

## ภาคผนวกที่ 7

### เอกสารการสอบเทียบความถูกต้องของเครื่องมือ

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# **Maintenance Protocol**

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**Atomic Absorption Spectrometer**  
**contrAA<sup>®</sup> 600**

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Serial-No.: 162K0111 Customer-No.: C04-007  
 Date: 11/10/2021 Carried out by: Srichai Pak-an.

**Maintenance with following Operational Qualification (OQ)**  
 (requires a separate OQ protocol)



Company	บริษัท 100% 100% 100% 100%
User	garcia
Department	Lab.
Street	77/11 หมู่ 2 ถนนพหลโยธิน ซอย 5 อ.เมือง
Zip Code, City	0.1000 @-mng 11000
Phone	
Fax	
E-mail	

### Maintenance works Autosampler and MPE

Serial No.:

(MPE 60)

- lubricate the dosing-winding (spindle oil) ☒
- clean the dosing cylinder, if necessary exchange it ☒
- lubricate the winding system of the height drive with some drops of oil ☒
- check the toothed belt ☒
- check the pump rate of mixing pump (AS52S, typ.10s) ☒
- check the pump rate of washing cup ☒
- check the electrical hose connections for good contact ☒
- check the dosing hose for buckling, if necessary exchange it ☒

### Maintenance works basic unit (graphite)

- clean the furnace inside with alcohol (electrodes, shroud) ☒
  - if the pyro-coat is destroyed exchange the shroud
  - exchange the electrodes (or rotate the electrodes about 45°)
- clean the furnace windows, if necessary exchange it ☒
- clean the graphite insert, if necessary exchange it ☒
- put in a new graphite tube without platform ☒
- if necessary clean the windows in the sample compartment ☒
- check the gas flows and write the values in the protocol (service software) ☒
- check the tube value (service software 250±50) ☒
- compare the water temperature from the water tank and the PC (service software, max. difference: 1grd) ☒
- check the furnace temperature (980grd) ☒
  - Attention: Only use a Pyrometer!
  - WinAAS cleaning program without forming routine in before
- check and adjust the formation factor (Tol +3...-3%) ☒
- check level cooling water KM5 (2 cm below full) ☒



Device parameter		nominal value	actual value
Firm and software versions		actual version	version after update
	HPS	2.21	-
	FPGA	47,07 CCD:02	-
	Aspect CS	2.2.2.0	-
Neon and prism correction		before Corr.	after Corr.
As 193.6950	Neon	0	0
	Prism	-91	0
Cu 324.7540	Neon	0	0
	Prism	178	0
Na 588.9953	Neon	0	0
	Prism	279	0
K 766.4908	Neon	0	0
	Prism	300	0
Energy of Xe-lamp		Int. time	Intensity
As 193.6950		72.984	0.052
Se 196.0267		72.984	0.077
Mg 202.5820		72.978	0.051
Zn 213.8570		72.978	0.105
Pb 217.0005		72.978	0.057
Cd 228.8018		72.978	0.140
Ti 365.3496		9.602	1.890
K 766.4908		0.558	23.930
Energy of Neon-lamp			
585.2488 nm		3500-7000	3871
594.4834 nm		3500-7000	4265
616.3594 nm		3500-7000	3692
865.4384 nm		1500-3500	3253
588.1895 nm		3500-7000	3514
659.8953 nm		1500-3500	2203
748.8871 nm		3500-7000	4265
703.2410 nm		3500-7000	4538
Wavelength accuracy		Pixel	Pixel
Cr 359.3488		± 1	0.13

Gas Supply Graphite tube furnace		NI/min	NI/min
Gas flow level min		0,20 ± 0,05	0.2
Gas flow level max		2,00 ± 0,2	2.0
outside gas flow		0,15 ± 0,05	0.15
Open and close furnace		3 ± 2 sec	3.00
Basic function furnace		nominal value	actual value
Formation factor		±3,0 %	
after 3 times / electrodes cleaned / graphite tube replaced		-0.5, -0.7, -0.7	OK
Safety loop			
Inert gas pressure		OK	OK
Transformer temperature		OK	OK
Cooling water level		OK	OK
Check MPE			
Error-check		OK	OK
Check level sensor		OK	OK
Check/adjustment: dipping arm, sample tray, pump-function		OK	OK
Analytical parameters			
10 µg/l Cr			
Req.: Cr 10 µg/l in 0.5 % HNO <sub>3</sub>			
	Cr 357.8687 c <sub>0</sub> (mg/l)	< 0.5	0.155
	RSD	< 5.0 %	3.6
Comments:			

*Sirchai Pak-on*  
Signature Technician

11/10/2021

Place, Date (DD/MM/YYYY)

*Damon Kossin*  
Signature Customer

11/10/2021

Place, Date (DD/MM/YYYY)



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: 5 February 2022

#### Instruments Information

Analyzer Type: NO/NO <sub>2</sub> /NO <sub>x</sub> Analyzer Model: 200AU	Manufacturer API Environmental S/N: 1176
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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 <sub>2</sub> Conc 55.11 PPM CO Conc 4,535 PPM Cylinder number EB0129027 Expire Date: 20 Oct. 2027

Environment: Temperature 25.5 °C

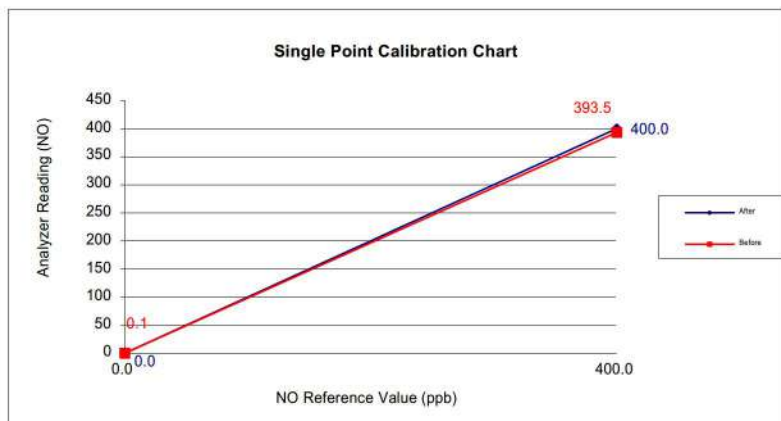
Humidity: 51 %RH

#### 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	393.5	400.0	-1.6
NO <sub>x</sub>	0.1	0.0	0.1	400.0	400.0	0.0

#### 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 <sub>x</sub>	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By : Mr. Pasagorn Samol



บริษัท เอ็นไวร์ เซอร์วิส จำกัด  
ENVIR SERVICE CO., LTD.

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

### Analyzer Performance Test

Calibrated Date: 5 February 2022

#### Instruments Information

Analyzer Type: NO/NO <sub>2</sub> /NO <sub>x</sub> Analyzer Model: 200A	Manufacturer API Environmental S/N: 1524
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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 <sub>2</sub> Conc 55.11 PPM CO Conc 4,535 PPM Cylinder number EB0129027 Expire Date: 20 Oct. 2027

Environment: Temperature 25.5 °C

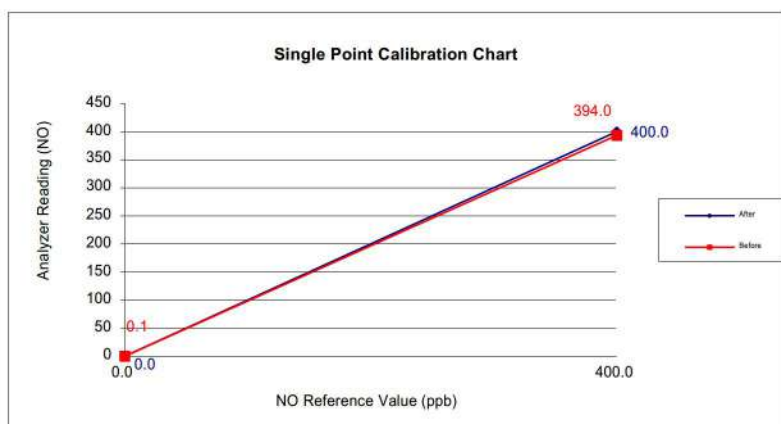
Humidity: 51 %RH

#### 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	394.0	400.0	-1.5
NO <sub>x</sub>	0.1	0.0	0.1	400.0	400.0	0.0

#### 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 <sub>x</sub>	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By : Mr. Pasagorn Samol





บริษัท เอ็นไวร์ เซอร์วิส จำกัด  
ENVIR SERVICE CO., LTD.

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

### Analyzer Performance Test

Calibrated Date: 5 February 2022

#### Instruments Information

Analyzer Type: NO/NO <sub>2</sub> /NO <sub>x</sub> Analyzer Model: 200A	Manufacturer API Environmental S/N: 2364
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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 <sub>2</sub> Conc 55.11 PPM CO Conc 4,535 PPM Cylinder number EB0129027 Expire Date: 20 Oct. 2027

Environment: Temperature 25.5 °C

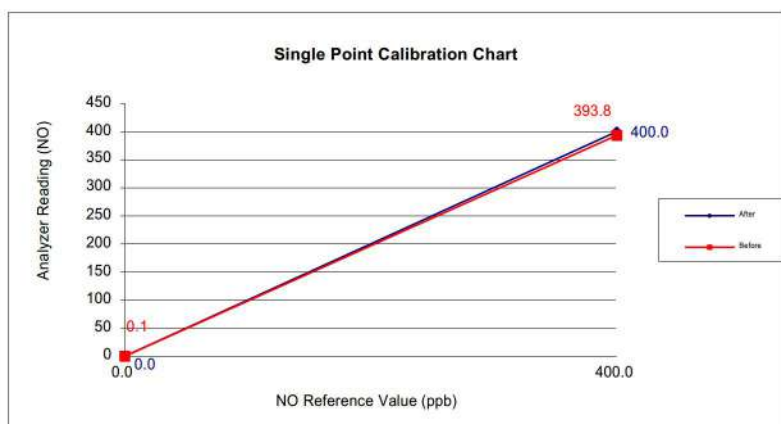
Humidity: 51 %RH

#### 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	393.8	400.0	-1.8
NO <sub>x</sub>	0.1	0.0	0.1	400.0	400.0	0.0

#### 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 <sub>x</sub>	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By : Mr. Pasagorn Samol



บริษัท เอ็นไวร์ เซอร์วิส จำกัด  
ENVIR SERVICE CO., LTD.

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

### Analyzer Performance Test

Calibrated Date: 5 February 2022

#### Instruments Information

Analyzer Type: SO2 Analyzer Model: 100A	Manufacturer API Environmental S/N: 488
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#### Calibration System

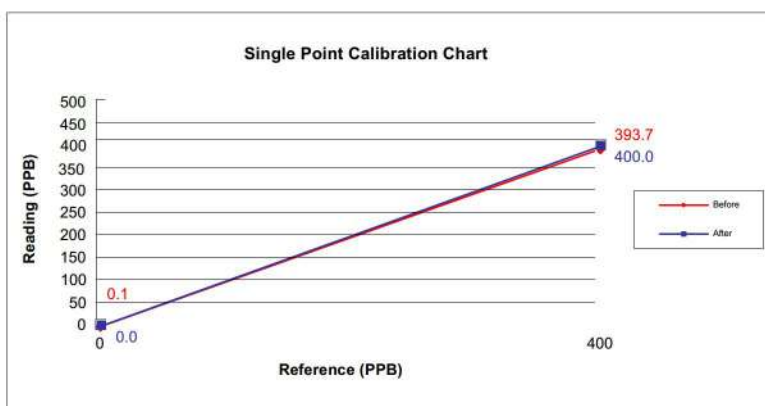
Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008 S/N: 705 ZERO AIR Generator API MODEL 701 S/N: 1924	NO Conc 55.47 PPM SO2 Conc 55.11 PPM CO Conc 4,535 PPM Cylinder number EB0129027 Expire Date: 20 Oct. 2027

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	393.7	-1.6
After	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By :

Mr.PASAGORN SAMOL



บริษัท เอ็นไวร์ เซอร์วิส จำกัด  
ENVIR SERVICE CO., LTD.

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

### Analyzer Performance Test

Calibrated Date: 5 February 2022

#### Instruments Information

Analyzer Type: SO2 Analyzer Model: 100A	Manufacturer API Environmental S/N: 1157
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#### Calibration System

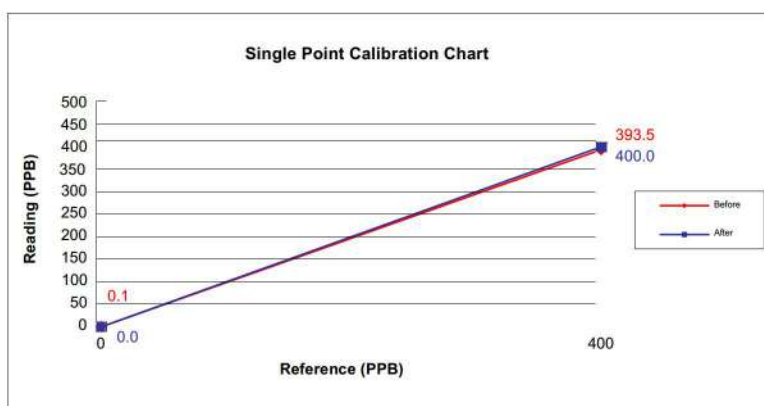
Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008 S/N: 705 ZERO AIR Generator API MODEL 701 S/N: 1924	NO Conc 55.47 PPM SO2 Conc 55.11 PPM CO Conc 4,535 PPM Cylinder number EB0129027 Expire Date: 20 Oct. 2027

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	393.5	-1.6
After	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By :

Mr.PASAGORN SAMOL





บริษัท เอ็นไวร์ เซอร์วิส จำกัด  
ENVIR SERVICE CO., LTD.

## บริษัท เอ็นไวร์ เซอร์วิส จำกัด

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

### Analyzer Performance Test

Calibrated Date: 5 February 2022

#### Instruments Information

Analyzer Type: SO2 Analyzer Model: 100AS	Manufacturer API Environmental S/N: 2008
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#### Calibration System

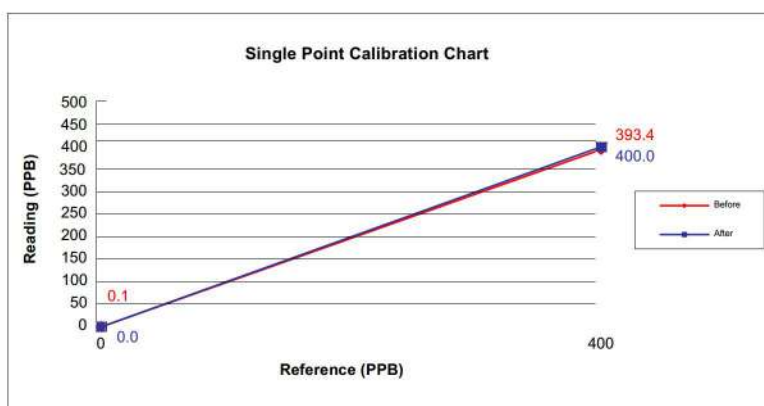
Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008 S/N: 705 ZERO AIR Generator API MODEL 701 S/N: 1924	NO Conc 55.47 PPM SO2 Conc 55.11 PPM CO Conc 4,535 PPM Cylinder number EB0129027 Expire Date: 20 Oct. 2027

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	393.4	-1.7
After	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By :

Mr.PASAGORN SAMOL

## 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.Bangkheng, 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 :

  
( Surachai Promthong )

Laboratory Manager

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 Calibratech Co.,Ltd.



## 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.

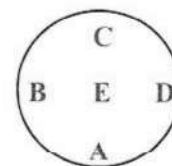
This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor  $k = 2.20$ , providing a level of confidence of approximately 95%

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

- o0o -

*Handwritten signature*





# 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. 043/22

Page : 1 of 2

Object : THERMAL ENVIRONMENT MONITOR

Manufacturer : QUEST TECHNOLOGIES

Type : QUESTEMP<sup>®</sup>32

Serial No. : TPG040022

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

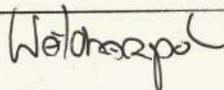
Calibration Condition : Temperature 25.1 °C Barometric Pressure 1009.9 hPa

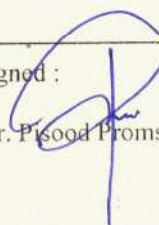
STANDARD THERMOMETER : Theodor Friedrich : Dry No.8390/94 Wet No. 8389/94

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

: TT-3 Serial 43BE04

Japan Meteorological Agency

Calibrated by :   
Mr. Watcharapol Subwat  
Mechanical Engineer

Signed :   
Mr. Pisood Promsut







# THAI METEOROLOGICAL DEPARTMENT

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

## The Result of Calibration

Certification No. 043/22

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	50.1	0.02	50.0	0.12
40.24	40.1	0.14	40.1	0.14	40.0	0.24
30.41	30.4	0.01	30.4	0.01	30.3	0.11
22.24	22.3	-0.06	22.3	-0.06	22.4	-0.16

Calibrated by :

*Watcharapol*

Mr. Watcharapol Subwat

Mechanical Engineer

Calibration & Test Section  
Meteorological Instruments Bureau





TISCH ENVIRONMENTAL, INC.  
145 SOUTH MIAMI AVE  
VILLAGE OF CLEVELAND, OH  
45002  
513.467.9000  
877.263.7610 TOLL FREE  
513.467.9009 FAX

## Air Pollution Monitoring Equipment

### ORIFICE TRANSFER STANDARD CERTIFICATION WORKSHEET TE-5025A

Date – December 4, 2021      Roots meter S/N      9833620      Ta (K) -      296  
Operator Tisch      Orifice I.D. -      0256      Pa (mm)      752.8  
=====

PLATE OR RUN #	VOLUME START (m3)	VOLUME STOP (m3)	DIFF VOLUME (m3)	DIFF VOLUME (min)	METER DIFF Hg (mm)	ORFICE DIFF H2O (in.)
1	NA	NA	1.00	1.3800	3.1	2.00
2	NA	NA	1.00	0.9770	6.2	4.00
3	NA	NA	1.00	0.8720	7.8	5.00
4	NA	NA	1.00	0.8320	8.5	5.50
5	NA	NA	1.00	0.6870	12.5	8.00

### DATA TABULATION

Vstd	(x axis) Qstd	(y axis)		Va	(x axis) Qa	(y axis)
0.9885	0.7163	1.4090		0.9959	0.7216	0.8889
0.9844	1.0076	1.9926		0.9918	1.0151	1.2570
0.9823	1.1265	2.2278		0.9896	1.1349	1.4054
0.9813	1.1795	2.3365		0.9886	1.1883	1.4740
0.9760	1.4207	2.8179		0.9833	1.4313	1.7777
Qstd slope	(m) =	1.99991		Qa slope	(m) =	1.25231
Intercept	(b) =	-0.02348		Intercept	(b) =	-0.01481
Coefficient	(r) =	1.00000		Coefficient	(r) =	1.00000

Y axis = SQRT [H2O (Pa / 760) (298/Ta)]

y axis = SQRT [H2O (Ta/Pa)]

### CALCULATIONS

$$Vstd = \text{Diff. Vol } [(Pa - \text{Diff. Hg}) / 760] (298 / Ta)$$

$$Qstd = Vstd / \text{Time}$$

$$Va = \text{Diff Vol } [(Pa - \text{Diff Hg}) / Pa]$$

$$Qa = Va / \text{Time}$$

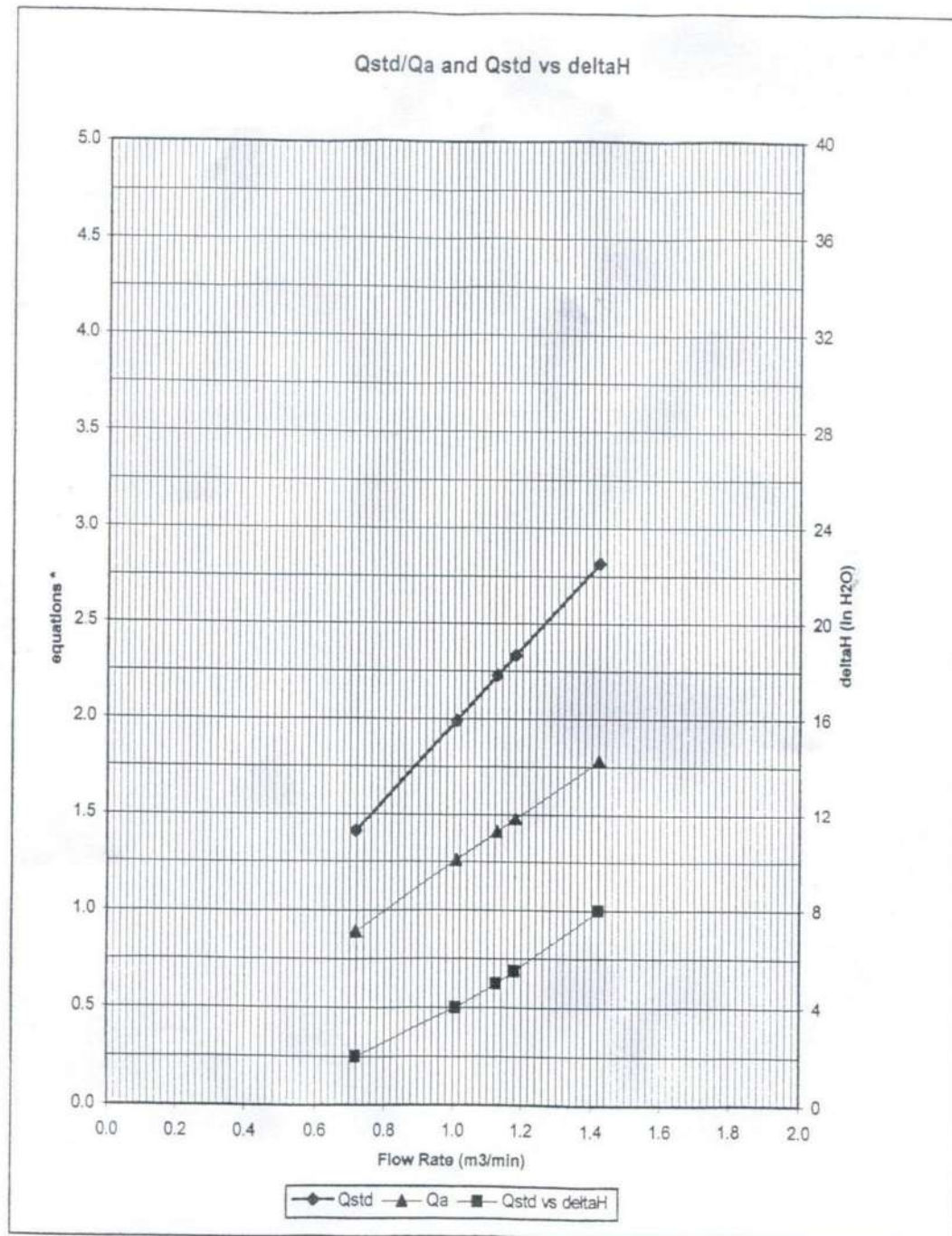
For subsequent flow rate calculations :

$$Qstd = 1/m \{ [\text{SQRT (H2O (Pa/760) (298/Ta))}] - b \}$$

$$Qa = 1/m \{ [\text{SQRT H2O (Ta/Pa)}] - b \}$$



## Air Pollution Monitoring Equipment



\* y-axis equations:

Qstd series: 
$$\sqrt{\Delta H \left( \frac{P_a}{P_{std}} \right) \left( \frac{T_{std}}{T_a} \right)}$$

Qa series: 
$$\sqrt{\Delta H (T_a / P_a)}$$





# 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 coverage factor  $k = 2$ , providing a level of confidence of not less than 95%



**Calibrated by :** Mr.Nattaphong Phogard

**Issue date :** Nov 05, 2021

**Approved by :** \_\_\_\_\_

( Mr.Choophong Khumdet )

This calibration certificate shall not be reproduced other than in full except with the prior written approval of Inctech Metrological Center Co.,Ltd

**Certificate No.** : MT21-5759

**Page** : 2 of 2

**Function** : Temperature measurement

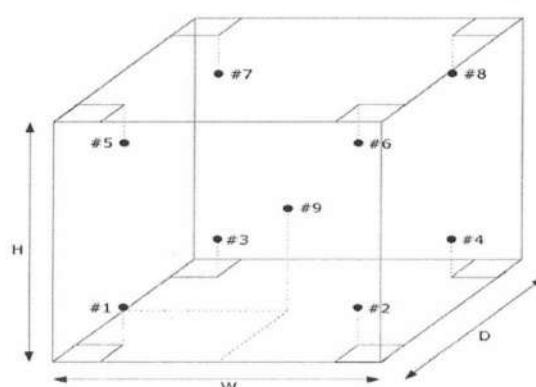
**Result** : Without adjustment

**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



- #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

Front view

**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.

-oOo-

# Maintenance Protocol

## PlasmaQuant PQ 9000 (Elite)

### ICP-OES





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# 1 Customer and service data

## Customer address

Company	บริษัท เอนด์ เฮาส์ เอเชีย จำกัด
Department	Lab
Address (street, number, zip code, city)	77/11 หมู่ 2 อ. บางพลีใหญ่ จ.5 ต.บางพลี อ. บางพลี จ. บางพลี 11000
Phone	
E-mail	
Customer number	
Order number	

## Device data (model and serial number)

ICP OES	PQ9000	S/N	582 A 0019
Mobile cooling unit	PolyScience	S/N	1A1371933
Autosampler			

## Analytik Jena representative information

Name	Sanchai Noomtak
Company	Analytik Jena FarEast Thailand.

