

ภาคผนวก ง

เอกสารสอบเทียบเครื่องมือที่ใช้ในการวิเคราะห์



right solutions.
right partner.

รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Ambient	Propylene Oxide	Field Rotameter	BKK_FS1041	2-Jul-24	2-Oct-24	3
Ambient	Propylene Oxide	DRYCAL FLOWMETER	BKK_FS1347	18-Aug-23	18-Aug-24	12
Ambient	Propylene Oxide	DRYCAL FLOWMETER	BKK_FS0619	25-Sep-23	25-Sep-24	12
Ambient	Propylene Oxide	DRYCAL FLOWMETER	BKK_FS1346	29-Jan-24	28-Jan-25	12
Ambient	Propylene Oxide	Field Rotameter	RYG_FS0657	2-Oct-24	2-Jan-25	3
Ambient	Propylene Oxide	GC-FID	BKK_EN0126	21-Apr-23	21-Oct-24	18
Ambient	Propylene Oxide	GC-FID	BKK_EN0126	22-Oct-24	22-Apr-26	18
Noise	Leq 24 hrs	Sound Calibrator	RYG_FS0496	26-Jan-24	25-Jan-25	12
Noise	Leq 24 hrs	Sound Level Meter	RYG_FS0433	22-Feb-24	21-Feb-25	12
Noise	Leq 24 hrs	Sound Level Meter	RYG_FS0431	22-Feb-24	21-Feb-25	12
Noise	Leq 24 hrs	Sound Level Meter	RYG_FS0434	22-Feb-24	21-Feb-25	12
Noise	Leq 12 hrs	Sound Calibrator	RYG_FS0213	28-Feb-24	27-Feb-25	12
Noise	Leq 12 hrs	Sound Level Meter	RYG_FS0388	5-Jan-24	4-Jan-25	12
Noise	Leq 12 hrs	Sound Level Meter	RYG_FS0389	5-Jan-24	4-Jan-25	12
Noise	Leq 12 hrs	Sound Calibrator	RYG_FS0496	26-Jan-24	25-Jan-25	12
Noise	Leq 12 hrs	Sound Level Meter	RYG_FS0018	22-Jan-24	21-Jan-25	12
Noise	Leq 12 hrs	Sound Level Meter	RYG_FS0017	22-Jan-24	21-Jan-25	12
Heat	Heat Stress	Heat Stress Monitor	RYG_FS0230	8-Jan-24	7-Jan-25	12
Rayong Lab	pH at 25 °C	pH Meter	RYG_EN0152	14-Dec-23	14-Jun-25	18
Rayong Lab	BOD	DO meter with Sensor	RYG_EN0032	24-Jul-23	24-Jan-25	18
Rayong Lab	BOD	Incubator	RYG_EN0154	1-Nov-24	1-May-26	18
Rayong Lab	BOD	Burette	RYG_EN0216	24-Sep-24	24-Sep-25	12
Rayong Lab	COD	Spectrophotometer	RYG_EN0037	18-Sep-23	18-Mar-25	18
Rayong Lab	Oil & Grease	Electronic Balance	RYG_EN0002	22-Feb-24	22-Feb-25	12
Rayong Lab	Oil & Grease	Hot Air Oven	RYG_EN0213	21-Mar-24	21-Mar-25	12
Rayong Lab	Oil & Grease	Water Bath	RYG_EN0061	21-Mar-24	21-Sep-25	18
Rayong Lab	Total Suspended Solids	Electronic Balance	RYG_EN0002	22-Feb-24	22-Feb-25	12
Rayong Lab	Total Suspended Solids	Hot Air Oven	RYG_EN0010	21-Mar-24	21-Sep-25	18
Water Lab	Propylene Glycol	Gas Chromatography (FID)	BKK_EN0411	10-May-24	10-May-25	12
Water Lab	Total Organic carbon	TOC Analyzer	BKK_EN0066	26-Jun-24	26-Jun-25	12
Water Lab	Propylene Oxide	Gas Chromatography (FID)	BKK_EN0126	21-Apr-23	21-Oct-24	18
Soil	Propylene Oxide	Gas Chromatography (FID)	BKK_EN0126	21-Apr-23	21-Oct-24	12



ROTA METER CALIBRATION RESULT JULY 2024

Rotameter ID.	Calibration Date	Regression Result	Coefficient (R ²)
BKK_FS0577	01 Jul 24	$Y = 1.0001x + 0.0433$	1.0000
BKK_FS0584	01 Jul 24	$Y = 1.0056x - 2.7674$	1.0000
BKK_FS0585	02 Jul 24	$Y = 1.0315x + 3.0033$	0.9998
BKK_FS0587	02 Jul 24	$Y = 1.0294x + 0.71$	1.0000
BKK_FS0588	01 Jul 24	$Y = 0.9751x + 9.8452$	0.9999
BKK_FS0591	01 Jul 24	$Y = 1.0035x - 8.2303$	1.0000
BKK_FS0592	02 Jul 24	$Y = 1.002x + 14.273$	1.0000
BKK_FS0594	02 Jul 24	$Y = 1.0003x + 7.0095$	1.0000
BKK_FS0595	01 Jul 24	$Y = 1.0671x - 114.97$	0.9985
BKK_FS1004	02 Jul 24	$Y = 0.9926x + 13.51$	0.9999
BKK_FS1005	02 Jul 24	$Y = 1.0217x - 0.5833$	0.9997
BKK_FS1006	02 Jul 24	$Y = 1.149x - 1.0422$	0.9981
BKK_FS1007	02 Jul 24	$Y = 1.1116x + 3.3558$	0.9994
BKK_FS1008	02 Jul 24	$Y = 1.1273x - 0.4837$	0.9999
BKK_FS1009	01 Jul 24	$Y = 1.1044x - 0.8245$	1.0000
BKK_FS1017	02 Jul 24	$Y = 1.0488x + 2.2027$	0.9998
BKK_FS1018	02 Jul 24	$Y = 1.0173x - 0.1967$	0.9998
BKK_FS1019	02 Jul 24	$Y = 1.0022x + 5.619$	1.0000
BKK_FS1026	01 Jul 24	$Y = 1.072x - 2.4954$	1.0000
BKK_FS1027	01 Jul 24	$Y = 1.0104x - 4.4788$	0.9999
BKK_FS1028	01 Jul 24	$Y = 1.0009x - 3.7755$	1.0000
BKK_FS1029	01 Jul 24	$Y = 1.1118x - 4.4431$	0.9965
BKK_FS1030	01 Jul 24	$Y = 1.0159x - 6.395$	1.0000
BKK_FS1031	01 Jul 24	$Y = 0.9973x - 5.3371$	0.9999
BKK_FS1039	02 Jul 24	$Y = 0.9992x + 9.6833$	0.9992
BKK_FS1040	01 Jul 24	$Y = 1.0034x - 2.5343$	1.0000
BKK_FS1041	02 Jul 24	$Y = 1.0511x + 1.1272$	0.9996
BKK_FS1042	02 Jul 24	$Y = 1.0016x + 10.387$	0.9995
BKK_FS1043	01 Jul 24	$Y = 0.9965x + 9.3743$	1.0000
BKK_FS1044	02 Jul 24	$Y = 1.1237x - 0.4231$	0.9981
BKK_FS1200	01 Jul 24	$Y = 1.0337x - 0.1016$	0.9994
BKK_FS1201	01 Jul 24	$Y = 0.9871x + 5.0931$	0.9986
BKK_FS1202	01 Jul 24	$Y = 0.7978x + 301.39$	0.9334
PHK_FS0027	02 Jul 24	$Y = 1.0722x + 3.4395$	0.9988
PHK_FS0028	02 Jul 24	$Y = 1.0254x + 1.04$	1.0000
PHK_FS0029	02 Jul 24	$Y = 0.999x + 12.73$	1.0000
RYG_FS0197	01 Jul 24	$Y = 1.0045x + 10.291$	1.0000
RYG_FS0198	01 Jul 24	$Y = 1.0056x + 1.8883$	1.0000
RYG_FS0199	02 Jul 24	$Y = 1.0029x + 3.2361$	0.9990

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ALS Laboratory Group



ROTA METER CALIBRATION RESULT JULY 2024

Rotameter ID.	Calibration Date	Regression Result	Coefficient (R ²)
RYG_FS0654	02 Jul 24	$Y = 1.0421x + 1.4935$	1.0000
RYG_FS0655	02 Jul 24	$Y = 0.975x + 15.2$	0.9994
RYG_FS0656	01 Jul 24	$Y = 1.0042x + 7.1067$	0.9999
RYG_FS0657	02 Jul 24	$Y = 1.0337x + 1.8918$	0.9998
RYG_FS0658	02 Jul 24	$Y = 0.9921x + 10.87$	0.9996
RYG_FS0659	01 Jul 24	$Y = 1.0022x + 8.4152$	1.0000
SGK_FS0135	02 Jul 24	$Y = 1.0193x + 3.6833$	0.9999
SGK_FS0136	02 Jul 24	$Y = 1.0217x + 1.63$	1.0000
SGK_FS0138	02 Jul 24	$Y = 1.055x + 4.5833$	0.9999
SGK_FS0139	02 Jul 24	$Y = 1.0154x + 3.74$	0.9998
SGK_FS0140	02 Jul 24	$Y = 1.0006x + 13.353$	1.0000
SGK_FS0141	02 Jul 24	$Y = 1.1185x + 1.4867$	0.9998
SGK_FS0142	02 Jul 24	$Y = 1.0211x + 1.39$	1.0000
SGK_FS0143	02 Jul 24	$Y = 1.0045x + 5.9981$	1.0000

Review By:

(Mr. Wichan Choonharat)

Enviro Field Services Manager

Approved By:

(Mr. Sarayuth Jitranont)

Assistant General Manager

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ALS Laboratory Group



MesaLabs

NVLAP Lab Code 200661-0
Calibration

Calibration Certificate

Certificate No. 551422
Product 200-S10M Defender 510 Medium Flow
Serial No. 206345
Cal. Date 18-Aug-2023

Sold To:

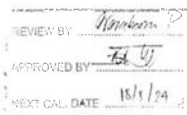
All calibrations are performed in accordance with ISO 17025 at Mesa Laboratories, Inc., 12100 W. 6th Ave, Lakewood, CO 80228, an ISO 17025:2017 accredited laboratory through NVLAP. This report shall not be reproduced except in full without the written approval of the laboratory. Results only relate to 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		Lab. Pressure		Lab. Temperature		Lab. Pressure		Lab. Temperature	
Aaron Schwartz		620.1 mmHg		23.5 °C					
Instrument Reading	Lab Standard Reading	Deviation	Allowable Deviation	As Received					
4523.09 ccm	4519.02 ccm	0.09%	1.00%	In Tolerance					
999.43 ccm	999.31 ccm	0.01%	1.00%	In Tolerance					
245.22 ccm	245.88 ccm	-0.27%	1.00%	In Tolerance					

Mesa Laboratories Standards Used

Description	Standard Serial Number	Calibration Date	Calibration Due Date
ML_800_24	205307	25-May-2023	23-May-2024



MesaLabs

NVLAP Lab Code 200661-0
Calibration

As Shipped Calibration Data

Certificate No		Lab. Pressure		Lab. Temperature		Lab. Pressure		Lab. Temperature	
551422		615.8 mmHg		24.2 °C					
Technician		Xiern Ly							
Instrument Reading	Lab Standard Reading	Deviation	Allowable Deviation	As Shipped					
4516.61 ccm	4515.56 ccm	0.02%	1.00%	In Tolerance					
1000.87 ccm	1000.67 ccm	0.02%	1.00%	In Tolerance					
249.84 ccm	249.95 ccm	-0.04%	1.00%	In Tolerance					

Mesa Laboratories Standards Used

Description	Standard Serial Number	Calibration Date	Calibration Due Date
ML_800_24	100439	14-Sep-2022	14-Sep-2023

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:

Approved By:

Xiern Ly
Production Technician IIINorma Aragon
QC Inspector

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. Calibration process includes a Test Uncertainty Ratio (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.



Calibration Certificate

Certificate No. 561587
Product 200-510L Defender 510 Low Flow
Serial No. 130026
Cal. Date 25-Sep-2023

Sold To:

All calibrations are performed in 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	Aaron Schwartz	Lab. Pressure	616.1 mmHg	Lab. Temperature	24 °C
Instrument Reading	Lab Standard Reading	Deviation	Allowable Deviation	As Received	
0 ccm	456.41 ccm	-100.0%	1.00%	Out of Tolerance	
0 ccm	101.19 ccm	-100.0%	1.00%	Out of Tolerance	
0 ccm	30.36 ccm	-100.0%	1.00%	Out of Tolerance	

Mesa Laboratories Standards Used

Description	Standard Serial Number	Calibration Date	Calibration Due Date
ML_800_10	103743	25-Jan-2023	25-Jan-2024

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FM-00228 Rev B



As Shipped Calibration Data

Certificate No	561587	Lab. Pressure	622.2 mmHg	Lab. Temperature	23.5 °C
Technician	Aaron Schwartz				
Instrument Reading	Lab Standard Reading	Deviation	Allowable Deviation	As Shipped	
449.75 ccm	450.46 ccm	-0.16%	1.00%	In Tolerance	
100.96 ccm	103.82 ccm	0.14%	1.00%	In Tolerance	
30.63 ccm	30.38 ccm	0.82%	1.00%	In Tolerance	

Mesa Laboratories Standards Used

Description	Standard Serial Number	Calibration Date	Calibration Due Date
ML_800_10	103743	25-Jan-2023	25-Jan-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:

Approved By:

Aaron Schwartz
Assembler I

David Thomas
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. Calibration process has a Test Uncertainty Ratio (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.

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Calibration Certificate

Certificate No. 561588
Product 200-510M Defender 510 Medium Flow
Serial No. 151114
Cal. Date 30-Sep-2023

Sold To:

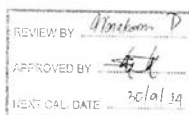
All calibrations are performed in accordance with ISO 17025 at Mesa Laboratories, Inc., 12100 W. 6th Ave., Lakewood, CO 80228, an ISO 17025:2017 accredited laboratory through NVLAP. This report shall not be reproduced except in full without the written approval of the laboratory. Results only relate 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	Xiem Ly	Lab. Pressure	616.9 mmHg	Lab. Temperature	25.8 °C
Instrument Reading	Lab Standard Reading	Deviation	Allowable Deviation	As Received	
0 ccm	4499.66 ccm	-100.0%	1.00%	Out of Tolerance	
0 ccm	997.39 ccm	-100.0%	1.00%	Out of Tolerance	
0 ccm	250.32 ccm	-100.0%	1.00%	Out of Tolerance	

Mesa Laboratories Standards Used

Description	Standard Serial Number	Calibration Date	Calibration Due Date
ML_800_24	117991	16-Aug-2023	16-Aug-2024



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FM-00228 Rev B



As Shipped Calibration Data

Certificate No	561588	Lab. Pressure	616.2 mmHg	Lab. Temperature	26.1 °C
Technician	Xiem Ly				
Instrument Reading	Lab Standard Reading	Deviation	Allowable Deviation	As Shipped	
4495.74 ccm	4494.43 ccm	0.05%	1.00%	In Tolerance	
997.03 ccm	997.16 ccm	-0.01%	1.00%	In Tolerance	
249.84 ccm	250.5 ccm	-0.26%	1.00%	In Tolerance	

Mesa Laboratories Standards Used

Description	Standard Serial Number	Calibration Date	Calibration Due Date
ML_800_24	117991	05-Dec-2022	05-Dec-2023

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:

Approved By:

Xiem Ly
Production Technician II

Norma Aragon
QC Inspector

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. Calibration process has a Test Uncertainty Ratio (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.

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FM-00228 Rev B

Certificate of Calibration

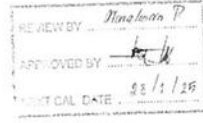
Customer: Certificate No : 24-AFM-018 Rev.1
Name: AJS Laboratory Group Thailand Co., Ltd. Request No : Req-2024-0043
Address: 104 Soi Phatthanakan 40, Phatthanakan Road, Suan Luang, Bangkok 10250

Unit Under Calibration Details

Measurement Item : Air Flow Meter
Manufacturer : Bios
Model : Defender S10-L
Serial Number : 206895
ID : BKK_FSI346
Sensor Model :
Sensor Serial Number :
Location of Calibration : LAB 4 AIR VELOCITY METER

Calibration Environment and Details

Temperature : $\pm 23^{\circ}\text{C} \pm 3^{\circ}\text{C}$
Humidity : $55\% \text{RH} \pm 20\% \text{RH}$
Barometric Pressure : $\pm 1013 \text{ hPa} \pm 10 \text{ hPa}$
Received Date : 3 January 2024
Calibration Date : 3 January 2024
Calibration Procedure : In house method CP-AFM-01 by Comparison technique with Standard Primary Flow Calibrator



Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Gilibrator 3 Low flow	1850101006	Sensidyne	12 July 2024
Air Flow Meter	Gilibrator 3 Standard flow	19031011003	Sensidyne	12 July 2024
Temperature meter	GT 11	08060857	Quborn	27 February 2024
Pressure meter	CPG2400	41000KDL 651557	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 %.

This Certificate was issued in replace to Calibration Certificate No. 24-AFM-018

Calibration By : Mr. Noppradon Luangrat
Service Calibration Engineer

Approved By : Mr. Paei Mallavorn
Calibration Engineer Supervisor
Issue Date : 1 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

Certificate No : 24-AFM-018 Rev.1
Request No : Req-2024-0043

Result of Calibration : Without Adjustment

Temperature ($^{\circ}\text{C}$)	Pressure (kPa)	STD (ml/min)	UUC (ml/min)	Error (ml/min)	Uncertainty (ml/min)
25.00	101.66	20	20.148	0.1	1.3
25.00	101.67	100	99.409	-0.6	2.8
24.90	101.63	199	197.46	-1.5	5.6
25.00	101.61	300	298.15	-1.8	8.4
25.00	101.69	399	400.13	1	11
24.90	101.59	480	478.02	-2.0	6.8

Note : STD : Standard UUC : Unit Under Calibration
- UUC Reference Condition : At atmospheric pressure and room temperature condition
- Flow Rate was corrected for non-standard operating condition by using equation

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

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

Certificate of Calibration

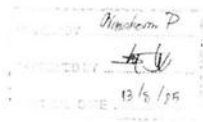
Customer: Certificate No : 24-AFM-033
Name: AJS Laboratory Group Thailand Co., Ltd. Request No : Req-2024-0241
Address: 104 Soi Phatthanakan 40, Phatthanakan Road, Suan Luang, Bangkok 10250

Unit Under Calibration Details

Measurement Item : Primary Flow Calibrator
Manufacturer : Bios
Model : Defender S10-L
Serial Number : 130027
ID : RYG_F50208
Sensor Model :
Sensor Serial Number :
Location of Calibration : LAB 4 AIR VELOCITY METER

Calibration Environment and Details

Temperature : $25^{\circ}\text{C} \pm 3^{\circ}\text{C}$
Humidity : $55\% \text{RH} \pm 20\% \text{RH}$
Barometric Pressure : $\pm 1013 \text{ hPa} \pm 10 \text{ hPa}$
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



Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Gilibrator 3 Low flow	1850101006	Sensidyne	12 July 2024
Air Flow Meter	Gilibrator 3 Standard flow	19031011003	Sensidyne	12 July 2024
Temperature meter	GT 11	08060857	Quborn	27 February 2024
Pressure meter	CPG2400	41000KDL 651557	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. Noppradon Luangrat
Service Calibration Engineer

Approved By : Mr. Paei Mallavorn
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

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

Result of Calibration : Without Adjustment

Temperature ($^{\circ}\text{C}$)	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	101.21	200	199.13	-0.9	5.6
23.90	101.42	301	303.56	2.6	8.4
24.10	101.41	401	401.57	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

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

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

Certificate of Calibration

Customer: ALS Laboratory Group Thailand Co., Ltd.
Name: ALS Laboratory Group Thailand Co., Ltd.
Address: 104 Soi Phattanakarn 40, Phattanakarn Road, Suan Luang, Bangkok 10250
Certificate No: 24-AFM-032
Request No: Req-2024-0240

Unit Under Calibration Details

Measurement Item: Primary Flow Calibrator

Manufacturer: Bais

Model: Defender 510-M

Sensor Model: -

Serial Number: 129958

Sensor Serial Number: -

ID: RYGI-FS0209

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

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Gillibrator 3 Low Flow	1550H01006	Sensu-Sync	12 July 2024
Air Flow Meter	Calibrator 3 Standard Flow	19031011003	Sensu-Sync	12 July 2024
Temperature meter	GT II	08000057	Qtechem	27 February 2024
Pressure meter	CPU2400	4100061DUK5185-2	TPA	9 November 2024


Traceability:

This Certificate is traceable to SI Unit through Sensu-Sync A2LA Accreditation No. 3942.01

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. Noppadol Luangnir
Service Calibration Engineer

Approved By: 
Mr. Pavin Mathayom
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

Certificate No: 24-AFM-032
Request No: Req-2024-0240

Result of Calibration: Without Adjustment

Temperature (°C)	Pressure (hPa)	STD (cc/min)	UUC (cc/min)	Error (cc/min)	Uncertainty (cc/min)
23.50	101.89	95	109.13	5.1	2.8
23.90	101.71	501	513.93	12.9	7.2
24.18	101.62	1006	1019.3	13	14
24.00	101.81	1997	2023.0	26	29
24.00	101.87	2099	2035.5	37	45
24.60	102.00	3944	3991.8	48	59
24.60	102.08	4739	4790.5	52	72

Note:

STD = Standard UUC = Unit Under Calibration

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

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

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

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

* Indicates non accredited

End of Certificate

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

BKK_FS0619

MesaLabs

NVLAP
NVLAP Lab Code 200661-0
Calibration

Calibration Certificate

Certificate No. 561587
Product: 200-510L Defender 510 Low Flow
Serial No. 130026
Cal. Date: 25-Sep-2023

Sold To:

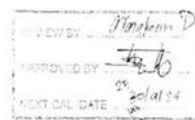
All calibrations are performed in accordance with ISO 17025 at Mesa Laboratories, Inc., 12100 W 6th Ave, Lakewood, CO 80226, an ISO 17025:2017 accredited laboratory through NVLAP. This report shall not be reproduced except in full without the written approval of the laboratory. Results only relate to 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	Lab. Pressure	Lab. Temperature	618.1 mmHg	24 °C
Aaron Schwartz	Lab Standard Reading	Deviation	Allowable Deviation	As Received
0 ccm	-56.41 ccm	+100.0%	1.00%	Out of Tolerance
0 ccm	101.19 ccm	-100.0%	1.00%	Out of Tolerance
0 ccm	30.36 ccm	-100.0%	1.00%	Out of Tolerance

Mesa Laboratories Standards Used

Description	Standard Serial Number	Calibration Date	Calibration Due Date
ML_800_10	103743	25-Jan-2023	25-Jan-2024



MesaLabs

NVLAP
NVLAP Lab Code 200661-0
Calibration

As Shipped Calibration Data

Certificate No Technician	561587 Aaron Schwartz	Lab. Pressure Lab. Temperature	622.2 mmHg 23.6 °C	
Instrument Reading	Lab Standard Reading	Deviation	Allowable Deviation	As Shipped
449.75 ccm	450.48 ccm	+0.16%	1.00%	In Tolerance
100.95 ccm	100.82 ccm	0.14%	1.00%	In Tolerance
30.63 ccm	30.38 ccm	0.82%	1.00%	In Tolerance

Mesa Laboratories Standards Used

Description	Standard Serial Number	Calibration Date	Calibration Due Date
ML_800_10	103743	25-Jan-2023	25-Jan-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 0.77% 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:

Approved By:


Aaron Schwartz
Assembler I


David Thomas
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. Calibration process has a Test Uncertainty Ratio (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.

