

Site Information

Location : TNP Environment Co.,Ltd. **Date** : 21-Nov-23
Serial : TNP-F-01-PM10 **Tech** : Mr.Nattachai Triprawat

Site Conditions

Barometric Pressure (mmHg)	: 760	Corrected Pressure (mmHg)	: 760
Temperature (deg C)	: 29	Temperature (deg K)	: 302
Average Press.(mmHg)	: 760	Corrected Average (mmHg)	: 760
Average Temp.(deg C)	: 29	Average Temp.(deg K)	: 302

Calibration Orifice

Make : Tish Environment **Slope** : 1.69297
Model : TE-5028A **Intercept** : -0.02707
Serial : 3945 **Calibration Due Date** : October 1, 2023

Calibration Data

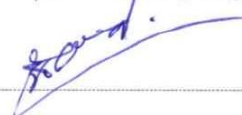
Plate or Test #	H2O (in)	Qa (m3/min)	I (Chart)	IC (Corrected)	Linear Regression
1	6.60	0.973	56.00	35.30	Slope : 40.6720
2	5.50	0.889	51.00	32.15	Intercept : -4.2291
3	4.60	0.815	46.00	29.00	Corr. Coeff : 0.9984
4	3.60	0.722	39.00	24.58	# of Observations : 5
5	2.40	0.593	34.00	20.17	

Calibrate By :



(Mr.Woharn Thongkiang)

Approved By :



(Mr.Nattachai Triprawat)

Site and Calibration Information

Location : TNP Environment Co.,Ltd.	Date : 14-Nov-23
Serial : TNP-F-01-TSP	Tech : Mr.Nattachai Triprawat

Site Conditions

Barometric Pressure (mmHg) : 759	Corrected Pressure (mmHg) : 759
Temperature (deg C) : 30	Temperature (deg K) : 303
Average Press.(mmHg) : 759	Corrected Average (mmHg) : 759
Average Temp.(deg C) : 30	Average Temp.(deg K) : 303

Calibration Orifice

Make : Tish Environment	Qstd Slope : 1.69297
Model : TE-5028A	Qstd Intercept : -0.02707
Serial : 3945	Date Certified : October 1, 2023

Calibration Information

Plate or Test #	H2O (In)	Qstd (m3/min)	I (Chart)	IC (Corrected)	Linear Regression	
1	7.20	1.587	56.00	56.49	Slope	: 34.84626
2	5.50	1.401	49.00	48.56	Intercept	: 0.434914
3	4.60	1.258	44.00	44.60	Corr. Coeff	: 0.9928
4	3.40	1.111	39.00	37.66	# of Observations	: 5
5	2.40	0.923	34.00	33.70		

Calibrate By :

(Mr.Woharn Thongkiang)

Approved By :

(Mr.Nattachai Triprawat)

Site Information

Location : TNP Environment Co.,Ltd. **Date** : 21-Nov-23
Serial : TNP-F-02-PM10 **Tech** : Mr.Nattachai Triprawat

Site Conditions

Barometric Pressure (mmHg) : 760 **Corrected Pressure (mmHg)** : 760
Temperature (deg C) : 29 **Temperature (deg K)** : 302
Average Press.(mmHg) : 760 **Corrected Average (mmHg)** : 760
Average Temp.(deg C) : 29 **Average Temp.(deg K)** : 302

Calibration Orifice

Make : Tish Environment **Slope** : 1.69297
Model : TE-5028A **Intercept** : -0.02707
Serial : 3945 **Calibration Due Date** : October 1, 2023

Calibration Data

Plate or Test #	H2O (in)	Qa (m3/min)	I (Chart)	IC (Corrected)	Linear Regression
1	7.20	1.001	57.00	35.93	Slope : 42.4302
2	5.70	0.905	52.00	32.78	Intercept : -6.4391
3	4.60	0.815	44.00	27.74	Corr. Coeff : 0.9910
4	3.80	0.742	38.00	23.95	# of Observations : 5
5	2.80	0.639	34.00	21.43	

Calibrate By :

(Mr.Woham Thongkhang)

Approved By :

(Mr.Nattachai Triprawat)

Site and Calibration Information

Location	: TNP Environment Co.,Ltd.	Date	: 14-Nov-23
Serial	: TNP-F-02-TSP	Tech	: Mr.Nattachai Triprawat

Site Conditions

Barometric Pressure (mmHg)	: 759	Corrected Pressure (mmHg)	: 759
Temperature (deg C)	: 30	Temperature (deg K)	: 303
Average Press.(mmHg)	: 759	Corrected Average (mmHg)	: 759
Average Temp.(deg C)	: 30	Average Temp.(deg K)	: 303

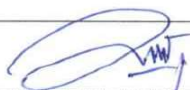
Calibration Orifice

Make	: Tish Environment	Qstd Slope	: 1.69297
Model	: TE-5028A	Qstd Intercept	: -0.02707
Serial	: 3945	Date Certified	: October 1, 2023

Calibration Information

Plate or	H2O	Qstd	I	IC	Linear Regression	
Test #	(in)	(m3/min)	(Chart)	(Corrected)	Slope	: 33.9984
1	7.30	1.598	59.00	57.48	Intercept	: 4.50629
2	5.60	1.401	54.00	53.52	Corr. Coeff	: 0.9908
3	4.50	1.258	49.00	47.57	# of Observations	: 5
4	3.40	1.095	43.00	42.62		
5	2.40	0.923	35.00	34.69		

Calibrate By :



(Mr.Woharn Thongkijiang)

Approved By :



(Mr.Nattachai Triprawat)



บริษัท เอ็นไวร์ เซอร์วิส จำกัด
ENVIR SERVICE CO., LTD.

บริษัท เอ็นไวร์ เซอร์วิส จำกัด

42 รามอินทรา 14 แยก 9 แขวงท่าแร้ง เขตบางเขน กรุงเทพฯ 10230 โทรศัพท์ 02-9435814-5 โทรสาร 02-9438201

42 Raminthra 14 yeak 9, Tha Rang, Bangkhen, Bangkok 10230 Tel : 02-9435814-5 Fax : 02-9438201

Analyzer Performance Test

Calibrated Date: 18 January 2022

Instruments Information

Analyzer Type: CO Analyzer Model: 48C	Manufacturer Thermo Environmental S/N: 48C-67713-358
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Calibration System

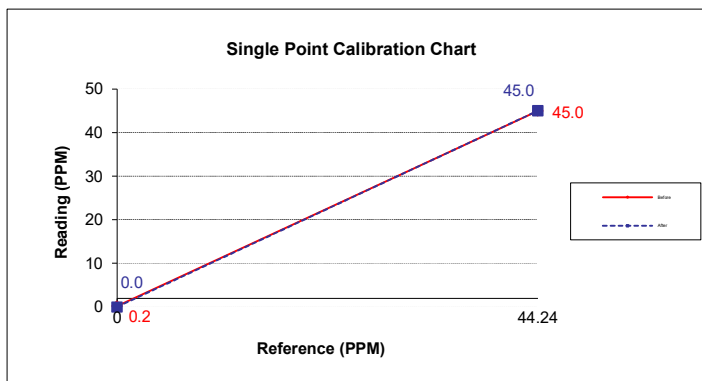
Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008 S/N: 705 ZERO AIR Generator API MODEL 701 S/N: 1924	NO Conc 55.47 PPM SO2 Conc 55.11 PPM CO Conc 4,535 PPM Cylinder number EB0129027 Expire Date: 29 Oct. 2027

Environment: Temperature 25.5 °C

Humidity: 51 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Before	0.0	0.2	0.2	44.2	45.0	1.7
After	0.0	0.0	0.0	45.0	45.0	0.0



Calibrate By :

Mr. PASAGORN SAMOL

Analyzer Performance Test

Calibrated Date: 17 September 2023

Instruments Information

Analyzer Type : CO Analyzer

Model : 48C

Manufacturer :

Thermo Environmental

Serial Number :

48C-79177-391

Calibrator Unit

Dilutor Model :

Dasibi Model 5008

Serial Number :

705

ZERO AIR Generator :

API MODEL 701

Serial Number :

1924

Standard Gas Concentration

Nitric Oxide (NO) 55.47 PPM

Sulphur Dioxide (SO₂) 55.11 PPM

Carbon Monoxide (CO) 4,535 PPM

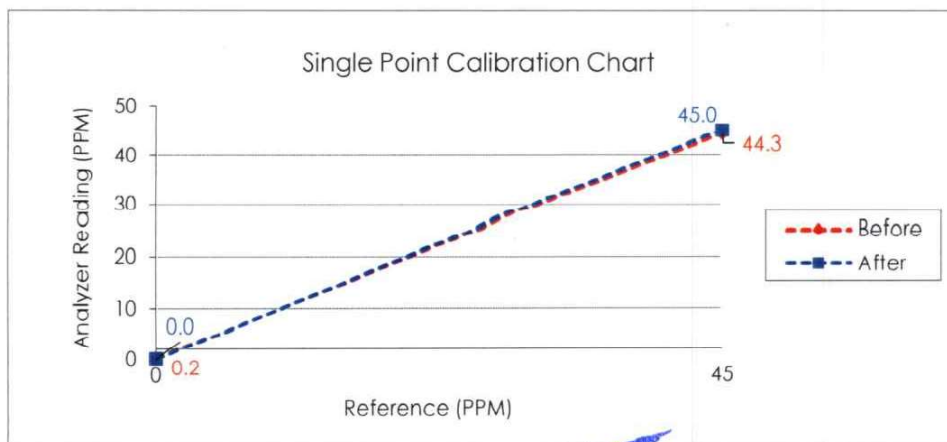
Cylinder number EB0129027

Expire Date: 29 Oct. 2027

Environment : Temperature 25.5 °C Humidity: 51 %RH

Calibration Report

	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Before	0.0	0.2	0.2	45.0	44.3	-1.6
After	0.0	0.0	0.0	45.0	45.0	0.0



Calibrate By :

MR. KITTISAK JANSANGWATTANA

Approve by :

MR. PASAGORN SAMOL

MR. KITTISAK JANSANGWATTANA

MR. PASAGORN SAMOL

ENVIR SERVICE CO., LTD.



บริษัท เอ็นไวร์ เซอร์วิส จำกัด

บริษัท เอ็นไวร์ เซอร์วิส จำกัด
ENVIR SERVICE CO., LTD.

42 รามอินทรา 14 แยก 9 แขวงท่าแร้ง เขตบางเขน กรุงเทพฯ 10230 โทรศัพท์ 02-9435814-5 โทรสาร 02-9438201

42 Raminthra 14 yeak 9, Tha Rang, Bangkhen, Bangkok 10230 Tel : 02-9435814-5 Fax : 02-9438201

Analyzer Performance Test

Calibrated Date: 20 January 2022

Instruments Information

Analyzer Type: NO/NO ₂ /NO _x Analyzer Model: 42C	Manufacturer: Thermo Environmental S/N: 42C-56817-311
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Calibration System

Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008 S/N: 705 ZERO AIR Generator API Model 701 S/N: 1924	NO Conc 55.47 PPM SO ₂ Conc 55.11 PPM CO Conc 4,535 PPM Cylinder number EB0129027 Expire Date: 29 Oct. 2027

Environment: Temperature 25.5 °C

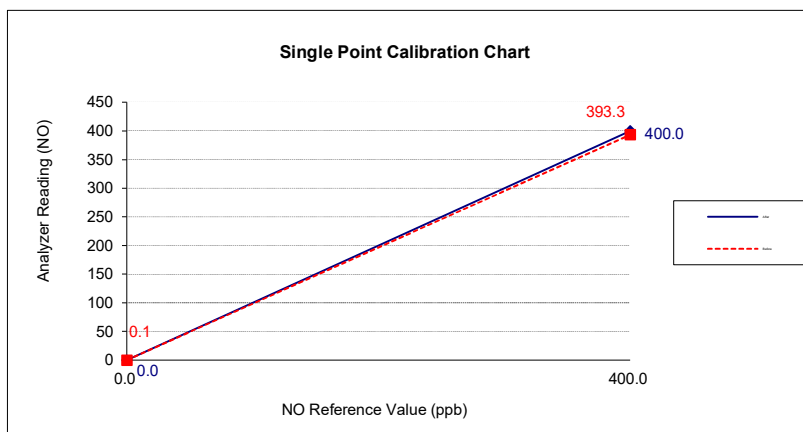
Humidity: 51 %RH

Calibration Check (Before adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.1	0.0	0.1	393.3	400.0	-1.7
NO _x	0.1	0.0	0.1	396.5	400.0	-0.9

Calibration Check (After adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.0	0.0	0.0	400.0	400.0	0.0
NO _x	0.0	0.0	0.0	400.0	400.0	0.0



Signature

Calibrate By : Mr. Pasagorn Samol

Analyzer Performance Test

Calibrated Date: 18 September 2023

Instruments Information

Analyzer Type : NO-NO₂-NO_x Analyzer

Manufacturer : Thermo Environmental

Model : 42C

Serial Number : 0413406269

Calibrator Unit

Dilutor Model : Dasibi Model 5008

Serial Number : 705

ZERO AIR Generator : API MODEL 701

Serial Number : 1924

Standard Gas Concentration

Nitric Oxide (NO) 55.47 PPM

Sulphur Dioxide (SO₂) 55.11 PPM

Carbon Monoxide (CO) 4,535 PPM

Cylinder number EB0129027

Expire Date: 29 Oct. 2027

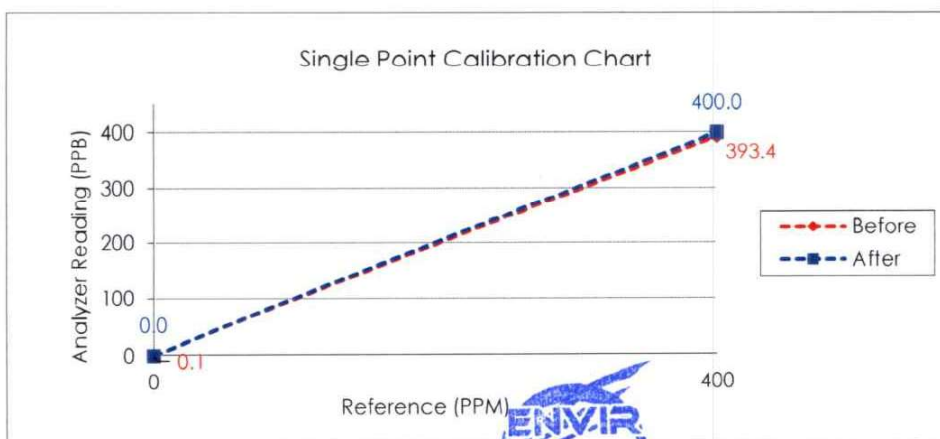
Environment : Temperature 25.5 °C Humidity: 51 %RH

Calibration Report (Before Adjust)

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
NO	0.0	0.1	0.1	400.0	393.4	-1.7
NO _x	0.0	0.0	0.0	400.0	394.6	-1.3

Calibration Report (After Adjust)

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
NO	0.0	0.1	0.1	400.0	400.0	0.0
NO _x	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By :

กิตติศักดิ์ จันทะเลววัฒนา

Approve by :

MR. PASAGORN SAMOL

MR. KITTISAK JANSANGWATTANA

บริษัท เอ็นไวร์ เซอร์วิส จำกัด
ENVIR SERVICE CO., LTD.

MR. PASAGORN SAMOL

Analyzer Performance Test

Calibrated Date: 31 October 2023

Instruments Information

Analyzer Type : SO2 Analyzer

Model : 43C

Manufacturer : Thermo Environmental

Serial Number : 0327402325

Calibrator Unit

Dilutor Model : Dasibi Model 5008

Serial Number : 705

ZERO AIR Generator : API MODEL 701

Serial Number : 1924

Standard Gas Concentration

Nitric Oxide (NO) 55.47 PPM

Sulphur Dioxide (SO2) 55.11 PPM

Carbon Monoxide (CO) 4,535 PPM

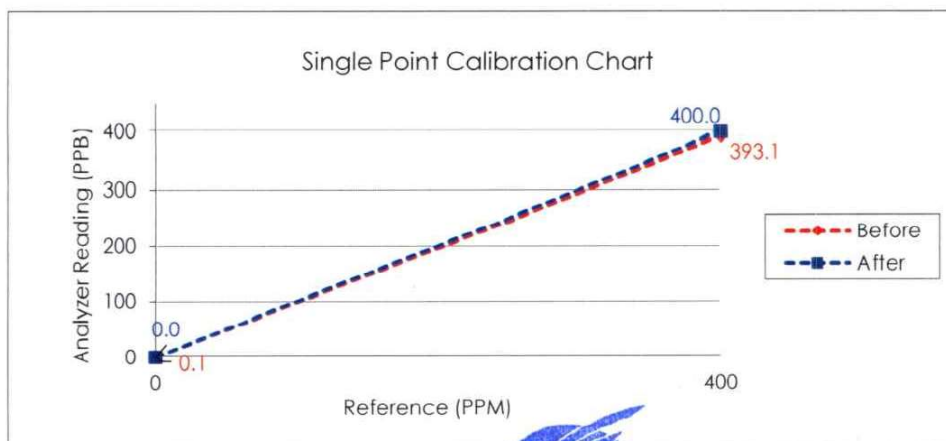
Cylinder number EB0129027

Expire Date: 29 Oct. 2027

Environment : Temperature 25.5 °C Humidity: 51 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
Before	0.0	0.1	0.1	400.0	393.1	-1.7
After	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By :

กิตติศักดิ์ จันทะเลววัฒนา

Approve by :

MR. PASAGORN SAMOL

MR. KITTISAK JANSANGWATTANA

ENVIR SERVICE CO., LTD.

MR. PASAGORN SAMOL

ENVIR SERVICE CO., LTD.

42 Ramintra 14 Yeak 9, Tha Raeng, Bang Khen, Bangkok 10230
Tel. 02-9435814-5 Fax. 02-9438201 www.envirservice.co.th

Analyzer Performance Test

Calibrated Date: 17 September 2023

Instruments Information

Analyzer Type : SO2 Analyzer

Model : 43C

Manufacturer : Thermo Environmental

Serial Number : 0411405899

Calibrator Unit

Dilutor Model : Dasibi Model 5008

Serial Number : 705

ZERO AIR Generator : API MODEL 701

Serial Number : 1924

Standard Gas Concentration

Nitric Oxide (NO) 55.47 PPM

Sulphur Dioxide (SO2) 55.11 PPM

Carbon Monoxide (CO) 4,535 PPM

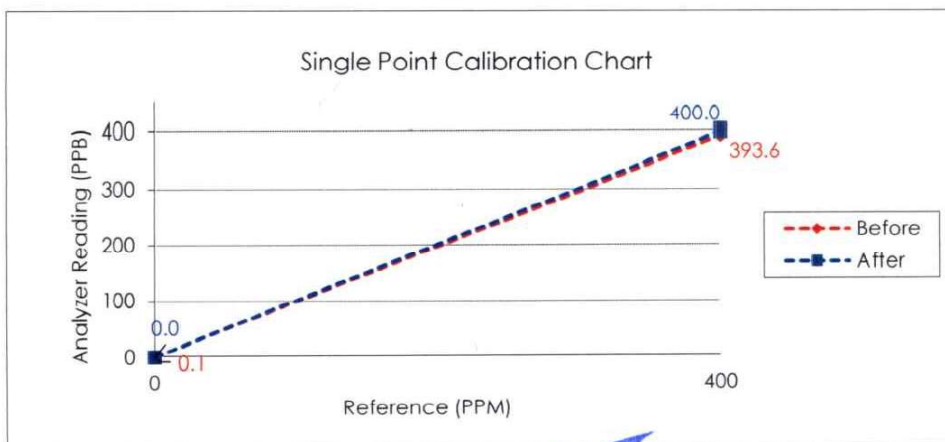
Cylinder number EB0129027

Expire Date: 29 Oct. 2027

Environment : Temperature 25.5 °C Humidity: 51 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
Before	0.0	0.1	0.1	400.0	393.6	-1.6
After	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By :

กิตติศักดิ์ จันทะเลววัฒน

MR. KITTISAK JANSANGWATTANA

Approve by :

MR. PASAGORN SAMOL

ENVIR SERVICE CO., LTD.

Analyzer Performance Test

Calibrated Date: 2023-Nov-1

Instruments Information

Analyzer Type : CH4-NMHC-THC Analyzer

Manufacturer : HORIBA

Model : APHA-360CE

Serial Number : 423740300209

Calibrator Unit

Dilutor Model : Dasibi Model 5008

Serial Number : 705

ZERO AIR Generator : API MODEL 701

Serial Number : 1924

Standard Gas Concentration

Methane (CH₄) 181.0 PPM

Propane 180.7 PPM

Cylinder number EB0123130

Expire Date: 3 Oct. 2027

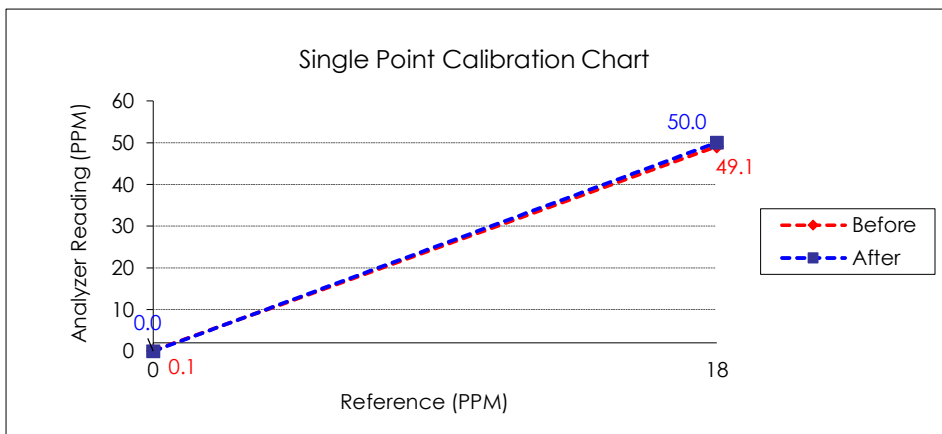
Environment : Temperature 25.5 °C Humidity: 51 %RH

Calibration Report (Before adjust)

Status	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Methane	0.0	0.1	0.1	50.0	49.1	-1.8
NMHC	0.0	0.1	0.1	50.0	48.9	-2.2

Calibration Report (After adjust)

Status	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Methane	0.0	0.0	0.0	50.0	50.0	0.0
NMHC	0.0	0.0	0.0	50.0	50.0	0.0



Calibrate By : 

MR. KITTISAK JANSANGWATTANA

Approve by : 

MR. PASAGORN SAMOL



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

Approved by :

(Mr.Nirut Loha)

Authorized Signatory



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 -



JIRANATEE ASSOCIATES CO.,LTD.

Jiranatee Associates Co.,Ltd.
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Petchkasem 7,7/1, Rd. Watthapra, Bangkokyai,
Bangkok 10600 (Thailand)
Tel: +6608680812
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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 Jitraporn 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	Y	Standard Flow [Q_s] m ³ /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 m³/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	Y	Standard Flow [Q_a] m ³ /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 m³/min

End of Certificate of Calibration





Certificate of Calibration

Certificate Number : SPR23060536-3

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 : 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

Approved by :

(Mr.Nirut Loha)

Authorized Signatory



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 : 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

Approved by :

(Mr.Nirut Loha)

Authorized Signatory



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 –



Certificate of Calibration

Certificate Number : SPR23010301-1

Page : 1 of 4

Customer : TNP ENVIRONMENT CO.,LTD.

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

Equipment Name : Vibration Meter

Manufacturer : Instantel

Model : 721A2501/721A2901

Serial Number : UM13538

ID. Number : TNP-F-V01

Environmental Conditions

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

Received Date : 23 Jan 2023

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

Calibration Date : 26 Jan 2023

Location of Calibration : In-Lab

Recommend Due Date : 26 Jan 2024

Calibration Procedure : In-House Method

Date of Issue : 27 Jan 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 Metrology System (Thailand).

