



CRYSTAL CALIBRATION SALES AND SERVICE CO., LTD.

45/48 Soi Salathammasop31, Salathammasop Rd.,

Salathammasop, Thawewatthana, Bangkok 10170 Thailand

Tel : 0-2408-8474-5 Fax : 0-2408-8477 Email : info@crystalcal.com www.crystalcal.com



CERTIFICATE OF CALIBRATION

Certificate No. : 23-1739-001

Issue Date : 25 December 2023

Work Order No. : 23/1739

Customer Name : Faculty of Science and Technology
Suan Sunandha Rajabhat University
1 U-Thong nok Road, Dusit, Bangkok 10300 Thailand

Date of Received : 22 December 2023

Date of Calibration : 22 December 2023

Instrument Details : Description : Temperature Controlled Enclosures [Hot Air Oven]
Manufacturer : memmert
Model : UN 55
Serial No. : B216.3645
ID No. : สส.07.99.05.0012/60
Resolution : 0.1 °C
Location : ห้อง 2424 อาคาร 24 คณะวิทยาศาสตร์และเทคโนโลยี

Calibration Method : This instrument was calibrated by insert standard thermometer into the chamber according to calibration procedure no. CWI-T-10 follow up to TLAS G-20-1/02-08 (E) : Guidelines for Calibration and Checks of Temperature Controlled Enclosures.

Environmental Conditions :

Temperature : Area Monitoring between 15°C to 40°C


Humidity : Area Monitoring between 30%RH to 85%RH

Line Voltage : Area Monitoring 220 VAC \pm 10%

Traceability of Measurement :

This certificate of calibration documents the traceability to national standard, which realize the unit of measurement according to the International system of Units (SI) and The temperature scale in use at this laboratory is The International Temperature scale of 1990.

Calibrated by : Mr. Kritsada Kaewwangpa
Calibration Engineer

Approved by : 
(Mr. Thichakorn Srisupob)
Asst. Laboratory Manager

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CERTIFICATE OF CALIBRATION

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Details of Calibration

1. Reference Standards Instrument

Instrument	Model	Serial No./Ins No.	Certificate No.	Due Date
Data Acquisition unit	34972A	MY49024826	23-1564-005	14 November 2024
Sensor type	RTD	CH # 101-109	23-1564-005	14 November 2024

2. Certificate traceable : This certificate traceable to The International System of Unit refer to
Crystal Calibration Sales and Service Co., Ltd. , NAC Calibration No. 0260
3. Condition of item : Used
4. Calibration site : On - Site
5. Result of Calibration : Without adjustment
6. Evaluate Condition : Time Constant : - Hour 33 Minute At cal. point 105 °C
Air vent : Off
Fan speed status : None Fan Speed
7. Calibration note : The results reported in this certificate refer to the condition of instrument on
the process into the steady state of chamber
8. Sensors Installation Diagram : When ; Sensor installation location in Chamber @ Working Space
A = Distance between sensor and wall of chamber is 5 cm
9. Dimensions of chamber : W = 0.4 m ; D = 0.336 m ; H = 0.4 m

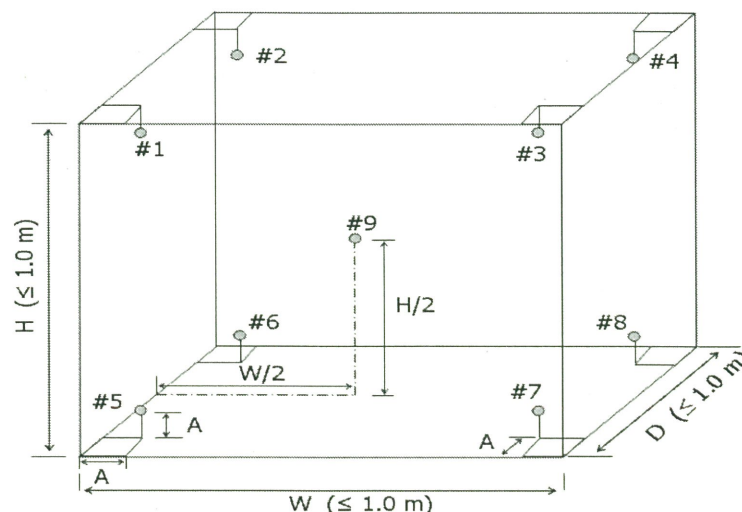


Diagram of Chamber



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Result of Temperature Distribution and Performance Check

Table1 : Reporting of Temperature Distribution

Calibration point (°C)	Average Measured Temperature (°C) @ Sensor No. (Sensor No.9 is REF)									Uncertainty ± (°C)
	#1	#2	#3	#4	#5	#6	#7	#8	#9	
105.0	105.71	105.69	105.66	105.64	105.41	105.86	105.29	105.40	106.03	0.40
150.0	150.08	149.94	149.94	149.83	149.55	150.19	149.39	149.51	150.61	0.65

Table 2 : Reporting of Performance check

Calibration Point (°C)	Indicator Set Point (°C)	Indicator Reading (°C)			Stability ± (°C)	Uniformity (°C)	Overall variation (°C)
		MAX	MIN	Average			
105.0	105.0	105.0	104.9	105.0	0.26	0.86	0.96
150.0	150.0	150.0	149.9	150.0	0.35	1.55	1.68

Note

Calibrate items it good condition and this report customer request and accepted in certificate

The reference sensor is preferably located of the geometric center of chamber

The measured temperature data readout by software "Benchlink Datalogger 3"

The quoted uncertainty include " Stability " and " Loading effect (20% of Temp Uniformity) "

Stability - one-half of the greatest maximum difference of measured temperatures at any one sensor.

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 throughtout observation time.

Indicating Temperature - the average reading of indicating device that forms the integral part of the enclosure.

