	0.19 %
Agilent Recommended:	<= 5.00	<= 5.00
	Pass	Pass

Overall Mass Ratio Precision Test Status
Pass

Instrument Details

Purpose

This section describes the as found system configuration.

Details

System

System ID	GM-12
Manufacturer	Agilent Technologies
Name	8890
Flow Data Input	Manual Data
Temperature Data Input	Manual Data or Other Data Logging

Tested Combination1

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

Sampler 1

Manufacturer	Agilent Technologies
Type	Injection Tower
Name	7693A
Model Number	G4513A
Serial Number	CN23125102
Firmware Revision	A.11.07
Usage	Sample Injection
Location	Front
Syringe Volume (µL)	10

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:	4 mV			RFPA Voltage:	482 mV
Agilent Recommended:		>= -100	and	<= 100		<= 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

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:	0.72 %	0.01 %
Agilent Recommended:	<= 5.00	<= 1.00
Status:	Pass	Pass

Instrument Detection Limit:	2.41164 fg
Agilent Recommended:	<= 16.82500
Status:	Pass

Overall Instrument Detection Limit Test Status
Pass

Mass Ratio Precision

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:	May 10, 2024
Reason for Signature:	Executed protocol and published this original version of document

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User Name: supasak.nimsongtham
System Id: GM-12
Report Generated by Hostname: 5CG1115HKC
Print Date: May 10, 2024 2:18:57 PM

GM-12 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
May 9, 2024 2:25:19 PM	Audit	SessionCreated	Session	None
May 9, 2024 2:25:19 PM	Start	Configuration	Session	None
May 9, 2024 2:25:19 PM	Audit	Entitlement	Licensing	User is FieldEngineer and does not require an unlock code
May 9, 2024 2:31:20 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] 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]
May 9, 2024 2:31:23 PM	End	Configuration	Session	None
May 9, 2024 2:31:27 PM	Start	Qualification	Session	OQ
May 9, 2024 2:31:27 PM	Start	Execution	CDS Logon Verification - GC - 8890: - Qualitative test.	None
May 9, 2024 2:32:31 PM	End	Execution	CDS Logon Verification - GC - 8890: - Qualitative test	Run Count : 1
May 9, 2024 2:32:35 PM	Start	Execution	System Inspection and Basic Safety and Operation - 8890: - Qualitative Test - No setpoints associated	None

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User Name: supasak.nimsongtham
System Id: GM-12
Report Generated by Hostname: 5CG1115HKC
Print Date: May 10, 2024 2:18:57 PM

GM-12 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
May 9, 2024 2:32:44 PM	End	Execution	System Inspection and Basic Safety and Operation - 8890: - Qualitative Test - No setpoints associated	Run Count : 1
May 9, 2024 2:32:47 PM	Start	Execution	Inlet Pressure Accuracy - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	None
May 9, 2024 2:32:54 PM	End	Execution	Inlet Pressure Accuracy - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	Run Count : 1
May 9, 2024 2:33:05 PM	Audit	AceClosed	Session	None
May 9, 2024 2:33:43 PM	Audit	AceRestarted	Session	None
May 9, 2024 2:33:44 PM	Audit	SessionReloaded	Session	None
May 9, 2024 2:33:45 PM	Start	Qualification	Session	OQ
May 9, 2024 2:33:54 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, 2024 2:34:16 PM	Start	Execution	Mass Ratio Precision - Injection Tower, Front SSL, SQ: - Source: EI - Extractor - L (RSD): <= 5.00%	None
May 9, 2024 2:34:29 PM	Audit	AceClosed	Session	None
May 10, 2024 10:19:05 AM	Audit	AceRestarted	Session	None
May 10, 2024 10:19:06 AM	Audit	SessionReloaded	Session	None
May 10, 2024 10:19:08 AM	Start	Qualification	Session	OQ
May 10, 2024 10:19:09 AM	Start	Execution	Mass Ratio Precision - Injection Tower, Front SSL, SQ: - Source: EI - Extractor - L (RSD): <= 5.00%	None

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User Name: supasak.nimsongtham
System Id: GM-12
Report Generated by Hostname: 5CG1115HKC
Print Date: May 10, 2024 2:18:57 PM

GM-12 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
May 10, 2024 10:20:08 AM	Start	Execution	GC Oven Temperature Accuracy - 8890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
May 10, 2024 10:24:46 AM	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 10, 2024 10:24:48 AM	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 10, 2024 10:24:50 AM	Start	Execution	GC Oven Temperature Accuracy - 8890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
May 10, 2024 10:25:33 AM	Audit	AceClosed	Session	None
May 10, 2024 10:27:35 AM	Audit	AceRestarted	Session	None
May 10, 2024 10:27:38 AM	Audit	SessionReloaded	Session	None
May 10, 2024 10:27:38 AM	Start	Qualification	Session	OQ
May 10, 2024 10:27:38 AM	Start	Execution	GC Oven Temperature Accuracy - 8890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
May 10, 2024 10:28:03 AM	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
May 10, 2024 10:28:05 AM	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

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User Name: supasak.nimsongtham
System Id: GM-12
Report Generated by Hostname: 5CG1115HKC
Print Date: May 10, 2024 2:18:57 PM

GM-12 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
May 10, 2024 10:28:08 AM	Start	Execution	GC Oven Temperature Stability - 8890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	None
May 10, 2024 10:51:26 AM	Audit	Data	GC Oven Temperature Stability - 8890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Manual Data Entry
May 10, 2024 10:51:28 AM	End	Execution	GC Oven Temperature Stability - 8890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Run Count : 1
May 10, 2024 10:51:30 AM	Start	Execution	Log Amp - 5977C SQ: - Source: EI - Extractor	None
May 10, 2024 10:55:40 AM	Audit	AceClosed	Session	None
May 10, 2024 10:57:32 AM	Audit	AceRestarted	Session	None
May 10, 2024 10:57:33 AM	Audit	SessionReloaded	Session	None
May 10, 2024 10:57:35 AM	Start	Qualification	Session	OQ
May 10, 2024 10:57:35 AM	Start	Execution	Log Amp - 5977C SQ: - Source: EI - Extractor	None
May 10, 2024 11:00:05 AM	End	Execution	Log Amp - 5977C SQ: - Source: EI - Extractor	Run Count : 1
May 10, 2024 11:00:07 AM	Start	Execution	RFPA - 5977C SQ: - Source: EI - Extractor	None
May 10, 2024 11:01:19 AM	End	Execution	RFPA - 5977C SQ: - Source: EI - Extractor	Run Count : 1
May 10, 2024 11:01:25 AM	Start	Execution	Tune EI - 5977C SQ: - Source: - EI - Extractor Filament 1 (Qualitative - No setpoints associated)	None
May 10, 2024 11:01:50 AM	End	Execution	Tune EI - 5977C SQ: - Source: - EI - Extractor Filament 1 (Qualitative - No setpoints associated)	Run Count : 1

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User Name: supasak.nimsongtham
System Id: GM-12
Report Generated by Hostname: 5CG1115HKC
Print Date: May 10, 2024 2:18:57 PM

GM-12 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
May 10, 2024 11:01:52 AM	Start	Execution	Tune EI - 5977C SQ: - Source: - EI - Extractor Filament 2 (Qualitative - No setpoints associated)	None
May 10, 2024 11:05:40 AM	End	Execution	Tune EI - 5977C SQ: - Source: - EI - Extractor Filament 2 (Qualitative - No setpoints associated)	Run Count : 1
May 10, 2024 11:05:42 AM	Start	Execution	Scouting Run - Injection Tower, Front SSL, SQ: - Source: - EI - Extractor- Part of GCMS System Preparation	None
May 10, 2024 11:06:10 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 10, 2024 11:17:54 AM	Start	Execution	Scouting Run - Injection Tower, Front SSL, SQ: - Source: - EI - Extractor- Part of GCMS System Preparation	None
May 10, 2024 11:17:58 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 10, 2024 11:18:02 AM	Start	Execution	Mass Ratio Precision - Injection Tower, Front SSL, SQ: - Source: EI - Extractor - L (RSD): <= 5.00%	None
May 10, 2024 11:33:05 AM	Audit	AceClosed	Session	None
May 10, 2024 1:14:06 PM	Audit	AceRestarted	Session	None
May 10, 2024 1:14:09 PM	Audit	SessionReloaded	Session	None

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BKK_EN0126

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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 Yuda K.
APPROVED BY Tanyatorn 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

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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: <= 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: >= -2.0 and <= 0.5

Overall Inlet Pressure Decay Test Status

Pass

Inlet Pressure Accuracy

Name: 7890
Back SSL

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User Name: supasak.simsongtham
Report Generated by Hostname: SCG1115HKC
System Id: GM-12
Print Date: May 10, 2024 2:18:57 PM

GM-12 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
May 10, 2024 1:21:55 PM	Start	Execution	Mass Ratio Precision - Injection Tower, Front SSL, SQ: - Source: EI - Extractor - L (RSD): <= 5.00%	None
May 10, 2024 2:02:45 PM	Audit	Data	Mass Ratio Precision - Injection Tower, Front SSL, SQ: - Source: EI - Extractor - L (RSD): <= 5.00%	Data files Path : D:\GM-12 OQ20240MRP002.D
May 10, 2024 2:02:45 PM	Audit	Data	Mass Ratio Precision - Injection Tower, Front SSL, SQ: - Source: EI - Extractor - L (RSD): <= 5.00%	Data files Path : D:\GM-12 OQ20240MRP003.D
May 10, 2024 2:02:45 PM	Audit	Data	Mass Ratio Precision - Injection Tower, Front SSL, SQ: - Source: EI - Extractor - L (RSD): <= 5.00%	Data files Path : D:\GM-12 OQ20240MRP004.D
May 10, 2024 2:02:45 PM	Audit	Data	Mass Ratio Precision - Injection Tower, Front SSL, SQ: - Source: EI - Extractor - L (RSD): <= 5.00%	Data files Path : D:\GM-12 OQ20240MRP005.D
May 10, 2024 2:02:45 PM	Audit	Data	Mass Ratio Precision - Injection Tower, Front SSL, SQ: - Source: EI - Extractor - L (RSD): <= 5.00%	Data files Path : D:\GM-12 OQ20240MRP006.D
May 10, 2024 2:02:45 PM	Audit	Data	Mass Ratio Precision - Injection Tower, Front SSL, SQ: - Source: EI - Extractor - L (RSD): <= 5.00%	Data files Path : D:\GM-12 OQ20240MRP007.D

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User Name: supasak.simsongtham
Report Generated by Hostname: SCG1115HKC
System Id: GM-12
Print Date: May 10, 2024 2:18:57 PM

GM-12 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
May 10, 2024 1:14:12 PM	Start	Qualification	Session	OQ
May 10, 2024 1:14:12 PM	Start	Execution	Mass Ratio Precision - Injection Tower, Front SSL, SQ: - Source: EI - Extractor - L (RSD): <= 5.00%	None
May 10, 2024 1:15:17 PM	Start	Execution	Scouting Run - Injection Tower, Front SSL, SQ: - Source: - EI - Extractor- Part of GCMS System Preparation	None
May 10, 2024 1:15:49 PM	Audit	Data	Scouting Run - Injection Tower, Front SSL, SQ: - Source: - EI - Extractor- Part of GCMS System Preparation	Data files Path : D:\GM-12 OQ20240ScoutingRun001.D
May 10, 2024 1:15:50 PM	Audit	Reporting	Reintegration	Reintegration Count: 1 – { Integration Type: Injections; BaselineCorrectionMode: Advanced; InitialSlopeSensitivity: 10; InitialPeakWidth: 0.01; InitialAreaReject: 0; InitialHeightReject: 50; Integration: Off at 0; Integration: On at 4; }
May 10, 2024 1:15:57 PM	Audit	Reporting	Reintegration	Reintegration Count: 2 – { Integration Type: Injections; BaselineCorrectionMode: Advanced; InitialSlopeSensitivity: 10; InitialPeakWidth: 0.01; InitialAreaReject: 0; InitialHeightReject: 300; Integration: Off at 0; Integration: On at 4; }

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User Name: supasak.simsongtham
Report Generated by Hostname: SCG1115HKC
System Id: GM-12
Print Date: May 10, 2024 2:18:57 PM

GM-12 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
May 10, 2024 2:03:15 PM	Audit	Reporting	Reintegration	Reintegration Count: 1 – { Integration Type: Injections; BaselineCorrectionMode: Advanced; InitialSlopeSensitivity: 10; InitialPeakWidth: 0.01; InitialAreaReject: 0; InitialHeightReject: 50000; Integration: Off at 0; Integration: On at 2; }
May 10, 2024 2:03:31 PM	End	Execution	Mass Ratio Precision - Injection Tower, Front SSL, SQ: - Source: EI - Extractor - L (RSD): <= 5.00%	Run Count : 1
May 10, 2024 2:03:49 PM	End	Qualification	Session	OQ
May 10, 2024 2:03:49 PM	Start	Reporting	Session	None
May 10, 2024 2:16:42 PM	Audit	Reporting	Session	Report Generated : Certificate
May 10, 2024 2:17:39 PM	Audit	Reporting	Session	Report Generated : Report

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User Name: supasak.simsongtham
Report Generated by Hostname: SCG1115HKC
System Id: GM-12
Print Date: May 10, 2024 2:18:57 PM

GM-12 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
May 10, 2024 1:16:43 PM	Audit	Reporting	Reintegration	Reintegration Count: 1 – { Integration Type: Injections; BaselineCorrectionMode: Advanced; InitialSlopeSensitivity: 10; InitialPeakWidth: 0.01; InitialAreaReject: 0; InitialHeightReject: 200; Integration: Off at 0; Integration: On at 3; }
May 10, 2024 1:16:50 PM	Audit	Reporting	Reintegration	Reintegration Count: 2 – { Integration Type: Injections; BaselineCorrectionMode: Advanced; InitialSlopeSensitivity: 10; InitialPeakWidth: 0.01; InitialAreaReject: 0; InitialHeightReject: 200; Integration: Off at 0; Integration: On at 4; }
May 10, 2024 1:17:02 PM	End	Execution	Instrument Detection Limit - Injection Tower, Front SSL, SQ: - Source: - EI - Extractor - RSD L (Area): <= 5.00% - RSD L (Rat. Time): <= 1.00%	Run Count : 1
May 10, 2024 1:17:09 PM	Start	Execution	Mass Ratio Precision - Injection Tower, Front SSL, SQ: - Source: EI - Extractor - L (RSD): <= 5.00%	None
May 10, 2024 1:21:55 PM	Start	Execution	Mass Ratio Precision - Injection Tower, Front SSL, SQ: - Source: EI - Extractor - L (RSD): <= 5.00%	None

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

	ASTM Noise pA	Drift pA/Hr
	0.05	0.01
Agilent Recommended:	<= 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: <= 3.00 <= 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: >= 300000

Overall Signal to Noise Test Status
Pass

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

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	Drift pA/Hr
	0.05	0.03
Agilent Recommended:	<= 0.10	<= 2.50
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: <= 3.00 <= 1.00

Overall Injection Precision Test Status
Pass

Signal to Noise

Setpoint Status: Pass
Inlet Pressure: Setpoint 25.0 psi Actual 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: <= 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: <= 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: <= 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

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: <= 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: <= 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: <= 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

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

System Id: GC-6_CN11461066
Print Date: October 22, 2024 9:27:05 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 Hoopeying and does not require an unlock code
October 21, 2024 3:22:40 PM	Audit	EcpLoaded	Session	ECP details for primary technique [Gc] - File path: [ProtocolPacks/GcConfigurations/02.03/Gc.02.03.ecpp], ECP File Name: [Gc.02.03.ecp], ECP Name: [AgilentRecommended],Protocol Revision: [Gc.02.03]
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 3:23:39 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 3:23:56 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 9:27:05 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 3:25:28 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: <= 1.3 psi	None
October 21, 2024 3:25:33 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: <= 1.5 psi	None
October 21, 2024 3:26:10 PM	End	Execution	Inlet Pressure Accuracy - Back SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.3 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

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

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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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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	CN15360030
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

User Name: saengpathai.tarak
Report Generated by Hostname: LAPTOP-CQ35KOMV
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 22, 2024 9:01:43 AM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Rel. 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 (Rel. 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 (Rel. 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 (Rel. 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 (Rel. 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 (Rel. 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 (Rel. 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: saengpathai.tarak
Report Generated by Hostname: LAPTOP-CQ35KOMV
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 3:31:59 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 8:55:56 AM	Audit	SessionReloaded	Session	None
October 22, 2024 8:55:02 AM	Start	Qualification	Session	OQ

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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 3:28:50 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 3:28:53 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 3:28:54 PM	Start	Execution	Detector Flow Accuracy - Front FID: - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	None
October 21, 2024 3:37:10 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 3:37:13 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: saengpathai.tarak
Report Generated by Hostname: LAPTOP-CQ35KOMV
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 22, 2024 9:02:54 AM	End	Execution	Signal to Noise - Injection Tower, Front SSL, Front FID: - Detector FID - L: >= 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 9:04:08 AM	Start	Execution	Noise and Drift - Back FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	None
October 22, 2024 9:08:56 AM	Audit	Data	Noise and Drift - Back FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	Data files Path : G:\Data\Back\Back_ND03.D\FID2B.ch
October 22, 2024 9:09:13 AM	End	Execution	Noise and Drift - Back FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 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): <= 3.00% - L (Rel. Time): <= 1.00%	None