Calibrated by : Mr. Munin Khumpum

Calibration Officer

Approved by :


(Mr. Prayoon Topart)

Authorized Signatory



Calibration Report

Certificate Number : SPR23010301-1

Page : 2 of 4

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. : SPR23010301-1

Page : 3 of 4

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

Geophone P/N 721A3301 Functional Performance Test @160Hz

Function	STD Reading	UUC. Reading	Error	Uncertainty (\pm)
Velocity (mm/s)	5.002	5.007	0.005	0.059

Frequency Response Performance Test @ 5 mm/s

Unit : mm/s

Frequency (Hz)	STD Reading	UUC. Reading	Error	Uncertainty (\pm)
10.0	5.006	5.015	0.009	0.058
20.0	5.005	5.012	0.007	0.058
50.0	5.004	5.009	0.005	0.058
80.0	5.003	5.011	0.008	0.058
100.0	5.003	5.009	0.006	0.058
160.0	5.004	5.011	0.007	0.058
200.0	5.005	5.012	0.007	0.058



Result of Calibration

Certificate No. : SPR23010301-1

Page : 4 of 4

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

Linearity Performance Test

Unit : m/s^2

Frequency (Hz)	STD Reading	UUC. Reading	Error	Uncertainty (\pm)
160.0	0.501	0.504	0.003	0.0060
160.0	1.001	1.003	0.002	0.012
160.0	1.502	1.508	0.006	0.017
160.0	2.001	2.008	0.007	0.023
160.0	3.002	3.011	0.009	0.035
160.0	5.001	5.011	0.010	0.058

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 -

Site Information

Location : TNP Environment Co.,Ltd. **Date** : 21-Nov-23
Serial : TNP-F-01-PM10 **Tech** : Mr.Nattachai Triprawat

Site Conditions

Barometric Pressure (mmHg)	: 760	Corrected Pressure (mmHg)	: 760
Temperature (deg C)	: 29	Temperature (deg K)	: 302
Average Press.(mmHg)	: 760	Corrected Average (mmHg)	: 760
Average Temp.(deg C)	: 29	Average Temp.(deg K)	: 302

Calibration Orifice

Make : Tish Environment **Slope** : 1.69297
Model : TE-5028A **Intercept** : -0.02707
Serial : 3945 **Calibration Due Date** : October 1, 2023

Calibration Data

Plate or Test #	H2O (in)	Qa (m3/min)	I (Chart)	IC (Corrected)	Linear Regression
1	6.60	0.973	56.00	35.30	Slope : 40.6720
2	5.50	0.889	51.00	32.15	Intercept : -4.2291
3	4.60	0.815	46.00	29.00	Corr. Coeff : 0.9984
4	3.60	0.722	39.00	24.58	# of Observations : 5
5	2.40	0.593	34.00	20.17	

Calibrate By :



(Mr.Woharn Thongkiang)

Approved By :



(Mr.Nattachai Triprawat)

Site and Calibration Information

Location : TNP Environment Co.,Ltd.	Date : 14-Nov-23
Serial : TNP-F-01-TSP	Tech : Mr.Nattachai Triprawat

Site Conditions

Barometric Pressure (mmHg) : 759	Corrected Pressure (mmHg) : 759
Temperature (deg C) : 30	Temperature (deg K) : 303
Average Press.(mmHg) : 759	Corrected Average (mmHg) : 759
Average Temp.(deg C) : 30	Average Temp.(deg K) : 303

Calibration Orifice

Make : Tish Environment	Qstd Slope : 1.69297
Model : TE-5028A	Qstd Intercept : -0.02707
Serial : 3945	Date Certified : October 1, 2023

Calibration Information

Plate or Test #	H2O (In)	Qstd (m3/min)	I (Chart)	IC (Corrected)	Linear Regression	
1	7.20	1.587	56.00	56.49	Slope	: 34.84626
2	5.50	1.401	49.00	48.56	Intercept	: 0.434914
3	4.60	1.258	44.00	44.60	Corr. Coeff	: 0.9928
4	3.40	1.111	39.00	37.66	# of Observations	: 5
5	2.40	0.923	34.00	33.70		

Calibrate By :

(Mr.Woharn Thongkhang)

Approved By :

(Mr.Nattachai Triprawat)

Site Information

Location : TNP Environment Co.,Ltd. **Date** : 21-Nov-23
Serial : TNP-F-02-PM10 **Tech** : Mr.Nattachai Triprawat

Site Conditions

Barometric Pressure (mmHg) : 760 **Corrected Pressure (mmHg)** : 760
Temperature (deg C) : 29 **Temperature (deg K)** : 302
Average Press.(mmHg) : 760 **Corrected Average (mmHg)** : 760
Average Temp.(deg C) : 29 **Average Temp.(deg K)** : 302

Calibration Orifice

Make : Tish Environment **Slope** : 1.69297
Model : TE-5028A **Intercept** : -0.02707
Serial : 3945 **Calibration Due Date** : October 1, 2023

Calibration Data

Plate or Test #	H2O (in)	Qa (m3/min)	I (Chart)	IC (Corrected)	Linear Regression
1	7.20	1.001	57.00	35.93	Slope : 42.4302
2	5.70	0.905	52.00	32.78	Intercept : -6.4391
3	4.60	0.815	44.00	27.74	Corr. Coeff : 0.9910
4	3.80	0.742	38.00	23.95	# of Observations : 5
5	2.80	0.639	34.00	21.43	

Calibrate By :

(Mr.Woham Thongkhang)

Approved By :

(Mr.Nattachai Triprawat)

Site and Calibration Information

Location :	TNP Environment Co.,Ltd.	Date :	14-Nov-23
Serial :	TNP-F-02-TSP	Tech :	Mr.Nattachai Triprawat

Site Conditions

Barometric Pressure (mmHg) :	759	Corrected Pressure (mmHg) :	759
Temperature (deg C) :	30	Temperature (deg K) :	303
Average Press.(mmHg) :	759	Corrected Average (mmHg) :	759
Average Temp.(deg C) :	30	Average Temp.(deg K) :	303

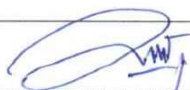
Calibration Orifice

Make :	Tish Environment	Qstd Slope :	1.69297
Model :	TE-5028A	Qstd Intercept :	-0.02707
Serial :	3945	Date Certified :	October 1, 2023

Calibration Information

Plate or	H2O	Qstd	I	IC	Linear Regression	
Test #	(in)	(m3/min)	(Chart)	(Corrected)	Slope	: 33.9984
1	7.30	1.598	59.00	57.48	Intercept	: 4.50629
2	5.60	1.401	54.00	53.52	Corr. Coeff	: 0.9908
3	4.50	1.258	49.00	47.57	# of Observations	: 5
4	3.40	1.095	43.00	42.62		
5	2.40	0.923	35.00	34.69		

Calibrate By :



(Mr.Woharn Thongkijiang)

Approved By :



(Mr.Nattachai Triprawat)



บริษัท เอ็นไวร์ เซอร์วิส จำกัด
ENVIR SERVICE CO., LTD.

บริษัท เอ็นไวร์ เซอร์วิส จำกัด

42 รามอินทรา 14 แยก 9 แขวงท่าแร้ง เขตบางเขน กรุงเทพฯ 10230 โทรศัพท์ 02-9435814-5 โทรสาร 02-9438201

42 Raminthra 14 yeak 9, Tha Rang, Bangkhen, Bangkok 10230 Tel : 02-9435814-5 Fax : 02-9438201

Analyzer Performance Test

Calibrated Date: 18 January 2022

Instruments Information

Analyzer Type: CO Analyzer Model: 48C	Manufacturer Thermo Environmental S/N: 48C-67713-358
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Calibration System

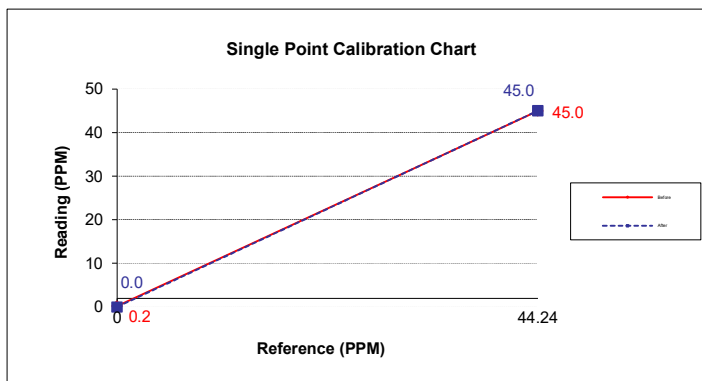
Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008 S/N: 705 ZERO AIR Generator API MODEL 701 S/N: 1924	NO Conc 55.47 PPM SO2 Conc 55.11 PPM CO Conc 4,535 PPM Cylinder number EB0129027 Expire Date: 29 Oct. 2027

Environment: Temperature 25.5 °C

Humidity: 51 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Before	0.0	0.2	0.2	44.2	45.0	1.7
After	0.0	0.0	0.0	45.0	45.0	0.0



Calibrate By :

Mr. PASAGORN SAMOL

Analyzer Performance Test

Calibrated Date: 17 September 2023

Instruments Information

Analyzer Type : CO Analyzer

Model : 48C

Manufacturer : Thermo Environmental

Serial Number : 48C-79177-391

Calibrator Unit

Dilutor Model : Dasibi Model 5008

Serial Number : 705

ZERO AIR Generator : API MODEL 701

Serial Number : 1924

Standard Gas Concentration

Nitric Oxide (NO) 55.47 PPM

Sulphur Dioxide (SO₂) 55.11 PPM

Carbon Monoxide (CO) 4,535 PPM

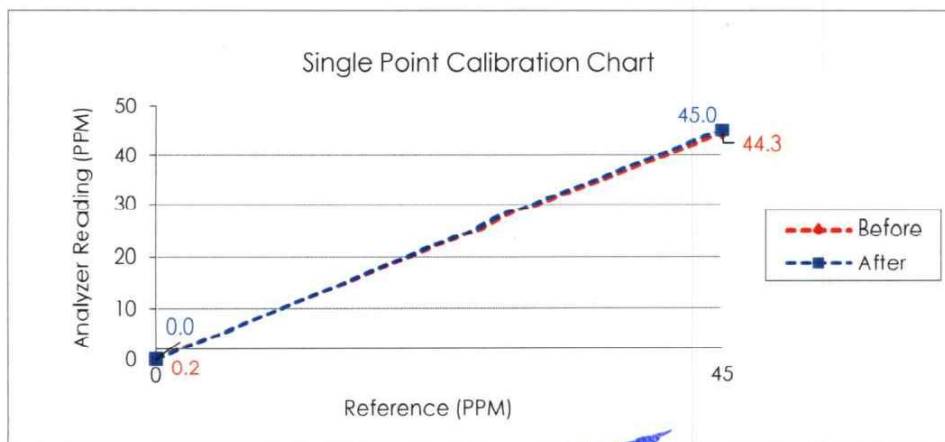
Cylinder number EB0129027

Expire Date: 29 Oct. 2027

Environment : Temperature 25.5 °C Humidity: 51 %RH

Calibration Report

	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Before	0.0	0.2	0.2	45.0	44.3	-1.6
After	0.0	0.0	0.0	45.0	45.0	0.0



Calibrate By : 

MR. KITTISAK JANSANGWATTANA

Approve by : 

MR. PASAGORN SAMOL

ENVIR SERVICE CO., LTD.



บริษัท เอ็นไวร์ เซอร์วิส จำกัด

บริษัท เอ็นไวร์ เซอร์วิส จำกัด
ENVIR SERVICE CO., LTD.

42 รามอินทรา 14 แยก 9 แขวงท่าแร้ง เขตบางเขน กรุงเทพฯ 10230 โทรศัพท์ 02-9435814-5 โทรสาร 02-9438201

42 Raminthra 14 yeak 9, Tha Rang, Bangkhen, Bangkok 10230 Tel : 02-9435814-5 Fax : 02-9438201

Analyzer Performance Test

Calibrated Date: 20 January 2022

Instruments Information

Analyzer Type: NO/NO ₂ /NO _x Analyzer Model: 42C	Manufacturer: Thermo Environmental S/N: 42C-56817-311
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Calibration System

Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008 S/N: 705 ZERO AIR Generator API Model 701 S/N: 1924	NO Conc 55.47 PPM SO ₂ Conc 55.11 PPM CO Conc 4,535 PPM Cylinder number EB0129027 Expire Date: 29 Oct. 2027

Environment: Temperature 25.5 °C

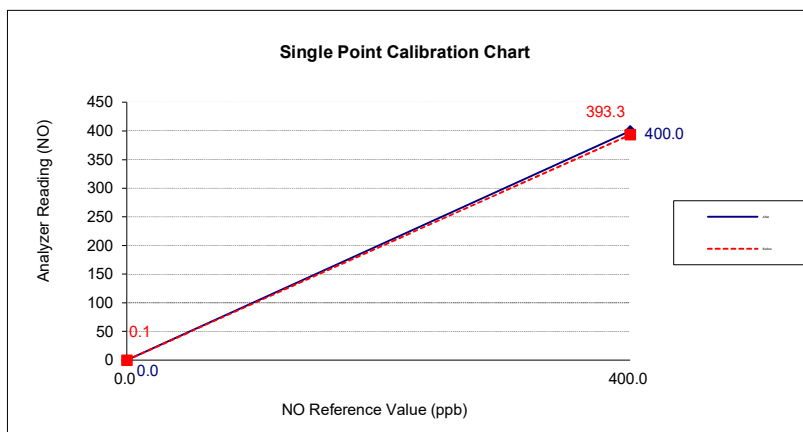
Humidity: 51 %RH

Calibration Check (Before adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.1	0.0	0.1	393.3	400.0	-1.7
NO _x	0.1	0.0	0.1	396.5	400.0	-0.9

Calibration Check (After adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.0	0.0	0.0	400.0	400.0	0.0
NO _x	0.0	0.0	0.0	400.0	400.0	0.0



Signature

Calibrate By : Mr. Pasagorn Samol

Analyzer Performance Test

Calibrated Date: 18 September 2023

Instruments Information

Analyzer Type : NO-NO₂-NO_x Analyzer

Manufacturer : Thermo Environmental

Model : 42C

Serial Number : 0413406269

Calibrator Unit

Dilutor Model : Dasibi Model 5008

Serial Number : 705

ZERO AIR Generator : API MODEL 701

Serial Number : 1924

Standard Gas Concentration

Nitric Oxide (NO) 55.47 PPM

Sulphur Dioxide (SO₂) 55.11 PPM

Carbon Monoxide (CO) 4,535 PPM

Cylinder number EB0129027

Expire Date: 29 Oct. 2027

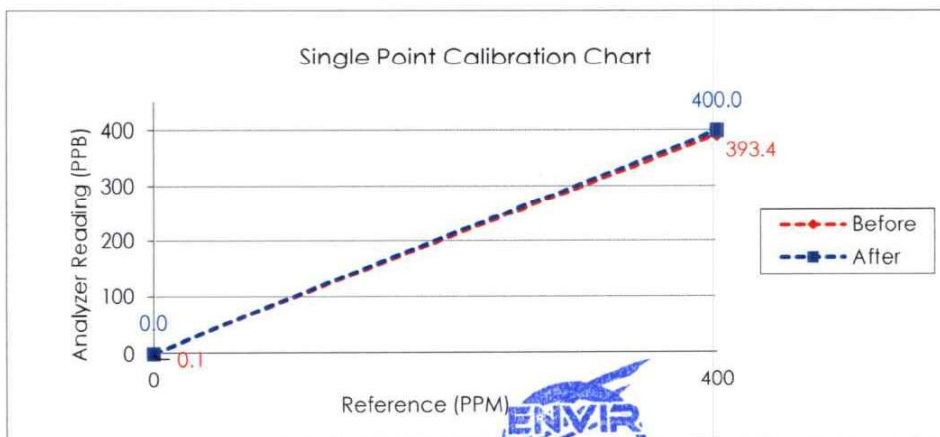
Environment : Temperature 25.5 °C Humidity: 51 %RH

Calibration Report (Before Adjust)

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
NO	0.0	0.1	0.1	400.0	393.4	-1.7
NO _x	0.0	0.0	0.0	400.0	394.6	-1.3

Calibration Report (After Adjust)

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
NO	0.0	0.1	0.1	400.0	400.0	0.0
NO _x	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By :

กิตติศักดิ์ จันทะเลววัฒนา

Approve by :

MR. PASAGORN SAMOL

MR. KITTISAK JANSANGWATTANA

บริษัท เอ็นไวร์ เซอร์วิส จำกัด
ENVIR SERVICE CO., LTD.

MR. PASAGORN SAMOL

Analyzer Performance Test

Calibrated Date: 31 October 2023

Instruments Information

Analyzer Type : SO2 Analyzer

Model : 43C

Manufacturer : Thermo Environmental

Serial Number : 0327402325

Calibrator Unit

Dilutor Model : Dasibi Model 5008

Serial Number : 705

ZERO AIR Generator : API MODEL 701

Serial Number : 1924

Standard Gas Concentration

Nitric Oxide (NO) 55.47 PPM

Sulphur Dioxide (SO2) 55.11 PPM

Carbon Monoxide (CO) 4,535 PPM

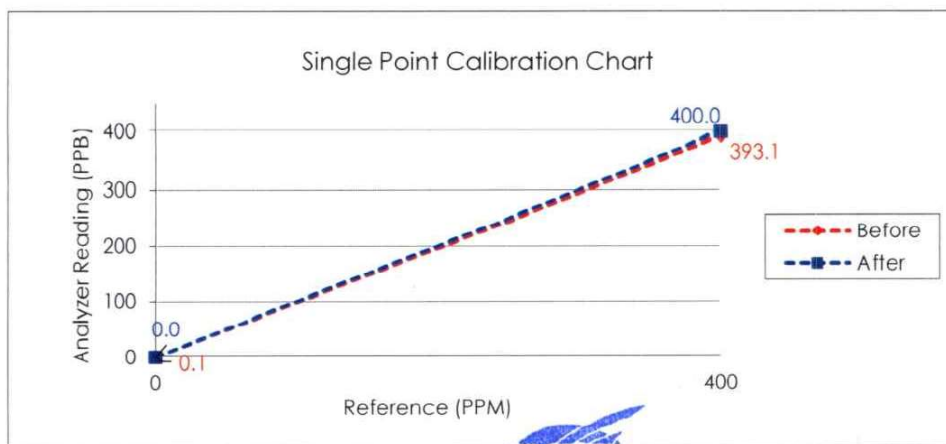
Cylinder number EB0129027

Expire Date: 29 Oct. 2027

Environment : Temperature 25.5 °C Humidity: 51 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
Before	0.0	0.1	0.1	400.0	393.1	-1.7
After	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By :

กิตติศักดิ์ จันทะเลวรวัฒนา

Approve by :

MR. PASAGORN SAMOL

MR. KITTISAK JANSANGWATTANA

ENVIR SERVICE CO., LTD.

MR. PASAGORN SAMOL

Analyzer Performance Test

Calibrated Date: 17 September 2023

Instruments Information

Analyzer Type : SO₂ Analyzer

Model : 43C

Manufacturer :

Thermo Environmental

Serial Number :

0411405899

Calibrator Unit

Dilutor Model :

Dasibi Model 5008

Serial Number :

705

ZERO AIR Generator :

API MODEL 701

Serial Number :

1924

Standard Gas Concentration

Nitric Oxide (NO) 55.47 PPM

Sulphur Dioxide (SO₂) 55.11 PPM

Carbon Monoxide (CO) 4,535 PPM

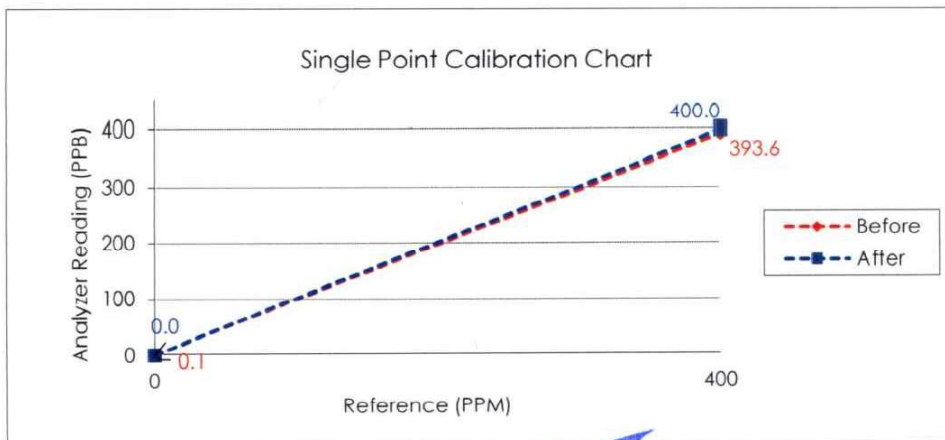
Cylinder number EB0129027

Expire Date: 29 Oct. 2027

Environment : Temperature 25.5 °C Humidity: 51 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
Before	0.0	0.1	0.1	400.0	393.6	-1.6
After	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By :

กิตติศักดิ์ จันทะวงษ์วัฒนา



Approve by :

MR. PASAGORN SAMOL

MR. KITTISAK JANSANGWATTANA บริษัท เอ็นไวร์ เซอร์วิส จำกัด

ENVIR SERVICE CO., LTD

Analyzer Performance Test

Calibrated Date: 2023-Nov-1

Instruments Information

Analyzer Type : CH4-NMHC-THC Analyzer

Manufacturer : HORIBA

Model : APHA-360CE

Serial Number : 423740300209

Calibrator Unit

Dilutor Model : Dasibi Model 5008

Serial Number : 705

ZERO AIR Generator : API MODEL 701

Serial Number : 1924

Standard Gas Concentration

Methane (CH₄) 181.0 PPM

Propane 180.7 PPM

Cylinder number EB0123130

Expire Date: 3 Oct. 2027

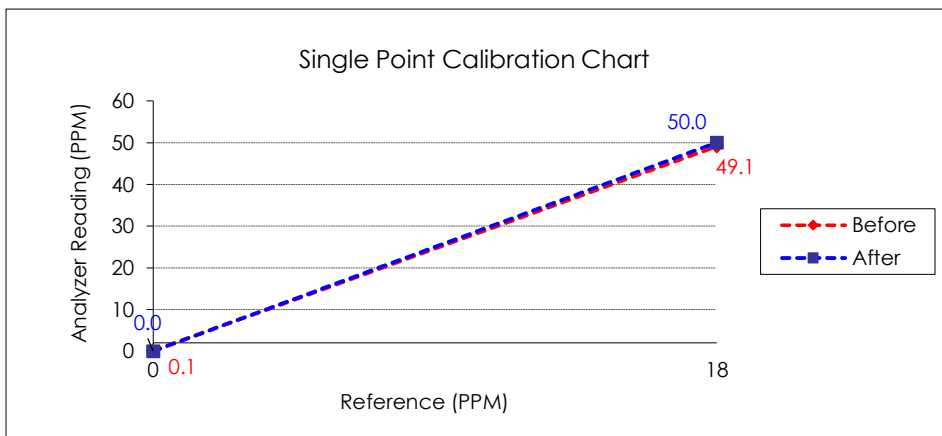
Environment : Temperature 25.5 °C Humidity: 51 %RH

Calibration Report (Before adjust)

Status	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Methane	0.0	0.1	0.1	50.0	49.1	-1.8
NMHC	0.0	0.1	0.1	50.0	48.9	-2.2

Calibration Report (After adjust)

Status	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Methane	0.0	0.0	0.0	50.0	50.0	0.0
NMHC	0.0	0.0	0.0	50.0	50.0	0.0



Calibrate By : 

MR. KITTISAK JANSANGWATTANA

Approve by : 

MR. PASAGORN SAMOL



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

Approved by :

(Mr.Nirut Loha)

Authorized Signatory



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 -



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 Jitraporn 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	Y	Standard Flow [Q_s] m ³ /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 m³/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	Y	Standard Flow [Q_a] m ³ /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 m³/min

End of Certificate of Calibration





Certificate of Calibration

Certificate Number : SPR23060536-3

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 : 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

Approved by :

(Mr.Nirut Loha)

Authorized Signatory



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 : 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

Approved by :

(Mr.Nirut Loha)

Authorized Signatory



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 –



Certificate of Calibration

Certificate Number : SPR23010301-1

Page : 1 of 4

Customer : TNP ENVIRONMENT CO.,LTD.

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

Equipment Name : Vibration Meter

Manufacturer : Instantel

Model : 721A2501/721A2901

Serial Number : UM13538

ID. Number : TNP-F-V01

Environmental Conditions

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

Received Date : 23 Jan 2023

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

Calibration Date : 26 Jan 2023

Location of Calibration : In-Lab

Recommend Due Date : 26 Jan 2024

Calibration Procedure : In-House Method

Date of Issue : 27 Jan 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 Metrology System (Thailand).