This result of calibration was found accurate as shown on date and place of calibration only.

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%.



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CERTIFICATE OF CALIBRATION

Certificate No. : 23-1739-002

Issue Date : 25 December 2023

Work Order No. : 23/1739

Customer Name : Faculty of Science and Technology
Suan Sunandha Rajabhat University
1 U-Thong nok Road, Dusit, Bangkok 10300 Thailand

Date of Received : 22 December 2023

Date of Calibration : 22 December 2023

Instrument Details : Description : Electronic Balance
Manufacturer : METTLER TOLEDO
Model : ME204
Serial No. : B534348442
ID No. : สส.07.14.02.0003/59
Resolution : 0.0001 g
Capacity : 220 g
Location : ห้อง 26311 อาคาร 26 คณะวิทยาศาสตร์และเทคโนโลยี

Calibration Method : This calibration was conducted by using in-house method according to calibration procedure no. CWI-B-01 based on UKAS LAB14 edition 6, October 2019

Environmental Condition

Temperature : Maximum 25.1°C / Minimum 24.6°C
Humidity : Maximum 48%R.H. / Minimum 44%R.H.
Air Pressure : Maximum 1019.1hPa / Minimum 1018.9hPa

Traceability of Measurement

: This certificate of calibration documents the traceability to national standard, which realize the unit of measurement according to the International system of Units (SI)

Calibrated by : Mr. Kritsada Kaewwangpa
Calibration Engineer

Approved by : 
(Mr. Thichakorn Srisupob)
Technical Manager

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CERTIFICATE OF CALIBRATION

Issue Date : 25 December 2023

Certificate No. : 23-1739-002

Work Order No. : 23/1739

Details of Calibration

1. Reference Standards Instrument

Instrument	Capacity of Weight	Serial No. / ID No.	Certificate No.	Due date
Weight Set E2	1mg to 200g	B744909236	22-130801	6 December 2025

2. Certificate traceable : This certificate traceable to The International System of Unit refer to
Asia Medical and Agricultural Laboratory and Research center Co., Ltd. , NAC Calibration No.
0152

3. Condition of item : Used

4. Calibration site : On-site

Result of Calibration

1. Calibration result : Check performance before calibration

Applied Weight g	Balance Reading g	Correction Value g	Uncertainty (\pm) g	Coverage Factor (k)
100.0000	100.0000	0.0000	0.00019	2.00
200.0000	200.0000	0.0000	0.00032	2.00

2. The result of check performance in frist step has to Without Reset span

3. Calibration result : Without adjustment

3.1 Repeatability number of repeatability is 10 times

Norminal Value (g)	Standard Deviation of Reading (g)
100	0.0000422
200	0.0000422

This result of calibration was found accurate as shown on date and place of calibration only.

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%.



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CERTIFICATE OF CALIBRATION

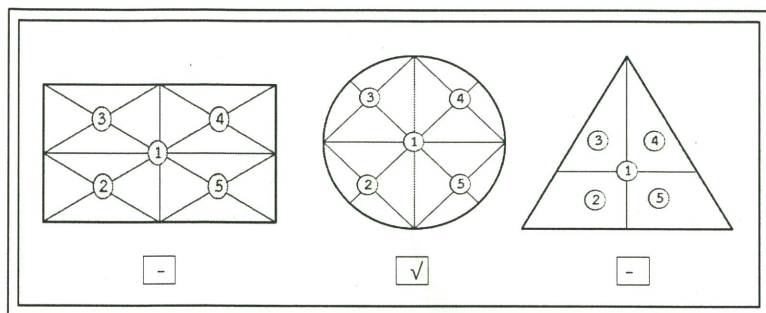
Issue Date : 25 December 2023

Certificate No. : 23-1739-002

Work Order No. : 23/1739

3. Calibration result : Without adjustment (continued)

3.2 Eccentric or Off-center Error A mass of 100 g was placed and moved to various position on pan.



Result of Eccentric Error		
Position 1	100.0000	g
Position 2	100.0001	g
Position 3	100.0000	g
Position 4	100.0000	g
Position 5	100.0001	g
(Maximum Difference)	0.0001	g

3.3 Departure of indication from nominal value

Applied Weight g	Balance Reading g	Correction Value g	Uncertainty (±) g	Coverage Factor (k)
Unload	0.0000	0.0000	0.00010	2.00
0.1000	0.1000	0.0000	0.00010	2.00
0.5000	0.5000	0.0000	0.00010	2.00
1.0000	1.0000	0.0000	0.00010	2.00
2.0000	2.0000	0.0000	0.00010	2.00
3.0000	3.0000	0.0000	0.00010	2.00
4.0000	4.0000	0.0000	0.00010	2.00
5.0000	5.0000	0.0000	0.00010	2.00
10.0000	10.0000	0.0000	0.00011	2.00
50.0000	50.0000	0.0000	0.00013	2.00
100.0000	100.0000	0.0000	0.00019	2.00
150.0000	150.0000	0.0000	0.00026	2.00
200.0000	200.0000	0.0000	0.00032	2.00

Note

Calibrate items it good condition and this report customer request and accepted in certificate

This result of calibration was found accurate as shown on date and place of calibration only.

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%.



JIRANATEE ASSOCIATES CO.,LTD.

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

Flow measurement laboratory
Calibration services department.



NSC – TISI – TIS 17025
CALIBRATION 0367

CERTIFICATE OF CALIBRATION

Certificate No. : CO-006-66

Page 1 of 2 Pages

MEASUREMENT ITEM : Top Load Orifice
MANUFACTURER : TISCH
MODEL/TYPE : TE-5025A
SERIAL NUMBER : 710725
ID NUMBER : -
CONDITION AS-RECEIVED : Used item
CUSTOMER : Pacific Laboratory Co., Ltd.
14/5358 Moo14, T.Bang Bua Thong, A.Bang Bua Thong,
Nonthaburi 11110, Thailand.

