

ภาคผนวกที่ 7

เอกสารการสอบเทียบความถูกต้องของเครื่องมือตรวจวัด



ponpe

INSTRUMENTS

Calibration Report

Name	Portable multi gas detector		Model	PONPE 323-1		
Date	10/01/2564		Serial No.	PONPE5899050		
Gas	CO	H ₂ S	LEL	O ₂		
Range	(0~1000) μmol/mol	(0~100) μmol/mol	(0~100)%lel	(0~30) %vol		
Testing Content	CO (70/300/700) μmol/mol; H ₂ S (20/50/80) μmol/mol; LEL (10%/40%/60%) lel; O ₂ (5%/10%/25%) vol					
Inspection Item		Technical requirements				Result
		CO	H ₂ S	LEL	O ₂	
1. Deviation		±5%μmol/mol	±5%μmol/mol	±5%FS	±3%FS	Qualified
2. Repetition		≤2%	≤2%	≤2%	≤2%	Qualified
3. Zero drift		±3 μmol/mol	±3 μmol/mol	±3%FS	±3%FS	Qualified
4. Span drift		±5%μmol/mol	±5%μmol/mol	±2%FS	±2%FS	Qualified
5. Response time		Diffusions≤60s				Qualified
6. Appearance		Appearance should be smooth, neat				Qualified
7. Sign and mark		Sign and mark.complete, correct				Qualified
8. Electrified inspection		electrified inspection normal				Qualified
9. Insulation resistance		≥20MΩ				Qualified
10. Alarm function		Sound, light, vibration alarm normal				Qualified
11. Alarm value		CO μmol/mol	H ₂ S μmol/mol	LEL %lel	O ₂ %vol	Qualified
		15/150	10/35	20/50	19.5/23.5	
12. Calibration		CO μmol/mol	H ₂ S μmol/mol	LEL %lel	O ₂ %vol	Qualified
		500	50	50	20.9	

Calibrated by: 



PONPE INSTRUMENTS



CERT.No.: HS-S031H

Calibration Date : 17 Aug 21

Model : YSI 5000

Submitted by : Health & Envitech Co., Ltd.

S/N : 13K100715

77/11 Moo 2 Ngamwongwan 5 Rd., Bangkok,

Probe : YSI 5010

Nonthaburi 11000

S/N : 13J100364

ID NO. : -

Avg Room Temp : 20 °C

Air Temp ref : S/N. E00522

Avg Water Temp : 20 °C

Barometric ref : S/N. E00522

Air Pressure : 760.00 mmHg

Water Temp ref : S/N. 11431

Salinity : 0 ppt

Technician : Kittipong M.

Calibration Details

Calibration Point	100% air sat. (@20 °C, DO = 9.09 mg/l)	(status)	(status)
Measurement 1 (mg/l)	9.09	(PASS)	-
Measurement 2 (mg/l)	9.08	(PASS)	-
Measurement 3 (mg/l)	9.08	(PASS)	-
Measurement 4 (mg/l)	9.09	(PASS)	-
Measurement 5 (mg/l)	9.09	(PASS)	-
Measurement 6 (mg/l)	9.08	(PASS)	-
Measurement 7 (mg/l)	9.08	(PASS)	-
Measurement 8 (mg/l)	9.08	(PASS)	-
Measurement 9 (mg/l)	9.09	(PASS)	-
Measurement 10 (mg/l)	9.08	(PASS)	-

Mean Measurement	9.08	mg/l	-	-
Inaccuracy	0.01	mg/l	-	-

Overall Status (PASS)

Manufacturer Specification

Accuracy = +/- 0.02 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

Laboratory Manager

Certificate of Calibration

Certificate No. : 64-200318-1

Page : 1 of 2

Submitted by : Health & Envitech Co., Ltd.

77/11 Moo 2, Ngamwongwan Rd., Soi 5, T.Bangkhen, A.Muang, Nonthaburi 11000

Equipment : Electronic Balance

Manufacturer : Sartorius

Model : MSE125P-100-DU

Serial No. : 32203794

ID No. : LB-HE-071

Capacity : 120 g

Resolution : 0.00001g/60g, 0.0001g/120g

Environment : On site calibration was carried out at the Laboratory, Health & Envitech Co., Ltd.

Ambient Temperature : (26.0 to 26.4) °C

Relative Humidity : (61.7 to 64.4) %

Air Pressure : 1013.0 mbar

Date of Received : 09 November 2021

Date of Calibration : 09 November 2021

Date of Issue : 10 November 2021

Calibrated by : Akaradath Thippichai

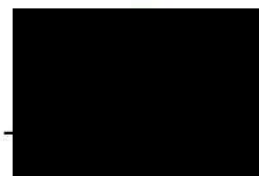
Calibration Method : In-house method CAL-M2001 based on UKAS Publication ref : LAB 14
Edition 5, July 2015

Reference Standard Instruments : This certification is traceable to the International System of Units

Standard Weights

ID No.	Cert. No.	Due Date	Traceability
E261-E2624	C02204101	17 Nov 2021	National Institute of Metrology (Thailand), (NIMT)

Approved by :



Laboratory Manager

Certificate of Calibration

Certificate No. : 64-200318-1

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Departure of indication from nominal value

Nominal Value (g)	Correction (g)	Uncertainty \pm (g)
0.001	0.00001	0.000014
0.01	0.00001	0.000013
0.1	0.00001	0.000016
1	0.00000	0.000026
2	0.00000	0.000034
5	-0.00001	0.000043
10	0.00000	0.000053
50	0.00000	0.00011
100	0.0001	0.00021
120	0.0001	0.00038

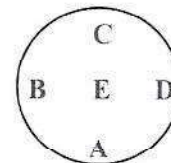
This result of calibration was found accurate as shown on date and place of calibration only.

This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2.20$, providing a level of confidence of approximately 95%

Eccentric error

Load test : 10 g

A B C D E
0.00000 0.00000 0.00000 0.00000 0.00000 g



Repeatability

Load test : 100 g

Stdev. : 0.000053 g





THAI METEOROLOGICAL DEPARTMENT

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

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 10 February, 2022

Certification No. 047/22

Page : 1 of 2

Object : THERMAL ENVIRONMENT MONITOR

Manufacturer : QUEST TECHNOLOGIES

Type : QUESTEMP[®]32

Serial No. : TPJ040011

Customer : Health and Envitech Co.,Ltd.
6 Ngamwongwan Road, Soi 5 Bang Khen,
Muang Nonthaburi, Nonthaburi 11000.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1009.9 hPa

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

: testo, testo 645 Serial No. 02848057 : Thermoschneider No.6169 , No.6178

: TT-3 Serial 43BE04

Japan Meteorological Agency



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 047/22

10 February, 2022

Page : 2 of 2

Standard Temp. °C	Temperature Sensor Reading					
	Dry Bulb °C	Correction °C	Wet Bulb °C	Correction °C	Globe °C	Correction °C
50.12	50.1	0.02	50.2	-0.08	50.1	0.02
40.24	40.0	0.24	40.1	0.14	40.0	0.24
30.41	30.2	0.21	30.3	0.11	30.2	0.21
22.24	22.3	-0.06	22.2	0.04	22.4	-0.16

Calibrate

Mechanical Engineer

Me



THAI METEOROLOGICAL DEPARTMENT

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

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 10 February, 2022

Certification No. 046/22

Page : 1 of 2

Object : THERMAL ENVIRONMENT MONITOR

Manufacturer : QUEST TECHNOLOGIES

Type : QUESTEMP[®]32

Serial No. : TPJ040012

Customer : Health and Envitech Co.,Ltd.
6 Ngamwongwan Road, Soi 5 Bang Khen,
Muang Nonthaburi, Nonthaburi 11000.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1009.9 hPa

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

: testo, testo 645 Serial No. 02848057 : Thermoschneider No.6169 , No.6178

: TT-3 Serial 43BE04

Japan Meteorological Agency



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 046/22

10 February, 2022

Page : 2 of 2

Standard Temp. °C	Temperature Sensor Reading					
	Dry Bulb	Correction	Wet Bulb	Correction	Globe	Correction
	°C	°C	°C	°C	°C	°C
50.12	50.0	0.12	50.3	-0.18	50.0	0.12
40.24	40.3	-0.06	40.5	-0.26	40.3	-0.06
30.41	30.5	-0.09	30.6	-0.19	30.5	-0.09
22.24	22.4	-0.16	22.5	-0.26	22.4	-0.16

Cal



Mechanical Engineer

Met





Certificate of Calibration

Certificate No. : MT21-5759

Page : 1 of 2

Customer : Health & Envitech Co.,Ltd.

Address : 77/11 M.2 Ngamwongwan Rd., Soi 5, T.Bangkhen, A.Muang Nontaburi 11000

Description : Hot Air Oven

Manufacturer : Memmert

Model : UNB400

Serial No. : C410.0346

Identification No. : LB-HE-030

Calibration Place : Laboratory 2

Order No. : 3061/21

Received date : Nov 03, 2021

Calibration date : Nov 03, 2021

Environment Condition :

Temperature : (25+/-10) °C

Humidity : (50+/-30) %RH

Calibration Method : Calibration were conducted using In-house calibration procedure *CP-MT-006* According to comparison with LXI Data Acquisition Switch Unit with sensor. The calibration methods based on DKD-R5-7 guidelines for calibration of climatic chamber edition 07:2009.

Reference Standard Instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
LXI Data Acquisition Switch Unit with Sensor	34972A	MY49028922	MT20-7637	Nov 27, 2021

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

Traceability : This measurement are traceable to the International System of Unit (SI), through National Institute of Metrology Thailand (NIMT)

The reported uncertainty of measurement was base on standard uncertainty multiplied by c providing a level of confidence of not less than 95%

Calibrated by :

Issue date : Nov 05, 2021

Approved by


Certificate No. : MT21-5759

Page : 2 of 2

Function : Temperature measurement

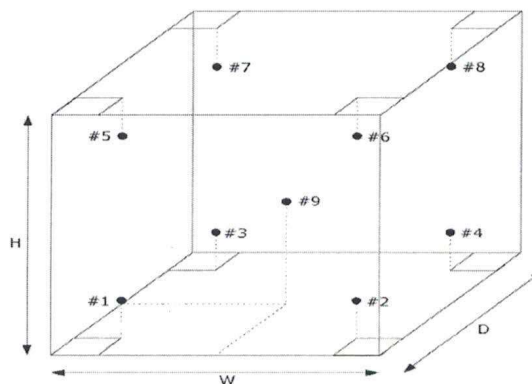
Result : Without adjustment

Calibration point : 104, 150, 180 °C

Resolution : 0.5 °C

Calibration point (°C)	Temperature of UUC* at each position (°C)									Uncertainty of measurement (+/- °C)
	Ch.1	Ch.2	Ch.3	Ch.4	Ch.5	Ch.6	Ch.7	Ch.8	Ch.9	
104	104.183	104.335	104.173	104.292	104.161	104.125	104.016	104.035	103.980	0.44
150	150.166	150.533	150.304	150.128	150.136	149.949	150.444	150.486	150.393	0.47
180	179.978	180.014	180.074	180.305	180.294	179.966	180.310	180.497	180.359	0.49

Setting temperature (°C)	Indicating Temperature (°C)	Measured stability (+/- °C)	Measured uniformity (°C)	Overall variation (°C)
104.0	104.0	0.18	0.69	0.94
150.0	150.0	0.26	0.83	1.4
180.0	180.0	0.25	1.0	1.7


Front view

- #1 Lower Left Front
- #2 Lower Right Front
- #3 Lower Left Rear
- #4 Lower Right Rear
- #5 Upper Left Front
- #6 Upper Right Front
- #7 Upper Left Rear
- #8 Upper Right Rear
- #9 Geometric Center

UUC* = Unit under calibration

Uniformity = Maximum and Minimum difference of measured temperature at any probes and the measured temperature at the reference and same time.

Overall Variation = Difference of temperature value between the maximum and minimum any time.

Stability = One half of the maximum difference of measured temperatures at any one probe.



บริษัท เฮลท์ แอนด์ เอ็นไวเทค จำกัด

Health & Envitech Co.,Ltd.

77/11 หมู่ที่ 2 ถนนงามวงศ์วานซอย 5 ตำบลบางเขน อำเภอเมือง จังหวัดนนทบุรี 11000
77/11 Moo 2 Ngamwongwan Rd. Soi 5, Tumbon Bangkhen, Muang, Nontaburi 11000
Tel. (02) 9526305-9 Fax : (02) 9526310, 5898355 www.healthenvi.com Email : service@healthenvi.com

Calibration Date: January 8, 2022

Calibration Report No. Ref. H.E. 083/2022

SITE

Site: #บ้านปอเชากวางทอง 1

Date: 10-17/01/2022

CONDITIONS

Operator

Environment Condition: Temperature (25 \pm 5) $^{\circ}$ C, Humidity (50 \pm 15) %RH

Corrected Pressure (mm Hg): 756

Temperature (deg K): 301

Corrected Seasonal (mm Hg) : 760

Seasonal Temp. (deg K) : 298

CALIBRATION

Description: **Personal Sampler Calibrator**

Manufacturer: SKC

Model: 303

Serial No.: N/A

Date Certified: Dec 03, 2021

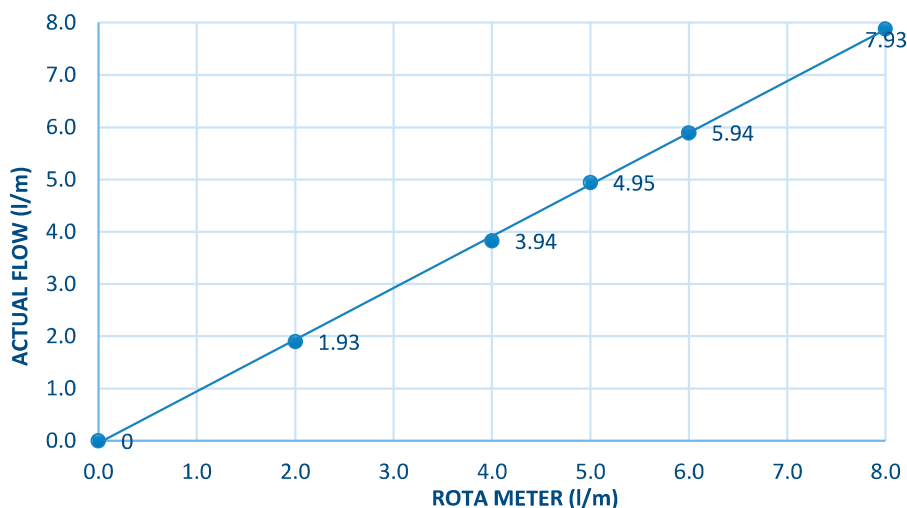
EQUIPMENT:

Measurement Sampling: Minivol Air Sampler

Model: Minivol TAS Serial#: 4084

Technical: Patsakorn M. Approval: Rung R.

Result Calibration:



Approved by :

Approved Signatory

(Managing Director)



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Health & Envitech Co.,Ltd.