Calibrated by : Mr. Munin Khumpum

Calibration Officer

Approved by :


(Mr. Prayoon Topart)

Authorized Signatory



Calibration Report

Certificate Number : SPR23010301-1

Page : 2 of 4

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. : SPR23010301-1

Page : 3 of 4

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

Geophone P/N 721A3301 Functional Performance Test @160Hz

Function	STD Reading	UUC. Reading	Error	Uncertainty (±)
Velocity (mm/s)	5.002	5.007	0.005	0.059

Frequency Response Performance Test @ 5 mm/s

Unit : mm/s

Frequency (Hz)	STD Reading	UUC. Reading	Error	Uncertainty (±)
10.0	5.006	5.015	0.009	0.058
20.0	5.005	5.012	0.007	0.058
50.0	5.004	5.009	0.005	0.058
80.0	5.003	5.011	0.008	0.058
100.0	5.003	5.009	0.006	0.058
160.0	5.004	5.011	0.007	0.058
200.0	5.005	5.012	0.007	0.058



Result of Calibration

Certificate No. : SPR23010301-1

Page : 4 of 4

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

Linearity Performance Test

Unit : m/s^2

Frequency (Hz)	STD Reading	UUC. Reading	Error	Uncertainty (\pm)
160.0	0.501	0.504	0.003	0.0060
160.0	1.001	1.003	0.002	0.012
160.0	1.502	1.508	0.006	0.017
160.0	2.001	2.008	0.007	0.023
160.0	3.002	3.011	0.009	0.035
160.0	5.001	5.011	0.010	0.058

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 -

Site Information

Location : TNP Environment Co.,Ltd. **Date** : 21-Nov-23
Serial : TNP-F-01-PM10 **Tech** : Mr.Nattachai Triprawat

Site Conditions

Barometric Pressure (mmHg)	: 760	Corrected Pressure (mmHg)	: 760
Temperature (deg C)	: 29	Temperature (deg K)	: 302
Average Press.(mmHg)	: 760	Corrected Average (mmHg)	: 760
Average Temp.(deg C)	: 29	Average Temp.(deg K)	: 302

Calibration Orifice

Make : Tish Environment **Slope** : 1.69297
Model : TE-5028A **Intercept** : -0.02707
Serial : 3945 **Calibration Due Date** : October 1, 2023

Calibration Data

Plate or Test #	H2O (in)	Qa (m3/min)	I (Chart)	IC (Corrected)	Linear Regression
1	6.60	0.973	56.00	35.30	Slope : 40.6720
2	5.50	0.889	51.00	32.15	Intercept : -4.2291
3	4.60	0.815	46.00	29.00	Corr. Coeff : 0.9984
4	3.60	0.722	39.00	24.58	# of Observations : 5
5	2.40	0.593	34.00	20.17	

Calibrate By :

(Mr.Woharn Thongkhang)

Approved By :

(Mr.Nattachai Triprawat)

Site and Calibration Information

Location	: TNP Environment Co.,Ltd.	Date	: 14-Nov-23
Serial	: TNP-F-01-TSP	Tech	: Mr.Nattachai Triprawat

Site Conditions

Barometric Pressure (mmHg)	: 759	Corrected Pressure (mmHg)	: 759
Temperature (deg C)	: 30	Temperature (deg K)	: 303
Average Press.(mmHg)	: 759	Corrected Average (mmHg)	: 759
Average Temp.(deg C)	: 30	Average Temp.(deg K)	: 303

Calibration Orifice

Make	: Tish Environment	Qstd Slope	: 1.69297
Model	: TE-5028A	Qstd Intercept	: -0.02707
Serial	: 3945	Date Certified	: October 1, 2023

Calibration Information

Plate or Test #	H2O (In)	Qstd (m3/min)	I (Chart)	IC (Corrected)	Linear Regression	
1	7.20	1.587	56.00	56.49	Slope	: 34.84626
2	5.50	1.401	49.00	48.56	Intercept	: 0.434914
3	4.60	1.258	44.00	44.60	Corr. Coeff	: 0.9928
4	3.40	1.111	39.00	37.66	# of Observations : 5	
5	2.40	0.923	34.00	33.70		

Calibrate By :

(Mr.Woharn Thongkiang)

Approved By :

(Mr.Nattachai Triprawat)

Site Information

Location : TNP Environment Co.,Ltd. **Date** : 21-Nov-23
Serial : TNP-F-02-PM10 **Tech** : Mr.Nattachai Triprawat

Site Conditions

Barometric Pressure (mmHg) : 760 **Corrected Pressure (mmHg)** : 760
Temperature (deg C) : 29 **Temperature (deg K)** : 302
Average Press.(mmHg) : 760 **Corrected Average (mmHg)** : 760
Average Temp.(deg C) : 29 **Average Temp.(deg K)** : 302

Calibration Orifice

Make : Tish Environment **Slope** : 1.69297
Model : TE-5028A **Intercept** : -0.02707
Serial : 3945 **Calibration Due Date** : October 1, 2023

Calibration Data

Plate or Test #	H2O (in)	Qa (m3/min)	I (Chart)	IC (Corrected)	Linear Regression
1	7.20	1.001	57.00	35.93	Slope : 42.4302
2	5.70	0.905	52.00	32.78	Intercept : -6.4391
3	4.60	0.815	44.00	27.74	Corr. Coeff : 0.9910
4	3.80	0.742	38.00	23.95	# of Observations : 5
5	2.80	0.639	34.00	21.43	

Calibrate By :

(Mr.Woham Thongkhang)

Approved By :

(Mr.Nattachai Triprawat)

Site and Calibration Information

Location :	TNP Environment Co.,Ltd.	Date :	14-Nov-23
Serial :	TNP-F-02-TSP	Tech :	Mr.Nattachai Triprawat

Site Conditions


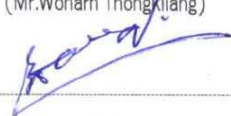
Barometric Pressure (mmHg) :	759	Corrected Pressure (mmHg) :	759
Temperature (deg C) :	30	Temperature (deg K) :	303
Average Press.(mmHg) :	759	Corrected Average (mmHg) :	759
Average Temp.(deg C) :	30	Average Temp.(deg K) :	303

Calibration Orifice

Make :	Tish Environment	Qstd Slope :	1.69297
Model :	TE-5028A	Qstd Intercept :	-0.02707
Serial :	3945	Date Certified :	October 1, 2023

Calibration Information

Plate or	H2O	Qstd	I	IC	Linear Regression	
Test #	(in)	(m3/min)	(Chart)	(Corrected)	Slope	: 33.9984
1	7.30	1.598	59.00	57.48	Intercept	: 4.50629
2	5.60	1.401	54.00	53.52	Corr. Coeff	: 0.9908
3	4.50	1.258	49.00	47.57	# of Observations	: 5
4	3.40	1.095	43.00	42.62		
5	2.40	0.923	35.00	34.69		

Calibrate By :	
	(Mr.Woharn Thongkijiang)
Approved By :	
	(Mr.Nattachai Triprawat)



บริษัท เอ็นไวร์ เซอร์วิส จำกัด
ENVIR SERVICE CO., LTD.

บริษัท เอ็นไวร์ เซอร์วิส จำกัด

42 รามอินทรา 14 แยก 9 แขวงท่าแร้ง เขตบางเขน กรุงเทพฯ 10230 โทรศัพท์ 02-9435814-5 โทรสาร 02-9438201

42 Raminthra 14 yeak 9, Tha Rang, Bangkhen, Bangkok 10230 Tel : 02-9435814-5 Fax : 02-9438201

Analyzer Performance Test

Calibrated Date: 18 January 2022

Instruments Information

Analyzer Type: CO Analyzer Model: 48C	Manufacturer Thermo Environmental S/N: 48C-67713-358
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Calibration System

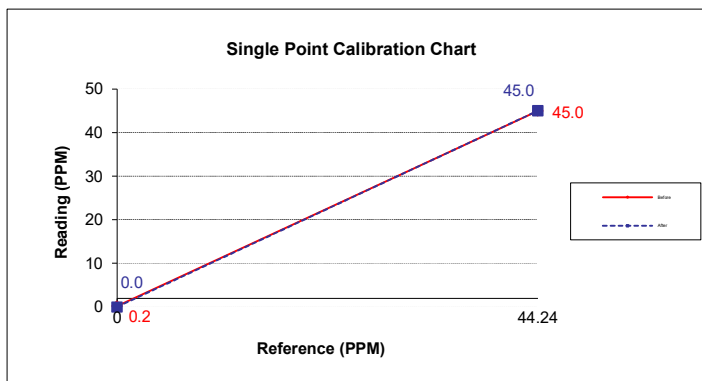
Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008 S/N: 705 ZERO AIR Generator API MODEL 701 S/N: 1924	NO Conc 55.47 PPM SO2 Conc 55.11 PPM CO Conc 4,535 PPM Cylinder number EB0129027 Expire Date: 29 Oct. 2027

Environment: Temperature 25.5 °C

Humidity: 51 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Before	0.0	0.2	0.2	44.2	45.0	1.7
After	0.0	0.0	0.0	45.0	45.0	0.0



Calibrate By :

Mr. PASAGORN SAMOL

Analyzer Performance Test

Calibrated Date: 17 September 2023

Instruments Information

Analyzer Type : CO Analyzer

Model : 48C

Manufacturer :

Thermo Environmental

Serial Number :

48C-79177-391

Calibrator Unit

Dilutor Model :

Dasibi Model 5008

Serial Number :

705

ZERO AIR Generator :

API MODEL 701

Serial Number :

1924

Standard Gas Concentration

Nitric Oxide (NO) 55.47 PPM

Sulphur Dioxide (SO₂) 55.11 PPM

Carbon Monoxide (CO) 4,535 PPM

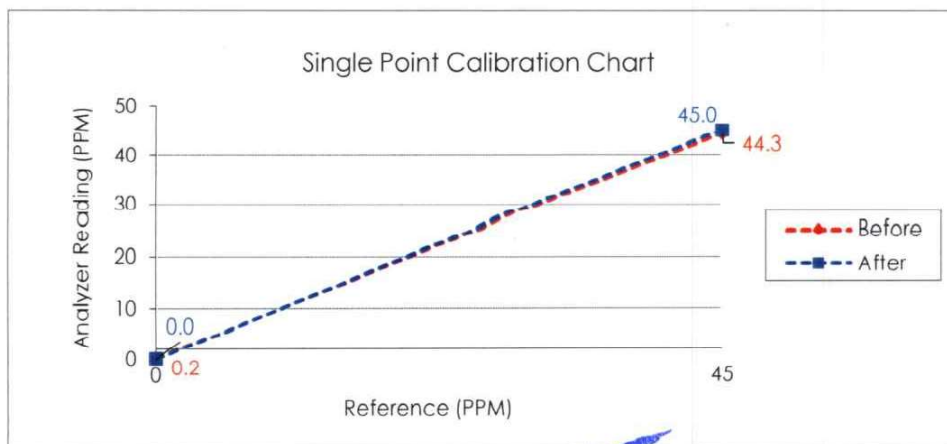
Cylinder number EB0129027

Expire Date: 29 Oct. 2027

Environment : Temperature 25.5 °C Humidity: 51 %RH

Calibration Report

	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Before	0.0	0.2	0.2	45.0	44.3	-1.6
After	0.0	0.0	0.0	45.0	45.0	0.0



Calibrate By :

MR. KITTISAK JANSANGWATTANA

Approve by :

MR. PASAGORN SAMOL

MR. KITTISAK JANSANGWATTANA

MR. PASAGORN SAMOL

ENVIR SERVICE CO., LTD.



บริษัท เอ็นไวร์ เซอร์วิส จำกัด

บริษัท เอ็นไวร์ เซอร์วิส จำกัด
ENVIR SERVICE CO., LTD.

42 รามอินทรา 14 แยก 9 แขวงท่าแร้ง เขตบางเขน กรุงเทพฯ 10230 โทรศัพท์ 02-9435814-5 โทรสาร 02-9438201

42 Raminthra 14 yeak 9, Tha Rang, Bangkhen, Bangkok 10230 Tel : 02-9435814-5 Fax : 02-9438201

Analyzer Performance Test

Calibrated Date: 20 January 2022

Instruments Information

Analyzer Type: NO/NO ₂ /NO _x Analyzer Model: 42C	Manufacturer: Thermo Environmental S/N: 42C-56817-311
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Calibration System

Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008 S/N: 705 ZERO AIR Generator API Model 701 S/N: 1924	NO Conc 55.47 PPM SO ₂ Conc 55.11 PPM CO Conc 4,535 PPM Cylinder number EB0129027 Expire Date: 29 Oct. 2027

Environment: Temperature 25.5 °C

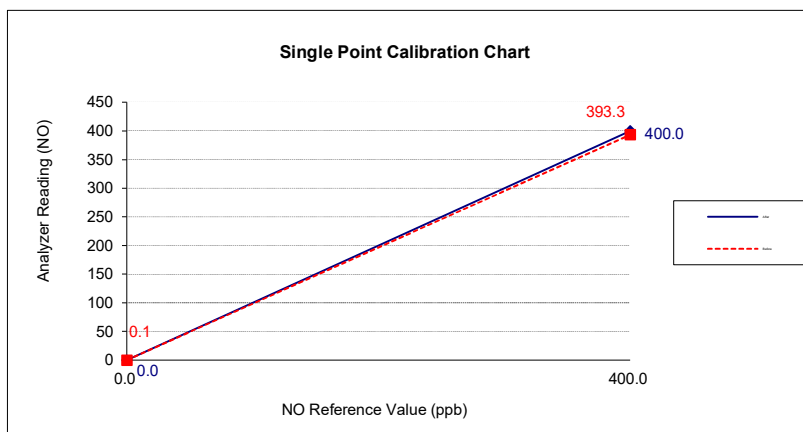
Humidity: 51 %RH

Calibration Check (Before adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.1	0.0	0.1	393.3	400.0	-1.7
NO _x	0.1	0.0	0.1	396.5	400.0	-0.9

Calibration Check (After adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.0	0.0	0.0	400.0	400.0	0.0
NO _x	0.0	0.0	0.0	400.0	400.0	0.0



Signature

Calibrate By : Mr. Pasagorn Samol

Analyzer Performance Test

Calibrated Date: 18 September 2023

Instruments Information

Analyzer Type : NO-NO₂-NO_x Analyzer

Manufacturer : Thermo Environmental

Model : 42C

Serial Number : 0413406269

Calibrator Unit

Dilutor Model : Dasibi Model 5008

Serial Number : 705

ZERO AIR Generator : API MODEL 701

Serial Number : 1924

Standard Gas Concentration

Nitric Oxide (NO) 55.47 PPM

Sulphur Dioxide (SO₂) 55.11 PPM

Carbon Monoxide (CO) 4,535 PPM

Cylinder number EB0129027

Expire Date: 29 Oct. 2027

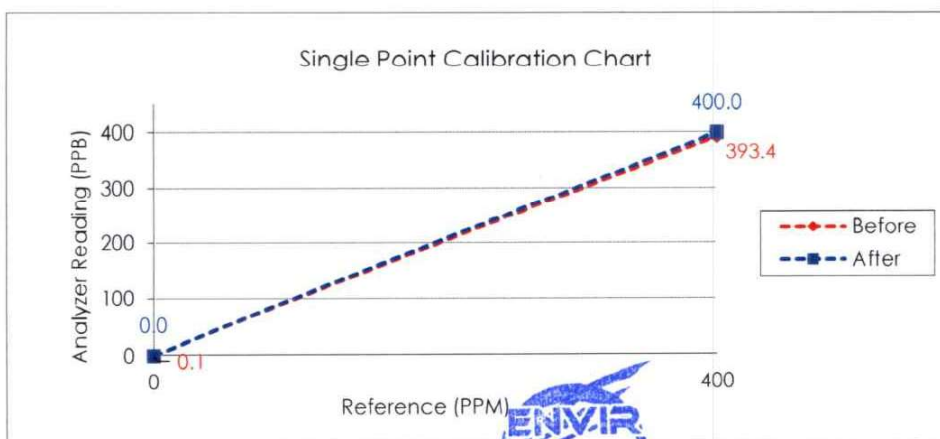
Environment : Temperature 25.5 °C Humidity: 51 %RH

Calibration Report (Before Adjust)

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
NO	0.0	0.1	0.1	400.0	393.4	-1.7
NO _x	0.0	0.0	0.0	400.0	394.6	-1.3

Calibration Report (After Adjust)

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
NO	0.0	0.1	0.1	400.0	400.0	0.0
NO _x	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By :

กิตติศักดิ์ จันทะเลววัฒนา
MR. KITTISAK JANSANGWATTANA

Approve by :

MR. PASAGORN SAMOL

Analyzer Performance Test

Calibrated Date: 31 October 2023

Instruments Information

Analyzer Type : SO2 Analyzer

Model : 43C

Manufacturer : Thermo Environmental

Serial Number : 0327402325

Calibrator Unit

Dilutor Model : Dasibi Model 5008

Serial Number : 705

ZERO AIR Generator : API MODEL 701

Serial Number : 1924

Standard Gas Concentration

Nitric Oxide (NO) 55.47 PPM

Sulphur Dioxide (SO2) 55.11 PPM

Carbon Monoxide (CO) 4,535 PPM

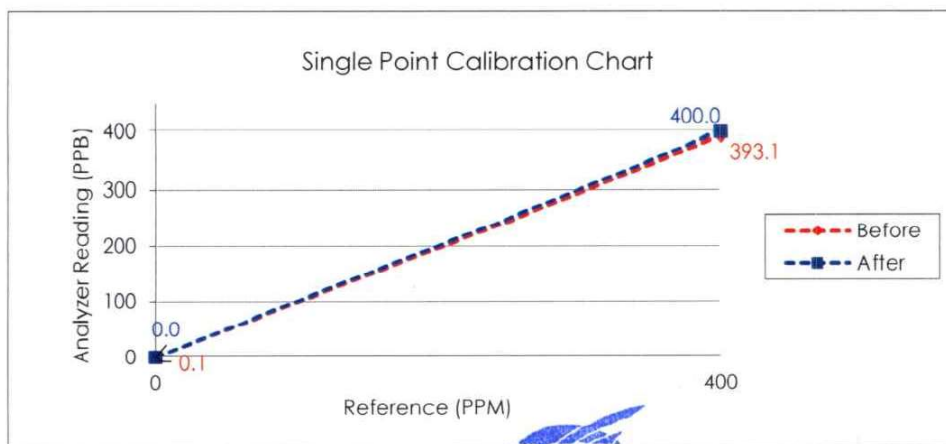
Cylinder number EB0129027

Expire Date: 29 Oct. 2027

Environment : Temperature 25.5 °C Humidity: 51 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
Before	0.0	0.1	0.1	400.0	393.1	-1.7
After	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By :

กิตติศักดิ์ จันทะเลวรวัฒนา

MR. KITTISAK JANSANGWATTANA

Approve by :

MR. PASAGORN SAMOL

MR. PASAGORN SAMOL

Analyzer Performance Test

Calibrated Date: 17 September 2023

Instruments Information

Analyzer Type : SO₂ Analyzer

Model : 43C

Manufacturer :

Thermo Environmental

Serial Number :

0411405899

Calibrator Unit

Dilutor Model :

Dasibi Model 5008

Serial Number :

705

ZERO AIR Generator :

API MODEL 701

Serial Number :

1924

Standard Gas Concentration

Nitric Oxide (NO) 55.47 PPM

Sulphur Dioxide (SO₂) 55.11 PPM

Carbon Monoxide (CO) 4,535 PPM

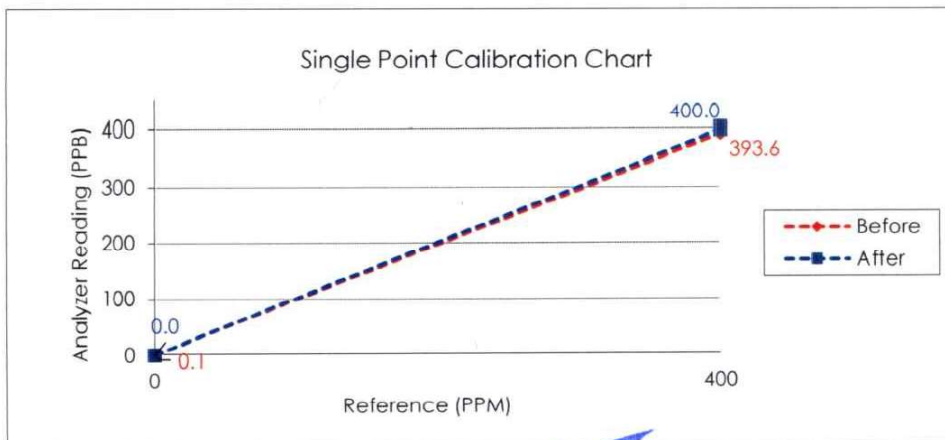
Cylinder number EB0129027

Expire Date: 29 Oct. 2027

Environment : Temperature 25.5 °C Humidity: 51 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
Before	0.0	0.1	0.1	400.0	393.6	-1.6
After	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By :

กิตติศักดิ์ จันทะวงษ์วัฒนา



Approve by :

MR. PASAGORN SAMOL

MR. KITTISAK JANSANGWATTANA บริษัท เอ็นไวร์ เซอร์วิส จำกัด

ENVIR SERVICE CO., LTD

Analyzer Performance Test

Calibrated Date: 2023-Nov-1

Instruments Information

Analyzer Type : CH4-NMHC-THC Analyzer

Manufacturer : HORIBA

Model : APHA-360CE

Serial Number : 423740300209

Calibrator Unit

Dilutor Model : Dasibi Model 5008

Serial Number : 705

ZERO AIR Generator : API MODEL 701

Serial Number : 1924

Standard Gas Concentration

Methane (CH₄) 181.0 PPM

Propane 180.7 PPM

Cylinder number EB0123130

Expire Date: 3 Oct. 2027

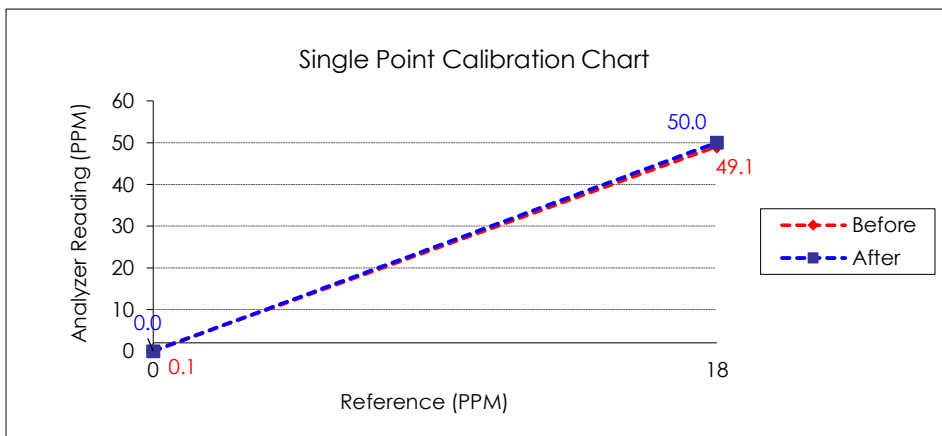
Environment : Temperature 25.5 °C Humidity: 51 %RH

Calibration Report (Before adjust)

Status	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Methane	0.0	0.1	0.1	50.0	49.1	-1.8
NMHC	0.0	0.1	0.1	50.0	48.9	-2.2

Calibration Report (After adjust)

Status	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Methane	0.0	0.0	0.0	50.0	50.0	0.0
NMHC	0.0	0.0	0.0	50.0	50.0	0.0



Calibrate By : 

MR. KITTISAK JANSANGWATTANA

Approve by : 

MR. PASAGORN SAMOL



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

Approved by :

(Mr.Nirut Loha)

Authorized Signatory



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 -



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
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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 Jitraporn 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	Y	Standard Flow [Q_s] m ³ /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 m³/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	Y	Standard Flow [Q_a] m ³ /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 m³/min

End of Certificate of Calibration





Certificate of Calibration

Certificate Number : SPR23060536-3

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 : 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

Approved by :

(Mr.Nirut Loha)

Authorized Signatory



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 : 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

Approved by :

(Mr.Nirut Loha)

Authorized Signatory



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 –



Certificate of Calibration

Certificate Number : SPR23040172-1

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 : Instantel

Model : 721A0501/721A2901

Serial Number : UM6150/UM12863

ID. Number : TNP-F-V12

Environmental Conditions

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

Received Date : 18 Apr 2023

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

Calibration Date : 21 Apr 2023

Location of Calibration : In-Lab

Recommend Due Date : 21 Apr 2024

Calibration Procedure : In-House Method

Date of Issue : 22 Apr 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 Metrology System (Thailand).

