

# ภาคผนวก ง

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ใบรับรองการสอบเทียบเครื่องมือ



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รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Ambient	Particulate Matter (PM-10)	High Volume	RYG_FS0667	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	High Volume	RYG_FS0399	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	Digital Balance	RYG_EN0001	20-Feb-25	20-Feb-26	12
Ambient	Total Suspended Particulate	High Volume	RYG_FS0292	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	RYG_FS0396	-	-	On site Calibration
Ambient	Total Suspended Particulate	Digital Balance	RYG_EN0001	20-Feb-25	20-Feb-26	12
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	RYG_FS0087	7-Oct-24	7-Apr-26	18
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	RYG_FS0081	4-Oct-24	4-Apr-26	18
Noise	Leq 24 hrs	Sound Calibrator	RYG_FS0496	19-Mar-25	19-Mar-26	12
Noise	Leq 24 hrs	Sound Level Meter	RYG_FS0026	27-Jan-25	27-Jan-26	12
Noise	Leq 24 hrs	Sound Level Meter	RYG_FS0020	21-Jan-25	21-Jan-26	12
Noise	Leq 24 hrs	Sound Level Meter	RYG_FS0017	27-Jan-25	27-Jan-26	12
Noise	Noise Annoyance	Sound Calibrator	RYG_FS0496	19-Mar-25	19-Mar-26	12
Noise	Noise Annoyance	Sound Level Meter	RYG_FS0026	27-Jan-25	27-Jan-26	12
Noise	Noise Annoyance	Sound Level Meter	RYG_FS0020	21-Jan-25	21-Jan-26	12
Noise	Noise Annoyance	Sound Level Meter	RYG_FS0017	27-Jan-25	27-Jan-26	12
Noise	Noise Annoyance	Sound Level Meter	RYG_FS0019	21-Jan-25	21-Jan-26	12
Noise	Noise Annoyance	Sound Level Meter	RYG_FS0022	19-Mar-25	19-Mar-26	12
Noise	Noise Annoyance	Sound Level Meter	RYG_FS0018	21-Jan-25	21-Jan-26	12
Rayong Lab	Temperature	Digital Thermometer	RYG_FS0571	8-Oct-24	8-Oct-25	12
Water Lab	Hexavalent Chromium	Spectrophotometer	BKK_EN0018	13-Sep-24	13-Sep-25	12
Water Lab	Mercury	DUO-CVAFS / CVAAS	BKK_EL0023	12-Dec-24	12-Jun-26	18
Water Lab	Arsenic	ICP-MS	BKK_EL0043	4-Oct-24	3-Apr-26	18
Water Lab	Arsenic	Hot Block	BKK_EL0054	4-Mar-25	4-Sep-26	18
Water Lab	Arsenic	Chamber (Cooling Room)	BKK_EN0167	6-Dec-23	6-Jun-25	18
Water Lab	Copper	ICP-MS	BKK_EL0043	4-Oct-24	3-Apr-26	18
Water Lab	Copper	Hot Block	BKK_EL0054	4-Mar-25	4-Sep-26	18
Water Lab	Copper	Chamber (Cooling Room)	BKK_EN0167	6-Dec-23	6-Jun-25	18
Water Lab	Iron	ICP-MS	BKK_EL0043	4-Oct-24	3-Apr-26	18
Water Lab	Iron	Hot Block	BKK_EL0054	4-Mar-25	4-Sep-26	18
Water Lab	Iron	Chamber (Cooling Room)	BKK_EN0167	6-Dec-23	6-Jun-25	18
Water Lab	Lead	ICP-MS	BKK_EL0043	4-Oct-24	3-Apr-26	18
Water Lab	Lead	Hot Block	BKK_EL0054	4-Mar-25	4-Sep-26	18
Water Lab	Lead	Chamber (Cooling Room)	BKK_EN0167	6-Dec-23	6-Jun-25	18
Water Lab	Zinc	ICP-MS	BKK_EL0043	4-Oct-24	3-Apr-26	18
Water Lab	Zinc	Hot Block	BKK_EL0054	4-Mar-25	4-Sep-26	18
Water Lab	Zinc	Chamber (Cooling Room)	BKK_EN0167	6-Dec-23	6-Jun-25	18
Rayong Lab	BOD	Incubator	RYG_EN0154	1-Nov-24	1-May-26	18
Rayong Lab	BOD	Burette	RYG_EN0162	21-Oct-24	21-Oct-25	12
Rayong Lab	pH at 25 °C	pH meter	RYG_EN0183	19-Jan-24	19-Jul-25	18
Rayong Lab	Total Dissolved Solids 180°C	Electronic Balance	RYG_EN0002	20-Feb-25	20-Feb-26	12
Rayong Lab	Total Dissolved Solids 180°C	Hot Air Oven	RYG_EN0010	21-Mar-24	21-Sep-25	18
Rayong Lab	COD	Spectrophotometer	RYG_EN0037	18-Sep-23	18-Mar-25	18
Rayong Lab	Dissolved Oxygen	Chamber (Cold Room)	RYG_EN0184	11-Jun-24	11-Dec-25	18
Rayong Lab	Oil & Grease	Electronic Balance	RYG_EN0002	20-Feb-25	20-Feb-26	12
Rayong Lab	Oil & Grease	Hot Air Oven	RYG_EN0213	21-Mar-24	21-Mar-25	12
Rayong Lab	Oil & Grease	Water Bath	RYG_EN0061	21-Mar-24	21-Sep-25	18
Water Lab	Total Coliform	Autoclave	BKK_ML0041	4-Mar-25	4-Sep-26	18
Water Lab	Total Coliform	Incubator	BKK_ML0010	3-Dec-24	3-Dec-25	12
Water Lab	Total Coliform	Hot Air Oven	BKK_ML0013	23-Apr-24	23-Oct-25	18
Water Lab	Fecal Coliform	Autoclave	BKK_ML0041	4-Mar-25	4-Sep-26	18
Water Lab	Fecal Coliform	Incubator	BKK_ML0010	3-Dec-24	3-Dec-25	12
Water Lab	Fecal Coliform	Hot Air Oven	BKK_ML0013	23-Apr-24	23-Oct-25	18
Water Lab	Fecal Coliform	Water Bath	BKK_ML0056	4-Mar-25	4-Mar-26	12
Water Lab	Organochlorine Pesticide	GC MSMS	BKK_EN0284	21-Nov-24	21-May-26	18



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รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

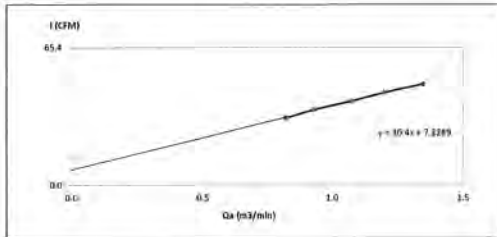
Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Sediment	Arsenic	ICP-OES	BKK_EL0037	23-Sep-24	23-Mar-26	18
Sediment	Arsenic	Hot Block	BKK_EL0054	4-Mar-25	4-Sep-26	18
Sediment	Arsenic	Chamber (Cooling Room)	BKK_EN0167	6-Dec-23	6-Jun-25	18
Sediment	Copper	ICP-OES	BKK_EL0037	23-Sep-24	23-Mar-26	18
Sediment	Copper	Hot Block	BKK_EL0054	4-Mar-25	4-Sep-26	18
Sediment	Copper	Chamber (Cooling Room)	BKK_EN0167	6-Dec-23	6-Jun-25	18
Sediment	Hexavalent Chromium	Spectrophotometer	BKK_EN0018	13-Sep-24	13-Sep-25	12
Sediment	Iron	ICP-OES	BKK_EL0037	23-Sep-24	23-Mar-26	18
Sediment	Iron	Hot Block	BKK_EL0054	4-Mar-25	4-Sep-26	18
Sediment	Iron	Chamber (Cooling Room)	BKK_EN0167	6-Dec-23	6-Jun-25	18
Sediment	Lead	ICP-OES	BKK_EL0037	23-Sep-24	23-Mar-26	18
Sediment	Lead	Hot Block	BKK_EL0054	4-Mar-25	4-Sep-26	18
Sediment	Lead	Chamber (Cooling Room)	BKK_EN0167	6-Dec-23	6-Jun-25	18
Sediment	Mercury	Mercury Analyzer	BKK_EL0128	6-Dec-24	6-Dec-25	12
Sediment	Moisture	Electronic Top-Loading Balance	BKK_EN0003	2-Aug-24	2-Aug-25	12
Sediment	Zinc	ICP-OES	BKK_EL0037	23-Sep-24	23-Mar-26	18
Sediment	Zinc	Hot Block	BKK_EL0054	4-Mar-25	4-Sep-26	18
Sediment	Zinc	Chamber (Cooling Room)	BKK_EN0167	6-Dec-23	6-Jun-25	18



### High Volume Air Sampler Calibration Worksheet

Project Site: WIA Industrial Development Public Company Limited  
Calibrate Location: กรุงเทพมหานคร 7/1 ถนนรามคำแหง เขต 1 (ถนนสุขุมวิทซอย 11/1 ถนนรามคำแหง)  
Calibrate Date: 4 May 25  
Calibration Sheet No.: C-040525-RYG-FS0667  
Calibrator ID: RYG-FS0206  
Calibrator Model: TE-5028A  
Calibrator S/N: 1543  
Barometric Pressure (mm Hg): 758.3  
Temperature (°C): 32.6  
High Volume ID: RYG-FS0667  
High Volume Model: TE-5009K  
High Volume S/N: 6266  
Calibrator Slope: 0.92987  
Calibrator Intercept: -0.01578

Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>a</sub> (m <sup>3</sup> /min)	I: Chart (CFM)	Linear Regression
1	1.4	0.874	32	Slope: 38.3996 Intercept: 7.3289 Correlation Coefficient: 0.9988
2	1.8	0.932	36	
3	2.4	1.073	48	
4	3.0	1.198	44	
5	3.8	1.347	48	



Calibrated by: [Signature]  
(Mr. Anuwat Terna)  
RYG Field Services Section (1)

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

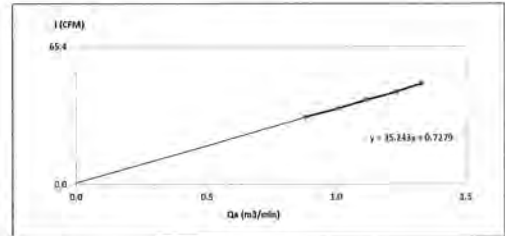
FORM HQ, F-05-074 REVISION NO. 2 ISSUE DATE: 20/11/21



### High Volume Air Sampler Calibration Worksheet

Project Site: WIA Industrial Development Public Company Limited  
Calibrate Location: กรุงเทพมหานคร 7/1 ถนนรามคำแหง เขต 1 (ถนนสุขุมวิทซอย 11/1 ถนนรามคำแหง)  
Calibrate Date: 4 May 25  
Calibration Sheet No.: C-040525-RYG-FS0399  
Calibrator ID: RYG-FS0206  
Calibrator Model: TE-5028A  
Calibrator S/N: 1543  
Barometric Pressure (mm Hg): 758.3  
Temperature (°C): 33.1  
High Volume ID: RYG-FS0399  
High Volume Model: TE-5009K  
High Volume S/N: 5681  
Calibrator Slope: 0.92987  
Calibrator Intercept: -0.01578

Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>a</sub> (m <sup>3</sup> /min)	I: Chart (CFM)	Linear Regression
1	1.6	0.880	32	Slope: 35.2432 Intercept: 0.7279 Correlation Coefficient: 0.9988
2	2.1	1.006	36	
3	2.6	1.118	40	
4	3.2	1.239	44	
5	3.7	1.330	48	



Calibrated by: [Signature]  
(Mr. Anuwat Terna)  
RYG Field Services Section (1)

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

FORM HQ, F-05-074 REVISION NO. 2 ISSUE DATE: 20/11/21

## SARTORIUS



Accredited by  
NSC-TISI-TIS 17025  
Calibration 0426

### Calibration certificate

Calibration Certificate No. 25BK0001

Object	Electronic non-automatic weighing instrument	This calibration certificate documents the traceability to national standards.
Manufacturer	Sartorius	Uncertainties of measurements are taken into account when only statements of compliance are made.
Type	LA130S-F	This certificate was prepared by Sartorius Corporation in accordance to the current ISO/IEC 17025:2017 standard and Sartorius Work Instruction (Method) SOP VM 08.
Serial   QM Ident. no.	25409564   RYG_EN0001	This certificate relate and apply this equipment only.
Customer	ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch) 616/10 Moo 5 T. Maenam Khui, A. Puak Daeng, Rayong 21140, Thailand.	
Order no.	2230	
Number of pages	4	
Date of calibration	20 Feb 2025	

REVIEW BY: [Signature]  
APPROVED BY: [Signature]  
NEXT CAL DATE: 20/02/26

This calibration certificate may not be reproduced other than in full except with the permission of NSC-TISI-TIS-17025 and the issuing laboratory. Calibration certificates without signature are not valid.  
The user is obliged to have the object recalibrated at appropriate intervals.

Date: 06 Mar 2025  
Approval of the Calibration Certificate: [Signature]  
Mr. Chonchai Inthana  
Person in charge: [Signature]  
Kachien Laee

Calibration certificate No.: 25BK0001

Calibration Certificate

### Calibration object

Single range instrument

Model: LA130S-F  
Serial Number: 25409564  
QM Ident. no | Inventory no.: RYG\_EN0001 | —

Maximum capacity (Max. load): 150.0000 g  
Measured range: 150.0000 g  
Scale interval: 0.0001 g

### Place of calibration

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

### Calibration procedure

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

### Test equipment

Test equipment type	Test equipment ID	Valid until
Thermometer	MIB-382SD s/nB011342 Traceable to SI unit through DKSH	21 Aug 2025
Test weight set OIML R111 E2	Certificate No.M23081975_E2(Traceable to SI unit through TCS)	23 Aug 2025



## CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

### MEASUREMENT ITEM MANUFACTURER MODEL/TYPE

Cup anemometer  
Novalline  
Sensor: WS-G21  
Data logger: 200-WS-250L

### SERIAL NUMBER

Sensor: WS-A4986  
Data logger: A4986  
NSC-TIS0007

### ID NUMBER

Used item

### CONDITION AS RECEIVED

### CUSTOMER

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

### RECEIVED DATE

30 Sep 2024

### MEASUREMENT DATE

07 Oct 2024

### ISSUE DATE

07 Oct 2024

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follows:

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

### PLACE OF CALIBRATION

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

### CALIBRATION CONDITIONS

Wind tunnel cross-section area<sup>1</sup>: 900 cm<sup>2</sup>  
Wind direction frontal area<sup>2</sup>: 100 cm<sup>2</sup>  
Diameter of mounting pipe<sup>3</sup>: 6 mm  
Blockage ratio of test object<sup>4</sup>: 0.133 [-]

### Preconditioning

24 hours at ambient conditions

### Measurement Condition

The average values during measurement are (23.3) °C, (40.9) %RH and (1012.3) hPa

### TABULATION OF RESULTS:

The table on next page gives the measured values.

Calibrated by:  
S.M. Sorwaj, Thailand  
Jirantee Associates Co., Ltd.

Approved signature:

REVIEW BY: *[Signature]*  
APPROVED BY: *[Signature]*  
NEXT CAL. DATE: 9/1/26

Mr. Parinya Booncharoen  
Laboratory Department Manager

### Remarks:

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

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

Page 2 of 2 Pages

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

This Cup anemometer, Unit Under Calibration (UUC) was exercised at 10 m/s for 5 minutes prior to calibration being performed. The standard air velocity 0.3 m/s was calculated by a standard air velocity transducer which was installed 50 mm away from wind tunnel nozzle and installed 40 mm away from top of the test section and the standard air velocity 5 m/s to 30 m/s was calculated by a pitot tube with precision differential pressure meter which was installed 50 mm away from wind tunnel nozzle and installed 40 mm away from the test section. UUC was mounted on a round vertical tube at the lower plate of center of test section. The calibration was carried out under both rising and falling air velocity in the range of 1 m/s to 30 m/s at calibration interval of 1 m/s. The results of calibration and associated measurement uncertainties are reported in the table below

$v_{ref}$ [m/s]	Temp. wind tunnel [°C]	Temp. room [°C]	$v_{ref}$ [m/s]	Error [m/s]	$U(95\%)$ [m/s]
1.013	23.26	23.30	0.8	-0.2	0.31
2.237	23.24	23.30	2.0	-0.2	0.31
3.651	23.28	23.30	3.0	-0.1	0.31
4.204	23.16	23.30	4.0	-0.2	0.31
4.96	22.92	23.30	5.0	0.0	0.31
5.88	22.70	23.30	6.0	0.0	0.31
7.05	22.84	23.30	7.0	0.0	0.31
7.58	22.58	23.30	8.0	0.0	0.31
8.87	23.00	23.30	9.0	0.0	0.31
9.87	22.96	23.30	10.1	0.1	0.31
11.03	23.10	23.30	11.2	0.2	0.31
12.03	23.34	23.30	12.1	0.1	0.31
12.95	23.70	23.30	13.2	0.2	0.31
13.93	23.04	23.30	14.2	0.3	0.31
14.98	23.20	23.30	15.2	0.2	0.31
15.91	23.14	23.30	16.2	0.3	0.31

### Remarks:

- <sup>1</sup> Calibration results only valid for the stated measurement and environmental conditions during which calibration took place
- <sup>2</sup> Velocity of standard
- <sup>3</sup> Velocity of Unit Under Calibration

### PHOTO OF CALIBRATION SET-UP



Calibration set-up of the Cup anemometer calibration in the wind tunnel of Jirantee Associates Co., Ltd. The Cup anemometer, Unit Under Calibration (UUC) was exercised at 10 m/s for 5 minutes prior to calibration being performed. The standard air velocity 0.3 m/s was calculated by a standard air velocity transducer which was installed 50 mm away from wind tunnel nozzle and installed 40 mm away from top of the test section and the standard air velocity 5 m/s to 30 m/s was calculated by a pitot tube with precision differential pressure meter which was installed 50 mm away from wind tunnel nozzle and installed 40 mm away from the test section. UUC was mounted on a round vertical tube at the lower plate of center of test section. The calibration was carried out under both rising and falling air velocity in the range of 1 m/s to 30 m/s at calibration interval of 1 m/s. The results of calibration and associated measurement uncertainties are reported in the table below

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

Page 2 of 2 Pages

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

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

Air speed m/s	$\theta^{+90}$ Degree (°)	$\theta^{+180}$ Degree (°)	Error Degree (°)	$U(95\%)$ Degree (°)
0.000	0	0	0	0.05
45.000	42	-3	-3	0.40
50.000	47	-3	-3	0.40
155.000	133	-2	-2	0.35
180.000	128	-2	-2	0.35
225.000	224	-2	-2	0.35
270.000	273	3	3	0.35
315.000	318	3	3	0.35

### Remarks:

- <sup>1</sup> Calibration results only valid for the stated measurement and environmental conditions during which calibration took place
- <sup>2</sup> Directional standard
- <sup>3</sup> Direction of Unit Under Calibration

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

## CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

### MEASUREMENT ITEM MANUFACTURER MODEL/TYPE

Wind Direction Sensor  
Novalline  
Sensor: WS-G21  
Data logger: 200-WS-250L

### SERIAL NUMBER

Sensor: WS-A4986  
Data logger: A4986  
NSC-TIS0007

### ID NUMBER

Used item

### CONDITION AS RECEIVED

### CUSTOMER

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

### RECEIVED DATE

30 Sep 2024

### MEASUREMENT DATE

07 Oct 2024

### ISSUE DATE

07 Oct 2024

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follows:

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

### PLACE OF CALIBRATION

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

### CALIBRATION CONDITION

Wind tunnel cross-section area<sup>1</sup>: 900 cm<sup>2</sup>  
Wind direction frontal area<sup>2</sup>: 129 cm<sup>2</sup>  
Diameter of mounting pipe<sup>3</sup>: 6 mm  
Blockage ratio of test object<sup>4</sup>: 0.143 [-]

### Preconditioning

24 hours at ambient conditions

### Measurement Condition

The average values during measurement are (23.3) °C, (47.3) %RH and (1012.3) hPa

### TABULATION OF RESULTS:

The table on next page gives the measured values.

Calibrated by:  
S.M. Sorwaj, Thailand  
Jirantee Associates Co., Ltd.

Approved signature:

REVIEW BY: *[Signature]*  
APPROVED BY: *[Signature]*  
NEXT CAL. DATE: 9/1/26

Mr. Parinya Booncharoen  
Laboratory Department Manager

### Remarks:

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

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

## CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

### MEASUREMENT ITEM

### MANUFACTURER

### MODEL/TYPE

### SERIAL NUMBER

### ID NUMBER

### CONDITION AS-RECEIVED

### CUSTOMER

Cup anemometer

Novalyne

Sencon: WS-02E

Data logger: 110-WS-16V

Sensor: WS0-1155

Data logger: 1155

Used item

ALS laboratory group (Thailand) Co., Ltd.

