



รายงานผลการปฏิบัติตามมาตรการป้องกันและแก้ไขผลกระทบสิ่งแวดล้อม และมาตรการติดตามตรวจสอบ

ผลกระทบสิ่งแวดล้อม (ระยะดำเนินการ)

โครงการทำเหมืองแร่หินอัคนี ฉบับปรับปรุงเดือนมกราคม-มิถุนายน 2567

ภาคผนวก 3-16-2

เอกสารผลการสอบเทียบเครื่องมือวัด



TSP High Volume Sampler Calibration

Verification Report No.

AO2300034-E003 -TSP 01

☐ PM ☒ Onsite

Site: บริเวณหน้าท่าเทียบเรือสินวัฒนา

UTM: 47P N 1596980 E 672458

Sampler: NTSP#21

Recorder: ECRDCPR4169240

Date: 7 Apr 24

Technical: Wuttipong K.

Approval: Wisan R.

CONDITIONS

Barometric Press. (hPa): 1002.0

Temperature (deg C): 32.0

Average Press. (hPa): 1013.0

Average Temp. (deg C): 30.0

Corrected Pressure (mm Hg): 751.6

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-5025A

Serial#: 5411

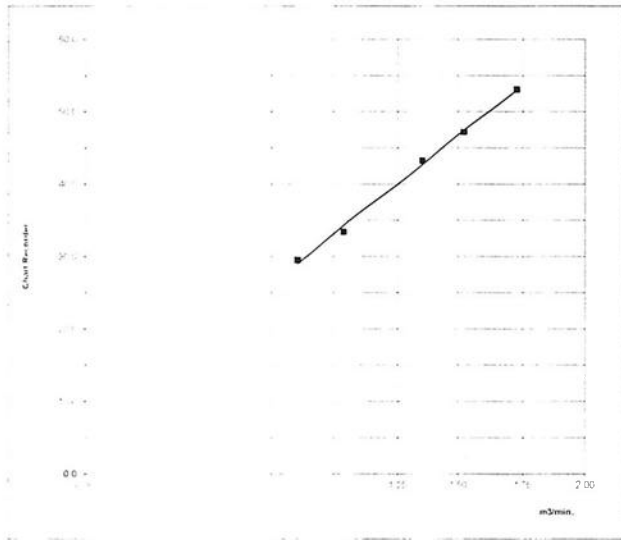
Qstd Slope: 2.02024

Qstd Intercept: -0.02667

Date Certified: 9 Feb 24

CALIBRATIONS

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION Slope = 27.3626 Intercept = 5.8094 Corr. coeff = 0.9982 # of Observations: 5 Range of Chart at 1.1 - 1.7 m3/min. 37 53
1	12.38	1.725	54.0	53.08	
2	9.61	1.522	48.0	47.18	
3	7.52	1.347	44.0	43.25	
4	4.46	1.041	34.0	33.42	
5	2.94	0.847	30.0	29.49	



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บริษัท เอ็นวิล เทสติ้ง จำกัด 440/5402 ถนนพหลโยธิน 7 แขวงจตุจักร เขตจตุจักร กรุงเทพฯ 10110
Envilab Co., Ltd. 440/5402 ถนนพหลโยธิน 7 แขวงจตุจักร เขตจตุจักร กรุงเทพฯ 10110
Tel : 02-0000-352 ext. Fax : 02-0000-352 ext. E-mail : info@evltesting.com



TSP High Volume Sampler Calibration

Verification Report No.

AO2300034-E003 -TSP 02

☐ PM ☒ Onsite

Site: บริเวณหลังท่าเทียบเรือสินวัฒนา

UTM : 47P N 1596822 E 672178

Sampler: NTSP#42

Recorder: ECRANG15315224

Date: 7 Apr 24

Technical: Wutipong K.

Approval: Wisan R.

CONDITIONS

Barometric Press. (hPa): 1002.0

Temperature (deg C): 32.0

Average Press. (hPa): 1013.0

Average Temp. (deg C): 30.0

Corrected Pressure (mm Hg): 751.6

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-5025A

Serial#: 5411

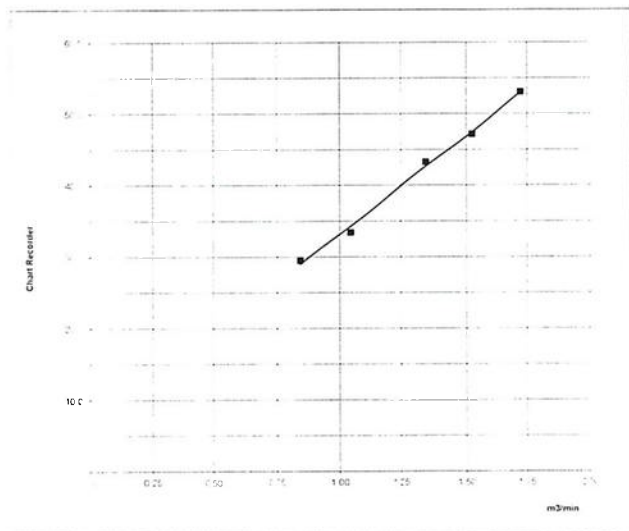
Qstd Slope: 2.02024

Qstd Intercept: -0.02667

Date Certified: 9 Feb 24

CALIBRATIONS

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION
1	12.15	1.709	54.0	53.08	Slope = 31.2531
2	9.35	1.501	50.0	49.15	Intercept = 0.9015
3	7.37	1.334	44.0	43.25	Corr. coeff.= 0.9955
4	4.62	1.059	34.0	33.42	# of Observations: 5
5	3.01	0.857	28.0	27.52	Range of Chart at 1.1 - 1.7 m3/min. 36
					54



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TSP High Volume Sampler Calibration

Verification Report No.

AO2300034-E003 -TSP 03

☐ PM ☒ Onsite

Site: โรงเรียนวัดละมุด

UTM : 47P N 1597414 E 672616

Sampler: ETSP#39

Recorder: ECRANG15315228

Date: 7 Apr 24

Technical: Wutipong K.

Approval: Wisan R.

CONDITIONS

Barometric Press. (hPa): 1006.0

Temperature (deg C): 32.0

Average Press. (hPa): 1013.0

Average Temp. (deg C): 30.0

Corrected Pressure (mm Hg): 754.6

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-5025A

Serial#: 5411

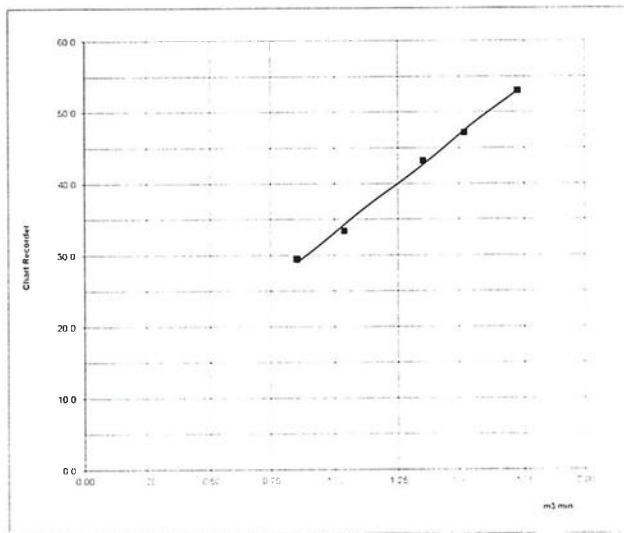
Qstd Slope: 2.02024

Qstd Intercept: -0.02667

Date Certified: 9 Feb 24

CALIBRATIONS

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION
1	12.12	1.710	54.0	53.19	Slope = 29.9074
2	10.25	1.574	50.0	49.25	Intercept = 2.1508
3	8.28	1.416	46.0	45.31	Corr. coeff. = 0.9930
4	4.51	1.049	32.0	31.52	# of Observations: 5
5	3.11	0.873	30.0	29.55	Range of Chart at 1.1 - 1.7 m3/min. 36
					53



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FE-MNT-27 Rev.00 (01/06/63)

EnviLab Co., Ltd.



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Tel: 02-002-3576-9 Fax: 02-002-3773 E-mail: info@evltesting.com



TSP High Volume Sampler Calibration

Verification Report No.

A02300034-E003 -TSP 04

☐ PM ☒ Onsite

Site: บริเวณชุมชนหมู่ที่ 6 บ้านหัวโคก

UTM: 47P N 1596867 E 671686

Sampler: ETSP#30

Recorder: ECRANG15315274

Date: 7 Apr 24

Technical: Wuttipong K.

Approval: Wisan R.

CONDITIONS

Barometric Press. (hPa): 1008.0

Temperature (deg C): 32.0

Average Press. (hPa): 1013.0

Average Temp. (deg C): 30.0

Corrected Pressure (mm Hg): 756.1

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-5025A

Serial#: 5411

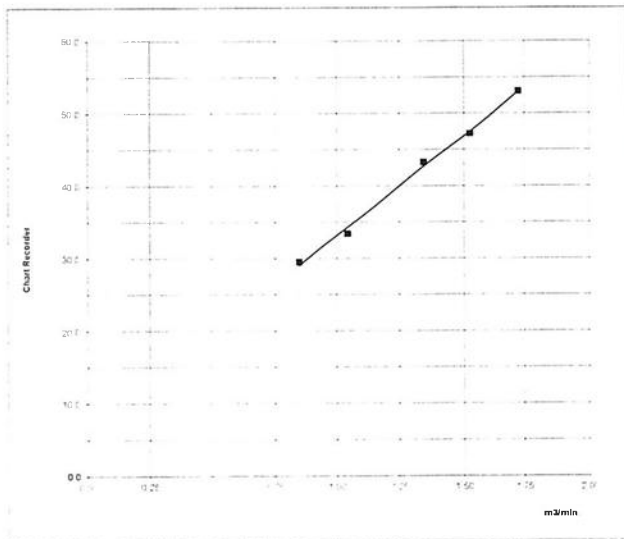
Qstd Slope: 2.02024

Qstd Intercept: -0.02667

Date Certified: 9 Feb 24

CALIBRATIONS

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION Slope = 30.1235 Intercept = 1.7893 Corr. coeff = 0.9965 # of Observations: 5 Range of Chart at 1.1 - 1.7 m3/min.
1	12.52	1.740	56.0	55.21	
2	10.43	1.589	50.0	49.29	
3	8.35	1.423	44.0	43.38	
4	4.37	1.033	34.0	33.52	
5	3.46	0.921	30.0	29.58	



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Tel: 02-802-3577-8 Fax: 02-802-3773 E-mail: info@evltesting.com



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TSP High Volume Sampler Calibration

Verification Report No.

AO2300034-E003 -TSP 05

☒ PM ☐ Onsite

Site: บ้านเกาะกลางน้ำ หมู่ 1 บ้านเกาะปากจั่น

UTM : 47P N 1596484 E 672426

Sampler: ETSP#29

Recorder: ECRANG15315321

Date: 7 Apr 24

Technical: Wutipong K.

Approval: Wisan R.

CONDITIONS

Barometric Press. (hPa): 1001.0

Temperature (deg C): 34.0

Average Press. (hPa): 1013.0

Average Temp. (deg C): 30.0

Corrected Pressure (mm Hg): 750.8

Temperature (deg K): 307.0

Corrected Avg. Press. (mm Hg): 759.8

Average Temp. (deg K): 303.0

CALIBRATION ORIFICE

Brand: Tisch Environmental, Inc

Model: TE-5025A

Serial#: 5411

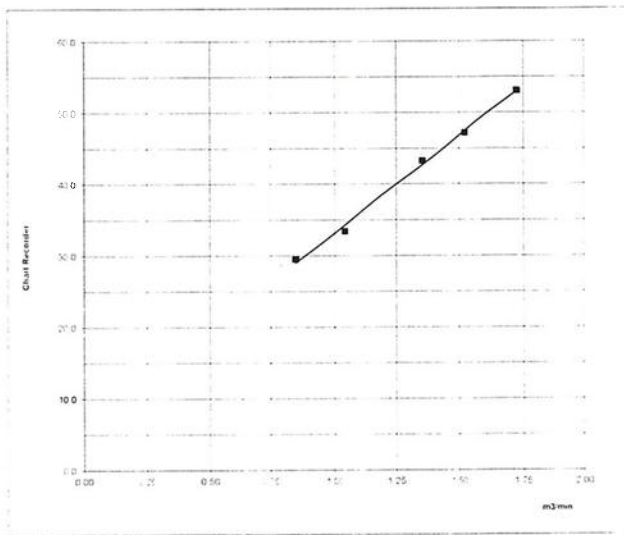
Qstd Slope: 2.02024

Qstd Intercept: -0.02667

Date Certified: 9 Feb 24

CALIBRATIONS

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION Slope = 29.1731 Intercept = 5.4492 Corr. coeff. = 0.9972 # of Observations: 5 Range of Chart at 1.1 - 1.7 m3/min. 39 56
1	11.76	1.675	56.0	54.84	
2	10.65	1.595	52.0	50.92	
3	7.39	1.331	46.0	45.05	
4	4.91	1.087	38.0	37.21	
5	3.32	0.896	32.0	31.34	



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TE MNT 27 Rev.00 (01/05/63)



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Tel: 02-1007-3773 Fax: 02-3773-3773 E-mail: info@evltesting.com



Source: EVL Calibration

PM10 High Volume Sampler Calibration

Verification Report No.

AO2300034-E003 -PM 01

☒ PM ☐ Onsite

Site: บริเวณหน้าท่าเทียบเรือสินวัฒนา

UTM: 47P N 1596980 E 672458

Sampler: NPM#18

Recorder: ECRDS01618124

Date: 7 Apr 24

Technical: Wutipong K.

Approval: Wisan R.

CONDITIONS

Barometric Press. (hPa): 1002.0

Temperature (deg C): 32.0

Average Press. (hPa): 1013.0

Average Temp. (deg C): 30.0

Corrected Pressure (mm Hg): 751.6

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-5025A

Serial#: 5411

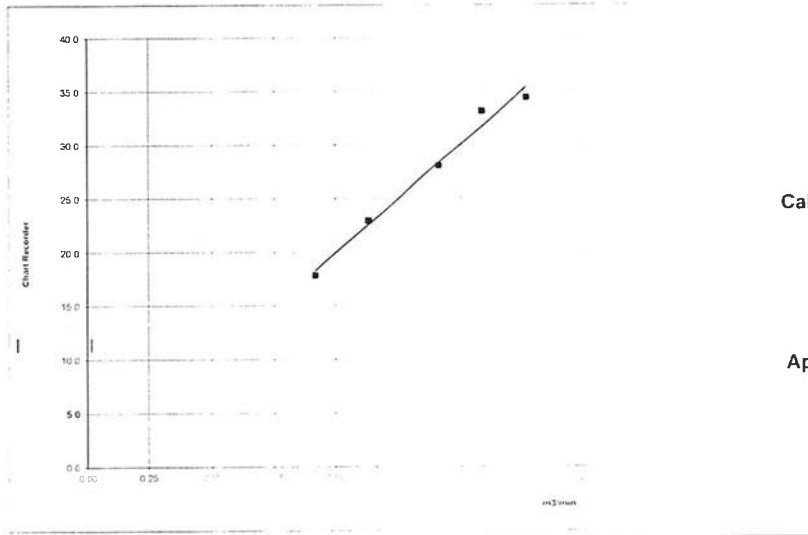
Slope: 1.26504

Intercept: -0.01677

Date Certified: 9 Feb 24

CALIBRATIONS

Plate or Test #	H2O (in)	Qa (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION
1	12.06	1.762	54.0	34.40	Slope = 20.2848
2	9.65	1.578	52.0	33.13	Intercept = -0.3214
3	7.74	1.414	44.0	28.03	Corr. coeff. = 0.9907
4	4.91	1.129	36.0	22.93	SFR = 1.150
5	3.22	0.917	28.0	17.84	SSP = 36.11
					# of Observations: 5
					Range of Chart 33
					at SFR $\pm 10\%$ 39



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บริษัท เอวิล เทสติ้ง จำกัด 547/547/1 ซอยสุขุมวิท 7 แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10110
EnviLab Co., Ltd. 547/547/1 Soi Sukhumvit 7 Bangkok Bangkok 10110
Tel : 02-802-3577-9 Fax: 02-802-3773 E-mail: info@evltesting.com



PM10 High Volume Sampler Calibration

Verification Report No.

AO2300034-E003 -PM 02

<input type="checkbox"/> PM	<input checked="" type="checkbox"/> Onsite
Site: บริเวณหลังท่าเทียบเรือสินวัฒนา	
UTM : 47P N 1596822 E 672178	
Sampler: EPM#45	
Recorder: ECRDSU1618125	
Date: 7 Apr 24	
Technical: Wutipong K.	
Approval: Wisan R.	

CONDITIONS

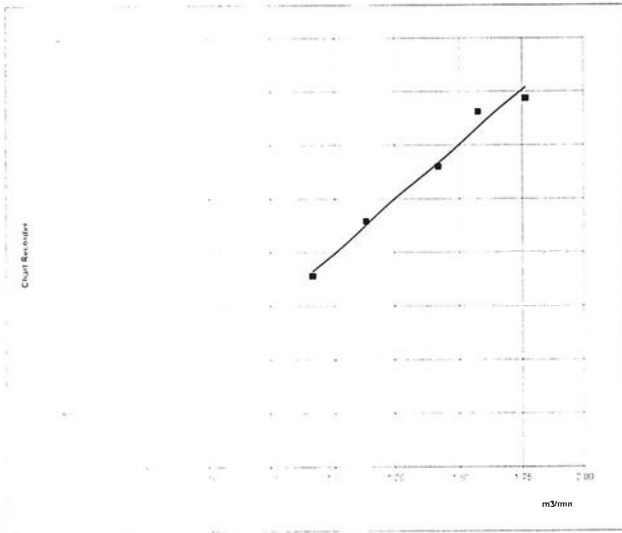
Barometric Press. (hPa): 1004.0	Corrected Pressure (mm Hg): 753.1
Temperature (deg C): 34.0	Temperature (deg K): 307.0
Average Press. (hPa): 1013.0	Corrected Avg.Press. (mm Hg): 759.8
Average Temp. (deg C): 30.0	Average Temp. (deg K): 303.0

CALIBRATION ORIFICE

Brand: Tisch Environmental, Inc	Slope: 1.26504
Model: TE-5025A	Intercept: -0.01677
Serial#: 5411	Date Certified: 9 Feb 24

CALIBRATIONS

Plate or Test #	H2O (in)	Qa (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION
1	11.98	1.760	52.0	33.20	Slope = 16.4505
2	9.52	1.571	50.0	31.92	Intercept = 5.0798
3	7.57	1.402	44.0	28.09	Corr. coeff.= 0.9927
4	4.36	1.067	36.0	22.99	SFR = 1.155
5	2.98	0.885	30.0	19.15	SSP = 37.72
					# of Observations: 5
					Range of Chart 36
					at SFR ±10% 40



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PM10 Test Key Issue Date Mar 27 2020

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Tel: 02-502-3771-8 Fax: 02-502-3773 E-mail: info@evltesting.com



PM10 High Volume Sampler Calibration

Verification Report No.

AO2300034-E003 -PM 03

☒ PM ☐ Onsite

Site: โรงเรือนวัดละมุด

UTM: 47P N 1597414 E 672616

Sampler: EPM#27

Recorder: ECRAN000004599

Date: 7 Apr 24

Technical: Wutipong K.

Approval: Wisan R.

CONDITIONS

Barometric Press. (hPa): 1006.0

Temperature (deg C): 32.0

Average Press. (hPa): 1013.0

Average Temp. (deg C): 30.0

Corrected Pressure (mm Hg): 754.6

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-5025A

Serial#: 5411

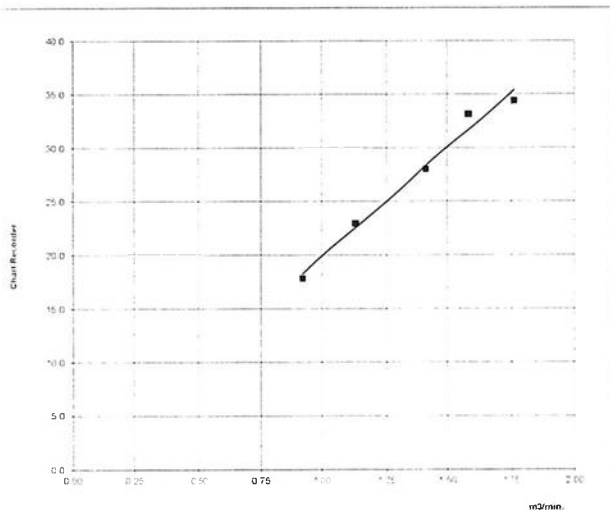
Slope: 1.26504

Intercept: -0.01677

Date Certified: 9 Feb 24

CALIBRATIONS

Plate or Test #	H2O (in)	Qa (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION
1	11.35	1.706	52.0	33.06	Slope = 16.3396
2	9.75	1.583	48.0	30.52	Intercept = 4.9120
3	7.02	1.345	42.0	26.70	Corr. coeff. = 0.9988
4	3.86	1.001	34.0	21.62	SFR = 1.145
5	2.96	0.878	30.0	19.07	SSP = 37.16
					# of Observations: 5
					Range of Chart 35
					at SFR $\pm 10\%$ 39



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

Environmental Engineering & Testing Co., Ltd.



Envilab Co., Ltd. 14/101/1 Soi Sukhumvit 7 Bangkok 10110
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PM10 High Volume Sampler Calibration

Verification Report No.

AO2300034-E003 -PM 04

☐ PM ☐ Onsite

Site: บริเวณชุมชนหมู่ที่ 6 บ้านหัวโคก

UTM : 47P N 1596867 E 671686

Sampler: EPM#38

Recorder: ECRDS016187180

Date: 7 Apr 24

Technical: Wuttipong K.

Approval: Wisan R.

CONDITIONS

Barometric Press. (hPa): 1008.0

Temperature (deg C): 32.0

Average Press. (hPa): 1013.0

Average Temp. (deg C): 30.0

Corrected Pressure (mm Hg): 756.1

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-5025A

Serial#: 5411

Slope: 1.26504

Intercept: -0.01677

Date Certified: 9 Feb 24

CALIBRATIONS

Plate or Test #	H2O (in)	Qa (m3/min)	I (chart)	IC (corrected)
1	11.94	1.748	54.0	34.30
2	9.29	1.544	48.0	30.49
3	7.77	1.413	46.0	29.22
4	4.25	1.048	34.0	21.59
5	2.87	0.864	28.0	17.78

LINEAR REGRESSION

Slope = 18.6878

Intercept = 1.9461

Corr. coeff. = 0.9972

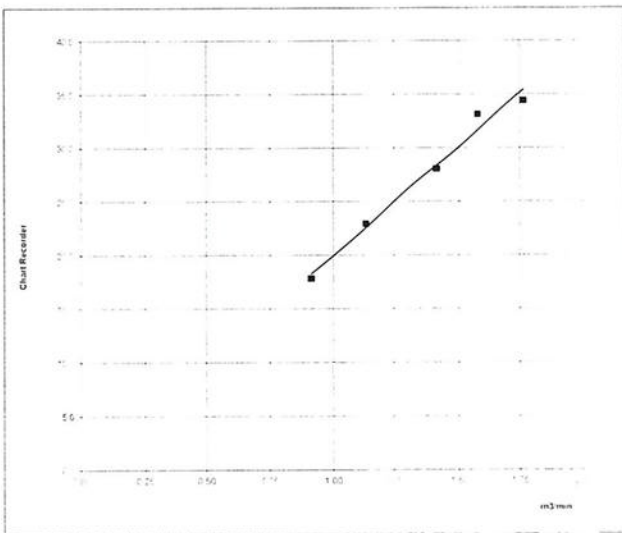
SFR = 1.143

SSP = 36.70

of Observations: 5

Range of Chart at SFR $\pm 10\%$

34
39



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PM10 Cal Rev 07 / Iss Date Mar 17 2020

Environmental



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EVL Co., Ltd. 540/540/1 Soi Bangkapi 7 Bangkapi Bangkok 10710
Tel. 02-3577 8 Fax. 02-802-3773 E-mail: info@evltesting.com



PM10 High Volume Sampler Calibration

Verification Report No.

AO2300034-E003 -PM 05

L PM	Onsite
Site: บ้านเกาะกลางน้ำ หมู่ 1 บ้านเกาะปากจั่น	
UTM : 47P N 1596484 E 672426	
Sampler: EPM#32	
Recorder: ECRDS016187168	
Date: 7 Apr 24	
Technical: Wuttipong K.	
Approval: Wisan R.	

