



รายงานผลการปฏิบัติตามมาตรการป้องกันและแก้ไขผลกระทบสิ่งแวดล้อม และมาตรการติดตามตรวจสอบ

ผลกระทบสิ่งแวดล้อม (ระยะดำเนินการ)

โครงการทำเทียบเรือสินค้า ณ บับประจำเดือนกรกฎาคม-ธันวาคม 2567

ภาคผนวก 3-16-2

เอกสารผลการสอบเทียบเครื่องมือวัด



บริษัท เอ็นไวแล็บ จำกัด 540,540/1 ซอยบางแค 7 แขวงบางแค เขตบางแค กรุงเทพฯ 10160
Envilab Co., Ltd. 540,540/1 Soi Bangkhoe 7 Bangkhoe Bangkok Bangkok 10160
Tel : 02-802-3577-8 Fax. 02-802-3773 E-mail : info@evltesting.com



Envilab & Enviding Quality Instrument

TSP High Volume Sampler Calibration

Verification Report No.

AO2300034-E004 -TSP 01

<input type="checkbox"/> PM	<input checked="" type="checkbox"/> Onsite
Site: บริเวณหน้าท่าเทียบเรือสินวัฒนา	
UTM : 47P N 1596885 E 672433	
Sampler: ETSP#40	
Recorder: EVFCDPR02TC008	
Date: 26 Oct 24	
Technical: Panlop Prommee	
Approval: Wisan Ritthikamon	

CONDITIONS

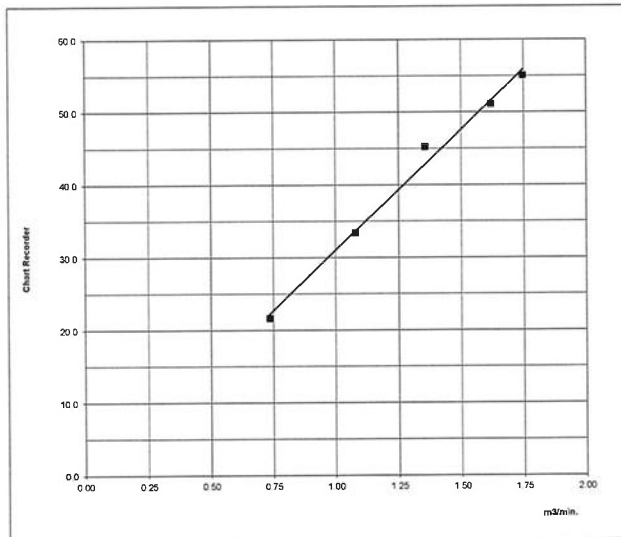
Barometric Press. (hPa): 1002.3	Corrected Pressure (mm Hg): 751.8
Temperature (deg C): 32.0	Temperature (deg K): 305.0
Average Press. (hPa): 1002.5	Corrected Avg.Press. (mm Hg): 751.9
Average Temp. (deg C): 31.0	Average Temp. (deg K): 304.0

CALIBRATION ORIFICE

Brand: Tisch Environmental, Inc	Qstd Slope: 2.02024
Model: TE-5025A	Qstd Intercept: -0.02667
Serial#: 5411	Date Certified: 9 Feb 2024

CALIBRATIONS

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION
1	12.70	1.747	56.0	55.05	
2	10.90	1.620	52.0	51.12	Slope = 33.2219 Intercept = -2.1392 Corr. coeff.= 0.9953 # of Observations: 5 Range of Chart at 1.1 - 1.7 m3/min. 35 55
3	7.60	1.355	46.0	45.22	
4	4.80	1.079	34.0	33.43	
5	2.20	0.735	22.0	21.63	



Calibrated by :

Panlop Prommee
26 October 2024

Approved by :

Wisan Ritthikamon
26 October 2024

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FE-MNT-29 Rev.02:05/07/67





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Envilab & Needles Supply Instrument

TSP High Volume Sampler Calibration

Verification Report No.

AO2300034-E004 -TSP 02

☐ PM ☒ Onsite

Site: บริเวณหลังท่าเทียบเรือสินวัฒนา

UTM : 47P N 1596712 E 672285

Sampler: ETSP#26

Recorder: EVFC DPR02TC013

Date: 26 Oct 24

Technical: Panlop Prommee

Approval: Wisan Ritthikamon

CONDITIONS

Barometric Press. (hPa): 1002.3

Temperature (deg C): 32.0

Average Press. (hPa): 1002.5

Average Temp. (deg C): 31.0

Corrected Pressure (mm Hg): 751.8

Temperature (deg K): 305.0

Corrected Avg. Press. (mm Hg): 751.9

Average Temp. (deg K): 304.0

CALIBRATION ORIFICE

Brand: Tisch Environmental, Inc

Model: TE-5025A

Serial#: 5411

Qstd Slope: 2.02024

Qstd Intercept: -0.02667

Date Certified: 9 Feb 2024

CALIBRATIONS

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)
1	13.50	1.801	56.0	55.05
2	10.30	1.575	50.0	49.16
3	7.40	1.337	44.0	43.26
4	4.20	1.010	34.0	33.43
5	2.20	0.735	26.0	25.56

LINEAR REGRESSION

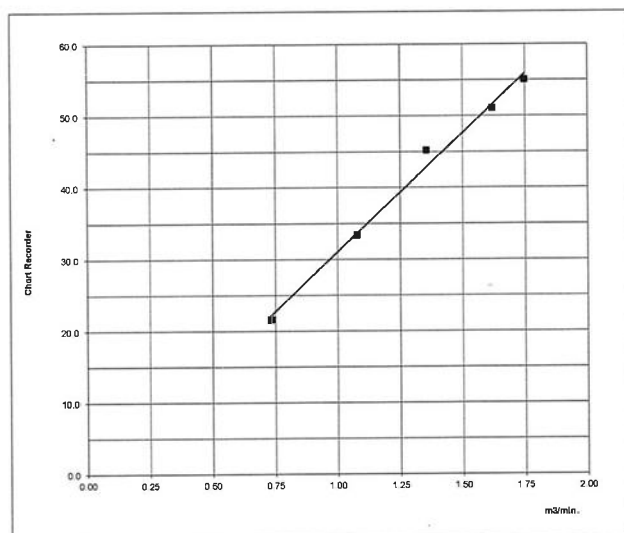
Slope = 27.7719

Intercept = 5.4169

Corr. coeff. = 0.9994

of Observations: 5

Range of Chart at 1.1 - 1.7 m3/min. 37 53



Calibrated by :

Approved by :

Wisan Ritthikamon
26 October 2024

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TSP High Volume Sampler Calibration

Verification Report No.

AO2300034-E004 -TSP 03

<input type="checkbox"/> PM	<input checked="" type="checkbox"/> Onsite
Site: โรงเรียนวัดละมุด	
UTM: 47P N 1597407 E 672627	
Date: 26 Oct 24	
Sampler: ETSP#38	
Technical: Panlop Prommee	
Recorder: ECRAN000031073	
Approval: Wisan Ritthikamon	

CONDITIONS

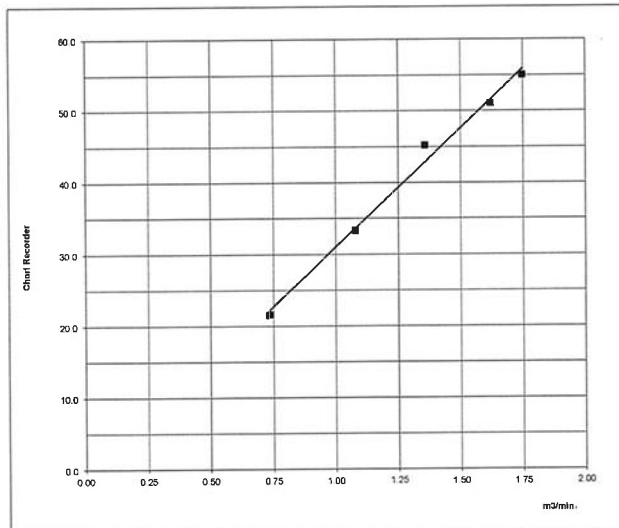
Barometric Press. (hPa): 1006.5	Corrected Pressure (mm Hg): 754.9
Temperature (deg C): 33.0	Temperature (deg K): 306.0
Average Press. (hPa): 1006.7	Corrected Avg.Press. (mm Hg): 755.1
Average Temp. (deg C): 31.0	Average Temp. (deg K): 304.0

CALIBRATION ORIFICE

Brand: Tisch Environmental, Inc	Qstd Slope: 2.02024
Model: TE-5025A	Qstd Intercept: -0.02667
Serial#: 5411	Date Certified: 9 Feb 2024

CALIBRATIONS

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION	
1	12.10	1.707	54.0	53.11		
2	10.20	1.568	50.0	49.18	Slope = 29.9667	
3	8.20	1.407	46.0	45.24	Intercept = 2.1558	
4	4.50	1.046	32.0	31.47	Corr. coeff.= 0.9927	
5	3.10	0.870	30.0	29.51	# of Observations: 5	
					Range of Chart at 1.1 - 1.7 m3/min.	36 53



Calibrated by :

Approved by :

Wisan Ritthikamon
26 October 2024

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Evaluate & Monitor Supply Instrument

TSP High Volume Sampler Calibration

Verification Report No.

AO2300034-E004 -TSP 04

☐ PM ☒ Onsite

Site: บริเวณชุมชนหมู่ที่ 6 ป่านหัวโคก

UTM : 47P N 1596873 E 671682

Sampler: ETSP#33

Recorder: ECRDS016339509

Date: 26 Oct 24

Technical: Panlop Prommee

Approval: Visan Ritthikamon

CONDITIONS

Barometric Press. (hPa): 1008.3

Temperature (deg C): 33.0

Average Press. (hPa): 1008.5

Average Temp. (deg C): 31.0

Corrected Pressure (mm Hg): 756.3

Temperature (deg K): 306.0

Corrected Avg. Press. (mm Hg): 756.4

Average Temp. (deg K): 304.0

CALIBRATION ORIFICE

Brand: Tisch Environmental, Inc

Model: TE-5025A

Serial#: 5411

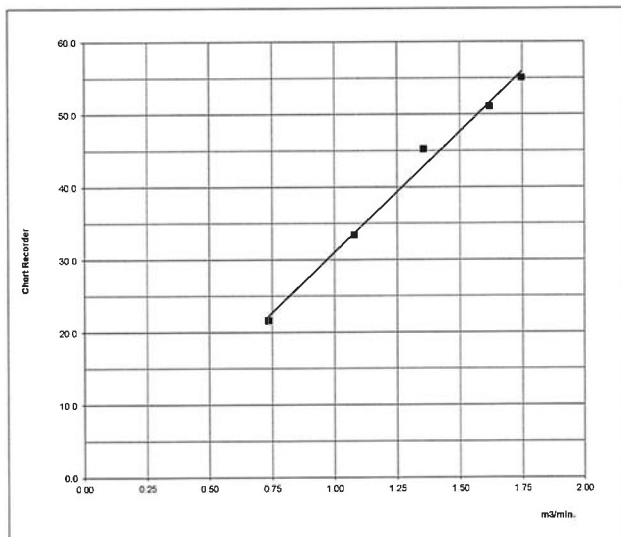
Qstd Slope: 2.02024

Qstd Intercept: -0.02667

Date Certified: 9 Feb 2024

CALIBRATIONS

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION
1	12.50	1.736	56.0	55.13	
2	10.40	1.585	50.0	49.22	Slope = 29.8597 Intercept = 2.2824 Corr. coeff. = 0.9965 # of Observations: 5 Range of Chart at 1.1 - 1.7 m3/min. 36 53
3	8.30	1.417	44.0	43.31	
4	4.30	1.024	34.0	33.47	
5	3.40	0.912	30.0	29.53	



Calibrated by :

Approved by :

26 October 2024

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FE-MNT-29 Rev 02:05/07/67





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TSP High Volume Sampler Calibration

Verification Report No.

AO2300034-E004 -TSP 05

<input type="checkbox"/> PM	<input checked="" type="checkbox"/> Onsite
Site: ป่านเกาะกลางน้ำ (หมู่ที่ 1 ป่านเกาะปากจั่น)	
UTM : 47P N 1596560 E 672405	
Sampler: ETSP#42	
Recorder: EVFCDPR02TC010	
Date: 26 Oct 24	
Technical: Panlop Prommee	
Approval: Wisan Ritthikamon	

CONDITIONS

Barometric Press. (hPa): 1001.5
Temperature (deg C): 33.0
Average Press. (hPa): 1001.7
Average Temp. (deg C): 31.0

Corrected Pressure (mm Hg): 751.2
Temperature (deg K): 306.0
Corrected Avg.Press. (mm Hg): 751.3
Average Temp. (deg K): 304.0

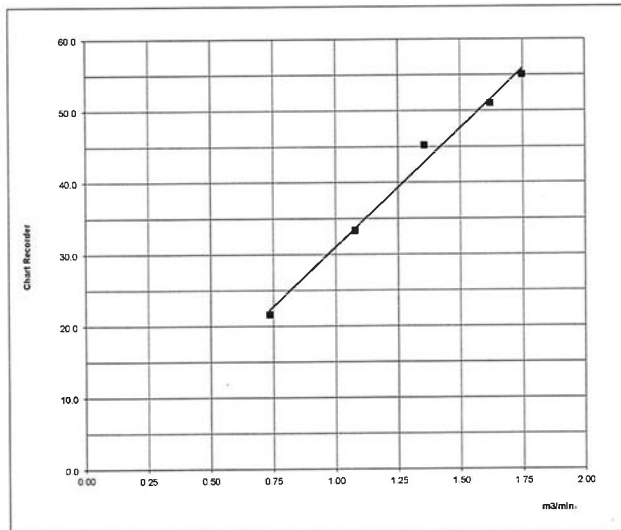
CALIBRATION ORIFICE

Brand: Tisch Environmental, Inc
Model: TE-5025A
Serial#: 5411

Qstd Slope: 2.02024
Qstd Intercept: -0.02667
Date Certified: 9 Feb 2024

CALIBRATIONS

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION	
1	11.70	1.674	56.0	54.94		
2	10.60	1.594	52.0	51.02	Slope = 29.2498	
3	7.30	1.325	46.0	45.13	Intercept = 5.4748	
4	4.90	1.088	38.0	37.28	Corr. coeff. = 0.9969	
5	3.30	0.895	32.0	31.40	# of Observations: 5	
					Range of Chart at 1.1 - 1.7 m3/min.	39 56



Calibrated by :

Approved by :

26 October 2024

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FE-MNT-27 Rev.00 (01/08/63)

Environmental responsibility with accuracy measurement

FE-MNT-29 Rev.02:05/07/67





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Envilab & Member Supply Instrument

PM10 High Volume Sampler Calibration

Verification Report No.

AO2300034-E004 -PM 01

<input checked="" type="checkbox"/> PM	<input type="checkbox"/> Onsite
Site: บริเวณหน้าท่าเทียบเรือสินวัฒนา	
UTM : 47P N 1596885 E 672433	
Sampler: EM10#47	
Recorder: EVFCDPR02TC007	
Date: 26 Oct 24	
Technical: Panlop Prommee	
Approval: Wisan Ritthikamon	

CONDITIONS

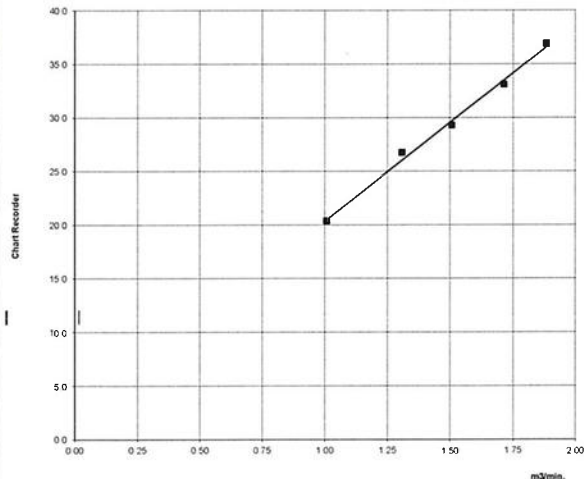
Barometric Press. (hPa): 1002.3	Corrected Pressure (mm Hg): 751.8
Temperature (deg C): 32.0	Temperature (deg K): 305.0
Average Press. (hPa): 1002.5	Corrected Avg. Press. (mm Hg): 751.9
Average Temp. (deg C): 31.0	Average Temp. (deg K): 304.0

CALIBRATION ORIFICE

Brand: Tisch Environmental, Inc	Qstd Slope: 1.2654
Model: TE-5025A	Qstd Intercept: -0.01667
Serial#: 5411	Date Certified: 9 Feb 2024

CALIBRATIONS

Plate or Test #	H2O (in)	Qa (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION Slope = 18.3219 Intercept = 2.1258 Corr. coeff. = 0.9970 SFR = 1.134 SSP = 35.96 # of Observations: 5 Range of Chart at SFR $\pm 10\%$ 34 38
1	13.80	1.883	58.0	36.94	
2	11.40	1.713	52.0	33.12	
3	8.80	1.506	46.0	29.30	
4	6.60	1.306	42.0	26.75	
5	3.90	1.007	32.0	20.38	



Calibrated by :

Approved by :

Wisan Ritthikamon
26 October 2024

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Envilab & Handout Supply Instrument

PM10 High Volume Sampler Calibration

Verification Report No.

