



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

Flow measurement laboratory  
Calibration services department.



NSC – TISI – TIS 17025  
CALIBRATION 0367

## CERTIFICATE OF CALIBRATION

Certificate No. : COF-014-66

Page 1 of 2 Pages

**MEASUREMENT ITEM** : Top Load Orifice  
**MANUFACTURER** : TISCH  
**MODEL/TYPE** : TE-5028  
**SERIAL NUMBER** : 3945  
**ID NUMBER** : TNP-F-CAL02  
**CONDITION AS-RECEIVED** : Used item  
**CUSTOMER** : TNP Environment Co., Ltd.  
332/173 Vision Smart Life Village, Bangrak Phatthana,  
Bang Bua Thong District, Nonthaburi 11110

**RECEIVED DATE** : 29 Sep 2023  
**MEASUREMENT DATE** : 01 Oct 2023  
**ISSUE DATE** : 01 Oct 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 25.1 °C and 57.0 %RH.

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

### TABULATION OF RESULTS:

The table on next page give the measured values.

### Calibration procedure:

The 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:

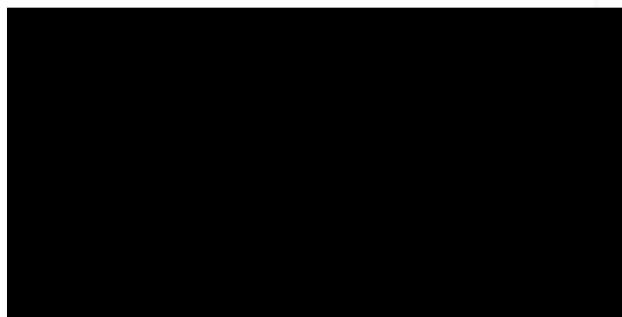
This certificate provides a traceability of The measurement to recognized the national standards, and to realization of the international system of units (SI) through the VSL (National Metrology Institute of Netherlands) via Certificate number: G2211901

### 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



**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 <sup>3</sup> /min	Pressure [Pa] mmHg	Temperature [Ta] °C	Temperature [Tm] °C	$\Delta p_{\text{meter}}$ mmHg	$\Delta p_{\text{Orifice}}$ inH <sub>2</sub> O	$\gamma$	Standard Flow [ $Q_s$ ] m <sup>3</sup> /min
1	0.705	755.985	24.95	23.76	68.702	1.098	1.045	0.641
2	1.005	756.073	24.81	23.66	53.939	2.343	1.527	0.933
3	1.122	756.065	24.44	23.62	48.579	2.981	1.724	1.050
4	1.166	756.080	24.33	23.58	46.771	3.229	1.794	1.093
5	1.421	756.160	24.48	23.64	34.286	4.973	2.226	1.356

Slope ( $m$ ): **1.65230**  
 Intercept ( $b$ ): **-0.01279**  
 Correlation coefficient ( $r$ ): **0.99984**  
 Uncertainty ( $k=2$ ): **0.015 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 [Ta] °C	Temperature [Tm] °C	$\Delta p_{\text{meter}}$ mmHg	$\Delta p_{\text{Orifice}}$ inH <sub>2</sub> O	$\gamma$	Standard Flow [ $Q_s$ ] m <sup>3</sup> /min
1	0.705	755.985	24.95	23.76	68.702	1.098	0.658	0.644
2	1.005	756.073	24.81	23.66	53.939	2.343	0.961	0.937
3	1.122	756.065	24.44	23.62	48.579	2.981	1.083	1.053
4	1.166	756.080	24.33	23.58	46.771	3.229	1.127	1.097
5	1.421	756.160	24.48	23.64	34.286	4.973	1.399	1.360

Slope ( $m$ ): **1.03492**  
 Intercept ( $b$ ): **-0.00806**  
 Correlation coefficient ( $r$ ): **0.99984**  
 Uncertainty ( $k = 2$ ): **0.015 m<sup>3</sup>/min**

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





## Certificate of Calibration

Certificate Number : SPR23070550-1

Page : 1 of 3

Customer : TNP ENVIRONMENT CO.,LTD.