RECEIVED DATE : 08 Jun 2023
MEASUREMENT DATE : 13 Jun 2023
ISSUE DATE : 13 Jun 2023

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 24.3 °C and 57.1%RH.

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

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibration procedure:

The Orifice gas flow device was calibrated against Standard Rotary Displacement Meter (Roots Meter) Model G65/IMC/W2-dp. The WI-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 VSL (National Metrology Institute of Netherlands) via Certificate number: G2211901

Uncertainty of Measurement:

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

Calibrated by:

- ☐ Mr. Sorawit Thachalad
☒ Miss Jittraporn Lertsomphol



Approved signatory:

Mr. Parinya Booncharoen
Calibration Department Manager

MEASUREMENT RESULTS:

The Orifice gas flow device was calibrated by direct comparison method with the Standard Rotary Displacement Meter (Roots Meter). The Humid air was used as a medium in the system. The standard conditions are 25°C (298.15 K) and 760 mmHg for standard temperature and standard pressure respectively.

Table 1: The results of Q Standard calibration data

Plate	Flow rate m^3/min	Pressure [Pa] mmHg	Temperature [Ta] °C	Temperature [Tm] °C	Δp_{meter} mmHg	$\Delta p_{\text{Orifice}}$ inH ₂ O	γ	Standard Flow [Q_s] m^3/min
1	0.706	755.735	24.45	23.61	50.097	1.703	1.302	0.659
2	0.998	755.793	24.22	23.66	63.145	3.306	1.816	0.914
3	1.119	755.870	24.25	23.69	43.259	4.386	2.091	1.054
4	1.167	755.926	24.11	23.44	32.309	4.937	2.219	1.117
5	1.409	755.921	24.03	23.51	29.079	7.321	2.703	1.354

Slope (m): **2.01034**
 Intercept (b): **-0.02337**
 Correlation coefficient (r): **0.99984**
 Uncertainty ($k=2$): **0.015** m^3/min

Table 2: The results of Q actual calibration data

Plate	Flow rate m^3/min	Pressure [Pa] mmHg	Temperature [Ta] °C	Temperature [Tm] °C	Δp_{meter} mmHg	$\Delta p_{\text{Orifice}}$ inH ₂ O	γ	Standard Flow [Q_a] m^3/min
1	0.706	755.735	24.45	23.61	50.097	1.703	0.819	0.661
2	0.998	755.793	24.22	23.66	63.145	3.306	1.141	0.916
3	1.119	755.870	24.25	23.69	43.259	4.386	1.314	1.057
4	1.167	755.926	24.11	23.44	32.309	4.937	1.393	1.120
5	1.409	755.921	24.03	23.51	29.079	7.321	1.697	1.357

Slope (m): **1.25919**
 Intercept (b): **-0.01471**
 Correlation coefficient (r): **0.99983**
 Uncertainty ($k=2$): **0.015** m^3/min

End of Certificate of Calibration





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CALIBRATION 0367

Air speed measurement laboratory
Calibration services department.



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CALIBRATION 0367

Certificate Number

CWS-001-67

CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM : Cup anemometer
MANUFACTURER : Novalyntx
MODEL/TYPE : Sensor: WS-02F
Data logger: 200-WS-25LS
SERIAL NUMBER : Sensor: -
Data logger: A5548
ID NUMBER : -
CONDITION AS-RECEIVED : Used item
CUSTOMER : All Quip Co., Ltd.
84 Soi Petchkasem 74, Bangkhae-Nuea, Bangkhae,
Bangkok 10160, Thailand.

RECEIVED DATE : 25 Dec 2023
MEASUREMENT DATE : 03 Jan 2024
ISSUE DATE : 05 Jan 2024

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

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

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

CALIBRATION CONDITIONS : Wind tunnel cross-section area¹ 900 cm²
Wind direction frontal area² 100 cm²
Diameter of mounting pipe³ - mm
Blockage ratio of test object⁴ 0.111 [-]

Preconditioning : 24 hours at ambient conditions.
Measurement Condition : The average values during measurement are (23.5) °C, (53.2) %RH and (1015.5) hPa.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

- ☒ Mr. Sorawit Thachalad
☐ Miss Jittraporn Lertsomphol



Approved signatory:

Mr. Parinya Booncharoen
Calibration Department Manager

Remark:

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

MEASUREMENT RESULTS⁵

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

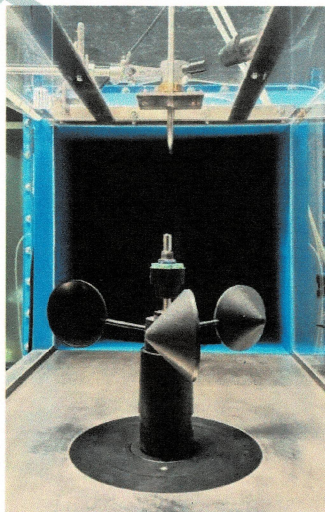
V_{std}^6 (m/s)	Temp. wind tunnel (°C)	Temp. room (°C)	V_{UUC}^7 (m/s)	Error (m/s)	$U (k=2)$ (m/s)
1.024	23.30	23.45	0.9	-0.1	0.31
2.054	23.60	23.45	1.9	-0.2	0.31
3.017	23.30	23.45	2.8	-0.2	0.31
4.170	23.30	23.45	3.9	-0.3	0.31
5.04	23.18	23.45	4.9	-0.1	0.31
6.00	23.40	23.45	5.9	-0.1	0.31
7.01	23.00	23.45	7.0	0.0	0.31
7.96	23.32	23.45	7.9	0.0	0.31
8.96	23.18	23.45	9.0	0.0	0.31
10.02	23.30	23.45	10.0	0.0	0.31
11.02	23.06	23.45	11.0	0.0	0.31
12.02	23.28	23.45	12.2	0.1	0.31
13.04	23.66	23.45	13.1	0.0	0.37
14.03	23.14	23.45	14.1	0.1	0.39
15.05	23.46	23.45	15.1	0.0	0.49
16.02	22.92	23.45	16.0	0.0	0.37

Remark:

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

⁶ Velocity of standard

⁷ Velocity of Unit Under Calibration

PHOTO OF CALIBRATION SET-UP

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

End of Certificate of Calibration

J
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JIRANATEE ASSOCIATES CO., LTD.