77/11 หมู่ที่ 2 ถนนงามวงศ์วานซอย 5 ตำบลบางเขน อำเภอเมือง จังหวัดนนทบุรี 11000
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Tel. (02) 9526305-9 Fax : (02) 9526310, 5898355 www.healthenvi.com Email : service@healthenvi.com

Calibration Date: January 8, 2022

Calibration Report No. Ref. H.E. 083/2022

SITE

Site: #บ้านปอเชากวางทอง 2

Date: 10-17/01/2022

CONDITIONS

Operator

Environment Condition: Temperature (25 \pm 5) $^{\circ}$ C, Humidity (50 \pm 15) %RH

Corrected Pressure (mm Hg): 756

Temperature (deg K): 301

Corrected Seasonal (mm Hg) : 760

Seasonal Temp. (deg K) : 298

CALIBRATION

Description: **Personal Sampler Calibrator**

Manufacturer: SKC

Model: 303

Serial No.: N/A

Date Certified: Dec 03, 2021

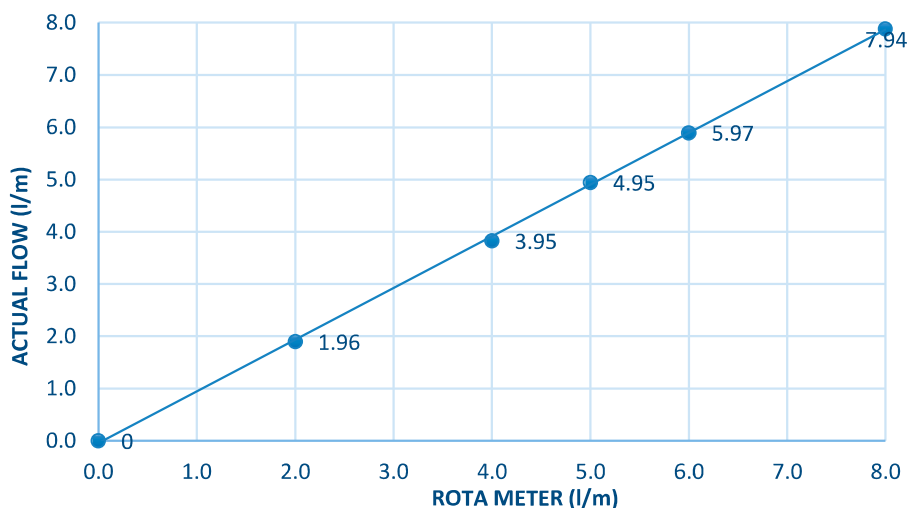
EQUIPMENT:

Measurement Sampling: Minivol Air Sampler

Model: Minivol TAS Serial#: 4085

Technical: Patsakorn M. Approval: Rung R.

Result Calibration:



Approved by :

Approved Signatory



บริษัท เฮลท์ แอนด์ เอ็นไวเทค จำกัด

Health & Envitech Co.,Ltd.

77/11 หมู่ที่ 2 ถนนงามวงศ์วานซอย 5 ตำบลบางเขน อำเภอเมือง จังหวัดนนทบุรี 11000
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Tel. (02) 9526305-9 Fax : (02) 9526310, 5898355 www.healthenvi.com Email : service@healthenvi.com

Calibration Date: January 8, 2022

Calibration Report No. Ref. H.E. 083/2022

SITE

Site: #บ้านหนองบอน 1

Date: 10-17/01/2022

CONDITIONS

Operator

Environment Condition: Temperature (25 \pm 5) $^{\circ}$ C, Humidity (50 \pm 15) %RH

Corrected Pressure (mm Hg): 756

Temperature (deg K): 301

Corrected Seasonal (mm Hg) : 760

Seasonal Temp. (deg K) : 298

CALIBRATION

Description: **Personal Sampler Calibrator**

Manufacturer: SKC

Model: 303

Serial No.: N/A

Date Certified: Dec 03, 2021

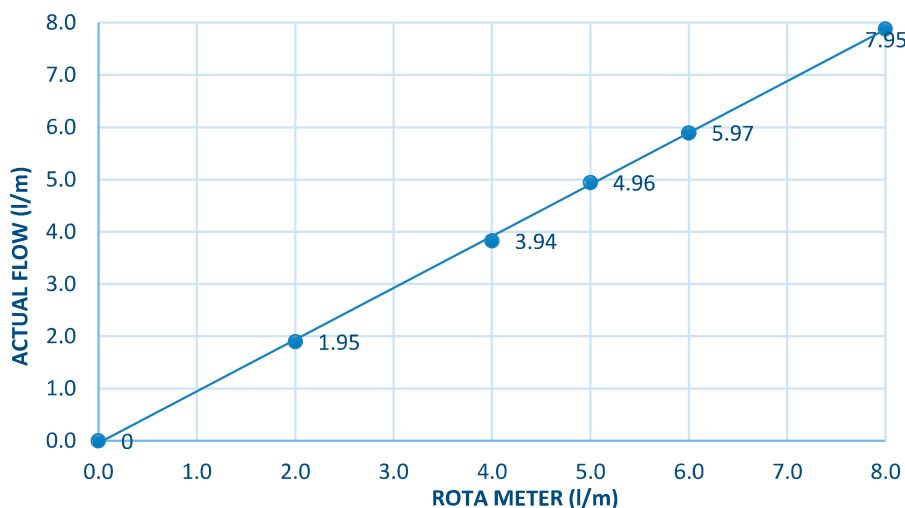
EQUIPMENT:

Measurement Sampling: Minivol Air Sampler

Model: Minivol TAS Serial#: 4087

Technical: Patsakorn M. Approval: Rung R.

Result Calibration:



Approved by :

Approved Signatory

(Managing Director)



บริษัท เฮลท์ แอนด์ เอ็นไวเทค จำกัด

Health & Envitech Co.,Ltd.

77/11 หมู่ที่ 2 ถนนงามวงศ์วานซอย 5 ตำบลบางเขน อำเภอเมือง จังหวัดนนทบุรี 11000
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Tel. (02) 9526305-9 Fax : (02) 9526310, 5898355 www.healthenvi.com Email : service@healthenvi.com

Calibration Date: January 8, 2022

Calibration Report No. Ref. H.E. 083/2022

SITE

Site: #บ้านหนองบอน 2

Date: 10-17/01/2022

CONDITIONS

Operator

Environment Condition: Temperature (25 \pm 5) $^{\circ}$ C, Humidity (50 \pm 15) %RH

Corrected Pressure (mm Hg): 756

Temperature (deg K): 301

Corrected Seasonal (mm Hg): 760

Seasonal Temp. (deg K): 298

CALIBRATION

Description: **Personal Sampler Calibrator**

Manufacturer: SKC

Model: 303

Serial No.: N/A

Date Certified: Dec 03, 2021

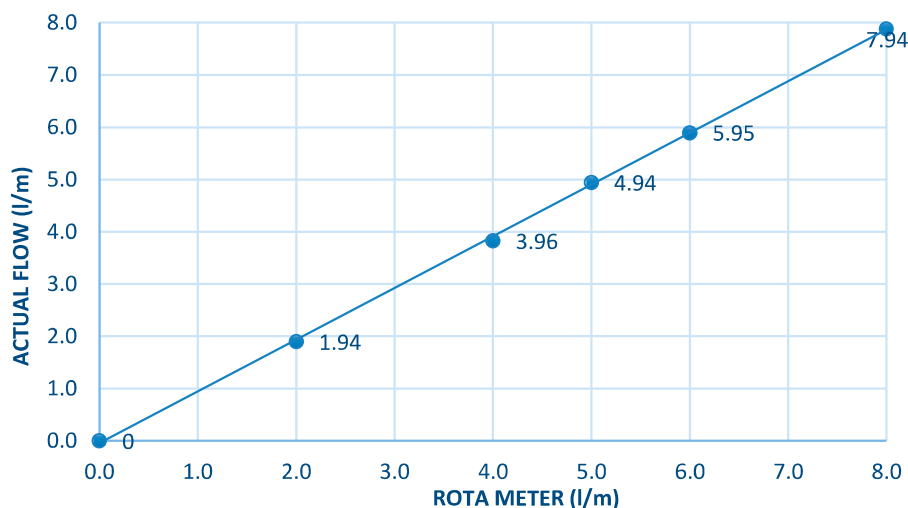
EQUIPMENT:

Measurement Sampling: Minivol Air Sampler

Model: Minivol TAS Serial#: 4089

Technical: Patsakorn M. Approval: Rung R.

Result Calibration:



Approved by :

Approved Signatory

(Managing Director)

**Intech Metrological Center Co.Ltd.**

39/1 Soi 82, Sukhapiban 5 Rd., O ngoen,

Saimai, Bangkok 10220, Thailand

Tel. (662) 909-8820 (Auto 10 lines) www.imcinstrument.com

Certificate of Calibration

Certificate No. : MC21-2398**Page** : 1 of 2**Customer** : Health & Envitech Co.,Ltd.**Address** : 77/11 M.2 Ngamwongwan Rd., Soi 5, T.Bangkhen, A.Muang Nontaburi 11000**Description** : Personal Sampler Calibrator**Manufacturer** : SKC**Model** : 303**Serial No.** : N/A**Identification No.** : LB-HE-033**Calibration Place** : Chemical Laboratory 2**Order No.** : 3361/21**Received date** : Dec 01, 2021**Calibration date** : Dec 03, 2021**Environment Condition :****Temperature** : (20+/-2) °C**Humidity** : (50+/- 15) %RH

Calibration Method : Calibration were conducted using In-house calibration procedure *CP-MC-004* According to comparison with Analytical Balance. The calibration methods based on ASTM E542-01.

Reference Standard Instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
Analytical Balance	AE-FA220	201907106	MM21-2569	Sep 01, 2022
Humidity / Baro / Temp. Data Recorder	MH-382SD	N/A	MT21-4247	Aug 09, 2022
Digital Thermometer	EFT-4	EFT42020033	MT21-2968	May 07, 2022

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

Traceability : This measurement are traceable to the International System of Unit (SI), through National Institute of Metrology Thailand (NIMT)

The reported uncertainty of measurement was base on standard uncertainty mu providing a level of confidence of not less than 95%

Calibrated by :**Issue date :**

Dec 03, 2021

Approved by :

**Inctech Metrological Center Co.Ltd.**

39/1 Soi 82, Sukhapiban 5 Rd., O ngoen,

Saimai, Bangkok 10220, Thailand

Tel. (662) 909-8820 (Auto 10 lines) www.imcinstrument.com**Certificate No.** : MC21-2398**Page** : 2 of 2**Result** : Without adjustment**Calibration Point** : 50, 90, 100, 110 ml

Nominal value (ml)	Standard reading (ml)	UUC* correction (ml)	Uncertainty of measurement (+/- ml)
50	50.0156	0.0156	0.056
90	90.0193	0.0193	0.063
100	100.0256	0.0256	0.063
110	110.0276	0.0276	0.073



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Health & Envitech Co.,Ltd.

77/11 หมู่ที่ 2 ถนนงามวงศ์วานซอย 5 ตำบลบางเขน อำเภอเมือง จังหวัดนนทบุรี 11000

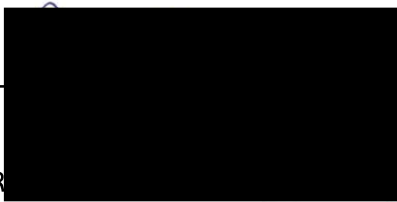
77/11 Moo 2 Ngamwongwan Rd. Soi 5, Tumbon Bangkhen, Muang, Nontaburi 11000

Tel. (02) 9526305-9 Fax : (02) 9526310, 5898355 www.healthenvi.com Email : service@healthenvi.com

PAGE: 1 OF 8

Certification of Calibration

Equipment ; Personal Sampler Pump
Capacity ; 110 ml
Manufacturer ; Air check sampler
Barometric Pressure ; 760 mmHg
Temperature ; 22 ± 25 °C
Relative Humidity ; 50 ± 10 %
Calibrated by ; Laboratory of HEALTH & ENVITECH CO., LTD
77/11 Soi Ngamwongwan 5 M.2 Bangken
Muang nontaburi, Nontaburi 11000

Approved by ;  Approved Signatory
(Managing Director)

Issue Date ; January 5, 2022 

The uncertainties are for a confidence probability of approximately 95 %

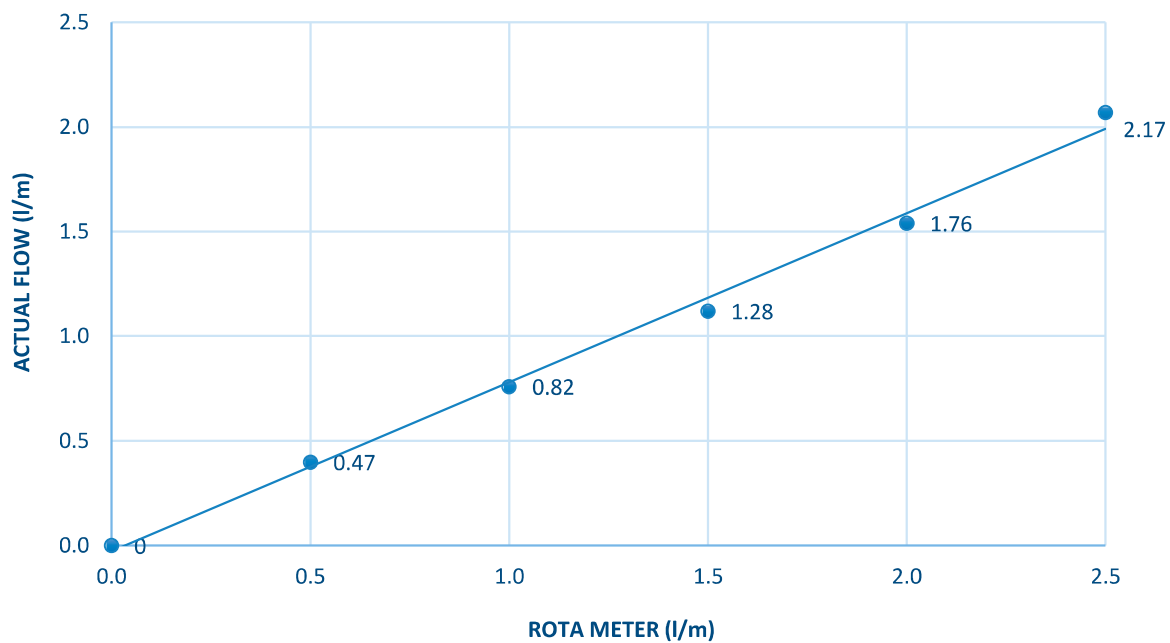
CALBRATER EQUIPMENT SOAP-BUBBLE METER (FUNDAMENTALS OF AIR SAMPLING)

