

ภาคผนวก ง  
เอกสารสอบเทียบเครื่องมือ

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รายการใบรับรองสอบเทียบ/ทวนสอบ เครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์ สำหรับวิเคราะห์คุณภาพสิ่งแวดล้อม

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
เครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์คุณภาพอากาศ									
1	Analytical Balance (Readability 0.1 mg)	ปริมาณฝุ่นละอองรวม ฝุ่นละอองขนาดเล็กสะอองขนาดไม่เกิน 10 ไมครอน (PM10)	Mettler-Toledo	MS204TS/00 C252436235	Mettler Toledo (Thailand) Co., Ltd.	TH2036-017- 050623-ACC-TH	6 May 23	4 May 24	-

Due Date of Calibration\* : Based on the annual calibration plan. At least 1 time per year.

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
1	Orifice Transfer Standard Calibrator	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM <sub>10</sub> )	Tisch Environmental Inc.	TE-5025A 3540	Jiranatee Associates Co., Ltd.	CL-011-65	31 Oct 22	30 Oct 24	-
2	U-Tube Manometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM <sub>10</sub> )	Dwyer	1221-36-W/M	Technology Promotion Association (Thailand-Japan)	23P1400	9 May 23	8 May 24	-
3	Aneroid Barometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM <sub>10</sub> )	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	23P1856	2 Jun 23	1 Jun 24	-
4	Dial Thermo-Hygrometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM <sub>10</sub> )	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	23H1201	5 Jun 23	5 Jun 24	-
5	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i CM08130002	UAE Consultant Co.,Ltd.	01112023	1 Nov 23	31 Oct 24	-
6	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i CM19050148	UAE Consultant Co.,Ltd.	13112023	13 Nov 23	12 Nov 24	-
7	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i CM19050149	UAE Consultant Co.,Ltd.	01112023	1 Nov 23	31 Oct 24	-
8	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i CM19050150	UAE Consultant Co.,Ltd.	01112023	1 Nov 23	31 Oct 24	-
9	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i CM22387035	UAE Consultant Co.,Ltd.	07112023	7 Nov 23	6 Nov 24	-
10	Standard Gases (Mixture)	Nitrogen Dioxide	Airgas	EB0143262 2015PSIG	Airgas an Air Liquide company	E04NI99E15A01D3	21 Jun 21	21 Jun 24	-
11	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1200906875	UAE Consultant Co.,Ltd.	03112023	3 Nov 23	2 Nov 24	-
12	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1200906876	UAE Consultant Co.,Ltd.	09112023	9 Nov 23	8 Nov 24	-
13	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1201778115	UAE Consultant Co.,Ltd.	09112023	9 Nov 23	8 Nov 24	-

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
14	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1201778114	UAE Consultant Co.,Ltd.	03052023	3 May 23	2 May 24	-
15	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1182920012	UAE Consultant Co.,Ltd.	03112023	3 Nov 23	2 Nov 24	-
16	Standard Gases (Mixture)	Sulphur Dioxide	Airgas	EB0143262 2015PSIG	Airgas an Air Liquide company	E04NI99E15A01D3	21 Jun 21	21 Jun 24	-
17	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2205DT0106	Thai Meteorological Department	102/24	27 Feb 24	26 Feb 25	-
18	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2205DT0113	Thai Meteorological Department	390/23	1 Nov 23	31 Oct 24	-
19	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2205DT0114	Thai Meteorological Department	099/24	22 Feb 24	21 Feb 25	-
20	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2205DT0116	Thai Meteorological Department	100/24	22 Feb 24	21 Feb 25	-
21	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2301DR0024	Thai Meteorological Department	096/24	22 Feb 24	21 Feb 25	-
22	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	Svantek	SV36 107224	Innovative Instrument Co.,Ltd.	23-ACT-117	4 Aug 23	3 Aug 24	-
23	Sound Level Meter	$L_{Aeq,1\text{ hr}}, L_{Aeq,24\text{ hrs}}, L_{A_{dnt}}, L_{A00}$	Rion, Japan	NL-62 00130355	Sithiporn Associates Co., Ltd.	ACT23199	27 Jun 23	26 Jun 24	-
24	Sound Level Meter	$L_{Aeq,1\text{ hr}}, L_{Aeq,24\text{ hrs}}, L_{A_{dnt}}, L_{A00}$	Rion, Japan	NL-62 00130359	Sithiporn Associates Co., Ltd.	ACL23182	8 Jun 23	7 Jun 24	-
25	Sound Level Meter	$L_{Aeq,1\text{ hr}}, L_{Aeq,24\text{ hrs}}, L_{A_{dnt}}, L_{A00}$	Rion, Japan	NL-62 00511775	Sithiporn Associates Co., Ltd.	ACL23150	9 May 23	8 May 24	-

Mettler-Toledo (Thailand) Ltd.  
846/4 - 846/5 Lasalle Rd., Bangna Tai Sub-District  
Bangna District, Bangkok 10260  
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MT-TH-ServicesSupport@mtl.com



## Accuracy Calibration Certificate

### Customer

Company: United Analyst and Engineering Consultant Co., Ltd.  
Address: 3 Soi Udon Suk 41, Sukhumvit Rd., Bang Chak  
City: Phra Khanong  
Zip / Postal: 10260  
State / Province: Bangkok  
Order Number: 0370225000

### Weighing Device

Manufacturer: Mettler Toledo  
Model: MS204TS00  
Serial No.: C252436235  
Building: N/A  
Floor: 2  
Room: Balance Room 2 (205)  
Instrument Type: Weighing Instrument  
Asset Number: UAE-AIR-023/2566  
Terminal Model: N/A  
Terminal Serial No.: N/A  
Terminal Asset No.: N/A

Range	Max. Capacity	Repeatability (g)
1	220 g	0.0001 g

### Procedure

Calibration Guideline: EURAMET cp-18 v. 4.0 (11/2015)  
Mettler TOLEDO Work Instruction: CP/W002/20  
This calibration certificate contains measurements for As Found calibration. No As Left calibration was performed because the device was not modified after As Found calibration. Therefore, results for As Left correspond to As Found.  
The sensitivity/span of the weighing instrument was adjusted before calibration with a built-in weight.  
In accordance with EURAMET cp-18 (11/2015), the test loads were selected to reflect the specific use of the weighing device or to accommodate specific calibration conditions.

As Found	Temperature	Humidity
	Start: 22.4 °C End: 22.6 °C	Start: 63.3 % End: 66.3 %

As Found Calibration Date: 06-May-2023  
As Left Calibration Date: N/A  
Issue Date: 08-May-2023

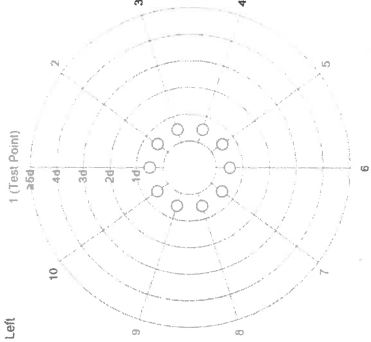
Approved Signatory:   
Chawalit Mertsuloke  
Technical Manager / Head of Calibration Center

## Measurement Results

### Repeatability

Test Load: 100 g

	As Found	As Left
1	100.0000 g	N/A
2	100.0000 g	N/A
3	100.0001 g	N/A
4	100.0001 g	N/A
5	100.0000 g	N/A
6	100.0001 g	N/A
7	100.0001 g	N/A
8	100.0001 g	N/A
9	100.0000 g	N/A
10	100.0000 g	N/A
Standard Deviation	0.00005 g	N/A

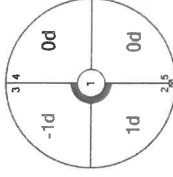


The "c" in the graph represents the repeatability of the range/interval in which the test was performed.  
The results of this graph are based upon the absolute values of the differences from the mean value.

### Eccentricity

Test Load: 100 g

Position	As Found	As Left
1	100.0000 g	N/A
2	100.0001 g	N/A
3	99.9999 g	N/A
4	100.0000 g	N/A
5	100.0000 g	N/A
Maximum Deviation	0.0001 g	N/A



As Found

The "c" in the graph represents the repeatability of the range/interval in which the test was performed.

Error of Indication	
As Found	
Reference Value	Indication
1 0.0000 g	0.0000 g
2 0.1000 g	0.1000 g
3 1.0000 g	1.0000 g
4 5.0000 g	5.0000 g
5 10.0000 g	10.0000 g
6 20.0000 g	20.0000 g
7 50.0000 g	50.0001 g
8 70.0001 g	70.0000 g
9 100.0000 g	100.0000 g
10 150.0000 g	150.0001 g
11 200.0001 g	200.0002 g
Expanded Uncertainty	
k	
2	0.12 mg
2	0.13 mg
2	0.14 mg
2	0.14 mg
2	0.15 mg
2	0.16 mg
2	0.18 mg
2	0.24 mg
2	0.24 mg
2	0.34 mg
2	0.39 mg
End of Accredited Section	
The information below and any attachments to this calibration certificate are not part of the accredited calibration.	

Remarks

FACT adjustment functionally activated

Equipment condition: Good

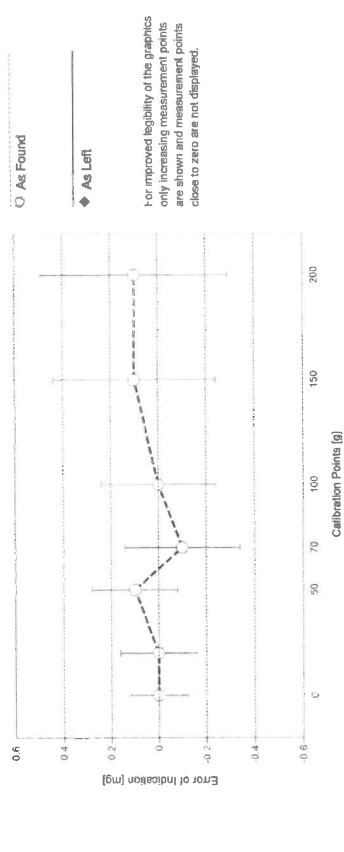
Calibration after installation

Next calibration according to customer's procedure

Calibration data not decide by calibration laboratory

Test weight by filter pan at 1g = 1.000 g, 3g = 2.9995 g, 5g = 4.9999 g

Error of Indication	
As Found	
Reference Value	Indication
1 0.0000 g	0.0000 g
2 0.1000 g	0.1000 g
3 1.0000 g	1.0000 g
4 5.0000 g	5.0000 g
5 10.0000 g	10.0000 g
6 20.0000 g	20.0000 g
7 50.0000 g	50.0001 g
8 70.0001 g	70.0000 g
9 100.0000 g	100.0000 g
10 150.0000 g	150.0001 g
11 200.0001 g	200.0002 g
Expanded Uncertainty	
k	
2	0.12 mg
2	0.13 mg
2	0.14 mg
2	0.14 mg
2	0.15 mg
2	0.16 mg
2	0.18 mg
2	0.24 mg
2	0.24 mg
2	0.34 mg
2	0.39 mg
End of Accredited Section	
The information below and any attachments to this calibration certificate are not part of the accredited calibration.	