Certificate of Calibration

Customer

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

Certificate No : 24-AFM-018 Rev.1
Request No : Req-2024-0013

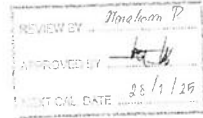
Unit Under Calibration Details

Measurement Item : Air Flow Meter
Manufacturer : Bios
Model : Defensor S104L
Serial Number : 206895
ID : BKK_FS1546
Sensor Model : *
Sensor Serial Number : *

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 : 3 January 2024
Calibration Date : 29 January 2024
Calibration Procedure : In house method CP-AFM-01 by Comparison technique with Standard Primary Flow Calibration



Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Gilibrator 3 Low flow	1850101006	Sensodyne	12 July 2024
Air Flow Meter	Gilibrator 3 Standard flow	1903101003	Sensodyne	12 July 2024
Temperature meter	GT 11	180906057	Oxlowm	27 February 2024
Pressure meter	CPG2400	41001KDU-651822	TPA	9 November 2024

Traceability :

This Certificate is traceable to SI Unit through Sensodyne A2LA Accreditation No. J943.07.

Note :

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

This Certificate was issued in replace to Calibration Certificate No. 24-AFM-018.

Calibration By : prc
Mr Noppadol Tunjan
Service Calibration Engineer

Approved By : Mr Pich Mathavorn
Calibration Engineer Supervisor
Issue Date : 1 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-705-AFM-01 Rev 01 Issue date 25/01/24

Certificate No : 24-AFM-018 Rev.1
Request No : Req-2024-0013

Result of Calibration : Without Adjustment

Temperature (°C)	Pressure (kPa)	STD (ml/min)	UUC (ml/min)	Error (ml/min)	Uncertainty (ml/min)
25.00	101.66	20	20.148	0.1	1.3
25.00	101.67	100	99.409	-0.6	2.8
24.00	101.63	199	197.46	-1.5	5.6
23.00	101.61	300	298.15	-1.8	8.4
22.00	101.60	399	400.13	1	11
21.00	101.59	499	478.02	-2.0	6.8

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.

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

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-705-AFM-01 Rev 01 Issue date 25/01/24



Calibration Certificate

Certificate No. 610563
Product : 200-510M Delender S10 Medium Flow
Serial No. 151114
Cal. Date : 21-May-2024

Sold To:

All calibrations are performed in 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 Dallape	Lab. Pressure	614.2 mmHg	Lab. Temperature	24.3 °C
Instrument Reading	Lab Standard Reading	Deviation	Allowable Deviation	As Received	
0 ccm	4504.81 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	Standards Serial Number	Calibration Date	Calibration Due Date
ML-800-24	117991	13-Nov-2023	13-Nov-2024

Handwritten signature and date 21/5/24



As Shipped Calibration Data

Certificate No	610563	Lab. Pressure	617 mmHg	
Technician	Derek Dallape	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
997.25 ccm	996.83 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: _____ Approved By: _____

Handwritten signature: Troy Thacker

Derek Dallape
Production Assembler II

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 Ratio (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.

Certificate of Calibration

Customer

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

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

Unit Under Calibration Details

Measurement Item Primary Flow Calibrator

Manufacturer Bios

Model Defender S10-L

Sensor Model

Serial Number 130027

Sensor Serial Number

ID RYG-FS020S

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

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Calibrator 3 Low flow	18501010006	Sensidyne	12 July 2024
Air Flow Meter	Calibrator 3 Standard flow	19031011003	Sensidyne	12 July 2024
Temperature meter	GT 11	08000037	Oxtronic	27 February 2024
Pressure meter	CPG2400	41050KDU/651852	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 Luangrat
Service Calibration Engineer

Approved By :

Mr Poon Matharom
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

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	101.21	200	199.13	-0.9	5.6
23.80	101.42	301	303.56	2.6	8.4
24.10	101.41	401	404.57	4	11
24.10	101.49	450	453.81	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 :

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

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

Certificate of Calibration

Customer

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

Certificate No : 24-AFM-032
Request No : Req-2024-0240

Unit Under Calibration Details

Measurement Item Primary Flow Calibrator

Manufacturer Bios

Model Defender S10-M

Sensor Model

Serial Number 129958

Sensor Serial Number

ID RYG-FS0209

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

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Calibrator 3 Low flow	18501010006	Sensidyne	12 July 2024
Air Flow Meter	Calibrator 3 Standard flow	19031011003	Sensidyne	12 July 2024
Temperature meter	GT 11	08000037	Oxtronic	27 February 2024
Pressure meter	CPG2400	41050KDU/651852	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 Luangrat
Service Calibration Engineer

Approved By :

Mr Poon Matharom
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

Certificate No : 24-AFM-032
Request No : Req-2024-0240

Result of Calibration : Without Adjustment

Temperature (°C)	Pressure (kPa)	STD (cc/min)	UUC (cc/min)	Error (cc/min)	Uncertainty (cc/min)
23.80	101.89	95	103.13	5.1	2.9
23.90	101.71	501	513.93	12.9	7.2
24.18	101.62	1006	1019.3	13	14
24.00	101.81	1997	2023.0	26	29
24.10	101.87	2999	3035.5	37	45
24.60	102.00	3944	3991.8	48	59
24.60	102.08	4719	4799.5	53	72

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 :

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

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

Certificate of Calibration

Customer

Name ALS Laboratory Group Thailand Co., Ltd.
Address 101 Soi Phatthana 40, Phatthana Road, Nuan Luang,
Bangkok 10250

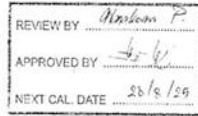
Certificate No : 24-AFM-174
Request No : Req-2024-1861

Unit Under Calibration Details

Measurement Item : Air Flow Meter
Manufacturer : Mesa Labs
Model : F10-M
Serial Number : 205345
ID : BKK_FSI147
Location of Calibration : LAB 4 AIR VELOCITY METER
Accuracy : 1% of Reading
Sensor Model :
Sensor Serial Number :
Instrument State : Used

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 22 August 2024
Calibration Date : 28 August 2024
Calibration Procedure : In-house method CP-AFM-01 by Comparison technique with Standard Primary Flow Calibrator



Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Calibrator 3 Low flow	1859101006	Scandynave	6 August 2025
Air Flow Meter	Calibrator 3 Standard flow	1901011003	Scandynave	2 August 2025
Temperature meter	GT II	08960057	Oreborn	1 March 2025
Pressure meter	CPG2400	4100KDU651852	TFA	9 November 2024

Traceability :

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

Note :

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

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

Approved By : *[Signature]*
Mr. Pait Mathayon
Calibration Engineer Supervisor
Issue Date : 28 August 2024

The results relate 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 04 Issue date 17/6/24

Certificate No : 24-AFM-174
Request No : Req-2024-1861

Result of Calibration : Without Adjustment

Temperature (°C)	Pressure (kPa)	STD (cc/min)	UCC (cc/min)	Error (cc/min)	Uncertainty (cc/min)	MPE (cc/min)	Result
22.30	100.57	100	99.526	-0.5	2.8	1	N/A
22.40	100.61	499	500.48	1.5	7.8	5	N/A
22.50	100.56	1004	1004.8	1	15	10	N/A
22.60	100.54	2068	2062.5	-5	29	20	N/A
22.80	100.62	3034	3032.1	-2	45	30	N/A
23.20	100.71	4052	4022.4	-30	60	40	N/A
23.40	100.72	5086	5056.4	-30	79	51	N/A

Note : STD = Standard UCC = Unit Under Calibration
= UCC Reference Condition : At atmospheric pressure and room temperature condition
= Flow Rate was corrected for non-standard operating condition by using equation 1

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

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

* Indicates non accredited

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

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

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

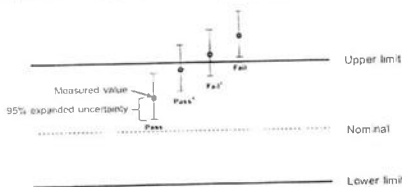
FM-708-AFM-01 Rev 04 Issue date 17/6/24

Certificate No : 24-AFM-174
Request No : Req-2024-1861

Decision Rule for Statements of Conformity

The standard decision rule employed for the statements of conformity to each calibration result shall be applied using ILAC G19:2019 Guidelines on the Reporting of Conformity with Specifications as follows for Tag statements

- Pass : The measurement result plus the expanded uncertainty with a 95% coverage probability, were within the limit.
Fail : The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.
Fail : The measurement result is within the limit. However, a portion of the expanded uncertainty of measurement at 95% is within the limit.
Fail : The measurement result plus the expanded uncertainty with a 95% coverage probability, were outside the limit.



End of Certificate

The results relate 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 34 Issue date 25/21/24

Certificate of Calibration

Customer

Name ALS Laboratory Group Thailand Co., Ltd.
Address 101 Soi Phatthana 40, Phatthana Road, Nuan Luang, Bangkok,
10250

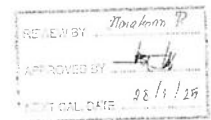
Certificate No : 24-AFM-018 Rev. 1
Request No : Req-2024-0043

Unit Under Calibration Details

Measurement Item : Air Flow Meter
Manufacturer : Bios
Model : Defenlar S10-L
Serial Number : 206845
ID : BKK_FSI146
Location of Calibration : LAB 4 AIR VELOCITY METER
Sensor Model :
Sensor Serial Number :

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 3 January 2024
Calibration Date : 29 January 2024
Calibration Procedure : In-house method CP-AFM-01 by Comparison technique with Standard Primary Flow Calibrator



Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Calibrator 3 Low flow	1859101006	Scandynave	12 July 2024
Air Flow Meter	Calibrator 3 Standard flow	19031011003	Scandynave	12 July 2024
Temperature meter	GT II	08960057	Oreborn	27 February 2024
Pressure meter	CPG2400	4100KDU651852	TFA	9 November 2024

Traceability :

This Certificate is traceable to SI Unit through Scandynave 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 %.

This Certificate was issued to replace to Calibration Certificate No. 24-AFM-018

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

Approved By : *[Signature]*
Mr. Pait Mathayon
Calibration Engineer Supervisor
Issue Date : 1 February 2024

The results relate 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 03 Issue date 25/21/24

Certificate No : 24-AFM-018 Rev 1
Request No : Req-2024-0032

Result of Calibration : Without Adjustment

Temperature (°C)	Pressure (kPa)	STD (ml/min)	UUC (ml/min)	Error (ml/min)	Uncertainty (ml/min)
25.00	101.66	20	20.148	0.1	1.3
25.00	101.67	100	99.409	-0.6	2.8
24.90	101.63	199	197.46	-1.5	5.6
25.00	101.64	300	298.15	-1.8	9.1
24.90	101.60	399	400.13	1	11
24.80	101.59	480	478.02	-2.0	8.8

Note: STD = Standard UUC = Unit Under Calibration
- UUC Reference Condition : At atmospheric pressure and room temperature condition
- Flow Rate was corrected for non-standard operating condition by using equation

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

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

* Indicates non accredited

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



As Shipped Calibration Data

Certificate No	610563	Lab. Pressure	617 mmHg	
Technician	Derek Dellape	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
997.25 ccm	996.83 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: Approved By:

Troy Thacker

Derek Dollape
Production Assembler II

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 Ratio (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.



Calibration Certificate

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

Sold To:

All calibrations are performed in 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 Dellape		Lab. Pressure	614.2 mmHg
			Lab. Temperature	24.3 °C
Instrument Reading	Lab Standard Reading	Deviation	Allowable Deviation	As Received
0 ccm	4504.81 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	117991	13-Nov-2023	13-Nov-2024

Certificate of Calibration

Customer: ALS Laboratory Group Thailand Co., Ltd.
Name: Certificate No : 24-AFM-033
Request No : Req-2024-0241

Address: 104 Soi Phatthanakan 40, Phatthanakan Road, Suan Luang, Bangkok
10250

Unit Under Calibration Details

Measurement Item: Primary Flow Calibrator
Manufacturer: Bux
Model: Defender 510-L
Serial Number: 130627
ID: RYG-180208
Sensor Model:
Sensor Serial Number:
Location of Calibration: 1 LAB 4 AIR VOLUME 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: Indirect method CP-AFM-01 by Comparison technique with Standard Primary Flow Calibrator

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Calibrator 3 Low Flow	18801010006	Sensodyne	12 July 2024
Air Flow Meter	Calibrator 3 Standard Flow	19031011003	Sensodyne	12 July 2024
Temperature meter	GT 11	080800937	Qreborn	27 February 2024
Pressure meter	CPG2-000	41000KDU1651002	TPA	9 November 2024

Traceability :

This Certificate is traceable to SI Unit through Sensodyne 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. Noppadol Luangart
Service Calibration Engineer

Approved By :
Mr. Pasi Madhuom
Calibration Engineer Supervisor
Issue Date : 13 February 2024

Certificate No : 24-AFM-037

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	101.36	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	483.21	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

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

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

* Indicates non accredited

End of Certificate

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

Certificate of Calibration

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 : Dms

Model Defender S10-M

Sensor Model : -

Serial Number 129958

Sensor Serial Number : -

ID

RYQ_FS0209

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 : 24 January 2024

Calibration Date : 13 February 2024

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

Reference Standard	Model	Serial Number	Traceable	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	QT 11	08000057	Qtech	27 February 2024
Pressure meter	CPG2400	41000KDU651852	TPA	9 November 2024

Traceability :

This Certificate is traceable in SI Unit through Sensidyne A2LA Accreditation No. 3493.01

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. Noppadol Luangrat

Service Calibration Engineer

Approved By :

Mr. Pici 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

Certificate No : 24-AFM-032

Request No : Req-2024-0240

Result of Calibration : Without Adjustment

Temperature (°C)	Pressure (kPa)	STD (cc/min)	UUC (cc/min)	Error (cc/min)	Uncertainty (cc/min)
23.80	101.39	95	100.13	5.1	2.8
23.90	101.71	501	513.93	12.9	7.2
24.18	101.62	1006	1019.3	13	14
24.00	101.91	1997	2023.0	26	29
24.10	101.87	2999	3035.5	37	45
24.60	102.00	3944	3991.8	48	59
24.60	102.06	4739	4790.5	52	72

Note
STD : Standard UUC : Unit Under Calibration
* UUC Reference Condition : At atmospheric pressure and room temperature condition
* Flow Rate was corrected for non-standard operating condition by using equation

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

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

* Indicates non accredited

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

Certificate of Calibration

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 : Air Flow Meter

Manufacturer : MesaLabs

Model : S10-M

Serial Number : 200345

ID

BKK_FS1347

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 : 22 August 2024

Calibration Date : 28 August 2024

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

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Gilibrator 3 Low flow	18501010050	Sensidyne	6 August 2025
Air Flow Meter	Gilibrator 3 Standard flow	19031011003	Sensidyne	7 August 2025
Temperature meter	QT 11	08000057	Qtech	1 March 2025
Pressure meter	CPG2400	41000KDU651852	TPA	9 November 2024

Traceability :

This Certificate is traceable in SI Unit through Sensidyne A2LA Accreditation No. 3493.01

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. Noppadol Luangrat

Service Calibration Engineer

Approved By :

Mr. Pici Mathavorn

Calibration Engineer Supervisor

Issue Date : 28 August 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 04 Issue date 17/02/24

Certificate No : 24-AFM-174
Request No : Req-2024-1861

Result of Calibration : Without Adjustment

Temperature (°C)	Pressure (kPa)	STD (cc/min)	UUC (cc/min)	Error (cc/min)	Uncertainty (cc/min)	MPE (cc/min)	Result
22.30	100.57	100	99.526	-0.5	2.8	1	N/A
22.40	100.61	100	99.538	-1.5	7.8	5	N/A
22.50	100.56	100	99.548	-1	15	10	N/A
22.60	100.54	200	200.3	-5	29	20	N/A
22.70	100.62	3034	3032.1	-2	45	30	N/A
22.20	100.71	4032	4022.4	-10	69	40	N/A
22.40	100.73	5060	5056.4	-4	79	51	N/A

Note STD = Standard UUC = Unit Under Calibration
• UUC Reference Condition = At atmospheric pressure and room temperature condition
• Flow Rate was corrected for non-standard operating condition by using equation

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

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

* Indicates non accredited

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

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

The results relate 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 04 Issue date 17/5/24

Certificate No : 24-AFM-174
Request No : Req-2024-1861

Decision Rule for Statements of Conformity

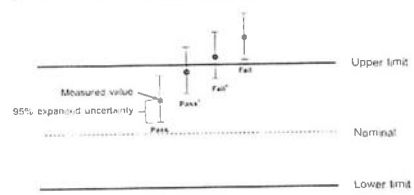
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ISO/IEC 17025:2019 Guidelines on the Reporting of Compliance with Specification as follows Fig. 1 and statement

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

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

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

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



End of Certificate

The results relate 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 04 Issue date 17/5/24

Certificate of Calibration

Certificate No : 24-AFM-173
Request No : Req-2024-1862

Customer ALS Laboratory Group (Thailand) Co., Ltd
Name
Address 104 Sri Phatthanasak 40, Phatthanasak Road, Suan Luang,
Bangkok 10250

Unit Under Calibration Details
Measurement Item Air Flow Meter
Manufacturer Hvac
Model Defender 510PL
Serial Number J30026
ID BKK_750019
Location of Calibration LAB 4 AIR VELOCITY METER

Calibration Environment and Details
Temperature 23.70 ± 0.1 °C
Humidity 55 % RH ± 20 % RH
Barometric Pressure 1013 hPa ± 10 hPa
Received Date 22 August 2024
Calibration Date 9 September 2024

Calibration Procedure In-house method (IP-AFM-01) by Comparison technique with Standard Primary Flow Calibrator

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Gilibrator 3 Low Flow	18501010006	Sensidyne	6 August 2025
Air Flow Meter	Gilibrator 3 Standard Flow	19034011000	Sensidyne	2 August 2025
Temperature meter	GT 11	004000947	Orechim	1 March 2025
Pressure meter	CP42400	41000KDL1651802	TPA	9 November 2024

Traceability :

This Certificate is traceable to SI Unit through Sensidyne A2LA Accreditation No. 1943-01

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. Noppon Unangart
Service Calibration Engineer

Approved By :
Mr. Pait Mathavasin
Calibration Engineer Supervisor
Issue Date : 9 September 2024

The results relate 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 04 Issue date 17/5/24

Certificate No : 24-AFM-177
Request No : Req-2024-1862

Result of Calibration : Without Adjustment

Temperature (°C)	Pressure (kPa)	STD (cc/min)	UUC (cc/min)	Error (cc/min)	Uncertainty (cc/min)	MPE (cc/min)	Result
24.70	100.92	20	20.192	0.2	1.3	0.2	N/A
24.70	100.90	100	99.923	-0.1	2.8	1.0	N/A
24.70	100.94	200	200.7	-0.3	5.6	2.0	N/A
24.70	100.95	200	200.1	-2.1	8.4	3.0	N/A
24.70	101.50	402	399.1	-4	11	10	N/A
24.80	101.05	452	477.6	-4.4	6.9	4.5	N/A

Note STD = Standard UUC = Unit Under Calibration
• UUC Reference Condition = At atmospheric pressure and room temperature condition
• Flow Rate was corrected for non-standard operating condition by using equation

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

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

* Indicates non accredited

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

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

The results relate 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 04 Issue date 17/5/24

Certificate No : 24-ATM-177
Request No : Req-2024-1862

Decision Rule for Statements of Conformity

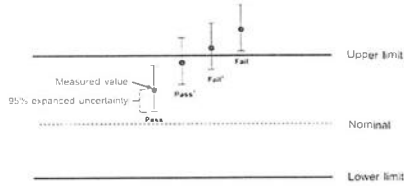
The standard decision rule employed for the statements of conformity to each calibration result will be applying ISO/IEC 17025:2017 (Decision on the Reporting of Conformity) with Scale Factors as following Table and statement.

Table 1 - The measurement results plus the expanded uncertainty U at a 95% coverage probability were within the limit.

Table 2 - The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.

Table 3 - The measurement result was out of the limit. However, a portion of the expanded uncertainty of measurement at 95% is within the limit.

Table 4 - The measurement result plus the expanded uncertainty U at a 95% coverage probability were outside the limit.



Unit of Certificate

The item (s) related to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovate Instrument Co., Ltd.

FM 708-ATM-01 Rev 24 Issue date 17/6/24



ROTA METER CALIBRATION RESULT OCTOBER 2024

Rotameter ID.	Calibration Date	Regression Result	Coefficient (R ²)
BKK_FS0573	02 Oct 24	$Y = 1.0146x + 4.4306$	1.0000
BKK_FS0577	02 Oct 24	$Y = 1.1097x + 3.8082$	0.9994
BKK_FS0584	02 Oct 24	$Y = 1.0163x + 3.55$	0.9997
BKK_FS0585	02 Oct 24	$Y = 1.0324x + 2.63$	0.9997
BKK_FS0587	02 Oct 24	$Y = 1.029x + 1.25$	0.9999
BKK_FS0591	02 Oct 24	$Y = 1.0002x + 15.177$	1.0000
BKK_FS0592	02 Oct 24	$Y = 1.0003x + 15.506$	1.0000
BKK_FS0594	02 Oct 24	$Y = 1.0024x + 7.9314$	1.0000
BKK_FS1006	02 Oct 24	$Y = 1.0705x + 3.1952$	1.0000
BKK_FS1007	02 Oct 24	$Y = 1.0883x + 4.1833$	0.9998
BKK_FS1008	02 Oct 24	$Y = 1.1231x + 0.6782$	0.9998
BKK_FS1017	02 Oct 24	$Y = 1.0361x + 2.7864$	0.9998
BKK_FS1018	02 Oct 24	$Y = 1.0137x + 0.9333$	1.0000
BKK_FS1019	02 Oct 24	$Y = 1.0016x + 6.9648$	1.0000
BKK_FS1026	02 Oct 24	$Y = 1.1424x - 0.8571$	0.9975
BKK_FS1027	02 Oct 24	$Y = 1.0293x + 3.5233$	1.0000
BKK_FS1028	02 Oct 24	$Y = 1.0026x + 9.8067$	1.0000
BKK_FS1039	02 Oct 24	$Y = 1.0041x + 9.1033$	0.9993
BKK_FS1040	02 Oct 24	$Y = 1.0025x + 1.1619$	1.0000
BKK_FS1041	02 Oct 24	$Y = 1.0352x + 1.6626$	1.0000
BKK_FS1042	02 Oct 24	$Y = 1.0015x + 11.25$	0.9995
BKK_FS1044	02 Oct 24	$Y = 1.1163x + 0.7323$	0.9973
PHK_FS0027	02 Oct 24	$Y = 1.0849x + 3.3133$	0.9991
PHK_FS0028	02 Oct 24	$Y = 1.0257x + 1.5667$	0.9999
PHK_FS0029	02 Oct 24	$Y = 0.9989x + 14.706$	1.0000
RYG_FS0195	02 Oct 24	$Y = 1.0031x + 10.024$	1.0000
RYG_FS0196	02 Oct 24	$Y = 1.0047x + 8.6114$	1.0000
RYG_FS0197	02 Oct 24	$Y = 1.0049x + 10.074$	1.0000
RYG_FS0198	02 Oct 24	$Y = 1.0051x + 3.3883$	1.0000
RYG_FS0199	02 Oct 24	$Y = 1.0349x + 2.3983$	0.9993
RYG_FS0627	02 Oct 24	$Y = 1.0162x + 6.0933$	0.9999
RYG_FS0628	02 Oct 24	$Y = 1.0035x + 7.8667$	0.9999
RYG_FS0654	02 Oct 24	$Y = 1.0541x + 2.2446$	0.9999
RYG_FS0655	02 Oct 24	$Y = 0.9734x + 17.51$	0.9997
RYG_FS0656	02 Oct 24	$Y = 1.0034x + 8.661$	0.9998
RYG_FS0657	02 Oct 24	$Y = 1.0322x + 4.2303$	0.9999
RYG_FS0658	02 Oct 24	$Y = 0.9945x + 10.98$	0.9996
RYG_FS0659	02 Oct 24	$Y = 1.0022x + 9.2876$	1.0000
SGK_FS0135	02 Oct 24	$Y = 1.0203x + 3.7733$	0.9999

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ALS Laboratory Group



ROTA METER CALIBRATION RESULT OCTOBER 2024

Rotameter ID.	Calibration Date	Regression Result	Coefficient (R ²)
SGK_FS0136	02 Oct 24	$Y = 1.0313x - 1.0933$	0.9999
SGK_FS0138	02 Oct 24	$Y = 1.0479x + 5.6214$	1.0000
SGK_FS0139	02 Oct 24	$Y = 1.0166x + 4.0367$	0.9998
SGK_FS0140	02 Oct 24	$Y = 1.0006x + 14.979$	1.0000
SGK_FS0141	02 Oct 24	$Y = 1.0846x + 3.8398$	1.0000
SGK_FS0142	02 Oct 24	$Y = 1.0211x + 2.0233$	1.0000
SGK_FS0143	02 Oct 24	$Y = 1.0042x + 8.461$	1.0000