## Maintenance date

Date	11 Oct 2021
------	-------------

2     **Maintenance with subsequent Operational Qualification (OQ)**

- If an Operational Qualification (OQ) is carried out after maintenance, there is no need to check analytical parameters in the maintenance report.
- The analytical parameters are then checked in the separate OQ report.

	Yes	No
Maintenance with subsequent Operational Qualification (OQ)	<input type="checkbox"/>	<input checked="" type="checkbox"/>

### 3 Maintenance work on the base unit

#### Update firmware and software

		Complies	Does not comply
Save device parameters and neon table		<input checked="" type="checkbox"/>	<input type="checkbox"/>
Check the firmware version and FPGA		<input checked="" type="checkbox"/>	<input type="checkbox"/>
Check the version of the ASpect PQ software		<input checked="" type="checkbox"/>	<input type="checkbox"/>
Update software, FPGA and firmware		<input checked="" type="checkbox"/>	<input type="checkbox"/>
Approval for firmware and software updates was given by the customer.			
The customer's was informed that the Operational Qualification (OQ) and software validation may have to be repeated for validated systems after a firmware/software update.		<input checked="" type="checkbox"/>	<input type="checkbox"/>
Update ASpect PQ		<input checked="" type="checkbox"/>	<input type="checkbox"/>
▪ Current version	1.2.3.0		
▪ Version after update	-		
Update FPGA		<input checked="" type="checkbox"/>	<input type="checkbox"/>
▪ Current version	h09, h00		
▪ Version after update	-		
Updating the firmware		<input checked="" type="checkbox"/>	<input type="checkbox"/>
▪ Current version	1.36		
▪ Version after update	-		
Record running time (in hours)		<input checked="" type="checkbox"/>	<input type="checkbox"/>
▪ Base unit	2697		
▪ RF generator	1546		

#### Service the rear of the device

	Complies	Does not comply
Replace the air filter mat	<input checked="" type="checkbox"/>	<input type="checkbox"/>



## Maintenance Protocol

### Service the sample introduction system

	Complies	Does not comply
Remove, disassemble and clean the torch	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<ul style="list-style-type: none"> <li>Check the surface of the glass parts (injector, inner tube, outer tube and glass holder) for damage, heavily coated and broken parts. Replace glass parts, if necessary</li> <li>Clean glass parts in aqua regia</li> </ul>		
Check the sealing rings, replace if necessary	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<ul style="list-style-type: none"> <li>Sealing rings in torch holder (3 pieces) and torch shuttle (2 pieces)</li> <li>Sealing rings in injector and mixing chamber mount</li> </ul>		
(Check sealing rings for porous and hardened areas, replace if necessary)		
Check pump tubing (sample, waste), replace if necessary	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Check peristaltic pump, disassemble and lubricate if necessary	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Check the nebulizer for damage and clean it	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Remove and clean the mixing chamber	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Check the sealing ring of the mixing chamber	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Check and clean torch height adjustment drive	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Lubricate the linear drive with a little oil	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Check the igniting pin for signs of wear	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Comments:

### Service the plasma compartment

	Complies	Does not comply
Disassemble the cone, check geometry and clean it if necessary	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Take out the windows (axial/radial) and clean or replace them		
Replacing the sealing rings		
Check the surface of the first mirror, clean or replace it if necessary	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Check the air outlet for deposits and blockages, clean it if necessary	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Remove the cover plate below the plasma compartment and clean it	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Renew the filter mat		
Check the coil for its material condition, position, geometry and for the tightness of connections	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Clean or replace bonnet	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Check RF deflector spring, replace it if necessary	<input checked="" type="checkbox"/>	<input type="checkbox"/>

## Maintenance Protocol

Comments:

### Service the spectrometer

	Complies	Does not comply
Clean and lubricate the spindle of the prism and grating with a little oil	<input checked="" type="checkbox"/>	<input type="checkbox"/>

### Check gas flows at the gas box

Gas flow	Rated value	Actual value	Complies	Does not comply
Nebulizer gas flow	0.5 L/min $\pm$ 15 %	0.501	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Auxiliary gas flow	0.5 L/min $\pm$ 15 %	0.499	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Cone gas flow	1,7 ... 2,8 L/min	1.801	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Oxygen is used (optional)			<input type="checkbox"/>	<input type="checkbox"/>
Oxygen flow	00.5 L/min $\pm$ 15 %		<input type="checkbox"/>	<input type="checkbox"/>

Comments:

plasma gas flow = 12 L/min.

## 4 Maintenance work on accessories

### Service the mobile cooling unit

	Complies	Does not comply
Vacuum or clean the condenser	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Record the condition of the cooling water before maintenance:	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Particles and discoloration present: <input type="checkbox"/> yes <input checked="" type="checkbox"/> No		
cooling water flow rate	1.40	
Cooling water primary pressure	59	
Conductivity of the cooling water	67	
Clean the water filter on the base unit (if filter is installed)	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Renew cooling water	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<ul style="list-style-type: none"> <li>Prepare cooling water according to Analytik Jena's specifications</li> <li>Use cooling water additive from Analytik Jena</li> </ul>		
Check filling level of cooling water, top up if required	<input checked="" type="checkbox"/>	<input type="checkbox"/>

### Cooling water circuit after maintenance

	Rated value	Actual value	Complies	Does not comply
cooling water flow rate	1.5 to 2.0 L/min	1	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Cooling water primary pressure	max. 6 bar (85 psi)	59	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Conductivity of the cooling water	50 to 200 µS/cm	70	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Cooling water temperature (in mobile cooling unit)	18 °C	18	<input checked="" type="checkbox"/>	<input type="checkbox"/>

### Service the autosampler

n/A

	Complies	Does not comply
Check cannula and tubing to the base unit	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Check pump tubing (washing solution, waste), replace if necessary	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Clean the covers, rack mount and accessories	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Check the condition of the toothed belts for cracks, gaps and changes in color	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Check the peristaltic pump for smooth operation	<input checked="" type="checkbox"/>	<input type="checkbox"/>



## Maintenance Protocol

	Complies	Does not comply
Check the functionality of the washing cup	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Check the hose connections for leaks	<input checked="" type="checkbox"/>	<input type="checkbox"/>

## 5 Checking basic functions and device parameters

### 5.1 Check of correction functions

	Rated value (Steps)	Actual value (Steps)	Complies	Does not comply
As (193.6950 nm)	± 500	317	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Cu (324.7540 nm)	± 500	276	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Na (588.9953 nm)	± 500	-127	<input checked="" type="checkbox"/>	<input type="checkbox"/>
K (766.4908 nm)	± 500	320	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Comments:

-

### 5.2 Check of safety circuits

	Complies	Does not comply
Safety circuit for torch position	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Safety circuit for door of plasma compartment	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Safety circuit for interrupted cooling water flow (cooling water flow < 0.85 L/min )	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Safety circuit for suction power (check the setting Par[85])	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Value Par[85]:	3260	
Safety circuit for argon inlet pressure (p < 4 bar)* * if sensor is installed (Par[116] = 1)	<input checked="" type="checkbox"/> N/A	<input type="checkbox"/>

Comments:

-

### 5.3 Check of neon energy

The plasma must be ignited for this test (CCD cooling active).

	Rated value (Steps)	Actual value (Steps)	Complies	Does not comply
585.2462 nm	> 4000 ct/s	16531	<input checked="" type="checkbox"/>	<input type="checkbox"/>
594.4807 nm	> 3000 ct/s	6308	<input checked="" type="checkbox"/>	<input type="checkbox"/>
640.2217 nm	> 3000 ct/s	31833	<input checked="" type="checkbox"/>	<input type="checkbox"/>
849.5322 nm	> 3000 ct/s	2218	<input type="checkbox"/>	<input type="checkbox"/>
607.4311 nm	> 3000 ct/s	5368	<input checked="" type="checkbox"/>	<input type="checkbox"/>
659.8923 nm	> 3000 ct/s	7927	<input checked="" type="checkbox"/>	<input type="checkbox"/>
743.8864 nm	> 3000 ct/s	2862	<input type="checkbox"/>	<input type="checkbox"/>
703.2381 nm	> 10000 ct/s	31752	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Comments:

recommend to replace Neon lamp.

### 5.4 Adjustment of transfer optics (Mn 257.610 nm)

Adjust detection (axial)		Complies	Does not comply
X offset	-1	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Y offset	-0.2	<input checked="" type="checkbox"/>	<input type="checkbox"/>

## Maintenance Protocol

Adjust detection (axial)	Complies	Does not comply
Intensity value 204 6713	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Adjust detection (radial)	Complies	Does not comply
X offset 15	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Y offset -0.5	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Intensity value 354 9 01	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Comments:

### 5.5 Verification of the wavelength accuracy, generator robustness and analytical performance

- Requirements
  - Start ASpect PQ
  - Perform measurements with the standard sample introduction kit
  - Load the sequence "maintenance\_PQ9000"
  - Plasma burn-in time 15 min
  - 1 mg/L multi-element solution (Merck standard IV for ICP) in 3 % HNO<sub>3</sub>
  - Plasma conditions 12 L/min plasma gas, 0.5 L/min auxiliary gas, 0.6 L/min nebulizer gas
  - Plasma power 1200 W
  - Measurement time 10 s
- Start the sequence "maintenance\_PQ9000" (duration approx. 40 min).  
The sequence automatically loads the methods that are necessary to determine the data.

#### Wavelength accuracy

- Open the spectra display of the measured lines one after the other. Read off the peak position (peak position before correction). Carry out the peak correction by clicking on **[Find peak center]** and read off the peak position again (peak position after correction). Calculate the difference between the two values (peak position before correction - peak position after correction).



## Maintenance Protocol

Line	Peak position before correction	Peak position after correction	Difference Rated value	Difference Actual value
Zn 213.8560 nm	181.0 ± 2.3	181.0 ± 2.4	± 1.0	0.1
Mn (257.6100 nm)	181.0 ± 0.3	181.0 ± 0.3	± 1.0	0.0
Cu (324.7540 nm)	181.0 ± 0.1	181.0 ± 0.1	± 1.0	0.0
Li 670.7910 nm	181.0 ± - 2.5	181.0 ± - 2.0	± 1.0	0.5

Comments:

## Robustness factor

Calculation according to the following formula:

$$F_r = \frac{\text{intensity Mg}_{280.271} / \text{intensity BG Mg}_{280.271}}{\text{intensity Mg}_{285.213} / \text{intensity BG Mg}_{285.213}}$$

Intensity / calculated factor	Value
Intensity Mg 280.271	1205308
Intensity BG Mg 280.271	7846
Intensity Mg 285.213	136698
Intensity BG Mg 285.213	9326
$F_r$	10.48

Comments:

## Analytical performance

☐ PlasmaQuant PQ 9000 Elite

N/A

		Rated value	Actual value
Zn 213.8560 nm	Limit of detection LOD [mg/L]	< 0.0015	
	Recovery [%]	100 ± 10	
	Relative standard deviation (RSD) [%]	< 2	
Mn (257.6100 nm)	Limit of detection LOD [mg/L]	< 0.0002	
	Recovery [%]	100 ± 10	
	Relative standard deviation (RSD) [%]	< 1.5	
Cu (324.7540 nm)	Limit of detection LOD [mg/L]	< 0.0010	
	Recovery [%]	100 ± 10	
	Relative standard deviation (RSD) [%]	< 1.5	
Li 670.7910 nm	Limit of detection LOD [mg/L]	< 0.0025	
	Recovery [%]	100 ± 10	
	Relative standard deviation (RSD) [%]	< 1.5	

☒ PlasmaQuant PQ 9000

		Rated value	Actual value
Zn 213.8560 nm	Limit of detection LOD [mg/L]	<0.002	0.000220
	Recovery [%]	100 ± 10	97.3

## Maintenance Protocol

		Rated value	Actual value
Mn (257.6100 nm)	Relative standard deviation (RSD) [%]	< 2	0.33
	Limit of detection LOD [mg/L]	< 0.0004	0.000023
	Recovery [%]	100 ± 10	99.0
Cu (324.7540 nm)	Relative standard deviation (RSD) [%]	< 1.5	0.45
	Limit of detection LOD [mg/L]	< 0.0015	0.000561
	Recovery [%]	100 ± 10	100.2
Li 670.7910 nm	Relative standard deviation (RSD) [%]	< 1.5	0.68
	Limit of detection LOD [mg/L]	< 0.003	0.000429
	Recovery [%]	100 ± 10	99.8
	Relative standard deviation (RSD) [%]	< 1.5	0.22

Comments:

## 6 Comments and objections

Comments and possible objections raised during installation and commissioning are to be recorded in writing in this section.

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## 7 Completing maintenance

	Complies	Does not comply
Maintenance on the analyzer has been completed.	<input checked="" type="checkbox"/>	<input type="checkbox"/>
The functionality and analytical performance of the device was checked in the presence of the user. The device meets its technical specification.	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Name	Function	Date	Signature
சீமன் காரைசலா	Representative Customer	14 / 10 / 2021	
Somchai Noonfat	Representative Analytik Jena AG	14 / 10 / 2021	



# 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 multiplied by coverage factor  $k = 2$ ,  
providing a level of confidence of not less than 95%



**Calibrated by :** Miss Nuengruethai Siripoch

**Issue date :** Dec 03, 2021

**Approved by :**

( Mr.Panuwat Phuklan )

This calibration certificate shall not be reproduced other than in full except with the  
prior written approval of Inctech Metrological Center Co.,Ltd

**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](http://www.imcinstrument.com)**Certificate No. : MC21-2398****Page : 2 of 2****Result : Without adjustment****Calibration Point : 50, 90, 100, 110 ml**

<b>Nominal value ( ml )</b>	<b>Standard reading ( ml )</b>	<b>UUC* correction ( ml )</b>	<b>Uncertainty of measurement ( +/- ml )</b>
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

**UUC\*** = Unit under calibration



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

PAGE: 1 OF 8

## Certification of Calibration

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

Approved by

;   
Rung Rittiyan

Approved Signatory  
(Managing Director)

Registered Lab No. ว-152-3214

Issue Date

; February 1, 2022



The uncertainties are for a confidence probability of approximately 95 %



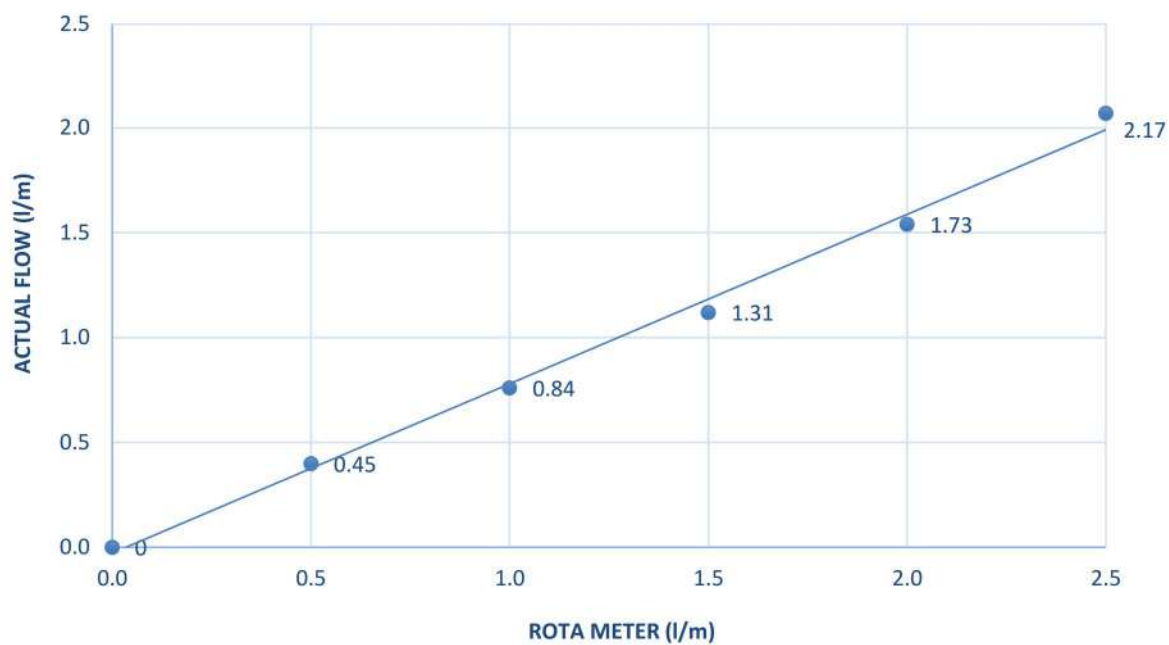
## CALIBRATER EQUIPMENT SOAP-BUBBLE METER (FUNDAMENTALS OF AIR SAMPLING)

## SUPPLEMENTARY EQUIREMENTS FOR REGISTRATION: CHEMICAL TESTING

CALIBRATION RESULTS

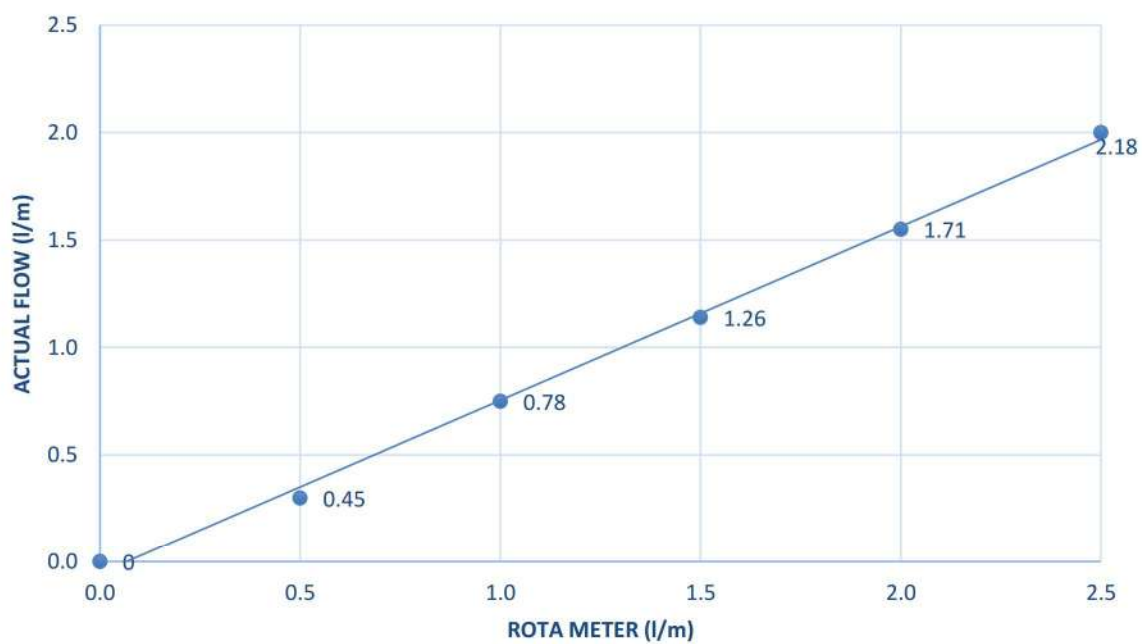
Serial No. ; 20140202100

Model ; Gillian BDXII



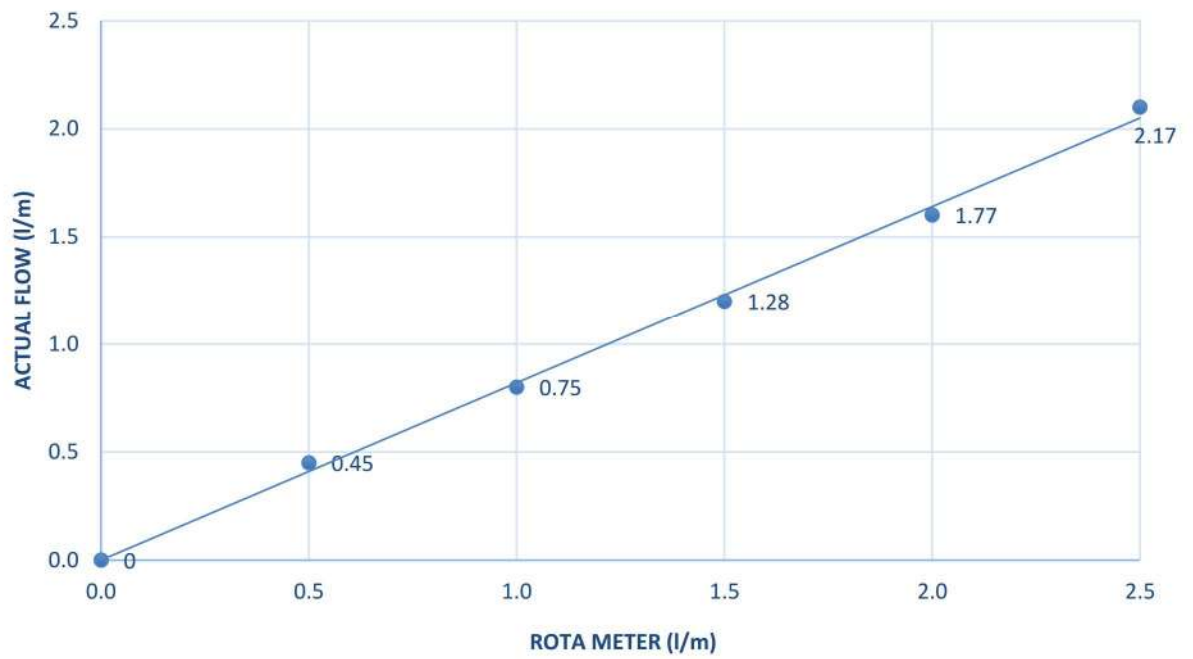
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Model ; Gillian BDXII