104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang,

Khet Suan Luang, Bangkok 10250 Thailand

RECEIVED DATE

MEASUREMENT DATE

ISSUE DATE

30 Sep 2024

24 Oct 2024

07 Oct 2024

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follows:

Temperature

Relative Humidity

Atmospheric Pressure

23.0 ± 0.5 °C

55.0 ± 3.0 %RH

1010 ± 10 hPa

### PLACE OF CALIBRATION

Eiffel type wind tunnel of Jirantee Associates Co., Ltd.

### CALIBRATION CONDITIONS

Wind tunnel cross-section area<sup>1</sup>

Wind direction length area<sup>2</sup>

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

Blockage ratio of test object<sup>4</sup>

900 cm<sup>2</sup>

100 cm<sup>2</sup>

100 mm

0.111 [-]

### Preconditioning

### Measurement Condition

24 hours at ambient condition

The average values during measurement are (23.0) °C, (55.0) %RH and (1010.4) hPa

### TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

Mr. Sorawat Thangthong

Mr. Jirantee Thangthong



Approved signature

REVIEW BY

APPROVED BY

NEXT CAL DATE

4/14/26

Mr. Parinya Boonchao

Calibration Department Manager

### Remark:

<sup>1</sup> Nozzle opening section area of the wind tunnel

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

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

<sup>4</sup> Ratio (%)

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

Page 2 of 2 Pages

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

The Cup anemometer, used under Calibration (NAC) was exerted at 10 m/s for 5 minutes prior to calibration being performed. The standard air velocity 0.5 m/s to 5 m/s was calculated by a standard air velocity transducer which was installed 50 mm away from wind tunnel nozzle and installed 40 mm away from top of the test section and the standard air velocity 5 m/s to 30 m/s was calculated by a pitot tube with precision differential pressure meter which was installed 50 mm away from wind tunnel nozzle and installed 40 mm away from top of the test section. UIC was mounted on a round vertical tube of the lower pipe at center of test section. The calibration was carried out under both rising and falling air velocity in the range of 1 m/s to 16 m/s at calibration interval of 2 m/s. The results of calibration and associated measurement uncertainties are reported in the table below.

V <sub>ref</sub> (m/s)	Temp. wind tunnel (°C)	Temp. room (°C)	V <sub>meas</sub> (m/s)	Error (m/s)	U/(k=2) (m/s)
1.013	23.20	23.50	0.9	-0.1	0.31
2.133	23.24	23.50	2.0	0.1	0.31
3.084	23.30	23.50	3.0	-0.2	0.31
4.125	23.36	23.50	4.0	0.2	0.31
5.103	23.62	23.50	5.0	0.0	0.31
5.96	23.42	23.50	5.9	0.1	0.31
7.04	22.98	23.50	7.0	0.0	0.31
7.90	23.40	23.50	7.9	0.0	0.31
9.04	23.08	23.50	8.1	0.5	0.31
9.97	23.22	23.50	10.1	0.1	0.31
10.98	23.18	23.50	11.1	0.2	0.31
12.09	23.18	23.50	12.2	0.2	0.31
12.97	23.28	23.50	13.2	0.2	0.31
13.96	23.22	23.50	14.2	0.2	0.31
14.99	23.30	23.50	15.2	0.3	0.31
15.93	23.26	23.50	16.2	0.3	0.31

### Remark:

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

<sup>2</sup> Velocity of standard

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

### PHOTO OF CALIBRATION SET-UP



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



## CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

### MEASUREMENT ITEM

### MANUFACTURER

### MODEL/TYPE

### SERIAL NUMBER

### ID NUMBER

### CONDITION AS-RECEIVED

### CUSTOMER

Wind Direction Sensor

Novalyne

Sensor: WS-02E

Data logger: 110-WS-16V

Sensor: WS0-1155

Data logger: 1155

Used item

ALS laboratory group (Thailand) Co., Ltd.

104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang,

Khet Suan Luang, Bangkok 10250 Thailand

RECEIVED DATE

MEASUREMENT DATE

ISSUE DATE

30 Sep 2024

04 Oct 2024

07 Oct 2024

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follows:

Temperature

Relative Humidity

Atmospheric Pressure

23.0 ± 0.5 °C

55.0 ± 3.0 %RH

1010 ± 10 hPa

### PLACE OF CALIBRATION

Eiffel type wind tunnel of Jirantee Associates Co., Ltd.

### CALIBRATION CONDITION

Wind tunnel cross-section area<sup>1</sup>

Wind direction length area<sup>2</sup>

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

Blockage ratio of test object<sup>4</sup>

900 cm<sup>2</sup>

120 cm<sup>2</sup>

100 mm

0.145 [-]

### Preconditioning

### Measurement Condition

24 hours at ambient condition

The average values during measurement are (23.0) °C, (55.0) %RH and (1010.4) hPa

### TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

Mr. Sorawat Thangthong

Mr. Jirantee Thangthong



Approved signature

REVIEW BY

APPROVED BY

NEXT CAL DATE

4/14/26

Mr. Parinya Boonchao

Calibration Department Manager

### Remark:

<sup>1</sup> Nozzle opening section area of the wind tunnel

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

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

<sup>4</sup> Ratio (%)

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

Page 2 of 2 Pages

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

The wind direction sensor was calibrated against standard rotary encoder by comparison method. During calibration, the sensor output was carried out at 10° intervals in clockwise and counterclockwise directions after offset adjustment has been made. The flow speed of wind tunnel (usually 5 m/s) is kept constant while the sensor is rotated around its vertical axis. The results of calibration and associated measurement uncertainties are reported in the table below.

Air speed m/s	D <sub>ref</sub> Degree (°)	D <sub>meas</sub> Degree (°)	Error Degree (°)	U/(k=2) Degree (°)
	0.000	0	0	0.80
	45.000	43	-2	0.80
	90.000	88	-2	0.80
5.01	135.000	134	-1	0.80
	180.000	177	-3	0.80
	225.000	229	4	0.80
	270.000	273	3	0.80
	315.000	312	-3	0.80

### Remark:

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

<sup>2</sup> Direction of standard

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

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

### Certificate of Calibration

#### Customer

Name : ALS Laboratory Group Thailand Co., Ltd. Certificate No : 25-ACI-042  
Address : 104 Soi Phatthanakan 40, Phatthanakan Road, Suai Luang, Request No : Req-2025-0604  
Bangkok 10250

#### Unit Under Calibration Details

Measurement item : Acoustic Calibrator Class : 1  
Manufacturer : RION Range : 94 dB / 1000 Hz  
Model : NC-75 Instrument Status : Used  
Serial Number : 35002736  
ID : RYG\_FS0406

#### Calibration Environment and Details

Temperature : ( 23 ± 2 °C )  
Humidity : ( 50 ± 20 %RH )  
Barometric Pressure : ( 1013 ± 10.0 hPa )  
Received Date : 6 March 2025  
Calibration Date : 19 March 2025  
Location of Calibration : LAH 1 Acoustic  
Calibration Procedure : In-house method CP/ACT-02 based on IEC 60942:2017 Electroacoustics - Sound calibrators

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Sound Calibrator	SV 35A	58079	FET	12 June 2025
THD Multimeter	2015	104765	NIMT	4 February 2026

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

#### Note

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

Calibrated By : Mr. Noppakorn Luangam Service Calibration Engineer  
Approved By : Mr. Paoi Mahavorn Calibration Engineer Supervisor  
Issue Date : 19 March 2025

This means intended only for the purpose stated. The certificate shall not be reproduced except in full, without prior approval of the Issuing Laboratory (Labs).

TM-208 ACT 02 Rev 03 Issue date 5/1/24

Certificate No : 25-ALT-042

Request No : Req-2025-0604

#### Decision Rule for Statements of Conformity

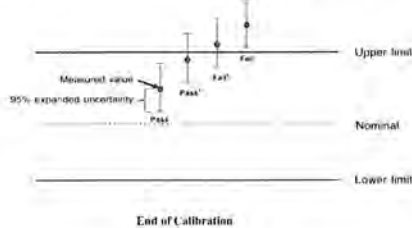
The standard decision rule employed for the statement of conformity in each calibration result will be applied using ILAC-G8:2019, Guidelines on the Reporting of Conformity with Specifications as follows (Fig. 1) and statements:

Pass - The measurement result plus the expanded uncertainty is within the tolerance limits.

Pass - The measurement result is within the limit. However, a portion of the expanded uncertainty of measurement is outside the limit.

Fail - The measurement result was outside the limit. However, a portion of the expanded uncertainty of measurement is within the limit.

Fail - The measurement result plus the expanded uncertainty is outside the tolerance limits.



End of Calibration

Certificate No : 25-ACT-042

Request No : Req-2025-0604

#### Sound pressure level

Calibration Results : Without Adjustment

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

#### Frequency of Sound pressure level

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

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

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

#### Note :

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

Acceptance limit will be 0.50dB/0.50% Class 1

The calibration results exclude the calibration priority correction.

The calibration results exclude the measurement reference correction.

This means intended only for the purpose stated. The certificate shall not be reproduced except in full, without prior approval of the Issuing Laboratory (Labs).

TM-208 ACT 02 Rev 03 Issue date 5/1/24

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

45/1-45/11 Sathiporn Road, Bangtumru, Bangkok, 10700 Thailand  
Tel : +66 2432 8231 Email : calibration@sithiporn.com

Cert. No. : ACT.25087

Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42 / Microphone UC-52 / Pre-amplifier NH-24  
Serial No. : 00734220 / 157226 / 34371  
ID No. : RYG\_FS0026

Condition As Found : GOOD

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

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

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

Calibrated by :

Nathakorn Pinutpaisan

Approved by :

( Thanakul Petchumai )

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.

This means intended only for the purpose stated. The certificate shall not be reproduced except in full, without prior approval of the Issuing Laboratory (Labs).

TM-208 ACT 02 Rev 03 Issue date 5/1/24

Calibration Procedure : CP-AC-01

Cert. No. : ACL25087  
Job No. : VC68AC0059  
Pages : 2 of 8

## Calibration Method :

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

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

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

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

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

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

3.1 National Institute of Metrology (Thailand).

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

*Z. Petch*Cert. No. : ACL25087  
Job No. : VC68AC0059  
Page : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

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

## 2. Self-generated noise

## 2.1 Normal test

Measured Value (dB)
13.1

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

Frequency Weighting	Weighting (dB)
A-weight	9.8
C-weight	16.2
Flat	22.1

## 3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	1.5	1.5	1.5	±1.5
1000	0.1	0.1	0.1	±1.0
8000	-4.2	-4.2	-4.2	±5.0

*Z. Petch*Cert. No. : ACL25087  
Job No. : VC68AC0059  
Pages : 3 of 8

## Summary of Measurement Result :

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

*Z. Petch*Cert. No. : ACL25087  
Job No. : VC68AC0059  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz:

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	-0.1	-0.1	0.0	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	-0.1	-0.1	±1.5
500	0.0	0.0	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	-0.1	0.0	0.0	±2.0
4000	-0.1	0.0	-0.1	±3.0
8000	-0.1	0.0	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	93.9	-0.1	±0.1
Leq	94.0	94.0	0.0	±0.1

## 6. Long-term stability

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

*Z. Petch*

Cert. No. : ACL25087  
Job No. : VC68AC0059  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	$\pm 1.1$
136.0	136.0	0.0	$\pm 1.1$
135.0	135.0	0.0	$\pm 1.1$
134.0	134.0	0.0	$\pm 1.1$
133.0	133.0	0.0	$\pm 1.1$
132.0	132.0	0.0	$\pm 1.1$
131.0	131.0	0.0	$\pm 1.1$
129.0	129.0	0.0	$\pm 1.1$
124.0	124.0	0.0	$\pm 1.1$
119.0	119.0	0.0	$\pm 1.1$
114.0	114.0	0.0	$\pm 1.1$
109.0	109.0	0.0	$\pm 1.1$
104.0	104.1	0.1	$\pm 1.1$
99.0	99.0	0.0	$\pm 1.1$
94.0	94.0	0.0	$\pm 1.1$
89.0	89.0	0.0	$\pm 1.1$
84.0	84.0	0.0	$\pm 1.1$
79.0	79.0	0.0	$\pm 1.1$
74.0	74.0	0.0	$\pm 1.1$
69.0	69.0	0.0	$\pm 1.1$
64.0	64.0	0.0	$\pm 1.1$
59.0	59.0	0.0	$\pm 1.1$
54.0	54.0	0.0	$\pm 1.1$
49.0	49.0	0.0	$\pm 1.1$
44.0	44.0	0.0	$\pm 1.1$
39.0	39.0	0.0	$\pm 1.1$
34.0	34.0	0.0	$\pm 1.1$
30.0	30.0	0.0	$\pm 1.1$
29.0	29.0	0.0	$\pm 1.1$
28.0	28.0	0.0	$\pm 1.1$
27.0	27.0	0.0	$\pm 1.1$
26.0	26.0	0.0	$\pm 1.1$
25.0	25.0	0.0	$\pm 1.1$

T. Petchur

Cert. No. : ACL25087  
Job No. : VC68AC0059  
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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)
130	94.0	94.0	0.0	$\pm 1.1$

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	29.0	29.8	0.8	$\pm 1.1$

## 9. Tone burst response

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

T. Petchur

Cert. No. : ACL25087  
Job No. : VC68AC0059  
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## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Leq <sub>pk</sub> (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	130.0	130.0	0.0	$\pm 3.0$
One	133.4	133.4	0.0	$\pm 3.0$

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	$\pm 2.0$
Positive half cycle	135.4	135.1	-0.3	$\pm 2.0$
Negative half cycle	135.4	135.1	-0.3	$\pm 2.0$

## 11. Overload indication

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

## 12. High level stability

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

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

End of Calibration Certificate

T. Petchur

Cert. No. : ACL25073  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42 / Microphone UC-S2 / Pre-amplifier NH-24  
Serial No. : 01222716 / 143R32 / 22763  
ID No. : RYQ\_J30020

Condition As Found : GOOD

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

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

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

Calibrated by :

Nattakorn Pritpitsan

Approved by :

T. Petchur  
( Thanakul Petchur )

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Cert. No. : ACL25073  
Job No. : VC68AC0059  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

**Calibration Method :**

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

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

**Condition of this result of calibration :**

1. Reference Standard Instruments :

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

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

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

3.1 National Institute of Metrology (Thailand).

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

*S. Petcha*Cert. No. : ACL25073  
Job No. : VC68AC0059  
Page : 4 of 8**Result of calibration :****1. Absolute sensitivity**

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

**2. Self-generated noise****2.1 Normal test**

Measured Value ( dB )
13.4

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

Frequency Weighting	Weighting ( dB )
A - weight	10.8
C - weight	16.7
Flat	22.6

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

Metz 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	-0.6	-0.6	-0.6	± 1.0
8000	-1.0	-1.0	-1.0	± 1.0

*S. Petcha*Cert. No. : ACL25073  
Job No. : VC68AC0059  
Pages : 3 of 8**Summary of Measurement Result :**

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

*S. Petcha*Cert. No. : ACL25073  
Job No. : VC68AC0059  
Pages : 5 of 8**4. Electrical signal tests of frequency weightings**

Weighting network response with relative to 1 kHz.

Frequency ( Hz )	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.2	0.2	0.3	±2.0
125	0.2	0.2	0.2	±1.5
250	0.1	0.1	0.1	±1.5
500	0.1	0.1	0.1	±1.5
1000	0.0	0.0	0.1	±1.0
2000	0.0	0.0	0.0	±2.0
4000	-0.1	-0.1	0.0	±3.0
8000	-0.1	0.0	0.0	±5.0

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

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

**5.2 Time weighting at 1 kHz**

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

*S. Petcha*

Cert. No. : ACL25073  
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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	140.0	3.0	$\pm 1.1$
136.0	140.0	-4.0	$\pm 1.1$
135.0	140.0	5.0	$\pm 1.1$
134.0	140.0	6.0	$\pm 1.1$
133.0	133.1	0.1	$\pm 1.1$
132.0	132.1	0.1	$\pm 1.1$
131.0	131.1	0.1	$\pm 1.1$
129.0	129.1	0.1	$\pm 1.1$
124.0	124.0	0.0	$\pm 1.1$
119.0	119.1	0.1	$\pm 1.1$
114.0	114.1	0.1	$\pm 1.1$
109.0	109.0	0.0	$\pm 1.1$
104.0	104.1	0.1	$\pm 1.1$
99.0	99.1	0.1	$\pm 1.1$
94.0	94.0	0.0	$\pm 1.1$
89.0	89.0	0.0	$\pm 1.1$
84.0	84.0	0.0	$\pm 1.1$
79.0	79.0	0.0	$\pm 1.1$
74.0	74.0	0.0	$\pm 1.1$
69.0	69.0	0.0	$\pm 1.1$
64.0	64.0	0.0	$\pm 1.1$
59.0	59.0	0.0	$\pm 1.1$
54.0	54.0	0.0	$\pm 1.1$
49.0	49.0	0.0	$\pm 1.1$
44.0	44.0	0.0	$\pm 1.1$
39.0	39.0	0.0	$\pm 1.1$
34.0	34.0	0.0	$\pm 1.1$
30.0	30.1	0.1	$\pm 1.1$
29.0	29.1	0.1	$\pm 1.1$
28.0	28.2	0.2	$\pm 1.1$
27.0	27.1	0.1	$\pm 1.1$
26.0	26.2	0.2	$\pm 1.1$
25.0	25.3	0.3	$\pm 1.1$

T. Petchur

## 8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	94.0	94.0	0.0	$\pm 1.1$

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	29.0	29.2	0.2	$\pm 1.1$

## 9. Tone burst response

Time Weighting	Tone burst duration, $T_b$ (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.1	0.1	$\pm 1.0$
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	$\pm 1.0$
	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	$\pm 1.0$

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Cert. No. : ACL25073  
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Pages : 8 of 8

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, $L_{peak}$ (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	130.0	130.0	0.0	$\pm 3.0$
One	133.4	133.4	0.0	$\pm 3.0$

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	$\pm 2.0$
Positive half cycle	135.4	135.1	-0.3	$\pm 2.0$
Negative half cycle	135.4	135.1	-0.3	$\pm 2.0$

## 11. Overload indication

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

## 12. High level stability

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

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

End of Calibration Certificate

T. Petchur

Cert. No. : ACL25086  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24  
Serial No. : 01122578 / 143842 / 74027  
ID No. : RYG\_FS0017

Condition As Found : GOOD

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

Location :  
Ambient Temperature : ( 23.0  $\pm$  1 ) °C  
Pressure : ( 101.3  $\pm$  3 ) kPa  
Relative Humidity : ( 50.0  $\pm$  20 ) %

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

Calibrated by :

Nathakorn Pisutpaisan

Approved by :

T. Petchur  
( Thanakul Petchurai )

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

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

Calibration Procedure : CP-AC-01

## Calibration Method :

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

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

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-24	05-FEB-25
Waveform Generator	33511B	MY52302742	EF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	EEL_BP 21/0267	13-FEB-25
Digital Multimeter	33461A	MY53220076	EEL_BP 20/0267	15-FEB-25
Digital Multimeter	34461A	MY60024273	EEL_BP 22/0267	15-FEB-25
Programmable Attenuator	MAT-1070	62100114	EF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-37K A1	34560495	AA-3001-24	05-FEB-25

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

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

3.1 National Institute of Metrology (Thailand);

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

Z. Petcha

Cert. No. : ACL25086  
Job No. : VC68AC0059  
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## Result of calibration :

## 1. Absolute sensitivity

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

## 2. Self-generated noise

## 2.1 Normal test

Measured Value (dB)
17.6

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

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

## 3. Acoustical signal tests of frequency weightings

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

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

Z. Petcha

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

## Summary of Measurement Result :

Parameter	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	0.2	N/A
2. Self-generated noise	0.2	N/A
3. Acoustical signal tests of frequency weightings		
125 Hz	0.3	0.6
1000 Hz	0.3	0.6
8000 Hz	0.3	0.7
4. Electrical signal tests of frequency weightings		
For 10 Hz to 4 kHz	0.3	0.6
For > 4 kHz to 10 kHz	0.3	0.7
For > 10 kHz to 20 kHz	0.3	1.0
5. Frequency and time weightings at 1 kHz	0.2	0.2
6. Long-term stability	0.1	0.1
7. Level linearity on the reference level range	0.2	0.3
8. Level linearity including the level range control	0.2	0.3
9. Time 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. : ACL25086  
Job No. : VC68AC0059  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