SUPPLEMENTARY EQUIREMENTS FOR REGISTRATION: CHEMICAL TESTING

CALIBRATION RESULTS

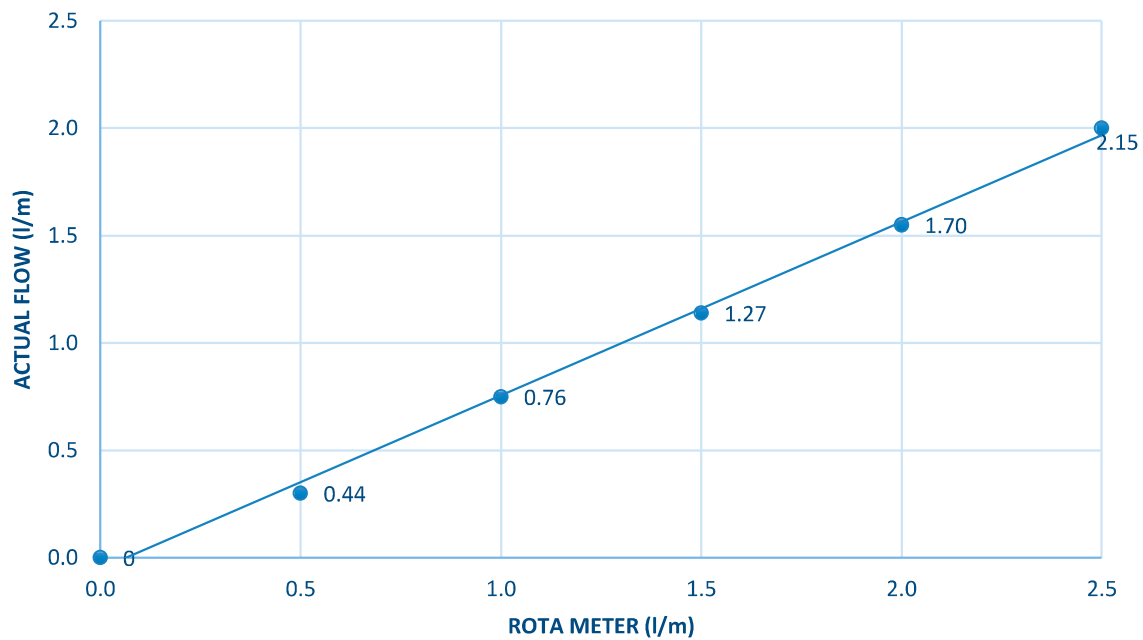
Serial No. ; 20140202100

Model ; Gillian BDXII



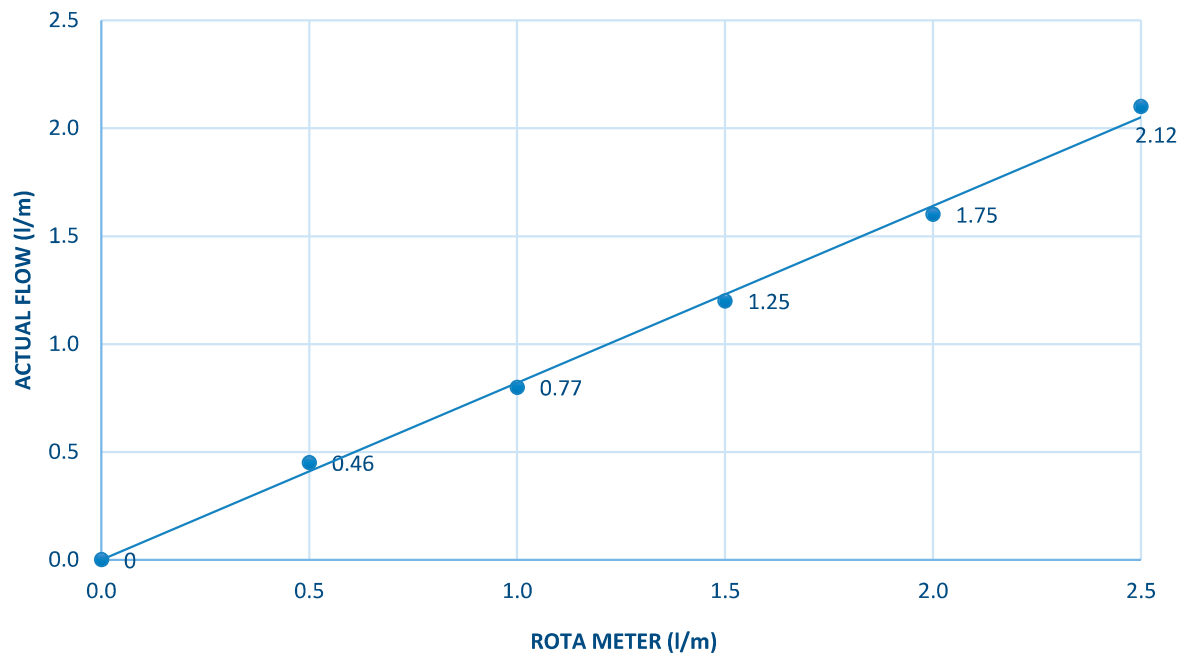
Serial No. ; 20140602092

Model ; Gillian BDXII



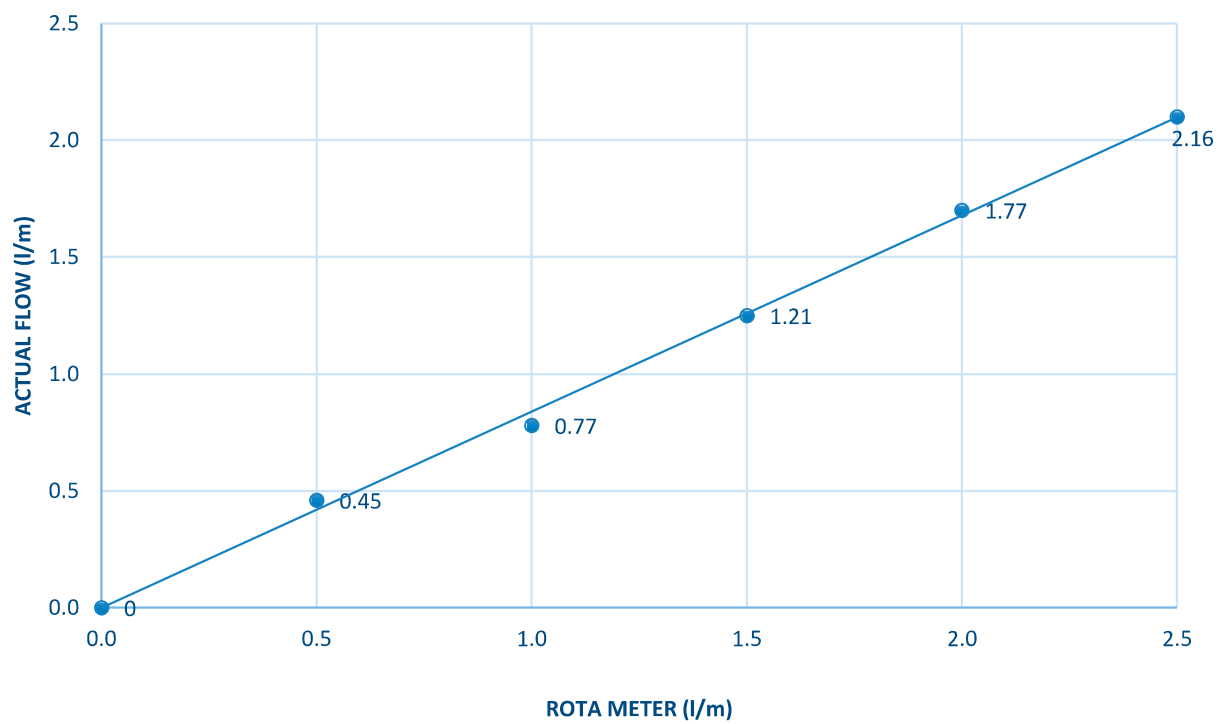
Serial No. ; 201406020108

Model ; Gillian BDXII



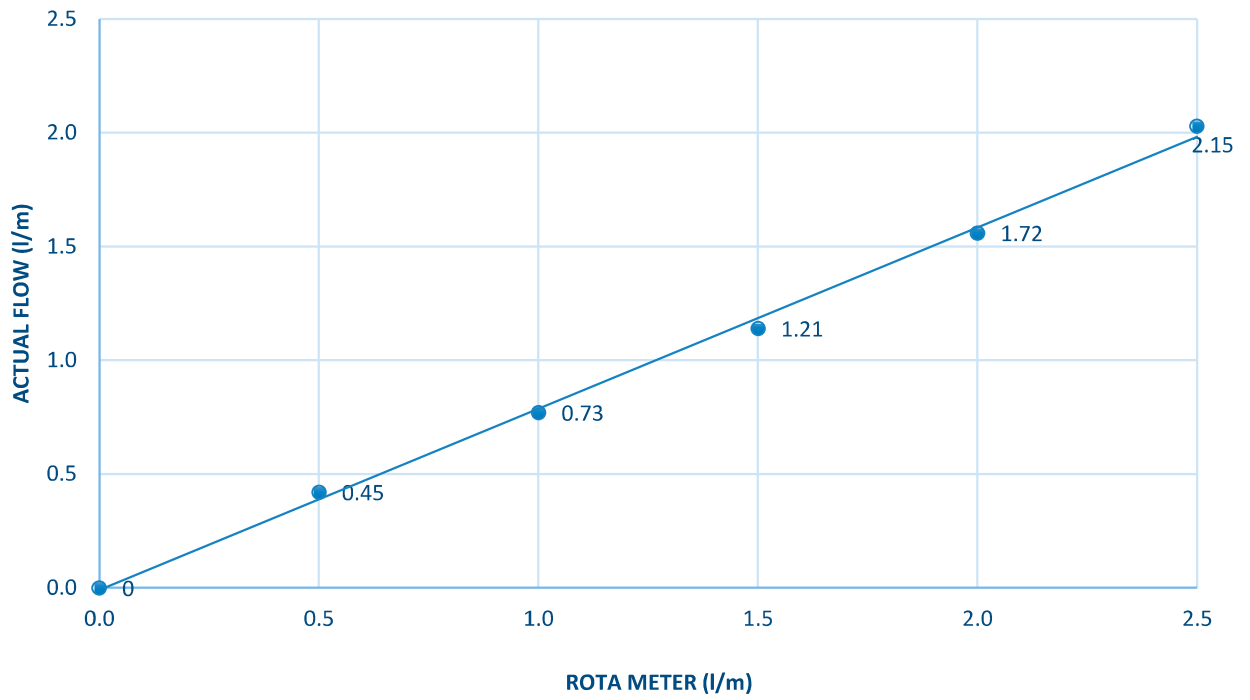
Serial No. ; 20121102029

Model ; Gillian BDXII



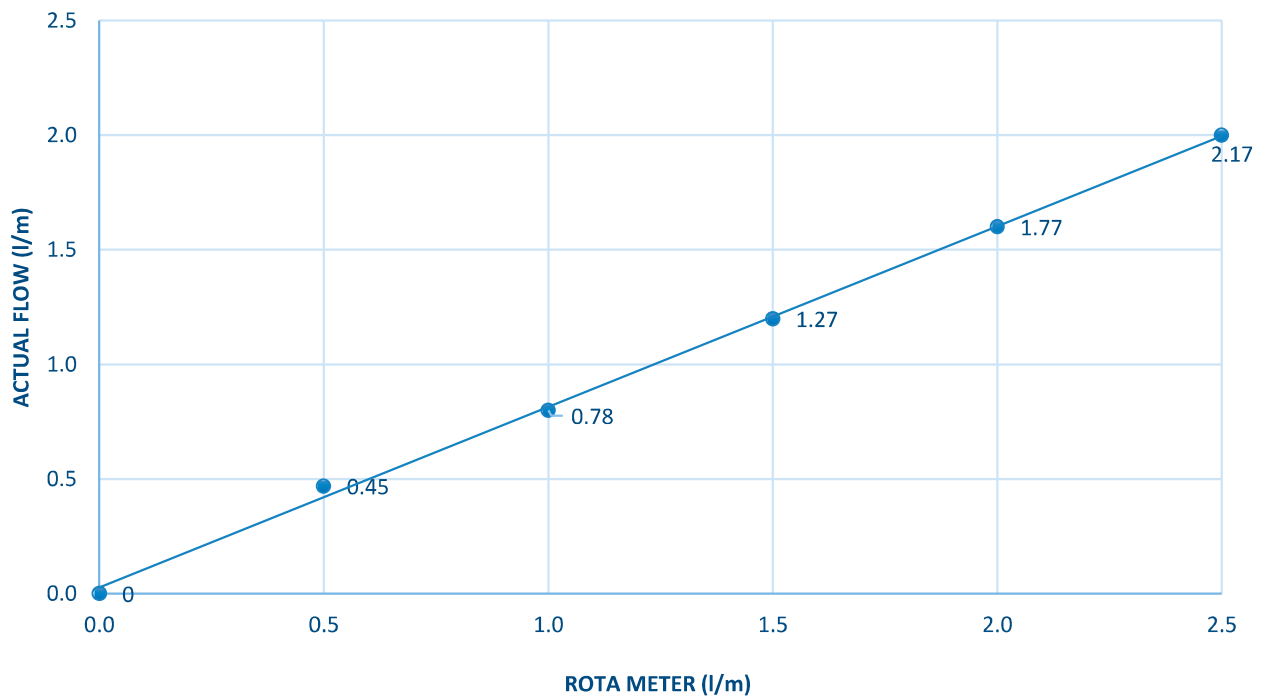
Serial No. ; 20121102051

Model ; Gillian BDXII



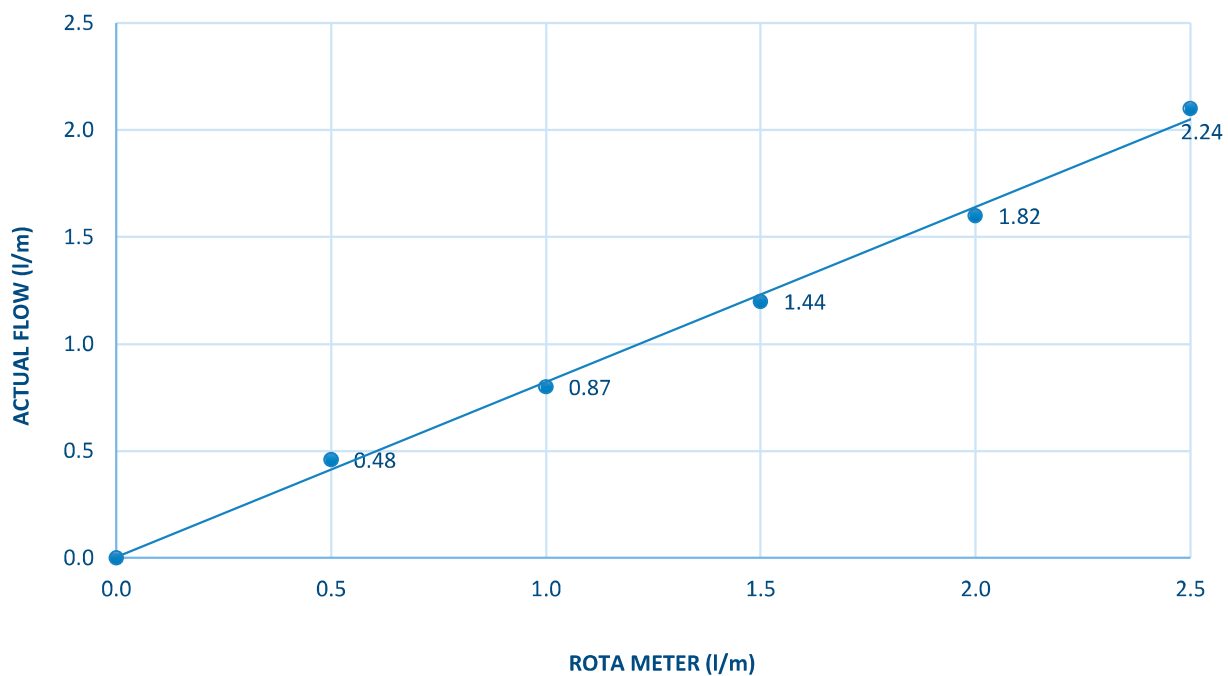
Serial No. ; 20120703007

Model ; Gillian BDXII



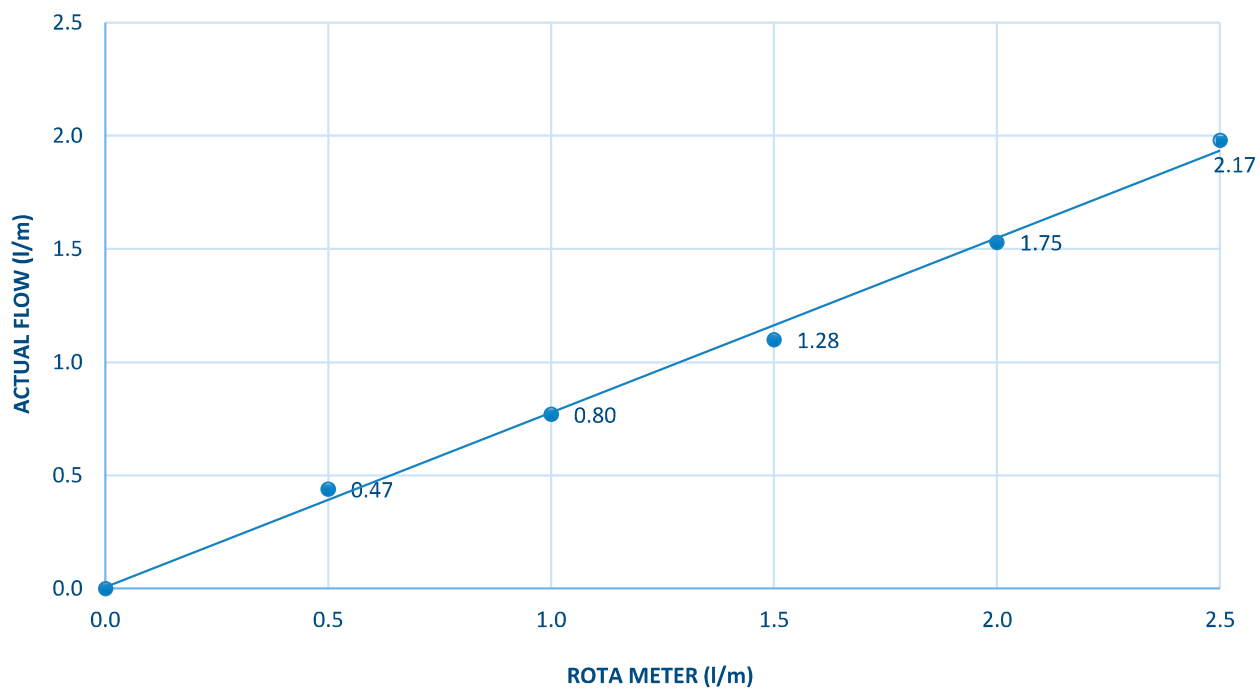
Serial No. ; 20121102038

Model ; Gillian BDXII



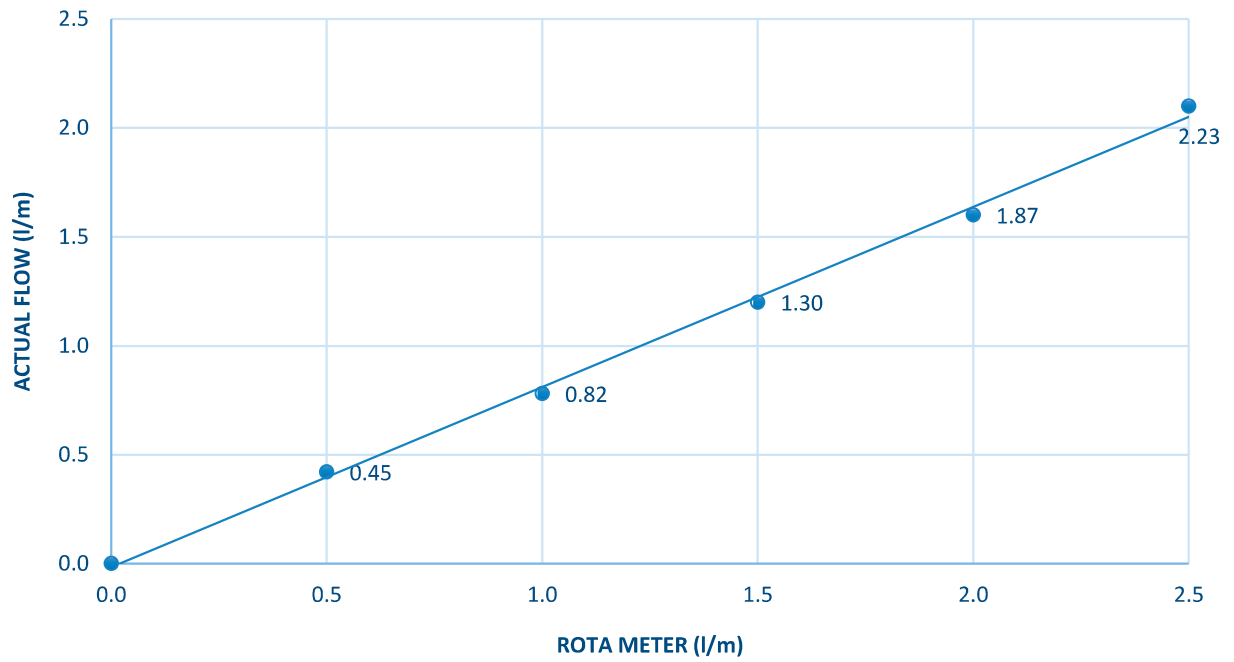