Calibrated by : Mr. Munin Khumpum

Calibration Officer

Approved by :

(Mr. Nirut Loha)

Authorized Signatory



Calibration Report

Certificate Number : SPR23040172-1

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. : SPR23040172-1

Page : 3 of 3

Results of Calibration : (★) Without () After Adjustment

Velocity Performance Test

Unit : mm/s_{pk}

Frequency (Hz)	STD Reading	UUC. Reading	Error	Uncertainty (±)
80.0	1.002	1.034	0.032	0.012
80.0	2.004	2.045	0.041	0.023
80.0	3.001	3.056	0.055	0.035
80.0	4.004	4.067	0.063	0.046
80.0	5.004	5.051	0.047	0.058
80.0	6.003	6.069	0.066	0.069
80.0	7.005	7.082	0.077	0.081
80.0	8.008	8.112	0.104	0.092
80.0	9.011	9.184	0.173	0.10
80.0	10.015	10.238	0.223	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 –

Site Information

Location : TNP Environment Co.,Ltd. **Date** : 26-Oct-23
Serial : TNP-F-02-PM10 **Tech** : Mr.Nattachai Triprawat

Site Conditions


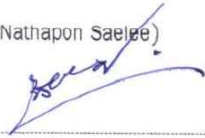
Barometric Pressure (mmHg)	: 760	Corrected Pressure (mmHg)	: 760
Temperature (deg C)	: 29	Temperature (deg K)	: 302
Average Press.(mmHg)	: 760	Corrected Average (mmHg)	: 760
Average Temp.(deg C)	: 29	Average Temp.(deg K)	: 302

Calibration Orifice

Make : Tish Environment **Slope** : 1.69297
Model : TE-5028A **Intercept** : -0.02707
Serial : 3945 **Calibration Due Date** : October 1, 2023

Calibration Data

Plate or Test #	H2O (in)	Qa (m3/min)	I (Chart)	IC (Corrected)	Linear Regression
1	7.00	1.001	57.00	35.93	Slope : 42.4302
2	5.70	0.905	52.00	32.78	Intercept : -6.4391
3	4.60	0.815	44.00	27.74	Corr. Coeff : 0.9910
4	3.80	0.742	38.00	23.95	
5	2.80	0.639	34.00	21.43	# of Observations : 5

Calibrate By : 
(Mr.Nathapon Saelee)
Approved By : 
(Mr.Nattachai Triprawat)

Site and Calibration Information

Location :	TNP Environment Co.,Ltd.	Date :	20-Oct-23
Serial :	TNP-F-02-TSP	Tech :	Mr.Nattachai Triprawat

Site Conditions

Barometric Pressure (mmHg) :	759	Corrected Pressure (mmHg) :	759
Temperature (deg C) :	30	Temperature (deg K) :	303
Average Press.(mmHg) :	759	Corrected Average (mmHg) :	759
Average Temp.(deg C) :	30	Average Temp.(deg K) :	303

Calibration Orifice

Make :	Tish Environment	Qstd Slope :	1.69297
Model :	TE-5028A	Qstd Intercept :	-0.02707
Serial :	3945	Date Certified :	October 1, 2023


Calibration Information

Plate or Test #	H2O (in)	Qstd (m3/min)	I (Chart)	IC (Corrected)	Linear Regression	
1	7.30	1.598	58.00	57.48	Slope	: 33.9984
2	5.60	1.401	54.00	53.52	Intercept	: 4.50629
3	4.50	1.258	49.00	47.57	Corr. Coeff	: 0.9908
4	3.50	1.095	43.00	42.62	# of Observations	: 5
5	2.40	0.923	35.00	34.69		

Calibrate By :


(Mr.Nathapon Saelee)

Approved By :


(Mr.Nattachai Triprawat)

Site Information

Location : TNP Environment Co.,Ltd. **Date** : 26-Oct-23
Serial : TNP-F-03-PM10 **Tech** : Mr.Nattachai Triprawat

Site Conditions



Barometric Pressure (mmHg) : 760 **Corrected Pressure (mmHg)** : 760
Temperature (deg C) : 29 **Temperature (deg K)** : 302
Average Press.(mmHg) : 760 **Corrected Average (mmHg)** : 760
Average Temp.(deg C) : 29 **Average Temp.(deg K)** : 302

Calibration Orifice

Make : Tish Environment **Slope** : 1.69297
Model : TE-5028A **Intercept** : -0.02707
Serial : 3945 **Calibration Due Date** : October 1, 2023

Calibration Data

Plate or Test #	H2O (in)	Qa (m3/min)	I (Chart)	IC (Corrected)	Linear Regression
1	6.80	0.987	57.00	35.93	Slope : 49.2516
2	5.90	0.920	50.00	31.52	Intercept : -13.1842
3	5.00	0.849	45.00	28.37	Corr. Coeff : 0.9963
4	3.80	0.742	38.00	23.95	# of Observations : 5
5	3.20	0.682	33.00	20.17	

Calibrate By : 
(Mr.Nathapon Saelee)
Approved By : 
(Mr.Nattachai Triprawat)



บริษัท เอ็นไวร์ เซอร์วิส จำกัด
ENVIR SERVICE CO., LTD.

บริษัท เอ็นไวร์ เซอร์วิส จำกัด

42 รามอินทรา 14 แยก 9 แขวงท่าแร้ง เขตบางเขน กรุงเทพฯ 10230 โทรศัพท์ 02-9435814-5 โทรสาร 02-9438201

42 Raminthra 14 yeak 9, Tha Rang, Bangkhen, Bangkok 10230 Tel : 02-9435814-5 Fax : 02-9438201

Analyzer Performance Test

Calibrated Date: 18 January 2022

Instruments Information

Analyzer Type: CO Analyzer Model: 48C	Manufacturer Thermo Environmental S/N: 48C-67713-358
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Calibration System

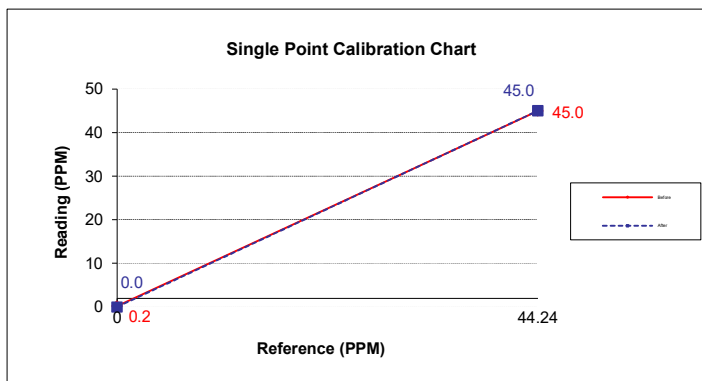
Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008 S/N: 705 ZERO AIR Generator API MODEL 701 S/N: 1924	NO Conc 55.47 PPM SO2 Conc 55.11 PPM CO Conc 4,535 PPM Cylinder number EB0129027 Expire Date: 29 Oct. 2027

Environment: Temperature 25.5 °C

Humidity: 51 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Before	0.0	0.2	0.2	44.2	45.0	1.7
After	0.0	0.0	0.0	45.0	45.0	0.0



Calibrate By :

Mr. PASAGORN SAMOL

Analyzer Performance Test

Calibrated Date: 17 September 2023

Instruments Information

Analyzer Type : CO Analyzer

Model : 48C

Manufacturer :

Thermo Environmental

Serial Number :

48C-79177-391

Calibrator Unit

Dilutor Model :

Dasibi Model 5008

Serial Number :

705

ZERO AIR Generator :

API MODEL 701

Serial Number :

1924

Standard Gas Concentration

Nitric Oxide (NO) 55.47 PPM

Sulphur Dioxide (SO₂) 55.11 PPM

Carbon Monoxide (CO) 4,535 PPM

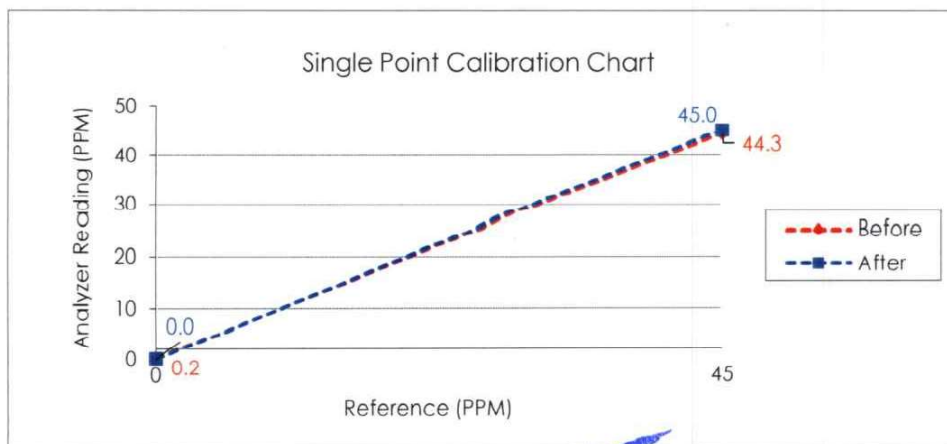
Cylinder number EB0129027

Expire Date: 29 Oct. 2027

Environment : Temperature 25.5 °C Humidity: 51 %RH

Calibration Report

	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Before	0.0	0.2	0.2	45.0	44.3	-1.6
After	0.0	0.0	0.0	45.0	45.0	0.0



Calibrate By :

MR. KITTISAK JANSANGWATTANA

Approve by :

MR. PASAGORN SAMOL

MR. KITTISAK JANSANGWATTANA

MR. PASAGORN SAMOL

ENVIR SERVICE CO., LTD.



บริษัท เอ็นไวร์ เซอร์วิส จำกัด

บริษัท เอ็นไวร์ เซอร์วิส จำกัด
ENVIR SERVICE CO., LTD.

42 รามอินทรา 14 แยก 9 แขวงท่าแร้ง เขตบางเขน กรุงเทพฯ 10230 โทรศัพท์ 02-9435814-5 โทรสาร 02-9438201

42 Raminthra 14 yeak 9, Tha Rang, Bangkhen, Bangkok 10230 Tel : 02-9435814-5 Fax : 02-9438201

Analyzer Performance Test

Calibrated Date: 20 January 2022

Instruments Information

Analyzer Type: NO/NO ₂ /NO _x Analyzer Model: 42C	Manufacturer: Thermo Environmental S/N: 42C-56817-311
---	--

Calibration System

Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008 S/N: 705 ZERO AIR Generator API Model 701 S/N: 1924	NO Conc 55.47 PPM SO ₂ Conc 55.11 PPM CO Conc 4,535 PPM Cylinder number EB0129027 Expire Date: 29 Oct. 2027

Environment: Temperature 25.5 °C

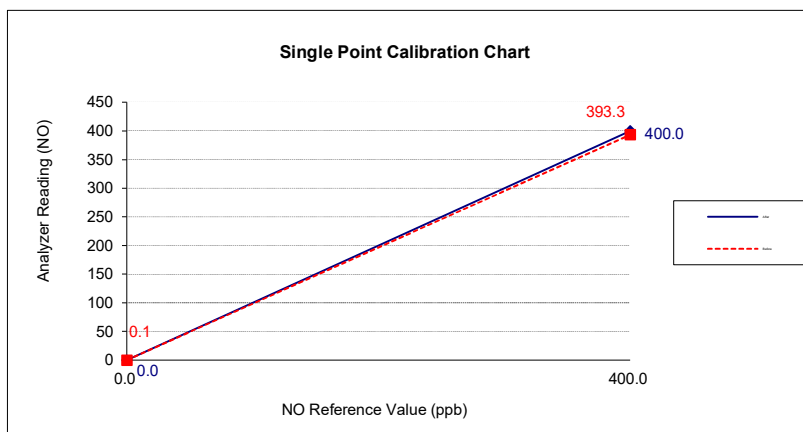
Humidity: 51 %RH

Calibration Check (Before adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.1	0.0	0.1	393.3	400.0	-1.7
NO _x	0.1	0.0	0.1	396.5	400.0	-0.9

Calibration Check (After adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.0	0.0	0.0	400.0	400.0	0.0
NO _x	0.0	0.0	0.0	400.0	400.0	0.0



Signature

Calibrate By : Mr. Pasagorn Samol

Analyzer Performance Test

Calibrated Date: 18 September 2023

Instruments Information

Analyzer Type : NO-NO₂-NO_x Analyzer

Manufacturer : Thermo Environmental

Model : 42C

Serial Number : 0413406269

Calibrator Unit

Dilutor Model : Dasibi Model 5008

Serial Number : 705

ZERO AIR Generator : API MODEL 701

Serial Number : 1924

Standard Gas Concentration

Nitric Oxide (NO) 55.47 PPM

Sulphur Dioxide (SO₂) 55.11 PPM

Carbon Monoxide (CO) 4,535 PPM

Cylinder number EB0129027

Expire Date: 29 Oct. 2027

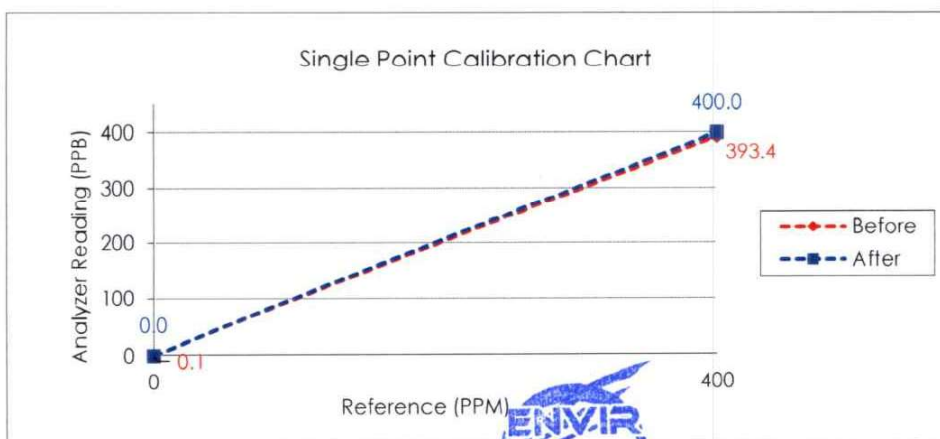
Environment : Temperature 25.5 °C Humidity: 51 %RH

Calibration Report (Before Adjust)

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
NO	0.0	0.1	0.1	400.0	393.4	-1.7
NO _x	0.0	0.0	0.0	400.0	394.6	-1.3

Calibration Report (After Adjust)

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
NO	0.0	0.1	0.1	400.0	400.0	0.0
NO _x	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By :

กิตติศักดิ์ จันทะเลววัฒนา

Approve by :

MR. PASAGORN SAMOL

MR. KITTISAK JANSANGWATTANA

บริษัท เอ็นไวร์ เซอร์วิส จำกัด
ENVIR SERVICE CO., LTD.

MR. PASAGORN SAMOL

Analyzer Performance Test

Calibrated Date: 31 October 2023

Instruments Information

Analyzer Type : SO2 Analyzer

Model : 43C

Manufacturer : Thermo Environmental

Serial Number : 0327402325

Calibrator Unit

Dilutor Model : Dasibi Model 5008

Serial Number : 705

ZERO AIR Generator : API MODEL 701

Serial Number : 1924

Standard Gas Concentration

Nitric Oxide (NO) 55.47 PPM

Sulphur Dioxide (SO2) 55.11 PPM

Carbon Monoxide (CO) 4,535 PPM

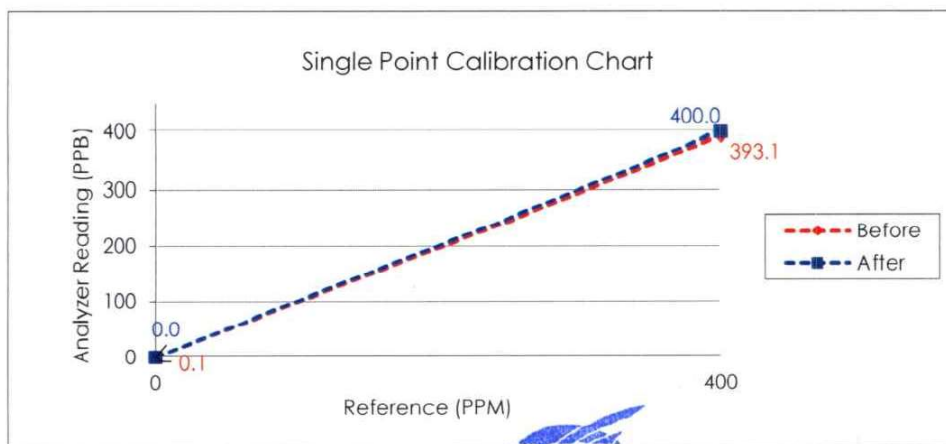
Cylinder number EB0129027

Expire Date: 29 Oct. 2027

Environment : Temperature 25.5 °C Humidity: 51 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
Before	0.0	0.1	0.1	400.0	393.1	-1.7
After	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By :

กิตติศักดิ์ จันทะเลววัฒนา

Approve by :

MR. PASAGORN SAMOL

MR. KITTISAK JANSANGWATTANA

ENVIR SERVICE CO., LTD.

MR. PASAGORN SAMOL

ENVIR SERVICE CO., LTD.

42 Ramintra 14 Yeak 9, Tha Raeng, Bang Khen, Bangkok 10230
Tel. 02-9435814-5 Fax. 02-9438201 www.envirservice.co.th

Analyzer Performance Test

Calibrated Date: 17 September 2023

Instruments Information

Analyzer Type : SO2 Analyzer

Model : 43C

Manufacturer : Thermo Environmental

Serial Number : 0411405899

Calibrator Unit

Dilutor Model : Dasibi Model 5008

Serial Number : 705

ZERO AIR Generator : API MODEL 701

Serial Number : 1924

Standard Gas Concentration

Nitric Oxide (NO) 55.47 PPM

Sulphur Dioxide (SO2) 55.11 PPM

Carbon Monoxide (CO) 4,535 PPM

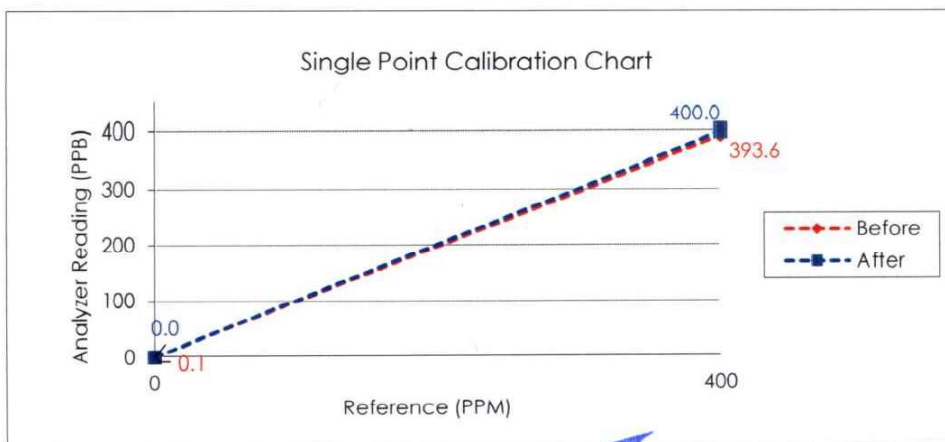
Cylinder number EB0129027

Expire Date: 29 Oct. 2027

Environment : Temperature 25.5 °C Humidity: 51 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
Before	0.0	0.1	0.1	400.0	393.6	-1.6
After	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By :

กิตติศักดิ์ จันทะวงษ์วัฒนา

MR. KITTISAK JANSANGWATTANA

Approve by :

MR. PASAGORN SAMOL

ENVIR SERVICE CO., LTD.

Analyzer Performance Test

Calibrated Date: 2023-Nov-1

Instruments Information

Analyzer Type : CH4-NMHC-THC Analyzer

Manufacturer : HORIBA

Model : APHA-360CE

Serial Number : 423740300209

Calibrator Unit

Dilutor Model : Dasibi Model 5008

Serial Number : 705

ZERO AIR Generator : API MODEL 701

Serial Number : 1924

Standard Gas Concentration

Methane (CH₄) 181.0 PPM

Propane 180.7 PPM

Cylinder number EB0123130

Expire Date: 3 Oct. 2027

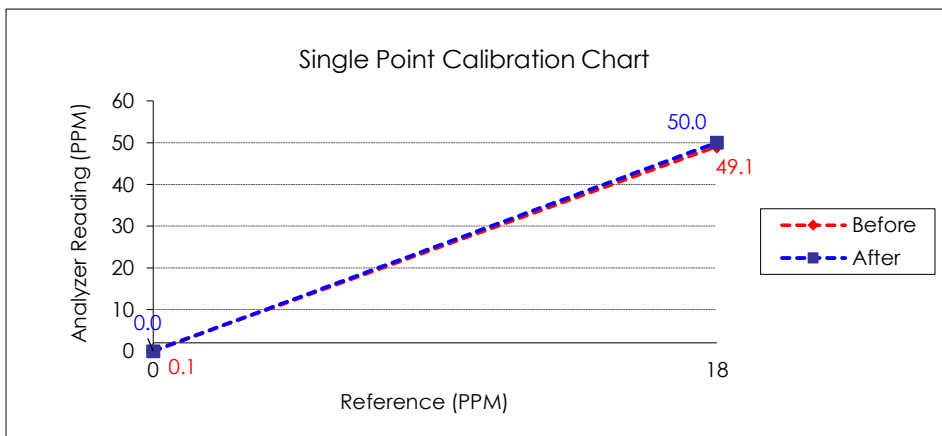
Environment : Temperature 25.5 °C Humidity: 51 %RH

Calibration Report (Before adjust)

Status	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Methane	0.0	0.1	0.1	50.0	49.1	-1.8
NMHC	0.0	0.1	0.1	50.0	48.9	-2.2

Calibration Report (After adjust)

Status	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Methane	0.0	0.0	0.0	50.0	50.0	0.0
NMHC	0.0	0.0	0.0	50.0	50.0	0.0



Calibrate By : 

MR. KITTISAK JANSANGWATTANA

Approve by : 

MR. PASAGORN SAMOL



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

Approved by :

(Mr.Nirut Loha)

Authorized Signatory



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 -



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 Jitraporn 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	Y	Standard Flow [Q_s] m ³ /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 m³/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	Y	Standard Flow [Q_a] m ³ /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 m³/min

End of Certificate of Calibration





Certificate of Calibration

Certificate Number : SPR23060536-3

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 : 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

Approved by :

(Mr.Nirut Loha)

Authorized Signatory



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:

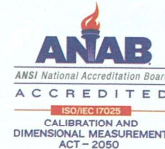
The result of calibration was found accurate as show on date and place of calibration only.

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 : SPR23080172-4

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 : 10340946

ID. Number : TNP-F-S31

Environmental Conditions

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

Received Date : 14 Aug 2023

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

Calibration Date : 14 Aug 2023

Location of Calibration : In-Lab

Recommend Due Date : 14 Aug 2024

Calibration Procedure : SP-CPE-04-01

Date of Issue : 15 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).

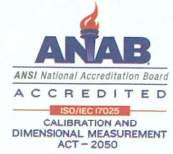
Calibrated by : Mr.Karoon Pengsalung

Calibration Officer

Approved by :

(Mr.Nirut Loha)

Authorized Signatory



Calibration Report

Certificate Number : SPR23080172-4

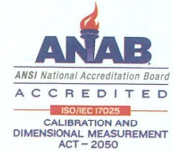
Page : 2 of 3

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. : SPR23080172-4

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	113.9	113.9	-0.1	-0.1	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	113.9	113.9	-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 -



Certificate of Calibration

Certificate Number : SPR23040172-1

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 : Instantel

Model : 721A0501/721A2901

Serial Number : UM6150/UM12863

ID. Number : TNP-F-V12

Environmental Conditions

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

Received Date : 18 Apr 2023

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

Calibration Date : 21 Apr 2023

Location of Calibration : In-Lab

Recommend Due Date : 21 Apr 2024

Calibration Procedure : In-House Method

Date of Issue : 22 Apr 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 Metrology System (Thailand).

Calibrated by : Mr. Munin Khumpum

Calibration Officer

Approved by :

(Mr. Nirut Loha)

Authorized Signatory



Calibration Report

Certificate Number : SPR23040172-1

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. : SPR23040172-1

Page : 3 of 3

Results of Calibration : (★) Without () After Adjustment

Velocity Performance Test

Unit : mm/s_{pk}

Frequency (Hz)	STD Reading	UUC. Reading	Error	Uncertainty (±)
80.0	1.002	1.034	0.032	0.012
80.0	2.004	2.045	0.041	0.023
80.0	3.001	3.056	0.055	0.035
80.0	4.004	4.067	0.063	0.046
80.0	5.004	5.051	0.047	0.058
80.0	6.003	6.069	0.066	0.069
80.0	7.005	7.082	0.077	0.081
80.0	8.008	8.112	0.104	0.092
80.0	9.011	9.184	0.173	0.10
80.0	10.015	10.238	0.223	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 –



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 Jitraporn 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	Y	Standard Flow [Q_s] m ³ /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 m³/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	Y	Standard Flow [Q_a] m ³ /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 m³/min

End of Certificate of Calibration





บริษัท เอ็นไวร์ เซอร์วิส จำกัด
ENVIR SERVICE CO., LTD.

บริษัท เอ็นไวร์ เซอร์วิส จำกัด

42 รามอินทรา 14 แยก 9 แขวงท่าแร้ง เขตบางเขน กรุงเทพฯ 10230 โทรศัพท์ 02-9435814-5 โทรสาร 02-9438201

42 Raminthra 14 yeak 9, Tha Rang, Bangkhen, Bangkok 10230 Tel : 02-9435814-5 Fax : 02-9438201

Analyzer Performance Test

Calibrated Date: 18 January 2022

Instruments Information

Analyzer Type: CO Analyzer Model: 48C	Manufacturer Thermo Environmental S/N: 48C-67713-358
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Calibration System

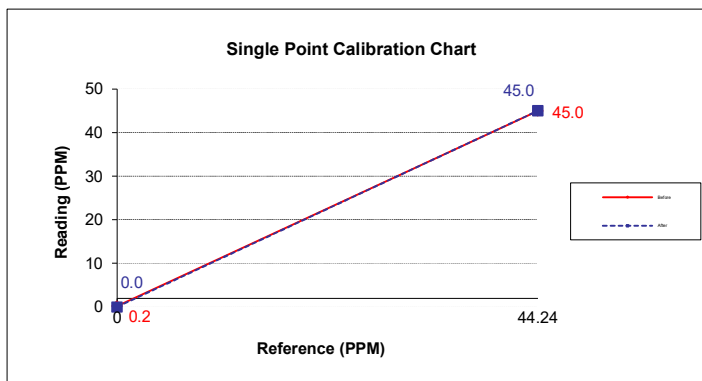
Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008 S/N: 705 ZERO AIR Generator API MODEL 701 S/N: 1924	NO Conc 55.47 PPM SO2 Conc 55.11 PPM CO Conc 4,535 PPM Cylinder number EB0129027 Expire Date: 29 Oct. 2027

Environment: Temperature 25.5 °C

Humidity: 51 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Before	0.0	0.2	0.2	44.2	45.0	1.7
After	0.0	0.0	0.0	45.0	45.0	0.0



Calibrate By :

Mr. PASAGORN SAMOL



บริษัท เอ็นไวร์ เซอร์วิส จำกัด

บริษัท เอ็นไวร์ เซอร์วิส จำกัด
ENVIR SERVICE CO., LTD.