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

## 5.2 Time weighting at 1 kHz

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

## 6. Long-term stability

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

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Cert. No. : ACL25086  
Job No. : VC68AC0059  
Pages : 6 of 8Cert. No. : ACL25086  
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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	$\pm 1.1$
136.0	136.0	0.0	$\pm 1.1$
135.0	135.0	0.0	$\pm 1.1$
134.0	134.0	0.0	$\pm 1.1$
133.0	133.0	0.0	$\pm 1.1$
132.0	132.0	0.0	$\pm 1.1$
131.0	131.0	0.0	$\pm 1.1$
129.0	129.0	0.0	$\pm 1.1$
124.0	124.0	0.0	$\pm 1.1$
119.0	119.0	0.0	$\pm 1.1$
114.0	114.0	0.0	$\pm 1.1$
109.0	109.0	0.0	$\pm 1.1$
104.0	104.0	0.0	$\pm 1.1$
99.0	99.0	0.0	$\pm 1.1$
94.0	94.0	0.0	$\pm 1.1$
89.0	89.0	0.0	$\pm 1.1$
84.0	84.0	0.0	$\pm 1.1$
79.0	78.9	-0.1	$\pm 1.1$
74.0	74.0	0.0	$\pm 1.1$
69.0	69.0	0.0	$\pm 1.1$
64.0	63.9	-0.1	$\pm 1.1$
59.0	59.0	0.0	$\pm 1.1$
54.0	53.9	-0.1	$\pm 1.1$
49.0	48.9	-0.1	$\pm 1.1$
44.0	43.9	-0.1	$\pm 1.1$
39.0	38.9	-0.1	$\pm 1.1$
34.0	34.0	0.0	$\pm 1.1$
30.0	30.0	0.0	$\pm 1.1$
29.0	29.0	0.0	$\pm 1.1$
28.0	28.0	0.0	$\pm 1.1$
27.0	27.1	0.1	$\pm 1.1$
26.0	26.1	0.1	$\pm 1.1$
25.0	25.2	0.2	$\pm 1.1$

T. Petchum

## 8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	94.0	94.0	0.0	$\pm 1.1$

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

## 9. Tone burst response

Time Weighting	Tone burst duration, $T_b$ (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	$\pm 1.0$
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	$\pm 1.0$
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	$\pm 1.0$

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## 10. Peak C sound level

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

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	$\pm 2.0$
Positive half cycle	135.4	135.2	-0.2	$\pm 2.0$
Negative half cycle	135.4	135.2	-0.2	$\pm 2.0$

## 11. Overload indication

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

## 12. High level stability

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

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

End of Calibration Certificate

T. Petchum

Cert. No. : ACL25072  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NI-42 / Microphone UC-52 / Preamplifier NH-24  
Serial No. : 01122607 / 145554 / 34373  
ID No. : RYG\_FS0019

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  $\pm$  3 ) °C  
Pressure : ( 101.3  $\pm$  3 ) kPa  
Relative Humidity : ( 50.0  $\pm$  20 ) %

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

Calibrated by :

Nathakorn Pinutpaisan

Approved by :

T. Petchum  
( Thanakul Petchum )

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

Cert. No. : ACL25072  
Job No. : VC68AC0059  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

## Calibration Method :

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

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

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-2A	05-FEB-25
Waveform Generator	33511B	MY52302742	EF-0007-2A	05-FEB-25
Digital Multimeter	33461A	MY53220104	EEL_BP 21/0267	13-FEB-25
Digital Multimeter	33461A	MY53220076	EEL_BP 20/0267	13-FEB-25
Digital Multimeter	34461A	MY60024273	EEL_BP 22/0267	13-FEB-25
Programmable Attenuator	MAT-1070	62100114	EF-0008-2A	05-FEB-25
Condenser Microphone	4189	2977900	AA-1001-2A	12-FEB-25
Measuring Amplifier	NA-82KAJ	34560495	AA-3001-2A	05-FEB-25

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

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

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

Z. Petch

Cert. No. : ACL25072  
Job No. : VC68AC0059  
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## Result of calibration :

## 1. Absolute sensitivity

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

## 2. Self-generated noise

## 2.1 Normal test

Measured Value ( dB )
16.0

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

Frequency Weighting	Weighting ( dB )
A - weight	12.6
C - weight	17.7
Flat	22.6

## 3. Acoustical signal tests of frequency weightings

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

Frequency ( Hz )	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.5	0.5	0.5	± 1.5
1000	0.1	0.1	0.1	± 1.0
8000	-1.2	-1.2	-1.2	±5.0

Z. Petch

Cert. No. : ACL25072  
Job No. : VC68AC0059  
Pages : 3 of 8

## Summary of Measurement Result :

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

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Cert. No. : ACL25072  
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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	-0.1	±2.0
125	-0.1	0.0	-0.1	±1.5
250	-0.1	0.0	-0.1	±1.5
500	0.0	0.0	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.0	0.0	±5.0

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

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

## 5.2 Time weighting at 1 kHz

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

## 6. Long - term stability

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

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Cert. No. : ACL25072  
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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	134.1	0.1	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.1	0.1	±1.1
114.0	114.1	0.1	±1.1
109.0	109.0	0.0	±1.1
104.0	104.1	0.1	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	34.0	0.0	±1.1
30.0	30.0	0.0	±1.1
29.0	29.0	0.0	±1.1
28.0	28.0	0.0	±1.1
27.0	27.0	0.0	±1.1
26.0	25.9	-0.1	±1.1
25.0	24.9	-0.1	±1.1

T. R. R.

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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)
130	94.0	94.0	0.0	±1.1

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

## 9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	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	108.1	0.1	1.5 ; -5.0
	200	800	127.6	127.7	0.1	±1.0
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.1	0.1	±1.0

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## 10. Peak C sound level

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

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

## 11. Overload indication

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

## 12. High level stability

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

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

End of Calibration Certificate

T. R. R.

## INNOVATIVE INSTRUMENT CALIBRATION LAB

INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE

118 MOO 13, SOI SUTONAKORN 11, LAMBOO BANG KALU

AMPHOE BANG PHU SAMUT PRAKAN PROVINCE 10540 THAILAND

TEL: 0906-2110-5990 | FAX: 0906-2110-7140



## Certificate of Calibration

## Customer

Name : AIS Laboratory Group Thailand Co., Ltd.

Address : 101 Soi Phatthanasarn 40, Phatthanasarn Road, Sam Luang, Bangkok 10250

Certificate No : 25-SLM-114

Request No : IRCP-2025-0603

## Unit Under Calibration Details

Measurement Item : Sound Level Meter

Manufacturer : RION

Model : SL-42

Serial Number : 01222723

ID : RYG 150022

Resolution : 0.1 dB

Calibration Environment and Details

Temperature : 23 °C ± 2 °C

Humidity : &gt; 50 % RH ± 20 % RH

Barometric Pressure : 1013 hPa ± 10 hPa

Received Date : 6 March 2025

Calibrated Date : 19 March 2025

Calibration Procedure : In-house (per ISO CP-SLM-01) based on IEC 61672-2:2013 Electroacoustics - Sound level meters - Part 2: Periodic tests

Location of Calibration : Lab Acoustic

Reference Standard

Instrument	Brand	Model	SL	Date calibration	Traceability
Standard Microphone	Brüel & Kjær	4102	2204985	25 June 2025	NIMT
Audio Generator	Sony	Scan01	131	15 October 2025	WK Electric

Note

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

Calibrated By :

Mr. Noppadol Jungsart

Service Calibration Engineer

Approved By :

Mr. Pich Manivatt

Calibration Engineer Supervisor

Issue Date :

19 March 2025

Certificate No : 25-SLM-114

Request No : Req-2025-0003

#### 1. Indication at the calibration check frequency

UUC Setting	Nominal	Before Adjust		After Adjust		UNCERTAINTY	Acceptance	Result
Level	Level	UUC	ERR	UUC	ERR	( $\pm$ dB)	Limit	
Calibrator Setting	(dB)	(dB)	(dB)	(dB)	(dB)		( $\pm$ dB)	
1000 Hz 94 dB	94.00	94.0	-0.00	94.1	-0.04	0.20	0.30	Pass

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand R108, Model NC-75, SN:35002736

#### 2. Self-generated noise, Microphone installed

UUC Setting	Measured	UNCERTAINTY
FAST / 30-130	(dB)	( $\pm$ dB)
A	15.4	0.10

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

UUC Setting	Measured	UNCERTAINTY
FAST / 30-130	(dB)	( $\pm$ dB)
A	12.2	0.10
C	16.6	0.10
Z	20.4	0.10

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

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY	Acceptance	Result
Level	A	C	Z	( $\pm$ dB)	Limit	
STD Setting	(dB)	(dB)	(dB)		( $\pm$ dB)	
125 Hz	0.3	0.5	0.5	0.00	1.5	Pass
1000 Hz	0.0	0.0	0.0	0.00	1.0	Pass
4000 Hz	0.4	0.4	0.3	0.60	3.0	Pass
5000 Hz	-1.3	-1.3	-1.3	0.70	5.0	Pass

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.

FD-700-SLM-01 Rev.00 Issue date 5/5/21

Certificate No : 25-SLM-114

Request No : Req-2025-0003

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

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY	Acceptance	Result
Level	A	C	Z	( $\pm$ dB)	Limit	
STD Setting	(dB)	(dB)	(dB)		( $\pm$ dB)	
63 Hz	-0.1	0.0	0.0	0.20	2.0	Pass
125 Hz	-0.1	0.0	0.0		1.5	Pass
250 Hz	0.0	0.0	0.0		1.5	Pass
500 Hz	0.0	0.1	0.0		1.5	Pass
1000 Hz	0.0	0.0	0.0		1.0	Pass
2000 Hz	0.0	0.1	0.0		2.0	Pass
4000 Hz	0.0	0.0	0.0		3.0	Pass
8000 Hz	0.1	0.1	0.0		5.0	Pass
10000 Hz	-1.3	-1.3	0.0		>5, -INF.	Pass

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

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance	Result
Level	REF	UUC	ERR	( $\pm$ dB)	Limit	
UUC Weighting	(dB)	(dB)	(dB)		( $\pm$ dB)	
A	114.00	114.0	0.0	0.20	0.20	Pass
C	114.00	114.0	0.0		0.20	Pass
Z	114.00	114.0	0.0		0.20	Pass

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance	Result
Level	REF	UUC	ERR	( $\pm$ dB)	Limit	
UUC Time Response	(dB)	(dB)	(dB)		( $\pm$ dB)	
Fast	114.00	114.0	0.0	0.20	0.10	Pass
Slow	114.00	114.0	0.0		0.10	Pass
1 sec	114.00	114.0	0.0		0.10	Pass

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.

FD-700-SLM-01 Rev.00 Issue date 5/5/21

Certificate No : 25-SLM-114

Request No : Req-2025-0003

#### 7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance	Result
Level	UUC	( $\pm$ dB)	Limit	
STD Setting	(dB)		( $\pm$ dB)	
Initial	114.0	0.10	0.30	Pass
Final	114.0			
Deviation	0.0			

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

UUC Setting	Anticipated	Deviation		UNCERTAINTY	Acceptance	Result
Level	REF	UUC	ERR	( $\pm$ dB)	Limit	
STD dB	(dB)	(dB)	(dB)		( $\pm$ dB)	
138.00	138	137.9	-0.1	0.10	1.1	Pass
134.00	134	134.0	0.0		1.1	Pass
129.00	129	129.0	0.0		1.1	Pass
125.00	125	125.0	0.0		1.1	Pass
119.00	119	119.0	0.0		1.1	Pass
114.00	114	114.0	0.0		1.1	Pass
109.00	109	109.0	0.0		1.1	Pass
104.00	104	104.0	0.0		1.1	Pass
99.00	99	99.0	0.0		1.1	Pass
94.00	94	94.0	0.0		1.1	Pass
89.00	89	89.0	0.0		1.1	Pass
84.00	84	84.0	0.0		1.1	Pass
79.00	79	79.0	0.0		1.1	Pass
74.00	74	74.0	0.0		1.1	Pass
69.00	69	69.0	0.0		1.1	Pass
64.00	64	64.0	0.0		1.1	Pass
59.00	59	59.0	0.0		1.1	Pass
54.00	54	54.0	0.0		1.1	Pass
49.00	49	49.0	0.0		1.1	Pass
44.00	44	44.0	0.0		1.1	Pass
39.00	39	39.0	0.0		1.1	Pass
34.00	34	34.0	0.0		1.1	Pass
29.00	29	29.0	0.0		1.1	Pass
24.00	24	24.0	0.0		1.1	Pass

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FD-700-SLM-01 Rev.00 Issue date 5/5/21

Certificate No : 25-SLM-114

Request No : Req-2025-0003

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

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance	Result
Level	REF	UUC	ERR	( $\pm$ dB)	Limit	
UUC Range	(dB)	(dB)	(dB)		( $\pm$ dB)	
30-130	29.50	29.7	0.2	0.30	1.1	Pass
	114	114.0	0.0		1.1	Pass

#### 10. Tone burst response

UUC Setting	STD	Anticipated	Measured		UNCERTAINTY	Acceptance	Result
Level	Toneburst	Ref	UUC	ERR	( $\pm$ dB)	Limit	
UUC Time Response	(ms)	(dB)	(dB)	(dB)		( $\pm$ dB)	
Fast	200	126.0	126.1	+0.1	0.20	1.0	Pass
	2	109.0	109.0	0.0		-1.0, +2.5	Pass
	-0.25	108.0	99.9	-8.1		-1.5, +5.0	Pass
Slow	200	119.6	119.6	0.0		1.0	Pass
	2	100.0	100.0	0.0		-1.0, +5.0	Pass
	200	120.0	120.0	0.0		1.0	Pass
SH	2	100.0	100.0	0.0		-1.0, +2.5	Pass
	-0.25	99.0	99.0	-0.1		-1.5, +5.0	Pass

#### 11. Peak C Sound level

UUC Setting	Anticipated	Measured		UNCERTAINTY	Acceptance	Result
Level	REF	UUC	ERR	( $\pm$ dB)	Limit	
UUC Time Response	(dB)	(dB)	(dB)		( $\pm$ dB)	
Complete cycle	135.4	135.8	+0.40	0.20	3.0	Pass
Positive half cycle	135.4	135.2	-0.20		2.0	Pass
Negative half cycle	135.4	135.2	-0.20		2.0	Pass

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.

FD-700-SLM-01 Rev.00 Issue date 5/5/21

Certificate No. : 25-SLM-114  
Request No. : Req-2025-0601

## 12. Overload indication

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

## 13. High Level Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance Limit	Result
TAST + A / 90-130	UUC			
STD Setting	(dB)	(± dB)	(± dB)	
Initial	129.0			
Final	129.0			
Deviation	0.0	-0.10	0.30	Pass

Note :

Function	Maximum-permitted Uncertainty of measurement
1. Indication at the calibration check frequency	Not applicable
2. Self-generated noise, Microphone installed	Not applicable
3. Self-generated noise, Microphone replaced by the electrical input signal device	Not applicable
4. Acoustic signal test of frequency weightings at 10 Hz to 4 kHz	0.60 dB
4. Acoustic signal test of frequency weightings at 4 kHz to 10 kHz	0.50 dB
5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz	0.20 dB
6. Frequency and time weightings in dB	0.20 dB
7. Long Term Stability	0.10 dB
8. Level Immunity on the reference level range	0.30 dB
9. Level Immunity including the level range control	0.30 dB
10. Tone burst response	0.50 dB
11. Peak C Sound level	0.35 dB
12. Overload indication	0.25 dB
13. High Level Stability	0.10 dB

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

This certificate is valid only to the item calibrated. The certificate shall not be reproduced or copy in full, without written approval of the Innovate Instrument Co., Ltd.

TEL: 060-2116-5860, Fax: 060-2116-7140

Certificate No. : 25-SLM-114  
Request No. : Req-2025-0601

## Decision Rule for Statements of Conformity

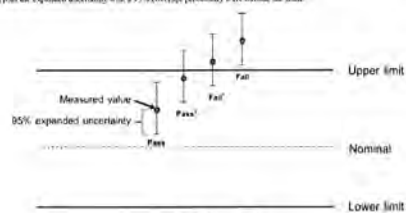
The standard decision rule is applied for the statement of conformity to each calibration result will be applied using ILAC-C8 99/2019. Guidance on the Reporting of Compliance with Specification as following Fig. and statements

Pass<sup>1</sup> : The measurement result plus the expanded uncertainty with a 95% coverage probability may not exceed the limit

Pass<sup>2</sup> : The measurement result is within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit

Fail<sup>1</sup> : The measurement result is out of the limit. However, a portion of the expanded uncertainty of measurement at 95% is within the limit

Fail<sup>2</sup> : The measurement result plus the expanded uncertainty with a 95% coverage probability may exceed the limit



End of Certificate

This certificate is valid only to the item calibrated. The certificate shall not be reproduced or copy in full, without written approval of the Innovate Instrument Co., Ltd.

TEL: 060-2116-5860, Fax: 060-2116-7140

## SITHIPORN ASSOCIATES CO., LTD. CALIBRATION LABORATORY

451-454/1 Srinakorn Road, Bangkum, Bangkok, 10700 Thailand  
Tel: +66 2633 8383 Email: calibration@sithiporn.co.th

SITHIPORN  
CALIBRATION LABORATORY



Cert. No. : ACL25071  
Pages : 1 of 8

## Calibration Certificate

**Equipment :** SOUND LEVEL METER  
**Manufacturer :** RION  
**Model :** NL-42 / Microphone UC-52 / Preamplifier NII-24  
**Serial No.:** 01122579 / 172172 / 74022  
**ID No.:** RYG\_FS0018

**Condition As Found :** GOOD

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

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

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

REVIEW BY: *S.P.S.*  
APPROVED BY: *[Signature]*  
NEXT CAL DATE: 21/01/2026

Calibrated by : Nathakorn Petchurani

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

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

## SITHIPORN associates

## SITHIPORN ASSOCIATES CALIBRATION LABORATORY

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

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

## Calibration Method :

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

## Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-24	05-FEB-25
Waveform Generator	33511B	MY53202742	EF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	EEL-BP 21/0267	13-FEB-25
Digital Multimeter	33461A	MY53220076	EEL-BP 20/0267	15-FEB-25
Digital Multimeter	34461A	MY60024273	EEL-BP 22/0267	15-FEB-25
Programmable Attenuator	MAT-1070	62100114	EF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KA	34560495	AA-3001-24	05-FEB-25

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

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

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

*[Signature]*

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

## Summary of Measurement Result :

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

T. Petch

Cert. No. : ACL25071  
Job No. : VC68AC0059  
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## Result of calibration :

## 1. Absolute sensitivity

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

## 2. Self-generated noise

## 2.1 Normal test

Measured Value (dB)
14.8

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

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

## 3. Acoustical signal tests of frequency weightings

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

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

T. Petch

Cert. No. : ACL25071  
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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	0.0	0.0	0.0	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.0	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

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

## 5.2 Time weighting at 1 kHz

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

## 6. Long-term stability

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

T. Petch

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

## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.0	0.0	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.0	0.0	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.0	0.0	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	78.9	-0.1	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	63.9	-0.1	±1.1
59.0	59.0	0.0	±1.1
54.0	53.9	-0.1	±1.1
49.0	48.9	-0.1	±1.1
44.0	43.9	-0.1	±1.1
39.0	38.9	-0.1	±1.1
34.0	33.9	-0.1	±1.1
30.0	30.0	0.0	±1.1
29.0	28.9	-0.1	±1.1
28.0	28.0	0.0	±1.1
27.0	27.0	0.0	±1.1
26.0	26.0	0.0	±1.1
25.0	25.1	0.1	±1.1

T. Petch

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

## 8. Level linearity including the level range control

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

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

## 9. Tone burst response

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

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

## 10. Peak C sound level

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

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

## 11. Overload indication

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

## 12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	137.0	137.0	0.0	±0.5

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



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
5144 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250  
TEL. 0-2717-3000-24 FAX. 0-2719-9484



## Certificate of Calibration

Certificate No. : 24T1733  
Page : 1 of 2

Equipment : Digital Thermometer

Manufacturer: Testo

Model : 106

Serial No.: 8351776910921

ID No.: RYG\_F50571

Condition As-Received: Used Item

Received Date: 30 September 2024

Calibration Date: 08 October 2024

Reference Temperature: 24.09-1061DSC

Ambient Temperature: ( 25 ± 3 ) °C

Relative Humidity: ( 50 ± 20 ) %

This certificate may not be reproduced other than in full, except with the prior written approval of the head of Corporate Services 3: Equipment Calibration and Testing Services.

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

616/10 Moo 5, T.Maenam Khu, A Phrakdang,  
Rayong 21140, Thailand

Procedure used: Calibration were conducted using in-house calibration procedure CP-T01 according to comparison with Industrial Platinum Resistance Thermometer (IPRT) into liquid bath temperature controller.  
The temperature scale used was based on ITS-90.

