

ภาคผนวก ง.

เอกสารผลการสอบเทียบเครื่องมือตรวจวัด



บริษัท เอ็นวิล เทสติ้ง จำกัด 50/3021 ถนนวิภาวดีรังสิต แขวงจตุจักร กรุงเทพมหานคร 10160
Envilab Co., Ltd. 50/3021 Rd Bangkok 7 Bangkok Bangkok Bangkok 10160
Tel : 02-006-007-8 Fax : 02-006-0770 E-mail : info@envilab.com



Report Number: 0001/2023

TSP High Volume Sampler Calibration

Verification Report No.

B6612 -TSP 02

☐ PM ☐ Onsite

Site: บริษัท เอ็นวิล เทสติ้ง จำกัด

UTM : 47P N1514475 E654269

Sampler: ETSP#20

Recorder: ECRANG15315224

Date: 1 Dec 23

Technical: Sanayu J.

Approval: Wisan R.

CONDITIONS

Barometric Press. (hPa): 1008.4

Temperature (deg C): 32.0

Average Press. (hPa): 1013.0

Average Temp. (deg C): 30.0

Corrected Pressure (mm Hg): 756.4

Temperature (deg K): 305.0

Corrected Avg. Press. (mm Hg): 759.8

Average Temp. (deg K): 303.0

CALIBRATION ORIFICE

Brand: Tisch Environmental, Inc

Model: TE-5028A

Serial#: 1328

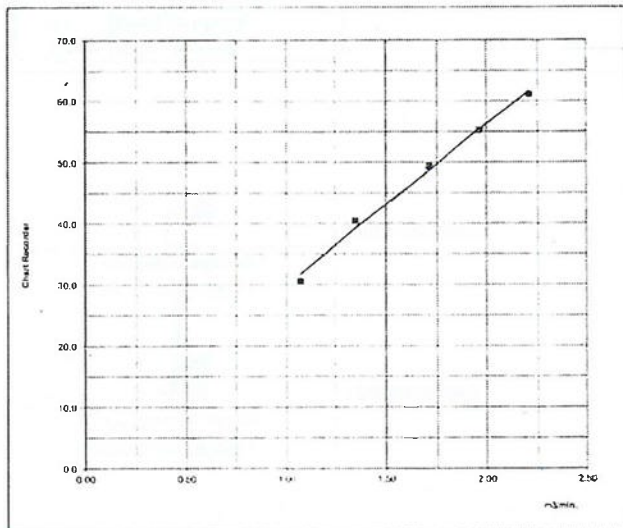
Qstd Slope: 1.63957

Qstd Intercept: -0.01202

Date Certified: 19 Jan 2023

CALIBRATIONS

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION
1	13.10	2.184	56.0	55.22	Slope = 21.0539
2	10.20	1.928	49.0	48.32	Intercept = 8.1849
3	8.10	1.719	44.0	43.39	Corr. coeff = 0.9954
4	5.10	1.366	37.0	36.49	# of Observations: 5
5	3.12	1.070	32.0	31.55	Range of Chart 32
					at 1.1 - 1.7 m3/min. 44



Calibrated by :

(Sanayu Jantason)
1 December 2023

Approved by :

(Wisan Ritthikamon)
1 December 2023

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FE-MNT-29 Rev. 00.01/08/13



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ผู้จัดการฝ่ายควบคุมคุณภาพ



บริษัท เอ็นวิลแล็บ จำกัด 360/547 หมู่ 7 ต.บ้านใหม่ อ.เมือง จ.นนทบุรี 11000
EnviLab Co., Ltd. 360/547 Th. Bangnuea 7 Bangnuea Sub-town Bangkok 11000
Tel : 02-632-3517-8 Fax : 02-632-3773 E-mail : info@evltesting.com



ผู้จัดทำรายงาน : นายสุวิทย์ วัฒนศิริ

PM10 High Volume Sampler Calibration

Verification Report No.

B6612 -PM 01

☒ PM ☐ Onsite

Site: บริษัท เอ็นวิลแล็บ จำกัด

UTM: 47P N1514475 E654269

Sampler: EPM#27

Recorder: ECRDS01618124

Date: 1 Dec 23

Technical: Sanayu J.

Approval: Wisan R.

CONDITIONS

Barometric Press. (hPa): 1008.4

Temperature (deg C): 32.0

Average Press. (hPa): 1013.0

Average Temp. (deg C): 30.0

Corrected Pressure (mm Hg): 756.4

Temperature (deg K): 305.0

Corrected Avg. Press. (mm Hg): 759.8

Average Temp. (deg K): 303.0

CALIBRATION ORIFICE

Brand: Tisch Environmental, Inc

Model: TE-5028A

Serial#: 1328

Qstd Slope: 1.02667

Qstd Intercept: -0.00753

Date Certified: 19 Jan 2023

CALIBRATIONS

Plate or Test #	H2O (in)	Qa (m3/min)	I (chart)	IC (corrected)
1	12.44	2.189	54.0	34.29
2	9.01	1.864	47.0	29.85
3	7.88	1.744	44.0	27.94
4	4.51	1.321	37.0	23.50
5	2.26	0.937	32.0	20.32

LINEAR REGRESSION

Slope = 11.0886

Intercept = 9.3161

Corr. coeff. = 0.9932

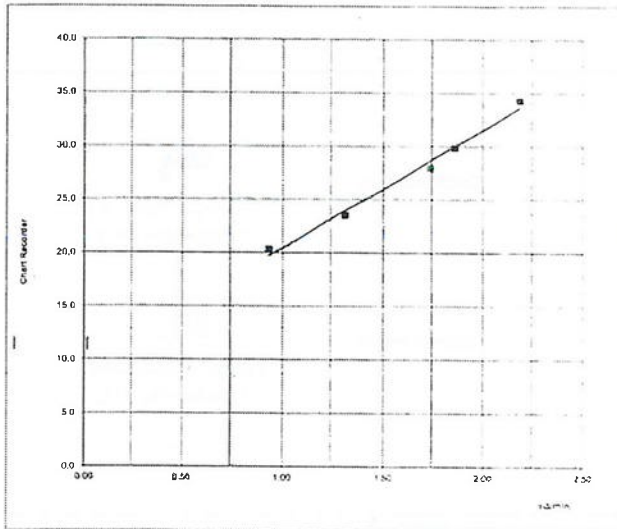
SFR = 1.143

SSP = 34.62

of Observations: 5

Range of Chart 33

at SFR $\pm 10\%$ 36



Calibrated by :

(Sanayu Jantason)
1 December 2023

Approved by :

(Wisan Ritthikamon)
1 December 2023

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FE-NHT-23 Rev.00-01/24/23



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SO₂ Analyzer Verification Test Report

Calibration Report No.: 6612004

Page:1/1

Calibrated Date: 1-Dec-23

☒ PM ☐ Onsite

Instruments Information

Analyzer Type: SO2 Analyzer	Manufacturer THERMO
Model: THERMO_43C	S/N: ESOTE43C668327

Calibration System

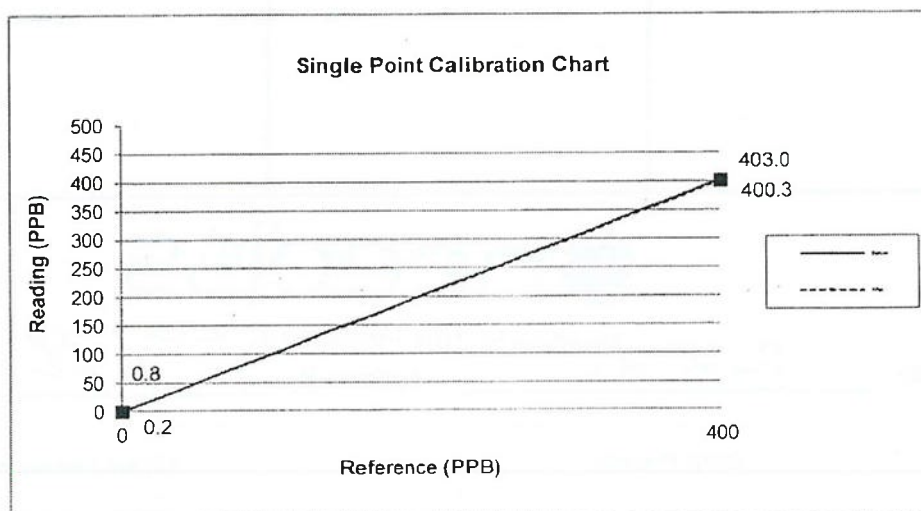
Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101	NOx Conc 46.50 PPM
S/N: 792	NO Conc 46.50 PPM
ZERO AIR Generator ZAG7001	SO2 Conc 45.59 PPM
S/N: 644	CO Conc 4507 PPM
	Expire Date: Mar 31,2026 EB0160267

Environment: Temperature 23.9 °C

Humidity: 59 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
Before	0.0	0.8	0.8	400.0	403	0.8
After	0.0	0.2	0.2	400.0	400	0.1



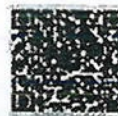
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MODEL : S02 ANALYZER Model 43C THERMO

DATE : 1-12-2023

S/N : ESOTE43C668327

Test Function Value	Before	After
Range 500 (PPB)	500	500
PMT VOLTS -450 --850 (V)	-650	-653
LAMP VOLTAGE 950 - 1,200 (V)	990	985
LAMP INTENSITY 20000 - 50000 Hz	32568	32577
INTER TEMP 15 - 45 DEG C	37	37
CHAMBER TEMP 47 - 51 C	49	49
COOLER TEMP -5 - (-2) DEG C	-2.5	-2.5
PRESSURE 400 - 1000.0 mm Hg	764	765
FLOW 0.350 - 0.650 LPM	0.42	0.4

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Neediss Supply Instrument Co., Ltd

Calibrate By :

Sirir Poonlak

Approve By :

Sarawat Keawsrinual

Sirir Poonlak

Sarawat Keawsrinual

Date:

1-Dec-23

Date:

1-Dec-23

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NOx Analyzer Verification Test Report

Calibration Report No.: 6612004
Calibrated Date: 1-Dec-23

Page:1/2

☒ PM ☐ Onsite

Instruments Information

Analyzer Type: NO/NO2/NOx Analyzer Model: 42C	Manufacturer THERMO S/N: ENOTE42CD75279
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Calibration System

Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792 ZERO AIR Generator ZAG7001 S/N: 644	NOx Conc 46.50 PPM NO Conc 46.50 PPM SO2 Conc 45.59 PPM CO Conc 4507 PPM Expire Date: Mar 31,2026 EB0160267

Environment: Temperature 24.0 °C

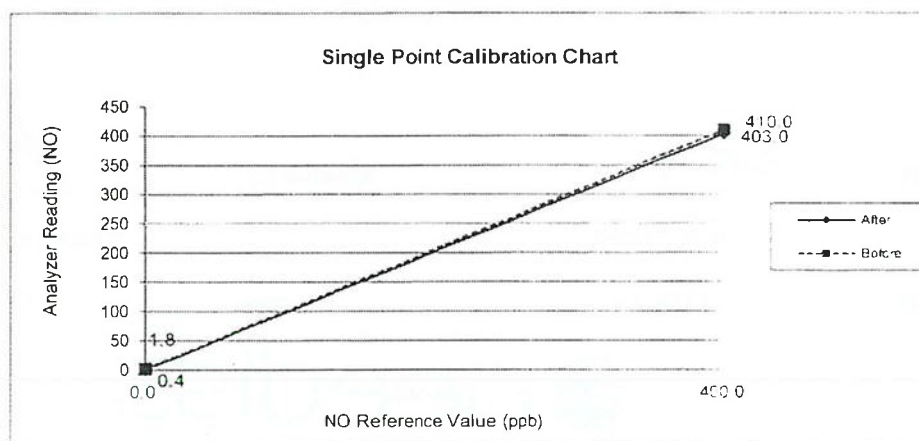
Humidity: 60 %RH

Calibration Check (Before adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	1.8	0.0	1.8	410	400.0	1.2
NO ₂	0.2	0.0	0.2	2.0	0.0	0.2
NOx	2.0	0.0	2.0	412	400.0	1.5

Calibration Check (After adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.4	0.0	0.4	403	400.0	0.4
NO ₂	0.4	0.0	0.4	2.0	0.0	0.2
NOx	0.8	0.0	0.8	405	400.0	0.6



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**neediss**บริษัท นีดีส ซัพพลาย อินสตรูเมนต์ จำกัด
Neediss Supply Instrument Co., Ltd.536 ซอยบางkhoe 7 แขวงบางkhoe เขตบางkhoe 10160 536 Soi Bangkhoe 7 Bangkhoe Bangkok Bangkok
Tel. 02-602-3980-2 Fax. 02-602-3988 E:info@neediss.com

MODEL : NOx ANALYZER Model 42C THERMO

DATE : 1-12-2023

S/N : ENOTE42CD75279

Page:2/2

Test Function Value	Before	After
Range 500 (PPB)	500	500
PMT VOLTS -450 - -850 (V)	-675	-678
LAMP VOLTAGE 950 - 1,200 (V)		
INTER TEMP 15 - 45 DEG C	43	43
CHAMBER TEMP 47 - 51 C	49	50
COOLER TEMP -5 - (-2) DEG C	-2	-2
PRESSURE 400 - 1000.0 mm Hg	350	380
SAMPLE FLOW 0.350 - 0.900 LPM	0.45	0.46
OZONEATOR FLOW 0.035 - 0.075 LPM	0.05	0.05
No/Nox BKG	12/9.0	12/9.1
No/Nox Slope	1.0/0.8	0.9/0.8

Calibrate By :

Sirir Poonlak

Approve By :

Sarawut Keawsrinual

Sirirat Poonlak

Sarawut Keawsrinual

Date:

1-Dec-23

Date:

1-Dec-23

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บริษัท เอ็นไวแล็บ จำกัด 540,540/1 ซอยบางแค 7 แขวงบางแค เขตบางแค กรุงเทพมหานคร 10160
Envilab Co., Ltd. 540,540/1 Soi Bangkhae 7 Bangkhae Bangkok Bangkok 10160
Tel : 02-802-5377-8 Fax : 02-802-3773 E-mail : info@evltesting.com



Document No.: EVL-001-001

Verification Test Report

Report No.:

CONDO -SLM 07

☒ PM

☐ Onsite UTM :

47P N 1514455 E 654248

Calibrated Date: 1 December 2023

Site : บริษัทเอ็นไวแล็บ จำกัด

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 45

Serial : 0024

Environment: Temperature 25 °C Humidity 64 %RH

Reference Standard: Acoustic Calibrator Class 1 Model 4230, Bruel&Kjaer

Serial No.1351075

Date of Calibration : 16 March 2023

Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.78	93.81	0.03	93.78

Calibrated By:

(Sanayu Jantason)

Date:

1 December 2023

Approve By:

(Wisan Ritthikamon)

Date:

1 December 2023

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EnviLab Co., Ltd. 100 หมู่ 7 ตำบล คลองเตย อำเภอ คลองเตย จังหวัด สงขลา 90100
Tel : 09-302-3577-6 Fax : 09-302-1273 E-mail : info@envilab.com



TSP High Volume Sampler Calibration

Verification Report No.