42 รามอินทรา 14 แยก 9 แขวงท่าแร้ง เขตบางเขน กรุงเทพฯ 10230 โทรศัพท์ 02-9435814-5 โทรสาร 02-9438201

42 Raminthra 14 yeak 9, Tha Rang, Bangkhen, Bangkok 10230 Tel : 02-9435814-5 Fax : 02-9438201

Analyzer Performance Test

Calibrated Date: 20 January 2022

Instruments Information

Analyzer Type: NO/NO ₂ /NO _x Analyzer Model: 42C	Manufacturer: Thermo Environmental S/N: 42C-56817-311
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Calibration System

Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008 S/N: 705 ZERO AIR Generator API Model 701 S/N: 1924	NO Conc 55.47 PPM SO ₂ Conc 55.11 PPM CO Conc 4,535 PPM Cylinder number EB0129027 Expire Date: 29 Oct. 2027

Environment: Temperature 25.5 °C

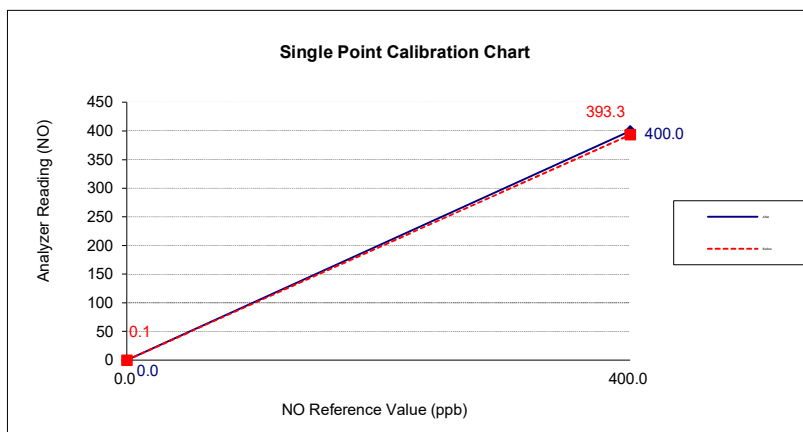
Humidity: 51 %RH

Calibration Check (Before adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.1	0.0	0.1	393.3	400.0	-1.7
NO _x	0.1	0.0	0.1	396.5	400.0	-0.9

Calibration Check (After adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.0	0.0	0.0	400.0	400.0	0.0
NO _x	0.0	0.0	0.0	400.0	400.0	0.0



Signature

Calibrate By : Mr. Pasagorn Samol

Analyzer Performance Test

Calibrated Date: 17 September 2023

Instruments Information

Analyzer Type : CO Analyzer

Model : 48C

Manufacturer :

Thermo Environmental

Serial Number :

48C-79177-391

Calibrator Unit

Dilutor Model :

Dasibi Model 5008

Serial Number :

705

ZERO AIR Generator :

API MODEL 701

Serial Number :

1924

Standard Gas Concentration

Nitric Oxide (NO) 55.47 PPM

Sulphur Dioxide (SO₂) 55.11 PPM

Carbon Monoxide (CO) 4,535 PPM

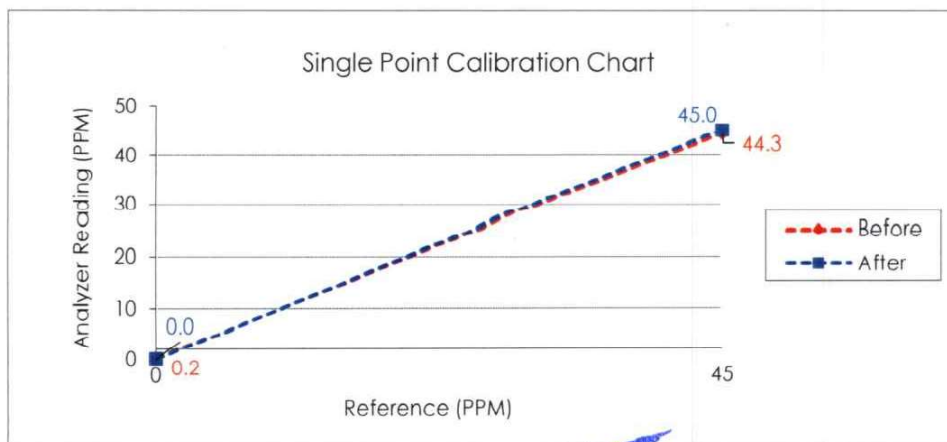
Cylinder number EB0129027

Expire Date: 29 Oct. 2027

Environment : Temperature 25.5 °C Humidity: 51 %RH

Calibration Report

	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Before	0.0	0.2	0.2	45.0	44.3	-1.6
After	0.0	0.0	0.0	45.0	45.0	0.0



Calibrate By :

MR. KITTISAK JANSANGWATTANA

Approve by :

MR. PASAGORN SAMOL

MR. KITTISAK JANSANGWATTANA

MR. PASAGORN SAMOL

ENVIR SERVICE CO., LTD.

Analyzer Performance Test

Calibrated Date: 18 September 2023

Instruments Information

Analyzer Type : NO-NO₂-NO_x Analyzer

Manufacturer : Thermo Environmental

Model : 42C

Serial Number : 0413406269

Calibrator Unit

Dilutor Model : Dasibi Model 5008

Serial Number : 705

ZERO AIR Generator : API MODEL 701

Serial Number : 1924

Standard Gas Concentration

Nitric Oxide (NO) 55.47 PPM

Sulphur Dioxide (SO₂) 55.11 PPM

Carbon Monoxide (CO) 4,535 PPM

Cylinder number EB0129027

Expire Date: 29 Oct. 2027

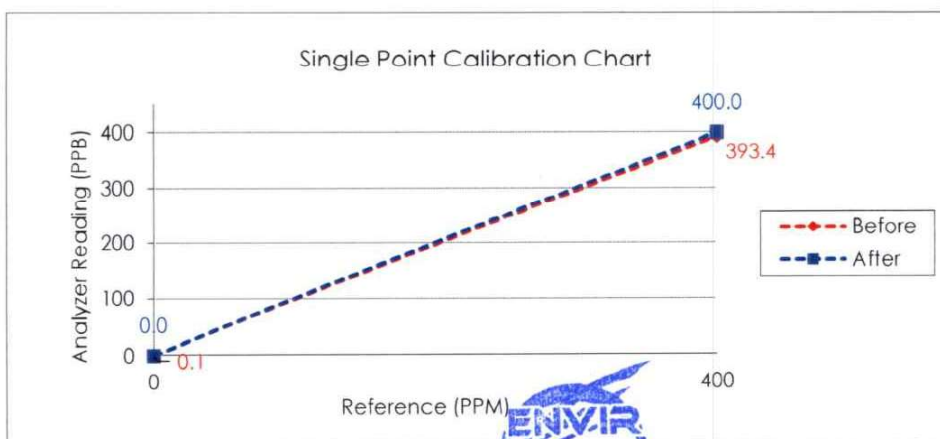
Environment : Temperature 25.5 °C Humidity: 51 %RH

Calibration Report (Before Adjust)

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
NO	0.0	0.1	0.1	400.0	393.4	-1.7
NO _x	0.0	0.0	0.0	400.0	394.6	-1.3

Calibration Report (After Adjust)

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
NO	0.0	0.1	0.1	400.0	400.0	0.0
NO _x	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By :

กิตติศักดิ์ จันทะเลววัฒนา

Approve by :

MR. PASAGORN SAMOL

MR. KITTISAK JANSANGWATTANA

บริษัท เอ็นไวร์ เซอร์วิส จำกัด
ENVIR SERVICE CO., LTD.

MR. PASAGORN SAMOL

Analyzer Performance Test

Calibrated Date: 31 October 2023

Instruments Information

Analyzer Type : SO2 Analyzer

Model : 43C

Manufacturer : Thermo Environmental

Serial Number : 0327402325

Calibrator Unit

Dilutor Model : Dasibi Model 5008

Serial Number : 705

ZERO AIR Generator : API MODEL 701

Serial Number : 1924

Standard Gas Concentration

Nitric Oxide (NO) 55.47 PPM

Sulphur Dioxide (SO2) 55.11 PPM

Carbon Monoxide (CO) 4,535 PPM

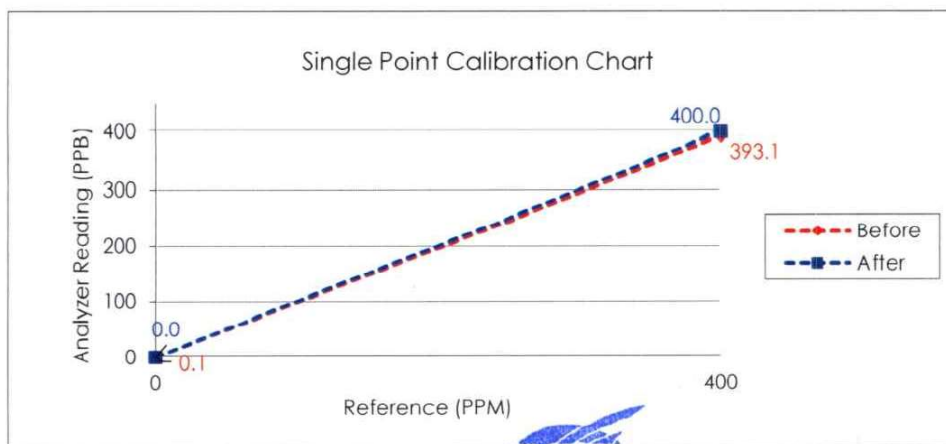
Cylinder number EB0129027

Expire Date: 29 Oct. 2027

Environment : Temperature 25.5 °C Humidity: 51 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
Before	0.0	0.1	0.1	400.0	393.1	-1.7
After	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By :

กิตติศักดิ์ จันทะเลววัฒนา

MR. KITTISAK JANSANGWATTANA

Approve by :

MR. PASAGORN SAMOL

MR. PASAGORN SAMOL

Analyzer Performance Test

Calibrated Date: 2023-Nov-1

Instruments Information

Analyzer Type : CH4-NMHC-THC Analyzer

Manufacturer : HORIBA

Model : APHA-360CE

Serial Number : 423740300209

Calibrator Unit

Dilutor Model : Dasibi Model 5008

Serial Number : 705

ZERO AIR Generator : API MODEL 701

Serial Number : 1924

Standard Gas Concentration

Methane (CH₄) 181.0 PPM

Propane 180.7 PPM

Cylinder number EB0123130

Expire Date: 3 Oct. 2027

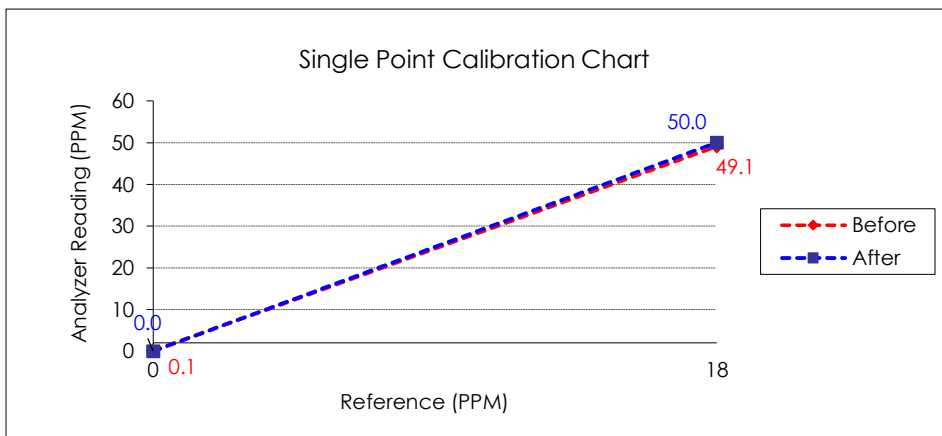
Environment : Temperature 25.5 °C Humidity: 51 %RH

Calibration Report (Before adjust)

Status	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Methane	0.0	0.1	0.1	50.0	49.1	-1.8
NMHC	0.0	0.1	0.1	50.0	48.9	-2.2

Calibration Report (After adjust)

Status	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Methane	0.0	0.0	0.0	50.0	50.0	0.0
NMHC	0.0	0.0	0.0	50.0	50.0	0.0



Calibrate By : 

MR. KITTISAK JANSANGWATTANA

Approve by : 

MR. PASAGORN SAMOL

ENVIR SERVICE CO., LTD.

42 Ramintra 14 Yeak 9, Tha Raeng, Bang Khen, Bangkok 10230
Tel. 02-9435814-5 Fax. 02-9438201 www.envirservice.co.th

Analyzer Performance Test

Calibrated Date: 17 September 2023

Instruments Information

Analyzer Type : SO2 Analyzer

Model : 43C

Manufacturer :

Thermo Environmental

Serial Number :

0411405899

Calibrator Unit

Dilutor Model : Dasibi Model 5008

Serial Number : 705

ZERO AIR Generator : API MODEL 701

Serial Number : 1924

Standard Gas Concentration

Nitric Oxide (NO) 55.47 PPM

Sulphur Dioxide (SO2) 55.11 PPM

Carbon Monoxide (CO) 4,535 PPM

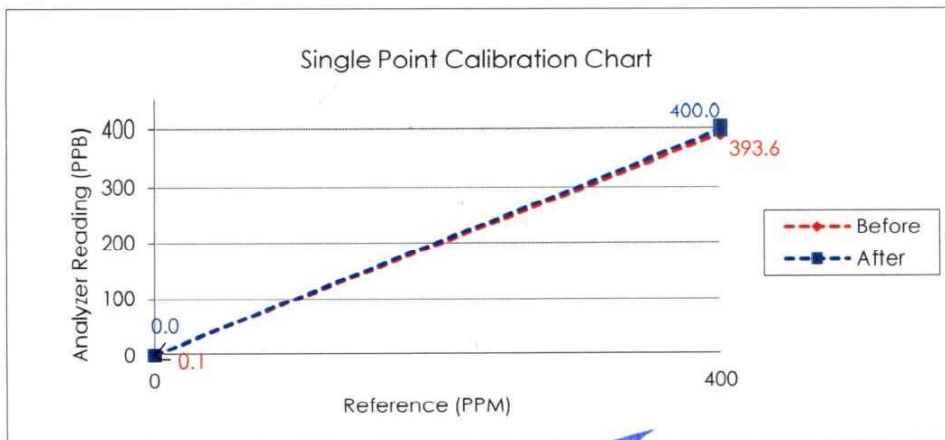
Cylinder number EB0129027

Expire Date: 29 Oct. 2027

Environment : Temperature 25.5 °C Humidity: 51 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
Before	0.0	0.1	0.1	400.0	393.6	-1.6
After	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By :

กิตติศักดิ์ จันทะวงษ์

MR. KITTISAK JANSANGWATTANA

Approve by :

MR. PASAGORN SAMOL

MR. PASAGORN SAMOL

ENVIR SERVICE CO., LTD.



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

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

Location of Calibration : In-Lab

Calibration Procedure : In-House Method

Received Date : 31 Jul 2023

Calibration Date : 02 Aug 2023

Recommend Due Date : 02 Aug 2024

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

Approved by :

(Mr.Nirut Loha)

Authorized Signatory



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



Certificate of Calibration

Certificate Number : SPR23060536-3

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 : 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

Approved by :

(Mr.Nirut Loha)

Authorized Signatory



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 -



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

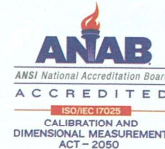
Note:

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 : SPR23080172-4

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 : 10340946

ID. Number : TNP-F-S31

Environmental Conditions

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

Received Date : 14 Aug 2023

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

Calibration Date : 14 Aug 2023

Location of Calibration : In-Lab

Recommend Due Date : 14 Aug 2024

Calibration Procedure : SP-CPE-04-01

Date of Issue : 15 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).

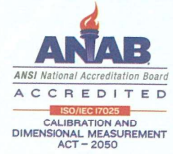
Calibrated by : Mr.Karoon Pengsalung

Calibration Officer

Approved by :

(Mr.Nirut Loha)

Authorized Signatory



Calibration Report

Certificate Number : SPR23080172-4

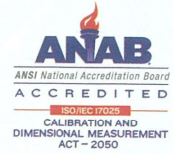
Page : 2 of 3

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. : SPR23080172-4

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	113.9	113.9	-0.1	-0.1	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	113.9	113.9	-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 -



Certificate of Calibration

Certificate Number : SPR23040172-1

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 : Instantel

Model : 721A0501/721A2901

Serial Number : UM6150/UM12863

ID. Number : TNP-F-V12

Environmental Conditions

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

Received Date : 18 Apr 2023

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

Calibration Date : 21 Apr 2023

Location of Calibration : In-Lab

Recommend Due Date : 21 Apr 2024

Calibration Procedure : In-House Method

Date of Issue : 22 Apr 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 Metrology System (Thailand).

Calibrated by : Mr. Munin Khumpum

Calibration Officer

Approved by :

(Mr. Nirut Loha)

Authorized Signatory



Calibration Report

Certificate Number : SPR23040172-1

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. : SPR23040172-1

Page : 3 of 3

Results of Calibration : (★) Without () After Adjustment

Velocity Performance Test

Unit : mm/s_{pk}

Frequency (Hz)	STD Reading	UUC. Reading	Error	Uncertainty (±)
80.0	1.002	1.034	0.032	0.012
80.0	2.004	2.045	0.041	0.023
80.0	3.001	3.056	0.055	0.035
80.0	4.004	4.067	0.063	0.046
80.0	5.004	5.051	0.047	0.058
80.0	6.003	6.069	0.066	0.069
80.0	7.005	7.082	0.077	0.081
80.0	8.008	8.112	0.104	0.092
80.0	9.011	9.184	0.173	0.10
80.0	10.015	10.238	0.223	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 –



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 Jitraporn 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	Y	Standard Flow [Q_s] m ³ /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 m³/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	Y	Standard Flow [Q_a] m ³ /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 m³/min

End of Certificate of Calibration





บริษัท เอ็นไวร์ เซอร์วิส จำกัด
ENVIR SERVICE CO., LTD.

บริษัท เอ็นไวร์ เซอร์วิส จำกัด

42 รามอินทรา 14 แยก 9 แขวงท่าแร้ง เขตบางเขน กรุงเทพฯ 10230 โทรศัพท์ 02-9435814-5 โทรสาร 02-9438201

42 Raminthra 14 yeak 9, Tha Rang, Bangkhen, Bangkok 10230 Tel : 02-9435814-5 Fax : 02-9438201

Analyzer Performance Test

Calibrated Date: 18 January 2022

Instruments Information

Analyzer Type: CO Analyzer Model: 48C	Manufacturer Thermo Environmental S/N: 48C-67713-358
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Calibration System

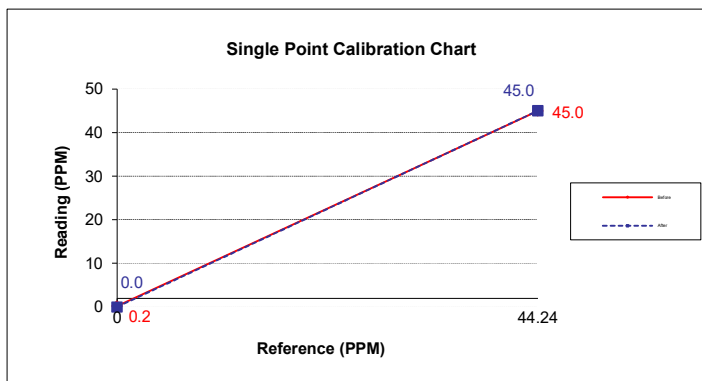
Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008 S/N: 705 ZERO AIR Generator API MODEL 701 S/N: 1924	NO Conc 55.47 PPM SO2 Conc 55.11 PPM CO Conc 4,535 PPM Cylinder number EB0129027 Expire Date: 29 Oct. 2027

Environment: Temperature 25.5 °C

Humidity: 51 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Before	0.0	0.2	0.2	44.2	45.0	1.7
After	0.0	0.0	0.0	45.0	45.0	0.0



Calibrate By :

Mr. PASAGORN SAMOL



บริษัท เอ็นไวร์ เซอร์วิส จำกัด

บริษัท เอ็นไวร์ เซอร์วิส จำกัด
ENVIR SERVICE CO., LTD.

42 รามอินทรา 14 แยก 9 แขวงท่าแร้ง เขตบางเขน กรุงเทพฯ 10230 โทรศัพท์ 02-9435814-5 โทรสาร 02-9438201

42 Raminthra 14 yeak 9, Tha Rang, Bangkhen, Bangkok 10230 Tel : 02-9435814-5 Fax : 02-9438201

Analyzer Performance Test

Calibrated Date: 20 January 2022

Instruments Information

Analyzer Type: NO/NO ₂ /NO _x Analyzer Model: 42C	Manufacturer: Thermo Environmental S/N: 42C-56817-311
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Calibration System

Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008 S/N: 705 ZERO AIR Generator API Model 701 S/N: 1924	NO Conc 55.47 PPM SO ₂ Conc 55.11 PPM CO Conc 4,535 PPM Cylinder number EB0129027 Expire Date: 29 Oct. 2027

Environment: Temperature 25.5 °C

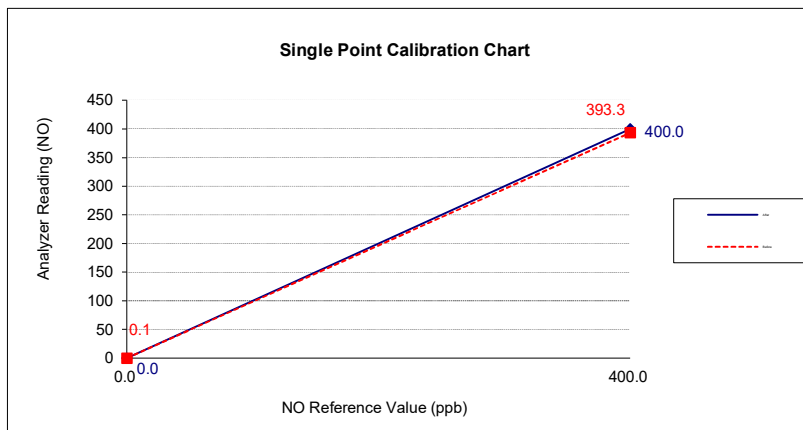
Humidity: 51 %RH

Calibration Check (Before adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.1	0.0	0.1	393.3	400.0	-1.7
NO _x	0.1	0.0	0.1	396.5	400.0	-0.9

Calibration Check (After adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.0	0.0	0.0	400.0	400.0	0.0
NO _x	0.0	0.0	0.0	400.0	400.0	0.0



Handwritten signature

Calibrate By : Mr. Pasagorn Samol

Analyzer Performance Test

Calibrated Date: 17 September 2023

Instruments Information

Analyzer Type : CO Analyzer

Model : 48C

Manufacturer :

Thermo Environmental

Serial Number :

48C-79177-391

Calibrator Unit

Dilutor Model :

Dasibi Model 5008

Serial Number :

705

ZERO AIR Generator :

API MODEL 701

Serial Number :

1924

Standard Gas Concentration

Nitric Oxide (NO) 55.47 PPM

Sulphur Dioxide (SO₂) 55.11 PPM

Carbon Monoxide (CO) 4,535 PPM

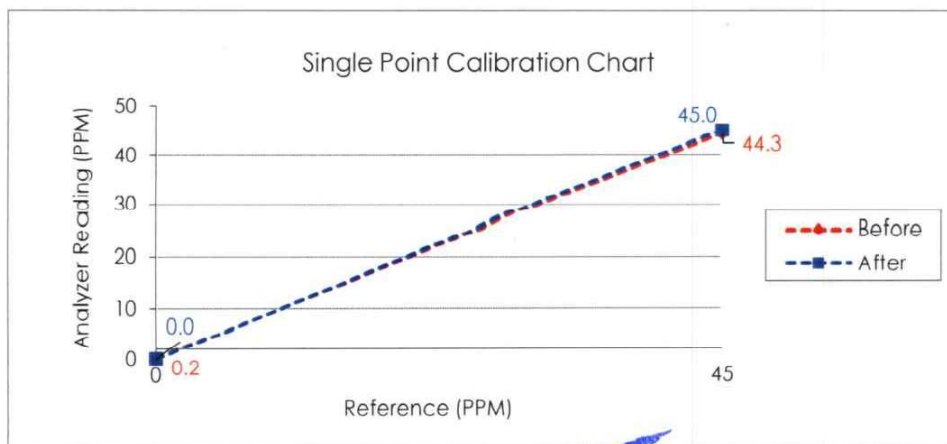
Cylinder number EB0129027

Expire Date: 29 Oct. 2027

Environment : Temperature 25.5 °C Humidity: 51 %RH

Calibration Report

	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Before	0.0	0.2	0.2	45.0	44.3	-1.6
After	0.0	0.0	0.0	45.0	45.0	0.0



Calibrate By :

MR. KITTISAK JANSANGWATTANA

Approve by :

MR. PASAGORN SAMOL

MR. KITTISAK JANSANGWATTANA

MR. PASAGORN SAMOL

ENVIR SERVICE CO., LTD.