The uncertainty stated is the expanded uncertainty at calibration obtained by multiplying the standard combined uncertainty by the coverage factor  $k$  – which can be larger than 2 according to EURAMET cg-18. The value of the measurand lies within the assigned range of values with a probability of approximately 95%.

The user is responsible for maintaining environmental conditions and the settings of the weighing instrument when it was calibrated.

Test Equipment	
All weights used for metrological testing are traceable to national or international standards. The weights were calibrated and certified by an accredited calibration laboratory.	
Weight Set 1: OIML E2	
Weight Set No.:	WS80
Certificate Number:	C208581631
Date of Issue:	23-Feb-2022
Calibration Due Date:	14-Aug-2023
Thermo Hygrometer	
Equipment No.:	IN255
Certificate Number:	22H1503
Date of Issue:	20-Jul-2022
Calibration Due Date:	04-Jul-2023

Error of Indication	
As Found	
Reference Value	Indication
1 0.0000 g	0.0000 g
2 0.1000 g	0.1000 g
3 1.0000 g	1.0000 g
4 5.0000 g	5.0000 g
5 10.0000 g	10.0000 g
6 20.0000 g	20.0000 g
7 50.0000 g	50.0001 g
8 70.0001 g	70.0000 g
9 100.0000 g	100.0000 g
10 150.0000 g	150.0001 g
11 200.0001 g	200.0002 g
Expanded Uncertainty	
k	
2	0.12 mg
2	0.13 mg
2	0.14 mg
2	0.14 mg
2	0.15 mg
2	0.16 mg
2	0.18 mg
2	0.24 mg
2	0.24 mg
2	0.34 mg
2	0.39 mg
End of Accredited Section	
The information below and any attachments to this calibration certificate are not part of the accredited calibration.	

Remarks

FACT adjustment functionally activated

Equipment condition: Good

Calibration after installation

Next calibration according to customer's procedure

Calibration data not decide by calibration laboratory

Test weight by filter pan at 1g = 1.000 g, 3g = 2.9995 g, 5g = 4.9999 g

Measurement Uncertainty of the Weighing Instrument in Use

Stated is the expanded uncertainty with  $k=2$  in use. The formula shall be used for the estimation of the uncertainty under consideration of the errors of indication. The value R represents the net load indication in the unit of measure of the device.

Temperature coefficient for the evaluation of the measurement uncertainty in use:  $1.5 \cdot 10^{-6} / K$

Temperature range on site for the evaluation of the measurement uncertainty in use: 3 K

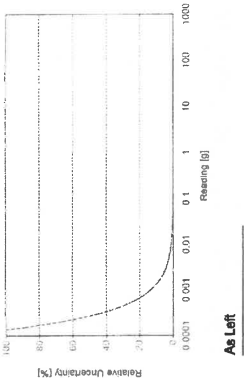
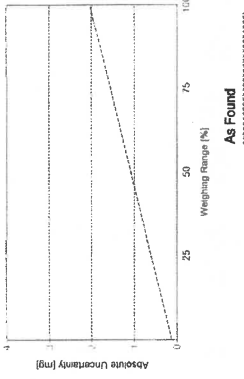
Linearization of Uncertainty Equation

Range		As Found		As Left	
d	Max				
1	0.0001 g	220 g	$U_1 = 0.13 \text{ mg} + 0.00688 \text{ mg/g} \cdot R$	N/A	N/A

To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

Absolute and Relative Measurement Uncertainty In Use for Various Net Indications (Examples)

Net Indication	As Found		As Left	
0.0220 g	0.13 mg	0.59%	N/A	N/A
0.2200 g	0.13 mg	0.060%	N/A	N/A
2.2000 g	0.15 mg	0.0068%	N/A	N/A
22.0000 g	0.32 mg	0.0015%	N/A	N/A
220.0000 g	2.0 mg	0.00093%	N/A	N/A



GWP®  
Certificate



As Found



As Left



The weighing device meets the given process requirements.

The weighing device meets the given process requirements.

Tests Performed:

☒ As Found

☐ As Left

☒ No adjustments/modifications made. As Left results correspond to As Found.

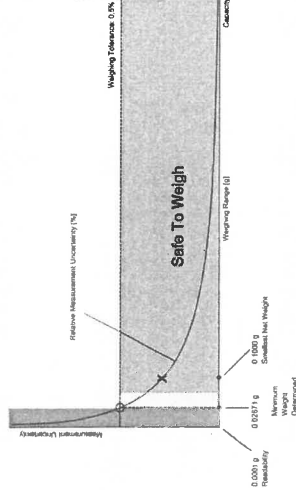
Process Requirements

Weighing Tolerance: 0.5 %

Smallest Net Weight: 0.1000 g

Safety Factor: 2

Safe Weighing Range



While the values in this graph reflect the actual calibration results, the measurement uncertainty curves are simply a visual representation. The graph reflects As Left testing, unless only As Found was performed.

## Minimum Weight

### As Found Minimum Weight Table

Minimum weights for different weighing tolerances and safety factors					
Tolerance	Safety Factor				
	1	2	3	5	10
0.1%	0.13450 g	0.27138 g	0.41069 g	0.69691 g	1.46006 g
0.2%	0.06696 g	0.13450 g	0.20264 g	0.34075 g	0.69691 g
0.5%	0.02671 g	0.05352 g	0.08042 g	0.13450 g	0.27138 g
1%	0.01334 g	0.02671 g	0.04010 g	0.06696 g	0.13450 g
2%	0.00667 g	0.01334 g	0.02003 g	0.03341 g	0.06696 g
5%	0.00267 g	0.00534 g	0.00800 g	0.01334 g	0.02671 g

Pass: The determined minimum weight meets the requirement for the smallest net weight.

### As Left Minimum Weight Table

Minimum weights for different weighing tolerances and safety factors					
Tolerance	Safety Factor				
	1	2	3	5	10
0.1%	0.13450 g	0.27138 g	0.41069 g	0.69691 g	1.46006 g
0.2%	0.06696 g	0.13450 g	0.20264 g	0.34075 g	0.69691 g
0.5%	0.02671 g	0.05352 g	0.08042 g	0.13450 g	0.27138 g
1%	0.01334 g	0.02671 g	0.04010 g	0.06696 g	0.13450 g
2%	0.00667 g	0.01334 g	0.02003 g	0.03341 g	0.06696 g
5%	0.00267 g	0.00534 g	0.00800 g	0.01334 g	0.02671 g

Pass: The determined minimum weight meets the requirement for the smallest net weight.

At these net minimum weight values, the measurement uncertainty of the weighing device is equal to or less than 1/1 (no safety factor), 1/2, 1/3, 1/5, or 1/10 of the required tolerance. The values are calculated with  $k = 2$  and based on the linear formula of the measurement uncertainty of the weighing device in use.

The safety factor for As Found is always 1. This implies no safety factor. As Found testing looks at the behavior of the instrument from the past until test occurred. For the past, it is necessary to know that the tolerance was met, but not the safety factor. The safety factor is a proactive measure to apply for future measurements.

#### Notes on minimum weight values in above table:

1. If "N/A" is shown above, no appropriate value could be calculated.
2. METTLER TOLEDO is not responsible for the definition of the process requirements.

## Measurement Results

### Results Summary

Repeatability		Eccentricity	Error of Indication
As Found	As Left		
✓	✓	✓	✓

✓ = Passed  
✗ = Failed  
Δ = Safety Factor not met

### Repeatability

Test Load: 100 g

Tolerance	Control Limit	As Found		As Left	
		Std. Deviation	Result	Std. Deviation	Result
0.1%	0.00005 g		✓		✓
0.2%	0.00010 g		✓		✓
0.5%	0.00025 g		✓		✓
1%	0.00050 g	0.00005 g	✓	0.00005 g	✓
2%	0.00100 g		✓		✓
5%	0.00250 g		✓		✓

The weighing tolerance is met if the standard deviation is less than or equal to the corresponding control limit.

### Eccentricity

Test Load: 100 g

Tolerance	Control Limit	As Found		As Left	
		Deviation	Result	Deviation	Result
0.1%	0.0500 g		✓		✓
0.2%	0.1000 g		✓		✓
0.5%	0.2500 g		✓		✓
1%	0.5000 g	0.0001 g	✓	0.0001 g	✓
2%	1.0000 g		✓		✓
5%	2.5000 g		✓		✓

The weighing tolerance is met if the deviation is less than or equal to the corresponding control limit.



Error of Indication

As Found

Reference Value	Error	Control limits for various weighing tolerances					
		0.1%	0.2%	0.5%	1%	2%	5%
0.0000 g	0.0000 g	N/A	N/A	N/A	N/A	N/A	N/A
20.0000 g	0.0000 g	0.0100 g	0.0200 g	0.0500 g	0.1000 g	0.2000 g	0.5000 g
50.0000 g	0.0001 g	0.0250 g	0.0500 g	0.1250 g	0.2500 g	0.5000 g	1.2500 g
70.0001 g	-0.0001 g	0.0350 g	0.0700 g	0.1750 g	0.3500 g	0.7000 g	1.7500 g
100.0000 g	0.0000 g	0.0500 g	0.1000 g	0.2500 g	0.5000 g	1.0000 g	2.5000 g
150.0000 g	0.0001 g	0.0750 g	0.1500 g	0.3750 g	0.7500 g	1.5000 g	3.7500 g
200.0001 g	0.0001 g	0.1000 g	0.2000 g	0.5000 g	1.0000 g	2.0000 g	5.0000 g
Result		✓	✓	✓	✓	✓	✓

As Left

Reference Value	Error	Control limits for various weighing tolerances					
		0.1%	0.2%	0.5%	1%	2%	5%
0.0000 g	0.0000 g	N/A	N/A	N/A	N/A	N/A	N/A
20.0000 g	0.0000 g	0.0100 g	0.0200 g	0.0500 g	0.1000 g	0.2000 g	0.5000 g
50.0000 g	0.0001 g	0.0250 g	0.0500 g	0.1250 g	0.2500 g	0.5000 g	1.2500 g
70.0001 g	-0.0001 g	0.0350 g	0.0700 g	0.1750 g	0.3500 g	0.7000 g	1.7500 g
100.0000 g	0.0000 g	0.0500 g	0.1000 g	0.2500 g	0.5000 g	1.0000 g	2.5000 g
150.0000 g	0.0001 g	0.0750 g	0.1500 g	0.3750 g	0.7500 g	1.5000 g	3.7500 g
200.0001 g	0.0001 g	0.1000 g	0.2000 g	0.5000 g	1.0000 g	2.0000 g	5.0000 g
Result		✓	✓	✓	✓	✓	✓

The weighing tolerance is met if the error (of indication) for each test point is less than or equal to the corresponding control limit for that particular weighing tolerance. Results at or close to the zero point cannot be assessed.