A6612 -TSP 02

<input type="checkbox"/> PM <input type="checkbox"/> Onsite	Site: บริษัท เอ็นวี เทสติ้ง จำกัด	Date: 1 Dec 23
	UTM : 47P N1514475 E654269	Technical: Sanayu J.
	Sampler: NTSP#14	Approval: Wisan R.
	Recorder: NCRT1500903158	

CONDITIONS

Barometric Press. (hPa): 1010.0	Corrected Pressure (mm Hg): 757.6
Temperature (deg C): 30.0	Temperature (deg K): 303.0
Average Press. (hPa): 1013.0	Corrected Avg. Press. (mm Hg): 759.8
Average Temp. (deg C): 30.0	Average Temp. (deg K): 303.0

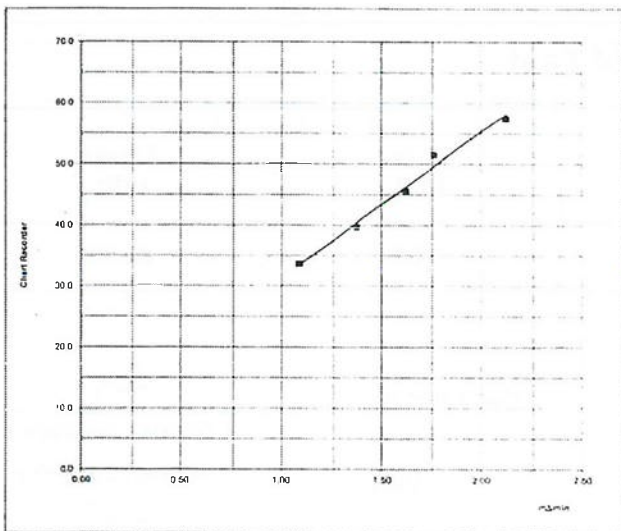
CALIBRATION ORIFICE

Brand: Tisch Environmental, Inc
Model: TE-5028A
Serial#: 1328

Qstd Slope: 1.63957
Qstd Intercept: -0.01202
Date Certified: 19 Jan 2023

CALIBRATIONS

Plate or Test #	H ₂ O (in)	Qstd (m ³ /min)	I (chart)	IC (corrected)	LINEAR REGRESSION
1	12.24	2.120	56.0	55.45	Slope = 21.9810
2	9.40	1.859	52.0	51.49	Intercept = 9.0581
3	8.12	1.728	46.0	45.55	Corr. coeff. = 0.9921
4	5.28	1.395	40.0	39.60	
5	3.32	1.108	34.0	33.66	
					# of Observations: 5
					Range of Chart at 1.1 - 1.7 m ³ /min.
					34
					46



Calibrated by :

(Sanayu Jantason)
1 December 2023

Approved by :

(Wisan Ritthikamon)
1 December 2023

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TH-VNT-29 Rev 00 01/08/63



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ผู้จัดการฝ่ายควบคุมคุณภาพ



บริษัท เอ็นวี แอล จำกัด 545/501 ถนนพหลโยธิน / แขวงจตุจักร กรุงเทพมหานคร 10160
Envilab Co., Ltd. 545/501 Soi Bangkoke / Khwaeng Jathukarn Bangkok 10160
Tel : 02-802-3577-8 Fax: 02-802-3773 E-mail : info@envilab.com



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PM10 High Volume Sampler Calibration

Verification Report No.

A6612 -PM 02

<input checked="" type="checkbox"/> PM	<input type="checkbox"/> Onsite
Site: บริษัท เอ็นวี แอล จำกัด	
UTM : 47P N1514475 E654269	
Sampler: EPM#38	
Recorder: ECRAN000052436	
Date: 1 Dec 23	
Technical: Sanayu J.	
Approval: Wisan R.	

CONDITIONS

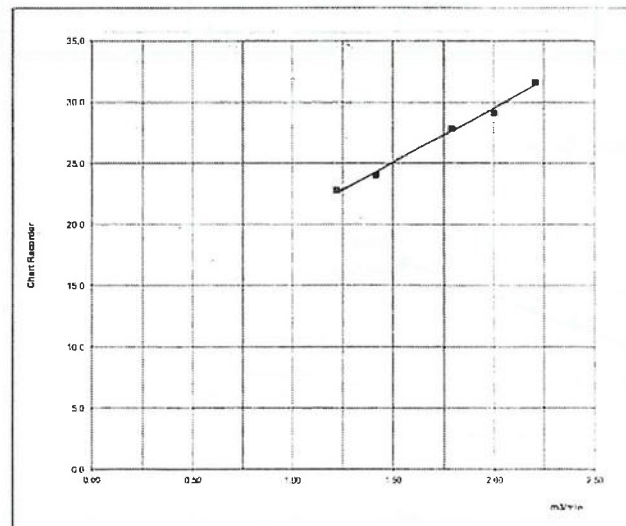
Barometric Press. (hPa): 1010.0	Corrected Pressure (mm Hg): 757.6
Temperature (deg C): 30.0	Temperature (deg K): 303.0
Average Press. (hPa): 1013.0	Corrected Avg. Press. (mm Hg): 759.8
Average Temp. (deg C): 30.0	Average Temp. (deg K): 303.0

CALIBRATION ORIFICE

Brand: Tisch Environmental, Inc	Qstd Slope: 1.02667
Model: TE-5028A	Qstd Intercept: -0.00753
Serial#: 1328	Date Certified: 19 Jan 2023

CALIBRATIONS

Plate or Test #	H2O (in)	Qa (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION
1	12.70	2.203	48.0	30.36	Slope = 7.1807
2	8.80	1.835	44.0	27.83	Intercept = 14.5552
3	6.20	1.541	40.0	25.30	Corr. coeff. = 0.9965
4	4.14	1.261	38.0	24.03	SFR = 1.133
5	2.56	0.993	34.0	21.50	SSP = 35.88
					# of Observations: 5
					Range of Chart at SFR $\pm 10\%$
					35
					37



Calibrated by :

(Sanayu Jantason)
1 December 2023

Approved by :

(Wisan Ritthikamon)
1 December 2023

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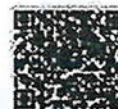
PM10 Cal. Rev. 07 / Iss. Date: Mar 17, 2020

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FE-MNT-29 Rev. 00 01/06/63



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ผู้จัดการฝ่ายควบคุมคุณภาพ



SO₂ Analyzer Verification Test Report

Calibration Report No.: 6612002

Page:1/1

Calibrated Date: 1-Dec-23

☒ PM ☐ Onsite

Instruments Information

Analyzer Type: SO2 Analyzer Model: THERMO,43C	Manufacturer THERMO S/N: ESOTE43C069865
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Calibration System

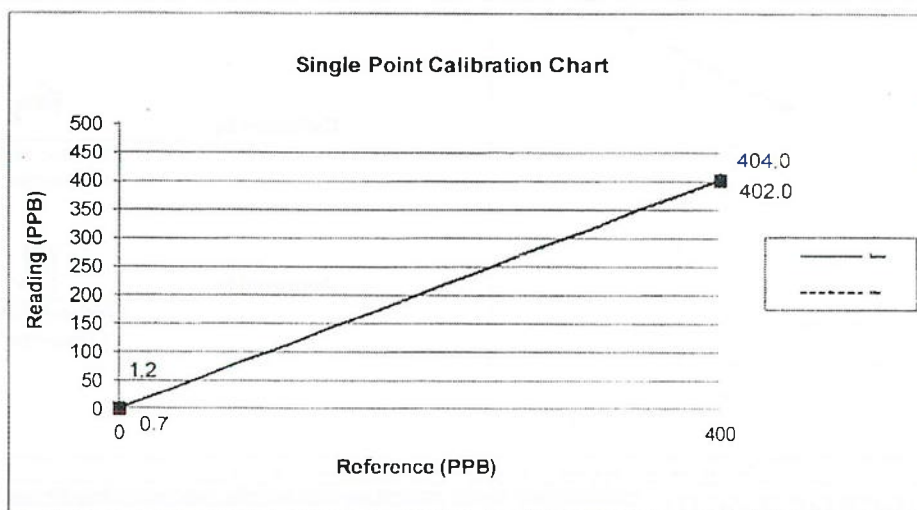
Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792 ZERO AIR Generator ZAG7001 S/N: 644	NOx Conc 46.50 PPM NO Conc 46.50 PPM SO2 Conc 45.59 PPM CO Conc 4507 PPM Expire Date: Mar 31,2026 EB0160267

Environment: Temperature 23.8 °C

Humidity: 57 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
Before	0.0	1.2	1.2	400.0	404	1.0
After	0.0	0.7	0.7	400.0	402	0.5



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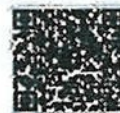
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MODEL : SO2 ANALYZER Model 43C THERMO

DATE : 1-12-2023

S/N : ESOTE43C069865

Test Function Value	Before	After
Range 500 (PPB)	500	500
PMT VOLTS -450 - -850 (V)	-650	-653
LAMP VOLTAGE 950 - 1,200 (V)	990	985
LAMP INTENSITY 20000 - 50000 Hz	32568	32577
INTER TEMP 15 - 45 DEG C	37	37
CHAMBER TEMP 47 - 51 C	49	49
COOLER TEMP -5 - (-2) DEG C	-2.5	-2.5
PRESSURE 400 - 1000.0 mm Hg	764	765
FLOW 0.350 - 0.650 LPM	0.42	0.4



Neediss Supply Instrument Co., Ltd

Calibrate By :

Sirir Poonlak

Approve By :

Sarawut Keawsrinual

Sirirat Poonlak

Sarawut Keawsrinual

Date:

1-Dec-23

Date:

1-Dec-23

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**neediss**บริษัท นีดีส ซัพพลาย อินสตรูเมนต์ จำกัด
Neediss Supply Instrument Co., Ltd.536 ซอยบางนา 7 แขวงบางนา เขตบางนา กรุงเทพมหานคร 10160 536 Soi Bangna 7 Bangnae Bangkok Bangkok
Tel. 02-802-3950-2 Fax. 02-802-3988 E: info@neediss.com

NOx Analyzer Verification Test Report

Calibration Report No.: 6612008

Calibrated Date: 1-Dec-23

Page: 1/2

☒ PM ☐ Onsite

Instruments Information

Analyzer Type: NO/NO2/NOx Analyzer
Model: 42CManufacturer THERMO
S/N: ENOTE42C304780

Calibration System

Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101	NOx Conc 46.50 PPM
S/N: 792	NO Conc 46.50 PPM
ZERO AIR Generator ZAG7001	SO2 Conc 45.59 PPM
S/N: 644	CO Conc 4507 PPM
	Expire Date: Mar 31, 2026 EB0160267

Environment: Temperature 24.1 °C

Humidity: 60 %RH

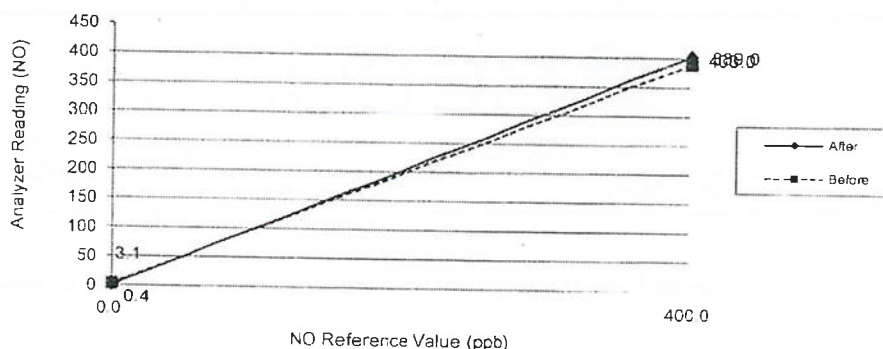
Calibration Check (Before adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	3.1	0.0	3.1	389	400.0	-1.4
NO ₂	0.4	0.0	0.4	6.0	0.0	0.8
NOx	3.5	0.0	3.5	395	400.0	-0.6

Calibration Check (After adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.4	0.0	0.4	403	400.0	0.4
NO ₂	0.4	0.0	0.4	3.0	0.0	0.4
NOx	0.8	0.0	0.8	406	400.0	0.7

Single Point Calibration Chart



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รับรองสำเนาถูกต้อง

Envilab Co., Ltd. ผู้จัดการฝ่ายควบคุมคุณภาพ



MODEL : NOx ANALYZER Model 42C THERMO

DATE : 1-12-2023

S/N : ENOTE42C304780

Page:2/2

Test Function Value	Before	After
Range 500 (PPB)	500	500
PMT VOLTS -450 - -850 (V)	-675	-678
LAMP VOLTAGE 950 - 1,200 (V)		
INTER TEMP 15 - 45 DEG C	43	43
CHAMBER TEMP 47 - 51 C	49	50
COOLER TEMP -5 - (-2) DEG C	-2	-2
PRESSURE 400 - 1000.0 mm Hg	350	380
SAMPLE FLOW 0.350 - 0.900 LPM	0.45	0.46
OZONEATOR FLOW 0.035 - 0.075 LPM	0.05	0.05
No/Nox BKG	12/9.0	12/9.1
No/Nox Slope	1.0/0.8	0.9/0.8

Calibrate By :

Sirir Poonlak

Approve By :

Sarawut Keawsrinual

Sirir Poonlak

Sarawut Keawsrinual

Date:

1-Dec-23

Date:

1-Dec-23

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Neediss Supply Instrument Co., Ltd.