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

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

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Agilent CrossLab Compliance Services

Certificate of System Qualification

GC-QQ

System ID: 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: April 21, 2023 3:26:38 PM
EQP Name: AgilentRecommended
EQP Revision: GC.02.52
Overall Qualification Status: Pass

CDS Logon Verification - GC

Logon: Saenguthai Tarak

Overall CDS Logon Verification - GC Test Status

Pass

System Inspection and Basic Safety and Operation

Name: 7890
Setup 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: -0.1 psi / 5 minutes
Agilent Recommended: ≥ -2.0 and ≤ 0.5

Date: April 21, 2023 3:26:38 PM
System ID: CN11461066

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Overall Inlet Pressure Decay Test Status

Pass

Inlet Pressure Accuracy

Name: 7890
Front SSL

Setpoint Status: Pass

Inlet Pressure: Setpoint 25.0 psi Actual 25.2 psi

Accuracy: 0.2 psi

Agilent Recommended: ≤ 1.2 psi

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 SSLDate: April 21, 2023 3:26:38 PM
System ID: CN11461066

Setpoint Status:

Pass

Inlet Pressure: Setpoint 25.0 psi Actual 24.8 psi

Accuracy: 0.2 psi

Agilent Recommended: ≤ 1.2 psi

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: 28.9 mL/min

Accuracy: 1.1 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: 400 mL/min

Accuracy: 0.0 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: 24.9 mL/min

Accuracy: 0.1 mL/min

Agilent Recommended: ≤ 10.0 % setpoint (2.5 mL/min)

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

Date: April 21, 2023 3:26:38 PM
System ID: CN11461066

Overall Detector Flow Accuracy Test Status

Pass

Detector Flow Accuracy

Name: 7890
Back FID

Setpoint Status: Pass

Flow Type: Fuel

Setpoint: 30.0 mL/min Measured Flow: 30.7 mL/min

Accuracy: 0.7 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: 399 mL/min

Accuracy: 1.0 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: 24.6 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

GC Oven Temperature Accuracy

Name: 7890

Date: April 21, 2023 3:26:38 PM
System ID: CN11461066

Setpoint Status:

Pass

Zone: Oven

Setpoint/Actual

Temperature: 230.0 230.6 °C

Accuracy: 0.6 °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: 100.0 100.9 °C

Accuracy: 0.9 °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: 100.0 100.833 °C

Stability: 0.1 °C

Agilent Recommended: ≤ 0.5 °C

Overall GC Oven Temperature Stability Test Status

Pass

Scouting Run

Tested Combination1 Front SSL / Front FID
Injection Tower
Name: 7893ADate: April 21, 2023 3:26:38 PM
System ID: CN11461066

Setpoint Status: **Completed**

Injection Volume on Column: 1.0 uL

Overall Scouting Run Status

Completed

Noise and Drift

Tested Combination1 Front SSL / Front FID

Name: 7890

Setpoint Status: **Pass**

Base Signal: 22.7 pA

ASTM Noise		Drift	
pA		pA/Hr	
0.06	0.05	0.05	2.50
ce 0.10		ce	

Agilent Recommended: **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:		Retention Time RSD:	
0.32	0.67	0.67	1.00
ce 3.00		ce	

Overall Injection Precision Test Status

Pass

Signal to Noise

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System ID: CN11461066

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Tested Combination1 Front SSL / Front FID

Injection Tower

Name: 7890

Setpoint Status: **Pass**

Signal to Noise: 721755

Agilent Recommended: **Pass** 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: 22.6 pA

ASTM Noise		Drift	
pA		pA/Hr	
0.07	0.09	0.09	2.50
ce 0.10		ce	

Agilent Recommended: **Pass** **Pass**

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System ID: CN11461066

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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:		Retention Time RSD:	
1.28	0.63	0.63	1.00
ce 3.00		ce	

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: 2404398

Agilent Recommended: **Pass** 300000

Overall Signal to Noise Test Status

PassDate: April 21, 2023 3:28:38 PM
System ID: CN11461066

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Instrument Details

Purpose

This section describes the as found system configuration.

Details

System

System ID	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 2
Inlet	Front
Detector	Front
LTM Included?	No

Tested Combination2

Injection Technique	Injection Tower
Sampler Identifier	Sampler 3
Inlet	Back
Detector	Back
LTM Included?	No

Sampler 1

Manufacturer	Agilent Technologies
Type	Tray
Name	7693A
Model Number	G4514A
Serial Number	CN15380030
Firmware Revision	A.11.01
Vial Heater	Not Installed

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Sampler 2

Manufacturer Agilent Technologies
Type Injection Tower
Name 7883A
Model Number G4513A
Serial Number CN16280128
Firmware Revision A.10.09
Usage Sample Injection
Location Front
Syringe Volume (µL) 10

Sampler 3

Manufacturer Agilent Technologies
Type Injection Tower
Name 7893A
Model Number G4513A
Serial Number CN10340103
Firmware Revision A.10.09
Usage Sample Injection
Location Back
Syringe Volume (µL) 10

Mainframe 1

Manufacturer Agilent Technologies
Name 7890
Model Number G3440A
Serial Number CN11481066
Firmware Revision Version 4.27
Oven Type Standard

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Inlet 1

Manufacturer Agilent Technologies
Name 7880
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 7880
Type FID
Adapter Capillary
Control Type Electronic Pressure Control (EPC)
Location Back
Makeup Gas Nitrogen

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System ID: CN11481066

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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: April 21, 2023
Reason for Signature: Executed protocol and published this original version of document

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System ID: CN11481066

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User Name: saenguthai.tarak
Host Name: LAPTOP-G2B8GDMV

System ID: CN11481066
Print Date: April 21, 2023 3:35:40 PM

GC4_BIOGEN177_ALB Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
April 21, 2023 11:21:56 AM	Auth	SessionCreated	Session	None
April 21, 2023 11:21:56 AM	Start	Configuration	Session	None
April 21, 2023 11:21:56 AM	Auth	Entitlement	Licensing	User is Nonpaying and does not require an unlock code
April 21, 2023 11:22:04 AM	Auth	ExpLoaded	Session	EOP details for primary technique [GC] - File path: (ProtocolPath\OutDir\Signatures\June01_2020_02_02_exp). EOP File Name: [GC02_32.exp], EOP Name [AgilentRecommended]Protocol Revision: [GC02.02]
April 21, 2023 11:22:06 AM	End	Configuration	Session	None
April 21, 2023 11:22:14 AM	Start	Qualification	Session	QC
April 21, 2023 11:22:14 AM	Start	Execution	CDS Login Verification - GC	None - Qualitative test
April 21, 2023 11:23:14 AM	End	Execution	CDS Login Verification - GC	Run Count: 1 - Qualitative test
April 21, 2023 11:23:16 AM	Start	Execution	System Inspection and Basic Safety and Operation - 7890 - Qualitative Test - No sample associated	None
April 21, 2023 11:23:35 AM	End	Execution	System Inspection and Basic Safety and Operation - 7890 - Qualitative Test - No sample associated	Run Count: 1
April 21, 2023 11:23:37 AM	Start	Execution	Intel Pressure Decay - Front GSI - Pressure Controlled Inlet	None - S: 25.0 psi - L: 1.0 psi and <= 0.5 psi

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Date: April 21, 2023 3:26:38 PM
System ID: CN11481066

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User Name: saangulathLark
Hostname: LAPTOP-CQ35KGMVSystem ID: CN11461066
Print Date: April 21, 2023 3:26:43 PM

GC-6_BK06_ENH127_ALB Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
April 21, 2023 11:24:01 AM	End	Execution	Inlet Pressure Decay - Front SSL - Pressure Controlled Inlet - S: 25.0 psi - L: >= -0.0 psi and ≤ 0.5 psi	Run Count: 1
April 21, 2023 11:24:04 AM	Start	Execution	Inlet Pressure Accuracy - Front SSL - Pressure Controlled Inlet - S: 25.0 psi - L: ≤ 1.2 psi	None
April 21, 2023 11:24:09 AM	End	Execution	Inlet Pressure Accuracy - Front SSL - Pressure Controlled Inlet - S: 25.0 psi - L: ≤ 1.2 psi	Run Count: 1
April 21, 2023 11:24:11 AM	Start	Execution	Inlet Pressure Decay - Back SSL - Pressure Controlled Inlet - S: 25.0 psi - L: >= -0.0 psi and ≤ 0.5 psi	None
April 21, 2023 11:24:43 AM	End	Execution	Inlet Pressure Decay - Back SSL - Pressure Controlled Inlet - S: 25.0 psi - L: >= -0.0 psi and ≤ 0.5 psi	Run Count: 1
April 21, 2023 11:24:45 AM	Start	Execution	Inlet Pressure Accuracy - Back SSL - Pressure Controlled Inlet - S: 25.0 psi - L: ≤ 1.2 psi	None
April 21, 2023 11:24:51 AM	End	Execution	Inlet Pressure Accuracy - Back SSL - Pressure Controlled Inlet - S: 25.0 psi - L: ≤ 1.2 psi	Run Count: 1
April 21, 2023 11:24:53 AM	Start	Execution	Detector Flow Accuracy - Front FID - Type: Fuel - S: 30.0 mL/min - L: ≤ 10.0% setpoint	None
April 21, 2023 11:25:20 AM	Audit	Data	Detector Flow Accuracy - Front FID - Type: Fuel - S: 30.0 mL/min - L: ≤ 10.0% setpoint	Manual Data Entry
April 21, 2023 11:25:25 AM	End	Execution	Detector Flow Accuracy - Front FID - Type: Fuel - S: 30.0 mL/min - L: ≤ 10.0% setpoint	Run Count: 1

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Date: April 21, 2023 3:26:38 PM
System ID: CN11461066

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User Name: saangulathLark
Hostname: LAPTOP-CQ35KGMVSystem ID: CN11461066
Print Date: April 21, 2023 3:26:45 PM

GC-6_BK06_ENH127_ALB Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
April 21, 2023 11:25:28 AM	Start	Execution	Detector Flow Accuracy - Front FID - Type: Fuel - S: 400.0 mL/min - L: ≤ 10.0% setpoint	None
April 21, 2023 11:25:49 AM	Audit	Data	Detector Flow Accuracy - Front FID - Type: Fuel - S: 400.0 mL/min - L: ≤ 10.0% setpoint	Manual Data Entry
April 21, 2023 11:25:42 AM	End	Execution	Detector Flow Accuracy - Front FID - Type: Fuel - S: 400.0 mL/min - L: ≤ 10.0% setpoint	Run Count: 1
April 21, 2023 11:25:44 AM	Start	Execution	Detector Flow Accuracy - Front FID - Type: Makeup - S: 25.0 mL/min - L: ≤ 10.0% setpoint	None
April 21, 2023 11:26:01 AM	Audit	Data	Detector Flow Accuracy - Front FID - Type: Makeup - S: 25.0 mL/min - L: ≤ 10.0% setpoint	Manual Data Entry
April 21, 2023 11:26:04 AM	End	Execution	Detector Flow Accuracy - Front FID - Type: Makeup - S: 25.0 mL/min - L: ≤ 10.0% setpoint	Run Count: 1
April 21, 2023 11:26:05 AM	Start	Execution	Detector Flow Accuracy - Back FID - Type: Fuel - S: 30.0 mL/min - L: ≤ 10.0% setpoint	None
April 21, 2023 11:26:19 AM	Audit	Data	Detector Flow Accuracy - Back FID - Type: Fuel - S: 30.0 mL/min - L: ≤ 10.0% setpoint	Manual Data Entry
April 21, 2023 11:26:22 AM	End	Execution	Detector Flow Accuracy - Back FID - Type: Fuel - S: 30.0 mL/min - L: ≤ 10.0% setpoint	Run Count: 1
April 21, 2023 11:26:24 AM	Start	Execution	Detector Flow Accuracy - Back FID - Type: Fuel - S: 400.0 mL/min - L: ≤ 10.0% setpoint	None
April 21, 2023 11:26:38 AM	Audit	Data	Detector Flow Accuracy - Back FID - Type: Fuel - S: 400.0 mL/min - L: ≤ 10.0% setpoint	Manual Data Entry

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Date: April 21, 2023 3:26:38 PM
System ID: CN11461066

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User Name: saangulathLark
Hostname: LAPTOP-CQ35KGMVSystem ID: CN11461066
Print Date: April 21, 2023 3:26:40 PM

GC-6_BK06_ENH127_ALB Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
April 21, 2023 11:26:43 AM	End	Execution	Detector Flow Accuracy - Back FID - Type: Fuel - S: 400.0 mL/min - L: ≤ 10.0% setpoint	Run Count: 1
April 21, 2023 11:26:45 AM	Start	Execution	Detector Flow Accuracy - Back FID - Type: Makeup - S: 25.0 mL/min - L: ≤ 10.0% setpoint	None
April 21, 2023 11:27:01 AM	Audit	Data	Detector Flow Accuracy - Back FID - Type: Makeup - S: 25.0 mL/min - L: ≤ 10.0% setpoint	Manual Data Entry
April 21, 2023 11:27:05 AM	End	Execution	Detector Flow Accuracy - Back FID - Type: Makeup - S: 25.0 mL/min - L: ≤ 10.0% setpoint	Run Count: 1
April 21, 2023 11:27:07 AM	Start	Execution	GC Oven Temperature Accuracy - 7890 - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
April 21, 2023 11:27:33 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
April 21, 2023 11:27:38 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
April 21, 2023 11:27:37 AM	Start	Execution	GC Oven Temperature Accuracy - 7890 - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
April 21, 2023 11:27:54 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

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System ID: CN11461066

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User Name: saangulathLark
Hostname: LAPTOP-CQ35KGMVSystem ID: CN11461066
Print Date: April 21, 2023 3:26:40 PM

GC-6_BK06_ENH127_ALB Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
April 21, 2023 11:27:57 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
April 21, 2023 11:27:59 AM	Start	Execution	GC Oven Temperature Stability - 7890 - Temperature : Oven - S: 100.0°C - L: ≤ 0.5°C	None
April 21, 2023 11:28:07 AM	Audit	Data	GC Oven Temperature Stability - 7890 - Temperature : Oven - S: 100.0°C - L: ≤ 0.5°C	Manual Data Entry
April 21, 2023 11:28:10 AM	End	Execution	GC Oven Temperature Stability - 7890 - Temperature : Oven - S: 100.0°C - L: ≤ 0.5°C	Run Count: 1
April 21, 2023 11:29:12 AM	Start	Execution	GC Scouting Run - Injection Tower, Front SSL, Front FID - Part of System Preparation - No limits associated	None
April 21, 2023 11:30:27 AM	Audit	Data	GC Scouting Run - Injection Tower, Front SSL, Front FID - Part of System Preparation - No limits associated	Data File Path: C:\Users\Public\Documents\C rossLab\Scouting\GC-6 _ALB_2023-04-20 _2023-04-20 14-36-08\SCOUTING\FID1A.c h
April 21, 2023 11:31:04 AM	End	Execution	GC Scouting Run - Injection Tower, Front SSL, Front FID - Part of System Preparation - No limits associated	Run Count: 1
April 21, 2023 11:31:07 AM	Start	Execution	None and Det - Front FID - Detector FID - L (Noise) <= 0.10 pA - L (Drift) <= 2.50 pA/hour	None

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Date: April 21, 2023 3:26:38 PM
System ID: CN11461066

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User Name: saengulhal.tarak
Hostname: LAPTOP-CQ35KQWVSystem ID: CN11461066
Print Date: April 21, 2023 3:26:49 PM

GC4_BKK_BN0127_ALS Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
April 21, 2023 11:31:43 AM	Audit	Data	Noise and Drift - Front FID - Detector FID - L (Noise) <= 0.10 pA - L (Drift) <= 2.50 pA/hour	Data File Path: C:\Users\Public\Documents\GC4_BKK_BN0127_ALS_2023-04-20_14-36-08\N1-013F.D\FID 1A.ch
April 21, 2023 11:32:00 AM	End	Execution	Noise and Drift - Front FID - Detector FID - L (Noise) <= 0.10 pA - L (Drift) <= 2.50 pA/hour	Run Count: 1
April 21, 2023 11:32:02 AM	Start	Execution	Injection Precision - Injection Tower, Front SSL, Front FID - GC - L (Area) <= 3.00% - L (Ret. Time) <= 1.00%	None
April 21, 2023 11:32:22 AM	Start	Execution	Injection Precision - Injection Tower, Front SSL, Front FID - GC - L (Area) <= 3.00% - L (Ret. Time) <= 1.00%	None
April 21, 2023 11:33:55 AM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID - GC - L (Area) <= 3.00% - L (Ret. Time) <= 1.00%	Data File Path: C:\Users\Public\Documents\GC4_BKK_BN0127_ALS_2023-04-20_14-36-08\N1-013F.D\FID 1A.ch
April 21, 2023 11:33:55 AM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID - GC - L (Area) <= 3.00% - L (Ret. Time) <= 1.00%	Data File Path: C:\Users\Public\Documents\GC4_BKK_BN0127_ALS_2023-04-20_14-36-08\N1-014F.D\FID 1A.ch

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User Name: saengulhal.tarak
Hostname: LAPTOP-CQ35KQWVSystem ID: CN11461066
Print Date: April 21, 2023 3:26:49 PM

GC4_BKK_BN0127_ALS Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
April 21, 2023 11:33:56 AM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID - GC - L (Area) <= 3.00% - L (Ret. Time) <= 1.00%	Data File Path: C:\Users\Public\Documents\GC4_BKK_BN0127_ALS_2023-04-20_14-36-08\N1-015F.D\FID 1A.ch
April 21, 2023 11:33:59 AM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID - GC - L (Area) <= 3.00% - L (Ret. Time) <= 1.00%	Data File Path: C:\Users\Public\Documents\GC4_BKK_BN0127_ALS_2023-04-20_14-36-08\N1-016F.D\FID 1A.ch
April 21, 2023 11:33:59 AM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID - GC - L (Area) <= 3.00% - L (Ret. Time) <= 1.00%	Data File Path: C:\Users\Public\Documents\GC4_BKK_BN0127_ALS_2023-04-20_14-36-08\N1-017F.D\FID 1A.ch
April 21, 2023 11:33:59 AM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID - GC - L (Area) <= 3.00% - L (Ret. Time) <= 1.00%	Data File Path: C:\Users\Public\Documents\GC4_BKK_BN0127_ALS_2023-04-20_14-36-08\N1-018F.D\FID 1A.ch
April 21, 2023 11:35:00 AM	End	Execution	Injection Precision - Injection Tower, Front SSL, Front FID - GC - L (Area) <= 3.00% - L (Ret. Time) <= 1.00%	Run Count: 1
April 21, 2023 11:35:04 AM	Start	Execution	Signal to Noise - Injection Tower, Front SSL, Front FID - Detector FID - L >= 300000	None

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Date: April 21, 2023 3:26:38 PM
System ID: CN11461066

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User Name: saengulhal.tarak
Hostname: LAPTOP-CQ35KQWVSystem ID: CN11461066
Print Date: April 21, 2023 3:26:49 PM

GC4_BKK_BN0127_ALS Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
April 21, 2023 11:35:28 AM	Audit	Data	Signal to Noise - Injection Tower, Front SSL, Front FID - Detector FID - L >= 300000	Data File Path: C:\Users\Public\Documents\GC4_BKK_BN0127_ALS_2023-04-20_14-36-08\N1-Front.D\FID 1A.ch
April 21, 2023 11:36:00 AM	End	Execution	Signal to Noise - Injection Tower, Front SSL, Front FID - Detector FID - L >= 300000	Run Count: 1
April 21, 2023 11:36:03 AM	Start	Execution	GC Scouting Run - Injection Tower, Back SSL, Back FID - Part of System Preparation - No limits associated	None
April 21, 2023 11:36:36 AM	Audit	Data	GC Scouting Run - Injection Tower, Back SSL, Back FID - Part of System Preparation - No limits associated	Data File Path: C:\Users\Public\Documents\GC4_BKK_BN0127_ALS_2023-04-20_14-36-08\N1_SCO1.D\FID 2B.ch
April 21, 2023 11:37:30 AM	End	Execution	GC Scouting Run - Injection Tower, Back SSL, Back FID - Part of System Preparation - No limits associated	Run Count: 1
April 21, 2023 11:37:32 AM	Start	Execution	Noise and Drift - Back FID - Detector FID - L (Noise) <= 0.10 pA - L (Drift) <= 2.50 pA/hour	None

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Date: April 21, 2023 3:26:38 PM
System ID: CN11461066

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User Name: saengulhal.tarak
Hostname: LAPTOP-CQ35KQWVSystem ID: CN11461066
Print Date: April 21, 2023 3:26:49 PM

GC4_BKK_BN0127_ALS Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
April 21, 2023 11:38:06 AM	Audit	Data	Noise and Drift - Back FID - Detector FID - L (Noise) <= 0.10 pA - L (Drift) <= 2.50 pA/hour	Data File Path: C:\Users\Public\Documents\GC4_BKK_BN0127_ALS_2023-04-20_14-36-08\N1-015.D\FID 2B.ch
April 21, 2023 11:38:23 AM	End	Execution	Noise and Drift - Back FID - Detector FID - L (Noise) <= 0.10 pA - L (Drift) <= 2.50 pA/hour	Run Count: 1
April 21, 2023 11:38:32 AM	Start	Execution	Injection Precision - Injection Tower, Back SSL, Back FID - GC - L (Area) <= 3.00% - L (Ret. Time) <= 1.00%	None
April 21, 2023 11:38:51 AM	Start	Execution	Injection Precision - Injection Tower, Back SSL, Back FID - GC - L (Area) <= 3.00% - L (Ret. Time) <= 1.00%	None
April 21, 2023 11:40:17 AM	Audit	Data	Injection Precision - Injection Tower, Back SSL, Back FID - GC - L (Area) <= 3.00% - L (Ret. Time) <= 1.00%	Data File Path: C:\Users\Public\Documents\GC4_BKK_BN0127_ALS_2023-04-20_14-36-08\N1-016.D\FID 2B.ch
April 21, 2023 11:42:17 AM	Audit	Data	Injection Precision - Injection Tower, Back SSL, Back FID - GC - L (Area) <= 3.00% - L (Ret. Time) <= 1.00%	Data File Path: C:\Users\Public\Documents\GC4_BKK_BN0127_ALS_2023-04-20_14-36-08\N1-017.D\FID 2B.ch

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Date: April 21, 2023 3:26:38 PM
System ID: CN11461066

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User Name: a.singh@alstl.com
Host Name: LAPTOP-CQ36KQWVSystem ID: CN11461066
Print Date: April 21, 2023 3:26:40 PM

GC-6_BKK_EN0127_ALS Transaction Log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
April 21, 2023 11:40:17 AM	Audio	Data	Injection Prediction - Injection Tower, Back SSL, Back FID - GC - L (Area) <= 3.00% - L (Rel. Time) <= 1.00%	Data File Path: C:\Users\Public\Documents\hemStation3\data\GC-6_ALS_2023-04-20\GC-6_2023_Pm_2023-04-21_10-37-32Pm11-008B.D\FID 28.ch
April 21, 2023 11:40:17 AM	Audio	Data	Injection Prediction - Injection Tower, Back SSL, Back FID - GC - L (Area) <= 3.00% - L (Rel. Time) <= 1.00%	Data File Path: C:\Users\Public\Documents\hemStation3\data\GC-6_ALS_2023-04-20\GC-6_2023_Pm_2023-04-21_10-37-32Pm11-007B.D\FID 28.ch
April 21, 2023 11:40:21 AM	Audio	Data	Injection Prediction - Injection Tower, Back SSL, Back FID - GC - L (Area) <= 3.00% - L (Rel. Time) <= 1.00%	Data File Path: C:\Users\Public\Documents\hemStation3\data\GC-6_ALS_2023-04-20\GC-6_2023_Pm_2023-04-21_10-37-32Pm11-008B.D\FID 28.ch
April 21, 2023 11:40:21 AM	Audio	Data	Injection Prediction - Injection Tower, Back SSL, Back FID - GC - L (Area) <= 3.00% - L (Rel. Time) <= 1.00%	Data File Path: C:\Users\Public\Documents\hemStation3\data\GC-6_ALS_2023-04-20\GC-6_2023_Pm_2023-04-21_10-37-32Pm11-008B.D\FID 28.ch
April 21, 2023 11:41:29 AM	End	Execution	Injection Prediction - Injection Tower, Back SSL, Back FID - GC - L (Area) <= 3.00% - L (Rel. Time) <= 1.00%	Run Count: 1
April 21, 2023 11:41:33 AM	Start	Execution	Signal to Noise - Injection Tower, Back SSL, Back FID - Detector FID - L >= 300000	None

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Date: April 21, 2023 3:26:38 PM
System ID: CN11461066

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User Name: a.singh@alstl.com
Host Name: LAPTOP-CQ36KQWVSystem ID: CN11461066
Print Date: April 21, 2023 3:26:40 PM

GC-6_BKK_EN0127_ALS Transaction Log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
April 21, 2023 11:42:22 AM	Audio	Data	Signal to Noise - Injection Tower, Back SSL, Back FID - Detector FID - L >= 300000	Data File Path: C:\Users\Public\Documents\hemStation3\data\GC-6_ALS_2023-04-20\GC-6_2023_Pm_2023-04-20_10-36-07Pm11-008B.D\FID 28.ch
April 21, 2023 11:42:50 AM	End	Execution	Signal to Noise - Injection Tower, Back SSL, Back FID - Detector FID - L >= 300000	Run Count: 1
April 21, 2023 11:42:53 AM	End	Qualification	Session	OQ
April 21, 2023 12:01:47 PM	Start	Reporting	Session	None
April 21, 2023 12:01:47 PM	Audio	AcqClosed	Session	None
April 21, 2023 12:16:07 PM	Audio	AcqRestarted	Session	None
April 21, 2023 12:16:10 PM	Audio	SessionReloaded	Session	None
April 21, 2023 12:16:31 PM	Start	Qualification	Session	OQ
April 21, 2023 12:20:59 PM	Audio	AcqRestarted	Session	None
April 21, 2023 12:21:00 PM	Audio	SessionReloaded	Session	None
April 21, 2023 12:21:07 PM	Start	Qualification	Session	OQ
April 21, 2023 12:25:45 PM	Audio	Reporting	Session	Report Generated: Certificate

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Date: April 21, 2023 3:26:38 PM
System ID: CN11461066

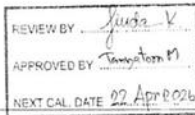
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BKK_EN0126

Certificate of System Qualification
GC-OQ

System ID: GC-6_CN11461066
Organization Name: ALS Laboratory Group (Thailand) Co., Ltd.
Organization Location: 104 Soi 40 Phatthana-karn Rd, Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250

Date: October 22, 2024 9:27:05 AM
EOP Name: Agilent Recommended
EOP Revision: GC-02.53
Overall Qualification Status: Pass



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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System ID: GC-6_CN11461066

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Overall Inlet Pressure Decay Test Status

Pass

Inlet Pressure Accuracy

Name: 7890
Front: SSL

Setpoint Status: Pass

Inlet Pressure: 25.0 psi Actual: 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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Setpoint Status:

Pass

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

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: 28.6 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: 26.4 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.