CONDITIONS

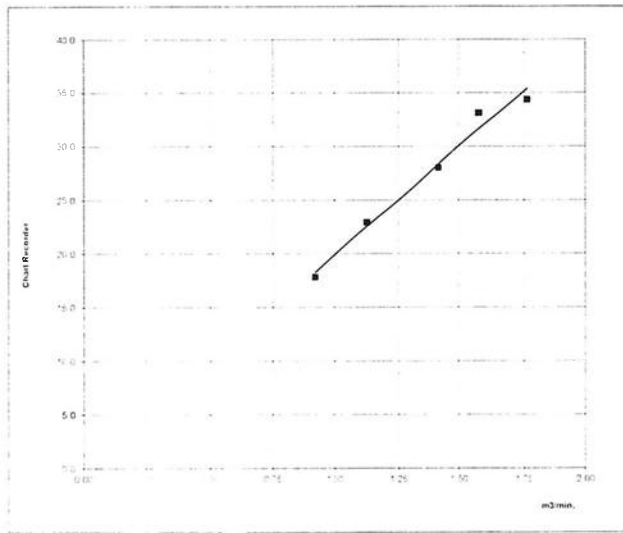
Barometric Press. (hPa): 1001.0	Corrected Pressure (mm Hg): 750.8
Temperature (deg C): 34.0	Temperature (deg K): 307.0
Average Press. (hPa): 1013.0	Corrected Avg. Press. (mm Hg): 759.8
Average Temp. (deg C): 30.0	Average Temp. (deg K): 303.0

CALIBRATION ORIFICE

Brand: Tisch Environmental, Inc	Slope: 1.26504
Model: TE-5025A	Intercept: -0.01677
Serial#: 5411	Date Certified: 9 Feb 24

CALIBRATIONS

Plate or Test #	H2O (in)	Qa (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION
1	11.54	1.730	54.0	34.53	Slope = 19.4591
2	9.32	1.556	48.0	30.69	Intercept = 0.6265
3	7.74	1.420	44.0	28.14	Corr. coeff = 0.9997
4	4.47	1.082	34.0	21.74	SFR = 1.159
5	2.98	0.886	28.0	17.90	SSP = 36.24
					# of Observations: 5
					Range of Chart 34
					at SFR $\pm 10\%$ 39



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PM10 Cal Rev 07 / Iss Date Mar 17, 2020

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Envilab Co., Ltd. 540,540/1 Soi Bangnae 7 Bang-nae Bangnae Bangkok 10160
Tel : 02-802-3577-8 Fax. 02-802-3773 E-mail info@evltesting.com



Calibration & Testing Supply Instrument

Verification Test Report

Report No.:

AO2300034-E003 -SLM 01

☐ PM ☒ Onsite UTM : 47P N 1596914 E 672458

Calibrated Date: 7 April 2024

Site : บริเวณหน้าท่าเทียบเรือสินวัฒนา

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 45

Serial : 0016

Environment: Temperature 25 °C Humidity 72 %RH

Reference Standard: Acoustic Calibrator Class 1 Model 103,Pulsar

Serial No.98971

Date of Calibration : 18 Dec 2023

Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
94.10	94.40	0.30	94.10

Calibra

Appro

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บริษัท เอ็นวิลแล็บ จำกัด 540,540/1 ซอยบางแค 7 แขวงบางแค เขตบางแค กรุงเทพฯ 10160
Envilab Co., Ltd. 540,540/1 Soi Bangkhae 7 Bangkhae Bangkok Bangkok 10160
Tel : 02-402-3574-8 Fax : 02-802-3773 E-mail : info@evltesting.com



Envilab & Envilab Supply Equipment

Verification Test Report

Report No.:

AO2300034-E003 -SLM 02

☐ PM

☒ Onsite UTM :

47P N 1597414 E 672616

Calibrated Date: 7 April 2024

Site : โรงเรียนวัดละมุด

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 45

Serial : 0013

Environment: Temperature 25 °C Humidity 72 %RH

Reference Standard: Acoustic Calibrator Class 1 Model 103,Pulsar

Serial No.98971

Date of Calibration : 18 Dec 2023

Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
94.10	94.30	0.20	94.10

Calibrated

Da

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EnviLab Co., Ltd. 540,540/1 Soi Bangkhae 7 Bangkhae Bangkok Bangkok 10160
Tel : 02-802-3577-8 Fax : 02-802-3773 E-mail : info@evltesting.com



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

Verification Test Report

Report No.:

AO2300034-E003 -SLM 03

☐ PM ☒ Onsite UTM : 47P N 1596484 E 672426

Calibrated Date: 7 April 2024

Site : บ้านเกาะกลางน้ำ

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 45

Serial : 0015

Environment: Temperature 25 °C Humidity 72 %RH

Reference Standard: Acoustic Calibrator Class 1 Model 103,Pulsar

Serial No.98971

Date of Calibration : 18 Dec 2023

Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
94.10	94.20	0.10	94.10

Calibrate

Appro

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บริษัท เอ็นไวแล็บ จำกัด (มหาชน) 542407/101 Bangkadee 7 Bangkadee Bangkhoe Bangkok 10160
Envilab Co., Ltd. 542407/101 Bangkadee 7 Bangkadee Bangkhoe Bangkok 10160
Tel : 02-802-3577-6 Fax : 02-802-3775 E-mail : info@evltesting.com



ISO 9001:2015 CERTIFIED

Verification Test Report

Report No.:

AO2300034-E019 -SLM 01

☒ PM ☐ Onsite UIM : 47P 1514458 654247

Calibrated Date: 8 April 2024

Site : บริษัท เอ็นไวแล็บ จำกัด

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 44

Serial : 1877

Environment: Temperature 25 °C Humidity 62 %RH

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

Serial No.1351075

Date of Calibration : 1 Apr 2024

Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.72	93.97	0.25	93.72

Calibrate

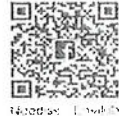
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Neediss Supply Instrument Co., Ltd.
536 ซอยบางแค 7 แขวงบางแค เขตบางแค กรุงเทพฯ 10150 Tel.02-002-3980-2 e-mail: info@neediss.com



Verification Test Report

Report No.: OP01-6704001

Calibrated Date: 2-Apr-2024

☒ PM ☐ Onsite UTM :

Site: Neediss Supply Instrument

Equipment: Smoke Opacity

Manufacturer: Wager

Model: 8500

Serial or ID No. EOPWA850015944

Environment: Temperature 23 °C Humidity: 60 %RH

Reference Standard: Natural Density Verification Filter Standard

Result of Calibration

Reference Standard (% Opacity)	Instrument reading (% Opacity)	Error (% Opacity)	Result (dB)
0.00	0.00	0.00	PASS
31.50	30.28	1.22	PASS

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Neediss Supply Instrument Co.,Ltd.

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535 ซอยบางนา 7 แขวงบางนาแค เขตบางนา กรุงเทพมหานคร 10160 Tel.02-602-3980-2 e-mail: info@neediss.com



neediss.com

Verification Test Report

Report No.: OP01-6706001

Calibrated Date: 1-Jun-2024

☒ PM ☐ Onsite UTM :

Site: Neediss Supply Instrument

Equipment: Smoke Opacity

Manufacturer: Wager

Model: 8500

Serial or ID No. EOPWA850015944

Environment: Temperature 23.1 °C Humidity: 49 %RH

Reference Standard: Natural Density Verification Filter Standard

Result of Calibration

Reference Standard (% Opacity)	Instrument reading (% Opacity)	Error (% Opacity)	Result (dB)
0.00	0.00	0.00	PASS
31.50	30.95	0.55	PASS

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Certificate of Calibration

Calibration Certification Information

Cal. Date: February 9, 2024 Roots-meter S/N: 438320 Ta: 295 °K
 Operator: Jim Tisch Pa: 749.0 mm Hg
 Calibration Model #: TE-5025A Calibrator S/N: 5411

Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H2O)
1	1	2	1	1.3950	3.2	2.00
2	3	4	1	0.9840	6.4	4.00
3	5	6	1	0.8790	7.9	5.00
4	7	8	1	0.8430	8.8	5.50
5	9	10	1	0.6940	12.7	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)
0.9914	0.7106	1.4111	0.9957	0.7138	0.8875
0.9871	1.0032	1.9956	0.9915	1.0076	1.2551
0.9851	1.1207	2.2312	0.9895	1.1257	1.4033
0.9839	1.1672	2.3401	0.9883	1.1723	1.4718
0.9787	1.4103	2.8222	0.9830	1.4165	1.7750
QSTD	m=	2.02024	QA	m=	1.26504
	b=	-0.02667		b=	-0.01677
	r=	0.99993		r=	0.99993

Calculations

Vstd=	$\Delta Vol((Pa-\Delta P)/Pstd)(Tstd/Ta)$	Va=	$\Delta Vol((Pa-\Delta P)/Pa)$
Qstd=	Vstd/ΔTime	Qa=	Va/ΔTime
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

Certificate of Calibration

Certificate No. : 67-200034-1

Page : 1 of 2

Submitted by : Envilab Co.,Ltd.
540, 540/1 Soi Bangkhæ 7, Bangkhæ, 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 : (22.8 to 23.6) °C
Relative Humidity : (44.6 to 45.3) %
Air Pressure : 1014.0 mbar

Date of Received : 01 February 2024

Date of Calibration : 01 February 2024

Date of Issue : 06 February 2024

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	C02232088	08 Nov 2024	National Institute of Metrology (Thailand), (NIMT)

The Uncertainties are for a confidence probability of approximately 95%

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CAL

Calibratech Co.,Ltd.

7/106-7 Moo 2, Sukhaphrasan 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. : 67-200034-1

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Departure of indication from nominal value

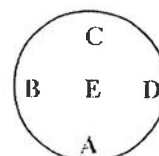
Nominal Value (g)	Correction (g)	Uncertainty \pm (g)
0.01	0.0001	0.00012
0.1	0.0001	0.00012
1	0.0000	0.00013
2	0.0001	0.00013
5	0.0000	0.00013
10	0.0000	0.00013
20	-0.0001	0.00014
50	-0.0001	0.00015
100	-0.0001	0.00020
200	-0.0001	0.00038

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 $k = 2.06$, providing a level of confidence of approximately 95%

Eccentric error

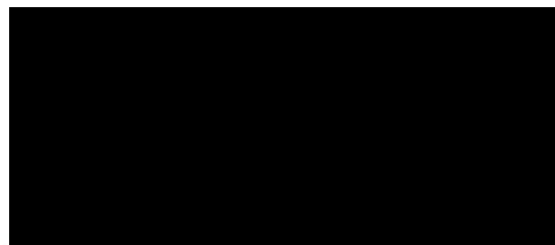
Load test : 50 g
A B C D E
-0.0001 -0.0001 -0.0001 0.0001 0.0000 g



Repeatability

Load test : 200 g
Stdev. : 0.00005 g

- o0o -



CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

Customer: BANGKOK INDUSTRIAL
GAS CO LTD
Part Number: E04NI99E15A00V3
Cylinder Number: EB0160267
Laboratory: 124 - Plumsteadville - PA
PGVP Number: A12023
Gas Code: CO,NO,NOX,SO2,BALN
Reference Number: 160-402685487-1
Cylinder Volume: 144.0 CF
Cylinder Pressure: 2015 PSIG
Valve Outlet: 660
Certification Date: Mar 31, 2023

Expiration Date: Mar 31, 2026

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted. The results relate only to the items tested. The report shall not be reproduced except in full without approval of the laboratory. Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	45.00 PPM	46.50 PPM	G1	+/- 1.4% NIST Traceable	03/24/2023, 03/31/2023
NITRIC OXIDE	45.00 PPM	46.50 PPM	G1	+/- 1.4% NIST Traceable	03/24/2023, 03/31/2023
SULFUR DIOXIDE	45.00 PPM	45.59 PPM	G1	+/- 1.0% NIST Traceable	03/24/2023, 03/31/2023
CARBON MONOXIDE	4500 PPM	4507 PPM	G1	+/- 1.4% NIST Traceable	03/24/2023
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	210607-22	CC708067	48.41 PPM NITRIC OXIDE/NITROGEN	+/- 1.2%	Sep 21, 2025
PRM	12395	D887660	9.91 PPM NITROGEN DIOXIDE/AIR	+/- 2.0%	Feb 22, 2022
GMIS	124206889104	CC322509	4.326 PPM NITROGEN DIOXIDE/AIR	+/- 2.0%	Feb 21, 2025
NTRM	160610-01	CC473196	49.02 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Mar 22, 2028
GMIS	07212022B109	EB0141209	50.08 PPM SULFUR DIOXIDE/NITROGEN	+/- 1.0%	Dec 21, 2026
CO	220608	CC744768	2501.8 PPM CARBON MONOXIDE/NITROGEN	+/-0.5%	Sep 30, 2028

The SRM, NTRM, PRM, or RGM noted above is only in reference to the GMIS used in the assay and not part of the analysis.

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
SIEMENS ULTRAMAT 6 N1KD579	NDIR	Mar 07, 2023
Nicolet iS50 FTIR AUP2010245 NO	FTIR	Mar 09, 2023
Nicolet iS50 FTIR AUP2010245 NO2	FTIR	Mar 23, 2023
Nicolet iS50 FTIR AUP2010245 SO2	FTIR	Mar 16, 2023

Triad Data Available Upon Request

NOTES: Gross Weight: 27.8 Kg
Net Weight: 4.8 Kg
PO# 5223001123





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Neediss Supply Instrument Co., Ltd.

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Tel: 02-802-0300-3 Fax: 02-802-3938 Email: info@neediss.com



SO2 Analyzer Verification Test Report

Calibration Report No.: ES-S6704003

Calibrated Date: 1-Apr-24

☒ PM ☐ Onsite

Page:1/2

Instruments Information

Analyzer Type: SO2 Analyzer Model: AF22e	Manufacturer Environnement SA., France S/N: NSOESAAF32E453
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Calibration System

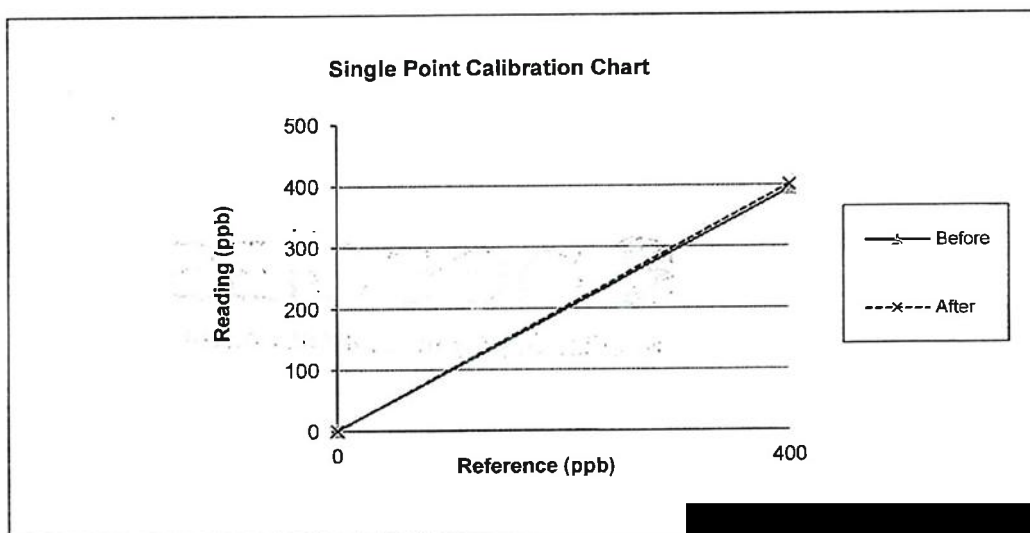
Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792 ZERO AIR Generator ZAG7001 S/N: 644	NOx Conc 45.50 PPM NO Conc 45.50 PPM SO2 Conc 45.59 PPM CO Conc 4500 PPM Expire Date: Mar 31,2026 EB0160267

Environment: Temperature 25.1 °C

Humidity: 67 %RH

Calibration Report

Status	Zero			Span		
	Reference (ppb)	Reading (ppb)	Drift (ppb)	Reference (ppb)	Reading (ppb)	Drift%
Before	0.0	0.7	0.7	400.0	394.0	-0.8
After	0.0	0.3	0.3	400.0	401.0	0.1



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Neediss Supply Instrument Co., Ltd.538 ซอยบางนา 7 แขวงบางนาแค เขตคลองเตย กรุงเทพฯ 10150 538 Soi BangNa 7 BangNaiae BangNaek Bangkok
Tel 02-902-0100-2 Fax 02-600-3988 E-mail neediss@neediss.co.th**S02 Analyzer Verification Test Report**

Calibration Report No.: ES-S6704003

Calibrated Date: 1-Apr-24

☒ PM ☐ Onsite

Page:2/2

Analyzer Signal Values					
Date	1-Apr-24	Time	13:11:00		
Power Supplies					
Option	0.00	mV	+5 V Sensor	5	V
+4 V	4068	mV	+3.3 V	3.3	V
+24 V	24.1	V	+12 V	11.9	V
+5 V	5	V	I UV lamp	44.3	mA
I+24 V	1.2	A			
Optical Bench					
Dark UV sig.	0	mV	Dark PM sig.	88	mV
UV ref.	0	mV	PM ref.	0	mV
UV sig.	24.1	mV	PM sig.	138.6	mV
Ref.ratio	0		Meas ratio	0.34	
Mean sig.	0.7		Raw trend	11	
Raw sig.	24.4	ppb	inst.meas.	22.8	ppb
I UV Lamp	44.7	mA	HV PM	2626.80	mV
Sample					
Internal Temp.	31.9	deg.C	Chamber T.	50	deg.C
Gas Pr.	970	hPa	Pump Pr.	355.5	hPa
Flow	18.7	l/h			

Calibrate By :

Date:

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Neediss Supply Instrument Co.,Ltd

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Tel: 02-802-0167-2 Fax: 02-802-0168 Email: info@neediss.com



SO2 Analyzer Verification Test Report

Calibration Report No.: AP-S6704001

Calibrated Date: 1-Apr-24

☒ PM ☐ Onsite

Instruments Information

Page:1/2

Analyzer Type: SO2 Analyzer Model: 100A	Manufacturer API S/N: ESOAIT10003032
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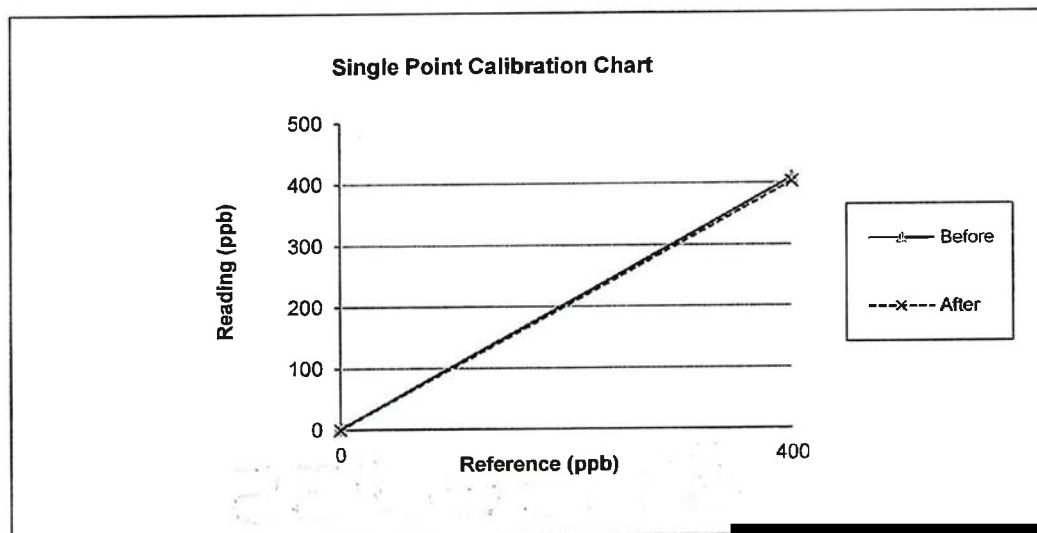
Calibration System

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 24.9 °CHumidity: 53 %RH

Calibration Report

Status	Zero			Span		
	Reference (ppb)	Reading (ppb)	Drift (ppb)	Reference (ppb)	Reading (ppb)	Drift%
Before	0.0	1.5	1.5	400.0	409.3	1.1
After	0.0	0.3	0.3	400.0	403.0	0.4



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Tel: 02-802-5760 Fax: 02-802-3786 E-mail: neediss@neediss.com

SO2 Analyzer Verification Test Report

Calibration Report No.: AP-S6704001

Calibrated Date: 1-Apr-24

☒ PM ☐ Onsite

Page:2/2

Test Function Value	Normal range	Unit	Before	After	Note
Date	1-Apr-24				
Time	8:30				
Range	50 - 20000	PPB	500	500	
Stability (Zero Gas)	< 0.2	PPB	0.4	0.2	
Sample Flow	650 (+/- 50)	cc/min	666	662	
PMT Detector	0 - 5000	mV	24.3	28.2	
Norm PMT Detector	0 - 5000	mV	31.4	34.3	
HVPS	400-900 constant	V	725	725	
DCPS	2500 (+/- 200)	mV	-	-	
RCELL TEMP	50 (+/- 1)	Dreegee C	50	50	
BOX TEMP	20-40	Dreegee C	32.6	35.1	
PMT TEMP	7 (+/-1)	Dreegee C	8.3	8.3	
UV lamp	1000-4900	mV	3251	3251	
Lamp Ratio	30-120	%	87.4	87.4	
STR. Light (Zero Gas)	<100	PPB	38.5	38.5	
Dark PMT	(-50) - (+200)	mV	27.6	27.6	
Dark lamp	(-50) - (+200)	mV	3.6	3.6	
SAMP PRES	20-30 contant	IN-Hg-A	26.9	27.3	
Electric Test/Optic Test					
PMT Volts	2000 (+/- 500)	mV	2010	2006	
SO2 Conc	1000 (+/- 250)	PPB	1005	1003	
SO2 Slope	1 (+/- 0.3)	-	1.054	1.053	
SO2 Offset	< 250	mV	94.7	90.4	
Stability at Zero	< 0.2	PPB	0.1	0.1	
Stability at Span	< 2 ppb @ 400 ppb	PPB	0.4	0.2	
Gas Test Response					
Zero Gas (0.00 PPB)	0	ppb	1.5	0.3	
Span Gas (400 PPB)	400	ppb	409.3	403.0	± 5% of Range

Calibrate By: [REDACTED]

Date: [REDACTED]

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Neediss Supply Instrument



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บริษัท นีดิส ซัพพลาย อินสตรูमेंท์ จำกัด
Neediss Supply Instrument Co., Ltd.

533 ซอยบางนาซอย 7 แขวงบางนาเขต บางนา กรุงเทพมหานคร 10760 533 Soi Bangnae 7 Bangnae Bangkok
Tel : 02-802-6760-011 02-802-6766 Fax : 02-802-6767



SO2 Analyzer Verification Test Report

Calibration Report No.: AP-S6704004

Calibrated Date: 1-Apr-24

☒ PM ☐ Onsite

Instruments Information

Page:1/2

Analyzer Type: SO2 Analyzer Model: 100E	Manufacturer API S/N: ESOAI100E01218
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Calibration System

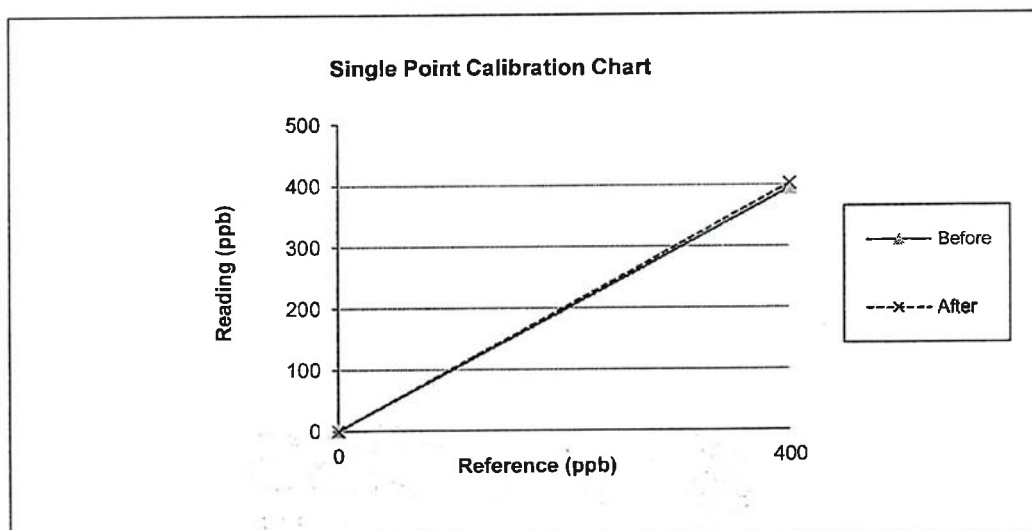
Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792 ZERO AIR Generator ZAG7001 S/N: 644	NOx Conc 45.50 PPM NO Conc 45.50 PPM SO2 Conc 45.59 PPM CO Conc 4500 PPM Expire Date: Mar 31,2026 EB0160267

Environment: Temperature 27.4 °C

Humidity: 60 %RH

Calibration Report

Status	Zero			Span		
	Reference (ppb)	Reading (ppb)	Drift (ppb)	Reference (ppb)	Reading (ppb)	Drift%
Before	0.0	0.3	0.3	400.0	395.0	-0.6
After	0.0	0.2	0.2	400.0	402.1	0.3



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Neediss Supply Instrument Co., Ltd.536 ซอยสุขุมวิท 7 ถนนสุขุมวิท กรุงเทพมหานคร 10150 536 Soi Sukhumvit 7 Bangkok Bangkok 10150
Tel : 02-801-5980-2 Fax : 02-802-3788 E-mail : info@neediss.com

SO2 Analyzer Verification Test Report

Calibration Report No.: AP-S6704004

Calibrated Date: 1-Apr-24

☒ PM ☐ Onsite

Page:2/2

Test Function Value	Normal range	Unit	Before	After	Note
Date	1-Apr-24				
Time	13:10				
Range	50 - 20000	PPB	500	500	
Stability (Zero Gas)	< 0.2	PPB	0.6	0.2	
Sample Flow	650 (+/- 50)	cc/min	663	659	
PMT Detector	0 - 5000	mV	36.5	34.5	
Norm PMT Detector	0 - 5000	mV	34.1	32.8	
HVPS	400-900 constant	V	719	648	
DCPS	2500 (+/- 200)	mV	-	-	
RCELL TEMP	50 (+/- 1)	Dreegee C	50	50	
BOX TEMP	20-40	Dreegee C	34.1	32.7	
PMT TEMP	7 (+/-1)	Dreegee C	8.0	8.0	
UV lamp	1000-4900	mV	4034.0	4034.0	
Lamp Ratio	30-120	%	114.0	114.0	
STR. Light (Zero Gas)	<100	PPB	29	29	
Dark PMT	(-50) - (+200)	mV	44.7	44.7	
Dark lamp	(-50) - (+200)	mV	5.1	5.1	
SAMP PRES	20-30 contant	IN-Hg-A	28.1	27.8	
Electric Test/Optic Test					
PMT Volts	2000 (+/- 500)	mV	2004	2020	
SO2 Conc	1000 (+/- 250)	PPB	1002	1010	
SO2 Slope	1 (+/- 0.3)	-	0.920	0.866	
SO2 Offset	< 250	mV	65	130.1	
Stability at Zero	< 0.2	PPB	0.1	0.1	
Stability at Span	< 2 ppb @ 400 ppb	PPB	0.6	0.2	
Gas Test Response					
Zero Gas (0.00 PPB)	0	ppb	0.3	0.2	
Span Gas (400 PPB)	400	ppb	395.0	402.1	± 5% of Range

Calibrate By : _____

Date: _____


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SO2 Analyzer Verification Test Report

Calibration Report No.: AP-S6704002

Calibrated Date: 1-Apr-24

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Instruments Information

Page:1/2

Analyzer Type: SO2 Analyzer Model: 100E	Manufacturer API S/N: ESOAI100E01108
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Calibration System

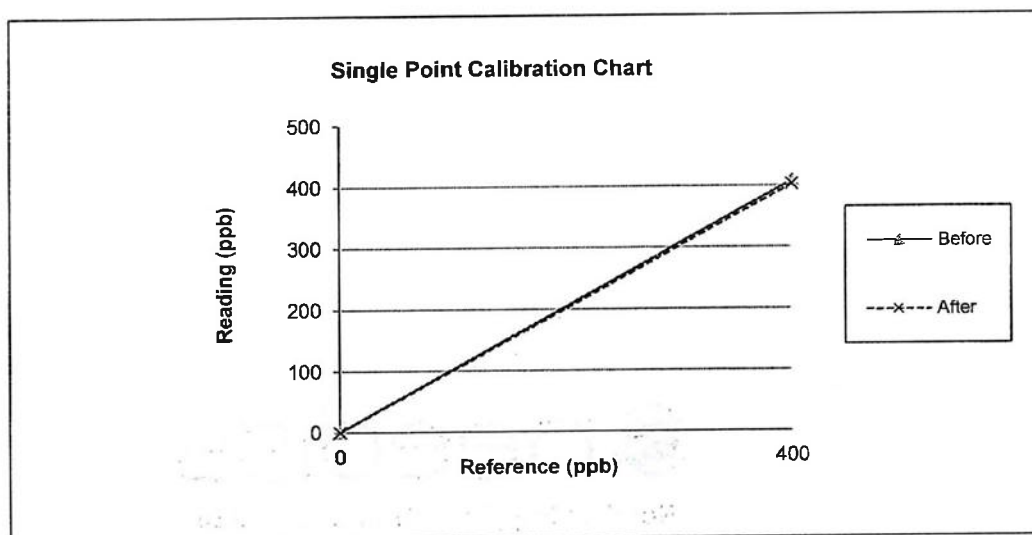
Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792 ZERO AIR Generator ZAG7001 S/N: 644	NOx Conc 45.50 PPM NO Conc 45.50 PPM SO2 Conc 45.59 PPM CO Conc 4500 PPM Expire Date: Mar 31,2026 EB0160267

Environment: Temperature 25.1 °C

Humidity: 66 %RH

Calibration Report

Status	Zero			Span		
	Reference (ppb)	Reading (ppb)	Drift (ppb)	Reference (ppb)	Reading (ppb)	Drift%
Before	0.0	1.0	1.0	400.0	408.0	1.0
After	0.0	0.2	0.2	400.0	402.0	0.2





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SO2 Analyzer Verification Test Report