INNOVATIVE INSTRUMENT CALIBRATION LAB  
INNOVATIVE INSTRUMENT CO.,LTD. HEAD OFFICE  
7/139 MOO 13, SOI SUTTHANAKORN 11 TAMBON BANG KHAO,  
AMPHOE BANG PHU 1 SAHIT PRAKAN PROVINCE 10540 THAILAND  
TEL: (66)0-2116-5560-1 FAX: (66)0-2116-7140



Certificate of Calibration

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.  
Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260  
Certificate No : 23-ACT-117  
Request No : Req-2023-1546

Unit Under Calibration Details

Measurement item : Acoustic Calibrator  
Manufacturer : SVANTEK  
Model : SV 36  
Serial Number : 107224  
ID : UAE.EFM.171/2564  
Class : 1  
Range : 94 , 114 dB / 1000 Hz  
Instrument Status : Used

Calibration Environment and Details

Temperature : (23 ±2 °C )  
Humidity : (50 ± 20 %RH )  
Barometric Pressure : (1013 ±10.0 hPa )  
Received Date : 21 July 2023  
Calibration Date : 4 August 2023  
Location of Calibration : LAB 1 Acoustic  
Calibration Procedure : In-house method CP-ACT-02 based on IEC 60942:2017 Electroacoustics - Sound calibrators

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Sound Calibrator	SV 35A	58079	EEI	31 May 2024
THD Multimeter	2015	1047765	NIMT	31 January 2024

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

Note

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

Calibrated By : Mr. Noppadon Luangart  
Approved By : Mr. Pacit Mahavorn  
Service Calibration Engineer  
Calibration Engineer Supervisor  
Issue Date : 4 August 2023

Certificate No : 23-ACT-117  
Request No : Req-2023-1546

Calibration Results : Without Adjustment

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty ( $\pm$ dB)	Acceptance limit Class 1 ( $\pm$ dB)
	Measured	Error	Measured	Error		
94 dB / 1000 Hz	94.03	0.03	-	-	0.13	0.25
114 dB / 1000 Hz	114.11	0.11	-	-	0.13	0.25

Frequency of Sound pressure level

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty ( $\pm$ %)	Acceptance limit Class 1 ( $\pm$ %)
	Measured (Hz)	Error (%)	Measured (Hz)	Error (%)		
94 dB / 1000 Hz	1000.00	0.00	-	-	0.01	0.70
114 dB / 1000 Hz	1000.00	0.00	-	-	0.01	0.70

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

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty ( $\pm$ %)	Acceptance limit Class 1 ( $\pm$ %)
	Measured (%)	Error (%)	Measured (%)	Error (%)		
94 dB / 1000 Hz	0.26	-	-	-	0.40	2.5
114 dB / 1000 Hz	0.38	-	-	-	0.40	2.5

Note :

- Acceptance limit was IEC 60601-2-301 : Class 1
- The calibration results exclude the calibrator pressure correction
- The calibration results exclude the microphone volume correction

End of Calibration



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
53/44 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250  
TEL. 0-2717-3000-24 FAX. 0-2719-9484



Certificate of Calibration

Certificate No. : 23H1201  
Page : 1 of 2

Equipment : Dial Thermo-Hygrometer

Manufacturer : Barigo

Model : -

Serial No. : -

ID No. : UAE/EMA2.014/2555

Condition As-Received: Used Item

Received Date: 26 May 2023

Calibration Date: 30 May 2023  
to 06 June 2023

Reference: 2305-0919WSC

Ambient Temperature: ( $25 \pm 3$ ) °C

Relative Humidity: ( $50 \pm 20$ ) %

Submitted by: United Analyst and Engineering Consultant Co., Ltd.

81 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phraekhanong, Bangkok 10260

Procedure used: Calibration were conducted using in-house calibration procedure CP-H02 according to comparison with standard chilled mirror sensor for humidity measurement function and comparison with standard temperature probe for temperature measurement function into humidity / temperature chamber.

Condition of this result of calibration

1. Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Hygro-M2 Dew Point Monitor	5112	2360195	20703	02 Aug 2023
2) Handheld Thermometer With Sensor	1523	3240076	23305	15 Mar 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:-

- National Institute of Standards and Technology (NIST), The United States of America
- Technology Promotion Association (Thailand-Japan), NSC-ONSC Accredited No. Calibration 0008

Calibrated by : Sornchai Dumwor  
Issue Date : 07 June 2023

Approved Signatory :

[✓] Chakrit Waewwanjua  
[ ] Porntippa Taneyakul  
[ ] Viporn Tantiyawutti



Cert. No.: 23H1201  
Page.: 2 of 2

Result of Calibration:-  
Function: Humidity Measurement

Before Adjustment

Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (±%R.H.)
25.0	40.1	55	14.9	1.6
25.0	60.0	66	6.0	1.7
25.0	80.0	78	-2.0	1.9

Result of Calibration:-  
Function: Humidity Measurement

After Adjustment

Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (±%R.H.)
25.0	40.1	46	5.9	1.6
25.0	60.0	60	0.0	1.7
25.0	80.0	72	-8.0	1.9

Result of Calibration:-  
Function: Temperature Measurement

Without Adjustment

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
19.987	20.0	0.013	0.72
30.016	30.0	-0.016	0.72
39.944	39.0	-0.944	0.72

UUC\* : Unit Under Calibration

The reported uncertainty of measurement was based on standard uncertainty multiplied by coverage factor  $k = 2.00$ , providing confidence level approximately 95%.

-o0o-



## Certificate of Calibration

Certificate No.: 23P1400  
Page.: 1 of 2

Equipment: U-Tube Manometer

Manufacturer: Dwyer

Model: 1221-36-W/M

Serial No.: -

ID No.: UAE.EFM.020/2560

Condition As-Received: Used Item

Received Date: 26 April 2023

Calibration Date: 09 May 2023

Reference: 2304-0703WSC Submitted by: United Analyst and Engineering Consultant Co., Ltd.

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

Relative Humidity:  $(50 \pm 15) \%$

Atmospheric Pressure: 1010 mbar

Procedure used: The calibration was conducted by direct comparison method against Pressure Measuring Instruments Standard according to in-house calibration procedure CP-P04, using "DKD-R 6-1"; Calibration of Pressure Gauges, Edition 03/2014 " as a guideline.

Condition of this result of calibration:

1. Reference standards instruments:

Instrument	Model	Serial No.	Certificate No.	Due Date
Pressure Calibrator	PC106P	1189	MP-0137-22	24 Aug 2023

1) Pressure calibration was made on requested at the point specified by customer.

2) Scale and conversion factor is 1 kPa = 4.0146293 inH<sub>2</sub>O

3) This instrument was used clean air as pressure media.

4) This instrument was calibrated by applied pressure to high-port (+) side and low-port (-) side open to atmospheric pressure.

5) This instrument was installed in vertical orientation and top of the pressure port was used as the reference level.

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

7) This Certification is traceable to the International System of Unit maintained through:-

-National Institute of Metrology Thailand (NIMT)

Calibrated by: Suwit Aussarnee  
Issue Date: 11 May 2023

Approved Signatory: Attapee P.  
☐ J Phalinee Prabpai  
☐ J Sura Suwanasri  
☒ Attapee Panurach

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1168284

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B 0314240



# THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangum, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

## Calibration Certificate

Cert.No.: 23P1400  
Page: 2 of 2

Result of calibration:- Without adjustment  
Function:- Pressure Measurement  
Increasing Pressure

Range: 0 inH<sub>2</sub>O to 36 inH<sub>2</sub>O

Scale Interval: 0.1 inH<sub>2</sub>O (The Fifth Estimate)

### UUC Indication

Applied Pressure (inH <sub>2</sub> O)	High-port side (inH <sub>2</sub> O)	Low-port side (inH <sub>2</sub> O)	$\Delta P$ (inH <sub>2</sub> O)	Error (inH <sub>2</sub> O)
0.00	0.00	0.00	0.00	0.00
2.00	1.00	-1.00	2.00	0.00
4.00	2.00	-2.00	4.00	0.00
6.00	3.00	-3.00	6.00	0.00
8.00	4.00	-4.00	8.00	0.00
10.00	5.00	-5.00	10.00	0.00
12.00	6.00	-6.00	12.00	0.00
14.00	7.02	-7.02	14.04	0.04
16.00	8.02	-8.02	16.04	0.04
18.00	9.04	-9.04	18.08	0.08
20.00	10.04	-10.04	20.08	0.08
22.00	11.02	-11.02	22.04	0.04
24.00	12.02	-12.02	24.04	0.04
26.00	13.02	-13.00	26.02	0.02
28.00	14.00	-14.00	28.00	-28.00
30.00	15.00	-15.00	30.00	0.00
32.00	16.00	-16.00	32.00	-0.02
34.00	17.00	-17.00	34.00	-0.04
35.80	18.00	-17.94	35.94	0.14

The uncertainty of measurement was  $\pm 0.11$  inH<sub>2</sub>O

\* UUC = Unit Under Calibration

\*  $\Delta P$  = High-port side - Low-port side

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 %.

-o0o-

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue : 22 February, 2024 Certification No. 096724

Page : 1 of 5

Object : Wind Speed & Wind Direction Data Logger

Manufacturer : SCARLET/TECH

Type : WL-21

Mfg Code : Wireless Receiver 2301DR0024

Wind Sensor 2301DT0024

Customer : United Analyst and Engineering Consultant Co.,Ltd.