Analyzer Performance Test

Calibrated Date: 18 September 2023

Instruments Information

Analyzer Type : NO-NO₂-NO_x Analyzer

Manufacturer : Thermo Environmental

Model : 42C

Serial Number : 0413406269

Calibrator Unit

Dilutor Model : Dasibi Model 5008

Serial Number : 705

ZERO AIR Generator : API MODEL 701

Serial Number : 1924

Standard Gas Concentration

Nitric Oxide (NO) 55.47 PPM

Sulphur Dioxide (SO₂) 55.11 PPM

Carbon Monoxide (CO) 4,535 PPM

Cylinder number EB0129027

Expire Date: 29 Oct. 2027

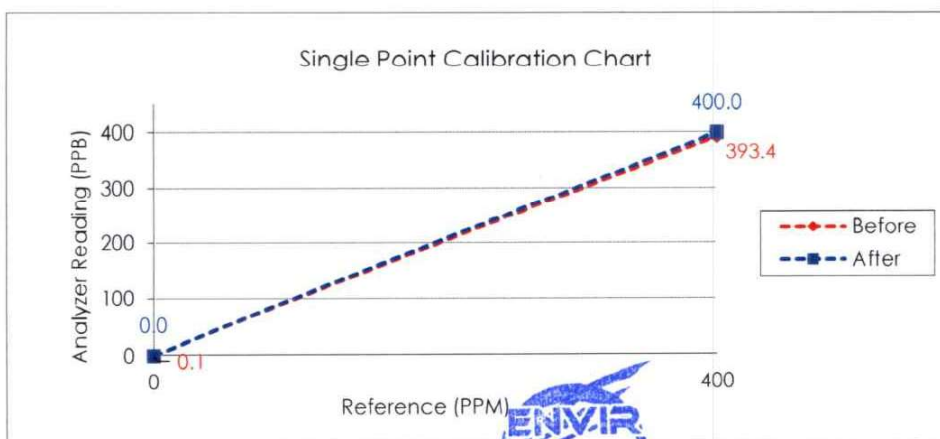
Environment : Temperature 25.5 °C Humidity: 51 %RH

Calibration Report (Before Adjust)

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
NO	0.0	0.1	0.1	400.0	393.4	-1.7
NO _x	0.0	0.0	0.0	400.0	394.6	-1.3

Calibration Report (After Adjust)

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
NO	0.0	0.1	0.1	400.0	400.0	0.0
NO _x	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By :

กิตติศักดิ์ จันทะเลววัฒนา

Approve by :

MR. PASAGORN SAMOL

MR. KITTISAK JANSANGWATTANA

บริษัท เอ็นไวร์ เซอร์วิส จำกัด
ENVIR SERVICE CO., LTD.

MR. PASAGORN SAMOL

ENVIR SERVICE CO., LTD.

42 Ramintra 14 Yeak 9, Tha Raeng, Bang Khen, Bangkok 10230
Tel. 02-9435814-5 Fax. 02-9438201 www.envirservice.co.th

Analyzer Performance Test

Calibrated Date: 31 October 2023

Instruments Information

Analyzer Type : SO2 Analyzer

Model : 43C

Manufacturer : Thermo Environmental

Serial Number : 0327402325

Calibrator Unit

Dilutor Model : Dasibi Model 5008

Serial Number : 705

ZERO AIR Generator : API MODEL 701

Serial Number : 1924

Standard Gas Concentration

Nitric Oxide (NO) 55.47 PPM

Sulphur Dioxide (SO2) 55.11 PPM

Carbon Monoxide (CO) 4,535 PPM

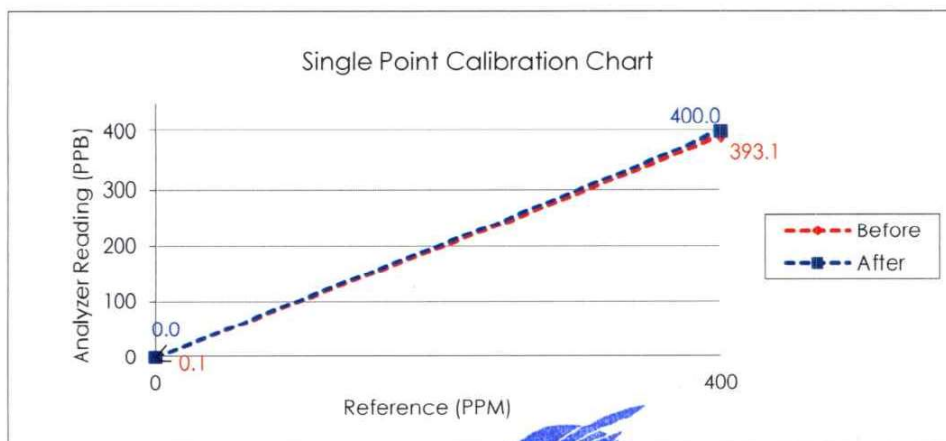
Cylinder number EB0129027

Expire Date: 29 Oct. 2027

Environment : Temperature 25.5 °C Humidity: 51 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
Before	0.0	0.1	0.1	400.0	393.1	-1.7
After	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By :

กิตติศักดิ์ จันทะเลววัฒนา

Approve by :

MR. PASAGORN SAMOL

MR. KITTISAK JANSANGWATTANA

ENVIR SERVICE CO., LTD.

MR. PASAGORN SAMOL

Analyzer Performance Test

Calibrated Date: 2023-Nov-1

Instruments Information

Analyzer Type : CH4-NMHC-THC Analyzer

Manufacturer : HORIBA

Model : APHA-360CE

Serial Number : 423740300209

Calibrator Unit

Dilutor Model : Dasibi Model 5008

Serial Number : 705

ZERO AIR Generator : API MODEL 701

Serial Number : 1924

Standard Gas Concentration

Methane (CH₄) 181.0 PPM

Propane 180.7 PPM

Cylinder number EB0123130

Expire Date: 3 Oct. 2027

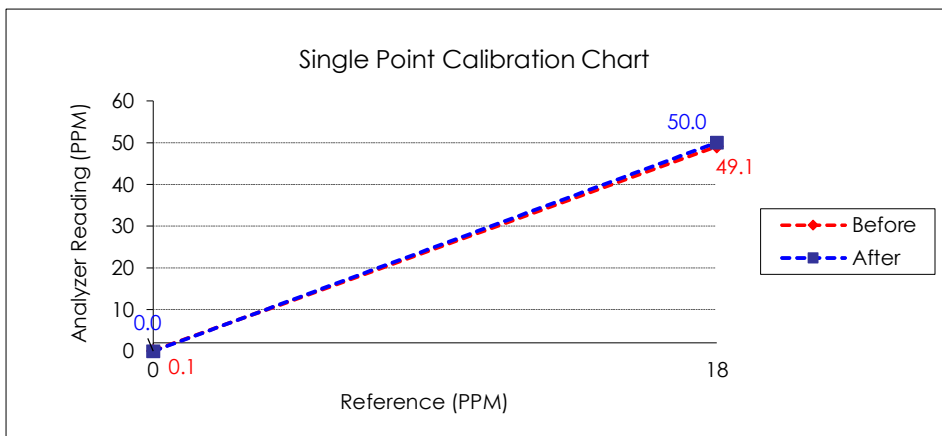
Environment : Temperature 25.5 °C Humidity: 51 %RH

Calibration Report (Before adjust)

Status	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Methane	0.0	0.1	0.1	50.0	49.1	-1.8
NMHC	0.0	0.1	0.1	50.0	48.9	-2.2

Calibration Report (After adjust)

Status	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Methane	0.0	0.0	0.0	50.0	50.0	0.0
NMHC	0.0	0.0	0.0	50.0	50.0	0.0



Calibrate By : 

MR. KITTISAK JANSANGWATTANA

Approve by : 

MR. PASAGORN SAMOL

Analyzer Performance Test

Calibrated Date: 17 September 2023

Instruments Information

Analyzer Type : SO₂ Analyzer

Model : 43C

Manufacturer :

Thermo Environmental

Serial Number :

0411405899

Calibrator Unit

Dilutor Model :

Dasibi Model 5008

Serial Number :

705

ZERO AIR Generator :

API MODEL 701

Serial Number :

1924

Standard Gas Concentration

Nitric Oxide (NO) 55.47 PPM

Sulphur Dioxide (SO₂) 55.11 PPM

Carbon Monoxide (CO) 4,535 PPM

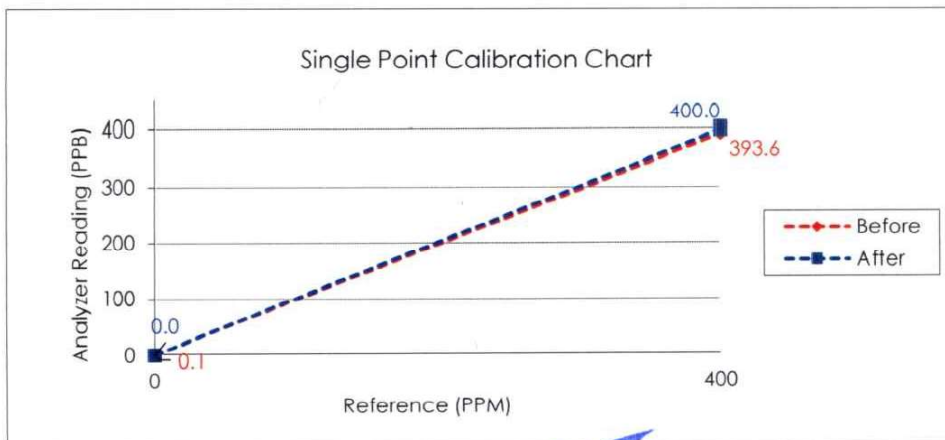
Cylinder number EB0129027

Expire Date: 29 Oct. 2027

Environment : Temperature 25.5 °C Humidity: 51 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
Before	0.0	0.1	0.1	400.0	393.6	-1.6
After	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By :

กิตติศักดิ์ จันทะเลววัฒน



Approve by :

MR. PASAGORN SAMOL

MR. KITTISAK JANSANGWATTANA บริษัท เอ็นไวร์ เซอร์วิส จำกัด

ENVIR SERVICE CO., LTD



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

Approved by :

(Mr.Nirut Loha)

Authorized Signatory



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



Certificate of Calibration

Certificate Number : SPR23060536-3

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 : 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

Approved by :

(Mr.Nirut Loha)

Authorized Signatory



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 -



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

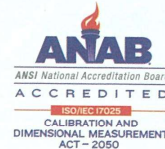
Note:

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 : SPR23080172-4

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 : 10340946

ID. Number : TNP-F-S31

Environmental Conditions

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

Received Date : 14 Aug 2023

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

Calibration Date : 14 Aug 2023

Location of Calibration : In-Lab

Recommend Due Date : 14 Aug 2024

Calibration Procedure : SP-CPE-04-01

Date of Issue : 15 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).

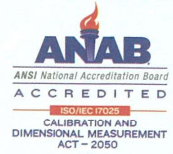
Calibrated by : Mr.Karoon Pengsalung

Calibration Officer

Approved by :

(Mr.Nirut Loha)

Authorized Signatory



Calibration Report

Certificate Number : SPR23080172-4

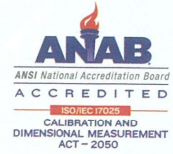
Page : 2 of 3

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. : SPR23080172-4

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	113.9	113.9	-0.1	-0.1	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	113.9	113.9	-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 -



Certificate of Calibration

Certificate Number : SPR23040172-1

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 : Instantel

Model : 721A0501/721A2901

Serial Number : UM6150/UM12863

ID. Number : TNP-F-V12

Environmental Conditions

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

Received Date : 18 Apr 2023

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

Calibration Date : 21 Apr 2023

Location of Calibration : In-Lab

Recommend Due Date : 21 Apr 2024

Calibration Procedure : In-House Method

Date of Issue : 22 Apr 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 Metrology System (Thailand).

Calibrated by : Mr. Munin Khumpum

Calibration Officer

Approved by :

(Mr. Nirut Loha)

Authorized Signatory



Calibration Report

Certificate Number : SPR23040172-1

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. : SPR23040172-1

Page : 3 of 3

Results of Calibration : (★) Without () After Adjustment

Velocity Performance Test

Unit : mm/s_{pk}

Frequency (Hz)	STD Reading	UUC. Reading	Error	Uncertainty (±)
80.0	1.002	1.034	0.032	0.012
80.0	2.004	2.045	0.041	0.023
80.0	3.001	3.056	0.055	0.035
80.0	4.004	4.067	0.063	0.046
80.0	5.004	5.051	0.047	0.058
80.0	6.003	6.069	0.066	0.069
80.0	7.005	7.082	0.077	0.081
80.0	8.008	8.112	0.104	0.092
80.0	9.011	9.184	0.173	0.10
80.0	10.015	10.238	0.223	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 –



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



Cert.No.: 23CH126

Page.: 1 of 2

Certificate of Calibration

Equipment : pH Meter
Manufacturer : Adwa
Model : AD 12
Serial No. : 1328
ID No. : TNP.LAB.13
Condition As-Received: Used Item
Received Date : 27 January 2023
Calibration Date : 30 January 2023
Reference : 2301-0937WN-2
Submitted by : TNP ENVIRONMENT CO.,LTD
332/173 Moo 3, Bang Rak Phatthana,
Bang Bua Thong, Nonthaburi 11110
Ambient Temperature : $(25 \pm 2.5) ^\circ\text{C}$
Relative Humidity : $(50 \pm 15) \%$
Calibration Procedure : In - house method :
- CP-CH5 by direct measurement with standard
voltage calibrator and direct measurement
with certified reference material (CRM)

Calibrated by : Walalak Sirithean

Approved by :

Malee

Approved Signatory

- (/) Malee Butkruea
() Saithip Meangmai
() Warakorn Lergagtrakul

Issue Date : 31 January 2023

The Uncertainties are for a confidence probability of approximately 95%

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

A 0050390



Cert.No.: 23CH126

Page.: 2 of 2

Condition of this calibration result

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

<u>Buffer Solution</u>	<u>Manufacturer</u>	<u>Lot No.</u>	<u>Exp. date</u>
pH 4.008	CPA chem	826588	09 July 2024
pH 6.987	CPA chem	826589	09 July 2023
pH 10.008	CPA chem	826590	09 July 2023

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

Calibration Results

Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH Measurement (\pm)	Coverage factor k
pH Electrode S/N.: 1328	4.008	4.01	N/A	0.0085	2.05
	6.987	6.99	N/A	0.011	2.00
	10.008	10.02	N/A	0.0095	2.00

- Remark**
- pH meter does not have voltage mode.
 - Can not connect the BNC because the plug does not match with the socket.
 - N/A = Not Available

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

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Certificate of Calibration

Customer

Name : Innovative Instrument Co.,Ltd.
Address : 7/139 Moo 13, Soi Suntinakorn 11 Tambon Bang Kaeo, Amphoe Bang
Phli Samut Prakan Province 10540 Thailand

Certificate No : 22-DPM-236

Request No : Req-2022-1811

Unit Under Calibration Details

Measurement Item : Bioaerosol Sampler Resolution : 0.001 inch H₂O
Manufacturer : Aquaria
Model : Microflow α
Serial Number : M3290
ID : -

Calibration Environment and Details

Temperature : 23 °C \pm 3 °C
Humidity : 55 %RH \pm 15 %RH
Received Date : 26 September 2022
Calibrated Date : 6 October 2022
Calibration By : Mr. Noppadon Luangart
Location of Calibration : LAB 4 Air Velocity
Calibration Procedure : In-house method CP-DPM-02 by Comparison With Standard Differential Pressure Transducer

Reference Standard	Model	Serial Number	Due Calibration
Digital Pressure Calibrator	ADT672-05-DP20-MBAR	273160C0023	4 July 2023
Thermo Hygrometer	SD700	Q597552	21 October 2022

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

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

Calibration By : Mr. Noppadon Luangart
Service Calibration Engineer

Approved By : Mr. Pacit Mathavorn
Calibration Engineer Supervisor

Issue Date : 6 October 2022

Certificate No : 22-DPM-236

Request No : Req-2022-1811

Calibration Results : Without Adjustment

Flow Rate Accuracy

Flow Rate (L/min)	ΔP SETRA (inch H ₂ O)	Mean STD Reading (inch H ₂ O)	Error (inch H ₂ O)		Uncertainty (±) (inch H ₂ O)
30	0.014	0.014	0.0%	0.0000	0.0012
60	0.050	0.050	0.0%	0.0000	0.0012
90	0.118	0.118	0.0%	0.0000	0.0012
100	0.138	0.138	0.0%	0.0000	0.0012
120	0.206	0.206	0.0%	0.0000	0.0012

Note :

Mean : The average standard of 4 values on each Point

inch H₂O = 249.0889 Pascal

ΔP = Differential Pressure

End of Certificate

Certificate No. T/O 660071

Date of issue : 14-Mar-2023

Equipment Description : Incubator
Equipment Model : SMART i250-DS
Equipment Serial No. : 0410-0121-0003
I.D. No. or Control No. : -
Manufacturer : Entech Industrial Solution Co.,Ltd.
Customer Name : TNP ENVIRONMENT CO.,LTD.
Customer Address : 332/173 Moo 3 Tambon Bang Rak Phatthana, Amphoe Bang Bua Thong,
Nonthaburi 11110
Total pages of certificate : 2 pages
Instrument Receiving Date : 3-Mar-2023
Receiving No. : O-230081
Environmental Conditions : All of the measurement were carried out in the working area
Temperature : (25 ± 15) °C
Humidity : (55 ± 30) % RH
Voltage : (220 ± 22) VAC
Calibration Place : 332/173 Moo 3 Tambon Bang Rak Phatthana, Amphoe Bang Bua Thong,
Nonthaburi 11110

Calibration Procedure No. : This instrument was calibrated by comparison of reference radiation source standard
according to calibration work instration no WI-CL-18-C

*The calibration certificate expended uncertainty of measurement is stated as the standard uncertainty of measurement
multiplied by the coverage factor k, which for a normal distribution corresponds to a coverage probability of approximately 95%*

The standard uncertainty of measurement has been determined in accordance with M 3003

The expression uncertainty and confidence in measurement.

This certificate is applied only to item under test environmental condition.

*This calibration certificate may not be reproduced other than in full except with the permission of the issuing laboratory.
Calibration certificates without signature and seal are not valid and The results relate only to the items tested/calibrated.*

*This calibration certificate documents are traceability to national standards, which realize the unit of measurement
according to the International system of units (SI).*

Date of Calibration : 3-Mar-2023



Mr. Kittipong Kaewsai
Calibration Engineer



Ms. Nongluck Wongsettee
Technical Manager

Certificate No. : T/O 660071

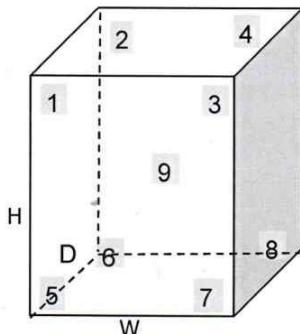
The Reference Standard Instrument :-

Instrument	Model	Serial No.	Cert No.	Due date
1) Data logger with RTD Probe	Agilent 34972A	MY49017365	PSL-T 0524-2/65	4-Apr-2023

Measured room conditions

Temperature :	Minimum: 21.3 °C	Maximum: 22.8 °C
Humidity :	Minimum: 49.3 %RH	Maximum: 54.7 %RH
Voltage :	Minimum: 220.1 VAC	Maximum: 223.4 VAC
Fresh Air Setting:	off	

Sensor Position :



Working Space of chamber :

(Inside Dimensions) W x D x H : 500 mm x 480 mm x 1100 mm

Sensor Installation Details :

- Sensor Number 1 to 8 installed approximately 50 mm From each wall.
- Sensor Number 9 installed approximately geometric of the chamber.

Results : The measurement results of the calibration were reported in the table below.

(*) Without adjustment () After adjustment

UUC* Setting	UUC* Reading	Temperature Reading of Standard Sensor								
(°C)	(°C)	Sensor Position								
		1	2	3	4	5	6	7	8	9
20.0	20.0	20.34	20.30	20.14	20.18	20.15	20.02	19.93	19.94	20.02

UUC* Setting	UUC* Reading	Temperature Uniformity	Temperature Stability	Overall Variation	Uncertainty of Measurement	Coverage Factor
(°C)	(°C)	(°C)	(± °C)	(°C)	(± °C)	K
20.0	20.0	0.50	0.40	1.00	0.61	2

UUC* = Unit Under Calibration

Remark :-

- Temperature reading of Standard Sensors shown in the table were taken from the average of Standard reading at each position.
- Temperature Uniformity was calculated from the difference between the maximum and minimum of actual temperature reading from all reference sensors at the same time.
- Temperature Stability was calculated from the maximum stability of nine positions, and formula of Stability is [(Maximum Temperature Value - Minimum Temperature Value) / 2]
- Overall Variation was calculated from the difference between the maximum and minimum measured temperature throughout observation time.

End of Report

Calibration Certificate

Cert. No. : CT-23-01-23295

Page : 1 of 4

Issued date : 24 January 2023

Equipment : Water Bath , Manufacturer : MLAB , Model : WBN30
S/N = 0347 , Customer ID = -

Client : TNP ENVIRONMENT CO.,LTD.

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

Received Date : 20 January 2023

Ref. Job No. : SO6601-00020

Calibrated by : Mr.Apiwat Mungsamak

Cert. prepare by : Ms.Nattanicha Panumram

Calibrated Date : 20 January 2023

Approved by : Mr.Montree Ruschasetkul

Calibration Place : ห้องปฏิบัติการ2

Environment Condition : Temperature $28.5 \pm 2.7 (^{\circ}\text{C})$, Humidity $57.5 \pm 14.5 (\%RH)$

Calibration Method : In-house method based on ASTM E715-80 (Reapproved 2006) , (MTEC WI No. # WICAL-02-003-R01)

Reference Standard Instrument :

No	Instrument	code	Model	Due date
1	Temperature Data Logger	MTEC-CE-0175	MLAB	10/2023
2	Thermo Hygrometer	MTEC-CE-0183	TP-50	06/2023

Condition of certificate :

(1) This certificate is traceable to International System of units (SI Units). , (2) This certificate was certified only for the instrument we calibrated.
, (3) This result of calibration was found accurate as show on date and place of calibration only. , (4) The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k =$ (see result table) , providing a level of confidence of approximately 95%. , (5) This certificate may not be reproduced other than in full, except with the prior written approval of the head of Calibration Division, Metrology Technical Co.,Ltd.

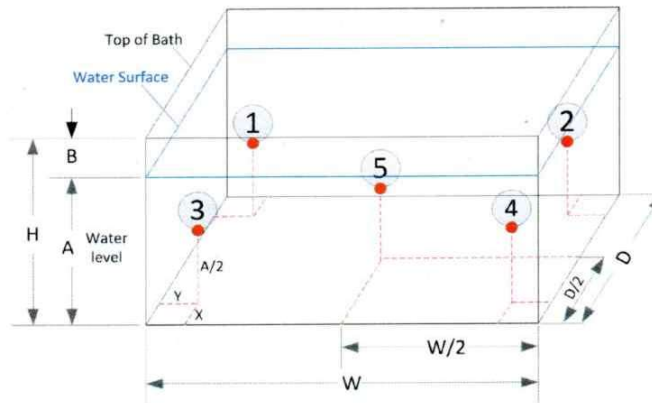


Approved Signatory

Calibration Result :

Condition of UUC :

- 1) Adjust Condition : Without Adjustment
- 2) Lid Cover : Flat Sheet (Plastic , from
- 3) Circulation : without circulation
- 4) X,Y = 5 cm. , B ~ 3 cm.



Pic 1 : Position of each sensor No.

(1) The quoted uncertainty include with "Stability".

(2) Stability = One-half of the greatest maximum difference of measured temperatures at any one sensors , for at least half an hour after reaching sted state.

(3) Uniformity = The maximum difference of measured temperatures at two any sensor which are observed at the same time.

(4) Overall variation = The difference of the maximum and the minimum measured temperature throughout observation time.