Calibration Report No.: AP-S6704002

Calibrated Date: 1-Apr-24

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Page:2/2

Test Function Value	Norminal range	Unit	Before	After	Note
Date	1-Apr-24				
Time	13:10				
Range	50 - 20000	PPB	500	500	
Stability (Zero Gas)	< 0.2	PPB	0.6	0.2	
Sample Flow	650 (+/- 50)	cc/min	663	659	
PMT Detector	0 - 5000	mV	36.5	34.5	
Norm PMT Detector	0 - 5000	mV	34.1	32.8	
HVPS	400-900 constant	V	719	648	
DCPS	2500 (+/- 200)	mV	-	-	
ROCELL TEMP	50 (+/- 1)	Dreegee C	50	50	
BOX TEMP	20-40	Dreegee C	34.1	32.7	
PMT TEMP	7 (+/-1)	Dreegee C	8.0	8.0	
UV lamp	1000-4900	mV	4034.0	4034.0	
Lamp Ratio	30-120	%	114.0	114.0	
STR. Light (Zero Gas)	<100	PPB	29	29	
Dark PMT	(-50) - (+200)	mV	44.7	44.7	
Dark lamp	(-50) - (+200)	mV	5.1	5.1	
SAMP PRES	20-30 contant	IN-Hg-A	28.1	27.8	
Electric Test/Optic Test					
PMT Volts	2000 (+/- 500)	mV	2004	2020	
SO2 Conc	1000 (+/- 250)	PPB	1002	1010	
SO2 Slope	1 (+/- 0.3)	-	0.920	0.866	
SO2 Offset	< 250	mV	65	130.1	
Stability at Zero	< 0.2	PPB	0.1	0.1	
Stability at Span	< 2 ppb @ 400 ppb	PPB	0.6	0.2	
Gas Test Response					
Zero Gas (0.00 PPB)	0	ppb	1.0	0.2	
Span Gas (400 PPB)	400	ppb	408.0	402.0	± 5% of Range

Calibrate By : _____

Date: _____



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SO2 Analyzer Verification Test Report

Calibration Report No.: AP-S6704005

Calibrated Date: 1-Apr-24

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Page:1/2

Instruments Information

Analyzer Type: SO2 Analyzer Model: 100E	Manufacturer: API S/N: ESOA1100E01225
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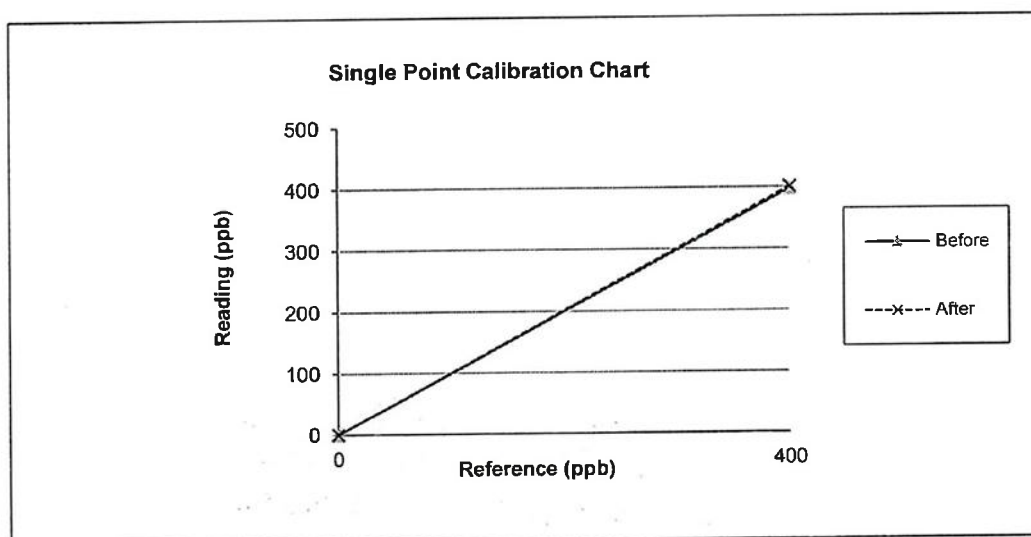
Calibration System

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 27.3 °CHumidity: 60 %RH

Calibration Report

Status	Zero			Span		
	Reference (ppb)	Reading (ppb)	Drift (ppb)	Reference (ppb)	Reading (ppb)	Drift%
Before	0.0	0.3	0.3	400.0	398.0	-0.3
After	0.0	0.1	0.1	400.0	401.0	0.1





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SO2 Analyzer Verification Test Report

Calibration Report No.: AP-S6704005

Calibrated Date: 1-Apr-24

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Test Function Value	Norminal range	Unit	Before	After	Note
Date	1-Apr-24				
Time	13:10				
Range	50 - 20000	PPB	500	500	
Stability (Zero Gas)	< 0.2	PPB	0.6	0.2	
Sample Flow	650 (+/- 50)	cc/min	663	659	
PMT Detector	0 - 5000	mV	36.5	34.5	
Norm PMT Detector	0 - 5000	mV	34.1	32.8	
HVPS	400-900 constant	V	719	648	
DCPS	2500 (+/- 200)	mV	-	-	
ROCELL TEMP	50 (+/- 1)	Dreegee C	50	50	
BOX TEMP	20-40	Dreegee C	34.1	32.7	
PMT TEMP	7 (+/-1)	Dreegee C	8.0	8.0	
UV lamp	1000-4900	mV	4034.0	4034.0	
Lamp Ratio	30-120	%	114.0	114.0	
STR. Light (Zero Gas)	<100	PPB	29	29	
Dark PMT	(-50) - (+200)	mV	44.7	44.7	
Dark lamp	(-50) - (+200)	mV	5.1	5.1	
SAMP PRES	20-30 contant	IN-Hg-A	28.1	27.8	
Electric Test/Optic Test					
PMT Volts	2000 (+/- 500)	mV	2004	2020	
SO2 Conc	1000 (+/- 250)	PPB	1002	1010	
SO2 Slope	1 (+/- 0.3)	-	0.920	0.866	
SO2 Offset	< 250	mV	65	130.1	
Stability at Zero	< 0.2	PPB	0.1	0.1	
Stability at Span	< 2 ppb @ 400 ppb	PPB	0.6	0.2	
Gas Test Response					
Zero Gas (0.00 PPB)	0	ppb	0.3	0.1	
Span Gas (400 PPB)	400	ppb	398.0	401.0	± 5% of Range

Calibrate By :

Date:



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NOx Analyzer Verification Test Report

Calibration Report No.: AP-N6704003

Page:1/1

Calibrated Date: 1-Apr-24

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Instruments Information

Analyzer Type: NO/NO2/NOx Analyzer Model: T200	Manufacturer API S/N: ENOAIT20003573
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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

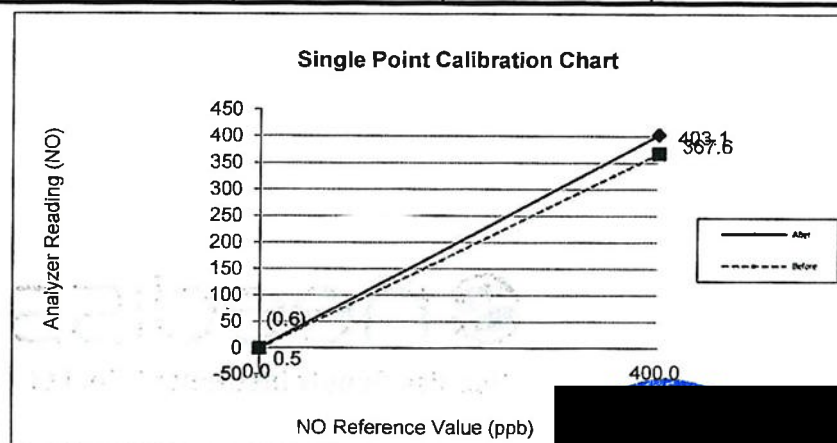
Environment: Temperature 24.6 °CHumidity: 55 %RH

Calibration Check (Before adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	-0.9	0.0	-0.9	365.2	400.0	-4.5
NO ₂	0.3	0.0	0.3	2.4	0.0	0.3
NOx	-0.6	0.0	-0.6	367.6	400.0	-4.2

Calibration Check (After 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	401.2	400.0	0.1
NO ₂	0.4	0.0	0.4	1.9	0.0	0.2
NOx	0.5	0.0	0.5	403.1	400.0	0.4





NOx Analyzer Verification Test Report

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Calibration Report No.: AP-N6704003

Calibrated Date: 1-Apr-24

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Test Function Value	Normal range	Unit	Before	After	Note
Date	1-Apr-24				
Time	9:25				
Range	0.00 - 500.00 PPB	PPB	500	500	
Stability (Zero Gas)	< 0.2	PPB	0.5	0.2	
Sample Flow	500+/- 50	cc/min	491	485	
Ozone Flow	60-90	cc/min	80	80	
PMT Detector	0-5000	mV	85.0	25.0	
AZERO	-20-150	mV	94.1	14.5	
HVPS	400-900 constant	V	734	734	
DCPS	2500 +/- 200	mV	-	-	
RCELL TEMP	50+/- 1	Dreegee C	50	50	
BOX TEMP	20-35	Dreegee C	34.7	33.6	
PMT TEMP	7 +/-1	Dreegee C	7.0	7.0	
IZS TEMP	50+/- 4	Dreegee C	-	-	
MOLY Temp	315 +/- 5	Dreegee C	314.0	314.0	
RCEL PRES	4-10 contant	IN-Hg-A	5.0	5.0	
SAMP PRES	20-30 contant	IN-Hg-A	28.8	27.9	
NO Slope	1 +/- 0.3		1.135	1.197	
Nox Slope	1 +/- 0.3		1.260	1.114	
NO Offset	-10 to + 150	mV	0.8	-3.6	
NOx Offset	-10 to + 150	mV	-2.6	6.1	
Span and Cal Values					
Zero Value	NO	0	ppb	-0.9	0.1
	NOx	0	ppb	-0.6	0.5
Span Value	NO	400	ppb	365.2	401.2
	NOx	400	ppb	367.6	403.1

Calibrate By : _____

Date: _____



NOx Analyzer Verification Test Report

Calibration Report No.: AP-N6/04005

Page:1/1

Calibrated Date: 1-Apr-24

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Instruments Information

Analyzer Type: NO/NO2/NOx Analyzer Model: 200E	Manufacturer: API S/N: ENOAI200E02788
---	--

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: 45.50 PPM CO Conc: 4507 PPM Expire Date: Mar 31,2026 EB0160267

Environment: Temperature 24.9 °C

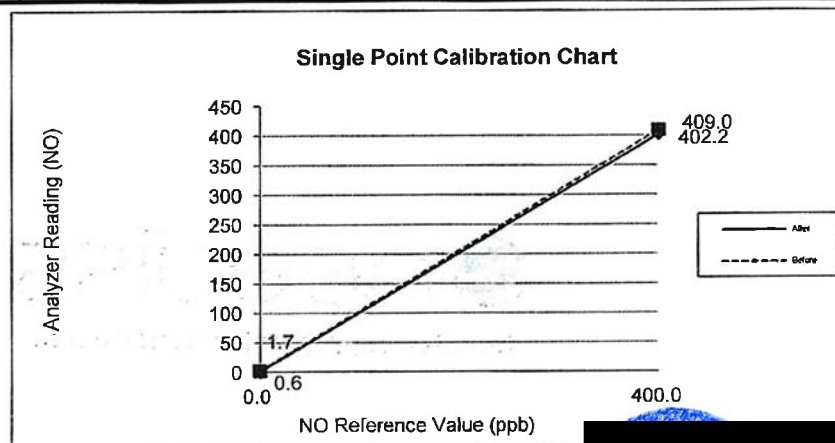
Humidity: 62 %RH

Calibration Check (Before adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	1.0	0.0	1.0	406.0	400.0	0.7
NO ₂	0.7	0.0	0.7	3.0	0.0	0.4
NOx	1.7	0.0	1.7	409.0	400.0	1.1

Calibration Check (After adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.3	0.0	0.3	400.5	400.0	0.1
NO ₂	0.3	0.0	0.3	1.7	0.0	0.2
NOx	0.6	0.0	0.6	402.2	400.0	0.3





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NOx Analyzer Verification Test Report

Calibration Report No.: AP-N6704005

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Calibrated Date: 1-Apr-24

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Test Function Value	Normal range	Unit	Before	After	Note
Date	1-Apr-24				
Time	10:10				
Range	0.00 - 500.00 PPB	PPB	500	500	
Stability (Zero Gas)	< 0.2	PPB	0.5	0.2	
Sample Flow	500+/- 50	cc/min	511	532	
Ozone Flow	60-90	cc/min	80	80	
PMT Detector	0-5000	mV	27.4	16.4	
AZERO	-20-150	mV	54.2	54.2	
HVPS	400-900 constant	V	819	819	
DCPS	2500 +/- 200	mV	-	-	
RCELL TEMP	50+/- 1	Dreegee C	50	50	
BOX TEMP	20-35	Dreegee C	33.7	32.9	
PMT TEMP	7 +/-1	Dreegee C	7.1	7.1	
IZS TEMP	50+/- 4	Dreegee C	-	-	
MOLY Temp	315 +/- 5	Dreegee C	314.4	315.0	
RCEL PRES	4-10 contant	IN-Hg-A	10	10	
SAMP PRES	20-30 contant	IN-Hg-A	29.0	29.4	
NO Slope	1 +/- 0.3		0.820	0.801	
Nox Slope	1 +/- 0.3		0.848	0.813	
NO Offset	-10 to + 150	mV	10.2	15.3	
NOx Offset	-10 to + 150	mV	-2.0	-3.4	
Span and Cal Values					
Zero Value	NO	0	ppb	1.0	0.3
	NOx	0	ppb	1.7	0.6
Span Value	NO	400	ppb	406.0	400.5
	NOx	400	ppb	409.0	402.2

Calibrate By :

Date:



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5/5 หมู่ 7 ตำบล ๖๖๖ อำเภอ ๖๖๖ จังหวัด ๖๖๖
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NOx Analyzer Verification Test Report

Calibration Report No.: AP-N6704006

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Calibrated Date: 1-Apr-24

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Instruments Information

Analyzer Type: NO/NO2/NOx Analyzer Model: T200	Manufacturer API S/N: ENOAIT20002470
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Calibration System

Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792 ZERO AIR Generator ZAG7001 S/N: 644	NO Conc 44.68 PPM SO2 Conc 45.34 PPM CO Conc 4500 PPM Expire Date: Feb 19,2024 EB0140762

Environment: Temperature 27.7 °CHumidity: 62 %RH

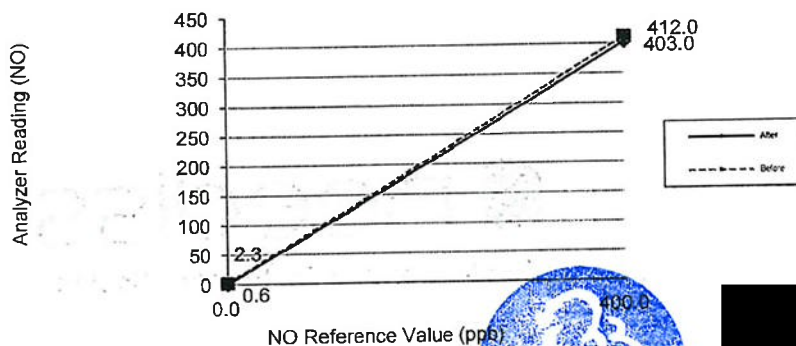
Calibration Check (Before adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	1.5	0.0	1.5	410.0	400.0	1.2
NO ₂	0.8	0.0	0.8	2.0	0.0	0.2
NOx	2.3	0.0	2.3	412.0	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	0.3	0.0	0.3	399.6	400.0	-0.1
NO ₂	0.3	0.0	0.3	3.4	0.0	0.4
NOx	0.6	0.0	0.6	403.0	400.0	0.4

Single Point Calibration Chart



ภาคผนวก 3-16-2

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NOx Analyzer Verification Test Report

Calibration Report No.: AP-N6704006

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Calibrated Date: 1-Apr-24

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Test Function Value	Normal range	Unit	Before	After	Note
Date	1-Apr-24				
Time	10:10				
Range	0.00 - 500.00 PPB	PPB	500	500	
Stability (Zero Gas)	< 0.2	PPB	0.5	0.2	
Sample Flow	500+/- 50	cc/min	511	532	
Ozone Flow	60-90	cc/min	80	80	
PMT Detector	0-5000	mV	27.4	16.4	
AZERO	-20-150	mV	54.2	54.2	
HVPS	400-900 constant	V	819	819	
DCPS	2500 +/- 200	mV	-	-	
RCELL TEMP	50+/- 1	Dreegee C	50	50	
BOX TEMP	20-35	Dreegee C	33.7	32.9	
PMT TEMP	7 +/-1	Dreegee C	7.1	7.1	
IZS TEMP	50+/- 4	Dreegee C	-	-	
MOLY Temp	315 +/- 5	Dreegee C	314.4	315.0	
RCEL PRES	4-10 contant	IN-Hg-A	10	10	
SAMP PRES	20-30 contant	IN-Hg-A	29.0	29.4	
NO Slope	1 +/- 0.3		0.820	0.801	
Nox Slope	1 +/- 0.3		0.848	0.813	
NO Offset	-10 to + 150	mV	10.2	15.3	
NOx Offset	-10 to + 150	mV	-2.0	-3.4	
Span and Cal Values					
Zero Value	NO	0	ppb	1.5	0.3
	NOx	0	ppb	2.3	0.6
Span Value	NO	400	ppb	410.0	399.6
	NOx	400	ppb	412.0	403.0

Calibrate By: _____

Date: _____



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NOx Analyzer Verification Test Report

Calibration Report No.: AP-N6704008

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Calibrated Date: 1-Apr-24

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Instruments Information

Analyzer Type: NO/NO2/NOx Analyzer Model: T200	Manufacturer API S/N: ENOAIT20002467
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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

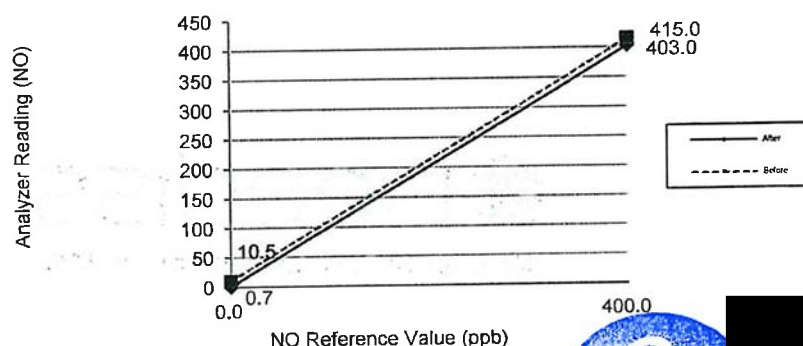
Environment: Temperature 27.7 °CHumidity: 61 %RH

Calibration Check (Before adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	8.3	0.0	8.3	413.0	400.0	1.6
NO ₂	2.2	0.0	2.2	2.0	0.0	0.2
NOx	10.5	0.0	10.5	415.0	400.0	1.8

Calibration Check (After adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.5	0.0	0.5	395.0	400.0	-0.6
NO ₂	0.2	0.0	0.2	8.0	0.0	1.0
NOx	0.7	0.0	0.7	403.0	400.0	0.4

Single Point Calibration Chart



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Neediss Supply Instrument Co., Ltd.

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NOx Analyzer Verification Test Report

Calibration Report No.: AP-N6704008

Page:1/1

Calibrated Date: 1-Apr-24

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Page:2/2

Test Function Value	Normal range	Unit	Before	After	Note
Date	1-Apr-24				
Time	13:20				
Range	0.00 - 500.00 PPB	PPB	500.0	500.0	
Stability (Zero Gas)	< 0.2	PPB	0.5	0.2	
Sample Flow	500+/- 50	cc/min	474.0	441.0	
Ozone Flow	60-90	cc/min	76.0	76.0	
PMT Detector	0-50000	mV	24.5	62.2	
AZERO	-20-150	mV	8.6	67.5	
HVPS	400-900 constant	V	839.0	836.0	
DCPS	2500 +/- 200	mV	-	-	
RCELL TEMP	50+/- 1	Dreegee C	50.0	50.0	
BOX TEMP	20-35	Dreegee C	34.5	30.5	
PMT TEMP	7 +/-1	Dreegee C	7.0	7.1	
IZS TEMP	50+/- 4	Dreegee C	-	-	
MOLY Temp	315 +/- 5	Dreegee C	315.0	314.4	
RCEL PRES	4-10 contant	IN-Hg-A	4.20	7.90	
SAMP PRES	20-30 contant	IN-Hg-A	29.9	28.6	
NO Slope	1 +/- 0.3		1.256	1.032	
Nox Slope	1 +/- 0.3		1.232	1.048	
NO Offset	-10 to + 150	mV	4.50	6.90	
NOx Offset	-10 to + 150	mV	-5.00	-1.50	
Span and Cal Values					
Zero Value	NO	0	ppb	8.3	0.5
	NOx	0	ppb	10.5	0.7
Span Value	NO	400	ppb	413.0	395.0
	NOx	400	ppb	415.0	403.0

Calibrate By :

Date:

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Tel : 02-502-5760-2 Fax : 02-502-3955 E-mail : neediss@neediss.com



NOx Analyzer Verification Test Report

Calibration Report No.: AP-N6704002

Page:1/1

Calibrated Date: 1-Apr-24

☒ PM ☐ Onsite

Instruments Information

Analyzer Type: NO/NO ₂ /NO _x Analyzer Model: T200	Manufacturer API S/N: ENOAIT20003572
--	---

Calibration System

Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792 ZERO AIR Generator ZAG7001 S/N: 644	NO _x Conc 46.50 PPM NO Conc 46.50 PPM SO ₂ Conc 45.59 PPM CO Conc 4507 PPM Expire Date: Mar 31,2026 EB0160267

Environment: Temperature 24.9 °C

Humidity: 64 %RH

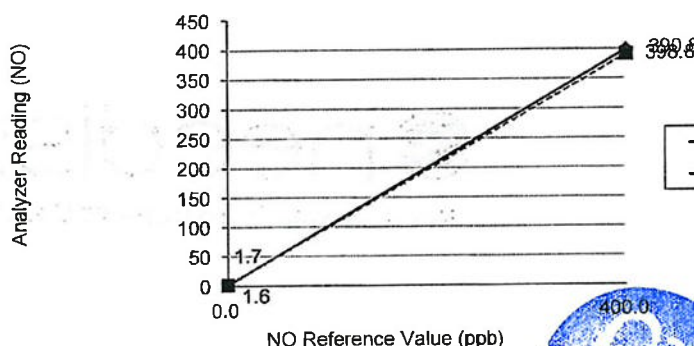
Calibration Check (Before adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	1.7	0.0	1.7	397.3	400.0	-0.3
NO ₂	0.0	0.0	0.0	-6.5	0.0	-0.8
NO _x	1.7	0.0	1.7	390.8	400.0	-1.2

Calibration Check (After adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	1.7	0.0	1.7	396.1	400.0	-0.5
NO ₂	-0.1	0.0	-0.1	2.7	0.0	0.3
NO _x	1.6	0.0	1.6	398.8	400.0	-0.2

Single Point Calibration Chart



ภาคผนวก 3-16-2

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NOx Analyzer Verification Test Report

Page:1/1

Calibration Report No.: AP-N6704002

Calibrated Date: 1-Apr-24

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Page:2/2

Test Function Value	Nominal range	Unit	Before	After	Note
Date	1-Apr-24				
Time	11:25				
Range	0.00 - 500.00 PPB	PPB	500	500	
Stability (Zero Gas)	< 0.2	PPB	0.4	0.2	
Sample Flow	500+/- 50	cc/min	500	490	
Ozone Flow	60-90	cc/min	89	80	
PMT Detector	0-5000	mV	50.9	20.4	
AZERO	-20-150	mV	48.3	49.1	
HVPS	400-900 constant	V	745	745	
DCPS	2500 +/- 200	mV	-	-	
RCELL TEMP	50+/- 1	Dreegee C	50.0	50.0	
BOX TEMP	20-35	Dreegee C	33.2	32.6	
PMT TEMP	7 +/-1	Dreegee C	7.2	7.2	
IZS TEMP	50+/- 4	Dreegee C	-	-	
MOLY Temp	315 +/- 5	Dreegee C	313.3	314.5	
RCEL PRES	4-10 contant	IN-Hg-A	3.7	3.7	
SAMP PRES	20-30 contant	IN-Hg-A	28.3	28.7	
NO Slope	1 +/- 0.3		1.025	1.178	
Nox Slope	1 +/- 0.3		1.066	1.153	
NO Offset	-10 to + 150	mV	8.7	-1.6	
NOx Offset	-10 to + 150	mV	2.1	2.6	
Span and Cal Values					
Zero Value	NO	0	ppb	1.7	1.7
	NOx	0	ppb	1.7	1.6
Span Value	NO	400	ppb	397.3	396.1
	NOx	400	ppb	390.8	398.8

Calibrate By: _____

Date: _____


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CO Analyzer Verification Test Report

Calibration Report No.: ES-C6704002

Calibrated Date: 1-Apr-24

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Page:1/2

Instruments Information

Analyzer Type: CO Analyzer Model: CO12E	Manufacturer Environnement SA., France S/N: ECOESACO12E205
--	---

Calibration System

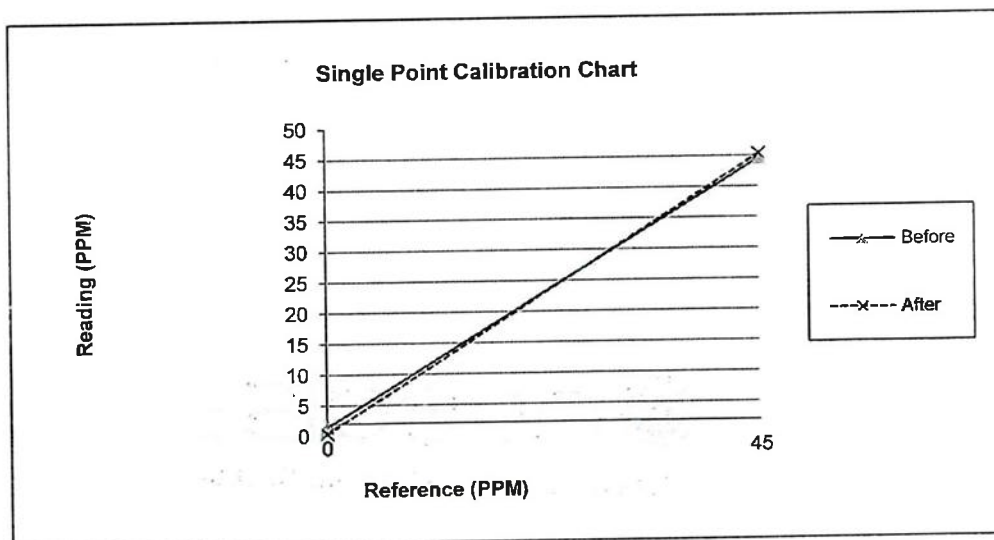
Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792 ZERO AIR Generator ZAG7001 S/N: 644	NOx Conc 46.50 PPM NO Conc 46.50 PPM So2 Conc 45.59 PPM Co Conc 4507 PPM Expire Date: Mar 31,2026 EB0160267

Environment: Temperature 24.6 °C

Humidity: 56 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Before	0.0	1.420	1.4	45.0	44.59	-0.5
After	0.0	0.361	0.4	45.0	45.33	0.4



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CO Analyzer Verification Test Report

Calibration Report No.: ES-C6704002

Calibrated Date: 1-Apr-24

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Page:2/2

Analyzer Signal Values					
Date	1-Apr-24	Time	10:09:00		
Power Supplies					
Option	0.0	mV	+5 V Sensor	5	V
+3.3 V	3.3	V	+24 V	24.2	V
+12 V	11.8	V	+5 V	5.1	V
+24 V	1.1	mV			
Optical Bench					
IR current ratio	884.7	mA	Pbse current	618.2	mV
Optical T.	46.0	deg.C	Pbse T.	-24.2	deg.C
Measure sig.	506.4	mV	Refer Sig.	456.4	mV
Min sig.	945.0	mV	Max Sig.	2840	mV
Sample					
inst. Ratio	1.109		Ratio	1.105	
Ref. ratio	1.109		Internal Temp.	28.9	deg.C
Source Temp.	46.0	deg.C	Gas Pressure	997	hPa
Up Pressure	947.0	hPa	Flow	59	l/h