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Accredited calibration laboratory
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CALIBRATION 0367

Wind direction measurement laboratory
Calibration services department.



NSC – TISI – TIS 17025
CALIBRATION 0367

Certificate Number

CWD-001-67

CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM : Wind Direction Sensor
MANUFACTURER : Novalynx
MODEL/TYPE : Sensor: WS-02F
Data logger: 200-WS-25LS
SERIAL NUMBER : Sensor: -
Data logger: A5548
ID NUMBER : -
CONDITION AS-RECEIVED : Used item
CUSTOMER : All Quip Co., Ltd.
84 Soi Petchkasem74, Bangkhae-Nuea, Bangkhae,
Bangkok 10160, Thailand.

RECEIVED DATE : 25 Dec 2023
MEASUREMENT DATE : 03 Jan 2024
ISSUE DATE : 05 Jan 2024

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

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

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

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

Preconditioning : 24 hours at ambient conditions.
Measurement Condition : The average values during measurement are (24.2)°C, (43.5) %RH and (1014.8) hPa.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

- ☒ Mr. Sorawit Thachalad
☐ Miss Jitraporn Lertsomphol



Approved signatory:

Mr. Parinya Booncharoen
Calibration Department Manager

Remark:

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

MEASUREMENT RESULTS⁵

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

Air speed	D^6_{std}	D^7_{uuc}	Error	$U (k=2)$
m/s	Degree (°)	Degree (°)	Degree (°)	Degree (°)
5.04	45.000	43	-2	0.80
	90.000	90	0	0.80
	135.000	132	-3	0.80
	180.000	183	3	0.80
	225.000	229	4	0.80
	270.000	273	3	0.80
	315.000	317	2	0.80
	360.000	359	-1	0.80

Remark:

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

⁶ Direction of standard

⁷ Direction of Unit Under Calibration

End of Certificate of Calibration





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CALIBRATION 0367

Air speed measurement laboratory
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Certificate Number

CWS-002-67

CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM : Cup anemometer
MANUFACTURER : Novalynx
MODEL/TYPE : Sensor: WS-02F
Data logger: 200-WS-25LS
SERIAL NUMBER : Sensor: -
Data logger: A5549
ID NUMBER : -
CONDITION AS-RECEIVED : Used item
CUSTOMER : All Quip Co., Ltd.
84 Soi Petchkasem74, Bangkhae-Nuea, Bangkhae,
Bangkok 10160, Thailand.

RECEIVED DATE : 25 Dec 2023
MEASUREMENT DATE : 03 Jan 2024
ISSUE DATE : 05 Jan 2024

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

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

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

CALIBRATION CONDITIONS : Wind tunnel cross-section area¹ 900 cm²
Wind direction frontal area² 100 cm²
Diameter of mounting pipe³ - mm
Blockage ratio of test object⁴ 0.111 [-]

Preconditioning : 24 hours at ambient conditions.
Measurement Condition : The average values during measurement are (24.1) °C, (40.2) %RH and (1012.8) hPa.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

- ☒ Mr. Sorawit Thachalad
☐ Miss Jittraporn Lertsomphol



Approved signatory:

Mr. Parinya Booncharoen
Calibration Department Manager

Remark:

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

MEASUREMENT RESULTS⁵

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

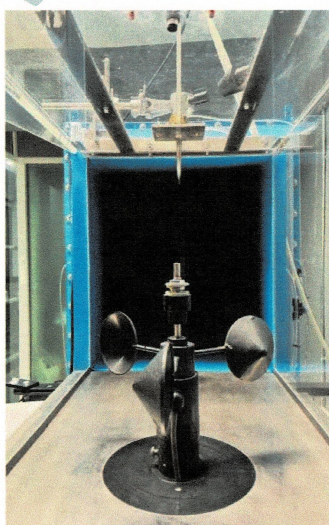
v_{std}^6 (m/s)	Temp. wind tunnel (°C)	Temp. room (°C)	v_{uuc}^7 (m/s)	Error (m/s)	$U (k=2)$ (m/s)
1.028	24.20	24.10	0.9	-0.1	0.31
2.089	24.24	24.10	1.8	-0.2	0.31
3.028	23.96	24.10	2.8	-0.2	0.31
4.187	24.02	24.10	3.9	-0.3	0.31
5.07	23.82	24.10	5.0	-0.1	0.31
5.99	24.40	24.10	6.0	0.0	0.31
7.01	23.80	24.10	7.0	0.0	0.31
7.95	24.24	24.10	8.0	0.0	0.31
8.97	23.80	24.10	9.0	0.0	0.31
10.03	24.10	24.10	10.1	0.0	0.31
11.03	23.90	24.10	11.0	0.0	0.31
12.02	23.96	24.10	12.1	0.1	0.31
13.02	23.88	24.10	13.1	0.1	0.31
14.02	23.84	24.10	14.1	0.1	0.33
15.02	23.80	24.10	15.1	0.1	0.31
16.00	23.78	24.10	16.1	0.1	0.33

Remark:

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

⁶ Velocity of standard

⁷ Velocity of Unit Under Calibration

PHOTO OF CALIBRATION SET-UP

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

End of Certificate of Calibration

NAC

JIRANATEE ASSOCIATES CO., LTD.