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User Name: saengpathai.tarak
Report Generated by Hostname: LAPTOP-CQ35KOMV
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 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 8:57:35 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 (Rel. Time): <= 1.00%	None
October 22, 2024 8:59:00 AM	Audit	Data	DataManager	DataManager was in a data verification state but the user chose to start over

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User Name: saengpathai.tarak
Report Generated by Hostname: LAPTOP-CQ35KOMV
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 3:28:54 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

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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. $T_{weights}$ - T_{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

Test load (nominal): 10 g | 200 g		
	10 g	200 g
1	10.0000 g	200.0000 g
2	10.0000 g	200.0001 g
3	9.9999 g	200.0000 g
4	10.0000 g	200.0000 g
5	10.0000 g	200.0001 g
6	9.9999 g	200.0000 g
7	10.0000 g	200.0000 g
8	10.0000 g	200.0000 g
9	10.0000 g	200.0000 g
10	10.0000 g	200.0001 g
	s = 0.00004 g	s = 0.00005 g

Eccentricity

Test load (nominal):	100 g
Center	100.0000 g
Front left	100.0000 g
Back left	100.0001 g
Back right	99.9999 g
Front right	99.9999 g
Maximum deviation from centric loading indication $\lvert \Delta I_{ecc} \rvert_{max}$ = 0.0001 g	

Error of indication

Test load L	Indication I	Error E	Expansion factor k	Uncertainty $U(E)$	Uncertainty relative $U_{rel}(E)$
0.0100 g	0.0100 g	0.0000 g	2.00	0.00012 g	1.2 %
0.1000 g	0.1000 g	0.0000 g	2.00	0.00013 g	0.13 %
0.5000 g	0.5000 g	0.0000 g	2.00	0.00013 g	0.026 %
1.0000 g	1.0000 g	0.0000 g	2.00	0.00013 g	0.013 %
5.0000 g	5.0000 g	0.0000 g	2.00	0.00013 g	0.0026 %
10.0000 g	10.0000 g	0.0000 g	2.00	0.00013 g	0.0013 %
20.0000 g	20.0000 g	0.0000 g	2.00	0.00014 g	0.00068 %
50.0000 g	50.0000 g	0.0000 g	2.00	0.00015 g	0.00029 %
100.0000 g	100.0001 g	0.0001 g	2.00	0.00018 g	0.00018 %
200.0000 g	200.0000 g	0.0000 g	2.00	0.00028 g	0.00014 %
220.0000 g	220.0000 g	0.0000 g	2.00	0.00032 g	0.00015 %
Maximum error of indication		$\lvert E \rvert_{max}$ = 0.0001 g			

$U_{rel}(E)$ is the quotient of $U(E)$ and test load L. The uncertainty of measurement $U(E)$ is valid only if error E is considered. You will find reference notes on the uncertainty of measurement in use under: Appendix to the calibration certificate | Interpretation of measurement results.
Reference note: The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the documented expansion factor k. Reference to a common document: the European Calibration Guideline EURAMET cg-18, V4.0. There is a 95 % probability that the value of the measurand will be in the assigned value range.

End of calibration certificate

SARTORIUS

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

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User Name: saengsithai.lerak
Report Generated by Hostname: LAPTOP-CQ35KO8V
System Id: GC-6_CN11461066
Print Date: October 22, 2024 9:27:56 AM

2024_ALS_GC-6_CN11461066_DQHW 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 9:11:43 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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Date: October 22, 2024 9:27:05 AM
System ID: GC-6_CN11461066

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Interpretation of measurement results | Appendix to the calibration certificate

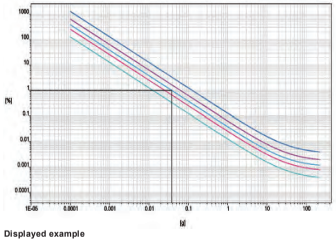
Uncertainty of measurement in use

Device adjusted before measurement	Yes
Temperature deviation considered	1.5 K (isoCAL active)
Temperature coefficient considered	1 · 10⁻⁶/K
Uncertainty of the weighing result $U_{gi}(W)$	$U_{gi}(W) = 0.00013\ g + 3.42 \cdot 10^{-6} \cdot R$

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 $U_{gi}(W)$	Uncertainty relative $U_{gi}(W)_{rel}$
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



Safety factor
10
5
3
2
1

Displayed example

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

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

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Agilent CrossLab Compliance Services

User Name: saengsithai.lerak
Report Generated by Hostname: LAPTOP-CQ35KO8V
System Id: GC-6_CN11461066
Print Date: October 22, 2024 9:27:56 AM

2024_ALS_GC-6_CN11461066_DQHW 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 9:25:58 AM	Audit	Reporting	Session	Report Generated : Report

Page 10 / 10

Date: October 22, 2024 9:27:05 AM
System ID: GC-6_CN11461066

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

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NSC-TISI-TIS 17025 CALIBRATION 0394

Cert. No. : ACL24282
Job No. : VC67AC0148
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

Condition of this result of calibration :

1. Reference Standard Instruments :

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

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.
3. This certificate is traceable to the international system of unit maintained at :
   3.1 National Institute of Metrology (Thailand),
   3.2 Thailand Institute of Scientific and Technological Research (TISTR).

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INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE:
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AMPHOE BANG PHLI SAMUT PRAKAN PROVINCE 10540 THAILAND
TEL.: 0600-2116-7880-1 FAX: 0600-2116-7140

Certificate No : 25-ACT-042
Request No : Req-2025-0604

Decision Rule for Statements of Conformity

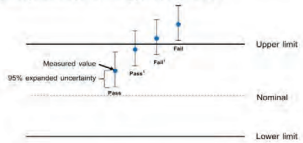
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09/2019, Guidelines on the Reporting of Compliance with Specification as following Fig. and statements.

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

Pass[1] – The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.

Fail[1] – The measurement result was out of the limit. However, a portion of the expanded uncertainty of measurement at 95% is within the limit.

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



End of Calibration

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

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TEL.: 0600-2116-7880-1 FAX: 0600-2116-7140

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-ACT-042
Request No : Req-2025-0604

Unit Under Calibration Details

Measurement item : Acoustic Calibrator
Manufacturer : RION
Model : NC-75
Serial Number : 35002736
ID : RYG_FS0496

Class : 1
Range : 94 dB / 1000 Hz
Instrument Status : Used

Calibration Environment and Details

Temperature : (23 ±2 °C)
Humidity : (50 ± 20 %RH)
Barometric Pressure : (1013 ±10.0 hPa)
Received Date : 6 March 2025
Calibration Date : 19 March 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..... 19/03/26

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

Traceability : This certificate providoes 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 : 19 March 2025

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

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CALIBRATION LABORATORY

Cert. No. : ACL24282
Job No. : VC67AC0148
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 conirol	0.2	0.3
9. Tone burst response	0.2	0.3
10. Peak C sound level	0.2	0.35
11. Overload indication	0.2	0.25
12. High level stability	0.1	0.1

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CALIBRATION LABORATORY
451-451/1 Sirinthorn Road, Bangbumru, Bangplud, Bangkok, 10700 Thailand
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NSC-TISI-TIS 17025 CALIBRATION 0394

Cert. No. : ACL24282
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 01122567 / 143473 / 22605
ID No.: RYG_FS0016

Condition As Found : GOOD

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

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

REVIEW BY .....
APPROVED BY .....
NEXT CAL. DATE 18/9/25

Received Date : 04 SEPTEMBER 2024
Calibration Date : 19 SEPTEMBER 2024
Date of Issue : 20 SEPTEMBER 2024

Calibrated by : Nathakorn Pisutpaisan

Approved by : (Thanakul Petchurai)

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

INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE:
7/139 MOO 13, SOI SUNTISNAKORN 11 TAMBON BANG KAPO,
AMPHOE BANG PHLI SAMUT PRAKAN PROVINCE 10540 THAILAND
TEL.: 0600-2116-7880-1 FAX: 0600-2116-7140

Certificate No : 25-ACT-042
Request No : Req-2025-0604

Sound pressure level — **Calibration Results :** Without Adjustment

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

Frequency of Sound pressure level

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

Note :

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

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

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

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Cert. No. : ACL24282
Job No. : VC67AC0148
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	136.0	-0.4	±3.0

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

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.6	89.6	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 lavel of confidence of approximately 95 %

End of Calibration Certificate

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Cert. No. : ACL24282
Job No. : VC67AC0148
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.1	0.1	± 1.1
135.0	135.1	0.1	± 1.1
134.0	134.1	0.1	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.1	0.1	± 1.1
114.0	114.1	0.1	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.1	0.1	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.0	0.0	± 1.1
26.0	26.0	0.0	± 1.1
25.0	24.8	-0.2	± 1.1

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Cert. No. : ACL24282
Job No. : VC67AC0148
Page : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
15.4

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

Frequency Weighting	Weighting (dB)
A - weight	12.0
C - weight	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	0.1	0.1	0.1	± 1.5
1000	-0.1	-0.1	-0.1	± 1.0
8000	-2.4	-2.4	-2.4	±5.0

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NSC-TISI-TIS 17025 CALIBRATION 0394

Cert. No. : ACL25086
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 01122578 / 143842 / 74027
ID No.: RYG_FS0017

Condition As Found : GOOD

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

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

Received Date : 07 JANUARY 2025
Calibration Date : 27 JANUARY 2025
Date of Issue : 28 JANUARY 2025

REVIEW BY .....
APPROVED BY .....
NEXT CAL DATE 27 /01/ 2026

Calibrated by : Nathakorn Pisutpaisan

Approved by : (Thanakul Petchurai)

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

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Cert. No. : ACL24282
Job No. : VC67AC0148
Pages : 7 of 8

8. Level linearity including the level range control

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

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

9. Tone burst response

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

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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NSC-TISI-TIS 17025 CALIBRATION 0394

Cert. No. : ACL24282
Job No. : VC67AC0148
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

Cert. No. : ACL25086
Job No. : VC68AC0059
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

Condition of this result of calibration :

1. Reference Standard Instruments :

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

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.
3. This certificate is traceable to the international system of unit maintained at :
   3.1 National Institute of Metrology (Thailand).
   3.2 Thailand Institute of Scientific and Technological Research (TISTR).

Cert. No. : ACL25086
Job No. : VC68AC0059
Page : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
17.6

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

Frequency Weighting	Weighting (dB)
A - weight	11.6
C - weight	17.5
Flat	23.3

3. Acoustical signal tests of frequency weightings

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

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

Cert. No. : ACL25086
Job No. : VC68AC0059
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

Cert. No. : ACL25086
Job No. : VC68AC0059
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	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	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.1	0.1	± 1.1
26.0	26.1	0.1	± 1.1
25.0	25.2	0.2	± 1.1

Cert. No. : ACL25086
Job No. : VC68AC0059
Pages : 7 of 8

8. Level linearity including the level range control

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

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

9. Tone burst response

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

Cert. No. : ACL25086
Job No. : VC68AC0059
Pages : 3 of 8

Summary of Measurement Result :

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

Cert. No. : ACL25071
Job No. : VC68AC0059
Page : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.8

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

Frequency Weighting	Weighting (dB)
A - weight	12.0
C - weight	18.3
Flat	24.0

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.3	0.3	0.3	± 1.5
1000	0.1	0.1	0.1	± 1.0
8000	1.1	1.1	1.1	±5.0

Cert. No. : ACL25071
Job No. : VC68AC0059
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

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

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.
3. This certificate is traceable to the international system of unit maintained at :
   3.1 National Institute of Metrology (Thailand).
   3.2 Thailand Institute of Scientific and Technological Research (TISTR).

Cert. No. : ACL25086
Job No. : VC68AC0059
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 lavel of confidence of approximately 95 %

End of Calibration Certificate

Cert. No. : ACL25071
Job No. : VC68AC0059
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

Cert. No. : ACL25071
Job No. : VC68AC0059
Pages : 3 of 8

Summary of Measurement Result :

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

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

Cert. No. : ACL25071
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 01122579 / 172172 / 74022
ID No.: RYG_FS0018

Condition As Found : GOOD

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

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

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

REVIEW BY .....
APPROVED BY .....
NEXT CAL DATE ..... 21/ 01/ 2026 .....

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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NSC-TISI-TIS 17025 CALIBRATION 0394

Cert. No. : ACC24054
Job No. : VC68AC0015
Pages : 2 of 3

Calibration Procedure : CP-AC-03

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

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

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.
3. This certificate is traceable to the international system of unit maintained at :
   3.1 National Institute of Metrology (Thailand).
   3.2 Thailand Institute of Scientific and Technological Research (TISTR).

T. Petch.

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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NSC-TISI-TIS 17025 CALIBRATION 0394

Cert. No. : ACC24054
Job No. : VC68AC0015
Pages : 3 of 3

Result of calibration :

1. Sound pressure level

Specified sound pressure level (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (dB)	Acceptance limit (dB)
94	94.09	0.09	0.14	0.40

2. Frequency

Specified Frequency (Hz)	Measured value (Hz)	Deviated value (%)	Uncertainty (%)	Acceptance limit (%)
1000	1001.5	0.1	0.1	1.0

3. Total distortion

Measured value (%)	Uncertainty (%)	Acceptance limit (%)
1.55	0.10	3.0

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

End of Calibration Certificate

T. Petch.

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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NSC-TISI-TIS 17025 CALIBRATION 0394

Cert. No. : ACC24054
Pages : 1 of 3

Calibration Certificate

Equipment : SOUND CALIBRATOR
Manufacturer : RION
Model : NC-74
Serial No.: 34178123
ID No.: RYG_FS0215

REVIEW BY .....
APPROVED BY .....
NEXT CAL DATE.....22-Oct-25.....

Condition As Found : GOOD

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

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

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

Calibrated by : Nathakorn Pisutpaisan

Approved by : T. Petch.
(Thanakul Petchurai)

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

Cert. No. : ACL25071
Job No. : VC68AC0059
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 lavel of confidence of approximately 95 %

End of Calibration Certificate

T. Petch.

Cert. No. : ACL25071
Job No. : VC68AC0059
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	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	28.9	-0.1	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.0	0.0	± 1.1
26.0	26.0	0.0	± 1.1
25.0	25.1	0.1	± 1.1

T. Petch.

Cert. No. : ACL25071
Job No. : VC68AC0059
Pages : 7 of 8

8. Level linearity including the level range control

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

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

9. Tone burst response

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

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

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

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Summary of Measurement Result :

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

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Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 01222716 / 143832 / 22763
ID No.: RYG_FS0020

Condition As Found : GOOD

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

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

VERIFIED BY Monkorn P
APPROVED BY
EXPIRY DATE 21/1/26

Received Date : 11 JANUARY 2024
Calibration Date : 22-24 JANUARY 2024
Date of Issue : 24 JANUARY 2024

Calibrated by : Nathakorn Pisutpaisan

Approved by : (Thanakul Petchurai)

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

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7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	53.9	-0.1	± 1.1
49.0	49.0	0.0	± 1.1
44.0	43.9	-0.1	± 1.1
39.0	38.9	-0.1	± 1.1
34.0	33.9	-0.1	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.9	-0.1	± 1.1

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

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.4

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

Frequency Weighting	Measured value (dB)
A - weight	11.6
C - weight	17.7
Flat	23.6

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.5	0.5	0.5	± 1.5
1000	0.1	0.1	0.1	± 1.0
8000	-0.7	-0.6	-0.6	±5.0

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

Calibration Procedure : CP-AC-01

Calibration Method :

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL_BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL_BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL_BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAI	34560495	AA-3002-23	14-FEB-24

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.
3. This certificate is traceable to the international system of unit maintained at :
   3.1 National Institute of Metrology (Thailand).
   3.2 Thailand Institute of Scientific and Technological Research (TISTR).

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451-451/1 Sirinthorn Road, Bangbumru, Bangplud, Bangkok, 10700 Thailand
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NSC-TISI-TIS 17025 CALIBRATION 0394

Cert. No. : ACL24090
Job No. : VC67AC0058
Pages : 3 of 8

Summary of Measurement Result :

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

T. Petch.

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

SITHIPORN associates IAC-MRA
NSC-TISI-TIS 17025 CALIBRATION 0394

Cert. No. : ACL24090
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00233183 / 144835 / 23230
ID No.: RYG_FS0024

Condition As Found : GOOD

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

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

REVIEWED BY Nathakorn P.
APPROVED BY
TECHNICAL DATE 24/1/24

Received Date : 19 JANUARY 2024
Calibration Date : 25-26 JANUARY 2024
Date of Issue : 29 JANUARY 2024

Calibrated by : Nathakorn Pisutpaisan

Approved by : T. Petch.
(Thanakul Petchurai)

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CALIBRATION LABORATORY
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Tel. +66 2433 8331 Email : calibration@sithiphorn.com

SITHIPORN associates
NSC-TISI-TIS 17025 CALIBRATION 0394

Cert. No. : ACL24075
Job No. : VC67AC0054
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lcpeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	135.3	-1.1	±3.0

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

T. Petch.

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

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NSC-TISI-TIS 17025 CALIBRATION 0394

Cert. No. : ACL24090
Job No. : VC67AC0058
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
18.3

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

Frequency Weighting	Measured value (dB)
A - weight	14.2
C - weight	20.0
Flat	25.6

3. Acoustical signal tests of frequency weightings

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

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

T. Petch.

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

SITHIPORN associates
NSC-TISI-TIS 17025 CALIBRATION 0394

Cert. No. : ACL24090
Job No. : VC67AC0058
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL.BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL.BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL.BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAI	34560495	AA-3002-23	14-FEB-24

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.
3. This certificate is traceable to the international system of unit maintained at :
   3.1 National Institute of Metrology (Thailand).
   3.2 Thailand Institute of Scientific and Technological Research (TISTR).