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System ID: GC-6_CN11461056

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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
Date: October 22, 2024 9:27:05 AM
System ID: GC-6_CN11461056

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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 °C

Overall GC Oven Temperature Stability Test Status

Pass

Scouting Run

Tested Combination1 Front SSL / Front FID
Injection Tower
Name: 7693A

Date: October 22, 2024 9:27:05 AM
System ID: GC-6_CN11461056

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Setpoint Status:

Completed

Injection Volume on Column: 1.0 uL

Overall Scouting Run Status

Completed

Noise and Drift

Tested Combination1 Front SSL / Front FID
Name: 7890
Setpoint Status: Pass
Base Signal: 14.05 pA
ASTM Noise pA 0.05
Drift pA/hr 0.03
Agilent Recommended: <= 0.10 pA
Status: 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

Date: October 22, 2024 9:27:05 AM
System ID: GC-6_CN11461056

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Tested Combination1

Front SSL / Front FID

Injection Tower

Name: 7890

Setpoint Status:

Pass

Signal to Noise:

11076525

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

µL

Overall Scouting Run Status

Completed

Noise and Drift

Tested Combination2

Back SSL / Back FID

Injection Tower

Name: 7690

Setpoint Status:

Pass

Base Signal:

13.79

pA

ASTM Noise

pA

0.05

<= 0.10

Drift

pA/Hr

0.01

<= 2.50

Agilent Recommended:

Status:

Pass

Pass

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

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Overall Noise and Drift Test Status

Pass

Injection Precision

Tested Combination2

Back SSL / Back FID

Injection Tower

Name: 7693A

Setpoint Status:

Pass

Injection Volume on Column:

1.0

µL

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

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

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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

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Sampler 2

Manufacturer	Agilent Technologies
Type	Injection Tower
Name	7893A
Model Number	G4513A
Serial Number	CN16280128
Firmware Revision	A.11.06
Usage	Sample Injection
Location	Back
Syringe Volume (µL)	10

Sampler 3

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

Mainframe 1

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

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System ID: GC-6_CN11461066

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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

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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 login to access ACE and electronically sign this document. (Other e-signatures can be applied to this document using a Document Content Management or other suitable method defined in your data access and control procedures.)

Details

Full Name of Signer: Saengulhai Tarak
Logged On User Name: saengulhai.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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Date: October 22, 2024 9:27:05 AM
System ID: GC-6_CN11461066

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User Name: saengulhai.tarak
Report Generated by Hostname: LAPTOP-CQ35KQMV
System ID: GC-6_CN11461066
Print Date: October 22, 2024 9:27:05 AM

2024_ALS_GC-6_CN11461066_OQHW Transaction log:

Time	Transaction Date	Activity Performed	Type of Transaction	Optional Information
October 21, 2024 3:16:06 PM	2024-10-21 15:06	Audit	Session Created	Session
October 21, 2024 3:16:07 PM	2024-10-21 15:07	Start	Configuration	Session
October 21, 2024 3:16:07 PM	2024-10-21 15:07	Audit	Entitlement	Licensing User is Nonpaying and does not require an unlock code
October 21, 2024 3:22:40 PM	2024-10-21 15:22:40	Audit	EtcLoaded	Session EQP data for primary technique (3d): File path: (ProtocolPedia\GoToConfig\Items\02_SVGo.02.53) eqp EQP File Name: (GC.02.53) eqp, EQP Name: (AgilentRecommended) Protocol Revision: (GC.02.53)
October 21, 2024 3:22:44 PM	2024-10-21 15:22:44	End	Configuration	Session
October 21, 2024 3:22:47 PM	2024-10-21 15:22:47	Start	Qualification	Session OQ
October 21, 2024 3:22:48 PM	2024-10-21 15:22:48	Start	Execution	QDS Logon Verification - GC - 7890 - Qualitative test
October 21, 2024 3:23:05 PM	2024-10-21 15:23:05	End	Execution	QDS Logon Verification - GC - 7890 - Qualitative test Run Count: 1
October 21, 2024 3:23:45 PM	2024-10-21 15:23:45	Start	Execution	System Inspection and Basic Safety and Operation - 7890 - Qualitative Test - No endpoints associated
October 21, 2024 3:23:59 PM	2024-10-21 15:23:59	End	Execution	System Inspection and Basic Safety and Operation - 7890 - Qualitative Test - No endpoints associated Run Count: 1

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

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User Name: saengulhai.tarak
Report Generated by Hostname: LAPTOP-CQ35KQMV
System ID: GC-6_CN11461066
Print Date: October 22, 2024 9:27:05 AM

2024_ALS_GC-6_CN11461066_OQHW Transaction log:

Time	Transaction Date	Activity Performed	Type of Transaction	Optional Information
October 21, 2024 3:24:01 PM	2024-10-21 15:24:01	Start	Execution	Inlet Pressure Decay - Front SSL - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi
October 21, 2024 3:25:26 PM	2024-10-21 15:25:26	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	2024-10-21 15:25:28	Start	Execution	Inlet Pressure Accuracy - Front SSL - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi
October 21, 2024 3:25:32 PM	2024-10-21 15:25:32	End	Execution	Inlet Pressure Accuracy - Front SSL - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi Run Count: 1
October 21, 2024 3:25:30 PM	2024-10-21 15:25:30	Start	Execution	Inlet Pressure Decay - Back SSL - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi
October 21, 2024 3:26:21 PM	2024-10-21 15:26:21	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 3:26:06 PM	2024-10-21 15:26:06	Start	Execution	Inlet Pressure Accuracy - Back SSL - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi
October 21, 2024 3:26:10 PM	2024-10-21 15:26:10	End	Execution	Inlet Pressure Accuracy - Back SSL - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi Run Count: 1
October 21, 2024 3:26:12 PM	2024-10-21 15:26:12	Start	Execution	Detector Flow Accuracy - Front FID - Type: FID - S: 30.0 mL/min - L: <= 10.0% error

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

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User Name: saangulha@lark
Report Generated by Hostname: LAPTOP-CQ35K0MV

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 3:26:50 PM	Start	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 3:26:54 PM	Start	Execution	Detector Flow Accuracy - Front FID - Type: Oxygen - S: 400.0 mL/min - L: <= 10.0% setpoint	None
October 21, 2024 3:27:10 PM	Start	Data	Detector Flow Accuracy - Front FID - Type: Oxygen - S: 400.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
October 21, 2024 3:27:13 PM	End	Execution	Detector Flow Accuracy - Front FID - Type: Oxygen - 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	Start	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 3:28:30 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	Start	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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Date: October 22, 2024 9:27:05 AM
System ID: GC-6_CN11461066

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User Name: saangulha@lark
Report Generated by Hostname: LAPTOP-CQ35K0MV

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: Oxygen - S: 400.0 mL/min - L: <= 10.0% setpoint	None
October 21, 2024 3:30:07 PM	Start	Data	Detector Flow Accuracy - Back FID - Type: Oxygen - 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: Oxygen - 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	Start	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 - 7800 - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
October 21, 2024 3:31:05 PM	Start	Data	GC Oven Temperature Accuracy - 7800 - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry
October 21, 2024 3:31:07 PM	End	Execution	GC Oven Temperature Accuracy - 7800 - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Run Count: 1

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

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User Name: saangulha@lark
Report Generated by Hostname: LAPTOP-CQ35K0MV

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 3:31:09 PM	Start	Execution	GC Oven Temperature Accuracy - 7800 - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
October 21, 2024 3:34:27 PM	Start	Data	GC Oven Temperature Accuracy - 7800 - 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 - 7800 - 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 - 7800 - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	None
October 21, 2024 3:38:05 PM	Start	Data	GC Oven Temperature Stability - 7800 - 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 - 7800 - 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	Start	AccClosed	Session	None
October 22, 2024 8:55:47 AM	Start	AccRestarted	Session	None
October 22, 2024 8:55:50 AM	Start	SessionRelabeled	Session	None
October 22, 2024 8:56:02 AM	Start	Qualification	Session	OQ

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

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User Name: saangulha@lark
Report Generated by Hostname: LAPTOP-CQ35K0MV

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	Start	Data	GC Scouting Run - Injection Tower, Front SSL, Front FID - Part of System Preparation - No limits associated	Data files Path: G:\Data\rawData\SC19\01
October 22, 2024 8:57:25 AM	End	Execution	GC Scouting Run - Injection Tower, Front SSL, Front FID - Part of System Preparation - No limits associated	Run Count: 1
October 22, 2024 8:57:29 AM	Start	Execution	Hold 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	Start	Data	Hold and Drift - Front FID - Detector FID - L (Noise) <= 0.10 pA - L (Drift) <= 2.50 pA/hour	Data files Path: G:\Data\rawData\N01\01
October 22, 2024 8:58:37 AM	End	Execution	Hold and Drift - Front FID - Detector FID - L (Noise) <= 0.10 pA - L (Drift) <= 2.50 pA/hour	Run Count: 1
October 22, 2024 8:58:40 AM	Start	Execution	Injection Precision - Injection Tower, Front SSL, Front FID - GC - L (Area) <= 3.00% - L (Ret. Time) <= 1.00%	None
October 22, 2024 8:59:06 AM	Start	Data	DatatManager	DatatManager was in a data verification state but the user chose to start over

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

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User Name: seenguthal.sarak
Report Generated by Hostname: LAPTOP-CQ3SK0MV
2024_ALS_GC-6_CNI1461066_QQHW Transaction log:

System ID: GC-6_CNI1461066
Print Date: October 22, 2024 9:27:05 AM

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 File Path : G:\Data\FrontFrom_IP0109.D\FID1A.ch
October 22, 2024 9:01:43 AM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID - GC - L (Area) <= 3.00% - L (Rel. Time) <= 1.00%	Data File Path : G:\Data\FrontFrom_IP0109.D\FID1A.ch
October 22, 2024 9:01:43 AM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID - GC - L (Area) <= 3.00% - L (Rel. Time) <= 1.00%	Data File Path : G:\Data\FrontFrom_IP0109.D\FID1A.ch
October 22, 2024 9:01:43 AM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID - GC - L (Area) <= 3.00% - L (Rel. Time) <= 1.00%	Data File Path : G:\Data\FrontFrom_IP0109.D\FID1A.ch
October 22, 2024 9:01:43 AM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID - GC - L (Area) <= 3.00% - L (Rel. Time) <= 1.00%	Data File Path : G:\Data\FrontFrom_IP0109.D\FID1A.ch
October 22, 2024 9:01:43 AM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID - GC - L (Area) <= 3.00% - L (Rel. Time) <= 1.00%	Data File Path : G:\Data\FrontFrom_IP0109.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 File Path : G:\Data\FrontFrom_IP0110.D\FID1A.ch

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Date: October 22, 2024 9:27:05 AM
System ID: GC-6_CNI1461066

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User Name: seenguthal.sarak
Report Generated by Hostname: LAPTOP-CQ3SK0MV
2024_ALS_GC-6_CNI1461066_QQHW Transaction log:

System ID: GC-6_CNI1461066
Print Date: October 22, 2024 9:27:05 AM

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 9:03:20 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 File Path : G:\Data\BackFrom_IP0113.D\FID2B.ch
October 22, 2024 9:04:03 AM	End	Execution	GC Scouting Run - Injection Tower, Back SSL, Back FID - Part of System Preparation - No limits associated	Run Count: 1
October 22, 2024 9:04:06 AM	Start	Execution	Noise and Dist - Back FID - Detector FID - L (Noise) <= 0.10 pA - L (Dist) <= 2.50 pA/hour	None
October 22, 2024 9:05:56 AM	Audit	Data	Noise and Dist - Back FID - Detector FID - L (Noise) <= 0.10 pA - L (Dist) <= 2.50 pA/hour	Data File Path : G:\Data\BackFrom_IP0113.D\FID2B.ch
October 22, 2024 9:09:13 AM	End	Execution	Noise and Dist - Back FID - Detector FID - L (Noise) <= 0.10 pA - L (Dist) <= 2.50 pA/hour	Run Count: 1
October 22, 2024 9:09:25 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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Date: October 22, 2024 9:27:05 AM
System ID: GC-6_CNI1461066

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User Name: seenguthal.sarak
Report Generated by Hostname: LAPTOP-CQ3SK0MV
2024_ALS_GC-6_CNI1461066_QQHW Transaction log:

System ID: GC-6_CNI1461066
Print Date: October 22, 2024 9:27:05 AM

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 (Rel. Time) <= 1.00%	Data File Path : G:\Data\BackFrom_IP0111.D\FID2B.ch
October 22, 2024 9:12:44 AM	Audit	Data	Injection Precision - Injection Tower, Back SSL, Back FID - GC - L (Area) <= 3.00% - L (Rel. Time) <= 1.00%	Data File Path : G:\Data\BackFrom_IP0112.D\FID2B.ch
October 22, 2024 9:12:44 AM	Audit	Data	Injection Precision - Injection Tower, Back SSL, Back FID - GC - L (Area) <= 3.00% - L (Rel. Time) <= 1.00%	Data File Path : G:\Data\BackFrom_IP0113.D\FID2B.ch
October 22, 2024 9:12:44 AM	Audit	Data	Injection Precision - Injection Tower, Back SSL, Back FID - GC - L (Area) <= 3.00% - L (Rel. Time) <= 1.00%	Data File Path : G:\Data\BackFrom_IP0114.D\FID2B.ch
October 22, 2024 9:12:44 AM	Audit	Data	Injection Precision - Injection Tower, Back SSL, Back FID - GC - L (Area) <= 3.00% - L (Rel. Time) <= 1.00%	Data File Path : G:\Data\BackFrom_IP0115.D\FID2B.ch
October 22, 2024 9:12:44 AM	Audit	Data	Injection Precision - Injection Tower, Back SSL, Back FID - GC - L (Area) <= 3.00% - L (Rel. Time) <= 1.00%	Data File Path : G:\Data\BackFrom_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 (Rel. Time) <= 1.00%	Run Count: 1
October 22, 2024 9:11:23 AM	Start	Execution	Signal to Noise - Injection Tower, Back SSL, Back FID - Detector FID - L >= 300000	None
October 22, 2024 9:11:45 AM	Audit	Data	Signal to Noise - Injection Tower, Back SSL, Back FID - Detector FID - L >= 300000	Data File Path : G:\Data\BackFrom_IP0117.D\FID2B.ch

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Date: October 22, 2024 9:27:05 AM
System ID: GC-6_CNI1461066

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User Name: seenguthal.sarak
Report Generated by Hostname: LAPTOP-CQ3SK0MV
2024_ALS_GC-6_CNI1461066_QQHW Transaction log:

System ID: GC-6_CNI1461066
Print Date: October 22, 2024 9:27:05 AM

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 22, 2024 9:12:09 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	Execution	Signal to Noise - Injection Tower, Back SSL, Back FID - Detector FID - L >= 300000	Run Count: 1
October 22, 2024 9:12:15 AM	Start	Execution	Signal to Noise - Injection Tower, Back SSL, Back FID - Detector FID - L >= 300000	Run Count: 1
October 22, 2024 9:24:09 AM	Audit	Reporting	Session	Report Generated: Certificate
October 22, 2024 9:25:56 AM	Audit	Reporting	Session	Report Generated: Report

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Date: October 22, 2024 9:27:05 AM
System ID: GC-6_CNI1461066

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SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

451-451/1 Srinthorn Road, Bangbunru, Bangkok, 10100 Thailand
Tel : +66 2433 8331 Email : calibration@sithiporn.com

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associates



Cert. No. : ACC24008
Pages : 1 of 3

Calibration Certificate

Equipment : SOUND CALIBRATOR
Manufacturer : RION
Model : NC-75
Serial No.: 35002736
ID No.: RYG_FS0496

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KHWAEANG PHATTHANAKAN, KHEI 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 : 26 JANUARY 2024
Date of Issue : 29 JANUARY 2024

Calibrated by : Nathakorn Pisutpaan

Approved by :

T. Petchurai
(Thanakul Petchurai)

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

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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SITHIPORN
associates



Cert. No. : ACC24008
Job No. : VC67AC0058
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	EI-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL-BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL-BP 30/0267	13-FEB-24
Digital Multimeter	33461A	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-42KAJ	34560495	AA-3002-23	14-FEB-24
Audio Analyzer	AVR-3360A	V744B6069	EF-0012-23	10-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. Petchurai

SITHIPORN ASSOCIATES CO., LTD.
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Cert. No. : ACC24008
Job No. : VC67AC0058
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	93.98	-0.02	0.14	0.40

2. Frequency

Specified Frequency (Hz)	Measured value (Hz)	Deviated value (%)	Uncertainty (%)	Acceptance limit (%)
1000	1000.0	0.0	0.1	1.0

3. Total distortion

Measured value (%)	Uncertainty (%)	Acceptance limit (%)
0.83	0.10	3.0

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

End of Calibration Certificate

T. Petchurai



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-670232

MTC No. EEL. BP. 173-0167

CALIBRATION CERTIFICATE

Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.
Address : 104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan, Khet Suan Luang, Bangkok 10250
Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.

Sri LC, Bangpoo Industrial Estate, Sukhumvit Rd., A-Muang, Samutprakan 10280.

Instrument Calibrated :
Description : Sound Level Meter
Manufacturer : Rion
Model : NL-42
Serial No. : 00296516 (ID: RYG_FS0433)
Microphone : Type UC-52 No.180412
Preamplifier : Type NH-24 No.88182

Ambient Environment
Temperature : (23 ± 3) °C
Relative Humidity : (50 ± 15) %
Ambient Pressure : (101.325 ± 1.5) kPa

Standards used :

1. Band Pass Filter Wavetek 752A S/N 90010494.
2. Condenser Microphone Brüel&Kjær 4180 S/N 289871.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 120237.
6. Digital Multimeter Fluke 8520A S/N 4985007.
7. Pistophone Rion NC-72 S/N 00402446.
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 24 Jan. 2024

Date of Calibration : 22-28 Feb 2024

The reported uncertainty and the extent of the results are based on the values shown in the certificate and the results are not to be used for any other purpose without the prior written approval of the head of Calibration Laboratory.

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No.21-67-0232

MTC No. EEL, BP, 173-0167

9. Power Amplifier Brüel&Kjær 2706 S/N 1517650,
10. Speaker Tannoy Limited, Great Britain British Patent No. 215300,
11. Digital Multimeter Agilent 34401A S/N MY44005560,
12. Programmable Attenuator Tamagawa TPA-303A S/N 2212,

Calibration Procedure

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2013). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

This instrument has been calibrated against standards maintained at the Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

The reported expanded uncertainty is based upon a standard uncertainty multiplied by a coverage factor $k=2$, providing a level of confidence of approximately 95%.

Date of Calibration 22-28 Feb. 2024

2 of 9

The results relate only to the items tested and do not extend to other items.

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FMB-MTC-002 Rev.4



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No.21-67-0232

MTC No. EEL, BP, 173-0167

1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Measured value (dB)		Deviation value (dB)	Acceptance limit Class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	Before adjust	After adjust				
113.96	114.1	113.9	-0.1	1.0	0.30	N/A

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 124.1 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
18.9	0.10	N/A

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

Frequency	Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Weighting			
A-Weight	12.3	0.10	N/A
C-Weight	17.7	0.10	N/A
Flat	23.1	0.10	N/A

Date of Calibration 22-28 Feb. 2024

3 of 9

The results relate only to the items tested and do not extend to other items.

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FMB-MTC-002 Rev.4



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No.21-67-0232

MTC No. EEL, BP, 173-0167

3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)			Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight	Flat			
125	0.0	0.2	0.1	1.5	0.45	0.6
1 000	0.0	0.0	0.0	1.0	0.45	0.6
8 000	-0.3	-0.3	-0.3	5.0	0.45	0.7

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)			Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight	Flat			
63	-0.1	0.0	0.0	2.0	0.20	0.6
125	-0.1	0.0	0.0	1.5	0.20	0.6
250	0.0	0.0	0.0	1.5	0.20	0.6
500	0.0	0.0	0.0	1.5	0.20	0.6
1 000	0.0	0.0	0.0	1.0	0.20	0.6
2 000	0.0	0.0	0.0	2.0	0.20	0.6
4 000	0.0	0.0	0.0	3.0	0.20	0.6
8 000	0.0	0.0	0.0	5.0	0.20	0.7

Date of Calibration 22-28 Feb. 2024

4 of 9

The results relate only to the items tested and do not extend to other items.

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FMB-MTC-002 Rev.4



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No.21-67-0232

MTC No. EEL, BP, 173-0167

5. Long-term stability

Time	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	94.0	0.0	0.3	0.10	0.1
End	94.0				

6. Frequency and time weightings at 1 kHz

6.1 Frequency weightings at 1 kHz

Frequency	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Weighting					
A-weight	94.0	0.0	0.2	0.20	0.2
C-weight	94.0	0.0	0.2	0.20	0.2
Flat	94.1	0.1	0.2	0.20	0.2

6.2 Time weightings at 1 kHz

Frequency	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Weighting					
Fast	94.0	0.0	0.1	0.20	0.2
Slow	94.0	0.0	0.1	0.20	0.2
1 sec	94.0	0.0	0.1	0.20	0.2

Date of Calibration 22-28 Feb. 2024

5 of 9

The results relate only to the items tested and do not extend to other items.