JIRANATEE ASSOCIATES CO.,LTD.

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

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

Wind direction measurement laboratory
Calibration services department.



NSC – TISI – TIS 17025
CALIBRATION 0367

Certificate Number

CWD-002-67

CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM : Wind Direction Sensor
MANUFACTURER : Novalynx
MODEL/TYPE : Sensor: WS-02F
Data logger: 200-WS-25LS
SERIAL NUMBER : Sensor: -
Data logger: A5549
ID NUMBER : -
CONDITION AS-RECEIVED : Used item
CUSTOMER : All Quip Co., Ltd.
84 Soi Petchkasem 74, Bangkhae-Nuea, Bangkhae,
Bangkok 10160, Thailand.

RECEIVED DATE : 25 Dec 2023
MEASUREMENT DATE : 03 Jan 2024
ISSUE DATE : 05 Jan 2024

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

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

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

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

Preconditioning : 24 hours at ambient conditions.
Measurement Condition : The average values during measurement are (24.0)°C, (48.5) %RH and (1009.7) hPa.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

- ☒ Mr. Sorawit Thachalad
☐ Miss Jitraporn Lertsomphol



Approved signatory:

Mr. Parinya Booncharoen
Calibration Department Manager

Remark:

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

MEASUREMENT RESULTS⁵

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

Air speed m/s	D^{std} Degree (°)	D^{uuc} Degree (°)	Error Degree (°)	$U (k=2)$ Degree (°)
5.04	45.000	42	-3	0.80
	90.000	88	-2	0.80
	135.000	133	-2	0.80
	180.000	179	-1	0.80
	225.000	226	1	0.80
	270.000	271	1	0.80
	315.000	318	3	0.80
	360.000	359	-1	0.80

Remark:

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

⁶ Direction of standard

⁷ Direction of Unit Under Calibration

End of Certificate of Calibration





JIRANATEE ASSOCIATES CO.,LTD.

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

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

Air speed measurement laboratory
Calibration services department.



NSC – TISI – TIS 17025
CALIBRATION 0367

Certificate Number

CWS-007-67

CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM : Cup anemometer
MANUFACTURER : Novalynx
MODEL/TYPE : Sensor: WS-02F
Data logger: 200-WS-25LB
SERIAL NUMBER : Sensor: -
Data logger: A5360
ID NUMBER : -
CONDITION AS-RECEIVED : Used item
CUSTOMER : All Quip Co., Ltd.
84 Soi Petchkasem 74, Bangkhae-Nuea, Bangkhae,
Bangkok 10160, Thailand.

RECEIVED DATE : 08 Feb 2024
MEASUREMENT DATE : 13 Feb 2024
ISSUE DATE : 13 Feb 2024

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

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

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

CALIBRATION CONDITIONS

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

Preconditioning : 24 hours at ambient conditions.
Measurement Condition : The average values during measurement are (23.6) °C, (51.3) %RH and (1018.7) hPa.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

- ☒ Mr. Sorawit Thachalad
☐ Miss Jitraporn Lertsomphol



Approved signatory:

Mr. Parinya Booncharoen
Calibration Department Manager

Remark:

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

MEASUREMENT RESULTS⁵

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

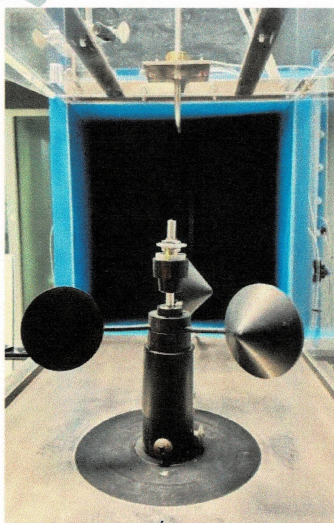
v_{std}^6 (m/s)	Temp. wind tunnel (°C)	Temp. room (°C)	v_{uuc}^7 (m/s)	Error (m/s)	$U (k=2)$ (m/s)
1.024	23.60	23.55	0.9	-0.1	0.31
2.047	23.58	23.55	1.9	-0.1	0.31
3.017	23.50	23.55	2.9	-0.1	0.31
4.172	23.52	23.55	4.0	-0.2	0.31
5.05	23.30	23.55	5.0	0.0	0.31
6.01	23.60	23.55	6.0	0.0	0.31
7.02	23.30	23.55	7.0	0.0	0.31
7.97	23.50	23.55	8.0	0.1	0.31
8.97	23.06	23.55	9.1	0.1	0.31
10.02	23.50	23.55	10.1	0.1	0.31
11.05	23.12	23.55	11.2	0.2	0.31
12.05	23.38	23.55	12.2	0.2	0.31
13.02	23.26	23.55	13.3	0.2	0.31
14.04	23.00	23.55	14.3	0.2	0.31
15.03	23.14	23.55	15.4	0.4	0.31
16.02	22.88	23.55	16.4	0.4	0.31

Remark:

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

⁶ Velocity of standard

⁷ Velocity of Unit Under Calibration

PHOTO OF CALIBRATION SET-UP

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

End of Certificate of Calibration

JIRANATEE ASSOCIATES CO., LTD.



JIRANATEE ASSOCIATES CO.,LTD.

Jiranatee Associates Co.,Ltd.
63/14-15, 67/35-36
Petchkasem 7,7/1, Rd. Watthapra, Bangkokyai,
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Web site: www.jiranatee.com

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

Wind direction measurement laboratory
Calibration services department.