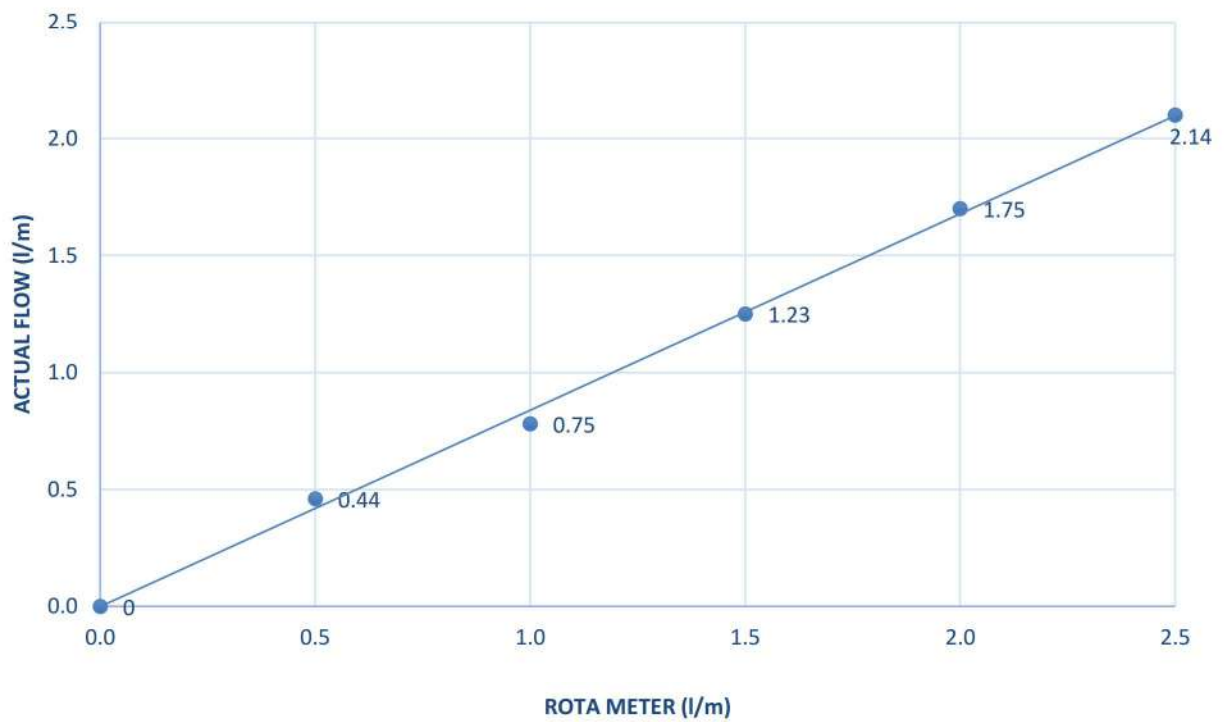
Serial No. ; 201406020108

Model ; Gillian BDXII



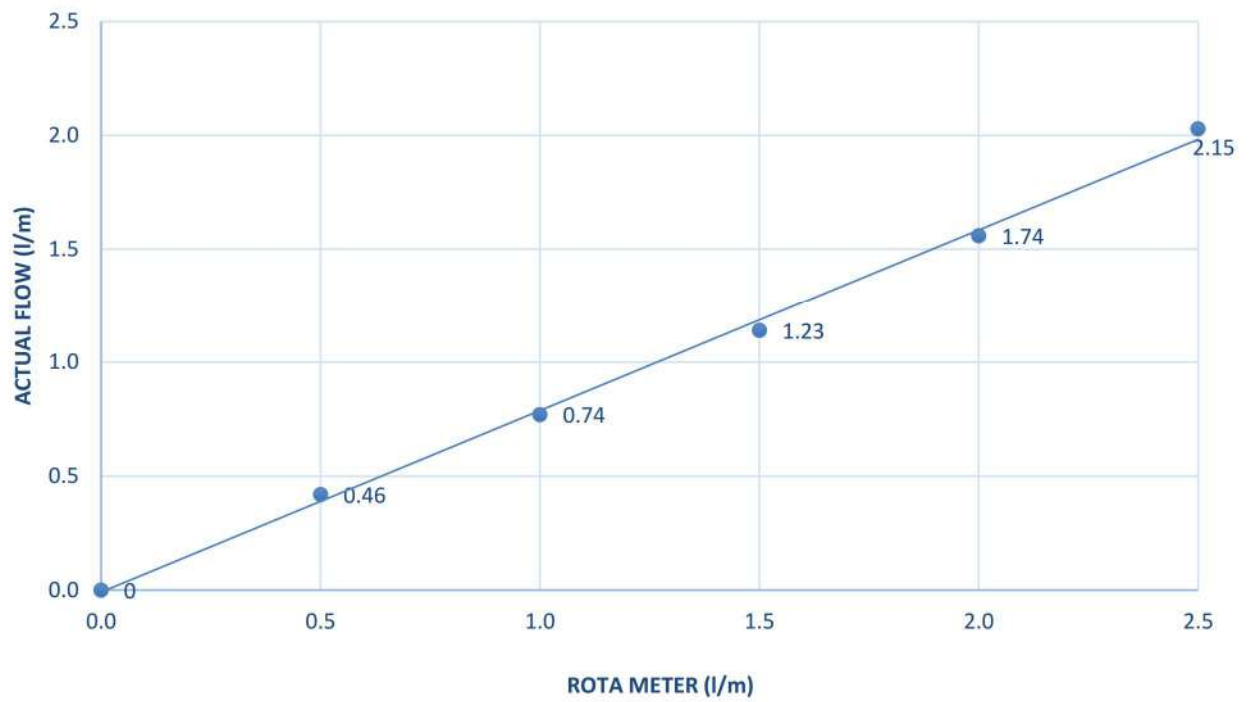
Serial No. ; 20121102029

Model ; Gillian BDXII



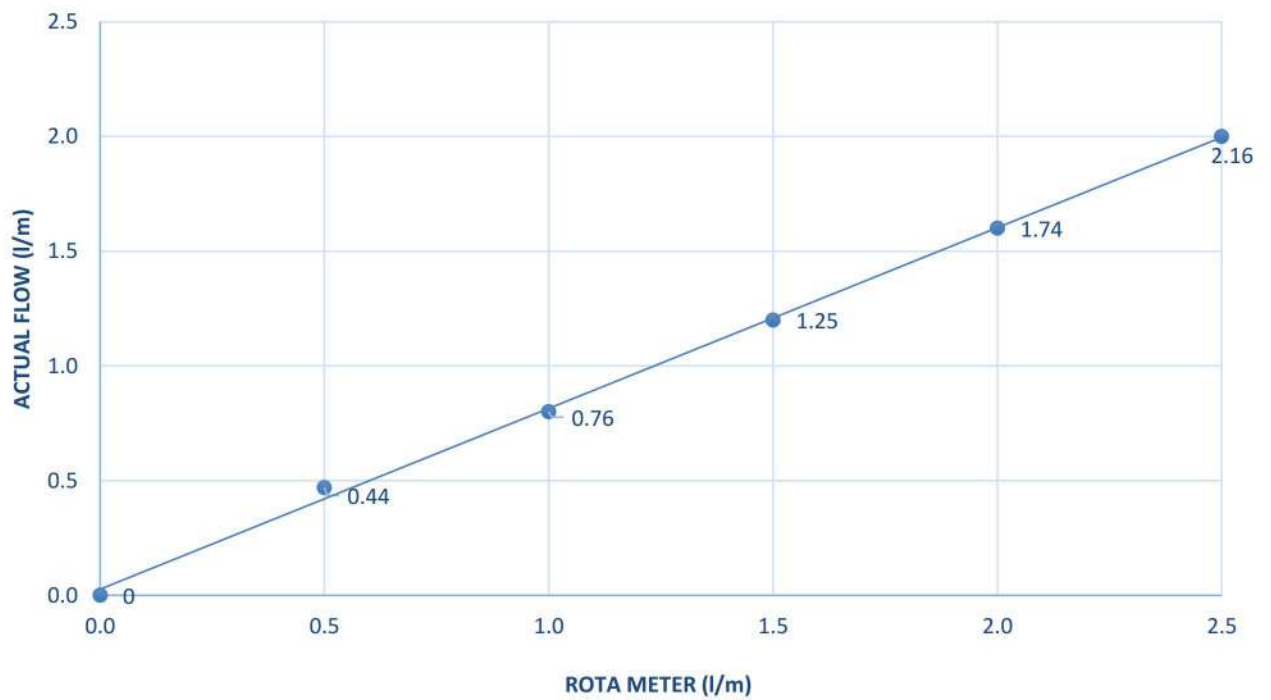
Serial No. ; 20121102051

Model ; Gillian BDXII



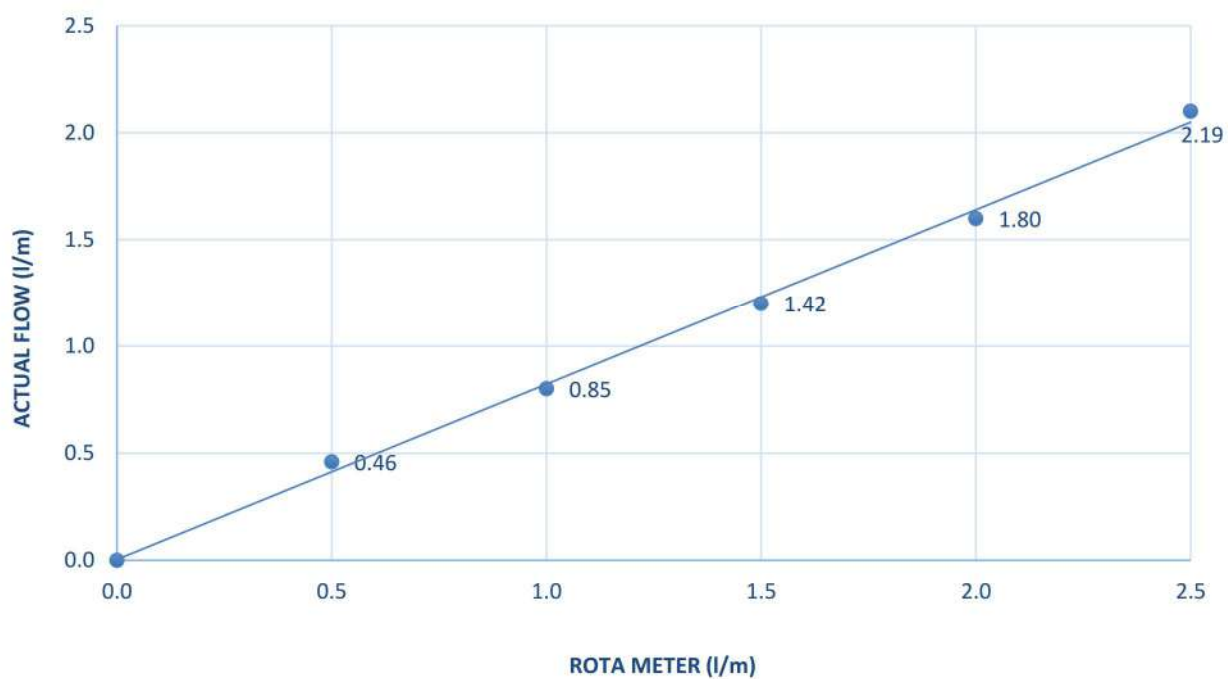
Serial No. ; 20120703007

Model ; Gillian BDXII



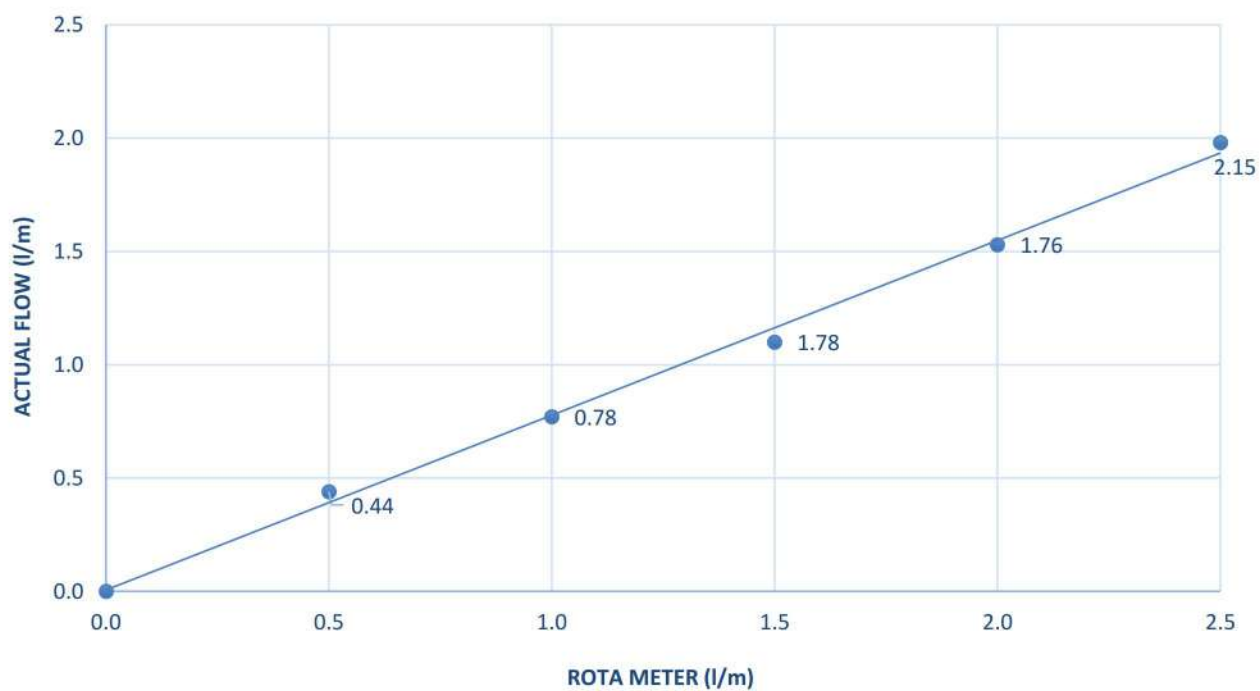
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Model ; Gillian BDXII