T. Petch.

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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NSC-TISI-TIS 17025 CALIBRATION 0394

Cert. No. : ACL24075
Job No. : VC67AC0054
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.7	89.5	-0.2	±1.5

12. High level stability

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

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

End of Calibration Certificate

T. Petch.

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00233184 / 144837 / 23232
ID No.: RYG_FS0025

Condition As Found : GOOD

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

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

Received Date : 19 JANUARY 2024
Calibration Date : 25-26 JANUARY 2024
Date of Issue : 29 JANUARY 2024

VIEW BY Monalom P
APPROVED BY
DATE 24/1/25

Calibrated by : Nathakorn Pisutpaisan

Approved by : (Thanakul Petchurai)

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8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lcpeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	135.7	-0.7	±3.0

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

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

Calibration Procedure : CP-AC-01

Calibration Method :

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL.BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL.BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL.BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAI	34560495	AA-3002-23	14-FEB-24

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.
3. This certificate is traceable to the international system of unit maintained at :
   3.1 National Institute of Metrology (Thailand).
   3.2 Thailand Institute of Scientific and Technological Research (TISTR).

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

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	74.1	0.1	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.1	0.1	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.1	0.1	± 1.1
30.0	30.1	0.1	± 1.1
29.0	29.2	0.2	± 1.1
28.0	28.3	0.3	± 1.1
27.0	27.3	0.3	± 1.1
26.0	26.4	0.4	± 1.1
25.0	25.4	0.4	± 1.1

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8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.1	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

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	135.6	-0.8	±3.0

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

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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. : ACL24091
Job No. : VC67AC0058
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

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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. : ACL24091
Job No. : VC67AC0058
Pages : 3 of 8

Summary of Measurement Result :

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

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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. : ACL24091
Job No. : VC67AC0058
Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

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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. : ACL24091
Job No. : VC67AC0058
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	132.9	-0.1	± 1.1
132.0	131.9	-0.1	± 1.1
131.0	130.9	-0.1	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.1	0.1	± 1.1
27.0	27.0	0.0	± 1.1
26.0	26.1	0.1	± 1.1
25.0	25.1	0.1	± 1.1

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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. : ACL24091
Job No. : VC67AC0058
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.6

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

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

3. Acoustical signal tests of frequency weightings

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

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

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Cert. No. : ACL24076
Job No. : VC67AC0054
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00734221 / 157777 / 22653
ID No.: RYG_FS0027

Condition As Found : GOOD

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

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

REVIEW BY Nitnakorn P.
APPROVED BY
NEXT CAL DATE 21/1/26

Received Date : 11 JANUARY 2024
Calibration Date : 22-24 JANUARY 2024
Date of Issue : 24 JANUARY 2024

Calibrated by : Nathakorn Pissatpaisan

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 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. : ACL24076
Job No. : VC67AC0054
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL_BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL_BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL_BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAI	34560495	AA-3002-23	14-FEB-24

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.
3. This certificate is traceable to the international system of unit maintained at :
   3.1 National Institute of Metrology (Thailand).
   3.2 Thailand Institute of Scientific and Technological Research (TISTR).

T. Petch

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. : ACL24076
Job No. : VC67AC0054
Pages : 3 of 8

Summary of Measurement Result :

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

T. Petch

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. : ACL24076
Job No. : VC67AC0054
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.4

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

Frequency Weighting	Measured value (dB)
A - weight	12.6
C - weight	18.9
Flat	24.7

3. Acoustical signal tests of frequency weightings

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

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

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CALIBRATION LABORATORY
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Cert. No. : ACL24076
Job No. : VC67AC0054
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

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. : ACL24076
Job No. : VC67AC0054
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.1	0.1	± 1.1
136.0	136.1	0.1	± 1.1
135.0	135.1	0.1	± 1.1
134.0	134.1	0.1	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.1	0.1	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.1	0.1	± 1.1
114.0	114.1	0.1	± 1.1
109.0	109.0	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	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.9	-0.1	± 1.1

T. Petch

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

Summary of Measurement Result :

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

T. Petch.

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. : ACL24228
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00734223 / 169439 / 72460
ID No.: RYG_FS0029

Condition As Found : GOOD

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

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

REVIEW BY Nattakorn P.
APPROVED BY
NEXT CAL. DATE 11/14/25

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

Calibrated by : Nathakorn Pisutpaisan

Approved by : T. Petch.
(Thanakul Petchurai)

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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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NSC-TISI-TIS 17025 CALIBRATION 0394

Cert. No. : ACL24076
Job No. : VC67AC0054
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lcpeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	136.0	-0.4	±3.0

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

T. Petch

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

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.6

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

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

3. Acoustical signal tests of frequency weightings

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

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

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

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

Calibration Procedure : CP-AC-01

Calibration Method :

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

Condition of this result of calibration :

1. Reference Standard Instruments :

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

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

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Cert. No. : ACL24076
Job No. : VC67AC0054
Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

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CALIBRATION LABORATORY
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NSC-TISI-TIS 17025 CALIBRATION 0394

Cert. No. : ACL24266
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00734218 / 146937 / 34368
ID No.: RYG_FS0031

Condition As Found : GOOD

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

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

REVIEW BY Nattakorn P.
APPROVED BY
NEXT CAL. DATE 30/8/25

Received Date : 09 AUGUST 2024
Calibration Date : 30 AUGUST 2024
Date of Issue : 03 SEPTEMBER 2024

Calibrated by : Nathakorn Pisutpaisan

Approved by : T. Petch.
(Thanakul Petchurai)

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NSC-TISI-TIS 17025 CALIBRATION 0394

Cert. No. : ACL24266
Job No. : VC67AC0140
Pages : 2 of 8

Calibration Procedure : CP-AC-01

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

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

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

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.
3. This certificate is traceable to the international system of unit maintained at :
   3.1 National Institute of Metrology (Thailand),
   3.2 Thailand Institute of Scientific and Technological Research (TISTR).

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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. : ACL24228
Job No. : VC67AC0127
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lcpeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	135.3	-1.1	±3.0

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

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CALIBRATION LABORATORY
451-451/1 Sirinthorn Road, Bangbumru, Bangplud, Bangkok, 10700 Thailand
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Cert. No. : ACL24228
Job No. : VC67AC0127
Pages : 5 of 8

4. Electrical signal tests of frequency weightings
Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

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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. : ACL24228
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Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

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

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Pages : 6 of 8

7. Level linearity on the reference level range

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

T. Petch.

Cert. No. : ACL24266
Job No. : VC67AC0140
Pages : 7 of 8

8. Level linearity including the level range control

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

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	30.0	29.8	-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	128.1	0.1	±1.0

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451-451/1 Sirinthorn Road, Bangbumru, Bangplud, Bangkok, 10700 Thailand
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Cert. No. : ACL24266
Job No. : VC67AC0140
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

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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. : ACL24266
Job No. : VC67AC0140
Pages : 3 of 8

Summary of Measurement Result :

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

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Cert. No. : ACL24266
Job No. : VC67AC0140
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	136.4	0.0	±3.0

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

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

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Cert. No. : ACL24266
Job No. : VC67AC0140
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.1	0.1	± 1.1
84.0	84.1	0.1	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.1	0.1	± 1.1
69.0	69.1	0.1	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.1	0.1	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.1	0.1	± 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	25.1	0.1	± 1.1

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451-451/1 Sirinthorn Road, Bangbumru, Bangplud, Bangkok, 10700 Thailand
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SITHIPORN associates
NSC-TISI-TIS 17025 CALIBRATION 0394

Cert. No. : ACL24266
Job No. : VC67AC0140
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)
19.5

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

Frequency Weighting	Weighting (dB)
A - weight	11.6
C - weight	17.6
Flat	23.3

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.5	0.6	0.6	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-1.1	-1.1	-1.1	±5.0

Cert. No. : ACL24283
Job No. : VC67AC0148
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	0.1	0.1	0.0	±1.5
250	0.1	0.0	0.0	±1.5
500	0.0	0.1	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	0.1	±2.0
4000	0.0	0.1	0.1	±3.0
8000	0.1	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

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451-451/1 Sirinthorn Road, Bangbumru, Bangplud, Bangkok, 10700 Thailand
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Cert. No. : ACL24283
Job No. : VC67AC0148
Pages : 3 of 8

Summary of Measurement Result :

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

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Tel. +66 2433 8331 Email : calibration@sithiphorn.com
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Cert. No. : ACL24283
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00472127 / 169440 / 72461
ID No.: RYG_FS0302

Condition As Found : GOOD

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

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

Received Date : 04 SEPTEMBER 2024
Calibration Date : 19 SEPTEMBER 2024
Date of Issue : 20 SEPTEMBER 2024

REVIEW BY
APPROVED BY
NEXT CAL. DATE 19/9/25

Calibrated by : Nathakorn Pisutpaisan

Approved by : (Thanakul Petchurai)

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CALIBRATION LABORATORY
451-451/1 Sirinthorn Road, Bangbumru, Bangplud, Bangkok, 10700 Thailand
Tel. +66 2433 8331 Email : calibration@sithiphorn.com
SITHIPORN associates
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Cert. No. : ACL24283
Job No. : VC67AC0148
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	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.1	0.1	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	33.9	-0.1	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.9	-0.1	± 1.1

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451-451/1 Sirinthorn Road, Bangbumru, Bangplud, Bangkok, 10700 Thailand
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Cert. No. : ACL24283
Job No. : VC67AC0148
Page : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
17.5

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	18.2
Flat	24.1

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.1	0.2	0.2	± 1.5
1000	-0.2	-0.2	-0.2	± 1.0
8000	-1.2	-1.1	-1.1	±5.0

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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. : ACL24283
Job No. : VC67AC0148
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

Condition of this result of calibration :

1. Reference Standard Instruments :

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

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.
3. This certificate is traceable to the international system of unit maintained at :
   3.1 National Institute of Metrology (Thailand),
   3.2 Thailand Institute of Scientific and Technological Research (TISTR).

Cert. No. : ACL24260
Job No. : VC67AC0140
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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CALIBRATION LABORATORY
451-451/1 Sirinthorn Road, Bangbumru, Bangplud, Bangkok, 10700 Thailand
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Cert. No. : ACL24260
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00472130 / 169816 / 72464
ID No.: RYG_FS0303

Condition As Found : GOOD

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

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

REVIEW BY Nathakorn P.
APPROVED BY
NEXT CAL. DATE 23/8/26

Received Date : 09 AUGUST 2024
Calibration Date : 23 AUGUST 2024
Date of Issue : 26 AUGUST 2024

Calibrated by : Nathakorn Pisutpaisan

Approved by : T. Petch.
(Thanakul Petchurai)

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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. : ACL24283
Job No. : VC67AC0148
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	30.0	0.0	±1.1

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	116.9	-0.1	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	107.9	-0.1	1.5 ; -5.0
	200	800	127.6	127.5	-0.1	±1.0
SEL	0.25	1	99.0	98.8	-0.2	1.5 ; -5.0
	2	8	108.0	107.9	-0.1	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

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CALIBRATION LABORATORY
451-451/1 Sirinthorn Road, Bangbumru, Bangplud, Bangkok, 10700 Thailand
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Cert. No. : ACL24260
Job No. : VC67AC0140
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)
14.50000003

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

Frequency Weighting	Weighting (dB)
A - weight	7.8
C - weight	14.8
Flat	20.5

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	1.3	1.4	1.4	± 1.5
1000	0.1	0.1	0.1	± 1.0
8000	-4.1	-4.0	-4.0	±5.0

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CALIBRATION LABORATORY
451-451/1 Sirinthorn Road, Bangbumru, Bangplud, Bangkok, 10700 Thailand
Tel. +66 2433 8331 Email : calibration@sithiphorn.com
SITHIPORN associates
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Cert. No. : ACL24260
Job No. : VC67AC0140
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

Condition of this result of calibration :

1. Reference Standard Instruments :

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

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.
3. This certificate is traceable to the international system of unit maintained at :
   3.1 National Institute of Metrology (Thailand).
   3.2 Thailand Institute of Scientific and Technological Research (TISTR).

T. Petch.

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY
451-451/1 Sirinthorn Road, Bangbumru, Bangplud, Bangkok, 10700 Thailand
Tel. +66 2433 8331 Email : calibration@sithiphorn.com
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NSC-TISI-TIS 17025 CALIBRATION 0394

Cert. No. : ACL24283
Job No. : VC67AC0148
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	135.8	-0.6	±3.0

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

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.7	89.7	0.0	±1.5

12. High level stability

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

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

End of Calibration Certificate

T. Petch.

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

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NSC-TISI-TIS 17025 CALIBRATION 0394

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00873057 / 171591 / 73333
ID No.: RYG_FS0381

Condition As Found : GOOD

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

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

REVIEW BY
APPROVED BY
NEXT CAL. DATE 9/10/25

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

Calibrated by : Nathakorn Pisutpaisan

Approved by : (Thanakul Petchurai)

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

Calibration Procedure : CP-AC-01

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

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

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

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.
3. This certificate is traceable to the international system of unit maintained at :
   3.1 National Institute of Metrology (Thailand).
   3.2 Thailand Institute of Scientific and Technological Research (TISTR).

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

8. Level linearity including the level range control

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

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

9. Tone burst response

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

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

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	135.2	-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

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

4. Electrical signal tests of frequency weightings
Weighting network response with relative to 1 kHz.

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

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

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

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7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	135.9	-0.1	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	132.9	-0.1	± 1.1
132.0	131.9	-0.1	± 1.1
131.0	130.9	-0.1	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.1	0.1	± 1.1
27.0	27.1	0.1	± 1.1
26.0	26.1	0.1	± 1.1
25.0	25.0	0.0	± 1.1

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NSC-TISI-TIS 17025 CALIBRATION 0394

Cert. No. : ACL24304
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

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NSC-TISI-TIS 17025 CALIBRATION 0394

Cert. No. : ACL24304
Job No. : VC67AC0164
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
16.7

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

Frequency Weighting	Weighting (dB)
A - weight	13.4
C - weight	19.3
Flat	25.0

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.3	0.4	0.4	± 1.5
1000	0.1	0.1	0.1	± 1.0
8000	1.1	1.2	1.2	±5.0

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NSC-TISI-TIS 17025 CALIBRATION 0394

Cert. No. : ACL24304
Job No. : VC67AC0164
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	0.0	0.0	±2.0
125	0.1	0.1	0.1	±1.5
250	0.1	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	94.1	0.1	± 0.3

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Cert. No. : ACL24304
Job No. : VC67AC0164
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.1	0.1	± 1.1
29.0	29.0	0.0	± 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

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Job No. : VC67AC0164
Pages : 7 of 8

8. Level linearity including the level range control

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

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

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.1	0.1	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.1	0.1	±1.0

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10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lepeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	135.9	-0.5	±3.0

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

Cert. No. : ACL24034
Job No. : VC67AC0052
Pages : 1 of 8

Calibration Certificate

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

Condition As Found : GOOD

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

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

REVIEW BY Nongkorn P.
APPROVED BY
NEXT CAL DATE 11/1/25

Received Date : 05 JANUARY 2024
Calibration Date : 12-15 JANUARY 2024
Date of Issue : 16 JANUARY 2024

Calibrated by : Nathakom Pisutpaisan

Approved by : T. Petch.
(Thanakul Petchurai)

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

Cert. No. : ACL24034
Job No. : VC67AC0052
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL_BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL_BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL_BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAI	34560495	AA-3002-23	14-FEB-24

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.
3. This certificate is traceable to the international system of unit maintained at :
   3.1 National Institute of Metrology (Thailand).
   3.2 Thailand Institute of Scientific and Technological Research (TISTR).

T. Petch.

Cert. No. : ACL24034
Job No. : VC67AC0052
Pages : 3 of 8

Summary of Measurement Result :

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

T. Petch.

Cert. No. : ACL24034
Job No. : VC67AC0052
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.6

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

Frequency Weighting	Measured value (dB)
A - weight	10.8
C - weight	17.4
Flat	23.3

3. Acoustical signal tests of frequency weightings

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

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

T. Petch.

Cert. No. : ACL24034
Job No. : VC67AC0052
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

T. Petch.

Cert. No. : ACL24034
Job No. : VC67AC0052
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	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.0	0.0	± 1.1
26.0	26.1	0.1	± 1.1
25.0	24.9	-0.1	± 1.1

T. Petch.

Certificate No : 25-ACT-010

Request No : Req-2025-0091

Decision Rule for Statements of Conformity

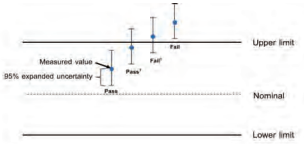
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09/2019, Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

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

Pass[1] = The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.

Fail[1] = 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 was outside the limit.