NSC – TISI – TIS 17025
CALIBRATION 0367

Certificate Number

CWD-007-67

CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM : Wind Direction Sensor
MANUFACTURER : Novalynx
MODEL/TYPE : Sensor: WS-02F
Data logger: 200-WS-25LB
SERIAL NUMBER : Sensor: -
Data logger: A5360
ID NUMBER : -
CONDITION AS-RECEIVED : Used item
CUSTOMER : All Quip Co., Ltd.
84 Soi Petchkasem 74, Bangkhae-Nuea, Bangkhae,
Bangkok 10160, Thailand.

RECEIVED DATE : 08 Feb 2024
MEASUREMENT DATE : 13 Feb 2024
ISSUE DATE : 13 Feb 2024

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

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

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

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

Preconditioning : 24 hours at ambient conditions.
Measurement Condition : The average values during measurement are (23.7)°C, (52.1) %RH and (1016.5) hPa.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

- ☒ Mr. Sorawit Thachalad
☐ Miss Jitraporn Lertsomphol



Approved signatory:

Mr. Parinya Booncharoen
Calibration Department Manager

Remark:

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

MEASUREMENT RESULTS⁵

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

Air speed m/s	D^6_{std} Degree (°)	D^7_{uuc} Degree (°)	Error Degree (°)	$U (k=2)$ Degree (°)
5.03	45.000	41	-4	0.80
	90.000	87	-3	0.80
	135.000	132	-3	0.80
	180.000	181	1	0.80
	225.000	228	3	0.80
	270.000	274	4	0.80
	315.000	319	4	0.80
	360.000	359	-1	0.80

Remark:

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

⁶ Direction of standard

⁷ Direction of Unit Under Calibration

End of Certificate of Calibration





THAI METEOROLOGICAL DEPARTMENT

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

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 24 January, 2024

Certification No. 045/24

Page : 1 of 3

Object : Wind speed and wind direction

Manufacturer : Davis Instruments Inc.

Type : Weather Wizard III Product No. 7425

Serial No. : WC90601A48

Customer : Evergreen Consulting Co.,Ltd.
17/106 Moo 3, Sattahip, Sattahip,
Chonburi 20180 Thailand.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1012.2 hPa

NATIONAL STANDARD WIND TUNNEL :

: Thermal Anemometer 642 S/N 91563

: HOOK GAGE NO 1425 Pitot Tube Theodor Friedrichs Type 0800.0000 serial 9023

N.I.S.T. Test Reference Number 731/241460

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


Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION

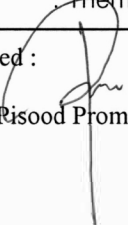
STANDARD THERMOMETER

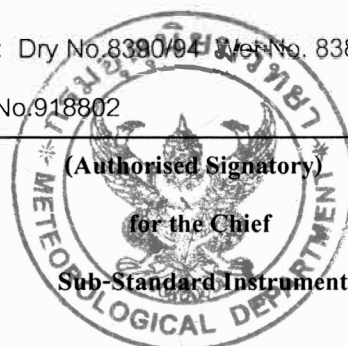
: Theodor Friedrich : Dry No. 8380/94 Wet No. 8389/94

: Thermoschneider No.918802

Calibrated by : 
Mr. Watcharapol Subwat

Mechanical Engineer

Signed : 
Mr. Pisood Promsut





THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 045/24

24 January, 2024

Page : 2 of 3

Standard Ultrasonic Anemometer m/sec	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure inches	Vacumm inches	Pressure hPa	Velocity m/sec	Correction m/sec
1.00	-	-	-	0.9	0.10
3.02	-	-	-	2.7	0.32
5.00	-	-	-	4.9	0.10
7.00	-	-	-	6.7	0.30
9.02	-	-	-	8.1	0.92
11.01	-	-	-	10.3	0.71
13.01	-	-	-	12.1	0.91
15.01	-	-	-	14.3	0.71
17.02	-	-	-	16.1	0.92
20.02	-	-	-	19.3	0.72

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

Calibrated by :

Watcharapol

Mr. Watcharapol Subwat

Mechanical Engineer





THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 045/24

24 January, 2024

Page : 3 of 3

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.1	44.8	0.3
30.4	30.2	0.2
15.6	15.4	0.2

Calibrated by :

Mr. Watchapol Subwat
Mechanical Engineer



Calibration Test

Calibrated Date: 19 July 2024

Certificate No. 020/24

Instruments Information

Manufacturer : YOUNG Instrument Type : four blade helicoid propeller
Model : 40C Serial Number : Logger 428007859

Environment : Temperature 25.5 °C Humidity: 51 %RH

NATIONAL STANDARD WIND TUNNEL : Thermal Anemometer 642 S/N 91563
: HOOK GAGE NO 1425 : Wind Aloft Plotting Board
N.I.S.T. Test Reference Number 731/241460
: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)
Serial Number 110730029 (sensor 120629586) JAPAN QUALITY ASSURANCE ORGANIZATION

Standard Ultrasonic Anemometer m/sec	HOOK GAGE NO 1425			TESTED ANEMOMETER			
	Pressure inches	Vacuum inches	Pressure hPa	Pressure hPa	Correction hPa	Velocity m/sec	Correction m/sec
1.00	-	-	-	-	-	0.9	0.1
3.02	-	-	-	-	-	2.9	0.12
5.04	-	-	-	-	-	4.8	0.24
7.03	-	-	-	-	-	6.8	0.23
9.01	-	-	-	-	-	8.7	0.31
11.03	-	-	-	-	-	10.7	0.33
13.01	-	-	-	-	-	12.5	0.51
15.03	-	-	-	-	-	14.4	0.63
17.05	-	-	-	-	-	16.5	0.55
20.02	-	-	-	-	-	19.3	0.72

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

Calibrate By :


MR. KITTISAK JANSANGWATTANA

Approve by :