Serial No. ; 20121102041

Model ; Gillian BDXII



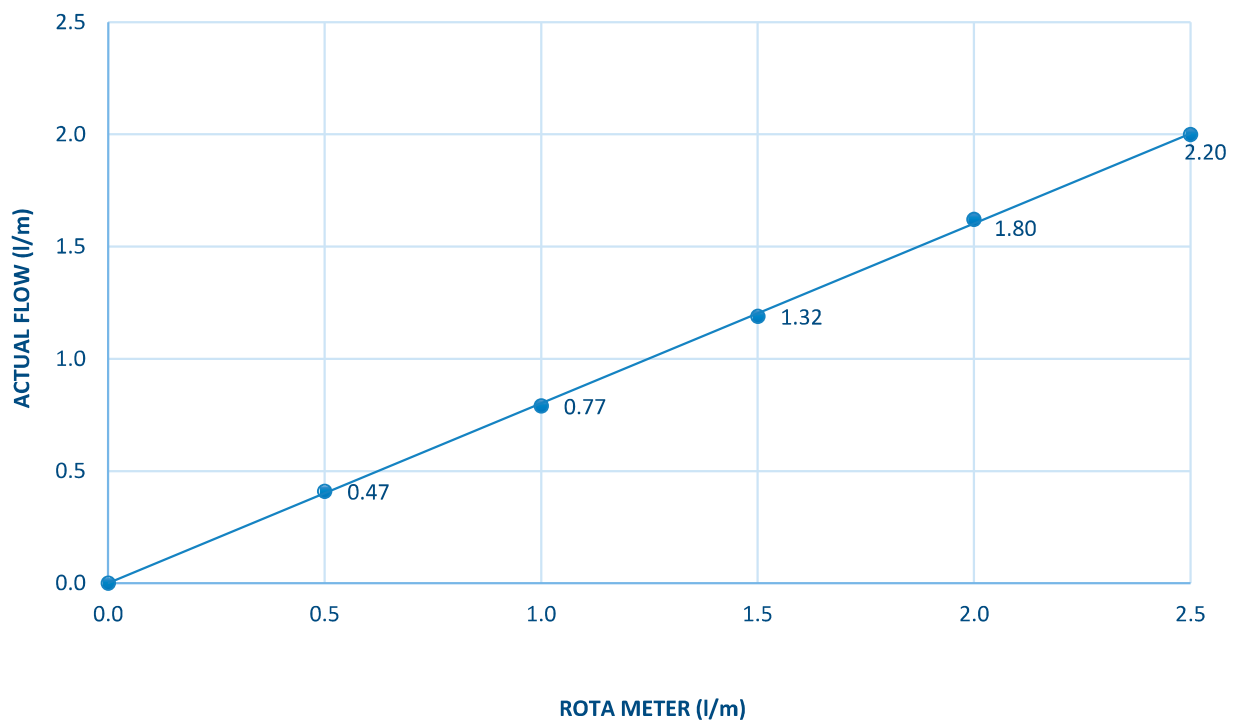
Serial No. ; 20130401088

Model ; Gillian BDXII



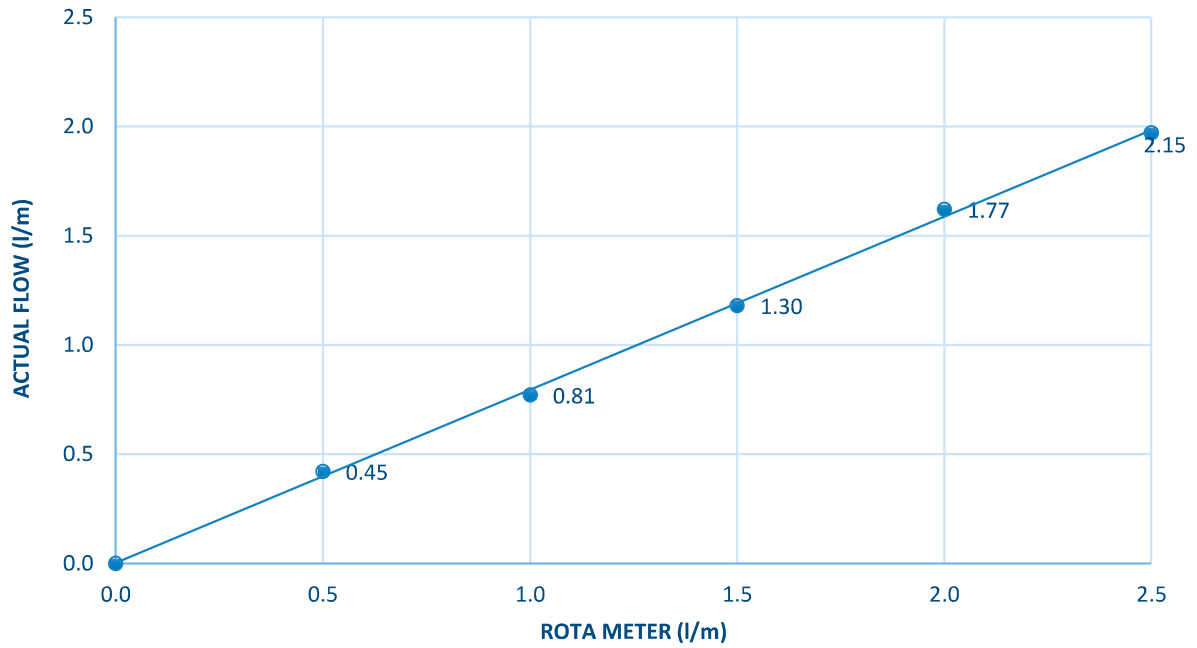
Serial No. ; 20130401107

Model ; Gillian BDXII



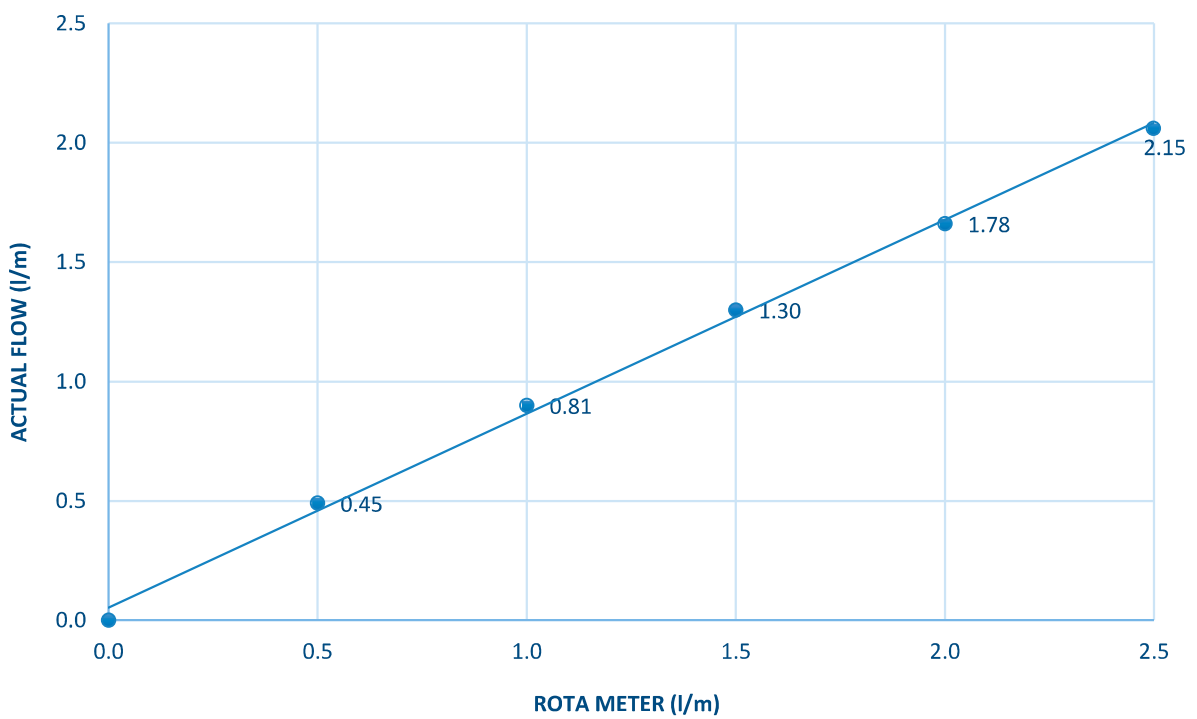
Serial No. ; 20140602109

Model ; Gillian BDXII



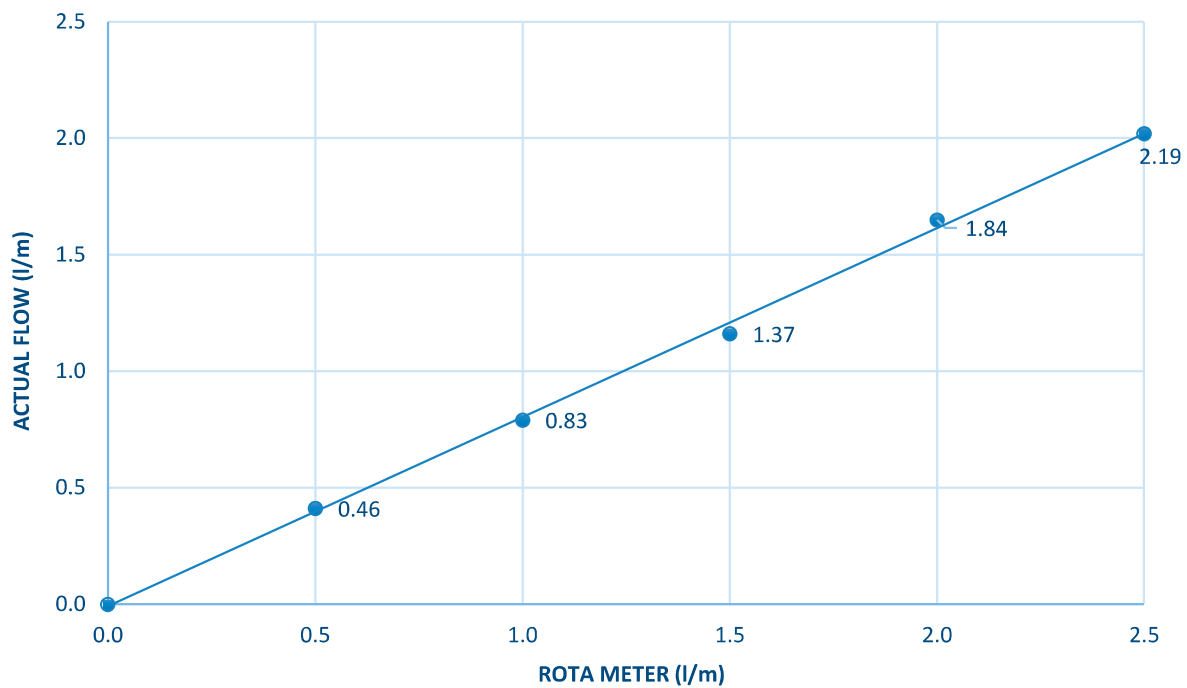
Serial No. ; 20140602089

Model ; Gillian BDXII



Serial No. ; 20140602095

Model ; Gillian BDXII



*This certification may be reproduced other than in full, except with the prior written
Approval of the head of Calibration services and environmental analysis department.*

Certificate of Calibration

Certificate No. : 64-420085-2

Page : 1 of 2

Submitted by : Health & Envitech Co., Ltd.