End of Calibration

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-ACT-010

Request No : Req-2025-0091

Unit Under Calibration Details

Measurement item : Acoustic Calibrator

Manufacturer : RION

Model : NC-74

Serial Number : 34178121

ID : RYG_FS0213

Class : 1

Range : 94 dB / 1000 Hz

Instrument Status : Used

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

Calibration Environment and Details

Temperature : (23 ±2 °C)

Humidity : (50 ± 20 %RH)

Barometric Pressure : (1013 ± 10.0 hPa)

Received Date : 15 January 2025

Calibration Date : 16 January 2025

Location of Calibration : LAB 1 Acoustic

Calibration Procedure : In-house method CP-ACT-02 based on IEC 60942:2017 Electroacoustics - Sound calibrators

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Sound Calibrator	SV 35A	58079	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

Cert. No. : ACL24304
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00873057 / 171591 / 73333
ID No.: RYG_FS0381

Condition As Found : GOOD

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

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

REVIEW BY .....
APPROVED BY .....
NEXT CAL. DATE 9/10/24

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

Calibrated by : Nathakorn Pisutpaisan

Approved by : (Thanakul Petchurai)

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

Certificate No : 25-ACT-010

Request No : Req-2025-0091

Sound pressure level — **Calibration Results :** Without Adjustment

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

Frequency of Sound pressure level

Calibration Range (Hz)	Without Adjustment Measured (Hz)	Without Adjustment Deviated	Adjustment Measured (Hz)	Adjustment Deviated	Uncertainty (± %)	Acceptance limit Class 1 (± %)	Result
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 Measured (%)	Adjustment Measured (%)	Uncertainty (± %)	Acceptance limit Class 1 (± %)	Result
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

Cert. No. : ACL24034
Job No. : VC67AC0052
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.1	0.1	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.1	0.1	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lcpeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	135.5	-0.9	±3.0

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

Cert. No. : ACL24034
Job No. : VC67AC0052
Pages : 8 of 8

11. Overload indication

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

Cert. No. : ACL24304
Job No. : VC67AC0164
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

Condition of this result of calibration :

1. Reference Standard Instruments :

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

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.
3. This certificate is traceable to the international system of unit maintained at :
   3.1 National Institute of Metrology (Thailand).
   3.2 Thailand Institute of Scientific and Technological Research (TISTR).

Cert. No. : ACL24304
Job No. : VC67AC0164
Page : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
16.7

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

Frequency Weighting	Weighting (dB)
A - weight	13.4
C - weight	19.3
Flat	25.0

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.3	0.4	0.4	± 1.5
1000	0.1	0.1	0.1	± 1.0
8000	1.1	1.2	1.2	±5.0

Cert. No. : ACL24304
Job No. : VC67AC0164
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	0.0	0.0	±2.0
125	0.1	0.1	0.1	±1.5
250	0.1	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	94.1	0.1	± 0.3

Cert. No. : ACL24304
Job No. : VC67AC0164
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.1	0.1	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.1	0.1	± 1.1
27.0	27.1	0.1	± 1.1
26.0	26.2	0.2	± 1.1
25.0	25.2	0.2	± 1.1

Cert. No. : ACL24304
Job No. : VC67AC0164
Pages : 7 of 8

8. Level linearity including the level range control

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

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

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.1	0.1	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.1	0.1	±1.0

Cert. No. : ACL24304
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

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

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
16.1

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

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

3. Acoustical signal tests of frequency weightings

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

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

T. Petch.

Cert. No. : ACL24305
Job No. : VC67AC0164
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

Condition of this result of calibration :

1. Reference Standard Instruments :

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

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.
3. This certificate is traceable to the international system of unit maintained at :
   3.1 National Institute of Metrology (Thailand).
   3.2 Thailand Institute of Scientific and Technological Research (TISTR).

T. Petch.

Cert. No. : ACL24304
Job No. : VC67AC0164
Pages : 8 of 8

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lepeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	135.9	-0.5	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.1	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 lavel of confidence of approximately 95 %

End of Calibration Certificate

T. Petch.

Cert. No. : ACL24305
Job No. : VC67AC0164
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

T. Petch.

Cert. No. : ACL24305
Job No. : VC67AC0164
Pages : 3 of 8

Summary of Measurement Result :

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

T. Petch.

Cert. No. : ACL24305
Pages : 1 of 8

Calibration Certificate

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

Condition As Found : GOOD

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

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

REVIEW BY Nathakorn P.
APPROVED BY
NEXT CAL. DATE 9/10/24

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

Calibrated by : Nathakorn Pisutpaisan

Approved by : T. Petch.
(Thanakul Petchurai)

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

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

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Cert. No. : ACL24305
Job No. : VC67AC0164

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.1	0.1	± 1.1
27.0	27.2	0.2	± 1.1
26.0	26.2	0.2	± 1.1
25.0	25.2	0.2	± 1.1

T. Retch

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

Cert. No. : ACL24305
Job No. : VC67AC0164

8. Level linearity including the level range control

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

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

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.1	0.1	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.1	0.1	±1.0

T. Retch

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

Cert. No. : ACL24305
Job No. : VC67AC0164

10. Peak C sound level

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

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

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

T. Retch

CERTIFICATE OF CALIBRATION

REVIEW BY Noraluen P.
APPROVED BY [signature]
NEXT CAL. DATE 4/9/25

ISSUED BY **Cirrus Research plc**

DATE OF ISSUE **04 September 2024** CERTIFICATE NUMBER **221730**

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: 76062
Class: 2

Test summary
Date of calibration: 04 September 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:

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: **221730**
Page 2 of 2

Environmental conditions

The following conditions were recorded at the time of the test:
Before Pressure: 101.10 kPa Temperature: 22.1 °C Humidity: 55.1 %
After Pressure: 101.10 kPa Temperature: 22.2 °C Humidity: 55.8 %

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	114.06	114.06	114.07	**114.06**	0.06	±0.75	0.11 dB
Distortion (%)	< 4.00	0.25	0.26	0.26	**0.25**	0.25	+4.00	0.13 %
Frequency (Hz)	1000.0	1009.5	1009.5	1009.5	**1009.5**	9.5	±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	113.99	114.02	114.02	**114.01**	0.01	±0.75	0.11 dB
Distortion (%)	< 4.00	0.25	0.26	0.25	**0.25**	0.25	+4.00	0.13 %
Frequency (Hz)	1000.0	1009.5	1009.6	1009.5	**1009.5**	9.5	±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

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CALIBRATION 0367

Acoustic calibration laboratory
Calibration services department.

REVIEW BY Noraluen P.
APPROVED BY [signature]
NEXT CAL. DATE 16/9/25

Calibration report Number
CDM-094-67

CALIBRATION REPORT

Page 1 of 1 Pages

MEASUREMENT ITEM : Dose meter
MANUFACTURER : Cirrus Research plc
MODEL/TYPE : CR:110A
SERIAL NUMBER : C01526
ID NUMBER : RYG_F50583
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 : 13 Sep 2024
MEASUREMENT DATE : 16 Sep 2024
ISSUE DATE : 17 Sep 2024

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

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

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[1] (dB)	Noise Dosimeter reading[2] (dB)	Error (dB)	Status
114.0	114.0	0.0	✓

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

Approved signatory: Mr. Pariyo Boonchareon, Calibration Department Manager

Remark:
[1] The decibel level of standard doseBadge reader that supplied to Unit Under Calibration.
[2] 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

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JIRANATEE ASSOCIATES CO.,LTD.

Jiranatee Associates Co.,Ltd
Petchkasem 77/1, Rd. Watthapra, Bangkokyai, Bangkok 10600 (Thailand)
E-mail: jnac.calibration@jiranatee.com
Website: www.jiranatee.com

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

Acoustic calibration laboratory
Calibration services department.

REVIEW BY ....
APPROVED BY ....
NEXT CAL. DATE 16/9/25

Calibration report Number
COM-099-67

CALIBRATION REPORT

Page 1 of 1 Pages

MEASUREMENT ITEM	: Dose meter
MANUFACTURER	: Cirrus Research plc
MODEL/TYPE	: CR:110A
SERIAL NUMBER	: CB1531
ID NUMBER	: RYG_FS0588
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	: 13 Sep 2024
MEASUREMENT DATE	: 16 Sep 2024
ISSUE DATE	: 17 Sep 2024

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

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

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[1] (dB)	Noise Dosimeter reading[2] (dB)	Error (dB)	Status
114.0	114.0	0.0	✓

Calibrated by:
☑ Mr. Sorawit Thachalad
☐ Miss Jittraporn Lertsomphol

Approved signatory: ....
Mr. Parinya Boonchuroen
Calibration Department Manager

Remark:
[1] The decibel level of standard doseBadge reader that supplied to Unit Under Calibration.
[2] The measurement reading of Unit Under Calibration.

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CALIBRATION 0367

Acoustic calibration laboratory
Calibration services department.

REVIEW BY ....
APPROVED BY ....
NEXT CAL. DATE 16/9/25

Calibration report Number
COM-097-67

CALIBRATION REPORT

Page 1 of 1 Pages

MEASUREMENT ITEM	: Dose meter
MANUFACTURER	: Cirrus Research plc
MODEL/TYPE	: CR:110A
SERIAL NUMBER	: CB1529
ID NUMBER	: RYG_FS0586
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	: 13 Sep 2024
MEASUREMENT DATE	: 16 Sep 2024
ISSUE DATE	: 17 Sep 2024

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

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

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[1] (dB)	Noise Dosimeter reading[2] (dB)	Error (dB)	Status
114.0	114.0	0.0	✓

Calibrated by:
☑ Mr. Sorawit Thachalad
☐ Miss Jittraporn Lertsomphol

Approved signatory: ....
Mr. Parinya Boonchuroen
Calibration Department Manager

Remark:
[1] The decibel level of standard doseBadge reader that supplied to Unit Under Calibration.
[2] The measurement reading of Unit Under Calibration.

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Calibration services department.

REVIEW BY ....
APPROVED BY ....
NEXT CAL. DATE 16/9/25

Calibration report Number
COM-095-67

CALIBRATION REPORT

Page 1 of 1 Pages

MEASUREMENT ITEM	: Dose meter
MANUFACTURER	: Cirrus Research plc
MODEL/TYPE	: CR:110A
SERIAL NUMBER	: CB1527
ID NUMBER	: RYG_FS0584
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	: 13 Sep 2024
MEASUREMENT DATE	: 16 Sep 2024
ISSUE DATE	: 17 Sep 2024

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

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

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[1] (dB)	Noise Dosimeter reading[2] (dB)	Error (dB)	Status
114.0	114.0	0.0	✓

Calibrated by:
☑ Mr. Sorawit Thachalad
☐ Miss Jittraporn Lertsomphol

Approved signatory: ....
Mr. Parinya Boonchuroen
Calibration Department Manager

Remark:
[1] The decibel level of standard doseBadge reader that supplied to Unit Under Calibration.
[2] The measurement reading of Unit Under Calibration.

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Calibration services department.

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APPROVED BY ....
NEXT CAL. DATE ....

Calibration report Number
COM-100-67

CALIBRATION REPORT

Page 1 of 1 Pages

MEASUREMENT ITEM	: Dose meter
MANUFACTURER	: Cirrus Research plc
MODEL/TYPE	: CR:110A
SERIAL NUMBER	: CB1532
ID NUMBER	: RYG_FS0589
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	: 13 Sep 2024
MEASUREMENT DATE	: 16 Sep 2024
ISSUE DATE	: 17 Sep 2024

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

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

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[1] (dB)	Noise Dosimeter reading[2] (dB)	Error (dB)	Status
114.0	114.0	0.0	✓

Calibrated by:
☑ Mr. Sorawit Thachalad
☐ Miss Jittraporn Lertsomphol

Approved signatory: ....
Mr. Parinya Boonchuroen
Calibration Department Manager

Remark:
[1] The decibel level of standard doseBadge reader that supplied to Unit Under Calibration.
[2] The measurement reading of Unit Under Calibration.

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Calibration services department.

REVIEW BY ....
APPROVED BY ....
NEXT CAL. DATE ....

Calibration report Number
COM-098-67

CALIBRATION REPORT

Page 1 of 1 Pages

MEASUREMENT ITEM	: Dose meter
MANUFACTURER	: Cirrus Research plc
MODEL/TYPE	: CR:110A
SERIAL NUMBER	: CB1530
ID NUMBER	: RYG_FS0587
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	: 13 Sep 2024
MEASUREMENT DATE	: 16 Sep 2024
ISSUE DATE	: 17 Sep 2024

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

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

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[1] (dB)	Noise Dosimeter reading[2] (dB)	Error (dB)	Status
114.0	114.0	0.0	✓

Calibrated by:
☑ Mr. Sorawit Thachalad
☐ Miss Jittraporn Lertsomphol

Approved signatory: ....
Mr. Parinya Boonchuroen
Calibration Department Manager

Remark:
[1] The decibel level of standard doseBadge reader that supplied to Unit Under Calibration.
[2] The measurement reading of Unit Under Calibration.

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Calibration services department.

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APPROVED BY ....
NEXT CAL. DATE ....

Calibration report Number
COM-096-67

CALIBRATION REPORT

Page 1 of 1 Pages

MEASUREMENT ITEM	: Dose meter
MANUFACTURER	: Cirrus Research plc
MODEL/TYPE	: CR:110A
SERIAL NUMBER	: CB1528
ID NUMBER	: RYG_FS0585
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	: 13 Sep 2024
MEASUREMENT DATE	: 16 Sep 2024
ISSUE DATE	: 17 Sep 2024

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

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

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[1] (dB)	Noise Dosimeter reading[2] (dB)	Error (dB)	Status
114.0	114.0	0.0	✓

Calibrated by:
☑ Mr. Sorawit Thachalad
☐ Miss Jittraporn Lertsomphol

Approved signatory: ....
Mr. Parinya Boonchuroen
Calibration Department Manager

Remark:
[1] The decibel level of standard doseBadge reader that supplied to Unit Under Calibration.
[2] 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

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[illegible]

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NSC-TISI-TIS 17025
CALIBRATION 0367

Acoustic calibration laboratory
Calibration services department.

REVIEW BY .... APPROVED BY .... NEXT CAL. DATE ....

Calibration report Number
COM 115-67

CALIBRATION REPORT

Page 1 of 1 Pages

MEASUREMENT ITEM	: Dose meter
MANUFACTURER	: Cirrus Research plc
MODEL/TYPE	: CR:110AIS
SERIAL NUMBER	: YT5G2
ID NUMBER	: RYG_FS0044
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

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

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

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[1] (dB)	Noise Dosimeter reading[2] (dB)	Error (dB)	Status
114.0	114.0	0.0	✓

Calibrated by:
☑ Mr. Sorawit Thachalad
☐ Miss Jittraporn Lertsomphol

Approved signatory: ....
Mr. Pariya Roonchoren
Calibration Department Manager

Remark:
[1] The decibel level of standard doseBadge reader that supplied to Unit Under Calibration.
[2] 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

CERTIFICATE OF CALIBRATION

Environmental conditions

The following conditions were recorded at the time of the test:

Before	Pressure: 101.42 kPa	Temperature: 25.1 °C	Humidity: 33.1 %
After	Pressure: 101.42 kPa	Temperature: 25.2 °C	Humidity: 35.9 %

Test equipment

Equipment	Manufacturer	Model	Serial number
Distortion Meter	Keithley	2015	1063074
Environmental Monitor	Comet	T7510	21962628

Initial Acoustic Results

	Expected	Sample 1	Sample 2	Sample 3	Average	Deviation	Tolerance	Uncertainty
Level (dB)	114.00	112.51	112.45	112.61	**112.52**	-1.48	±0.75	0.11 dB
Distortion (%)	< 4.00	1.46	1.70	2.01	**1.72**	1.72	+4.00	0.13 %
Frequency (Hz)	1000.0	998.2	998.2	998.2	**998.2**	-1.8	±20.0	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	114.00	113.99	114.01	**114.00**	0.00	±0.75	0.11 dB
Distortion (%)	< 4.00	0.97	0.96	0.95	**0.96**	0.96	+4.00	0.13 %
Frequency (Hz)	1000.0	998.1	998.1	998.1	**998.1**	-1.9	±20.0	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

JNAC
JIRANATEE ASSOCIATES CO.,LTD.
[illegible]

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

Acoustic calibration laboratory
Calibration services department.

REVIEW BY .... APPROVED BY .... NEXT CAL. DATE 16/9/25

Calibration report Number
COM-101-67

CALIBRATION REPORT

Page 1 of 1 Pages

MEASUREMENT ITEM	: Dose meter
MANUFACTURER	: Cirrus Research plc
MODEL/TYPE	: CR:110A
SERIAL NUMBER	: CD1533
ID NUMBER	: RYG_FS0590
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	: 13 Sep 2024
MEASUREMENT DATE	: 16 Sep 2024
ISSUE DATE	: 17 Sep 2024

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

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

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[1] (dB)	Noise Dosimeter reading[2] (dB)	Error (dB)	Status
114.0	114.0	0.0	✓

Calibrated by:
☑ Mr. Sorawit Thachalad
☐ Miss Jittraporn Lertsomphol

Approved signatory: ....
Mr. Pariya Roonchoren
Calibration Department Manager

Remark:
[1] The decibel level of standard doseBadge reader that supplied to Unit Under Calibration.
[2] 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

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JIRANATEE ASSOCIATES CO.,LTD.
[illegible]

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

Acoustic calibration laboratory
Calibration services department.

REVIEW BY .... APPROVED BY .... NEXT CAL. DATE 11/9/26

Calibration report Number
COM-061-67

CALIBRATION REPORT

Page 1 of 1 Pages

MEASUREMENT ITEM	: Dose meter
MANUFACTURER	: Cirrus Research plc
MODEL/TYPE	: CR:110AIS
SERIAL NUMBER	: YF563
ID NUMBER	: RYG_FS0045
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	: 06 Sep 2024
MEASUREMENT DATE	: 11 Sep 2024
ISSUE DATE	: 13 Sep 2024

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

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

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[1] (dB)	Noise Dosimeter reading[2] (dB)	Error (dB)	Status
114.0	114.0	0.0	✓

Calibrated by:
☑ Mr. Sorawit Thachalad
☐ Miss Jittraporn Lertsomphol

Approved signatory: ....
Mr. Pariya Roonchoren
Calibration Department Manager

Remark:
[1] The decibel level of standard doseBadge reader that supplied to Unit Under Calibration.
[2] 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

JNAC
JIRANATEE ASSOCIATES CO.,LTD.
[illegible]

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

Acoustic calibration laboratory
Calibration services department.