AO2300034-E004 -PM 02

☒ PM

☐ Onsite

Site: บริเวณหลังท่าเทียบเรือสินวัฒนา

UTM : 47P N 1596712 E 672285

Sampler: EPM10#46

Recorder: EVFCDPR02TC006

Date: 26 Oct 24

Technical: Panlop Prommee

Approval: Wisan Ritthikamon

CONDITIONS

Barometric Press. (hPa): 1002.3

Temperature (deg C): 32.0

Average Press. (hPa): 1002.5

Average Temp. (deg C): 31.0

Corrected Pressure (mm Hg): 751.8

Temperature (deg K): 305.0

Corrected Avg.Press. (mm Hg): 751.9

Average Temp. (deg K): 304.0

CALIBRATION ORIFICE

Brand: Tisch Environmental, Inc

Model: TE-5025A

Serial#: 5411

Qstd Slope: 1.26504

Qstd Intercept: -0.01667

Date Certified: 9 Feb 2024

CALIBRATIONS

Plate or Test #	H2O (in)	Qa (m3/min)	I (chart)	IC (corrected)
1	12.80	1.815	58.0	36.94
2	10.20	1.621	52.0	33.12
3	7.40	1.383	46.0	29.30
4	6.70	1.316	42.0	26.75
5	2.60	0.825	28.0	17.83

LINEAR REGRESSION

Slope = 19.3409

Intercept = 1.8671

Corr. coeff. = 0.9981

SFR = 1.134

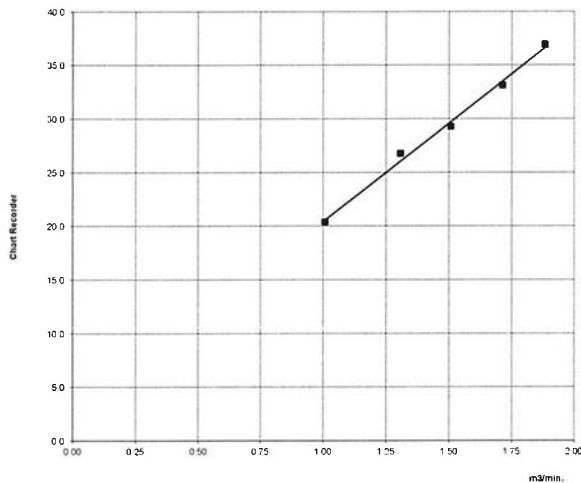
SSP = 37.36

of Observations: 5

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

35

40



Calibrated by :

Approved by :

Wisan Ritthikamon

26 October 2024

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

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ผู้จัดการฝ่ายควบคุมคุณภาพ



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PM10 High Volume Sampler Calibration

Verification Report No.

AO2300034-E004 -PM 03

<input checked="" type="checkbox"/> PM	<input type="checkbox"/> Onsite
Site: โรงเรียนวัดละมุด	
UTM : 47P N 1597407 E 672627	
Sampler: EPM10#14	
Recorder: ECRDS016108798	
Date: 26 Oct 24	
Technical: Panlop Prommee	
Approval: Wisan Ritthikamon	

CONDITIONS

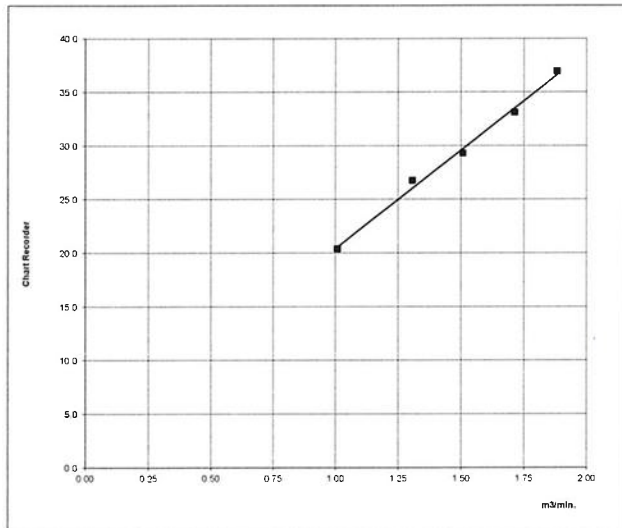
Barometric Press. (hPa): 1006.5	Corrected Pressure (mm Hg): 754.9
Temperature (deg C): 33.0	Temperature (deg K): 306.0
Average Press. (hPa): 1006.7	Corrected Avg.Press. (mm Hg): 755.1
Average Temp. (deg C): 31.0	Average Temp. (deg K): 304.0

CALIBRATION ORIFICE

Brand: Tisch Environmental, Inc	Qstd Slope: 1.26504
Model: TE-5025A	Qstd Intercept: -0.01667
Serial#: 5411	Date Certified: 9 Feb 2024

CALIBRATIONS

Plate or Test #	H2O (in)	Qa (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION
1	12.00	1.757	54.0	34.38	Slope = 20.3444
2	9.60	1.573	52.0	33.11	Intercept = -0.3357
3	7.70	1.410	44.0	28.01	Corr. coeff.= 0.9908
4	4.90	1.127	36.0	22.92	SFR = 1.138
5	3.20	0.913	28.0	17.83	SSP = 35.83
					# of Observations: 5
					Range of Chart at SFR $\pm 10\%$
					33
					39



Calibrated by :

Approved by :

Wisan Ritthikamon
26 October 2024

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FE-MNT-29 Rev.02/05/07/57





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



Envilab & Needles Supply Instrument

PM10 High Volume Sampler Calibration

Verification Report No.

AO2300034-E004 -PM 04

☐ PM

☒ Onsite

Site: บริเวณชุมชนหมู่ที่ 6 บ้านหัวโคก

UTM : 47P N 1596873 E 671682

Sampler: EPM10#30

Recorder: ECRDS016431077

Date: 26 Oct 24

Technical: Panlop Prommee

Approval: Wisan Ritthikamon

CONDITIONS

Barometric Press. (hPa): 1008.3

Temperature (deg C): 33.0

Average Press. (hPa): 1008.5

Average Temp. (deg C): 31.0

Corrected Pressure (mm Hg): 756.3

Temperature (deg K): 306.0

Corrected Avg. Press. (mm Hg): 756.4

Average Temp. (deg K): 304.0

CALIBRATION ORIFICE

Brand: Tisch Environmental, Inc

Model: TE-5025A

Serial#: 5411

Qstd Slope: 1.26504

Qstd Intercept: -0.01667

Date Certified: 9 Feb 2024

CALIBRATIONS

Plate or Test #	H2O (in)	Qa (m3/min)	I (chart)	IC (corrected)
1	11.90	1.748	54.0	34.35
2	9.20	1.538	48.0	30.53
3	7.70	1.408	46.0	29.26
4	4.20	1.044	34.0	21.63
5	2.80	0.855	28.0	17.81

LINEAR REGRESSION

Slope = 18.5806

Intercept = 2.2164

Corr. coeff. = 0.9972

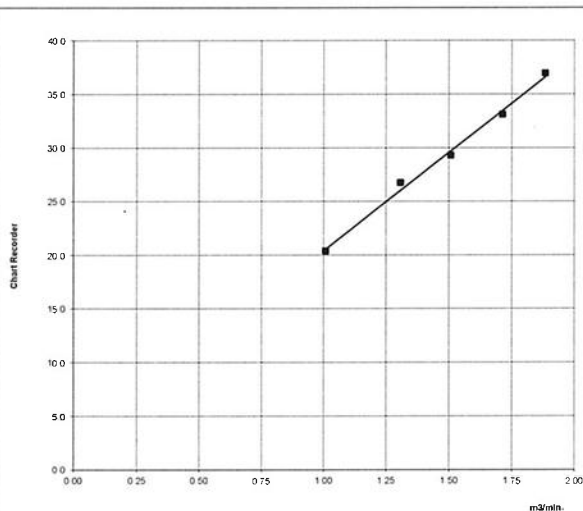
SFR = 1.138

SSP = 36.72

of Observations: 5

Range of Chart 34

at SFR $\pm 10\%$ 39



Calibrated by :

Approved by :

Wisan Ritthikamon

26 October 2024

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

Environmental responsibility with accuracy measurement

FE-MNT-29 Rev.02/05/07/67





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



Envilab & Heredia Supply Instrument

PM10 High Volume Sampler Calibration

Verification Report No.

AO2300034-E004 -PM 05

L PM

Onsite

Site: บ้านเกาะกลางน้ำ หมู่ที่ 1 บ้านเกาะปากจั่น

UTM : 47P N 1596560 E 672405

Sampler: EPM10#29

Recorder: ECRDS016431075

Date: 26 Oct 24

Technical: Panlop Prommee

Approval: Wisan Ritthikamon

CONDITIONS

Barometric Press. (hPa): 1001.5

Temperature (deg C): 33.0

Average Press. (hPa): 1001.7

Average Temp. (deg C): 31.0

Corrected Pressure (mm Hg): 751.2

Temperature (deg K): 306.0

Corrected Avg.Press. (mm Hg): 751.3

Average Temp. (deg K): 304.0

CALIBRATION ORIFICE

Brand: Tisch Environmental, Inc

Model: TE-5025A

Serial#: 5411

Qstd Slope: 1.26504

Qstd Intercept: -0.01667

Date Certified: 9 Feb 2024

CALIBRATIONS

Plate or Test #	H2O (in)	Qa (m3/min)	I (chart)	IC (corrected)
1	11.50	1.724	54.0	34.47
2	9.30	1.552	48.0	30.64
3	7.70	1.413	44.0	28.08
4	4.40	1.071	34.0	21.70
5	2.90	0.872	28.0	17.87

LINEAR REGRESSION

Slope = 19.2331

Intercept = 1.0367

Corr. coeff = 0.9996

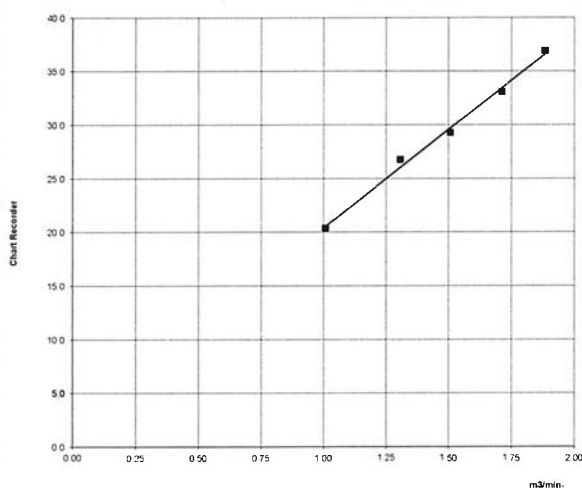
SFR = 1.138

SSP = 35.91

of Observations: 5

Range of Chart 33

at SFR $\pm 10\%$ 38



Calibrated by :

Approved by :

Wisan Ritthikamon

26 October 2024

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Environmental responsibility with accuracy measurement

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

FE-MNT-29 Rev.02:05/07/67





บริษัท เอ็นไวแล็บ จำกัด 540,540/1 ซอยบางแค 7 แขวงบางแค เขตบางแค กรุงเทพฯ 10160
Envilab Co., Ltd. 540,540/1 Soi Bangkhoe 7 Bangkhoe Bangkhoe Bangkok 10160
Tel : 02-802-3577-8 Fax. 02-802-3773 E-mail : info@evltesting.com



Envilab & Needas Supply Instrument

Verification Test Report

Report No.:

AO2300034-E004 -SLM 01

☐ PM ☒ Onsite UTM : 47P N 1596893 E 672440

Calibrated Date: 26 October 2024

Site : บริเวณหน้าท่าเทียบเรือสินวัฒนา

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 45

Serial : 0016

Environment: Temperature 33 °C Humidity 62 %RH

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

Serial No.1351075

Date of Calibration : 10 Apr 2024

Uncertainty : 0.10 dB

Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.72	94.00	0.28	93.72
Error After Adjust (dB)	Total Error (dB)	Acceptant value	Pass/Fail Judgment
0.00	0.10	±1.0 dB	Pass

Calibrated By:

(P. RITTHIKAMON)

Date:

Approve By:

(Wisan Ritthikamon)

Date:

26 October 2024

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



Envilab & Neediss Supply Instrument

Verification Test Report

Report No.:

AO2300034-E004 -SLM 02

☐ PM ☒ Onsite UTM : 47P N 1597407 E 672627

Calibrated Date: 26 October 2024

Site : โรงเรียนวัดละมุด

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 45

Serial : 0013

Environment: Temperature 33 °C Humidity 62 %RH

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

Serial No.1351075

Date of Calibration : 10 Apr 2024

Uncertainty : 0.10 dB

Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.72	93.60	-0.12	93.72
Error After Adjust (dB)	Total Error (dB)	Acceptant value	Pass/Fail Judgment
0.00	0.10	±1.0 dB	Pass

Calibrated By:

(PANLOP PROMMEE)

Date:

26 October 2024

Approve By:

(Wisan Ritthikamon)

Date:

26 October 2024

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



Envilab & Neediss Supply Instrument

Verification Test Report

Report No.:

AO2300034-E004 -SLM 03

☐ PM ☒ Onsite UTM : 47P N 1596560 E 672405

Calibrated Date: 26 October 2024

Site : บ้านเกาะกลางน้ำ (หมู่ที่ 1 บ้านเกาะปากจั่น)

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 45

Serial : 0018

Environment: Temperature 33 °C Humidity 62 %RH

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

Serial No.1351075

Date of Calibration : 10 Apr 2024

Uncertainty : 0.10 dB

Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.72	94.10	0.38	93.72
Error After Adjust (dB)	Total Error (dB)	Acceptant value	Pass/Fail Judgment
0.00	0.10	±1.0 dB	Pass

Calibrated By:

(PANLOP PROMMEE)

Date:

26 October 2024

Approve By:

(Wisan Ritthikamon)

Date:

26 October 2024

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



Envilab & Neediss Supply Instrument

Verification Test Report

Report No.:

AO2300034-E020 -SLM 01

☒ PM ☐ Onsite UTM : 47P 1514458 654247

Calibrated Date: 31 October 2024

Site : บริษัท เอ็นไวแล็บ จำกัด

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 44

Serial : 1821

Environment: Temperature 25 °C Humidity 65 %RH

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

Serial No.1351075

Date of Calibration : 10 Apr 2024

Uncertainty : 0.10 dB

Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.72	93.62	-0.10	93.72
Error After Adjust (dB)	Total Error (dB)	Acceptant value	Pass/Fail Judgment
0.00	0.10	,+-1.0 dB	Pass

Calibrated By:

(Worapon Narongsaksiri)

Date:

31 October 2024

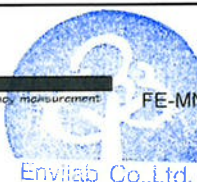
Approve By:

(Wisan Ritthikamon)

Date:

31 October 2024

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Certificate of Calibration

Calibration Certification Information

Cal. Date: February 9, 2024

Rootsmeter 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

$$Vstd = \Delta Vol \left(\frac{Pa - \Delta P}{Pstd} \right) \left(\frac{Tstd}{Ta} \right)$$

$$Va = \Delta Vol \left(\frac{Pa - \Delta P}{Pa} \right)$$

$$Qstd = Vstd / \Delta Time$$

$$Qa = Va / \Delta Time$$

For subsequent flow rate calculations:

$$Qstd = 1/m \left(\left(\sqrt{\Delta H \left(\frac{Pa}{Pstd} \right) \left(\frac{Tstd}{Ta} \right)} \right) - b \right)$$

$$Qa = 1/m \left(\left(\sqrt{\Delta H \left(\frac{Ta}{Pa} \right)} \right) - b \right)$$

Standard Conditions

Tstd: 298.15 °K

Pstd: 760 mm Hg

Key

ΔH: calibrator manometer reading (in H2O)

ΔP: rootsmeter manometer reading (mm Hg)

Ta: actual absolute temperature (°K)

Pa: actual barometric pressure (mm Hg)

b: intercept

m: slope

RECALIBRATION

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

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. : 67-200034-1

Page : 1 of 2

Submitted by : Envilab Co.,Ltd.
540, 540/1 Soi Bangkhuae 7, Bangkhuae, 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

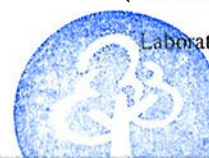
ID No.	Cert. No.	Due Date	Traceability
E261-E2624	C02232088	08 Nov 2024	National Institute of Metrology (Thailand), (NIMT)

Approved by :

(Surachai Promthong)

The Uncertainties are for a confidence probability of approximately 95%

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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. : 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.

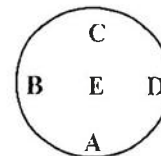
This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2.06$, providing a level of confidence of approximately 95%

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 -



รับรองสำเนา
ผู้จัดการฝ่ายค
ภาพ

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



Approved for Release





NOx Analyzer Verification Test Report

Calibration Report No.: ES-N6710006

Page:1/1

Calibrated Date: 1-Oct-24

☒ PM ☐ Onsite

Instruments Information

Analyzer Type: NO/NO2/NOx Analyzer Model: AC32e	Manufacturer Environnement SA.,France S/N: NNOESAAC32E277
--	--

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 24.3 °C

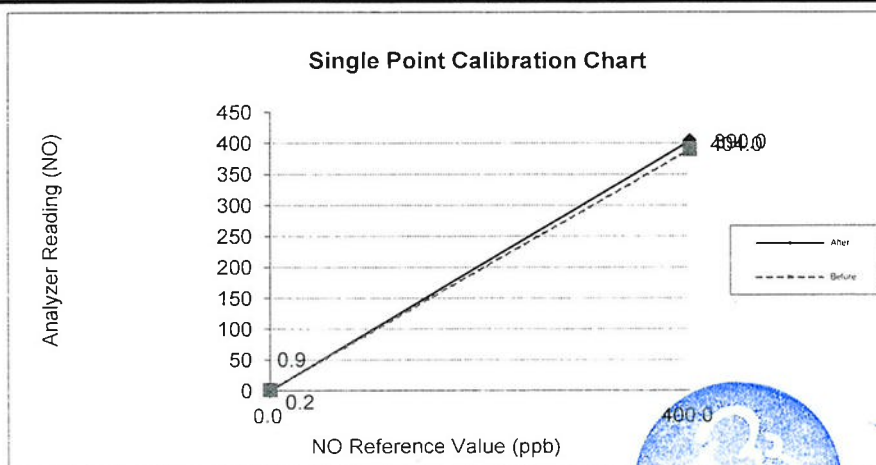
Humidity: 57 %RH

Calibration Check (Before adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.578	0.0	0.6	385.0	400.0	-1.9
NO ₂	0.356	0.0	0.4	5.0	0.0	0.6
NOx	0.934	0.0	0.9	390.0	400.0	-1.3

Calibration Check (After adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.196	0.0	0.2	403.0	400.0	0.4
NO ₂	-0.029	0.0	0.0	1.0	0.0	0.1
NOx	0.167	0.0	0.2	404.0	400.0	0.5





NOx Analyzer Verification Test Report

Calibration Report No.: ES-N6710006

Page:1/1

Calibrated Date: 1-Oct-24

☒ PM ☐ Onsite

Page:2/2

Analyzer Signal Values					
Date	1-Oct-24	Time	14:14		
Power Supplies					
Option	-13.52	mV	+5 V Sensor	4.99	V
+3.3 V	3.3	V	+24 V	23.96	V
+12 V	11.88	V	+5 V	4.99	V
+4 V	3974.3	mV	I+ 24V	2.4	A
I O3	82.74	mA			
Optical Bench					
Dark PM sig.	0.0	mV	PM NO sig.	84.28	mV
PM Nox sig.	107.0	mV	PM Ny sig.	86.71	mV
Sample					
Chamber T	60	deg.C	Internal Temp.	33.33	deg.C
Chamber P	1720.8	hPa	PM T.	1.46	deg.C
Flow	47.21	NI/h	Sample Pr.	993.2	hPa

Calibrate By :

Sirirat Poonlak

Date:

1-Oct-24

Approve By :

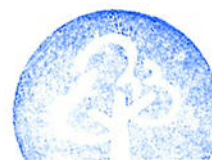
Sarawut Keawsrinual

Date:

1-Oct-24

neediss

Neediss Supply Instrument Co.,Ltd



รับรองสำเนาถูกต้อง

Envilab Co.,Ltd.