81 Soi Udomsuk 41, Sukhumvit Road,

Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1010.1 hPa

NATIONAL STANDARD WIND TUNNEL : Wind Aloft Plotting Board

: Micromanometer Theodor Friedrichs FC014 Serial No. 9310119 : HOOK GAGE NO 1425

N.I.S.T. Test Reference Number 731/241460 : Standard Velocity at 20 - 30 m/sec

: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION : Standard Velocity at 0 - 20 m/sec

STANDARD THERMOMETER : Theodor Friedrich : Dry No.8390/94 Wet No. 8389/94

: Iesto, testo 645 Serial No. 02848037 : Thermoschneider No.918802

STANDARD BAROMETER

: Digital Barometer Vaisala Type PIP2200 No. V1220015

: Digital Barometer Vaisala Type PIP2200 No. V1220015

Calibrated by : Mr. Watchapol Subwat

Mechanical Engineer

Signed : Mr. Pitsakorn Pomsut

(Authorized Signatory for the Chief Sub-Standard Instrument)

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## The Result of Calibration



## The Result of Calibration

Certification No. 096/24

22 February, 2024

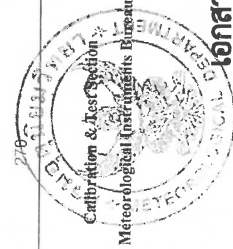
Page : 2 of 5

Standard Ultrasonic Anemometer m/sec	HOOK GAGE NO. 1425		TESTED ANEMOMETER	
	Pressure inches H2O	Vacuum inches H2O	Velocity m/sec	Correction m/sec
1.00	-	-	1.0	0.00
3.02	-	-	3.0	0.02
5.00	-	-	5.0	0.00
7.04	-	-	7.0	0.04
9.02	-	-	9.0	0.02
11.02	-	-	10.9	0.12
13.01	-	-	12.9	0.11
15.01	-	-	14.9	0.11
17.02	-	-	17.0	0.02
20.02	-	-	19.9	0.12

Wind Aloft Plotting Board.	
US.DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRECTION	TESTED WIND DIRECTION
0	0
90	90
180	180
270	270

Calibrated by : *Wacharapol*

Mr. Wacharapol Subwat  
Mechanical Engineer



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22 February, 2024

Certification No. 096/24

Page : 3 of 5

Standard Barometer Pressure	Tested Barometer Pressure	Correction mbar
1010.84	1011	-0.16
1010.60	1011	-0.40
1011.71	1012	-0.29
1012.17	1012	0.17
1012.31	1012	0.31
1012.25	1012	0.25
1012.79	1013	-0.21
1012.95	1013	-0.05
1013.52	1014	-0.48
1014.16	1014	0.16
1015.79	1016	-0.21
1016.02	1016	0.02
1015.86	1016	-0.14
1015.69	1015	0.69
1011.51	1012	-0.49
1011.80	1012	-0.20
1012.06	1012	0.06
1012.81	1013	-0.19
1013.22	1013	0.22
1013.49	1013	0.49
Average		-0.02

Calibrated by : *Wacharapol*

Mr. Wacharapol Subwat  
Mechanical Engineer



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The Result of Calibration



Certification No. 096/24

22 February, 2024

Page : 4 of 5

Standard Barometer Pressure	Tested Barometer Pressure	Correction mmHg
758.19	756	0.19
759.01	758	0.01
759.84	759	-0.16
759.19	759	0.19
759.29	759	0.29
759.25	759	0.25
759.65	760	-0.35
759.77	760	-0.23
760.20	760	0.20
760.68	761	-0.32
761.90	762	-0.10
762.08	762	0.08
761.96	762	-0.04
761.83	762	-0.17
759.69	759	-0.31
758.91	759	-0.09
759.11	759	0.11
759.67	760	-0.33
759.98	760	-0.02
760.18	760	0.18
Average		-0.03

Average

Calibrated by : *Wacharapol*

Mr. Wacharapol Subwat

Mechanical Engineer



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The Result of Calibration

22 February, 2024

Certification No. 096/24

Page : 5 of 5

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.2	45	0.2
30.3	30	0.3
15.8	16	-0.2

Calibrated by : *Wacharapol*

Mr. Wacharapol Subwat

Mechanical Engineer



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# Calibration Certificate



Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of issue : 27 February, 2024

Certification No. 102/24

Page : 1 of 5

Object : Wind Speed & Wind Direction Data Logger

Manufacturer : SCARLET/TECH

Type : WL-21

Mfg Code : Wireless Receiver 2205DR0106

Wind Sensor 2205DT0106

Customer : United Analyst and Engineering Consultant Co., Ltd.

81 Soi Udomsuk 41, Sukhumvit Road,

Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1011.2 hPa

NATIONAL STANDARD WIND TUNNEL : Wind Aloft Plotting Board

: Micromanometer Theodor Friedrichs FC014 Serial No. 9310119 : HOOK GAGE NO 1425

N.I.S.T. Test Reference Number 731/241460 : Standard Velocity at 20 - 30 m/sec

: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-50AH)  
Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION : Standard Velocity at 0 - 20 m/sec

STANDARD THERMOMETER : Theodor Friedrich : Dry No.8390/94 Wet No. 8389/94

: Iesio, Iesio 645 Serial No. 02848057 : Thermoschneider No.918802

STANDARD BAROMETER

: Digital Barometer Vaisala Type PTB220 No. V1220015

: Digital Barometer Vaisala Type PTB330 No. V1330001

Calibrated by : Signed :

Mr. Watchapol Subwat

Mr. Pisekai Promsat

Mechanical Engineer



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# The Result of Calibration

Certification No. 102/24

27 February, 2024

Page : 2 of 5

Standard Ultrasonic Anemometer m/sec	HOOK GAGE NO. 1425		TESTED ANEMOMETER	
	Pressure Inches H2O	Vacuum Inches H2O	Velocity m/sec	Correction m/sec
1.00	-	-	1.0	0.00
3.02	-	-	3.0	0.02
5.00	-	-	5.0	0.00
7.04	-	-	7.0	0.04
9.02	-	-	9.0	0.02
11.02	-	-	11.0	0.02
13.01	-	-	13.0	0.01
15.01	-	-	15.0	0.01
17.02	-	-	17.1	-0.08
20.02	-	-	20.1	-0.08

Wind Aloft Plotting Board.	
US DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRECTION	TESTED WIND DIRECTION
0	0
90	90
180	180
270	

Calibrated by :

Mr. Watchapol Subwat

Mechanical Engineer



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## The Result of Calibration

Certification No. 102/24

27 February, 2024

Page : 3 of 5

Standard Barometer Pressure	Tested Barometer Pressure	Correction mbar
1009.59	1009	0.59
1009.45	1009	0.45
1010.10	1010	0.10
1010.94	1011	-0.06
1011.46	1011	0.46
1011.84	1012	-0.16
1012.08	1012	0.06
1013.04	1013	0.04
1013.18	1013	0.18
1012.89	1013	-0.11
1013.20	1013	0.20
1013.44	1014	-0.56
1013.81	1014	-0.19
1014.19	1014	0.19
1015.95	1016	-0.04
1016.23	1016	0.23
1016.84	1015	0.64
1015.23	1015	0.23
1012.87	1013	-0.13
1013.63	1014	-0.37
Average		

Calibrated by :

*Wacharapol*

Mr. Wacharapol Subwat  
Mechanical Engineer



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Certification No. 102/24

Page : 4 of 5

27 February, 2024

Standard Barometer Pressure	Tested Barometer Pressure	Correction mmHg
757.25	757	0.25
757.15	757	0.15
757.64	757	0.64
758.27	758	0.27
758.66	759	-0.34
758.94	759	-0.06
759.11	759	0.11
759.84	760	-0.16
759.95	760	-0.05
759.73	760	-0.27
759.96	760	-0.04
760.14	760	0.14
760.42	761	-0.56
760.70	761	-0.30
762.03	762	0.03
762.24	762	0.24
761.79	762	-0.21
761.48	761	0.48
759.71	760	-0.29
760.28	760	0.28
Average		0.02

Calibrated by :

*Wacharapol*

Mr. Wacharapol Subwat  
Mechanical Engineer



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SITHIPORN ASSOCIATES CO.,LTD.  
CALIBRATION LABORATORY



451-451/1 Sirthom Rd., Bangbunru, Bangkok 10700 THAILAND.  
Tel.0-2435-8800 Fax.0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.com

Cert. No. : ACL23150  
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-62 / Microphone UC-59L / Preamplifier NH-26  
Serial No.: 00511775 / 02266 / 11973  
ID No.: UAE.EFM.091/2565

Condition As Found : GOOD

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT (UAE)  
81 SOI UDOMSUK 41, SUKHUMVIT ROAD,  
BANGCHAK SUB-DISTRICT,  
PHRAKHANONG DISTRICT, BANGKOK 10260  
THAILAND.

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

Received Date : 05 MAY 2023  
Calibration Date : 08-09 MAY 2023  
Date of Issue : 10 MAY 2023

Calibrated by : Nathakorn Pisutpaisan

Approved by :  
( Thanakul Petchurai )

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

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QF-TS12-04-04-020664

THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469



The Result of Calibration

Certification No. 102/24  
Page : 5 of 5

27 February, 2024

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.5	45	0.5
30.1	30	0.1
15.3	15	0.3

Calibrated by :  
Mr. Watchampol Subwat  
Mechanical Engineer



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## Continuation of Calibration Certificate

Cert. No. : ACL23150  
Job No. : VC66AC0053  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

## Calibration Method :

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

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

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

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

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

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

3.1 National Institute of Metrology (Thailand).

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

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T. Reichen

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL23150  
Job No. : VC66AC0053  
Pages : 3 of 8

## Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.3	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

Note : Pass/Fail evaluation for each parameter, will be considered together from the acceptance limit and the Maximum-permitted uncertainty of measurement.

เอกสารไม่ควบคุม  
T. Reichen

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL23150  
Job No. : VC66AC0053  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

Reference Acoustic Signal ( dB )	Measured Value ( dB )	Deviation ( dB )	Acceptance Limit ( dB )
93.9 (93.98)	94.0	0.0	±0.3

## 2. Self-generated noise

## 2.1 Normal test

Measured Value ( dB )
15.1

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

Frequency Weighting	Measured value ( dB )
A - weight	10.8
C - weight	16.4
Flat	23.5

## 3. Acoustical signal tests of frequency weightings

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

Frequency ( Hz )	Deviation from various frequency weighting response curve (dB)		
	Flat	C-weight	A-weight
125	0.5	0.5	0.5
1000	0.3	0.3	0.3
8000	0.3	0.4	0.4

## Continuation of Calibration Certificate

Cert. No. : ACL23150  
Job No. : VC66AC0053  
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
63	0.0	-0.1	0.0
125	0.0	0.0	0.0
250	0.0	0.0	0.0
500	0.0	0.0	0.0
1000	0.0	0.0	0.0
2000	0.0	0.0	0.0
4000	0.0	0.0	0.0
8000	0.0	0.1	0.1
16000	0.0	-1.2	-1.2

## 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	± 0.1

## Continuation of Calibration Certificate

Cert. No. : ACL23150  
Job No. : VC66AC0053  
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	±0.8
136.0	136.0	0.0	±0.8
135.0	135.0	0.0	±0.8
134.0	134.0	0.0	±0.8
133.0	133.0	0.0	±0.8
132.0	132.0	0.0	±0.8
131.0	131.0	0.0	±0.8
129.0	129.0	0.0	±0.8
124.0	124.0	0.0	±0.8
119.0	119.0	0.0	±0.8
114.0	114.0	0.0	±0.8
109.0	109.0	0.0	±0.8
104.0	104.0	0.0	±0.8
99.0	99.0	0.0	±0.8
94.0	94.0	0.0	±0.8
89.0	89.1	0.1	±0.8
84.0	84.0	0.0	±0.8
79.0	79.0	0.0	±0.8
74.0	74.1	0.1	±0.8
69.0	69.1	0.1	±0.8
64.0	64.0	0.0	±0.8
59.0	59.1	0.1	±0.8
54.0	54.0	0.0	±0.8
49.0	49.0	0.0	±0.8
44.0	44.0	0.0	±0.8
39.0	39.0	0.0	±0.8
34.0	34.0	0.0	±0.8
30.0	30.0	0.0	±0.8
29.0	29.0	0.0	±0.8
28.0	28.0	0.0	±0.8
27.0	27.0	0.0	±0.8
26.0	26.0	0.0	±0.8
25.0	24.9	-0.1	±0.8

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T. Petch.