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7. Level linearity on the reference level range

Anticipated value (dB)	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
137	137.1	0.1	1.1	0.30	0.3
136	136.1	0.1	1.1	0.30	0.3
135	135.1	0.1	1.1	0.30	0.3
133	133.1	0.1	1.1	0.30	0.3
132	132.1	0.1	1.1	0.30	0.3
131	131.0	0.0	1.1	0.30	0.3
130	130.0	0.0	1.1	0.30	0.3
129	129.0	0.0	1.1	0.30	0.3
124	124.0	0.0	1.1	0.30	0.3
119	119.0	0.0	1.1	0.30	0.3
114	114.0	0.0	1.1	0.30	0.3
109	109.0	0.0	1.1	0.30	0.3
104	104.0	0.0	1.1	0.30	0.3
99	99.0	0.0	1.1	0.30	0.3
94	94.0	0.0	1.1	0.30	0.3
89	89.0	0.0	1.1	0.30	0.3
84	84.1	0.1	1.1	0.30	0.3
79	79.0	0.0	1.1	0.30	0.3
74	74.0	0.0	1.1	0.30	0.3
69	69.0	0.0	1.1	0.30	0.3
64	64.0	0.0	1.1	0.30	0.3
59	59.0	0.0	1.1	0.30	0.3

Date of Calibration : 22-28 Feb. 2024

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7. Level linearity on the reference level range (cont.)

Anticipated value (dB)	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
54	54.0	0.0	1.1	0.30	0.3
49	48.9	-0.1	1.1	0.30	0.3
44	44.0	0.0	1.1	0.30	0.3
39	38.9	-0.1	1.1	0.30	0.3
34	33.9	-0.1	1.1	0.30	0.3
29	28.8	-0.2	1.1	0.30	0.3
28	27.8	-0.2	1.1	0.30	0.3
27	26.9	-0.1	1.1	0.30	0.3
26	25.9	-0.1	1.1	0.30	0.3
25	24.8	-0.2	1.1	0.30	0.3

8. Level linearity including the level range control

At reference sound level on the reference level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
30-120	94.0	94.0	0.0	1.1	0.30	0.3

Date of Calibration : 22-28 Feb. 2024

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8. Level linearity including the level range control

At reference level at 5 dB greater than the under-range on a level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
30-130	25	25.0	0.0	1.1	0.30	0.3

9. Tone burst response

Time Weighting	Toneburst Duration, T ₀ (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	200	126.0	0.0	±1.0	0.20	0.3
	2	108.9	-0.1	+1.0; -2.5	0.20	0.3
	0.25	100.0	0.0	+1.5; -5.0	0.20	0.3
Slow	200	119.5	+0.1	±1.0	0.20	0.3
	2	100.0	0.0	+1.0; -5.0	0.20	0.3

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10. Peak C sound level


Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Complete cycle	125.4	125.5	0.1	3.0	0.20	0.35
Positive half cycle	124.4	124.1	-0.3	2.0	0.20	0.35
Negative half cycle	124.4	124.1	-0.3	2.0	0.20	0.35

11. Overload indication

Measured value (dB)		Deviated	Acceptance limit	Uncertainty	Maximum-permitted uncertainty
Positive one-half cycle	Negative one-half cycle	value (dB)	class 2 (±dB)	(±dB)	of measurement (±dB)
135,4	135,4	0,0	1,5	0,55	0,25

12. High-level stability

Time	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	129.0	0.0	0.3	0.10	0.1
End	129.0				

Calibrated by : 
(Mr. Pamsit Phasingsri)

Approved by : 
(Mr. Prawat Klumrath)
Director
Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre
Ref: 2011267012400347003

Date of Calibration : 22-28 Feb. 2024

Date of Issue : 29 Feb. 2024

End of Certificate

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67-0232

MTC No. EEL, BP, 171/0167

CALIBRATION CERTIFICATE

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

Address 104 Phathanakan 40, Phathanakan Rd., Khwaeng Phathanakan, Khet Suan Luang, Bangkok 10250

Calibrated at Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre, Suo IC, Bangpoo Industrial Estate, Sukhumvit Rd., A-Muang, Samutprakan 10280,

Instrument Calibrated:

Description : Sound Level Meter

Manufacturer : Rion

Model : NL-42

Serial No. : 00296518 (UD, RYG_F04031)

Microphone : Type UC-52 No.66239

Preamplifier : Type N11-24 No.34375

Standards used:

1. Hand Pass Filter Wavelet 752A S/N 90010494.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2898781.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 120307.
6. Digital Multimeter Fluke 8520A S/N 4985007.
7. Pistonphone Rion NC-72 S/N 00402466.
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 24 Jan, 2024

Date of Calibration : 22-28 Feb, 2024

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FMEL-MTC-002 Rev.4



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67-0232

MTC No. EEL, BP, 171/0167

9. Power Amplifier Brüel&Kjær 2706 S/N 1517650.

10. Speaker Tanny Limited, Great Britain British Patent No. 215300.

11. Digital Multimeter Agilent 34401A S/N MY44005560.

12. Programmable Attenuator Tamagawa TPA-303A S/N 2212.

Calibration Procedure

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2013). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

This instrument has been calibrated against standards maintained at the Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

The reported expanded uncertainty is based upon a standard uncertainty multiplied by a coverage factor $k=2$, providing a level of confidence of approximately 95%.

Date of Calibration : 22-28 Feb, 2024

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Request No. 21-67-0232

MTC No. EEL, BP, 171/0167

1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Measured value (dB)		Deviation value (dB)	Acceptance limit Class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	Before adjust	After adjust				
113.96	114.3	113.9	+0.1	1.0	0.30	N/A

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 125.1 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
20.2	0.10	N/A

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

Frequency Weighting	Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
A-Weight	14.4	0.10	N/A
C-Weight	19.9	0.10	N/A
Flat	25.3	0.10	N/A

Date of Calibration : 22-28 Feb, 2024

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Request No. 21-67-0232

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3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)			Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight	Flat			
125	+0.1	0.2	0.1	1.5	0.45	0.6
1 000	0.0	0.0	0.0	1.0	0.45	0.6
8 000	+1.7	+1.7	+1.7	5.0	0.45	0.7

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)			Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight	Flat			
63	+0.1	+0.1	+0.1	2.0	0.20	0.6
125	+0.1	0.0	0.0	1.5	0.20	0.6
250	+0.1	0.0	0.0	1.5	0.20	0.6
500	+0.1	0.0	0.0	1.5	0.20	0.6
1 000	0.0	0.0	0.0	1.0	0.20	0.6
2 000	+0.1	0.0	+0.1	2.0	0.20	0.6
4 000	+0.1	0.0	0.0	3.0	0.20	0.6
8 000	0.0	0.0	0.0	5.0	0.20	0.7

Date of Calibration : 22-28 Feb, 2024

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5. Long-term stability

Time	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	94,0	0,0	0,3	0,10	0,1
End	94,0				

6. Frequency and time weightings at 1 kHz

6.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
A-weight	94,0	0,0	0,2	0,20	0,2
C-weight	94,0	0,0	0,2	0,20	0,2
Flat	94,1	0,1	0,2	0,20	0,2

6.2 Time weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	94,0	0,0	0,1	0,20	0,2
Slow	94,0	0,0	0,1	0,20	0,2
Leq	94,0	0,0	0,1	0,20	0,2

Date of Calibration : 22-28 Feb. 2024

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7. Level linearity on the reference level range

Anticipated value (dB)	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
137	137,0	0,0	1,1	0,30	0,3
136	136,0	0,0	1,1	0,30	0,3
135	135,0	0,0	1,1	0,30	0,3
133	133,0	0,0	1,1	0,30	0,3
132	132,0	0,0	1,1	0,30	0,3
131	131,0	0,0	1,1	0,30	0,3
130	130,0	0,0	1,1	0,30	0,3
129	129,0	0,0	1,1	0,30	0,3
124	124,0	0,0	1,1	0,30	0,3
119	119,0	0,0	1,1	0,30	0,3
114	114,0	0,0	1,1	0,30	0,3
109	109,0	0,0	1,1	0,30	0,3
104	104,0	0,0	1,1	0,30	0,3
99	99,0	0,0	1,1	0,30	0,3
94	94,0	0,0	1,1	0,30	0,3
89	89,0	0,0	1,1	0,30	0,3
84	84,0	0,0	1,1	0,30	0,3
79	79,0	0,0	1,1	0,30	0,3
74	74,0	0,0	1,1	0,30	0,3
69	69,0	0,0	1,1	0,30	0,3
64	63,9	-0,1	1,1	0,30	0,3
59	59,0	0,0	1,1	0,30	0,3

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7. Level linearity on the reference level range (cont.)

Anticipated value (dB)	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
54	53,9	-0,1	1,1	0,30	0,3
49	49,0	0,0	1,1	0,30	0,3
44	43,9	-0,1	1,1	0,30	0,3
39	39,0	0,0	1,1	0,30	0,3
34	33,9	-0,1	1,1	0,30	0,3
29	28,9	-0,1	1,1	0,30	0,3
28	27,9	-0,1	1,1	0,30	0,3
27	26,9	-0,1	1,1	0,30	0,3
26	25,9	-0,1	1,1	0,30	0,3
25	24,8	-0,2	1,1	0,30	0,3

8. Level linearity including the level range control

At reference sound level on the reference level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
30-130	94,0	94,0	0,0	1,1	0,30	0,3

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8. Level linearity including the level range control

At reference level at 5 dB greater than the under-range on a level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
30-130	25	25,0	0,0	1,1	0,30	0,3

9. Tone burst response

Time Weighting	Toneburst Duration, T _b (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	200	126,0	0,0	±1,0	0,20	0,3
	2	105,9	+0,1	+1,0; -2,5	0,20	0,3
	0,25	100,0	0,0	+1,5; -5,0	0,20	0,3
Slow	200	119,5	-0,1	±1,0	0,20	0,3
	2	100,0	0,0	+1,0; -5,0	0,20	0,3

Date of Calibration : 22-28 Feb. 2024

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No.21-67/0232

MTC No. EEL, BP, 174/0167

10. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Complete cycle	125,4	125,5	0,1	3,0	0,20	0,55
Positive half cycle	124,4	124,1	-0,3	2,0	0,20	0,35
Negative half cycle	124,4	124,1	-0,3	2,0	0,20	0,35

11. Overload indication

Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Positive one-half cycle	Negative one-half cycle			
135,4	135,4	0,0	1,5	0,55
				0,25

12. High-level stability

Time	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	129,0	0,0	0,3	0,10	0,1
End	129,0				

Calibrated by

(Mr. Panusit Phasingst)

Approved by

(Mr. Prayut Klaiyap)
Director
Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Calibration 22-28 Feb. 2024

Date of Issue 29 Feb. 2024

Ref: 2011267012400347001

End of Certificate

9 9

The results apply only to the items in which calibration was requested.

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FM.BE.MTC.002 Rev.4



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No.21-67/0232

MTC No. EEL, BP, 174/0167

CALIBRATION CERTIFICATE

Submitted by

ALS Laboratory Group (Thailand) Co., Ltd.

Address

104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan, Khet Suan Luang, Bangkok 10250.

Calibrated at

Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre,
Sui 1C, Bangpoo Industrial Estate, Sukhumvit Rd., A.Muang, Samutprakan 10280.

Instrument Calibrated:

Description : Sound Level Meter

Manufacturer : Rion

Model : NL-42

Serial No. : 00296517 (ID: RYG 150434)

Microphone : Type UC-52 No.135220

Preamplifier : Type N11-24 No.87527

Standards used :

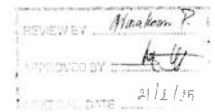
1. Band Pass Filter Wavelet 752A S/N 90010494.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871.
3. Decade Attenuator Ando AI-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Digital Multimeter Fluke 8520A S/N 4985007.
7. Pistonphone Rion NC-72 S/N 00402446.
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484

Ambient Environment

Temperature : (23 ± 3) °C

Relative Humidity : (50 ± 15) %

Ambient Pressure : (101,325 ± 1,5) kPa



Date of Receipt 24 Jan. 2024

Date of Calibration 22-28 Feb. 2024

1 9

The results apply only to the items in which calibration was requested.

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No.21-67/0232

MTC No. EEL, BP, 174/0167

9. Power Amplifier Brüel&Kjær 2706 S/N 1517650.
10. Speaker Tannoy Limited, Great Britain British Patent No. 215300.
11. Digital Multimeter Agilent 34401A S/N MY44005560
12. Programmable Attenuator Tamaagawa TPA-303A S/N 2212.

Calibration Procedure :

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2013). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

This instrument has been calibrated against standards maintained at the Electrical and Electronic Standards Laboratory (I.I.L.), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

The reported expanded uncertainty is based upon a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%.

Date of Calibration 22-28 Feb. 2024

2 9

The results apply only to the items in which calibration was requested.

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No.21-67/0232

MTC No. EEL, BP, 174/0167

1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Measured value (dB)		Deviation value (dB)	Acceptance limit Class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	Before adjust	After adjust				
113,96	114,3	113,9	-0,1	1,0	0,30	N/A

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 123,5 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
19,7	0,10	N/A

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

Frequency Weighting	Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
A-Weight	14,1	0,10	N/A
C-Weight	19,6	0,10	N/A
Flat	24,9	0,10	N/A

Date of Calibration 22-28 Feb. 2024

3 9

The results apply only to the items in which calibration was requested.

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FM.BE.MTC.002 Rev.4

3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)			Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight	Flat			
125	#DIV:0!	#DIV:0!	#DIV:0!	1,5	#DIV:0!	0,6
1 000	#DIV:0!	#DIV:0!	#DIV:0!	1,0	#DIV:0!	0,6
8 000	#DIV:0!	#DIV:0!	#DIV:0!	5,0	#DIV:0!	0,7

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)			Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight	Flat			
63	-0,1	-0,1	-0,1	2,0	0,20	0,6
125	-0,1	0,0	0,0	1,5	0,20	0,6
250	-0,1	0,0	0,0	1,5	0,20	0,6
500	-0,1	0,0	0,0	1,5	0,20	0,6
1 000	0,0	0,0	0,0	1,0	0,20	0,6
2 000	0,0	0,0	-0,1	2,0	0,20	0,6
4 000	0,0	0,0	0,0	3,0	0,20	0,6
8 000	0,0	0,0	0,0	5,0	0,20	0,7

Date of Calibration : 22-28 Feb. 2024

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The results refer only to the items tested as stated or value assigned.
Advertising the Report/Certificate and putting it to the results table is the responsibility of the user. The data obtained from the equipment of TISTR.

FM/BL/MTC.002 Rev.4

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5. Long-term stability

Time	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	94,0	0,0	0,3	0,10	0,1
End	94,0				

6. Frequency and time weightings at 1 kHz

6.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
A-weight	94,0	0,0	0,2	0,20	0,2
C-weight	94,0	0,0	0,2	0,20	0,2
Flat	94,1	0,1	0,2	0,20	0,2

6.2 Time weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	94,0	0,0	0,1	0,20	0,2
Slow	94,0	0,0	0,1	0,20	0,2
Leq	94,0	0,0	0,1	0,20	0,2

Date of Calibration : 22-28 Feb. 2024

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7. Level linearity on the reference level range

Anticipated value (dB)	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
137	137,0	0,0	1,1	0,30	0,3
136	136,0	0,0	1,1	0,30	0,3
135	135,0	0,0	1,1	0,30	0,3
133	133,0	0,0	1,1	0,30	0,3
132	132,0	0,0	1,1	0,30	0,3
131	131,0	0,0	1,1	0,30	0,3
130	130,0	0,0	1,1	0,30	0,3
129	129,0	0,0	1,1	0,30	0,3
124	124,0	0,0	1,1	0,30	0,3
119	119,0	0,0	1,1	0,30	0,3
114	114,0	0,0	1,1	0,30	0,3
109	109,0	0,0	1,1	0,30	0,3
104	104,0	0,0	1,1	0,30	0,3
99	99,0	0,0	1,1	0,30	0,3
94	94,0	0,0	1,1	0,30	0,3
89	89,0	0,0	1,1	0,30	0,3
84	84,0	0,0	1,1	0,30	0,3
79	79,0	0,0	1,1	0,30	0,3
74	74,0	0,0	1,1	0,30	0,3
69	69,0	0,0	1,1	0,30	0,3
64	64,0	-0,1	1,1	0,30	0,3
59	59,0	0,0	1,1	0,30	0,3

Date of Calibration : 22-28 Feb. 2024

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FM/BL/MTC.002 Rev.4

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7. Level linearity on the reference level range (cont.)

Anticipated value (dB)	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
54	53,9	-0,1	1,1	0,30	0,3
49	49,0	0,0	1,1	0,30	0,3
44	44,0	0,0	1,1	0,30	0,3
39	38,9	-0,1	1,1	0,30	0,3
34	33,9	-0,1	1,1	0,30	0,3
29	29,0	0,0	1,1	0,30	0,3
28	27,9	-0,1	1,1	0,30	0,3
27	26,9	-0,1	1,1	0,30	0,3
26	25,9	-0,1	1,1	0,30	0,3
25	24,9	-0,1	1,1	0,30	0,3

8. Level linearity including the level range control

At reference sound level on the reference level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
30-130	94,0	94,0	0,0	1,1	0,30	0,3

Date of Calibration : 22-28 Feb. 2024

7/9

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FM/BL/MTC.002 Rev.4

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0232

MTC No. EEL, BP, 174/0167

8. Level linearity including the level range control

At reference level at 5 dB greater than the under-range on a level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
30-130	25	25.0	0.0	±1.1	0.30	0.3

9. Tone burst response

Time Weighting	Duration, T _b (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	200	126.0	0.0	±1.0	0.20	0.3
	2	108.9	-0.1	+1.0, -2.5	0.20	0.3
	0.25	100.0	0.0	+1.5, -5.0	0.20	0.3
Slow	200	119.5	-0.1	±1.0	0.20	0.3
	2	100.0	0.0	+1.0, -5.0	0.20	0.3

Date of Calibration : 22-28 Feb. 2024

8/9

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0232

MTC No. EEL, BP, 174/0167

10. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Complete cycle	125.4	125.5	0.1	3.0	0.20	0.35
Positive half cycle	124.4	124.1	-0.3	2.0	0.20	0.35
Negative half cycle	124.4	124.1	-0.3	2.0	0.20	0.35

11. Overload indication

Measured value (dB)		Deviated	Acceptance limit	Uncertainty	Maximum-permitted uncertainty
Positive one-half cycle	Negative one-half cycle	value (dB)	class 2 (±dB)	(-dB)	of measurement (±dB)
135,4	135,4	0,0	1,5	0,55	0,25

12. High-level stability

Time	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	129.0	0.0	0.3	0.10	0.1
End	129.0				

Calibrated by :
(Mr. Punnat Phasingri)

Approved by :
(Mr. Pawale Kluyapa)
Director

Date of Calibration : 22-28 Feb. 2024

Date of Issue : 29 Feb. 2024

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Ref.: 2011267013400347004

End of Certificate

9/9

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FM.BL.MTC.002 Rev.4



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0292

MTC No. EEL, BP, 83/0267

CALIBRATION CERTIFICATE

Submitted by : A.I.S. Laboratory Group (Thailand) Co., Ltd.
Address : 104 Phathanakan 40, Phathanakan Rd., Klongkum Phathanakan, Khet Suan Luang, Bangkok, 10250,
Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre,
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., Muang, Samutprakan 10280.

Instrument Calibrated : Ambient Environment
Description : Sound Calibrator
Manufacturer : Rion
Model : NC-74
Serial No. : 34178121 (ID:RYG_TS0212)
Standards used : 1. Digital Function Synthesizer NF Electronic DF-193A S/N 122037,
2. Measuring Amplifier Bruel&Kjaer 2636 S/N 1537484,
3. Programmable Attenuator Tsutagawa TPA-303A S/N OF 2214,
4. Digital Multimeter Agilent 34401A S/N MY44005560,
5. Pressure Transmitter Vaisala PTB302AD S/N T0650001,
6. Audio Analyzer Keithley 2015-P S/N A106495,
7. Condenser Microphone B&K 4180 S/N 2889871.

Calibration Procedure: CP-102-04 based on IEC 60942:2003; The sound pressure level generated by sound calibrator under test shall be measured by standard microphone using an insert voltage technique.

This instrument has been calibrated against standards maintained at Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

Date of Receipt : 19 Feb. 2024

Date of Calibration : 28 Feb. 2024

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FM.BL.MTC.002 Rev.5



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0292

MTC No. EEL, BP, 83/0267

The reported expanded uncertainty is based upon a standard uncertainty multiplied by a coverage factor $k=2$, providing a level of confidence of approximately 95%.

Nominal Output of Unit Under Test = 94 dB re 20µPa at 1000 Hz

Acoustic Output in dB re 20µPa, Corrected to Reference Conditions: 101.325 kPa, 23.0 °C and 50 %RH.

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	94.01	0.01	± 0.10	±0.40 dB

2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	1003.1	3.1	± 1.5	±1.0%

3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	1.80	± 0.50	±3.0%

Note: 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was included at level of 0.16 dB from nominal.