## Condition of this result of calibration

1. Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Digital Thermometer	1529	ATA609	2311245	19 Oct 2024
2) Industrial Platinum Resistance Thermometer	5627-12	571975	2311245	19 Oct 2024

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

3. This Certification is traceable to the International System of Unit maintained through:-

-Technology Promotion Association (Thailand-Japan), NSG-ONSC Accredited No. Calibration 0006

REVIEW BY: Pithaya T.  
APPROVED BY: S.T.S.  
NEXT CAL DATE: 08/10/25

Calibrated by : Yossapon Poljorn  
Issue Date : 10 October 2024Approved Signatory :  
[ ] Phalinee Pratsapaip  
[ ] Chatchawan Khunpluek  
[x] Wanlop LarpkemCert. No.: 24T1733  
Page.: 2 of 2

## Result of Calibration:-

Function: Temperature measurement

Without Adjustment  
Dimension of probe : Diameter 3 mm., Length 55 mm. Sheath material : Stainless Steel

Immersion Depth (mm.)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
50	25.0033	25.0	-0.0033	0.12
50	30.0050	29.9	-0.1050	0.12
50	40.0027	40.0	-0.0027	0.12

UUC\* : Unit Under Calibration

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

-00-

## Certificate of Calibration

Number of Page(s) 1 of 3

Certificate No. BSCC-UV-374/24  
Equipment UVVis Spectrophotometer  
Model UV-1800  
Manufacturer Shimadzu  
Serial No. A11454008533 CD  
ID No. BKK\_EN0018  
Date of receipt 13 September 2024  
Date of calibration 13 September 2024  
Date of issue 13 SEP 2024

REVIEW BY *Junda K*  
APPROVED BY *Santi P*  
NEXT CAL DATE 13/9/2025

Customer name ALS Laboratory Group (Thailand) Co., Ltd.  
Address 104 So. Phatthanakan 40, Phatthanakan Road, Phatthanakan, Suan Luang, Bangkok 10250

Temperature (25.3 - 26.7) °C (On site)  
Humidity (59.4 - 55.8) %RH (On site)

Equipment condition Good Operation

Calibration Location Organic Preparation Lab

Calibration Procedure In-house method: WI-UV-702-01 based on ASTM E275-01

Traceability Wavelength Accuracy is traceable to certificate No. 106372 and 106371  
Photometric Accuracy is traceable to certificate No. 106364 and 111398  
Sray Light is traceable to certificate No. 106377  
The above certificate are traceable to SI unit through Siam Scientific Ltd.  
(UKAS accredited calibration laboratory NO. 0659)

Calibrated by Mr Wanchana Jantoo

Approved by

*Santi P*

Mr. Santi Temboonsakdi  
Service Manager

The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate.  
Advertising the report / Certificate and publicly of the results are prohibited and also shall not be reproduced  
except in full, without written approval of the Bara Scientific Co., Ltd.

FMUV-708-02 Rev.01 (23/01/23)

## Certificate of Calibration

Certificate No. BSCC-UV-374/24

Number of Page(s) 2 of 3

Calibration Results:

### 1. Wavelength Accuracy

Certified Wavelength (nm)	UUC (nm)	Error (nm)	Uncertainty (nm)
241.70	241.55	-0.15	0.18
334.02	333.85	-0.17	0.18
418.53	418.57	0.04	0.18
572.99	572.97	-0.02	0.18
879.41	879.17	-0.24	0.18

### 2. Photometric Accuracy (UV)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty (±A)
235	0.0000	0.0000	0.0000	0.0075
	0.7171	0.7168	-0.0002	0.0075
257	0.0000	0.0000	0.0000	0.0075
	0.8354	0.8345	-0.0009	0.0075
313	0.0000	0.0000	0.0000	0.0075
	0.2786	0.2781	-0.0005	0.0075
350	0.0000	0.0000	0.0000	0.0075
	0.6189	0.6194	-0.0005	0.0075

\*CNR = Customer not request

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FMUV-708-02 Rev.01 (23/01/23)

## Certificate of Calibration

Certificate No. BSCC-UV-374/24

Number of Page(s) 3 of 3

Calibration Results:

### 3. Photometric Accuracy (Visible)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty (±A)
420.0	0.0000	0.0000	0.0000	0.0042
	0.5761	0.5765	0.0004	0.0042
	0.7119	0.7105	-0.0014	0.0042
	1.0189	1.0174	-0.0015	0.0042
	0.0000	0.0000	0.0000	0.0042
440.0	0.0000	0.0000	0.0000	0.0042
	0.5610	0.5613	0.0003	0.0042
	0.7001	0.6984	-0.0017	0.0042
	1.0026	1.0011	-0.0015	0.0042
	0.0000	0.0000	0.0000	0.0042
460.0	0.0000	0.0000	0.0000	0.0042
	0.5235	0.5237	0.0002	0.0042
	0.8614	0.8598	-0.0016	0.0042
	0.9455	0.9444	-0.0012	0.0042
	0.0000	0.0000	0.0000	0.0042
546.1	0.5249	0.5245	-0.0004	0.0042
	0.6875	0.6868	-0.0007	0.0042
	1.0009	0.9994	-0.0015	0.0042
	0.0000	0.0000	0.0000	0.0042
	0.5590	0.5588	-0.0004	0.0042
600.0	0.7725	0.7708	-0.0017	0.0042
	1.1125	1.1114	-0.0011	0.0042
	0.0000	0.0000	0.0000	0.0042
	0.5865	0.5865	0.0000	0.0042
	0.7620	0.7604	-0.0016	0.0042
635.0	1.0962	1.0971	-0.0011	0.0042

\*CNR = Customer not request

### 4. Stray Light\*

Standard cut-off wavelength (nm)	Wavelength (nm)	Transmission (%)	Absorbance (A)
200.85±0.11nm	199.58	0.9520	2.0217

The Stray light transmission reference is less than 1.0% and Stray light absorbance reference is greater than 2.00A

\*Stray Light not NIS-ONSC Accredited.

The measurement uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2 providing a level of confidence of approximately 95%.

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

The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate.  
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except in full, without written approval of the Bara Scientific Co., Ltd.

FMUV-708-02 Rev.01 (23/01/23)

analytikjena

REVIEW BY *Dr. Junda K*  
APPROVED BY *Santi P*  
NEXT CAL DATE 13/09/2025

## Maintenance Protocol

Atomic Fluorescence Spectrometer  
mercur DUO /  
mercur DUO plus

Serial-No.: K170A0143 Customer-No.:  
Date: 12 December 2024 Carried out by: Srichai Fak-on

Maintenance with following Operational Qualification (OQ)  
(requires a separate OQ protocol)

Company บริษัท เอนเนลเอส แอสบราทอว์ กรุ๊ป (ประเทศไทย) จำกัด  
User  
Department ห้องแล็บปฏิบัติการ  
Street 104 ซอย 40 ถนนพัฒนาการ แขวงสวนหลวง เขตสวนหลวง  
Zip Code, City กรุงเทพมหานคร 10250  
Country ประเทศไทย  
Phone  
Fax  
E-mail

## Maintenance works basic unit

tightness visual check inside the Mercur  
visual check if gold-traps are broken  
visual check if spectrometer is contaminated  
visual check of the fluorescence cell  
visual check of the absorption cell, incl. window  
reactor cleaning  
check pump-hose, if necessary change it  
check swivel drive (SEV)  
check drying-hose, output gas-liquid-separator  
test Bubble-Sensor  
check gas flows  
check volume flows, reagents  
recording stray light values  
measurement with 30 ng/l

## Maintenance works Autosampler

Serial No.: 701 739

lubricate the dosing-winding (Teflon-grease-spray)  
clean the dosing cylinder, if necessary exchange it  
lubricate the winding system of the height drive with some drops of oil  
check the toothed belt  
check the position of the mechanical stopper (height: 13mm)  
check the pump rate of mixing pump (<14s AS52, typ.7s/<20s AS52S, typ.10s)  
check the pump rate of washing cup  
check the electrical hose connections for good contact  
check the connectors of the magnetic valves  
check the dosing hose for buckling, if necessary exchange it

Device parameter	nominal value	actual value
visual check general tightness inside the Mercur	o.k. <input checked="" type="checkbox"/>	changed: <input type="checkbox"/>
visual check Goldtraps	o.k. <input checked="" type="checkbox"/>	changed: <input type="checkbox"/>
visual check spectrometer		
Fluorescence cell	o.k. <input checked="" type="checkbox"/>	changed: <input type="checkbox"/>
Absorption cell, incl. window	o.k. <input checked="" type="checkbox"/>	changed: <input type="checkbox"/>
lens	o.k. <input checked="" type="checkbox"/>	changed: <input type="checkbox"/>
Swivel drive (SEV)	o.k. <input checked="" type="checkbox"/>	changed: <input type="checkbox"/>
check pump hoses	o.k. <input checked="" type="checkbox"/>	changed: <input type="checkbox"/>
check hoses and hose connectors	o.k. <input checked="" type="checkbox"/>	changed: <input type="checkbox"/>
check and clean reactor	o.k. <input checked="" type="checkbox"/>	changed: <input type="checkbox"/>
check drying hose output Gas-liquid-separator	o.k. <input checked="" type="checkbox"/>	changed: <input type="checkbox"/>
check bubble-sensor	o.k. <input checked="" type="checkbox"/>	not o.k.: <input type="checkbox"/>
Check gasflow		
Argon pressure valve 4	1.2 - 1.5 bar	1.5 bar
Valve 1	10 Nl/h or 0.166 NL/min	0.142 NL/min
Valve 2	50 Nl/h or 0.833 NL/min	0.785 NL/min
Valve 3	5 Nl/h or 0.083 NL/min	0.080 NL/min
Valve 4	10 Nl/h or 0.166 NL/min	-
Check liquidflow		
Acid	2.5ml/min ± 1 ml	2.5 ml/min
Red.-agent	2.5ml/min ± 1 ml	2.5 ml/min
Sample	10ml/min ± 2 ml	10 ml/min
Adventitious light - values (V)	from file	
100	0	0
200	0	0
300	0	0
350	0	0
400	1	1
450	2	3
500	6	7
550	13	15
575	18	21
600	25	29

Device parameter	nominal value	actual value
Analytical parameters Fluorescence cell		
Conditions.; max.conc.: 10µg/L PMT-voltage: 360 V		
Blank-solution without enrichment / FBR 30 ng/L	Int. > 0.0015 RSD < 3 %	Int. 0.00044... Ext. 0.00232... RSD < 30 %
Conditions.; max.conc.: 1.7µg/L PMT-voltage: 352 V		
Blank-solution with enrichment / FBR 30 ng/L	Int. > 0.008 RSD < 3 %	Int. .... Ext. .... RSD < 3 %
Fck - factor ( Int <sub>2</sub> / Int <sub>1</sub> )	> 3.5	
Analytical parameters Absorption cell		
Blank-solution without enrichment / FBR 100 ng/L	Ext. > 0.0012 RSD < 5 %	Ext. 0.0011... Ext. 0.0029... RSD < 5 %

## Comments

- การใส่มาตรฐาน Tech: With enrichment ไม่สามารถวัดค่าได้เนื่องจาก Valve 4 (Gas flow) ไม่ทำงาน เกิดที่บอร์ดควบคุม Board control จ่ายหลัก 24 Vdc.
- การวัดตัวอย่างวัดด้วย Tech: With enrichment ต้องยอมเปลี่ยนตัว Gas box



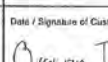
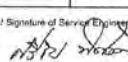
  
Signature Technician

12 December 2024  
Place, Date (DD/MM/YYYY)

  
Signature Customer

12 December 2024  
Place, Date (DD/MM/YYYY)

## Service Report

Customer's address : _____		Customer's Ref. No. Co-No. Service 2024 _____	
เครื่องสูบลมแบบมือถือ รุ่น (รุ่นมาตรฐาน) ใหม่			
104 หมู่ 40 ต.หนองปรือ อ.บางละมุง จ.ชลบุรี 10250			
E-Mail : _____		Phone : _____ Fax : _____	
Job No. Z-12571FB		User : _____	
Instrument Model : Mercury		Serial No. K170A0143	
Service Engineer : วิทย์ นวดีน		Date : 12/12/2024 Page 1/1	
Software Version No. WinAS 4.7.3.0			
<input type="checkbox"/> Repair (RE) <input checked="" type="checkbox"/> Maintenance (PM) <input type="checkbox"/> Installation (IN) <input type="checkbox"/> Warranty <input type="checkbox"/> Application (AP) <input type="checkbox"/> Site Prep (SP) <input type="checkbox"/> Visit(VI)			
Fault / Claim : เครื่อง PM info Mercury (Contact year 2025 / 1 Time)			
<input type="checkbox"/>		<input type="checkbox"/> Error Code	
Action taken :			
<ul style="list-style-type: none"> <li>Maintenance work basic unit</li> <li>Check Device parameters</li> <li>Check gas flow</li> <li>Check leak flow</li> <li>Check Advantus light -Valves</li> <li>Test run Analytical parameter Fluorescence cell</li> <li>Test run Analytical parameter Absorption cell</li> </ul>			
 		* Air valve + Valve * Recharge + Replace Serial no. 2024-12-12	
Actions Pending / Recommendation :			
<ul style="list-style-type: none"> <li>เครื่องสูบลมแบบมือถือ ไม่สามารถใช้งานได้ เนื่องจากแบตเตอรี่หมด</li> <li>ไม่มี low pressure lamp (Energy + Information PMT voltage up) ควรใช้แบตเตอรี่ใหม่ Low pressure lamp</li> </ul>			
<input type="checkbox"/> Spare Part <input checked="" type="checkbox"/> Instrument Configuration :			
Item No.	Name	Quantity	Unit Price
1. MS-386	B-Vale Assembly (SVC Gas box)	1	
2. H07-H01 808	Hg low pressure lamp	1	
3.			
4.			
5.			
6.			
7.			
8.			
Herein the undersigned confirm the time devoted, the work performed, the perfect function of the device and the reproductibility of the specified spare parts. *Traveled hours and kilometers can only be added after the return of the service engineer.		Date / Signature of Customer 	Date / Signature of Service Engineer 
		Work completed? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	

Services are subject to the General Terms and Conditions of Analytik Jena AG, which will be sent on request.

## Mercur

Report file:	C:\WinAAS\TMP\2024\DeclPro_008		
Program version:	4.7.10.0	Printed on:	12/12/2024 11:37
		Recording started on	12/12/2024 11:27 GMT+7.0
Operator:	PSU.OTA		
Laboratory:	ALS-BKK		
Code:	IL_Hg067_2024		
Remarks:			
Food, water			

### Method parameters

Method Without enrichment / FBR 30ng/L\_PM24052023  
Created on 5/24/2023 Time 12:27  
Program

## Parameters Mercur Technique: Hg fluorescence

Line	253.7 nm		
Lamp type	Hg- $\text{LP}$		
Integr. mode	Peak height	Integr. time	30 s
PMT	360 V		
AZ time	5 s	Peak smoothing	12/11
Delay	0 s		
	---		
Working mode	w/o enrich.	System cleaning	Acid
FBR technique	on	Wash time acid	10 s
Pump speed	3	Soaking time	20 s
Sample load time	10 s	Gas load time	5 NL/h
Reaction time	10 s		
Waiting time AZ	5 s		
Delay	0 s		
Purge time1	28 s		
Purge time2	15 s	Gas wash time2	10 NL/h
Autosampler			
Autosampler	AS515/F	Tray type	87/139
Working mode	continuous		

### Dilutions

Mar/Quil

### QC parameters

QC type	Conc. check		
QC check samp. 1	---	QC check samp. 2	---
Conc.	---	Conc.	---
Error limit	---	Error limit	---
Rep. measurement	off	Reaction	flag + continue
QC std.1 no.	1(30,000 ng/L)	QC std.2 no.	1(30,000 ng/L)
QC std.1 limit	± 50.00%	QC std.2 limit	± 50.00%
QC std. act.	flag + continue		
Expect. blank abs.	0.0100± 0.0100	Reaction	flag + continue
QC precision	off	Reaction	off
		QC Recal.factor	Off

### Calibration settings

Calib. meth.	Standard calib.	Calibr. unit	ng/L
No. standards	1	Conversion fac.	1000000
Type of standards	---	Standard prep.	Premixed
		Blank correct.	---
		Recalib. std. no.	---
Output unit	µg/L	Conversion fac.	1000
Calib. stat.	Mean	Meas. cycles	3
		Blind cycles	1
Stock sol. 1	---	Stock sol. 2	---
Stock sol. 3	---	Stock sol. 4	---
Type of cal. curve	linear	Intercept	calculated
Weighted cal.	off	Grubbs stat.	off
Check of cal. curve	no outlier test		

### Sample statistics

Stat. mode	Mean	Meas. cycles	2
Confid. level	95.4 %	Blind cycles	1
Grubbs stat.	—		

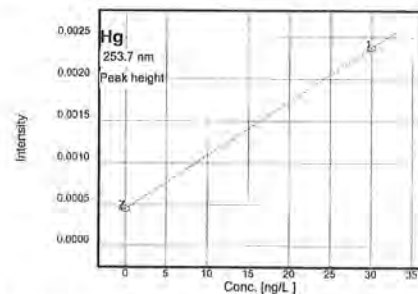
### Calibration standards

No.	Name	State	Pos	Conc./ ng/L	Ints	SD	RSD/%
1	Cal-Zero	(-)	79	0.000	H: 0.000445 A: 0.009414	0.000017 0.000140	3.813 1.497
2	Cal-Std1	(-)	80	30.000	H: 0.002375 A: 0.03403	0.000031 0.000423	1.305 1.244

Hg

Calibration function	1	12/12/2024 11:36 Calibration (Peak height)
----------------------	---	--

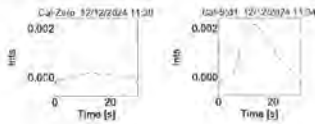
Ints=k1+k2*conc			
k1=0.000448	k2=0.000064	Recal. factor:	---
Slope	0.00006 Ints/(ng/L)	R2-adjusted	1.0000
sc0	1.00000 ng/L		
Lower limit	0 ng/L	Upper limit	33.0 ng/L
Detection limit	---	Deter. limit	---



### Measurements and events (sorted by time)

Hg ID	Without enrichment / FBR 30ng/L_PM24052023				12/12/2024	11:28	
	Conc.	In/s	RG	SD	RSD/%	Int. type	Time
Cal-Zero		0.000436				PkH	11:30
		0.000436					11:31
		0.000465					11:32
	0ng/L	0.000445		0.000017000	3.813		11:32
Cal-Std1		0.002402				PkH	11:34
		0.002341					11:35
		0.002381					11:36
	30.00ng/L	0.002375		0.000031020	1.306		11:36
Calibration	Calibration function: 01						11:38

## Peak plots



Hg

## Mercur

Report file: C:\WinAAS\TMP\2024\Doc\Pro\_010  
 Program version: 4.7.10.0 Printed on: 12/12/2024 13:31  
 Recording started on 12/12/2024 13:16 GMT+7.0  
 Operator: PSU,OTA  
 Laboratory: ALS-BKK  
 Code: IL\_Hg067\_2024  
 Remarks:  
 Food,water

## Method parameters

Method Without enrichment / Abs / FBR 100ng/L\_PM 24052023  
 Created on 12/12/2024 Time 12:42  
 Program

Hg

## Parameters Mercur Technique: Hg absorption

Line	253.7 nm		
Lamp type	Hg-LP		
Integr. mode	Peak height	Integr. time	56 s
PMT	225 V	Peak smoothing	8/5
AZ time	5 s		
Delay	8 s		
Working mode	w/o enrich.	System cleaning	Acid
FBR technique	on	Wash time acid	15 s
Pump speed	4	Soaking time	20 s
Sample load time	8 s	Gas load time	5 NL/h
Reaction time	12 s		
Waiting time AZ	15 s		
Delay	10 s		
Purge time1	50 s		
Purge time2	10 s	Gas wash time2	10 NL/h
Autosampler			
Autosampler	AS51S/F	Tray type	87/139
Working mode	continuous		

Dilution

Mercur

Mercur

## QC parameters

QC type	Conc. check	QC check samp. 2	---
QC check samp. 1	---	Conc.	---
Conc.	---	Error limit	---
Error limit	---	Reaction	flag + continue
Rep. measurement	off	QC std. 2 no.	1(100.00 ng/L)
QC std. 1 no.	1(100.00 ng/L)	QC std. 2 limit	± 0.00%
QC std. 1 limit	± 50.00%		
QC std. act.	flag + continue	Reaction	flag + continue
Expect. blank abs.	0.0100s 0.0100	Reaction	off
QC precision	off	QC Recal.factor	Off

## Calibration settings

Calib. meth	Standard calib.	Calibr. unit	ng/L
No. standards	1	Conversion fac.	1000000
Type of standards	---	Standard prep.	Premixed
		Blank correct.	---
Output unit	μg/L	Recalib. std. no.	---
Calib. stat.	Mean	Conversion fac.	1000
		Meas. cycles	3
Stock sol. 1	---	Blind cycles	1
Stock sol. 3	---	Stock sol. 2	---
Type of cal. curve	linear	Stock sol. 4	---
Weighted cal.	off	Intercept	calculated
Check of cal. curve	no outlier test	Grubbs stat.	off