Serial No. ; 20121102041

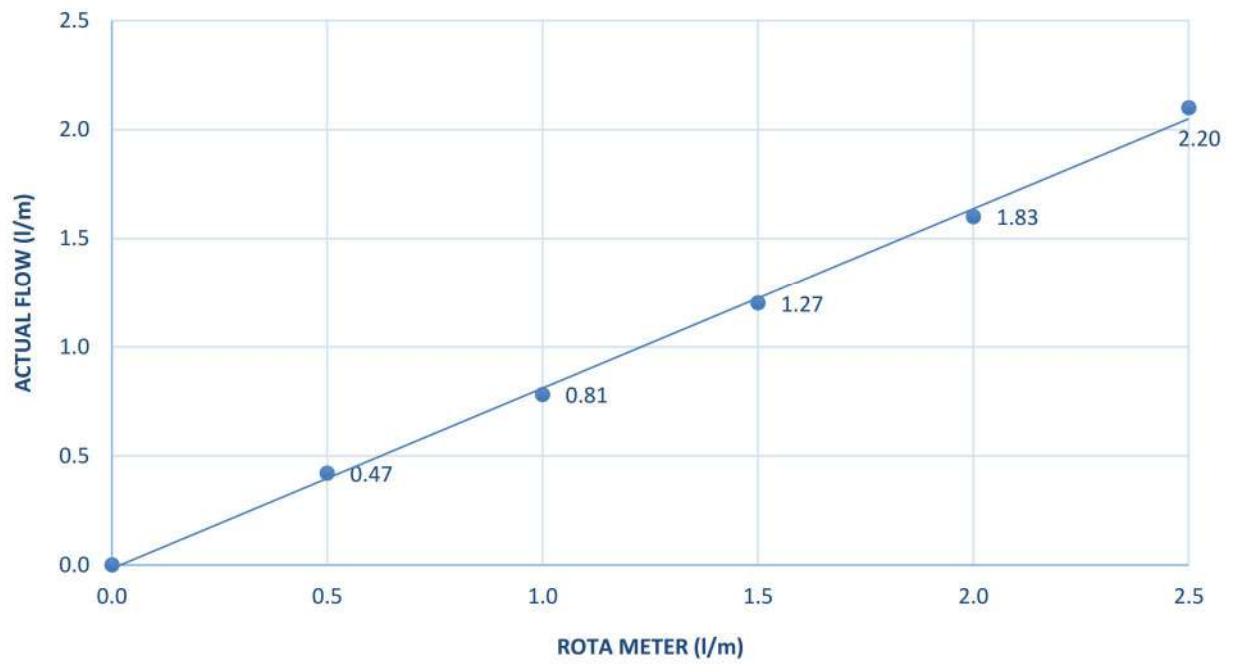
Model ; Gillian BDXII





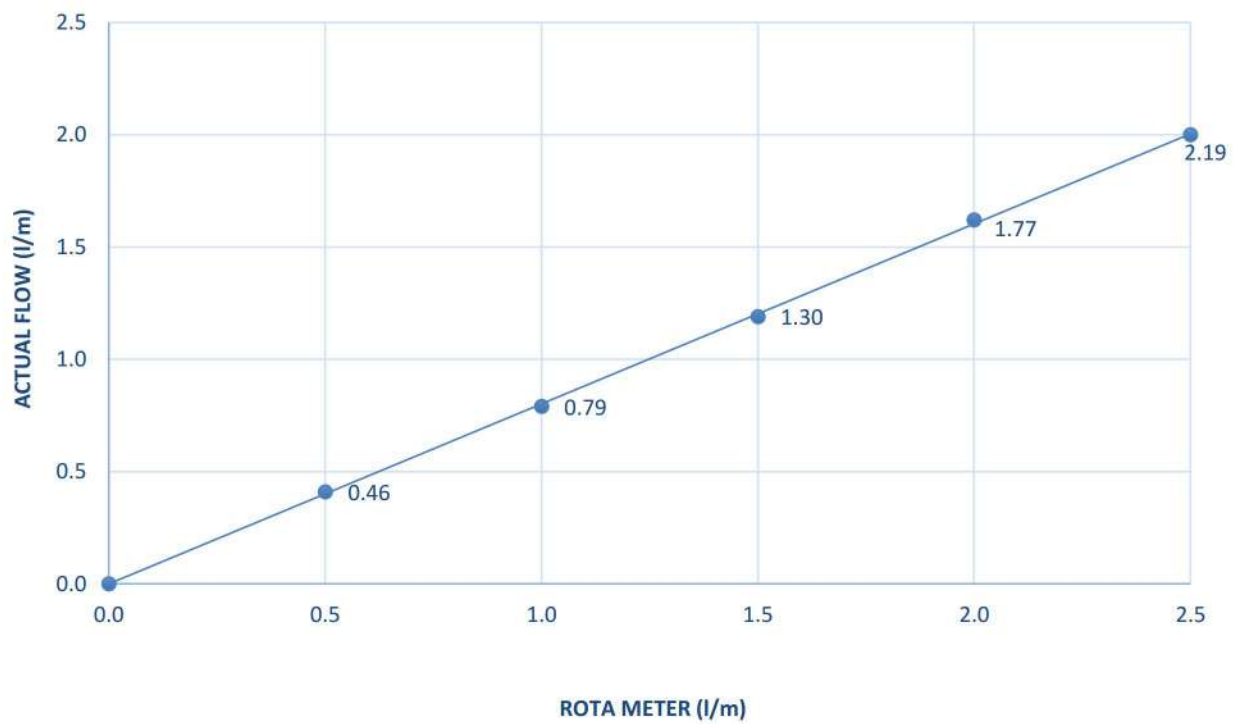
Serial No. ; 20130401088

Model ; Gillian BDXII



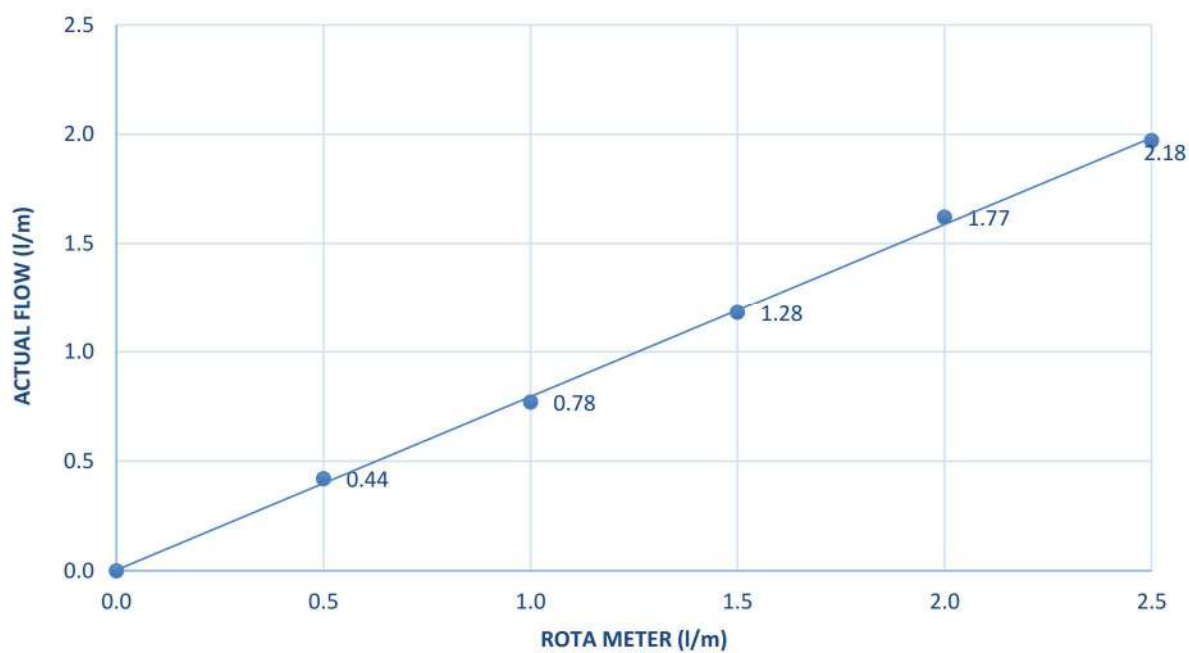
Serial No. ; 20130401107

Model ; Gillian BDXII



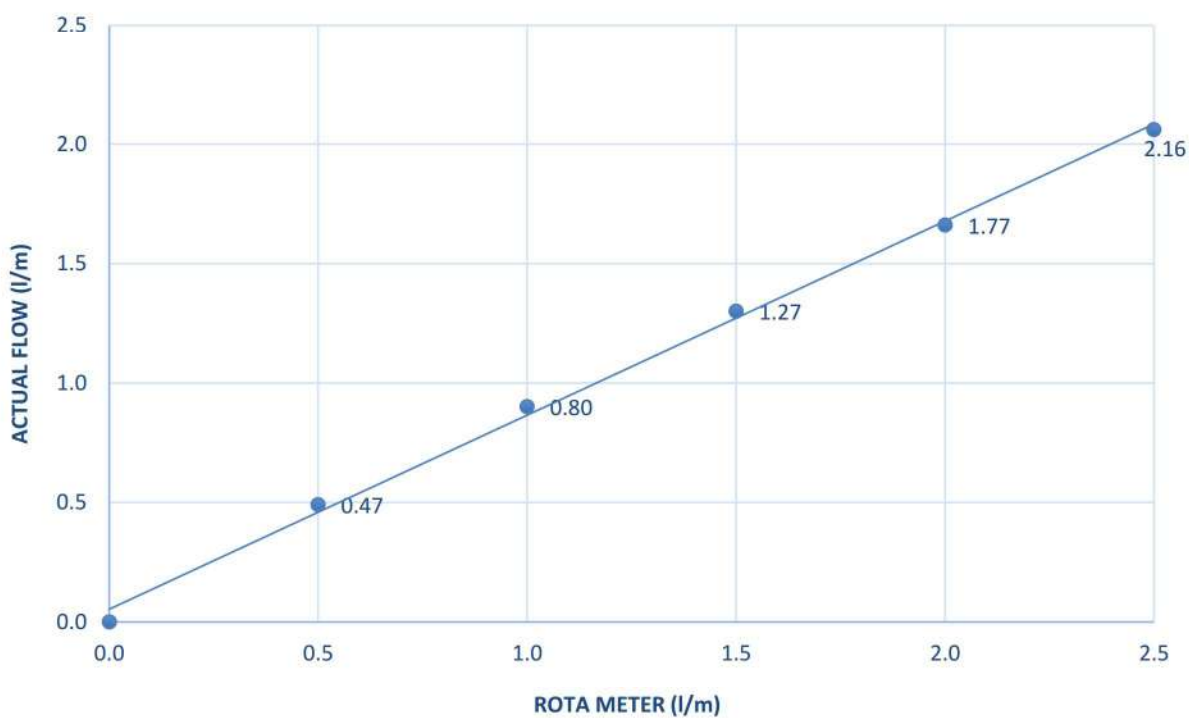
Serial No. ; 20140602109

Model ; Gillian BDXII



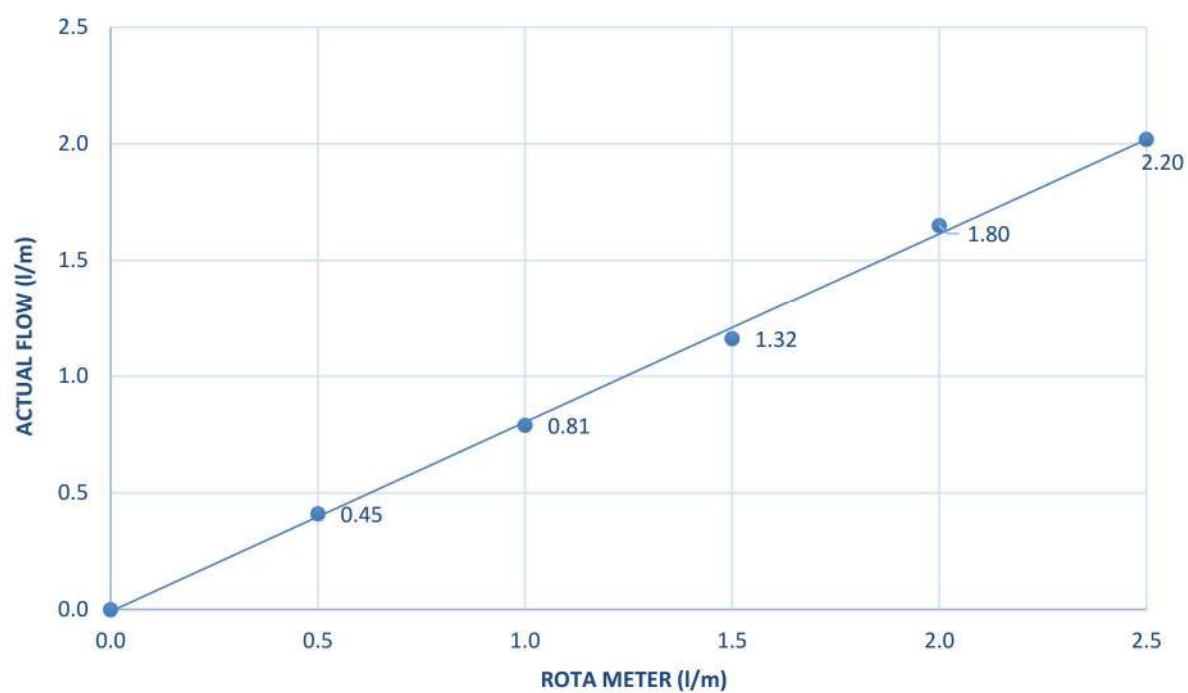
Serial No. ; 20140602089

Model ; Gillian BDXII



Serial No. ; 20140602095

Model ; Gillian BDXII



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## 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, Nontaburi 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 :  $(25 \pm 2)$  °C

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

**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 :   
( Bunjerd Masri )  
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 measurement was based on a standard uncertainty multiplied by a coverage factor  $k = 2$ , providing a level of confidence of approximately 95%

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## Certificate of Calibration

**Certificate No. :** 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 :  $(23 \pm 2)$  °C  
Relative Humidity :  $(50 \pm 15)$  %  
Line Voltage :  $(220 \pm 22)$  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 :

(Bunjerd Masri)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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## 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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www.calibratech.co.th



# 校正証明書

## CALIBRATION CERTIFICATE

品名 PRODUCT NAME : 普通騒音計  
Sound Level Meter  
型式 TYPE : 6236  
器物番号 PRODUCT NUMBER : 222081  
マイク MICROPHONE : 82896  
製造者 MANUFACTURER : 株式会社アコー ACO CO., LTD.

### ※特記事項

[基準器、校正機器のトレーサビリティ証明]

校正に使用した基準器、校正機器は国家基準にトレーサブルであることを証明致します。

### ※Special notes

[Traceability certificate of standard instruments and calibration equipment.]

We certify that the standard instruments and calibration equipment are traceable to the national standards.

2022年1月17日

January 17, 2022



東京都世田谷区代沢2-6-10  
株式会社アコー  
代表取締役 寺園信一  
2-6-10 Daizawa Setagaya-ku  
Tokyo Japan  
President : Shinichi Terazono  
ACO CO., LTD.



## 1 試験成績 Test Results

別紙試験成績表添付 Test results are attached as an exhibit.

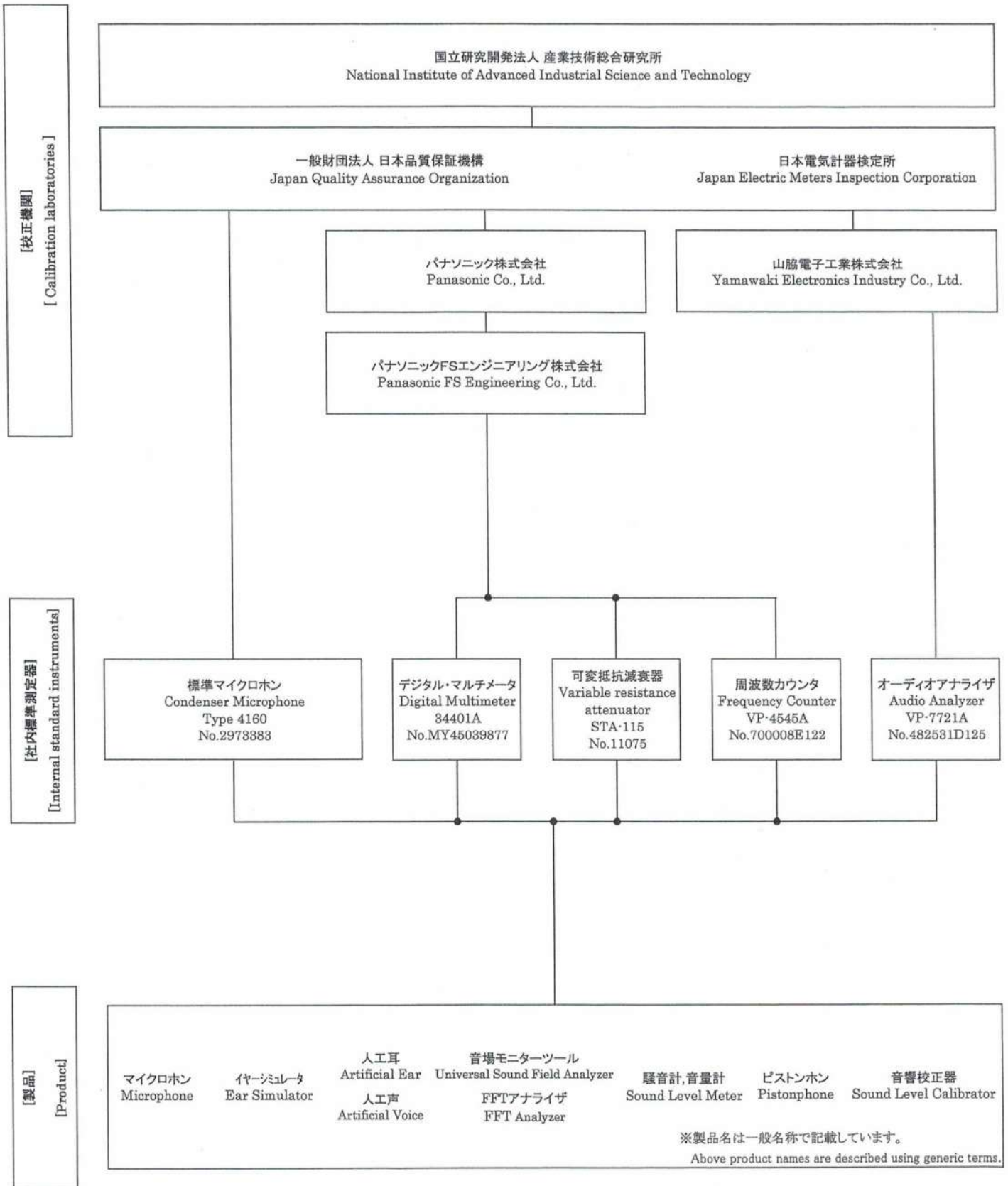
## 2 試験条件 Test Requirements

試験日	Test date	: 2022年1月17日	January 17, 2022
温度	Temperature	: 24 °C	
湿度	Humidity	: 40 %	
気圧	Barometric pressure	: 991 hPa	

## 3 使用機器 Used Equipment

デジタル・マルチメータ	Digital Multimeter	34401A	No. MY45039877
(有効期間	: 2021年 3 月 から 2022年 3 月 )		
( Effective life	: from March, 2021 to March, 2022 )		
可変抵抗減衰器	Variable resistance attenuator STA-115		No. 11075
(有効期間	: 2021年 3 月 から 2022年 3 月 )		
( Effective life	: from March, 2021 to March, 2022 )		
周波数カウンタ	Frequency Counter	VP-4545A	No. 700008E122
(有効期間	: 2021年 3 月 から 2022年 3 月 )		
( Effective life	: from March, 2021 to March, 2022 )		
オーディオアナライザ	Audio Analyzer	VP-7721A	No. 482531D125
(有効期間	: 2021年 3 月 から 2022年 3 月 )		
( Effective life	: from March, 2021 to March, 2022 )		
標準マイクロホン	Condenser Microphone	4160	No. 2973383
(有効期間	: 2021年 7 月 から 2023年 7 月 )		
( Effective life	: from July, 2021 to July, 2023 )		

# トレーサビリティ体系図 Traceability Flow Chart



普通騒音計  
Sound Level Meter  
TYPE 6236  
検査成績書  
INSPECTION CERTIFICATE

本体製造番号  
Serial No. of body: 222081  
マイクロホン製造番号  
Serial No. of Microphone: 82896

Ver:5.0 22-01-08

年月日: 2022年1月17日  
Date: January 17, 2022

承認 Approved	点検 Passed	担当 Inspected
<i>A. nagato</i>	<i>K. Ishiyama</i>	<i>N. Yamamoto</i>

株式会社 アコー  
ACO CO., LTD.

## 1. 検査年月日 Inspection Date

2022年1月17日

January 17, 2022

## 2. 検査条件 Inspection Condition

- 1) 温度 Temperature : 24 °C  
 2) 湿度 Humidity : 40 %  
 3) 気圧 Barometric pressure : 991 hPa

## 3. 検査項目及び結果 Inspection Results

## 1) RANGE 切換誤差検査 The RANGE Shifting Error

RANGE : 20-100dB 70dB 入力基準  $\pm 0.7$ dB以下Within  $\pm 0.7$ dB of the value at 70dB input, Range 20-100dB.

RANGE (dB)	入力レベル Input level (dB)	周波数 Frequency (Hz)		
		31.5	1000	8000
20-80	70	0.0	-0.1	0.0
20-90	70	0.0	0.0	0.0
20-100	70	0.0	0.0	0.0
20-110	70	0.1	0.0	0.1
30-120	70	-0.1	-0.1	-0.1
40-130	70	-0.2	-0.2	-0.1
判定	Passed	Pass		

## 2) 安定性特性検査 Stability Characteristic

RANGE : 20-100dB 1分後基準  $\pm 0.5$ dB以下Within  $\pm 0.5$ dB of the value one minute later, Range 20-100dB.

	10分後 ten minutes later
誤差 Error (dB)	0.0
判定 Passed	Pass



## 3) 目盛誤差特性検査 The Scale Error

RANGE : 30-120dB 31.5Hzは75.0dB入力基準 1kHz、8kHzは95dB入力基準

31.5Hz is 75.0dB input standard 1kHz, 8kHz is 95dB input standard

A特性 A weighting

A特性 A weighting

入力 Input (dB)	規格 Standard (dB)	周波数 Frequency (Hz)
		31.5
120		
115		
110		
105		
100		
95		
90		
85		
80	±0.5	0.0
75	0.0	0.0
70	±0.5	-0.1
65	±0.5	-0.2
60	±0.5	-0.1
55	±0.5	-0.1
50	±0.5	-0.1
45	±0.5	-0.2
40	±0.5	0.0
35	±0.5	0.0
30	±0.5	0.4
判定	Passed	Pass

入力 Input (dB)	規格 Standard (dB)	周波数 Frequency (Hz)	
		1000	8000
120	±0.5	0.0	0.1
115	±0.5	0.0	0.0
110	±0.5	-0.1	0.0
105	±0.5	-0.1	0.0
100	±0.5	0.0	0.0
95	0.0	0.0	0.0
90	±0.5	-0.1	0.0
85	±0.5	-0.1	-0.1
80	±0.5	-0.1	-0.1
75	±0.5	-0.1	-0.1
70	±0.5	-0.2	-0.1
65	±0.5	-0.3	-0.2
60	±0.5	-0.1	-0.2
55	±0.5	-0.2	-0.2
50	±0.5	-0.2	0.0
45	±0.5	-0.3	-0.2
40	±0.5	-0.2	-0.2
35	±0.5	0.1	0.0
30	±0.5	0.3	0.4
判定	Passed	Pass	

## 4) 動特性検査 Dynamic Characteristic

RANGE : 20-100dB 100dB、1kHz 入力基準

When 100dB input, Range 20-100dB at 1kHz.

	規格 Standard	測定 Measured Value
FAST	-1.0+0.5 -1.0 (dB)	-1.5
SLOW	-4.0±1.0 (dB)	-4.5
判定	Passed	Pass

## 5) 周波数特性検査 Frequency Response

RANGE : 20-100dB 95dB入力基準(マイクを含む)

When 95dB input, including Microphone value, Range 20-100dB

周波数 Frequency (Hz)	A特性			C特性			FLAT(Z)特性	許容差 Tolerance (dB)
	規格 Standard (dB)	レスポンス Response (dB)	偏差 Deviation (dB)	規格 Standard (dB)	レスポンス Response (dB)	偏差 Deviation (dB)	レスポンス Response (dB)	
10	-70.4	-70.0	0.4	-14.3	-13.0	1.3	-0.3	+5.0, -∞
20	-50.5	-50.9	-0.4	-6.2	-5.8	0.4	-0.2	±3.0
40	-34.6	-35.0	-0.4	-2.0	-2.1	-0.1	-0.2	±2.0
100	-19.1	-19.4	-0.3	-0.3	-0.4	-0.1	-0.1	±1.5
250	-8.6	-8.7	-0.1	0.0	0.0	0.0	-0.1	±1.5
500	-3.2	-3.3	-0.1	0.0	0.0	0.0	-0.1	±1.5
1000	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.1	±1.0
2k	1.2	1.1	-0.1	-0.2	-0.3	-0.1	-0.1	±2.0
4k	1.0	0.6	-0.4	-0.8	-1.4	-0.6	-0.3	±3.0
8k	-1.1	-1.7	-0.6	-3.0	-3.7	-0.7	-0.5	±5.0
10k	-2.5	-2.8	-0.3	-4.4	-4.8	-0.4	-0.5	+5.0, -∞
20k	-9.3	-9.7	-0.4	-11.2	-11.8	-0.6	-3.0	+5.0, -∞
判定 Passed		Pass						

## 6) 実効値指示誤差検査 波高率3のバースト信号に対して1.0dB以内

Within 1.0dB on the Burst signal of the peak factor 3, Range 20-100dB.