Calibrated by :
(Mr. Weerachai Deechaiyoo)

Approved by :
(Mr. Pawale Kluyapa)
Director

Date of Calibration : 28 Feb. 2024

Date of Issue : 29 Feb. 2024

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Ref.: 2011267021900719001

End of Certificate

2/2

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Cert. No. : ACL24007
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 01173609 / 172170 / 74021
ID No.: RYG_FS0388

Condition As Found : GOOD

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

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

Received Date : 19 DECEMBER 2023
Calibration Date : 05-08 JANUARY 2024
Date of Issue : 09 JANUARY 2024

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchurai
(Thanakul Petchurai)

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Cert. No. : ACL24007
Job No. : VC67AC0044
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-42KA1	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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Cert. No. : ACL24007
Job No. : VC67AC0044
Pages : 3 of 8

Summary of Measurement Result :

Parameter	Uncertainty	Maximum-permitted
	(dB)	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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Cert. No. : ACL24007
Job No. : VC67AC0044
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.9%)	93.9	0.0	±1.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
15.1

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

Frequency Weighting	Measured value (dB)
A-weight	13.4
C-weight	19.9
Flat	25.3

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	0.8	0.9	0.9	± 5.0

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4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

T. Ketun

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Job No. : VC67AC0044
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.1	0.1	± 1.1
27.0	27.1	0.1	± 1.1
26.0	26.1	0.1	± 1.1
25.0	25.1	0.1	± 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	94.0	0.0	±1.1

9. Tone burst response

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

10. Peak C sound level

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

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

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Job No. : VC67AC0044
Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

T. Ketun

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Cert. No. : ACL24008
Pages : 1 of 8

Calibration Certificate

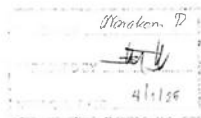
Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NI-24
Serial No.: 01173610 / 143485 / 22619
ID No.: RYG_TS0389

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 DECEMBER 2023
Calibration Date : 05-08 JANUARY 2024
Date of Issue : 09 JANUARY 2024



Calibrated by : Nathakorn Pisutpoison

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

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Cert. No. : ACL24008
Job No. : VC67AC0044
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	EELBP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EELBP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EELBP 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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Cert. No. : ACL24008
Job No. : VC67AC0044
Pages : 3 of 8

Summary of Measurement Result :

Parameter	Uncertainty	Maximum-permitted
	(dB)	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. Petchurai

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Cert. No. : ACL24008
Job No. : VC67AC0044
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)
18.6

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

Frequency Weighting	Measured value (dB)
A-weight	16.2
C-weight	22.1
Flat	28.0

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.4	0.5	0.5	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	0.5	0.5	0.6	± 5.0

T. Petchurai

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Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	-0.1	0.0	0.0	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.0	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
9000	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
Lcq	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	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	79.1	0.1	±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	34.1	0.1	±1.1
30.0	30.1	0.1	±1.1
29.0	29.1	0.1	±1.1
28.0	28.2	0.2	±1.1
27.0	27.4	0.4	±1.1
26.0	26.3	0.3	±1.1
25.0	25.4	0.4	±1.1

T. Petch

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

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	135.7	-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

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Job No. : VC67AC0044
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11. Overload indication

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

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Cert. No. : ACL24073
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 JS0018

Condition As Found : GOOD

Customer : A.I.S. LABORATORY GROUP (THAILAND) CO., LTD.
104 PIATTHANAKAN 40, PHATTHANAKAN ROAD,
KHIWAENG PIATTHANAKAN, 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 : 11 JANUARY 2024
Calibration Date : 22-24 JANUARY 2024
Date of Issue : 24 JANUARY 2024

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchurai
(Thanakul Petchurai)

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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 test results of each items were made by observation of each Instruments display and also with SI.M's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EELBP 30-0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EELBP 29-0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EELBP 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-42KAJ	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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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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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)
16.6

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	19.2
Flat	25.9

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.2	0.2	0.2	±1.5
1000	0.1	0.1	0.1	±1.0
8000	3.3	3.4	3.4	±5.0

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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	-0.1	±1.5
500	0.0	0.0	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	94.0	0.0	± 0.1
Slow	94.0	94.0	0.0	± 0.1
Imp	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	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.1	0.1	± 1.1
84.0	84.1	0.1	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.1	0.1	± 1.1
69.0	69.1	0.1	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.1	0.1	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	27.0	0.0	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.9	-0.1	± 1.1

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.1	0.1	±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	133.1	0.1	±2.0
Positive half cycle	135.4	135.3	-0.1	±2.0
Negative half cycle	135.4	135.3	-0.1	±2.0

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11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.5	89.5	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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Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 01122578 / 143842 / 22771
ID No.: RYG_FS0017

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KHUWAIENG 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 : 11 JANUARY 2024
Calibration Date : 22-24 JANUARY 2024
Date of Issue : 24 JANUARY 2024

Calibrated by : Nattakorn Pisuipaisan

Approved by :

T. Petchurai
(Thanakul Petchurai)

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Cert. No. : ACL24072
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	EELBP 30-0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EELBP 29-0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EELBP 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-42KAJ	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. Petchurai

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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

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Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.98)	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	Measured value (dB)
A - weight	11.6
C - weight	17.7
Flat	23.4

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.4	0.4	0.5	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	0.0	0.1	0.1	± 5.0

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4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

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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	119.1	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	34.0	0.0	±1.1
30.0	30.0	0.0	±1.1
29.0	28.9	-0.1	±1.1
28.0	28.0	0.0	±1.1
27.0	27.0	0.0	±1.1
26.0	26.0	0.0	±1.1
25.0	25.0	0.0	±1.1

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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	108.0	0.0	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.1	0.1	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
SEL	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

10. Peak C sound level

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

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

T. Petch

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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

SITHIPORN
associates



Cert. No. : ACL24072
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

T. Petch

CERTIFICATE OF CALIBRATION

Certificate No. : CDT-012-67

Page 1 of 2 Pages

MEASUREMENT ITEM

MANUFACTURER : Heat Stress Monitor
MODEL/TYPE : Delta OHM
SERIAL NUMBER : HC32.2
ID NUMBER : 15020734
CONDITION AS-RECEIVED : RYG_F50230
CUSTOMER : Used item

RECEIVED DATE : 05 Jan 2024
MEASUREMENT DATE : 08 Jan 2024
ISSUE DATE : 09 Jan 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 WP-CI 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: T1-025172, Certificate number: L8-0101-23

Reference Used During Calibration:

1. Standard Temperature Probe
Model: STS 100 AS500, Serial No: 66702-03, Due date: 28 Mar 2024
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 Intaraporn Lertsomphol
☒ Miss Ruangsakulpa Phoommit



Approved signatory

Mr. Parinya Booncharoen
Calibration Department Manager

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

Continuation of Certificate of Calibration Number CDT-012-67

Page 2 of 2 Pages

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 - 40 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 17015112.
Dimension: Diameter 3.3 mm, Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.059	20.0	0.1	0.099
80	25.050	24.9	-0.1	0.16
80	30.044	29.9	-0.1	0.099
80	35.037	34.9	-0.1	0.099
80	40.034	39.9	-0.1	0.099

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276 2 S/N: 15028482.
Dimension: Diameter 3.3 mm, Length 205 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.059	20.1	0.0	0.099
110	25.050	25.1	0.0	0.099
110	30.044	30.1	0.1	0.099
110	35.037	35.1	0.1	0.099
110	40.034	40.1	0.1	0.099

Table 3: This equipment was connected with temperature probe Model: TP3207.2 S/N: 15033222.
Dimension: Diameter 14 mm, Length 159 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
75	20.059	20.1	0.0	0.099
75	25.050	24.9	-0.2	0.099
75	30.044	29.8	-0.2	0.099
75	35.038	34.7	-0.3	0.099
75	40.034	39.6	-0.4	0.099

UUC: Unit Under Calibration

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

End of Certificate of Calibration



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Certificate of Calibration

Certificate No. : 23E3924
Page : 1 of 2

Equipment : pH Meter
Manufacturer : Mettler Toledo
Model : SevenExcellence
Serial No. : B834291455
ID No. : RYG_END152

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) %

Submitted by: ALS Laboratory Group (Thailand) Co., Ltd. Rayong Branch
616/10 Moo 5, T.Maenam Khu A, Puaokazeng
Rayong 21140, Thailand

Procedure used: Calibration were conducted using calibration procedure No. CH-E17 according to EURAMET og15

Condition of this result of calibration

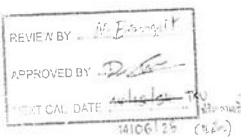
1. Reference standards instruments

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Multi-Product Calibrator	5502A	2435902	EE-0041-23	26 Apr 2024

2 This result of calibration was made on request at the point specified by customer

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

4 This Certification is traceable to the International System of Unit maintained through -
National Institute of Metrology Thailand (NIMT)



Calibrated by: Napsanach Prasomsakul
Issue Date: 15 December 2023

Approved Signatory:
[Signature]
[Signature]
[Signature]

B 0331106



Cert. No.: 23E3924
Page: 2 of 2

Result of calibration: (*) Without adjustment () After adjustment

Function: DC voltage measurement

Range: 2000 mV

Standard Value (mV)	UUC Reading (mV)	Error (mV)	Uncertainty ($\pm \mu V$)
-200.0000	-199.9	0.1	68
-150.0000	-150.0	0.0	65
-100.0000	-100.0	0.0	63
-50.0000	-50.0	0.0	61
0.0000	0.0	0.0	58
50.0000	50.0	0.0	61
100.0000	100.0	0.0	63
150.0000	150.0	0.0	65
200.0000	199.9	-0.1	68

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k=2$, providing a level of confidence of approximately 95 %

UUC= Unit Under Calibration.

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Cert.No.: 23CH1574
Page.: 1 of 3

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 Lerngagrakul

Approved by :
() Sathip Meangmai
() Warakorn Lerngagrakul
(x) Porpan Palpin

Issue Date : 19 December 2023

The Uncertainties are for a confidence probability of approximately 95%

This certificate was issued by the Technology Promotion Association (Thailand-Japan) on the basis of the results of the calibration performed by the company.

A 0061696



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	130RC118	23E2802	27 Aug 2024
2) Ref. Standard Thermometer	4982054	110RC044	23I908	26 July 2024

This certification is traceable to the International System of Unit maintained through:-
- Technology Promotion Association (Thailand-Japan)

2. Certified Reference Materials : The measurement results are traceable to SI through CPA chem Ltd.,
ANSI-ASQ National Accreditation Board, Accredited No. AR-1635

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	913598	14 July 2025
pH 6.985	CPA chem	931959	01 Oct 2024
pH 9.997	CPA chem	940106	02 Nov 2024

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

Calibration Results

Function : mV Measurement

Performing standard curve by Fluke at pH (4,7,10)

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (±mV)	Coverage factor k
			mV	pH		
pH Meter S/N.: B834291445	4.000	177.48	177.3	4.000	0.058	2.00
	7.000	0.00	-0.1	7.000	0.058	2.00
	10.000	-177.48	-177.5	10.000	0.058	2.00

a 1193852



Cert.No.: 23CH1574
Page.: 3 of 3

Calibration Results

Function : pH Measurement

Performing three buffers standard curve by using buffer nominal pH (4,7,10)

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH measurement (±)	Coverage factor k
pH Electrode S/N.: 3225368	4.008	4.013	184.1	0.0045	2.00
	6.986	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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Cert.No.: 23TW165
Page.: 1 of 2

Certificate of Testing

Equipment : DO Meter
Manufacturer : YSI
Model : 5000-115V
Serial No. : 15E102796
ID No. : RYG_EN0032
Received Date : 21 July 2023
Test Date : 24 July 2023
Reference : 2307-0713DSC-1
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.
Rayong Branch
616/10 Moo 5, T.Maenam Khu, A.Pluakdaeng,
Rayong 21140, Thailand
Laboratory Condition : Temperature (25 ± 5) °C
Humidity (50 ± 20) %
Test Procedure : In - house method : CP-CH9
by Comparison Technique with Azide Modification Method
Tested by : Walalak Siinthean
Approved by : Sathip Meangmai
() Malco Butkrua
(x) Sathip Meangmai
() Warakorn Lerngagrakul
Issue Date : 26 July 2023

a 0320211



Cert.No.: 23TW168
Page.: 2 of 2

Condition of this result of calibration

1. Reference Standard Instruments :

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

Instruments	Serial No.	ID No.	Certificate No.	Due Date
1) Burette	-	130BU10	23CG1172	22 Mar 2025
2) Balance	1126143764	140RC004	22MM50	20 Sep 2023

2. Standard Material :-

Material	Manufacturer	Lot.No.	Assay
Sodium Thiosulfate pentahydrate	Merck	AM1763316	100,2%

Result : Dissolved Oxygen Meter Adjustment With Air 100 %

Dissolved Oxygen Probe No.: 15E100464

Titration Method (Azide Modification Method)	DO Meter Reading	Standard Deviation
(mg/L)	(mg/L)	(mg/L)
8,18	8,17	0,0055

This report was certified only for the instrument we tested. It is allowable to use for study the system efficiency. The environmental impact control and present to organization it may concerned. Intend to use for advertising and referral purpose is prohibited. This report may not be reproduced other in full, without written approval of the laboratory.

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Saitip

a 1172155



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Cert. No.: 23LM125
Page.: 1 of 2

Certificate of Calibration

Equipment : DO Meter with Sensor
Manufacturer : YSI
Model : 5000-115V
Serial No. : 15E102796
ID No. : RYG_EN0032
Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.
Rayong Branch
616/10 Moo 5 T. Maenam Khu, A. Pluakdaeng,
Rayong 21140 Thailand
Location : TPA On Site Calibration Laboratory
Received Order : 25 July 2023
Calibrated Date : 27 July 2023
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
AC Line Voltage : (220 ± 22) V

Calibrated by : Preecha Hlathib

Approved by : *P. Hlathib*
Approved Signatory

() Pornthippa Tameyakul
() Malee Bulkruea
(✓) Suwit Imjai

Issue Date : 31 July 2023

The Uncertainties are for a confidence probability of approximately 95%

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A 0053616



Equipment : DO Meter with Sensor
Condition As-Received : Used Item
Reference : 2307-0713DSC-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	2211285	TPA	21 Oct 2023

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

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

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

Result of Calibration :- (°) Without Adjustment

Function : Temperature measurement.

This instrument was connected with temperature sensor, S/N.: 1228475367

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty (± °C)	Coverage Factor k
20.00	100	20.011	19.91	-0.101	0.15	2.00

UUC* : Unit Under Calibration

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

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Certificate of Calibration

Cert. No.: 24TM1653
Page : 1 of 3

Equipment : Low Temp. Incubator
Manufacturer : Memmert
Model : IPP750
Serial No. : VB18.0084
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 Palpin
() Suwit Imjai
(✓) Kunchit Promprat

Issue Date : 07 November 2024

The Uncertainties are for a confidence probability of approximately 95%

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Equipment : Low Temp. Incubator
Condition As-Received : Used Item
Reference : 2411-0002OC-1
Procedure Used :-

Cert. No.: 24TM1663
Page : 2 of 3

Calibration were conducted using calibration procedure CP-OT02 based on TLAS G-20 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).
The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY44073381	24LM73	TPA	18 May 2025

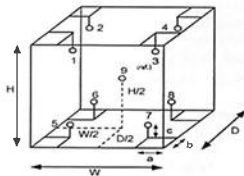
2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This certification is traceable to the International System of Unit.

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

Result of Calibration :- (') Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close



Probe Installation Details :

a = 10 cm
b = 10 cm
c = 10 cm

Dimension of Chamber :

D = 0.60 m
W = 1.0 m
H = 1.2 m
Capacity = 0.72 m³

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

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



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

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

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

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

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

Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.
Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.
Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.
UUC* : Unit Under Calibration

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

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

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Certificate of Calibration

Cert.No.: 24CG3711
Page: 1 of 2

Equipment : Burette

Capacity : 50 mL

Serial No. : *

ID. No. : RYG_EN0216

Manufacturer : Witag

Made in : Germany

Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.
Rayong Branch
616/10 Moo 5, T.Maenam Khu. A.Pluakdaeng
Rayong 21140, Thailand

Ambient Temperature : (20 ± 2.5) °C

Relative Humidity : (50 ± 10) %

Barometric Pressure : 756 mmHg

Calibration Procedure : ASTM E 542 - 01

Calibrated by : Sa-nguankam Wongsas

Approved by :

(✓) Sinsuda Khamtha
() Ponpan Paipim
() Unnopphol Harachai

Issue Date : 24 September 2024

REVIEW BY : *Thanitak*
APPROVED BY : *D. Sinsuda*
NEXT CAL. DATE : 24/09/25

Approved Signatory

The Uncertainties are for a confidence probability of approximately 95%

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Equipment : Burette
Received Date : 19 September 2024
Condition As-Received : Used Item
Calibration Date : 24 September 2024
Reference : 2409-0756DSC-3

Cert.No.: 24CG3711
Page: 2 of 2

Condition of this result of calibration

1. Reference Standard Instruments :

Instruments	Model	Serial No.	ID. No.	Certificate No.	Traceability	Due date
1) Balance	XP205	B134206712	140RC007	24MM316	TPA	15 July 2025
2) Data Logger	HL-20D	20683159	140EC012	23H2174	TPA	10 Oct 2024
3) Thermometer	-	1594592	140EC010	24H175	TPA	20 Feb 2025

This certification is traceable to SI Unit

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

3. True value is converted to true volume at the standard temperature of 20 °C

Calibration result :

Nominal capacity (mL)	Reading (mL)	Uncertainty (± mL)	k Factor
10	10.0259	0.0082	2.00
20	20.0214	0.0085	2.00
30	30.0006	0.0089	2.00
40	40.0003	0.0094	2.00
50	49.9988	0.011	2.00

Remark mL = cm³

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

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Certificate of Calibration

Equipment: SPECTROPHOTOMETER
Model: DR6000
Serial No. (or ID.): 1627845 (RYG_EN0037)
Manufacturer: HACH
Condition: In Condition

Certificate No.: C06230441
Issued Date: 19 September 2023
Job No.: WO-00005382
Page: 1 of 3

Customer: ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)
616/10 Moo 5 T.Maenam Khu,
A.Pluakdaeng, Rayong 21140, Thailand.

Environment Condition: Temperature 23.9 °C ± 0.2
Humidity 65.3 %RH ± 1.4

Calibration Place: ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch) (Wat Chemistry)
616/10 Moo 5 T.Maenam Khu,
A.Pluakdaeng, Rayong 21140, Thailand.

Calibration By: Mr.Nattapat Rungruang

Calibration Date: 18 September 2023

The Method used: In house method, CAL-WI-24, base on ASTM E 275-08 and ASTM E 367-04

Traceability: This certificate is traceable to the CRM maintained by National Institute of Standards and Technology (NIST) through Slama Scientific Limited.

The standard for Wavelength Certificate No. 111593 and 111584
The standard for Photometric Certificate No. 9114994 and 111588
The standard for Stray light Certificate No. 111586 and 111585
The standard for Spectral resolution Certificate No. 111587

(Mr. Nattapat Rungruang)
Person in charge

(Mr. Nitinun Srihawan)
Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.
The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).
These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. This report shall not be reproduced except in full without approval of DKSH Technology Limited.

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Phone: +66 2639 1700 Email: info@dksh.com Website: www.dksh.com/thailand

Delivering Growth - In Asia and Beyond.

CAL-FM-C06-15: 12 Sep 2022

Calibration Results:
Without Adjustment

Wavelength Accuracy (nm), The spectral bandwidth of Std at 2 nm and UUC at 2 nm

Standard Wavelength	Unit Under Calibration	Correction	Uncertainty
416.61	418.3	0.31	0.13
536.66	536.6	0.06	0.13
637.96	636.3	-0.32	0.13
748.48	746.7	-0.22	0.13
807.03	807.4	-0.37	0.13

Photometric Accuracy (Absorbance)

Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
420 nm	0.0000	0.000	0.0000	0.0045
	0.2930	0.289	0.0040	0.0045
	0.5168	0.519	-0.0022	0.0045
	1.0298	1.029	0.0008	0.0045
440 nm	0.0000	0.000	0.0000	0.0045
	0.2667	0.283	0.0037	0.0045
	0.5073	0.509	-0.0017	0.0045
	1.0083	1.007	0.0013	0.0045
465 nm	0.0000	0.000	0.0000	0.0045
	0.2516	0.250	0.0016	0.0045
	0.4595	0.462	-0.0025	0.0045
	0.9334	0.933	0.0004	0.0045
546.1 nm	0.0000	0.000	0.0000	0.0045
	0.2461	0.245	0.0011	0.0045
	0.4652	0.466	-0.0008	0.0045
	0.9468	0.946	0.0008	0.0045
590 nm	0.0000	0.000	0.0000	0.0045
	0.2594	0.259	0.0004	0.0045
	0.5040	0.506	-0.0010	0.0045
	1.0032	1.002	0.0012	0.0045
635 nm	0.0000	0.000	0.0000	0.0045
	0.2579	0.267	0.0009	0.0045
	0.4971	0.497	0.0001	0.0045
	0.9720	0.971	0.0010	0.0045

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Delivering Growth - In Asia and Beyond.

CAL-FM-C06-15: 12 Sep 2022

Calibration Results:
Without Adjustment

Photometric Accuracy (Absorbance)				
Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
235 nm	0.0000	0.000	0.0000	0.0080
	0.7355	0.737	-0.0015	0.0080
257 nm	0.0000	0.000	0.0000	0.0080
	0.8574	0.857	0.0004	0.0080
313 nm	0.0000	0.000	0.0000	0.0080
	0.2864	0.290	-0.0036	0.0080
350 nm	0.0000	0.000	0.0000	0.0080
	0.6374	0.637	0.0004	0.0080
Stray light *				
Standard: cut-off	UUC: Wavelength (nm)	UUC: Transmission (%T)	Absorbance (A)	
260.62 +/- 0.11 nm	260.6	1.3	1.886	
391.44 +/- 0.11 nm	391.4	1.3	1.886	
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	266.1		
Std Absorbance (A)	0.4566	0.2780		
Absorbance (A)	0.413	0.300		

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

The End of Certificate

DKSH Technology Limited
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CAL-FM-C06-15: 12 Sep 2022

ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: WO-00005382

ชนิดเครื่องมือ: SPECTROPHOTOMETER

รุ่น: DR6000

หมายเลขเครื่อง: 1627845

ตรวจสอบ (วัน)		รายการตรวจเช็ค	ตรวจสอบ (ครั้ง)		หมายเหตุ
18 Sep 2023			18 Sep 2023		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
General					
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. ความสมบูรณ์เครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. ความสะอาด (ช่องใส่ตัวอย่าง, ภายใน-นอกเครื่อง)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. สวิทช์ ปิด – เปิด เครื่อง (On-Off Switch)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. ปุ่มกด (Keypad)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. หน้าจอ (Display, Screen Contrast)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Spectrophotometer					
<input type="checkbox"/>	<input type="checkbox"/>	6. แบตเตอรี่ไฟฟ้า (Battery Backup) >= 2.5 VDC	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	7. ตัวหนึ่เลือกความยาวคลื่น (Wavelength Control)	<input type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. ความยาวคลื่น (Wavelength Check)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	*
<input checked="" type="checkbox"/>	<input type="checkbox"/>	9. แหล่งกำเนิดแสง (UV < 3,000 hour)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	9.2 Hours
<input checked="" type="checkbox"/>	<input type="checkbox"/>	10. แหล่งกำเนิดแสง (Visible < 5,000 hour)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	741.5 Hours
<input checked="" type="checkbox"/>	<input type="checkbox"/>	11. ช่องวัดหลายตัวอย่าง (Carousel Module)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
pH Meter and Conductivity Meter					
<input type="checkbox"/>	<input type="checkbox"/>	12. อิเล็กโทรด (Electrode and Connection Cable)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	13. ระดับสารละลายใน Electrode (Level KCl)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	14. ฝาปิดกันละออง Electrode (Dust Protection Hood)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	15. ขาตั้งอิเล็กโทรด (Stand)	<input type="checkbox"/>	<input type="checkbox"/>	
Turbidimeter					
<input type="checkbox"/>	<input type="checkbox"/>	16. ค่าความขุ่นที่ต่ำสุด (No Sample)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	17. ระดับการส่องสว่างของแสง (>= 2.5 ไม่นเกิน 3.0)	<input type="checkbox"/>	<input type="checkbox"/>	
Automatic titrator					
<input type="checkbox"/>	<input type="checkbox"/>	18. สภาพ Piston Burettes	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	19. Function Rinsing and Dosing	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	20. ระบบท่อสายยางและอุปกรณ์ประกอบ	<input type="checkbox"/>	<input type="checkbox"/>	

เพิ่มชิ้นส่วนแนะนำ: *656.1nm=656.1nm

*486.0nm=485.5nm

Mr.Nattapat Rungruang
Service Engineer

DKSH Technology Limited
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CAL-FM-R31-03: 20 Jul 2022



NSC-TIS-715 37025
CALIBRATION 0426

SARTORIUS

Certificate of Calibration

Model Number : MSE224S-100-DU
Description : Analytical Balance
Serial Number : 0026207038
ID No. : RYG_EN0002
Manufacturer : Sartorius
Certificate No. : 248C10069
Issued Date : Friday, February 23, 2024
Reference No. : 229196
Page No. : 1 of 2

Customer Name : ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch)
616/10 Moo 5 T.Maenam Khu, A.Pluakdaeng, Rayong 21140, Thailand.

Calibrated Place : ALS Laboratory Group (Thailand) Co., Ltd. (Balance Room)
616/10 Moo 5 T.Maenam Khu, A.Pluakdaeng, Rayong 21140, Thailand.

Calibrated By : Mr.Chonchai Inthana
Calibration Date : Thursday, February 22, 2024
Calibration Procedure No. : This calibration was conducted by
Using in-house calibration procedure number (WI-003)
Based on UKAS LAB 14 : 2019

Metrological data :
Capacity : 220 g Readability : 0.0001 g
Ambients Conditions :
Temperature : 24.2 °C ± 5.0 °C
Humidity : 57.0 % RH ± 10.0 % RH
Pressure : ±

Reasons for calibration

☐ New Installation ☐ Service / Repair ☒ Re-calibration / Maintenance

Equipment Condition : ☒ Good Operate ☐ Fair

Measurement Method UKAS Publication Ref : Lab 14

The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM). The calibration certificate documents the traceability to National Standards, which realise the unit of measurement according to the International Standard System of Units (SI). Report of Tolerance came from list of Sartorius Metrological Specifications.

Traceability:

Model Number	Description	Traceability	Certificate No.	Due Date
YCS011-522-00	Sartorius weight set 1mg - 5000g E2.YCS011-522-00	TCS	M2308197S	23-Aug-2025
MHB-382SD	Humidity/Barometer/Temp Lutron MHB-382SD	DKSH	C19231845	23-Aug-2024

This certificate relate and apply this equipment only.
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Sartorius (Thailand) Co., Ltd.