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL23150  
Job No. : VC66AC0053  
Pages : 7 of 8

## 8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±0.8

## 9. Tone burst response

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

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L <sub>peak</sub> (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±2.0
One	136.4	135.7	-0.7	±2.0

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	±1.0
Positive half cycle	135.4	135.1	-0.3	±1.0
Negative half cycle	135.4	135.1	-0.3	±1.0

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QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23150  
Job No. : VC66AC0053  
Pages : 8 of 8

11. Overload indication

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

12. High level stability

Frequency Weighting	SLM Display at initial ( dB )	SLM Display at final ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
A - weight	137.0	137.0	0.0	±0.1

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

End of Calibration Certificate

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T. Petchur



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NSC-TS1-TIS 17025  
CALIBRATION 0394

Cert. No. : ACL23182  
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-62 / Microphone UC-59L / Preamplifier NH-26  
Serial No. : 00130359 / 02371 / 00390  
ID No. : UAE.EFM.105/2556

Condition As Found : GOOD

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT (UAE)  
81 SOI UDOMSUK 41, SUKHUMVIT ROAD,  
BANGCHAK SUB-DISTRICT,  
PHRAKHANONG DISTRICT, BANGKOK 10260  
THAILAND.

Location :

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

Received Date : 29 MAY 2023  
Calibration Date : 07-08 JUNE 2023  
Date of Issue : 09 JUNE 2023

Calibrated by : Nathakorn Pisulpaisan

Approved by :

T. Petchur.  
( Thanakul Petchurai )

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

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## Continuation of Calibration Certificate

Cert. No. : ACL23182  
Job No. : VC66AC0062  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

## Calibration Method :

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

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

## Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY3220104	EEL-BP 300266	13-FEB-24
Digital Multimeter	33461A	MY3220076	EEL-BP 290266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL-BP 310266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KA1	34560495	AA-3002-23	14-FEB-24

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

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

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

## Continuation of Calibration Certificate

Cert. No. : ACL23182  
Job No. : VC66AC0062  
Pages : 3 of 8

## Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.3	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

Note : Pass/Fail evaluation for each parameter, will be considered together from the acceptance limit and the Maximum-permitted uncertainty of measurement.

## Continuation of Calibration Certificate

Cert. No. : ACL23182  
Job No. : VC66AC0062  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

Reference Acoustic Signal ( dB )	Measured Value ( dB )	Deviation ( dB )	Acceptance Limit ( dB )
93.9 (93.98)	94.0	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	Measured value ( dB )
A - weight	9.5
C - weight	13.9
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
125	0.3	0.3	0.3
1000	0.1	0.1	0.1
8000	0.1	0.1	0.1
Acceptance Limits			
± 1.0			
± 0.7			
+ 1.5, - 2.5			

## Continuation of Calibration Certificate

Cert. No. : ACL23182  
Job No. : VC66AC0062  
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
63	0.0	-0.1	-0.1
125	0.0	0.0	0.0
250	0.0	0.0	-0.1
500	0.0	0.0	-0.1
1000	0.0	0.0	0.0
2000	0.0	0.0	0.0
4000	0.0	0.0	0.0
8000	0.0	0.0	0.1
16000	0.0	-1.3	-1.2
Acceptance Limits			
±1.0			
±1.0			
±1.0			
±1.0			
±1.0			
+ 1.5, - 2.5			
+ 2.5, -16.0			

## 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	± 0.1

## Continuation of Calibration Certificate

Cert. No. : ACL23182  
Job No. : VC66AC0062  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.1	0.1	±0.8
136.0	136.1	0.1	±0.8
135.0	135.1	0.1	±0.8
134.0	134.1	0.1	±0.8
133.0	133.0	0.0	±0.8
132.0	132.0	0.0	±0.8
131.0	131.0	0.0	±0.8
129.0	129.0	0.0	±0.8
124.0	124.0	0.0	±0.8
119.0	119.0	0.0	±0.8
114.0	114.0	0.0	±0.8
109.0	109.0	0.0	±0.8
104.0	104.0	0.0	±0.8
99.0	99.0	0.0	±0.8
94.0	94.0	0.0	±0.8
89.0	89.0	0.0	±0.8
84.0	84.0	0.0	±0.8
79.0	79.0	0.0	±0.8
74.0	74.0	0.0	±0.8
69.0	69.0	0.0	±0.8
64.0	64.0	0.0	±0.8
59.0	59.0	0.0	±0.8
54.0	54.0	0.0	±0.8
49.0	49.0	0.0	±0.8
44.0	44.0	0.0	±0.8
39.0	39.0	0.0	±0.8
34.0	34.0	0.0	±0.8
30.0	30.0	0.0	±0.8
29.0	29.0	0.0	±0.8
28.0	28.0	0.0	±0.8
27.0	26.9	-0.1	±0.8
26.0	25.9	-0.1	±0.8
25.0	24.9	-0.1	±0.8

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P. Petch.

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL23182  
Job No. : VC66AC0062  
Pages : 7 of 8

## 8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±0.8

## 9. Tone burst response

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

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L <sub>peak</sub> (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±2.0
One	136.4	136.0	-0.4	±2.0

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	±1.0
Positive half cycle	135.4	135.1	-0.3	±1.0
Negative half cycle	135.4	135.0	-0.4	±1.0

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QF-TS12-04-04-020664



Continuation of Calibration Certificate

Cert. No. : ACL23182  
Job No. : VC66AC0062  
Pages : 8 of 8

11. Overload indication

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

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

End of Calibration Certificate

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T. Petch.

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NSC-TS17025  
CALIBRATION 0394

Cert. No. : ACL23199  
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-62 / Microphone UC-59L / Preamplifier NH-26  
Serial No. : 00130355 / 02734 / 00389  
ID No. : UAE.EMA2.1022556

Condition As Found : GOOD

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT (UAE)  
81 SOI UDOMSUK 41, SUKHUMVIT ROAD,  
BANGCHAK SUB-DISTRICT,  
PHRAKHANONG DISTRICT, BANGKOK 10260  
THAILAND.

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

Received Date : 21 JUNE 2023  
Calibration Date : 26-27 JUNE 2023  
Date of Issue : 28 JUNE 2023

Calibrated by : Nathakorn Pisutpaisan

Approved by : T. Petch.  
( Thanakul Petchurai )

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## Continuation of Calibration Certificate

Cert. No. : ACL23199  
Job No. : VC66AC0067  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

## Calibration Method :

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

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

## Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL-BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL-BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL-BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KA1	34560495	AA-3002-23	14-FEB-24

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

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

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

## Continuation of Calibration Certificate

Cert. No. : ACL23199  
Job No. : VC66AC0067  
Pages : 3 of 8

## Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.4	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

Note : Pass/Fail evaluation for each parameter, will be considered together from the acceptance limit and the Maximum-permitted uncertainty of measurement.

## Continuation of Calibration Certificate

Cert. No. : ACL23199  
Job No. : VC66AC0067  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

Reference Acoustic Signal ( dB )	Measured Value ( dB )	Deviation ( dB )	Acceptance Limit ( dB )
93.9 (93.98)	94.0	0.0	±0.3

## 2. Self-generated noise

## 2.1 Normal test

Measured Value ( dB )
15.4

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

Frequency Weighting	Measured value ( dB )
A - weight	11.0
C - weight	15.7
Flat	24.8

## 3. Acoustical signal tests of frequency weightings

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

Frequency ( Hz )	Deviation from various frequency weighting response curve (dB)		
	Flat	C-weight	A-weight
125	0.1	0.1	0.1
1000	-0.1	-0.1	-0.1
8000	-0.7	-0.6	-0.6
+ 1.5, - 2.5			

## Continuation of Calibration Certificate

Cert. No. : ACL23199  
Job No. : VC66AC0067  
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
63	0.1	0.0	0.0
125	0.0	0.1	0.1
250	0.0	0.0	0.0
500	0.0	0.1	0.0
1000	0.0	0.0	0.0
2000	0.0	0.0	0.0
4000	0.0	0.0	0.0
8000	0.0	0.1	0.1
16000	0.0	-1.2	-1.2
+ 1.5, - 2.5			
+ 2.5, -16.0			

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

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

## 5.2 Time weighting at 1 kHz

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

## 6. Long - term stability

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

Continuation of Calibration Certificate

Cert. No. : ACL23199  
Job No. : VC66AC0067  
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.1	0.1	±0.8
136.0	136.1	0.1	±0.8
135.0	135.1	0.1	±0.8
134.0	134.1	0.1	±0.8
133.0	133.1	0.1	±0.8
132.0	132.1	0.1	±0.8
131.0	131.1	0.1	±0.8
129.0	129.1	0.1	±0.8
124.0	124.0	0.0	±0.8
119.0	119.0	0.0	±0.8
114.0	114.0	0.0	±0.8
109.0	109.0	0.0	±0.8
104.0	104.0	0.0	±0.8
99.0	99.0	0.0	±0.8
94.0	94.0	0.0	±0.8
89.0	89.0	0.0	±0.8
84.0	84.0	0.0	±0.8
79.0	79.0	0.0	±0.8
74.0	74.0	0.0	±0.8
69.0	69.0	0.0	±0.8
64.0	64.0	0.0	±0.8
59.0	59.0	0.0	±0.8
54.0	53.9	-0.1	±0.8
49.0	49.0	0.0	±0.8
44.0	44.0	0.0	±0.8
39.0	38.9	-0.1	±0.8
34.0	33.9	-0.1	±0.8
30.0	29.9	-0.1	±0.8
29.0	28.9	-0.1	±0.8
28.0	28.0	0.0	±0.8
27.0	26.9	-0.1	±0.8
26.0	25.9	-0.1	±0.8
25.0	25.0	0.0	±0.8

เอกสารไม่ควบคุม  
T. Koteh.