## Sample statistics

Stat. mode	Mean	Meas. cycles	2
Confid. level	95.4 %	Blind cycles	1
Grubbs stat.	---		

## Calibration standards

No.	Name	State	Pos	Conc./ng/L	Abs	SD	RSD/%
1	Cal-Zero	(-)	79	0.00	H: 0.001129 A: 0.039764	0.000085 0.004386	7.666 11.03
2	Cal-Std1	(-)	81	100.00	H: 0.003950 A: 0.070560	0.000116 0.004290	2.993 6.081

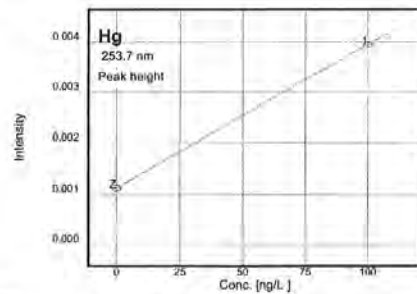
Hg

Mercur

## Calibration function 1

12/12/2024 13:31 Calibration (Peak height)

Abs=k1+k2*conc			
k1=0.001130	k2=0.000028	Recal. factor:	---
Slope	0.00003 Abs/(ng/L)	R2-adjusted	1.0000
se0	1.00000 ng/L	Charact. conc.	154.568 (ng/L)/1%
Lower limit	0 ng/L	Upper limit	110. ng/L
Detection limit	---	Deter. limit	---

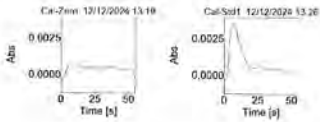


## Measurements and events (sorted by time)

Hg ID	Without enrichment / Abs / FBR 100ng/L_PM 24052023					12/12/2024	13:16	
	Conc.	Abs	BG	SD	RSD/%	Int. type	Time	
Cal-Zero		0.001062				PkH	13:19	
		0.001227					13:20	
		0.001089					13:22	
	0ng/L	0.001129		0.00008605	7.666		13:22	
Cal-Std1		0.003949				PkH	13:26	
		0.004069					13:27	
		0.003832					13:29	
	100,ng/L	0.003950		0.00011625	2.993		13:29	
Calibration	Calibration function: 01							13:31

Mercur

## Peak plots



Hg

## Agilent Technologies

Agilent Technologies (Thailand) Co., Ltd.  
 4300 LAMAR BLVD, 22nd FLOOR, A/D  
 100 BANGKOK ROAD, SUKHUMVIT ROAD  
 Bangkok 10110, Thailand  
 Tel: +662 833 1363  
 Fax: +662 833 4334  
 Email: [cs@agilent.com](mailto:cs@agilent.com)  
 Website: [www.agilent.com/thai](http://www.agilent.com/thai)

## Customer Contact

ALS Laboratory Group (Thailand) Co., Ltd.  
 104 Phatthanaburi 41 Phatthanaburi Rd  
 Phrasang Phatthanaburi Road  
 TAX ID: 01655000458

## Invoice To:

ALS Laboratory Group (Thailand) Co., Ltd.  
 104 Phatthanaburi 41 Phatthanaburi Rd  
 Phrasang Phatthanaburi Road

## SERVICE REPORT

Customer Purchase Order Number: 40371613  
 Customer Number: 40371613

Service Request: Service Request Date:

Service Order: 628567658  
 Service Confirmation: 695595441

REVIEW BY: *[Signature]*  
 APPROVED BY: *[Signature]*  
 NEXT CAL DATE: 4/9/2026

## Delivery Site:

ALS Laboratory Group (Thailand) Co., Ltd.  
 104 Phatthanaburi 41 Phatthanaburi Rd  
 Phrasang Phatthanaburi Road

## Direct Inquiries to:

Contact Name: Customer Contact: Enduser  
 Contact E-mail: [als.asia@agilent.com](mailto:als.asia@agilent.com)  
 Contact Telephone: +662 837 6363  
 Contact Fax: +662 837 4334

Location:  
 Room:  
 Bldg:  
 Lab:  
 Dept:

Agilent Technologies (Thailand) Co., Ltd.  
 4300 LAMAR BLVD, 22nd FLOOR, A/D  
 100 BANGKOK ROAD, SUKHUMVIT ROAD  
 Bangkok 10110, Thailand  
 Tel: +662 833 1363

Customer: *[Signature]*  
 Representative: *[Signature]*  
 Date: 08 Oct 2024  
 Signature: *[Signature]*  
 Date: 08 Oct 2024

Page 1 of 3

Service Confirmation Number: 695595441  
 Service Confirmation Date: 08.10.2024

Service Confirmation Number: 695595441  
 Service Confirmation Date: 08.10.2024

## Service Instrument:

Model Number	Model Description	Serial Number	System Handle	Parent Asset
SYS-IM-7900	ICPMS 7900 System			
G8410A	SPS 4 Autosampler	AU15439722	ICP MS 7900	SYS-IM-7900
G8411A	ISIS 3 for Agilent 7850/7900/8900	JP15510227	ICP MS 7900	SYS-IM-7900
G3292A	PSC 6100T Chiller	2U15A1948	ICP MS 7900	SYS-IM-7900
G8483A	Agilent 7900 ICP-MS	JP15471169	ICP MS 7900	SYS-IM-7900

## Service Items:

Item	Service/Part #	Description	Qty	Entitlement	Service Start	Service End
1000	EQ	Enterprise Operational Qualification	1.00	Agreement Entitlement 100 % covered	04.10.2024	04.10.2024
1010	5105-5950	ICP-MS Checkout Solutions	1.00	Agreement Entitlement 100 % covered		

## Additional Information:

## Service Information:

**Problem Description:**  
 \*WU EQO-IM-7900-5001263655

**Service Provided:**  
 Perform QC Hardware. Test CDS Igon, auto sampler, Auto tune, BG and 20 Min stability.  
 I calibrate the instrument No BKK\_EL0043 test all pass.

**Service Overview Code:**  
 Reason Code: Scheduled Service  
 Diagnosis Code: Scheduled Service  
 Resolution Code: Scheduled Service

Reported Hours: 7.0	Travel Hours: 2.0
Customer Field Service Representative Name: Paothep Kurasathin	Customer Field Service Representative Signature: <i>[Signature]</i>
Customer Name: Sophaan Mak	Customer Signature: <i>[Signature]</i>
Date: 08 Oct 2024	Date: 08 Oct 2024

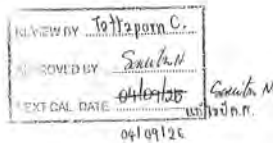
**Additional Comments:**

Certificate No. T250355

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## Certificate of Calibration

**Equipment** : HEATING BLOCK  
**Manufacturer** : Environmental Express  
**Model** : SC 196  
**Serial No.** : 6974CECW3285  
**Customer Code** : BKK\_EL0054  
**ID No.** : TS306A3  
**Customer** : ALS Laboratory Group (Thailand) Co.,Ltd.  
104 Phatthanakan 40, Phatthanakan Rd.,  
Khwaeng Phatthanakan, Khet Suan Luang, Bangkok 10250  
**Customer Location** : Acid Digestion Lab  
**Date of Receipt** : 26 February 2025  
**Calibrated By** : Atiphong Rongrit (Technician)  
**Approved By** : [Signature] / Boonchai Suriyawong (Site Calibration Manager)  
**Date of Issue** : 17 MAR 2025



The uncertainties are for a confidence probability of approximately 95%.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrological Center.

FM-1.12 109/30-05-57

Certificate No. T250355

Page 2 of 6

## Calibration Report

**Equipment** : HEATING BLOCK  
**Date of Calibration** : 4 March 2025  
**Environment** : Temperature : 24.4-24.9 °C  
Line Voltage : 221.6-226.3 V  
Relative Humidity : 55 - 65 %RH

### Condition of this results of calibration :

1. This equipment was calibrated by insert nine standard thermocouples type T into its chamber, the other one standard thermocouples type T use for ambient temperature measurement. The calibration was done in according to WI-T20.

All data show below were final values and the initial data from customer request. The temperature scale used was based on ITS - 90.

### 2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	TYPE T	TN221-TN230	T240712	19 April 2025
TC	TYPE T	TN231-TN240	T240712	19 April 2025
TC	TYPE T	TN241-TN250	T240401	16 March 2025
TC	TYPE T	TN251-TN260	T240401	16 March 2025
DATA LOGGER	34970A	T193	T240401	16 March 2025

### 3. This certificate is traceable to :

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

### 4. Condition of calibrated item : good

#### Equipment Description :

Time Constant	2	Hour	40	Minute	At	95	°C
Fresh Air Damper	<input type="checkbox"/> Open	<input type="checkbox"/> Min	<input type="checkbox"/> Medium	<input type="checkbox"/> Max			
	<input type="checkbox"/> Close						
	<input checked="" type="checkbox"/> Not Available						

### 5. Adjustment :

( ) without adjustment ( X ) after adjustment

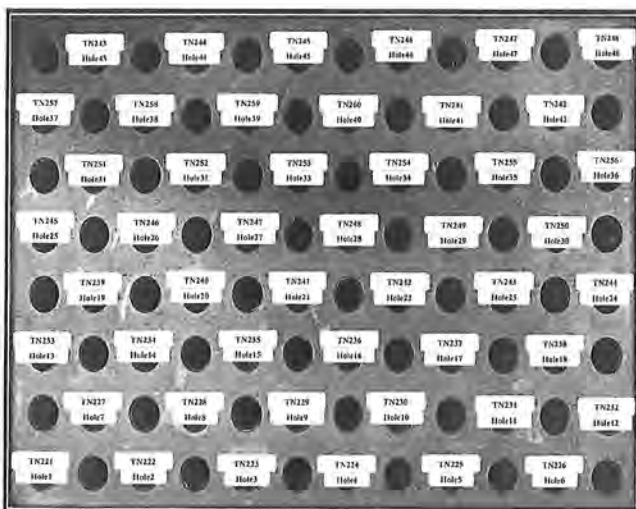
Approved By. [Signature]

FM-L13 109/30-05-57

Certificate No. T250355

Page 3 of 6

## Calibration Report



FRONT CONTROL

Approved By. [Signature]

FM-L13 109/30-05-57

Certificate No. T250355

Page 4 of 6

## Calibration Report

### Measurement Results

Calibration Point	Average Standard Reading at each position (°C)				
R1 Hole1-Hole6	TN221	TN222	TN223	TN224	TN225
CAL POINT	Max	94.85	95.37	95.03	95.25
	Min	94.17	94.66	94.38	94.63
	Average	94.51	95.02	94.70	94.94
R2 Hole7-Hole12	TN227	TN228	TN229	TN230	TN231
	Max	94.71	94.56	94.79	95.32
	Min	94.05	93.88	94.10	94.65
	Average	94.38	94.22	94.44	94.99
R3 Hole13-Hole18	TN233	TN234	TN235	TN236	TN237
	Max	95.26	95.43	95.40	95.71
	Min	94.54	94.64	94.71	95.10
	Average	94.90	95.03	95.06	95.41
R4 Hole19-Hole24	TN239	TN240	TN241	TN242	TN243
	Max	95.13	95.06	95.68	95.16
	Min	94.39	94.43	94.86	95.51
	Average	94.76	94.75	95.27	95.83
R5 Hole25-Hole30	TN245	TN246	TN247	TN248	TN249
	Max	94.95	95.81	95.39	95.82
	Min	94.47	95.03	94.67	94.99
	Average	94.71	95.42	95.03	95.41
R6 Hole31-Hole36	TN251	TN252	TN253	TN254	TN255
	Max	95.07	95.34	95.28	95.39
	Min	95.28	94.55	95.51	94.62
	Average	95.67	94.95	95.90	95.00
R7 Hole37-Hole42	TN257	TN258	TN259	TN260	TN241
	Max	95.15	95.63	95.11	95.09
	Min	94.38	94.88	95.32	94.28
	Average	94.76	95.25	95.71	94.69
R8 Hole43-Hole48	TN243	TN244	TN245	TN246	TN247
	Max	95.84	95.87	95.44	95.72
	Min	95.05	95.10	94.60	94.95
	Average	95.45	95.48	95.02	95.34

Approved By. [Signature]

FM-L13 109/30-05-57



Certificate No. T250355

Page 5 of 6

### Calibration Report

#### Measurement Results

Calibration Point		Average Standard Reading at each position (°C)					
R1 Hole1-Hole6		TN221	TN222	TN223	TN224	TN225	TN226
CAL POINT	Max	104.48	104.40	104.60	105.27	105.24	105.19
	Min	104.13	104.02	104.25	104.94	104.91	104.83
	Average	104.32	104.21	104.42	105.10	105.08	105.06
R2 Hole7-Hole12		TN227	TN228	TN229	TN230	TN231	TN232
	Max	105.30	105.45	105.38	105.96	105.81	106.03
	Min	104.92	105.14	105.29	105.64	105.53	105.79
	Average	105.06	105.29	105.43	105.80	105.67	105.91
R3 Hole13-Hole18		TN233	TN234	TN235	TN236	TN237	TN238
	Max	105.09	106.14	105.83	106.25	105.97	105.88
	Min	105.80	105.89	105.57	106.09	105.69	105.65
	Average	105.94	106.01	105.70	106.13	105.83	105.77
R4 Hole19-Hole24		TN239	TN240	TN241	TN242	TN243	TN244
	Max	105.87	105.75	105.30	105.07	105.22	105.66
	Min	105.62	105.52	105.13	104.90	105.05	105.49
	Average	105.74	105.63	105.21	104.98	105.14	105.57
R5 Hole25-Hole30		TN245	TN246	TN247	TN248	TN249	TN250
	Max	105.62	105.54	105.52	105.73	105.97	105.69
	Min	105.45	105.35	105.41	105.57	105.81	105.49
	Average	105.53	105.44	105.41	105.66	105.89	105.59
R6 Hole31-Hole36		TN251	TN252	TN253	TN254	TN255	TN256
	Max	106.19	106.34	106.47	105.96	105.76	105.35
	Min	106.02	106.16	106.31	105.77	105.58	105.18
	Average	106.10	106.25	106.39	105.87	105.67	105.27
R7 Hole37-Hole42		TN257	TN258	TN259	TN260	TN241	TN242
	Max	106.21	105.59	105.45	105.36	106.08	106.09
	Min	106.04	105.42	105.28	105.20	105.90	105.92
	Average	106.12	105.51	105.37	105.28	105.99	106.00
R8 Hole43-Hole48		TN243	TN244	TN245	TN246	TN247	TN248
	Max	106.54	106.32	105.78	105.38	105.42	105.69
	Min	106.38	106.16	105.60	105.20	105.25	105.52
	Average	106.46	106.25	105.69	105.29	105.33	105.61

Approved By:

TM-L13 108/30-03-57

Page 6 of 6

### Calibration Report

#### Measurement Results:

HEATING BLOCK			Temperature Distribution	
Setting (°C)	Reading (°C)		Stability (±°C)	Uncertainty (±°C)
	Min, Max	Average		
102.0	-	102.0	0.63	0.83
107.0	-	107.0	0.20	0.70

\* The quoted uncertainty exclude " uniformity "

The calibration result apply only the above calibrated item.

The result of test was found accurate at chosen date and place of test only.

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

Approved By:

TM-L13 108/30-03-57



Certificate No. T232160

Page 1 of 4

### Certificate of Calibration

Equipment : Chamber ( Cooling Room )  
Manufacturer : KOLDTECH  
Model : KM 320  
Serial No. : TBN-1012061/05  
Customer Code : BKK\_EN0167  
ID No. : T2463A3  
Customer : ALS Laboratory Group (Thailand) Co.,Ltd.  
104 Phatthanakan 40, Phatthanakan Rd., Kluweng Phatthanakan,  
Khet Suan Luang, Bangkok 10250  
Customer Location : Laboratory  
Date of Receipt : 29 November 2023  
Calibrated By : Atiphong Rongrat ( Technician )  
Approved By : / Boonchai Suriyawong (Site Calibration Manager)  
Date of Issue : 09 JAN 2024

REVIEW BY	
APPROVED BY	
NEXT CAL DATE	06/01/25

The uncertainties are for a confidence probability of approximately 95%.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrology.

TM-L14 119/18-08-66



Certificate No. T232160

Page 2 of 4

### Calibration Report

Equipment : Chamber ( Cooling Room )  
Date of Calibration : 6 December 2023  
Environment : Temperature : 23.4-24.9 °C  
Line Voltage : 221.4-230.2 V  
Relative Humidity : 55 - 65 %RH

#### Condition of this results of calibration :

1. This equipment was calibrated by insert 16 standard thermocouples type T into its chamber , the other one standard thermocouples type T use for ambient temperature measurement . The calibration was done in according to WI-T20 ( based on ASTM E145-94 ( Reapproved 2001 ) and AS2853-1986 ). All data show below were final values and the initial data from customer request . The temperature scale used was based on ITS - 90 .

#### 2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	TYPE T	TN161-TN170	T230773	10 April 2024
TC	TYPE T	TN171-TN180	T230773	10 April 2024
DATA LOGGER	34970A	T149	T230773	10 April 2024

#### 3. This certificate is traceable to :

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

#### 4. Condition of calibrated item : good

##### Equipment Description :

Time Constant : 1 Hour 30 Minute At 3 °C  
Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max  
☐ Close  
☒ Not Available

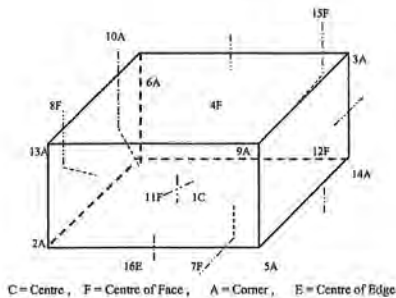
#### 5. Adjustment :

( X ) without adjustment ( ) after adjustment

Approved By:

TM-L15 118/18-08-66

## Calibration Report



1C = TN161	12F = TN172
2A = TN162	13A = TN173
3A = TN163	14A = TN174
4F = TN164	15F = TN175
5A = TN165	16E = TN176
6A = TN166	
7F = TN167	
8F = TN168	
9A = TN169	
10A = TN170	
11F = TN171	

Approved By:

FM-L15 118/18-08-66

## Calibration Report

## Measurement Results

Calibration Point	Average Standard Reading at each position (°C)											
	TN161	TN162	TN163	TN164	TN165	TN166	TN167	TN168	TN169	TN170	TN171	TN172
3.0	2.83	3.34	2.95	3.46	3.45	3.76	3.25	3.46	3.39	3.50	3.58	3.42
	TN173	TN174	TN175	TN176								
	3.33	3.39	3.15	3.43								

Chamber (Cooling Room)			Temperature Distribution					
Setting (°C)	Reading (°C)		Average (°C)	Stability (± °C)	Uniformity (°C)	Uncertainty (± °C)	Coverage Factor k	
	Min	Max						
3.0	2.8	4.1	3.5	3.36	1.10	2.00	1.90	2.09

The calibration result apply only the above calibrated item.

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

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

Approved By:

FM-L15 118/18-08-66

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
53/4/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL.0-2717-3000-29 FAX 0-2719-9484

## Certificate of Calibration

Cert. No.: 24TM1663  
Page: 1 of 3

Equipment : Low Temp. Incubator  
Manufacturer : Memmert  
Model : IPP750  
Serial No. : V818.0084  
ID No. : RYG\_EN0154  
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd. Rayong Branch  
618/10 Moo 5, T.Maenam Khu,  
A.Pluakdaeng,  
Rayong 21140, Thailand  
Location : BOD Room  
Received Order : 01 November 2024  
Calibration Date : 01 November 2024  
Ambient Temperature : ( 26 ± 10 ) °C  
Relative Humidity : ( 50 ± 30 ) %  
AC Line Voltage : ( 220 ± 22 ) V

Calibrated by : Krisda Malee  
Approved by :   
Approved Signatory

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

Issue Date : 07 November 2024

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written  
Approval of the head of Corporate Services 3: Equipment Calibration and Testing Services.

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

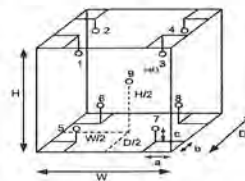
Remark : TPA : Technology Promotion Association ( Thailand - Japan )

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Close

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



## Probe Installation Details :

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

## Dimension of Chamber :

D = 0.60 m  
W = 1.0 m  
H = 1.2 m  
Capacity = 0.72 m<sup>3</sup>

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



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

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

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

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

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

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

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

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

UUC\* : Unit Under Calibration

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

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

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



## Certificate of Calibration

Cert.No.: 24CG3997  
Page: 1 of 2

Equipment : Burette  
Capacity : 50 mL  
Serial No. :  
ID. No. : RYG\_EN0162  
Manufacturer : Witeg  
Made in : Germany  
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd. Rayong Branch  
616/10 Moo 5, T.Maenam Khu, A.Puakdaeng,  
Rayong 21140, Thailand  
Ambient Temperature : (20 ± 2.5) °C  
Relative Humidity : (50 ± 10) %  
Barometric Pressure : 758 mmHg  
Calibration Procedure : ASTM E 542 - 01  
Calibrated by : Srisuda Khamtha  
Approved by :  
( ) Srisuda Khamtha  
(✓) Ponpan Palpim  
( ) Unnopphol Harachai  
Issue Date : 21 October 2024

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written approval of the head of Corporate Services 3: Equipment Calibration and Testing Services.