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ผู้จัดการฝ่ายควบคุมคุณภาพ



บริษัท เอ็นไวแล็บ จำกัด 540,540/1 ซอยบางแค 7 แขวงบางแค เขตบางแค กรุงเทพมหานคร 10160
Envilab Co., Ltd. 540,540/1 Soi Bangkhae 7 Bangkhae Bangkok Bangkok 10160
Tel : 02-802-3777-8 Fax : 02-802-3773 E-mail : info@envilab.com



Envilab Co., Ltd. 540,540/1 Soi Bangkhae 7 Bangkhae Bangkok Bangkok 10160

Verification Test Report

Report No.:

CONDO -SLM 05

☒ PM

☐ Onsite UTM :

47P N 1514455 E 654248

Calibrated Date: 1 December 2023

Site : บริษัทเอ็นไวแล็บ จำกัด

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 45

Serial : 0018

Environment: Temperature 25 °C Humidity 64 %RH

Reference Standard: Acoustic Calibrator Class 1 Model 4230, Bruel&Kjaer

Serial No. 1351075

Date of Calibration : 16 March 2023

Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.78	93.80	0.02	93.78

Calibrated By:

(Sanayu Jantason)

Date:

1 December 2023

Approve By:

(Wisan Ritthikamon)

Date:

1 December 2023

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RECALIBRATION

DUE DATE:

January 18, 2024

Certificate of Calibration

Calibration Certification Information

Cal. Date: January 18, 2023 Rootmeter S/N: 438320 Ta: 294 °K
 Operator: Jim Tisch Pa: 750.1 mm Hg
 Calibration Model #: TE-5025A Calibrator S/N: 0759

Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H2O)
1	1	2	1	1.3960	3.2	2.00
2	3	4	1	0.9950	6.4	4.00
3	5	6	1	0.8850	8.0	5.00
4	7	8	1	0.8450	8.8	5.50
5	9	10	1	0.6990	12.8	8.00

Data Tabulation

Vstd (m3)	Qstd (x-axis)	$\sqrt{\Delta H \left(\frac{Pa}{Pstd} \right) \left(\frac{Tstd}{Ta} \right)}$ (y-axis)	Va	Qa (x-axis)	$\sqrt{\Delta H \left(\frac{Ta}{Pa} \right)}$ (y-axis)
0.9961	0.7135	1.4145	0.9957	0.7133	0.8854
0.9918	0.9968	2.0004	0.9915	0.9964	1.2521
0.9897	1.1183	2.2365	0.9893	1.1179	1.3999
0.9886	1.1700	2.3456	0.9883	1.1695	1.4683
0.9833	1.4067	2.8289	0.9829	1.4062	1.7708
QSTD	m=	2.03736	QA	m=	1.27576
	b=	-0.03733		b=	-0.02337
	r=	0.99997		r=	0.99997

Calculations

Vstd=	$\Delta Vol((Pa-\Delta P)/Pstd)(Tstd/Ta)$	Va=	$\Delta Vol((Pa-\Delta P)/Pa)$
Qstd=	$Vstd/\Delta Time$	Qa=	$Va/\Delta Time$
For subsequent flow rate calculations:			
Qstd=	$1/m \left(\left(\sqrt{\Delta H \left(\frac{Pa}{Pstd} \right) \left(\frac{Tstd}{Ta} \right)} \right) - b \right)$	Qa=	$1/m \left(\left(\sqrt{\Delta H \left(\frac{Ta}{Pa} \right)} \right) - b \right)$

Standard Conditions

Tstd:	298.15 °K
Pstd:	760 mm Hg
Key	
ΔH: calibrator manometer reading (in H2O)	
ΔP: rootmeter manometer reading (mm Hg)	
Ta: actual absolute temperature (°K)	
Pa: actual barometric pressure (mm Hg)	
b: intercept	
m: slope	

RECALIBRATION

US EPA recommends annual recalibration per 1998 40 Code of Federal Regulations Part 50 to 51, Appendix B to Part 50, Reference Method for the Determination of Suspended Particulate Matter in the Atmosphere, 9.2.17, page 30

Certificate of Calibration

Certificate No. : 66-200035-1

Page : 1 of 2

Submitted by : Envilab Co., Ltd.
540, 540/1 Soi Bangkhae 7, Bangkhae, Bangkok 10160

Equipment : Electronic Balance
Manufacturer : Sartorius **Model :** SECURA224-1S
Serial No. : 0034803270 **ID No. :** ELABBALANCEN04
Capacity : 220 g **Resolution :** 0.0001 g

Environment : On site calibration was carried out at the Balance Room, Envilab Co., Ltd.
Ambient Temperature : (23.4 to 23.7) °C
Relative Humidity : (61.4 to 62.8) %
Air Pressure : 1011.0 mbar

Date of Received : 02 February 2023

Date of Calibration : 02 February 2023

Date of Issue : 04 February 2023

Calibrated by : Akaradath Thippichai

Calibration Method : In-house method CAL-M2001 based on UKAS Publication ref : LAB 14
Edition 7 - November 2022

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

Standard Weights

ID No.	Cert. No.	Due Date	Traceability
E261-E2624	C02222.345	10 Nov 2023	National Institute of Metrology (Thailand), (NIMT)

Approved by :

(Surachai Pronthong)

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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CAL-F0031-03



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ผู้จัดการฝ่ายควบคุมคุณภาพ

CAL

Calibratech Co.,Ltd.

7/106-7 Moo 2, Sukhprachasan 3 Rd., Bangpood, Pakkred, Nonthaburi 11120

Tel.(02) 964-6211 Fax. (02) 964-5155, e-mail : calibratech.cal@yahoo.com, calibratech.cal@hotmail.com

Certificate of Calibration

Certificate No. : 66-200035-2

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)
10	0.00	0.0082
20	0.00	0.0082
50	0.00	0.0082
100	0.00	0.0082
200	0.00	0.0083
500	0.00	0.0085
1000	0.00	0.0110
1500	0.00	0.012
2000	0.00	0.012
3000	0.00	0.023

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

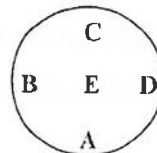
This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2.00$, providing a level of confidence of approximately 95%

Eccentric error

Load test : 1000 g

A	B	C	D	E
0.00	-0.01	0.01	0.00	0.00

g



Repeatability

Load test : 2000 g

Stdev. : 0.000 g

- o o o -

Handwritten signature





THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0123

MTC No. EEL. BP. 76/1165

CALIBRATION CERTIFICATE

Submitted by : Envilab Co.,Ltd.

Address : 540, 540/1 Soi Bangkhae 7, Bangkhae, Bangkok 10160.

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

Instrument Calibrated :

Description : Acoustic Calibrator

Manufacturer : CESVA

Model : CB011

Serial No. : T252953

Ambient Environment

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

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

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

- Standards used :
1. Digital Function Synthesizer NF Electronic DF-193A S/N 122037.
 2. Measuring Amplifier Bruel&Kjaer 2636 S/N 1537484.
 3. Programmable Attenuator Tamagawa TPA-303A S/N OF 2214.
 4. Digital Multimeter Agilent 34401A S/N MY44005560.
 5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.
 6. Audio Analyzer Panasonic VP-7722A S/N 041477D122.
 7. Condenser Microphone Bruel&Kjaer 4180 S/N 2889871.

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

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

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

Date of Receipt : 28 Nov. 2022

Date of Calibration : 2 Dec. 2022

1 / 2

The results are only valid for the item tested, calibrated or value assigned.

Advertising the Report/Certificate and publicity of the results are prohibited without written permission is obtained from the governor of TISTR.

FM.BLMTC.002 Rev.4

Head Office
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand
Tel: (66) 0 2577 9000
Fax: (66) 0 2577 9009
E-mail: tumpak@tistr.or.th Web: www.tistr.or.th

Office/Laboratory
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Samutprakan 10280, Thailand
Tel: (66) 0 2577 9000
Fax: (66) 0 2577 9009
E-mail: tumpak@tistr.or.th Web: www.tistr.or.th

Office
196 Phahonyothin Road, Chatuchak, Bangkok 10900,
Thailand
Tel: (66) 0 2577 9000
Fax: (66) 0 2577 9009
E-mail: tumpak@tistr.or.th Web: www.tistr.or.th



รับรองสำเนาถูกต้อง
ผู้จัดการฝ่ายควบคุมคุณภาพ

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0123

MTC No. EEL. BP. 76/1165

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

Nominal Output of Unit Under Test = 94 dB re 20 μ Pa at 1000 Hz

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

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	93.92	-0.08	± 0.10	± 0.40 dB

2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	1000.0	0.0	± 1.5	$\pm 1.0\%$

3. Total distortion

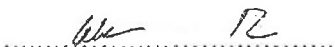
Standard Microphone Type	Measured Total distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	1.30	± 0.50	$\pm 3.0\%$

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :



(Mr. Weerachai Deechaiyae)

Approved by :


(Mr. Prawate Kluaypa)
Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 2 Dec. 2022

Date of Issue : 2 Dec. 2022

Ref : 2011265112805100001

End of Certificate

2 / 2

The results relate only to the items tested/calibrated or value assigned.

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FM.BL.MTC.002 Rev.4

Head Office

35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9900
Fax. (66) 0 2577 9909
E-mail : tistr@tistr.or.th Website: www.tistr.or.th

Office/Laboratory

Soi 10, Bangpoo Industrial Estate, Suk Jitwit Road,
Amphoe Muang, Changwat Samutprakan 10260, Thailand
Tel. (66) 0 2323 1672 ext. 115, 116
Fax. (66) 0 2323 9265
E-mail : tmlc@tistr.or.th

Office

196 Phahonyothin Road, Chatuchak, Bangkok 10900, Thailand

Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
Fax. (66) 0 2579 6552
E-mail : tistr@tistr.or.th




รับรองสำเนาถูกต้อง
ผู้จัดการฝ่ายควบคุมคุณภาพ

SINGLE-POINT CALIBRATION REPORT

Customer : Envilab
Application : AQMS AND CEMs
Location (s) : Environmental Solution Integrator Co., Ltd.

Calibration Date : 9/06/2023
Calibration Time : 14.00
Calibrated by : Environmental Solution Integrator Co., Ltd.

Gas Measurement	: CH4,HCNM,THC
Measuring Range	: 0-1000 PPM
Cylinder ID Number	: EB0109077
Certification Date	: Mar 28,2019
Expiry Date	: Mar 28,2027
K	: before calibration CH4 : 1.325
K	: after calibration CH4 : 1.395
CH4 Reading	: before calibration : 1.98
	: after calibration : 2.15

Manufacturer	
Analyzer Model	: HC51M
Serial Number	: 845
Note	: GAS METHANE CONC 454.9 PPM

Zero Calibration

Gas	Before Calibration		
	Zero Adjustment	Reading	Result
CH4	0	0	PASS
	Note		

After Calibration		
Zero Adjustment	Reading	Result
0	0	PASS
Note		

Span Calibration

Gas	Before Calibration		
	K	Reading	Result
CH4	1.325	9.52	PASS
	Note		

After Calibration		
K	Reading	Result
1.395	10.01	PASS
Note		
Expect 10.0 PPM		

Remark :

Performed by

Ta'indanti

Service Engineer

Approved by

Terada Sangthong

Service Manager

Environmental Solution Integrator Co.,Ltd.

82/42 Moo 19 Pruthamrathon Sai2 Road, Sak, Thammassop, Thua Wathana, Bangkok 10110

Phone: 0-2408-2042 • Fax: 0-2408-2043 • www.esi-thailand.com



บริษัท อีเอสไอ โซลูชันส์ จำกัด
Environmental Solution Integrator Co., Ltd.

Customer : Envilab
Application : AQMS AND CEMS
Location (s) : Environmental Solution Integrator Co., Ltd.

Equipment : HC51M
Serial Number : 845

Report Check Sheet

Job Number :
Working Date : 6/9/2023
Calibrated by : Environmental Solution Integrator Co., Ltd.

Manufacturer



Environnement S.A.

FID		
Status	Reading	Result
Sample T°	55	Passed
FID T°	153	Passed
NMHC T°	213	Passed
ZERO T°	405	Passed
CH4 REF	299.3	Passed
THC REF	283.4	Passed
CH4	2.1	Passed
THC	3.2	Passed
NMHC	1.1	Passed
Sample flow	70	Passed
Air	372	Passed
H2 P	606	Passed
Air P	1308	Passed
Sample P.	386	Passed
Signal	2313	Passed
Auto-Zero	1162.0	Passed

Mux Signals		
Status	Reading	Result
GND ((-5)-(+10)) mv	0	Passed
Int.Temp. (150-550) mv	400	Passed
H2 Press. (450-750) mv	608	Passed
Air Press. (1100-1500) mv	1308	Passed
Sample Pres (200-400) mv	385	Passed
Air Flow (3000-4600) mv	3698	Passed
Sample Flow (2500-3900) mv	3152	Passed
Signal (0-9999) mv	2307	Passed
Auto-Zero (500-1500) mv	1162	Passed
Flame (off or on) mv	9998	Passed
2V Ref (1800-2200) mv	1986	Passed
Sample Tem (750-950) mv	807	Passed
FID Temp. (880-980) mv	937	Passed
HCNM Tem (950-1050) mv	1002	Passed
ZERO Temp (1095-1195) mv	1159	Passed
Baro/Ext.	2	Passed

Offset / Conversion			
Gas	Offset	Convers	Result
THC	0	1.96	Passed
CH4	0	1	Passed
HCNM	0	0.720	Passed

Remark :

Performed by

Tai Indana

Service Engineer

Approved by

Terdaj Sangthong

Service Manager

Environmental Solution Integrator Co., Ltd.

82/42 Moo 10 Phuthamonthon Sai2 Road, Sala Thammasol, Thungyai, Nakhon Si Thammarat 90110

Phone: 0-2408-2042 = Fax: 0-2408-2043 = www.esi-thailand.co.th



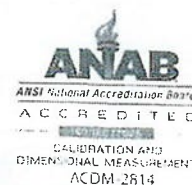
รับรองสำเนาถูกต้อง
ผู้จัดการฝ่ายควบคุมคุณภาพ



CLC
Accredited
ISO/IEC 17025

CALIBRATION LABORATORY Co., LTD.

2/10-11, 14, 56 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel. 02-578-0353-4 Fax. 02-578-2672 www.cal-laboratory.com E-mail: sale@cal-laboratory.com



Supplement to Calibration Certificate No. Q23101517

CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2601
SERIAL NO. : UM11737/UM11737 [EVMINMMATE1737]
CLID. NO. : 252301795
JOB CONTROL NO. : 230913101517

CUSTOMER : ENVILAB CO., LTD. (HEAD OFFICE)
540, 540/1 SOI BANGKHAE 7,
BANGKHAE, BANGKHAE, BANGKOK 10160

DATE OF RECEIVED : 13 September 2023

DATE OF ISSUED : 30 September 2023

Report of calibration screening must not be taken in part. Except complete. Without the approval of the Calibration Laboratory Co., Ltd.

Calibrated By : Suwit Phuanbusabong
Calibration Engineer



Approved By : Mongkol Yotsoontorn
Authorized Signatory
30 September 2023

This Calibration Certificate documents the traceability to national standards, which realize the units of measurement according to the International System of Units (SI)

Certificate No. Q23101517A1

F3-012-04/01-12



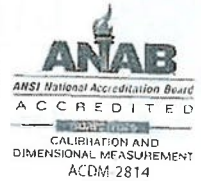
page 1 of 3

รับรองสำเนาถูกต้อง
ผู้จัดการฝ่ายควบคุมคุณภาพ



CALIBRATION LABORATORY Co., LTD.

2/10-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



REPORT OF CALIBRATION FOR

NOMENCLATURE	:	VIBRATION METER
MANUFACTURER	:	INSTANTEL
MODEL / TYPE	:	721A2601
SERIAL NO.	:	UM11737/UM11737 [EVMINMMATE1737]
DATE OF CALIBRATION	:	14 September 2023

ENVIRONMENT CONDITIONS :

Temperature : $(23 \pm 2) ^\circ\text{C}$

Relative Humidity : $(55 \pm 15) \% \text{RH}$

PROCEDURE USED :

This instrument was calibrated under procedure No. **CLC-CPEE-08** based on **ISO 16063-21** as calibration guideline.

The calibration was performed by using Digital Multimeter, Programmable Timer/Counter and Accelerometer with Conditioning Amplifier which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

1. Digital Multimeter, Hewlett Packard Model 34401A S/N. 3146A75935.
2. Programmable Timer/Counter, Philips Model PM6680B S/N. SM607101.
3. Accelerometer with Conditioning Amplifier, Bruel & Kjaer Model 8305, 2626 S/N. 705491, 1741406.

TRACEABILITY :

1. The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. EI-0136-22, Due Date 11 November 2023.
2. The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 07-0043-23, Due Date 12 April 2024.
3. The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. AV-0025-22, Due Date 12 October 2023.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2.00$ which for a normal distribution corresponds to a coverage probability of approximately 95 %. It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2022)"

Certificate No. Q23191517

13-011-04/01-12

page 2 of 3



รับรองสำเนาถูกต้อง
ผู้จัดการฝ่ายควบคุมคุณภาพ





CALIBRATION LABORATORY Co., LTD.