77/11 Moo 2 Ngamwongwan Rd., Soi 5, Tumbon Bangken, Muang, Nonthaburi 11000

Equipment : pH Meter with electrode

pH meter

Manufacturer : Hanna

Model : HI 3220

Range : -2.00 to 20.00 pH

Resolution : 0.01 pH

Serial No. : 08631549

ID No. : LB-HE-051

Electrode

Model : HI 1131

Serial No. : 0438399N

Environment : Ambient Temperature : (25 ± 2) °C

Relative Humidity : (50 ± 15) %

Date of Received : 17 June 2021

Date of Calibration : 19 June 2021

Date of Issue : 19 June 2021

Calibrated by : Bunjerd Masri

Calibration Method : In-house method CAL-M4201 direct measurement by using standard voltage calibrator and using certified reference material (CRM)

Reference Standard Instruments : This certification is traceable to the International System of Units

1. Multiproduct Calibrator

ID No.	Cert. No.	Due Date	Traceability
440001	21E997	17 Mar 2023	National Institute of Metrology Thailand (NIMT)

2. Standard Buffer Solution

pH	Cert. No.	Lot No.	Exp. Date	Traceability
4.004	61208711	684575	01 Sep 2021	CPA chem
6.985	61191143	684576	01 Sep 2021	CPA chem
9.963	61208865	684577	01 Sep 2021	CPA chem

Approved by

Supervisor

Certificate of Calibration

Certificate No. : 64-420085-2

Page : 2 of 2

Result of Calibration :

UUC Condition As-Received : Good

Function : Electrical measurement

pH meter

Performing standard curve by Multiproduct Calibrator at pH (4,7,10)

Adjustment Curve at nominal pH	Applied Voltage (mV)	Nominal Value (pH)	UUC Reading		Correction (mV)	Uncertainty (± mV)
			(pH)	(mV)		
4, 7, 10	177.4800	4	4.00	177.3	0.2	0.060
	0.0000	7	7.00	-0.1	0.1	0.060
	-177.4800	10	10.00	-177.5	0.0	0.060

Function : pH meter with electrode

Performing a three - buffer standard curve using buffer nominal pH (4,7,10)

Adjustment Curve at nominal pH	Standard Buffer (pH)	UUC Reading (pH)	Correction (pH)	Uncertainty (± pH)
4, 7, 10	4.004	4.01	0.00	0.011
	6.985	7.01	-0.02	0.021
	9.963	10.01	-0.04	0.053

Remark

UUC : Unit Under Calibration

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

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

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Certificate of Calibration

Certificate No. : 64-400320-1

Page : 1 of 2

Submitted by : Health & Envitech Co., Ltd.
77/11 Moo 2, Ngamwongwan Rd., Soi 5, Tumbon Bangkhen, Muang, Nonthaburi 11000

Equipment : Digital Thermometer with Thermistor Probe (Temp pH)
Temperature Indicator

Manufacturer : Hanna

Model : HI3220

Range : N/A

Resolution : 0.1 °C

Serial No. : 08631549

ID No. : LB-HE-051

Thermistor Probe

Model : N/A

Sheath Material : Stainless

Diameter : 3.5 mm.

Length : 100 mm.

Serial No. : TH 050363

ID No. : LB-HE-051

Environment : Ambient Temperature : (23 ± 2) °C
Relative Humidity : (50 ± 15) %
Line Voltage : (220 ± 22) VAC

Date of Received : 17 June 2021

Date of Calibration : 19 June 2021

Date of Issue : 19 June 2021

Calibrated by : Bunjerd Masri

Calibration Method : This instrument was calibrated by In-house method comparison technique CAL-M4003 by compared with PRT in the liquid bath at the constant controlled temperature.

The temperature scale used was based on ITS-90

Reference Standard Instruments : This certification is traceable to the International System of Units

1. Platinum Resistance Thermometer (PRT)

ID No.	Cert. No.	Due Date	Traceability
400001	TT-0016-20	04 Mar 2022	National Institute of Metrology Thailand (NIMT)

2. Standard Digital Thermometer

ID No.	Cert. No.	Due Date	Traceability
400033	20E612	17 Feb 2022	National Institute of Metrology Thailand (NIMT)

Approved by :

Supervisor

Certificate of Calibration

Certificate No. : 64-400320-1

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

Immersion Depth (mm.)	Standard Reading (° C)	UUC Reading (° C)	Correction (° C)	Uncertainty (± ° C)
100	25.0021	25.1	-0.1	0.12
100	35.0019	35.1	-0.1	0.12
100	45.0017	45.1	-0.1	0.12

Remark

UUC : Unit Under Calibration

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

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

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Certificate of Calibration

Certificate Number : SPR22020179-1

Page : 1 of 3

Customer : Health & Envitech Co., Ltd.

6 Ngamwongwan Road, Soi 5, Bang Khen, Mueang Nonthaburi,
Nonthaburi 11000

Equipment Name : Sound Level Meter

Manufacturer : ACO

Model : 6236

Serial Number : 192030

ID. Number : N/A

Environmental Conditions

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

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

Location of Calibration : In-Lab

Calibration Procedure : SP-CPE-04-01

Received Date : 11 Feb 2022

Calibration Date : 11 Feb 2022

Recommend Due Date : 11 Feb 2023

Date of Issue : 12 Feb 2022

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 :



Calibration Officer

Approved by :



Authorized Signatory



Calibration Report

Certificate Number : SPR22020179-1

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	SC-942	B014059	EEL.BP. 34/1264	22 Dec 2022

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. : SPR22020179-1

Page : 3 of 3

Range : 94 to 114 dB

Function : @1kHz

Select A

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	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	94.0	94.0	0.0	0.0	0.15
114	113.9	113.9	-0.1	-0.1	0.15

Select Z

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

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 : SPR21120367-1

Page : 1 of 3

Customer : Health and Envitech Co., Ltd

77/11 Moo 2, Ngamwongwan Road, Soi 5, Bang Khen , Mueang
Nonthaburi , Nonthaburi 11000

Equipment Name : Sound Calibrator

Manufacturer : Quest Technologies

Model : QC-10

Serial Number : QE7060323

ID. Number : N/A

Environmental Conditions

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

Received Date : 27 Dec 2021

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

Calibration Date : 27 Dec 2021

Location of Calibration : In-Lab

Recommend Due Date : N/A

Calibration Procedure : In-House Method

Date of Issue : 28 Dec 2021

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 :



Calibration Officer

Approved by :



Authorized Signatory



Calibration Report

Certificate Number : SPR21120367-1

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Measuring Receiver	8902A	2950A02471	EF-0001-21	08 Jan 2022
AUDIO Analyzer	8903B	3011A09975	EL04965/21	19 Feb 2022

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. : SPR21120367-1

Page : 3 of 3

Function : Sound Level

UUC Setting (\pm dB)	Standard Reading (dB)	Error (dB)	Uncertainty (\pm dB)
114	113.84	0.16	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 : SPR21120367-2

Page : 1 of 3

Customer : Health and Envitech Co., Ltd

77/11 Moo 2, Ngamwongwan Road, Soi 5, Bang Khen , Mueang
Nonthaburi , Nonthaburi 11000

Equipment Name : Sound Level Meter

Manufacturer : ACO

Model : 6236

Serial Number : 78383

ID. Number : N/A

Environmental Conditions

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

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

Location of Calibration : In-Lab

Calibration Procedure : SP-CPE-04-01

Received Date : 27 Dec 2021

Calibration Date : 27 Dec 2021

Recommend Due Date : N/A

Date of Issue : 28 Dec 2021

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 :



Calibration Officer

Approved by :



Authorized Signatory



Calibration Report

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	SC-942	B014059	EEL.BP.19/1063	15 Oct 2022

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. : SPR21120367-2

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	93.9	93.9	-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	94.0	94.0	0.0	0.0	0.15
114	114.1	114.1	0.1	0.1	0.15

Select Z

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	93.9	0.0	-0.1	0.15
114	114.1	114.0	0.1	0.0	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 : SPR21120367-3

Page : 1 of 3

Customer : Health and Envitech Co., Ltd

77/11 Moo 2, Ngamwongwan Road, Soi 5, Bang Khen , Mueang
Nonthaburi , Nonthaburi 11000

Equipment Name : Sound Level Meter

Manufacturer : Rion

Model : NL-20

Serial Number : 00532379

ID. Number : N/A

Environmental Conditions

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

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

Location of Calibration : In-Lab

Calibration Procedure : SP-CPE-04-01

Received Date : 27 Dec 2021

Calibration Date : 27 Dec 2021

Recommend Due Date : N/A

Date of Issue : 28 Dec 2021

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.

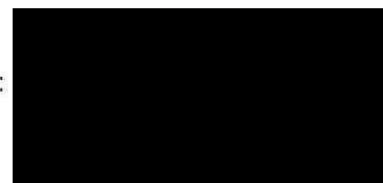
All calibrations are performed within manufacture's specifications. The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by :



Calibration Officer

Approved by :



Authorized Signatory



Calibration Report

Certificate Number : SPR21120367-3

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	SC-942	B014059	EEL.BP.19/1063	15 Oct 2022

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. : SPR21120367-3

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	114.1	114.1	0.1	0.1	0.15

Select C

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.1	94.0	0.1	0.0	0.15
114	114.2	114.2	0.2	0.2	0.15

Select P

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.1	94.1	0.1	0.1	0.15
114	114.2	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 : SPR21120367-4

Page : 1 of 3

Customer : Health and Envitech Co., Ltd

77/11 Moo 2, Ngamwongwan Road, Soi 5, Bang Khen , Mueang
Nonthaburi , Nonthaburi 11000

Equipment Name : Sound Level Meter

Manufacturer : Rion

Model : NL-20

Serial Number : 00732581

ID. Number : N/A

Environmental Conditions

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

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

Location of Calibration : In-Lab

Calibration Procedure : SP-CPE-04-01

Received Date : 27 Dec 2021

Calibration Date : 27 Dec 2021

Recommend Due Date : N/A

Date of Issue : 28 Dec 2021

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.

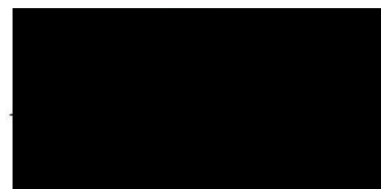
All calibrations are performed within manufacture's specifications. The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by :



Calibration Officer

Approved by :



Authorized Signatory



Calibration Report

Certificate Number : SPR21120367-4

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	SC-942	B014059	EEL.BP.19/1063	15 Oct 2022

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. : SPR21120367-4

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	92.5	92.5	-1.5	-1.5	0.15
114	112.6	112.6	-1.4	-1.4	0.15

Select C

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	92.5	92.5	-1.5	-1.5	0.15
114	112.6	112.6	-1.4	-1.4	0.15

Select P

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	92.6	94.6	-1.4	0.6	0.15
114	112.7	112.6	-1.3	-1.4	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 : SPR21120367-5

Page : 1 of 3

Customer : Health and Envitech Co., Ltd

77/11 Moo 2, Ngamwongwan Road, Soi 5, Bang Khen , Mueang
Nonthaburi , Nonthaburi 11000

Equipment Name : Noise Dosimeter
Manufacturer : Quest Technologies
Model : NoisePro DL Dosimeter
Serial Number : NLE070203
ID. Number : N/A

Environmental Conditions

Ambient Temperature	: 23 °C \pm 3 °C	Received Date	: 27 Dec 2021
Relative Humidity	: 50 % \pm 15 %	Calibration Date	: 27 Dec 2021
Location of Calibration	: In-Lab	Recommend Due Date	: N/A
Calibration Procedure	: SP-CPE-04-01	Date of Issue	: 28 Dec 2021

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 :



Calibration Officer

Approved by :



Authorized Signatory



Calibration Report

Certificate Number : SPR21120367-5

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	SC-942	B014059	EEL.BP.19/1063	15 Oct 2022

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. : SPR21120367-5

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	94.2	94.2	0.2	0.2	0.15
114	114.3	114.3	0.3	0.3	0.15

Note:

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

Measurement Uncertainty

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

- End of Certificate -



Certificate of Calibration

Certificate Number : SPR21120367-6

Page : 1 of 3

Customer : Health and Envitech Co., Ltd

77/11 Moo 2, Ngamwongwan Road, Soi 5, Bang Khen , Mueang
Nonthaburi , Nonthaburi 11000

Equipment Name : Noise Dosimeter
Manufacturer : Quest Technologies
Model : NoisePro DL Dosimeter
Serial Number : NLG070140
ID. Number : N/A

Environmental Conditions

Ambient Temperature	: 23 °C \pm 3 °C	Received Date	: 27 Dec 2021
Relative Humidity	: 50 % \pm 15 %	Calibration Date	: 27 Dec 2021
Location of Calibration	: In-Lab	Recommend Due Date	: N/A
Calibration Procedure	: SP-CPE-04-01	Date of Issue	: 28 Dec 2021

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.