332/173 Moo.3, Bang Rak Phatthana, Bang Bua Thong, Nonthaburi  
11110

Equipment Name : Sound Calibrator

Manufacturer : KEPLER

Model : KSM-42C

Serial Number : 160100568

ID. Number : TNP-F-CAL01

### Environmental Conditions

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

Received Date : 31 Jul 2023

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

Calibration Date : 02 Aug 2023

Location of Calibration : In-Lab

Recommend Due Date : 02 Aug 2024

Calibration Procedure : In-House Method

Date of Issue : 03 Aug 2023

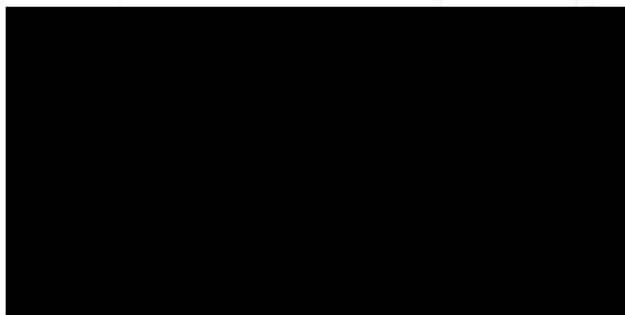
### Method of Calibration

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







## Calibration Report

Certificate Number : SPR23070550-1

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. : SPR23070550-1

Page : 3 of 3

Function : Sound Level

UUC Setting ( $\pm$ dB )	Standard Reading ( dB )	Error ( dB )	Uncertainty ( $\pm$ dB )
94	94.0	0.0	1.5
114	114.0	0.0	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  $k = 2.00$ , providing a level of confidence approximately 95%.

- End of Certificate -



## Certificate of Calibration

Certificate Number : SPR23060536-1

Page : 1 of 3

Customer : TNP ENVIRONMENT CO.,LTD.

332/173 Moo.3, Bang Rak Phatthana, Bang Bua Thong, Nonthaburi  
11110

Equipment Name : Sound Level Meter

Manufacturer : Scarlet Tech

Model : ST-25D

Serial Number : 10340942

ID. Number : TNP-F-S23

### 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 : SP-CPE-04-01

Received Date : 30 Jun 2023

Calibration Date : 11 Jul 2023

Recommend Due Date : 11 Jul 2024

Date of Issue : 12 Jul 2023

### 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 by the Metrology System (Thailand).

Calibrated by : Mr.Karoon Pengsalung

Calibration Officer

Authorized Signatory





## Calibration Report

Certificate Number : SPR23060536-1

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



## Result of Calibration

Certificate No. : SPR23060536-1

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	94.0	94.0	0.0	0.0	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	94.0	94.0	0.0	0.0	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 -





## Certificate of Calibration

Certificate Number : SPR23060536-3

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Customer : TNP ENVIRONMENT CO.,LTD.

332/173 Moo.3, Bang Rak Phatthana, Bang Bua Thong, Nonthaburi  
11110

Equipment Name : Sound Level Meter

Manufacturer : Scarlet Tech

Model : ST-25D

Serial Number : 10340945

ID. Number : TNP-F-S25

### 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 : SP-CPE-04-01

Received Date : 30 Jun 2023

Calibration Date : 11 Jul 2023

Recommend Due Date : 11 Jul 2024

Date of Issue : 12 Jul 2023

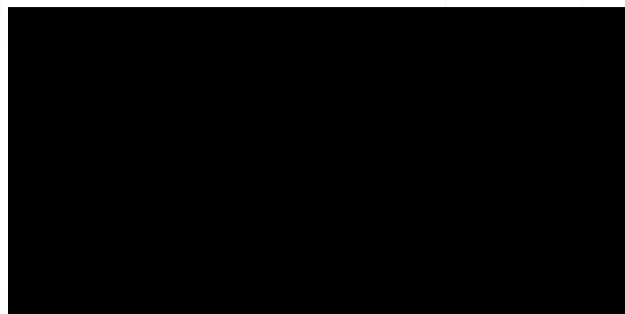
### Method of Calibration

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





## Calibration Report

Certificate Number : SPR23060536-3

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



## Result of Calibration

Certificate No. : SPR23060536-3

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	94.0	94.0	0.0	0.0	0.15
114	114.2	114.2	0.2	0.2	0.15

Select C

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty ( ± )
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	114.2	114.2	0.2	0.2	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 -





## Certificate of Calibration

Certificate Number : SPR23030201-1

Page : 1 of 3

Customer : TNP ENVIRONMENT CO.,LTD.