2/10-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

CALIBRATION DATA

VELOCITY RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm/s)	(frequency)		(mm/s)	(mm/s)	(mm/s)	± (% of rdg.)
10.000	160 Hz	peak	10.000	10.125	-0.125	1.8
20.000	160 Hz		20.000	20.156	-0.156	1.8
30.000	160 Hz		30.000	30.189	-0.189	1.8
40.000	160 Hz		40.000	40.215	-0.215	1.0
50.000	160 Hz		50.000	50.269	-0.269	1.0

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 008 Page 1 of 54

This report is valid for the above stated instrument/s only.

End of Certificate

Certificate No. Q23101517

E3-011-04/01-12

page 3 of 3



รับรองสำเนาถูกต้อง
ผู้จัดการฝ่ายควบคุมคุณภาพ



Certificate of Calibration

Certificate No. : 66-420026-1

Page : 1 of 2

Submitted by : Envilab Co., Ltd.
540,540/1 Soi Bangkhae7, Bangkhae, Bangkok 10160

Equipment : pH Meter with electrode
pH meter
Manufacturer : Horiba Model : F-74BW-G
Range : N/A pH Resolution : 0.001 pH
Serial No. : B41J0001 ID No. : ELABPHHB74BW01
Electrode
Model : 9615S Serial No. : 9X1K0003

Environment : On site calibration was carried out at the Laboratory, Envilab Co., Ltd.
Ambient Temperature : (23.8 to 24.8)^o C
Relative Humidity : (54 to 57) %

Date of Received : 23 March 2023

Date of Calibration : 23 March 2023

Date of Issue : 24 March 2023

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
400005	SG-E-00473/64	27 Aug 2023	National Institute of Metrology Thailand (NIMT)

2. Standard Buffer Solution

pH	Cert. No.	Lot No.	Exp. Date	Traceability
4.008	61270213	879344	13 Mar 2025	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
6.986	61267169	879345	13 Mar 2024	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
10.010	61260481	879346	13 Mar 2024	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025

Approved by :

(Bunjerd Masri)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 66-420026-1

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	177.5	0.0	0.12
	0.0000	7	7.00	0.0	0.0	0.086
	-177.4800	10	10.00	-177.6	0.1	0.12

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	4.008	4.006	0.002	0.0084
	6.986	7.000	-0.014	0.0094
	10.010	10.008	0.002	0.014

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%

- 000 -

(Signature)



CAL

Calibratech Co.,Ltd.

7/106-7 Moo 2, Sukhaphrachasan 3 Rd., Bangpood, Pakkred, Nonthaburi 11120

Tel.(02) 964-6211 Fax.(02) 964-5155, e-mail : calibratech.cal@yahoo.com, calibratech.cal@hotmail.com



Certificate of Calibration

Certificate No. : 66-400546-1

Page : 1 of 2

Submitted by : Envilab Co., Ltd.
540, 540/1 Soi Bangkhac 7, Bangkhac, Bangkok 10160

Equipment : Air Chamber (Incubator)
Manufacturer : M-LAB **Model :** BIC-140
Range : N/A °C **Resolution :** 0.1 °C
Serial No. : 100613-1 **ID No. :** ELABBODC140N01

Environment : On site calibration was carried out at the Laboratory, Envilab Co., Ltd.

Ambient Temperature : (25.0 to 26.0) °C

Relative Humidity : (50 to 55) %

Line Voltage : (224.0 to 225.0) V

Date of Received : 03 October 2023

Date of Calibration : 03 October 2023

Date of Issue : 06 October 2023

Calibrated by : Permpon Chanpu

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

Reference Standard Instruments : This certification is traceable to the International System of Units
Standard Digital Thermometer with RTD Probe

<u>ID No.</u>	<u>Cert. No.</u>	<u>Due Date</u>	<u>Traceability</u>
400029 & 400048	66-400454-1	05 Feb 2024	National Institute of Metrology Thailand (NIMT)

Approved by :

(Surachai Promthong)

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%.

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CAL-F0031-03



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ผู้จัดการฝ่ายควบคุมคุณภาพ

CAL

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Tel.(02) 964-6211 Fax.(02) 964-5155, e-mail : calibratech_cal@yahoo.com, calibratech_cal@hotmail.com

Certificate of Calibration

Certificate No. : 66-400546-1

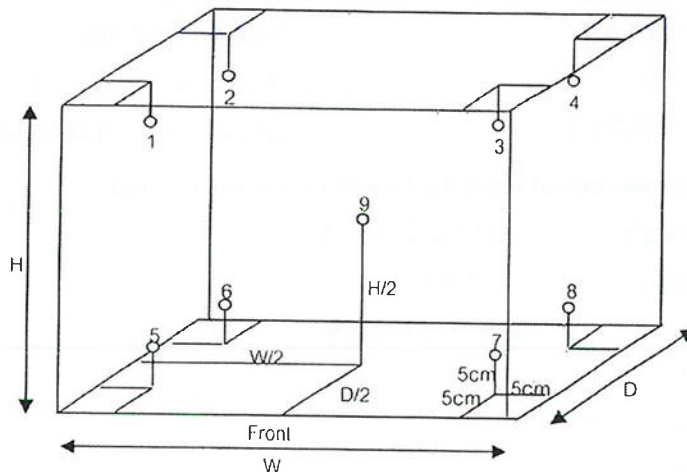
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

This instrument was setting air ventilation at position 0 (close)



Inside of Chamber

W = 0.38 m

D = 0.35 m

H = 1.15 m

Capacity = 0.15 m³

Test Point (" C)	Setting Temperature (" C)	Indicating Temperature (" C)	Measured Temperature (" C) @ Sensor No.									Uncertainty (± " C)
			1	2	3	4	5	6	7	8	9	
20.0	20.0	20.0	20.18	19.98	20.08	19.97	20.39	20.36	20.20	20.18	20.28	0.30

Test Point (" C)	Setting Temperature (" C)	Indicating Temperature (" C)	Measured Uniformity (" C)	Measured Stability (" C)	Overall Variation (" C)
20.0	20.0	20.0	0.35	0.03	0.47

Remark The uncertainty is not combine uniformity of the air chamber

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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11/10/2551



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3 : EQUIPMENT CALIBRATION AND TESTING SERVICES

534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250

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

Cert.No.: 23TW79

Page.: 1 of 2

Certificate of Testing

Equipment : DO Meter
Manufacturer : Hanna
Model : HI9146-04
Serial No. : G00007931
ID No. : ELABDOHI914601
Received Date : 17 March 2023
Test Date : 20 March 2023
Reference : 2303-0651DN-1
Submitted by : Envilab Co.,Ltd (Head office)
540, 540/1 Soi Bangkhae 7,
Bangkhae, Bangkhae, Bangkok 10160
Laboratory Condition : Temperature (25 ± 5) °C
Humidity (50 ± 20) %
Test Procedure : In - house method : CP-CH9
by Comparison Technique with Azide Modification Method
Tested by : Walalak Sirithean

Approved by :

Malee

Approved Signatory

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

Issue Date :

23 March 2023



B 0310344

รับรองสำเนาถูกต้อง
ผู้จัดการฝ่ายควบคุมคุณภาพ



Cert.No.: 23TW79

Page.: 2 of 2

Condition of this result of calibration

1. Reference Standard Instruments :

This certification is traceable to the International System of Unit through the reference standards laboratory of Industrial Calibration Center, Technology Promotion Association (Thailand-Japan).

<u>Instruments</u>	<u>Serial No.</u>	<u>ID No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1) Burette	-	130BU10	21CG1389	25 Mar 2023
2) Balance	1126143764	140RC004	22MM50	20 Sep 2023

2. Standard Material :-

<u>Material</u>	<u>Manufacturer</u>	<u>Lot.No.</u>	<u>Assay</u>
Sodium Thiosulfate pentahydrate	Merck	AM1763316	100.2%

Result : Dissolved Oxygen Meter Adjustment With Air 100 %

Dissolved Oxygen Probe No.: KC1A01TAF

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.14	8.16	0.0084

This report was certified only for the instrument we tested. It is allowable to use for study the system efficiency, The environmental impact control and present to organization it may concerned. Intend to use for advertising and referral purpose is prohibited. This report may not be reproduced other in full, without written approval of the laboratory

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ผู้จัดการฝ่ายควบคุมคุณภาพ

Certificate of Calibration

Certificate No. : 66-400056-1

Page : 1 of 2

Submitted by : Envilab Co., Ltd.

540,540/1 Soi Bangkhuae7, Bangkhuae, Bangkok 10160

Equipment : Water Bath

Manufacturer : Memmert

Model : WNB29

Range : N/A °C

Resolution : 0.1 °C

Serial No. : L617.0156

ID No. : ELABWBWNB29N01

Environment : On site calibration was carried out at the Laboratory, Envilab Co., Ltd.

Ambient Temperature : (22.5 to 23.0) °C

Relative Humidity : (45 to 50) %

Line Voltage : (224.0 to 225.0) V

Date of Received : 02 February 2023

Date of Calibration : 02 February 2023

Date of Issue : 04 February 2023

Calibrated by : Permpon Chanpu

Calibration Method : This instrument was calibrated by In-house method CAL-M4006 based on ASTM E715-80
The temperature scale used was based on ITS-90

Reference Standard Instruments : This certification is traceable to the International System of Units
Standard Digital Thermometer with RTD probe

ID No.	Cert. No.	Due Date	Traceability
400029 & 400031	65-400549-1	22 Apr 2023	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

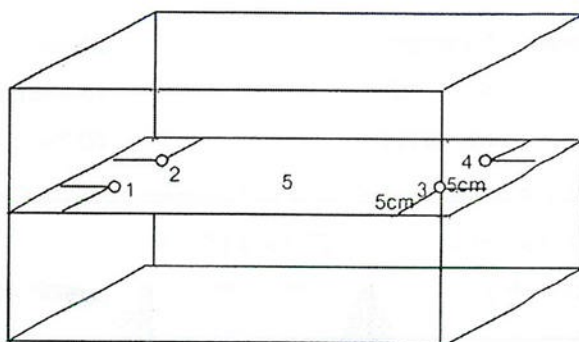
Certificate No. : 66-400056-1

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement



Front

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) @ Sensor					Uncertainty (± °C)	Measured Uniformity (°C)	Measured Stability (°C)
			No.							
			1	2	3	4	5			
95.0	95.0	95.0	95.41	95.41	95.68	95.62	95.57	0.22	0.33	0.10

Remark The uncertainty is not combine uniformity of the water bath

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. : 66-400156-2

Page : 1 of 2

Submitted by : Envilab Co., Ltd.
540, 540/1 Soi Bangkhac 7, Bangkhac, Bangkok 10160

Equipment : Air Chamber (Oven)
Manufacturer : Memmert **Model :** UF 75
Range : N/A °C **Resolution :** 0.1 °C
Serial No. : B319.0600 **ID No. :** ELABHAOVEN0600

Environment : On site calibration was carried out at the Laboratory, Envilab Co., Ltd.
Ambient Temperature : (30.0 to 30.8) °C
Relative Humidity : (60 to 65) %
Line Voltage : (224.2 to 225.2) V

Date of Received : 23 March 2023

Date of Calibration : 23 March 2023

Date of Issue : 25 March 2023

Calibrated by : Permpon Chanpu


Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

Reference Standard Instruments : This certification is traceable to the International System of Units
Standard Digital Thermometer with Thermocouple probe

ID No.	Cert. No.	Due Date	Traceability
400029 & 400030	65-400548-1	26 Apr 2023	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. : 66-400156-2

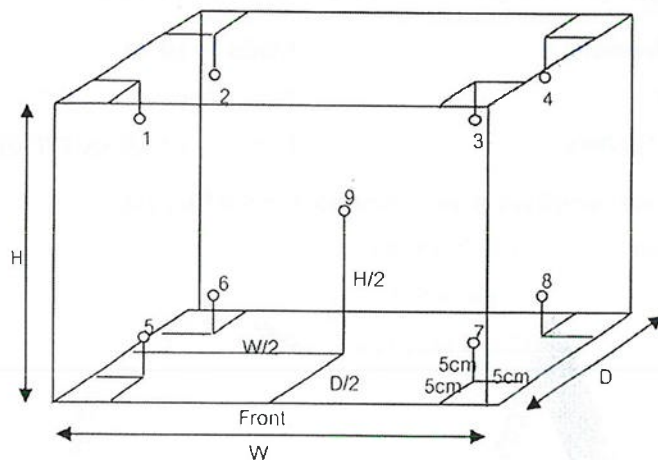
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

This instrument was setting air ventilation at position 0 (close)



Inside of Chamber

W = 0.40 m

D = 0.33 m

H = 0.56 m

Capacity = 0.07 m³

Test Point (° C)	Setting Temperature (° C)	Indicating Temperature (° C)	Measured Temperature (° C) @ Sensor No.									Uncertainty (± ° C)
			1	2	3	4	5	6	7	8	9	
104.0	103.5	103.5	104.3	104.3	104.3	104.2	104.3	104.1	103.7	104.0	104.3	0.70
110.0	109.5	109.5	110.3	110.3	110.3	110.3	110.3	110.1	109.7	110.0	110.3	0.71
180.0	179.0	179.0	179.4	180.1	180.3	180.1	180.6	179.9	179.2	179.6	180.4	0.95

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
104.0	103.5	103.5	0.7	0.1	0.8
110.0	109.5	109.5	0.8	0.1	1.0
180.0	179.0	179.0	1.4	0.2	1.5

Remark The uncertainty is not combine uniformity of the air chamber

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%

- o0o -

B.



Certificate of Calibration

Certificate No. : 66-200066-1

Page : 1 of 2

Submitted by : Envilab Co., Ltd.

540, 540/1 Soi Bangkhae7, Bangkhae, Bangkok 10160

Equipment : Electronic Balance

Manufacturer : Sartorius

Model : SECURA125-1S

Serial No. : 0034606552

ID No. : ELABBALANCEN05

Capacity : 120 g

Resolution : 0.0001 g

Environment :

On site calibration was carried out at the B304 Balance Room, Envilab Co., Ltd.

Ambient Temperature : (21.7 to 22.0) °C

Relative Humidity : (47.0 to 47.1) %

Air Pressure : (1015.0 to 1016.0) mbar

Date of Received : 01 March 2023

Date of Calibration : 01 March 2023

Date of Issue : 04 March 2023

Calibrated by : Akaradath Thippichai

Calibration Method : In-house method CAL-M2001 based on UKAS Publication ref : LAB 14
Edition 7 - November 2022

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

Standard Weights

ID No.	Cert. No.	Due Date	Traceability
E261-E2624	C02222345	10 Nov 2023	National Institute of Metrology (Thailand), (NIMT)

Approved by :



(Surachai Promthong)

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 66-200066-1

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)
0.1	0.0000	0.000083
0.5	0.0000	0.000084
1	0.0000	0.000085
2	0.0000	0.000099
5	0.0000	0.000110
10	0.0000	0.000092
20	0.0000	0.000120
50	0.0000	0.00012
100	0.0000	0.00020
120	-0.0001	0.00038

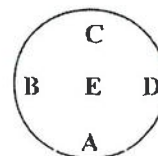
This result of calibration was found accurate as shown on date and place of calibration only.