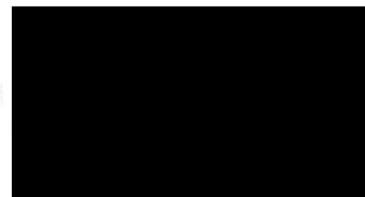
All calibrations are performed within manufacture's specifications. The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by :



Calibration Officer

Approved by :



Authorized Signatory



Calibration Report

Certificate Number : SPR21120367-6

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	SC-942	B014059	EEL.BP.19/1063	15 Oct 2022

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. : SPR21120367-6

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	94.2	94.2	0.2	0.2	0.15
114	114.3	114.3	0.3	0.3	0.15

Note:

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

Measurement Uncertainty

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

- End of Certificate -



Certificate of Calibration

Certificate Number : SPR21120367-7

Page : 1 of 3

Customer : Health and Envitech Co., Ltd

77/11 Moo 2, Ngamwongwan Road, Soi 5, Bang Khen , Mueang
Nonthaburi , Nonthaburi 11000

Equipment Name : Noise Dosimeter
Manufacturer : Quest Technologies
Model : NoisePro DL Dosimeter
Serial Number : NLG070138
ID. Number : N/A

Environmental Conditions

Ambient Temperature	: 23 °C \pm 3 °C	Received Date	: 27 Dec 2021
Relative Humidity	: 50 % \pm 15 %	Calibration Date	: 27 Dec 2021
Location of Calibration	: In-Lab	Recommend Due Date	: N/A
Calibration Procedure	: SP-CPE-04-01	Date of Issue	: 28 Dec 2021

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.

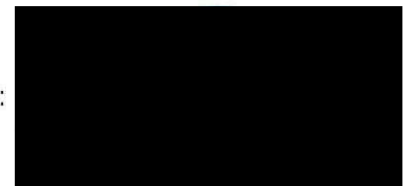
All calibrations are performed within manufacture's specifications. The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by :



Calibration Officer

Approved by :



Authorized Signatory



Calibration Report

Certificate Number : SPR21120367-7

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	SC-942	B014059	EEL.BP.19/1063	15 Oct 2022

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. : SPR21120367-7

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	94.1	94.1	0.1	0.1	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 : SPR21120367-8

Page : 1 of 3

Customer : Health and Envitech Co., Ltd

77/11 Moo 2, Ngamwongwan Road, Soi 5, Bang Khen , Mueang
Nonthaburi , Nonthaburi 11000

Equipment Name : Noise Dosimeter

Manufacturer : Quest Technologies

Model : NoisePro DL Dosimeter

Serial Number : NLG070139

ID. Number : N/A

Environmental Conditions

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

Received Date : 27 Dec 2021

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

Calibration Date : 27 Dec 2021

Location of Calibration : In-Lab

Recommend Due Date : N/A

Calibration Procedure : SP-CPE-04-01

Date of Issue : 28 Dec 2021

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 :

Calibration Officer

Approved by :

Authorized Signatory



Calibration Report

Certificate Number : SPR21120367-8

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	SC-942	B014059	EEL.BP.19/1063	15 Oct 2022

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. : SPR21120367-8

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	93.9	93.9	-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	94.1	94.1	0.1	0.1	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 : SPR21120367-9

Page : 1 of 3

Customer : Health and Envitech Co., Ltd

77/11 Moo 2, Ngamwongwan Road, Soi 5, Bang Khen , Mueang
Nonthaburi , Nonthaburi 11000

Equipment Name : Noise Dosimeter
Manufacturer : Quest Technologies
Model : NoisePro DL Dosimeter
Serial Number : NLG070141
ID. Number : N/A

Environmental Conditions

Ambient Temperature	: 23 °C \pm 3 °C	Received Date	: 27 Dec 2021
Relative Humidity	: 50 % \pm 15 %	Calibration Date	: 27 Dec 2021
Location of Calibration	: In-Lab	Recommend Due Date	: N/A
Calibration Procedure	: SP-CPE-04-01	Date of Issue	: 28 Dec 2021

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 :

Calibration Officer

Approved by :

Authorized Signatory



Calibration Report

Certificate Number : SPR21120367-9

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	SC-942	B014059	EEL.BP.19/1063	15 Oct 2022

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. : SPR21120367-9

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	94.2	94.2	0.2	0.2	0.15
114	114.3	114.3	0.3	0.3	0.15

Note:

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

Measurement Uncertainty

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

- End of Certificate -



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0184

MTC No. EEL. BP. 63/1263

CALIBRATION CERTIFICATE

Submitted by : HEALTH & ENVITECH CO., LTD.

Address : 77/11 M.2 Ngamwongwan Rd., Soi 5, T.Bangkhen, A.Muang, Nontaburi 11000.

Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.
: Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., Muang, Samutprakan 10280.

Instrument Calibrated :

Description : Calibrator

Manufacturer : Castle

Model : GA 607

Serial No. : 033647

Ambient Environment

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

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

Ambient Pressure : $(101.325 \pm 1.500) \text{ kPa}$

Standards used : 1. Digital Function Synthesizer NF Electronic DF-193A S/N 122037.

2. Measuring Amplifier Bruel&Kjaer 2636 S/N 1537484.

3. Programmable Attenuator Tamagawa TPA-303A S/N OF 2214.

4. Digital Multimeter Agilent 34401A S/N MY44005560.

5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.

6. Audio Analyzer Keithley 2015-P S/N 4106495.

7. Condenser Microphone B&K 4180 S/N 2889871.

Calibration Procedure: CP-102-04 based on IEC 60942-2003. The sound pressure level of instrument was measured by standard microphone using an insert voltage technique.

This instrument has been calibrated against standards maintained at Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

Date of Receipt : 18 Dec. 2020

Date of Calibration : 22 Dec. 2020

1 / 2

The results relate only to the items tested or calibrated.

Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

FM.BL.MTC.002 Rev.3

Head Office

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Fax. (66) 0 2577 9009

E-mail : rumpai@tistr.or.th Website:www.tistr.or.th

Office/Laboratory

Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakan 10280, Thailand

Tel. (66) 0 2323 1672-80 ext. 115, 116

Fax. (66) 0 2323 9165

E-mail : mtc@tistr.or.th

Office

196 Phahonyothin Road, Chatuchak, Bangkok 10900,
Thailand

Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217

Fax. (66) 0 2579 8592

E-mail : sumalee@tistr.or.th



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0184

MTC No. EEL. BP. 63/1263

The reported expanded uncertainty is based upon a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95%.

Nominal Output of Unit Under Test = 104 dB re 20 μ Pa at 1000 Hz

Acoustic Output in dB re 20 μ Pa, Corrected to Reference Conditions: 101.325 kPa, 23.0 °C and 50 %RH.

1. Sound Pressure Level

Standard Microphone Type	Sound Pressure Level			
	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty [#] (dB)	Tolerance limit IEC60942:2003 Class 1
1/2 inch B&K 4180	104.35	0.35	± 0.15	± 0.40 dB

2. Frequency

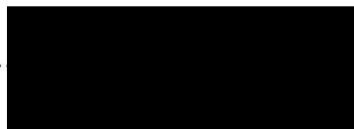
Standard Microphone Type	Frequency			
	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 1
1/2 inch B&K 4180	1000.1	0.1	± 1.5	$\pm 1.0\%$

3. Total Distortion

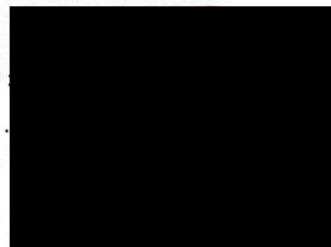
Standard Microphone Type	Total Distortion		
	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch B&K 4180	1.84	± 0.50	$\pm 3.0\%$

- Note :**
1. No adjustment.
 2. The calibrator pressure correction was not included.
 3. The microphone volume correction was not included.
 4. Results marked " # " mean coverage factor $k = 2.32$.

Calibrated by :



Approved by :



Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 22 Dec. 2020

Date of Issue : 25 Dec. 2020

Ref : 2011263121804946002 **2 / 2**

End of Certificate

The results relate only to the items tested or calibrated.
Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

FM.BL.MTC.002 Rev.3

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E-mail : sumalee@tistr.or.th



Certificate of Calibration

Equipment:	SPECTROPHOTOMETER	Certificate No.:	C06210223
Model:	SPECORD 50 PLUS	Issued Date:	18 May 2021
Serial No. (or ID.):	232H1012 (LB-HE-073)	Job No.:	KSPR2106842
Manufacturer:	Analytik jena	Page:	1 of 3
Condition:	In Condition		

Customer: Health & Envitech Co.,Ltd.
77/11 Moo 2 Ngamwongwan Rd. Soi 5,
Tumbon Bangkhen, Mueang, Nontaburi 11000 Thailand

Environment Condition:

Temperature	27.7	°C	±	0.2	°C
Humidity	55.5	%RH	±	1.2	%RH

Calibration Place: Health & Envitech Co.,Ltd. (Laboratory 2)
77/11 Moo 2 Ngamwongwan Rd. Soi 5,
Tumbon Bangkhen, Mueang, Nontaburi 11000 Thailand

Calibration By: Mr.Nattapat Rungrueang
Calibration Date: 17 May 2021
The Method used: In house method, SPCC-WI-24, base on ASTM E 275-08 and ASTM E 387-04

Traceability: This certificate is traceable to the CRM maintained by National Institute of Standards and Technology (NIST) through Starna Scientific Limited.

The standard for Wavelength Certificate No. 87146 and 85282
The standard for Photometric Certificate No. 87220 and 87139
The standard for Stray light Certificate No. 87163 and 87161
The standard for Spectral resolution Certificate No. 87173



Person in charge



Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.

The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).

These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of SPC RT Co., Ltd.

Calibration Results:

Without Adjustment

Wavelength Accuracy (nm), The spectral bandwidth of Std at 1.5 nm and UUC at 1.4 nm

Standard Wavelength	Unit Under Calibration	Correction	Uncertainty
360.93	360.80	0.13	0.13
418.59	418.56	0.03	0.13
460.02	459.88	0.14	0.13
536.59	536.54	0.05	0.13
684.40	684.48	-0.08	0.13

Photometric Accuracy (Absorbance)

Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
420 nm	0.0000	0.0000	0.0000	0.0045
	0.5890	0.5910	-0.0020	0.0045
	0.7616	0.7626	-0.0010	0.0045
	1.0263	1.0310	-0.0047	0.0045
440 nm	0.0000	0.0000	0.0000	0.0045
	0.5787	0.5799	-0.0012	0.0045
	0.7442	0.7442	0.0000	0.0045
	1.0039	1.0061	-0.0022	0.0045
465 nm	0.0000	0.0000	0.0000	0.0045
	0.5292	0.5294	-0.0002	0.0045
	0.6865	0.6861	0.0004	0.0045
	0.9534	0.9581	-0.0047	0.0045
546.1 nm	0.0000	0.0000	0.0000	0.0045
	0.5468	0.5444	0.0024	0.0045
	0.6957	0.6924	0.0033	0.0045
	0.9991	0.9976	0.0015	0.0045
590 nm	0.0000	0.0000	0.0000	0.0045
	0.5851	0.5817	0.0034	0.0045
	0.7238	0.7195	0.0043	0.0045
	1.0957	1.0916	0.0041	0.0045
635 nm	0.0000	0.0000	0.0000	0.0045
	0.5692	0.5657	0.0035	0.0045
	0.6914	0.6873	0.0041	0.0045
	1.0881	1.0838	0.0043	0.0045

Calibration Results:

Without Adjustment

Photometric Accuracy (Absorbance)				
Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
235 nm	0.0000	0.0000	0.0000	0.0080
	0.7307	0.7264	0.0043	0.0080
257 nm	0.0000	0.0000	0.0000	0.0080
	0.8516	0.8465	0.0051	0.0080
313 nm	0.0000	0.0000	0.0000	0.0080
	0.2836	0.2846	-0.0010	0.0080
350 nm	0.0000	0.0000	0.0000	0.0080
	0.6319	0.6258	0.0061	0.0080

Stray light *

Standard: cut-off	UUC: Wavelength (nm)	UUC: Transmission (%T)	Absorbance (A)
260.57 +/- 0.11 nm	260.58	0.32	2.4949
392.03 +/- 0.11 nm	392.02	0.88	2.0555

The stray light transmission reference is less than 1.0 T(%) and absorbance is greater than 2.0 (A)

Spectral Resolution *

Nominal Concentration 0.02 % v/v	Peak	Trough	Ratio	SBW
Standard Wavelength (nm)	268.72	266.76	1.59	1.50
UUC: Wavelength (nm)	268.78	266.78		
Std Absorbance (A)	0.4616	0.2797		
Absorbance (A)	0.4465	0.2816		

* Calibration Marked " Not TISI Accredited " in this Certificate have been included for completeness.

The End of Certificate

Certificate No.: C06210223 Page: 1 of 3

Statements of conformity:

This conformity certificate documents the validity of the following statements of conformity based on the measurement results of corresponding calibration certificate:

The error of temperature determined during calibration are under given measurement and environmental conditions and considering the expanded measurement uncertainty (coverage probability 95%) within the specification. The given measurement uncertainty already includes other all effects by according to the standard method, ASTM E 275-08 and ASTM E 387-04. Therefore, those parameters have not been assessed separately.

Tolerance and Decision rules:

Assessment of the conformity of the measurement device are done based on direct comparison of the relevant measurement results with the tolerances and decision rule are prescribed by the customer.

- Decision rule :**
- ☐ Choice A Binary Statement for Simple Acceptance Rule ($w = 0$), Specific Risk $< 50\%$ PFA
 - ☒ Choice B Non-binary statement with guard band ($w = 1$ U), Specific Risk $< 2.5\%$ PFA
 - ☐ Choice C Customer defined, Customers may define arbitrary multiple of r to have applied as guard band ($w = r$ U) .
- ; PFA – Probability of False Accept

Without Adjustment

Wavelength Accuracy (nm), The spectral bandwidth of Std at 1.5 nm and UUC at 1.4 nm

Unit Under Calibration	Correction	Guard Band (w)	Tolerance (\pm)	Conformity
360.80	0.13	0.13	3	Pass
418.56	0.03	0.13	3	Pass
459.88	0.14	0.13	3	Pass
536.54	0.05	0.13	3	Pass
684.48	-0.08	0.13	3	Pass

The validity of the statements of conformity cannot be guaranteed for different places of use, environmental conditions or improper use.

Without Adjustment

Photometric Accuracy (Absorbance)					
Wavelength	Unit Under Calibration	Correction	Guard Band (w)	Tolerance (\pm)	Conformity
420 nm	0.0000	0.0000	0.0045	0.015	Pass
	0.5910	-0.0020	0.0045	0.015	Pass
	0.7626	-0.0010	0.0045	0.015	Pass
	1.0310	-0.0047	0.0045	0.015	Pass
440 nm	0.0000	0.0000	0.0045	0.015	Pass
	0.5799	-0.0012	0.0045	0.015	Pass
	0.7442	0.0000	0.0045	0.015	Pass
	1.0061	-0.0022	0.0045	0.015	Pass
465 nm	0.0000	0.0000	0.0045	0.015	Pass
	0.5294	-0.0002	0.0045	0.015	Pass
	0.6861	0.0004	0.0045	0.015	Pass
	0.9581	-0.0047	0.0045	0.015	Pass
546.1 nm	0.0000	0.0000	0.0045	0.015	Pass
	0.5444	0.0024	0.0045	0.015	Pass
	0.6924	0.0033	0.0045	0.015	Pass
	0.9976	0.0015	0.0045	0.015	Pass
590 nm	0.0000	0.0000	0.0045	0.015	Pass
	0.5817	0.0034	0.0045	0.015	Pass
	0.7195	0.0043	0.0045	0.015	Pass
	1.0916	0.0041	0.0045	0.015	Pass
635 nm	0.0000	0.0000	0.0045	0.015	Pass
	0.5657	0.0035	0.0045	0.015	Pass
	0.6873	0.0041	0.0045	0.015	Pass
	1.0838	0.0043	0.0045	0.015	Pass

The validity of the statements of conformity cannot be guaranteed for different places of use, environmental conditions or improper use.