ผู้จัดการควบคุมคุณภาพ

ภาคผนวก 3-16-2

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20/160



NOx Analyzer Verification Test Report

Calibration Report No.: AP-N6710007

Page:1/1

Calibrated Date: 1-Oct-24

☒ PM ☐ Onsite

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 24.3 °C

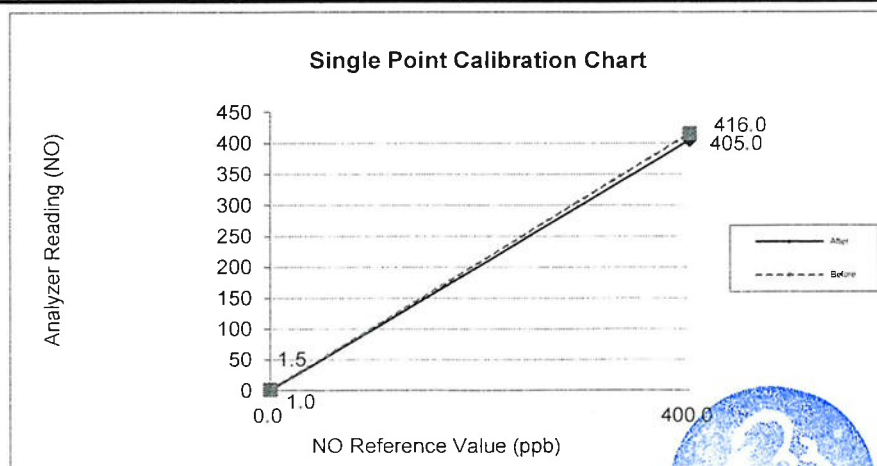
Humidity: 57 %RH

Calibration Check (Before adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	1.3	0.0	1.3	412.0	400.0	1.5
NO ₂	0.2	0.0	0.2	4.0	0.0	0.5
NOx	1.5	0.0	1.5	416.0	400.0	2.0

Calibration Check (After adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.6	0.0	0.6	403.6	400.0	0.4
NO ₂	0.4	0.0	0.4	1.4	0.0	0.2
NOx	1.0	0.0	1.0	405.0	400.0	0.6





NOx Analyzer Verification Test Report

Calibration Report No.: AP-N6710007

Page:1/1

Calibrated Date: 1-Oct-24

☒ PM ☐ Onsite

Page:2/2

Test Function Value	Normal range	Unit	Before	After	Note
Date	1-Oct-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	1.3	0.6
	NOx	0	ppb	1.5	1.0
Span Value	NO	400	ppb	412.0	403.6
	NOx	400	ppb	416.0	405.0

Calibrate By :

Sirirat Poonlak

Date:

1-Oct-24

Approve By :

Sarawut Keawsrinual

Date:

1-Oct-24

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Neediss Supply Instrument Co., Ltd.



ภาคผนวก 3-16-2

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รับรองสำเนาถูกต้อง
22/160
ผู้จัดการฝ่ายควบคุมคุณภาพ



NOx Analyzer Verification Test Report

Calibration Report No.: AP-N6710001

Page:1/1

Calibrated Date: 1-Oct-24

☒ PM ☐ Onsite

Instruments Information

Analyzer Type: NO/NO2/NOx Analyzer Model: 200E	Manufacturer API S/N: ENOA1200E00305
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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 24.1 °C

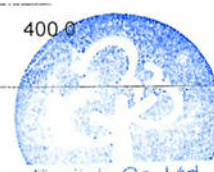
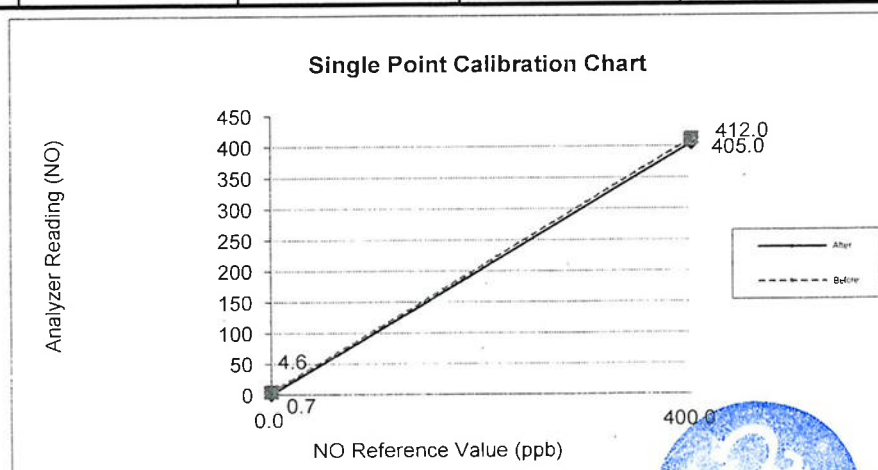
Humidity: 57 %RH

Calibration Check (Before adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	3.2	0.0	3.2	410.0	400.0	1.2
NO ₂	1.4	0.0	1.4	2.0	0.0	0.2
NOx	4.6	0.0	4.6	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	0.4	0.0	0.4	403.0	400.0	0.4
NO ₂	0.3	0.0	0.3	2.0	0.0	0.2
NOx	0.7	0.0	0.7	405.0	400.0	0.6





NOx Analyzer Verification Test Report

Calibration Report No.: AP-N6710001

Page:1/1

Calibrated Date: 1-Oct-24

☒ PM ☐ Onsite

Page:2/2

Test Function Value	Normal range	Unit	Before	After	Note
Date	1-Oct-24				
Time	13:25				
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	0-5000	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	3.2	0.4
	NOx	0	ppb	4.6	0.7
Span Value	NO	400	ppb	410.0	403.0
	NOx	400	ppb	412.0	405.0

Calibrate By :

Date:

Sirirat Poonlak

1-Oct-24

Approve By :

Date:

Sarawut Keawsrinal
1-Oct-24

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รับรองสำเนาถูกต้อง

ผู้จัดทำ 24/100 ความถูกต้องคุณภาพ

ภาคผนวก 3-16-2

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**NOx Analyzer Verification Test Report**

Calibration Report No.: AP-N6709003

Page:1/1

Calibrated Date: 1-Sep-24

☒ PM ☐ Onsite**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 26.0 °C

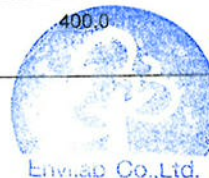
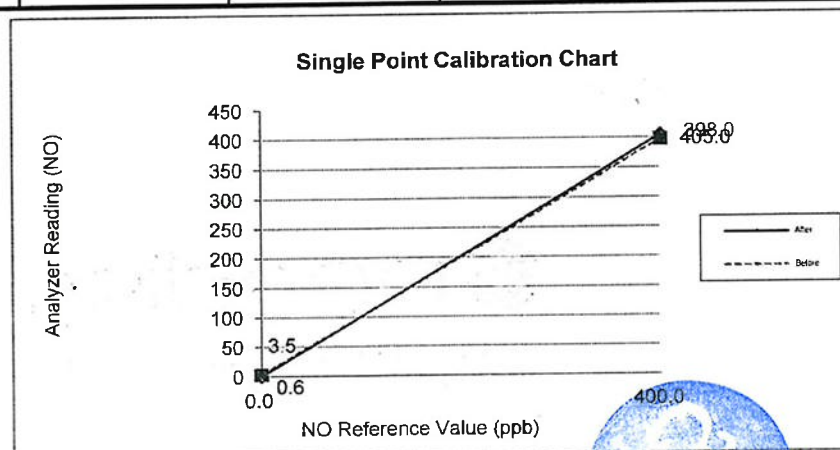
Humidity: 70 %RH

Calibration Check (Before adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	2.1	0.0	2.1	395.0	400.0	-0.6
NO ₂	1.4	0.0	1.4	3.0	0.0	0.4
NOx	3.5	0.0	3.5	398.0	400.0	-0.3

Calibration Check (After adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.4	0.0	0.4	403.0	400.0	0.4
NO ₂	0.2	0.0	0.2	2.0	0.0	0.2
NOx	0.6	0.0	0.6	405.0	400.0	0.6



รับรอง Page:2/2 ถูกต้อง

ผู้จัดการฝ่ายควบคุมคุณภาพ

NOx Analyzer Verification Test Report

Page:1/1

Calibrated Date: 1-Sep-24

☒ PM ☐ Onsite

Test Function Value		Normalinal range	Unit	Before	After	Note
Date		1-Sep-24				
Time		10:10				
Range		0.00 - 500.00 PPB	PPB	500	500	
Stabiility (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	2.1	0.4	
	NOx	0	ppb	3.5	0.6	
Span Value	NO	400	ppb	395.0	403.0	
	NOx	400	ppb	398.0	405.0	

Calibrate By :

Date:

Sirirat Poonlak

1-Sep-24

Approve By :

Date:

Sarawut Keawsrinual

1-Sep-24

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รับรองสำเนาถูกต้อง

ผู้จัดการฝ่ายควบคุมคุณภาพ

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NOx Analyzer Verification Test Report

Calibration Report No.: AP-N6710004

Page:1/1

Calibrated Date: 1-Oct-24

☒ PM ☐ Onsite

Instruments Information

Analyzer Type: NO/NO2/NOx Analyzer Model: T200	Manufacturer API S/N: ENOAIT20003572
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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 24.2 °C

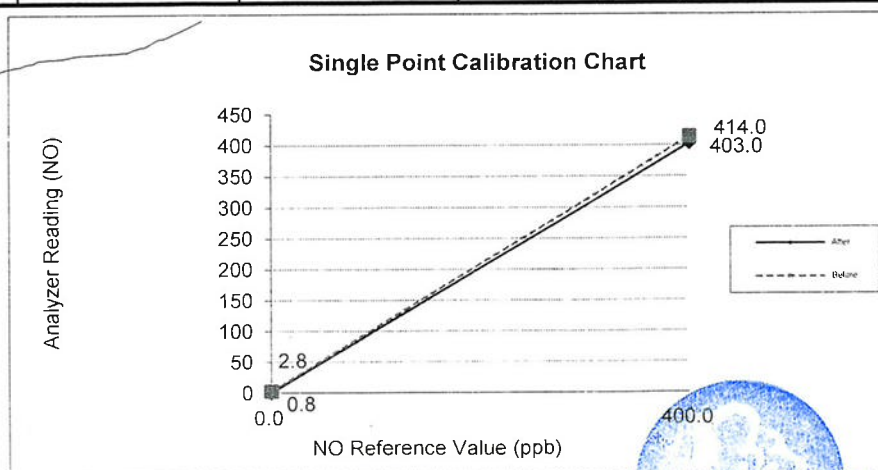
Humidity: 57 %RH

Calibration Check (Before adjust)

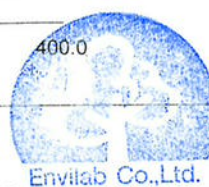
GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	2.5	0.0	2.5	412.0	400.0	1.5
NO ₂	0.3	0.0	0.3	2.0	0.0	0.2
NOx	2.8	0.0	2.8	414.0	400.0	1.7

Calibration Check (After adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.6	0.0	0.6	400.0	400.0	0.0
NO ₂	0.2	0.0	0.2	3.0	0.0	0.4
NOx	0.8	0.0	0.8	403.0	400.0	0.4



ภาคผนวก 3-16-2



รับรองว่าถูกต้อง
ผู้จัดการฝ่ายควบคุมคุณภาพ



NOx Analyzer Verification Test Report

Calibration Report No.: AP-N6710004

Page:1/1

Calibrated Date: 1-Oct-24

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Test Function Value	Normal range	Unit	Before	After	Note
Date	1-Oct-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	2.5	0.6
	NOx	0	ppb	2.8	0.8
Span Value	NO	400	ppb	412.0	400.0
	NOx	400	ppb	414.0	403.0

Calibrate By : Sirirat Poonlak

Date: 1-Oct-24

Approve By : Sarawat Keawsrinual

Date: 1-Oct-24





SO2 Analyzer Verification Test Report

Calibration Report No.: ES-S6710001

Calibrated Date: 1-Oct-24

☒ PM ☐ Onsite

Instruments Information

Page:1/2

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

Calibration System

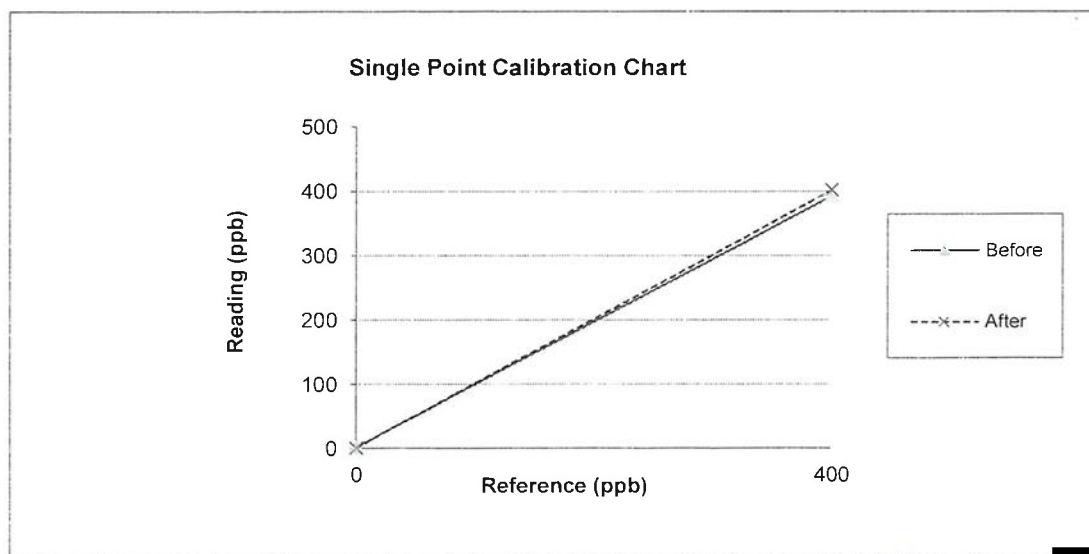
Calibrator Unit	Standard Gas
Dilutor Model: ESA MGC101 S/N: 792 ZERO AIR Generator: ZAG7001 S/N: 644	NOx Conc: 45.50 PPM NO Conc: 45.50 PPM SO2 Conc: 45.59 PPM CO Conc: 4500 PPM Expire Date: Mar 31, 2026 EB0160267

Environment: Temperature 24.4 °C

Humidity: 57 %RH

Calibration Report

Status	Zero			Span		
	Reference (ppb)	Reading (ppb)	Drift (ppb)	Reference (ppb)	Reading (ppb)	Drift%
Before	0.0	1.6	1.6	400.0	393.0	-0.9
After	0.0	0.8	0.8	400.0	402.0	0.2





SO2 Analyzer Verification Test Report

Calibration Report No.: ES-S6710001

Calibrated Date: 1-Oct-24

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Analyzer Signal Values					
Date	1-Oct-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 :



Sirirat Poonlak

Date:

1-Oct-24

Approve By :



Sarawut Keawsrinual

Date:

1-Oct-24

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รับรองสำเนาถูกต้อง
ผู้จัดทำ: 30/160
ควบคุมคุณภาพ



SO2 Analyzer Verification Test Report

Calibration Report No.: AP-S6710004

Calibrated Date: 1-Oct-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

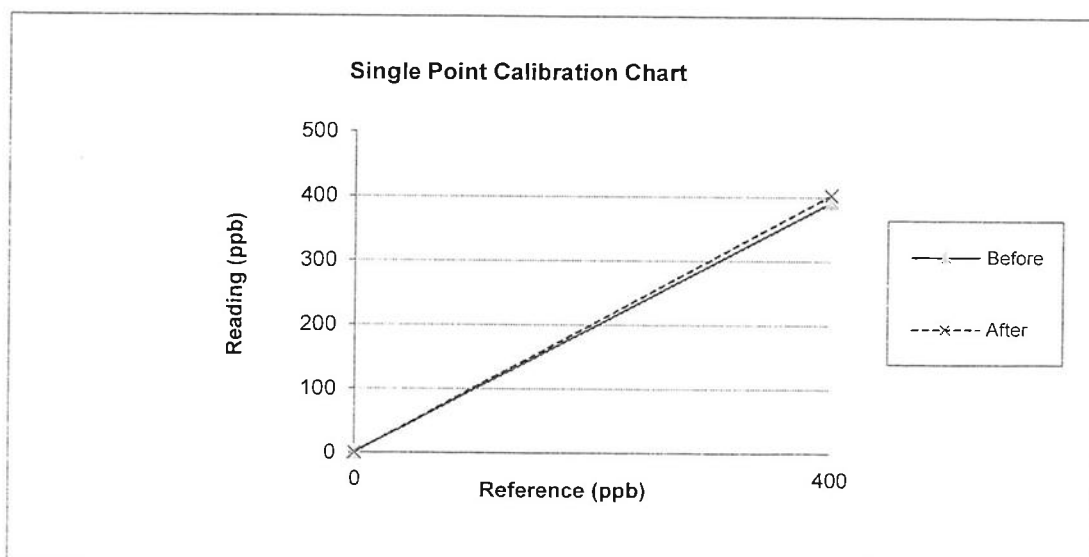
Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792 ZERO AIR Generator ZAG7001 S/N: 644	NOx Conc 45.50 PPM NO Conc 45.50 PPM SO2 Conc 45.59 PPM CO Conc 4500 PPM Expire Date: Mar 31,2026 EB0160267