This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2.00$, providing a level of confidence of approximately 95%

Eccentric error Load test : 20 g

A	B	C	D	E
0.0001	0.0001	0.0000	0.0000	0.0000

g



Repeatability Load test : 100 g

Stdev. : 0.00004 g

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CAL

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7/106-7 Moo 2, Sukhprachasan 3 Rd., Bangpood, Pakkred, Nonthaburi 11120

Tel.(02) 964-6211 Fax.(02) 964-5155, e-mail : calibratech.cal@yahoo.com, calibratech.cal@hotmail.com



NSC-TISI-TIS17025
CALIBRATION 0030

Certificate of Calibration

Certificate No. : 66-300140-2

Page : 1 of 2

Submitted by : Envilab Co.,Ltd.

540, 540/1 Soi Bangkhac 7, Bangkhac, Bangkok 10160

Equipment : Cylinder

Manufacturer : PYREX

Class : A

Capacity : 50 ml

Graduation : 1 ml

ID No. : C-WW-003/23

Environment : Ambient Temperature : (23 ± 2) °C

Relative Humidity : (50 ± 15) %

Air Pressure : 1009.9 mbar.

Date of Received : 15 March 2023

Date of Calibration : 20 March 2023

Date of Issue : 20 March 2023

Calibrated by : Areerat Sombun

Calibration Method : In-house method CAL-M3001 based on ASTM E 542-01

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

Electronic Balance

ID No.	Cert. No.	Due Date	Traceability
241002	65-200370-1	02 Jun 2023	National Institute of Metrology (Thailand) (NIMT)

Approved by :

(Wipa Tovadee)

Supervisor

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CAL-F0031-03



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ผู้จัดการฝ่ายควบคุมคุณภาพ



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7/106-7 Moo 2, Sukhaprachasan 3 Rd., Bangpood, Pakkred, Nonthaburi 11120

Tel.(02) 964-6211 Fax.(02) 964-5155, e-mail : calibratech.cal@yahoo.com, calibratech.cal@hotmail.com

Certificate of Calibration

Certificate No. : 66-300140-2

Page : 2 of 2

Result of Calibration : This result of true Volume is referred to standard temperature at 20 °C

UUC Condition As-Received : Good

Nominal Volume (ml)	Measuring Volume (ml)
30	29.98
50	50.12

Uncertainty of measurement with in \pm 0.054 ml

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 $k = 2.00$,
providing a level of confidence of approximately 95%

- o0o -

D.



CAL

Calibratech Co.,Ltd.

7/106-7 Moo 2, Sukhprachasan 3 Rd., Bangpood, Pakkred, Nonthaburi 11120

Tel.(02) 964-6211 Fax.(02) 964-5155, e-mail : calibratech.cal@yahoo.com, calibratech.cal@hotmail.com



Certificate of Calibration

Certificate No. : 66-300140-5

Page : 1 of 2

Submitted by : Envilab Co.,Ltd.

540, 540/1 Soi Bangkhuae 7, Bangkhuae, Bangkok 10160

Equipment : Cylinder

Manufacturer : PYREX

Class : A

Capacity : 500 ml

Graduation : 5 ml

ID No. : C-WW-006/21

Environment : Ambient Temperature : (23 ± 2) °C

Relative Humidity : (50 ± 15) %

Air Pressure : 1009.9 mbar.

Date of Received : 15 March 2023

Date of Calibration : 20 March 2023

Date of Issue : 20 March 2023

Calibrated by : Areerat Sombun

Calibration Method : In-house method CAL-M3001 based on ASTM E 542-01

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

Electronic Balance

ID No.	Cert. No.	Due Date	Traceability
241002	65-200370-1	02 Jun 2023	National Institute of Metrology (Thailand) (NIMT)

Approved by

(Wipa Tovadee)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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CAL F0031 03



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ผู้จัดการฝ่ายควบคุมคุณภาพ

CAL

Calibratech Co.,Ltd.

7/106-7 Moo 2, Sukhprachasan 3 Rd., Bangpood, Pakkred, Nonthaburi 11120

Tel.(02) 964-6211 Fax.(02) 964-5155, e-mail : calibratech.cal@yahoo.com, calibratech.cal@hotmail.com

Certificate of Calibration

Certificate No. : 66-300140-5

Page : 2 of 2

Result of Calibration : This result of true Volume is referred to standard temperature at 20 °C

UUC Condition As-Received : Good

Nominal Volume (ml)	Measuring Volume (ml)
250	250.53
500	499.90

Uncertainty of measurement with in \pm 0.12 ml

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 $k = 2.00$, providing a level of confidence of approximately 95%

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D.



TSP High Volume Sampler Calibration

Project Name	โครงการก่อสร้างอาคารที่พักกองบัญชาการกองทัพไทย	Location	กรุงเทพ	Date	March 28, 2024
Sampler Location	พื้นที่โครงการ	Sampler Number	TSP No.2	Person	Mr.Atrat Thaipradit

CALIBRATION ORIFICE

Date Certified	September 9, 2023	Make	Tisch Environmental, Inc	Intercept (b)	-0.01612
Calibration Model	TE-5025A	Calibrator Serial	0438	Slope (m)	1.18584

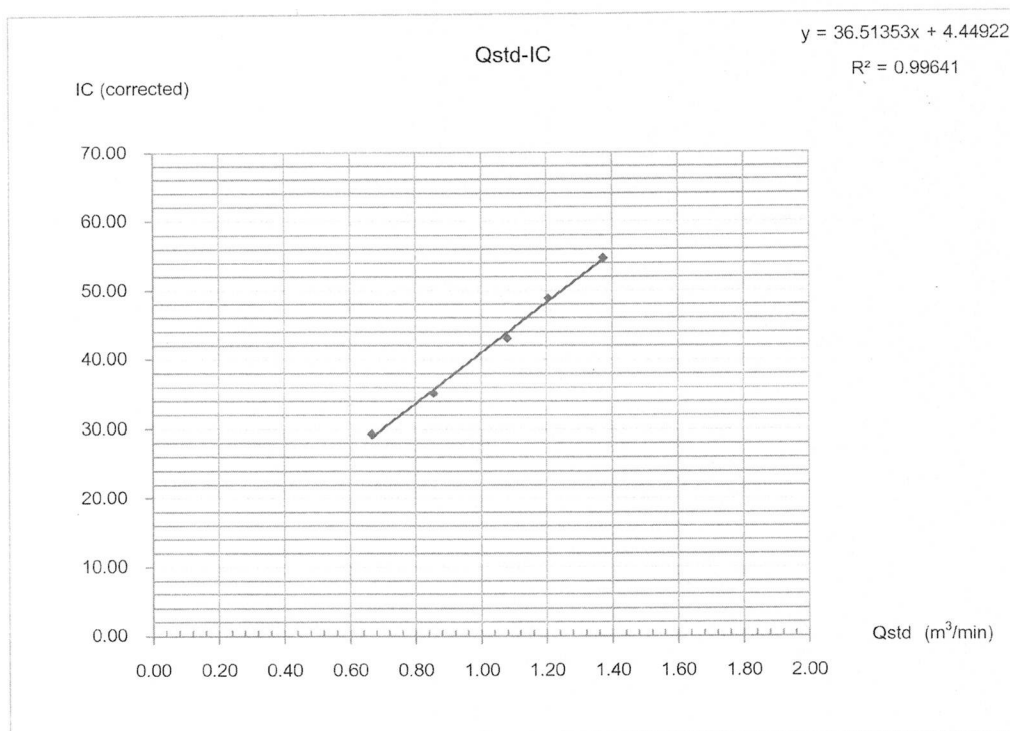
CONDITIONS

Actual Temperature (Ta) (deg C)	38	Corrected Temperature (Ta) (deg K)	311
Actual pressure (Pa)(mm Hg)	758.5	Corrected pressure (Pa)(mm Hg)	758.5
Average Temp: (Deg K)	291	Temperature (Tstd)(deg K)	298.15
Corrected Average (mm Hg)	748.8	Pressure (Pstd)(mm Hg)	760

TEST

Plate No.	H ₂ O (in)	Qstd (m ³ /min)	I (chart)	IC (corrected)
5	0.6	0.66599	30.00	29.34
7	1	0.85583	36.00	35.21
10	1.6	1.07895	44.00	43.04
13	2	1.20470	50.00	48.91
18	2.6	1.37166	56.00	54.78

LINEAR REGRESSION	
Slope	36.51353
Intercept	4.44922
Corr. Coeff (r)	0.99820
# of Observation	5
Corr. Coeff (r ²)	0.99641


 Test by : P. Pakawat

 (Mr.Pakawat Pratoomchat)
 Environmental Scientist

 Approved by : T. Atirat

 (Mr.Atirat Thaipradit)
 Environmental Monitoring Manager

PM10 High Volume Sampler Calibration

Project Name	โครงการก่อสร้างอาคารที่พักกึ่งบัญชาการกองทัพไทย	Location	กรุงเทพ	Date	March 28, 2024
Sampler Location	พื้นที่โครงการ	Sampler Number	PM10 No.2	Person	Mr.Atrat Thaipradit

CALIBRATION ORIFICE

Date Certified	September 9, 2023	Make	Tisch Environmental, Inc	Intercept (b)	-0.01612
Calibration Model	TE-5025A	Calibrator Serial	0438	Slope (m)	1.18584

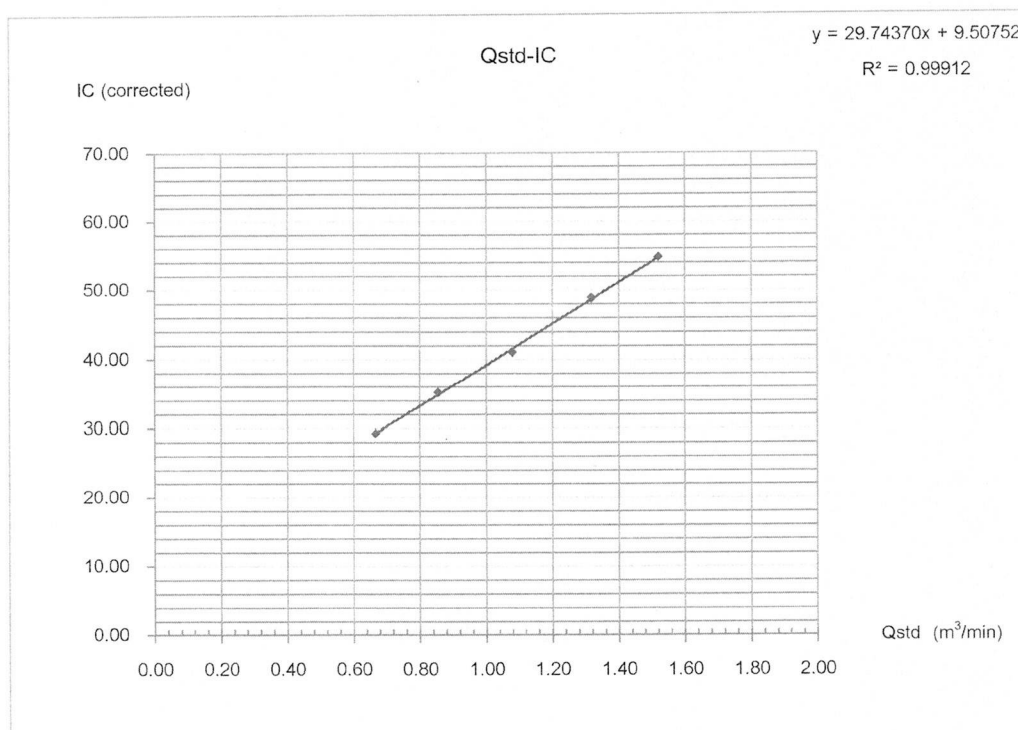
CONDITIONS


Actual Temperature (Ta) (deg C)	38	Corrected Temperature (Ta) (deg K)	311
Actual pressure (Pa)(mm Hg)	758.5	Corrected pressure (Pa)(mm Hg)	758.5
Average Temp: (Deg K)	291	Temperature (Tstd)(deg K)	298.15
Corrected Average (mm Hg)	748.8	Pressure (Pstd)(mm Hg)	760

TEST

Plate No.	H ₂ O (in)	Qstd (m ³ /min)	I (chart)	IC (corrected)
5	0.6	0.66599	30.00	29.34
7	1	0.85583	36.00	35.21
10	1.6	1.07895	42.00	41.08
13	2.4	1.31839	50.00	48.91
18	3.2	1.52024	56.00	54.78


LINEAR REGRESSION	
Slope	29.74370
Intercept	9.50752
Corr. Coeff (r)	0.99956
# of Observation	5
Corr. Coeff (r ²)	0.99912



Test by : 
 (Mr.Pakawat Pratoomchat)
 Environmental Scientist

 **Smart Envir**
 Smart Environmental Consultants Co.,Ltd.

Approved by :


 (Mr.Atirat Thaipradit)
 Environmental Monitoring Manager

TSP High Volume Sampler Calibration

Project Name	โครงการก่อสร้างอาคารที่พักกึ่งบัญชาการกองทัพไทย	Location	กรุงเทพ	Date	March 28, 2024
Sampler Location	บริเวณพื้นที่ศูนย์รักษาความปลอดภัย	Sampler Number	TSP No.1	Person	Mr.Atrat Thaipradit

CALIBRATION ORIFICE

Date Certified	September 9, 2023	Make	Tisch Environmental, Inc	Intercept (b)	-0.01612
Calibration Model	TE-5025A	Calibrator Serial	0438	Slope (m)	1.18584

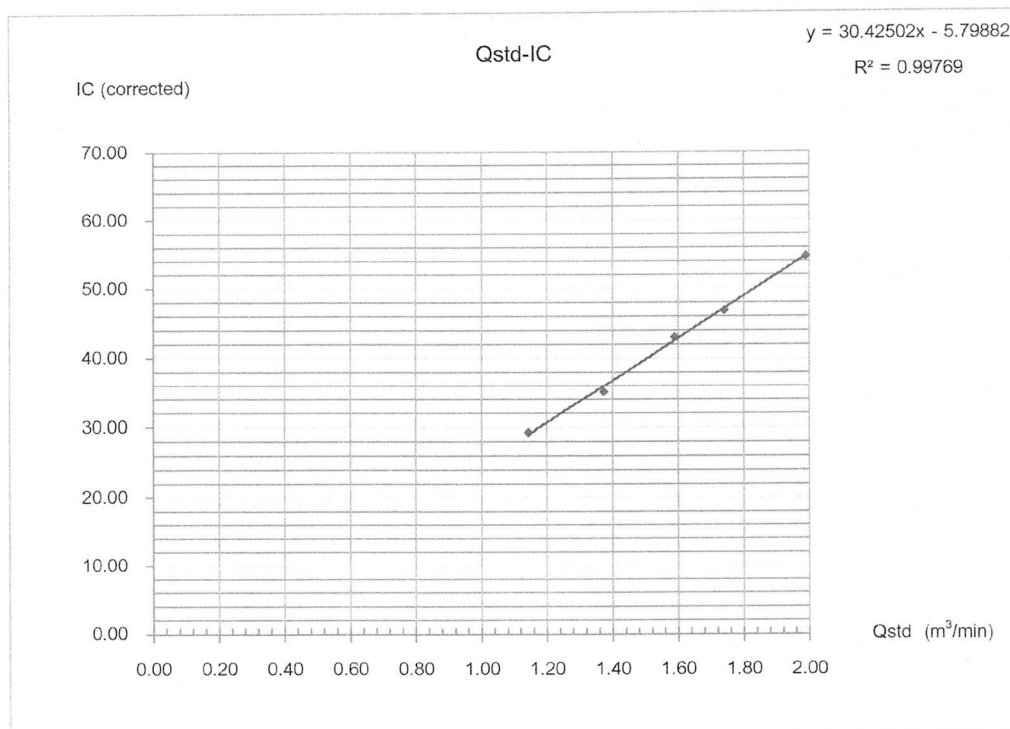
CONDITIONS

Actual Temperature (Ta) (deg C)	38	Corrected Temperature (Ta) (deg K)	311
Actual pressure (Pa)(mm Hg)	758.5	Corrected pressure (Pa)(mm Hg)	758.5
Average Temp: (Deg K)	291	Temperature (Tstd)(deg K)	298.15
Corrected Average (mm Hg)	748.8	Pressure (Pstd)(mm Hg)	760

TEST

Plate No.	H ₂ O (in)	Qstd (m ³ /min)	I (chart)	IC (corrected)
5	1.8	1.14358	30.00	29.34
7	2.6	1.37166	36.00	35.21
10	3.5	1.58928	44.00	43.04
13	4.2	1.73967	48.00	46.95
18	5.5	1.98882	56.00	54.78

LINEAR REGRESSION	
Slope	30.42502
Intercept	-5.79882
Corr. Coeff (r)	0.99884
# of Observation	5
Corr. Coeff (r ²)	0.99769


 Test by : 

 (Mr.Pakawat Pratoomchat)
 Environmental Scientist


Smart Envir
 Smart Environmental Consultants Co.,Ltd.