周波数 Frequency 2kHz、繰り返し周波数 Repeat frequency 40Hz

実効値指示誤差 Effective value Error (dB)	判定
0.3	Pass

## 7) 自己雑音特性検査 Self-noise

RANGE : 20-80dB

RANGE : 20-80dB (Including Microphone value)	A特性	C特性	FLAT(Z)特性
規格 Standard (dB)	22以下 Below 22	30以下 Below 30	32以下 Below 32
自己雑音 Self-noise (dB)	19.1	28.2	30.0
判定 Passed	Pass		

発行日：2021年3月18日

## 校正証明書

貴社名 株式会社 アコー

下記製品は、当社の作業規程に従って校正が行われていることを証明します。  
この校正に使用した標準器は、パナソニックSNEハルリューションテクノロジー株式会社、メーカー  
JEMIC(日本電気計器検定所)、JQA(日本品質保証機構)などを通じて  
国家標準、またはNIST(National Institute of Standards and Technology)  
などにトレーサビリティがとれています。

管 理 番 号	EMC-1 0013
品 名	デジタル・マルチメータ
型 式	34401A
製 造 番 号	MY45039877
校 正 年 月 日	2021年3月18日
環 境 条 件	温度 23℃ 湿度 50%
発 行 番 号	202101351

### 使用標準器

管理番号	型 式	製造番号	名 称	有効期限
ST-031	5700A	4635001	キャリブレータ	2021/10

〒561-0854 大阪府豊中市稲津町3丁目1番1号

パナソニックFSエンジニアリング株式会社

CS統括部 校正サービス課

校正証明書発行責任者 佐藤 信治



# 試験・校正成績書

( Calibration Report )

成績書番号

39710K

管理番号 (Control Number)	EMC-1 0013
品名 (Description)	デジタル・マルチメータ Digital Multimeter
製造者 (Manufacturer)	Agilent Technologies
型式 (Model Number)	34401A
製造番号 (Serial Number)	MY45039877
依頼者 (Customer)	株式会社 7コー

校正日 (Calibration Date)	2021年3月18日
温度 (Temperature)	23 °C
湿度 (Humidity)	50 %

校正者 (Calibrated by)	松嶋 宏幸
総合判定 (Judgement)	合格/Pass

承認者 (Approved by)



備考

標準器 (Standard)

管理番号  
(Control Number)  
ST-031

型式  
(Model Number)  
5700A

製造番号  
(Serial Number)  
4635001

名称  
(Description)  
キャリブ レータ

この成績書に記載する標準器は国家標準にトレーサブルである。

パナソニック F S エンジニアリング株式会社



# 試験・校正成績書

型式 34401A 製造番号 MY45039877 管理番号 EMC-1 0013

## DC V

レンジ /Range	標準入力 /Input	下限 /Lower Limit	測定値 /Measured Value	上限 /Upper Limit	判定 /Result
100 mV	100 mV	99.991 5 mV	100.000 0 mV	100.008 5 mV	PASS
1 V	0.2 V	0.199 985 V	0.199 998 V	0.200 015 V	PASS
1 V	0.4 V	0.399 977 V	0.399 998 V	0.400 023 V	PASS
1 V	0.6 V	0.599 969 V	0.599 998 V	0.600 031 V	PASS
1 V	0.8 V	0.799 961 V	0.799 998 V	0.800 039 V	PASS
1 V	1.0 V	0.999 953 V	0.999 995 V	1.000 047 V	PASS
1 V	-0.2 V	- 0.200 015 V	- 0.200 000 V	- 0.199 985 V	PASS
1 V	-0.4 V	- 0.400 023 V	- 0.400 000 V	- 0.399 977 V	PASS
1 V	-0.6 V	- 0.600 031 V	- 0.599 999 V	- 0.599 969 V	PASS
1 V	-0.8 V	- 0.800 039 V	- 0.799 998 V	- 0.799 961 V	PASS
1 V	-1.0 V	- 1.000 047 V	- 0.999 997 V	- 0.999 953 V	PASS
10 V	10 V	9.999 60 V	9.999 89 V	10.000 40 V	PASS
100 V	100 V	99.994 9 V	100.000 2 V	100.005 1 V	PASS
1000 V	1000 V	999.945 V	999.994 V	1 000.055 V	PASS

## AC V

周波数 /Frequency	レンジ /Range	標準入力 /Input	下限 /Lower Limit	測定値 /Measured Value	上限 /Upper Limit	判定 /Result
400 Hz	100 mV	100 mV	99.900 0 mV	100.086 5 mV	100.100 0 mV	PASS
400 Hz	1 V	1 V	0.999 100 V	1.000 830 V	1.000 900 V	PASS
400 Hz	10 V	10 V	9.991 00 V	10.008 48 V	10.009 00 V	PASS
400 Hz	100 V	100 V	99.910 0 V	99.991 4 V	100.090 0 V	PASS
400 Hz	750 V	700 V	699.355 V	699.873 V	700.645 V	PASS

## OHMS (4W)

レンジ /Range	標準入力 /Input	下限 /Lower Limit	測定値 /Measured Value	上限 /Upper Limit	判定 /Result
100 Ω	100 Ω	99.986 0 Ω	100.007 0 Ω	100.014 0 Ω	PASS
1 kΩ	1 kΩ	0.999 890 kΩ	1.000 050 kΩ	1.000 110 kΩ	PASS
10 kΩ	10 kΩ	9.998 90 kΩ	10.000 50 kΩ	10.001 10 kΩ	PASS
100 kΩ	100 kΩ	99.989 0 kΩ	100.003 7 kΩ	100.011 0 kΩ	PASS
1 MΩ	1 MΩ	0.999 890 MΩ	1.000 033 MΩ	1.000 110 MΩ	PASS
10 MΩ	10 MΩ	9.995 90 MΩ	9.998 69 MΩ	10.004 10 MΩ	PASS
100 MΩ	100 MΩ	99.190 0 MΩ	100.797 8 MΩ	100.810 0 MΩ	PASS

## DC I

レンジ /Range	標準入力 /Input	下限 /Lower Limit	測定値 /Measured Value	上限 /Upper Limit	判定 /Result
10 mA	10 mA	9.993 00 mA	9.999 19 mA	10.007 00 mA	PASS
100 mA	100 mA	99.945 0 mA	99.987 8 mA	100.055 0 mA	PASS
1 A	1 A	0.998 900 A	0.999 788 A	1.001 100 A	PASS
3 A	1 A	0.998 20 A	0.999 84 A	1.001 80 A	PASS

## AC I

周波数 /Frequency	レンジ /Range	標準入力 /Input	下限 /Lower Limit	測定値 /Measured Value	上限 /Upper Limit	判定 /Result
400 Hz	1 A	1 A	0.998 600 A	1.000 244 A	1.001 400 A	PASS
400 Hz	3 A	1 A	0.996 70 A	1.000 08 A	1.003 30 A	PASS

発行日：2021年3月18日

## 校正証明書

貴社名 株式会社 アコー

下記製品は、当社の作業規程に従って校正が行われていることを証明します。  
この校正に使用した標準器は、パナソニックSNEハリエーションテクノロジー株式会社、メーカー  
JEMIC(日本電気計器検定所)、JQA(日本品質保証機構)などを通じて  
国家標準、またはNIST(National Institute of Standards and Technology)  
などにトレーサビリティがとれています。

管	理	番	号	EMC-1 0006
品		名		可変抵抗減衰器
型		式		STA-115
製	造	番	号	11075
校	正	年	月	日
環	境	条	件	温度 23℃ 湿度 50%
発	行	番	号	202101355

### 使用標準器

管理番号	型 式	製造番号	名 称	有効期限
ST-031	5700A	4635001	キャリブレータ	2021/10
EO-027	URE3	101273	RMS/PEAK 電圧計	2021/3

〒561-0854 大阪府豊中市稲津町3丁目1番1号

パナソニックFSエンジニアリング株式会社

CS統括部 校正サービス課

校正証明書発行責任者 佐藤 信治



# 試験・校正成績書

( Calibration Report )

成績書番号

39711K

管理番号 (Control Number)	EMC-1 0006
品名 (Description)	可変抵抗減衰器 Variable resistance attenuator
製造者 (Manufacturer)	TOKYO KO-ON DENPA
型式 (Model Number)	STA-115
製造番号 (Serial Number)	11075
依頼者 (Customer)	株式会社 7コー

校正日 (Calibration Date)	2021年3月18日
温度 (Temperature)	23 °C
湿度 (Humidity)	50 %

校正者 (Calibrated by)	水澤 和弘
総合判定 (Judgement)	合格/Pass

承認者 (Approved by)



備考

## 標準器 (Standard)

管理番号 (Control Number)	型式 (Model Number)	製造番号 (Serial Number)	名称 (Description)
ST-031	5700A	4635001	キャリブ レータ
E0-027	URE3	101273	RMS/PEAK 電圧計

この成績書に記載する標準器は国家標準にトレーサブルである。

パナソニック F S エンジニアリング株式会社



# 試験・校正成績書

型式 STA-115 製造番号 11075 管理番号 EMC-1 0006

## 減衰確度/Attenuation accuracy

周波数 /Frequency	ステップ /Step	ダイヤル /Dial	下限 /Lower Limit	校正値 /Calibration Value	上限 /Upper Limit	判定 /Result
1 kHz	0.1 dB	0 dB		0.0 (REF.) dB		
1 kHz	0.1 dB	0.1 dB	0.05 dB	0.10 dB	0.15 dB	PASS
1 kHz	0.1 dB	0.2 dB	0.15 dB	0.20 dB	0.25 dB	PASS
1 kHz	0.1 dB	0.3 dB	0.25 dB	0.30 dB	0.35 dB	PASS
1 kHz	0.1 dB	0.4 dB	0.35 dB	0.40 dB	0.45 dB	PASS
1 kHz	0.1 dB	0.5 dB	0.45 dB	0.50 dB	0.55 dB	PASS
1 kHz	0.1 dB	0.6 dB	0.55 dB	0.60 dB	0.65 dB	PASS
1 kHz	0.1 dB	0.7 dB	0.65 dB	0.70 dB	0.75 dB	PASS
1 kHz	0.1 dB	0.8 dB	0.75 dB	0.80 dB	0.85 dB	PASS
1 kHz	0.1 dB	0.9 dB	0.85 dB	0.90 dB	0.95 dB	PASS
1 kHz	0.1 dB	1.0 dB	0.95 dB	1.00 dB	1.05 dB	PASS
1 kHz	1 dB	1 dB	0.90 dB	1.00 dB	1.10 dB	PASS
1 kHz	1 dB	2 dB	1.90 dB	2.00 dB	2.10 dB	PASS
1 kHz	1 dB	3 dB	2.90 dB	3.01 dB	3.10 dB	PASS
1 kHz	1 dB	4 dB	3.90 dB	4.01 dB	4.10 dB	PASS
1 kHz	1 dB	5 dB	4.90 dB	5.01 dB	5.10 dB	PASS
1 kHz	1 dB	6 dB	5.90 dB	6.01 dB	6.10 dB	PASS
1 kHz	1 dB	7 dB	6.90 dB	7.01 dB	7.10 dB	PASS
1 kHz	1 dB	8 dB	7.90 dB	8.01 dB	8.10 dB	PASS
1 kHz	1 dB	9 dB	8.90 dB	9.01 dB	9.10 dB	PASS
1 kHz	1 dB	10 dB	9.90 dB	10.00 dB	10.10 dB	PASS
1 kHz	10 dB	10 dB	9.70 dB	10.02 dB	10.30 dB	PASS
1 kHz	10 dB	20 dB	19.70 dB	19.99 dB	20.30 dB	PASS
1 kHz	10 dB	30 dB	29.70 dB	29.97 dB	30.30 dB	PASS
1 kHz	10 dB	40 dB	39.70 dB	40.04 dB	40.30 dB	PASS
1 kHz	10 dB	50 dB	49.70 dB	50.08 dB	50.30 dB	PASS
1 kHz	20 dB	20 dB	19.70 dB	20.02 dB	20.30 dB	PASS
1 kHz	20 dB	40 dB	39.70 dB	40.07 dB	40.30 dB	PASS



発行日: 2021年3月18日

## 校正証明書

貴社名 株式会社 アコー

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この校正に使用した標準器は、パナソニックSNEハリュエーションテクノロジー株式会社、メーカー  
JEMIC(日本電気計器検定所)、JQA(日本品質保証機構)などを通じて  
国家標準、またはNIST(National Institute of Standards and Technology)  
などにトレーサビリティがとれています。

管	理	番	号	EMC-1 0005
品		名		周波数カウンタ
型		式		VP-4545A
製	造	番	号	700008E122
校	正	年	月	日
環	境	条	件	温度 23℃ 湿度 50%
発	行	番	号	202101454

### 使用標準器

管理番号	型 式	製造番号	名 称	有効期限
EO-030	FT-001S	1504010016	時間周波数遠隔校正装置	2021/6
EO-037	33250A	MY40005937	ファンクションジェネレータ	2021/9

〒561-0854 大阪府豊中市稲津町3丁目1番1号

パナソニックFSエンジニアリング株式会社

CS統括部 校正サービス課

校正証明書発行責任者 佐藤 信治



# 試験・校正成績書

( Calibration Report )

成績書番号

39712K

管理番号 (Control Number)	EMC-1 0005
品名 (Description)	周波数カウンタ Frequency Counter
製造者 (Manufacturer)	Panasonic
型式 (Model Number)	VP-4545A
製造番号 (Serial Number)	700008E122
依頼者 (Customer)	株式会社 7コー

校正日 (Calibration Date)	2021年3月18日
温度 (Temperature)	23 °C
湿度 (Humidity)	50 %

校正者 (Calibrated by)	水澤 和弘
総合判定 (Judgement)	合格/Pass

承認者 (Approved by)



備考

標準器 (Standard)

管理番号 (Control Number)	型式 (Model Number)	製造番号 (Serial Number)	名称 (Description)
E0-030	FT-001S	1504010016	時間周波数遠隔校正装置
E0-037	33250A	MY40005937	ファンクションジェネレータ

この成績書に記載する標準器は国家標準にトレーサブルである。

パナソニック F S エンジニアリング株式会社

# 試験・校正成績書

型式 VP-4545A 製造番号 700008E122 管理番号 EMC-1 0005

## 入力感度試験/Sensitivity (1kHz)

入力レベル /INPUT LEVEL		OK/NG		判定 /Result
INPUT A	50 mVrms		OK	PASS
INPUT A (フリスケーラ)	25 mVrms		OK	PASS
INPUT B	50 mVrms		OK	PASS

## 基準時間確度試験/Timebase

エーシング 194 H		下限 /Lower Limit	測定値 /Measured Value	上限 /Upper Limit	判定 /Result
■ 標準	10 MHz	9.999 50 MHz	10.000 00 MHz	10.000 50 MHz	PASS
□ OPT 57	10 MHz	9.999 950 MHz	MHz	10.000 050 MHz	N/A
□ OPT 27	10 MHz	9.999 980 MHz	MHz	10.000 020 MHz	N/A

一般動作		OK/NG		判定 /Result
DISPLAY			OK	PASS
ATT			OK	PASS
TEST			OK	PASS
Other measurement functions			OK	PASS

## 校正証明書

依頼者： 株式会社アコー様  
製品名： オーディオアナライザ  
型式名： VP-7721A  
製造番号： 482531D125  
校正実施日： 2021 年 3 月 18 日

上記の計測器は当社の作業標準に従って校正・試験を行い、校正作業に於ける検査または試験の結果が仕様を満足していることを証明します。

この校正・試験に使用された標準器は、日本電気計器検定所(JEMIC)、及び日本品質保証機構(JQA)など日本の公的校正機関、または米国国立標準技術研究所(NIST)など国際度量衡委員会に加盟している諸外国の公的校正機関に対してトレーサビリティが保たれております。

また、一部の測定は自然物理定数もしくは合意標準にトレースしています。

We hereby certify that the above product has been calibrated in accordance with job standard of Yamawaki Electronics Industry Co., Ltd. and that the inspection and or test results of the calibration satisfy the specification Measurement of the calibration is traceable such as JEMIC (JAPAN ELECTRIC METERS INSPECTION CORPORATION) or JQA (JAPAN QUALITY ASSURANCE ORGANIZATION) ,or to overseas public calibration organization participating international measurement committee such as NIST(NATIONAL INSTITUTE OF STANDARDS TECHNOLOGY).

### 使用標準器

型式名	製造番号	製品名	有効期限
5700A	5745305	マルチファンクション校正器	2021年05月
3458A	US28027886	デジタルマルチメータ	2021年05月
53132A	MY40002181	ユニバーサルカウンタ	2021年05月
VP-7722A	590019A122	オーディオアナライザ	2021年05月
AC-12B	M-61112004	歪率計校正器	2021年05月
MG-443B	M-46748	シンセサイザ・シミュレータ	2021年05月

山脇電子工業株式会社

Yamawaki Electronics Industry Co., Ltd.

〒151-0072 東京都渋谷区幡ヶ谷1-21-7 TEL: 03-3465-2421







# 試験成績書

総数 3 枚中 1 枚

管理番号 : YD-210308

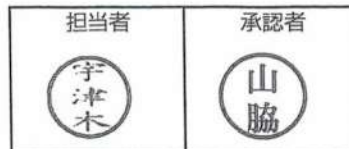
製品名 : オーディオアナライザ  
型式名 : VP-7721A  
製造番号 : 482531D125  
製造者名 : 松下通信工業株式会社

試験年月日 : 2021 年 3 月 18 日  
温度・湿度 : 23 °C 51 %RH  
使用標準器 : 5700A,3458A,53132A,VP7722A  
AC-12B,MG-443B

判定 : 合格

試験の結果は、下記であることを証明します。

この校正に関わる測定は、国家標準にトレーサビリティがとれています。



試験項目	規格	測定点	測定値	判定
発振部				
周波数	$\pm 3\%$ 以内 (全範囲) $\pm 2\%$ 以内 (0.16 kHz~15.99 kHz)	周波数	測定値	判定
		10 Hz	10.13 Hz	良
		20 Hz	20.25 Hz	良
		50 Hz	50.55 Hz	良
		400 Hz	404.17 Hz	良
		1 kHz	1.01 Hz	良
		20 kHz	20.031 kHz	良
		50 kHz	50.014 kHz	良
		100 kHz	99.856 kHz	良
出力振幅	$\pm 0.5$ dB (4 dB~-35.9 dB) $\pm 0.8$ dB (-36 dB以下)	出力	測定値	判定
		4.0 dB	3.93 dB	良
		1.5 dB	1.43 dB	良
		-1.0 dB	-1.08 dB	良
		-3.5 dB	-3.58 dB	良
		-6.0 dB	-6.03 dB	良
		-16.0 dB	-16.03 dB	良
		-35.9 dB	-35.87 dB	良
		-36.0 dB	-36.05 dB	良
フラットネス	1 kHz 基準 $\pm 0.3$ dB (全範囲) $\pm 0.1$ dB (20 Hz~20 kHz)	周波数	測定値	判定
		10 Hz	-0.02 dB	良
		20 Hz	-0.02 dB	良
		50 Hz	-0.02 dB	良
		20 kHz	0.03 dB	良
		50 kHz	0.02 dB	良
		100 kHz	-0.03 dB	良

山脇電子工業株式会社

試験項目	規格	測定点		測定値	判定
発振部					
ひずみ率	≤0.3 %（全範囲） ≤0.005 % (30 Hz～49.9 kHz, 20 kHz～39.9 kHz) ≤0.002 % (50 Hz～19.99 kHz, 80 kHz BW)	周波数		測定値	判定
		10 Hz		0.00147 %	良
		20 Hz		0.00150 %	良
		50 Hz		0.00108 %	良
		400 Hz		0.00031 %	良
		1 kHz		0.00029 %	良
		20 kHz		0.00093 %	良
		50 kHz		0.00153 %	良
		100 kHz		0.00419 %	良
測定部					
残留雑音	<10 μV（500 kHz BW）  UNBAL			測定値	判定
				4.2 μV	良
ACレベル測定	フルスケルの ±3 %  UNBAL	レンジ	入力電圧	測定値	判定
		100 V	100.0 V	100.1 V	良
		30 V	30.00 V	29.94 V	良
		10 V	10.00 V	10.05 V	良
		3 V	3.000 V	3.004 V	良
		1 V	1.000 V	1.001 V	良
		300 mV	300.0 mV	300.3 mV	良
		100 mV	100.0 mV	99.8 mV	良
		30 mV	30.00 mV	29.97 mV	良
		10 mV	10.00 mV	10.02 mV	良
		3 mV	3.000 mV	3.004 mV	良
		1 mV	1.000 mV	1.003 mV	良
		0.3 mV	0.300 mV	0.3005 mV	良
		0.1 mV	0.100 mV	0.1004 mV	良
フラットネス	1 kHz 基準  ±0.5 dB（20 Hz～100 kHz） ±3 dB（5 Hz～500 kHz）	周波数		測定値	判定
		10 Hz		-0.21 dB	良
		20 Hz		-0.04 dB	良
		50 Hz		0.02 dB	良
		10 kHz		-0.05 dB	良
		20 kHz		-0.07 dB	良
		50 kHz		-0.12 dB	良
		100 kHz		-0.23 dB	良
		200 kHz		-0.08 dB	良

試験項目	規格	測定点		測定値	判定	
測定部						
ひずみ率	第 2 高調波偏差 ±1.5 dB (5 Hz～15.99 kHz) ±2.5 dB (16 kHz～50 kHz) +2.5 dB, -4 dB (50 kHz～159.9 kHz)	周波数	レンジ	測定値	判定	
		400 Hz	- 10 dB	-9.80 dB	良	
			- 40 dB	-39.65 dB	良	
			- 60 dB	-59.40 dB	良	
		1 kHz	- 10 dB	-10.05 dB	良	
			- 40 dB	-39.95 dB	良	
			- 60 dB	-59.55 dB	良	
		20 kHz	- 10 dB	-10.95 dB	良	
			- 40 dB	-40.80 dB	良	
			- 60 dB	-60.25 dB	良	
	基本波除去比	周波数		測定値	判定	
		100 dB (5 Hz～15.99 kHz)		400 Hz	107.0 dB	良
		90 dB (16 kHz～50 kHz)		1 kHz	108.0 dB	良
		86 dB (50 kHz～159.9 kHz)		20 kHz	94.5 dB	良
	残留雑音ひずみ率 Ein<1 V <-95 dB (10 Hz～15.99 kHz) <-85 dB (5 Hz～50 kHz) <-65 dB (50 kHz～159.9 kHz)	周波数		測定値	判定	
		10 Hz		-96.8 dB	良	
		20 Hz		-97.4 dB	良	
		1 kHz		-99.5 dB	良	
		15 kHz		-98.7 dB	良	
		50 kHz		-93.8 dB	良	
		100 kHz		-87.4 dB	良	
フィルター	検査仕様				判定	
	HPF	400 Hz	oct/-18 dB パワー特性		良	
	LPF	30 kHz	oct/-18 dB パワー特性		良	
		80 kHz	oct/-18 dB パワー特性			



JCSS  
JCSS 0029総数 2頁の1頁  
証明書番号 1351-01114

## 校正証明書

依頼者	株式会社 アコー
住所	東京都世田谷区代沢2-6-10
品名	標準マイクロホン
型式	4160
製造番号	2973383
製造者	Brüel & Kjær
校正項目	音圧感度レベル
校正方法	IEC 61094-2に準拠した相互校正法を用いた音圧絶対校正
校正条件	別紙のとおり
校正実施場所	東京都八王子市南大沢四丁目4番地4 一般財団法人 日本品質保証機構 計量計測センター 計器検定課校正室
校正年月日	2021年7月8日

校正結果は次頁以降のとおりであることを証明します。

2021年7月12日

東京都八王子市南大沢四丁目4番地4  
一般財団法人 日本品質保証機構  
計量計測センター

所長 佐野 弘明



この証明書は、計量法第144条第1項に基づくものであり、特定標準器(国家標準)にトレーサブルな標準器により校正した結果を示すものです。  
書面による承認なしに、この証明書のカラーコピー及び一部分のみを複製して使用することを禁じます。  
当センターは、ISO/IEC 17025:2017に基づく校正機関として認定されています。



## 校正結果

### 音圧感度レベル

周波数 (Hz)	感度レベル (dB)	周波数 (Hz)	感度レベル (dB)
20	-27.03	2000	-26.96
30	-27.06	3000	-26.69
50	-27.08	4000	-26.38
100	-27.15	5000	-26.11
125	-27.17	6000	-26.03
150	-27.21	7000	-26.30
200	-27.23	8000	-27.07
250	-27.19	9000	-28.32
300	-27.15	10000	-30.06
500	-27.13	11000	-32.07
700	-27.19	12000	-33.88
1000	-27.11	12500	-34.61
1500	-27.05		

校正の不確かさ( $k=2$ ):

周波数	不確かさ
20 Hz以上 8000 Hz以下	0.07 dB
8000 Hz超 10000 Hz以下	0.17 dB
10000 Hz超 12500 Hz以下	0.33 dB

校正の不確かさは、包含係数 $k=2$ とした拡張不確かさであり、約95 %の信頼の水準を持つと推定される区間を与える。

### 校正条件

1. 校正値は、1 V/Pa を0 dBとした値である。
2. 校正に使用した標準器等：  
標準マイクロホン(可逆) Brüel & Kjær 4160 No.2652764
3. 偏極電圧：200 V
4. 校正結果は、下記校正室の環境条件における値である。  
温度 23~24 °C 湿度 62~65 % 気圧 99.1~99.2 kPa

### 特記事項

校正品の受領後、修理及び調整を行わず校正を実施した。

以 上

# 校正証明書

## CALIBRATION CERTIFICATE

品名	PRODUCT NAME	:	普通騒音計 Sound Level Meter
型式	TYPE	:	6236
器物番号	PRODUCT NUMBER	:	222082
マイク	MICROPHONE	:	82897
製造者	MANUFACTURER	:	株式会社アコー ACO CO., LTD.