SOP FM 33 05 February 2022

Mr.chonchai inthana(Technical Manager)

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T
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P



SARTORIUS

Certificate of Calibration

Model Number : MSE224S-100-DU
Description : Analytical Balance
Serial Number : 0026207038
ID No. : RYG_EN0002
Manufacturer : Sartorius
Certificate No. : 248C10069
Issued Date : Friday, February 23, 2024
Reference No. : 229196
Page No. : 2 of 2

Calibration Results : Without Adjustment

Repeatability			Eccentricity (Off-center loading error)		
The reproducibility is the ability of a weighing instrument to display nearly identical readouts under constant test conditions when the same load within a measurement series is placed repeatedly on the weighing pan in the same manner. The standard deviation is used to express reproducibility quantitatively.					
Nominal Value : (Low Load)	20.0000	199.9999			
20 g	20.0000	200.0000			
Tolerance	20.0001	200.0000			
0.0001 g	20.0000	199.9999			
	20.0001	200.0000			
Nominal Value : (High Load)	19.9999	200.0000			
200 g	20.0000	200.0000			
Tolerance	20.0000	199.9999			
0.0001 g	19.9999	200.0001			
	19.9999	200.0000			
Standard Deviation	0.00007	0.00006			

Eccentricity (Off-center loading error)		
The off-center loading error is yielded by the difference between the readout of the load, i.e. 1/2 or 1/4 of maximum capacity, placed in the middle of the weighing pan and between each of four additional measurement points (positions defined according to OIML R110).		
Nominal value :	100 g	
Tolerance	0.0004 g	
		Difference
1		-
2		-0.0001
3		-0.0001
4		0.0000
5		-0.0001
6		-

Linearity

The linearity, also called linearity error, describes the deviation of the characteristic curve of a weighing instrument from the linear slope.

Tolerance 0.0002 g				
Nominal Value	Conventional Mass Value	Displayed Value	Deviation	Uncertainty
(g)	(g)	(g)	(g)	(g)
0.01	0.0100	0.0100	0.0000	0.00018
0.05	0.0500	0.0500	0.0000	0.00018
0.1	0.1000	0.1000	0.0000	0.00018
0.5	0.5000	0.5000	0.0000	0.00018
1	1.0000	1.0000	0.0000	0.00018
5	5.0000	5.0000	0.0000	0.00018
10	10.0000	10.0000	0.0000	0.00018
20	20.0000	20.0000	0.0000	0.00024
50	50.0000	49.9999	-0.0001	0.00019
100	100.0000	100.0000	0.0000	0.00023
200	200.0000	199.9999	-0.0001	0.00032

End of Report.

SOP FM 33 03 February 2022



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.: 24TM634
Page : 1 of 3

Equipment : Hot Air Oven
Manufacturer : Memmert
Model : UF 110
Serial No. : B423.0853
ID No. : RYG_EN0213
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 - 22 March 2024
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Man Paltanapongpaiboon
Approved by :
() Pornthippa Tamoyakul
() Unnophol Harachai
(x) Suwit Imjai

REVIEW BY : Thanitak
APPROVED BY :
NEXT CAL. DATE : 21/03/25



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2403-0563OC-3
Procedure Used :-

Cert. No.: 24TM634
Page : 2 of 3

Calibration was 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)

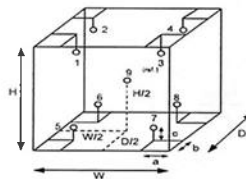
Result of Calibration :-

(*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close

Environment during calibration		
	Beginning	Finished
Temp. (°C)	27	27
REL.Humid. (%)	59	59
AC Supply (Volt)	224	223



Probe Installation Details : Dimension of Chamber :
a = 5.0 cm D = 0.40 m
b = 5.0 cm W = 0.56 m
c = 5.0 cm H = 0.48 m
Capacity = 0.11 m³

Ref. Std. ID No. : @ Calibration Point		
Position :	(180) °C	(104) °C
1	18-18TC-01	18-18RTD-01
2	18-18TC-02	18-18RTD-02
3	18-18TC-03	18-18RTD-03
4	18-18TC-04	18-18RTD-04
5	18-18TC-05	18-18RTD-05
6	18-18TC-06	23-18RTD-06
7	18-18TC-07	18-18RTD-07
8	18-18TC-08	22-18RTD-08
9 (ref.)	18-18TC-09	18-18RTD-09

The Uncertainties are for a confidence probability of approximately 95%

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Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2403-0563OC-3
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Close

Cert. No.: 24TM634
Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
104.0	104.0	104.0	0.065	0.52	0.90	2
180.0	180.0	180.0	0.20	1.2	2.0	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	1	2	3	4	5	6	7	8	9 (ref.)	
104.0	104.169	103.506	103.898	103.712	103.772	103.730	104.289	103.605	103.798	0.42
180.0	180.701	179.239	179.935	179.999	180.127	180.138	180.895	179.313	180.211	1.1

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

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

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

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

UUC* : Unit Under Calibration

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

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

-000-



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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TEL 0-2717-3000-29 FAX 0-2719-9484



Certificate of Calibration

Cert. No.: 24TM635
Page : 1 of 3

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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Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2403-0563OC-4
Procedure Used :-

Cert. No.: 24TM635
Page : 2 of 3

Calibration were conducted using in-house calibration procedure CP-OT04 Based on ASTM E715 according to direct measurement method with Data Acquisition which connected with Industrial Platinum Resistance Thermometer (IPRT).

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY57013711	23LM115	TPA	11 Jul 2024

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

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

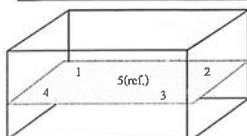
Remark : TPA: Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Heat transfer medium used : Water

	Environmental		AC Voltage Supply
	(°C)	(%R.H.)	(Volt)
Beginning of Calibration	25	55	222
Finished of Calibration	25	57	223



Front

Position :	Ref. Std. ID No.:
1	4803988-001
2	4803988-002
3	4803988-003
4	4803988-004
5(ref.)	4803988-005



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2403-0563OC-4
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source

Cert. No.: 24TM635
Page : 3 of 3

Calibration point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Average* Standard Reading (°C)					Uncertainty (± °C)
			1	2	3	4	5 (ref.)	
85.0	85.0	85.0	84.428	84.424	84.489	84.507	84.477	0.18

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Coverage Factor k
85.0	0.19	0.11	2

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

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

Stability : One-half of the greatest maximum difference of measured temperature at any one probe.

UUC* : Unit Under Calibration

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

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

-000-



Certificate of Calibration

Cert. No.: 24TM632
Page : 1 of 3

Equipment : Hot Air Oven
Manufacturer : Memmert
Model : UFE 500
Serial No. : G511.1572
ID No. : RYG_EN0010
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)
616/10 Moo 5 T. Maenam Khu,
A. Pluakdaeng,
Rayong 21140 Thailand
Location : Oven Room
Received Order : 21 March 2024
Calibration Date : 21 March 2024
Ambient Temperature : $(26 \pm 10) ^\circ\text{C}$
Relative Humidity : $(50 \pm 30) \%$
Calibrated by : Man Pattanapongpaiboon
Approved by :
() Ponthippa Tameyakul
() Unnopphol Harachai
(x) Suwit Imjai
Issue Date : 22 March 2024

REVIEW BY:
APPROVED BY:
NEXT CAL DATE: 21/09/25

The Uncertainties are for a confidence probability of approximately 95%
This certificate may not be reproduced other than in full, except with the prior written
Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.



Equipment : 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.

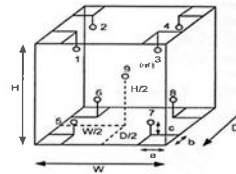
3. This certification is traceable to the International System of Unit.

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

Result of Calibration :-

Function of UUC* : () Without Adjustment
Temperature Source
Fresh air setting : Close

Environment during calibration		
	Beginning	Finished
Temp. (°C)	27	27
REL.Humid. (%)	57	59
AC Supply (Volt)	222	224



Probe Installation Details : Dimension of Chamber :
a = 5.0 cm D = 0.40 m
b = 5.0 cm W = 0.56 m
c = 5.0 cm H = 0.48 m
Capacity = 0.11 m³

Ref. Std. ID No. : @ Calibration Point		
Position :	(180) °C	(104) °C
1	18-18TC-01	18-18RTD-01
2	18-18TC-02	18-18RTD-02
3	18-18TC-03	18-18RTD-03
4	18-18TC-04	18-18RTD-04
5	18-18TC-05	18-18RTD-05
6	18-18TC-06	23-18RTD-06
7	18-18TC-07	18-18RTD-07
8	18-18TC-08	22-18RTD-08
9 (ref.)	18-18TC-09	18-18RTD-09



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2403-0563OC-1
Result of Calibration :- () Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Close

Cert. No.: 24TM632
Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor
104.0	104.0	104.0	0.051	0.59	0.62	2
180.0	180.0	180.0	0.15	1.3	1.7	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	1	2	3	4	5	6	7	8	9 (ref.)	
104.0	103.921	103.786	103.757	103.759	103.950	103.817	104.213	103.672	103.673	0.42
180.0	179.614	179.270	179.145	179.599	180.001	180.423	180.293	180.629	179.429	1.1

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

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

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

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

UUC* : Unit Under Calibration

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

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

-o0o-

BKK_EN0411

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Agilent CrossLab Compliance Services

Certificate of System Qualification

GC-00

System ID : 2024_ALS_GC#11_CN2303A021_OQHW
Organization Name : ALS Laboratory Group (Thailand) Co., Ltd.
Organization Location : 104 Soi 40 Phatthanakan Rd, Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250
Date : May 10, 2024 10:07:52 AM
EOP Name : Agilent Recommended
EOP Revision : GC.02.53
Overall Qualification Status : Pass

REVIEW BY:
APPROVED BY:
NEXT CAL DATE: 30 May 2025

CDS Logon Verification - CG

Logon : Saengulit Tarak

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 Decay

Name : 8890

Back

SSL

Setpoint Status : Pass

Pressure

25.0

psi

Pressure Change

±0.1

psi

15 minutes

Agilent Recommended

>= ±2.0

atd

<= 0.5

Date :

May 10, 2024 10:07:52 AM

System ID :

2024_ALS_GC#11_CN2303A021_OQ

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Overall Inlet Pressure Decay Test Status

Pass

Inlet Pressure Accuracy

Name:

8890

Back

SSL

Setpoint Status:

Pass

Inlet Pressure: 25.0 psi

Actual: 24.85 psi

Accuracy: 0.2 psi

Agilent Recommended: ≤ 1.2

Overall Inlet Pressure Accuracy Test Status

Pass

Inlet Pressure Decay

Name:

8890

Front

SSL

Setpoint Status:

Pass

Pressure: 25.0 psi

Pressure Change: 0.0 psi

15 minutes

Agilent Recommended: ≥ -2.0 and ≤ 0.5

Overall Inlet Pressure Decay Test Status

Pass

Inlet Pressure Accuracy

Name:

8890

Front

SSL

Date: May 10, 2024 10:07:52 AM

System ID: 2024_ALS_GC#11_CN2303A021_OQ

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Setpoint Status:

Pass

Inlet Pressure: 25.0 psi

Actual: 24.86 psi

Accuracy: 0.1 psi

Agilent Recommended: ≤ 1.2

Overall Inlet Pressure Accuracy Test Status

Pass

Detector Flow Accuracy

Name:

8890

Back

FID

Setpoint Status:

Pass

Flow Type: Fuel

Setpoint: 30.0 mL/min

Measured Flow: 29.5 mL/min

Accuracy: 0.5 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: 25.1 mL/min

Accuracy: 0.1 mL/min

Agilent Recommended: ≤ 10.0 % setpoint (2.5 mL/min)

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

Date: May 10, 2024 10:07:52 AM

System ID: 2024_ALS_GC#11_CN2303A021_OQ

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Overall Detector Flow Accuracy Test Status

Pass

Detector Flow Accuracy

Name:

8890

Front

FID

Setpoint Status:

Pass

Flow Type: Fuel

Setpoint: 30.0 mL/min

Measured Flow: 30.2 mL/min

Accuracy: 0.2 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: 394 mL/min

Accuracy: 6.0 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

GC Oven Temperature Accuracy

Name:

8890

Date: May 10, 2024 10:07:52 AM

System ID: 2024_ALS_GC#11_CN2303A021_OQ

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Setpoint Status:

Pass

Zone:

Oven

Setpoint/Actual

Temperature: 230.0 229.9 °C

Accuracy: -0.1 °C

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

≤ 1.0 % setpoint in K (5.0 °C)

Setpoint Status:

Pass

Zone:

Oven

Setpoint/Actual

Temperature: 100.0 100.0 °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:

8890

Setpoint Status:

Pass

Setpoint/Average

Temperature: 100.0 99.98333 °C

Stability: 0.1 °C

Agilent Recommended: ≤ 0.5 °C

Overall GC Oven Temperature Stability Test Status

Pass

Scouting Run

Tested Combination1

Back

SSL

/ Back

FID

Name:

7663A

Date: May 10, 2024 10:07:52 AM

System ID: 2024_ALS_GC#11_CN2303A021_OQ

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Setpoint Status: Completed

Injection Volume on Column: 1.0 µL

Overall Scouting Run Status
Completed

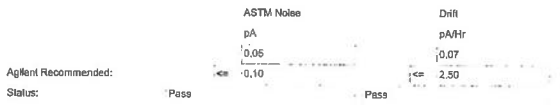
Noise and Drift

Tested Combination1 Back SSL / Back FID

Name: 8890

Setpoint Status: Pass

Base Signal: 25.0 pA



Overall Noise and Drift Test Status

Pass

Injection Precision

Tested Combination1 Back SSL / Back FID

Name: 7693A

Setpoint Status: Pass

Injection Volume on Column: 1.0 µL



Overall Injection Precision Test Status

Pass

Signal to Noise

Date: May 10, 2024 10:07:52 AM
System ID: 2024_ALS_GC#11_CN2303A021_OQ

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Tested Combination1 Back SSL / Back FID

Name: 8890 Injection Tower

Setpoint Status: Pass

Signal to Noise: 1263118

Agilent Recommended: >= 300000

Overall Signal to Noise Test Status

Pass

Scouting Run

Tested Combination2 Front SSL / Front FID

Name: 7693A Injection Tower

Setpoint Status: Completed

Injection Volume on Column: 1.0 µL

Overall Scouting Run Status

Completed

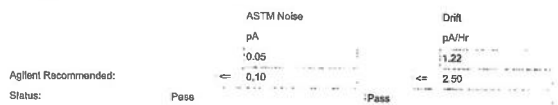
Noise and Drift

Tested Combination2 Front SSL / Front FID

Name: 8890

Setpoint Status: Pass

Base Signal: 11.30 pA

Date: May 10, 2024 10:07:52 AM
System ID: 2024_ALS_GC#11_CN2303A021_OQ

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Overall Noise and Drift Test Status

Pass

Injection Precision

Tested Combination2 Front SSL / Front FID

Name: 7693A

Setpoint Status: Pass

Injection Volume on Column: 1.0 µL



Overall Injection Precision Test Status

Pass

Signal to Noise

Tested Combination2 Front SSL / Front FID

Name: 8890 Injection Tower

Setpoint Status: Pass

Signal to Noise: 1555368

Agilent Recommended: >= 300000

Overall Signal to Noise Test Status

Pass

Date: May 10, 2024 10:07:52 AM
System ID: 2024_ALS_GC#11_CN2303A021_OQ

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Instrument Details

Purpose

This section describes the as found system configuration.

Details

System

System ID	2024_ALS_GC#11_CN2303A021_OQHW
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
Sampler Identifier	Sampler 2
Inlet	Back
Detector	Back
LTM Included?	No

Tested Combination2

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

Sampler 1

Manufacturer	Agilent Technologies
Type	Injection Tower
Name	7693A
Model Number	G4513A
Serial Number	CN23125107
Firmware Revision	A.11.07
Usage	Sample Injection
Location	Front
Syringe Volume (µL)	10

Date: May 10, 2024 10:07:52 AM
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Sampler 2

Manufacturer	Agilent Technologies
Type	Injection Tower
Name	7693A
Model Number	G4513A
Serial Number	CN23125121
Firmware Revision	A.11.07
Usage	Sample Injection
Location	Back
Syringe Volume (µL)	10

Sampler 3

Manufacturer	Agilent Technologies
Type	Tray
Name	7693A
Model Number	G4514A
Serial Number	CN23147054
Firmware Revision	A.12.03
Vial Heater	Not Installed

Mainframe 1

Manufacturer	Agilent Technologies
Name	8890
Model Number	G3540A
Serial Number	CN2303A021
Firmware Revision	2.5.0.258
Oven Type	Standard

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Inlet 1

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

Inlet 2

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	8890
Type	FID
Adapter	Capillary
Control Type	Electronic Pressure Control (EPC)
Location	Back
Makeup Gas	Nitrogen

Detector 2

Manufacturer	Agilent Technologies
Name	8890
Type	FID
Adapter	Capillary
Control Type	Electronic Pressure Control (EPC)
Location	Front
Makeup Gas	Nitrogen

Date: May 10, 2024 10:07:52 AM
System ID: 2024_ALS_GCR11_CN2303A021_OO

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Electronic Signature

Purpose

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Details

Full Name of Signer: Seenguthai Tarak
Logged On User Name: seenguthai.tarak@non.agilent.com
Signature Creation Date: May 10, 2024
Reason for Signature: Executed protocol and published this original version of document

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Date: May 10, 2024 10:07:52 AM
System ID: 2024_ALS_GCR11_CN2303A021_OO

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User Name: seenguthai.tarak
Report Generated by Hostname: LAPTOP-QD35KDMV
System ID: 2024_ALS_GCR11_CN2303A021_OO-HW
Print Date: May 10, 2024 10:17:53 AM

2024_ALS_GCR11_CN2303A021_OO-HW Transaction Log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
May 10, 2024 9:09:08 AM	Audit	Session Created	Session	None
May 10, 2024 9:09:08 AM	Start	Configuration	Session	None
May 10, 2024 9:09:08 AM	Audit	Enrollment	Unlocking	User is Nonpaying and does not require an unlock code
May 10, 2024 9:30:10 AM	Audit	ExpLoaded	Session	EOP details for primary technique (3d) - File path: [ProtocolPackage\Conf\Conf\form02_SWSec02.53.asp] EOP File Name: [Gc02.S3.asp], EOP Name: [AgilentResonanceMod Probact]Revision: [Gc02.S3]
May 10, 2024 9:30:55 AM	End	Configuration	Session	None
May 10, 2024 9:31:00 AM	Start	Qualification	Session	OQ
May 10, 2024 9:31:00 AM	Start	Execution	CDS Logon Verification - GC - 8890 - Qualitative Test	None
May 10, 2024 9:32:14 AM	End	Execution	CDS Logon Verification - GC - 8890 - Qualitative Test	Run Count: 1
May 10, 2024 9:32:18 AM	Start	Execution	System Inspection and Basic Safety and Operation - 8890 - Qualitative Test - No suspents associated	None
May 10, 2024 9:32:34 AM	End	Execution	System Inspection and Basic Safety and Operation - 8890 - Qualitative Test - No suspents associated	Run Count: 1
May 10, 2024 9:32:36 AM	Start	Execution	Inlet Pressure Decay - Back SSL - Pressure Controlled Inlet - S: 23.0 psi - L: >= -2.0 psi and <= 0.2 psi	Note

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Date: May 10, 2024 10:07:52 AM
System ID: 2024_ALS_GCR11_CN2303A021_OO

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User Name: xanaguthal.azark
Report Generated by Hostname: LAPTOP-CQ35KQMV
System ID: 2024_ALS_GCF11_CN2303A021_OOHV
Print Date: May 10, 2024 10:07:53 AM

2024_ALS_GCF11_CN2303A021_OOHV Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
May 10, 2024 9:33:54 AM	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
May 10, 2024 9:33:56 AM	Start	Execution	Inlet Pressure Accuracy - Back SSL - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	None
May 10, 2024 9:34:09 AM	End	Execution	Inlet Pressure Accuracy - Back SSL - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	Run Count: 1
May 10, 2024 9:34:02 AM	Start	Execution	Inlet Pressure Decay - Front SSL - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi	None
May 10, 2024 9:34:31 AM	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
May 10, 2024 9:34:33 AM	Start	Execution	Inlet Pressure Accuracy - Front SSL - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	None
May 10, 2024 9:34:37 AM	End	Execution	Inlet Pressure Accuracy - Front SSL - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	Run Count: 1
May 10, 2024 9:34:40 AM	Start	Execution	Detector Flow Accuracy - Back FID - Type: Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	None
May 10, 2024 9:35:15 AM	Audit	Data	Detector Flow Accuracy - Back FID - Type: Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
May 10, 2024 9:35:18 AM	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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Date: May 10, 2024 10:07:52 AM
System ID: 2024_ALS_GCF11_CN2303A021_OO

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User Name: xanaguthal.azark
Report Generated by Hostname: LAPTOP-CQ35KQMV
System ID: 2024_ALS_GCF11_CN2303A021_OOHV
Print Date: May 10, 2024 10:07:53 AM

2024_ALS_GCF11_CN2303A021_OOHV Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
May 10, 2024 9:35:20 AM	Start	Execution	Detector Flow Accuracy - Back FID - Type: Outflow - S: 400.0 mL/min - L: <= 10.0% setpoint	None
May 10, 2024 9:35:32 AM	Audit	Data	Detector Flow Accuracy - Back FID - Type: Outflow - S: 400.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
May 10, 2024 9:35:35 AM	End	Execution	Detector Flow Accuracy - Back FID - Type: Outflow - S: 400.0 mL/min - L: <= 10.0% setpoint	Run Count: 1
May 10, 2024 9:35:37 AM	Start	Execution	Detector Flow Accuracy - Back FID - Type: Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	None
May 10, 2024 9:35:53 AM	Audit	Data	Detector Flow Accuracy - Back FID - Type: Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
May 10, 2024 9:35:55 AM	End	Execution	Detector Flow Accuracy - Back FID - Type: Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Run Count: 1
May 10, 2024 9:35:57 AM	Start	Execution	Detector Flow Accuracy - Front FID - Type: Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	None
May 10, 2024 9:36:37 AM	Audit	Data	Detector Flow Accuracy - Front FID - Type: Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
May 10, 2024 9:36:39 AM	End	Execution	Detector Flow Accuracy - Front FID - Type: Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	Run Count: 1
May 10, 2024 9:36:41 AM	Start	Execution	Detector Flow Accuracy - Front FID - Type: Outflow - S: 400.0 mL/min - L: <= 10.0% setpoint	None
May 10, 2024 9:36:54 AM	Audit	Data	Detector Flow Accuracy - Front FID - Type: Outflow - S: 400.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry

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Date: May 10, 2024 10:07:52 AM
System ID: 2024_ALS_GCF11_CN2303A021_OO

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User Name: xanaguthal.azark
Report Generated by Hostname: LAPTOP-CQ35KQMV
System ID: 2024_ALS_GCF11_CN2303A021_OOHV
Print Date: May 10, 2024 10:07:53 AM

2024_ALS_GCF11_CN2303A021_OOHV Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
May 10, 2024 9:36:56 AM	End	Execution	Detector Flow Accuracy - Front FID - Type: Outflow - S: 400.0 mL/min - L: <= 10.0% setpoint	Run Count: 1
May 10, 2024 9:36:57 AM	Start	Execution	Detector Flow Accuracy - Front FID - Type: Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	None
May 10, 2024 9:37:20 AM	Audit	Data	Detector Flow Accuracy - Front FID - Type: Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
May 10, 2024 9:37:22 AM	End	Execution	Detector Flow Accuracy - Front FID - Type: Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Run Count: 1
May 10, 2024 9:37:24 AM	Start	Execution	GC Oven Temperature Accuracy - 8800 - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
May 10, 2024 9:37:57 AM	Audit	Data	GC Oven Temperature Accuracy - 8800 - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry
May 10, 2024 9:37:58 AM	End	Execution	GC Oven Temperature Accuracy - 8800 - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Run Count: 1
May 10, 2024 9:38:00 AM	Start	Execution	GC Oven Temperature Accuracy - 8800 - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
May 10, 2024 9:38:23 AM	Audit	Data	GC Oven Temperature Accuracy - 8800 - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry

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Date: May 10, 2024 10:07:52 AM
System ID: 2024_ALS_GCF11_CN2303A021_OO

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User Name: xanaguthal.azark
Report Generated by Hostname: LAPTOP-CQ35KQMV
System ID: 2024_ALS_GCF11_CN2303A021_OOHV
Print Date: May 10, 2024 10:07:53 AM