Calibrate By :

Date:

1-Apr-24

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CO Analyzer Verification Test Report

Calibration Report No.: TD-C6704004

Calibrated Date: 1-Apr-24

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Page:1/2

Instruments Information

Analyzer Type: CO Analyzer Model: T300	Manufacturer API S/N: ECOAIT30000098
---	---

Calibration System

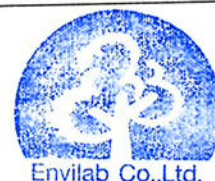
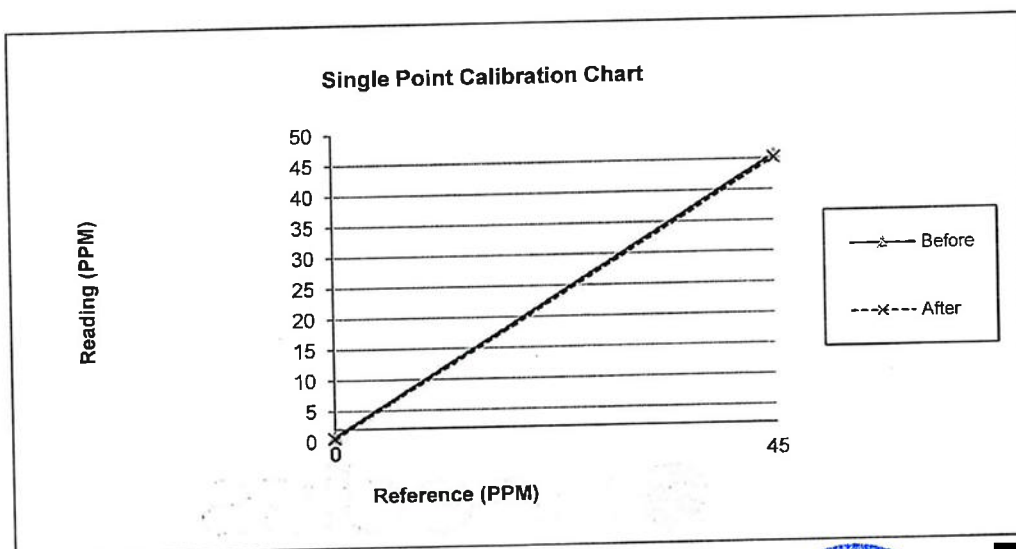
Calibrator Unit	Standard Gas
Dilutor Model ESA MGA101 S/N: 792 ZERO AIR Generator ZAG7001 S/N: 644	NOx Conc 46.50 PPM NO Conc 46.50 PPM So2 Conc 45.59 PPM Co Conc 4507 PPM Expire Date: Mar 31,2026 EB0160267

Environment: Temperature 24.6 °C

Humidity: 57 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Before	0.0	0.8	0.8	45.0	45.7	0.8
After	0.0	0.5	0.5	45.0	45.2	0.2



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CO Analyzer Verification Test Report

Calibration Report No.: TD-C6704004

Calibrated Date: 1-Apr-24

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Page:2/2

Detail	Range	Unit	Before	After	Note
Date	1-Apr-24				
Time	10:51				
Range	0.1-1000 PPM	PPM	50	50	
Stability	(0.1-2PPB)	ppb	0.04	0.2	
CO Measure	2500 - 4800 MV.	mV	4465.6	4431.3	
CO Reference	2500 - 4800 MV.	mV	3788.5	3730.2	
MR Ratio	1.2 +/- 0.5		1.19	1.20	
Sample Pressure	26 - 30 in-Hg-A	in-Hg-A	28.7	28.6	
Sample Flow	720 - 880 cc/min	cc/min	904	898	
Sample Temp	44 - 52 deg.C	deg.C	48.5	43.3	
Bench Temp	47 - 49 deg.C	deg.C	48	48	
Wheel Temp	66 - 70 deg.C	deg.C	68	68	
Box Temp	27 - 50 deg.C	deg.C	33.3	34.8	
PHT drive	250 - 4750 mv.	mV	2912.3	2913.5	
Slope	0.800 - 1.200		1.197	1.138	
Offset	0.05 +/- 0.2		-0.015	-0.016	
Gas Test Response					
Zero Gas	0	PPM	0.8	0.5	
Span Gas	45	PPM	45.7	45.2	± 5% of Range

Calibrate By : _____

Date: _____

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CO Analyzer Verification Test Report

Calibration Report No.: ES-C6704007

Calibrated Date: 1-Apr-24

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Page:1/2

Instruments Information

Analyzer Type: CO Analyzer Model: CO12E	Manufacturer Environnement SA., France S/N: ECOESACO12E201
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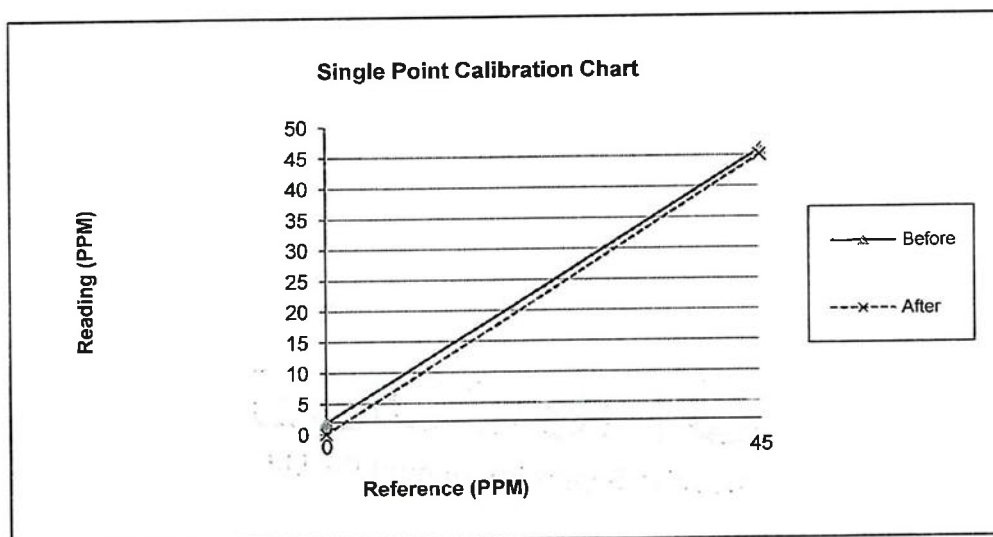
Calibration System

Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792 ZERO AIR Generator ZAG7001 S/N: 644	NO Conc 44.68 PPM SO2 Conc 45.34 PPM CO Conc 4500 PPM Expire Date: Feb 19,2024 EB0140762

Environment: Temperature 27.2 °CHumidity: 58 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Before	0.0	1.887	1.9	45.0	45.98	1.1
After	0.0	0.050	0.1	45.0	45.05	0.1



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CO Analyzer Verification Test Report

Calibration Report No.: ES-C6704007

Calibrated Date: 1-Apr-24

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Analyzer Signal Values					
Date	1-Apr-24	Time	10:09:00		
Power Supplies					
Option	0.0	mV	+5 V Sensor	5	V
+3.3 V	3.3	V	+24 V	24.2	V
+12 V	11.8	V	+5 V	5.1	V
+24 V	1.1	mV			
Optical Bench					
IR current ratio	884.7	mA	Pbse current	618.2	mV
Optical T.	46.0	deg.C	Pbse T.	-24.2	deg.C
Measure sig.	506.4	mV	Refer Sig.	456.4	mV
Min sig.	945.0	mV	Max Sig.	2840	mV
Sample					
inst. Ratio	1.109		Ratio	1.105	
Ref. ratio	1.109		Internal Temp.	28.9	deg.C
Source Temp.	46.0	deg.C	Gas Pressure	997	hPa
Up Pressure	947.0	hPa	Flow	59	l/h

Calibrate By : _____

Date: 1-Apr-24

Date: 1-Apr-24

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CO Analyzer Verification Test Report

Calibration Report No.: TD-C6704003

Calibrated Date: 1-Apr-24

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Instruments Information

Page:1/2

Analyzer Type: CO Analyzer Model: T300	Manufacturer API S/N: ECOAIT30000099
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Calibration System

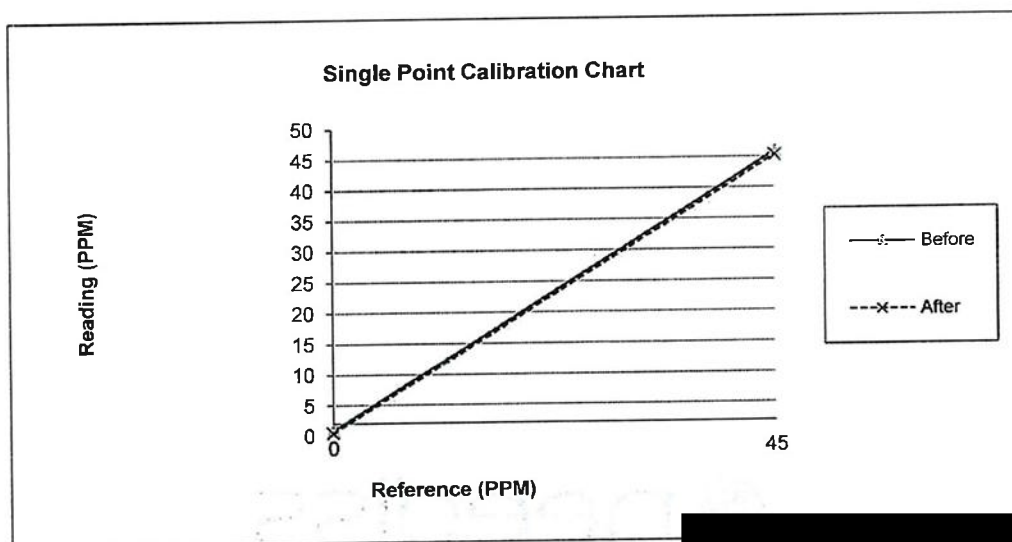
Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792 ZERO AIR Generator ZAG7001 S/N: 644	NOx Conc 46.50 PPM NO Conc 46.50 PPM So2 Conc 45.59 PPM Co Conc 4507 PPM Expire Date: Mar 31,2026 EB0160267

Environment: Temperature 24.6 °C

Humidity: 57 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Before	0.0	0.9	0.9	45.0	45.9	0.9
After	0.0	0.5	0.5	45.0	45.3	0.3





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CO Analyzer Verification Test Report

Calibration Report No.: TD-C6704003

Calibrated Date: 1-Apr-24

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Detail	Range	Unit	Before	After	Note
Date	1-Apr-24				
Time	14:57				
Range	0.1-1000 PPM	PPM	50	50	
Stability	(0.1-2PPB)	ppb	0.22	0	
CO Measure	2500 - 4800 MV.	mV	3793.2	3836.5	
CO Reference	2500 - 4800 MV.	mV	3143.6	3179.5	
MR Ratio	1.2 +/- 0.5		1.215	1.215	
Sample Pressure	26 - 30 in-Hg-A	in-Hg-A	28.6	28.6	
Sample Flow	720 - 880 cc/min	cc/min	859	859	
Sample Temp	44 - 52 deg.C	deg.C	47.8	46.7	
Bench Temp	47 - 49 deg.C	deg.C	48	48	
Wheel Temp	66 - 70 deg.C	deg.C	68	68	
Box Temp	27 - 50 deg.C	deg.C	32	34.9	
PHT drive	250 - 4750 mv.	mV	3015	3018.6	
Slope	0.800 - 1.200		0.867	0.875	
Offset	0.05 +/- 0.2		0.006	0.005	
Gas Test Response					
Zero Gas	0	PPM	0.9	0.5	
Span Gas	45	PPM	45.9	45.3	± 5% of Range

Calibrate By :

Date:

1-Apr-24

Date:

1-Apr-24



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CO Analyzer Verification Test Report

Calibration Report No.: ES-C6704006

Calibrated Date: 1-Apr-24

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Page:1/2

Instruments Information

Analyzer Type: CO Analyzer Model: CO12E	Manufacturer Environnement SA., France S/N: ECOESACO12E202
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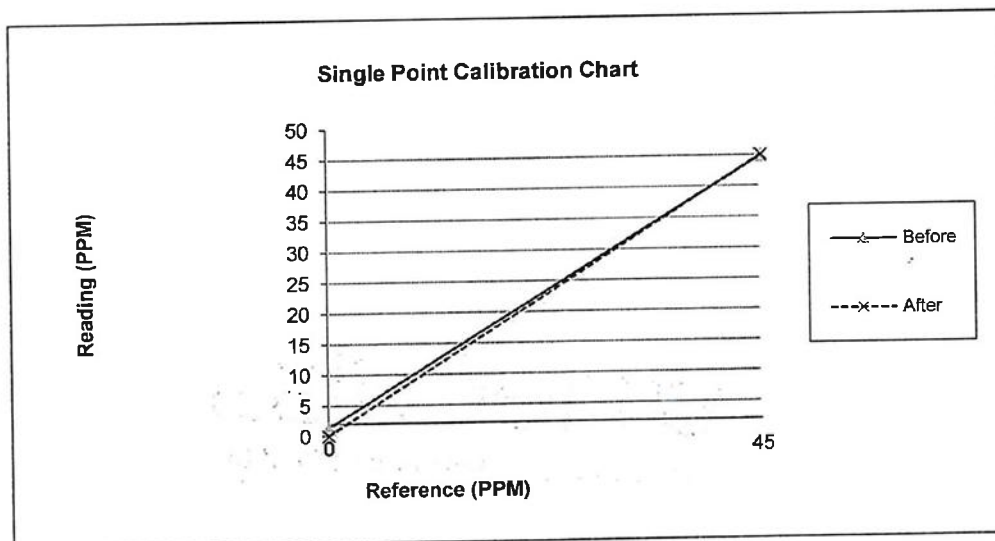
Calibration System

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 27.2 °CHumidity: 59 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Before	0.0	1.342	1.3	45.0	44.89	-0.1
After	0.0	0.078	0.1	45.0	45.02	0.0





CO Analyzer Verification Test Report

Calibration Report No.: ES-C6704006

Calibrated Date: 1-Apr-24

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Page:2/2

Analyzer Signal Values					
Date	1-Apr-24	Time	10:09:00		
Power Supplies					
Option	0.0	mV	+5 V Sensor	5	V
+3.3 V	3.3	V	+24 V	24.2	V
+12 V	11.8	V	+5 V	5.1	V
+24 V	1.1	mV			
Optical Bench					
IR current ratio	884.7	mA	Pbse current	618.2	mV
Optical T.	46.0	deg.C	Pbse T.	-24.2	deg.C
Measure sig.	506.4	mV	Refer Sig.	456.4	mV
Min sig.	945.0	mV	Max Sig.	2840	mV
Sample					
inst. Ratio	1.109		Ratio	1.105	
Ref. ratio	1.109		Internal Temp.	28.9	deg.C
Source Temp.	46.0	deg.C	Gas Pressure	997	hPa
Up Pressure	947.0	hPa	Flow	59	l/h

Calibrate By : _____

Date: 1-Apr-24

Date: 1-Apr-24


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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 : 6 April, 2024

Certification No. 168/24

Page : 1 of 6

Object : เครื่องมือตรวจวัดอุณหภูมิตามวิทย

Manufacturer : DYACON

Type : Data Logger MS-100

Serial No. : 130148 ID No. : EWSDCMS1200148

Customer : ENVILAB Co.,Ltd.
540,540/1 Soi Bangkhae 7, Bangkhae, Bangkhae,
Bangkok 10160, Thailand.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1008.2 hPa

NATIONAL STANDARD WIND TUNNEL : Wind Aloft Plotting Board

: Micromanometer Theodor Friedrichs FC014 Serial No. 9310119 : HOOK GAGE NO 1425

N.I.S.T. Test Reference Number 731/241460 : Standard Velocity at 20 - 30 m/sec

: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)
Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION : Standard Velocity at 0 - 20 m/sec

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

: Thermoschneider No.9188 : testo, testo 645 Serial No. 02848057

STANDARD BAROMETER : Digital Barometer Vaisala Type PTB220 No. V1220015

Calibrated by

Mr. Watchara

Mechanica



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Sensor Wind Speed & Wind Direction Model WSD-1 F Certification No. 168/24

6 April, 2024

Serial No. 1222

Page : 2 of 6

Standard Ultrasonic Anemometer m/sec	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure inches H2O	Vacumm inches H2O	Velocity m/sec	Velocity m/sec	Correction m/sec
1.00	-	-	-	1.0	0.00
3.02	-	-	-	2.9	0.12
5.00	-	-	-	5.0	0.00
7.04	-	-	-	6.9	0.14
9.02	-	-	-	9.0	0.02
11.01	-	-	-	11.0	0.01
13.01	-	-	-	13.0	0.01
15.01	-	-	-	15.0	0.01
17.02	-	-	-	17.0	0.02
20.02	-	-	-	20.0	0.02

Wind Aloft Plotting Board.	
US.DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRETION	TESTED WIND DIRECTION
0	0
90	90
180	182
270	270

Calibrate



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Sensor Pressure Model TPH-1 C

Serial No. 6273

Certification No. 168/24

6 April, 2024

Page : 3 of 6

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	
1009.59	1009.1	0.49
1009.45	1009.0	0.45
1010.10	1009.5	0.60
1010.94	1010.5	0.44
1011.46	1010.9	0.56
1011.84	1011.3	0.54
1012.06	1011.6	0.46
1013.04	1012.6	0.44
1013.18	1012.6	0.58
1012.89	1012.3	0.59
1013.20	1012.8	0.40
1013.44	1012.9	0.54
1013.81	1013.3	0.51
1014.19	1013.6	0.59
1015.96	1015.4	0.56
1016.23	1015.8	0.43
1015.64	1015.1	0.54
1015.23	1014.8	0.43
1012.87	1012.3	0.57
1013.63	1013.1	0.53

Average

0.51

Calibra



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Sensor Temperature Model TPH-1 C

Certification No. 168/24

6 April, 2024

Serial No. 6273

Page : 4 of 6

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.6	45.7	-0.1
30.1	30.2	-0.1
15.4	15.3	0.1



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The Result of Calibration

Sensor Humidity Model TPH-1 C

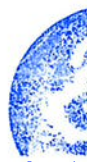
Certification No. 168/24

6 April, 2024

Serial No. 6273

Page : 5 of 6

Standard Humidity % R.H.	Relative Humidity Sensor Reading	
	Reading	Correction
	% R.H.	% R.H.
85.2	87.8	-2.6
62.4	65.2	-2.8
41.5	43.1	-1.6





Date of Issue 6 April, 2024

Certification No. 168/24

Page: 6 of 6

ใบรับรอง

หนังสือฉบับนี้ขอรับรองว่า เครื่องวัดฝน ยี่ห้อ Davis Instruments แบบ TIPPING BUCKET Product No. #7852 Mfg. Code. EWSDCMS1200148 ทำการสอบเทียบกับแก้ววัดฝน แบบแก้วดวง GAUGE DIAMETER 8.0 INCHES, NEGRETTI & ZAMBRA LONDON No. 71082 และสามารถนำไปใช้ได้ มีค่าถูกต้องตามรายละเอียดของเครื่องมือ (0.2 mm./TIP)



ลงชื่อ...

วิศวกรชำนาญการ





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 2 October, 2023

Certification No. 338/23

Page : 1 of 6

Object : เครื่องมือตรวจวัดอุตุนิยมวิทยา

Manufacturer : NovaLynx

Type : Data Logger 110-WS-25DL-D

Serial No. : EWSNV110WS2509

Customer : Envilab Co.,Ltd.(Head Office)
540.540/1 Soi Bangkhae 7, Bangkhae, Bangkhae
Bangkok 10160,Thailand.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1006.8 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 : Standard Velocity at 20 - 30 m/sec

: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION : Standard Velocity at 0 - 20 m/sec

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

: Thermoschneider No.918802

STANDARD BAROMETER : Digital Barometer Vaisala Type PTB220 No. V1220015



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Sensor model

EWSNV110WS2509

Certification No. 338/23

2 October, 2023

Page : 2 of 6

Standard Ultrasonic Anemometer m/sec	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacuum	Velocity	Velocity	Correction
	inches H2O	inches H2O	m/sec	m/sec	m/sec
1.00	-	-	-	0.4	0.60
3.02	-	-	-	2.7	0.32
5.00	-	-	-	4.5	0.50
7.04	-	-	-	7.0	0.04
9.02	-	-	-	9.0	0.02
11.01	-	-	-	11.0	0.01
13.01	-	-	-	13.0	0.01
15.01	-	-	-	15.0	0.01
17.02	-	-	-	17.0	0.02
20.02	-	-	-	20.1	-0.08

Wind Aloft Plotting Board.	
US.DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRECTION	TESTED WIND DIRECTION
0	0
90	89
180	175
270	266

Calibr



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Sensor model

EWSNV110WS2509

Certification No. 338/23

2 October, 2023

Page : 3 of 6

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	
1005.63	1005.12	0.51
1006.25	1005.65	0.60
1006.22	1005.72	0.50
1006.54	1006.00	0.54
1006.88	1006.30	0.58
1007.36	1006.80	0.56
1007.58	1007.04	0.54
1007.52	1007.02	0.50
1005.60	1005.02	0.58
1005.84	1005.35	0.49
1006.28	1005.72	0.56
1006.60	1006.06	0.54
1007.07	1006.54	0.53
1007.26	1006.73	0.53
1007.38	1006.86	0.52
1005.50	1004.98	0.52
1005.83	1005.34	0.49
1006.55	1006.04	0.51
1007.31	1006.86	0.45
1007.01	1006.51	0.50

Average

0.53

Cali



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Sensor model

EWSNV110WS2509

Certification No. 338/23

2 October, 2023

Page : 4 of 6

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.2	45.3	-0.1
31.1	31.1	0.0
15.8	15.9	-0.1

Cal

Mechanical Engineer



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Sensor model EWSNV110WS2509 Certification No. 338/23

2 October, 2023

Page : 5 of 6

Standard Humidity % R.H.	Relative Humidity Sensor Reading	
	Reading	Correction
	% R.H.	% R.H.
86.2	82.6	3.6
62.4	59.2	3.2
45.6	42.7	2.9

Mechanical Engineer





Date of Issue 2 October, 2023

Certification No. 338/23

Page: 6 of 6

ใบรับรอง

หนังสือฉบับนี้ขอรับรองว่า เครื่องวัดฝน ยี่ห้อ Davis Instruments แบบ TIPPING
BUCKET Product No. 7342.026 Mfg. Code. EWSNV110WS2509 ทำการสอบเทียบกับแก้ววัด
ฝนแบบแก้วตวง GAUGE DIAMETER 8.0 INCHES, NEGRETTI & ZAMBRA LONDON
No. 71082 และสามารถนำไปใช้ได้ มีค่าถูกต้องตามรายละเอียดของเครื่องมือ (0.01 in/TIP)



ลงชื่อ...

วิศวกรชำนาญการ





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 6 April, 2024

Certification No. 170/24

Page : 1 of 6

Object : เครื่องมือตรวจวัดอุณหภูมิตามวิทยา

Manufacturer : DYACON

Type : Data Logger MS-100

Serial No. : 130150 ID No. : EWSDCMS1200150

Customer : ENVILAB Co.,Ltd.
540,540/1 Soi Bangkhae 7, Bangkhae, Bangkhae,
Bangkok 10160, Thailand.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1008.7 hPa

NATIONAL STANDARD WIND TUNNEL : Wind Aloft Plotting Board

: Micromanometer Theodor Friedrichs FC014 Serial No. 9310119 : HOOK GAGE NO 1425

N.I.S.T. Test Reference Number 731/241460 : Standard Velocity at 20 - 30 m/sec

: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)
Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION : Standard Velocity at 0 - 20 m/sec

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

: Thermoschneider No.9188 : testo, testo 645 Serial No. 02848057

STANDARD BAROMETER : Digital Barometer Vaisala Type PTB220 No. V1220015



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Sensor Wind Speed & Wind Direction Model WSD-1 F

Certification No. 170/24

6 April, 2024

Serial No. 1224

Page : 2 of 6

Standard Ultrasonic Anemometer	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacumm	Velocity	Velocity	Correction
m/sec	inches H2O	inches H2O	m/sec	m/sec	m/sec
1.00	-	-	-	1.0	0.00
3.02	-	-	-	2.9	0.12
5.00	-	-	-	5.0	0.00
7.04	-	-	-	7.0	0.04
9.02	-	-	-	9.0	0.02
11.01	-	-	-	11.0	0.01
13.01	-	-	-	12.9	0.11
15.01	-	-	-	15.0	0.01
17.02	-	-	-	17.0	0.02
20.02	-	-	-	20.0	0.02

Wind Aloft Plotting Board.	
US.DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRETION	TESTED WIND DIRECTION
0	0
90	91
180	180
270	271

Calibra



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Sensor Presure Model TPH-1 C

Serial No. 6275

Certification No. 170/24

6 April, 2024

Page : 3 of 6

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	
1009.59	1009.1	0.49
1009.45	1009.0	0.45
1010.10	1009.6	0.50
1010.94	1010.5	0.44
1011.46	1011.0	0.46
1011.84	1011.5	0.34
1012.06	1011.6	0.46
1013.04	1012.6	0.44
1013.18	1012.7	0.48
1012.89	1012.4	0.49
1013.20	1012.8	0.40
1013.44	1013.0	0.44
1013.81	1013.4	0.41
1014.19	1013.6	0.59
1015.96	1015.5	0.46
1016.23	1015.7	0.53
1015.64	1015.2	0.44
1015.23	1014.7	0.53
1012.87	1012.3	0.57
1013.63	1013.1	0.53

Cal

Mechanical Engineer

Meteorological Instruments Bureau



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Sensor Temperature Model TPH-1 C

Certification No. 170/24

6 April, 2024

Serial No. 6275

Page : 4 of 6

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.6	45.6	0.0
30.1	30.1	0.0
15.4	15.5	-0.1

Ca

Mechanical Engineer





THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Sensor Humidity Model TPH-1 C

Certification No. 170/24

6 April, 2024

Serial No. 6275

Page : 5 of 6

Standard Humidity % R.H.	Relative Humidity Sensor Reading	
	Reading	Correction
	% R.H.	% R.H.
85.2	82.5	2.7
62.4	60.2	2.2
41.5	40.1	1.4

Mechanical Engineer



Date of Issue 6 April, 2024

Certification No. 170/24

Page: 6 of 6

ใบรับรอง

หนังสือฉบับนี้ขอรับรองว่า เครื่องวัดฝน ยี่ห้อ Davis Instruments แบบ TIPPING BUCKET Product No. #7852 Mfg. Code. EWSDCMS1200150 ทำการสอบเทียบกับแก้ววัดฝน แบบแก้วตวง GAUGE DIAMETER 8.0 INCHES, NEGRETTI & ZAMBRA LONDON No. 71082 และสามารถนำไปใช้ได้ มีค่าถูกต้องตามรายละเอียดของเครื่องมือ (0.2 mm./TIP)



วิศวกรชำนาญการ



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 31 August, 2023

Certification No. 304/23

Page : 1 of 6

Object : เครื่องมือตรวจวัดอุตุนิยมวิทยา

Manufacturer : NovaLynx

Type : Data Logger NDWD100

Serial No. : EWSNV110WS2506

Customer : Envilab Co.,Ltd.(Head Office)
540.540/1 Soi Bangkhao 7, Bangkhao, Bangkhao
Bangkok 10160,Thailand.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1008.1 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 : Standard Velocity at 20 - 30 m/sec