Environment: Temperature 24.3 °C

Humidity: 56 %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	392.0	-1.0
After	0.0	0.5	0.5	400.0	403.0	0.4



SO2 Analyzer Verification Test Report

Calibration Report No.: AP-S6710004

Calibrated Date: 1-Oct-24

☒ PM ☐ Onsite

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Test Function Value	Normal range	Unit	Before	After	Note
Date	1-Oct-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	0.7	0.5	± 5% of Range
Span Gas (400 PPB)	400	ppb	392.0	403.0	

Calibrate By :

Sirirat Poonlak

Date:

1-Oct-24

Approve By :

Sarawut Keawsrinual

Date:

1-Oct-24

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ภาคผนวก 3-16-2

รับรองสำเนาถูกต้อง

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SO2 Analyzer Verification Test Report

Calibration Report No.: AP-S6710006

Calibrated Date: 1-Oct-24

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Page:1/2

Instruments Information

Analyzer Type: SO2 Analyzer Model: 100A	Manufacturer API S/N: ESOAI100E01002
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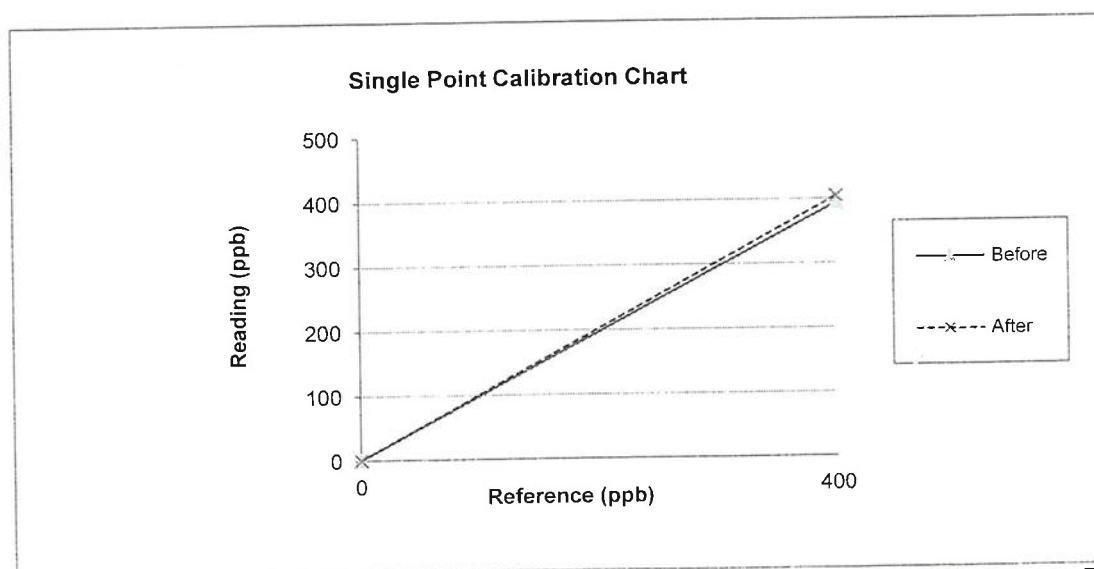
Calibration System

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 24.4 °CHumidity: 57 %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	394.0	-0.8
After	0.0	0.6	0.6	400.0	404.0	0.5



Calibration Report No.: AP-S6710006

Calibrated Date: 1-Oct-24

☒ PM ☐ Onsite

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Test Function Value	Normal range	Unit	Before	After	Note
Date	1-Oct-24				
Time	13:45				
Range	50 - 20000	PPB	500.0	500.0	
Stability (Zero Gas)	< 0.2	PPB	0.2	0.1	
Sample Flow	650 (+/- 50)	cc/min	592.0	591.0	
PMT Detector	0 - 5000	mV	255.6	61.0	
Norm PMT Detector	0 - 5000	mV	59.7	65.2	
HVPS	400-900 constant	V	607.0	607.0	
DCPS	2500 (+/- 200)	mV	-	-	
RCELL TEMP	50 (+/- 1)	Dreegee C	50.0	50.0	
BOX TEMP	20-40	Dreegee C	34.0	34.1	
PMT TEMP	7 (+/-1)	Dreegee C	8.0	8.0	
UV lamp	1000-4900	mV	1981.0	1981.0	
Lamp Ratio	30-120	%	82.6	82.6	
STR. Light (Zero Gas)	<100	PPB	61.5	61.7	
Dark PMT	(-50) - (+200)	mV	3.8	3.6	
Dark lamp	(-50) - (+200)	mV	56.5	57.0	
SAMP PRES	20-30 contant	IN-Hg-A	29.3	29.3	
Electric Test/Optic Test					
PMT Volts	2000 (+/- 500)	mV	1682.0	2044.0	
SO2 Conc	1000 (+/- 250)	PPB	841.0	1022.0	
SO2 Slope	1 (+/- 0.3)	-	1.224	1.104	
SO2 Offset	< 250	mV	24.8	8.0	
Stability at Zero	< 0.2	PPB	0.2	0.2	
Stability at Span	< 2 ppb @ 400 ppb	PPB	0.2	0.2	
Gas Test Response					
Zero Gas (0.00 PPB)	0	ppb	1.0	0.6	
Span Gas (400 PPB)	400	ppb	394.0	404.0	± 5% of Range

Calibrate By :

Sirirat Poonlak

Date:

1-Oct-24

Approve By :

Sarawut Keawsrinual

Date:

1-Oct-24



Neediss Supply Instrument Co., Ltd.

ภาคผนวก 3-16-2

EnvyLab Co., Ltd.

รับรองสำเนาถูกต้อง

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ความมั่นคงภาพ

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SO2 Analyzer Verification Test Report

Calibration Report No.: ES-S6709003

Calibrated Date: 1-Sep-24

☒ PM ☐ Onsite

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Instruments Information

Analyzer Type: SO2 Analyzer Model: AF22e	Manufacturer Environnement SA., France S/N: NSOESAAF32E454
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Calibration System

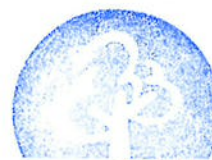
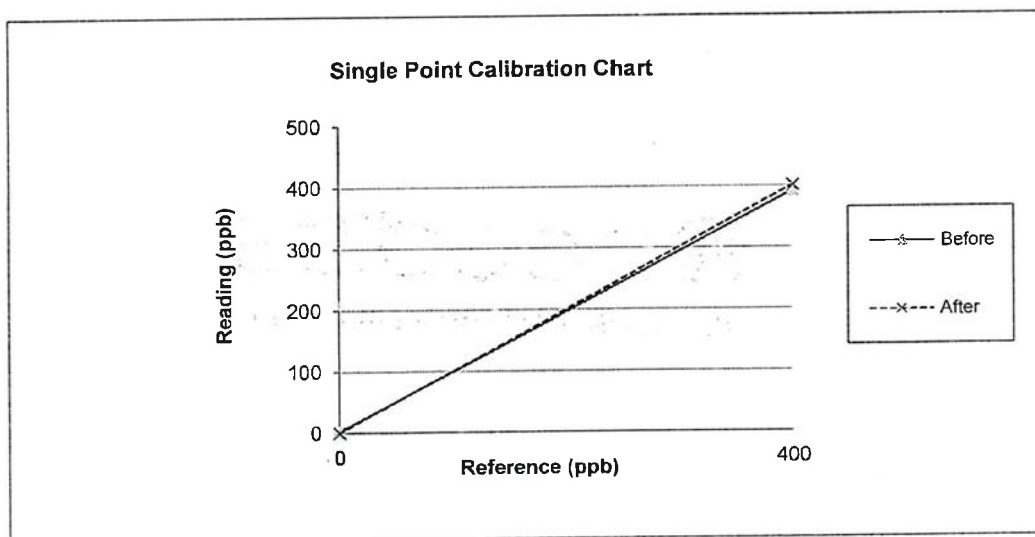
Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792 ZERO AIR Generator ZAG7001 S/N: 644	NOx Conc 46.50 PPM NO Conc 46.50 PPM SO2 Conc 45.59 PPM CO Conc 4507 PPM Expire Date: Mar 31,2026 EB0160267

Environment: Temperature 25.8 °C

Humidity: 71 %RH

Calibration Report

Status	Zero			Span		
	Reference (ppb)	Reading (ppb)	Drift (ppb)	Reference (ppb)	Reading (ppb)	Drift%
Before	0.0	2.3	2.3	400.0	392.0	-1.0
After	0.0	0.2	0.2	400.0	401.0	0.1



รับรองสำเนาถูกต้อง



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บริษัท นีดีส ซัพพลาย อินสตรูเมนต์ จำกัด
Neediss Supply Instrument Co., Ltd.

535 หมู่ 7 ต.วังน้ำเย็น อ.วังน้ำเย็น จ.สระแก้ว 31150 535 หมู่ 7 ต.วังน้ำเย็น อ.วังน้ำเย็น จ.สระแก้ว 31150
Tel: 09-8074-7617 Fax: 09-8074-7618 E-mail: neediss@neediss.com



SO2 Analyzer Verification Test Report

Calibration Report No.: ES-S6709003

Calibrated Date: 1-Sep-24

☒ PM ☐ Onsite

Page:2/2

Analyzer Signal Values					
Date	1-Sep-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 :



Sirirat Poonlak

Date:

1-Sep-24

Approve By :



Sarawut Keawsrinual

Date:

1-Sep-24

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ภาคผนวก 3-16-2

Envilab Co., Ltd.

ผู้ตรวจสอบคุณภาพ
36/160



SO2 Analyzer Verification Test Report

Calibration Report No.: AP-S6710007

Calibrated Date: 1-Oct-24

☒ PM ☐ Onsite

Instruments Information

Page:1/2

Analyzer Type: SO2 Analyzer Model: 100A	Manufacturer API S/N: ESOAIT10003031
--	---

Calibration System

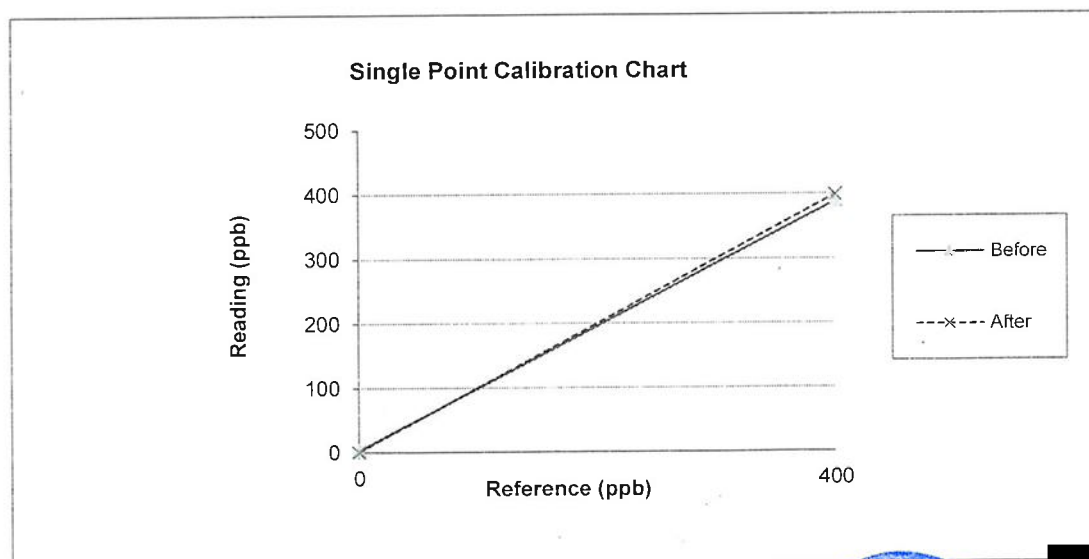
Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792 ZERO AIR Generator ZAG7001 S/N: 644	NOx Conc 46.50 PPM NO Conc 46.50 PPM SO2 Conc 45.59 PPM CO Conc 4507 PPM Expire Date: Mar 31,2026 EB0160267

Environment: Temperature 24.4 °C

Humidity: 57 %RH

Calibration Report

Status	Zero			Span		
	Reference (ppb)	Reading (ppb)	Drift (ppb)	Reference (ppb)	Reading (ppb)	Drift%
Before	0.0	3.1	3.1	400.0	389.0	-1.4
After	0.0	0.9	0.9	400.0	399.0	-0.1



รับรองสำเนาถูกต้อง
ผู้จัดทำ 37/160

ภาคผนวก 3-16-2



SO2 Analyzer Verification Test Report

Calibration Report No.: AP-S6710007

Calibrated Date: 1-Oct-24

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Page:2/2

Test Function Value	Normal range	Unit	Before	After	Note
Date	1-Oct-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	3.1	0.9	
Span Gas (400 PPB)	400	ppb	389.0	399.0	± 5% of Range

Calibrate By :

[Signature]

Sirirat Poonlak

Date:

1-Oct-24

Approve By :

[Signature]

Sarawut Keawsrinal

Date:

1-Oct-24



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Neediss Supply Instrument Co., Ltd.

536 ถนนสุขุมวิท 7 แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10160 536 Soi Bangkhoe 7 Bangkok Bangkok Bangkok
Tel: 02-502-3960-2 Fax: 02-502-3966 E-mail: info@neediss.com



CO Analyzer Verification Test Report

Calibration Report No.: ES-C6710003

Calibrated Date: 1-Oct-24

☒ PM ☐ Onsite

Instruments Information

Page:1/2

Analyzer Type: CO Analyzer Model: CO12E	Manufacturer Environnement SA.,France S/N: ECOESACO12E203
--	--

Calibration System

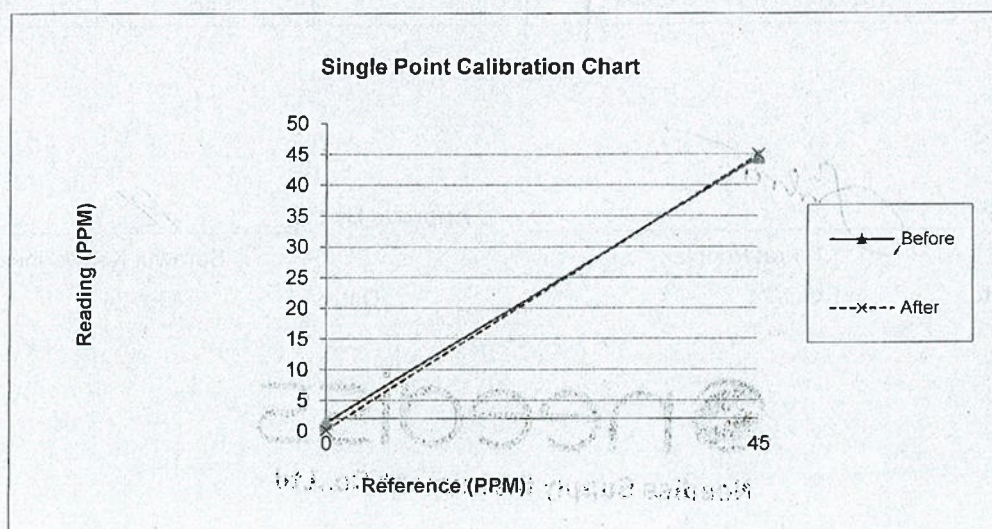
Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792 ZERO AIR Generator ZAG7001 S/N: 644	NOx Conc 46.50 PPM NO Conc 46.50 PPM So2 Conc 45.59 PPM Co Conc 4507 PPM Expire Date: Mar 31,2026 EB0160267

Environment: Temperature 23.2 °C

Humidity: 52 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Before	0.0	1.354	1.4	45.0	44.54	-0.5
After	0.0	0.145	0.1	45.0	44.98	0.0





CO Analyzer Verification Test Report

Calibration Report No.: ES-C6710003

Calibrated Date: 1-Oct-24

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Page:2/2

Analyzer Signal Values					
Date	1-Oct-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 :



Sirirat Poonlak

Date:

1-Oct-24

Approve By :



Sarawut Keawsrinual

Date:

1-Oct-24

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Neediss Supply Instrument Co., Ltd.

536 ซอยบางนา 7 แขวงคลองเตย เขตคลองเตย กรุงเทพฯ 10160 536 Soi Bangkhae 7 Bangkhae Bangkok Bangkok
Tel. 02-302-3980-2 Fax. 02-302-3936 E info@neediss.com



CO Analyzer Verification Test Report

Calibration Report No.: ES-C6710004

Calibrated Date: 1-Oct-24

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Instruments Information

Page:1/2

Analyzer Type: CO Analyzer Model: CO12E	Manufacturer Environnement SA.,France S/N: ECOESACO12E204
--	--

Calibration System

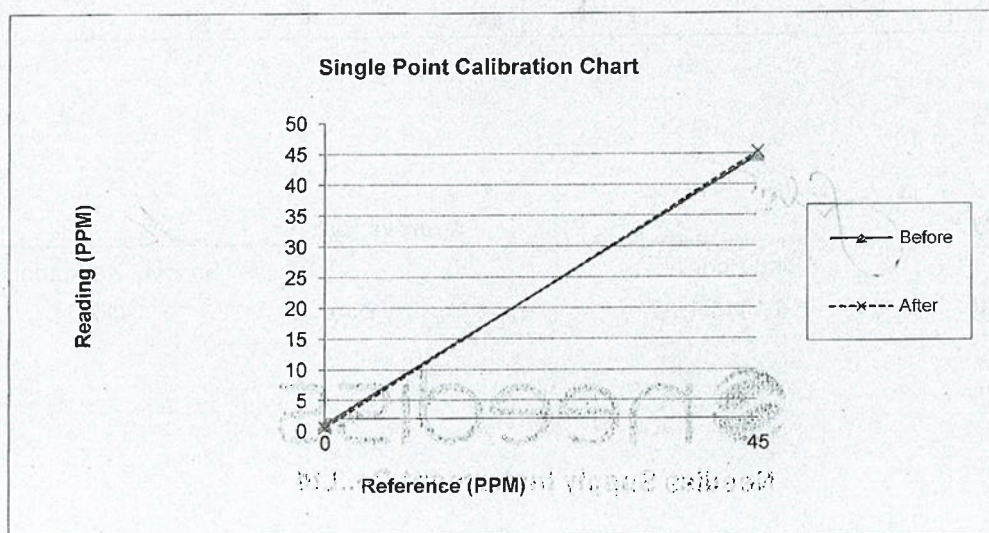
Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792 ZERO AIR Generator ZAG7001 S/N: 644	NOx Conc 46.50 PPM NO Conc 46.50 PPM So2 Conc 45.59 PPM Co Conc 4507 PPM Expire Date: Mar 31,2026 EB0160267

Environment: Temperature 23.3 °C

Humidity: 52 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Before	0.0	1.093	1.1	45.0	44.75	-0.3
After	0.0	0.541	0.5	45.0	45.34	0.4





CO Analyzer Verification Test Report

Calibration Report No.: ES-C6710004

Calibrated Date: 1-Oct-24

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Page:2/2

Analyzer Signal Values					
Date	1-Oct-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 :

[Redacted Signature]

Sirirat Poonlak

Date:

1-Oct-24

Approve By :

[Redacted Signature]

Sarawut Keawsrinal

Date:

1-Oct-24


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Neediss Supply Instrument Co., Ltd.