Without Adjustment

Photometric Accuracy (Absorbance)

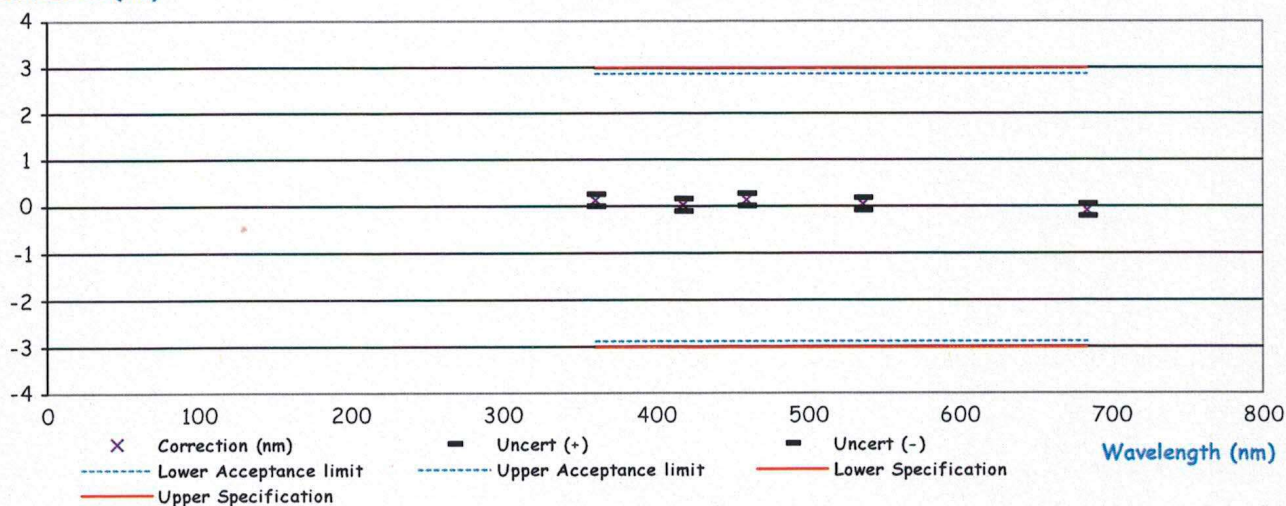
Wavelength	Unit Under Calibration	Correction	Guard Band (w)	Tolerance (±)	Conformity
235 nm	0.0000	0.0000	0.0080	0.015	Pass
	0.7264	0.0043	0.0080	0.015	Pass
257 nm	0.0000	0.0000	0.0080	0.015	Pass
	0.8465	0.0051	0.0080	0.015	Pass
313 nm	0.0000	0.0000	0.0080	0.015	Pass
	0.2846	-0.0010	0.0080	0.015	Pass
350 nm	0.0000	0.0000	0.0080	0.015	Pass
	0.6258	0.0061	0.0080	0.015	Pass

The validity of the statements of conformity cannot be guaranteed for different places of use, environmental conditions or improper use.

The End of Statements of Conformity

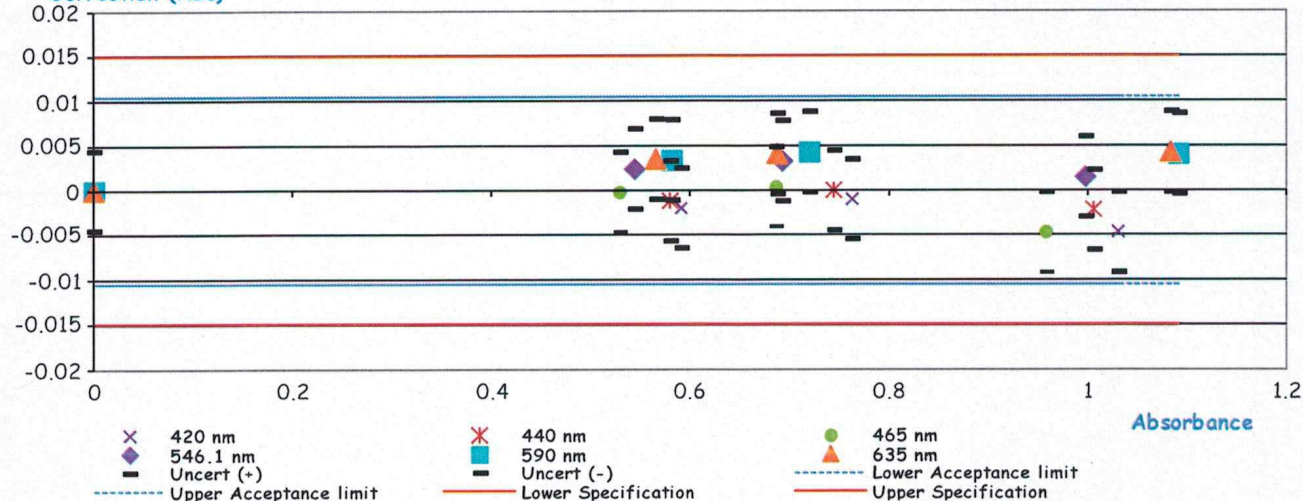
Wavelength accuracy Tolerance 3 (nm)

Correction (nm)



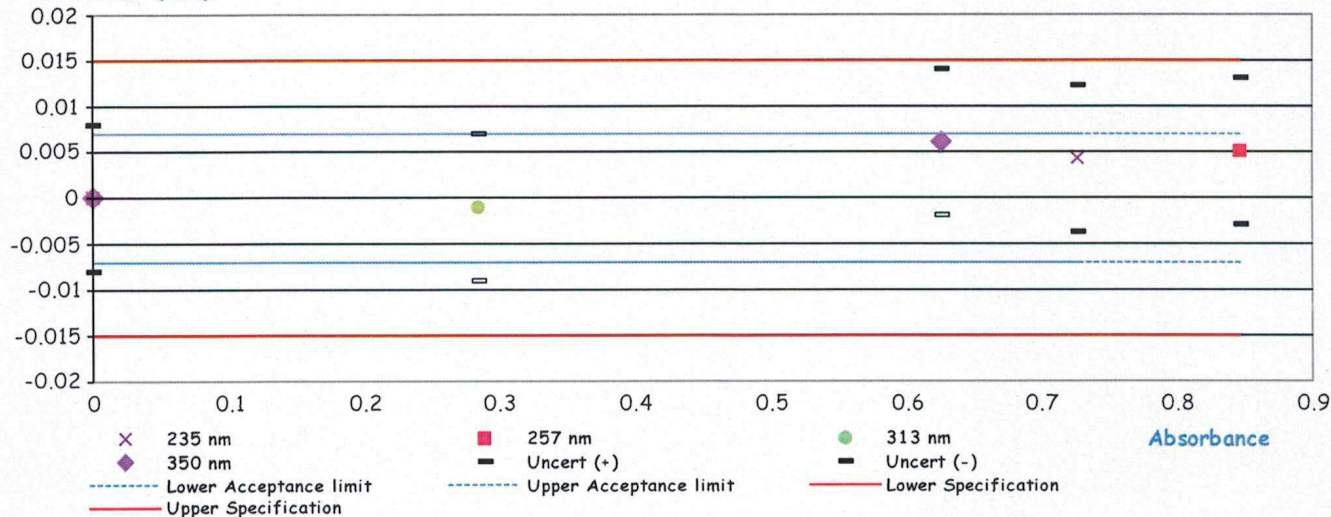
Photometric Accuracy (Absorbance) Tolerance 0.015 (Abs)

Correction (Abs)



Photometric Accuracy (Absorbance) Tolerance 0.015 (Abs)

Correction (Abs)



ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: KSPR2106842

ชนิดเครื่องมือ: SPECTROPHOTOMETER รุ่น: SPECORD 50 PLUS

หมายเลขเครื่อง: 232H1012

ตรวจสอบ (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
17 May 2021			17 May 2021		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
		General			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. ความสมบูรณ์เครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. ความสะอาด (ช่องใส่ตัวอย่าง, ภายใน-นอกเครื่อง)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. สวิตช์ ปิด – เปิด เครื่อง (On-Off Swicth)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. ปุ่มกด (Keypad)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. หน้าจอ (Display, Screen Contrast)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
		Spectrophotometer			
<input type="checkbox"/>	<input type="checkbox"/>	6. แรงดันไฟฟ้า (Battery Backup) ≥ 2.5 VDC	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	7. ตัวหมุนเลือกความยาวคลื่น (Wavelength Control)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	8. ความยาวคลื่น (Wavelength Check)	<input type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	9. แหล่งกำเนิดแสง (UV < 3,000 hour)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	10. แหล่งกำเนิดแสง (Visible < 5,000 hour)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	11. ช่องวัดหลายตัวอย่าง (Carousel Module)	<input type="checkbox"/>	<input type="checkbox"/>	
		pH Meter and Conductivity Meter			
<input type="checkbox"/>	<input type="checkbox"/>	12. อิเล็กโทรด (Electrode and Connection Cable)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	13. ระดับสารละลายใน Electrode (Level KCl)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	14. ฝาปิดกันปลาย Electrode (Dust Protection Hood)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	15. ขาจับอิเล็กโทรด (Stand)	<input type="checkbox"/>	<input type="checkbox"/>	
		Turbidimeter			
<input type="checkbox"/>	<input type="checkbox"/>	16. ค่าความขุ่นที่ต่ำสุด (No Sample)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	17. ระดับการส่องสว่างของแสง (≥ 2.5 ไม่นเกิน 3.0)	<input type="checkbox"/>	<input type="checkbox"/>	
		Automatic titrator			
<input type="checkbox"/>	<input type="checkbox"/>	18. สภาพ Piston Burettes	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	19. Function Rinsing and Dosing	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	20. ระบบท่อสายยางและอุปกรณ์ประกอบ	<input type="checkbox"/>	<input type="checkbox"/>	

เพิ่มเติม/ขอแนะนำ :

Service Engineer

Nomenclature

Barometric Pressure
Dry Gas Meter
Constant based on standard temp and press
Time, in minutes
Flow (Meter Pressure, gauge)
Volume collected by test meter, corrected for STP
Calculated flow rate of test meter
Flow coefficient
Theoretical pressure of reference meter
Temperature measured in reference meter

Equations

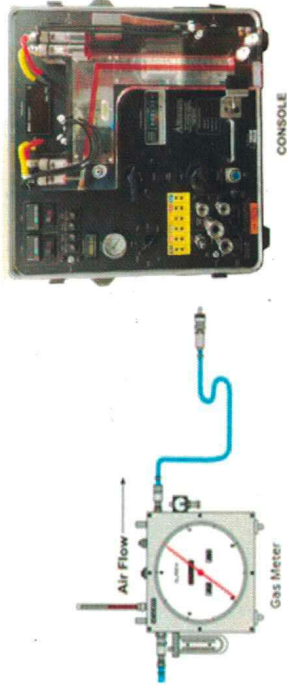
$$V_{w(std)} = Y * K_1 \frac{V_w * (P_{bar} + \frac{P_{m(g)}}{13.6})}{T_w}$$

$$V_{m(std)} = \frac{K_1 V_m (P_{bar} + \frac{\Delta H}{13.6})}{T_m}$$

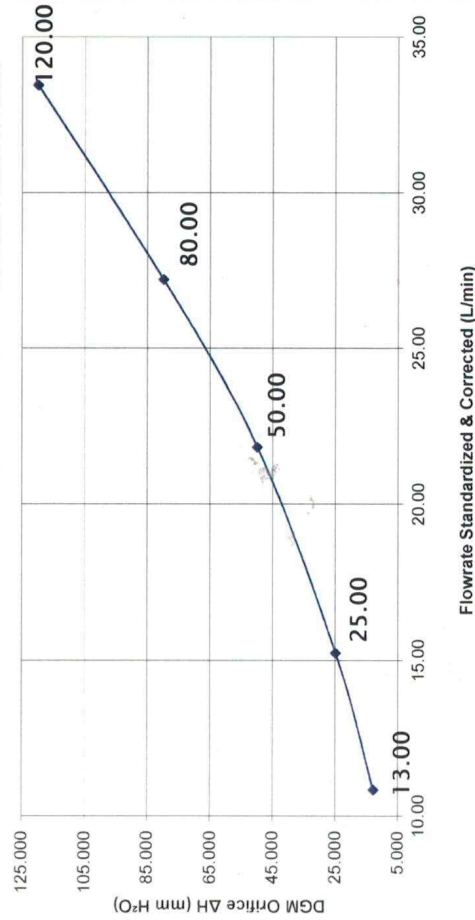
$$K_1 = \frac{V_{std}}{P_{std}} \quad Y = \frac{V_{cr(std)}}{V_{m(std)}} \quad Q_{w(std)} = \frac{V_{w(std)}}{\Theta}$$

$$Metric \Delta H_0 = \frac{P_{m(g)} * 0.0011696 * (P_{bar} + \frac{P_{m(g)}}{13.6}) * (T_w * \Theta)^2}{T_m}$$

Calibration Train



Meter Pressure vs. Flowrate



Meter Gamma vs. Flowrate





Console Sensor Audit QA Sheet

Meter Console Information (UUT)

Model #: XD-502-V
Serial #: A1912535
Units: Metric

Calibration Conditions

Pbar (mm. Hg): 756.06
Humidity (%): 54.5
Amb. Temp. (°C): 26.5
Altitude (m): 6.7
Corrected Pbar (mm. Hg): 755.50

Reference Devices

TC Simulator Model: CC-VTR-SH
Reference #: 91109269
Barometer Model: TMD
Barometer Serial #: N/A
Digital Pressure Calibrator Model: 718 30G
Reference #: 9543013

Audit Data

Reference Point	Reference Temp.	Thermocouple Probe Audit						Reference Point Status ¹
		Aux	Stack	Probe	Oven	Filter	Exit	
Water	°C	°C	°C	°C	°C	°C	°C	Pass/Fail
Boiling	100	101	101	101	101	101	101	PASS
Room	27.6	28	28	28	28	28	28	PASS
Room	0.1	0	0	0	0	0	0	PASS

Console Vacuum Audit			
Reference Point	Reference Vacuum	Console Vacuum	Reference Point Status ³
#	in. Hg	in. Hg	Pass/Fail
1	28.00	27.40	FAIL

Calibrate By: _____

Approved By: _____

Date: _____

Notes

¹For valid test results, the maximum difference between test and reference readings should be less than 5.4 °F (3 °C), for all thermocouples except for the stack thermocouple which should be less than 1.5% absolute temperature from the reference reading and the exit thermocouple which should be less than 2°F (1 °C) from the reference reading (EPA Method 2, Section 6.3 and EPA Method 5, Sections 6.1.1.7-6.1.1.8)

²For valid test results, the maximum difference between console and reference barometric pressure readings should be less than 0.1 in. Hg (2.5 mm Hg), (EPA Method 5, Section 6.1.2)

³For valid test results, the maximum difference between console and reference vacuum readings should be less than 0.5 in. Hg (12.5 mm Hg)

I certify that the above Thermocouple, Barometric, and Vacuum Sensors were calibrated and audited in accordance with US EPA Methods, CFR 40 Part 60.