Equipment : Burette  
Received Date : 16 October 2024  
Condition As-Received : Used Item  
Calibration Date : 21 October 2024  
Reference : 2410-0547DSC-1

Cert.No.: 24CG3997  
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	MS204TS	C226356983	140RC010	24MM603	TPA	10 Oct 2025
2) Thermo-Hygrograph	THDX-CE	00016540	140EC001	24H1153	TPA	10 June 2025
3) Thermometer	-	1594592	140EC010	24I175	TPA	20 Feb 2025

This certification is traceable to SI Unit

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

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

### Calibration result :

Nominal capacity (mL)	Reading (mL)	Uncertainty (± mL)	k Factor
50	49.9643	0.010	2.00

Remark mL = cm<sup>3</sup>

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

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Cert.No.: 24CH96  
Page: 1 of 3

## Certificate of Calibration

Equipment : pH Meter  
Manufacturer : Mettler Toledo  
Model : SevenCompact S220  
Serial No. : C104059460  
ID No. : RYG\_EN0163  
Condition As-Received : Used Item  
Received Date : 16 January 2024  
Calibration Date : 19 January 2024  
Reference : 2401-0578DSC-2  
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)  
616/10 Moo 5, T.Maenam Khu, A.Puakdaeng, 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-CH6 by comparison with temperature simulator  
Calibrated by : Warakorn Lemgagtrakul  
Approved by :  
(✓) Sathip Moangma  
( ) Warakorn Lemgagtrakul  
( ) Ponpan Palpim  
Issue Date : 24 January 2024

The Uncertainties are for a confidence probability of approximately 95%



Cert.No.: 24CH98  
Page.: 2 of 3

#### Condition of this calibration result

##### 1. Reference Standard Instrument

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC116	23E2802	27 Aug 2024
2) Ref. Standard Thermometer	4982054	110RC044	23F005	26 July 2024

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

##### 2. Certified Reference Materials

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

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	940102	27 Nov 2025
pH 6.886	CPA chem	940104	02 Nov 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 ( $\pm$ mV)	Coverage factor k
	pH	mV	mV	pH		
pH Meter S/N: C104059460	4.000	177.48	177.4	4.000	0.058	2.00
	7.000	0.00	0.0	7.000	0.058	2.00
	10.000	-177.48	-177.5	10.000	0.058	2.00



Cert.No.: 24CH98  
Page.: 3 of 3

#### Calibration Results

##### Function : pH Measurement

Performing three buffers standard curve by using buffer nominal pH (4.01,7.00,10.01)

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH Measurement ( $\pm$ )	Coverage factor k
pH Electrode S/N: 3225367	4.008	4.013	176.0	0.0064	2.07
	6.886	6.983	-2.2	0.0084	2.00
	9.997	9.996	-174.1	0.0085	2.03

##### Function : Temperature Measurement

(\*) Without adjustment

This equipment was connected with Temperature Probe

- Model : InLab®Expert Pro-ISM  
- Serial No. : 3225367

Dimension of probe

- Length : 120 mm.  
- Diameter : 12 mm.  
- Immersion Depth : 100 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement ( $\pm$ °C)	Coverage factor k
25.0	25.001	25.2	0.199	0.13	2.00

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

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Santhip

a 1198287

Santhip

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CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES  
511/1 PATTANAKARN ROAD SOI 11, SUANLUANG, SUANLUANG, BANGKOK 10710  
TEL: 02-017-3662-21 FAX: 0-2716-6082



#### Certificate of Calibration

Certificate No.: 24E289  
Page.: 1 of 2

Equipment: pH Meter  
Manufacturer: Mettler Toledo  
Model: SevenCompact S220  
Serial No.: C104059460  
ID No.: RYG\_EJ0183  
Condition As-Received: Used Item  
Received Date: 18 January 2024  
Calibration Date: 23 January 2024  
Reference: J401-057905C  
Ambient Temperature: ( 23  $\pm$  2 ) °C  
Relative Humidity: ( 50  $\pm$  10 ) %  
Submitted by: A.B. Laboratory Group (Thailand) Co., Ltd. (Rayong Branch)  
51/16 Moo 5, T. Maenam Kiri, A. Phakongk  
Rayong 21140, Thailand

Procedure used: Calibration with standard using calibration procedure No. CP-E17 According to EURAMET c9-15

#### Condition of this result of calibration

##### 1. Reference standard instruments

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Multi-Point Calibrator	5500A	5215011	E2U2300030	28 July 2024

2. The result of calibration was made on request of the client.

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

4. This Certificate is traceable to the International System of Unit maintained through:-

- JNA Calibration Co., Ltd. - ANAB Accredited No. Calibration AC-2558

Calibrated by: W. Chaitanont Vongkarnkarn  
Issue Date: 24 January 2024  
Approved Signatory: [Signature]  
[Signature]  
[Signature]  
[Signature]

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Cert. No.: 24E289  
Page.: 2 of 2

#### Result of calibration:- (\*) Without adjustment ( ) After adjustment

Function: DC voltage measurement	Standard Value (mV)	UUC* Reading (mV)	Range: 2000 mV	Error (mV)	Uncertainty ( $\pm$ $\mu$ V)
	-200.0000	-200.0		0.0	88
	-150.0000	-150.0		0.0	85
	-100.0000	-100.0		0.0	83
	-50.0000	-50.0		0.0	81
	0.0000	0.0		0.0	58
	50.0000	50.0		0.0	81
	100.0000	99.9		-0.1	83
	150.0000	149.9		-0.1	85
	200.0000	199.9		-0.1	88

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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Accredited by

NSC-TISI-TIS 17025  
Calibration 0426

## Calibration certificate

Calibration Certificate No. 25BKL0004

Object	Electronic non-automatic weighing instrument	This calibration certificate documents the traceability to national standards.
Manufacturer	Sartorius	Uncertainties of measurements are taken into account when only statements of compliance are made.
Type	MSE224S-100-DU	This certificate was prepared by Sartorius Corporation in accordance to the current ISO/IEC 17025:2017 standard and Sartorius Work Instruction (Method) SGP-WI-08.
Serial / QM Ident. no.	26207038   RYG_EN0002	This certificate relates and apply this equipment only.
Customer	ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch)	
	616/10 Moo 5 T.Maenam Khu, A.Puak Daeng, Rayong 21140, Thailand.	
Order no.	2230	
Number of pages	4	
Date of calibration	20 Feb 2025	

REVIEW BY: *Thanitak*

APPROVED BY: *D. Hansen*

NEXT CAL DATE: 20/02/26

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

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

Date	06 Mar 2025	Approval of the Calibration Certificate	Person in charge
		<i>Chonchai Inthana</i>	<i>Kachen</i>
		Mr. Chonchai Inthana	Kachen Latze

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10310 BangkokVerical®  
Version 6.5

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Calibration certificate No.: 25BKL0004  
Calibration Certificate

## Adjustment Status

The measuring device was internally adjusted before the calibration.

## Environmental and measuring conditions

Date of calibration	20 Feb 2025
Temperature at place of calibration   Temp. diff.	24.4 °C   0.6 K
Weights - Tolerance	
Measuring conditions	The installation site is suitable. The device was levelled. Balance was loaded up to Max before test.
Comments	Humidity 50.2 %RH.

## Measurement results | Measurement uncertainties

Repeatability	Eccentricity
Test load (nominal): 10 g   200 g	Test load (nominal): 100 g
1 10.0000 g 200.0000 g	Center 100.0000 g
2 10.0000 g 200.0001 g	Front left 99.9998 g
3 10.0001 g 200.0001 g	Back left 100.0000 g
4 10.0000 g 200.0000 g	Back right 100.0000 g
5 10.0001 g 200.0000 g	Front right 100.0000 g
6 10.0001 g 200.0001 g	Maximum deviation from centric loading indication
7 10.0000 g 200.0000 g	Δf <sub>cent</sub>   <sub>max</sub> = 0.0002 g
8 10.0000 g 200.0001 g	
9 10.0001 g 200.0000 g	
10 10.0000 g 200.0000 g	
s = 0.00005 g s = 0.00005 g	

Testload	Indication	Error	Expansion factor	Uncertainty	Uncertainty relative
L	f	E	k	U(E)	U <sub>rel</sub> (E)
0.0100 g	0.0100 g	0.0000 g	2.00	0.00013 g	1.3 %
0.1000 g	0.1000 g	0.0000 g	2.00	0.00013 g	0.13 %
0.5000 g	0.5000 g	0.0000 g	2.00	0.00013 g	0.027 %
1.0000 g	1.0000 g	0.0000 g	2.00	0.00013 g	0.013 %
5.0000 g	5.0000 g	0.0000 g	2.00	0.00014 g	0.0027 %
10.0000 g	10.0000 g	0.0000 g	2.00	0.00014 g	0.0014 %
20.0000 g	20.0000 g	0.0000 g	2.00	0.00014 g	0.00072 %
50.0000 g	50.0000 g	0.0000 g	2.00	0.00016 g	0.00032 %
100.0000 g	100.0001 g	0.0001 g	2.00	0.00021 g	0.00021 %
200.0000 g	200.0000 g	0.0000 g	2.00	0.00034 g	0.00017 %
220.0000 g	220.0000 g	0.0000 g	2.00	0.00039 g	0.00018 %
Maximum error of indication		E  <sub>max</sub> = 0.0001 g			

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

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

End of calibration certificate

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Calibration certificate No.: 25BKL0004  
Calibration Certificate

## Calibration object

## Single range instrument

Model	MSE224S-100-DU
Serial Number	26207038
QM Ident. no   Inventory no.	RYG_EN0002   --

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

## Place of calibration

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

## Calibration procedure

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

## Test equipment

Test equipment type	Test equipment ID	Valid until
Thermometer	MHB-382SD s/nB011342 Traceable to SI unit through DKSH	21 Aug 2025
Test weight set OIML R111 E2	Certificate No.M2308197S_E2(Traceable to SI unit through TCS)	23 Aug 2025

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Interpretation of measurement results | Appendix to the calibration certificate

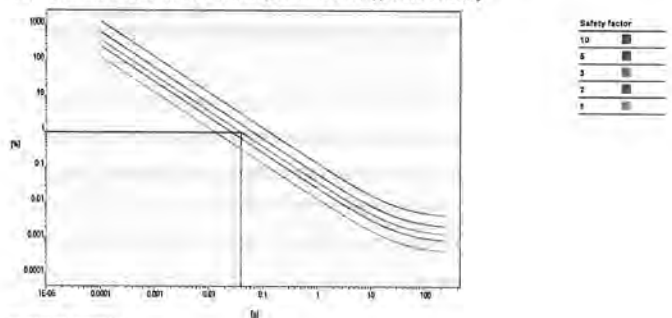
## Uncertainty of measurement in use

Device adjusted before measurement	Yes
Temperature deviation considered	1.5 K (isoCAL active)
Temperature coefficient considered	1 · 10 <sup>-4</sup> K
Uncertainty of the weighing result U <sub>B</sub> (W)	U <sub>B</sub> (W) = 0.00013 g + 3.95 · 10 <sup>-4</sup> · R

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

Indication in % from max load	Net indication	Uncertainty	Uncertainty relative
	R	U <sub>B</sub> (W)	U <sub>B</sub> (W) <sub>rel</sub>
1 %	2.2000 g	0.00014 g	0.0063 %
25 %	55.0000 g	0.00035 g	0.00063 %
50 %	110.0000 g	0.00066 g	0.00051 %
75 %	165.0000 g	0.00078 g	0.00047 %
100 %	220.0000 g	0.00100 g	0.00045 %

## Graphic realization of the relative uncertainty of measurement | process accuracy



## Displayed example

Process accuracy	1.00 %
Safety factor	3
Minimum sample weight	0.0395 g

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Calibration Results:  
Without Adjustment

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

Standard Wavelength	Unit Under Calibration	Correction	Uncertainty
418.61	418.3	0.31	0.13
536.66	536.6	0.06	0.13
637.98	638.3	-0.32	0.13
748.48	748.7	-0.22	0.13
807.03	807.4	-0.37	0.13

## Photometric Accuracy (Absorbance)

Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
	0.0090	0.000	0.0090	0.0045
	0.2930	0.289	0.0040	0.0045
	0.5168	0.519	-0.0022	0.0045
	1.0288	1.029	0.0008	0.0045
	0.0000	0.000	0.0000	0.0045
	0.2867	0.283	0.0037	0.0045
	0.5073	0.509	-0.0017	0.0045
	1.0063	1.007	0.0013	0.0045
	0.0090	0.000	0.0090	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
	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	0.948	-0.0008	0.0045
	0.0000	0.000	0.0000	0.0045
	0.2594	0.259	0.0004	0.0045
	0.5040	0.505	-0.0010	0.0045
	1.0032	1.002	0.0012	0.0045
	0.0000	0.000	0.0000	0.0045
	0.2579	0.257	0.0009	0.0045
	0.4971	0.497	0.0001	0.0045
	0.9720	0.971	0.0010	0.0045

DKSH Technology Limited  
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Phone: +66 2639 7000 Email: info@dksh.com Website: www.dksh.com

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CAL-PM-C06-15: 12 Sep 2022

Calibration Results:  
Without Adjustment

Photometric Accuracy (Absorbance)

Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
	0.0090	0.000	0.0090	0.0080
	0.7355	0.737	-0.0015	0.0080
	0.0090	0.000	0.0090	0.0080
	0.8574	0.857	0.0004	0.0080
	0.0090	0.000	0.0090	0.0080
	0.2864	0.280	-0.0036	0.0080
	0.0090	0.000	0.0090	0.0080
	0.6374	0.637	0.0004	0.0080

## Stray light \*

Standard: cut-off	UUC: Wavelength (nm)	UUC: Transmission (%)	Absorbance (A)
260.82 +/- 0.11 nm	260.8	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)	266.66	266.69	1.38	2.00
UUC: Wavelength (nm)	266.2	266.1		
Std Absorbance (A)	0.4568	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

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CAL-PM-C06-15: 12 Sep 2022

## ใบตรวจสอบสภาพเครื่องวัดคลื่นยาวคลื่น

เลขที่ใบงาน: WO-00005382

ชนิดเครื่องมือ: SPECTROPHOTOMETER

รุ่น: DR6000

หมายเลขเครื่อง: 1627845

ตรวจสอบ (วัน)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
18 Sep 2023			18 Sep 2023		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
General					
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. ความแม่นยำเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. ความเสถียร ( ช่วงหัวท้าย, ภายใน-นอกเครื่อง)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. สวิตช์ ปิด - เปิด เครื่อง (On-Off Switch)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. ปุ่มกด (Keypad)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. หน้าจอ (Display, Screen Contrast)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Spectrophotometer					
<input type="checkbox"/>	<input type="checkbox"/>	6. แบตเตอรี่ไฟฟ้า (Battery Backup) >= 2.5 VDC	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	7. ตัวควบคุมความยาวคลื่น (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. ฝาดักฝุ่น 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. ค่าความขุ่นที่สุญ (No Sample)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	17. ระดับการส่องสว่างของแสง (>= 2.5 ไม่น้อย 3.0)	<input type="checkbox"/>	<input type="checkbox"/>	
Automatic Dilutor					
<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. ระบบทำความสะอาดอุปกรณ์วัด	<input type="checkbox"/>	<input type="checkbox"/>	

เงื่อนไขเพิ่มเติม: \*656.1nm=656.1nm

\*486.0nm=486.5nm

Mr.Nattapat Rungwong  
Service Engineer

DKSH Technology Limited  
2533 Sukhumvit Road, Bangkok, Thailand 10260  
Phone: +66 2639 7000 Email: info@dksh.com Website: www.dksh.com

Delivering Growth - In Asia and Beyond.

CAL-EM-04-03: 20 Jul 2022

Certificate No. T241120

Page 1 of 4

## Certificate of Calibration

Equipment	: Chamber ( Cold Room )
Manufacturer	: MODULAR
Model	: IREVCOHCOO
Serial No.	: C00351459
Customer Code	: RYG_EN0184
ID No.	: T1939A5
Customer	: ALS Laboratory Group (Thailand) Co.,Ltd. ( Rayong Branch ) 616/10 Moo 5 T.Maenam Khu, A.Pluakdaeng, Rayong 21140
Customer Location	: Laboratory
Date of Receipt	: 5 June 2024
Calibrated By	: Sujjar Saknakred ( Site Calibration Manager )
Approved By	: Preecha Phisassuthikul (Temperature Calibration Manager)
Date of Issue	: 17 JUN 2024

The uncertainties are for a confidence probability of approximately 95%.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and the value of measurement realized at the corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrology.

Certificate No. T241120

Page 2 of 4

## Calibration Report

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

## Condition of this results of calibration :

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

## 2. Reference Standard Instrument:

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

## 3. This certificate is traceable to:

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

## 4. Condition of calibrated item : good

## Equipment Description :

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

## 5. Adjustment :

( ) without adjustment ( X ) after adjustment

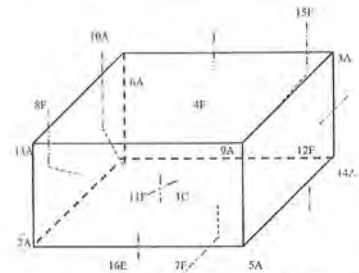
Approved By: 

NSC-TIS-TIS 17025

Certificate No. T241120

Page 3 of 4

## Calibration Report



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

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

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

Approved By: 

NSC-TIS-TIS 17025

Certificate No. T241120

Page 4 of 4

## Calibration Report

## Measurement Results:

Calibration Point	Average Standard Reading at each position (°C)								
	TN161	TN162	TN163	TN164	TN165	TN166	TN167	TN168	TN169
3	2.73	2.70	2.77	2.78	2.99	2.85	3.09	3.21	3.08
	TN171	TN172	TN173	TN174	TN175	TN176			
	3.39	3.01	2.92	2.81	3.42	3.42			

Chamber ( Cold Room )		Temperature Distribution				
Setting (°C)	Reading (°C)		Average (°C)	Stability (±°C)	Uniformity (°C)	Uncertainty (±°C)
	Min, Max	Average				
3.0	2.9 ~ 4.0	3.7	2.97	1.32	1.13	2.02

\* The quoted uncertainty exclude " uniformity "

The calibration result apply only the above calibrated item.

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

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




Approved By: 

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	REVIEW BY	
Manufacturer :	Memmert	APPROVED BY	
Model :	UF 110	NEXT CAL DATE	21/03/25
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. Phukdaeng, Rayong 21140 Thailand		
Location :	Oven Room		
Received Order :	21 March 2024		
Calibration Date :	21 - 22 March 2024		
Ambient Temperature :	( 28 ± 10 ) °C		
Relative Humidity :	( 50 ± 30 ) %		
Calibrated by :	Man Pattanapongpaiboon		
Approved by :	 Approved Signatory		
	( ) Pornthippa Tameyakul ( ) Unnopphol Harachai (x) Suwit Imjai		

Issue Date : 23 March 2024

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.



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

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

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector ( RTD ) and Thermocouple Type T.

The temperature scale used was based on ITS-90.

#### Condition of this result of calibration

##### 1. Reference standard instrument:-

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

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

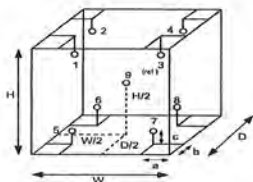
3. This certification is traceable to the International System of Unit.

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

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Close



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

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

Probe Installation Details : Dimension of Chamber :  
a = 5.0 cm D = 0.40 m  
b = 5.0 cm W = 0.56 m  
c = 5.0 cm H = 0.48 m  
Capacity = 0.11 m<sup>3</sup>



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	103.805	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 %.

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL. 0-2717-3000-29 FAX. 0-2719-9484



## Certificate of Calibration

Cert. No.: 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 Pattanapongpalboon

REVIEW BY : *Tharitak*  
APPROVED BY : *D. J. J. J.*  
NEXT CAL DATE : 21/09/25

Approved by :  
( ) Pornthipha Tameyakul  
( ) Unnopphol Harachai  
(✓) Suwit Imjai

Issue Date : 23 March 2024

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written Approval of the head of Corporate Services 3: Equipment Calibration and Testing Services.



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

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

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

The temperature scale used was based on ITS-90.