Approved by :



 (Mr.Atirat Thaipradit)
 Environmental Monitoring Manager

PM10 High Volume Sampler Calibration

Project Name	โครงการก่อสร้างอาคารที่พักกึ่งบัญชาการกองทัพไทย	Location	กรุงเทพ	Date	March 28, 2024
Sampler Location	บริเวณพื้นที่ศูนย์รักษาความปลอดภัย	Sampler Number	PM10 No.1	Person	Mr.Atrat Thaipradit

CALIBRATION ORIFICE

Date Certified	September 9, 2023	Make	Tisch Environmental, Inc	Intercept (b)	-0.01612
Calibration Model	TE-5025A	Calibrator Serial	0438	Slope (m)	1.18584

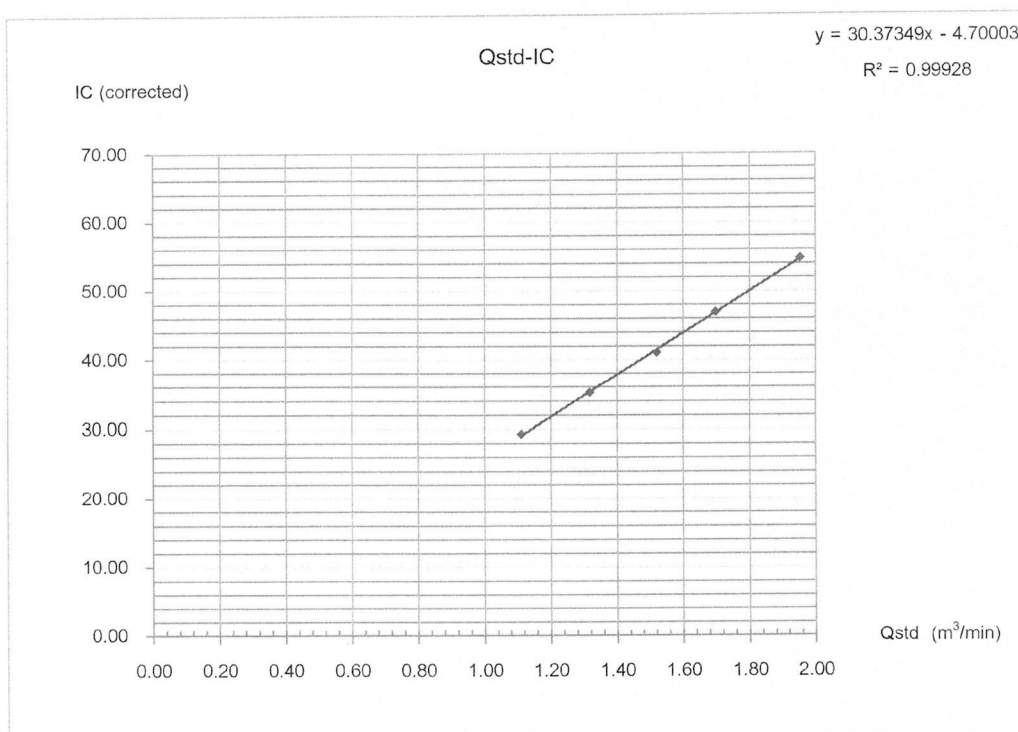
CONDITIONS


Actual Temperature (Ta) (deg C)	38	Corrected Temperature (Ta) (deg K)	311
Actual pressure (Pa)(mm Hg)	758.5	Corrected pressure (Pa)(mm Hg)	758.5
Average Temp: (Deg K)	291	Temperature (Tstd)(deg K)	298.15
Corrected Average (mm Hg)	748.8	Pressure (Pstd)(mm Hg)	760

TEST


Plate No.	H ₂ O (in)	Qstd (m ³ /min)	I (chart)	IC (corrected)
5	1.7	1.11174	30.00	29.34
7	2.4	1.31839	36.00	35.21
10	3.2	1.52024	42.00	41.08
13	4	1.69807	48.00	46.95
18	5.3	1.95257	56.00	54.78

LINEAR REGRESSION	
Slope	30.37349
Intercept	-4.70003
Corr. Coeff (r)	0.99964
# of Observation	5
Corr. Coeff (r ²)	0.99928



Test by : 
 (Mr.Pakawat Pratoomchat)
 Environmental Scientist

 **Smart Envir**
 Smart Environmental Consultants Co.,Ltd.
 Approved by :


 (Mr.Atirat Thaipradit)
 Environmental Monitoring Manager

Certificate of Calibration

Calibration Certification Information

Cal. Date: September 11, 2023

Rootsmeter S/N: 438320

Ta: 296

°K

Operator: Jim Tisch

Pa: 752.6

mm Hg

Calibration Model #: TE-5025A

Calibrator S/N: 0438

Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H2O)
1	1	2	1	1.3100	3.2	2.00
2	3	4	1	0.9240	6.4	4.00
3	5	6	1	0.8270	7.8	5.00
4	7	8	1	0.7880	8.7	5.50
5	9	10	1	0.6520	12.6	8.00

Data Tabulation

Vstd (m3)	Qstd (x-axis)	$\sqrt{\Delta H \left(\frac{Pa}{Pstd} \right) \left(\frac{Tstd}{Ta} \right)}$ (y-axis)	Va	Qa (x-axis)	$\sqrt{\Delta H \left(\frac{Ta}{Pa} \right)}$ (y-axis)
0.9927	0.7578	1.4121	0.9957	0.7601	0.8869
0.9885	1.0698	1.9970	0.9915	1.0730	1.2543
0.9866	1.1930	2.2327	0.9896	1.1967	1.4023
0.9854	1.2505	2.3416	0.9884	1.2544	1.4708
0.9803	1.5035	2.8241	0.9833	1.5081	1.7738
QSTD	m=	1.89377	QA	m=	1.18584
	b=	-0.02567		b=	-0.01612
	r=	0.99999		r=	0.99999

Calculations

Vstd= $\Delta Vol((Pa-\Delta P)/Pstd)(Tstd/Ta)$	Va= $\Delta Vol((Pa-\Delta P)/Pa)$
Qstd= $Vstd/\Delta Time$	Qa= $Va/\Delta Time$
For subsequent flow rate calculations:	
Qstd= $1/m \left(\left(\sqrt{\Delta H \left(\frac{Pa}{Pstd} \right) \left(\frac{Tstd}{Ta} \right)} \right) - b \right)$	Qa= $1/m \left(\left(\sqrt{\Delta H \left(\frac{Ta}{Pa} \right)} \right) - b \right)$

Standard Conditions

Tstd:	298.15 °K
Pstd:	760 mm Hg
Key	
ΔH: calibrator manometer reading (in H2O)	
ΔP: rootsmeter manometer reading (mm Hg)	
Ta: actual absolute temperature (°K)	
Pa: actual barometric pressure (mm Hg)	
b: intercept	
m: slope	

RECALIBRATION

US EPA recommends annual recalibration per 1998 40 Code of Federal Regulations Part 50 to 51, Appendix B to Part 50, Reference Method for the Determination of Suspended Particulate Matter in the Atmosphere, 9.2.17, page 30



S K SALES AND SERVICE CO.,LTD.

194/56, 194/57 Thakham Rd. Samae Dam

Bang Khun Thian Bangkok 10150

Tel. : 02-417-2144 Fax : 02-417-2155



Certificate of Calibration

Reference No. : C05073/2305-022 Certificate No. : S2305-2978
Customer : Smart Environmental Consultants Co.,Ltd
: 225/6 Moo3 Banchang, Mueang Pathumthani,
: Pathumthani 12000
Equipment : Electronic Balance
Manufacturer : JOANLAB
Model : FA2204
Serial No. : 1032301082
ID No. : BL001
Received Date : 16 May 2023
Calibrated Date : 16 May 2023
Issued Date : 19 May 2023

Environment	Minimum Value	Maximum Value
Ambient Temperature (°C)	30.9	31.2
Relative Humidity (% RH)	52	53
Atmospheric Pressure (mbar)	1010	1010

Place of Calibration : Production Line
Calibrated by : Mr. Kittichart Wannaros

Calibration Method

In-house method : SK-WI-08 base on UKAS Lab 14 Edition 6, July 2019

Guidance on the calibration of weighing machines used in testing and calibration laboratories

Reference standard instrument

<u>Instrument</u>	<u>ID No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
Standard Weight Set E2	MASS-WE-01	M2106171S/M2106175S	25 June 2023

Condition of this result of calibration

1. This result of calibration was found accurate as shown on date and place of calibration for this item only
2. This certificate can be traceable to International System of Unit :
 - Through Mass and scale calibration laboratory of Thai scale Co.,Ltd.

Approved by :

☒ Mr.Suphachai Saksri

☐ Mr.Phayak Tootit

☐ Miss Tantaraporn Pettong

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

Description of UUC

Capacity : 220 g

Resolution : 0.0001 g

Calibration Result

1.Repeatability of reading

Applied weight (g)	Standard Deviation of reading (g)
20	0.000053
200	0.000052

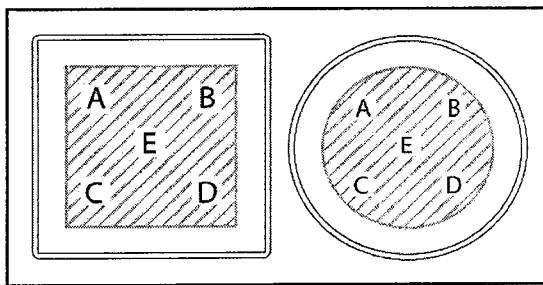
2.Departure from nominal value

Without adjustment

Applied weight (g)	Balance reading (g)	Correction (g)	Uncertainty (\pm g)
Zero setting	0.0000	0.0000	0.00010
1	1.0000	0.0000	0.00010
20	20.0001	-0.0001	0.00011
40	40.0000	0.0000	0.00013
60	60.0000	0.0000	0.00019
80	80.0001	-0.0001	0.00022
100	100.0000	0.0000	0.00018
120	120.0000	0.0000	0.00030
140	140.0000	0.0000	0.00030
160	160.0001	-0.0001	0.00031
180	180.0001	-0.0001	0.00034
200	200.0001	-0.0001	0.00039

3.Effect of off-center loading : Used weight 100 g was place to various position on the pan

Position	Balance reading (g)
E	100.0000
A	100.0001
B	100.0000
C	100.0001
D	100.0000
Maximum Difference	0.0001



** End of Calibration Report **

Personal Pump Calibration Report

Equipment Type	:	Personal Pump
Manufacturer	:	Bios
Model	:	DCL-M
Serial No.	:	107697
Equipment Range	:	0.05 – 5.0 L/min
Calibration Range	:	0.05 L/min
Calibration date	:	27 มีนาคม พ.ศ. 2567
Customer Name	:	บริษัท มิตรสิ่งแวดล้อมไทย จำกัด
Project Name	:	โครงการก่อสร้างอาคารที่พักข้าราชการกองบัญชาการกองทัพไทย พื้นที่ศูนย์รักษาความปลอดภัยของกองบัญชาการกองทัพไทย

No.	Personal Pump Serial Number	High Flow/ Low Flow	Flow (Liter per min)				Uncertainty
			1 st	2 nd	3 rd	Average	
1	QCD-1500 : 233323	0.05 L/min	0.06	0.04	0.05	0.05	±0.0100


 (Mr. Pakawat Pratoomchat)
 Environmental Scientist


 (Mr. Atirat Thaipradit)
 Environmental Monitoring Manager



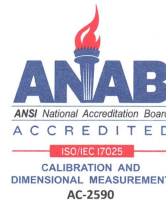


Professional Calibration & Services Co., Ltd.

50/888, 50/889 Moo 2, Rungsi-Nakornnayok Rd., Bungyeetho, Thunyaburi,
Pathumthani 12130 Thailand

Tel : (+66)2150-6641 (Autoline), (+66)2569-5158

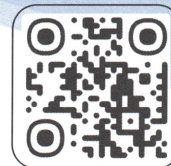
Email : info@p-cal.com www.p-cal.com



Certificate of Calibration

Certificate Number : PL27851/23
Control Number : PCAL149790
Customer Control : -
Description : Primary Flow Meter
Manufacturer : Bios
Model : DCL-M
Serial Number : 107697
Customer : Smart Environmental Consultants Co.,Ltd

Page 1 of 3



เลขที่ 225/6 หมู่ 3 ต.บ้านฉาง อ.เมืองปทุมธานี จ.ปทุมธานี 12000

Date of Receipt : 20-Jun-23
Date of Calibration : 24-Jun-23
Environment : Temperature $20^{\circ}\text{C} \pm 2^{\circ}\text{C}$
: Relative Humidity $50\% \pm 20\%$
Calibration Method : Calibration Procedure Number CP-PL78
Calibration Results : See data attached

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

This certificate is issued in accordance with ISO/IEC17025 and the conditions of accreditation granted by the Accreditation Body which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. The results relate only to the item calibrated.

This certificate shall not be reproduced other than in full except without the prior written approval of the Head of Calibration Laboratory of Professional Calibration & Services Co., Ltd.

Calibrated By

Mr. Ruttapol Thammalee

Authorized Signature

(Mr. Direk Sriphet)

27-Jun-23

Issued Date

CALIBRATION REPORT

Professional Calibration & Services Co.,Ltd.

Certificate Number : PL27851/23

Page 2 of 3

Equipment Standards Used

Description	Serial No.	Traceability to	Certificate No.	Cal. Due Date
Primary Flow Calibrator	20307-S	ANAB : AC-2487	WK2208-205-1	31-Aug-23

Condition as received : Normal

Definitions :-

* ANAB - The ANSI National Accreditation Board

CALIBRATION REPORT

Professional Calibration & Services Co., Ltd.