536 ซอยบางพลี 7 แขวงบางพลี เขตภาษีเจริญ กรุงเทพฯ 10160 536 Soi Bangkhoe 7 Bangkhoe Bangkok
Tel. 02-302-5960-2 Fax. 02-302-3988 E info@neediss.com



CO Analyzer Verification Test Report

Calibration Report No.: AP-C6710001

Calibrated Date: 1-Oct-24

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Instruments Information

Page:1/2

Analyzer Type: CO Analyzer Model: 300E	Manufacturer API S/N: ECOAI300E00449
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Calibration System

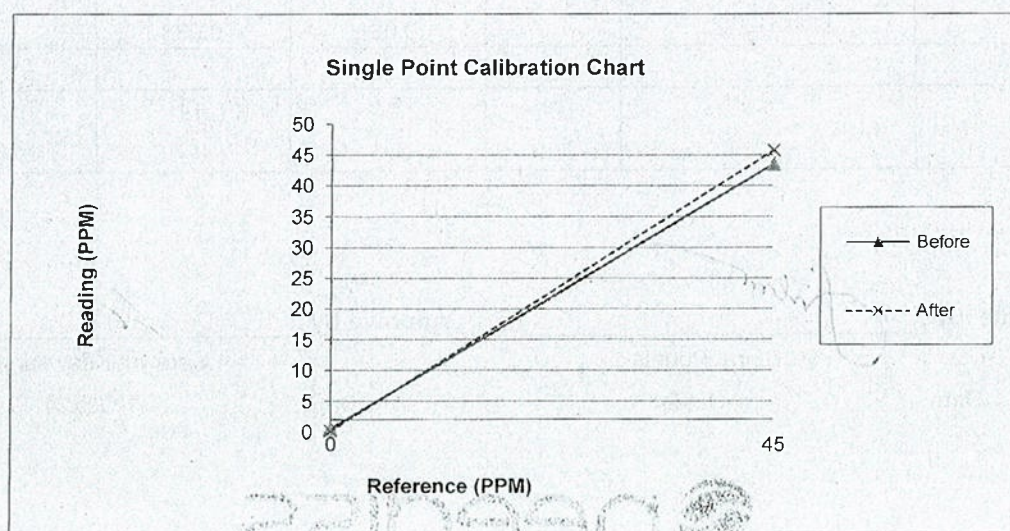
Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792 ZERO AIR Generator ZAG7001 S/N: 644	NOx Conc 46.50 PPM NO Conc 46.50 PPM So2 Conc 45.59 PPM Co Conc 4507 PPM Expire Date: Mar 31,2026 EB0160267

Environment: Temperature 21.4 °C

Humidity: 64 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Before	0.0	0.50	0.5	45.0	43.5	-1.7
After	0.0	0.14	0.1	45.0	45.7	0.8



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Neediss Supply Instrument Co., Ltd.536 ซอยบางพลี 7 แขวงบางพลี เขตบางพลี กรุงเทพฯ 10160 536 Soi Bangkhoe 7 Bangkhoe Bangkok
Tel: 02-802-5950-2 Fax: 02-802-2938 E-mail: info@neediss.com**CO Analyzer Verification Test Report**

Calibration Report No.: AP-C6710001

Calibrated Date: 1-Oct-24

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Page:2/2

Detail	Range	Unit	Before	After	Note
Date	1-Oct-24				
Time	11:00				
Range	0.1-1000 PPM	PPM	50	50	
Stability	(0.1-2PPB)	ppb	0.73	1.11	
CO Measure	2500 - 4800 MV.	mV	2913.3	2923.5	
CO Reference	2500 - 4800 MV.	mV	2444.3	2421.4	
MR Ratio	1.2 +/- 0.5		1.18	1.21	
Sample Pressure	26 - 30 in-Hg-A	in-Hg-A	29.1	29	
Sample Flow	720 - 880 cc/min	cc/min	890	886	
Sample Temp	44 - 52 deg.C	deg.C	50.3	50.4	
Bench Temp	47 - 49 deg.C	deg.C	48	48	
Wheel Temp	66 - 70 deg.C	deg.C	68.3	68.4	
Box Temp	27 - 50 deg.C	deg.C	35.2	35.1	
PHT drive	250 - 4750 mv.	mV	3323.4	3353.6	
Slope	0.800 - 1.200		1.051	1.112	
Offset	0.05 +/- 0.2		0.088	0.088	
Gas Test Response					
Zero Gas	0	PPM	0.5	0.1	
Span Gas	45	PPM	43.5	45.7	± 5% of Range

Calibrate By :

Sirirat Poonlak

Date:

1-Oct-24

Approve By :

Sarawut Keawsrinual

Date:

1-Oct-24

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Neediss Supply Instrument Co.,Ltd

**CO Analyzer Verification Test Report**

Calibration Report No.: ES-C6709007

Calibrated Date: 1-Sep-24

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Page:1/2

Instruments Information

Analyzer Type: CO Analyzer Model: CO12E	Manufacturer Environnement SA., France S/N: NCOESACO12E356
--	---

Calibration System

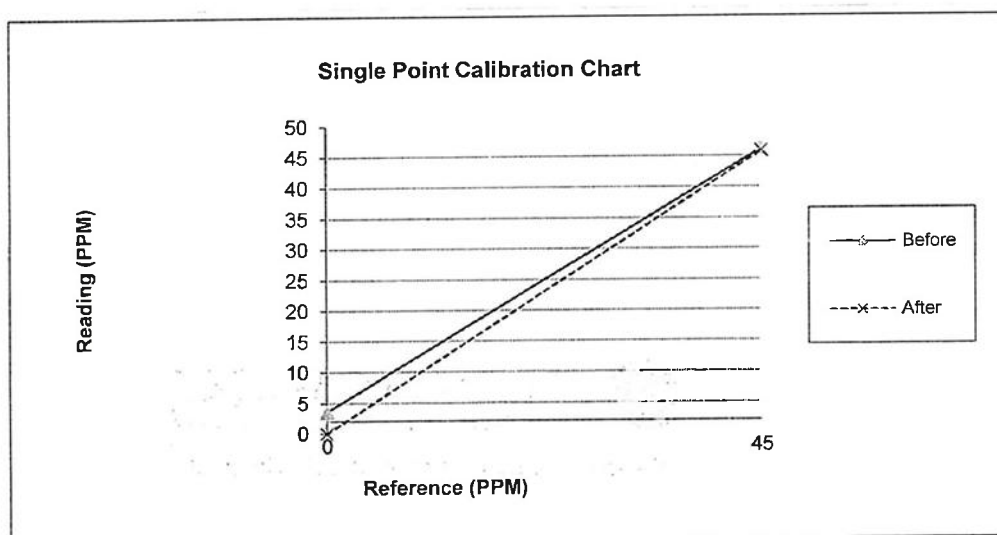
Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792 ZERO AIR Generator ZAG7001 S/N: 644	NO Conc 44.68 PPM SO2 Conc 45.34 PPM CO Conc 4500 PPM Expire Date: Feb 19,2024 EB0140762

Environment: Temperature 25.8 °C

Humidity: 71 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Before	0.0	3.603	3.6	45.0	46.20	1.3
After	0.0	0.067	0.1	45.0	45.87	1.0





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CO Analyzer Verification Test Report

Calibration Report No.: ES-C6709007

Calibrated Date: 1-Sep-24

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Page:2/2

Analyzer Signal Values					
Date	1-Sep-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 :

Sirirat Poonlak

Date:

1-Sep-24

Approve By :

Sarawut Keawsrinal

Date:

1-Sep-24

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536 ซอยบางนา 7 แขวงบางนา เขตบางนา กรุงเทพมหานคร 10160 536 Soi Bangna 7 Bangkhru Bangkok Bangkok
Tel. 02-802-3780-2 Fax. 02-802-3780 E-mail: neediss@neediss.com



CO Analyzer Verification Test Report

Calibration Report No.: AP-C6710002

Calibrated Date: 1-Oct-24

☒ PM ☐ Onsite

Instruments Information

Page:1/2

Analyzer Type: CO Analyzer Model: 300E	Manufacturer API S/N: ECOAI300E01034
---	---

Calibration System

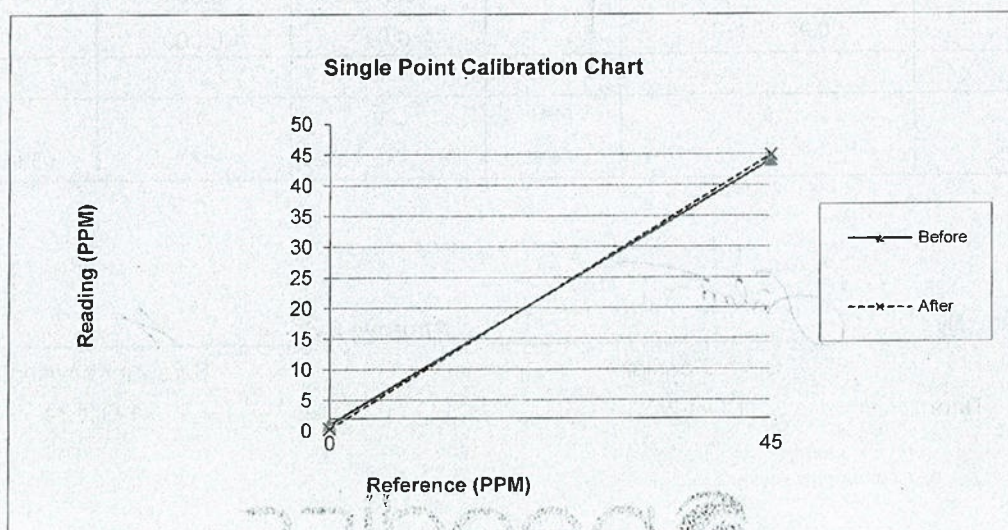
Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792 ZERO AIR Generator ZAG7001 S/N: 644	NOx Conc 46.50 PPM NO Conc 46.50 PPM So2 Conc 45.59 PPM Co Conc 4507 PPM Expire Date: Mar 31,2026 EB0160267

Environment: Temperature 21.5 °C

Humidity: 63 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Before	0.0	1.0	1.0	45.0	44.1	-1.0
After	0.0	0.3	0.3	45.0	44.9	-0.1



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CO Analyzer Verification Test Report

Calibration Report No.: AP-C6710002

Calibrated Date: 1-Oct-24

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Page:2/2

Detail	Range	Unit	Before	After	Note
Date	1-Oct-24				
Time	16:06				
Range	0.1-1000 PPM	PPM	50	50	
Stability	(0.1-2PPB)	ppb	0.01	0.06	
CO Measure	2500 - 4800 MV.	mV	3426.3	3401.3	
CO Reference	2500 - 4800 MV.	mV	2850.7	2832.1	
MR Ratio	1.2 +/- 0.5		1.21	1.21	
Sample Pressure	26 - 30 in-Hg-A	in-Hg-A	28.5	28.4	
Sample Flow	720 - 880 cc/min	cc/min	790	783	
Sample Temp	44 - 52 deg.C	deg.C	48.2	48.2	
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	35.2	35.4	
PHT drive	250 - 4750 mv.	mV	3114.8	3106.5	
Slope	0.800 - 1.200		0.972	0.981	
Offset	0.05 +/- 0.2		0.01	0.009	
Gas Test Response					
Zero Gas	0	PPM	1.0	0.3	
Span Gas	45	PPM	44.1	44.9	± 5% of Range

Calibrate By :

Sirirat Poonlak

Date:

1-Oct-24

Approve By :

Sarawat Keawsrinual

Date:

1-Oct-24



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 24 October, 2024

Certification No. 358/24

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 1009.5 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

Calibrated by :

Mr. Watcharaporn

Mechanical Engineer

Signature

Mr. Pissod Promsut





THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Sensor model

EWSNV110WS2509

Certification No. 358/24

24 October, 2024

Page : 2 of 6

Standard Ultrasonic Anemometer m/sec	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacumm	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	-	-	-	9.1	-0.08
11.01	-	-	-	11.0	0.01
13.01	-	-	-	13.1	-0.09
15.01	-	-	-	15.0	0.01
17.02	-	-	-	17.1	-0.08
20.02	-	-	-	20.1	-0.08

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

Calibrated by :

Mr. Watcharapol Subwat

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. 358/24

24 October, 2024

Page : 3 of 6

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	
1010.12	1009.52	0.60
1010.35	1009.78	0.57
1010.56	1009.98	0.58
1010.85	1010.35	0.50
1011.05	1010.48	0.57
1011.46	1010.82	0.64
1011.82	1011.23	0.59
1011.95	1011.42	0.53
1012.15	1011.58	0.57
1012.54	1011.95	0.59
1012.81	1012.29	0.52
1010.25	1009.68	0.57
1010.14	1009.64	0.50
1009.95	1009.38	0.57
1009.84	1009.18	0.66
1009.45	1008.85	0.60
1009.32	1008.73	0.59
1009.11	1008.58	0.53
1009.56	1008.93	0.63
1009.86	1009.21	0.65

Average

Calibrated by :

Mr. Watchapol Subwat

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. 358/24

24 October, 2024

Page : 4 of 6

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.6	45.8	-0.2
30.2	30.3	-0.1
15.1	14.9	0.2

Calibrated by :



Mr. Watcharapol Subwat

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. 358/24

24 October, 2024

Page : 5 of 6

Standard Humidity % R.H.	Relative Humidity Sensor Reading	
	Reading % R.H.	Correction % R.H.
92.5	96.5	-4.0
65.4	68.1	-2.7
45.2	46.1	-0.9

Calibrated by :



Mr. Watcharapol Subwat
Mechanical Engineer





Date of Issue 24 October, 2024

Certification No. 358/24

Page: 6 of 6

ใบรับรอง

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



ลงชื่อ...

(นายวัชรพล ทรัพย์วัฒน์)

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 24 October, 2024

Certification No. 356/24

Page : 1 of 6

Object : เครื่องมือตรวจวัดอุตุนิยมวิทยา

Manufacturer : NovaLynx

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

Serial No. : EWSNV110WS2510

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

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1010.1 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

Calibrated by :

Mr. Watcharap

Mechanical Engineer

Signed

Mr. Piboon Promsat





THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Sensor model

EWSNV110WS2510

Certification No. 356/24

24 October, 2024

Page : 2 of 6

Standard Ultrasonic Anemometer	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure inches H2O	Vacuum inches H2O	Velocity m/sec	Velocity m/sec	Correction m/sec
1.00	-	-	-	0.4	0.60
3.02	-	-	-	2.7	0.32
5.00	-	-	-	4.6	0.40
7.04	-	-	-	6.7	0.34
9.02	-	-	-	9.1	-0.08
11.01	-	-	-	10.7	0.31
13.01	-	-	-	13.0	0.01
15.01	-	-	-	14.8	0.21
17.02	-	-	-	17.1	-0.08
20.02	-	-	-	20.3	-0.28

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

Calibrated by :

Mr. Watcharapol Subwat

Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau





THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Sensor model

EWSNV110WS2510

Certification No. 356/24

24 October, 2024

Page : 3 of 6

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	
1010.12	1009.88	0.24
1010.35	1010.05	0.30
1010.56	1010.24	0.32
1010.85	1010.65	0.20
1011.05	1010.84	0.21
1011.46	1011.25	0.21
1011.82	1011.54	0.28
1011.95	1011.65	0.30
1012.15	1011.85	0.30
1012.54	1012.21	0.33
1012.81	1012.53	0.28
1010.25	1010.01	0.24
1010.14	1009.94	0.20
1009.95	1009.75	0.20
1009.84	1009.57	0.27
1009.45	1009.13	0.32
1009.32	1009.02	0.30
1009.11	1008.86	0.25
1009.56	1009.21	0.35
1009.86	1009.53	0.33

Average

Calibrated by :

Mr. Watcharapol Subwat

Mechanical Engineer





THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Sensor model

EWSNV110WS2510

Certification No. 356/24

24 October, 2024

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
15.1	15.2	-0.1

Calibrated by :



Mr. Watcharapol Subwat

Mechanical Engineer





THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

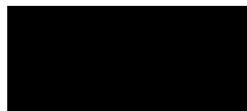
Sensor model EWSNV110WS2510 Certification No. 356/24

24 October, 2024

Page : 5 of 6

Standard Humidity % R.H.	Relative Humidity Sensor Reading	
	Reading % R.H.	Correction % R.H.
92.5	95.5	-3.0
65.4	68.2	-2.8
45.2	46.4	-1.2

Calibrated by :



Mr. Watcharapol Subwat

Mechanical Engineer



รับรองสำเนาถูกต้อง
ผู้จัดการฝ่ายควบคุมคุณภาพ



Date of Issue 24 October, 2024

Certification No. 356/24

Page: 6 of 6

ใบรับรอง

หนังสือฉบับนี้ขอรับรองว่า เครื่องวัดฝน ยี่ห้อ Davis Instruments แบบ TIPPING
BUCKET Product No. 7342.026 Code No. EWSNV110WS2510 ทำการสอบเทียบกับแก้ววัด
ฝนแบบแก้วตวง GAUGE DIAMETER 8.0 INCHES, NEGRETTI & ZAMBRA LONDON
No. 71082 และสามารถนำไปใช้ได้ มีค่าถูกต้องตามรายละเอียดของเครื่องมือ (0.2 mm./TIP)



ลงชื่อ...