332/173 Moo.3, Bang Rak Phatthana, Bang Bua Thong, Nonthaburi  
11110

Equipment Name : Vibration Meter

Manufacturer : Instatel

Model : 721A3301/721A2601

Serial Number : UM15019/UM14102

ID. Number : TNP-F-V02

### Environmental Conditions

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

Received Date : 13 Mar 2023

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

Calibration Date : 20 Mar 2023

Location of Calibration : In-Lab

Recommend Due Date : 20 Mar 2024

Calibration Procedure : In-House Method

Date of Issue : 21 Mar 2023

### 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.

All calibrations are performed within manufacture's specifications. The calibration certificate shall not be reproduced except in full, without written approval of SP M

Calibrated by : Mr. Munin Khumpum

Calibration Officer



## Calibration Report

Certificate Number : SPR23030201-1

Page : 2 of 3

### Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Vibration Calibrator	VC-02	2007014	AV-0050-20	10 Dec 2023

### Traceability

This certification is traceable to the International System of Unit maintained at :  
NIMT - The National Institute of Metrology, Thailand.



## Result of Calibration

Certificate No. : SPR23030201-1

Page : 3 of 3

Results of Calibration : (\*) Without ( ) After Adjustment

Velocity Performance Test

Unit : mm/s<sub>pk</sub>

Frequency ( Hz )	STD Reading	UUC. Reading	Error	Uncertainty ( ± )
80.0	1.002	1.036	0.034	0.012
80.0	2.003	2.034	0.031	0.023
80.0	3.002	3.049	0.047	0.035
80.0	4.004	4.058	0.054	0.046
80.0	5.005	5.076	0.071	0.058
80.0	6.002	6.088	0.086	0.069
80.0	7.003	7.124	0.121	0.081
80.0	8.001	8.231	0.230	0.092
80.0	9.003	9.342	0.339	0.10
80.0	10.005	10.445	0.440	0.12

### 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 -





## Certificate of Calibration

Certificate Number : SPR23060536-2

Page : 1 of 3

Customer : TNP ENVIRONMENT CO.,LTD.

332/173 Moo.3, Bang Rak Phatthana, Bang Bua Thong, Nonthaburi  
11110

Equipment Name : Sound Level Meter

Manufacturer : Scarlet Tech

Model : ST-25D

Serial Number : 10340943

ID. Number : TNP-F-S26

### 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 : SP-CPE-04-01

Received Date : 30 Jun 2023

Calibration Date : 11 Jul 2023

Recommend Due Date : 11 Jul 2024

Date of Issue : 12 Jul 2023

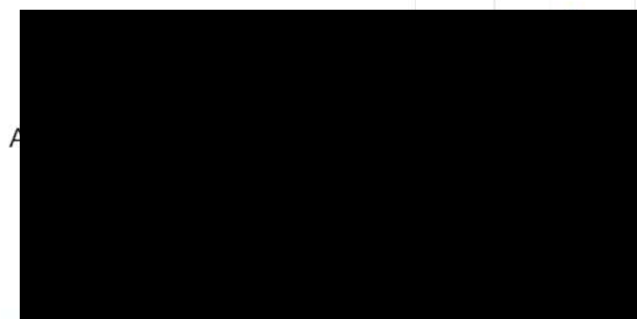
### Method of Calibration

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





## Calibration Report

Certificate Number : SPR23060536-2

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



## Result of Calibration

Certificate No. : SPR23060536-2

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	114.0	114.0	0.0	0.0	0.15

Select C

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty ( ± )
	Fast	Slow	Fast	Slow	
94	94.2	94.2	0.2	0.2	0.15
114	114.1	114.1	0.1	0.1	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 -