: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION : Standard Velocity at 0 - 20 m/sec

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

: Thermoschneider No.918802

STANDARD BAROMETER

: Digital Barometer Vaisala Type PTB220 No V1220015



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Sensor model

EWSNV110WS2506

Certification No. 304/23

31 August, 2023

Page : 2 of 6

Standard Ultrasonic Anemometer	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacuum	Velocity	Velocity	Correction
m/sec	inches H2O	inches H2O	m/sec	m/sec	m/sec
1.00	-	-	-	0.8	0.20
3.02	-	-	-	2.9	0.12
5.00	-	-	-	4.9	0.10
7.04	-	-	-	7.1	-0.06
9.02	-	-	-	9.1	-0.08
11.01	-	-	-	10.1	0.91
13.01	-	-	-	13.1	-0.09
15.01	-	-	-	15.0	0.01
17.02	-	-	-	17.0	0.02
20.02	-	-	-	20.1	-0.08

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

Calibr



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Sensor model EWSNV110WS2506

Certification No. 304/23

31 August, 2023

Page : 3 of 6

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	
1010.30	1011.12	-0.82
1010.57	1011.35	-0.78
1010.38	1011.16	-0.78
1010.23	1011.03	-0.80
1009.93	1010.85	-0.92
1009.66	1010.61	-0.95
1009.41	1010.36	-0.95
1009.13	1009.95	-0.82
1008.96	1009.74	-0.78
1008.58	1009.46	-0.88
1008.25	1009.13	-0.88
1007.57	1008.41	-0.84
1007.27	1008.15	-0.88
1007.04	1007.91	-0.87
1006.63	1007.42	-0.79
1010.02	1010.86	-0.84
1008.77	1009.57	-0.80
1008.67	1009.48	-0.81
1008.54	1009.32	-0.78
1008.23	1009.06	-0.83

Average

-0.84



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Sensor model

EWSNV110WS2506

Certification No. 304/23

31 August, 2023

Page : 4 of 6

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.6	45.9	-0.3
30.2	30.4	-0.2
15.8	15.7	0.1

Mechanical Engineer





THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Sensor model FWSNV110WS2506 Certification No. 304/23

31 August, 2023

Page : 5 of 6

Standard Humidity % R.H.	Relative Humidity Sensor Reading	
	Reading % R.H.	Correction % R.H.
86.2	82	4.2
65.4	62	3.4
46.4	44	2.4

Calibrated by

Mechanical Engineer





Date of Issue 31 August, 2023

Certification No. 304/23

Page: 6 of 6

ใบรับรอง

หนังสือฉบับนี้รับรองว่า เครื่องวัดฝน ชีห้อ Davis Instruments แบบ TIPPING
BUCKET Product No. 7342.026 Mfg. Code. EWSNV110WS2506 ทำการสอบเทียบกับแก้ววัด
ฝนแบบแก้วดวง GAUGE DIAMETER 8.0 INCHES, NEGRETTI & ZAMBRA LONDON
No. 71082 และสามารถนำไปใช้ได้ มีค่าถูกต้องตามรายละเอียดของเครื่องมือ (0.2 mm/TIP)



ลงชื่อ



วิศวกรชำนาญการ



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 6 April, 2024

Certification No. 171/24

Page : 1 of 6

Object : เครื่องมือตรวจวัดอุตุนิยมวิทยา

Manufacturer : NovaLynx

Type : Data Logger 110-WS-25DL-D

Serial No. : EWSNV110WS2501

Customer : ENVILAB Co.,Ltd.
540, 540/1 Soi Bangkhae 7, Bangkhae, Bangkhae,
Bangkok 10160,Thailand.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1008.9 hPa

NATIONAL STANDARD WIND TUNNEL : Wind Aloft Plotting Board

: Micromanometer Theodor Friedrichs FC014 Serial No. 9310119 : HOOK GAGE NO 1425

N.I.S.T. Test Reference Number 731/241460 : Standard Velocity at 20 - 30 m/sec

: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)
Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION : Standard Velocity at 0 - 20 m/sec

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

: Thermoschneider No.9188 : testo, testo 645 Serial No. 02848057

STANDARD BAROMETER : Digital Barometer Vaisala Type PTB220 No. V1220015



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Sensor model

EWSNV110WS2501

Certification No. 171/24

6 April, 2024

Page : 2 of 6

Standard Ultrasonic Anemometer m/sec	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure inches H2O	Vacumm inches H2O	Velocity m/sec	Velocity m/sec	Correction m/sec
1.00	-	-	-	0.3	0.70
3.02	-	-	-	2.4	0.62
5.00	-	-	-	4.9	0.10
7.04	-	-	-	6.9	0.14
9.02	-	-	-	8.8	0.22
11.01	-	-	-	10.8	0.21
13.01	-	-	-	12.8	0.21
15.01	-	-	-	14.8	0.21
17.02	-	-	-	17.1	-0.08
20.02	-	-	-	19.9	0.12

Wind Aloft Plotting Board.	
US.DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRETION	TESTED WIND DIRECTION
0	0
90	92
180	181
270	269

Calibra





THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Sensor model

EWSNV110WS2501

Certification No. 171/24

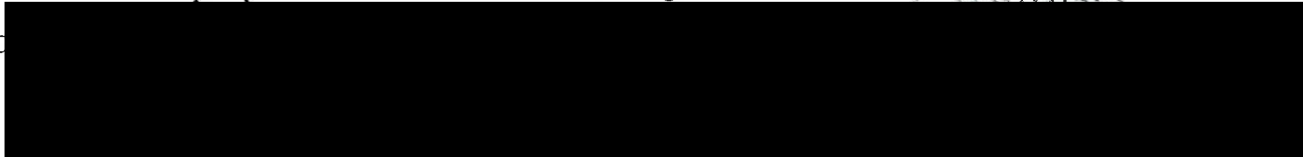
6 April, 2024

Page : 3 of 6

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	
1009.59	1009.46	0.13
1009.45	1009.56	-0.11
1010.10	1010.09	0.01
1010.94	1010.83	0.11
1011.46	1011.49	-0.03
1011.84	1011.96	-0.12
1012.06	1012.23	-0.17
1013.04	1013.05	-0.01
1013.18	1013.29	-0.11
1012.89	1012.79	0.10
1013.20	1013.32	-0.12
1013.44	1013.49	-0.05
1013.81	1013.76	0.05
1014.19	1014.23	-0.04
1015.96	1016.09	-0.13
1016.23	1016.31	-0.08
1015.64	1015.63	0.01
1015.23	1015.19	0.04
1012.87	1012.72	0.15
1013.63	1013.62	0.01

Average

-0.02 mmHg





THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Sensor model

EWSNV110WS2501

Certification No. 171/24

6 April, 2024

Page : 4 of 6

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.6	45.9	-0.3
30.1	30.3	-0.2
15.4	15.6	-0.2

Mechanical Engineer





THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Sensor model EWSNV110WS2501 Certification No. 171/24

6 April, 2024

Page : 5 of 6

Standard Humidity % R.H.	Relative Humidity Sensor Reading	
	Reading	Correction
	% R.H.	% R.H.
85.2	90.2	-5.0
62.4	66.8	-4.4
41.5	44.2	-2.7

Mechanical Engineer



Date of Issue 6 April, 2024

Certification No. 171/24

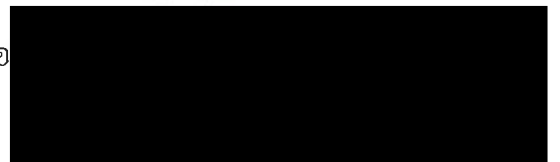
Page: 6 of 6

ใบรับรอง

หนังสือฉบับนี้ขอรับรองว่า เครื่องวัดฝน ยี่ห้อ Davis Instruments แบบ TIPPING
BUCKET Product No. #7852 Mfg. Code. EWSNV110WS2501 ทำการสอบเทียบกับแก้ววัดฝน
แบบแก้วตวง GAUGE DIAMETER 8.0 INCHES, NEGRETTI & ZAMBRA LONDON No.
71082 และสามารถนำไปใช้ได้ มีค่าถูกต้องตามรายละเอียดของเครื่องมือ (0.2 mm./TIP)



ลงชื่อ



วิศวกรชำนาญการ



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0148

MTC No. EEL. BP. 28/1266

CALIBRATION CERTIFICATE

Submitted by : Neediss Supply Instrument Co.,Ltd.

Address : 536 Soi Bangkhae 7, Bangkhae, Bangkok 10160 Thailand.

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 : Pulsar

Model : 103

Serial No. : 98971

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 B&K 4180 S/N 2889871.

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

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

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

Date of Receipt : 14 Dec. 2023

Date of Calibration : 18 Dec. 2023

1 / 3

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

FM.BL.MTC.002 Rev.4

Head Office
35 Mu 5 Tambon Khlong Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail: humpai@tistr.or.th Website: www.tistr.or.th

Office/Laboratory
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
Fax. (66) 0 2323 9165
E-mail : mtc@tistr.or.th

Office
196 Phahonyothin Road, Chatuchak, Bangkok 10900,
Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0148

MTC No. EEL. BP. 28/1266

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	94.10	0.10	± 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	1000.5	0.5	± 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	1.65	± 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.

Date of Calibration : 18 Dec. 2023

2 / 8

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

FM.BL.MTC.002 Rev.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 : rumpai@tistr.or.th Website:www.tistr.or.th

Office/Laboratory
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
Fax. (66) 0 2323 9165
E-mail : mtc@tistr.or.th

Office
196 Phahonyothin Road, Chatuchak, Bangkok 10900,

ภาคผนวก 3-16-2

Envilab Co.,Ltd. ผู้จัดการฝ่ายควบคุมคุณภาพ



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0148

MTC No. EEL. BP. 28/1266

Nominal Output of Unit Under Test = 114 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	114.19	0.19	± 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	1000.3	0.3	± 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	1.12	± 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 Khuaypa)
Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 18 Dec. 2023

Date of Issue : 20 Dec. 2023

Ref: 2011266121404935002

End of Certificate

3 / 3

The results relate only to the items tested/calibrated or value assigned.
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FM.BL.MTC.002 Rev.4

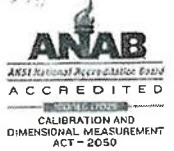
Head Office
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail : rumpai@tistr.or.th Website: www.tistr.or.th

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E-mail : mtc@tistr.or.th

Office
196 Phahonyothin Road, Chatuchak, Bangkok 10900,
Thailand
Tel. (66) 0 2570 1121-30 ext. 5219, 5225, 5217

ภาคผนวก 3-16-2

Envilab Co., Ltd. ผู้จัดการฝ่ายควบคุมคุณภาพ



Certificate of Calibration

Certificate Number : SPR23070059-6

Page : 1 of 3

Customer : Envilab Co., Ltd.

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

Equipment Name : Sound Level Meter

Manufacturer : Pulsar

Model : 44

Serial Number : PN1877

ID. Number : NSMPUMD44N1877

Environmental Conditions

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

Received Date : 05 Jul 2023

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

Calibration Date : 06 Jul 2023

Location of Calibration : In-Lab

Recommend Due Date : 06 Jul 2024

Calibration Procedure : SP-CPE-04-01

Date of Issue : 07 Jul 2023

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand)

Calibrated by :

Authorized Signatory



Calibration Report

Certificate Number : SPR23070059-6

Page : 2. of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	ST-120	211203773	EEL.BP. 114/0166	17 Jan 2024

Traceability

This certification is traceable to the International System of Unit maintained at :
TISTR - Thailand Institute of Scientific and Technological Research



Result of Calibration

Certificate No. : SPR23070059-6

Page : 3 of 3

Range : 94 to 114 dB

Function : @1kHz

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	114.3	114.3	0.3	0.3	0.15

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.1	94.1	0.1	0.1	0.15
114	114.3	114.3	0.3	0.3	0.15

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.1	94.1	0.1	0.1	0.15
114	114.3	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%.

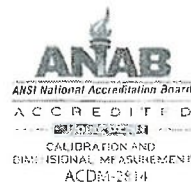
- End of Certificate -





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



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : HEAT STRESS MONITOR
MANUFACTURER : METROSONICS
MODEL / TYPE : hs-32
SERIAL NO. : MCH110040[EHEMTHS3211040]
CLID. NO. : 232400811
JOB CONTROL NO. : 240227021069
CALIBRATION SERVICE : ☒ IN-LABORATORY ☐ ON-SITE

CUSTOMER : ENVILAB CO., LTD.
540, 540/1 SOI BANGKHAE 7, BANGKHAE,
BANGKHAE, BANGKOK 10160 THAILAND

DATE OF RECEIVED : 27 February 2024

DATE OF ISSUED : 29 February 2024

The report of calibration shall not be reproduced except in full without approval of the Calibration Laboratory Co., Ltd.

Calibrated By :

Approved By :

29 February 2024



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. Q24021069

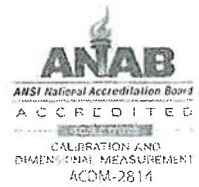
F3-011-05/12-23

page 1 of 3



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 : HEAT STRESS MONITOR
MANUFACTURER : METROSONICS
MODEL / TYPE : hs-32
SERIAL NO. : MCH110040[EHEMTHS3211040]
DATE OF CALIBRATION : 28 February 2024

ENVIRONMENT CONDITIONS :

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

Relative Humidity : $(55 \pm 10) \% \text{RH}$

PROCEDURE USED :

This instrument was calibrated under procedure No. **CLC-CPTH-11**. The calibration was performed by using Chilled Mirror Hygrometer which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

Chilled Mirror Hygrometer, Edgetech Model Dew Master S/N. 44602.
Temperature & Humidity Chamber, PGC Model 9141-5116 S/N. 1304261.

TRACEABILITY :

The measurements are traceable to International System of Units (SI), through Thunder Scientific Corporation.
Certificate No. 21594, Due Date 06 July 2024.

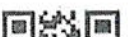
UNCERTAINTY :

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. Q24021069

F3-011-05/12-23

page 2 of 3



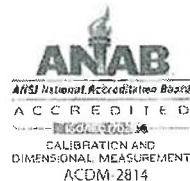
ภาคผนวก 3-16-2



CLC
Accredited
ISO/IEC 17025

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 : RECEIVED IN GOOD OPERATIONAL CONDITION

MEASUREMENT RESULTS : (X) without adjustment () adjustment

The table in the following gives the calibration results and associated measurement uncertainties of the measuring heat stress monitor.

CALIBRATION DATA

1. CORRECTION OF TEMPERATURE : WET

Test point (° C)	Actual Temperature (° C)	DUC Reading (° C)	Correction (° C)	Uncertainty ± (° C)
20.0	20.00	20.2	-0.20	0.27
30.0	30.00	30.2	-0.20	
40.0	39.99	40.0	-0.01	

2. CORRECTION OF TEMPERATURE : DRY

Test point (° C)	Actual Temperature (° C)	DUC Reading (° C)	Correction (° C)	Uncertainty ± (° C)
20.0	20.00	19.9	+0.10	0.27
30.0	30.00	30.1	-0.10	
40.0	39.99	40.2	-0.21	

3. CORRECTION OF TEMPERATURE : GLOBE

Test point (° C)	Actual Temperature (° C)	DUC Reading (° C)	Correction (° C)	Uncertainty ± (° C)
20.0	20.00	19.9	+0.10	0.27
30.0	30.00	29.9	+0.10	
40.0	39.99	39.7	+0.29	

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 012 Page 59 of 67

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

End of Certificate

Certificate No. Q24021069

F3-011-05/12-23

page 3 of 3



ภาคผนวก 3-16-2

Envilab Co.,Ltd. ผู้จัดการฝ่ายควบคุมคุณภาพ



Certificate of Calibration

Certificate Number : SPR24030525-1

Page : 1 of 3

Customer : Envilab Co., Ltd.

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

Equipment Name : Light Meter

Manufacturer : Tenmars

Model : TM-720

Serial Number : 190600485

ID. Number : N/A

Environmental Conditions

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

Received Date : 30 Mar 2024

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

Calibration Date : 18 Apr 2024

Location of Calibration : In-Lab

Recommend Due Date : 18 Apr 2025

Calibration Procedure : SP-CPE-04-32

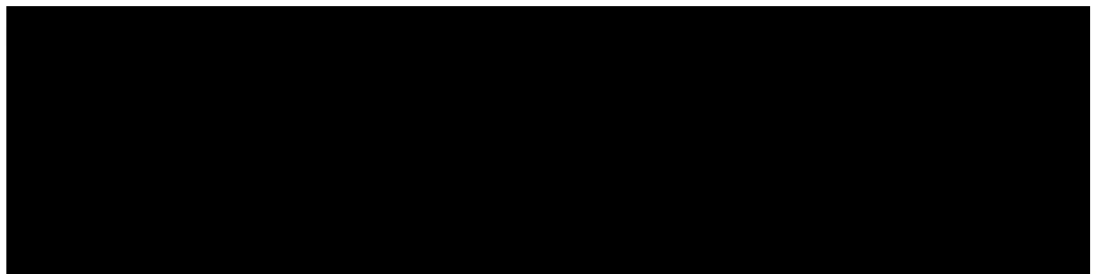
Date of Issue : 19 Apr 2024

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by





ID LINE : IEC17025



Calibration Report

Certificate Number : SPR24030525-1

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Digital Light Meter	LX-73	Q842777	23PH462	05 Sep 2024

Traceability

This certification is traceable to the International System of Unit maintained at :

TPA - Technology Promotion Association (Thailand-Japan)



ID LINE : IEC17025



Result of Calibration

Certificate No. : SPR24030525-1

Page : 3 of 3

Function: Illumination Measurement

Unit : Lux

Calibration Point	Standard Reading	UUC Reading	Error	Uncertainty (±)
100	100.0	93.0	-7.0	1.3
500	500	457.7	-42.3	6.6
1000	1000	912.2	-87.8	13
1500	1500	1357	-143	20
2000	2000	1810	-190	26

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 No. : 67-420034-1

Page : 1 of 2

Submitted by : Envilab Co., Ltd.
540,540/1 Soi Bangkhac7, Bangkhac, 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. : ELABPIIIB74BW01
Electrode
Model : 9615S Serial No. : 9X1K0003

Environment : On site calibration was carried out at the Laboratory, Envilab Co., Ltd.
Ambient Temperature : (22.0 to 23.0)°C
Relative Humidity : (50 to 55) %

Date of Received : 20 March 2024

Date of Calibration : 20 March 2024

Date of Issue : 23 March 2024

Calibrated by : Permpon Chanpu

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-00307/66	23 Aug 2025	National Institute of Metrology Thailand (NIMT)

2. Standard Buffer Solution

pH	Cert. No.	Lot No.	Exp. Date	Traceability
4.008	61293328	944535	27 Nov 2025	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
6.986	61281486	944537	17 Nov 2024	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
9.997	61281073	944536	17 Nov 2024	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025

Ap

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

Certificate of Calibration

Certificate No. : 67-420034-1

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	3.998	177.5	0.0	0.12
	0.0000	7	7.000	0.0	0.0	0.086
	-177.4800	10	10.000	-177.4	-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	4.009	-0.001	0.0084
	6.986	7.000	-0.014	0.0092
	9.997	10.008	-0.011	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%

UUC (pH) :

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. : 66-400546-1

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

ID No.

Cert. No.

Due Date

Traceability

400029 & 400048

66-400454-1

05 Feb 2024

National Institute of Metrology Thailand (NIMT)

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 66-400546-1

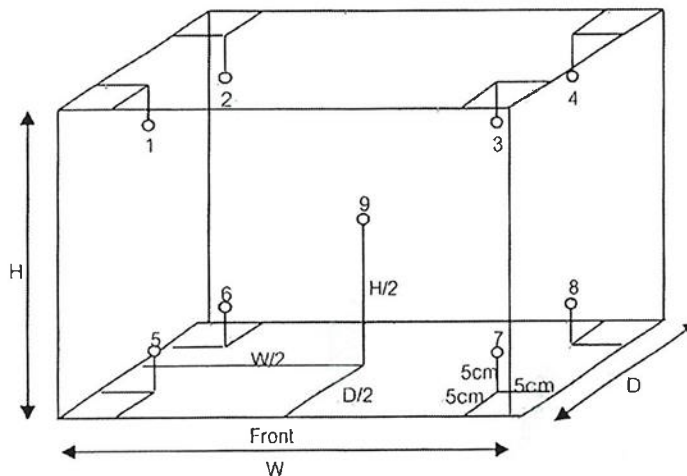
Page : 2 of 2

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%

- o0o -



SCIMET Co., Ltd.
1194 Soi Wachirathamsathit 57, Bangchak,
Phrakhanong, Bangkok 10260 Thailand
Email:scimet2022@gmail.com, Tel:095-552-4939

Certificate No. C27240001

Calibration Certificate

Equipment: DO METER
Model: HI9147
Serial No.(or ID): H00007030
Manufacturer: HANNA
Condition: In Condition

Job No.: KSMT2400445
Received Date: 04 March 2024
Issued Date: 14 March 2024
Page: 1 of 2

Customer

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

Calibration Place

Environment Laboratory, SCIMET Co., Ltd.
1194 Soi Wachirathamsathit 57, Bangchak, Prakhnong, Bangkok 10260 Thailand

Calibration Date

14 March 2024

Environment Condition

Temperature: 23 °C \pm 2 °C
Humidity: 50 %RH \pm 15 %RH

The Method used

In-house method, WI27 , By comparison with certified
dissolved oxygen solution standard

Traceability

This is certificate is traceable to SI Units , Sample test and
temperature test are assured through HANNA instruments
company certificare No. 29E31, through Quality Reborn
Co.,LTD certificare No.QR23-1169

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
SCIMET Co., Ltd.



Calibration Results:

Electrode Serial No. KC3N05V1R
Model : H176409
Brand : HANNA

Electrode Test

Atmospheric pressure measured while calibrating. 755.54 mmHg
Temperature measured while calibrating. (± 0.2 °C) 25.0 °C
The Oxygen Solubility was calculated from the ambient conditions. 8.21 \pm 0.03 mg/L
The Oxygen Solubility reading from the DO METER 8.23 mg/L

Sample Test

Standard Oxygen Solution	Unit Under Calibration Reading	Correction	Coverage Factor (k)	Uncertainty of Measurement (\pm)
0.00 mg/L	0.00 mg/L	0.000 mg/L	2.00	0.13 mg/L

Temperature Electrode

Dimension of Probe;

Length : 140 mn.
Diameter : 21 mn.
Immersion Depth 80 mn.

STD. Reading (°C)	UUC. Reading (°C)	Correction of UUC (°C)	Coverage Factor (k)	Uncertainty of Measurement (\pm °C)
25.01	25.0	0.01	2.00	0.15

The End of Certificate

บริษัท ชายนีเมท จำกัด (SCIMET CO., LTD.)

1194 Soi Wachirathamsathit 57, Bengchak, Phrakhanong, Bangkok 10260 Thailand
Email: scimet2022@gmail.com, Tel: 095 552 4939

ภาคผนวก 3-16-2



EnviLab Co., Ltd. ผู้ให้บริการด้านสิ่งแวดล้อม



ใบตรวจสอบสภาพเครื่อง Do Meter

เลขที่ใบงาน: KSMT2400445

ชนิดเครื่องมือ: DO METER

รุ่น: HI9147

หมายเลขเครื่อง: H00007030

ตรวจสอบ (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
14 Mar 2024			14 Mar 2024		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
<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. สวิทช์ 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"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	6. อิเล็กโทรด (Electrode and Connection Cable)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	7. สายอิเล็กโทรด	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. เชื้อนเซอร์อิเล็กโทรด	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	9. ขาจับอิเล็กโทรด (Stand)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

ข้อแนะนำ :

Mr.Dumrong Boonsopon

Service Engineer

บริษัท ซายน์เมท จำกัด (SCIMET CO., LTD.)

1194 Soi Wachuathamsathit 57, Bangchak, Phraekhanong, Bangkok 10260 Thailand
Email: scimet2022@gmail.com, Tel. 095 552 4939

Certificate of Calibration

Certificate No. : 67-400054-1

Page : 1 of 2

Submitted by : Envilab Co., Ltd.

540,540/1 Soi Bangkhac7, Bangkhac, 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 : (25.0 to 26.0) °C

Relative Humidity : (45 to 50) %

Line Voltage : (224.0 to 225.0)V

Date of Received : 01 February 2024

Date of Calibration : 01 February 2024

Date of Issue : 03 February 2024

Calibrated by : Kittisak Kokaeo

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
400046 & 400024	66-400547-2	02 Apr 2024	National Institute of Metrology Thailand (NIMT)

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

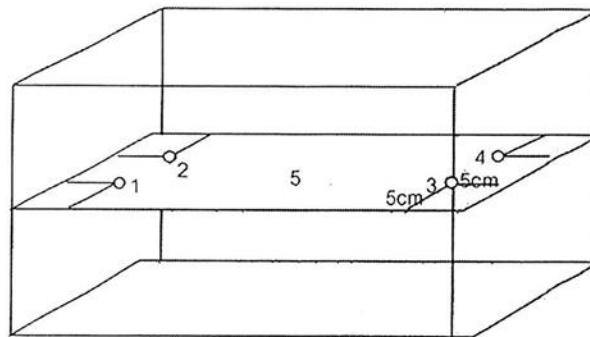
Certificate No. : 67-400054-1

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	95.38	95.52	95.56	95.74	95.55	0.20	0.27	0.07

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%

- o0o -

Certificate of Calibration

Certificate No. : 66-400387-1

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 : UF55
Range : N/A °C Resolution : 0.1 °C
Serial No. : B215.1147 ID No. : ELABHAOVEN1147

Environment : On site calibration was carried out at the Laboratory, Envilab Co., Ltd.
Ambient Temperature : (28.5 to 29.6) °C
Relative Humidity : (50 to 55) %
Line Voltage : (224.0 to 225.0) V

Date of Received : 11 July 2023

Date of Calibration : 11 July 2023

Date of Issue : 15 July 2023

Calibrated by : Bunjerd Masri

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
400046 & 400023	66-400184-1	03 Oct 2023	National Institute of Metrology Thailand (NIMT)

The Uncertainties are for a confidence probability of approximately 95%

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Envilab Co., Ltd.

ผู้จัดการฝ่ายควบคุมคุณภาพ

Certificate of Calibration

Certificate No. : 66-400387-1

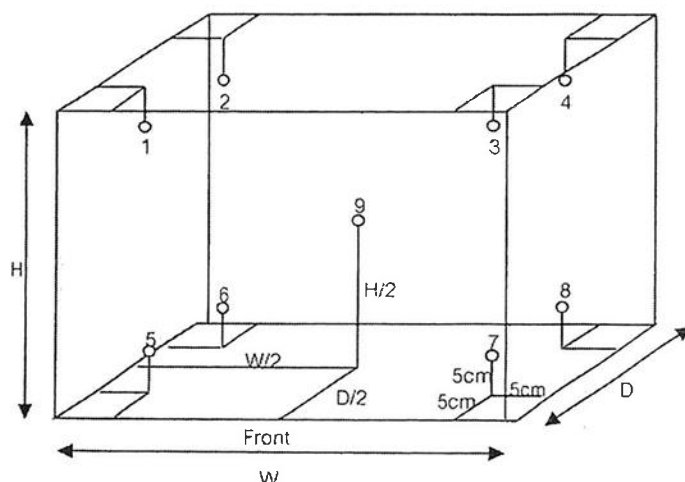
Page : 2 of 2

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 = 0.40 m

D = 0.34 m

H = 0.40 m

Capacity = 0.05 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	104.0	104.0	104.2	104.0	104.1	104.0	104.1	104.0	103.9	104.0	104.1	0.69
110.0	110.0	110.0	110.3	110.0	110.1	110.0	110.1	110.0	110.1	109.7	110.1	0.69
180.0	180.0	180.0	179.7	179.6	180.1	180.2	180.6	180.2	178.9	179.9	180.8	1.0

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
104.0	104.0	104.0	0.3	0.1	0.5
110.0	110.0	110.0	0.5	0.1	0.8
180.0	180.0	180.0	2.2	0.3	2.6

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 -

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



NSC-TISI-TIS17025
CALIBRATION 0030

Certificate of Calibration

Certificate No. : 67-200060-2

Page : 1 of 2

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

Equipment : Electronic Balance
Manufacturer : METTLER TOLEDO **Model :** XSR205DU
Serial No. : B911363567 **ID No. :** ELABBALANCEN06
Capacity : 220 g **Resolution :** 0.00001g/81g, 0.0001g/220g

Environment : On site calibration was carried out at the B304 Balance Room, Envilab Co., Ltd.
Ambient Temperature : (20.0 to 20.5) °C
Relative Humidity : (54.2 to 59.1) %
Air Pressure : 1013.0 mbar

Date of Received : 20 February 2024

Date of Calibration : 20 February 2024

Date of Issue : 21 February 2024

Calibrated by : Satja Sangkhum

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

<u>ID No.</u>	<u>Cert. No.</u>	<u>Due Date</u>	<u>Traceability</u>
E261-E2624	C02232088	08 Nov 2024	National Institute of Metrology (Thailand), (NIMT)

Approved by

The Uncertainties are for a confidence probability of approximately 95%

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Envilab Co.,Ltd. ผู้จัดการฝ่ายควบคุมคุณภาพ

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Calibratech Co.,Ltd.