### ※特記事項

[基準器、校正機器のトレーサビリティ証明]

校正に使用した基準器、校正機器は国家基準にトレーサブルであることを証明致します。

### ※Special notes

[Traceability certificate of standard instruments and calibration equipment.]

We certify that the standard instruments and calibration equipment are traceable to the national standards.

2022年1月17日

January 17, 2022



東京都世田谷区代沢2-6-10  
株式会社アコー  
代表取締役 寺園信一  
2-6-10 Daizawa Setagaya-ku  
Tokyo Japan  
President : Shinichi Terazono  
ACO CO., LTD.

## 1 試験成績 Test Results

別紙試験成績表添付 Test results are attached as an exhibit.

## 2 試験条件 Test Requirements

試験日 Test date : 2022年1月17日 January 17, 2022  
温度 Temperature : 24 °C  
湿度 Humidity : 40 %  
気圧 Barometric pressure : 991 hPa

## 3 使用機器 Used Equipment

デジタル・マルチメータ Digital Multimeter 34401A No. MY45039877  
(有効期間 : 2021年 3 月 から 2022年 3 月 )  
( Effective life : from March, 2021 to March, 2022 )

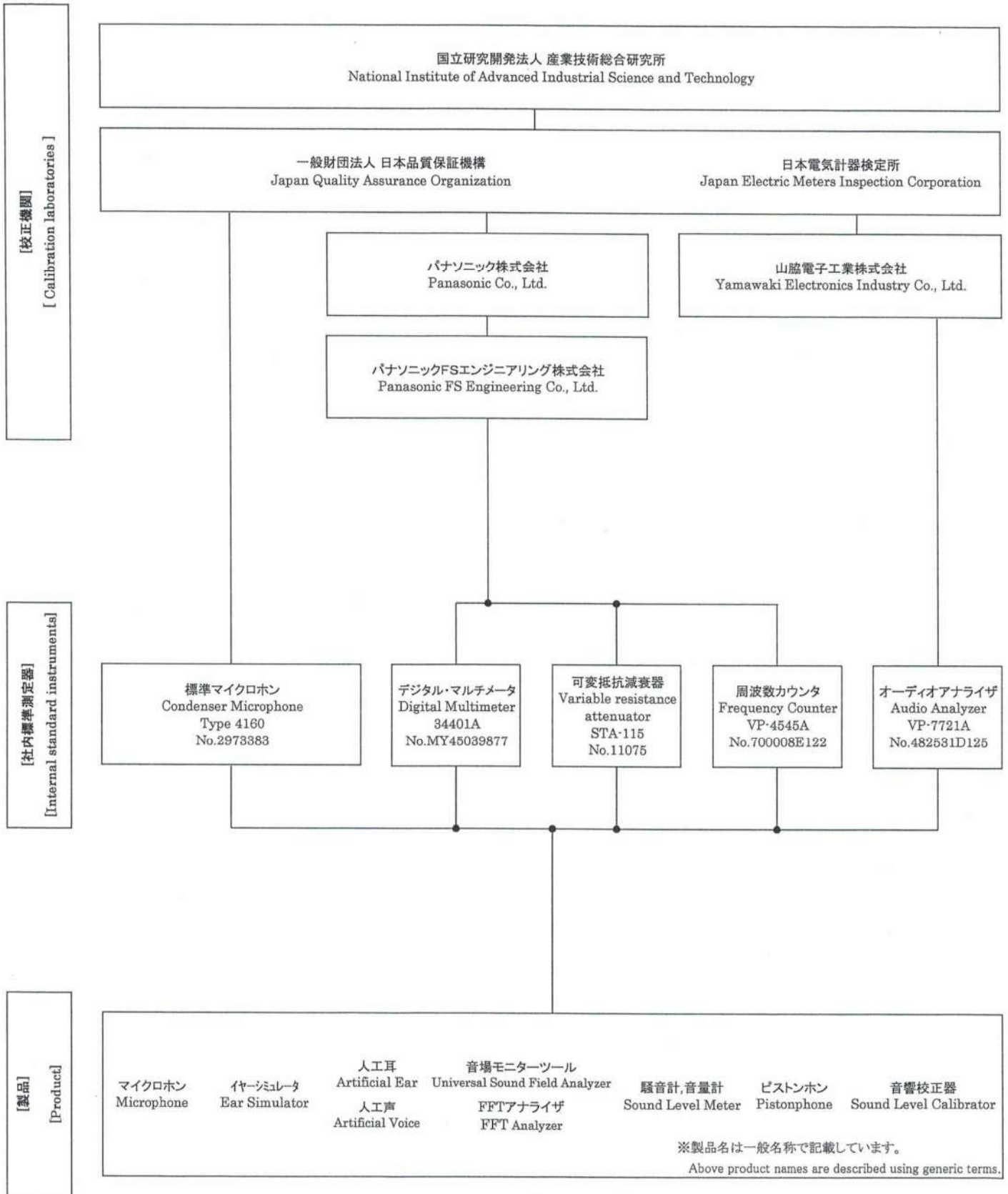
可変抵抗減衰器 Variable resistance attenuator STA-115 No. 11075  
(有効期間 : 2021年 3 月 から 2022年 3 月 )  
( Effective life : from March, 2021 to March, 2022 )

周波数カウンタ Frequency Counter VP-4545A No. 700008E122  
(有効期間 : 2021年 3 月 から 2022年 3 月 )  
( Effective life : from March, 2021 to March, 2022 )

オーディオアナライザ Audio Analyzer VP-7721A No. 482531D125  
(有効期間 : 2021年 3 月 から 2022年 3 月 )  
( Effective life : from March, 2021 to March, 2022 )

標準マイクロホン Condenser Microphone 4160 No. 2973383  
(有効期間 : 2021年 7 月 から 2023年 7 月 )  
( Effective life : from July, 2021 to July, 2023 )

# トレーサビリティ体系図 Traceability Flow Chart





普通騒音計  
Sound Level Meter  
TYPE 6236  
検査成績書  
INSPECTION CERTIFICATE

本体製造番号  
Serial No. of body: 222082  
マイクロホン製造番号  
Serial No. of Microphone: 82897

Ver:5.0 22-01-08

年月日: 2022年1月17日  
Date: January 17, 2022

承認 Approved	点検 Passed	担当 Inspected
<i>A. nagato</i>	<i>K. Ishiyama</i>	<i>N. Yamamoto</i>

株式会社 アコー  
ACO CO., LTD.

## 1. 検査年月日 Inspection Date

2022年1月17日

January 17, 2022

## 2. 検査条件 Inspection Condition

- 1) 温度 Temperature : 24 °C  
 2) 湿度 Humidity : 40 %  
 3) 気圧 Barometric pressure : 991 hPa

## 3. 検査項目及び結果 Inspection Results

## 1) RANGE 切換誤差検査 The RANGE Shifting Error

RANGE : 20-100dB 70dB 入力基準  $\pm 0.7$ dB以下Within  $\pm 0.7$ dB of the value at 70dB input, Range 20-100dB.

RANGE (dB)	入力レベル Input level (dB)	周波数 Frequency (Hz)		
		31.5	1000	8000
20-80	70	-0.1	-0.1	-0.1
20-90	70	0.0	0.0	0.0
20-100	70	0.0	0.0	0.0
20-110	70	0.0	0.0	0.0
30-120	70	-0.2	-0.1	-0.1
40-130	70	-0.2	-0.2	-0.2
判定	Passed	Pass		

## 2) 安定性特性検査 Stability Characteristic

RANGE : 20-100dB 1分後基準  $\pm 0.5$ dB以下Within  $\pm 0.5$ dB of the value one minute later, Range 20-100dB.

	10分後 ten minutes later
誤差 Error (dB)	0.0
判定 Passed	Pass

## 3) 目盛誤差特性検査 The Scale Error

RANGE : 30-120dB 31.5Hzは75.0dB入力基準 1kHz、8kHzは95dB入力基準

31.5Hz is 75.0dB input standard 1kHz, 8kHz is 95dB input standard

A特性 A weighting

入力 Input (dB)	規格 Standard (dB)	周波数 Frequency (Hz)
		31.5
120		
115		
110		
105		
100		
95		
90		
85		
80	±0.5	0.1
75	0.0	0.0
70	±0.5	-0.1
65	±0.5	-0.2
60	±0.5	-0.1
55	±0.5	-0.2
50	±0.5	-0.1
45	±0.5	-0.1
40	±0.5	-0.2
35	±0.5	0.0
30	±0.5	0.5
判定	Passed	Pass

A特性 A weighting

入力 Input (dB)	規格 Standard (dB)	周波数 Frequency (Hz)	
		1000	8000
120	±0.5	0.0	0.0
115	±0.5	0.0	0.0
110	±0.5	-0.1	-0.1
105	±0.5	0.0	-0.1
100	±0.5	0.0	-0.1
95	0.0	0.0	0.0
90	±0.5	-0.1	-0.1
85	±0.5	-0.1	-0.1
80	±0.5	-0.1	0.1
75	±0.5	-0.1	-0.1
70	±0.5	-0.2	-0.3
65	±0.5	-0.3	-0.3
60	±0.5	-0.3	-0.3
55	±0.5	-0.2	-0.3
50	±0.5	-0.2	-0.3
45	±0.5	-0.2	-0.3
40	±0.5	-0.1	-0.3
35	±0.5	0.2	-0.1
30	±0.5	0.5	0.4
判定	Passed	Pass	

## 4) 動特性検査 Dynamic Characteristic

RANGE : 20-100dB 100dB、1kHz 入力基準

When 100dB input, Range 20-100dB at 1kHz.

	規格 Standard	測定 Measured Value
FAST	-1.0+0.5 -1.0 (dB)	-1.5
SLOW	-4.0±1.0 (dB)	-4.5
判定	Passed	Pass

## 5) 周波数特性検査 Frequency Response

RANGE : 20-100dB 95dB入力基準(マイクを含む)

When 95dB input, including Microphone value, Range 20-100dB

周波数 Frequency (Hz)	A特性			C特性			FLAT(Z)特性	許容差 Tolerance (dB)
	規格 Standard (dB)	レスポンス Response (dB)	偏差 Deviation (dB)	規格 Standard (dB)	レスポンス Response (dB)	偏差 Deviation (dB)	レスポンス Response (dB)	
10	-70.4	-68.8	1.6	-14.3	-12.9	1.4	-0.1	+5.0, -∞
20	-50.5	-50.8	-0.3	-6.2	-5.8	0.4	-0.1	±3.0
40	-34.6	-34.8	-0.2	-2.0	-2.0	0.0	-0.1	±2.0
100	-19.1	-19.3	-0.2	-0.3	-0.3	0.0	0.0	±1.5
250	-8.6	-8.8	-0.2	0.0	0.0	0.0	-0.1	±1.5
500	-3.2	-3.4	-0.2	0.0	-0.1	-0.1	-0.1	±1.5
1000	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.1	±1.0
2k	1.2	1.0	-0.2	-0.2	-0.4	-0.2	-0.2	±2.0
4k	1.0	0.5	-0.5	-0.8	-1.5	-0.7	-0.4	±3.0
8k	-1.1	-1.7	-0.6	-3.0	-3.7	-0.7	-0.5	±5.0
10k	-2.5	-3.1	-0.6	-4.4	-5.1	-0.7	-0.8	+5.0, -∞
20k	-9.3	-8.5	0.8	-11.2	-10.6	0.6	-1.7	+5.0, -∞
判定 Passed		Pass						

## 6) 実効値指示誤差検査 波高率3のバースト信号に対して1.0dB以内

Within 1.0dB on the Burst signal of the peak factor 3, Range 20-100dB.

周波数 Frequency 2kHz、繰り返し周波数 Repeat frequency 40Hz

実効値指示誤差 Effective value Error (dB)	判定
0.3	Pass

## 7) 自己雑音特性検査 Self-noise

RANGE : 20-80dB

RANGE : 20-80dB (Including Microphone value)	A特性	C特性	FLAT(Z)特性
規格 Standard (dB)	22以下 Below 22	30以下 Below 30	32以下 Below 32
自己雑音 Self-noise (dB)	19.8	28.7	30.2
判定 Passed	Pass		



発行日：2021年3月18日

## 校正証明書

貴社名 株式会社 アコー

下記製品は、当社の作業規程に従って校正が行われていることを証明します。  
この校正に使用した標準器は、パナソニックSNIハルキュエーションテクノロジー株式会社、メーカー  
JEMIC(日本電気計器検定所)、JQA(日本品質保証機構)などを通じて  
国家標準、またはNIST(National Institute of Standards and Technology)  
などにトレーサビリティがとれています。

管	理	番	号	EMC-1 0013
品			名	デジタル・マルチメータ
型			式	34401A
製	造	番	号	MY45039877
校	正	年	月	日
環	境	条	件	温度 23℃ 湿度 50%
発	行	番	号	202101351

### 使用標準器

管理番号	型 式	製造番号	名 称	有効期限
ST-031	5700A	4635001	キャリブレータ	2021/10

〒561-0854 大阪府豊中市稲津町3丁目1番1号

パナソニックFSエンジニアリング株式会社

CS統括部 校正サービス課

校正証明書発行責任者 佐藤 信治



# 試験・校正成績書

( Calibration Report )

成績書番号

39710K

管理番号 (Control Number)	EMC-1 0013
品名 (Description)	デジタル・マルチメータ Digital Multimeter
製造者 (Manufacturer)	Agilent Technologies
型式 (Model Number)	34401A
製造番号 (Serial Number)	MY45039877
依頼者 (Customer)	株式会社 7コー

校正日 (Calibration Date)	2021年3月18日
温度 (Temperature)	23 °C
湿度 (Humidity)	50 %

校正者 (Calibrated by)	松嶋 宏幸
総合判定 (Judgement)	合格/Pass

承認者 (Approved by)



備考

標準器 (Standard)

管理番号

(Control Number)

ST-031

型式

(Model Number)

5700A

製造番号

(Serial Number)

4635001

名称

(Description)

キャリブレーション

この成績書に記載する標準器は国家標準にトレーサブルである。

パナソニック F S エンジニアリング株式会社

# 試験・校正成績書

型式 34401A 製造番号 MY45039877 管理番号 EMC-1 0013

## DC V

レンジ /Range	標準入力 /Input	下限 /Lower Limit	測定値 /Measured Value	上限 /Upper Limit	判定 /Result
100 mV	100 mV	99.991 5 mV	100.000 0 mV	100.008 5 mV	PASS
1 V	0.2 V	0.199 985 V	0.199 998 V	0.200 015 V	PASS
1 V	0.4 V	0.399 977 V	0.399 998 V	0.400 023 V	PASS
1 V	0.6 V	0.599 969 V	0.599 998 V	0.600 031 V	PASS
1 V	0.8 V	0.799 961 V	0.799 998 V	0.800 039 V	PASS
1 V	1.0 V	0.999 953 V	0.999 995 V	1.000 047 V	PASS
1 V	-0.2 V	- 0.200 015 V	- 0.200 000 V	- 0.199 985 V	PASS
1 V	-0.4 V	- 0.400 023 V	- 0.400 000 V	- 0.399 977 V	PASS
1 V	-0.6 V	- 0.600 031 V	- 0.599 999 V	- 0.599 969 V	PASS
1 V	-0.8 V	- 0.800 039 V	- 0.799 998 V	- 0.799 961 V	PASS
1 V	-1.0 V	- 1.000 047 V	- 0.999 997 V	- 0.999 953 V	PASS
10 V	10 V	9.999 60 V	9.999 89 V	10.000 40 V	PASS
100 V	100 V	99.994 9 V	100.000 2 V	100.005 1 V	PASS
1000 V	1000 V	999.945 V	999.994 V	1 000.055 V	PASS

## AC V

周波数 /Frequency	レンジ /Range	標準入力 /Input	下限 /Lower Limit	測定値 /Measured Value	上限 /Upper Limit	判定 /Result
400 Hz	100 mV	100 mV	99.900 0 mV	100.086 5 mV	100.100 0 mV	PASS
400 Hz	1 V	1 V	0.999 100 V	1.000 830 V	1.000 900 V	PASS
400 Hz	10 V	10 V	9.991 00 V	10.008 48 V	10.009 00 V	PASS
400 Hz	100 V	100 V	99.910 0 V	99.991 4 V	100.090 0 V	PASS
400 Hz	750 V	700 V	699.355 V	699.873 V	700.645 V	PASS

## OHMS (4W)

レンジ /Range	標準入力 /Input	下限 /Lower Limit	測定値 /Measured Value	上限 /Upper Limit	判定 /Result
100 Ω	100 Ω	99.986 0 Ω	100.007 0 Ω	100.014 0 Ω	PASS
1 kΩ	1 kΩ	0.999 890 kΩ	1.000 050 kΩ	1.000 110 kΩ	PASS
10 kΩ	10 kΩ	9.998 90 kΩ	10.000 50 kΩ	10.001 10 kΩ	PASS
100 kΩ	100 kΩ	99.989 0 kΩ	100.003 7 kΩ	100.011 0 kΩ	PASS
1 MΩ	1 MΩ	0.999 890 MΩ	1.000 033 MΩ	1.000 110 MΩ	PASS
10 MΩ	10 MΩ	9.995 90 MΩ	9.998 69 MΩ	10.004 10 MΩ	PASS
100 MΩ	100 MΩ	99.190 0 MΩ	100.797 8 MΩ	100.810 0 MΩ	PASS

## DC I

レンジ /Range	標準入力 /Input	下限 /Lower Limit	測定値 /Measured Value	上限 /Upper Limit	判定 /Result
10 mA	10 mA	9.993 00 mA	9.999 19 mA	10.007 00 mA	PASS
100 mA	100 mA	99.945 0 mA	99.987 8 mA	100.055 0 mA	PASS
1 A	1 A	0.998 900 A	0.999 788 A	1.001 100 A	PASS
3 A	1 A	0.998 20 A	0.999 84 A	1.001 80 A	PASS

## AC I

周波数 /Frequency	レンジ /Range	標準入力 /Input	下限 /Lower Limit	測定値 /Measured Value	上限 /Upper Limit	判定 /Result
400 Hz	1 A	1 A	0.998 600 A	1.000 244 A	1.001 400 A	PASS
400 Hz	3 A	1 A	0.996 70 A	1.000 08 A	1.003 30 A	PASS

発行日：2021年3月18日

## 校正証明書

貴社名 株式会社 アコー

下記製品は、当社の作業規程に従って校正が行われていることを証明します。  
この校正に使用した標準器は、パナソニックSNEソリューションテクノロジー株式会社、メーカー  
JEMIC(日本電気計器検定所)、JQA(日本品質保証機構)などを通じて  
国家標準、またはNIST(National Institute of Standards and Technology)  
などにトレーサビリティがとれています。

管	理	番	号	EMC-1 0006
品			名	可変抵抗減衰器
型			式	STA-115
製	造	番	号	11075
校	正	年	月	日
環	境	条	件	温度 23℃ 湿度 50%
発	行	番	号	202101355

### 使用標準器

管理番号	型 式	製造番号	名 称	有効期限
ST-031	5700A	4635001	キャリブレータ	2021/10
EO-027	URE3	101273	RMS/PEAK 電圧計	2021/3

〒561-0854 大阪府豊中市稲津町3丁目1番1号

パナソニックFSエンジニアリング株式会社

CS統括部 校正サービス課

校正証明書発行責任者 佐藤 信治





# 試験・校正成績書

( Calibration Report )

成績書番号

39711K

管理番号 (Control Number)	EMC-1 0006
品名 (Description)	可変抵抗減衰器 Variable resistance attenuator
製造者 (Manufacturer)	TOKYO KO-ON DENPA
型式 (Model Number)	STA-115
製造番号 (Serial Number)	11075
依頼者 (Customer)	株式会社 アー

校正日 (Calibration Date)	2021年3月18日
温度 (Temperature)	23 °C
湿度 (Humidity)	50 %

校正者 (Calibrated by)	水澤 和弘
総合判定 (Judgement)	合格/Pass

承認者 (Approved by)



備考

## 標準器 (Standard)

管理番号 (Control Number)	型式 (Model Number)	製造番号 (Serial Number)	名称 (Description)
ST-031	5700A	4635001	キャリブレータ
E0-027	URE3	101273	RMS/PEAK 電圧計

この成績書に記載する標準器は国家標準にトレーサブルである。

パナソニックFSエンジニアリング株式会社

# 試験・校正成績書

型式 STA-115 製造番号 11075 管理番号 EMC-1 0006

## 減衰確度/Attenuation accuracy

周波数 /Frequency	ステップ /Step	ダイヤル /Dial	下限 /Lower Limit	校正値 /Calibration Value	上限 /Upper Limit	判定 /Result
1 kHz	0.1 dB	0 dB		0.0 (REF.) dB		
1 kHz	0.1 dB	0.1 dB	0.05 dB	0.10 dB	0.15 dB	PASS
1 kHz	0.1 dB	0.2 dB	0.15 dB	0.20 dB	0.25 dB	PASS
1 kHz	0.1 dB	0.3 dB	0.25 dB	0.30 dB	0.35 dB	PASS
1 kHz	0.1 dB	0.4 dB	0.35 dB	0.40 dB	0.45 dB	PASS
1 kHz	0.1 dB	0.5 dB	0.45 dB	0.50 dB	0.55 dB	PASS
1 kHz	0.1 dB	0.6 dB	0.55 dB	0.60 dB	0.65 dB	PASS
1 kHz	0.1 dB	0.7 dB	0.65 dB	0.70 dB	0.75 dB	PASS
1 kHz	0.1 dB	0.8 dB	0.75 dB	0.80 dB	0.85 dB	PASS
1 kHz	0.1 dB	0.9 dB	0.85 dB	0.90 dB	0.95 dB	PASS
1 kHz	0.1 dB	1.0 dB	0.95 dB	1.00 dB	1.05 dB	PASS
1 kHz	1 dB	1 dB	0.90 dB	1.00 dB	1.10 dB	PASS
1 kHz	1 dB	2 dB	1.90 dB	2.00 dB	2.10 dB	PASS
1 kHz	1 dB	3 dB	2.90 dB	3.01 dB	3.10 dB	PASS
1 kHz	1 dB	4 dB	3.90 dB	4.01 dB	4.10 dB	PASS
1 kHz	1 dB	5 dB	4.90 dB	5.01 dB	5.10 dB	PASS
1 kHz	1 dB	6 dB	5.90 dB	6.01 dB	6.10 dB	PASS
1 kHz	1 dB	7 dB	6.90 dB	7.01 dB	7.10 dB	PASS
1 kHz	1 dB	8 dB	7.90 dB	8.01 dB	8.10 dB	PASS
1 kHz	1 dB	9 dB	8.90 dB	9.01 dB	9.10 dB	PASS
1 kHz	1 dB	10 dB	9.90 dB	10.00 dB	10.10 dB	PASS
1 kHz	10 dB	10 dB	9.70 dB	10.02 dB	10.30 dB	PASS
1 kHz	10 dB	20 dB	19.70 dB	19.99 dB	20.30 dB	PASS
1 kHz	10 dB	30 dB	29.70 dB	29.97 dB	30.30 dB	PASS
1 kHz	10 dB	40 dB	39.70 dB	40.04 dB	40.30 dB	PASS
1 kHz	10 dB	50 dB	49.70 dB	50.08 dB	50.30 dB	PASS
1 kHz	20 dB	20 dB	19.70 dB	20.02 dB	20.30 dB	PASS
1 kHz	20 dB	40 dB	39.70 dB	40.07 dB	40.30 dB	PASS