Continuation of Calibration Certificate

Cert. No. : ACL23199  
Job No. : VC66AC0067  
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±0.8

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	1.0 ; -3.0
	2	8	117.0	117.0	0.0	1.0 ; -1.5
	200	800	134.0	134.0	0.0	±0.5
Slow	2	8	108.0	108.0	0.0	1.0 ; -3.0
	200	800	127.6	127.6	0.0	±0.5
	0.25	1	99.0	98.8	-0.2	1.0 ; -3.0
SEL	2	8	108.0	108.0	0.0	1.0 ; -1.5
	200	800	128.0	128.0	0.0	±0.5

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lepeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±2.0
One	136.4	135.7	-0.7	±2.0

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	±1.0
Positive half cycle	135.4	135.2	-0.2	±1.0
Negative half cycle	135.4	135.1	-0.3	±1.0

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Continuation of Calibration Certificate

Cert. No. : ACL23199  
Job No. : VC66AC0067  
Pages : 8 of 8

11. Overload indication

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

12. High level stability

Frequency Weighting	SLM Display at initial ( dB )	SLM Display at final ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
	A - weight			
	137.0	137.0	0.0	±0.1

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

เอกสารไม่ควบคุม  
J. Lechn

Jiranatee Associates Co., Ltd.  
63/14-15, 67/15-16  
Pochaisarn 77/1, 84, Vithitarn, Bangkok, Thailand  
Bangkok 10600 (Thailand)  
Tel. +66286800312  
Mobile : +66863999453  
E-mail: jnac-calibration@jiranatee.com  
Web site: www.jiranatee.com

Accredited calibration laboratory  
ISO/IEC 17025:2017  
NSC-TIS-TIS 17025  
CALIBRATION 0367  
Flow measurement laboratory  
Calibration services department

CERTIFICATE OF CALIBRATION

Certificate No. : CL-011-65

MEASUREMENT ITEM : Top Load Orifice  
MANUFACTURER : TISCH  
MODEL/TYPE : TE-5025A  
SERIAL NUMBER : 3540  
ID NUMBER : UAE EFM.176/2561  
CONDITION AS-RECEIVED : Used item  
CUSTOMER : United Analyst and Engineering Consultant Co., Ltd.  
81 Soi Udomsuk 41, Sukhumvit Road, Bangkok, Phrakhanong, Bangkok 10260

RECEIVED DATE : 25 Oct 2022  
MEASUREMENT DATE : 31 Oct 2022  
ISSUE DATE : 02 Nov 2022

ENVIRONMENTAL CONDITIONS:

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

CALIBRATION CONDITION:

Preconditioning : 24 hours at ambient conditions.  
Measurement Condition : The average values during measurement are 24.5 °C and 61.0%RH.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

☒ Mr. Sorawit Thachalad  
☐ Miss Jitraporn Lertsomphol

Approved signatory:

Mr. Pajing Booncharoen  
Calibration Department Manager



Calibration procedure:  
The Orifice gas flow device was calibrated against Standard Rotary Displacement Meter (Roots Meter) Model G65/MC/M2-dp. The WH-CL-004 was used as a calibration guideline.

Traceability:

This certificate provides a traceability of the measurement to recognized the national standards, and to realization of the international system of units (SI) through the US (National Metrology Institute of Netherlands) via Certificate number: G7211901

Uncertainty of Measurement:

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

Table 1: The results of Q Standard calibration data

Plate	Flow rate m <sup>3</sup> /min	Pressure [Pa] mmHg	Temperature [T <sub>o</sub> ] °C	Temperature [T <sub>m</sub> ] °C	Δp_meter mmHg	Δp_orifice mmHg	γ	Standard Flow [Q <sub>s</sub> ] m <sup>3</sup> /min
1	0.702	758.204	24.560	23.900	57.190	1.568	1.252	0.650
2	0.999	758.182	24.620	24.010	60.852	3.088	1.756	0.919
3	1.119	758.204	24.550	23.960	40.965	4.167	2.041	1.060
4	1.169	758.228	24.540	24.060	30.007	4.728	2.174	1.124
5	1.419	758.202	24.720	24.250	28.776	7.044	2.652	1.366

Slope (m): 1.96180  
Intercept (b): -0.03332  
Correlation coefficient (r): 0.99914  
Uncertainty (k=2): 0.017 m<sup>3</sup>/min

Table 2: The results of Q actual calibration data

Plate	Flow rate m <sup>3</sup> /min	Pressure [Pa] mmHg	Temperature [T <sub>o</sub> ] °C	Temperature [T <sub>m</sub> ] °C	Δp_meter mmHg	Δp_orifice mmHg	γ	Standard Flow [Q <sub>s</sub> ] m <sup>3</sup> /min
1	0.702	758.204	24.560	23.900	57.190	1.568	0.785	0.651
2	0.999	758.182	24.620	24.010	60.852	3.088	1.101	0.920
3	1.119	758.204	24.550	23.960	40.965	4.167	1.279	1.060
4	1.169	758.228	24.540	24.060	30.007	4.728	1.362	1.124
5	1.419	758.202	24.720	24.250	28.776	7.044	1.664	1.368

Slope (m): 1.22877  
Intercept (b): -0.02091  
Correlation coefficient (r): 0.99914  
Uncertainty (k=2): 0.018 m<sup>3</sup>/min

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



เอกสารไม่ควบคุม

**MULTI-POINT GAS TEST REPORT**

Test Date : Nov 1, 2023

Equipment : Gas Analyzer (NO<sub>2</sub>) Model : 421  
Manufacturer : Thermo Scientific Serial Number : CW08130002

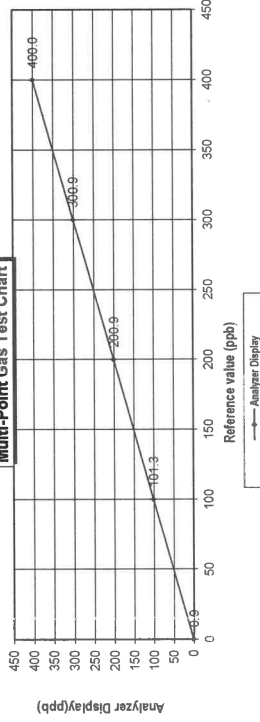
**Standard Gas Concentration**

Sulphur Dioxide (SO<sub>2</sub>) 44.68 PPM Manufacturer : Thermo Scientific  
Nitric Oxide (NO) 45.94 PPM Model : 1461  
Methane (CH<sub>4</sub>) - PPM Serial Number : 1180540071  
Carbon Monoxide (CO) 984.8 PPM  
Cylinder No. : EB0143262  
Expiration Date : Jun 21, 2024

**Multi-point gas test data**

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	% Error ]
Level 1	Zero	0.0	0.9	0.90	0.90
Level 2	20.00%	100.0	101.3	1.30	1.28
Level 3	40.00%	200.0	200.9	0.90	0.45
Level 4	60.00%	300.0	300.9	0.90	0.30
Level 5	80.00%	400.0	400.0	0.00	0.00
Remark : Measuring Range 500.0 ppb					0.59
: Acceptable Limit ± 5%					

**Multi-Point Gas Test Chart**



Calculate by

Signature: [Signature]

01 Nov 2023

Approve by

Signature: [Signature]

01 Nov 2023

เอกสารไม่ควบคุม

**MULTI-POINT GAS TEST REPORT**

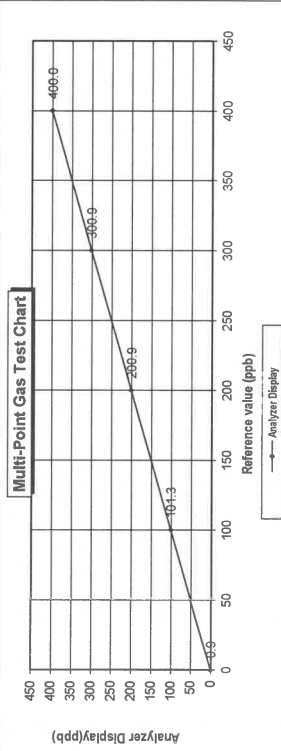
Test Date : Nov 1, 2023

Equipment : Gas Analyzer (NO<sub>2</sub>) Model : 421  
Manufacturer : Thermo Scientific Serial Number : CM08130002

Standard Gas Concentration		Dilutor Detail	
Sulphur Dioxide (SO <sub>2</sub> )	44.68	PPM	Manufacturer : Thermo Scientific
Nitric Oxide (NO)	45.94	PPM	Model : 1461
Methane (CH <sub>4</sub> )	-	PPM	Serial Number : 11805-40071
Carbon Monoxide (CO)	984.8		
Cylinder No. :	EB0143262		
Expiration Date :	Jun 21, 2024		

**Multi-point gas test data**

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error ]
Level 1 Zero 0.0	0.9	0.90	0.90	0.90
Level 2 20.00%	101.3	1.30	1.28	1.28
Level 3 40.00%	200.9	0.90	0.45	0.45
Level 4 60.00%	300.9	0.90	0.30	0.30
Level 5 80.00%	400.0	0.00	0.00	0.00
Remark : Measuring Range 500.0 ppb		Average Difference (%)		0.59
: Acceptable Limit ± 5%				



Calculate by  
Srinai S.  
01 Nov 2023

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Srinai S.  
01 Nov 2023

**MULTI-POINT GAS TEST REPORT**

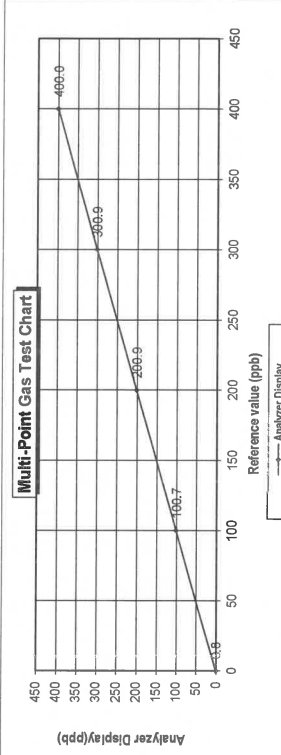
Test Date : Nov 13, 2023

Equipment : Gas Analyzer (NO<sub>2</sub>) Model : 421  
Manufacturer : Thermo Scientific Serial Number : CM19050148

Standard Gas Concentration		Dilutor Detail	
Sulphur Dioxide (SO <sub>2</sub> )	44.68	PPM	Manufacturer : Thermo Scientific
Nitric Oxide (NO)	45.94	PPM	Model : 1461
Methane (CH <sub>4</sub> )	-	PPM	Serial Number : 11805-40071
Carbon Monoxide (CO)	984.8		
Cylinder No. :	EB0143262		
Expiration Date :	Jun 21, 2024		

**Multi-point gas test data**

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error ]
Level 1 Zero 0.0	0.8	0.80	0.80	0.80
Level 2 20.00%	100.0	100.7	0.70	0.70
Level 3 40.00%	200.9	0.90	0.45	0.45
Level 4 60.00%	300.9	0.90	0.30	0.30
Level 5 80.00%	400.0	0.00	0.00	0.00
Remark : Measuring Range 500.0 ppb		Average Difference (%)		0.45
: Acceptable Limit ± 5%				