Certificate No. : PL27851/23

Page 3 of 3

Calibration Result

Appearance and function of use : Good

Results of Calibration: ☒ Without adjustment ☐ With adjustment

Details of Equipment: Measuring Range: 0.05 to 5 L/min Resolution: 0.0001, 0.001 L/min

Standard Value (L/min)	UUC Reading (L/min)	UUC Error (L/min)	Uncertainty (± L/min)
0.0500	0.0489	-0.0011	0.06
1.250	1.243	-0.007	0.06
2.500	2.489	-0.011	0.06
3.700	3.685	-0.015	0.06
5.000	4.981	-0.019	0.06

...End...

Analyzer Performance Test

Calibrated Date: 01 June 2023

Instruments Information

Analyzer Type : NO-NO₂-NO_x Analyzer

Manufacturer : Thermo Environmental

Model : 42C

Serial Number : 42CLS-75458-380

Calibrator Unit

Dilutor Model : Dasibi Model 5008

Serial Number : 705

ZERO AIR Generator : API MODEL 701

Serial Number : 1924

Standard Gas Concentration

Nitric Oxide (NO) 55.47 PPM

Sulphur Dioxide (SO₂) 55.11 PPM

Carbon Monoxide (CO) 4,535 PPM

Cylinder number EB0129027

Expire Date: 29 Oct. 2027

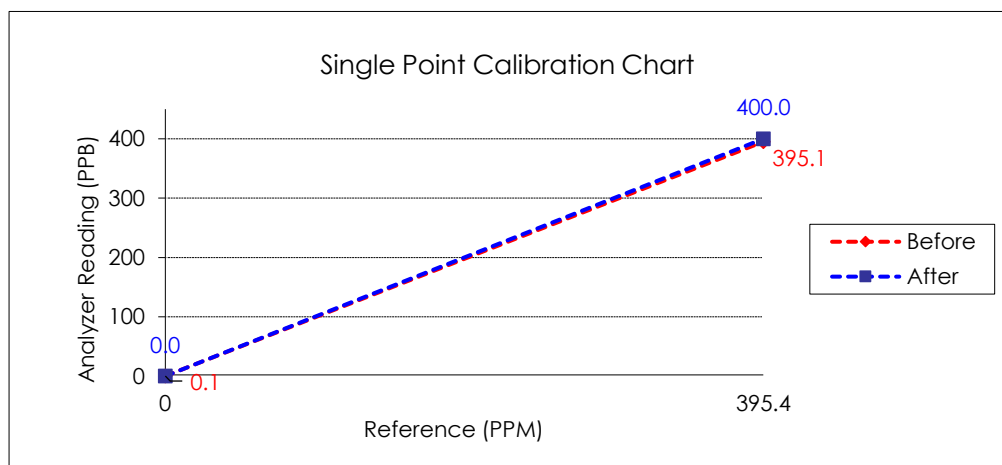
Environment : Temperature 25.5 °C Humidity: 51 %RH

Calibration Report (Before Adjust)

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
NO	0.0	0.1	0.1	400.0	395.1	-1.2
NO _x	0.0	0.0	0.0	400.0	395.4	-1.2

Calibration Report (After Adjust)

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



Calibrate By : 

MR. KITTISAK JANSANGWATTANA

Approve by :



MR. PASAGORN SAMOL

Analyzer Performance Test

Calibrated Date: 01 August 2023

Instruments Information

Analyzer Type : SO2 Analyzer

Manufacturer : Thermo Environmental

Model : 43C

Serial Number : 43C-71080-367

Calibrator Unit

Dilutor Model : Dasibi Model 5008

Serial Number : 705

ZERO AIR Generator : API MODEL 701

Serial Number : 1924

Standard Gas Concentration

Nitric Oxide (NO) 55.47 PPM

Sulphur Dioxide (SO₂) 55.11 PPM

Carbon Monoxide (CO) 4,535 PPM

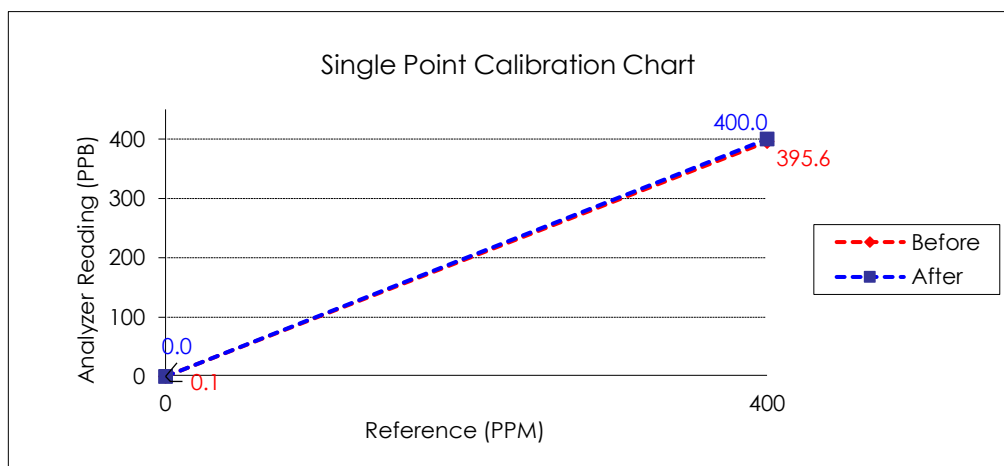
Cylinder number EB0129027

Expire Date: 29 Oct. 2027

Environment : Temperature 25.5 °C Humidity: 51 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
Before	0.0	0.1	0.1	400.0	395.6	-1.1
After	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By : กิตติศักดิ์ จันทะวงษ์
MR. KITTISAK JANSANGWATTANA

Approve by : MR. PASAGORN SAMOL

Analyzer Performance Test

Calibrated Date: 01 March 2024

Instruments Information

Analyzer Type : CO Analyzer
Model : 300E

Manufacturer : API
Serial Number : 597

Calibrator Unit

Dilutor Model : Dasibi Model 5008
Serial Number : 705
ZERO AIR Generator : API MODEL 701
Serial Number : 1924

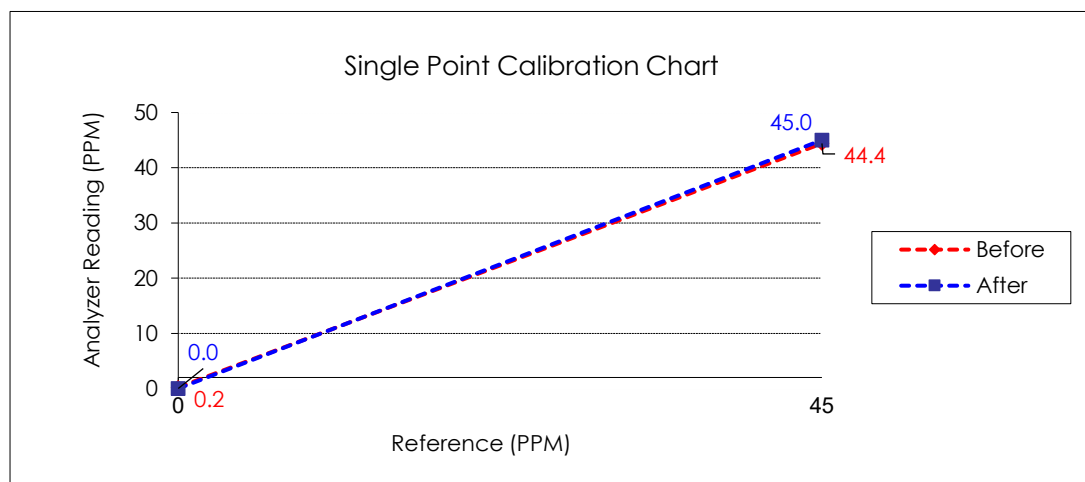
Standard Gas Concentration

Nitric Oxide (NO) 55.47 PPM
Sulphur Dioxide (SO₂) 55.11 PPM
Carbon Monoxide (CO) 4,535 PPM
Cylinder number EB0129027
Expire Date: 29 Oct. 2027

Environment : Temperature 25.5 °C Humidity: 51 %RH

Calibration Report

	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Before	0.0	0.2	0.2	45.0	44.4	-1.3
After	0.0	0.0	0.0	45.0	45.0	0.0



Calibrate By : กิตติศักดิ์ จันทะวงษ์วัฒนา
MR. KITTISAK JANSANGWATTANA

Approve by : MR. PASAGORN SAMOL

ENVIR SERVICE CO., LTD.

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

Analyzer Performance Test

Calibrated Date: 16 September 2023

Instruments Information

Analyzer Type : SO2 Analyzer

Model : 43C

Manufacturer : Thermo Environmental

Serial Number : 43C-57533-317

Calibrator Unit

Dilutor Model : Dasibi Model 5008

Serial Number : 705

ZERO AIR Generator : API MODEL 701

Serial Number : 1924

Standard Gas Concentration

Nitric Oxide (NO) 55.47 PPM

Sulphur Dioxide (SO2) 55.11 PPM

Carbon Monoxide (CO) 4,535 PPM

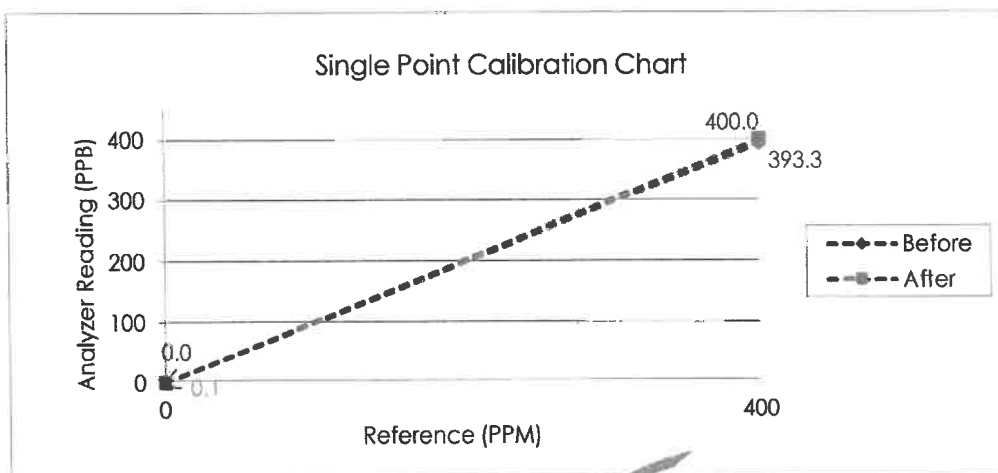
Cylinder number EB0129027

Expire Date: 29 Oct. 2027

Environment : Temperature 25.5 °C Humidity: 51 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
Before	0.0	0.1	0.1	400.0	393.3	-1.7
After	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By: กิตติศักดิ์ จันทะวงษ์

MR. KITTISAK JANSANGWATTANA บริษัท เอ็นไวร์ เซอร์วิส จำกัด

ENVIR SERVICE CO., LTD.



Approved by: MR. PASAGORN SAMOL

Analyzer Performance Test

Calibrated Date: 16 September 2023

Instruments Information

Analyzer Type : CO Analyzer

Model : 48C

Manufacturer : Thermo Environmental

Serial Number : 48C-67526-357

Calibrator Unit

Dilutor Model : Dasibi Model 5008

Serial Number : 705

ZERO AIR Generator : API MODEL 701

Serial Number : 1924

Standard Gas Concentration

Nitric Oxide (NO) 55.47 PPM

Sulphur Dioxide (SO₂) 55.11 PPM

Carbon Monoxide (CO) 4,535 PPM

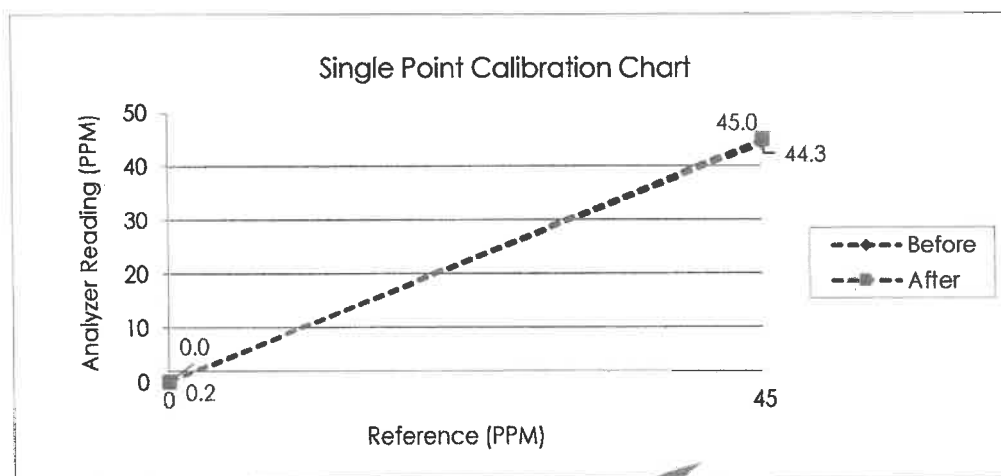
Cylinder number EB0129027

Expire Date: 29 Oct. 2027

Environment : Temperature 25.5 °C Humidity: 51 %RH

Calibration Report

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



Calibrate By: กิตติศักดิ์ จันทะนาถ

MR. KITTISAK JANSANGWATTANA



Approved by:


MR. PASAGORN SAMOL

บริษัท เอ็นไวร์ เซอร์วิส จำกัด
ENVIR SERVICE CO., LTD.

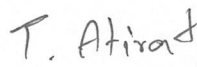
Sound Level Meter Calibration Report

Equipment Type	:	Sound Level Calibrator
Manufacturer	:	Hangzhon
Model	:	AWA6221A
Serial No.	:	AWA6221A0467E
Sound Output (dB(A))	:	94.0
Calibration date	:	27 มีนาคม พ.ศ. 2567
Customer Name	:	บริษัท มิตรสิ่งแวดล้อมไทย จำกัด
Project Name	:	โครงการก่อสร้างอาคารที่พักข้าราชการกองบัญชาการกองทัพไทย พื้นที่ศูนย์รักษาความปลอดภัยของกองบัญชาการกองทัพไทย

No.	Sound Level Meter	Serial Number	Actual Reading (dB(A))		Status
			Before	After	
1	Scarlet Model ST-21D	821001	93.6	94.0	Pass
2	Scarlet Model ST-21D	820776	93.8	94.0	Pass


 (Mr. Pakawat Pratoomchat)
 Environmental Scientist


Smart Envir
 Smart Environmental Consultants Co.,Ltd.


 (Mr. Atirat Thaipradit)
 Environmental Monitoring Manager



Professional Calibration & Services Co., Ltd.