MR. PASAGORN SAMOL

Calibration Test

Calibrated Date: 30 October 2024

Certificate No. 048/24

Instruments Information

Manufacturer : YOUNG Instrument

Type : four blade helicoid propeller

Model : 40C

Serial Number : Logger 35262528

Environment : Temperature 25.5 °C

Humidity: 51 %RH

NATIONAL STANDARD WIND TUNNEL

: Thermal Anemometer 642 S/N 91563

: HOOK GAGE NO 1425

: Wind Aloft Plotting Board

N.I.S.T. Test Reference Number 731/241460

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

Serial Number 110730029 (sensor 120629586) JAPAN QUALITY ASSURANCE ORGANIZATION

Standard Ultrasonic Anemometer m/sec	HOOK GAGE NO 1425			TESTED ANEMOMETER			
	Pressure inches	Vacuum inches	Pressure hPa	Pressure hPa	Correction hPa	Velocity m/sec	Correction m/sec
1.00	-	-	-	-	-	0.9	0.10
3.02	-	-	-	-	-	2.7	0.32
5.04	-	-	-	-	-	4.8	0.24
7.03	-	-	-	-	-	6.9	0.13
9.01	-	-	-	-	-	8.8	0.21
11.03	-	-	-	-	-	10.8	0.23
13.01	-	-	-	-	-	12.7	0.31
15.03	-	-	-	-	-	14.4	0.63
17.05	-	-	-	-	-	16.7	0.35
20.02	-	-	-	-	-	19.5	0.52

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

Calibrate By : 
MR. KITISAK JANSANGWATTANA

Approve by : 
MR. PASAGORN SAMOL

Calibration Test

Calibrated Date: 01 November 2024

Certificate No. 049/24

Instruments Information

Manufacturer : NRG Instrument

Type : 3 Cup Anemometer

Model : 40C

Serial Number : Logger 309012581

Environment : Temperature 25.5 °C

Humidity: 51 %RH

NATIONAL STANDARD WIND TUNNEL

: Thermal Anemometer 642 S/N 91563

: HOOK GAGE NO 1425

: Wind Aloft Plotting Board

N.I.S.T. Test Reference Number 731/241460

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

Serial Number 110730029 (sensor 120629586) JAPAN QUALITY ASSURANCE ORGANIZATION

Standard Ultrasonic Anemometer m/sec	HOOK GAGE NO 1425			TESTED ANEMOMETER			
	Pressure inches	Vacuum inches	Pressure hPa	Pressure hPa	Correction hPa	Velocity m/sec	Correction m/sec
1.00	-	-	-	-	-	0.9	0.10
3.02	-	-	-	-	-	3.0	0.03
5.04	-	-	-	-	-	4.9	0.16
7.03	-	-	-	-	-	6.9	0.13
9.01	-	-	-	-	-	8.9	0.11
11.03	-	-	-	-	-	10.9	0.13
13.01	-	-	-	-	-	12.7	0.31
15.03	-	-	-	-	-	14.4	0.63
17.05	-	-	-	-	-	16.8	0.25
20.02	-	-	-	-	-	19.3	0.72

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

Calibrate By : 

MR. KITTISAK JANSANGWATTANA

Approve by : 

MR. PASAGORN SAMOL

Calibration Test

Calibrated Date: 05 February 2024

Certificate No. 027/24

Instruments Information

Manufacturer : YOUNG Instrument

Type :

four blade helicoid propeller

Model : CR510

Serial Number :

Logger 4630

Environment : Temperature 25.5 °C

Humidity: 51 %RH

NATIONAL STANDARD WIND TUNNEL

: Thermal Anemometer 642 S/N 91563

: HOOK GAGE NO 1425

: Wind Aloft Plotting Board

N.I.S.T. Test Reference Number 731/241460

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

Serial Number 110730029 (sensor 120629586) JAPAN QUALITY ASSURANCE ORGANIZATION

Standard Ultrasonic Anemometer m/sec	HOOK GAGE NO 1425			TESTED ANEMOMETER			
	Pressure inches	Vacuum inches	Pressure hPa	Pressure hPa	Correction hPa	Velocity m/sec	Correction m/sec
1.00	-	-	-	-	-	0.8	0.20
3.02	-	-	-	-	-	2.8	0.22
5.04	-	-	-	-	-	4.9	0.14
7.03	-	-	-	-	-	6.8	0.23
9.01	-	-	-	-	-	8.8	0.21
11.03	-	-	-	-	-	10.7	0.33
13.01	-	-	-	-	-	12.6	0.41
15.03	-	-	-	-	-	14.4	0.63
17.05	-	-	-	-	-	16.5	0.55
20.02	-	-	-	-	-	19.3	0.72

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

Calibrate By : 

MR. KITTISAK JANSANGWATTANA

Approve by :



MR. PASAGORN SAMOL



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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, test and inspected following the standard calibration procedure (st-wl-21) and is within manufacture's specification at the time when the calibration is don

Client: Envir Service Co., Ltd.
Serial: 2122DR0059
Calibration Date: 2024/5/9
Calibration Expiry Date: 2025/5/8

The Result of Calibration

Measured Value (m/s)	Actual Value (m/s)	Velocity		Result
		Deviation	Tolerance	
1.0	1.0	0.0	0.9-1.1	Pass
1.9	2.0	0.1	1.8-2.2	Pass
4.9	5.0	0.1	4.7-5.3	Pass
7.0	7.0	0.0	6.0-8.0	Pass
10.0	10.0	0.0	9.5-10.5	Pass
19.6	20.0	0.4	19.0-21.0	Pass

Measured Value (m/s)	Actual Value (m/s)	Wind Direction		Result
		Deviation	Tolerance	
48°	47°	1	42-48	Pass
135°	135°	0	132-138	Pass
226°	225°	1	222-228	Pass
316°	315°	1	312-318	Pass
359°	0°	1	357-3	Pass

Inspection Room Temp	Actual Value	Deviation	Tolerance	Result
22.2°C	22.5	0.3	21.5-23.5	Pass

Atmospheric Pressure Inspection	Actual Value	Deviation	Tolerance	Result
1007	1005	2	1001-1019	Pass

Environment Conditions:

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

Performed by:

Certified by Head of Engineering Department



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Obtaining permission in writing from Scarlet Tech Ltd.
4F-3, No. 347, 2nd Sec., Heping E. Rd., Daan Dist. Taipei City 106, Taiwan



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, test and inspected following the standard calibration procedure (st-wl-21) and is within manufacture's specification at the time when the calibration is don

Client: Envir Service Co., Ltd.