Section 1 : Report of Temperature distribution

Unit : (°C)

Calibration Point	UUC Setting (*)	UUC Reading (*)	Measured Temperature @ Sensor No.					Uncertainty (±)	k (**)
			#1	#2	#3	#4	#5		
85	85	85.0	85.30	85.30	84.83	84.76	85.51	0.627	2

(*) = The average of 30 values in each point , (**) = Coverage factor (k) value

Section 2 : Report of Chamber Performance

Unit : (°C)

Calibration Point	UUC Setting (*)	UUC Reading (*)	Temperature Uniformity	Temperature Stability (± °C)	Temperature Overall Variation
85	85	85.0	1.34	0.45	1.64

(*) = The average of 30 values in each point

Approved Signatory :

Certificate No. : CT-23-01-23295

Page : 3 of 4

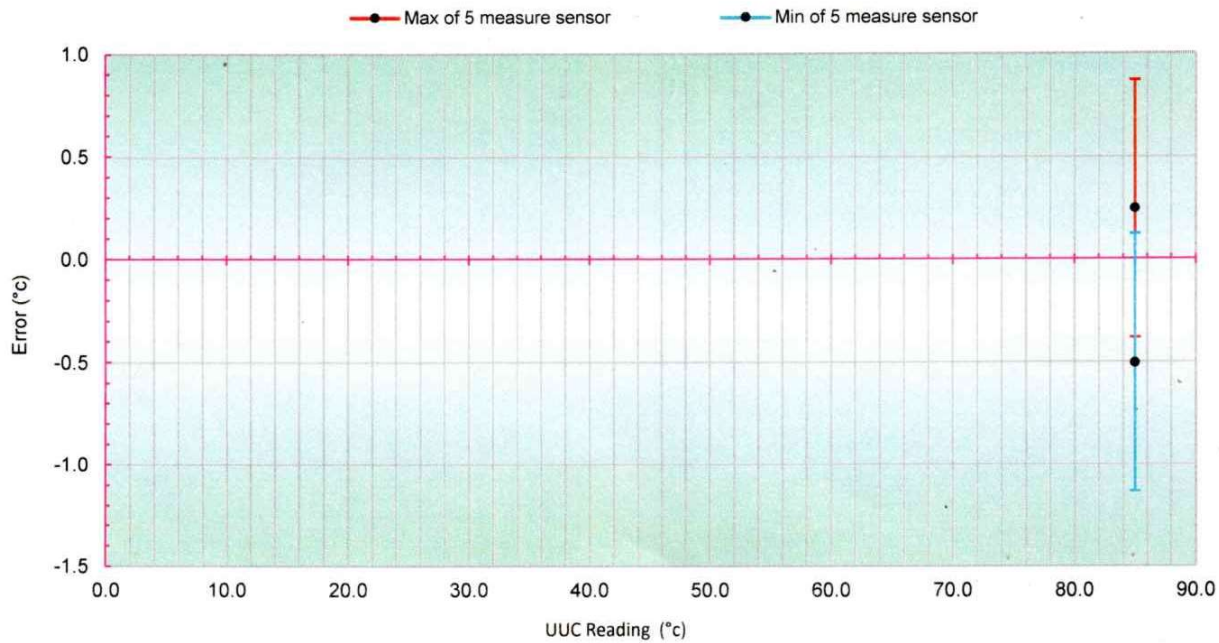
Section 3 : Possible of temperature in chamber. Show minimum and maximum of the average values and include with uncertainty of measurement. , The average values is average of each position standard sensor throughout observation time.

Unit : (°C)

Calibration Point	UUC Setting ^(*)	UUC Reading ^(*)	Possible of Minimum temperature in chamber	Possible Maximum temperature in chamber
85	85	85.0	84.13	86.13

(*) = The average of 30 values in each point

Section 4 : Trend of accuracy



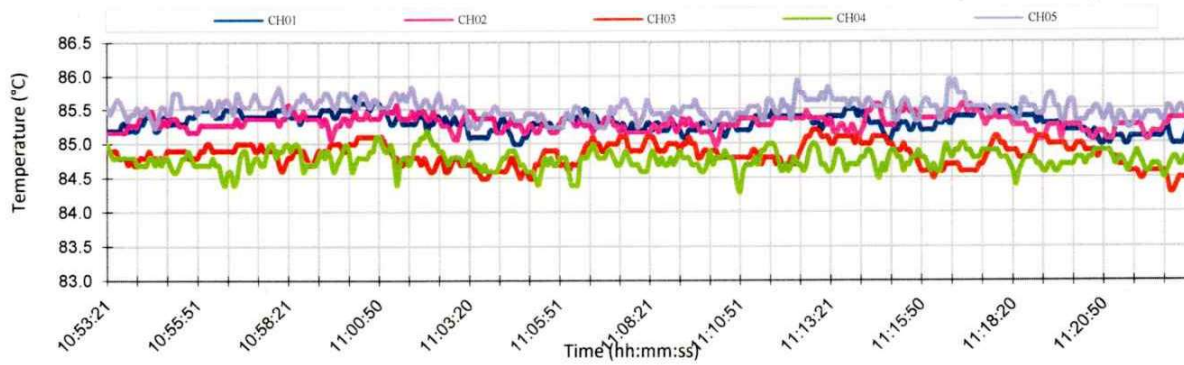
Approved Signatory : 

Certificate No. : CT-23-01-23295

Page : 4 of 4

Section 5 : Graph report for Temperature distribution , not include uncertainty of measurement

(5.1) Temperature Distribution at UUC Reading 85.0 °C



Approved Signatory :



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534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250
TEL. 0-2717-3000-24 FAX. 0-2719-9484



Certificate of Calibration

Certificate No. : 23T238

Page : 1 of 2

Equipment : Liquid-in Glass Thermometer

Manufacturer: SK

Model : -

Serial No.: -

ID No.: TNP.LAB.12

Condition As-Received: Used Item

Received Date: 27 January 2023

Calibration Date: 07 February 2023
to 10 February 2023

Reference: 2301-0937WN

Submitted by: TNP ENVIRONMENT CO.,LTD

Ambient Temperature: (25 ± 3) °C

Relative Humidity: (50 ± 20) %

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

Procedure used: Calibration were conducted using in-house calibration procedure CP-T02 according to comparison with Industrial Platinum Resistance Thermometer (IPRT) into liquid bath temperature controller.
The temperature scale used was based on ITS-90.

Condition of this result of calibration

1.Reference standards instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1) Digital Thermometer	1529	A7A609	22I1274	17 Oct 2023
2) Industrial Platinum Resistance Thermometer	5627-12	571975	22I1274	17 Oct 2023

2.The UUC* was immersed into liquid bath temperature controller and the top about 12 mm of the liquid column above the bath medium in every calibration points.

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

4.This Certification is traceable to the International System of Unit maintained at:-

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Thammanoon Phuwardkien
Issue Date : 14 February 2023

Approved Signatory : _____

[] Phalinee Prabpaipal

[] Chatchawan Khunpiluek

[✓] Wanlop Larpkurn

B 0307331



Cert. No.: 23T238

Page.: 2 of 2

Result of Calibration:-

Without Adjustment

Function: Temperature measurement.

Type: Total Immersion

Scale Division: 1 °C

Reference point (0 °C) Error = -0.9681 °C, with Uncertainty of Measurement of ± 0.16 °C

<u>UUC*</u> <u>Reading</u> (°C)	<u>Standard</u> <u>Temperature</u> (°C)	<u>Error</u> (°C)	<u>Uncertainty</u> <u>of Measurement</u> (\pm °C)
20	21.4342	-1.4342	0.16
30	31.5544	-1.5544	0.16
40	41.1382	-1.1382	0.16

Note: UUC* : Unit Under Calibration

The UUC* readings were made under magnification and resolved to one tenth of one scale division.

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

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TEL. 0-2717-3000-24 FAX. 0-2719-9484



Certificate of Calibration

Certificate No. : 23H486

Page : 1 of 2

Equipment : Digital Thermo-Hygrometer

Manufacturer: EXTECH

Model : 448515

Serial No.: PONPE5899554

ID No.: TNP.LAB.21

Condition As-Received: Used Item

Received Date: 02 March 2023

Calibration Date: 07 March 2023

Reference: 2303-0104WN

Submitted by: TNP ENVIRONMENT CO.,LTD.

Ambient Temperature: (25 ± 3) °C

Relative Humidity: (50 ± 20) %

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

Procedure used: Calibration were conducted using in-house calibration procedure CP-H03 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 :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1) Hygro-M2 Dew Point Monitor	5112	2360195	20703	02 Aug 2023
2) Standard Humidity/Temperature Meter	400	10203027	TH-0082-22	22 Aug 2023

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 at:-

- National Institute of Standards and Technology (NIST) , The United States of America
- National Institute of Metrology Thailand (NIMT)

Calibrated by : Viporn Tantiyawutti
Issue Date : 10 March 2023

Approved Signatory :

- ☒ Chakrit Waewanjua
☐ Pornthippa Tameyakul
☐ Viporn Tantiyawutti

B 0310047



Cert. No.: 23H486

Page.: 2 of 2

Result of Calibration:-

Without Adjustment

Function:

Humidity Measurement

<u>Reference</u> <u>Temperature</u> (°C)	<u>Standard</u> <u>Humidity</u> (%R.H.)	<u>UUC*</u> <u>Reading</u> (%R.H.)	<u>Error</u> (%R.H.)	<u>Uncertainty</u> <u>of Measurement</u> (±%R.H.)
25.0	50.1	48	-2.1	1.6

Result of Calibration:-

Without Adjustment

Function:

Temperature Measurement

<u>Standard</u> <u>Temperature</u> (°C)	<u>UUC*</u> <u>Reading</u> (°C)	<u>Error</u> (°C)	<u>Uncertainty</u> <u>of Measurement</u> (±°C)
20.06	19.7	-0.36	0.46
24.99	24.9	-0.09	0.46

UUC* : Unit Under Calibration

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

-o0o-



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250
TEL. 0-2717-3000-24 FAX. 0-2719-9484



Certificate of Calibration

Certificate No. : 23H487

Page : 1 of 2

Equipment : Digital Thermo-Hygrometer

Manufacturer: EXTECH

Model : 448515

Serial No.: PONPE5899555

ID No.: TNP.LAB.22

Condition As-Received: Used Item

Received Date: 02 March 2023

Calibration Date: 07 March 2023

Reference: 2303-0104WN

Submitted by: TNP ENVIRONMENT CO.,LTD.

Ambient Temperature: (25 ± 3) °C

Relative Humidity: (50 ± 20) %

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

Procedure used: Calibration were conducted using in-house calibration procedure CP-H03 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 :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1) Hygro-M2 Dew Point Monitor	5112	2360195	20703	02 Aug 2023
2) Standard Humidity/Temperature Meter	400	10203027	TH-0082-22	22 Aug 2023

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 at:-

-National Institute of Standards and Technology (NIST) , The United States of America

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Viporn Tantiyawutti

Issue Date : 10 March 2023

Approved Signatory : 

☒ Chakrit Waewanjua

☐ Pornthippa Tameyakul

☐ Viporn Tantiyawutti

B 0310048



Cert. No.: 23H487

Page.: 2 of 2

Result of Calibration:-

Without Adjustment

Function:

Humidity Measurement

<u>Reference</u> <u>Temperature</u> (°C)	<u>Standard</u> <u>Humidity</u> (%R.H.)	<u>UUC*</u> <u>Reading</u> (%R.H.)	<u>Error</u> (%R.H.)	<u>Uncertainty</u> <u>of Measurement</u> (±%R.H.)
25.0	50.1	29	-21.1	1.6

Result of Calibration:-

Without Adjustment

Function:

Temperature Measurement

<u>Standard</u> <u>Temperature</u> (°C)	<u>UUC*</u> <u>Reading</u> (°C)	<u>Error</u> (°C)	<u>Uncertainty</u> <u>of Measurement</u> (±°C)
20.06	19.9	-0.16	0.46
24.99	25.1	0.11	0.46

UUC* : Unit Under Calibration

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

-o0o-



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250
TEL. 0-2717-3000-24 FAX. 0-2719-9484



Certificate of Calibration

Certificate No. : 23M455

Page : 1 of 2

Equipment : Standard Weight Set

Manufacturer: -

Model : Class:F1

Serial No.: 15022021-01

ID No.: TNP.LAB.25

Condition As-Received: Used Item

Received Date: 02 March 2023

Calibration Date: 04 March 2023

Reference: 2303-0104WN

Submitted by: TNP ENVIRONMENT CO.,LTD.

Ambient Temperature: (23 ± 2) °C

Relative Humidity: (50 ± 15) %

Atmospheric Pressure: 1015.25 mbar

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except with the prior written approval of the head of
Corporate Services 3: Equipment Calibration and Testing Services.

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

Procedure used: Calibration were conducted using in-house calibration procedure CP-M01 according to comparison method against standard weights on the basis of weighings at an average air density of 1.2 kg/m³ and a temperature of 23.4 °C material density of weight is 8000 kg/m³.

Condition of this result of calibration

1.Reference standards instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1) Standard Weight Set (E2)	73336	20026	MM-0018-22	28 Feb 2024
2) Standard Weight Set (E2)	73338	20028	MM-0019-22	28 Feb 2024

2.This certificate is not certified for any commercial transaction.


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

4.This Certification is traceable to the International System of Unit maintained at:-

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Thapakorn Thammachai
Issue Date : 07 March 2023

Approved Signatory :


[] Phalinee Prabpaipal

[X] Sura Suwannasri

[] Chaowalit Rittirak

B 0309848



Cert No.: 23M455

Page: 2 of 2

Result of calibration

Nominal Value	Conventional mass		Uncertainty of Measurement (\pm)	Maximum Permissible error (\pm)
	Before Adjustment	After Adjustment		
200 g	199.99986 g	-	0.30 mg	1.0 mg
100 g	100.00015 g	-	0.16 mg	0.50 mg
50 g	50.00015 g	-	0.10 mg	0.30 mg
20 g	20.000116 g	-	0.080 mg	0.25 mg
10 g	10.000041 g	-	0.060 mg	0.20 mg
5 g	5.000010 g	-	0.050 mg	0.16 mg
2 g	1.999936 g	-	0.040 mg	0.12 mg
1 g	0.999973 g	-	0.030 mg	0.10 mg
200 mg	200.059 mg	200.007 mg	0.020 mg	0.060 mg
100 mg	100.037 mg	99.981 mg	0.016 mg	0.050 mg

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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THAI CALIBRATION SERVICES CO., LTD.

19/8 Moo 9 Soi Raiking 30 Puttamonthon 5 Rd., Sampran, Nakornpatom 73210

Tel. 0-3439-7682-5 Fax: 0-3439-7687

www.thaical.com E-mail : sale@thaicalibration.com, lab@thaicalibration.com



CALIBRATION CERTIFICATE

Certificate No.S2306518S

page 1 of 2

Customer : TNP ENVIRONMENT CO., LTD.
332/173 Moo 3 Tambon Bang Rak Phatthana,
Amphoe Bang Bua Thong, Nonthaburi 11110

Equipment : Non-automatic weighing instrument (Electronic instrument)

Manufacturer : Shimadzu **Order No. :** 66S2523-1

Model : AP225WD **Ambient temperature :** $(26.9 \pm 5.0) ^\circ\text{C}$

Accuracy class : - **Relative humidity :** $(52.0 \pm 10.0) \%$

Capacity : 10 g / 220 g **Received date :** 21-Jun-2023

Resolution : 0.00001 g / 0.0001 g **Date of calibration :** 21-Jun-2023

Serial No. : D316301848 **Date of issue :** 24-Jun-2023

ID No. : TNP.LAB.30 **Condition of the balance :** Good working conditions

Place of calibration : ห้อง LAB

Calibration method

This instrument was calibrated according to the EURAMET Calibration Guide No. 18.

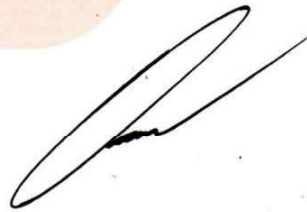
Condition of reference standard weight

Instrument	Nominal value	Serial No.	Certificate No.	Due-date	Density (kg/m ³)
1 Standard weight set	1 mg to 2 kg	15885+15849	M2210001S	8-Oct-2023	7950

Traceability of the reference standard weight

This certificate is traceable to SI unit through Mass Calibration Laboratory Thai Calibration Services Co., Ltd., NSC-ONSC accredited no. Calibration 0189.

Calibrated By : Aekhasak Silarut
Technician

Approved Signatory : 
Chonlatee Pongwatvisanon

This calibration certificate may not be reproduced other than in full,
except with the prior written approval of the head of TCS calibration laboratory.



THAI CALIBRATION SERVICES CO., LTD.

19/8 Moo 9 Soi Raiking 30 Puttamonthon 5 Rd., Sampran, Nakornpatom 73210

Tel. 0-3439-7682-5 Fax: 0-3439-7687

www.thaical.com E-mail : sale@thaicalibration.com, lab@thaicalibration.com



CALIBRATION CERTIFICATE

Certificate No.S2306518S

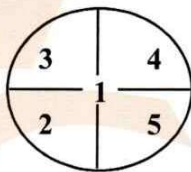
page 2 of 2

The repeatability of indication

Nominal Value (g)	Standard Deviation of reading (g)	Maximum difference between successive reading (g)	n
100	0.000005	0.00001	5
200	0.00005	0.0001	5

The effect of eccentric application of a load on the indication (test load : 100 g)

Position	Balance Reading (g)
Point 1	100.0000
Point 2	100.0002
Point 3	100.0001
Point 4	100.0000
Point 5	100.0001
Eccentric Value	0.0002



The error of indication

Nominal Value (g)	Value of Reference Standard Weight (g)	Balance Reading (g)	Correction (g)	Uncertainty (±) (g)	k
Unload	0.00000	0.00000	0.00000	0.000016	2.32
0.1	0.10000	0.10003	-0.00003	0.000019	2.10
0.5	0.50000	0.50001	-0.00001	0.000023	2.04
1	1.00001	1.00000	+0.00001	0.000026	2.00
5	5.00000	5.00001	-0.00001	0.000038	2.00
10	9.99999	10.00001	-0.00002	0.000046	2.00
20	20.0000	20.0000	0.0000	0.000085	2.00
50	50.0000	50.0001	-0.0001	0.00011	2.00
100	100.0000	100.0000	0.0000	0.00018	2.00
200	200.0000	200.0004	-0.0004	0.00034	2.00

Remark : Adjustment, External weight nominal value 100 g, Standard weight of Lab

Uncertainty of measurement

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor (k), which for a normal distribution corresponds to a coverage probability of approximately 95% (confidence level).

This report will certify of the calibrated equipment only.

--End--



THAI CALIBRATION SERVICES CO., LTD.

19/8 Moo 9 Soi Raiking 30 Puttamonthon 5 Rd., Sampran, Nakornpatom 73210

Tel. 0-3439-7682-5 Fax: 0-3439-7687

www.thaical.com E-mail : sale@thaicalibration.com, lab@thaicalibration.com



CALIBRATION CERTIFICATE

Certificate No.S2306519S

page 1 of 2

Customer : TNP ENVIRONMENT CO., LTD.
332/173 Moo 3 Tambon Bang Rak Phatthana,
Amphoe Bang Bua Thong, Nonthaburi 11110

Equipment : Non-automatic weighing instrument (Electronic instrument)

Manufacturer : Sartorius **Order No. :** 66S2523-2

Model : SECURA224-1S **Ambient temperature :** $(26.8 \pm 5.0) ^\circ\text{C}$

Accuracy class : - **Relative humidity :** $(52.0 \pm 10.0) \%$

Capacity : 220 g **Received date :** 21-Jun-2023

Resolution : 0.0001 g **Date of calibration :** 21-Jun-2023

Serial No. : 0041305301 **Date of issue :** 24-Jun-2023

ID No. : TNP.LAB.31 **Condition of the balance :** Good working conditions

Place of calibration : ห้อง LAB

Calibration method

This instrument was calibrated according to the EURAMET Calibration Guide No. 18.


Condition of reference standard weight

Instrument	Nominal value	Serial No.	Certificate No.	Due-date	Density (kg/m ³)
1 Standard weight set	1 mg to 2 kg	15885+15849	M2210001S	8-Oct-2023	7950

Traceability of the reference standard weight

This certificate is traceable to SI unit through Mass Calibration Laboratory Thai Calibration Services Co., Ltd., NSC-ONSC accredited no. Calibration 0189.

Calibrated By : Aekhasak Silarut
Technician

Approved Signatory : 
Chonlatee Pongwatvisanon

This calibration certificate may not be reproduced other than in full,
except with the prior written approval of the head of TCS calibration laboratory.



THAI CALIBRATION SERVICES CO., LTD.

19/8 Moo 9 Soi Raiking 30 Puttamonthon 5 Rd., Sampran, Nakornpatom 73210

Tel. 0-3439-7682-5 Fax: 0-3439-7687

www.thaical.com E-mail : sale@thaicalibration.com, lab@thaicalibration.com



CALIBRATION CERTIFICATE

Certificate No.S2306519S

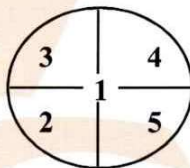
page 2 of 2

The repeatability of indication

Nominal Value (g)	Standard Deviation of reading (g)	Maximum difference between susscessive reading (g)	n
200	0.00000	0.0000	5

The effect of eccentric application of a load on the indication (test load : 100 g)

Position	Balance Reading (g)
Point 1	100.0000
Point 2	100.0000
Point 3	100.0000
Point 4	99.9998
Point 5	99.9998
Eccentric Value	0.0002



The error of indication

Nominal Value (g)	Value of Reference Standard Weight (g)	Balance Reading (g)	Correction (g)	Uncertainty (±) (g)	k
Unload	0.0000	0.0000	0.0000	0.000082	2.00
0.1	0.1000	0.1000	0.0000	0.000083	2.00
0.5	0.5000	0.5000	0.0000	0.000084	2.00
1	1.0000	0.9999	+0.0001	0.000085	2.00
5	5.0000	5.0000	0.0000	0.000090	2.00
10	10.0000	10.0000	0.0000	0.000094	2.00
20	20.0000	20.0001	-0.0001	0.00011	2.00
50	50.0000	50.0001	-0.0001	0.00013	2.00
100	100.0000	100.0000	0.0000	0.00019	2.00
200	200.0000	199.9998	+0.0002	0.00033	2.00

Remark : Without adjustment

Uncertainty of measurement

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor (k), which for a normal distribution corresponds to a coverage probability of approximately 95% (confidence level).

This report will certify of the calibrated equipment only.

--End--

CERT.No.: HS-U039F

Harikul Science Co.,Ltd.

694 Soi Ratchadanivet 24, Pracharatbampnen,

Samsaennok, Huaikhwang, Bangkok 10310

Tel: 0-2274-2456 Fax: 0-2274-2443

Email: info@harikul.com www.harikul.com

Certificate of Calibration

Calibration Date : 20 Jun 23

Submitted by : TNP ENVIRONMENT COMPANY LIMITED.

332/173 Moo. 3, Tambon Bang Rak Phatthana,

Amphoe Bang Bua Thong, Nonthaburi 11110

Avg Room Temp : 20 °C

Avg Water Temp : 20 °C

Air Pressure : 757.00 mmHg

Salinity : 0 ppt

Model : YSI 4010-2W

S/N : 22051520

Probe : YSI 4100

S/N : 22C102711

ID NO. : -

Air Temp ref : S/N. E00522

Barometric ref : S/N. E00522

Water Temp ref : S/N. 11431

Technician : Kittipong M.

Calibration Details

Calibration Point	100% air sat. (@20 °C, DO = 9.09 mg/l)	(status)	(status)
Measurement 1 (mg/l)	9.05	(PASS)	-
Measurement 2 (mg/l)	9.05	(PASS)	-
Measurement 3 (mg/l)	9.04	(PASS)	-
Measurement 4 (mg/l)	9.03	(PASS)	-
Measurement 5 (mg/l)	9.04	(PASS)	-
Measurement 6 (mg/l)	9.04	(PASS)	-
Measurement 7 (mg/l)	9.04	(PASS)	-
Measurement 8 (mg/l)	9.03	(PASS)	-
Measurement 9 (mg/l)	9.03	(PASS)	-
Measurement 10 (mg/l)	9.03	(PASS)	-

Mean Measurement	9.04	mg/l	-	-
Inaccuracy	0.05	mg/l	-	-

Overall Status (PASS)

Manufacturer Specification


Accuracy = +/- 0.2 mg/l

- 1) This certificate is issued based on the result that are found as shown on date and place of test only.
- 2) The calibration procedure followed in accordance with Harikul Science Co., Ltd.
- 3) This result shall not be used for advertising purpose.