発行日: 2021年3月18日

## 校正証明書

貴社名 株式会社 アコー

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JEMIC(日本電気計器検定所)、JQA(日本品質保証機構)などを通じて  
国家標準、またはNIST(National Institute of Standards and Technology)  
などにトレーサビリティがとれています。

管	理	番	号	EMC-1 0005
品			名	周波数カウンタ
型			式	VP-4545A
製	造	番	号	700008E122
校	正	年	月	日
環	境	条	件	温度 23℃ 湿度 50%
発	行	番	号	202101454

### 使用標準器

管理番号	型 式	製造番号	名 称	有効期限
EO-030	FT-001S	1504010016	時間周波数遠隔校正装置	2021/6
EO-037	33250A	MY40005937	ファンクションジェネレータ	2021/9

〒561-0854 大阪府豊中市稲津町3丁目1番1号

パナソニックFSエンジニアリング株式会社

CS統括部 校正サービス課

校正証明書発行責任者 佐藤 信治



# 試験・校正成績書

( Calibration Report )

成績書番号

39712K

管理番号 (Control Number)	EMC-1 0005
品名 (Description)	周波数カウンタ Frequency Counter
製造者 (Manufacturer)	Panasonic
型式 (Model Number)	VP-4545A
製造番号 (Serial Number)	700008E122
依頼者 (Customer)	株式会社 7コー

校正日 (Calibration Date)	2021年3月18日
温度 (Temperature)	23 °C
湿度 (Humidity)	50 %

校正者 (Calibrated by)	水澤 和弘
総合判定 (Judgement)	合格/Pass

承認者 (Approved by)



備考

標準器 (Standard)

管理番号

(Control Number)

EO-030

EO-037

型式

(Model Number)

FT-001S

33250A

製造番号

(Serial Number)

1504010016

MY40005937

名称

(Description)

時間周波数遠隔校正装置

ファンクションジェネレータ

この成績書に記載する標準器は国家標準にトレーサブルである。

パナソニックFSエンジニアリング株式会社



# 試験・校正成績書

型式 VP-4545A

製造番号 700008E122

管理番号 EMC-1 0005

## 入力感度試験/Sensitivity (1kHz)

入力レベル /INPUT LEVEL		OK/NG	判定 /Result
INPUT A	50 mVrms	OK	PASS
INPUT A (フ リスケール)	25 mVrms	OK	PASS
INPUT B	50 mVrms	OK	PASS

## 基準時間確度試験/Timebase

エ ー ジ ン グ 194 H		下限 /Lower Limit	測定値 /Measured Value	上限 /Upper Limit	判定 /Result
■ 標準	10 MHz	9.999 50 MHz	10.000 00 MHz	10.000 50 MHz	PASS
□ OPT 57	10 MHz	9.999 950 MHz	MHz	10.000 050 MHz	N/A
□ OPT 27	10 MHz	9.999 980 MHz	MHz	10.000 020 MHz	N/A

一般動作	OK/NG	判定 /Result
DISPLAY	OK	PASS
ATT	OK	PASS
TEST	OK	PASS
Other measurement functions	OK	PASS

証明書番号 : Y1557  
発行年月日 : 2021年 3月 18日

## 校正証明書

依頼者 : 株式会社アコー様  
製品名 : オーディオアナライザ  
型式名 : VP-7721A  
製造番号 : 482531D125  
校正実施日 : 2021 年 3 月 18 日

上記の計測器は当社の作業標準に従って校正・試験を行い、校正作業に於ける検査または試験の結果が仕様を満足していることを証明します。

この校正・試験に使用された標準器は、日本電気計器検定所(JEMIC)、及び日本品質保証機構(JQA)など日本の公的校正機関、または米国国立標準技術研究所(NIST)など国際度量衡委員会に加盟している諸外国の公的校正機関に対してトレーサビリティが保たれております。

また、一部の測定は自然物理定数もしくは合意標準にトレースしています。

We hereby certify that the above product has been calibrated in accordance with job standard of Yamawaki Electronics Industry Co., Ltd. and that the inspection and or test results of the calibration satisfy the specification Measurement of the calibration is traceable such as JEMIC (JAPAN ELECTRIC METERS INSPECTION CORPORATION) or JQA (JAPAN QUALITY ASSURANCE ORGANIZATION), or to overseas public calibration organization participating international measurement committee such as NIST(NATIONAL INSTITUTE OF STANDARDS TECHNOLOGY).

### 使用標準器

型式名	製造番号	製品名	有効期限
5700A	5745305	マルチファンクション校正器	2021年05月
3458A	US28027886	テシタルマルチメータ	2021年05月
53132A	MY40002181	ユニバーサルカウンタ	2021年05月
VP-7722A	590019A122	オーディオアナライザ	2021年05月
AC-12B	M-61112004	歪率計校正器	2021年05月
MG-443B	M-46748	シンセサイザシエネレータ	2021年05月

山脇電子工業株式会社

Yamawaki Electronics Industry Co., Ltd.

〒151-0072 東京都渋谷区幡ヶ谷1-21-7 TEL : 03-3465-2421



事前の許可なくして、この証明書の一部を複製しないでください。

yd2016-01a

This certificate shall not be reproduced except in full without the approval of Yamawaki Electronics Industry CORPORATION



# 試験成績書

総数 3 枚中 1 枚

管理番号 : YD-210308

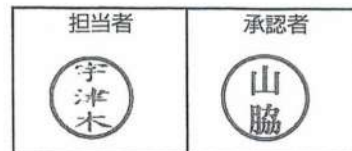
製品名 : オーディオアナライザ  
型式名 : VP-7721A  
製造番号 : 482531D125  
製造者名 : 松下通信工業株式会社

試験年月日 : 2021 年 3 月 18 日  
温度・湿度 : 23 ℃ 51 %RH  
使用標準器 : 5700A,3458A,53132A,VP7722A  
AC-12B,MG-443B

判定 : 合格

試験の結果は、下記であることを証明します。

この校正に関わる測定は、国家標準にトレーサビリティがとれています。



試験項目	規格	測定点	測定値	判定
発振部				
周波数	$\pm 3\%$ 以内 (全範囲) $\pm 2\%$ 以内 (0.16 kHz~15.99 kHz)	周波数	測定値	判定
		10 Hz	10.13 Hz	良
		20 Hz	20.25 Hz	良
		50 Hz	50.55 Hz	良
		400 Hz	404.17 Hz	良
		1 kHz	1.01 Hz	良
		20 kHz	20.031 kHz	良
		50 kHz	50.014 kHz	良
		100 kHz	99.856 kHz	良
出力振幅	$\pm 0.5$ dB (4 dB~-35.9 dB) $\pm 0.8$ dB (-36 dB以下)	出力	測定値	判定
		4.0 dB	3.93 dB	良
		1.5 dB	1.43 dB	良
		-1.0 dB	-1.08 dB	良
		-3.5 dB	-3.58 dB	良
		-6.0 dB	-6.03 dB	良
		-16.0 dB	-16.03 dB	良
		-35.9 dB	-35.87 dB	良
		-36.0 dB	-36.05 dB	良
フラットネス	1 kHz 基準 $\pm 0.3$ dB (全範囲) $\pm 0.1$ dB (20 Hz~20 kHz)	周波数	測定値	判定
		10 Hz	-0.02 dB	良
		20 Hz	-0.02 dB	良
		50 Hz	-0.02 dB	良
		20 kHz	0.03 dB	良
		50 kHz	0.02 dB	良
		100 kHz	-0.03 dB	良

山脇電子工業株式会社



試験項目	規格	測定点		測定値	判定
発振部					
ひずみ率	≤0.3 % （全範囲） ≤0.005 % (30 Hz～49.9 kHz, 20 kHz～39.9 kHz) ≤0.002 % (50 Hz～19.99 kHz, 80 kHz BW)	周波数		測定値	判定
		10 Hz		0.00147 %	良
		20 Hz		0.00150 %	良
		50 Hz		0.00108 %	良
		400 Hz		0.00031 %	良
		1 kHz		0.00029 %	良
		20 kHz		0.00093 %	良
		50 kHz		0.00153 %	良
		100 kHz		0.00419 %	良
測定部					
残留雑音	<10 μV （500 kHz BW）  UNBAL			測定値	判定
			4.2 μV	良	
ACバール測定	フルスケールの ±3 %  UNBAL	レンジ	入力電圧	測定値	判定
		100 V	100.0 V	100.1 V	良
		30 V	30.00 V	29.94 V	良
		10 V	10.00 V	10.05 V	良
		3 V	3.000 V	3.004 V	良
		1 V	1.000 V	1.001 V	良
		300 mV	300.0 mV	300.3 mV	良
		100 mV	100.0 mV	99.8 mV	良
		30 mV	30.00 mV	29.97 mV	良
		10 mV	10.00 mV	10.02 mV	良
		3 mV	3.000 mV	3.004 mV	良
		1 mV	1.000 mV	1.003 mV	良
		0.3 mV	0.300 mV	0.3005 mV	良
		0.1 mV	0.100 mV	0.1004 mV	良
フラットネス	1 kHz 基準  ±0.5 dB (20 Hz～100 kHz) ±3 dB (5 Hz～500 kHz)	周波数		測定値	判定
		10 Hz		-0.21 dB	良
		20 Hz		-0.04 dB	良
		50 Hz		0.02 dB	良
		10 kHz		-0.05 dB	良
		20 kHz		-0.07 dB	良
		50 kHz		-0.12 dB	良
		100 kHz		-0.23 dB	良
		200 kHz		-0.08 dB	良



試験項目	規格	測定点		測定値	判定	
測定部						
ひずみ率	第2高調波偏差 ±1.5 dB (5 Hz～15.99 kHz) ±2.5 dB (16 kHz～50 kHz) +2.5 dB, -4 dB (50 kHz～159.9 kHz)	周波数	レンジ	測定値	判定	
		400 Hz	- 10 dB	-9.80 dB	良	
			- 40 dB	-39.65 dB	良	
			- 60 dB	-59.40 dB	良	
		1 kHz	- 10 dB	-10.05 dB	良	
			- 40 dB	-39.95 dB	良	
			- 60 dB	-59.55 dB	良	
		20 kHz	- 10 dB	-10.95 dB	良	
			- 40 dB	-40.80 dB	良	
			- 60 dB	-60.25 dB	良	
		基本波除去比	周波数		測定値	判定
			100 dB (5 Hz～15.99 kHz)		400 Hz	107.0 dB
	90 dB (16 kHz～50 kHz)		1 kHz	108.0 dB	良	
	86 dB (50 kHz～159.9 kHz)		20 kHz	94.5 dB	良	
	残留雑音ひずみ率 Ein<1 V <-95 dB (10 Hz～15.99 kHz) <-85 dB (5 Hz～50 kHz) <-65 dB (50 kHz～159.9 kHz)	周波数		測定値	判定	
		10 Hz		-96.8 dB	良	
		20 Hz		-97.4 dB	良	
		1 kHz		-99.5 dB	良	
		15 kHz		-98.7 dB	良	
		50 kHz		-93.8 dB	良	
100 kHz		-87.4 dB	良			
検査仕様					判定	
フィルター	HPF	400 Hz	oct/-18 dB パワース特性		良	
	LPF	30 kHz	oct/-18 dB パワース特性		良	
		80 kHz	oct/-18 dB パワース特性			

JCSS  
JCSS 0029総数 2頁の1頁  
証明書番号 1351-01114

## 校正証明書

依頼者	株式会社 アコー
住所	東京都世田谷区代沢2-6-10
品名	標準マイクロホン
型式	4160
製造番号	2973383
製造者	Brüel & Kjær
校正項目	音圧感度レベル
校正方法	IEC 61094-2に準拠した相互校正法を用いた音圧絶対校正
校正条件	別紙のとおり
校正実施場所	東京都八王子市南大沢四丁目4番地4 一般財団法人 日本品質保証機構 計量計測センター 計器検定課校正室
校正年月日	2021年7月8日

校正結果は次頁以降のとおりであることを証明します。

2021年7月12日

東京都八王子市南大沢四丁目4番地4  
一般財団法人 日本品質保証機構  
計量計測センター

所長 佐野 弘明



この証明書は、計量法第144条第1項に基づくものであり、特定標準器(国家標準)にトレーサブルな標準器により校正した結果を示すものです。  
書面による承認なしに、この証明書のカラーコピー及び一部分のみを複製して使用することを禁じます。  
当センターは、ISO/IEC 17025:2017に基づく校正機関として認定されています。

## 校正結果

### 音圧感度レベル

周波数 (Hz)	感度レベル (dB)	周波数 (Hz)	感度レベル (dB)
20	-27.03	2000	-26.96
30	-27.06	3000	-26.69
50	-27.08	4000	-26.38
100	-27.15	5000	-26.11
125	-27.17	6000	-26.03
150	-27.21	7000	-26.30
200	-27.23	8000	-27.07
250	-27.19	9000	-28.32
300	-27.15	10000	-30.06
500	-27.13	11000	-32.07
700	-27.19	12000	-33.88
1000	-27.11	12500	-34.61
1500	-27.05		

校正の不確かさ( $k=2$ ):

周波数	不確かさ
20 Hz以上 8000 Hz以下	0.07 dB
8000 Hz超 10000 Hz以下	0.17 dB
10000 Hz超 12500 Hz以下	0.33 dB

校正の不確かさは、包含係数 $k=2$ とした拡張不確かさであり、約95 %の信頼の水準を持つと推定される区間を与える。

### 校正条件

1. 校正値は、1 V/Pa を0 dBとした値である。
2. 校正に使用した標準器等：  
標準マイクロホン(可逆) Brüel & Kjær 4160 No.2652764
3. 偏極電圧：200 V
4. 校正結果は、下記校正室の環境条件における値である。  
温度 23~24 °C 湿度 62~65 % 気圧 99.1~99.2 kPa

### 特記事項

校正品の受領後、修理及び調整を行わず校正を実施した。

以 上





## 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 : Mr. Surasak Vakjan

Calibration Officer

Approved by :

( Mr. Worapong Sinthusopa )

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 : Mr. Surasak Vakjan

Calibration Officer

Approved by :

( Mr. Worapong Sinthusopa )

Authorized Signatory





## Calibration Report

Certificate Number : SPR21120367-2

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 -







## 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 °C  $\pm$  3 °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 : Mr. Surasak Vakjan

Calibration Officer

Approved by :

( Mr. Worapong Sinthusopa )

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

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 : Mr. Surasak Vakjan

Calibration Officer

Approved by :

( Mr. Worapong Sinthusopa )

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

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 : Mr. Surasak Vakjan

Calibration Officer

Approved by :

( Mr. Worapong Sinthusopa )

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

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 : Mr. Surasak Vakjan

Calibration Officer

Approved by :

( Mr. Worapong Sinthusopa )

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 : Mr. Surasak Vakjan

Calibration Officer

Approved by :

( Mr. Worapong Sinthusopa )

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

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 : Mr. Surasak Vakjan

Approved by :

Calibration Officer

( Mr. Worapong Sinthusopa )

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 -





## Certificate of Calibration

Equipment: SPECTROPHOTOMETER  
Model: SPECORD 50 PLUS  
Serial No. (or ID.): 232H1012 (LB-HE-073)  
Manufacturer: Analytik jena  
Condition: In Condition

Certificate No.: C06210223  
Issued Date: 18 May 2021  
Job No.: KSPR2106842  
Page: 1 of 3

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



(Mr. Nattapat Rungrueang)

Person in charge

  
บริษัท เอสพีซี อาร์ที จำกัด  
SPC RT Co., Ltd.

(Mr. Dumrong Boonsopon)

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.

Certificate No.: C06210223

Page: 3 of 3

## Without Adjustment

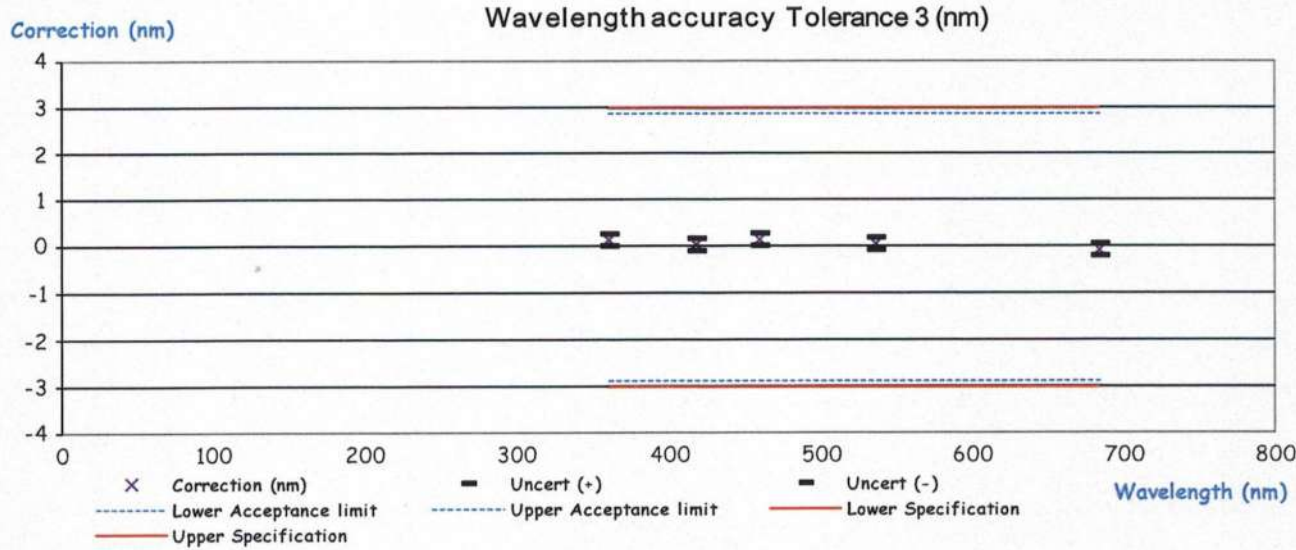
## Photometric Accuracy (Absorbance)

Wavelength	Unit Under Calibration	Correction	Guard Band (w)	Tolerance ( $\pm$ )	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

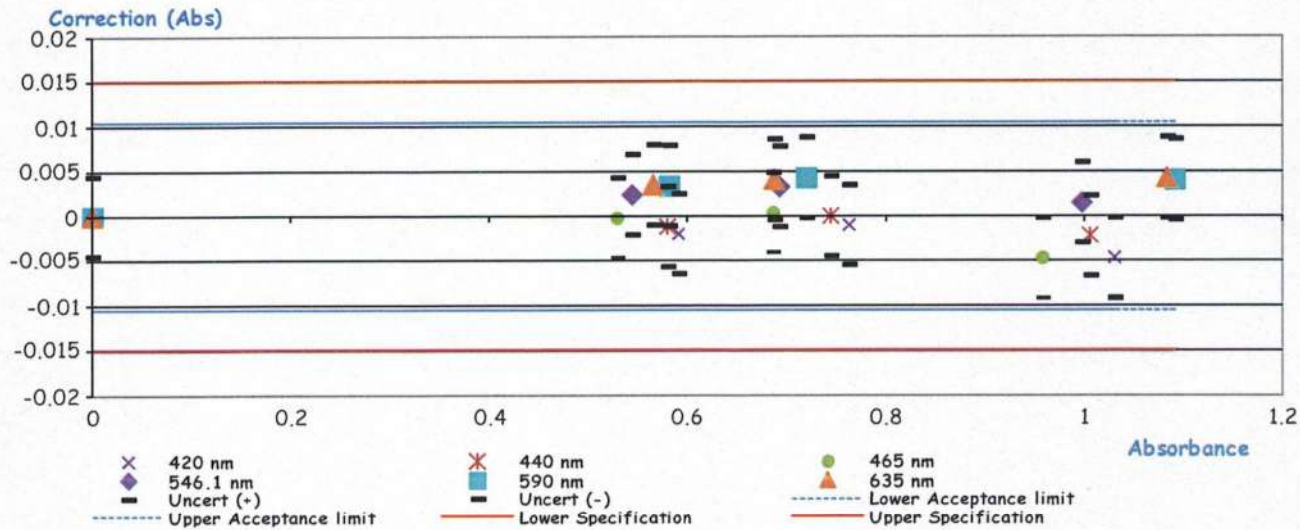
The validity of the statements of conformity cannot be guaranteed for different places of use, environmental conditions or improper use.