Serial: 2112DR0071

Calibration Date: 2024/5/9

Calibration Expiry Date: 2025/5/8

The Result of Calibration

Measured Value (m/s)	Actual Value (m/s)	Velocity		Result
		Deviation	Tolerance	
1.0	1.0	0.0	0.9-1.1	Pass
1.9	2.0	0.1	1.8-2.2	Pass
4.9	5.0	0.1	4.7-5.3	Pass
7.0	7.0	0.0	6.0-8.0	Pass
10.0	10.0	0.0	9.5-10.5	Pass
19.6	20.0	0.4	19.0-21.0	Pass

Measured Value (m/s)	Actual Value (m/s)	Wind Direction		Result
		Deviation	Tolerance	
48°	47°	1	42-48	Pass
135°	135°	0	132-138	Pass
226°	225°	1	222-228	Pass
316°	315°	1	312-318	Pass
359°	0°	1	357-3	Pass

Inspection Room Temp	Actual Value	Deviation	Tolerance	Result
22.2°C	22.5	0.3	21.5-23.5	Pass

Atmospheric Pressure Inspection	Actual Value	Deviation	Tolerance	Result
1007	1005	2	1001-1019	Pass

Environment Conditions:

Air temperature: 22 °C

Relative humidity: 55 %

Static pressure: 102.2 kPa

Performed by:

Certified by Head of Engineering Department



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



ID LINE : IEC17025



Certificate of Calibration

Certificate Number : SPR24010043-1

Page : 1 of 3

Customer : Safety Lab Co., Ltd.

20 Soi Borommaratchachonnani 34, Taling Chan Sub-district, Taling
Chan District, Bangkok 10170 Thailand

Equipment Name : Sound Level Meter

Manufacturer : Pulsar

Model : 44

Serial Number : PN1923

ID. Number : N/A

Environmental Conditions

Ambient Temperature : $23^{\circ}\text{C} \pm 3^{\circ}\text{C}$

Received Date : 05 Jan 2024

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

Calibration Date : 08 Jan 2024

Location of Calibration : In-Lab

Recommend Due Date : 08 Jan 2025

Calibration Procedure : SP-CPE-04-01

Date of Issue : 09 Jan 2024

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs. The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by : Mr.Karoon Pengsalung

Calibration Officer

Approved by :

(Mr.Yodyaim Chansang)

Authorized Signatory



Certificate of Calibration

Certificate Number : SPR24010043-7

Page : 1 of 3

Customer : Safety Lab Co., Ltd.

20 Soi Borommaratchachonnani 34, Taling Chan Sub-district, Taling
Chan District, Bangkok 10170 Thailand

Equipment Name : Sound Calibrator

Manufacturer : PONPE

Model : ND09

Serial Number : N753415

ID. Number : N/A

Environmental Conditions

Ambient Temperature : $23^{\circ}\text{C} \pm 3^{\circ}\text{C}$

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

Location of Calibration : In-Lab

Calibration Procedure : In-House Method

Received Date : 05 Jan 2024

Calibration Date : 08 Jan 2024

Recommend Due Date : 08 Jan 2025

Date of Issue : 09 Jan 2024

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by : Mr.Karoon Pengsalung

Calibration Officer

Approved by :

(Mr.Yodyaim Chansang)

Authorized Signatory



Calibration Report

Certificate Number : SPR24010043-7

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Measuring Receiver	8902A	2950A02471	EF-0001-23	12 Jan 2024
AUDIO Analyzer	8903B	3011A09975	EL05303/23	14 Feb 2024

Traceability

This certification is traceable to the International System of Unit maintained at :

NIMT - The National Institute of Metrology, Thailand.

PCAL - Professional Calibration & Services Co.,Ltd



Result of Calibration

Certificate No. : SPR24010043-7

Page : 3 of 3

Function : Sound Level

UUC Setting (\pm dB)	Standard Reading (dB)	Error (dB)	Uncertainty (\pm dB)
94	93.9	0.10	1.5
114	114.0	0.00	1.5

Note:

The result of calibration was found accurate as show on date and place of calibration only.
This Certificate is not certified for any commercial transaction.

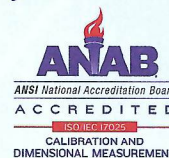
Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor $k = 2$, providing a level of confidence approximately 95%.

- End of Certificate -



ID LINE : IEC17025



Calibration Report

Certificate Number : SPR24010043-1

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	ST-120	211203773	EEL.BP. 114/0166	17 Jan 2024

Traceability

This certification is traceable to the International System of Unit maintained at :

TISTR - Thailand Institute of Scientific and Technological Research



ID LINE : IEC17025



Result of Calibration

Certificate No. : SPR24010043-1

Page : 3 of 3

Range : 94 to 114 dB

Function : @1kHz

Select A

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.1	94.1	0.1	0.1	0.15
114	114.3	114.3	0.3	0.3	0.15

Select C

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.1	94.1	0.1	0.1	0.15
114	114.3	114.3	0.3	0.3	0.15

Note:

The result of calibration was found accurate as show on date and place of calibration only.
This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor $k = 2.00$, providing a level of confidence approximately 95%.

- End of Certificate -