Technician Signature

(Kittipong Maekwong)



Laboratory Manager

(Natenapha Pisatkunchon)

Performance Verification Certificate

Job No. LSPR2208846

Equipment : AA SPECTROMETER **Customer :** Environment & Laboratory Co.,Ltd.
Manufacturer : GBC Scientific **Location :** Laboratory
Model Type : SavantAA **Verification Date :** 10 October 2022
Serial No. : A8631

Result of Verification

Test Description	Tolerance	Reading	Result
1. EHT Photometric Noise	< 350 V -	253 V -	PASS
2. Wavelength Accuracy , Cu 324.7 nm	± 0.20 nm	324.80 nm	PASS
3. Wavelength Accuracy , Cs 852.10 nm	± 0.20 nm	852.17 nm	PASS
4. Slit Width 0.2 nm	± 0.02 nm	0.22 nm	PASS
5. Slit Width 0.5 nm	± 0.05 nm	0.52 nm	PASS
6. Slit Width 1.0 nm	± 0.10 nm	1.05 nm	PASS
7. Standard Gauze Screen <u>0.49</u> Abs BC mode with gauze BC mode without gauze * Difference between With gauze and without gauze	± 0.02 Abs < 0.02 Abs	0.489 Abs 0.0007 Abs 0.0009 Abs -0.0002 Abs	PASS PASS
8. ABS Reading 5ppm,Cu	> 0.7 Abs	0.884 Abs	PASS
9. %RSD	< 0.5 %	0.19 %	PASS

We hereby certify that instrument complies with GBC factory specifications

Your satisfaction is our promise @ SPCRT

Verification By : Mr. NIWAT SUPATANIT
Issued Date : 12 October 2022

Signatory : 

DKSH Technology Limited
2533 Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Phone +662 639 7000, Fax +662 333 1026
Email: marketing.tec.th@dksh.com Website: www.dksh.com

บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด
2533 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพฯ 10260
โทรศัพท์ +662 639 7000 โทรสาร +662 333 1026
อีเมล marketing.tec.th@dksh.com www.dksh.com

PREVENTIVE MAINTENANCE AND PERFORMANCE VERIFICATION REPORT

ATOMIC ABSORPTION SPECTROPHOTOMETER (AAS)

Issued Date: 10/10/22

Customer :	บริษัท เอ็นไวรอนเม้นท์ แอนด์ แลборาตอรี จำกัด	Manufacturer :	GBC Scientific Equipment Pty Ltd.
Address :	53/3 หมู่ 3 ถนนเรวดี ตำบลตลาดขวัญ อำเภอเมือง นนทบุรี จังหวัดนนทบุรี 11000	Model :	SavantAA
Contract :	คุณ อลิสา ทรงสวัสดิ์	Serial No :	A8631
		Location :	Laboratory

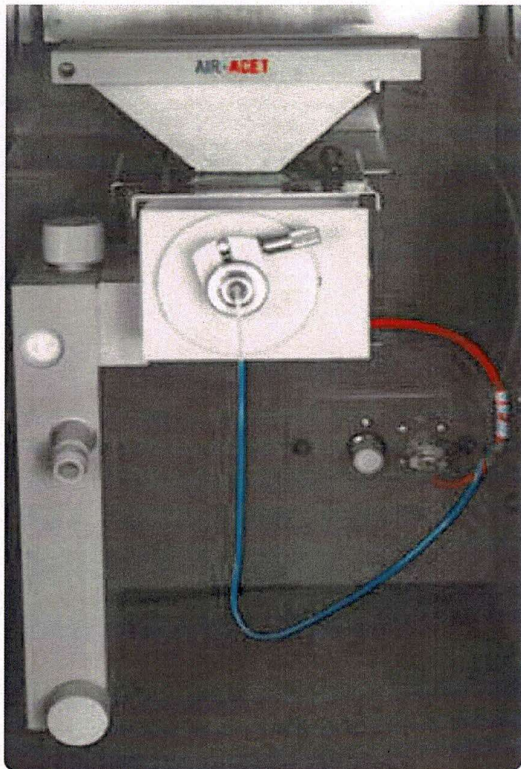
Power on switch and initial status

Instrument Ready สถานะเครื่องพร้อมใช้งาน

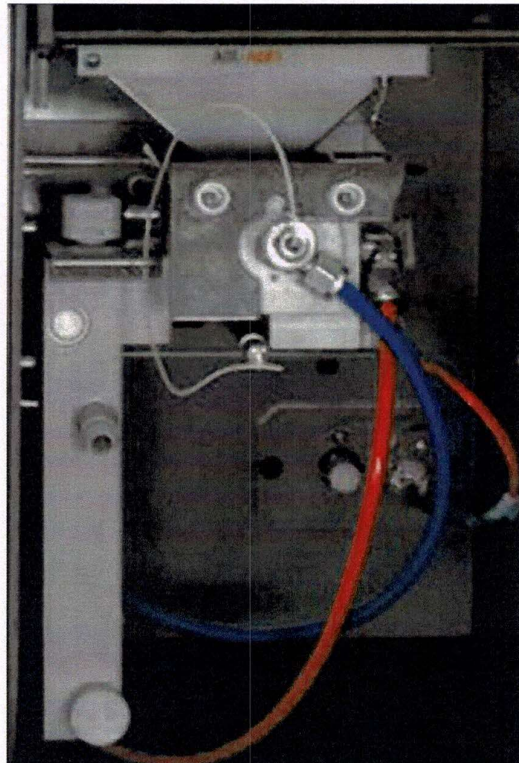
Preventive Maintenance	Pass	Fail	Remarks
<i>Electrical Voltage</i>			
- Main voltage (power supply check 220V \pm 10V).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	236.5 VAC
- Power indicator light (Replace if faulty).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
- Power core (Clean or replace as appropriate).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
- Fan (Clean or replace filter element as appropriate).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
<i>Environment</i>			
- Temperature (10 to 35 deg.C)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	25.2 C
- Humidity (8 to 80%).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	55%
- Air Quality (No Dust)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
- No corrosive vapours present from laboratory sample preparation or external sources.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
<i>Optics</i>			
- Windows lens (Clean or replace as appropriate).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Clean
- Light Source (Check operation. Replace if required).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- D2 Lamp (Check operation. Replace if required).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
<i>Gas system</i>			
- General (Tube and Fitting /Check for leaks).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- Air Zero (Inlet pressure range 300-400 kPa).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	4 Bar
- Acetylene (Inlet pressure range 55-96 kPa).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	0.9 Bar
- Nitrous oxide (Inlet pressure range 300-400 kPa).	<input type="checkbox"/>	<input type="checkbox"/>	
<i>Computer</i>			
- Operating system	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Windows 10
- Software Version	<input checked="" type="checkbox"/>	<input type="checkbox"/>	SavantAA3.11
- Verify that all computer links and installed software operate correctly	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready

Spray Chamber Type

☐ ABR Spray Chamber



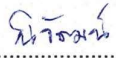
☒ Standard Spray Chamber



Preventive Maintenance	Pass	Fail	Remark
<i>Flame system</i>			
- Burner head (Clean the jaws using GBC Burner Cleaning Card).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- Burner mount (Check for wear. Replace the burner retaining plate if required).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- Spray chamber (Visually inspect the bead for cracks, pitting or solid deposits. Check or replace O-ring kit).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- Safety interlocks			
➢ Burner (Check for Interlocks connector)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
➢ Spray chamber (Check for Interlocks connector)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- Pressure relief bung. (Check or replace O-ring)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- Nebulizer (Clean and check operation).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- Gas connections (Check for leaks).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- Capillary tube (Check bends and clog).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- Liquid trap (Drain / clean and replace O-ring kit).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready

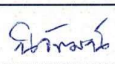
Gas Flow Optimisation	Pass	Fail	Remark
- Bleed gas lines (Relieve pressure in the spray chamber).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- Ignitor (Ignite the flame several times to check ignition reliability. Replace the glow plug if required).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- Extinguish (Check operation).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- Horizontal movement (Check operation for STD. Spray Chamber).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- Vertical movement (Check operation for STD. Spray Chamber).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- Burner Adjuster (Check operation for ABR Spray Chamber)			
➤ Burner Angle (°C)	<input type="checkbox"/>	<input type="checkbox"/>	
➤ Angle Zero (mm)	<input type="checkbox"/>	<input type="checkbox"/>	
➤ Workhead Height (mm)	<input type="checkbox"/>	<input type="checkbox"/>	
➤ Workhead Centre (mm)	<input type="checkbox"/>	<input type="checkbox"/>	

Note:

Signature	
Customer (.....)	Date :
Service Engineer  (Mr. NIWAT SUPATANIT)	Maintenance Date : 10/Oct/2022

Performance Verification	Specification	Actual Value	Pass	Failed	Remarks
1. Wavelength accuracy (optic calibration check).	Cu 324.75 nm \pm 0.2 nm	324.80 nm	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
	Cs 852.10 nm \pm 0.2 nm	852.17 nm	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
2. Slit width accuracy (0.2 nm ,0.5 nm,1.0 nm)	0.2 nm \pm 0.02 nm	0.22 nm	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
	0.5 nm \pm 0.05 nm	0.52 nm	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
	1.0 nm \pm 0.10 nm	1.05 nm	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
3. EHT	<350V	253 V	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
4. Absorbance accuracy (absorbance calibration check). ➤ <u>Gauze 0.49 A.U.</u>	Reading \pm 10% of calibrated value.	0.4891 Abs.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
5. Background correction (optics alignment check). difference between measurement with and without 0.49 A.U. gauze for 10 samples.	SavantAA <1% SensAA/XplorAA <2%	BC on with gauze: 0.0007 Abs. BC on without gauze: 0.0009 Abs.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
6. Sensitivity /noise flame test (aqueous Cu solution test under air-acetylene flame).	Cu 5 ppm >0.7 A.U.	0.8839 Abs.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
	<0.5% RSD	0.19 %	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A

Note:

Signature	
Customer (.....)	Date :
Service Engineer  (Mr. NIWAT SUPATANIT)	Maintenance Date : 10/Oct/2022



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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Cert. No.: 22TM1185

Page.: 1 of 3

Certificate of Calibration

Equipment : Autoclave
Manufacturer : Rexall
Model : LS-2D
Serial No. : 04131
ID No. : AUT-01
Submitted by : Environment & Laboratory Co.,Ltd.
40 Soi Liangmueangnonthaburi 13,
Talad Kwan, Mueang,
Nonthaburi 11000
Location : Room No. 205
Received Order : 14 July 2022
Calibration Date : 15 July 2022
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Tawatchai Pama

Approved by :

Approved Signatory

- () Pornthippa Tameyakul
(✓) Malee Butkruea
() Suwit Imjai

Issue Date :

27 July 2022

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

A 0043527



Equipment : Autoclave
Condition As-Received : Used Item
Reference : 2207-02500C-7

Cert. No.: 22TM1185
Page.: 2 of 3

Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-OT03 according to direct measurement method with Data Acquisition which connected with Thermocouple Type T

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
1) Data Acquisition	34970A	MY44073381	22LM78/1	12 May 2023

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

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

4. This result of calibration covers laboratory autoclaves for the sterilization of goods and material which could be infected with organisms categorized as Hazard Group 1, 2 and 3**

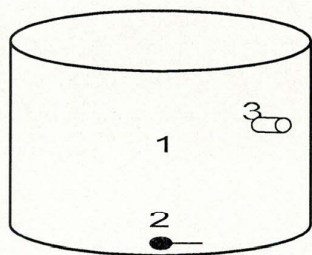
(** = Categorization of pathogens according to hazard and categories of containment, second edition, 1990)

It does not cover autoclaves for use with material infect with organisms in Hazard Group 4, for which complete containment and sterilization of infected condensate is considered to be essential.

This result of calibration does not apply to sterilizers or disinfectors used for medical, dental, pharmaceutical or veterinary purposes which are directly concerned with patient care, or those used for fabrics subjected to sterilization which are required to be dry at the end of cycle.

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source



	<u>Environmental</u>		
	(°C)	(%R.H.)	(Volt)
Beginning of Calibration	27	68	224
Finished of Calibration	28	63	223

<u>Position</u>	<u>Description</u>	<u>Ref. Std. ID No.:</u>
1 =	Center of chamber	20-01TC-01
2 =	Temperature sensor	20-01TC-02
3 =	Exhaust port	20-01TC-03

Mah



Equipment : Autoclave
Condition As-Received : Used Item
Reference : 2207-0250OC-7

Cert. No.: 22TM1185
Page.: 3 of 3

Result of Calibration :- (*) Without Adjustment

Operating parameter Set : Temperature = 120 °C
Sterilization period = 15 minute

UUC* Setting (°C)	UUC* Reading (°C)	Position	Average* Standard Reading (°C)	Stability (± °C)	Pressure Reading (kg/cm ²)	Uncertainty (± °C)	Coverage Factor <i>k</i>
120	-	1	121.644	0.82	1.2	1.2	2
		2	121.524				
		3	121.570				

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

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

UUC* : Unit Under Calibration

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

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

-o0o-

Mala .

MAINTENANCE AND IPV TEST CERTIFICATE MODEL

Avio 200

Customer :	<u>Environment & Laboratory</u>	Date Tested:	<u>September 9, 2022</u>
		Recommendation Recertification	
Address :	<u>40 Soi Liangmueangnon 13</u>	Period	<u>12</u> Months
	<u>Talad Kwan, Mueang</u>	Recertification Due:	<u>September 9, 2023</u>
	<u>Nonthaburi 11000</u>	Date Last Certified:	<u>January 14, 2021</u>
User Name:	<u>K. Alisa</u>	Visit Number:	<u>1 of 1</u>
Phone:	<u>086-568-4249</u>	PerkinElmer Phone:	<u>02-719-6420 ext 206</u>
E - Mail :		PerkinElmer Fax:	<u>02-318-5597</u>

CONFIGURATION TESTED

MODEL	SERIAL NUMBER	SOFTWARE
<u>Avio 200</u>	<u>079S16062402</u>	
TESTED EQUIPMENT	CALIBRATION NUMBER	EXPIRATION
<u>IPV Method</u>		
TEST STANDARD USED	PART NUMBER	EXPIRATION DATE
<u>Multielement Standard</u>	<u>N069-1579</u>	<u>Jun 30,2023</u>
<u>Instrument Cal. STD4</u>	<u>N930-0221</u>	<u>Nov 30, 2023</u>
CUSTOMER SUPPLIED	COMMENTS	CUSTOMER INITIALS
<u>2 % HNO3</u>		
<u>10 % HNO3</u>		

MAINTENANCE AND IPV TEST CERTIFICATE MODEL**Avio 200****SERIAL NUMBER:** 079S16062402**DATE TESTED:**September 9, 2022**1. MECHANICAL CHECKS**

A. Inspect and clean all fans and filters.

☐ OK

B. Inspect and replace as necessary, all torch components including the RF coil.

☐ OK

C. Inspect all tubing for sign of clacking or leaking.

☐ OK

D. Adjust water and gas pressure regulator settings.

☐ OK

E. Inspect and leak check pneumatics drawers.

☐ OK

F. Clean the exterior of the instrument.

☐ OK**2. OPTICAL CHECKS**

A. Inspect and clean all optical components.

☐ OK

B. As required, check and replace all purgebfilters.

☐ OK

C. Recheck optical alignment.

☐ OK**3. COOLING SYSTEM CHECKS**

A. Perform preventive maintenance on chiller.

☐ OK

B. Flush out the chiller every year.

☐ OK**4. PERFORMANCE CHECKS**

A. Torch View Alignment.

☐ OK

B. Wavelength Calibration.

☐ OK

MAINTENANCE AND IPV TEST CERTIFICATE MODEL

Avio 200

SERIAL NUMBER: 079S16062402

DATE TESTED:

September 9, 2022

PARAMETER

SPECIFICATION

FINAL VALUE

Spectral Resolution : UV

As	193.696 nm	≤ 0.009 nm	<u>0.00765</u> nm
Ni	231.604 nm	≤ 0.011 nm	<u>0.00885</u> nm
Ni	341.476 nm	≤ 0.015 nm	<u>0.01268</u> nm

Spectral Resolution : VIS

Ba	455.403 nm	≤ 0.020 nm	<u>0.01519</u> nm
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Precision

Zn	206.200 nm	% RSD ≤ 1.0 %	<u>0.58</u> %
Mg	280.271 nm	% RSD ≤ 1.0 %	<u>0.17</u> %
Mg	285.213 nm	% RSD ≤ 1.0 %	<u>0.18</u> %
Ba	455.403 nm	% RSD ≤ 1.0 %	<u>0.22</u> %

Detection Limits : Axial

Tl	190.801 nm	3(sd)	<u>0.25</u> ppb
As	193.696 nm	3(sd)	<u>1.92</u> ppb
Se	196.026 nm	3(sd)	<u>0.99</u>
Pb	220.353 nm	3(sd)	<u>1.24</u> ppb

Detection Limits : Radial

As	193.696 nm	3(sd)	<u>1.12</u> ppb
Zn	213.857 nm	3(sd)	<u>0.06</u> ppb
Mn	257.610 nm	3(sd)	<u>0.00</u> ppb
La	379.478 nm	3(sd)	<u>0.09</u> ppb
Ba	455.403 nm	3(sd)	<u>0.01</u> ppb
Ba	493.408 nm	3(sd)	<u>0.01</u> ppb

BEC : Axial (IB X 1000)/(IS-IB)

Mn	257.610 nm	≤ 30 ppb	<u>4.50</u> ppb
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BEC : Radial (IB X 1000)/(IS-IB)

Mn	257.610 nm	≤ 30 ppb	<u>5.91</u> ppb
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**MAINTENANCE AND IPV TEST CERTIFICATE MODEL****Avio 200****SERIAL NUMBER:** 079S16062402**DATE TESTED:** September 9, 2022**Remarks :**

Commissioning follow as commissioning performance sheets.

This is to certify that the above tests have been performed and the configuration tested



meets



does not meet

the PerkinElmer Specifications listed on this certificate.

This certificate does not modify PerkinElmer's standard terms and condition of sale,
including warranty terms.

Service Department PerkinElmer Ltd.

Customer Service Engineer:

(Duang Hiransuk)

Service Engineer



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Cert. No.: 22TM1184

Page.: 1 of 3

Certificate of Calibration

Equipment : Incubator

Manufacturer : Memmert

Model : BM 500

Serial No. : D593.0342

ID No. : CHI-002

Submitted by : Environment & Laboratory Co.,Ltd.
40 Soi Liangmueangnonthaburi 13,
Talad Kwan, Mueang,
Nonthaburi 11000

Location : Room No. 204

Received Order : 14 July 2022
Calibration Date : 15 July 2022
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %

Calibrated by : Tawatchai Pama

Approved by :

Malee

Approved Signatory

- () Pornthippa Tameyakul
(/) Malee Butkruea
() Suwit Imjai

Issue Date :

27 July 2022

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

A 0043524



Equipment : Incubator
 Condition As-Received : Used Item
 Reference : 2207-0250OC-4

Cert. No.: 22TM1184
 Page.: 2 of 3

Procedure Used :-

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34970A	MY44073381	22LM78/1	12 May 2023

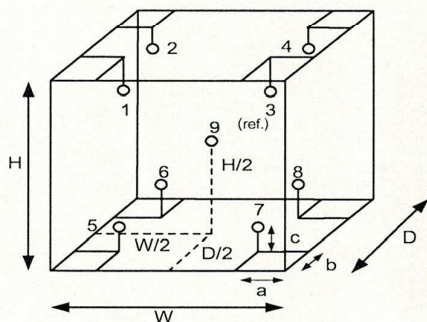
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close



Environment during calibration		
	Beginning	Finished
Temp. (°C)	23	22
REL.Humid. (%)	67	66
AC Supply (Volt)	223	224

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

Probe Installation Details :

a = 5.0 cm
 b = 5.0 cm
 c = 5.0 cm

Dimension of Chamber :

D = 0.40 m
 W = 0.56 m
 H = 0.48 m
 Capacity = 0.11 m³

Malu .



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2207-0250OC-4
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Close

Cert. No.: 22TM1184
Page.: 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (± °C)	Coverage Factor <i>k</i>
35.0	35.0	35.0	0.035	0.55	0.63	0.30	2

Calibration Point (°C)	Measured Temperature (°C)								
	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
35.0	35.100	34.653	35.131	34.871	35.067	34.888	35.092	35.235	35.170

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

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

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

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

UUC* : Unit Under Calibration

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

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

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Cert.No.: 22CHO415

Page.: 1 of 3

Certificate of Calibration

Equipment : Spectrophotometer
Manufacturer : Hach
Model : DR 3900
Serial No. : 1988383
ID No. : -
Condition As-Received: Used Item
Received Date : 14 July 2022
Calibration Date : 14 July 2022
Reference : 2207-0250OC-11
Submitted by : Environment & Laboratory Co.,Ltd.
40 Soi Liangmueangnonthaburi 13 Talad Kwan,
Mueang, Nonthaburi 11000
Calibration Place : Room No. 304
Ambient Temperature : (27.5 - 27.2) °C (On-Site)
Relative Humidity : (53.2 - 53.8) % (On-Site)
Calibration Procedure : In - house method :
CP-OCH4 based on ASTM E 275-01

Calibrated by : Saithip Meangmai

Approved by :

Malee

Approved Signatory

- (✓) Malee Butkruea
() Saithip Meangmai
() Warakorn Lerngagtrakul

Issue Date : 27 July 2022

The Uncertainties are for a confidence probability of approximately 95%

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A 0043531



Cert. No. : 22CHO415

Page : 2 of 3

Condition of calibration result

1. Reference Standard Material :

<u>Material</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due date</u>
1. Absorbance Standard set	8331	86623	08 Sep 2022
2. Wavelength Standard set	14536	89302	19 Jan 2023
3. Wavelength Standard set	14537	89303	19 Jan 2023

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

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

- National Physical Laboratory (NPL), The United Kingdom of Great Britain and Northern Ireland
- National Institute of Standards and Technology (NIST), The United States of America

4. Spectral BandWidth : 5 nm
Scan Speed : - nm/min

Calibration Results : without adjustment

Wavelength Accuracy

Certified Values of Reference Material (nm)	UUC Reading (nm)	Uncertainty of Measurement (\pm nm)	Coverage Factor <i>k</i>
418.40	418	0.59	2.00
537.00	536	0.59	2.00
638.00	638	0.66	2.00
747.61	748	0.59	2.00
807.04	807	0.59	2.00

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Cert. No. : 22CHO415

Page : 3 of 3

Calibration Results : without adjustment

Photometric Accuracy

Wavelength (nm)	Certified Values of Reference Material (Abs)	UUC Reading (Abs)	Uncertainty of Measurement (\pm Abs)	Coverage Factor <i>k</i>
420.0	Zero	0.000	0.0028	2.00
	0.5723	0.571	0.0034	2.00
	0.7522	0.750	0.0031	2.00
	1.0907	1.089	0.0033	2.00
440.0	Zero	0.000	0.0028	2.00
	0.5616	0.560	0.0034	2.00
	0.7345	0.732	0.0032	2.00
	1.0646	1.063	0.0034	2.00
465.0	Zero	0.000	0.0028	2.00
	0.5118	0.513	0.0034	2.00
	0.6773	0.678	0.0031	2.00
	0.9809	0.983	0.0034	2.00
546.1	Zero	0.000	0.0028	2.00
	0.5228	0.522	0.0030	2.00
	0.6861	0.684	0.0030	2.00
	0.9941	0.992	0.0031	2.00
590.0	Zero	0.000	0.0028	2.00
	0.5546	0.552	0.0029	2.00
	0.7159	0.714	0.0032	2.00
	1.0369	1.032	0.0030	2.00
635.0	Zero	0.000	0.0028	2.00
	0.5401	0.538	0.0029	2.00
	0.6835	0.681	0.0030	2.00
	0.9889	0.987	0.0031	2.00

Remark

- Each individual filter is measured against the empty filter holder (blank) used to zero the spectrophotometer

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

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Maku



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TEL. 0-2717-3000-27 FAX. 0-2719-9484



Cert. No.: 22TM1183

Page.: 1 of 3

Certificate of Calibration

Equipment : Water Bath

Manufacturer : Memmert

Model : WB22

Serial No. : I505.0053

ID No. : WAB-01

Submitted by : Environment & Laboratory Co.,Ltd.
40 Soi Liangmueangnonthaburi 13,
Talad Kwan, Mueang,
Nonthaburi 11000

Location : Room No. 303

Received Order : 14 July 2022

Calibration Date : 14 - 15 July 2022

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 30) %

Calibrated by : Tawatchai Pama

Approved by :

Malee

Approved Signatory

- () Pornthippa Tameyakul
(✓) Malee Butkruea
() Suwit Imjai

Issue Date : 27 July 2022

The Uncertainties are for a confidence probability of approximately 95%

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A 0043523



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2207-0250OC-3

Cert. No.: 22TM1183

Page.: 2 of 3

Procedure Used :-

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
1) Data Acquisition	34970A	MY44073381	22LM78/1	12 May 2023

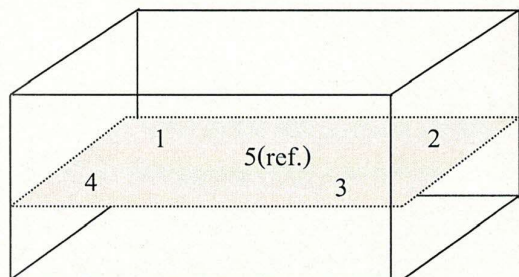
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

	Environmental		AC Voltage Supply
	(°C)	(%R.H.)	(Volt)
Beginning of Calibration	31	45	219
Finished of Calibration	30	52	218



Front

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

Malu



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2207-0250OC-3
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source

Cert. No.: 22TM1183

Page.: 3 of 3

Calibration point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Average* Standard Reading (°C)				
			Position				
			1	2	3	4	5 (ref.)
44.5	44.5	44.5	44.514	44.511	44.517	44.498	44.519
60.0	60.0	60.0	60.015	60.009	60.009	59.982	59.991

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Uncertainty (± °C)	Coverage Factor <i>k</i>
44.5	0.047	0.028	0.15	2
60.0	0.073	0.035	0.15	2

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

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

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

UUC* : Unit Under Calibration

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

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

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Malu