50/888, 50/889 Moo 2, Rungsit-Nakornnayok Rd., Bungyestha, Thunyaburi,
Pathumthani 12130 Thailand
Tel : (+66)2150-6641 (Autoline), (+66)2569-5158
Email : info@p-cal.com www.p-cal.com



Certificate of Calibration

Certificate Number : EL31084/23
Control Number : PCAL150226
Customer Control : SM-SC-01
Description : Sound Calibrator
Manufacturer : Hangzhon
Model : AWA6221A
Serial Number : AWA6221A0467E
Customer : Smart Environmental Consultants Co.,Ltd

Page 1 of 3



เลขที่ 225/6 หมู่ 3 ต.บ้านฉาง อ.เมืองปทุมธานี จ.ปทุมธานี 12000

Date of Receipt : 12-Jul-23
Date of Calibration : 13-Jul-23
Environment : Temperature $23\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$
: Relative Humidity $50\text{ \%} \pm 20\text{ \%}$
Calibration Method : Calibration Procedure Number CP-EL35
Calibration Results : See data attached

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

This certificate is issued in accordance with ISO/IEC17025 and the conditions of accreditation granted by the Accreditation Body which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. The results relate only to the item calibrated.

This certificate shall not be reproduced other than in full except without the prior written approval of the Head of Calibration Laboratory of Professional Calibration & Services Co., Ltd.

Calibrated By

Mr.Nattaya Iamnarm

Authorized Signature

(Mr. Songpol Nakanurak)

13-Jul-23

Issued Date

CALIBRATION REPORT

Professional Calibration & Services Co.,Ltd.

Certificate Number : EL31084/23

Page 2 of 3

Equipment Standards Used

Description	Serial No.	Traceability to	Certificate No.	Cal. Due Date
Sound Level Meter	030606101	ANAB : AC-2590	EL09782/23	29-Mar-24
Sound Level Calibrator	141208123	NSC : Calibration 0037	EEL.BP. 16/0366	06-Mar-24

Condition as received : Normal

Definitions :-

- * ANAB - The ANSI National Accreditation Board
- * NSC - National Standardization Council of Thailand

CALIBRATION REPORT

Professional Calibration & Services Co., Ltd.

Certificate No.: EL31084/23

Page : 3 of 3

Calibration Results

Sound Calibration

UUC Setting	Measured Value	Uncertainty (\pm)	Tolerance Limit Values
94 dB	94.0 dB	0.2 dB	93.7 ~ 94.3 dB
114 dB	114.1 dB	0.2 dB	113.7 ~ 114.3 dB

Note:

- 1). Tolerances or specifications report in table above are base on the product data sheet Sound Level Calibrator AWA6221A.

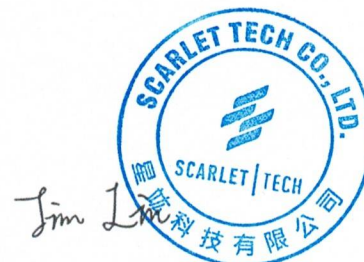
...End...

CERTIFICATE OF CALIBRATION

NO. 20230328046

Name of Product:	Sound Level Meter
Model:	ST-21D
Serial Number:	821001
Specification:	Class 2
Conclusion:	Pass
Date of calibration:	2023-04-10
Due Date:	2024-04-09

Calibrated by:



- This report certifies that all calibration equipment used in the test is traceable with the internal ISO9001 procedures and meets all specification given in the Manual(s) or respectively surpass then, and applies only to the unit identified above.
- This certificate is produced with advanced equipment & procedures which permit comprehensive quality assurance verification of all data supplied herein.
- This certificate of calibration shall not be reproduced except in full, without written permission of the Scarlet Tech Co Ltd Taiwan.

1. Preliminary inspection: OK

2. Type & serial No. of Microphone: AWA14421A-000513

3. Adjustments to indicated sound levels:

Type of Calibrator B&K 4231

Sound Pressure Level 94.0 dB

Equivalent Free-field Sound Level (reference environment conditions) 93.8 dB

4. Measuring up limit: 138 dBA

5. Frequency weightings (Acoustic signal tests for Z weighting, other electric signal tests.)

Nominal frequency /Hz	Frequency weighting / dB			Nominal frequency /Hz	Frequency weighting / dB		
	A	C	Z		A	C	Z
20	-50.5	-6.2	0.0	1000	0.1	0.1	0.1
31.5	-39.4	-3.0	0.0	2000	1.4	-0.1	0.1
63	-26.1	-0.8	0.0	4000	1.3	-0.5	0.1
125	-16.1	-0.1	0.1	8000	-1.1	-3.1	0.1
250	-8.6	0.0	0.1	12500	-10.9	-12.9	0.1
500	-3.2	0.1	0.1	/	/	/	/

6. Self-generated noise

Microphone replaced by electrical input signal device

24.4 dB(A)	25.6 dB(C)	34.9 dB(Z)
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7. F&S Weighting

Rate of the F weighting decrease (dB/s)	34.5
Rate of the S weighting decrease (dB/s)	4.2
Deviation of F&S	0.0

8. Level Linearity (A-weighting at frequency 1 kHz)

Reference sound level 90.0 dB

Max error at 10dB steps upper reference sound level 0.1 dB

Max error at 1dB steps within 5dB of the upper limit linear operating range 0.0 dB

Max error at 10dB steps below reference sound level 0.1 dB

Max error at 1dB steps within 5dB upper the lower limit linear operating range 0.1 dB

9. Tone burst response (A Weighting) :

Single Toneburst duration /ms	Toneburst response /dB			
	$L_{AFmax}-L_A$	$L_{ASmax}-L_A$	$L_{AE}-L_A$	$L_{AeqT}-L_A$
500	0.0	-4.0	-2.9	-7.0
200	-1.0	-16.9	-6.9	-7.0
2	-18.1	-26.9	-26.9	-7.0
0.25	-27.1	/	-36.0	-7.0

10. Peak C sound level (500Hz) :

Cycle	One cycle	nominal value	Positive half	nominal value	Negative half	nominal value
$LC_{peak}-LC(dB)$	3.5	3.5	2.4	2.4	2.4	2.4

11. Overload Indication: Pass

12. Statistical analysis function

Sweep signal maximum indicated sound level: 123.0 dB

Sweep amplitude: 40 dB

Scan cycle time: 60 S; Measurement period: 180 S.

Items	Measured value/dB	Theoretical calculated value/dB	Error/dB
$L_{Aeq,T}$	113.3	113.4	-0.1

L5	121.0	121.0	0.0
L10	119.0	119.0	0.0
L50	103.0	103.0	0.0
L90	87.1	87.0	0.1
L95	85.1	85.0	0.1

Uncertainty of measurement results: 0.4 dB (k=2)

Environment conditions:

Air temperature: 20 °C

Relative humidity: 50 %

Static pressure: 101.8 kPa

References:

IEC 61672-3 Sound Level Meters Part 3: Periodic tests

CERTIFICATE OF CALIBRATION

NO. 20230328042

Name of Product:	Sound Level Meter
Model:	ST-21D
Serial Number:	820776
Specification:	Class 2
Conclusion:	Pass
Date of calibration:	2023-04-10
Due Date:	2024-04-09

Calibrated by: 



- I. This report certifies that all calibration equipment used in the test is traceable with the internal ISO9001 procedures and meets all specification given in the Manual(s) or respectively surpass then, and applies only to the unit identified above.
- II. This certificate is produced with advanced equipment & procedures which permit comprehensive quality assurance verification of all data supplied herein.
- III. This certificate of calibration shall not be reproduced except in full, without written permission of the Scarlet Tech Co Ltd Taiwan.

1. Preliminary inspection: OK

2. Type & serial No. of Microphone: AWA14421A-000518

3. Adjustments to Indicated sound levels:

Type of Calibrator B&K 4231

Sound Pressure Level 94.0 dB

Equivalent Free-field Sound Level (reference environment conditions) 93.8 dB

4. Measuring up limit: 138 dBA

5. Frequency weightings (Acoustic signal tests for Z weighting, other electric signal tests.)

Nominal frequency /Hz	Frequency weighting / dB			Nominal frequency /Hz	Frequency weighting / dB		
	A	C	Z		A	C	Z
20	-50.3	-6.1	0.0	1000	0.1	0.0	0.0
31.5	-39.4	-3.0	-0.1	2000	1.3	-0.1	0.0
63	-26.2	-0.8	0.0	4000	1.3	-0.6	0.0
125	-16.2	-0.2	0.0	8000	-1.2	-3.1	0.1
250	-8.6	0.0	0.0	12500	-11.0	-13.0	0.1
500	-3.2	0.0	0.0	/	/	/	/

6. Self-generated noise

Microphone replaced by electrical input signal device

24.5 dB(A)	25.9 dB(C)	34.4 dB(Z)
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7. F&S Weighting

Rate of the F weighting decrease (dB/s)	34.5
Rate of the S weighting decrease (dB/s)	4.3
Deviation of F&S	0.0

8. Level Linearity (A-weighting at frequency 1 kHz)

Reference sound level 90.0 dB

Max error at 10dB steps upper reference sound level 0.1 dB

Max error at 1dB steps within 5dB of the upper limit linear operating range 0.0 dB

Max error at 10dB steps below reference sound level 0.1 dB

Max error at 1dB steps within 5dB upper the lower limit linear operating range 0.1 dB

9. Tone burst response (A Weighting) :

Single Toneburst duration /ms	Toneburst response /dB			
	$L_{AFmax}-L_A$	$L_{ASmax}-L_A$	$L_{AE}-L_A$	$L_{AeqT}-L_A$
500	0.0	-4.0	-2.9	-7.0
200	-1.0	-16.9	-6.9	-7.0
2	-18.1	-26.9	-26.9	-7.0
0.25	-27.2	/	-36.0	-7.0

10. Peak C sound level (500Hz) :

Cycle	One cycle	nominal value	Positive half	nominal value	Negative half	nominal value
$LC_{peak}-LC(dB)$	3.5	3.5	2.4	2.4	2.3	2.4

11. Overload Indication: Pass

12. Statistical analysis function

Sweep signal maximum indicated sound level: 123.0 dB

Sweep amplitude: 40 dB

Scan cycle time: 60 S; Measurement period: 180 S.

Items	Measured value/dB	Theoretical calculated value/dB	Error/dB
$L_{Aeq,T}$	113.3	113.4	-0.1

L5	121.0	121.0	0.0
L10	119.0	119.0	0.0
L50	103.0	103.0	0.0
L90	87.1	87.0	0.1
L95	85.1	85.0	0.1

Uncertainty of measurement results: 0.4 dB (k=2)

Environment conditions:

Air temperature: 20 °C

Relative humidity: 50 %

Static pressure: 101.8 kPa

References:

IEC 61672-3 Sound Level Meters Part 3: Periodic tests



Certificate of Calibration

Reference No. : C05073/2304-017 Certificate No. : L2304-161
Customer : บริษัท สมาร์ท เ็นไวรอนเมนทอล คอนซัลแตนท์ จำกัด Page 1 of 2

: 225/6 หมู่ที่ 3 ตำบลบ้านฉาง
: อำเภอเมืองปทุมธานี จ.ปทุมธานี 12000

Equipment : pH Meter

Manufacturer :

Model :

Serial No. :

ID No. :

Received Date : 5 April 2023

Calibrated Date : 10 April 2023

Issued Date : 20 April 2023

pH Meter	pH Electrode
EUTECH	EUTECH
pH 700	ECFC7252101B
3133752	-
-	-

Environment	Start Calibration	Stop Calibration
Ambient Temperature (°C)	20.5	20.3
Relative Humidity (% RH)	46	45

Place of Calibration : Chemical Calibration Laboratory

Calibrated by : Miss Sutida Prasansak

Calibration Method

In-house method : WI-28 based on direct measurement by using certified reference material (CRM) and standard voltage calibrator

Condition of this result of calibration

1. Reference standard material

pH Solution	Lot No.	Exp Date
1) pH Buffer Solution 4.0	754017	28 June 2023
2) pH Buffer Solution 7.0	819218	3 June 2023
3) pH Buffer Solution 10.0	863810	28 December 2023

2. Reference standard Instrument

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Multifunction Calibrator	CA 150	23M5018	23E629	16 February 2024

3. This result of calibration was found accurate as shown on date and place of calibration for this item only

4. This certificate can be traceable to International System of Unit :

- Through Technology Promotion Association (Thailand-Japan)
- Through C.P.A.Chem LTD.

Approved by :

☒ Mr.Suphachai Saksri

☐ Mr.Phayak Tootit

☐ Miss Tantaraporn Pettong

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

Calibration Result

Calibration by using standard buffer solution

Performing 3 Point calibration standard curve using buffer : 4,7,10

STD Buffer Solution (pH)	UUC Reading			UUC Error (pH)	Uncertainty (± pH)	Coverage factor k
	Before Adjust	After Adjustment				
	(pH)	(pH)	(mV)			
4.008	4.06	4.00	173.3	-0.008	0.017	2.00
6.987	7.00	6.98	-1.6	-0.007	0.017	2.00
10.015	9.96	10.01	-175.4	-0.005	0.017	2.09

Calibration by using electrical signals

Nominal Value (pH)	Standard Apply (mV)	Actual UUC Reading		Uncertainty (± mV)	Coverage factor k
		(mV)	(pH)		
0.00	414.12	414	0.00	0.58	2.00
1.00	354.96	355	1.00	0.58	2.00
2.00	295.8	296	2.00	0.58	2.00
3.00	236.64	237	3.00	0.58	2.00
4.00	177.48	177.5	4.00	0.060	2.00
5.00	118.32	118.3	5.00	0.060	2.00
6.00	59.16	59.1	6.00	0.060	2.00
7.00	0.00	0.0	7.00	0.060	2.00
8.00	-59.16	-59.2	8.00	0.060	2.00
9.00	-118.32	-118.3	9.00	0.060	2.00
10.00	-177.48	-177.5	10.00	0.060	2.00
11.00	-236.64	-237	11.00	0.58	2.00
12.00	-295.8	-296	12.00	0.58	2.00
13.00	-354.96	-355	13.00	0.58	2.00
14.00	-414.12	-414	14.00	0.58	2.00

Resolution: 0.01 For pH Function and 0.1/1 for mV Function

Slope 1 : 99.2 %

Slope 2 : 97 %

STD = Standard

UUC = Unit Under Calibration

** End of Calibration Report **





Certificate of Calibration

Reference No. : C05073/2304-017 Certificate No. : L2304-402
Customer : บริษัท สมาร์ท เ็นไวรอนเมนทอล คอนซัลแตนท์ จำกัด
: 225/6 หมู่ที่ 3 ตำบลบ้านฉาง
: อำเภอเมืองปทุมธานี จ.ปทุมธานี 12000
Equipment : Digital Thermometer
Manufacturer : EUTECH
Model : pH 700
Serial No. : 3133752
ID No. : -
Received Date : 5 April 2023
Calibrated Date : 20 April 2023
Issued Date : 20 April 2023

Environment	Minimum Value	Maximum Value
Ambient Temperature (°C)	24.6	25.2
Relative Humidity (% RH)	40	42

Place Of Calibration : Temperature Calibration Room

Calibrated by : Miss Sutida Prasansak

Calibration Method

In-house method :SK-WI-01 by comparison technique with temperature standard

Condition of this result of calibration

1. Reference standard instrument

Instrument

Model

Serial No.

Certificate No.

Due Date

1) Temperature indicator with PRT probe 282/AM1730 2502100200037 PSL-T 0522/66 26 February 2024

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

3. This certificate can be traceable to International System of Unit :

- Through Thailand Institute of Scientific And Technological Research (TISTR)

Approved by :

☒ Mr.Suphachai Saksri

☐ Mr.Phayak Tootit

☐ Miss Tantaraporn Pettong

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