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. : 67-200060-2

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Departure of indication from nominal value

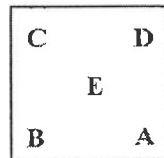
Nominal Value (g)	Correction (g)	Uncertainty \pm (g)
0.1	0.00000	0.000015
0.5	0.00001	0.000022
1	0.00000	0.000026
2	0.00001	0.000034
5	-0.00001	0.000043
10	0.00000	0.000053
50	0.00003	0.00011
100	0.0001	0.00020
150	0.0001	0.00038
200	0.0002	0.00038

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 : 50 g
A B C D E
0.00000 0.00000 0.00010 0.00000 0.00000 g



Repeatability

Load test : 200 g
Stdev. : 0.000032 g

- o o o -



Certificate of Calibration

Certificate No. : 67-200060-1

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 : (20.0 to 20.7) °C
 Relative Humidity : (56.2 to 60.3) %
 Air Pressure : 1013.0 mbar

Date of Received : 20 February 2024

Date of Calibration : 20 February 2024

Date of Issue : 21 February 2024

Calibrated by : Satja Sangkhum

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	C02232088	08 Nov 2024	National Institute of Metrology (Thailand), (NIMT)

Approved by

The Uncertainties are for a confidence probability of approximately 95%

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Envilab Co.,Ltd.

ผู้จัดการฝ่ายควบคุมคุณภาพ

CAL

Calibratech Co.,Ltd.

7/106-7 Moo 2, Sukhaprachasan 3 Rd., Bangpood, Pakdred, 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. : 67-200060-1

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

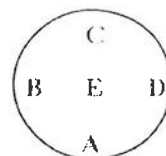
Departure of indication from nominal value

Nominal Value (g)	Correction (g)	Uncertainty \pm (g)
0.1	0.0000	0.00011
0.5	0.0000	0.00011
1	0.0000	0.00011
2	0.0000	0.00011
5	0.0000	0.00011
10	0.0000	0.00011
20	0.0000	0.00013
50	0.0001	0.00014
100	0.0001	0.00020
120	0.0000	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
 Sidev. : 0.00004 g

- o0o -

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



NSC-TISI-TIS 17025
CALIBRATION 0030

Certificate of Calibration

Certificate No. : 66-300675-4

Page : 1 of 2

Submitted by : Envilab Co.,Ltd.

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

Equipment : Cylinder

Manufacturer : BOROSIL

Class : A

Capacity : 50 ml

Graduation : 1 ml

ID No. : C-WW-008/23

Environment : Ambient Temperature : (20 ± 3) °C

Relative Humidity : (50 ± 10) %

Air Pressure : 1014.7 mbar.

Date of Received : 10 November 2023

Date of Calibration : 15 November 2023

Date of Issue : 15 November 2023

Calibrated by : Arcerat 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

<u>ID No.</u>	<u>Cert. No.</u>	<u>Due Date</u>	<u>Traceability</u>
241002	66-200196-1	02 Dec 2023	National Institute of Metrology (Thailand) (NIMT)

Approve

The Uncertainties are for a confidence probability of approximately 95%

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CAL-F0031-03

ภาคผนวก 3-16-2

108/160

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. : 66-300675-4

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	30.09
50	50.11

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 -



Enviao Co.,Ltd.

รับรองสำเนาถูกต้อง
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



NSC-TISI-TIS17025
CALIBRATION 0030

Certificate of Calibration

Certificate No. : 67-300147-4

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 : 250 ml

Graduation : 2 ml

ID No. : C-WW-007/23

Environment : Ambient Temperature : (20 ± 3) °C

Relative Humidity : (50 ± 10) %

Air Pressure : 1009.4 mbar.

Date of Received : 13 March 2024

Date of Calibration : 19 March 2024

Date of Issue : 19 March 2024

Calibrated by : Arccrat Sombun

Calibration Method : In-house method CAL-M3001 based on ASTM E 542-22

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

Electronic Balance

ID No.	Cert. No.	Due Date	Traceability
241002	66-200388-1	02 Jun 2024	National Institute of Metrology (Thailand) (NIMT)

Approved

The Uncertainties are for a confidence probability of approximately 95%

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CAL

Calibratech Co.,Ltd.

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. : 67-300147-4

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)
150	150.31
250	250.38

Uncertainty of measurement with in \pm 0.087 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 -

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



NSC-TISI-TIS 17025
CALIBRATION 0030

Certificate of Calibration

Certificate No. : 66-300675-1

Page : 1 of 2

Submitted by : Envilab Co.,Ltd.

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

Equipment : Measuring Pipette

Manufacturer : KIMAX

Capacity : 25 ml Graduation : 0.1 ml

ID No. : B-WW-001/15

Environment : Ambient Temperature : (20 ± 3) °C

Relative Humidity : (50 ± 10) %

Air Pressure : 1011.2 mbar.

Date of Received : 10 November 2023

Date of Calibration : 15 November 2023

Date of Issue : 15 November 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

<u>ID No.</u>	<u>Cert. No.</u>	<u>Due Date</u>	<u>Traceability</u>
241005	66-200196-4	02 Dec 2023	National Institute of Metrology (Thailand) (NIMT)

Appr

The Uncertainties are for a confidence probability of approximately 95%

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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. : 66-300675-1

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

Delivery Time : 2.17 sec.

Nominal Volume (ml)	Measuring Volume (ml)
5	5.0174
15	14.9776
25	24.9574

Uncertainty of measurement with in \pm 0.0067 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%

- oOo -



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



NSC-TISI-TIS 17025
CALIBRATION 0030

Certificate of Calibration

Certificate No. : 67-300147-5

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 : 500 ml

Graduation : 5 ml

ID No. : C-WW-005/21

Environment : Ambient Temperature : (20 ± 3) °C

Relative Humidity : (50 ± 10) %

Air Pressure : 1009.3 mbar.

Date of Received : 13 March 2024

Date of Calibration : 19 March 2024

Date of Issue : 19 March 2024

Calibrated by : Areerat Sombun

Calibration Method : In-house method CAL-M3001 based on ASTM E 542-22

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

Electronic Balance

ID No.	Cert. No.	Due Date	Traceability
241002	66-200388-1	02 Jun 2024	National Institute of Metrology (Thailand) (NIMT)

Approved

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

CAL-F0031-03

ภาคผนวก 3-16-2

Envilab Co.,Ltd. ผู้จัดการฝ่ายควบคุมคุณภาพ

114/160

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_cnl@yahoo.com, calibratech_cnl@hotmail.com

Certificate of Calibration

Certificate No. : 67-300147-5

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	250.57
500	500.25

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%

- oOo -

**SCIMET Co., Ltd.**

1194 Soi Wachirathamsathit 57, Bangchak,
Phrakhanong, Bangkok 10260 Thailand
Email:scimet2022@gmail.com, Tel:095-552-4939

Certificate No. C06230015

Calibration Certificate

Equipment: TURBIDIMETER

Model: 2100Q

Serial No.(or ID): 17110C062404 (ELABTB2100Q001)

Manufacturer: HACH

Condition: In Condition

Job No.: KSMT2300573

Received Date: 05 October 2023

Issued Date: 05 October 2023

Page: 1 of 2

Customer

Envilab Co., Ltd.

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

Calibration Place

Envilab Co., Ltd.(CH1 ROOM)

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

Calibration Date

05 October 2023

Environment Condition

Temperature: 22.3 °C ± 0.1 °C

Humidity: 55.2 %RH ± 0.6 %RH

The Method used

In-house method, WI06, based on Hach Manufacturer Method 8195

Traceability

This certificate is traceable to Primary standard Fromazin and StablCal accepted by United States Environmental Protection Agency (EPA) through Hach Company Certificate No. A2005 , A2286 , A2292 , A2283

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 SCIMET Co., Ltd.



**Calibration Results:****Before Adjustment**

Std Turbidity (NTU)	UUC Reading	Correction	Deviation	Uncertainty
0.080	0.06	0.020	0.0	0.070
20.40	20.5	-0.10	0.1	1.0
103.0	97.9	5.1	0.1	7.0
825.0	791	34.0	0.6	45

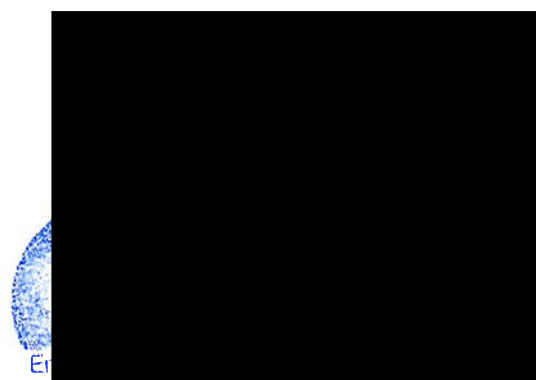
After Adjustment

Std Turbidity (NTU)	UUC Reading	Correction	Deviation	Uncertainty
0.080	0.06	0.020	0.0	0.070
20.40	20.3	0.10	0.1	1.0
103.0	103	0.0	0.0	7.0
825.0	825	0.0	0.7	45

The End of Certificate

บริษัท ชายนันเมท จำกัด (SCIMET CO., LTD.)

1194 Soi Wachirathamsathit 57, Bangchak, Phrakhanong, Bangkok 10260, Thailand
Email: scimet2022@gmail.com, Tel: 095 552 4939





ใบตรวจสอบสภาพเครื่องวัดสิ่งแขวนลอย

เลขที่ใบงาน: KSMT2300573

ชนิดเครื่องมือ: TURBIDIMETER

รุ่น: 2100Q

หมายเลขเครื่อง: 17110C062404

ตรวจสอบ (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
05 Oct 2023			05 Oct 2023		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
<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"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	6. ค่าความขุ่นที่ต่ำสุด (No Sample)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	0.03NTU
<input type="checkbox"/>	<input type="checkbox"/>	7. ระดับการส่องสว่างของแสง (≥ 2.5 ไม่นเกิน 3.0)	<input type="checkbox"/>	<input type="checkbox"/>	

เพิ่มเติม/ข้อแนะนำ :

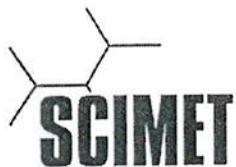
บริษัท ชายนันเมก จำกัด (SCIMET CO., LTD.)

1194 Soi Wachirathamsubat 57 Bangchak Thirakhanong, Bangkok 10260 Thailand
Email: scimet2022@gmail.com Tel: 095 552 4939

ภาคผนวก 3-16-2

Envilab Co.,Ltd.

118/180
ผู้จัดการฝ่ายควบคุมคุณภาพ

**SCIMET Co., Ltd.**

1194 Soi Wachirathamsathit 57, Bangchak,
Phrakhanong, Bangkok 10260 Thailand
Email:scimet2022@gmail.com, Tel: 02 460 9239
https://www.scimet.co.th

**Certificate No. C07240032**

Calibration Certificate

Equipment:**SPECTROPHOTOMETER****Model:****CARY 60UV-VIS****Serial No.(or ID):****MY17490026 (ELABSPECTRO00002)****Manufacturer:****Agilent****Condition:****In Condition****Job No.:****KSMT2400444****Received Date:****04 March 2024****Issued Date:****04 March 2024****Page:****1 of 3****Customer****Envilab Co., Ltd.****540, 540/1 Soi Bangkhuae 7, Bangkhuae, Bangkhuae, Bangkok 10160****Calibration Place****Envilab Co., Ltd.(B301 CO-THC ROOM)****540, 540/1 Soi Bangkhuae 7, Bangkhuae, Bangkhuae, Bangkok 10160****Calibration Date****04 March 2024****Environment Condition****Temperature: 22.3 °C ± 0.6 °C****Humidity: 65.7 %RH ± 0.5 %RH****The Method used****In-house method, W107, based 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. 108691 and 108692****The standard for Photometric Certificate No. 109010 , 114655 and 109009**

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 SCIMET Co., Ltd.



Calibration Results:

Without Adjustment

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

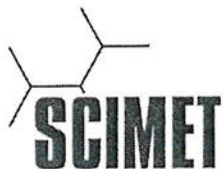
Standard Wavelength (nm)	Unit Under Calibration (nm)	Correction (nm)	Uncertainty of Measurement (\pm nm)
219.73	220.0	-0.27	0.14
241.55	241.8	-0.25	0.16
287.56	287.6	-0.04	0.14
333.77	333.7	0.07	0.19
360.45	360.1	0.35	0.14
417.59	417.0	0.59	0.14
472.50	472.3	0.20	0.14
513.47	513.4	0.07	0.14
528.88	528.9	-0.02	0.14
537.18	537.1	0.08	0.14
641.58	642.3	-0.72	0.16
740.72	741.3	-0.58	0.14
748.55	749.1	-0.55	0.14
807.03	807.4	-0.37	0.14
879.28	879.0	0.28	0.14

Photometric Accuracy (Absorbance)

Wavelength	Standard absorbance (Abs)	Unit Under Calibration (Abs)	Correction (Abs)	Uncertainty of Measurement (\pm Abs)
235 nm	0.0000	0.0000	0.0000	0.0080
	0.7293	0.7273	0.0020	0.0080
257 nm	0.0000	-0.0003	0.0003	0.0080
	0.8497	0.8457	0.0040	0.0080
313 nm	0.0000	0.0004	-0.0004	0.0080
	0.2833	0.2810	0.0023	0.0080
350 nm	0.0000	0.0001	-0.0001	0.0080
	0.6299	0.6259	0.0040	0.0080

บริษัท ชายนีเมท จำกัด (SCIMET CO., LTD.)

1194 So. Wachathamsathit 57, Bangchak, Phrakhanong, Bangkok 10260 Thailand
Email: scimet2022@gmail.com, Tel: 02 460 9239

**Calibration Results:****Without Adjustment****Photometric Accuracy (Absorbance)**

Wavelength	Standard absorbance (Abs)	Unit Under Calibration (Abs)	Correction (Abs)	Uncertainty of Measurement(\pm Abs)
420 nm	0.0000	0.0000	0.0000	0.0045
	0.2373	0.2386	-0.0013	0.0045
	0.5617	0.5637	-0.0020	0.0045
	0.7392	0.7382	0.0010	0.0045
	1.0550	1.0542	0.0008	0.0045
440 nm	0.0000	0.0000	0.0000	0.0045
	0.2335	0.2354	-0.0019	0.0045
	0.5513	0.5539	-0.0026	0.0045
	0.7230	0.7222	0.0008	0.0045
	1.0324	1.0343	-0.0019	0.0045
465 nm	0.0000	0.0000	0.0000	0.0045
	0.2126	0.2143	-0.0017	0.0045
	0.5036	0.5059	-0.0023	0.0045
	0.6735	0.6729	0.0006	0.0045
	0.9615	0.9638	-0.0023	0.0045
546.1 nm	0.0000	0.0000	0.0000	0.0045
	0.2201	0.2213	-0.0012	0.0045
	0.5176	0.5196	-0.0020	0.0045
	0.6930	0.6925	0.0005	0.0045
	0.9908	0.9925	-0.0017	0.0045
590 nm	0.0000	0.0000	0.0000	0.0045
	0.2443	0.2452	-0.0009	0.0045
	0.5530	0.5544	-0.0014	0.0045
	0.7196	0.7195	0.0001	0.0045
	1.0301	1.0316	-0.0015	0.0045
635 nm	0.0000	0.0000	0.0000	0.0045
	0.2646	0.2651	-0.0005	0.0045
	0.5370	0.5394	-0.0024	0.0045
	0.6862	0.6872	-0.0010	0.0045
	0.9822	0.9855	-0.0033	0.0045

The End of Certificate**บริษัท ชายนีเมท จำกัด (SCIMET CO., LTD.)**1194 Soi Wachirathamsathit 57, Bangchak, Phrakhanong, Bangkok 10260 Thailand
Email: scimet2022@gmail.com, Tel: 02 460 9239



Refer to Certificate No.: C07240032

Page: 1 of 3

Statements of conformity:

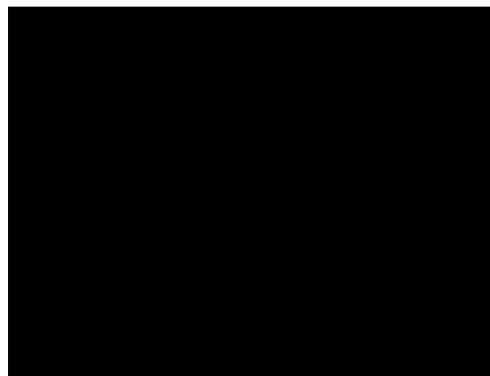
This conformity certificate documents the validity of the following statements of conformity based on the measurement results of corresponding calibration certificate:

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 ($w = 1 U$), Pass or Fail Specific Risk $< 2.5\%$ PFA and Condition Pass or Condition Fail Specific Risk $< 50\%$ 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



บริษัท ชายนัมเมท จำกัด (SCIMET CO., LTD.)

1194 Soi Wachirathamsathit 57, Bangchak, Phrakhanong, Bangkok 10260 Thailand
Email: scimet2022@gmail.com, Tel: 02 460 9239





Refer to Certificate No.: C07240032

Page: 2 of 3

Without Adjustment

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

Unit Under Calibration	Correction	Guard Band (w)	Tolerance (\pm)	Conformity
220.0	-0.27	0.14	1.0	Pass
241.8	-0.25	0.16	1.0	Pass
287.6	-0.04	0.14	1.0	Pass
333.7	0.07	0.19	1.0	Pass
360.1	0.35	0.14	1.0	Pass
417.0	0.59	0.14	1.0	Pass
472.3	0.20	0.14	1.0	Pass
513.4	0.07	0.14	1.0	Pass
528.9	-0.02	0.14	1.0	Pass
537.1	0.08	0.14	1.0	Pass
642.3	-0.72	0.16	1.0	Pass
741.3	-0.58	0.14	1.0	Pass
749.1	-0.55	0.14	1.0	Pass
807.4	-0.37	0.14	1.0	Pass
879.0	0.28	0.14	1.0	Pass

Photometric Accuracy (Absorbance)

Wavelength	Unit Under Calibration	Correction	Guard Band (w)	Tolerance (\pm)	Conformity
235 nm	0.0000	0.0000	0.0080	0.020	Pass
	0.7273	0.0020	0.0080	0.020	Pass
257 nm	-0.0003	0.0003	0.0080	0.020	Pass
	0.8457	0.0040	0.0080	0.020	Pass
313 nm	0.0004	-0.0004	0.0080	0.020	Pass
	0.2810	0.0023	0.0080	0.020	Pass
350 nm	0.0001	-0.0001	0.0080	0.020	Pass
	0.6259	0.0040	0.0080	0.020	Pass

บริษัท ชายนันเมท จำกัด (SCIMET CO., LTD.)

1194 Soi Wachirathamsathit 57, Bangchak, Phrakhanong, Bangkok 10260 Thailand
Email: scimet2022@gmail.com, Tel: 02 460 9239

ภาคผนวก 3-16-2





Refer to Certificate No.: C07240032

Page: 3 of 3

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
	0.2386	-0.0013	0.0045	0.015	Pass
	0.5637	-0.0020	0.0045	0.015	Pass
	0.7382	0.0010	0.0045	0.015	Pass
	1.0542	0.0008	0.0045	0.015	Pass
440 nm	0.0000	0.0000	0.0045	0.015	Pass
	0.2354	-0.0019	0.0045	0.015	Pass
	0.5539	-0.0026	0.0045	0.015	Pass
	0.7222	0.0008	0.0045	0.015	Pass
	1.0343	-0.0019	0.0045	0.015	Pass
465 nm	0.0000	0.0000	0.0045	0.015	Pass
	0.2143	-0.0017	0.0045	0.015	Pass
	0.5059	-0.0023	0.0045	0.015	Pass
	0.6729	0.0006	0.0045	0.015	Pass
	0.9638	-0.0023	0.0045	0.015	Pass
546.1 nm	0.0000	0.0000	0.0045	0.015	Pass
	0.2213	-0.0012	0.0045	0.015	Pass
	0.5196	-0.0020	0.0045	0.015	Pass
	0.6925	0.0005	0.0045	0.015	Pass
	0.9925	-0.0017	0.0045	0.015	Pass
590 nm	0.0000	0.0000	0.0045	0.015	Pass
	0.2452	-0.0009	0.0045	0.015	Pass
	0.5544	-0.0014	0.0045	0.015	Pass
	0.7195	0.0001	0.0045	0.015	Pass
	1.0316	-0.0015	0.0045	0.015	Pass
635 nm	0.0000	0.0000	0.0045	0.015	Pass
	0.2651	-0.0005	0.0045	0.015	Pass
	0.5394	-0.0024	0.0045	0.015	Pass
	0.6872	-0.0010	0.0045	0.015	Pass
	0.9855	-0.0033	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.

The End of Statements of Conformity

บริษัท ชัยนิเมท จำกัด (SCIMET CO., LTD.)

1194 Soi Wachirathamsathit 57, Bangchak, Phrakhanong, Bangkok 10260, Thailand
Email: scimet2022@gmail.com, Tel: 02 460 9239

Envilab Co., Ltd.

ผู้จัดการฝ่ายควบคุมคุณภาพ

124/160



ใบตรวจสอบสภาพเครื่อง Spectrophotometer

เลขที่ใบงาน: KSMT2400444

ชนิดเครื่องมือ: SPECTROPHOTOMETER

รุ่น: CARY 60UV-VIS

หมายเลขเครื่อง: MY17490026

ตรวจสอบ (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
04 Mar 2024			04 Mar 2024		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
<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"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	6. ตัวหมุนเลือกความยาวคลื่น (Wavelength Control)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	7. ความยาวคลื่น (Wavelength Check)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. แหล่งกำเนิดแสง (UV < 3,000 hour)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	9. แหล่งกำเนิดแสง (Visible < 5,000 hour)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	10. ช่องวัดหลายตัวอย่าง (Carousel Module)	<input type="checkbox"/>	<input type="checkbox"/>	-

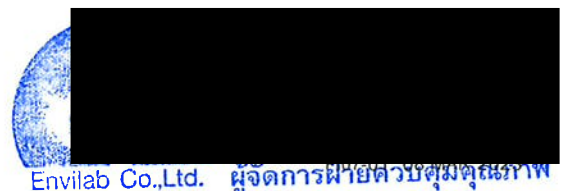
เพิ่มเติม/ข้อแนะนำ :

Mr. Dumrong Boonsopon

Service Engineer

บริษัท ชายนีเมก จำกัด (SCIMET CO., LTD.)

1194 Soi Wachirathamsesthit 52, Bangchak - Phraekhanong, Bangkok 10260 Thailand
Email: scimet2022@gmail.com, Tel: 02-460-9239



Agilent CrossLab Start Up Services

Agilent 5100 5110 ICP-OES Preventive Maintenance



Agilent Preventive Maintenance provides factory recommended service for your analytical instruments to assure reliable operation and the accuracy of your results

Delivered by highly trained and certified service engineers using genuine Agilent parts and supplies, Agilent Preventive Maintenance provides what you need to reduce unplanned downtime and keep your systems operating at their peak performance.

This checklist is used as a guide for completing the preventive maintenance tasks. A signed copy of this checklist is provided for your records.

Introduction

Customer Information

- Customers should provide all necessary operating supplies upon request of the engineer.
- A customer representative should be available to the engineer while performing the preventive maintenance procedures. Customers are responsible for regular maintenance and are encouraged to observe the service representative.
- Any parts not included in the Parts Lists section of this document are not part of the recommended Preventive Maintenance service nor are they included in the price of this service.
- If a system requires the use of extra or special procedures and/or parts for the maintenance service, then these must be ordered separately and charged as a repair, which may incur additional costs.
- For customer's using HF applications, the instrument should be returned to its standard sample introduction system.

Important Customer Web Links

- To access Agilent University, visit <http://www.agilent.com/crosslab/university/> to learn about training options, which include online, classroom and onsite delivery. A training specialist can work directly with you to help determine your best options.
- To access the Agilent Resource Center web page, visit <https://www.agilent.com/en-us/agilentresources>. The following information topics are available:
 - Sample Prep and Containment
 - Chemical Standards
 - Analysis
 - Service and Support
 - Application Workflows
- The Agilent Community is an excellent place to get answers, collaborate with others about applications and Agilent products, and find in-depth documents and videos relevant to Agilent technologies. Visit <https://community.agilent.com/welcome>
- Videos about specific preparation requirements for your instrument can be found by searching the Agilent YouTube channel at <https://www.youtube.com/user/agilent>
- Need to place a service call? Flexible Repair Options | Agilent

Service Engineer's Responsibilities

- Contact the customer and ensure that all necessary supplies are available before the preventive maintenance visit.
- Only select those pages that relate to the system or module being serviced.
- Complete empty fields with the relevant information.
- Complete the relevant checkboxes in the checklist using either a "X" or tick mark "✓".
- Check "Service not applicable" check boxes to indicate services/tasks not delivered, as appropriate.
- Complete the Preventive Maintenance services in the most logical order relevant to the individual system service in the order of the tasks listed.
- Complete the Service Review section together with the customer.
- Complete the fields for page numbers at the foot of each selected page
- Add relevant page numbers to selected pages and complete the total number of pages field in the Service Completion section
- Ask the customer to sign the Service Verification section including the customer's and your signature.

Instrument Maintenance

System Information

- ☐ Check this box if an instrument configuration report is attached instead of completing the table.

Instrument System Name and ID
Instrument System Site and Location

5110 VDU ICP-OES

Envilab Company limited

List System Component Product Numbers List the Serial Numbers of each Component

1. G 8405 A MY 1749002
2. G 8410 A AU1339376
3. G 8401-80002 1309-03327
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.

ICP-OES Configuration Table	Circle the type or write in the type if other
Nebulizer Type	<u>Spray</u> Neb <u>Conical</u> Other
Spray Chamber	Cyclonic Single Pass <u>Cyclonic Double Pass</u> Other
Torch	Radial <u>Dual View</u> Other
Torch Type	One Piece <u>Semi Dismountable</u> Fully Dismountable Other
Injector Diameter	2.4mm <u>1.8mm</u> 1.4mm 0.8mm Other
Injector Material	<u>Quartz</u> Ceramic Other

Preparation

- ☒ Discuss any specific issues with the customer before starting.
- ☒ Review the instrument logbook for recorded problems and comments.
- ☒ Save instrument control settings before starting the procedure.
- ☒ Perform a general inspection of the system for cleanliness.
- ☒ Check for proper installation of parts, assemblies, sensors etc.
- ☒ Check system for required installation of components and implementation of Service Notes
- ☒ Check for required firmware/software updates and verify with customers if they would like them installed.
- ☐ For HF application systems, if standard sample introduction system was not installed, ask the customer to install it.
- ☒ Ask the customer to remove any samples from the ICP-OES sample introduction area, auto sampler or around the ICP-OES.