(นายวัชรพล ทรัพย์วัฒน์)

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 24 October, 2024

Certification No. 361/24

Page : 1 of 6

Object : เครื่องมือตรวจวัดอุณหภูมิตามวิทยา

Manufacturer : DYACON

Type : Data Logger MS-100

Serial No. : 130152 ID No. : NWSDCMS1200152

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 1009.9 hPa

NATIONAL STANDARD WIND TUNNEL : Micromanometer Theodor Friedrichs FC014 Serial.9310119

: HOOK GAGE NO 1425 : Wind Aloft Plotting Board

N.I.S.T. Test Reference Number 731/241460

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

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION

STANDARD THERMOMETER

: Theodor Friedrichs : Dry No.8390/94 Wet No. 8389/94

: Thermoschneider No.918802

STANDARD BAR : Digital Barometer Vaisala Type PHE220 No. 1220015

Calibrated by :

Sig

Mr. Watcharapol Subwat

Mr. Piseed Promsri

Mechanical Engineer





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. 361/24

24 October, 2024

Serial No. 1226

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	-	-	-	0.7	0.30
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	-	-	-	13.0	0.01
15.01	-	-	-	15.0	0.01
17.02	-	-	-	17.1	-0.08
20.02	-	-	-	20.0	0.02

Wind Aloft Plotting Board.	
US.DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRECTION	TESTED WIND DIRECTION
0	0
90	91
180	182
270	

Calibrated by :

Mr. Watcharapol Subwat

Mechanical Engineer





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. 6277

Certification No. 361/24

24 October, 2024

Page : 3 of 6

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	
1010.12	1009.95	0.17
1010.35	1010.12	0.23
1010.56	1010.35	0.21
1010.85	1010.64	0.21
1011.05	1010.86	0.19
1011.46	1011.22	0.24
1011.82	1011.54	0.28
1011.95	1011.68	0.27
1012.15	1011.98	0.17
1012.54	1012.31	0.23
1012.81	1012.56	0.25
1010.25	1010.02	0.23
1010.14	1009.86	0.28
1009.95	1009.73	0.22
1009.84	1009.65	0.19
1009.45	1009.15	0.30
1009.32	1009.10	0.22
1009.11	1008.86	0.25
1009.56	1009.12	0.44
1009.86	1009.65	0.21

Average

Calibrated by :

Mr. Watcharapol Subwat

Mechanical Engineer





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. 361/24

24 October, 2024

Serial No. 6277

Page : 4 of 6

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.6	45.7	-0.1
30.2	30.2	0.0
15.1	15.1	0.0

Calibrated by :



Mr. Watcharapol Subwat

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. 361/24

24 October, 2024

Serial No. 6277

Page : 5 of 6

Standard Humidity % R.H.	Relative Humidity Sensor Reading	
	Reading	Correction
	% R.H.	% R.H.
92.5	89.5	3.0
65.4	64.3	1.1
45.2	44.8	0.4

Calibrated by :



Mr. Watcharapol Subwat

Mechanical Engineer





Date of Issue 24 October, 2024

Certification No. 361/24

Page: 6 of 6

ใบรับรอง

หนังสือฉบับนี้ขอรับรองว่า เครื่องวัดฝน ยี่ห้อ Davis Instruments แบบ TIPPING
BUCKET Product No, 7342.026 Code No. NWSDCMS1200152 ทำการสอบเทียบกับแก้ววัด
ฝนแบบแก้วตวง GAUGE DIAMETER 8.0 INCHES, NEGRETTI & ZAMBRA LONDON
No. 71082 และสามารถนำไปใช้ได้ มีค่าถูกต้องตามรายละเอียดของเครื่องมือ (0.2 mm./TIP)



ลงชื่อ...

(นายวัชรพล ทรัพย์วัฒน์)

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 24 October, 2024

Certification No. 360/24

Page : 1 of 6

Object : เครื่องมือตรวจวัดอุตุนิยมวิทยา

Manufacturer : DYACON

Type : Data Logger CM-1

Serial No. : 130129 ID No. : NWSDCMS1200129

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

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1009.5 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

Calibrated by :

Mr. Watcharapol

Mechanical Engineer

Sign

Mr. Pisood Promsut

meter Vaisala Type CM-1220 No. V4220015





THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Sensor model

NWSDCMS1200129

Certification No. 360/24

24 October, 2024

Serial No. 1198

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	92
180	181
270	

Calibrated by :

Mr. Watcharapol Subwat

Mechanical Engineer





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. 6235

Certification No. 360/24

24 October, 2024

Page : 3 of 6

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	
1010.12	1009.81	0.31
1010.35	1010.08	0.27
1010.56	1010.26	0.30
1010.85	1010.48	0.37
1011.05	1010.72	0.33
1011.46	1011.12	0.34
1011.82	1011.56	0.26
1011.95	1011.64	0.31
1012.15	1011.83	0.32
1012.54	1012.26	0.28
1012.81	1012.52	0.29
1010.25	1009.88	0.37
1010.14	1009.81	0.33
1009.95	1009.63	0.32
1009.84	1009.45	0.39
1009.45	1009.12	0.33
1009.32	1009.12	0.20
1009.11	1008.92	0.19
1009.56	1009.23	0.33
1009.86	1009.56	0.30

Average

Calibrated by :

Mr. Watcharapol Subwat

Mechanical Engineer





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. 360/24

24 October, 2024

Serial No. 6235

Page : 4 of 6

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.6	45.6	0.0
30.2	30.3	-0.1
15.1	15.1	0.0

Calibrated by :



Mr. Watcharapol Subwat

Mechanical Engineer



Envilab Co., Ltd.



รับรองสำเนาถูกต้อง
ผู้จัดการฝ่ายควบคุมคุณภาพ



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. 360/24

24 October, 2024

Serial No. 6235

Page : 5 of 6

Standard Humidity % R.H.	Relative Humidity Sensor Reading	
	Reading % R.H.	Correction % R.H.
92.5	91.2	1.3
65.4	64.8	0.6
45.2	44.8	0.4

Calibrated by :



Mr. Watcharapol Subwat
Mechanical Engineer





Date of Issue 24 October, 2024

Certification No. 360/24

Page: 6 of 6

ใบรับรอง

หนังสือฉบับนี้ขอรับรองว่า เครื่องวัดฝน ยี่ห้อ Davis Instruments แบบ TIPPING
BUCKET Product No. 7342.026 Code No. NWSDCMS1200129 ทำการสอบเทียบกับแก้ววัด
ฝนแบบแก้วดวง GAUGE DIAMETER 8.0 INCHES, NEGRETTI & ZAMBRA LONDON
No. 71082 และสามารถนำไปใช้ได้ มีค่าถูกต้องตามรายละเอียดของเครื่องมือ (0.2 mm./TIP)



ลงชื่อ.



(นายวัชรพล ทรัพย์วัฒน์)

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. 172/24

Page : 1 of 6

Object : เครื่องมือตรวจวัดอุตุนิยมวิทยา

Manufacturer : NovaLynx

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

Serial No. : EWSNV110WS2503

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

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1009.2 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 Type PTB220 No. V1220015

Calibrated by :

Mr. Watcharapol
Mechanical Engineer

Sig

Mr. Pirood Promsut

(Authorised Signatory)

for the Chief

Sub-Standard Instrument





THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Sensor model

EWSNV110WS2503

Certification No. 172/24

6 April, 2024

Page : 2 of 6

Standard Ultrasonic Anemometer m/sec	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacumm	Velocity	Velocity	Correction
	inches H2O	inches H2O	m/sec	m/sec	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	-	-	-	10.9	0.11
13.01	-	-	-	12.8	0.21
15.01	-	-	-	15.1	-0.09
17.02	-	-	-	16.8	0.22
20.02	-	-	-	20.1	-0.08

Wind Aloft Plotting Board.	
US.DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRETION	TESTED WIND DIRECTION
0	0
90	91
180	179
270	270

Calibrated by :

Mr. Watchapol Subwat

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Sensor model

EWSNV110WS2503

Certification No. 172/24

6 April, 2024

Page : 3 of 6

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	
1009.59	1010.02	-0.43
1009.45	1009.95	-0.50
1010.10	1010.53	-0.43
1010.94	1011.36	-0.42
1011.46	1011.85	-0.39
1011.84	1012.34	-0.50
1012.06	1012.47	-0.41
1013.04	1013.48	-0.44
1013.18	1013.56	-0.38
1012.89	1013.27	-0.38
1013.20	1013.61	-0.41
1013.44	1013.85	-0.41
1013.81	1014.21	-0.40
1014.19	1014.68	-0.49
1015.96	1016.32	-0.36
1016.23	1016.65	-0.42
1015.64	1016.03	-0.39
1015.23	1015.68	-0.45
1012.87	1013.31	-0.44
1013.63	1014.10	-0.47

Average

-0.43

Calibrated by :

Mr. Watchapol Subwat

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Sensor model

EWSNV110WS2503

Certification No. 172/24

6 April, 2024

Page : 4 of 6

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.6	46.0	-0.4
30.1	30.3	-0.2
15.4	15.7	-0.3

Calibrated by :

Mr. Watcharapol Subwat
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau





THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Sensor model EWSNV110WS2503 Certification No. 172/24

6 April, 2024

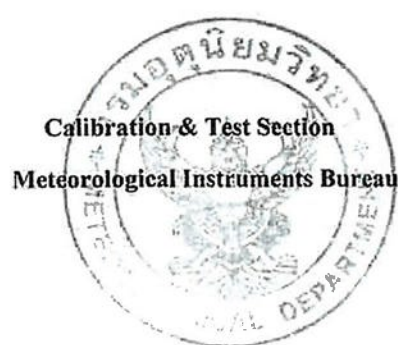
Page : 5 of 6

Standard Humidity % R.H.	Relative Humidity Sensor Reading	
	Reading % R.H.	Correction % R.H.
85.2	91.5	-6.3
62.4	67.7	-5.3
41.5	46.2	-4.7

Calibrated by :



Mr. Watcharapol Subwat
Mechanical Engineer





Date of Issue 6 April, 2024

Certification No. 172/24

Page: 6 of 6

ใบรับรอง

หนังสือฉบับนี้ขอรับรองว่า เครื่องวัดฝน ซีรี่ย์ Davis Instruments แบบ TIPPING
BUCKET Product No. #7852 Mfg. Code. EWSNV110WS2503 ทำการสอบเทียบกับแก้ววัดฝน
แบบแก้วดวง GAUGE DIAMETER 8.0 INCHES, NEGRETTI & ZAMBRA LONDON No.
71082 และสามารถนำไปใช้ได้ มีค่าถูกต้องตามรายละเอียดของเครื่องมือ (0.2 mm./TIP)



ลงชื่อ.....

(นายวัชรพล ทรัพย์วัฒน์)

วิศวกรชำนาญการ



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0391

MTC No. EEL. BP. 30/0467

CALIBRATION CERTIFICATE

Submitted by : Envilab Co.,Ltd.

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

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

Instrument Calibrated :

Description : Sound Level Calibrator

Manufacturer : Bruel & Kjaer

Model : 4230

Serial No. : 1351075

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

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

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

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

5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.

6. Audio Analyzer Keithley 2015-P S/N4106495.

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

Ambient Environment

Temperature : (23 + 3) °C

Relative Humidity : (50 ± 15) %

Ambient Pressure : (101.325 ± 1.500) kPa

Calibration Procedure: CP-102-04 based on IEC 60942-2003; The sound pressure level generated by sound calibrator under test shall be 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 : 9 Apr. 2024

Date of Calibration : 10 Apr. 2024

1 / 2

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.5

Head Office

35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9036
Fax. (66) 0 2577 9009

Office/Laboratory

668 Mu 2 Tambon Bangpoomai, Amphoe Muang Samutprakan,
Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
(66) 08 3219 9440
E-mail : mtc@tistr.or.th Website : www.tistr.or.th
ภาคผนวก 3-16-2

Office

196 Phahonyothin Road, Ladyao, Chatuchak,
Bangkok 10900, Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
(66) 08 1 [REDACTED]



Envilab Co.,Ltd.

ผู้จัดการฝ่ายควบคุมคุณภาพ

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0391

MTC No. EEL. BP. 30/0467

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

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

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

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	93.72	-0.28	± 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	994.9	-5.1	± 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	1.25	± 0.50	$\pm 3.0\%$

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :

(Mr. Weerachai Deechaiyae)

Approved by :



(Mr. Prawate Kluaypa)
Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 10 Apr. 2024

Date of Issue : 11 Apr. 2024

Ref : 2011267040901374001

End of Certificate

2 / 2

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.5

Head Office

35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9036
Fax. (66) 0 2577 9009

Office/Laboratory

668 Mu 2 Tambon Bangpoomai, Amphoe Muang Samutprakan,
Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
(66) 08 3219 9440
E-mail : mtc@tistr.or.th Website : www.tistr.or.th

Office

196 Phahonyothin Road, Ladyao, Chatuchak,
Bangkok 10900, Thailand
Tel. (66) 0 2579 5555
(66) 08 1889 5217

ภาคผนวก 3-16-2

Envilab Co., Ltd.

ผู้จัดการฝ่ายควบคุมคุณภาพ



บริษัท นีดีส ซัพพลาย อินสตรูเมนต์ จำกัด
Neediss Supply Instrument Co., Ltd.

501/501/1 ซอย 7 ถนนพหลโยธิน แขวงจตุจักร เขตจตุจักร กรุงเทพฯ 10130 โทร 02-002-0280-2 e-mail: info@neediss.com



Verification Test Report

Report No.: OP01-6710001

Calibrated Date: 1-Oct-2024

☒ PM ☐ Onsite UTM :

Site: Neediss Supply Instrument

Equipment: Smoke Opacity

Manufacturer: Wager

Model: 8500

Serial or ID No. EOPWA850015944

Environment: Temperature 21.1 °C Humidity: 44 %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	30.61	0.89	PASS

 neediss
Neediss Supply Instrument Co.,Ltd

Calibrated By: _____

Date: _____

Approve By: _____

Date: _____

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neediss

บริษัท นีดีส ซัพพลาย อินสตรูमेंท์ จำกัด
Neediss Supply Instrument Co., Ltd.
536 ซอยบางแค 7 แขวงบางแค เขตบางแค กรุงเทพฯ 10160 Tel.02-802-3980-2 e-mail: info@neediss.com



Neediss EnviroLab

Verification Test Report

Report No.: OP01-6712001

Calibrated Date: 1-Dec-2024

☒ PM ☐ Onsite UTM :

Site: Neediss Supply Instrument

Equipment: Smoke Opacity

Manufacturer: Wager

Model: 8500

Serial or ID No. EOPWA850015944

Environment: Temperature 24.1 °C Humidity: 54 %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	29.83	1.67	PASS

 **neediss**
Neediss Supply Instrument Co., Ltd.

Calibrated By: _____

Date: _____

Approve By: _____

Date: _____

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all about env



ID LINE : IEC17025



Certificate of Calibration

Certificate Number : SPR24080268-5

Page : 1 of 3

Customer : Envilab Co., Ltd.

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

Equipment Name : Sound Level Meter

Manufacturer : Pulsar

Model : 44

Serial Number : PN1821

ID. Number : NSMPUMD44N1821

Environmental Conditions

Ambient Temperature : 23 °C ± 3 °C

Received Date : 15 Aug 2024

Relative Humidity : 50 % ± 15 %

Calibration Date : 16 Aug 2024

Location of Calibration : In-Lab

Recommend Due Date : 16 Aug 2025

Calibration Procedure : SP-CPE-04-01

Date of Issue : 17 Aug 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 : Mr.Nanthawat Wanasit

Approved by :

Calibration Officer

(Mr.Prayoon Topart)

Authorized Signatory





ID LINE : IEC17025



Calibration Report

Certificate Number : SPR24080268-5

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	ST-120	211203773	EEL.BP. 140/0167	26 Jan 2025

Traceability

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

TISTR - Thailand Institute of Scientific and Technological Research





ID LINE : IEC17025



Result of Calibration

Certificate Number : SPR24080268-5

Page : 3 of 3

Range : 94 to 114 dB

Function : @1kHz

Select A

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	114.0	114.0	0.0	0.0	0.15

Select C

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	114.0	114.0	0.0	0.0	0.15

Select Z

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	114.0	114.0	0.0	0.0	0.15

Note :

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

Measurement Uncertainty

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

- End of Certificate -





ID LINE : IEC17025



Certificate of Calibration

Certificate Number : SPR24030525-3

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 : 190600323

ID. Number : N/A

Environmental Conditions

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

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

Location of Calibration : In-Lab

Calibration Procedure : SP-CPE-04-32

Received Date : 30 Mar 2024

Calibration Date : 18 Apr 2024

Recommend Due Date : 18 Apr 2025

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 NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

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

Calibrated by : Mr.Nanthawat Wanasit

Calibration Officer

Approved by :

(Ms.Bussakorn Chaikaew)

Authorized Signatory





ID LINE : IEC17025



Calibration Report

Certificate Number : SPR24030525-3

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. : SPR24030525-3

Page : 3 of 3

Function: Illumination Measurement

Unit : Lux

Calibration Point	Standard Reading	UUC Reading	Error	Uncertainty (±)
100	100.0	92.6	-7.4	1.3
500	500	459.7	-40.3	6.6
1000	1000	911.2	-88.8	13
1500	1500	1355	-145	20
2000	2000	1804	-196	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 %

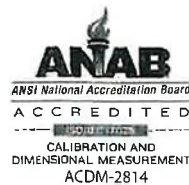
- End of Certificate -





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

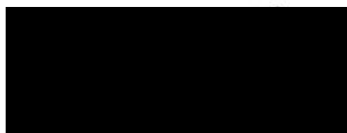
CUSTOMER : ENVILAB CO., LTD.
540, 540/1 SOI BANGKHAE 7, BANGKHAE,
BANGKHAE, BANGKOK 10160 THAILAND

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 : Tanawan Seenam-Ngoen
Calibration Engineer



Approved By : Mongkol Yotsoontorn
Authorized Signatory
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

ภาคผนวก 3-16-2



รับรองสาขาเพื่อ
ผู้จัดการฝ่ายควบคุมคุณภาพ @clccalibration



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-CPH-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





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 \pm (° 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 \pm (° 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 \pm (° 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.