#### Condition of this result of calibration

##### 1. Reference standard instrument:-

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

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

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

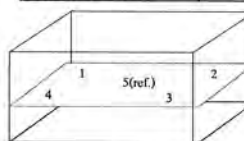
Remark : TPA : Technology Promotion Association ( Thailand - Japan )

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Heat transfer medium used : Water

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



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 : 2403-05630C-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 this 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 %.

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## Metrology

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoh, Saraburi 18110, Thailand.

Saraburi Tel : +66 3627 3096 Fax : +66 3627 3100

Bangkok Tel : +668 9205 6851, +669 8247 2360

Website : www.scieco.co.th E-Mail : calibrate@scg.com



Certificate No. T250353

Page 1 of 4

## Certificate of Calibration

Equipment : Autoclave

Manufacturer : TOMY

Model : SX-700

Serial No. : 48134190

Customer Code : BKK\_ML0041

ID No. : T7725A3


Customer : ALS Laboratory Group (Thailand) Co.,Ltd.

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

Customer Location : Washing Room

Date of Receipt : 26 February 2025

Calibrated By : Boonchai Suriyawong ( Site Calibration Manager )

Approved By :  / Sujjar Naknakred (Site Calibration Manager)

Date of Issue : 10 Mar 2025

The uncertainties are for a confidence probability of approximately 95%.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrology.

PM-L15 118/18-08-66



## Metrology

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoh, Saraburi 18110, Thailand.



## Metrology

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoh, Saraburi 18110, Thailand.



Certificate No. T250353

## Calibration Report

Page 2 of 4

Equipment : Autoclave  
 Date of Calibration : 4 March 2025  
 Environment : Temperature : 22.2-25.4 °C  
 Line Voltage : 221.1-224.7 V  
 Relative Humidity : 55 - 65 %RH

### Condition of this results of calibration :

1. This equipment was calibrated by insert 3 standard temperature recorder into its chamber and test according to WI-T23 inhouse method.( based on BS 2646-1 : 2021)  
 All data show below were final values and the initial data from customer request .The temperature scale used was based on ITS - 90 .

### 2. Reference Standard Instrument :

Instrument	Model	Standard No.	Certificate No.	Due Date
1. Temperature recorder	RTD	T210	T242028	11 December 2025
2. Temperature recorder	RTD	T211	T242029	11 December 2025
3. Temperature recorder	RTD	T212	T242030	11 December 2025

### 3. This certificate is traceable to :

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

### 4. Condition of calibrated item : good

#### Equipment Description :

Pressure Indicator 0.11-0.12 MPa At 121 °C Holding time 20 minute

### 5. Adjustment :

( X ) without adjustment

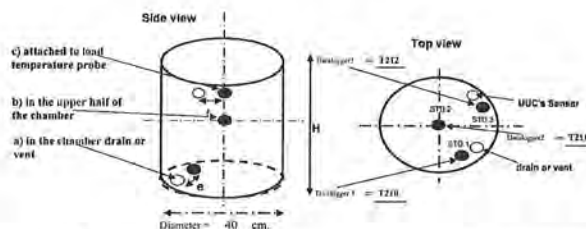
( ) after adjustment

Approved By. 

Certificate No. T250353

## Calibration Report

Page 3 of 4



### Remark :

Size of Installed Standard sensor STD.1 : Distance the chamber drain or vent  $\leq 10$  cm.(less than or be equal to 10 cm.)

Size of Installed Standard sensor STD.2 : Geometric Center (upper half of the chamber)

Size of Installed Standard sensor STD.3 : Distance UUC's Sensor  $r = 2$  cm.

### Measurement Results :

Calibration Point	Average Standard Reading at each position ( °C )		
	T210	T211	T212
121	121.2	121.1	121.1

Setting ( °C )	Autoclave		Temperature Distribution				
	Reading ( °C )		Average ( °C )	Stability ( ± °C )	Uniformity ( ± °C )	Uncertainty ( ± °C )	Coverage Factor k
121	Min	Max	Average				
	-	121	121.2	0.1	0.1	0.65	2.00

\* The quoted uncertainty exclude "uniformity"

The calibration result apply only the above calibrated item.

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

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

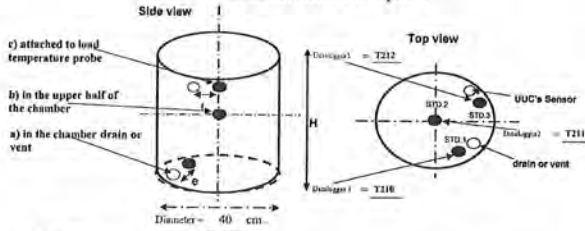
End of Certificate

Approved By. \_\_\_\_\_

PM-L15 118/18-08-66

PM-L15 118/18-08-66

### Calibration Report



#### Remark :

- Size of Installed Standard sensor STD.1 : Distance the chamber drain or vent  $e \leq 10$  cm. (less than or be equal to 10 cm.)
- Size of Installed Standard sensor STD.2 : Geometric Center (upper half of the chamber)
- Size of Installed Standard sensor STD.3 : Distance UUC's Sensor  $f = 2$  cm.

#### Measurement Results :

Calibration Point	Average Standard Reading at each position (°C)		
	T210	T211	T212
121	121.18	121.12	121.13

Autoclave Setting (°C)	Temperature Distribution					
	Min	Max	Average	Stability	Uniformity	Uncertainty
121	121	121	121.16	(±0.10)	(±0.10)	(±0.65)
						Coverage Factor # 2.00

\* The quoted uncertainty exclude "uniformity"

The calibration result apply only the above calibrated item.

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

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

End of Certificate

Approved By: 

FM-L13 108/10-65-57

### Certificate of Calibration

Cert. No.: 24TM1398  
Page : 1 of 3

Equipment : Incubator  
Manufacturer : SHEL-LAB  
Model : 1915A  
Serial No. : 0200599  
ID No. : BKK\_ML0010

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

Location : Incubation & Micrological Reading

Received Order : 03 December 2024  
Calibration Date : 03 December 2024  
Ambient Temperature : ( 26 ± 10 ) °C  
Relative Humidity : ( 50 ± 30 ) %  
AC Line Voltage : ( 220 ± 22 ) V

Calibrated by : Kunchit Promprut

Approved by :

- ( ) Pornthippa Tameyakul
- ( ) Ponpan Paipim
- (✓) Suwit Imjai

Approved Signatory

Issue Date : 17 December 2024

The Uncertainties are for a confidence probability of approximately 95%

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Equipment : Incubator  
Condition As-Received : Used Item  
Reference : 2412-0004OC-1

Cert. No.: 24TM1398  
Page : 2 of 3

#### Procedure Used :-

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

#### Condition of this result of calibration

- Reference standard instrument-  
Instrument Serial No. Cert. No. Traceable Due Date  
1 ) Data Acquisition MY49023932 24LM119 TPA 27 Jul 2025
- This certificate is valid only to the item calibrated on date and place of calibration.
- This certification is traceable to the International System of Unit.

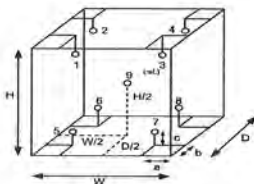
Remark : TPA : Technology Promotion Association ( Thailand - Japan )

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Close

	Environment during calibration	
	Beginning	Finished
Temp. ( °C )	24	24
REL.Humid. ( % )	51	55
AC Supply ( Volt )	223	223



#### Probe Installation Details :

a = 10 cm  
b = 10 cm  
c = 10 cm  
D = 0.50 m  
W = 0.75 m  
H = 1.2 m  
Capacity = 0.45 m³

Position :	Ref. Std. ID No.:
1	19-16RTD-01
2	19-16RTD-02
3	19-16RTD-03
4	23-16RTD-04
5	19-16RTD-05
6	19-14RTD-06
7	21-16RTD-07
8	19-16RTD-08
9 (ref.)	19-16RTD-09



Equipment : Incubator  
Condition As-Received : Used Item  
Reference : 2412-0004OC-1  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Close

Cert. No.: 24TM1398  
Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor #
35.0	35.0	35.0	0.048	0.40	0.46	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (±°C)
	1	2	3	4	5	6	7	8	9 (ref.)	
35.0	34.888	34.840	35.116	35.141	34.750	34.896	34.921	35.054	34.768	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.: 24TM657  
Page : 1 of 3

Equipment : Hot Air Oven  
Manufacturer : Binder  
Model : ED 240/E2  
Serial No. : 00-15533  
ID No. : BKK\_ML0013

Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.  
104 Phatthanakan 40, Phatthanakan Rd.,  
Khwaeng Phatthanakan, Khet Suan Luang,  
Bangkok 10250 Thailand  
Location : Media Preparation Room

Received Order : 23 April 2024  
Calibration Date : 23 April 2024  
Ambient Temperature :  $(26 \pm 10) ^\circ\text{C}$   
Relative Humidity :  $(50 \pm 30) \%$

Calibrated by : Tawatchai Pama

Approved by :   
Approved Signatory

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

Issue Date : 26 April 2024

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written  
Approval of the head of Corporate Services 3: Equipment Calibration and Testing Services.



Equipment : Hot Air Oven  
Condition As-Received : Used Item  
Reference : 2404-0439OC-8  
Procedure Used :-

Cert. No.: 24TM657  
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 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	MY49001451	24LM44	TPA	17 Mar 2025

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

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

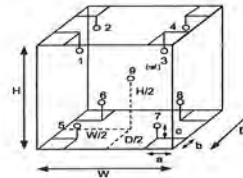
Remark : TPA : Technology Promotion Association ( Thailand - Japan )

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Close

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	24	23
REL.Humid. ( % )	65	65
AC Supply ( Volt )	223	222



#### Probe Installation Details :

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

#### Dimension of Chamber :

D = 0.50 m  
W = 0.80 m  
H = 0.80 m  
Capacity = 0.24 m<sup>3</sup>

Position :	Ref. Std. ID No.:
1	24-19TC-01
2	24-19TC-02
3	24-19TC-03
4	24-19TC-04
5	24-19TC-05
6	24-19TC-06
7	24-19TC-07
8	24-19TC-08
9 (ref.)	24-19TC-09



Equipment : Hot Air Oven  
Condition As-Received : Used Item  
Reference : 2404-0439OC-8  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Close

Cert. No.: 24TM657  
Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor
180	180	180	0.64	2.7	3.7	2

Calibration Point (°C)	Measured Temperature (°C)								Uncertainty (±°C)
	1	2	3	4	5	6	7	8 (ref.)	
180	181.009	181.511	180.922	181.359	181.217	183.659	181.664	181.986	1.5

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

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

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

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

UUC\* : Unit Under Calibration

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

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

-o0o-



## Certificate of Calibration

Cert. No.: 25TM460  
Page : 1 of 3

Equipment : Water Bath  
Manufacturer : Memmert  
Model : WNE 45  
Serial No. : L712.0429  
ID No. : BKK\_ML0056

Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.  
104 Phatthanakan 40, Phatthanakan Rd.,  
Khwaeng Phatthanakan, Khet Suan Luang,  
Bangkok 10250 Thailand  
Location : Incubation & Microbiological Reading

Received Order : 04 March 2025  
Calibration Date : 04 March 2025  
Ambient Temperature :  $(26 \pm 10) ^\circ\text{C}$   
Relative Humidity :  $(50 \pm 30) \%$   
AC Line Voltage :  $(220 \pm 22) \text{ V}$

Calibrated by : Khit Ruitanaprapachai

Approved by :   
Approved Signatory

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

Issue Date : 06 March 2025

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written  
Approval of the head of Corporate Services 3: Equipment Calibration and Testing Services.



Equipment : Water Bath  
Condition As-Received : Used Item  
Reference : 2503-0006OC-2  
Procedure Used :-

Cert. No.: 25TM460  
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	MY44073381	23LM73	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.

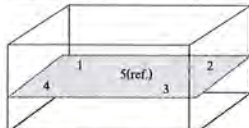
Remark : TPA : Technology Promotion Association ( Thailand - Japan )

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Heat transfer medium used : Water

	Environmental		AC Voltage Supply
	( °C )	( %R.H. )	
Beginning of Calibration	24	49	220
Finished of Calibration	25	51	221



Front

Position :	Ref. Std. S/N.:
1	4803988-006
2	4803988-007
3	4804539-014
4	4804539-015
5(ref.)	4804539-016



Equipment : Water Bath  
Condition As-Received : Used Item  
Reference : 2503-0006OC-2  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source

Cert. No.: 25TM460  
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.)	
44.5	44.5	44.5	44.489	44.469	44.497	44.476	44.479	0.15
45.0	45.0	45.0	44.990	44.966	44.997	44.983	44.980	0.15

Calibration point ( °C )	Uniformity ( °C )	Stability ( ± °C )	Coverage Factor k
44.5	0.045	0.035	2
45.0	0.047	0.031	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-

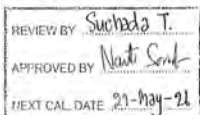
## Certificate of System Qualification

GC-OQ + GCMS-OQ

System ID: GM-10  
Organization Name: ALS Laboratory Group (Thailand) Co., Ltd.  
Organization Location: 104 Pathanakarn 40, Pathanakarn Rd., Kwang Suan Luang, Khet Suan Luang, Bangkok 10250

Date: November 21, 2024 2:12:44 PM  
EQP Name: AgilentRecommended, AgilentRecommended

EQP Revision: GC.02.55, GCMS.02.56  
Overall Qualification Status: Pass



CDS Logon Verification - GC

Logon: estkk.env03

Overall CDS Logon Verification Test Status

Pass

System Inspection and Basic Safety and Operation

Name: 7890

Setpoint Status: Pass

Overall System Inspection and Basic Safety and Operation Test Status

Pass

Inlet Pressure Accuracy

Name: 7890  
Front  
Setpoint Status: Pass  
Setpoint: 25.0 psi  
Actual: 25.2 psi  
Accuracy: 0.2 psi  
Agilent Recommended: <= 1.2

Date: November 21, 2024 2:12:44 PM  
System ID: GM-10

Overall Inlet Pressure Accuracy Test Status

Pass

GC Oven Temperature Accuracy

Name: 7890  
Setpoint Status: Pass  
Zone: Oven  
Temperature: 230.0 °C  
Accuracy: -1.8 °C  
Agilent Recommended: >= -1.0 °C, <= 1.0 °C  
Setpoint Status: Pass  
Zone: Oven  
Temperature: 100.0 °C  
Accuracy: 0.7 °C  
Agilent Recommended: >= -1.0 °C, <= 1.0 °C

Overall GC Oven Temperature Accuracy Test Status

Pass

NOTE: This test's 2 comment(s) and 0 deviation(s) are available in the Attachments section.

GC Oven Temperature Stability

Name: 7890  
Setpoint Status: Pass  
Setpoint/Average  
Temperature: 100.0 °C  
Stability: 0.1 °C  
Agilent Recommended: <= 0.5

Date: November 21, 2024 2:12:44 PM  
System ID: GM-10

Overall GC Oven Temperature Stability Test Status

Pass

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

Tune EI

Tested Combination1 Front MMH / External TQ

Name: 7000D

Setpoint Status: Pass

Filament: 1

Setpoint Status: Pass

Filament: 2

Overall Tune EI Test Status

Pass

Scouting Run

Tested Combination1 Front MMH / External TQ

Name: Injection Tower

Source: 7693A

Source: EI - Extractor

Setpoint Status: Completed

Injection Volume on Column: 1.0 uL

Overall Scouting Run Status

Completed

Instrument Detection Limit

Tested Combination1 Front MMH / External TQ

Name: Injection Tower

Name: 7693A

Source: EI - Extractor

Date: November 21, 2024 2:12:44 PM  
System ID: GM-10

Setpoint Status:

Pass

Injection Volume on Column: 1.0 uL

Minimum RSD: 4.56 %

Agilent Recommended: <= 12.00

Status: Pass

Instrument Detection Limit: 1.54238 fg

Agilent Recommended: <= 4.03800

Status: Pass

Retention Time

0.01 %

<= 1.00

Pass

Overall Instrument Detection Limit Test Status

Pass

Mass Ratio Precision

Tested Combination1 Front MMH / External TQ

Name: Injection Tower

Name: 7693A

Source: EI - Extractor

Setpoint Status: Pass

Injection Volume on Column: 0.5 uL

Area Mass 1 Abundance's 2.23 %

RSD: 2.23 %

Agilent Recommended: <= 5.00

Status: Pass

Mass Ratio

0.10 %

<= 5.00

Pass

Overall Mass Ratio Precision Test Status

Pass

Date: November 21, 2024 2:12:44 PM  
System ID: GM-10

Instrument Details

Purpose

This section describes the as found system configuration.

Details

System

System ID: GM-10  
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  
Inlet: Front  
Detector: External  
LTM Included?: No

Sampler 1

Manufacturer: Agilent Technologies  
Type: Injection Tower  
Name: 7693A  
Model Number: G4513A  
Serial Number: CN18180003  
Firmware Revision: A.11.02  
Usage: Sample Injection  
Location: Front  
Syringe Volume (uL): 10

Date: November 21, 2024 2:12:44 PM  
System ID: GM-10

Sampler 2

Manufacturer: Agilent Technologies  
Type: Tray  
Name: 7693A  
Model Number: G4514A  
Serial Number: CN18170137  
Firmware Revision: A.11.03  
Vial Heater: Not Installed

Mainframe 1

Manufacturer: Agilent Technologies  
Name: 7890  
Model Number: G3442B  
Serial Number: CH16163080  
Firmware Revision: B.02.05  
Oven Type: Standard

Inlet 1

Manufacturer: Agilent Technologies  
Name: 7890  
Type: MMH  
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

Date: November 21, 2024 2:12:44 PM  
System ID: GM-10

Detector 1	
Manufacturer	Agilent Technologies
Name	Mass Spectrometer
Type	Mass Spectrometer
Location	External
Mass Spectrometer 1	
Manufacturer	Agilent Technologies
Type	TQ
Name	7000D
Model Number	G7000D
Serial Number	US1626U108
Firmware Revision	G.7000.005A
High Vacuum System	Turbo Pump
Liquid Injection Scouting Run Standard	OFN Std
MS EI Source 1	
Manufacturer	Agilent Technologies
Source Type	EI - Extractor
Number of Filaments	2

Date: November 21, 2024 2:12:44 PM  
System ID: GM-10

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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:	Supasak Nimsongtham
Logged On User Name:	nupasak.nimsongtham@agilent.com
Signature Creation Date:	November 21, 2024
Reason for Signature:	Executed protocol and published this original version of document

### ACE Self Qualification Status

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

### Regulatory Disclaimer

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

### Warranty

Agilent Technologies makes no warranty of any kind to this material, including but not limited to, the implied warranties or merchantability and fitness for a particular purpose. Agilent Technologies shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material.