Preventive Maintenance Procedures

Record Pre-PM Instrument performance

- ☒ Run Instrument Performance test.
- ☒ Record results in Instrument Performance Test Results Table – Pre-PM.

Clean and inspect ICP-OES system

- ☒ Look for any obvious external damage or problems.
- ☒ Inspect water cooling hoses, gas lines and power cord for excessive wear or damage.
- ☒ Perform a general internal inspection of the system for excessive dust accumulation, clean if necessary.
- ☒ Inspect sample introduction components and record any required maintenance in the Service Engineer Comments and notify the customer as the required actions required.
- ☒ Record the instrument operating conditions in the ICP-OES Status Results Table.
- ☒ Replace the polychromator purge filter.
- ☒ Replace the radial pre-optics window
- ☒ Replace the axial pre-optics window for SVDV and VDV instruments.
- ☒ Check exhaust flow for the correct positive extraction at the exhaust duct to insure they meet minimum specifications.
- ☒ Replace air inlet dust filter.
- ☐ Replace high capacity air inlet dust filter element if installed. *N/A*
- ☒ Remove and clean instrument water inlet filter.

Agilent Water Recirculator

- ☐ Service not applicable
- ☒ Drain cooling fluid and remove any particles from the chiller reservoir
- ☒ Remove, clean and reinstall water inlet metal mesh filter if present.
- ☒ Re fill with Agilent Cool Clear cooling fluid.
- ☒ Clean the cooling system Air filter and the condenser.

SPS 3 Auto Sampler

- ☒ Service not applicable
- ☐ Power cycle the autosampler and verify successful initialization.
- ☐ Inspect X and Z axis belts for wear. Replace is necessary.
- ☐ Clean X and Z axis slide shafts.
- ☐ Using customer's racks and the Agilent software move the sample probe to the 4 outermost corners and rinse port, ensure that the probe is approximately centered in the vial.

SPS 4 Auto sampler

- ☐ Service not applicable
- ☒ Clean the spill tray, rack location mat, end frames and chassis with a damp soft cloth and diluted mild detergent.
- ☒ Clean the auto sampler cover panels, if cover kit is installed, with domestic window cleaner.
- ☒ Check the X-axis and Z-axis drive belts for cracks, splits, damaged teeth, excessive fraying, color changes or degradation from fumes.
- ☒ Check the X-axis, Theta-axis and Z-axis FFC cables for cracks, incorrect positioning, damaged edges or damaged connectors.
- ☒ Pump Tubing Replacement. Replace peristaltic pump tubing. Replace all tubing that goes from the rinse station to the pump and from the pump to the waste/rinse bottles only. *checked; passed*
- ☒ Test using customer's tray and move the sample probe to the sample vial 1, wash vial and rinse port and ensure that the probe is centered in the vial. If not use calibration wizard and calibrate the position.

AVS 4, 6, 7 Advanced Valve System

- ☒ Service not applicable
- ☐ Replace valve rotor seal
- ☐ Check fittings for signs of leaks
- ☐ Check tubing including autosampler tubing for kinks or excessive wear
- ☐ Check high flow pump for signs of leaks

ICP-OES adjustment

- ☒ Check position of Zn peak, adjust if required.
- ☒ Check Argon Ratio, adjust to specified value if required.
- ☒ Perform Detector Calibration.
- ☒ Perform Instrument Calibration.

Record Post-PM instrument performance

- ☒ Run Instrument Performance test.
- ☒ Record results in Instrument Performance Test Results Table - Post PM.
- ☒ For systems using ICP Expert version 7.3 and above, run the following instrument tests
 - ☒ Subsystem Communications Test
 - ☒ Air Flow
 - ☒ Water Flow
 - ☒ Gas Flows
 - ☒ RF Generator
 - ☒ Camera Test
 - ☒ Optics Test
 - ☒ Nebulizer Test

- ☒ Record the result in the Instrument Test Results Table

Restore Instrument

- ☐ For HF applications, ask the customer to reinstall their sample introduction system. **Not**
- ☒ Leave system in an idle state: on and purging.
- ☒ Guidance: If the PM service is performed prior to a qualification service, then use the qualification procedure as a guide for final instrument set up and checkout.

Service Review

- ☒ Attach available reports/printouts of all tests to this documentation.
- ☒ Record the Preventive Maintenance service activity in the customer's records/logbook.
- ☒ Record the PM event in the Smart Alerts logbook, if applicable.
- ☒ Update/reset instrument maintenance counters as appropriate.
- ☒ Affix the PM sticker to the system or instrument logbook based on the customer's request.
- ☒ Complete the Service Engineer Comments section if there are additional comments.
- ☒ Review this service, parts replaced, and test results obtained with the customer.
- ☒ If the instrument firmware was updated, record the details of the change in the Service Engineer's Comments box. Systems in a compliant environment may need additional documentation.
- ☒ Complete the Signature Page with both Service Engineer and Customer signatures.

Test Results

Instrument Performance Test Results Table

Note: These measurements do not form part of any specification and are for reference only.

	Pre PM Sensitivity Check		Post PM Sensitivity Check	
	Radial	Axial *	Radial	Axial*
Zn 213.857 nm SRBR	1377.1	3382.6	2548.2	6129.9
Mn 257.610 nm SRBR	3945.3	16145.3	10368.1	39073.2
Al 396.152 nm SBR	7.0	16.3	8.9	25.7
K 766.491 nm SBR	3.2	61.3	4.7	83.6

* Axial result is not applicable for G8016AA, G8012AA Radial View instruments.

Instrument Test Results Table

Note: The Instrument Test results are for systems using ICP Expert version 7.3 and above only.

Instrument Test	Result
Subsystem Communications Test	Pass
Air Flow	Pass
Water Flow	Pass
Gas Flows	Pass
RF Generator	Pass
Camera Test	Pass
Optics Test	Pass
Nebulizer test	Pass

ICP-OES Status Results Table

Note: These measurements do not form part of any specification and are for reference only.

Measurement	Standby Mode		Plasma On	
Mains Voltage	219.371	VAC	217.484	VAC
Mains Current	0.082	A	0.098	A
Instrument Temperature	23.5	°C	23.1	°C
RF Air Flow (sensor speed)	13.0	Hz	19.0	Hz
Plasma Exhaust Temperature	No measurement		56.4	°C
Water Flow Oscillator	No measurement		1.31	L/min
Water Flow Detector	1.09	L/min	1.06	L/min
Water Inlet Temperature	16.9	°C	16.7	°C
Polychromator Temperature	33.0	°C	33.0	°C
CCD Temperature	-39.6	°C	-39.4	°C
Thermal Stabilizer	33.0	°C	33.0	°C
Argon Supply Pressure	619.13	kPa	500.32	kPa
Purge Gas Supply Pressure*1	616.63	kPa	597.43	kPa
Option Gas Supply Pressure*1	-	kPa	-	kPa
Nebulizer Flow	No measurement		0.70	L/min
Nebulizer Back Pressure	No measurement		243.19	kPa
Plasma Gas Flow	No measurement		11.98	L/min
Auxiliary Gas Flow	No measurement		1.00	L/min
RF Power	No measurement		1195.1	W
RF Supply Current	No measurement		8.190	A
RF Supply Voltage	No measurement		194.557	V

*1 If option installed

Consumed PM Parts

Part Description	Part Number	Product or Model# where used	Quantity consumed
Axial Pre-Optic Window	G8010A-68014	G8010A, G8011A, G8014A/G8015A	1
Radial Pre-Optic Window	G8010-68015	All	1
Agilent Cool Clear Coolant Fluid	5799-0037	Agilent Water Recirculator	1
Purge Gas Filter	G8010-60136	All	1
Air Inlet Filter	G8000-68002	All	1
High Capacity Air Filter	G8010-60189	Optional	1
Rotor seal for 6-7 port valve for AVS4/7	G8494-60002	G8494A/G8495	1
Rotor seal for 4 port valve for AVS4	G8493-60002	G8493A	1
Rinse solution to rinse station 2.5mm id x 1m	G8410-80123	SPS4	1
Barb connector 2.5mm-1.5mm ID	G8410-80124	SPS4	1
PVC waste tubing 8mm od x 5mm id, 2m	G8410-80122	SPS4	1
Additional Parts may be required from engineer's stock:			
X axis drive belt	5410047500	SPS3	1
Z axis drive belt	5410047400	SPS3	1
Peristaltic pump tubing, PVC SolvaFlex, 3 bridged.	3710049000	SPS4	1

Consumed Parts Reference

(Purchased by customer, not included as part of PM)

☐ Section Not Applicable.

Part Description	Part Number	Product or Model# where used	Quantity consumed
------------------	-------------	------------------------------	-------------------

Signature Page

Service Engineer Comments (optional)

If there are any specific points you wish to note as part of performing the installation or other items of interest for the customer, please write in this box.

Service Verification

Service Request Number: 6006121636
Date Service Completed: 31 May 2023
Service Engineer Name: Kanyakorn S.
Customer Name: Kanyakorn S.
Service Engineer Signature: Kanyakorn S.
Customer Signature: Kanyakorn S.
Total number of pages in this document: 14

Report Summary	
Instrument Model	Agilent 5100/5110 VDV ICP-OES
Instrument ID	G8011A/G8015A
Instrument Serial Number	MY17490002
Software Version	7.4.0.10280
Firmware Version	3562
Tested By	Kanyakorn S.
Test Started On	5/31/2023 12:22:01 PM
Test Completed On	5/31/2023 12:26:21 PM
Result Summary	
Subsystem Communications Test	Pass
Air Flow Test	Skipped
Water Flow Test	Skipped
Gas Flows Test	Skipped
RF Generator Test	Skipped
Camera Test	Skipped
Optics Test	Pass
Advanced Valve System Test	Skipped
Resolution Test	Pass
Sensitivity Test	Pass
Precision Test	Pass
Subsystem Communications Test	Pass

Optics Test	
Radial	Axial
Intensity	3397602
Wavelength	737.212
	2923418
	737.212

Resolution Test	
Element Wavelength	Specification
N (174.213 nm)	≤ 9.40
As (188.980 nm)	≤ 8.20
C (193.027 nm)	≤ 11.50
Mo (202.032 nm)	≤ 8.20
Cr (206.158 nm)	≤ 13.40
Zn (213.857 nm)	≤ 8.70
Pb (220.353 nm)	≤ 9.50
Co (228.615 nm)	≤ 17.20
Ba (230.424 nm)	≤ 9.40
Mn (257.610 nm)	≤ 13.30
Mn (260.568 nm)	≤ 20.30
Cr (267.716 nm)	≤ 11.00
Cu (324.754 nm)	≤ 25.00
Cu (327.395 nm)	≤ 14.20
Sr (338.071 nm)	≤ 33.50
Ba (455.403 nm)	≤ 44.00
Sr (460.733 nm)	≤ 36.00
Ba (493.408 nm)	≤ 36.00
Ba (614.171 nm)	≤ 42.00
Ar (675.283 nm)	≤ 74.00
K (766.491 nm)	≤ 80.00
	6.72
	6.49
	8.01
	6.43
	8.50
	7.16
	7.51
	11.32
	7.80
	9.78
	13.88
	9.09
	18.88
	12.41
	24.27
	34.07
	22.56
	27.79
	27.97
	62.41
	65.95

Sensitivity Test

Pass

Radial

Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 46.0	SRBR	108.0	934.0	64.8
Se (196.026 nm)	≥ 41.0	SRBR	110.2	1159.4	93.6
Zn (213.857 nm)	≥ 1421.0	SRBR	2348.2	23561.0	99.8
Pb (220.353 nm)	≥ 46.0	SRBR	98.7	1075.1	98.0
Mn (257.610 nm)	≥ 3518.0	SRBR	10768.1	218704.5	411.0
Al (396.152 nm)	≥ 3.4	SBR	8.5	40909.0	4325.8
Ba (493.408 nm)	≥ 34.0	SBR	111.9	1396218.4	12367.4
K (766.491 nm)	≥ 1.8	SBR	4.7	108989.7	19076.8

Axial

Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 208.0	SRBR	267.6	3134.3	126.3
Se (196.026 nm)	≥ 159.0	SRBR	284.6	4158.5	194.0
Zn (206.200 nm)	≥ 234.0	SRBR	495.4	1165.9	5.5
Zn (213.857 nm)	≥ 1743.0	SRBR	6129.9	92298.3	225.6
Cd (214.439 nm)	≥ 4227.0	SRBR	16998.9	48382.7	8.1
Pb (220.353 nm)	≥ 320.0	SRBR	416.4	6520.1	228.4
Mn (257.610 nm)	≥ 10625.0	SRBR	39073.2	1331904.8	1159.9
Cr (267.716 nm)	≥ 1048.0	SRBR	5986.5	203686.5	1144.7
Cu (324.754 nm)	≥ 19.0	SBR	177.1	389900.7	4991.6
Al (396.152 nm)	≥ 6.0	SBR	25.7	268775.7	10073.7
Ba (493.408 nm)	≥ 60.0	SBR	293.9	8244793.3	27957.8
K (766.491 nm)	≥ 24.0	SBR	83.6	3030541.1	35817.8

Precision Test

Pass

Radial

Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 2.60	0.75
Se (196.026 nm)	≤ 2.60	0.69
Zn (213.857 nm)	≤ 1.50	0.27
Pb (220.353 nm)	≤ 2.60	1.06
Mn (257.610 nm)	≤ 1.50	0.30
Al (396.152 nm)	≤ 1.50	0.27
Ba (493.408 nm)	≤ 1.50	0.99
K (766.491 nm)	≤ 1.50	0.25

Axial

Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 1.50	0.54
Se (196.026 nm)	≤ 1.50	0.48
Zn (206.200 nm)	≤ 1.50	1.06
Zn (213.857 nm)	≤ 1.50	0.48
Cd (214.439 nm)	≤ 1.50	0.33
Pb (220.353 nm)	≤ 1.50	0.37
Mn (257.610 nm)	≤ 1.50	0.77
Cr (267.716 nm)	≤ 1.50	0.62
Cu (324.754 nm)	≤ 1.50	0.45
Al (396.152 nm)	≤ 1.50	0.45
Ba (493.408 nm)	≤ 1.50	0.80
K (766.491 nm)	≤ 1.50	0.91

Report Summary			
Instrument Model	Agilent 5100/6110 VDV ICP-OES		
Instrument ID	G8011A/G8015A		
Instrument Serial Number	MY17490002		
Software Version	7.4.0.10280		
Firmware Version	3562		
Tested By	Kanyakorn S.		
Test Started On	5/31/2023 12:34:17 PM		
Test Completed On	5/31/2023 12:46:55 PM		
Result Summary			
Subsystem Communications Test	Pass		
Air Flow Test	Pass		
Water Flow Test	Pass		
Gas Flows Test	Pass		
RF Generator Test	Pass		
Camera Test	Pass		
Optics Test	Skipped		
Advanced Valve System Test	Skipped		
Resolution Test	Skipped		
Sensitivity Test	Skipped		
Precision Test	Skipped		
Subsystem Communications Test	Pass		
Air Flow Test			
30% Air Flow (relative speed)	75% Air Flow (relative speed)	Pass	
12.00	18.00		
Water Flow Test			
RF Water Flow(L/min)	Camera Water Flow (L/min)	Water Inlet Temperature (°C)	Pass
1.45	1.06	16.78	

Gas Flows Test				Pass	
Nebulizer Target Flow	Actual Flow	Back Pressure	Auxiliary Target Flow	Actual Flow	Back Pressure
0.70	0.71	280.77	2.00	2.00	93.84
Makeup Target Flow	Actual Flow	Back Pressure	Plasma Target Flow	Actual Flow	Back Pressure
2.00	1.99	95.26	18.00	17.94	23.27
RF Generator Test					
Pass					
RF Power Supply Test	Passed				
RF Power Supply (V)	147.418				
RF Oscillator Test	Passed				
RF Oscillator Frequency (MHz)	25.961				
Work Coil Current (A)	45.326				
RF Power Supply Current (A)	2.000				
Camera Test					
Pass					
Electronic Offset Test	Integration Time (ms)	Standard Deviation	Status		
	1000	5.120	Passed		
Array Test	5	0.015	Passed		
Linearity Test		0.122	Passed		



PinAAcle 900F Preventive Maintenance Report

Company Name: ENVILAB CO.,LTD
Instrument Location: 540-540/1, SOI BANGKHAE 7, BANGKHAE
BANGKOK, 10160,
Instrument Serial No.: PFBS20011403
Date: 05-Oct-2023

PinAAcle 900F Preventive Maintenance (PM)			
Company Name:		ENVILAB CO.,LTD	
Address (Instrument Location):		540-540/1, SOI BANGKHAE 7, BANGKHAE, BANGKOK, 10160,	
Serial Number:		PFBS20011403	PM Number: 3/4
Customer Name (if applicable):		K. JENJIRA	Telephone Number: 095-550-0510
Customer Support Engineer Name:		K. DUANG	Service Order Number:
Date PM Performed: (DD-MMM-YYYY)		Oct 5, 2023	Next PM Due Date: (DD-MMM-YYYY)
			Apr 5, 2024
Standard Labor Hours to Complete PM :		5 hours	

Part Number	Release	Publication Date	
09370145 Rev.9	A	January 2018	

Scope
The purpose of this PM is to ensure the continued functionality of the PinAAcle 900F by inspecting and replacing any worn or damaged parts. This service should only be performed by a trained representative of PerkinElmer.
The customer should save their method before the PM begins.

General Instructions:
The customer must provide the engineer operational data to demonstrate recent instrument performance prior to starting the PM.
Always check with the customer before making any changes that may affect the customer's analysis or calibration, including a current back-up of system software and/or data files.
The completed document should be signed by an authorized PerkinElmer and customer representative and left with the customer.
Update the PM sticker and instrument logbook as required.

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Component List

Component / Specific Model	Serial #	Configuration Notes

Parts Lists

Parts Included with the PM		
Part Number (if applicable)	Description	Quantity
B0501696	Fan Filters	N/A
N3160156	O-Ring Kits for Sampling Introduction (Stainless Steels Nebulizer)	N/A
N3160157	O-Ring Kits for Sampling Introduction (Plastic Nebulizer)	N/A
N9301714	Replacement Acetylene Filter Cartridge	N/A
TH001022	Replacement Air Filter Cartridge	N/A

Additional Reagents and Standards Required for PM			
Part Number (if applicable)	Description	Quantity	Expired Date (MM/YY)
N9300183	1000 mg/L Copper Standard	AR	30-Jan-2024

Additional Reagents and Standards Required for PM (Customer Support Solution)			
Part Number (if applicable)	Description	Quantity	Expiration Date (MM/YY)
N/A	D1 Water	250 ml.	AR
N/A	0.5% HNO ₃	250 ml.	AR

Additional Tools Required for PM			
Part Number (if applicable)	Description	Quantity	Serial #
N1013000	0.2A Neutral density filter	1	MG0-252
N1013002	1.0A Neutral density filter	1	MG0-358
03030997	System 2 EDL Driver	1	03030997
N3050605	As System 2 EDL	1	16148
N3050121	Cu Lumina HCL	1	092216-010130
N3050109	Ba Lumina HCL	1	102416-040160
N3050139	K Lumina HCL	1	110716-010060
N3050152	Ni Lumina HCL	1	100516-030190

Procedure Checklist

Use (✓) to check off those steps in the checklist that have been completed.

1. General:
 - ☒ Review the instrument performance with the customer and document any recent problems.
 - ☒ Inspect the customer log book and make any appropriate PM entries.
 - ☒ Perform general inspection of system for cleanliness.
2. PC Instrument Software:
 - ☒ Instrument Software user files/databases archived, packed, and/or deleted as needed.
3. Mechanical:
 - ☒ Inspect and clean all fans and filters. Replace filters if necessary
 - ☒ Inspect all gas lines for leaks and/or wear. Replace if needed.
 - ☒ Clean exterior of the instrument.
 - ☒ Inspect the burner head, burner chamber, and nebulizer. Clean if needed as stated in the Hardware Guide.
 - ☒ Check burner head dimensions with the feeler gauge as stated in the Hardware Guide in the Maintenance chapter section on cleaning the burner head and checking sloth width. Replace if out of specification
 - ☒ Check the condition of the end cap, burner head, and nebulizer O-rings. Replace if necessary.
 - ☒ Check the drain system for signs of wear. Replace worn or damaged parts.
 - ☒ Visually check for proper flame conditions when igniting the Air-C2H2 and N2O-C2H2 flames (if applicable).
4. Electrical:
 - ☒ Inspect PC boards. Clean if necessary.
 - ☒ Carefully check all internal and external cable connections.
 - ☒ Check instrument firmware revisions upgrade to current levels (if necessary)
 - ☒ Run Diagnostics Test within the Advanced function of the Spectrometer page. Check the results in the service log folder in the Spectrometer BM Log Viewer.
5. Optics:
 - ☒ Inspect and clean the sample compartment windows, if needed.
 - ☒ Inspect optics. Clean or replace if necessary,
6. Gasses:
 - ☒ Verify that the Gasses supplied to the instrument are within the pressure and purity specifications found in the PinAAcle 900 Series Pre-installation Checklist SDB.
 - ☒ Verify that the acetylene filter and air filter element is dry. Replace if necessary.

7. Flame Interlock Check:

Description: Check to ensure that all safety interlocks are closed.

Parameter	Specification	Test Results	Pass/Fail
Flame Sensor	Air/C ₂ H ₂ Flame correctly shuts down	Active	Passed
Drain Sensor	Air/C ₂ H ₂ Flame correctly shuts down	Active	Passed
Nebulizer Sensor	Air/C ₂ H ₂ Flame correctly shuts down	Active	Passed
C ₂ H ₂ Pressure Sensor	Air/C ₂ H ₂ Flame correctly shuts down	Active	Passed
Air Pressure Sensor	Air/C ₂ H ₂ Flame correctly shuts down	Active	Passed
Burner Head Sensor	Choosing Nitrous Oxide as the oxidant should trigger an interlock shuts down	Active	Passed

8. After PM Performance tests:

8.1 Detector Linearity with Barium

Description: Ensures that the detector is linear in the Visible Range.

Parameter	Specification	Certificate Value at 553.6 nm (Abs.)	Test Results	Pass/Fail
1.0 A ND Filter	± 5% from Cert.	0.9798	0.9915	Passed
0.2 A ND Filter	± 5% from Cert.	0.2042	0.2037	Passed

8.2 Baseline Noise at 1.0 Absorbance with Barium

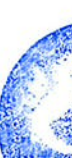
Description: Ensures that a high absorbance will not produce excessive noise.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.010	0.0014	Passed

8.3 AA Baseline Noise with Copper

Description: Check baseline noise.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.001	0.0004	Passed



8.4 D₂ Background Compensation with Copper

Description: Verifies the instruments ability to compensate for Background absorption.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.010	0.0091	Passed

8.5 AA-BG Baseline Noise with Copper

Description: Ensures that background correction does not produce excessive noise.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.005	0.0003	Passed

8.6 AA-BG Baseline Noise with Arsenic

Description: Ensures that background correction does not produce excessive noise at a low wavelength.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.005	0.0025	Passed

8.7 Flame Sensitivity

Description: Instrument Sensitivity checked against Copper standard.

Standard Copper Sensitivity	Specification	Results (Abs.)	Pass/Fail
5 mg/L Sensitivity 55 Neb (if applicable)	> 0.250 Abs.	NA	Not Applicable
2 mg/L Sensitivity Hs Neb (if applicable)	> 0.250 Abs.	0.3421	Passed

10. Review:

- ☒ Review with the customer PM work performed.
- ☒ Review with the customer routine maintenance procedures.
- ☒ Discuss recommended customer supplied materials to have on hand
- ☒ Attach PM sticker.

Additional Comments

Additional Comments Regarding the PM

Review

The preventive maintenance checks and if applicable performance tests for PinAAcle 900F have been completed.

This PinAAcle 900F Passes ☒ Fails ☐ the preventive maintenance.

Review of Preventive Maintenance:

Authorized PerkinElmer Representative:	Date: 05-Oct-2023 (DD-MMM-YYYY)
Authorized Customer Representative:	Date: 05-Oct-2023 (DD-MMM-YYYY)

Atomic Absorption/FIAS 100/400 Preventive Maintenance (PM)				
Company Name:	ENVILAB CO., LTD			
Address (Instrument Location):	540-540/1, SOI BANGKHAE 7, BANGKHAE, BANGKOK, 10160,			
Room Number:	-	Customer System ID:	KJENJIRA	
Asset Number (if applicable):	-	Service Order Number:	-	
Service Engineer Name:	K. DUANG	Next PM Due Date: (DD-MMM-YYYY)	05-Apr-2024	
Date PM Performed: (DD-MMM-YYYY)	05-Oct-2023			

Part Number	Release	Publication Date	 PerkinElmer®
09370005	C	January 2013	

Scope
The purpose of this PM is to ensure the continued functionality of the Atomic Absorption/FIAS 100/400 by inspecting and replacing any worn or damaged parts. This service should only be performed by a trained representative of PerkinElmer.
The customer should save their method before the PM begins.

General Instructions:
Always check with the customer before making any changes that may affect the customer's analysis or calibration.
The completed document should be signed by an authorized PerkinElmer and customer representative and left with the customer.
Update the PM sticker and instrument logbook as required.

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Component List

Component / Specific Model	Serial #	Firmware Version	Configuration Notes

Parts Lists

Parts Included with the PM			
Part Number (if applicable)	Description	Quantity	Batch/Lot #
B050 2706	Fan Filter	1	

Additional Tools Required for PM

Part Number (if applicable)	Description	Quantity	Serial #	Calibration Due Date (MM/YY)
	Digital Volt Meter	1		

Additional Reagents and Standards Required for PM

Part Number (if applicable)	Description	Quantity	Batch/Lot #	Expiration Date (MM/YY)

Procedure Checklist

Use (✓) to check off those steps in the checklist that have been completed.

1. General:

- ☒ Review the instrument performance with the customer and document any recent problems.

☒ Is the Working Environment Acceptable? If not, document.

NO

☒ Visual Damage (if yes, describe)

NO

- ☒ Check incoming AC line voltage for proper levels and grounding.
- ☒ Verify Voltage switch on back of instrument is correct
- ☒ Perform general inspection of system for cleanliness. Clean if needed.
- ☒ Gas supply cylinders secured, lines leak checked and argon or nitrogen supply pressure verified (45 – 58 psi).
- ☒ Inspect the customer log book and make any appropriate PM entries.
- ☒ Fan checked and filter cleaned
- ☒ Heating mantle or Universal Cell Holder checked

2. Instrument components

- ☒ Non-return valve checked/repaired/replaced if needed (B019 8111). Clean the valve if there is any liquid in it. Replace the rubber sleeve (B013 5123) if it is worn. Check the flow meter for any signs of fluid in it. Clean the flow meter if needed.
- ☒ Verify condition of pump pressure adjustment levers (B050 7794 - look for cracks or problems with the springs), pump rollers (B300 0251 check for wear), and thumb screws (B050 7796).
- ☒ Check the Multiport valve for proper switching, flow, and insure there are no leaks. Clean valve parts and replace o-rings if needed (large o-ring: B050 1250, small o-ring: B004 5095). Use a squirt bottle & fishing line to try to dislodge clogs.
- ☒ Firmware Version checked. Latest is 2.20.