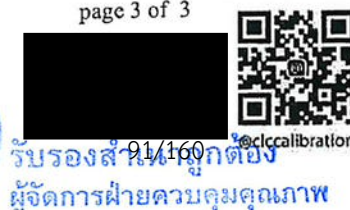
End of Certificate

Certificate No. Q24021069

F3-011-05/12-23

page 3 of 3

ภาคผนวก 3-16-2



Certificate of Calibration

Certificate No. : 67-420034-1

Page : 1 of 2

Submitted by : Envilab Co., Ltd.

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

Equipment : pH Meter with electrode

pH meter

Manufacturer : Horiba

Model : F-74BW-G

Range : N/A pH

Resolution : 0.001 pH

Serial No. : B41J0001

ID No. : ELABPHHB74BW01

Electrode

Model : 9615S

Serial No. : 9X1K0003

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

Ambient Temperature : (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

<u>ID No.</u>	<u>Cert. No.</u>	<u>Due Date</u>	<u>Traceability</u>
400005	SG-E-00307/66	23 Aug 2025	National Institute of Metrology Thailand (NIMT)

2. Standard Buffer Solution

<u>pH</u>	<u>Cert. No.</u>	<u>Lot No.</u>	<u>Exp. Date</u>	<u>Traceability</u>
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

Approved by :

(Surachai Promthong)

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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รับรองและควบคุมคุณภาพ
ผู้จัดการฝ่ายควบคุมคุณภาพ

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

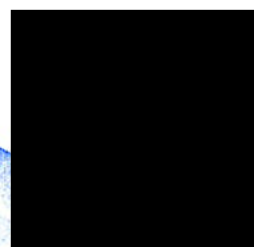
Remark

UUC : Unit Under Calibration

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

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

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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. : 67-400639-2

Page : 1 of 2

Submitted by : Envilab Co., Ltd.

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

Equipment : Temperature controlled enclosure (Incubator)

Manufacturer : M-Lab

Model : BIC-140

Range : N/A °C

Resolution : 0.1 °C

Serial No. : 1018

ID No. : ELABBODC140N04

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

Ambient Temperature : (24.4 to 25.0) °C

Relative Humidity : (40 to 45) %

Line Voltage : (227.0 to 230.0) V

Date of Received : 07 November 2024

Date of Calibration : 07 November 2024

Date of Issue : 13 November 2024

Calibrated by : Permpon Chanpu

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

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

<u>ID No.</u>	<u>Cert. No.</u>	<u>Due Date</u>	<u>Traceability</u>
400046 & 400047	67-400442-2	27 Jan 2025	National Institute of Metrology Thailand (NIMT)

Approved by :

(Permpon Chanpu)

The Uncertainties are for a confidence probability of approximately 95%

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CAL

Calibratech Co.,Ltd.

7/106-7 Moo 2, Sukhprachasan 3 Rd., Bangpoo, 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. : 67-400639-2

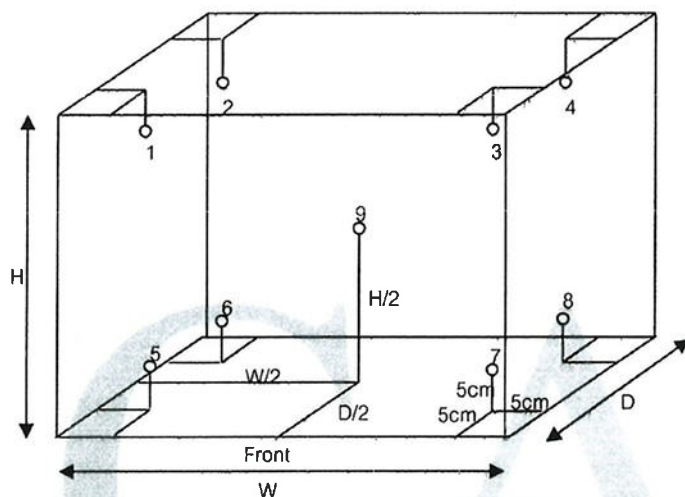
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

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



Inside of Chamber

W = 0.38 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	19.95	20.05	19.62	19.57	20.37	20.33	20.31	20.11	20.12	0.32

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
20.0	20.0	20.0	0.55	0.02	0.80

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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Envilab Co.,Ltd.

รับรองสำเนาถูกต้อง
ผู้จัดการฝ่ายควบคุมคุณภาพ





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 Sol 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

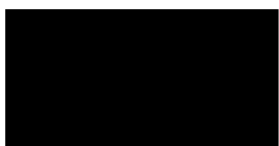
Traceability

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).

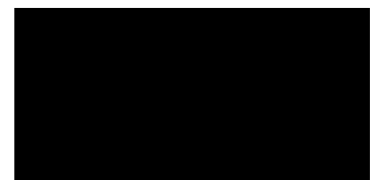
These results may be affected by
deviations from specified conditions. The
results relate only to the items tested,
calibrated or sampled. The report shall not be
reproduced except in full without approval of
SCIMET Co., Ltd.



Mr.Dumrong Boonsopon
Person in charge



บริษัท ชัยนิเมท จำกัด



Mr. Thalerngkeat POUNGNGARM



Authorized signatory



Envilab 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



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. เซ็นเซอร์อิเล็กโทรด	<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 ชายนัมเบก จำกัด (SCIMET CO., LTD.)

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

ภาคผนวก 3-16-2



98/160
รับรองตามมาตรฐาน
ผู้จัดการฝ่ายควบคุมคุณภาพ

Certificate of Calibration

Certificate No. : 67-400166-2

Page : 1 of 2

Submitted by : Envilab Co., Ltd.

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

Equipment : Water Bath

Manufacturer : Memmert

Model : WNB 14

Range : N/A °C

Resolution : 0.1 °C

Serial No. : L412.2222

ID No. : ELABWBWNB29N01

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

Ambient Temperature : (29.0 to 30.0) °C

Relative Humidity : (60 to 650) %

Line Voltage : (224.2 to 225.2) V

Date of Received : 20 March 2024

Date of Calibration : 20 March 2024

Date of Issue : 22 March 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)

Approved by :

(Surachai Promthong)

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

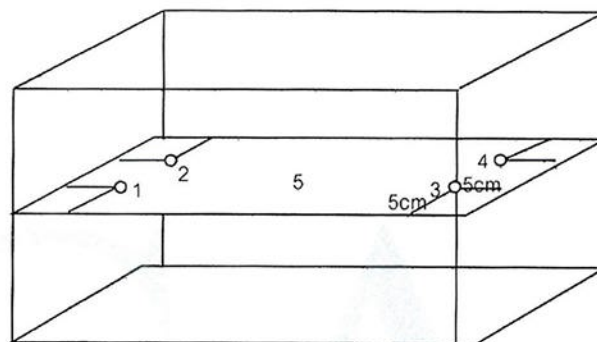
Certificate No. : 67-400166-2

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)
			1	2	3	4	5			
95.0	94.5	94.5	95.12	95.18	95.11	95.02	95.17	0.23	0.26	0.12

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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บริษัท แคลิเบรตเทค จำกัด
ผู้ให้บริการมาตรฐานคุณภาพ



Certificate of Calibration

Certificate No. : 67-400166-1

Page : 1 of 2

Submitted by : Envilab Co., Ltd.

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

Equipment : Temperature controlled enclosure (Oven)

Manufacturer : Memmert

Model : UF 75

Range : N/A °C

Resolution : 0.1 °C

Serial No. : B319.0600

ID No. : ELABHAOVEN0600

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

Ambient Temperature : (29.0 to 30.0) °C

Relative Humidity : (60 to 650) %

Line Voltage : (224.2 to 225.2) V

Date of Received : 20 March 2024

Date of Calibration : 20 March 2024

Date of Issue : 22 March 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 Thermocouple probe

ID No.	Cert. No.	Due Date	Traceability
400046 & 400028	66-400547-3	05 Apr 2024	National Institute of Metrology Thailand (NIMT)

Approved by :

(Surachai Promthong)

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 67-400166-1

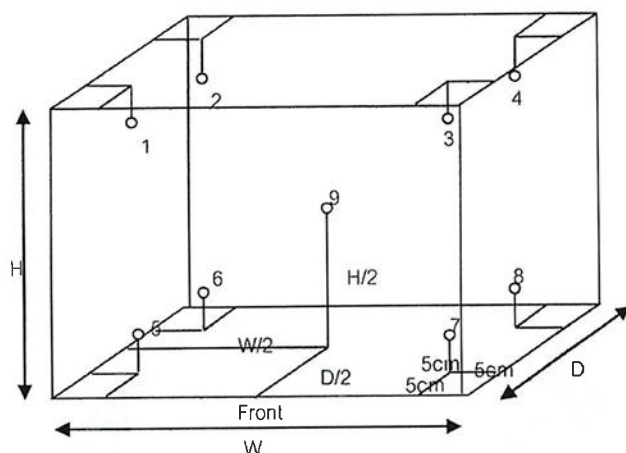
Page : 2 of 2

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 = 0.33 m

H = 0.56 m

Capacity = 0.07 m³

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) @ Sensor No.									Uncertainty (± °C)
			1	2	3	4	5	6	7	8	9	
104.0	103.5	103.5	104.1	104.4	104.1	104.3	104.1	104.0	104.0	103.7	104.3	0.70
110.0	109.5	109.5	110.1	110.4	110.1	110.3	110.2	110.1	110.1	109.4	110.3	0.72
180.0	179.0	179.0	179.5	180.9	180.3	180.6	180.5	180.3	180.2	180.2	180.8	0.95

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
104.0	103.5	103.5	0.7	0.1	1.0
110.0	109.5	109.5	1.1	0.1	1.2
180.0	179.0	179.0	1.5	0.2	1.6

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%

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EnviLab Co.,Ltd.

รับรองสำเนาถูกต้อง
ผู้จัดการฝ่ายเทคนิคคุณภาพ

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

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

Approved by :

(Surachai Promthong)

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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รับรอง
ผู้จัดการ
คุณภาพ

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

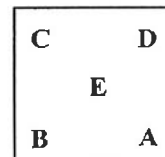
Nominal Value (g)	Correction (g)	Uncertainty \pm (g)
0.1	0.00000	0.000015
0.5	0.00001	0.000022
1	0.00000	0.000026
2	0.00001	0.000034
5	-0.00001	0.000043
10	0.00000	0.000053
50	0.00003	0.00011
100	0.0001	0.00020
150	0.0001	0.00038
200	0.0002	0.00038

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

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รับรอง
ผู้จัดการ
ผู้ควบคุม

Certificate of Calibration

Certificate No. : 67-200060-1

Page : 1 of 2

Submitted by : Envilab Co., Ltd.

540, 540/1 Soi Bangkhuae7, Bangkhuae, 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

<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 :

(Surachai Promthong)

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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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

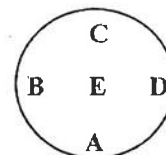
Nominal Value (g)	Correction (g)	Uncertainty \pm (g)
0.1	0.0000	0.00011
0.5	0.0000	0.00011
1	0.0000	0.00011
2	0.0000	0.00011
5	0.0000	0.00011
10	0.0000	0.00011
20	0.0000	0.00013
50	0.0001	0.00014
100	0.0001	0.00020
120	0.0000	0.00038

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

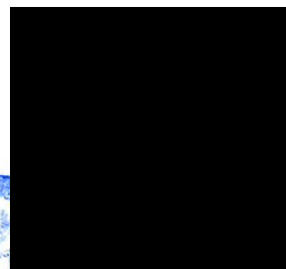
A	B	C	D	E	
0.0001	0.0001	0.0000	0.0000	0.0000	g



Repeatability Load test : 100 g

Stdev. : 0.00004 g

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รับรองว่าถูกต้อง
ผู้ตรวจการควบคุมคุณภาพ

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. : 67-300293-10

Page : 1 of 2

Submitted by : Envilab Co.,Ltd.

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

Equipment : Cylinder

Manufacturer : BOROSIL

Class : A

Capacity : 50 ml

Graduation : 1 ml

ID No. : C-WW-004/24

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

Relative Humidity : (50 ± 10) %

Air Pressure : 1006.0 mbar.

Date of Received : 15 May 2024

Date of Calibration : 20 May 2024

Date of Issue : 20 May 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

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

Approved by :

(Wipa Tovadce)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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รับรองสำเนาถูกต้อง
ผู้จัดทำ : อ. วรคุณคุณ



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. : 67-300293-10

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)
25	25.04
50	50.00

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 -



รับรองสำเนาถูกต้อง
ผู้จัดการฝ่ายค



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 : 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

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

Approved by :

(Wipa Tovadec)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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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. : 67-300147-4

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 -



Envilab Co.,Ltd.

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NSC-TISI-TIS17025
CALIBRATION 0030

Certificate of Calibration

Certificate No. : 67-300293-11

Page : 1 of 2

Submitted by : Envilab Co.,Ltd.

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

Equipment : Cylinder

Manufacturer : PYREX

Class : A

Capacity : 50 ml

Graduation : 1 ml

ID No. : C-WW-006/24

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

Relative Humidity : (50 ± 10) %

Air Pressure : 1006.0 mbar.

Date of Received : 15 May 2024

Date of Calibration : 20 May 2024

Date of Issue : 20 May 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 by :

(Wipa Tovadec)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 67-300293-11

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)
25	24.90
50	49.93

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 -



Envilab Co.,Ltd.

รับรองสำเนาถูกต้อง
ผู้จัดการฝ่ายคุณภาพ



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NSC-TISI-TIS17025
CALIBRATION 0030

Certificate of Calibration

Certificate No. : 67-300147-5

Page : 1 of 2

Submitted by : Envilab Co.,Ltd.

540, 540/1 Soi Bangkhae 7, Bangkhae, 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 by :

(Wipa Toadec)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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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%

- o0o -



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NSC-TISI-TIS17025
CALIBRATION 0030

Certificate of Calibration

Certificate No. : 67-300293-12

Page : 1 of 2

Submitted by : Envilab Co.,Ltd.

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

Equipment : Cylinder

Manufacturer : PYREX

Class : A

Capacity : 100 ml

Graduation : 1 ml

ID No. : C-HM-001/22

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

Relative Humidity : (50 ± 10) %

Air Pressure : 1006.0 mbar.

Date of Received : 15 May 2024

Date of Calibration : 20 May 2024

Date of Issue : 20 May 2024

Calibrated by : Areerat Sombun

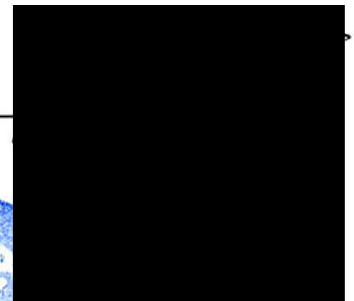
Calibration Method : In-house method CAL-M3001 based on ASTM E 542-22

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

Electronic Balance

<u>ID No.</u>	<u>Cert. No.</u>	<u>Due Date</u>	<u>Traceability</u>
241002	66-200388-1	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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Certificate of Calibration

Certificate No. : 67-300293-12

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)
50	50.19
100	100.16

Uncertainty of measurement with in \pm 0.063 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 -



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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)

Approved by :

The Uncertainties are for a confidence probability of approximately 95%

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Envilab Co. Ltd.



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

Certificate of Calibration

Certificate No. : 66-300675-1

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%

- o0o -



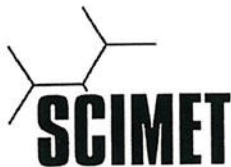
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Calibratech Co.,Ltd.

ผู้จัดการฝ่าย

ควบคุมภาพ





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 (ELABSPECTRO0002)
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 \pm 0.6 °C
Humidity: 65.7 %RH \pm 0.5 %RH

The Method used

In-house method, WI07, 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
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
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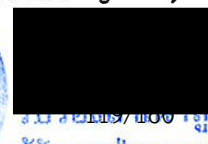
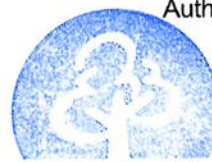
(Mr. Dumrong Boonsopon)

Person in charge



(Mr. Thalerngkeat Pongngam)

Authorized signatory



AY 2023

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 ชายนีเมก 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



รับรองสำเนาถูกต้อง
FC07-03: 30 MAY 2023
ผู้จัดการฝ่ายควบคุมคุณภาพ
120/160

**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
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ภาคผนวก 3-16-2

รับรอง
FC07-03-80 MAY 2023
ผู้จัดทำ 121/160 ควบคุมคุณภาพ



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





(Mr. Thalerngkeat Pongngam)
Authorized signatory

บริษัท ชายนีเมท จำกัด (SCIMET CO., LTD.)

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Email: scimet2022@gmail.com, Tel: 02 460 9239

ภาคผนวก 3-16-2




รับรองสำเนาถูกต้อง
FC07-03: 30 MAY 2023
ผู้จัดการฝ่ายควบคุมคุณภาพ
122/160



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

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วันที่รับส่ง 30 MAY 2023
ผู้ตรวจวัด 123/160



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 ชายันเมท 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

FC07-03: 30 MAY 2023
ผู้จัดทำ: 124/160
ผู้ตรวจสอบ: 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 ชายนีเมท 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



รับรองสำเนาถูกต้อง
F107-01: 08 MAR 2023
ผู้จัดการฝ่ายควบคุมคุณภาพ
125/160

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.

ภาคผนวก 3-16-2



รับรองคุณภาพ
ผู้ให้บริการฝ่ายควบคุมคุณภาพ

126/160

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 customers 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

ภาคผนวก 3-16-2



รับรองสำนักงานกักต้ง
ผู้จัดการฝ่ายควบคุมคุณภาพ

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

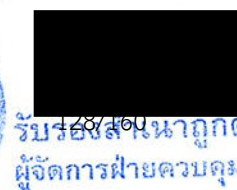
System Information

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

Instrument System Name and ID	ICP 5110 VDV / MY17490002
Instrument System Site and Location	ENVILAB Company Limited / Laboratory

List System Component	Product Numbers	List the Serial Numbers of each Component
1. G8015A		MY17490002
2. G8481A		1709-05327
3. G8410A		AU17393768
4.		
5.		
6.		
7.		
8.		
9.		