Calculate by  
Srinai S.  
13 Nov 2023

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Srinai S.  
13 Nov 2023

### MULTI-POINT GAS TEST REPORT

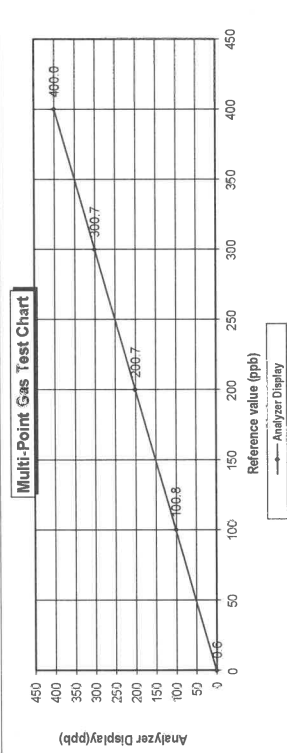
Test Date : Nov 1, 2023

Equipment : Gas Analyzer (NO<sub>2</sub>) Model : 42i  
Manufacturer : Thermo Scientific Serial Number : CH19050149

Standard Gas Concentration		Dilutor Detail	
Sulphur Dioxide (SO <sub>2</sub> )	44.68	PPM	Thermo Scientific
Nitric Oxide (NO)	45.94	PPM	146i
Methane (CH <sub>4</sub> )	-	PPM	1180540071
Carbon Monoxide (CO)	984.8		
Cylinder No. :	EB0143262		
Expiration Date :	Jun 21, 2024		

### Multi-point gas test data

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	% Error ]
Level 1 Zero	0.0	0.6	0.60	0.60
Level 2 20.00%	100.0	100.8	0.80	0.79
Level 3 40.00%	200.0	200.7	0.70	0.35
Level 4 60.00%	300.0	300.7	0.70	0.23
Level 5 80.00%	400.0	400.0	0.00	0.00
Remark : Measuring Range		500.0 ppb		0.40
		: Acceptable Limit $\pm$ 5%		



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01 Nov. 2023

01 Nov. 2023

### MULTI-POINT GAS TEST REPORT

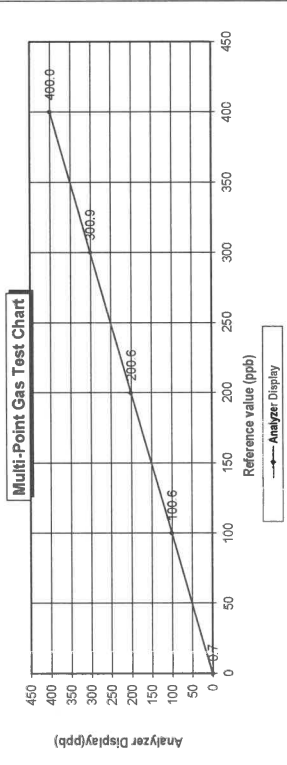
Test Date : Nov 1, 2023

Equipment : Gas Analyzer (NO<sub>2</sub>) Model : 42i  
Manufacturer : Thermo Scientific Serial Number : CW19050150

Standard Gas Concentration		Dilutor Detail	
Sulphur Dioxide (SO <sub>2</sub> )	44.68	PPM	Thermo Scientific
Nitric Oxide (NO)	45.94	PPM	146i
Methane (CH <sub>4</sub> )	-	PPM	1180540071
Carbon Monoxide (CO)	984.8		
Cylinder No. :	EB0143262		
Expiration Date :	Jun 21, 2024		

### Multi-point gas test data

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	% Error ]
Level 1 Zero	0.0	0.7	0.70	0.70
Level 2 20.00%	100.0	100.6	0.60	0.60
Level 3 40.00%	200.0	200.6	0.60	0.30
Level 4 60.00%	300.0	300.9	0.90	0.30
Level 5 80.00%	400.0	400.0	0.00	0.00
Remark : Measuring Range		500.0 ppb		0.38
		: Acceptable Limit $\pm$ 5%		



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01 Nov. 2023

01 Nov. 2023



**MULTI-POINT GAS TEST REPORT**

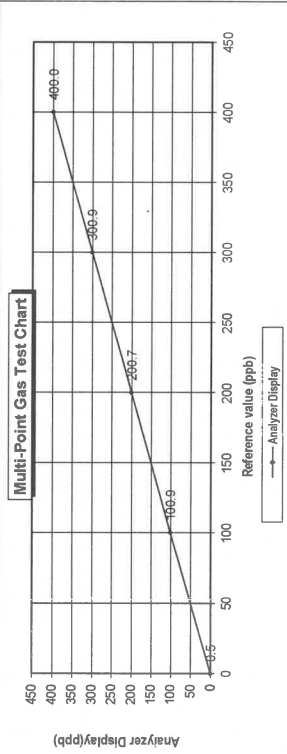
Test Date : Nov 7, 2023

Equipment : Gas Analyzer (NO<sub>2</sub>) Model : 421  
Manufacturer : Thermo Scientific Serial Number : GM22387035

**Standard Gas Concentration**  
Sulphur Dioxide (SO<sub>2</sub>) 44.68 PPM Manufacturer : Thermo Scientific  
Nitric Oxide (NO) 45.94 PPM Model : 1461  
Methane (CH<sub>4</sub>) - PPM Serial Number : 1180540071  
Carbon Monoxide (CO) 984.8 PPM  
Cylinder No. : EB0143262  
Expiration Date : Jun 21, 2024

**Multi-point gas test data**

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error ]
Level 1 Zero 0.0	0.5	0.50	0.50	0.50
Level 2 20.00%	100.9	0.90	0.89	0.89
Level 3 40.00%	200.7	0.70	0.35	0.35
Level 4 60.00%	300.9	0.90	0.30	0.30
Level 5 80.00%	400.0	0.00	0.00	0.00
Remark : Measuring Range 500.0 ppb		Average Difference (%)		0.41
		Acceptable Limit ± 5%		



Calculate by : *[Signature]*  
07 / Nov / 2023

Approve by : *[Signature]*  
08 / Nov / 2023

**MULTI-POINT GAS TEST REPORT**

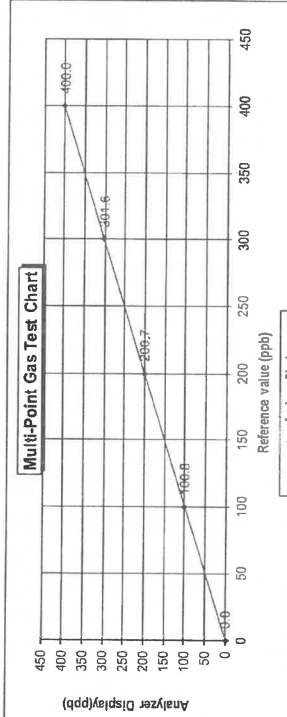
Test Date : May 3, 2023

Equipment : Gas Analyzer (SO<sub>2</sub>) Model : 431  
Manufacturer : Thermo Scientific Serial Number : 120178114

**Standard Gas Concentration**  
Sulphur Dioxide (SO<sub>2</sub>) 44.68 PPM Manufacturer : Thermo Scientific  
Nitric Oxide (NO) 45.94 PPM Model : 1461  
Methane (CH<sub>4</sub>) - PPM Serial Number : 1180540071  
Carbon Monoxide (CO) 984.8 PPM  
Cylinder No. : EB0143262  
Expiration Date : Jun 24, 2024

**Multi-point gas test data**

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error ]
Level 1 Zero 0.0	0.0	0.00	0.00	0.00
Level 2 20.00%	100.8	0.80	0.79	0.79
Level 3 40.00%	200.7	0.70	0.35	0.35
Level 4 60.00%	301.6	1.60	0.53	0.53
Level 5 80.00%	400.0	0.00	0.00	0.00
Remark : Measuring Range 500.0 ppb		Average Difference (%)		0.33
		Acceptable Limit ± 5%		



Calculate by : *[Signature]*  
3 / May / 2023

Approve by : *[Signature]*  
3 / May / 2023

**MULTI-POINT GAS TEST REPORT**

Test Date : Nov 3, 2023

Equipment : Gas Analyzer (SO<sub>2</sub>)  
Manufacturer : Thermo SCIENTIFIC

Model : 43i  
Serial Number : 1180540071

**Standard Gas Concentration**

Sulphur Dioxide (SO<sub>2</sub>) 44.68 PPM  
Nitric Oxide (NO) 45.94 PPM  
Methane (CH<sub>4</sub>) - PPM  
Carbon Monoxide (CO) 984.8 PPM  
Cylinder No. : EB0143262  
Expiration Date : Jun 24, 2024

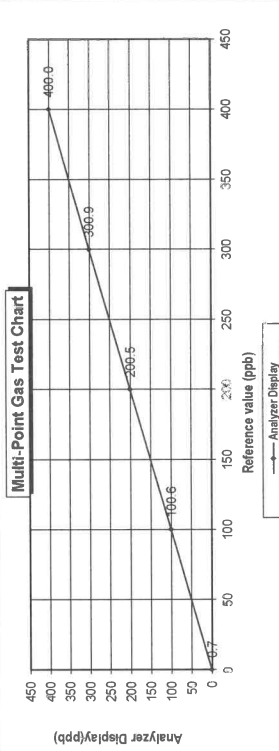
**Dilutor Detail**

Manufacturer : Thermo SCIENTIFIC  
Model : 146i  
Serial Number : 1180540071

**Multi-point gas test data**

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error ]
Zero	0.0	0.7	0.70	0.70	0.70
Level 1	100.0	100.6	0.60	0.60	0.60
Level 2	200.0	200.5	0.50	0.25	0.25
Level 3	300.0	300.9	0.90	0.30	0.30
Level 4	400.0	400.0	0.00	0.00	0.00
Level 5	500.0	500.0	0.00	0.00	0.00

Remark : Measuring Range 500.0 ppb  
Acceptable Limit  $\pm 5\%$



Calculate by

...03...../....Nov.../....2023

Approve by

...03...../....Nov.../....2023

**MULTI-POINT GAS TEST REPORT**

Test Date : Nov 3, 2023

Equipment : Gas Analyzer (SO<sub>2</sub>)  
Manufacturer : Thermo SCIENTIFIC

Model : 43i  
Serial Number : 1200906875

**Standard Gas Concentration**

Sulphur Dioxide (SO<sub>2</sub>) 44.68 PPM  
Nitric Oxide (NO) 45.94 PPM  
Methane (CH<sub>4</sub>) - PPM  
Carbon Monoxide (CO) 984.8 PPM  
Cylinder No. : EB0143262  
Expiration Date : Jun 24, 2024

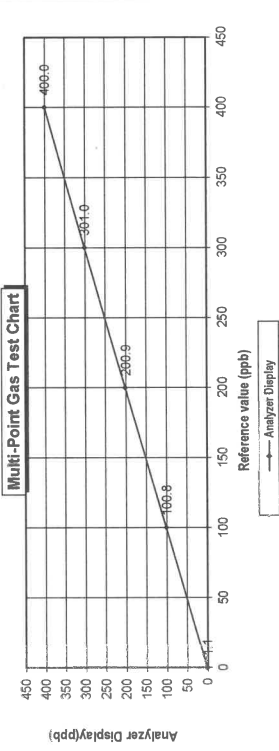
**Dilutor Detail**

Manufacturer : Thermo SCIENTIFIC  
Model : 146i  
Serial Number : 1180540071

**Multi-point gas test data**

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error ]
Zero	0.0	1.1	1.10	1.10	1.10
Level 1	100.0	100.8	0.80	0.79	0.79
Level 2	200.0	200.9	0.90	0.45	0.45
Level 3	300.0	301.0	1.00	0.33	0.33
Level 4	400.0	400.0	0.00	0.00	0.00
Level 5	500.0	500.0	0.00	0.00	0.00