3. Mixing/Separation Assembly & Pump Tubing:

- ☒ Mixing separator assembly checked
- ☒ Filter/membrane checked (B050 8306)
- ☒ Condition of the pump tubing (replace if necessary), correct pump tubing for the solutions being run. Make sure the correct magazines are being used. B050 7791 for 0.13 – 1.80 mm tubing; B050 7792 for 1.60 – 3.18 mm tubing.

4. Cell, Cell Windows, Transfer Line:

- ☒ Cell checked
- ☒ Cell windows checked
- ☒ Transfer line checked for moisture (if moisture is a problem, the Nafion dryer might be needed)

5. Operational Tests:

- ☒ Run DI water through the carrier/reculant/sample system. Verify smooth flow of liquid throughout without leaks. Replace tubing & fittings if needed.

6. Review:

- ☒ Review with the customer PM work performed.
- ☒ Review with the customer routine maintenance procedures.
- ☒ Discuss recommended customer-supplied materials to have on hand.
- ☒ Attach PM sticker.
- ☒ Update Logbook.

Additional Comments

Additional Comments Regarding the PM

Review

<p>The preventive maintenance checks and if applicable performance tests for FIAS 100/400 have been completed.</p> <p>This FIAS 100/400 Passes <input checked="" type="checkbox"/> Fails <input type="checkbox"/> the preventive maintenance.</p>	
<p>Review of Preventive Maintenance:</p>	
<p>Authorized PerkinElmer Representative:</p> <p><i>Uuy</i></p>	<p>Date: 05-Oct-2023 (DD-MMM-YYYY)</p>
<p>Authorized Customer Representative:</p> <p>เจษฎา</p>	<p>Date: 05-Oct-2023 (DD-MMM-YYYY)</p>

Document History

Revision	Description of Change	Page(s)	Date
A	First release		May 2008
B	Addition of Batch/Lot Number, Expiration Date, and Report Fields.	2,7	February 2009
C	Update to new format	All	January 2013



PerkinElmer TruQ

PerkinElmer Number: N9300183
Element and Matrix: 1000 µg/mL Copper in 2% HNO3
Starting Material: Copper Metal
Starting Material Lot No: 06201C
Density: 1.012 g/mL @ 20°C

Lot No: 26-87CUY1
Certification Date: JUL -- 2022
Expiration Date: JAN 30 2024

Trace Metallic Impurities in the Actual Solution via ICP-MS Analysis:

Element	µg/mL	Element	µg/mL	Element	µg/mL	Element	µg/mL
Ag	0.002	Dy	<0.001	Li	<0.005	Pt	<0.001
Al	<0.003	Er	<0.001	Lu	<0.001	Rb	<0.001
As	<0.002	Eu	<0.001	Mg	<0.001	Re	<0.001
Au	<0.002	Fe	<0.004	Mn	<0.001	Rh	<0.001
B	<0.002	Ga	<0.001	Mo	<0.001	Ru	<0.001
Ba	<0.001	Gd	<0.001	Na	0.05	Sb	<0.001
Be	<0.001	Ge	<0.002	Nb	<0.001	Sc	<0.001
Bi	<0.001	Hf	<0.001	Nd	<0.001	Se	<0.003
Ca	0.006	Hg	<0.001	Ni	<0.001	Si	<0.1
Cd	<0.001	Ho	<0.001	P	<0.2	Sm	<0.001
Ce	<0.001	In	<0.001	Pb	0.001	Sn	<0.001
Co	<0.001	Ir	<0.001	Pd	<0.001	Sr	<0.001
Cr	<0.001	K	<0.1	Pr	<0.001	Ta	<0.001
Cs	<0.001	La	<0.001				

Traceability Documentation for Solution Standard:
Certified Value: 1001 µg/mL ±5 µg/mL (refer to slide 2)
Certified Value is Traceable to: NIST SRM #3114
* Classical Wet Assay: 1000 µg/mL
Method: EDTA titration using PAN as indicator EDTA standardized against Pb(NO3)2 NIST SRM #289.

*Instrument Analysis using ICP Spectrometer: 1001 µg/mL
via NIST SRM #3114

We warrant that our PerkinElmer TruQ Atomic Spectroscopy Standards are stable and accurate to ±0.5% of certified concentration for the duration of the expiration date, provided the standards are kept tightly capped and stored under normal laboratory conditions. This value is the sum of cumulative errors associated with the analytical determinations, pipetting, and diluting to final volume. For these solutions we use high purity acids, ASTM Type 1 water (18 megohm double deionized), and leached, triple-rinsed bottles. All glassware used is



Secondary Spectrometric Calibration Standards
Certificate of Calibration

Ordinate Calibration
Calibration Data for Secondary Calibration Standards:

Wavelength / Absorbance	Number	Ordinate Reading (Absorbance) at the following wavelengths:			
Wavelength		193.70	324.75	553.55	766.49
Standard 1	MG2-358	0.9209	0.9078	0.9798	0.9553

The uncertainty of the given absorbance values is ±0.003 A at the given wavelengths.
The uncertainty is the expanded uncertainty expressed at an approximate level of confidence of 95% and a coverage factor of k=2 based on JCGM 100:2008 Evaluation of measurement data - Guide to the expression of uncertainty in measurement.

Conditions of Calibration

The following settings were used on the Lambda 900 UV/Vis/NIR Spectrometer employed to obtain the calibration data quoted on this certificate:

Measurement of Calibration			
Ordinate mode	Absorbance		
Slit mode UV/Vis	Flx	Slit UV/Vis	1 nm
Integration time UV/Vis	5 s		
Slit mode NIR	Servo	Slit NIR	Servo
Integration time NIR	5 s	Gain	2

The PerkinElmer "Certification Software" program - "Photometric Accuracy Vis/NIR" method utilizing the instrument set-up parameters as outlined above was used to measure the absorbance of the standards at the prescribed wavelengths reflected in the Calibration Data grid.

This set of Spectrometric Solution was calibrated on a PerkinElmer high performance Lambda 900 UV/Vis/NIR Spectrometer.
Serial Number: 101ND089015
This instrument is used solely for calibration purposes. The most recent quality control check of this instrument was performed on: 1/14/2015
Date / Time: 6/17/2015 / 8:21:03 AM
using the standard PerkinElmer quality control procedure. A set of NIST or NBS/PTB Standard Reference Standard Materials: NTRM PKI-1930 SIN 00038 Calibration Date 05/23/2014 National Research Council of Canada Calibration Report No. PAR 2014.3162 was used during this procedure. Measurements were performed at an ambient temperature of 22.1 °C and the humidity of: 53.9 %

Date / Time: 6/17/2015 / 8:21:03 AM
Operator: Cam Le Horvath
Signature: [Redacted]
PerkinElmer LAS, Inc., 710 Bridgeport Avenue, Shelton, CT 06484-4794, USA
End of Report

CERTIFICATE OF COMPLETION

This is to certify that

Duang Hiransuk

has completed the course

AA PinAAcle 900 T, H, Z, F and 500, S10/SA93+ and AS900

26 October 2018

Vinny Maharaj - Sr. Manager Service Training

Date

Certified by

This Certificate has been generated electronically from PerkinElmer Learning Management System, LMS ES-009-000, 0-05-55-11

Secondary Spectrometric Calibration Standards

Certificate of Calibration

Ordinate Calibration

Calibration Data for Secondary Calibration Standards:

Wavelength / Absorbance	Number	Ordinate Reading (Absorbance) at the following wavelengths:			
Wavelength		193.70	232.00	324.75	553.55
Standard 1	MGO-262	0.2762	0.2459	0.2124	0.1912

The uncertainty of the given absorbance values is ± 0.003 A at the given wavelengths. The uncertainty is the expanded uncertainty expressed at an approximate level of confidence of 95% and a coverage factor of $k=2$ based on JCGM 100:2008 Evaluation of measurement data - Guide to the expression of uncertainty in measurement.

Conditions of Calibration

The following settings were used on the Lambda 900 UV/Vis/NIR Spectrometer employed to obtain the calibration data quoted on this certificate:

Measurement of Calibration

Ordinate mode	Absorbance	
Slit mode UV/Vis	Fix	1 nm
Integration time UV/Vis	5 s	
Slit mode NIR	Servo	Servo
Integration time NIR	5 s	2

The PerkinElmer "Certification Software" program - "Photometric Accuracy Vis/NIR" method utilizing the instrument set-up parameters as outlined above was used to measure the absorbance of the standards at the prescribed wavelengths reflected in the Calibration Data grid.

This set of Spectrometric Solution was calibrated on a PerkinElmer high performance Lambda 900 UV/Vis/NIR Spectrometer.

Serial Number:

101N0089015

The instrument is used solely for calibration purposes. The most recent quality control check of this instrument was performed on:

Date / Time:

12/1/2014

The standard PerkinElmer quality control procedure, A set of NIST or NBS/PTB Standard Reference Standard Materials:

NTR-PK1-1930 model filler set S/N 00038 Calibration Date 05/23/2014 NRC Calibration Report No. PAR 2014 3102

was used during this procedure. Measurements were performed at an ambient temperature of 24.1 °C and the humidity of 19.8 %



CERTIFICATE OF COMPLETION

This is to certify that

Duang Hiransuk

has completed the course

AA Theory, Operation and WinLab 32 and Syngistix Software

12 October 2018

Vinny Maharaj - Sr. Manager Service
Training

Date

Certified by

This Certificate has been generated electronically from PerkinElmer Learning Management System, LMS ES-009-000, 0-05-55-11



AIRFLOW CALIBRATION CO.,LTD.

CERTIFICATION OF TEST REPORT

Equipment : Biological Safety Cabinet (Class II)

Manufacturer : Heal Force

Model : HFsafe-1200LC

Serial Number : EX042012LC5497

Identification Number : ELABMICROBSC01

Report Number : B224051

Issued Date : 1 March 2024

Job Number : B224051

Page : 1 of 7 Pages

Customer : ENVILAB CO.,LTD. (HEAD OFFICE)
540, 540/1 Soi Bangkhuae 7, Bangkhuae, Bangkhuae, Bang 10160

Environment Condition : Temperature: 20.8 °C ± 0.5 °C
Humidity: 53.0 %RH ± 3.1 %RH
Voltage: 221.5 VAC ± 0.3 VAC

Test Place : ENVILAB CO.,LTD. (HEAD OFFICE) Laboratory Floor 3

Test By : Mr.Achira Kaewpaitoon

Test Date : 29 February 2024

Due Date : 28 February 2025

Test Procedure : EN 12469: 2000 Biotechnology performance criteria for microbiological safety cabinet
AS 1807.23: 2000 Determination of intensity of radiation from germicidal ultraviolet lamp

Traceability : Velocity test is traceable to TAT Certificate Number :TTH-0-86850
Leak test of HEPA filter is traceable to WK Certificate Number :WK2309-176-1
Illumination test is traceable to SP Certificate Number :SPR23030030-1
Ultraviolet Radiation test is traceable to EEI Certificate Number :CO20230085EA
Sound test is traceable to SP Certificate Number :SPR23030030-2

This calibration certificate documents the traceability to national standards, which realize the unit of measurement according to the International System of Units (SI).

This certificate may not be reproduced other than in full except with the prior written approval of the Air Flow Calibration Company Limited.



Primary Test Results

1. Downflow Velocity Test

Test equipment used

- Thermo anemometer
- Brand: Testo
- Model: 425
- Serial number: 3101751
- Calibration due: 6-Nov-2024

Instruction: Work opening in normal positions. With the anemometer inside the MSC, make air velocity measurements in horizontal plane 50 mm to 100 mm above the top edge of the front aperture. Make measurements over a period of at least 1 min in each position. Measure in 2 rows along a line 1/4 of the depth of the working space forward of the rear wall and along a line the same distance behind the front window. Start 150 mm from the left side window and with 300 mm between the measuring spots.

Downflow Velocity Unit m/s

Back			
0.35	0.36	0.35	0.34
0.33	0.35	0.35	0.34
Front			

Characteristic of downflow velocities

Specification	Mean	Maximum	Minimum	±20 % of Mean	
• Mean downflow velocity to achieve product protection : 0.25 m/s - 0.50 m/s. All measurements should be within ±20 % of mean values.	0.35	0.36	0.33	0.28	0.42

Result Summary : Pass

AIR FM - SV - 08 : 01 Sep 2021

51/104 Moo 9, Ladkawai, Lamlukka Phatumthani 12150 Thailand

Tel : 0 2152 8350 , 0 2152 8348 , 0 2152 8070 , 08 4360 2558 , 09 2265 3175

http://www.airflow-calibration.com E-mail : bm.airflow@gmail.com , nopa



2. Inflow Velocity Test

Test equipment used

- Thermo anemometer
- Brand: Testo
- Model: 425
- Serial number: 3101751
- Calibration due: 6-Nov-2024

Exhaust Measurement

Instruction: The alternative procedure to determine inflow velocity uses a thermoanemometer in a constricted window access opening of 3 inches (76mm) with the armrest removed. Inflow air velocity is measured in the center of the constricted opening 1-1/2 inches (38mm) below the top of the work access opening on the following specified grid. Use the correction factor table to calculate the inflow velocity.

Inflow Velocity Unit: m/s										
1.29	1.28	1.29	1.31	1.32	1.32	1.31	1.32	1.31	1.32	1.32

Characteristic of air velocities in the work opening

Specification	Mean inflow (m/s)
• Mean Inflow velocity to achieve product protection : ≥ 0.40 m/s.	0.50

Result Summary : Pass

Adjustments Required

Fan speed
✓ No Change

Damper
✓ No Change

AIR FM - SV - 08 : 01 Sep 2021



3. Leak Test of HEPA Filters

Test equipment used

- Aerosol Photometer ● Brand: ATI ● Model: 2H
- Serial number: 20627 ● Calibration due: 20-Sep-2024

Test equipment used:

- Aerosol Generator ● Brand: ATI ● Model: 6C
- Serial number: 20554 ● Calibration date: -

Instruction: The aerosol through the "Challenge" valve to the backside of HEPA filter and maximum local penetration: 0.01 % of upstream concentration. (PAO test substitute for DOP test)

Characteristic of PAO test

Concentration on the upstream side of main HEPA filter	34	µg/l
Downstream aerosol and the ratio of concentration in percentage of main HEPA filter	0.001	%
Downstream aerosol and the ratio of concentration in percentage of exhaust HEPA filter	0.001	%

Main HEPA Filter

Leak position

☐ : 10 cm. x 10 cm. X : Media leak position G : Gasket leak position M : Maximum leak position



Exhaust HEPA Filter

Leak position

☐ : 10 cm x 10 cm X : Media leak position G : Gasket leak position M : Maximum leak position

Result Summary : Pass

4. Airflow Patterns

Test equipment used

Smoke Generator

Instruction : The purpose of the test is to verify that no smoke escapes from the working space to the room, and that smoke will be drawn into the working space from the room.

Pass the smoke in an easy movement along the front opening outside the cabinet. The smoke must be drawn into the cabinet without visible turbulence.

Test the laminarity of the downflow and along the side and back wall. No smoke must come out in the room and only small Turbulence must be observed.

Result Summary :

Downflow Pattern Test	<u>Pass</u>
View Screen Retention Test	<u>Pass</u>
Work Opening Edge Retention Test	<u>Pass</u>
Sash/Window Seal Test	<u>Pass</u>

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AIRFLOW CALIBRATION CO.,LTD.

Continuation of the Certificate of Test Report Number : B224051

Page 6 of 7 Pages

5. Site Installation

5.1 Sash Alarm	Pass
5.2 Interlocks	N/A
5.3 Exhaust System Alarm	N/A

6. Soap Solution

Instruction: Comprising 25g/l soft soap in tepid distilled water prepared in grease free vessel.

Result Summary : Absence of soap bubbles. N/A

Secondary Test Results

7. Illumination Test

Instruction: Take readings at approximately 300 mm centres across the full front width of the work floor surface, starting approximately 150 mm in from each side.

Test equipment used

- Lux meter
- Brand: Daiichi
- Model: LM507
- Serial number: 1300421511013
- Calibration due: 2-Mar-2024

Illumination Unit: Lux

Back

819	923	944	1059	1049
-----	-----	-----	------	------

Front

Lighting should be adequate for safe working within the cabinet. Illumination measured at the work surface should be at least 750 lux.

Result Summary : Pass

AIR FM - SV - 08 : 01 Sep 2021

51/104 Moo 9, Ladsawai, Lam Lukka Phatunthani 12150 Thailand

Tel : 0 2152 8350 , 0 2152 8348 , 0 2152 8070 , 08 4360 2558 , 09 2265 3175 Fax

http://www.airflow-calibration.com E-mail : bm.airflow@gmail.com , nop.airflow@gmail.com

ภาคผนวก 3-16-2

Envilab Co.,Ltd.

ผู้จัดการฝ่ายควบคุมคุณภาพ



AIRFLOW CALIBRATION CO.,LTD.

Continuation of the Certificate of Test Report Number : B224051

Page 7 of 7 Pages

8. Ultraviolet Radiation Test

Instruction: Take readings at approximately 300 mm centres across the full front width of the work floor surface, starting approximately 150 mm in from each side.

Test equipment used

- UVC Light Meter
- Brand: Lutron
- Model: UVC-254SD
- Serial number: Q853539
- Calibration due: 26-Sep-2024

Ultraviolet Radiation Unit: mW/m ²				
Back				
2300	2920	3350	2080	1960
Front				

Ultraviolet radiation where UV lamps are fitted, the intensity of radiation at a wave length of 254 nm shall be not less than 400 mW/m² when measured at the work floor surface.

Result Summary : Pass

9. Sound levels Test

Instruction: Sound levels in a cabinet should be low enough not to distract a worker. When tested in accordance with EN ISO 3744 using a sound level meter situated 1.0 m from the centre of the front aperture of the cabinet, or 1.0 m from any part of the installation within the laboratory, the A-weighted sound pressure level generated by the cabinet should not exceed 65 dB when the A-weighted sound pressure level of the background is less than 55 dB. If the background noise exceeds 55 dB then the corrected cabinet A-weighted sound pressure level should not exceed 65 dB.

Test equipment used

- Sound Meter
- Brand: Daiichi
- Model: SL332
- Serial number: 19090231
- Calibration due: 2-Mar-2024

* Sound pressure level of the background: 50.6 dBA

* Sound levels: 59.2 dBA

Result Summary : Pass

End of Certificate of Test Report

AIR FM - SV - 08 : 01 Sep 2021

51/104 Moo 9, Ladsawai, Lamphukha Phatunthani 12150 Thailand

Tel : 0 2152 8350 , 0 2152 8348 , 0 2152 8070 , 08 4360 2558 , 09 2265 3175

http://www.airflow-calibration.com E-mail : bm.airflow@gmail.com

ภาคผนวก 3-16-2

Envilab Co.,Ltd. ผู้จัดการฝ่ายควบคุมคุณภาพ

Certificate of Calibration

Certificate No. : 67-400054-2

Page : 1 of 2

Submitted by : Envilab Co., Ltd.
540,540/1 Soi Bangkhac7, Bangkhac, Bangkok 10160

Equipment : Autoclave
Manufacturer : Tomy Model : SX-500
Range : N/A °C Resolution 1 °C
Serial No. : 55133094 ID No. : N/A

Environment : On site calibration was carried out at the Laboratory, Envilab Co., Ltd.
Ambient Temperature : (30.0 to 31.0) °C
Relative Humidity : (50 to 55) %
Line Voltage : (224.0 to 225.0) V

Date of Received : 01 February 2024

Date of Calibration : 01 February 2024

Date of Issue : 03 February 2024

Calibrated by : Permpon Chanpu

Calibration Method : This instrument was calibrated by In-house method CAL-M4007 based on
BS 2646 Part 1 : 2021
The temperature scale used was based on ITS-90

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

Standard Temperature Data Logger with RTD pt 100

ID No.	Cert. No.	Due Date	Traceability
400039	66-400707-1	27 Jun 2024	National Institute of Metrology Thailand (NIMT)
400040	66-400707-2	27 Jun 2024	National Institute of Metrology Thailand (NIMT)
400041	66-400707-3	27 Jun 2024	National Institute of Metrology Thailand (NIMT)

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

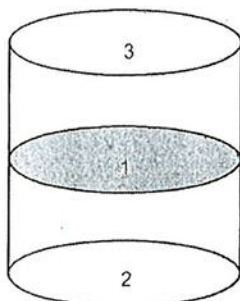
Certificate No. 67-400054-2

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 No.			Uncertainty (± °C)	Measured Uniformity (°C)	Measured Stability (°C)	Sterilizing Time (minute)	Pressure Gauge Reading (MPa)
			1	2	3					
121	121	121	121.4	121.4	121.4	1.0	1.0	0.5	15	0.11

Remark

1. UUC : Unit Under Calibration
2. Pressure Gauge reading are out of accreditation's scope.

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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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. : 67-300021-2

Page : 1 of 2

Submitted by : Envilab Co.,Ltd.

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

Equipment : Piston Pipette

Manufacturer : sartorius

Model : N/A

Serial No. : 4538803008

ID No. : ELABMICROPP005

Capacity : 100 µl to 1000 µl Resolution : 5 µl

Environment : Ambient Temperature : (20 ± 3) °C

Relative Humidity : (55 ± 10) %

Air Pressure : (1007.9 to 1008.1) mbar.

Date of Received : 18 January 2024

Date of Calibration : 20 January 2024

Date of Issue : 20 January 2024

Calibrated by : Wipa Tovadec

Calibration Method : In-house method CAL-M3002 base on ISO 8655-6 : 2022-04

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

Electronic Balance

ID No.	Cert. No.	Due Date	Traceability
241003	66-200388-2	02 Jun 2024	National Institute of Metrology (Thailand) (NIMT)

Approved by

The Uncertainties are for a confidence probability of approximately 95%

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CAL-F0031-03

ภาคผนวก 3-16-2

Envilab Co.,Ltd.

รับรอง 155/160 ผู้จัดการฝ่ายควบคุมคุณภาพ

Certificate of Calibration

Certificate No. : 67-300021-2

Page : 2 of 2

Result of Calibration : Without Adjustment

based on the gravimetric determination of the quantity of water which is converted to true volume at the standard temperature of 20 °C

Setting Volume (µl)	Measuring Volume (µl)	e_s (µl)	η_s (%)	S_r (µl)	C_v (%)	Uncertainty (± µl)	Coverage Factor (k)
100	99.47	-0.53	0.53	0.10	0.10	3.1	2.00
500	498.36	-1.64	0.33	0.06	0.01	3.2	2.00
1000	997.93	-2.07	0.21	0.07	0.01	3.3	2.00

Note : e_s : Systematic error (µl) , η_s : Relative systematic error (%)

S_r : Standard deviation (µl) , C_v : Coefficient of variation (%)

The formula used to convert weighing values into volume is

$$V_{20} = M \times Z$$

V_{20} = is the water volume at standard temperature of 20 °C

M = is the balance reading of delivered water

Z = is the combined factor for buoyancy correction and conversion from mass to volume

UUC Condition As-Received : Good

UUC Calibrated to delivery (Ex) by using : White Tip

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

This reported uncertainty of measurment was based on a standard uncertainty multiplied by a coverage factor (k)

providing a level of confidence of approximately 95%

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CAL

Calibratech Co.,Ltd.

7/106-7 Moo 2, Sukhaphrasan 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-TIS 17025
CALIBRATION 0030

Certificate of Calibration

Certificate No. : 67-400101-1

Page : 1 of 2

Submitted by : Envilab Co., Ltd.

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

Equipment : Temperature controlled enclosure (Incubator)

Manufacturer : Memmert

Model : IF 110

Range : N/A °C

Resolution : 0.1 °C

Serial No. : D419.0525

ID No. : ELABINCUBATOR1

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

Ambient Temperature : (23.0 to 24.0) °C

Relative Humidity : (50 to 55) %

Line Voltage : (223.0 TO 225.0)V

Date of Received : 20 February 2024

Date of Calibration : 20 February 2024

Date of Issue : 22 February 2024

Calibrated by : Kittisak Kokaeo

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>
400046 & 400042	67-400047-1	25 Jul 2024	National Institute of Metrology Thailand (NIMT)

The Uncertainties are for a confidence probability of approximately 95%

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CAL-F0031-03

ภาคผนวก 3-16-2

Envilab Co.,Ltd.

รับรองส่วนทุกข้อ
ผู้จัดการฝ่ายควบคุมคุณภาพ

Certificate of Calibration

Certificate No. : 67-400101-1

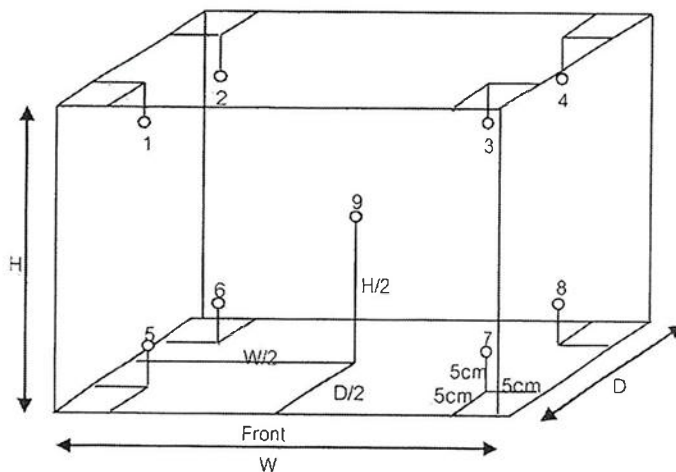
Page : 2 of 2

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 = 0.56 m

D = 0.48 m

H = 0.40 m

Capacity = 0.11 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	
35.0	35.0	35.0	35.00	35.10	35.16	35.14	35.15	35.14	35.03	35.00	35.12	0.30
37.0	37.0	37.0	37.01	37.11	37.17	37.15	37.16	37.15	37.04	37.01	37.13	0.30

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
35.0	35.0	35.0	0.1	0.0	0.2
37.0	37.0	37.0	0.1	0.0	0.2

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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CAL

Calibratech Co.,Ltd.

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



NSC-TISI-TIS 17025
CALIBRATION 0030

Certificate of Calibration

Certificate No. : 66-400477-1

Page : 1 of 2

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

Equipment : Water Bath
Manufacturer : LAUDA Model : A 24
Range : N/A " C Resolution : 0.1 " C
Serial No. : CN21001882 ID No. : ELABWBALPHA241

Environment : On site calibration was carried out at the Laboratory, ENVILAB CO.LTD
Ambient Temperature : (22.5 to 23.0) " C
Relative Humidity : (40 to 45) %
Line Voltage : (228.0 to 230.1) V

Date of Received : 25 August 2023

Date of Calibration : 25 August 2023

Date of Issue : 25 August 2023

Calibrated by : Permpoon 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

<u>ID No.</u>	<u>Cert. No.</u>	<u>Due Date</u>	<u>Traceability</u>
400046 & 400024	66-400184-2	06 Oct 2023	National Institute of Metrology Thailand (NIMT)

The Uncertainties are for a confidence probability of approximately 95%

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CAL-F0031-03

ภาคผนวก 3-16-2

Envilab Co.,Ltd.

บริษัท อีวิลแลบ จำกัด
ผู้จัดการฝ่ายควบคุมคุณภาพ

Certificate of Calibration

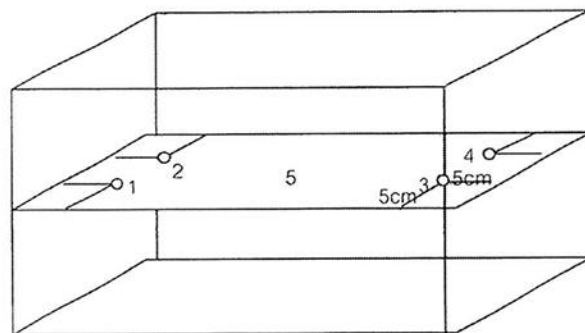
Certificate No. : 66-400477-1

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			
44.5	44.5	44.5	44.52	44.50	44.50	44.50	44.50	0.18	0.06	0.01

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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