## The End of Statements of Conformity

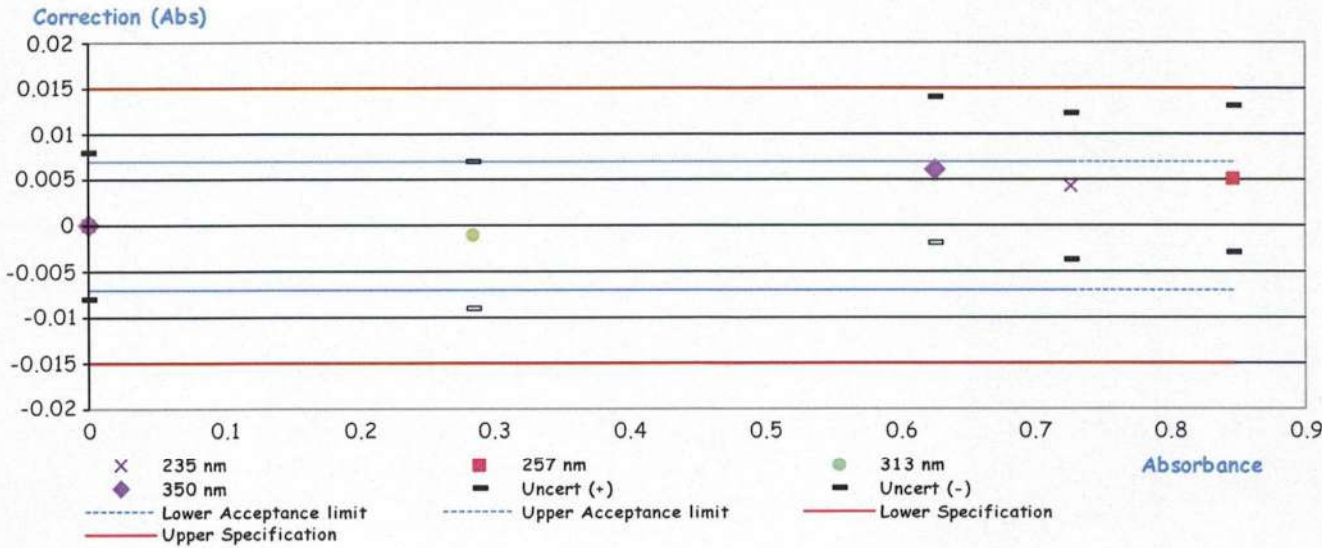




Photometric Accuracy (Absorbance) Tolerance 0.015 (Abs)



Photometric Accuracy (Absorbance) Tolerance 0.015 (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	
		<i>General</i>			
<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"/>	
		<i>Spectrophotometer</i>			
<input type="checkbox"/>	<input type="checkbox"/>	6. แรงดันไฟฟ้า (Battery Backup) $\geq 2.5$ 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"/>	
		<i>pH Meter and Conductivity Meter</i>			
<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"/>	
		<i>Turbidimeter</i>			
<input type="checkbox"/>	<input type="checkbox"/>	16. ค่าความขุ่นที่ต่ำสุด (No Sample)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	17. ระดับการส่องสว่างของแสง ( $\geq 2.5$ ไม่เกิน 3.0)	<input type="checkbox"/>	<input type="checkbox"/>	
		<i>Automatic titrator</i>			
<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/ข้อแนะนำ :

Mr.Nattapat Rungrueang

Service Engineer



## Calibration Certificate

Date of Issue 5 February 2022 Page : 1 of 2  
Object Wind speed and wind direction  
Manufacture NRG Instruments  
Type Sensor : NRG 40C, 200P  
Serial No Basic Datalogger : 309017846  
Customer Health & Envitech CO.,Ltd.  
77/11 Moo 2 Ngamwongwan Rd.Soi 5, Tumbon Bangkhen, Muang,Nontaburi 11000

Calibration Condition : Temperature 25.2 °C Barometric Pressure 1012.8 hPa  
NATIONAL STANDARD WIND TUNNEL : Thermal Anemometer 642 S/N 91563  
: HOOK GAGE NO 1425 : Wind Aloft Plotting Board  
N.I.S.T. Test Reference Number 731/241460  
: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)  
Serial Number 110730029 (sensor 120629586)  
JAPAN QUALITY ASSURANCE ORGANIZATION  
: Theodor Friedrich : Dry No. 8390/94 Wet No.  
STANDARD THERMOMETER 8389/94  
: Thermoschneider No. 918802  
STANDARD BAROMETER : Digital Barometer Vaisaia Type RTB220 No. V1220015

Calibrated by :



Mr. Pasagorn Samol

## The Result of Calibration

Date of Issue 5 February 2022

Page : 2 of 2

Standard  Ultrasonic Anemometer m/sec	HOOK GAGE NO 1425			TESTED ANEMOMETER			
	Pressure inches	Vacuum inches	Pressure hPa	Pressure hPa	Correction hPa	Velocity m/sec	Correction m/sec
1.00	-	-	-	-	-	0.9	0.10
3.02	-	-	-	-	-	2.7	0.32
5.04	-	-	-	-	-	4.9	0.14
7.03	-	-	-	-	-	6.9	0.13
9.01	-	-	-	-	-	8.7	0.31
11.03	-	-	-	-	-	10.8	0.23
13.01	-	-	-	-	-	12.5	0.51
15.03	-	-	-	-	-	14.1	0.93
17.05	-	-	-	-	-	16.4	0.65
20.02	-	-	-	-	-	19.1	0.92

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

Calibrated by :



Mr. Pasagorn Samol





## 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

### Calibration Conditions

Bar. Pressure (mm Hg): 768.1  
Ambient Temperature (°C): 25.2  
Relative Humidity (%): 51  
Altitude (m): 1.83  
Bar. Pressure Corr. (mm Hg): 767.9

### Factors/Conversions

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

### Reference Equipment

Calibration Meter Model: DGM-200H  
Cal. Due Date: 13-May-22  
Serial No.: 0000026  
Gamma: 1.0000

### UUT Meter (DGM)

Run Time (seconds)	Orifice, ΔH (mm H <sub>2</sub> O)	Volume		Meter Temperature (°C)		Meter Pressure (in H <sub>2</sub> O)	Volume (L)		Reference Meter (WTM)		Outlet Temperature (°C)	
		Initial (L)	Final (L)	Initial	Final		Initial	Final	Initial	Total	Initial	Final
Θ	P <sub>m(g)</sub>	V <sub>m(i)</sub>	V <sub>m(f)</sub>	t <sub>m(i)</sub>	t <sub>m(f)</sub>	P <sub>w</sub>	V <sub>w(i)</sub>	V <sub>w(f)</sub>	V <sub>w(i)</sub>	V <sub>w</sub>	t <sub>w(i)</sub>	t <sub>w(f)</sub>
870.00	13.00	9187.6	9348.2	24.0	24.0	0.3	0.00	156.61	0.00	156.61	24.0	24.0
630.00	25.00	9348.2	9512.2	24.0	25.0	0.5	0.00	159.97	0.00	159.97	24.0	24.0
430.00	50.00	9512.2	9678.0	25.0	26.0	0.6	0.00	162.08	0.00	162.08	24.0	24.0
360.00	80.00	9678.0	9854.8	26.0	27.0	2.0	0.00	172.97	0.00	172.97	24.0	24.0
300.00	120.00	9854.8	10035.8	27.0	28.0	2.4	0.00	178.07	0.00	178.07	24.0	24.0

### Standardized Data

Reference Meter (L)		UUT Meter (L)		Correction Factor		ΔH @ (mm H <sub>2</sub> O)	
Std. Vol.	Std. Flow	Std. Vol.	Std. Flow	Value	Variance	0.0212 SCMM	Variance
V <sub>w(std)</sub>	Q <sub>w(std)</sub>	V <sub>m(std)</sub>	V <sub>w(std)</sub>	Y	ΔY	ΔH@	ΔΔH@
156.22	10.77	160.29	10.8	0.9746	-0.0061	50.5	4.530
159.66	15.21	163.59	15.2	0.9759	-0.0048	48.8	2.809
161.80	22.58	165.23	22.6	0.9793	-0.0014	44.2	-1.740
173.26	28.88	176.10	28.9	0.9838	0.0031	43.5	-2.437
178.53	35.71	180.37	35.7	0.9898	0.0091	42.8	-3.162
		= Y Avg.		0.9807		46.0	= 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<sub>g</sub>, orifice pressure differential that equates to 0.0212m<sup>3</sup>/min at standard temperature and pressure, acceptable tolerance of individual values from the average is ±0.2 inches (5.1mm) H<sub>2</sub>O.

Pass/Fail Judgment : **Pass**

Calibrate By : *Pattanyan P.*

Approved By :

Date:

14 Jan 22

The instruments listed 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.

## Nomenclature

$P_b$  - Barometric Pressure  
DGM - Dry Gas Meter  
 $K_1$  - Constant based on standard temp and press  
 $t$  - Run time, in minutes  
 $P_m$  -  $\Delta H$  (Meter Pressure, gauge)  
 $V_m$  - Volume collected by test meter, corrected for STP  
 $Q_{m(std)}$  - Calculated flow rate of test meter  
 $K'$  - Critical orifice coefficient  
 $P_{ref}$  - Measured pressure of reference meter  
 $t_{ref}$  - Temperature measured in reference meter

## Equations

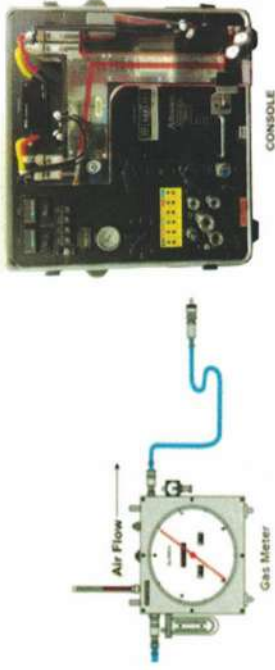
$$V_{w(std)} = Y * K_1 \frac{V_w * (P_{bar} + \frac{P_{m(g)}}{13.6})}{T_w}$$

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

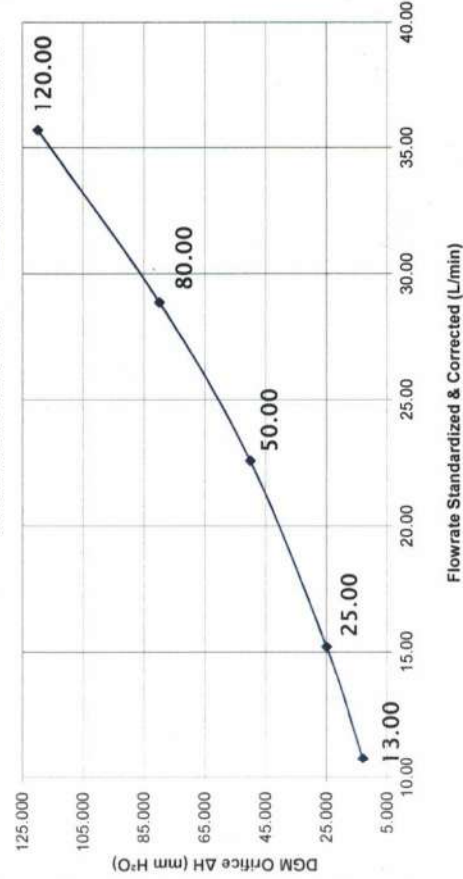
$$K_1 = \frac{T_{std}}{P_{std}} \quad Y = \frac{V_{cr(std)}}{V_m(std)} \quad Q_{w(std)} = \frac{V_{w(std)}}{\Theta}$$

$$Metric \Delta H_0 = \frac{P_{m(g)} * 0.0011606 * (P_{bar} + \frac{P_{m(g)}}{13.6})}{T_m} * \left( \frac{T_w * \Theta}{V_w * P_{bar}} \right)^2$$

## Calibration Train



Meter Pressure vs. Flowrate



Meter Gamma vs. Flowrate







## Certificate of Calibration

Method 5 Console Sensor Calibration - Metric Units

### Console Information

Model #: XC-572-V  
Serial #: A1912535  
Units: Metric

### Calibration Conditions

Pbar (mm. Hg): 768.1  
Humidity (%): 51  
Tamb (°C): 25.2  
Elevation (m): 1.8  
Corr. Pbar (mm. Hg): 767.9

### Reference Devices

TC Calibrator Model: CC-VTR-SH  
Reference #: 091109269  
Barometer Model: 736930  
Reference #: EBARODIALSPE01  
Pressure Model: 718 30G  
Reference #: 9543013

### Temperature Sensors Calibration Data

Reference Point <sup>1</sup>	Reference Temp.	Test Thermocouple Calibrations						Reference Point Status <sup>2</sup>
		Aux	Stack	Probe	Oven	Filter	Exit	
#	°C	°C	°C	°C	°C	°C	°C	Pass/Fail
1	-18	-16	-16	-17	-18	-18	-18	PASS
2	38	38	38	37	36	36	37	PASS
3	93	94	94	93	92	92	92	PASS
4	149	150	150	149	149	149	148	PASS
5	260	259	260	259	259	259	259	PASS
6	371	372	372	372	371	371	371	PASS
7	482	482	482	483	482	482	482	PASS
8	593	593	594	595	594	594	593	PASS
9	816	815	815	818	816	817	817	PASS
10	1038	1038	1038	1040	1039	1039	1038	PASS
								PASS

Overall Audit Status

### NIST Reference Thermocouple ID:

12702001

Ref Point	Theoretical Temp.	DGM Thermocouple Sensor Reading	$\Delta T_{abs}$ <sup>4</sup>
#	°C	°C	°C
Ice Water	1	0.1	0
Ambient <sup>5</sup>	2	25.2	25
Maximum <sup>6</sup>			0.04%
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:

*Pattananan P.*

Approved By:

*[Signature]*

Date:

14 Jan 22

### Notes

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

<sup>2</sup> For valid test results, the maximum difference between temperature and reference readings should be less than  $\pm 5.4$  °F ( $\pm 3$  °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  $\pm 2$  °F ( $\pm 1$  °C) from the reference reading (EPA Method 2, Section 6.3 and EPA Method 5, Sections 6.1.1, 7-6.1.1, 8)

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

<sup>4</sup> 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"

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

<sup>6</sup> For valid test results, the maximum difference between console and reference vacuum readings should be less than  $\pm 0.5$  in. Hg ( $\pm 12.5$  mm Hg)

<sup>7</sup> For valid test results, the maximum difference between console and reference vacuum readings should be less than  $\pm 0.05$  in. H<sub>2</sub>O ( $\pm 1.25$  mm H<sub>2</sub>O), or 5% of full scale



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## Console Sensor Calibration Data Sheet

### Console Information

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

### Calibration Conditions

Pbar (mm. Hg): 768.1  
Humidity (%): 51.0  
Tamb (°C): 25.2  
Corr. Pbar (mm. Hg): 767.9

### Reference Devices

TC Simulator Model: CC-VTR-SH  
Reference #: 091109269  
Barometer Model: 736930  
Reference #: EBARODIALSPE01  
Digital Pressure Calibrator Model: 718 30G  
Reference #: 9543013

### Pressure Gauge / Manometer Calibration Data

Console Vacuum Calibration			
Reference Point	Reference Vacuum	Console Vacuum	Reference Point
#	in. Hg	in. Hg	Status <sup>5</sup> Pass/Fail
1	-5.0	-5.0	PASS
2	-15.0	-15.0	PASS
3	-20.0	-20.0	PASS

Reference Point <sup>1</sup>	ΔH_Manometer Calibration			Reference Point Status <sup>2</sup> Pass/Fail
	Reference Pressure mm H <sub>2</sub> O	Positive (+) Pitot mm H <sub>2</sub> O	Negative (-) Pitot mm H <sub>2</sub> O	
#				
1	-200.000	0.0	-202.0	PASS
2	-150.000	0.0	-151.0	PASS
3	-100.000	0.0	-100.0	PASS
4	-80.000	0.0	-80.0	PASS
5	-50.000	0.0	-50.0	PASS
6	0.000	0.0	0.0	PASS
7	50.000	50.0	0.0	PASS
8	80.000	80.0	0.0	PASS
9	100.000	100.0	0.0	PASS
10	150.000	151.0	0.0	PASS
11	200.000	202.0	0.0	PASS
ΔH Overall Audit Status				PASS

Reference Point <sup>1</sup>	ΔP_Manometer Calibration			Reference Point Status <sup>2</sup> Pass/Fail
	Reference Pressure mm H <sub>2</sub> O	Positive (+) Pitot mm H <sub>2</sub> O	Negative (-) Pitot mm H <sub>2</sub> O	
#				
1	-200.000	0.0	-201.0	PASS
2	-150.000	0.0	-151.0	PASS
3	-100.000	0.0	-100.0	PASS
4	-80.000	0.0	-80.0	PASS
5	-50.000	0.0	-50.0	PASS
6	0.000	0.0	0.0	PASS
7	50.000	50.0	0.0	PASS
8	80.000	81.0	0.0	PASS
9	100.000	101.0	0.0	PASS
10	150.000	151.0	0.0	PASS
11	200.000	201.0	0.0	PASS
ΔP Overall Audit Status				PASS

Calibrate By: Pattangam P. Approved By: [Signature] Date: 14 Jan 22

### Notes

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

<sup>2</sup> 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

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

<sup>4</sup> 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"

<sup>5</sup> 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 5.1.2)

<sup>6</sup> 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)

<sup>7</sup> For valid test results, the maximum difference between console and reference vacuum readings should be less than ±0.05 in. H<sub>2</sub>O (±1.25 mm H<sub>2</sub>O), 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.



## Console Sensor Audit QA Sheet

### Meter Console Information (UUT)

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

### Calibration Conditions

Pbar (mm. Hg): 768.1  
Humidity (%): 51%  
Amb. Temp. (°C): 25.2  
Altitude (m): 1.8  
Corrected Pbar (mm. Hg): 767.9

### Reference Devices

TC Simulator Model: CC-VTR-SH  
Reference #: 91109269  
Barometer Model: 369307  
Reference #: EBARODIALSPE01  
Digital Pressure Calibrator Model: 718 30G  
Reference #: 9543013

### Audit Data

Reference Point	Reference Temp.	Thermocouple Probe Audit						Reference Point Status <sup>1</sup>
		Aux	Stack	Probe	Oven	Filter	Exit	
	°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
Ice Water	0	0	0	0	0	0	0	PASS

Console Vacuum Audit			
Reference Point	Reference Vacuum	Console Vacuum	Reference Point Status <sup>3</sup>
#	in. Hg	in. Hg	Pass/Fail
1	17.0	17.0	PASS

Calibrate By: Pattanaporn P

Approved By: [Signature]

Date: 14 Jan 22

### Notes

<sup>1</sup>For 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)

<sup>2</sup>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)

<sup>3</sup>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)

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



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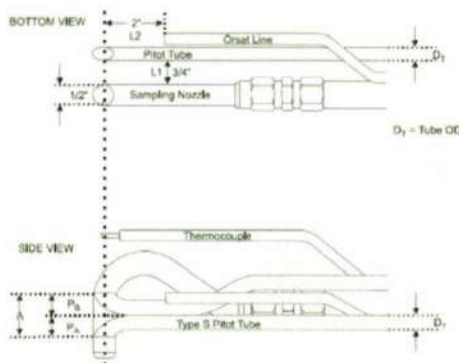
## Sampling Probe and Pitot Validation

### Sampling System Equipment Information

Probe Sheat	Apex 1 in. , 3 ft.
Probe Number	W1909281
Pitot tube Number	A8895
Pitot tube Type	S Type 3/8 Inc.
Validation method	Standard Probe 1 in. and 1/2 in. Sampling Nozzle

### Validation Conditions and Equipment

Reference No.	ET123456
Digital Calipers	Vernier ,0-200mm
Digital Inclinator	FEI 12-1057
Temperatute	25.2 °C±3
Validation Date	14 Jan 22



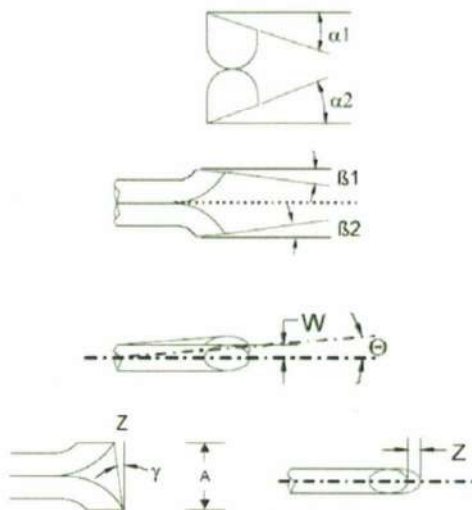
### Sampling Probe Validation with Tune up

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

Measured	Standard Range
$L_1 = 1.98 \text{ cm.}$	( 1.905 cm. or 3/4 in. )
$L_2 = 5.00 \text{ cm.}$	( 5.08 cm. or 2.0 in. )
$D_T = 0.947 \text{ cm.}$	( 3/8 in. )
$A = 2.27 \text{ cm.}$	( $2.1 D_T \leq A \leq 3D_T$ )
$A/2D_T = 1.199 \text{ cm.}$	( $1.05 P_A / D_T \leq A \leq 1.5$ )

### Pitot Tube Validations and Engles measurement Result

☒ : Measure Result after Maintanance and Adjustable



### P\_B Size

$\alpha_1 = 0.20^\circ \leq 10^\circ$

$\beta_1 = 0.70^\circ \leq 5^\circ$

### P\_A Size

$\alpha_2 = 1.20^\circ \leq 10^\circ$

$\beta_2 = 0.10^\circ \leq 5^\circ$

### Engles measurement

$W = 0.00^\circ$  0.000 cm.  $W < 0.08 \text{ cm ( 1/32 in. )}$

$Z = -0.10^\circ$  -0.004 cm.  $Z < 0.032 \text{ cm ( 1/8 in. )}$

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

Validation By:

*Pattanyan P.*

Approved By:

*[Signature]*

Date:

14 Jan 22



Neediss Supply Instrument Co., Ltd.





## Nozzle Validation

### Samplig System Equipment Information

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

### Validation Conditions

Date	14 Jan 22
Barometric Pressure	758 mm Hg
Calibration	Vernier ,0-200mm
Validation Method	US.EPA Method

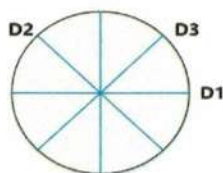
Validation Data					Results	
Nozzle ID	Nozzle Diameter				Different	$(D_1 + D_2 + D_3) / 3$
Sizes		D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	$\Delta D$	D <sub>avg</sub>
	mm	mm	mm	mm	mm	mm
4	3.17	3.17	3.16	3.17	0.006	3.167
6	4.77	4.76	4.75	4.77	0.010	4.760
8	6.35	6.35	6.35	6.35	0.000	6.350
10	7.92	7.90	7.90	7.92	0.012	7.907
12	9.52	9.52	9.53	9.53	0.006	9.527
14	11.09	11.03	11.05	11.05	0.012	11.043
16	12.70	12.70	12.73	12.72	0.015	12.717

Where :

D<sub>1</sub>, D<sub>2</sub>, D<sub>3</sub> = There difference nozzle diameters , mm ; diameter must be within 0.025 mm

$\Delta D$  = Maximum difference between any two diameters, must be  $\leq 0.100$  mm

D<sub>avg</sub> =  $(D_1 + D_2 + D_3) / 3$



Validation By:

*Pattampan P.*

Approved By:

*[Signature]*

Date:

14 Jan 22



Neediss Support Instrument Co., Ltd.