REVIEW BY .... APPROVED BY .... NEXT CAL. DATE 17/9/25

Calibration report Number
COM-114-67

CALIBRATION REPORT

Page 1 of 1 Pages

MEASUREMENT ITEM	: Dose meter
MANUFACTURER	: Cirrus Research plc
MODEL/TYPE	: CR:110AIS
SERIAL NUMBER	: YF561
ID NUMBER	: RYG_FS0043
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

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

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

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[1] (dB)	Noise Dosimeter reading[2] (dB)	Error (dB)	Status
114.0	114.0	0.0	✓

Calibrated by:
☑ Mr. Sorawit Thachalad
☐ Miss Jittraporn Lertsomphol

Approved signatory: ....
Mr. Pariya Roonchoren
Calibration Department Manager

Remark:
[1] The decibel level of standard doseBadge reader that supplied to Unit Under Calibration.
[2] 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

CERTIFICATE OF CALIBRATION

ISSUED BY **Cirrus Research**
DATE OF ISSUE **13 February 2025** CERTIFICATE NUMBER **232797**

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

Approved signatory
R.Thomas
Electronically signed:

doseBadge Reader : IEC 60942:2003

Instrument information

Manufacturer: Cirrus Research plc
Model: RC:110A
Serial number: 73729
Class: 2

Notes:

Test summary

Date of calibration: 12 February 2025

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 11/ 02/ 2026

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

ISSUED BY **Cirrus Research**

DATE OF ISSUE **13 February 2025** CERTIFICATE NUMBER **232797**

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

Approved signatory
R.Thomas
Electronically signed:

doseBadge Reader : IEC 60942:2003

Instrument information

Manufacturer: Cirrus Research plc **Notes:**
Model: RC:110A
Serial number: 73729
Class: 2

Test summary

Date of calibration: 12 February 2025

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 11/ 02/ 2026

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: **232797**

Environmental conditions

The following conditions were recorded at the time of the test:

Before	Pressure: 101.42 kPa	Temperature: 25.1 °C	Humidity: 33.1 %
After	Pressure: 101.42 kPa	Temperature: 25.2 °C	Humidity: 35.9 %

Test equipment

Equipment	Manufacturer	Model	Serial number
Distortion Meter	Keithley	2015	1063074
Environmental Monitor	Comet	T7510	21962628

Initial Acoustic Results

	Expected	Sample 1	Sample 2	Sample 3	Average	Deviation	Tolerance	Uncertainty
Level (dB)	114.00	112.51	112.45	112.61	**112.52**	-1.48	±0.75	0.11 dB
Distortion (%)	< 4.00	1.46	1.70	2.01	**1.72**	1.72	+4.00	0.13 %
Frequency (Hz)	1000.0	998.2	998.2	998.2	**998.2**	-1.8	±20.0	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	114.00	113.99	114.01	**114.00**	0.00	±0.75	0.11 dB
Distortion (%)	< 4.00	0.97	0.96	0.95	**0.96**	0.96	+4.00	0.13 %
Frequency (Hz)	1000.0	998.1	998.1	998.1	**998.1**	-1.9	±20.0	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

JIRANATEE ASSOCIATES CO.,LTD

Jiranatee Associates Co.,Ltd
14/14 15, 67/35 36
Petchkasem 2/21, Rd Watthapra, Bangkokyai,
Bangkok 10600 (Thailand)
Tel.
Mobile
E-mail: jaco-calibration@jiranatee.com
Website: www.jiranatee.com

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

Acoustic calibration laboratory
Calibration services department.

REVIEW BY ....
APPROVED BY ....
NEXT CAL DATE 11/4/25

Calibration report Number
CDM-070-67

CALIBRATION REPORT

MEASUREMENT ITEM	: Dose meter
MANUFACTURER	: Cirrus Research plc
MODEL/TYPE	: CR:110AIS
SERIAL NUMBER	: YF577
ID NUMBER	: RYG_FS0059
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	: 06 Sep 2024
MEASUREMENT DATE	: 11 Sep 2024
ISSUE DATE	: 13 Sep 2024

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

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

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[1] (dB)	Noise Dosimeter reading[2] (dB)	Error (dB)	Status
114.0	114.0	0.0	✓

Calibrated by:
☑ Mr. Sorawit Thachalad
☐ Miss Jittraporn Lertsomphol

Approved signatory:
Mr. Pariya Boonchuraen
Calibration Department Manager

Remark:
[1] The decibel level of standard doseBadge reader that supplied to Unit Under Calibration.
[2] 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

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
5344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250
TEL. 0-2717-3000-24 FAX. 0-2719-9484

NSC-TISI-TIS17025 CALIBRATION 0008

Certificate of Calibration

Certificate No. : 23E3924

Equipment :	pH Meter
Manufacturer:	Mettler Toledo
Model :	SevenExcellence
Serial No.:	B834291445
ID No.:	RYG_EN0152
Condition As-Received:	Used Item
Received Date:	08 December 2023
Calibration Date:	14 December 2023
Reference:	2312-0151DSC
Ambient Temperature:	(23 ± 2) °C
Relative Humidity:	(50 ± 10) %

This certificate may not be reproduced other than in full, except with the prior written approval of the head of Corporate Services 3: Equipment Calibration and Testing Services

Submitted by: ALS Laboratory Group (Thailand) Co.,Ltd. Rayong Branch 616/10 Moo 5, T.Maenam Khu, A.Pluakdaeng, Rayong 21140, Thailand

Procedure used: Calibration were conducted using calibration procedure No. CP-E17 according to EURAMET cg-15.

Condition of this result of calibration

1.Reference standards instruments

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Multi-Product Calibrator	5502A	2435802	EE-0041-23	26 Apr 2024

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 Certification is traceable to the International System of Unit maintained through:-
-National Institute of Metrology Thailand (NIMT)

REVIEW BY ....
APPROVED BY ....
NEXT CAL DATE 14/06/25

Calibrated by : Napachanok Prasomsoosin
Issue Date : 15 December 2023

Approved Signatory :
( ) Phalinee Prabpaipai
(✓) Nuntawat Khamchai
( ) Pongsagorn Boonyaporn

B 0331106

Cert. No.: 23E3924

Result of calibration :- (*) Without adjustment ( ) After adjustment

Function: DC voltage measurement Range: 2000 mV

Standard Value	UUC* Reading	Error	Uncertainty
(mV)	(mV)	(mV)	(± µV)
-200.0000	-199.9	0.1	68
-150.0000	-150.0	0.0	65
-100.0000	-100.0	0.0	63
-50.0000	-50.0	0.0	61
0.0000	0.0	0.0	58
50.0000	50.0	0.0	61
100.0000	100.0	0.0	63
150.0000	150.0	0.0	65
200.0000	199.9	-0.1	68

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

UUC*= Unit Under Calibration.

-o0o-

a 1193422

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
5344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-29 FAX. 0-2719-9484

NSC-TISI-TIS17025 CALIBRATION 0008

Cert.No.: 23CH1574

Certificate of Calibration

Equipment :	pH Meter
Manufacturer :	Mettler Toledo
Model :	SevenExcellence
Serial No. :	B834291445
ID No. :	RYG_EN0152
Condition As-Received:	Used Item
Received Date :	08 December 2023
Calibration Date :	15 December 2023
Reference :	2312-0151DSC-3
Submitted by :	ALS Laboratory Group (Thailand) Co.,Ltd. Rayong Branch 616/10 Moo 5, T.Maenam Khu, A.Pluakdaeng, Rayong 21140, Thailand
Ambient Temperature :	(25 ± 2.5) °C
Relative Humidity :	(50 ± 15) %
Calibration Procedure :	In - house method : - CP-CH5 by direct measurement with standard voltage calibrator and direct measurement with certified reference material (CRM) - CP-CH8 by comparison with standard thermometer

Calibrated by : Warakorn Lerngagtrakul

Approved by : Approved Signatory

( ) Saithip Meangmai
( ) Warakorn Lerngagtrakul
(✓) Ponpan Paipim

Issue Date : 19 December 2023

The Uncertainties are for a confidence probability of approximately 95%

A 0061696

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3 : EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000 FAX. 0-2719-9484

Certificate of Testing

Cert.No.: 25TW15
Page.: 1 of 2

Equipment : DO Meter
Manufacturer : YSI
Model : 5000-115V
Serial No. : 15E102796
ID No. : RYG_EN0032
Received Date : 17 January 2025
Test Date : 20 January 2025
Reference : 2501-0600DSC-1
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch) 616/10 Moo 5, T.Maenam Khu, A.Pluakdaeng, Rayong 21140, Thailand
Laboratory Condition : Temperature (25 ± 5) °C, Humidity (50 ± 20) %
Test Procedure : In - house method : CP-CH9 by Comparison Technique with Azide Modification Method
Tested by : Walalak Sirithean
Approved by : Approved Signatory

( ) Pomthippa Tameyakul
( ) Ponpan Paipim
(✓) Saithip Meangmai

Issue Date : 21 January 2025

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL.0-2717-3000-29 FAX.0-2719-9484

Certificate of Calibration

Cert. No.: 25LM10
Page.: 1 of 2

Equipment : DO Meter with Sensor
Manufacturer : YSI
Model : 5000-115V
Serial No. : 15E102796
ID No. : RYG_EN0032
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch) 616/10 Moo 5 T. Maenam Khu, A. Pluakdaeng, Rayong 21140 Thailand
Location : TPA On Site Calibration Laboratory
Received Order : 17 January 2025
Calibrated Date : 20 January 2025
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
AC Line Voltage : (220 ± 22) V
Calibrated by : Warakorn Lemgagtrakul
Approved by : Approved Signatory

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

REVIEW BY Photchanna S.
APPROVED BY
NEXT CAL DATE 20/07/26

Issue Date : 23 January 2025

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

Cert.No.: 23CH1574
Page.: 2 of 3

Condition of this calibration result

1. Reference Standard Instrument : -

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC116	23E2802	27 Aug 2024
2) Ref. Standard Thermometer	4982054	110RC044	23I908	26 July 2024

This certification is traceable to the International System of Unit maintained through:-
- Technology Promotion Association (Thailand-Japan)

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

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	913598	14 July 2025
pH 6.986	CPA chem	931959	01 Oct 2024
pH 9.997	CPA chem	940106	02 Nov 2024

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

Calibration Results
Function : mV Measurement
Performing standard curve by Fluke at pH (4,7,10)

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement	Coverage factor
	pH	mV	mV	pH	(±mV)	k
pH Meter	4.000	177.48	177.3	4.000	0.058	2.00
S/N.: B834291445	7.000	0.00	-0.1	7.000	0.058	2.00
	10.000	-177.48	-177.5	10.000	0.058	2.00

a 1193852

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

Condition of this result of calibration

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

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

2. Standard Material :-

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

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

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

This report was certified only for the instrument we tested.It is allowable to use for study Intend to use for advertising and referral purpose is prohibited.This report may not be reproduced other in full, without written approval of the laboratory

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Equipment : DO Meter with Sensor
Condition As-Received : Used Item
Reference : 2501-0600DSC-2
Cert. No.: 25LM10
Page.: 2 of 2

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

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Digital Thermometer	2188080	24I1022	TPA	17 Sep 2025

2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This certification is traceable to the International System of Unit.
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment
Function : Temperature measurement.
This instrument was connected with temperature sensor, S/N.: 15E100464

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty (± °C)	Coverage Factor k
20.00	60	20.002	19.81	-0.192	0.15	2.00

UUC* : Unit Under Calibration

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

-o0o-

Cert.No.: 23CH1574
Page.: 3 of 3

Calibration Results
Function : pH Measurement
Performing three buffers standard curve by using buffer nominal pH (4,7,10)

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH measurement (±)	Coverage factor k
pH Electrode	4.008	4.013	184.1	0.0045	2.00
S/N.: 3225368	6.986	6.998	8.7	0.0084	2.00
	9.997	10.002	-164.7	0.0088	2.11

Function : Temperature Measurement
(*) Without adjustment
This equipment was connected with Temperature Probe;
- Model : InLab®Expert Pro-ISM
- Serial No. : 3225368
Dimension of probe;
- Length : 120 mm
- Diameter : 12 mm
- Immersion Depth : 100 mm

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement (± °C)	Coverage factor k
25.0	25.003	24.3	-0.703	0.13	2.00

Remark : - UUC* = Unit Under Calibration

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

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a 1193851

DKSH

Certificate No.: C06250108 Page 2 of 3

Calibration Results:

Without Adjustment

Wavelength Accuracy (nm), The spectral bandwidth of Std at 2 nm and UUC at 2 nm

Standard Wavelength	Unit Under Calibration	Correction	Uncertainty
418.61	418.5	0.11	0.13
536.66	536.7	-0.04	0.13
637.98	638.3	-0.32	0.13
748.48	748.8	-0.32	0.13
807.03	807.5	-0.47	0.13

Photometric Accuracy (Absorbance)

Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
420 nm	0.0000	0.000	0.0000	0.0045
	0.2930	0.291	0.0020	0.0045
	0.5168	0.518	-0.0012	0.0045
	1.0298	1.031	-0.0012	0.0045
440 nm	0.0000	0.000	0.0000	0.0045
	0.2867	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

บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด
DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงพระโขนงเหนือ 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

Delivering Growth – in Asia and Beyond.

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

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

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

Calibration Point (°C)	Measured Temperature (°C) Position 1	2	3	4	5	6	7	8	9 (ref.)	Uncertainty (± °C)
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 %.

-oOo-

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PAITANAKARN ROAD SOI 18, SUAN LUANG, SUAN LUANG BANGKOK 10250
TEL 0-2717-3000-29 FAX 0-2719-9484

Certificate of Calibration

Cert. No.: 24TM1663
Page : 1 of 3

REVIEW BY ..... Thanitat.
APPROVED BY.....
NEXT CAL DATE..... 01/05/26

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

The Uncertainties are for a confidence probability of approximately 95%

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Certificate No.: C06250108 Page 3 of 3

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)
260.82 +/- 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

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DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงพระโขนงเหนือ 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

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Certificate of Calibration

Equipment:	SPECTROPHOTOMETER	Certificate No.:	C06250108
Model:	DR6000	Issued Date:	18 March 2025
Serial No. (or ID.):	1627845 (RYG_EN0037)	Job No.:	WO-00064379
Manufacturer:	HACH	Page:	1 of 3
Condition:	In Condition		

Customer: ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)
616/10 Moo 5 T.Maenam Khu,
A.Pluakdaeng, Rayong 21140, Thailand.

Photchanat.
APPROVED BY .....
NEXT CAL. DATE 18/04/26

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.

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2533 Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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Equipment : Low Temp. Incubator
Condition As-Received : Used Item
Reference : 2411-0002OC-1

Cert. No.: 24TM1663
Page : 2 of 3

Procedure Used :-
Calibration were conducted using calibration procedure CP-OT02 based on TLAS G-20 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).
The temperature scale used was based on ITS-90.