2024_ALS_GCF11_CN2303A021_OOHV Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
May 10, 2024 9:38:24 AM	End	Execution	GC Oven Temperature Accuracy - 8800 - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Run Count: 1
May 10, 2024 9:38:27 AM	Start	Execution	GC Oven Temperature Stability - 8800 - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	None
May 10, 2024 9:38:06 AM	Audit	Data	GC Oven Temperature Stability - 8800 - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Manual Data Entry
May 10, 2024 9:38:10 AM	End	Execution	GC Oven Temperature Stability - 8800 - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Run Count: 1
May 10, 2024 9:38:19 AM	Start	Execution	GC Scouting Run - Injection Tower, Back SSL, Back FID - Part of System Preparation - No limits associated	None
May 10, 2024 9:40:12 AM	Audit	Data	GC Scouting Run - Injection Tower, Back SSL, Back FID - Part of System Preparation - No limits associated	Data (See Path: C:\020004Data\GC2024_5 C01\10Back_SSL1-6.txt)
May 10, 2024 9:40:51 AM	Audit	Reporting	Reintegration	Reintegration Count: 1 - [Integration Type: Injection; Station/Connector/Inlet: Advanced; InitialPeakSensitivity: 10; InitialPeakWidth: 0.05; InitialPeakArea: 0; InitialPeakHeight: 100; Integration: Off at 0; Integration: On at 0.015; Integration: Off at 0.5;]

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Date: May 10, 2024 10:07:52 AM
System ID: 2024_ALS_GCF11_CN2303A021_OO

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User Name: xiangqin@alstark
Report Generated by Hostname: LAPTOP-CQ35KQNV
System ID: 2024_ALS_GCP11_CN233A021_OQHW
Print Date: May 10, 2024 10:07:53 AM

2024_ALS_GCP11_CN233A021_OQHW Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
May 10, 2024 9:41:07 AM	End	Execution	GC Scouting Run - Injection Tower, Back SSL, Back FID - Part of System Preparation - No limits associated	Run Count: 1
May 10, 2024 9:41:10 AM	Start	Execution	Noise and DHT - Back FID - Detector FID - L (Noise) <= 0.10 pA - L (DHT) <= 2.50 pA/hour	None
May 10, 2024 9:42:03 AM	Audit	Data	Noise and DHT - Back FID - Detector FID - L (Noise) <= 0.10 pA - L (DHT) <= 2.50 pA/hour	Data File Path: G:\OQ2024\Data\OQ2024_05_09\FID_Back_IP08-B.d
May 10, 2024 9:42:13 AM	End	Execution	Noise and DHT - Back FID - Detector FID - L (Noise) <= 0.10 pA - L (DHT) <= 2.50 pA/hour	Run Count: 1
May 10, 2024 9:42:16 AM	Start	Execution	Injection Precision - Injection Tower, Back SSL, Back FID - GC - L (Area) <= 3.00% - L (Rel. Time) <= 1.00%	None
May 10, 2024 9:43:44 AM	Audit	Data	Injection Precision - Injection Tower, Back SSL, Back FID - GC - L (Area) <= 3.00% - L (Rel. Time) <= 1.00%	Data File Path: G:\OQ2024\Data\OQ2024_05_09\FID_Back_IP08-B.d
May 10, 2024 9:43:44 AM	Audit	Data	Injection Precision - Injection Tower, Back SSL, Back FID - GC - L (Area) <= 3.00% - L (Rel. Time) <= 1.00%	Data File Path: G:\OQ2024\Data\OQ2024_05_09\FID_Back_IP08-B.d
May 10, 2024 9:43:44 AM	Audit	Data	Injection Precision - Injection Tower, Back SSL, Back FID - GC - L (Area) <= 3.00% - L (Rel. Time) <= 1.00%	Data File Path: G:\OQ2024\Data\OQ2024_05_09\FID_Back_IP08-B.d

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Date: May 10, 2024 10:07:52 AM
System ID: 2024_ALS_GCP11_CN233A021_OQ

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User Name: xiangqin@alstark
Report Generated by Hostname: LAPTOP-CQ35KQNV
System ID: 2024_ALS_GCP11_CN233A021_OQHW
Print Date: May 10, 2024 10:07:53 AM

2024_ALS_GCP11_CN233A021_OQHW Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
May 10, 2024 9:43:44 AM	End	Data	Injection Precision - Injection Tower, Back SSL, Back FID - GC - L (Area) <= 3.00% - L (Rel. Time) <= 1.00%	Data File Path: G:\OQ2024\Data\OQ2024_05_09\FID_Back_IP08-B.d
May 10, 2024 9:43:44 AM	End	Data	Injection Precision - Injection Tower, Back SSL, Back FID - GC - L (Area) <= 3.00% - L (Rel. Time) <= 1.00%	Data File Path: G:\OQ2024\Data\OQ2024_05_09\FID_Back_IP08-B.d
May 10, 2024 9:43:44 AM	End	Data	Injection Precision - Injection Tower, Back SSL, Back FID - GC - L (Area) <= 3.00% - L (Rel. Time) <= 1.00%	Data File Path: G:\OQ2024\Data\OQ2024_05_09\FID_Back_IP08-B.d
May 10, 2024 9:44:06 AM	End	Reporting	Reintegration	Reintegration Count: 1 - [Integration Type: Injection; BaselineCorrectionMode: Advanced; InitialPeakWidth: 10; InitialAreaReject: 0; InitialHeightReject: 100; Integration: Off at 0; Integration: On at 0.015; Integration: Off at 0.5;]
May 10, 2024 9:44:14 AM	End	Execution	Injection Precision - Injection Tower, Back SSL, Back FID - GC - L (Area) <= 3.00% - L (Rel. Time) <= 1.00%	Run Count: 1
May 10, 2024 9:44:17 AM	Start	Execution	Signal to Noise - Injection Tower, Back SSL, Back FID - Detector FID - L (Noise) <= 0.10 pA - L (DHT) <= 2.50 pA/hour	None
May 10, 2024 9:44:58 AM	End	Data	Signal to Noise - Injection Tower, Back SSL, Back FID - Detector FID - L (Noise) <= 0.10 pA - L (DHT) <= 2.50 pA/hour	Data File Path: G:\OQ2024\Data\OQ2024_05_09\FID_Back_IP08-B.d

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Date: May 10, 2024 10:07:52 AM
System ID: 2024_ALS_GCP11_CN233A021_OQ

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User Name: xiangqin@alstark
Report Generated by Hostname: LAPTOP-CQ35KQNV
System ID: 2024_ALS_GCP11_CN233A021_OQHW
Print Date: May 10, 2024 10:07:53 AM

2024_ALS_GCP11_CN233A021_OQHW Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
May 10, 2024 9:45:10 AM	End	Reporting	Reintegration	Reintegration Count: 1 - [Integration Type: Injection; BaselineCorrectionMode: Advanced; InitialPeakWidth: 10; InitialAreaReject: 0; InitialHeightReject: 100; Integration: Off at 0; Integration: On at 0.015; Integration: Off at 0.5;]
May 10, 2024 9:45:17 AM	End	Execution	Signal to Noise - Injection Tower, Back SSL, Back FID - Detector FID - L (Noise) <= 0.10 pA - L (DHT) <= 2.50 pA/hour	Run Count: 1
May 10, 2024 9:45:20 AM	Start	Execution	GC Scouting Run - Injection Tower, Front SSL, Front FID - Part of System Preparation - No limits associated	None
May 10, 2024 9:46:09 AM	End	Data	GC Scouting Run - Injection Tower, Front SSL, Front FID - Part of System Preparation - No limits associated	Data File Path: G:\OQ2024\Data\OQ2024_05_09\FID_Front_IP12-F.d
May 10, 2024 9:46:22 AM	End	Reporting	Reintegration	Reintegration Count: 1 - [Integration Type: Injection; BaselineCorrectionMode: Advanced; InitialPeakWidth: 10; InitialAreaReject: 0; InitialHeightReject: 100; Integration: Off at 0; Integration: On at 0.015; Integration: Off at 0.5;]

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Date: May 10, 2024 10:07:52 AM
System ID: 2024_ALS_GCP11_CN233A021_OQ

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User Name: xiangqin@alstark
Report Generated by Hostname: LAPTOP-CQ35KQNV
System ID: 2024_ALS_GCP11_CN233A021_OQHW
Print Date: May 10, 2024 10:07:53 AM

2024_ALS_GCP11_CN233A021_OQHW Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
May 10, 2024 9:46:37 AM	End	Execution	GC Scouting Run - Injection Tower, Front SSL, Front FID - Part of System Preparation - No limits associated	Run Count: 1
May 10, 2024 9:46:39 AM	Start	Execution	Noise and DHT - Front FID - Detector FID - L (Noise) <= 0.10 pA - L (DHT) <= 2.50 pA/hour	None
May 10, 2024 9:47:25 AM	End	Data	Noise and DHT - Front FID - Detector FID - L (Noise) <= 0.10 pA - L (DHT) <= 2.50 pA/hour	Data File Path: G:\OQ2024\Data\OQ2024_05_09\FID_Front_IP12-F.d
May 10, 2024 9:48:13 AM	End	Execution	Noise and DHT - Front FID - Detector FID - L (Noise) <= 0.10 pA - L (DHT) <= 2.50 pA/hour	Run Count: 1
May 10, 2024 9:48:17 AM	Start	Execution	Injection Precision - Injection Tower, Front SSL, Front FID - GC - L (Area) <= 3.00% - L (Rel. Time) <= 1.00%	None
May 10, 2024 9:49:12 AM	End	Data	Injection Precision - Injection Tower, Front SSL, Front FID - GC - L (Area) <= 3.00% - L (Rel. Time) <= 1.00%	Data File Path: G:\OQ2024\Data\OQ2024_05_09\FID_Front_IP12-F.d
May 10, 2024 9:49:12 AM	End	Data	Injection Precision - Injection Tower, Front SSL, Front FID - GC - L (Area) <= 3.00% - L (Rel. Time) <= 1.00%	Data File Path: G:\OQ2024\Data\OQ2024_05_09\FID_Front_IP12-F.d
May 10, 2024 9:49:12 AM	End	Data	Injection Precision - Injection Tower, Front SSL, Front FID - GC - L (Area) <= 3.00% - L (Rel. Time) <= 1.00%	Data File Path: G:\OQ2024\Data\OQ2024_05_09\FID_Front_IP12-F.d

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Date: May 10, 2024 10:07:52 AM
System ID: 2024_ALS_GCP11_CN233A021_OQ

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User Name: sseenguthai.tawak Report Generated by Hostname: LAPTOP-GQ3SKQNV System Id: 2024_ALS_GCF11_CN2303A021_OQHW Print Date: May 10, 2024 10:07:53 AM				
2024_ALS_GCF11_CN2303A021_OQHW Transaction Log :				
Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
May 10, 2024 9:49:12 AM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID - GC - L (Area) <= 3.00% - L (Ret. Time) <= 1.00%	Data File Path : G:\002024\Data\002024_05_10\FID_Front_IP15-Fide
May 10, 2024 9:49:12 AM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID - GC - L (Area) <= 3.00% - L (Ret. Time) <= 1.00%	Data File Path : G:\002024\Data\002024_05_10\FID_Front_IP14-Fide
May 10, 2024 9:49:12 AM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID - GC - L (Area) <= 3.00% - L (Ret. Time) <= 1.00%	Data File Path : G:\002024\Data\002024_05_10\FID_Front_IP15-Fide
May 10, 2024 9:49:22 AM	Audit	Reporting	Reintegration	Reintegration Count: 1 - [Integration Type: Injection; Baseline Correction Mode: Advanced; InitialSlopeSensitivity: 10; InitialPeakWidth: 0.05; InitialHeightReject: 100; Integration: Off at 0; Integration: On at 0.01; Integration: Off at 0.5;]
May 10, 2024 9:49:40 AM	End	Execution	Injection Precision - Injection Tower, Front SSL, Front FID - GC - L (Area) <= 3.00% - L (Ret. Time) <= 1.00%	Run Count: 1
May 10, 2024 9:49:44 AM	Start	Execution	Signal to Noise - Injection Tower, Front SSL, Front FID - Detector FID - L1 >= 300000	None
May 10, 2024 9:50:10 AM	Audit	Data	Signal to Noise - Injection Tower, Front SSL, Front FID - Detector FID - L1 >= 300000	Data File Path : G:\002024\Data\002024_05_10\FID_Front_SNS1-Fide

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Date: May 10, 2024 10:07:52 AM
System ID: 2024_ALS_GCF11_CN2303A021_OQ

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User Name: sseenguthai.tawak Report Generated by Hostname: LAPTOP-GQ3SKQNV System Id: 2024_ALS_GCF11_CN2303A021_OQHW Print Date: May 10, 2024 10:07:53 AM				
2024_ALS_GCF11_CN2303A021_OQHW Transaction Log :				
Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
May 10, 2024 9:50:22 AM	Audit	Reporting	Reintegration	Reintegration Count: 1 - [Integration Type: Injection; Baseline Correction Mode: Advanced; InitialSlopeSensitivity: 10; InitialPeakWidth: 0.05; InitialHeightReject: 100; Integration: Off at 0; Integration: On at 0.01; Integration: Off at 0.5;]
May 10, 2024 9:50:28 AM	End	Execution	Signal to Noise - Injection Tower, Front SSL, Front FID - Detector FID - L1 >= 300000	Run Count: 1
May 10, 2024 9:50:31 AM	End	Qualification	Session	OQ
May 10, 2024 9:50:31 AM	Start	Reporting	Session	None
May 10, 2024 10:08:27 AM	Audit	Reporting	Session	Report Generated: Certificate
May 10, 2024 10:07:22 AM	Audit	Reporting	Session	Report Generated: Report

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Date: May 10, 2024 10:07:52 AM
System ID: 2024_ALS_GCF11_CN2303A021_OQ

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Prachinburi : 858 M.10, Thabun, Srinakharaphi, Prachinburi (T. 037-225-880)

MTOC : L-0614/2024

Report No. : ALS-799/01

ASI Maintenance Report

Instrument : Automatic Sample Injector Measuring : Vial 40 mL
Model : ASI-L Place of Installation : -
Serial No. : HS7415200799 Department : LABORATORY
Manufacture : ShimadzuCustomer : ALS Laboratory Group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khwaen Suan Luang, Khot Suan Luang,
Bangkok 10250 Thailand

Date of Maintenance : 26 / 06 / 2024

Ambient Condition : Temperature 25.5 ± 5 °C

Humidifier 55 ± 15 %RH

Maintenance By : T. Somri
(Mr. Tawatchal Somri)
TechnicianApproved By : N. Phungsomsak
(Mr. Nipon Phungsomsak)
Technician ManagerUser Name : Sinluk P
(Mr.)SHIMADZU ANALYZER
1/3

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MTOC : L-0614/2024

Report No. : ALS-799/01

Maintenance Sheet

Customer : ALS Laboratory Date : 26 / 06 / 2024
Model : ASI-L Serial No. HS7415200799

Item	Carry out maintenance work	Result	Exchange	Comment
1.	Arm Drive section	O.K.		
	Check Arm Drive Belt for wear and tension	O.K.		
	Check grease of Screw Arm Drive	O.K.		
2.	Rinse pump (only ASI-V 24mL, 40mL)	O.K.		
	Check pump rate (>40mL/min)	O.K.		
	Check pump and tube connection for leakage	O.K.		
	Check if outlet flow is in proper condition	O.K.		
3.	Check and if necessary exchange consumable, Maintenance parts	O.K.		See appropriate list of maintenance parts
4.	Check Stirrer (When installed)	O.K.		
5.	Verify ASI function via mechanical check	O.K.		

Inspection by : T. Somri
(Mr. Tawatchal Somri)
TechnicianSHIMADZU ANALYZER
2/3



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MTOC : L-0614/2024

Report No. : ALS-799/01

List of Consumable, Maintenance parts

Pos.	Part Number	Part Name	Result	Exchange	Recommended Interval
1.	017-27021-01	Grease Paste, Lubricant 100g	O.K.	✓	1 time per year
2.	032-22661-02	Belt, 60S2m596, Arm Drive	O.K.		1 time per year
3.	034-03067-02	Spring, F-642, Arm Drive	O.K.		Depending on condition
4.	042-00405-11	Pump Head, for ASI Rinse Pump (only ASI-V 24mL, 40mL)	O.K.		Depending on condition
5.	638-41448-01	Std. Needle Type1 24mL, 40mL* (for tube 2, 1x1, 6), (Sparg needle)	N/A		After 300 h of operating
6.	638-41448-02	Std. Needle Type1 125mL* (for tube 2, 1x1, 6)	N/A		Depending on condition
7.	631-41660-03	Flare Pipe 2x1.5x700mm* (for Standard Needle Type1 24mL, 40mL, 125mL)	N/A		Depending on condition (may cut to origin length 600mm)
8.	638-41450-01	Needle for Suspended Particles, 0.8mm (only ASI-V 24mL, 40mL)	N/A		Depending on condition
9.	638-41450-01	Std. Needle Type2 125mL* (for tube 1.4x0.9)	N/A		Depending on condition
10.	638-41472-01	Std. Needle Type2 24mL, 40mL* (for tube 1.4x0.9)	O.K.		Depending on condition
11.	631-41660-02	Flare Pipe 1.4x0.6x600mm* (for Suspended + Needle Type2)	O.K.		Depending on condition
12.	638-41449-01	Double Needle, only 24mL, 40mL (simultaneous sparge type)*	N/A		Depending on condition
13.	631-41660-01	Flare Pipe 1.1x0.6x600mm* (for Double Needle 24mL, 40mL)	N/A		Depending on condition

*Note: needed parts depending on installed needle types!

Inspection by : T. Somri
(Mr. Tawatthal Somri)
Technician

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MTOC : L-0613/2024

Report No. : ALS-416/01

TOC-L Maintenance Report

Instrument : Total Organic Carbon Analyzer Measuring : TC O - 30000 mg/L
Model : TOC-LCSH Place of Installation : -
Serial No. : H54425300416 Department : LABORATORY
Manufacture : Shimadzu

Customer : ALS Laboratory Group (Thailand) Co.,Ltd.,
104 Phatthanakan 40, Phatthanakan Rd.,
Khwaen Suan Luang, Khel Suan Luang,
Bangkok 10250 Thailand

Date of Maintenance : 26 / 06 / 2024

Ambient Condition : Temperature 25.5 ± 5 °C
Humidifier 58 ± 15 %RH

Maintenance By : T. Somri
(Mr. Tawatthal Somri)
Technician

Approved By : N. Phongsomsak
(Mr. Nipon Phongsomsak)
Technician Manager

User Name : Sinluk P

SHIMADZU ANALYZER
1/4

REVIEW BY	<u>Ubon S.</u>
APPROVED BY	<u>Sinluk P</u>
NEXT CAL DATE	<u>26/11/25</u>



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MTOC : L-0613/2024

Report No. : ALS-416/01

Maintenance Sheet

Customer : ALS Laboratory Date : 26 / 06 / 2024
Model : TOC-LCSH Serial No. : H54425300416

Item	Carry out maintenance work	Result	Exchange	Comment
1.	Check functionality of the device	O.K.		
	Check furnace temperature (Standard cat. 680 °C / for TN cat. 720 °C)	O.K.		
	Check dehumidifier temperature (1 °C)	O.K.		
	Check the entire flow line related to leakage	O.K.		
	Check baseline status (OK)	O.K.		
	Check carrier gas pressure (200 ± 10 kPa)	O.K.		
	Check carrier gas flow rate (150 mL/min)	O.K.		
2.	Tubos	O.K.		
	Check all tubing for contamination, if necessary clean them	O.K.		
	Check all tubing for tight connection	O.K.		
3.	Container and Drainage	O.K.		
	Fill up humidifier with pure water to max. level	O.K.		
	Check filling of dilution water and acid container	O.K.		
	Rinse Drain Pot, after wards refill again with pure water	O.K.		
	Check if outlet flow is in proper conditions	O.K.		
4.	TC and IC Injection	O.K.		
	Clean injector Block	O.K.		
	Check injector Block for wear	O.K.		
	Check injection tube adjustment	O.K.		
	Check injection for leakage	O.K.		
	Check injection for clogging	O.K.		
5.	IC Measurement (N-type)	O.K.		
	Check acidification in syringe	O.K.		
	Check sparging in syringe	O.K.		
6.	Eye check of 8-Port valve, for sample residues or moist spots that indicate possible leakage	O.K.		
7.	Check and if necessary exchange consumable, Maintenance parts	O.K.		See list of consumable, maintenance parts

Inspection by : T. Somri
(Mr. Tawatthal Somri)
Technician

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Prachinburi : 66F M.10, Thabum, Srirachapale, Prachinburi (T. 037-208-880)

MTOC : L-0613/2024

Report No. : ALS-416/01

Item	Carry out maintenance work	Result	Exchange	Comment
8.	Due to instrument condition, clean the instrument inside and outside.	O.K.		
9.	After checking the system and exchanging of consumable and maintenance parts a new 1-3 point calibration have to be done.	O.K.		Addition test 1.
10.	After wards the calibration perform check sample measurement.	O.K.		Addition test 2.

Addition test

Test no.	Test conditions	Meas. value	Result
1.	Calibration TC standard solution at 0, 0.1, 0.5, 1, 5, 10, 20 Injection volume 50 µL No. of measurement 2 times (Max.3)		Attachment : ALS-416/01 Page 3/4 - 2/4
	Criteria : R ² = 0.995 or more	0.9996	Pass
2.	Measurement of reagent water and TC standard solution at 5.0 mg/L Injection volume 50 µL No. of measurement 2 times (Max.3) and calculate accuracy by Meas. of TC standard - Meas. of Reagent water		Attachment : ALS-416/01 Page 3/4 - 4/4
	Criteria : Accuracy % Recovery 10% or less	5.216 - 0.2800 = 4.936 ppm	Pass

Inspection by : T. Somri
(Mr. Tawatthal Somri)
Technician

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Pachinburi : MM M.30, Thum, Srinakharinwirot, Pachinburi (T. 037-226-880)

MTOC : L-0613/2024

Report No. : ALS-416/01

List of Consumable, Maintenance parts

Pos.	Part Number	Part Name	Result	Exchange	Recommended Interval
1.	036-11209-84	O-ring, 4D P10A (Viton, for TC.IC Slider)	O.K.	✓	1 time per year, Depending on condition
2.	036-11219-84	O-ring, 4D P20 (for sealing TC-Combustion tube)	O.K.	✓	1 time per year, Depending on condition
3.	638-15025	O-ring, PIPE (for TC.IC Slider)	O.K.	✓	1 time per year, Depending on condition
4.	630-00105-01	Platinum net, (2pcs-set) (to support catalyst)	O.K.	✓	6 month same time as catalyst exchange
5.	630-00557	Silica Wool (to support catalyst)	O.K.	✓	6 month same time as catalyst exchange
6.	630-00992	Halogen Scrubber	O.K.	✓	6 month
7.	630-00996	High Sensitivity TC Catalyst (When installed)	N/A		Depending on condition
8.	638-60116	Regular Catalyst (33g) (When installed)	O.K.	✓	6 month
9.	638-56251-01	8-Port valve rotor	O.K.		1 time per year
10.	638-41323	TC-Combustion Tube	O.K.	✓	6 month same time as catalyst exchange
11.	631-43404-01	Packing, gasket slider (for TC-Injection tube)	O.K.		1 time per year, Depending on condition
12.	638-59296	Syringe 5mL	O.K.		Depending on condition
13.	638-59296-01	Plunger Tyle (for syringe 5mL)	O.K.		6 month
14.	042-00405-11	IC reagent supply pump head	O.K.		1 time per year
15.	630-00999	CO2-Absorber (for cell space purge)	O.K.		1 time per year
16.	630-00964	Molecular Sieves 13x	O.K.	✓	1 time per year

Note: Table indicates the guidelines replacement periods when NPDC measurement is performed on sample that are comparatively as clean as tap water, use standard catalyst and at a rate of about 500 sample per month (operating five days a week)

Inspector By

T. Pim
(Mr. Tawatthol Somri)
Technician

SHIMADZU ANALYZER
4/4

TOC-Control L Report

7/24/2024 10:26:00 PM

Sample Information

Instrument Options
Catalytic

TOC : 0.000%
Sample Name

Cell, Carve

Sample Name

Sample ID

Status

Cell, Carve

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2056 (4,24,02) P&A 40

instrument One and
Cape of

303-4344 Fax:
Regina Schwartz

Source Name
Source ID

Source Name	Unit
SourceID	UnitID
Origin	Unit - To process
Status	Execution
On - Endat	

Type	Vol	Annual Disposal	Result
10/2/98	1	170	100%

204

Area: TC

No.	Area	Cont.	Ins. Mt.	Asst. St.	Ex.	Cat. Code	Cat. Title
1	1110	21.00	1.00	1.00	1.00	1110-21.00	1110-21.00
2	1110	21.00	1.00	1.00	1.00	1110-21.00	1110-21.00

Year Area	1943
Year Cont.	1943-1944