Certificate of Calibration

Method 5 Pre-Test Calibration - Liters (L)

UUT Meter Console Information

Model #:	XC-572-V
Serial #:	A1912535
DGM Model #:	SK25EX
DGM Serial #:	00006056
Initial Y _{sc} :	0.9955
Bar. Pressure (mm Hg):	756.1
Ambient Temperature (°C):	25.0
Relative Humidity (%):	53
Altitude (m):	6.71
Bar. Pressure Corr. (mm Hg):	755.5

Calibration Conditions

Std. Temp. (K):	293.15
Std. Press. (mm Hg):	760
K ₁ (K/mm Hg):	0.3857

Factors/Conversions

Reference Equipment

Calibration Meter Model:	DGMR-200H
Cal. Due Date:	04-May-21
Serial No.:	0000026
Gamma:	0.9962

UUT Meter (DGM)

Time (seconds)	Orifice, ΔH (mm H ₂ O)	Volume		Meter Temperature (°C)		Meter Pressure (in H ₂ O)	Reference Meter (WTM)		
		Initial (L)	Final (L)	Initial	Final		Initial	Final	Total
Θ	P _{m(g)}	V _{m(i)}	V _{m(f)}	t _{m(i)}	t _{m(f)}	P _w	V _{w(i)}	V _{w(f)}	V _w
80.00	13.00	2561.40	2704.80	26.0	27.0	0.3	0.00	145.48	145.48
90.00	25.00	2704.80	2860.00	27.0	28.0	0.5	0.00	157.30	157.30
138.00	50.00	2860.00	3023.50	28.0	29.0	0.6	0.00	165.08	165.08
160.00	80.00	3023.50	3190.40	29.0	30.0	2.0	0.00	168.45	168.45
300.00	120.00	3190.40	3361.00	30.0	31.0	2.4	0.00	172.45	172.45

Standardized Data

Reference Meter (L)		UUT Meter (L)		Correction Factor		ΔH @ (mm H ₂ O)	
Std. Flow	Std. Flow	Std. Vol.	Std. Flow	Value	Variance	ΔH @	Variance
Q _{w(Std)}	V _{m(Std)}	V _{w(Std)}	V _{w(Std)}	Y	ΔY	ΔH @	ΔΔH @
40.82	139.64	10.8	10.8	1.0085	0.0005	48.4	1.230
52.33	150.80	15.2	15.2	1.0101	0.0021	47.0	-0.159
59.37	158.72	21.8	21.8	1.0041	-0.0039	45.7	-1.415
63.19	161.96	27.2	27.2	1.0076	-0.0004	47.4	0.303
67.23	165.64	33.4	33.4	1.0096	0.0016	47.2	0.041
				1.0080	= Y Avg.	47.1	= ΔH @ Avg.

Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is ± 0.02 .

Note: For ΔH_g, orifice pressure differential that equates to 0.0212m³/min at standard temperature and pressure, acceptable tolerance of individual values from the average is ± 0.2 inches (5.1mm) H₂O.

Pass/Fail Judgment :

Pass

Calibrate By :

Approved By :

Date: 20 Jan 21

The instruments meter and described on this certificate have been calibrated against standards traceable to the National Institute of Standards and Technology (N.I.S.T.) and in reference to EPA Method 5, Section 10.3.1.

Neediss Supply Instrument Co., Ltd. - 536 Soi Bangkhuae 7 Bangkhuae Bangkok 10160 | Tel: (662) 8023980 Web: www.neediss.com



Certificate of Calibration

Method 5 Console Sensor Calibration - Metric Units

Console Information

Model #: XC-572-V
Serial #: 1602016
Units: Metric

Calibration Conditions

Pbar (mm. Hg): 756.06
Humidity (%): 54.5
Tamb (°C): 26.30
Elevation (m): 6.7
Corr. Pbar (mm. Hg): 755.50

Reference Devices

TC Calibrator Model: CC-VTR-SH
Reference #: 091109269
Barometer Model: TMD
Barometer Serial #: N/A
Pressure Model: 718 30G
Reference #: 9543013

Temperature Sensors Calibration Data

Reference Point ¹	Reference Temp.	Test Thermocouple Calibrations						Reference Point Status ²
		Aux	Stack	Probe	Oven	Filter	Exit	
#	°C	°C	°C	°C	°C	°C	°C	Pass/Fail
1	-18	-16	-17	-16	-17	-17	-17	PASS
2	38	38	38	38	38	38	38	PASS
3	93	94	93	93	93	93	93	PASS
4	149	150	150	149	149	150	150	PASS
5	260	259	259	259	259	259	259	PASS
6	371	372	372	371	371	371	371	PASS
7	482	482	482	482	482	482	482	PASS
8	593	593	593	593	593	593	593	PASS
9	816	815	815	815	815	815	815	PASS
10	1038	1038	1037	1037	1037	1037	1037	PASS

Overall Audit Status

NIST Reference Thermocouple ID:

12702001

NIST Reference Thermocouple ID: 12-02204				
	Ref Point	Theoretical Temp.	DGM Thermocouple Sensor Reading	ΔT_{abs}^4
	#	°C	°C	°C
Ice Water	1	0.1	0	0.04%
Ambient ³	2	26.3	26	0.06%
Maximum ²				0.06%
Status				PASS

Internal temperature thermocouple is not audited to EPA standards, and should not be used as an official reference for ambient temperature.

Calibrate By :

Approved By:

Date:

20 Jan 21

Notes

¹ Suggested, minimum reference points are 10 (0, 100, 200, 300, 500, 700, 900, 1100, 1500, 1900 °F), can test for more.

² For valid test results, the maximum difference between temperature and reference readings should be less than ± 5.4 °F (± 3 °C), for all thermocouples except for the stack thermocouple which should be less than $\pm 1.5\%$ absolute temperature from the reference reading and the exit thermocouple which should be less than ± 2 °F (± 1 °C) from the reference reading (EPA Method 2, Section 6.3 and EPA Method 5, Sections 6.1.1.7-6.1.1.8)

³ Do not change this cell value, it is instead based on input from Cell H8 at the top of this sheet under "Calibration Conditions"

⁴ Absolute temperature difference and other formulas are calculated based on unit input from cell C8 at the top of this sheet under "Meter Console Information"

⁵ For valid test results, the maximum difference between console and reference barometric pressure readings should be less than ± 0.1 in. Hg (± 2.5 mm Hg), (EPA Method 5, Section 6.1.2)

⁶ For valid test results, the maximum difference between console and reference vacuum readings should be less than ± 0.5 in. Hg (± 12.5 mm Hg)

⁷ For valid test results, the maximum difference between console and reference vacuum readings should be less than ± 0.05 in. H₂O (± 1.25 mm H₂O), or 5% of full scale



Nozzle Validation

Samplig System Equipment Information

Console Model Number XC-572-V
Console Serial Number A1912535
DGM Model Number SK25EX
DGM Serial Number 00006056

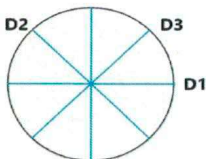
Validation Conditions

Date 20-Jan-20
Barometric Pressure 756 mm Hg
Validation Vernier ,0-200mm
Validation No. 21140201637
Validation Method US.EPA Method

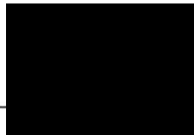
Validation Data					Results	
Nozzle ID	Nozzle Diameter				Different	$(D_1 + D_2 + D_3) / 3$
Sizes		D ₁	D ₂	D ₃	ΔD	Davg
	mm	mm	mm	mm	mm	mm
4	3.2	3.18	3.19	3.19	0.006	3.187
6	4.8	4.80	4.79	4.79	0.006	4.793
8	6.4	6.40	6.40	6.41	0.006	6.403
10	8.0	8.00	8.00	8.00	0.000	8.000
12	9.5	9.48	9.47	9.49	0.010	9.480
14	11.1	11.10	11.10	11.09	0.006	11.097
16	12.7	12.66	12.67	12.68	0.010	12.670

Where :

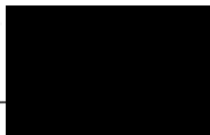
D₁, D₂, D₃ = There difference nozzle diameters , mm ; diameter must be within 0.025 mm
 ΔD = Maximum difference between any two diameters, must be ≤ 0.100 mm
D avg = $(D_1 + D_2 + D_3) / 3$



Validation By:



Approved By:



Date: 20 Jan 21



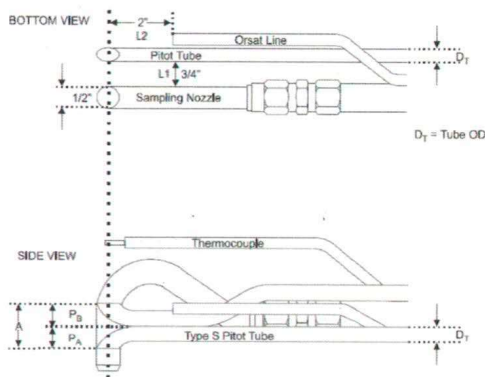
Sampling Probe and Pitot Validation

Samplig System Equipment Information

Probe Sheat	Apex 1 in. , 3 ft.
Probe Number	1203679
Pitot tube Number	A3611
Pitot tube Type	S Type 3/8 Inc.
Validation method	Standard Probe 1 in. and 1/2 in. Sampling Nozzle

Valibration Conditions and Equipment

Reference No.	ET123456
Digital Calipers	Vernier ,0-200mm
Digital Inclinator	FEL 12-1057
Temperature	24.0 °C±3
Validation Date	20 Jan 21



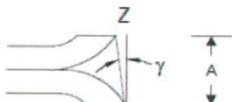
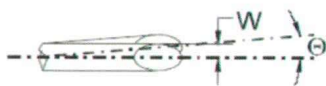
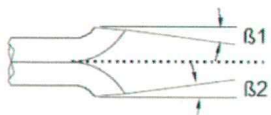
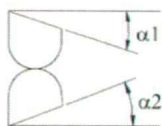
Sampling Probe Validation with Tune up

☒ Measure and Alinment with 1/2" Sampling Nozzle(12.7 mm)

Measured	Standard Range
$L_1 = 2.03$ cm.	(1.905 cm. or 3/4 in.)
$L_2 = 4.86$ cm.	(5.08 cm. or 2.0 in.)
$D_T = 0.954$ cm.	(3/8 in.)
$A = 2.22$ cm.	($2.1 D_T \leq A \leq 3 D_T$)
$A/2D_T = 1.164$ cm.	($1.05 P_A / D_T \leq A \leq 1.5$)

Pitot Tube Validations and Engles measurement Result

☒ : Measure Result after Maintanarice and Adjustable



P_B Size Standard Range

$\alpha_1 = 0.30^\circ \leq 10^\circ$

$\beta_1 = 0.20^\circ \leq 5^\circ$

P_A Size

$\alpha_2 = 0.80^\circ \leq 10^\circ$

$\beta_2 = 1.30^\circ \leq 5^\circ$

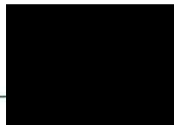
Engles measurement Calculated Result Standard Range

$W = 1.30^\circ$ 0.050 cm. $W < 0.08$ cm (1/32 in.)

$Z = -1.00^\circ$ -0.039 cm. $Z < 0.032$ cm (1/8 in.)

Can be use 0.84 for $C_p(s)$ if the type of face-opening misafgnment show above with not affect the base line value of $C_p(s)$ Solong as standard range

Validation By:



Approved By:



Date: 20 Jan 21



Console Sensor Calibration Data Sheet

Console Information

Model #: XC-572-V
Serial #: A1912535
Units: Metric
Type:
"English" or
"Metric 572"

Calibration Conditions

Pbar (mm. Hg): 756.06
Humidity (%): 54.50
Tamb (°C): 26.30
Corr. Pbar (mm. Hg): 755.50

Reference Devices

TC Simulator Model: CC-VTR-SH
Reference #: 091109269
Barometer Model: TMD
Barometer Serial #: N/A
Digital Pressure Calibrator Model: 718 30G
Reference #: 9543013

Pressure Gauge / Manometer Calibration Data

Console Vacuum Calibration			
Reference Point	Reference Vacuum	Console Vacuum	Reference Point Status ⁶
#	in. Hg	in. Hg	Pass/Fail
1	-5.0	-5.0	PASS
2	-10.0	-9.5	PASS
3	-15.0	-14.5	PASS

Reference Point ¹	ΔH_Manometer Calibration			Reference Point Status ²
	Reference Pressure	Positive (+) Pitot	Negative (-) Pitot	
#	mm H2O	mm H2O	mm H2O	Pass/Fail
1	-150.000	0.0	-150.2	PASS
2	-100.000	0.0	-100.2	PASS
3	-50.000	0.0	-50.0	PASS
4	-25.000	0.0	-25.4	PASS
5	-15.000	0.0	-15.2	PASS
6	0.000	0.0	0.0	PASS
7	15.000	15.0	0.0	PASS
8	25.000	25.0	0.0	PASS
9	50.000	50.0	0.0	PASS
10	100.000	100.2	0.0	PASS
11	150.000	150.2	0.0	PASS
ΔH Overall Audit Status				PASS

Reference Point ¹	ΔP_Manometer Calibration			Reference Point Status ²
	Reference Pressure	Positive (+) Pitot	Negative (-) Pitot	
#	mm H2O	mm H2O	mm H2O	Pass/Fail
1	-150.000	0.0	-150.2	PASS
2	-100.000	0.0	-100.4	PASS
3	-50.000	0.0	-50.4	PASS
4	-25.000	0.0	-25.0	PASS
5	-15.000	0.0	-15.0	PASS
6	0.000	0.0	0.0	PASS
7	15.000	15.0	0.0	PASS
8	25.000	25.2	0.0	PASS
9	50.000	50.2	0.0	PASS
10	100.000	100.4	0.0	PASS
11	150.000	150.4	0.0	PASS
ΔP Overall Audit Status				PASS

Calibrate By :

Approved By:

Date:

20 Jan 21

Notes

¹ Suggested, minimum reference points are 10 (0, 100, 200, 300, 500, 700, 900, 1100, 1500, 1900 F), can test for more.

² For valid test results, the maximum difference between temperature and reference readings should be less than ± 5.4 F (± 3 °C), for all thermocouples except for the stack thermocouple which should be less than ± 1.5 % absolute temperature from the reference reading and the exit thermocouple which should be less than ± 2 °F (± 1 °C) from the reference reading (EPA Method 2, Section 6.3 and EPA Method 5, Sections 6.1.1.7-6.1.1.8)

³ Do not change this cell value, it is instead based on input from Cell H8 at the top of this sheet under "Calibration Conditions"

⁴ Absolute temperature difference and other formulas are calculated based on unit input from cell C8 at the top of this sheet under "Meter Console Information"

⁵ For valid test results, the maximum difference between console and reference barometric pressure readings should be less than ± 0.1 in. Hg (± 2.5 mm Hg), (EPA Method 5, Section 6.1.2)

⁶ For valid test results, the maximum difference between console and reference vacuum readings should be less than ± 0.5 in. Hg (± 12.5 mm Hg)

⁶ For valid test results, the maximum difference between console and reference vacuum readings should be less than 0.05 in. H2O (± 1.25 mm H2O), or 5% of full scale

I certify that the above Thermocouple Sensors were calibrated in accordance with US EPA Methods 2 and 5, CFR 40 Part 60