Condition of this result of calibration

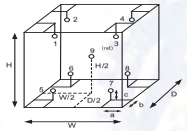
1. Reference standard instrument-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY44073381	24LM73	TPA	18 May 2025

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

Remark : TPA : Technology Promotion Association (Thailand - Japan)
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Close

Environment during calibration	Beginning	Finished
Temp. (°C)	24	25
R.EL.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^3

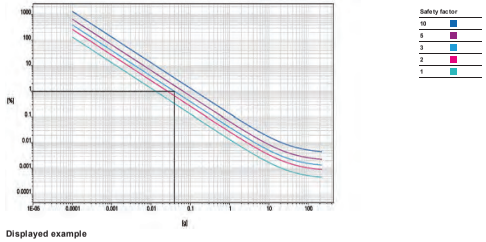
Uncertainty of measurement in use

Device adjusted before measurement	Yes
Temperature deviation considered	1.5 K (isoCAL active)
Temperature coefficient considered	1 · 10⁻⁶/K
Uncertainty of the weighing result $U_{gi}(W)$	**$U_{gi}(W) = 0.00013\ g + 3.95 \cdot 10^{-6} \cdot R$**

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 $U_{gi}(W)$	Uncertainty relative $U_{gi}(W)_{rel}$
1 %	2.2000 g	0.00014 g	0.0063 %
25 %	55.0000 g	0.00035 g	0.00063 %
50 %	110.0000 g	0.00056 g	0.00051 %
75 %	165.0000 g	0.00078 g	0.00047 %
100 %	220.0000 g	0.00100 g	0.00045 %

Graphic realization of the relative uncertainty of measurement | process accuracy



Displayed example

Process accuracy	1.00 %
Safety factor	3
Minimum sample weight	0.0395 g

Calibration object

Single range instrument

Model	MSE224S-100-DU
Serial Number	26207038
QM Ident. no | Inventory no.	RYG_EN0002 | ---
Maximum capacity (Max. load)	220.0000 g
Measured range	220.0000 g
Scale interval	0.0001 g

Place of calibration

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

Calibration procedure

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

Test equipment

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

DKSH

ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: WO-00064379

ชนิดเครื่องมือ: SPECTROPHOTOMETER รุ่น: DR6000 หมายเลขเครื่อง: 1627845

ตรวจส่อบ (รับ) 18 Mar 2025 ปกติ	ไม่ปกติ	รายการตรวจเช็ค	ตรวจสอบ (ส่ง) 18 Mar 2025 ปกติ	ไม่ปกติ	หมายเหตุ
		General			
☑	☐	1. ความสมบูรณ์เครื่อง	☑	☐	
☑	☐	2. ความสะอาด (ของไส้ตัวอย่าง, ภายใน-นอกเครื่อง)	☑	☐	
☑	☐	3. สวิทช์ ปิด – เปิด เครื่อง (On-Off Swicth)	☑	☐	
☑	☐	4. ปุ่มกด (Keypad)	☑	☐	
☑	☐	5. หน้าจอ (Display, Screen Contrast)	☑	☐	
		Spectrophotometer			
☐	☐	6. แรงดันไฟฟ้า (Battery Backup) >= 2.5 VDC	☐	☐	
☐	☐	7. ตัวหมุนเลือกความยาวคลื่น (Wavelength Control)	☐	☐	
☑	☐	8. ความยาวคลื่น (Wavelength Check)	☑	☐	*
☑	☐	9. แหล่งกำเนิดแสง (UV < 3,000 hour)	☑	☐	13.5 Hours
☑	☐	10. แหล่งกำเนิดแสง (Visible < 5,000 hour)	☑	☐	893.0 Hours
☑	☐	11. ช่องวัดหลายตัวอย่าง (Carousel Module)	☑	☐	
		pH Meter and Conductivity Meter			
☐	☐	12. อิเล็คโทรด (Electrode and Connection Cable)	☐	☐	
☐	☐	13. ระดับสารละลายใน Electrode (Level KCl)	☐	☐	
☐	☐	14. ฝาปิดกันปลาย Electrode (Dust Protection Hood)	☐	☐	
☐	☐	15. ขาจับอิเล็คโทรด (Stand)	☐	☐	
		Turbidimeter			
☐	☐	16. ค่าความขุ่นต่ำสุด (No Sample)	☐	☐	
☐	☐	17. ระดับการส่องสว่างของแสง (>= 2.5 ไม่เกิน 3.0)	☐	☐	
		Automatic titrator			
☐	☐	18. สภาพ Piston Burettes	☐	☐	
☐	☐	19. Function Rinsing and Dosing	☐	☐	
☐	☐	20. ระบบท่อสายยางและอุปกรณ์ประกอบ	☐	☐	

เพิ่มเติม/ข้อแนะนำ : * 656.1nm = 656.1nm

* 486.0nm = 485.7nm

Mr.Preecha Phooarsai

Service Engineer

บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด
DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงพระโขนง 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

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CAL-FM-R31-03: 20 Jul 2022

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

NSC-TISI-TIS17025 CALIBRATION 0008

Certificate of Calibration

Cert. No.: 24TM632
Page : 1 of 3

Equipment :	Hot Air Oven
Manufacturer :	Memmert
Model :	UFE 500
Serial No. :	G511.1572
ID No. :	RYG_EN0010
Submitted by :	ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch) 616/10 Moo 5 T. Maenam Khu, A. Pluakdaeng, Rayong 21140 Thailand
Location :	Oven Room
Received Order :	21 March 2024
Calibration Date :	21 March 2024
Ambient Temperature :	(26 ± 10) °C
Relative Humidity :	(50 ± 30) %
Calibrated by :	Man Pattanapongpaiboon
Approved by :	Approved Signatory

REVIEW BY Thanitak.
APPROVED BY
NEXT CAL DATE 21/09/25

( ) Pomthippa Tameyakul
( ) Unnopphol Harachai
(✓) Suwit Imjai

Issue Date : 22 March 2024

The Uncertainties are for a confidence probability of approximately 95%

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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. $T_{weights} - T_{place}$	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 50.2 %RH.

Measurement results | Measurement uncertainties

Repeatability

Test load (nominal):	10 g	200 g
1	10.0000 g	200.0000 g
2	10.0000 g	200.0001 g
3	10.0001 g	200.0001 g
4	10.0000 g	200.0000 g
5	10.0001 g	200.0000 g
6	10.0001 g	200.0001 g
7	10.0000 g	200.0000 g
8	10.0000 g	200.0001 g
9	10.0001 g	200.0000 g
10	10.0000 g	200.0000 g
s = 0.00005 g		s = 0.00005 g

Eccentricity

Test load (nominal):	100 g
Center	100.0000 g
Front left	99.9998 g
Back left	100.0000 g
Back right	100.0000 g
Front right	100.0000 g
Maximum deviation from centric loading indication $\lvert\Delta_{ecc}\rvert_{max}$ = 0.0002 g	

Error of indication

Testload L	Indication I	Error E	Expansion factor k	Uncertainty $U(E)$	Uncertainty relative $U_{rel}(E)$
0.0100 g	0.0100 g	0.0000 g	2.00	0.00013 g	1.3 %
0.1000 g	0.1000 g	0.0000 g	2.00	0.00013 g	0.13 %
0.5000 g	0.5000 g	0.0000 g	2.00	0.00013 g	0.027 %
1.0000 g	1.0000 g	0.0000 g	2.00	0.00013 g	0.013 %
5.0000 g	5.0000 g	0.0000 g	2.00	0.00014 g	0.0027 %
10.0000 g	10.0000 g	0.0000 g	2.00	0.00014 g	0.0014 %
20.0000 g	20.0000 g	0.0000 g	2.00	0.00014 g	0.00072 %
50.0000 g	50.0000 g	0.0000 g	2.00	0.00016 g	0.00032 %
100.0000 g	100.0001 g	0.0001 g	2.00	0.00021 g	0.00021 %
200.0000 g	200.0000 g	0.0000 g	2.00	0.00034 g	0.00017 %
220.0000 g	220.0000 g	0.0000 g	2.00	0.00039 g	0.00018 %
Maximum error of indication		$\lvert E\rvert_{max}$ = 0.0001 g			

$U_{rel}(E)$ is the quotient of $U(E)$ and load L. The uncertainty of measurement $U(E)$ is valid only if error E is considered. You will find reference notes on the calculation of the uncertainty of measurement in the Appendix to the calibration certificate.
Reference note: The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the documented Expansion factor, determined in accordance with the European Calibration Guideline EURAMET cg-18, V4.0. There is a 95 % probability that the value of the measurand will be in the assigned value range.

End of calibration certificate

SARTORIUS

Accredited by

NSC-TISI-TIS 17025
Calibration 0426

Calibration certificate

Calibration Certificate No. 25BKL0004

Object	Electronic non-automatic weighing instrument	This calibration certificate documents the traceability to national standards.
Manufacturer	Sartorius	Uncertainties of measurements are taken into account when only statements of compliance are made.
Type	MSE224S-100-DU	This certificate was prepared by Sartorius Corporation in accordance to the current ISO/IEC 17025:2017 standard and Sartorius Work Instruction (Method) SOP WI 08.
Serial | QM Ident. no.	26207038 | RYG_EN0002	This certificate relate and apply this equipment only.
Customer	ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch) 616/10 Moo 5 T.Maenam Khu, A.Pluak Daeng, Rayong 21140, Thailand.	
Order no.	2230	
Number of pages	4	
Date of calibration	20 Feb 2025	

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

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

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

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

SCG

Metrology

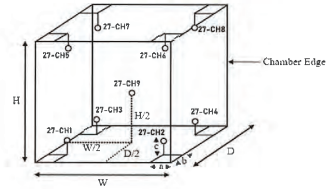
SCI ECO Services Company Limited

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

NSC-TISI-TIS 17025 CALIBRATION 0244

Certificate No. T250454 Page 3 of 3

Calibration Report



Remark : Internal Dimensions of Chamber : W (Width) = 56 cm. , H (Height) = 48 cm. and D (Depth) = 40 cm.

Size of Installed Standard sensor number 27-CH1 to number 27-CH8 : a = 5 cm. ,b = 5 cm. and c = 5 cm.

Size of Installed Standard sensor number 27-CH9 : W/2 = 56 cm./2 , H/2 = 48 cm./2 and D/2 = 40cm./2

Measurement Results

Calibration Point	Average Standard Reading at each position (°C)								
	27-CH1	27-CH2	27-CH3	27-CH4	27-CH5	27-CH6	27-CH7	27-CH8	27-CH9
104	103.84	104.10	104.10	104.48	103.73	104.14	103.95	103.57	104.22
180	179.41	179.92	180.80	181.37	179.54	179.52	179.82	179.41	180.31

Chamber (Oven)			Temperature Distribution				
Setting °C	Reading (°C) Min , Max	Reading (°C) Average	Average (°C)	Stability (± °C)	Uniformity (°C)	Uncertainty (± °C)	Coverage Factor k
104.0	103.9 , 104.1	104.0	104.01	0.08	0.65	0.42	2.00
180.0	-	180.0	180.01	0.17	1.26	0.49	2.00

* The quoted uncertainty exclude "uniformity"

The calibration result apply only the above calibrated item.

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

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

End of Certificate.

Approved By.

FM-L15 11/07/18-08-66

SCG

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

NSC-TISI-TIS 17025 CALIBRATION 0244

Certificate No. T250454 Page 1 of 3

Certificate of Calibration

REVIEW BY Thanitak.

APPROVED BY

NEXT CAL DATE 19/03/26

Equipment	:	Chamber (Oven)
Manufacturer	:	MEMMERT
Model	:	UF 110
Serial No.	:	B423.0853
Customer Code	:	RYG_EN0213
ID No.	:	T5884A5
Customer	:	ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch) 616/10 Moo 5 T.Maenam Khu, A.Pluakdaeng, Rayong 21140
Customer Location	:	ENVIRONMENT LABORATORY
Date of Receipt	:	12 March 2025
Calibrated By	:	Sujjar Naknakred (Site Calibration Manager)
Approved By	:	Boonchai Suriyawong (Site Calibration Manager)
Date of Issue	:	21 MAR 2025

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

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

FM-L14 11/07/18-08-66

Equipment : Hot Air Oven

Condition As-Received : Used Item

Reference : 2403-0563OC-1

Cert. No.: 24TM632

Page : 2 of 3

Procedure Used :-

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD) and Thermocouple Type T.

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY57013711	23LM115	TPA	11 Jul 2024

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

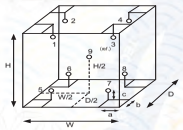
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close

Environment during calibration	Beginning	Finished
Temp. (°C)	27	27
REL.Humid. (%)	57	59
AC Supply (Volt)	222	224



Ref. Std. ID No.: @ Calibration Point		
Position :	(180) °C	(104) °C
1	18-18TC-01	18-18RTD-01
2	18-18TC-02	18-18RTD-02
3	18-18TC-03	18-18RTD-03
4	18-18TC-04	18-18RTD-04
5	18-18TC-05	18-18RTD-05
6	18-18TC-06	23-18RTD-06
7	18-18TC-07	18-18RTD-07
8	18-18TC-08	22-18RTD-08
9 (ref.)	18-18TC-09	18-18RTD-09

Probe Installation Details :

a = 5.0 cm

b = 5.0 cm

c = 5.0 cm

Dimension of Chamber :

D = 0.40 m

W = 0.56 m

H = 0.48 m

Capacity = 0.11 m^3

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

ilac-MRA

NSC-TISI-TIS17025 CALIBRATION 0008

Certificate of Calibration

Cert. No.: 24TM635

Page : 1 of 3

REVIEW BY Thanitak.

APPROVED BY

NEXT CAL DATE 21/09/25

Equipment :	Water Bath
Manufacturer :	Memmert
Model :	WNB22
Serial No. :	L513.0648
ID No. :	RYG_EN0061
Submitted by :	ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch) 616/10 Moo 5, T. Maenam Khu, A. Pluakdaeng, Rayong 21140, Thailand
Location :	Wet Chemistry Lab
Received Order :	21 March 2024
Calibration Date :	21 March 2024
Ambient Temperature :	(26 ± 10) °C
Relative Humidity :	(50 ± 30) %
Calibrated by :	Man Pattanapongpaiboon
Approved by :	Approved Signatory

( ) Pornthippa Tameyakul

( ) Unnopphol Harachai

(✓) Suwit Imjai

Issue Date : 23 March 2024

The Uncertainties are for a confidence probability of approximately 95%

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SCG

Metrology

SCI ECO Services Company Limited

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

NSC-TISI-TIS 17025 CALIBRATION 0244

Certificate No. T250454 Page 2 of 3

Calibration Report

Equipment	:	Chamber (Oven)
Date of Calibration	:	19 March 2025
Environment	:	Temperature : 26.5-26.9 °C
		Line Voltage : 223.9-231.3 V
		Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

1. This equipment was calibrated by insert nine resistance thermometer detectors into its chamber , the other one resistance thermometer detector use for ambient temperature measurement . The calibration was done in 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	27-(CH1-10)	T240709	19 April 2025
DATA LOGGER	34970A	T149	T240709	19 April 2025

3. This certificate is traceable to :
   National Institute of Metrology (Thailand) through Metrological Center (NSC-TISI-TIS 17025 CALIBRATION 0244)
4. Condition of calibrated item : good
   Equipment Description :
   Time Constant 1 Hour 44 Minute At 104 °C
   Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max
   ☒ Close
   ☐ Not Available
5. Adjustment :
   ( ) without adjustment (X) after adjustment

Approved By

FM-L15 11/07/18-08-66

Equipment : Hot Air Oven

Condition As-Received : Used Item

Reference : 2403-0563OC-1

Cert. No.: 24TM632

Page : 3 of 3

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
104.0	104.0	104.0	0.051	0.59	0.62	2
180.0	180.0	180.0	0.15	1.3	1.7	2

Calibration Point (°C)	Measured Temperature (°C) Position 1	2	3	4	5	6	7	8	9 (ref.)	Uncertainty (± °C)
104.0	103.921	103.786	103.757	103.759	103.950	103.817	104.213	103.672	103.673	0.42
180.0	179.614	179.270	179.145	179.599	180.001	180.423	180.293	180.629	179.429	1.1

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

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

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

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

UUC* : Unit Under Calibration

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

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

-oOo-

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.: 24LM108
Page.: 1 of 2

Equipment : pH Meter with Sensor
Manufacturer : Mettler Toledo
Model : Seven2Go S2
Serial No. : C221115514
ID No. : RYG_FS0596
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 : 28 June 2024
Calibrated Date : 01 July 2024
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
AC Line Voltage : (220 ± 22) V

Calibrated by : Warakorn Lerngagtrakul
Approved by : Approved Signatory

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

Issue Date : 03 July 2024

The Uncertainties are for a confidence probability of approximately 95%

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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.: 24CH774
Page.: 1 of 2

Equipment : pH Meter
Manufacturer : Mettler Toledo
Model : Seven2Go S2
Serial No. : C221115514
ID No. : RYG_FS0596
Condition As-Received: Used Item
Received Date : 28 June 2024
Calibration Date : 01 July 2024
Reference : 2406-0969DSC-6
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd. Rayong Branch
616/10 Moo 5, T.Maenam Khu,
A.Pluakdaeng, Rayong 21140, Thailand

REVIEW BY Pitthaya T.
APPROVED BY
NEXT CAL DATE 01/07/25

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

Calibrated by : Warakorn Lerngagtrakul
Approved by : Approved Signatory

( ) Unnopphol Harachai
( ) Ponpan Paipim
(✓) Saithip Meangmai

Issue Date : 03 July 2024

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-OT04 Based on ASTM E715 according to direct measurement method with Data Acquisition which connected with Industrial Platinum Resistance Thermometer (IPRT).

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

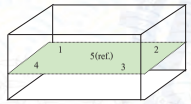
Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY57013711	23LM115	TPA	11 Jul 2024

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

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

Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Heat transfer medium used : Water

	Environmental		AC Voltage Supply
	(°C)	(%R.H.)	(Volt)
Beginning of Calibration	25	55	222
Finished of Calibration	25	57	223



Front

Position :	Ref. Std. ID No.:
1	4803988-001
2	4803988-002
3	4803988-003
4	4803988-004
5(ref.)	4803988-005

Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-OT01 according to comparison with Industrial Platinum Resistance Thermometer (IPRT) into Temperature Bath.

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Digital Thermometer	2188080	23I1216	TPA	11 Oct 2024

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

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

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

This instrument was connected with temperature sensor, S/N.: 3293232

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty (± °C)	Coverage Factor *k*
25.0	100	25.003	25.1	0.097	0.16	2.00
30.0	100	30.002	30.2	0.198	0.16	2.00
40.0	100	40.003	40.2	0.197	0.16	2.00
50.0	100	50.002	50.2	0.198	0.16	2.00

UUC* : Unit Under Calibration

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

-o0o-

Condition of this calibration result

1. Reference Standard Instrument

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC116	23E2802	27 Aug 2024

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

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

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	970851	25 Apr 2026
pH 6.986	CPA chem	970852	25 Apr 2025
pH 9.997	CPA chem	970853	25 Apr 2025

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

Calibration Results

Function : mV Measurement

Performing standard curve by Document Process Calibrator at pH (4,7,10)

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (±mV)	Coverage factor *k*
	pH	mV	mV	pH		
pH Meter	4.00	177.48	178	4.00	0.58	2.00
S/N.: C221115514	7.00	0.00	0	7.00	0.58	2.00
	10.00	-177.48	-178	10.00	0.58	2.00

Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH Measurement (±)	Coverage factor *k*
pH Electrode	4.008	4.01	180	0.0079	2.00
S/N.: 3293232	6.986	6.99	5	0.011	2.00
	9.997	10.00	-172	0.0092	2.00

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

-o0o-

Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source

Calibration point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Average* Standard Reading (°C) Position 1	2	3	4	5 (ref.)	Uncertainty (± °C)
85.0	85.0	85.0	84.428	84.424	84.489	84.507	84.477	0.18

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Coverage Factor *k*
85.0	0.19	0.11	2

Average* : The average of 30 values in each position.
Uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.
Stability : One-half of the greatest maximum difference of measured temperature at any one probe.
UUC* : Unit Under Calibration
Note : The reported uncertainty of measurement was included stability and excluded uniformity.