Remark : Measuring Range 500.0 ppb  
Acceptable Limit  $\pm 5\%$



Calculate by

...03...../....Nov.../....2023

Approve by

...03...../....Nov.../....2023

**MULTI-POINT GAS TEST REPORT**

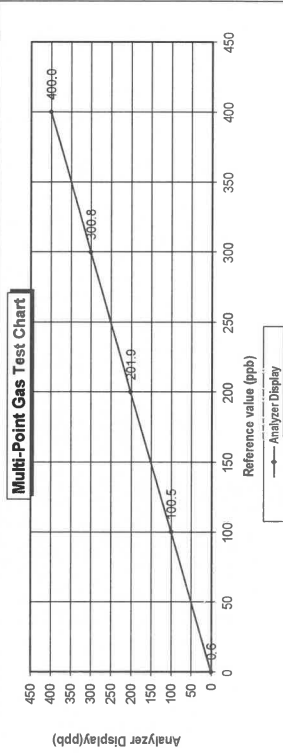
Test Date : Nov 9, 2023

Equipment :	Gas Analyzer (SO <sub>2</sub> )	Model :	43i
Manufacturer :	Thermo SCIENTIFIC	Serial Number :	1200906876

Standard Gas Concentration		Dilutor Detail	
Sulphur Dioxide (SO <sub>2</sub> )	44.68	PPM	Manufacturer :
Nitric Oxide (NO)	45.94	PPM	Model :
Methane (CH <sub>4</sub> )	-	PPM	Serial Number :
Carbon Monoxide (CO)	984.8		
Cylinder No. :	EB0143262		
Expiration Date :	Jun 24, 2024		

**Multi-point gas test data**

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error ]
Level 1 Zero	0.0	0.6	0.60	0.60
Level 2 20.00%	100.0	100.5	0.50	0.50
Level 3 40.00%	200.0	201.9	1.90	0.94
Level 4 60.00%	300.0	300.8	0.80	0.27
Level 5 80.00%	400.0	400.0	0.00	0.00
Remark : Measuring Range		500.0 ppb		
: Acceptable Limit $\pm$ 5%		Average Difference (%)		0.46



Calculate by  
Srinan C.  
9 Nov 2023

Approve by  
Srinan C.  
9 Nov 2023

**MULTI-POINT GAS TEST REPORT**

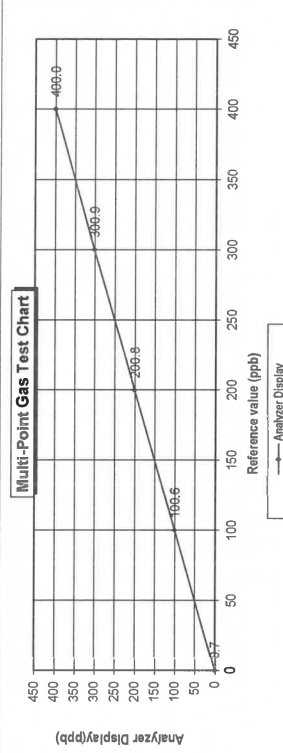
Test Date : Nov 9, 2023

Equipment :	Gas Analyzer (SO <sub>2</sub> )	Model :	43i
Manufacturer :	Thermo SCIENTIFIC	Serial Number :	1201778115

Standard Gas Concentration		Dilutor Detail	
Sulphur Dioxide (SO <sub>2</sub> )	44.68	PPM	Manufacturer :
Nitric Oxide (NO)	45.94	PPM	Model :
Methane (CH <sub>4</sub> )	-	PPM	Serial Number :
Carbon Monoxide (CO)	984.8		
Cylinder No. :	EB0143262		
Expiration Date :	Jun 24, 2024		

**Multi-point gas test data**

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error ]
Level 1 Zero	0.0	0.7	0.70	0.70
Level 2 20.00%	100.0	100.6	0.60	0.60
Level 3 40.00%	200.0	200.8	0.80	0.40
Level 4 60.00%	300.0	300.9	0.90	0.30
Level 5 80.00%	400.0	400.0	0.00	0.00
Remark : Measuring Range		500.0 ppb		
: Acceptable Limit $\pm$ 5%		Average Difference (%)		0.40



Calculate by  
Srinan C.  
9 Nov 2023

Approve by  
Srinan C.  
9 Nov 2023



Airgas Specialty Gases  
Airgas USA, LLC  
690 United Drive  
Durham, NC 27713  
Airgas.com

## CERTIFICATE OF ANALYSIS

### Grade of Product: EPA Protocol

Part Number: E04N199E15A01D3  
Cylinder Number: E80143252  
Laboratory: 124 - Durham (SAP) - NC  
PGVP Number: B22021  
Gas Code: CO, NO, NOX, SO2, BALN  
Reference Number: 122-402136167-1  
Cylinder Volume: 144.4 CF  
Cylinder Pressure: 2015 PSIG  
Valve Outlet: 680  
Certification Date: Jun 21, 2024  
Expiration Date: Jun 21, 2024

Certification performed in accordance with EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)\*, document EPA 800/R-12/031, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	45.00 PPM	45.98 PPM	G1	+/- 1.4% NIST Traceable	08/14/2021, 06/21/2021
NITRIC OXIDE	45.00 PPM	45.98 PPM	G1	+/- 1.4% NIST Traceable	08/14/2021, 06/21/2021
SULFUR DIOXIDE	45.00 PPM	44.68 PPM	G1	+/- 1.0% NIST Traceable	08/14/2021, 06/21/2021
CARBON MONOXIDE	1000 PPM	984.8 PPM	G1	+/- 0.7% NIST Traceable	08/14/2021
NITROGEN	Balance				
CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	20061120	CC708058	49.82 PPM NITRIC OXIDE/NITROGEN	+/- 1.0%	Feb 02, 2025
PRM	12386	D985025	9.91 PPM NITROGEN DIOXIDE/AIR	+/- 2.0%	Feb 20, 2020
GMIS	40142838102	CC605581	4.348 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.1	Feb 18, 2023
NTRM	18011043	CC475277	48.02 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Jun 17, 2022
NTRM	14080119	CC434277	990.9 PPM CARBON MONOXIDE/NITROGEN	+/-0.6%	Nov 15, 2025
The GMIS PRM or result noted above is only in reference to the GMIS used in the assay and not part of the analysis.					
ANALYTICAL EQUIPMENT					
Instrument/Make/Model	Last Multipoint Calibration				
Nicotel 6700 AHR0801333 CO	FTIR	Jun 03, 2021			
Nicotel 6700 AHR0801333 NO	FTIR	Jun 03, 2021			
Nicotel 6700 AHR0801333 NO2	FTIR	Jun 03, 2021			
Nicotel 6700 AHR0801333 SO2	FTIR	Jun 03, 2021			

Triad Data Available Upon Request

NOTES: PO #5221002807

GROSS WT: 28.40kg

NET WT: 4.73kg



CERT 3082.01

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The analytical test results reported on this certificate relate only to the cylinder number specified above. This concludes the test report.

Approved for Release



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## Certificate of Calibration

### WL-21 Wireless Anemometer

Scarlet Tech Ltd. hereby certifies that the WL-21 wireless anemometer listed below was thoroughly calibrated, tested and inspected following the standard calibration procedure (st-wl-21) and is within manufacturer's specification at the time when the calibration is done.

Client: Envir Service Co., Ltd.

Serial No.: 2205D0113

Calibration Date: 2022/9/14

Calibration Expiry Date: 2023/9/13

#### The Result of Calibration

Velocity			
Measured Value	Actual Value	Deviation	Result
1.0	1.0	0.0	Pass
2.1	2.0	0.1	Pass
5.1	5.0	0.1	Pass
7.0	7.0	0.0	Pass
10.2	10.0	0.2	Pass
19.8	20.0	0.2	Pass
Wind Direction			
Measured Value	Actual Value	Deviation	Result
45°	45°	0	Pass
136°	135°	1	Pass
227°	225°	2	Pass
316°	315°	1	Pass
358°	0°	2	Pass
Temperature			
Inspection Room Temp	Actual Value	Deviation	Result
22.5°C	22.5°C	0.0	Pass
Atmospheric Pressure			
Inspection	Actual Value	Deviation	Result
1005	1005	0	Pass

Environment conditions :

Air temperature: 22 °C  
Relative humidity: 55 %  
Static pressure: 102.2 kPa

Performed by:

Scarlet Tech Co., Ltd.  
Certified by Head of Engineering

This certificate may not be published or reproduced, except in full, unless obtaining permission in writing from Scarlet Tech Ltd.

4F-3, No. 347, 2nd Sec., Heping E. Rd., Daan Dist., Taipei City 106, Taiwan

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SCARLET | TECH

# Certificate of Calibration

## WL-21 Wireless Anemometer

Scarlet Tech Ltd. hereby certifies that the WL-21 wireless anemometer listed below was thoroughly calibrated, tested and inspected following the standard calibration procedure (st-wl-21) and is within manufacturer's specification at the time when the calibration is done.

Client: Envir Service Co., Ltd.

Serial No.: 2205DT0114

Calibration Date: 2022/9/14

Calibration Expiry Date: 2023/9/13

### The Result of Calibration

Velocity			
Measured Value(m/s)	Actual Value (m/s)	Deviation	Tolerance Result
1.0	1.0	0.0	0.9-1.1 Pass
1.9	2.0	0.1	1.8-2.2 Pass
5.1	5.0	0.1	4.7-5.3 Pass
7.0	7.0	0.0	6.0-8.0 Pass
10.1	10.0	0.1	9.5-10.5 Pass
19.6	20.0	0.4	19.0-21.0 Pass

Wind Direction			
Measured Value	Actual Value	Deviation	Tolerance Result
45°	45°	0	42-48 Pass
135°	135°	1	132-138 Pass
225°	225°	2	222-228 Pass
315°	315°	1	312-318 Pass
358°	0°	2	357-3 Pass

Inspection Room Temp	Actual Value	Deviation	Tolerance Result
22.5°C	22.5°C	0.0	21.5-23.5 Pass

Atmospheric Pressure Inspection	Actual Value	Deviation	Tolerance Result
1005	1005	0	1001-1019 Pass

### Environment conditions :

Air temperature: 22 °C  
Relative humidity: 55 %  
Static pressure: 102.2 kPa

Performed by:

*[Signature]*

Certified by Head of Calibration department



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