Date: November 21, 2024 2:12:44 PM  
System ID: GM-10

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User: Nimsongtham, Supasak Protocol Generated By: Nimsongtham, Supasak Print Date: November 21, 2024 2:12:44 PM				
System ID: GM-10				
GM-10 2024 Transaction Log:				
Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
November 21, 2024 11:58:17 AM	Auto	Session Created	Session	Host Name: SC0115504C, Data Serial Number: C0331778
November 21, 2024 11:58:17 AM	Start	Configuration	Session	None
November 21, 2024 11:58:17 AM	Auto	Entitlement	Licensing	User's FileEngine.exe does not require an unlock code
November 21, 2024 12:01:51 PM	Auto	File Transfer	Session	EGP passes for primary technique [G] - File path: [ProtocolPack\GCMS\Config\sm10255G192 G3.egp], EGP File Name: [GC-62.50.egp], EGP Name: [Agilent\Recommendations\sm10255G192 G3.egp], EGP details for supplementary techniques [GMS] - File path: [ProtocolPack\GCMS\Config\sm10255G192 G3.egp], EGP File Name: [GCMS-62.50.egp], EGP Name: [Agilent\Recommendations]
November 21, 2024 12:02:04 PM	End	Configuration	Session	None
November 21, 2024 12:02:12 PM	Start	Configuration	Session	GC
November 21, 2024 12:02:12 PM	Auto	Execution	GC5 Logon Verification - GC - 7000 - Qualitative Test	None
November 21, 2024 12:03:08 PM	End	Execution	GC5 Logon Verification - GC - 7000 - Qualitative Test	Run Count: 1

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Date: November 21, 2024 2:12:44 PM  
System ID: GM-10

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User: Nimsongtham, Supasak Protocol Generated By: Nimsongtham, Supasak Print Date: November 21, 2024 2:12:44 PM				
System ID: GM-10				
GM-10 2024 Transaction Log:				
Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
November 21, 2024 12:03:11 PM	Auto	Execution	System Inspection and Basic Safety and Operation - 1000 Qualitative Test - No external accessories	None
November 21, 2024 12:03:20 PM	End	Execution	System Inspection and Basic Safety and Operation - 1000 Qualitative Test - No external accessories	Run Count: 1
November 21, 2024 12:03:23 PM	Start	Execution	Initial Pressure Accuracy - Front MW - Pressure Controlled Inlet - R: 25.0 psi - L: <= 1.2 psi	None
November 21, 2024 12:03:28 PM	End	Execution	Initial Pressure Accuracy - Front MW - Pressure Controlled Inlet - R: 25.0 psi - L: <= 1.2 psi	Run Count: 1
November 21, 2024 12:03:30 PM	Auto	Execution	GC Oven Temperature Accuracy - 7000 - Temperature - Oven - S: 230.0°C - L: <= 1.0° AND <= 1.0 % setpoint in K	None
November 21, 2024 12:03:32 PM	Auto	Data	GC Oven Temperature Accuracy - 7000 - Temperature - Oven - S: 230.0°C - L: <= 1.0° AND <= 1.0 % setpoint in K	Manual Data Entry
November 21, 2024 12:03:35 PM	End	Execution	GC Oven Temperature Accuracy - 7000 - Temperature - Oven - S: 230.0°C - L: <= 1.0° AND <= 1.0 % setpoint in K	Run Count: 1
November 21, 2024 12:03:37 PM	Auto	Execution	GC Oven Temperature Accuracy - 7000 - Temperature - Oven - S: 230.0°C - L: <= 1.0° AND <= 1.0 % setpoint in K	None
November 21, 2024 12:03:39 PM	Auto	Data	GC Oven Temperature Accuracy - 7000 - Temperature - Oven - S: 230.0°C - L: <= 1.0° AND <= 1.0 % setpoint in K	Manual Data Entry

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Date: November 21, 2024 2:12:44 PM  
System ID: GM-10

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User Name: susan@crosslab.com  
Report Generated by: susan@crosslab.com  
Print Date: November 21, 2024 2:12:45 PM

System ID: GM-10  
Print Date: November 21, 2024 2:12:45 PM

GM-10 2024 Transaction Log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
November 21, 2024 12:06:23 PM	End	Execution	GC Oven Temperature Accuracy - 7000 - Temperature - Over - S: 100.0°C - L: -0.5°C AND -0.5% setpoint in K	Run Count: 1
November 21, 2024 12:06:25 PM	Start	Execution	GC Oven Temperature Stability - 7000 - Temperature - Over - S: 100.0°C - L: -0.5°C	None
November 21, 2024 12:07:10 PM	End	Data	GC Oven Temperature Stability - 7000 - Temperature - Over - S: 100.0°C - L: -0.5°C	Manual Data Entry
November 21, 2024 12:07:14 PM	End	Execution	GC Oven Temperature Stability - 7000 - Temperature - Over - S: 100.0°C - L: -0.5°C	Run Count: 1
November 21, 2024 12:07:16 PM	Start	Execution	Tune E1 - 70000 TQ - Source - None E1 - Extractor Element 1 (Qualitative - No setpoints associated)	
November 21, 2024 12:07:26 PM	End	Execution	Tune E1 - 70000 TQ - Source - None E1 - Extractor Element 1 (Qualitative - No setpoints associated)	Run Count: 1
November 21, 2024 12:07:28 PM	Start	Execution	Tune E1 - 70000 TQ - Source - None E1 - Extractor Element 2 (Qualitative - No setpoints associated)	
November 21, 2024 12:07:33 PM	End	Execution	Tune E1 - 70000 TQ - Source - None E1 - Extractor Element 2 (Qualitative - No setpoints associated)	Run Count: 1
November 21, 2024 12:07:41 PM	Start	Execution	Scanning Run - Injection Tower, Front MM, TQ - Source - E1 - Extraction Part of GCMS System Preparation	

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Date: November 21, 2024 2:12:44 PM  
System ID: GM-10

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User Name: susan@crosslab.com  
Report Generated by: susan@crosslab.com  
Print Date: November 21, 2024 2:12:45 PM

System ID: GM-10  
Print Date: November 21, 2024 2:12:45 PM

GM-10 2024 Transaction Log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
November 21, 2024 12:08:53 PM	End	Data	Scanning Run - Injection Tower, Front MM, TQ - Source - E1 - Extraction Part of GCMS System Preparation	Data File Path: C:\GM-10\OQ2024\OQ001.D
November 21, 2024 12:09:23 PM	Start	Reporting	Reintegration	Reintegration Count: 1 - [Integration Type: Injection Baseline Correction Mode: Advanced Peak Shape Sensitivity: 10 Initial Peak Width: 0.07 Initial Area Reject: 0 Initial Height Reject: 0 Integration: On at 4]
November 21, 2024 12:09:30 PM	End	Execution	Scanning Run - Injection Tower, Front MM, TQ - Source - E1 - Extraction Part of GCMS System Preparation	Run Count: 1
November 21, 2024 12:09:53 PM	Start	Execution	Instrument Detection Limit - Injection Tower, Front MM, TQ - Source - E1 - Extractor - RSD L (Area) -> 12.00% - RSD L (Rel. Time) -> 1.00%	None
November 21, 2024 12:10:46 PM	End	Data	Instrument Detection Limit - Injection Tower, Front MM, TQ - Source - E1 - Extractor - RSD L (Area) -> 12.00% - RSD L (Rel. Time) -> 1.00%	Data File Path: C:\GM-10\OQ2024\OQ001.D
November 21, 2024 12:10:46 PM	End	Data	Instrument Detection Limit - Injection Tower, Front MM, TQ - Source - E1 - Extractor - RSD L (Area) -> 12.00% - RSD L (Rel. Time) -> 1.00%	Data File Path: C:\GM-10\OQ2024\OQ002.D

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Date: November 21, 2024 2:12:44 PM  
System ID: GM-10

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User Name: susan@crosslab.com  
Report Generated by: susan@crosslab.com  
Print Date: November 21, 2024 2:12:45 PM

System ID: GM-10  
Print Date: November 21, 2024 2:12:45 PM

GM-10 2024 Transaction Log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
November 21, 2024 12:10:46 PM	End	Data	Instrument Detection Limit - Injection Tower, Front MM, TQ - Source - E1 - Extractor - RSD L (Area) -> 12.00% - RSD L (Rel. Time) -> 1.00%	Data File Path: C:\GM-10\OQ2024\OQ003.D
November 21, 2024 12:10:46 PM	End	Data	Instrument Detection Limit - Injection Tower, Front MM, TQ - Source - E1 - Extractor - RSD L (Area) -> 12.00% - RSD L (Rel. Time) -> 1.00%	Data File Path: C:\GM-10\OQ2024\OQ004.D
November 21, 2024 12:10:47 PM	End	Data	Instrument Detection Limit - Injection Tower, Front MM, TQ - Source - E1 - Extractor - RSD L (Area) -> 12.00% - RSD L (Rel. Time) -> 1.00%	Data File Path: C:\GM-10\OQ2024\OQ005.D
November 21, 2024 12:10:47 PM	End	Data	Instrument Detection Limit - Injection Tower, Front MM, TQ - Source - E1 - Extractor - RSD L (Area) -> 12.00% - RSD L (Rel. Time) -> 1.00%	Data File Path: C:\GM-10\OQ2024\OQ006.D
November 21, 2024 12:10:47 PM	End	Data	Instrument Detection Limit - Injection Tower, Front MM, TQ - Source - E1 - Extractor - RSD L (Area) -> 12.00% - RSD L (Rel. Time) -> 1.00%	Data File Path: C:\GM-10\OQ2024\OQ007.D
November 21, 2024 12:10:47 PM	End	Data	Instrument Detection Limit - Injection Tower, Front MM, TQ - Source - E1 - Extractor - RSD L (Area) -> 12.00% - RSD L (Rel. Time) -> 1.00%	Data File Path: C:\GM-10\OQ2024\OQ008.D
November 21, 2024 12:10:47 PM	End	Data	Instrument Detection Limit - Injection Tower, Front MM, TQ - Source - E1 - Extractor - RSD L (Area) -> 12.00% - RSD L (Rel. Time) -> 1.00%	Data File Path: C:\GM-10\OQ2024\OQ009.D
November 21, 2024 12:10:47 PM	End	Data	Instrument Detection Limit - Injection Tower, Front MM, TQ - Source - E1 - Extractor - RSD L (Area) -> 12.00% - RSD L (Rel. Time) -> 1.00%	Data File Path: C:\GM-10\OQ2024\OQ010.D

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Date: November 21, 2024 2:12:44 PM  
System ID: GM-10

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User Name: susan@crosslab.com  
Report Generated by: susan@crosslab.com  
Print Date: November 21, 2024 2:12:45 PM

System ID: GM-10  
Print Date: November 21, 2024 2:12:45 PM

GM-10 2024 Transaction Log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
November 21, 2024 12:10:47 PM	End	Data	Instrument Detection Limit - Injection Tower, Front MM, TQ - Source - E1 - Extractor - RSD L (Area) -> 12.00% - RSD L (Rel. Time) -> 1.00%	Data File Path: C:\GM-10\OQ2024\OQ011.D
November 21, 2024 12:10:47 PM	End	Reporting	Reintegration	Reintegration Count: 1 - [Integration Type: Injection Baseline Correction Mode: Advanced Peak Shape Sensitivity: 10 Initial Peak Width: 0.07 Initial Area Reject: 0 Initial Height Reject: 0 Integration: On at 4]
November 21, 2024 12:10:47 PM	End	Execution	Instrument Detection Limit - Injection Tower, Front MM, TQ - Source - E1 - Extractor - RSD L (Area) -> 12.00% - RSD L (Rel. Time) -> 1.00%	Run Count: 1
November 21, 2024 12:10:47 PM	Start	Execution	Mass Ratio Prediction - Injection Tower, Front MM, TQ - Source - E1 - Extractor - RSD L (Area) -> 12.00% - RSD L (Rel. Time) -> 1.00%	None
November 21, 2024 12:10:47 PM	End	Data	Mass Ratio Prediction - Injection Tower, Front MM, TQ - Source - E1 - Extractor - RSD L (Area) -> 12.00% - RSD L (Rel. Time) -> 1.00%	Data File Path: C:\GM-10\OQ2024\OQ012.D
November 21, 2024 12:10:47 PM	End	Data	Mass Ratio Prediction - Injection Tower, Front MM, TQ - Source - E1 - Extractor - RSD L (Area) -> 12.00% - RSD L (Rel. Time) -> 1.00%	Data File Path: C:\GM-10\OQ2024\OQ013.D
November 21, 2024 12:10:47 PM	End	Data	Mass Ratio Prediction - Injection Tower, Front MM, TQ - Source - E1 - Extractor - RSD L (Area) -> 12.00% - RSD L (Rel. Time) -> 1.00%	Data File Path: C:\GM-10\OQ2024\OQ014.D

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Date: November 21, 2024 2:12:44 PM  
System ID: GM-10

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User Name: Admin@agilent.com  
Report Generated by: Admin@agilent.com  
System ID: CCM-10  
Print Date: November 21, 2024 2:12:42 PM

CM-10 2024 Transaction Log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
November 21, 2024 12:27:38 PM	Audit	Data	Mass Ratio Precision - Injection Tower, Front MM, TO - Source: EI - Extractor - L (RSD) <= 5.00%	Data File Path: C:\CM-10\OQ2024\MP005.D
November 21, 2024 12:27:38 PM	Audit	Data	Mass Ratio Precision - Injection Tower, Front MM, TO - Source: EI - Extractor - L (RSD) <= 5.00%	Data File Path: C:\CM-10\OQ2024\MP006.D
November 21, 2024 12:27:38 PM	Audit	Data	Mass Ratio Precision - Injection Tower, Front MM, TO - Source: EI - Extractor - L (RSD) <= 5.00%	Data File Path: C:\CM-10\OQ2024\MP007.D
November 21, 2024 12:33:20 PM	Audit	Reporting	Integration	Integration Count: 1 - (Integration Type: Injection, Baseline Correction Mode: Advanced, Initial Slope Sensitivity: 10, Initial Peak Width: 0.01, Initial Area Reject: 0.000, Integration Report: 0000, Integration: OK or Integration: On etc.)
November 21, 2024 12:39:42 PM	End	Execution	Mass Ratio Precision - Injection Tower, Front MM, TO - Source: EI - Extractor - L (RSD) <= 5.00%	Run Count: 1
November 21, 2024 12:37:11 PM	End	Qualification	System	OQ
November 21, 2024 12:37:11 PM	Start	Reporting	Session	None
November 21, 2024 1:11:02 PM	Audit	Reporting	Session	Report Generated: Certificate
November 21, 2024 1:37:20 PM	Audit	Relocating	Session	Report Deleted: Report

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Date: November 21, 2024 2:12:44 PM  
System ID: CM-10

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Service Confirmation Number: 6905876103  
Service Confirmation Date: 23.09.2024

## Service Instrument:

Model Number	Model Description	Serial Number	System Handle	Parent Asset
SYS-ID-5100	ICP-DES 5100/5110 System			
G8010A	Agilent 5100 SVDV ICP-DES Spectrometer	MYT6010005	ICP DES 5100	SYS-ID-5100
G8410A	SPS 4 Autosampler	ALH5440764	ICP DES 5100	SYS-ID-5100

## Service Items:

Item	Service/Part #	Description	Qty	Entitlement	Service Start	Service End
1000	EOQ	Enterprise Operational Qualification	1.00	Agreement Entitlement 100 % covered	22.09.2024	23.09.2024
1010	6610030100	Bottle ICP-DES Wavecal soln 500mL 6 ppm	1.00	Agreement Entitlement 100 % covered		
1020	5100-7001	Calibration blank solution Spet HVD3	1.00	Agreement Entitlement 100 % covered		

## Additional Information:

## Agilent Technologies

## Customer Contact:

ALS Laboratory Group (Thailand) Co. Ltd Head Office  
104 Phatchanankarn Rd Phatchanankarn Rd  
Bangkok Phatchanankarn Khut Sun  
Tel: +662 833 8363  
Email: ccs@agilent.com  
Website: www.agilent.com/ccs

## Invoice To:

ALS Laboratory Group (Thailand) Co. Ltd Head Office

104 Phatchanankarn Rd Phatchanankarn Rd  
Bangkok Phatchanankarn Khut Sun

## Delivery Site:

ALS Laboratory Group (Thailand) Co. Ltd Head Office

104 Phatchanankarn Rd Phatchanankarn Rd  
Bangkok Phatchanankarn Khut Sun

## Location:

Room

Bldg

Lab

Dept

## SERVICE REPORT

Customer Purchase Order Number:	Customer Number: 70378193
Service Request:	Service Request Date:
Service Order: 6905876103	Service Confirmation: 6905876103

REVIEW BY: *Ponphen C.*  
APPROVED BY: *Sunthorn C.*  
NEXT CAL DATE: *23.09.2024*

## Direct Inquiries to:

Contact Name: Customer Contact Center  
Contact Email: ccs@agilent.com  
Contact Telephone: +662 833 8363  
Contact Fax: +662 833 8364

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## Service Information:

Problem Description: WU-OQ-ID-5100-5001253655

Service Provided: Complete OQHW 5100/CPDES Equipment ID: BKK\_EL0037, all test passed

Service Overview Code: Reason Code: Scheduled Service  
Diagnosis Code: Scheduled Service  
Resolution Code: Scheduled Service

Reported Hours: 4.0 Travel Hours: 2.0

Customer Field Service Representative Name: Sunthorn C. Customer Field Service Representative Signature: *Sunthorn C.* Date: 23 Sep 2024

Customer Name: CHANATTAGARN IMCHOM Customer Signature: *Ponphen C.* Date: 23 Sep 2024

Additional Comments:



# Performance Verification Certificate

PRODUCT ID                      *Quicktrace M-8000 , Teledyne Leeman Labs*

Equipment ID BKK\_EL0128 Mercury Analyzer  
S/N: US22133002

BKK\_EL0129 Autosampler  
S/N: 052222A560

Customer Name	ALS Laboratory Group (Thailand) Co., Ltd.
Address	104 Soi Pattana 40, Pattana Rd. Suan Luang, Suan Luang Bangkok 10250 Thailand

Date of Qualified	December 6, 2024
Next Due date	December 6, 2025

<sup>a</sup>This certifies for products which was performed in acceptable criteria specifications

Autosampler & Sample Introduction	PASSED
Analyzer	PASSED
Gas Liquid Separator & Dryer	PASSED
CVAFS Detector	PASSED
Electronics/Mechanical	PASSED
Data station/PC	PASSED
Analytical test	PASSED

Provided by

**Scientist Instrument Co., Ltd.**  
113 Soi Ekachai 44, Ekachai Road  
Klong Bang Pluran, Banghron  
Bangkok 10150 Thailand

Certified by   
Thunraphol Sakdayos

### Service Engineer

**Sartorius (Thailand) Co., Ltd.**  
121 Rama 9 Road, Huayklong, Huaykwang, Bangkok 10310  
Tel: +66 2643 8161-5, e-mail: [service.thailand@sartorius.com](mailto:service.thailand@sartorius.com)



REVIEW BY *Junda K*  
**SARTORILS**  
 APPROVED BY *Sinluk P*  
 NEXT CAL. DATE: **02/08/25**

# Certificate

Model Number :	MSE2245-100-BU	Certificate No.:	24BC027D
Description :	Analytical Balance	Issued Date :	Monday, August 05, 2024
Serial Number :	0027405655	Reference No.:	240942
ID No.:	RSK_EN0C03		
Manufacturer :	Sartorius	Page No.:	1 of 2

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

Calibrated Place: Lab Room

Calibrated By: Mr.Chenchai Intthama Calibration  
Calibration Date: Tuesday, August 02, 2024 Procedure No.: This calibration was conducted by

Capacity: 220 g Readability: 0.0001 g      Temperature: 23.0 °C ± 5.0 °C

Reasons for calibration: ☐ New Installation ☐ Service / Required ☐ Recalibration / Maintenance

Equipment Condition: ☒ Good Operation ☐ 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 relate the unit of measurement according to the International Standard System of Units (SI). Report of Tolerance came from list of Sortino Metrological Specifications.

**Traceability:**

Model Number	Description	Traceability	Certificate No.	Due Date
YCS011-S22-00	Sartorius weight set 150g - 5000g E2YCS011-S22-00	TCS	M32081975	23-Aug-2025
Testo 174 II	Thermo-Hygrometer, Testo 174H	EN18CH	W/T 061303.H661140	12-Nov-2024

This certificate may not be reproduced other than in full except with the prior written approval of the Verification Operation Division Sartorius (Thailand) Co., Ltd.

SDP FWA-33, 03 February 2022

**Mr. Jonathan Iwakura (Technical Manager)**



**Sartorius (Thailand) Co., Ltd.**  
129 Rama 9 Road, Huaykwang, Huaykwang, Bangkok 10310  
tel: +66 2643 8361-6 Fax: +66 2643 8367, e-mail: service.thailand@sartorius.com

SARTORIUS

# Certificate of Calibration

Model Number:	75SE245 100-DU	Certificate No.:	74806220
Description:	Analytical Balance	Issued Date:	Monday, August 05, 2024
Serial Number:	0027405555	Reference No.:	240942
ID No.:	RICK-FN0003		
Manufacturer:	Sartorius	Page No.:	7 of 2

### Calibration Results : Without Adjustment

### Repeatability

The repeatability is the ability of a measuring instrument to display exactly identical readings under constant test conditions when the same load within a measurement range is placed repeatedly on the weighing pan in the same manner; the standard deviation is used to express repeatability quantitatively.

Nominal Value : (Low Load)	2D.0006	200.0000
	20	2D.0006
Tolerance	2D.0001	200.0000
	0.0001 g	2D.0002
Nominal Value : (High Load)	2D.0006	200.0000
	200	2D.0001
Tolerance	2D.0006	200.0000
	0.0001 g	2D.0001
Standard Deviation		0.00004 0.00006

### Eccentricity (Off-center loading error)

The off-center loading error is defined as the difference between the maximum and the least ( $\pm 1/2$ ) of the maximum capacity, placed at the center of the weighing pan and between each of four additional measurement points [7] positions defined eccentrically by OIML R110.

Nominal value :	100	g
Tolerance	0.0004	
		Difference
	1	2 0.0000
	3	5 0.0000
	4	0 0.0000
	5	0.0001
	A	-

### Linearity

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

Tolerance 0.0002 g				
Nominal Value	Conventional Max Value	Displayed Value	Deviation	Uncertainty
(g)	(g)	(g)	(g)	(g)
0.01	0.0100	0.0100	0.0000	0.00013
0.1	0.1000	0.1000	0.0000	0.00015
1	1.0000	1.0000	0.0000	0.00015
2	2.0000	2.0000	0.0000	0.00015
5	5.0000	5.0000	0.0000	0.00015
10	10.0000	10.0000	0.0000	0.00015
20	20.0000	20.0000	0.0000	0.00015
50	50.0000	50.0001	0.0001	0.00016
100	100.0000	100.0001	0.0001	0.00019
200	200.0000	200.0002	0.0002	0.00029

Book of Recalls

SDIPTM 33 09 February 2022