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

-o0o-

REVIEW BY Matt Sant
APPROVED BY
NEXT CAL. DATE 13-Jun-25

Certificate of System Qualification

GC-OQ + GCMS-OQ

System ID:	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:	December 13, 2023 3:32:46 PM
EQP Name:	AgilentRecommended , AgilentRecommended
EQP Revision:	GC.02.50, GCMS.02.50
Overall Qualification 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	25.0	psi

Accuracy: 0.0 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	232.3	°C

Acuracy: 2.3 °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	100.7	°C

Accuracy: 0.7 °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	100.4	°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

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	mV		504	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: EI - Extractor Filament: 1

Setpoint Status: **Pass**
Signal to Noise: 11318
Agilent Recommended: >= 1200

Source: EI - Extractor Filament: 2

Setpoint Status: **Pass**
Signal to Noise: 16588
Agilent Recommended: >= 1200

Overall Signal to Noise EI Test Status

Pass

NOTE: This test's 0 comment(s) and 6 deviation(s) are available in the Attachments section.

Instrument Details

Purpose

This section describes the as found system configuration.

Details

System	
System ID	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

User Name: supasak.nimsongtham
Report Generated by Hostname: ASBKKWX492
System Id: GM-7
Print Date: December 13, 2023 3:32:47 PM

GM-7-2023 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
December 13, 2023 11:32:38 AM	Start	Execution	Tune EI - 5977A SQ - Source: EI - Extractor Filament 2 (Qualitative - No setpoints associated)	None
December 13, 2023 11:33:06 AM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	None
December 13, 2023 11:49:38 AM	Start	Execution	Tune EI - 5977A SQ - Source: EI - Extractor Filament 2 (Qualitative - No setpoints associated)	None
December 13, 2023 11:49:42 AM	End	Execution	Tune EI - 5977A SQ - Source: EI - Extractor Filament 2 (Qualitative - No setpoints associated)	Run Count : 1
December 13, 2023 11:49:43 AM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	None
December 13, 2023 11:49:48 AM	Audit	AceClosed	Session	None
December 13, 2023 12:36:39 PM	Audit	AceRestarted	Session	None
December 13, 2023 12:36:40 PM	Audit	SessionReleased	Session	None
December 13, 2023 12:36:42 PM	Start	Qualification	Session	OQ
December 13, 2023 12:36:42 PM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	None

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User Name: supasak.nimsongtham
Report Generated by Hostname: ASBKKWX492
System Id: GM-7
Print Date: December 13, 2023 3:32:47 PM

GM-7-2023 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
December 13, 2023 10:24:10 AM	End	Execution	System Inspection and Basic Safety and Operation - 7890: - Qualitative Test - No setpoints associated	Run Count : 1
December 13, 2023 10:24:11 AM	Start	Execution	Inlet Pressure Accuracy - Front SSL: - Pressure Controlled Inlet : S: 25.0 psi - L: <= 1.2 psi	None
December 13, 2023 10:24:15 AM	End	Execution	Inlet Pressure Accuracy - Front SSL: - Pressure Controlled Inlet : S: 25.0 psi - L: <= 1.2 psi	Run Count : 1
December 13, 2023 10:24:17 AM	Start	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
December 13, 2023 10:32:09 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
December 13, 2023 10:32:11 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
December 13, 2023 10:32:12 AM	Start	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
December 13, 2023 10:34:58 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
December 13, 2023 10:34:59 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

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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:	December 13, 2023
Reason for Signature:	Executed protocol and published this original version of document

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: supasak.nimsongtham
Report Generated by Hostname: ASBKKWX492
System Id: GM-7
Print Date: December 13, 2023 3:32:47 PM

GM-7-2023 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
December 13, 2023 12:37:33 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	Data files Path : D:\MassHunter\GCMS\1\data \OQ2023\52\N_F1.D
December 13, 2023 12:38:18 PM	End	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	Run Count : 1
December 13, 2023 12:39:51 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
December 13, 2023 12:39:51 PM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	None
December 13, 2023 12:40:15 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	Data files Path : D:\MassHunter\GCMS\1\data \OQ2023\52\N_F1.D
December 13, 2023 12:42:00 PM	End	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	Run Count : 2
December 13, 2023 12:42:06 PM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	None
December 13, 2023 12:42:47 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	Data files Path : D:\MassHunter\GCMS\1\data \OQ2023\52\N_F2.D

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User Name: supasak.nimsongtham
Report Generated by Hostname: ASBKKWX492
System Id: GM-7
Print Date: December 13, 2023 3:32:47 PM

GM-7-2023 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
December 13, 2023 10:35:00 AM	Start	Execution	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	None
December 13, 2023 10:35:07 AM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	None
December 13, 2023 10:36:39 AM	Start	Execution	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	None
December 13, 2023 10:55:10 AM	Audit	Data	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Manual Data Entry
December 13, 2023 10:55:12 AM	End	Execution	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Run Count : 1
December 13, 2023 10:55:13 AM	Start	Execution	Log Amp - 5977A SQ: - Source: EI - Extractor	None
December 13, 2023 10:56:42 AM	End	Execution	Log Amp - 5977A SQ: - Source: EI - Extractor	Run Count : 1
December 13, 2023 10:56:43 AM	Start	Execution	RFPA - 5977A SQ: - Source: EI - Extractor	None
December 13, 2023 11:04:44 AM	End	Execution	RFPA - 5977A SQ: - Source: EI - Extractor	Run Count : 1
December 13, 2023 11:04:45 AM	Start	Execution	Tune EI - 5977A SQ: - Source: - EI - Extractor Filament 1 (Qualitative - No setpoints associated)	None
December 13, 2023 11:32:36 AM	End	Execution	Tune EI - 5977A SQ: - Source: - EI - Extractor Filament 1 (Qualitative - No setpoints associated)	Run Count : 1

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User Name: supasak.nimsongtham
Report Generated by Hostname: ASBKKWX492
System Id: GM-7
Print Date: December 13, 2023 3:32:47 PM

GM-7-2023 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
December 13, 2023 10:22:24 AM	Audit	SessionCreated	Session	None
December 13, 2023 10:22:24 AM	Start	Configuration	Session	None
December 13, 2023 10:22:24 AM	Audit	Entitlement	Licensing	User is FieldEngineer and does not require an unlock code
December 13, 2023 10:23:53 AM	Audit	EqpLoaded	Session	EQP details for primary technique [Gc] - File path: [ProtocolPacks/Gc/Configurations/02.50/Gc.02.50.eqp], EQP File Name: [Gc.02.50.eqp], EQP Name: [AgilentRecommended],Protocol Revision: [Gc.02.50] EQP details for hyphenated technique [GcMs] - File path: [ProtocolPacks/GcMs/Configurations/02.50/GcMs.02.50.eqp], EQP File Name: [GcMs.02.50.eqp], EQP Name: [AgilentRecommended]
December 13, 2023 10:23:56 AM	End	Configuration	Session	None
December 13, 2023 10:23:59 AM	Start	Qualification	Session	OQ
December 13, 2023 10:23:59 AM	Start	Execution	System Inspection and Basic Safety and Operation - 7890: - Qualitative Test - No setpoints associated	None

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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: sebkk.svv02

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

User Name: supasak.nimsongtham
Report Generated by Hostname: ASBKKWX492
System Id: GM-7
Print Date: December 13, 2023 3:32:47 PM

GM-7-2023 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
December 13, 2023 2:27:42 PM	End	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	Run Count : 3
December 13, 2023 2:29:14 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 : 3
December 13, 2023 2:29:14 PM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	None
December 13, 2023 2:34:02 PM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	None
December 13, 2023 2:41:20 PM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	None
December 13, 2023 2:42:42 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	Data files Path : D:\MassHunter\GCMS\1\data \OQ2023\S2N_F2_001.D
December 13, 2023 2:44:32 PM	End	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	Run Count : 4
December 13, 2023 2:44:56 PM	End	Qualification	Session	OQ
December 13, 2023 2:44:56 PM	Start	Reporting	Session	None

User Name: supasak.nimsongtham
Report Generated by Hostname: ASBKKWX492
System Id: GM-7
Print Date: December 13, 2023 3:32:47 PM

GM-7-2023 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
December 13, 2023 12:43:54 PM	End	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	Run Count : 1
December 13, 2023 1:54:41 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 : 2
December 13, 2023 1:54:41 PM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	None
December 13, 2023 1:54:50 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	Data files Path : D:\MassHunter\GCMS\1\data \OQ2023\S2N_F1.D
December 13, 2023 1:55:22 PM	End	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	Run Count : 3
December 13, 2023 1:59:50 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 : 3
December 13, 2023 1:56:50 PM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	None
December 13, 2023 2:14:32 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	Data files Path : D:\MassHunter\GCMS\1\data \OQ2023\S2N_F1.D

Overall Inlet Pressure Accuracy Test Status

Pass

Headspace Leak

Name: 7697A ith Tray
Sampler 1

Setpoint Status: **Pass**

Overall Headspace Leak Test Status

Pass

Headspace Heated Zones Temperature Accuracy

Name: 7697A ith Tray
Sampler 1

Setpoint Status: **Pass**
one: Transferline
Temperature:
Setpoint 115.0 °C
Actual 115.4

Accuracy: 0.4 °C
Agilent Recommended: -1. % setpoint (-2.1 °C)
5.2 % setpoint (6.0 °C)

Setpoint Status: **Pass**
one: Sample Loop
Temperature:
Setpoint 110.0 °C
Actual 110.2

Accuracy: 0.2 °C
Agilent Recommended: -4.0
4.0

User Name: supasak.nimsongtham
Report Generated by Hostname: ASBKKWX492
System Id: GM-7
Print Date: December 13, 2023 3:32:47 PM

GM-7-2023 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
December 13, 2023 3:01:22 PM	Audit	AceClosed	Session	None
December 13, 2023 3:29:10 PM	Audit	AceRestarted	Session	None
December 13, 2023 3:29:10 PM	Audit	SessionReloaded	Session	None
December 13, 2023 3:29:13 PM	Start	Qualification	Session	OQ
December 13, 2023 3:31:33 PM	Audit	Reporting	Session	Report Generated : Certificate
December 13, 2023 3:32:15 PM	Audit	Reporting	Session	Report Generated : Report

User Name: supasak.nimsongtham
Report Generated by Hostname: ASBKKWX492
System Id: GM-7
Print Date: December 13, 2023 3:32:47 PM

GM-7-2023 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
December 13, 2023 2:15:03 PM	End	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	Run Count : 4
December 13, 2023 2:25:07 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
December 13, 2023 2:25:07 PM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	None
December 13, 2023 2:26:20 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	Data files Path : D:\MassHunter\GCMS\1\data \OQ2023\S2N_F2.D
December 13, 2023 2:25:41 PM	End	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	Run Count : 2
December 13, 2023 2:26:51 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
December 13, 2023 2:26:51 PM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	None
December 13, 2023 2:27:01 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	Data files Path : D:\MassHunter\GCMS\1\data \OQ2023\S2N_F2.D

Instrument Details

Purpose

This section describes the as found system configuration.

Details

System

System ID	GM-6
Manufacturer	Agilent Technologies
Name	7 90
Flo Data Input	Manual Data
Temperature Data Input	Manual Data or Other Data Logging

Tested Combination1

In ection Techni ue	Headspace
Inlet	Front
Detector	External
LTM Included	No

Sampler 1

Manufacturer	Agilent Technologies
Type	Headspace
Name	7697A ith Tray
Model Number	G4557A
Serial Number	CN13020009
Firm are Revision	A.01.05.1
Sampling System	Loop fill
Location	Front
In ection Volume (L)	1000
Headspace to GC Connection	EPC Headspace

Setpoint Status: Pass

Filament: 2

Overall Tune EI Test Status

Pass

Scouting Run

Tested Combination1 Front SSL / External S
Headspace

Name: 7697A ith Tray

Source: EI - Inert

Setpoint Status: Completed

In ection Volume on Column: 1000 uL

Overall Scouting Run Status

Completed

Injection Precision

Tested Combination1 Front SSL / External S

Name: 7697A ith Tray

Source: EI - Inert

Setpoint Status: Pass

In ection Volume on Column: 1000 uL

Area RSD: 1.46 % Retention Time RSD: 0.01 %

Agilent Recommended: 5.00 1.00

Overall Injection Precision Test Status

Pass

Mass Ratio Precision

Setpoint Status: Pass

one: Oven

Temperature:

Setpoint 100.0 °C

Actual 100.3

Accuracy: 0.3 °C

Agilent Recommended: -4.0 4.0

Overall Headspace Heated Zones Temperature Accuracy Test

Pass

GC Oven Temperature Accuracy

Name: 7 90

Setpoint Status: Pass

one: 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)

Setpoint Status: Pass

one: 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: 7 90

Mainframe 1

Manufacturer	Agilent Technologies
Name	7 90
Model Number	G3440A
Serial Number	CN125111 6
Firm are Revision	A.01.14
Oven Type	Standard

Inlet 1

Manufacturer	Agilent Technologies
Name	7 90
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	S
Name	5975C inert XL ith TAD
Model Number	G3172A
Serial Number	US13023A30
Firm are Revision	7.02.09
High Vacuum System	Turbo Pump
Scouting Run Standard	MRP Std

Tested Combination1 Front SSL / External S
Headspace

Name: 7697A ith Tray

Source: EI - Inert

Setpoint Status: Pass

In ection Volume on Column: 1000 uL

	Area Mass 1 Abundance s	Mass Ratio
RSD:	1.77 %	0.29 %
Agilent Recommended:	5.00	5.00
	Pass	Pass

Overall Mass Ratio Precision Test Status

Pass

Injection Carry Over

Tested Combination1 Front SSL / External S

Name: 7697A ith Tray

Source: EI - Inert

Setpoint Status: Pass

In ection Volume on Column: 1000 uL

Area Carry Over: 0.01 %

Agilent Recommended: 1.00

Overall Injection Carry Over Test Status

Pass

Setpoint Status: Pass

Setpoint/Average

Temperature: 100.0 100.1333 °C

Stability: 0.1 °C

Agilent Recommended: 0.5

Overall GC Oven Temperature Stability Test Status

Pass

Log Amp

Tested Combination1 Front SSL / External S

Name: 5975C inert XL ith TAD

Setpoint Status: Pass

Overall Log Amp Test Status

Pass

RFPA

Tested Combination1 Front SSL / External S

Name: 5975C inert XL ith TAD

Setpoint Status: Pass

Amu: 1050 mV Drift After Five Minutes: RFPA Voltage:

37 mV 566 mV

Agilent Recommended: -100 and 100 1100

Overall RFPA Test Status

Pass

Tune EI

Tested Combination1 Front SSL / External S

Name: **5975C inert XL ith TAD**

Setpoint Status: Pass

Filament: 1

User Name: sullifli.mama System Id: GM-6
Report Generated by Hostname: AG-SCG2030XXV Print Date: January 3, 2025 9:06:57 AM

6009666213_ALS_OQ_GM6 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
January 2 2025 11:11:21 AM	End	Execution	Headspace Heated ones Temperature Accuracy - 7697A ith Tray (Sampler 1) - one : Transferline - S: 115.0°C - L: -1. % setpoint and 5.2% setpoint	Run Count : 1
January 2 2025 11:11:26 AM	Start	Execution	Headspace Heated ones Temperature Accuracy - 7697A ith Tray (Sampler 1) - one : Sample Loop - S: 110.0°C - L: -4.0°C and 4.0°C	None
January 2 2025 11:15:07 AM	Start	Execution	Scouting Run - 7697A ith Tray Headspace Front SSL S : - Source: - EI - Inert- Part of GCMS System Preparation	None
January 2 2025 11:15:44 AM	Start	Execution	In ection Precision - 7697A ith Tray Headspace Front SSL S : - Source: - EI - Inert L (Area): 5.00%- L (Ret. Time): 1.00%	None
January 2 2025 11:16:10 AM	Start	Execution	Mass Ratio Precision - 7697A ith Tray Headspace Front SSL S : - Source: EI - Inert - L (RSD): 5.00%	None
January 2 2025 11:16:20 AM	Start	Execution	Headspace Heated ones Temperature Accuracy - 7697A ith Tray (Sampler 1) - one : Sample Loop - S: 110.0°C - L: -4.0°C and 4.0°C	None
January 2 2025 11:17:04 AM	Audit	Data	Headspace Heated ones Temperature Accuracy - 7697A ith Tray (Sampler 1) - one : Sample Loop - S: 110.0°C - L: -4.0°C and 4.0°C	Manual Data Entry

User Name: sullifli.mama System Id: GM-6
Report Generated by Hostname: AG-SCG2030XXV Print Date: January 3, 2025 9:06:57 AM

6009666213_ALS_OQ_GM6 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
January 2 2025 11:17:09 AM	End	Execution	Headspace Heated ones Temperature Accuracy - 7697A ith Tray (Sampler 1) - one : Sample Loop - S: 110.0°C - L: -4.0°C and 4.0°C	Run Count : 1
January 2 2025 11:17:17 AM	Start	Execution	Headspace Heated ones Temperature Accuracy - 7697A ith Tray (Sampler 1) - one : Oven - S: 100.0°C - L: -4.0°C and 4.0°C	None
January 2 2025 11:23:0 AM	Audit	Data	Headspace Heated ones Temperature Accuracy - 7697A ith Tray (Sampler 1) - one : Oven - S: 100.0°C - L: -4.0°C and 4.0°C	Manual Data Entry
January 2 2025 11:23:12 AM	End	Execution	Headspace Heated ones Temperature Accuracy - 7697A ith Tray (Sampler 1) - one : Oven - S: 100.0°C - L: -4.0°C and 4.0°C	Run Count : 1
January 2 2025 11:23:17 AM	Start	Execution	GC Oven Temperature Accuracy - 7 90 - Temperature : Oven - S: 230.0°C - L: -1.0 AND 1.0 % setpoint in K	None
January 2 2025 11:27:34 AM	Audit	Data	GC Oven Temperature Accuracy - 7 90 - Temperature : Oven - S: 230.0°C - L: -1.0 AND 1.0 % setpoint in K	Manual Data Entry
January 2 2025 11:27:36 AM	End	Execution	GC Oven Temperature Accuracy - 7 90 - Temperature : Oven - S: 230.0°C - L: -1.0 AND 1.0 % setpoint in K	Run Count : 1

User Name: sullifli.mama System Id: GM-6
Report Generated by Hostname: AG-SCG2030XXV Print Date: January 3, 2025 9:06:57 AM

6009666213_ALS_OQ_GM6 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
January 2 2025 10:51:32 AM	Audit	Session Created	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 re uire an unlock code
January 2 2025 11:01:24 AM	Audit	E pLoaded	Session	E P details for primary techni ue Gc - Rile path: Protocol Packs/Go/Configurations/02.53/Gc02.53.e p E P File Name: Gc.02.53.e p E P Name: AgilentRecommended Protocol Revision : Gc.02.53 E P details for hyphenated techni ue GcMs - Rile path: Protocol Packs/GcMs/Configurations/02.54/GcMs.02.54.e p E P File Name: GcMs.02.54.e p E P Name: AgilentRecommended
January 2 2025 11:01:53 AM	End	Configuration	Session	None
January 2 2025 11:02:05 AM	Start	ualification	Session	O
January 2 2025 11:02:05 AM	Start	Execution	CDS Logon Verification - GC - 7 90 - ualitative test	None
January 2 2025 11:0 :09 AM	End	Execution	CDS Logon Verification - GC - 7 90 - ualitative test	Run Count : 1

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User Name: sullifli.mama System Id: GM-6
Report Generated by Hostname: AG-SCG2030XXV Print Date: January 3, 2025 9:06:57 AM

6009666213_ALS_OQ_GM6 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
January 2 2025 11:0 :13 AM	Start	Execution	System Inspection and Basic Safety and Operation - 7 90: - ualitative Test - No setpoints associated	None
January 2 2025 11:0 :43 AM	End	Execution	System Inspection and Basic Safety and Operation - 7 90: - ualitative Test - No setpoints associated	Run Count : 1
January 2 2025 11:09:25 AM	Start	Execution	Inlet Pressure Accuracy - Front SSL - Pressure Controlled Inlet - S: 25.0 psi - L: 1.2 psi	None
January 2 2025 11:10:03 AM	End	Execution	Inlet Pressure Accuracy - Front SSL - Pressure Controlled Inlet - S: 25.0 psi - L: 1.2 psi	Run Count : 1
January 2 2025 11:10:07 AM	Start	Execution	Headspace Leak - 7697A ith Tray (Sampler 1) - ualitative Test - No setpoints associated	None
January 2 2025 11:10:31 AM	End	Execution	Headspace Leak - 7697A ith Tray (Sampler 1) - ualitative Test - No setpoints associated	Run Count : 1
January 2 2025 11:10:34 AM	Start	Execution	Headspace Heated ones Temperature Accuracy - 7697A ith Tray (Sampler 1) - one : Transferline - S: 115.0°C - L: -1. % setpoint and 5.2% setpoint	None
January 2 2025 11:11:1 AM	Audit	Data	Headspace Heated ones Temperature Accuracy - 7697A ith Tray (Sampler 1) - one : Transferline - S: 115.0°C - L: -1. % setpoint and 5.2% setpoint	Manual Data Entry

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M S EI Source 1

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

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Electronic Signature

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Signature Creation Date:	January 3 2025
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Report Generated by Hostname: AG-5CG2030XXV
System Id: GM-6
Print Date: January 3, 2025 9:06:57 AM

6006666213_ALS_OQ_GM6 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
January 2 2025 4:0 :2 PM	End	Execution	In ection Precision - 7697A ith Tray Headspace Front SSL S : - Source: -EI - Inert L (Area): 5.00% - L (Ret. Time): 1.00%	Run Count : 1
January 2 2025 4:0 :39 PM	Start	Execution	Mass Ratio Precision - 7697A ith Tray Headspace Front SSL S : - Source: EI - Inert - L (RSD): 5.00%	None
January 2 2025 4:10:31 PM	Audit	Data	DataManager	DataManager as in a data verification state but the user chose to start over
January 2 2025 4:10:5 PM	Audit	Data	Mass Ratio Precision - 7697A ith Tray Headspace Front SSL S : - Source: EI - Inert - L (RSD): 5.00%	Data files Path : F:\O 2025 ALS\O 2025\P_01.D
January 2 2025 4:10:5 PM	Audit	Data	Mass Ratio Precision - 7697A ith Tray Headspace Front SSL S : - Source: EI - Inert - L (RSD): 5.00%	Data files Path : F:\O 2025 ALS\O 2025\P_02.D
January 2 2025 4:10:5 PM	Audit	Data	Mass Ratio Precision - 7697A ith Tray Headspace Front SSL S : - Source: EI - Inert - L (RSD): 5.00%	Data files Path : F:\O 2025 ALS\O 2025\P_03.D
January 2 2025 4:10:5 PM	Audit	Data	Mass Ratio Precision - 7697A ith Tray Headspace Front SSL S : - Source: EI - Inert - L (RSD): 5.00%	Data files Path : F:\O 2025 ALS\O 2025\P_04.D
January 2 2025 4:10:5 PM	Audit	Data	Mass Ratio Precision - 7697A ith Tray Headspace Front SSL S : - Source: EI - Inert - L (RSD): 5.00%	Data files Path : F:\O 2025 ALS\O 2025\P_05.D

Date: January 3 2025 9:06:3 AM
System ID: GM-6

User Name: sulkifli.mama
Report Generated by Hostname: AG-5CG2030XXV
System Id: GM-6
Print Date: January 3, 2025 9:06:57 AM

6006666213_ALS_OQ_GM6 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
January 2 2025 2:01:32 PM	End	Execution	Tune EI - 5975C inert XL ith TAD S : - Source: - EI - Inert Filament 2 (ualitative - No setpoints associated)	Run Count : 1
January 2 2025 2:01:36 PM	Start	Execution	Scouting Run - 7697A ith Tray Headspace Front SSL S : - Source: - EI - Inert - Part of GCMS System Preparation	None
January 2 2025 2:42:01 PM	Start	Execution	In ection Precision - 7697A ith Tray Headspace Front SSL S : - Source: - EI - Inert L (Area): 5.00% - L (Ret. Time): 1.00%	None
January 2 2025 2:42:1 PM	Start	Execution	Mass Ratio Precision - 7697A ith Tray Headspace Front SSL S : - Source: EI - Inert - L (RSD): 5.00%	None
January 2 2025 2:42:30 PM	Start	Execution	In ection Carry Over - 7697A ith Tray Headspace Front SSL S : - Headspace Sampler - EI - Inert - L: 1.00%	None
January 2 2025 2:54:55 PM	Start	Execution	Scouting Run - 7697A ith Tray Headspace Front SSL S : - Source: - EI - Inert - Part of GCMS System Preparation	None
January 2 2025 4:06:47 PM	Audit	Data	Scouting Run - 7697A ith Tray Headspace Front SSL S : - Source: - EI - Inert - Part of GCMS System Preparation	Data files Path : F:\O 2025 ALS\O 2025\SC.D
January 2 2025 4:07:15 PM	End	Execution	Scouting Run - 7697A ith Tray Headspace Front SSL S : - Source: - EI - Inert - Part of GCMS System Preparation	Run Count : 1

Date: January 3 2025 9:06:3 AM
System ID: GM-6

User Name: sulkifli.mama
Report Generated by Hostname: AG-5CG2030XXV
System Id: GM-6
Print Date: January 3, 2025 9:06:57 AM

6006666213_ALS_OQ_GM6 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
January 2 2025 11:27:40 AM	Start	Execution	GC Oven Temperature Accuracy - 7 90: - Temperature : Oven - S: 100.0°C - L: -1.0 AND 1.0 % setpoint in K	None
January 2 2025 11:42:40 AM	Audit	Data	GC Oven Temperature Accuracy - 7 90: - Temperature : Oven - S: 100.0°C - L: -1.0 AND 1.0 % setpoint in K	Manual Data Entry
January 2 2025 11:42:43 AM	End	Execution	GC Oven Temperature Accuracy - 7 90: - Temperature : Oven - S: 100.0°C - L: -1.0 AND 1.0 % setpoint in K	Run Count : 1
January 2 2025 11:42:46 AM	Start	Execution	GC Oven Temperature Stability - 7 90: - Temperature : Oven - S: 100.0°C - L: 0.5°C	None
January 2 2025 12:03:34 PM	Audit	Data	GC Oven Temperature Stability - 7 90: - Temperature : Oven - S: 100.0°C - L: 0.5°C	Manual Data Entry
January 2 2025 12:03:37 PM	End	Execution	GC Oven Temperature Stability - 7 90: - Temperature : Oven - S: 100.0°C - L: 0.5°C	Run Count : 1
January 2 2025 12:04:21 PM	Start	Execution	In ection Precision - 7697A ith Tray Headspace Front SSL S : - Source: - EI - Inert L (Area): 5.00% - L (Ret. Time): 1.00%	None
January 2 2025 12:07:29 PM	Start	Execution	Log Amp - 5975C inert XL ith TAD S : - Source: EI - Inert	None
January 2 2025 12:12:20 PM	End	Execution	Log Amp - 5975C inert XL ith TAD S : - Source: EI - Inert	Run Count : 1
January 2 2025 12:12:25 PM	Start	Execution	RFPA - 5975C inert XL ith TAD S : - Source: EI - Inert	None

Date: January 3 2025 9:06:3 AM
System ID: GM-6

User Name: sulkifli.mama
Report Generated by Hostname: AG-5CG2030XXV
System Id: GM-6
Print Date: January 3, 2025 9:06:57 AM

6006666213_ALS_OQ_GM6 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
January 2 2025 4:10:5 PM	Audit	Data	Mass Ratio Precision - 7697A ith Tray Headspace Front SSL S : - Source: - EI - Inert L (Area): 5.00% - L (Ret. Time): 1.00% (RSD): 5.00%	Data files Path : F:\O 2025 ALS\O 2025\P_06.D
January 2 2025 4:11:27 PM	End	Execution	Mass Ratio Precision - 7697A ith Tray Headspace Front SSL S : - Source: EI - Inert - L (RSD): 5.00%	Run Count : 1
January 2 2025 4:11:3 PM	Start	Execution	In ection Carry Over - 7697A ith Tray Headspace Front SSL S : - Headspace Sampler - EI - Inert - L: 1.00%	None
January 2 2025 4:12:0 PM	Audit	Data	In ection Carry Over - 7697A ith Tray Headspace Front SSL S : - Headspace Sampler - EI - Inert - L: 1.00%	Data files Path : F:\O 2025 ALS\O 2025\P_07.D
January 2 2025 4:12:0 PM	Audit	Data	In ection Carry Over - 7697A ith Tray Headspace Front SSL S : - Headspace Sampler - EI - Inert - L: 1.00%	Data files Path : F:\O 2025 ALS\O 2025\Bla nk.D
January 2 2025 4:16:22 PM	End	Execution	In ection Carry Over - 7697A ith Tray Headspace Front SSL S : - Headspace Sampler - EI - Inert - L: 1.00%	Run Count : 1
January 2 2025 4:17:54 PM	Audit	AceClosed	Session	None
January 3 2025 :22:53 AM	Audit	AceRestarted	Session	None
January 3 2025 :22:56 AM	Audit	SessionReloaded	Session	None
January 3 2025 :23:10 AM	Start	ualification	Session	O

Date: January 3 2025 9:06:3 AM
System ID: GM-6

User Name: sulkifli.mama
Report Generated by Hostname: AG-5CG2030XXV
System Id: GM-6
Print Date: January 3, 2025 9:06:57 AM

6006666213_ALS_OQ_GM6 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
January 2 2025 4:07:1 PM	Start	Execution	In ection Precision - 7697A ith Tray Headspace Front SSL S : - Source: - EI - Inert L (Area): 5.00% - L (Ret. Time): 1.00%	None
January 2 2025 4:0 :03 PM	Audit	Data	In ection Precision - 7697A ith Tray Headspace Front SSL S : - Source: - EI - Inert L (Area): 5.00% - L (Ret. Time): 1.00%	Data files Path : F:\O 2025 ALS\O 2025\P_02.D
January 2 2025 4:0 :03 PM	Audit	Data	In ection Precision - 7697A ith Tray Headspace Front SSL S : - Source: - EI - Inert L (Area): 5.00% - L (Ret. Time): 1.00%	Data files Path : F:\O 2025 ALS\O 2025\P_03.D
January 2 2025 4:0 :03 PM	Audit	Data	In ection Precision - 7697A ith Tray Headspace Front SSL S : - Source: - EI - Inert L (Area): 5.00% - L (Ret. Time): 1.00%	Data files Path : F:\O 2025 ALS\O 2025\P_04.D
January 2 2025 4:0 :03 PM	Audit	Data	In ection Precision - 7697A ith Tray Headspace Front SSL S : - Source: - EI - Inert L (Area): 5.00% - L (Ret. Time): 1.00%	Data files Path : F:\O 2025 ALS\O 2025\P_05.D
January 2 2025 4:0 :03 PM	Audit	Data	In ection Precision - 7697A ith Tray Headspace Front SSL S : - Source: - EI - Inert L (Area): 5.00% - L (Ret. Time): 1.00%	Data files Path : F:\O 2025 ALS\O 2025\P_06.D
January 2 2025 4:0 :03 PM	Audit	Data	In ection Precision - 7697A ith Tray Headspace Front SSL S : - Source: - EI - Inert L (Area): 5.00% - L (Ret. Time): 1.00%	Data files Path : F:\O 2025 ALS\O 2025\P_07.D

Date: January 3 2025 9:06:3 AM
System ID: GM-6

User Name: sulkifli.mama
Report Generated by Hostname: AG-5CG2030XXV
System Id: GM-6
Print Date: January 3, 2025 9:06:57 AM

6006666213_ALS_OQ_GM6 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
January 2 2025 12:2 :24 PM	Audit	AceClosed	Session	None
January 2 2025 12:32:30 PM	Audit	AceRestarted	Session	None
January 2 2025 12:32:31 PM	Audit	SessionReloaded	Session	None
January 2 2025 12:32:36 PM	Start	ualification	Session	O
January 2 2025 12:32:36 PM	Start	Execution	RFPA - 5975C inert XL ith TAD S : - Source: EI - Inert	None
January 2 2025 1:02:57 PM	End	Execution	RFPA - 5975C inert XL ith TAD S : - Source: EI - Inert	Run Count : 1
January 2 2025 1:03:02 PM	Start	Execution	Tune EI - 5975C inert XL ith TAD S : - Source: - EI - Inert Filament 1 (ualitative - No setpoints associated)	None
January 2 2025 1:17:33 PM	Start	Execution	In ection Precision - 7697A ith Tray Headspace Front SSL S : - Source: - EI - Inert L (Area): 5.00% - L (Ret. Time): 1.00%	None
January 2 2025 1:26:33 PM	Start	Execution	Tune EI - 5975C inert XL ith TAD S : - Source: - EI - Inert Filament 1 (ualitative - No setpoints associated)	None
January 2 2025 1:52:07 PM	End	Execution	Tune EI - 5975C inert XL ith TAD S : - Source: - EI - Inert Filament 1 (ualitative - No setpoints associated)	Run Count : 1
January 2 2025 1:52:10 PM	Start	Execution	Tune EI - 5975C inert XL ith TAD S : - Source: - EI - Inert Filament 2 (ualitative - No setpoints associated)	None

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Report Generated by Hostname: AG-9CG2030XXV

System Id: GM-6
Print Date: January 3, 2025 9:06:07 AM

6006966213_ALS_OQ_GM6 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
January 3 2025 23:49 AM	End	ualification	Session	O
January 3 2025 23:49 AM	Start	Reporting	Session	None
January 3 2025 9:00:57 AM	Audit	Reporting	Session	Report Generated : Certificate
January 3 2025 9:03:33 AM	Audit	AceRestarted	Session	None
January 3 2025 9:03:34 AM	Audit	SessionReloaded	Session	None
January 3 2025 9:03:44 AM	Start	ualification	Session	O
January 3 2025 9:04:43 AM	Audit	Reporting	Session	Report Generated : Certificate
January 3 2025 9:05:31 AM	Audit	Reporting	Session	Report Generated : Report