ICP-OES Configuration Table	Circle the type or write in the type if other
Nebulizer Type	SeaSpray OneNeb Conical Other
Spray Chamber	Cyclonic Single Pass Cyclonic Double Pass Other
Torch	Radial Dual View Other
Torch Type	One Piece Semi Demountable Fully Demountable Other
Injector Diameter	2.4mm 1.8mm 1.4mm 0.8mm Other
Injector Material	Quartz 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.
- ☒ 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
- ☒ 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.
- ☒ 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	1597.1	3382.6	3780.2	7240.8
Mn 257.610 nm SRBR	5945.3	16145.3	11049.1	24678.4
Al 396.152 nm SBR	7.0	16.3	6.8	17.0
K 766.491 nm SBR	5.2	67.3	3.5	56.3

* 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	VAC	217	VAC
Mains Current	0.082	A	0.098	A
Instrument Temperature	23.5	°C	24.5	°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		1.51	L/min
Water Flow Detector	1.09	L/min	1.06	L/min
Water Inlet Temperature	16.9	°C	16.7	°C
Polychromator Temperature	35.0	°C	35.0	°C
CCD Temperature	-39.6	°C	-39.6	°C
Thermal Stabilizer	35.0	°C	35.0	°C
Argon Supply Pressure	619	kPa	560	kPa
Purge Gas Supply Pressure*1	616	kPa	597	kPa
Option Gas Supply Pressure*1	N/A	kPa	N/A	kPa
Nebulizer Flow	No measurement		0.7	L/min
Nebulizer Back Pressure	No measurement		283	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	G8010-68014	G8010A, G8011A, G8014A/G8015A	1
Radial Pre-Optic Window	G8010-68015	All	1
Agilent Cool Clear Coolant Fluid	5799-0037	Agilent Water Recirculator	
Purge Gas Filter	G8010-60136	All	1
Air Inlet filter	G8000-68002	All	1
High Capacity Air Filter	G8010-60189	Optional	
Rotor seal for 6-7 port valve for AVS6/7	G8494-60002	G8494A/G8495	
Rotor seal for 4 port valve for AVS4	G8493-60002	G8493A	
Rinse solution to rinse station 2.5mm id x 1m	G8410-80123	SPS 4	
Barb connector 2.5mm-1.5mm ID	G8410-80124	SPS 4	
PVC waste tubing, 8mm od x 5mm id, 2m	G8410-80122	SPS 4	
Additional Parts may be required from engineer's stock:			
X axis drive belt	5410047500	SPS 3	
Z axis drive belt	5410047400	SPS 3	
Peristaltic pump tubing, PVC SolvaFlex, 3/16" ID	3710049000	SPS 4	

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.

Performed PM on date 31 May 2024 but sensitivity is still low in some wavelength on Axial view.
After replace mirror kit and Prism grating test performance again all pass result

Service Verification

Service Request Number: 6006868005
Service Engineer Name: Worawit Timakul
Service Engineer Signature: *Worawit Timakul*
Date Service Completed: 3 July 2024
Customer Name: K Jernjira
Customer Signature: _____



PinAAcle 900F Preventive Maintenance Report

ภาคผนวก 3-16-2



Company Name: Envilab Co.,Ltd
Instrument Location: 540/1 ซอยบางแค 7, แขวงบางแค เขตบางแค
กรุงเทพมหานคร 10160
Instrument Serial No.: PFBS20011403
Date: 04-Oct-2024

วันที่ 1335160 นาฎกตอง
ผู้จัดการฝ่ายควบคุมคุณภาพ

PinAAcle 900F Preventive Maintenance (PM)				
Company Name:	Envilab Co.,Ltd			
Address (Instrument Location):	540/1 ซอยบางแค 7, แขวงบางแค เขตบางแค กรุงเทพมหานคร 10160			
Serial Number:	PFBS20011403	PM Number:	1/2	
Customer Name (if applicable):	K.Janjira	Telephone Number:	095-550-0510	
Customer Support Engineer Name:	Khwanchai	Service Order Number:	WO-02944419	
Date PM Performed: (DD-MMM-YYYY)	04-Oct-2024	Next PM Due Date: (DD-MMM-YYYY)	04-Apr-2025	
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	2
N3160156	O-Ring Kits for Sampling Introduction (Stainless Steels Nebulizer)	NA
N3160157	O-Ring Kits for Sampling Introduction (Plastic Nebulizer)	1
N9301714	Replacement Acetylene Filter Cartridge	1
TH001022	Replacement Air Filter Cartridge	2

Additional Reagents and Standards Required for PM			
Part Number (if applicable)	Description	Quality	Batch/Lot #
N9300183	1000 mg/L Copper Standard	AR	27-39CUIY1
			04/25

Additional Reagents and Standards Required for PM (Customer Support Solution)			
Part Number (if applicable)	Description	Quantity	Expiration Date (MM/YY)
N/A	DI 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	MG0-056
N1013002	1.0A Neutral density filter	1	MG2-054
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 slot 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.	1.0531	1.0542	Passed
0.2 A ND Filter	± 5% from Cert.	0.1806	0.1787	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	0.0023	Passed

8.3 AA Baseline Noise with Copper

Description: Check baseline noise.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.001	0.0002	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	0.0061	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	0.0006	Passed

8.7 Flame Sensitivity

Description: Instrument Sensitivity checked against Copper standard.

Standard Copper Sensitivity	Specification	Results (Abs.)	Pass/Fail
5 mg/L Sensitivity SS Neb (if applicable)	> 0.250 Abs.	-	Not Applicable
7 mg/L Sensitivity HS Neb (if applicable)	> 0.250 Abs.	0.3578	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: 04-Oct-2024
(DD-MMM-YYYY)

Authorized Customer Representative:

Date: 04-Oct-2024
(DD-MMM-YYYY)



Atomic Absorption/FIAS 100/400 Preventive Maintenance (PM)			
Company Name:	EnviLab Co., Ltd		
Address (Instrument Location):	540/1 ซอยบางแค 7, แขวงบางแค เขตบางแค กรุงเทพมหานคร 10160		
Room Number:	-		
Asset Number (if applicable):	100520010501	Customer System ID:	
Service Engineer Name:	Khwanchai	Service Order Number:	WO-02944418
Date PM Performed: (DD-MMM-YYYY)	04-Oct-2024	Next PM Due Date: (DD-MMM-YYYY)	04-Apr-2025

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 # Expiration Date (MM/YY)
B050 2706	Fan Filter	1	N/A

Additional Tools Required for PM			
Part Number (if applicable)	Description	Quantity	Serial # Calibration Due Date (MM/YY)
	Digital Volt Meter	1	N/A

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.

☒ Visual Damage (if yes, describe)

- ☒ 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 Nation dryer might be needed)

5. Operational Tests:

- ☒ Run DI water through the carrier/reductant/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

The preventive maintenance checks and if applicable performance tests for FIAS 100/400 have been completed.	
This FIAS 100/400 Passes <input checked="" type="checkbox"/> Fails <input type="checkbox"/> the preventive maintenance.	
Review of Preventive Maintenance:	
Authorized PerkinElmer Representative:	Date: 04-Oct-2024 (DD-MMM-YYYY)
Authorized Customer Representative:	Date: 04-Oct-2024 (DD-MMM-YYYY)

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
For the Better

PerkinElmer Scientific (Thailand) Co., Ltd.
290 Soi Soonyalai 4
Khwang Bangkok, Khet Huay Kwang
Bangkok 10310
Thailand
Tel: 66 2719 6420 : Fax: 466 2 319 7900
http://www.perkinelmer.com

Service Report

Work Order Number	WO-02944418	Activity Code	Planned Maintenance	Billing Type	Contract	Requested Start Date	13/08/2567 10:13 น.	Model	FIAS100	Serial Number	100520010501
Service Representative Name	Sangwong, Khwanchal	Contract Number	SC-0035621815	Expiry Date	04/05/2025	Equipment ID	N/A	System ID	N/A	Purchase Order	PO6500333
Customer Contact	สมชาย ทรัพย์	Phone Number	N/A	Fax Number	N/A	Email	kec@testing.com	UDI Number	N/A	Bill To Name	บริษัท เอ็มไพร์ จำกัด
Equipment Location	บริษัท เอ็มไพร์ จำกัด	Address	เลขที่ 51 หมู่ 10	City	TH	Postcode	10160	Country	TH	Customer Contact	สมชาย ทรัพย์

Work Description

- Clean sample introduction, valve, manifold, instrument exterior
- Perform instrument operation
- Instrument work normally

Start Date: 04/10/2024, End Date: 04/10/2024, Work Description: Work Description

Quantity	Calibrated Tool	Description	Serial Number	Last Calibration Date	Next Calibration Date
*** No Calibrated Tools Used ***					

Part Number	Material Used	Note	Lot/Serial Number	Quantity
*** No Parts Used ***				

Part Number	Labour Details	Part Description	Start Date	Quantity
SV000013	Preventative maintenance	Preventative maintenance	04/10/2024	1
SV000004	Service F.O.C. Travel	Service F.O.C. Travel	04/10/2024	1

Work Complete	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	Customer Signature	Technician Signature
PMOQIPV Left with Customer	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	Signature	Signature

Terms & Conditions

Customer Acknowledgment of receipt of the above repair / replacement.
Special Terms and Conditions: This is not an invoice.
Taxes will be applied to your invoice if applicable.

Certificate of Completion

This certifies that

Khwanchai Siangwong

Has successfully completed

FIAS 100 & 400 System

Completed on 8/17/2016 06:00 AM Eastern/New York

Certified By: Fred Rubino

Global Training Leader

Print Date Nov 17, 2016, 8:31 AM

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

Certificate of Completion

This certifies that

Khwanchai Siangwong

Has successfully completed

AA PinAAcle 900 T, H, Z, F and 500

Completed on 4/7/2017 05:00 AM Eastern/New York

Certified By: Fred Rubino

Global Training Leader

Print Date May 19, 2017, 2:42 AM

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		Ordinate Reading (Absorbance) at the following wavelengths:			
Wavelength	Number	193.70	324.60	553.60	766.50
Standard 1	MGO-056	0.2483	0.1857	0.1806	0.1874

The tolerance of the given absorbance values is ± 0.006 A in the ultra violet and visible range, and ± 0.010 A in the near infrared range. The uncertainty is the sum of the tolerance of the primary NIST/PTB reference material, the measurement reproducibility, and an estimated bias due to the possible systematic errors.

We recommend that you recalibrate this set of spectrometric standards once a year.

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

The instrument's wavelength program facility was used to measure the absorbance of the standards at the wavelength given above.

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

Serial Number: 88015

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

Date / Time: 9/18/2010

using the standard PerkinElmer quality control procedure. A set of NIST or NBS/PTB Standard Reference Standard Materials certified on:

Date: NIST 1930 SN 165 11/05/2009

was used during this procedure. Measurements were performed at an ambient temperature of: 25.6 C° and the humidity of: 14 %

Date / Time: 12/20/2010 / 1:48:28 PM

Operator: Cam Le Horvath

Signature:

PerkinElmer Instruments, 710 Bridgeport Avenue, Shelton, CT 06484-4794

PerkinElmer, Inc.
710 Bridgeport Avenue
Shelton, CT 06484-4794, U.S.A.

PerkinElmer
For the Reader

CERTIFICATE OF CALIBRATION
Test Standard for Instrument Performance Validation
(ISO 9000, GMP, GLP)

This is to certify that this PerkinElmer Reference Standard was tested and verified to be in conformance with all applicable quality requirements, including specifications, drawings, calibration, preservation, packing, marking requirements and part identification.

Declaration of Validation

The Reference Standard was found to meet its functional and performance specification prior to shipment. To support this declaration, the following Engineering, Production and Test Documents are held by PerkinElmer and are available for reference upon request in justified cases and to an appropriate extent:

- The Test Specification
- The Final Test Protocol
- The Records of the Primary Standard
- The Calibration Records

Note: PerkinElmer will maintain possession of all documents: their reproduction may require a nondisclosure agreement to be provided by those requiring access to them.

The existence of these documents and the procedures used in their production are formal requirements of the PerkinElmer Quality System. The integrity of this PerkinElmer Quality System is routinely audited and is certified by the British Standards Institution as meeting all the requirements of ISO 9001, the internationally recognized standard for Quality Assurance.

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Robert C. Vaughan

Quality Manager PKI RMCL
PerkinElmer Instruments
Shelton, CT, USA

PerkinElmer Inc., Shelton, CT 06484 USA An ISO 9001 Company

PKI RMCL 06-02-005
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Shelton, CT 06484-4794, U.S.A.



PerkinElmer Secondary Spectrometric Calibration Standards

Certificate of Calibration for Report Number: MG2-054-20110324

Ordinate Calibration

Calibration Data for Gray Glass Secondary Calibration Standards:

Wavelength / Absorbance		Ordinate Reading (Absorbance) at the following wavelengths:			
Wavelength	Number	193.70	324.80	553.60	766.50
Standard 1	MG2-054	1.0904	1.0082	1.0531	1.0170

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

The instrument's wavelength program facility was used to measure the absorbance of the standards at the wavelength given above.

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

Serial Number: 89015

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

Date / Time: 3/17/2011

using the standard PerkinElmer quality control procedure. A set of NIST or NBS/PTB Standard Reference Materials:

NIST model SRM 1930 filter set S/N 155 Calibration Date 11/05/2009 NRC Calibration Report No. PAR 2009 2759

was used during this procedure. Measurements were performed at an ambient temperature of 24.1 °C and the humidity of 18 %

Date / Time: 3/24/2011 / 11:15:32 AM

Operator:

Cam Le Horvath

Signature:

PerkinElmer LAS, Inc., 710 Bridgeport Avenue, Shelton, CT 06484-4794, USA

End of Report

CERTIFICATE OF CALIBRATION Test Standard for Instrument Performance Validation (ISO 9000, GMP, GLP)

This is to certify that this PerkinElmer Reference Standard was tested and verified to be in conformance with all applicable quality requirements, including specifications, drawings, calibration, preservation, packing, marking requirements and part identification.

Declaration of Validation

The Reference Standard was found to meet its functional and performance specification prior to shipment. To support this declaration, the following Engineering, Production and Test Documents are held by PerkinElmer and are available for reference upon request in justified cases and to an appropriate extent:

- The Test Specification
- The Final Test Protocol
- The Records of the Primary Standard
- The Calibration Records

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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: 1.011 g/mL @ 20°C

Lot No: 27-39CUY1
Certification Date: OCT -- 2023
Expiration Date: APR 3 0 2025

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

Element	µg/mL	Element	µg/mL	Element	µg/mL	Element	µg/mL
Ag	0.001	Li	<0.001	Pt	<0.001	Tb	<0.001
Al	0.003	Dy	<0.001	Rb	<0.001	Ti	<0.001
As	<0.001	Er	<0.001	Re	<0.001	Tl	<0.001
Au	<0.001	Eu	0.002	Rh	0.002	Tm	<0.001
B	<0.001	Fa	0.02	Ru	<0.001	U	<0.001
Ba	<0.001	Ga	<0.001	Sb	0.004	V	<0.001
Be	<0.001	Gd	<0.001	Sc	<0.001	W	<0.001
Bi	<0.001	Hf	<0.001	Se	<0.006	Y	<0.001
Ca	<0.01	Hg	<0.001	Si	<0.1	Yb	<0.001
Cd	<0.001	Ho	<0.001	Sn	<0.5	Zn	<0.02
Ce	<0.001	In	0.004	Sr	<0.001	Zr	<0.001
Co	<0.001	Ir	<0.001	Ta	<0.001		
Cr	<0.001	K	0.5				
Cs	<0.001	La	<0.001				

Traceability Documentation for Solution Standard:

Certified Value: 999 µg/mL ±5 µg/mL (refer to side 2)
Certified Value is Traceable to: NIST SRM #3114
Classical Wet Assay: 998 µg/mL
Method: EDTA titration using PAN as indicator. EDTA standardized against Pb(NO₃)₂ NIST SRM #928.

*Instrument Analysis using ICP Spectrometer: 1000 µg/mL
via NIST SRM #3114

We guarantee that our PerkinElmer TruQ Atomic Spectroscopy Standards are stable and accurate to ±0.5% of certified concentration until 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 class A.

Certifying Officer: [Signature]
Introspect



PerkinElmer
For the Better

PerkinElmer Scientific (Thailand) Co., Ltd.
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Kiwang Bangkok, Khel Huay Kwang
Bangkok 10310
Thailand
Tel: 66 2719 6420 ; Fax: +66 2 319 7900
http://www.perkinelmer.com

Service Report

Work Order Number	Activity Code	Billing Type	Requested Start Date	Model	Serial Number
WO-029444 B	Planned Maintenance	Contract	2008/2567 20:00 Y.	AAN3200051	PFB52011403
Service Representative Name	Contract Number	Expiry Date	Equipment ID	System ID	
Kanhan, Chayakun	SC-0035621845	04/03/2025	N/A	N/A	
UDI Number					
N/A					
Equipment Location					
บริษัท เวิลด์ไวด์ จำกัด เลขที่ 51/10160 ถนน พหลโยธิน แขวงจตุจักร กรุงเทพมหานคร 10110					
Bill To Name					
บริษัท เวิลด์ไวด์ จำกัด เลขที่ 51/10160 ถนน พหลโยธิน แขวงจตุจักร กรุงเทพมหานคร 10110					
Customer Contact	Phone Number	Fax Number	Email	Purchase Order	
establishment at true	N/A	N/A	tec@wvteaching.com	POS030333	

Work Description

- Clean sample introduction, mirrors, lens, instrument exterior
- Perform WCL and instrument test
- Replaced PM Kits
- Instrument work normally

Start Date	End Date	Work Description
04/10/2024	04/10/2024	
04/10/2024	04/10/2024	

Tools Used		Serial Number		Last Calibration Date	
Quantity	Calibrated Tool	Description	Serial Number	Date	Quantity
*** No Calibrated Tools Used ***					

Material Used		Note		Quantity	
Part Number	Part Description	Material Used	Note	Lot/Serial Number	Quantity
*** No Parts Used ***					

Part Number	Part Description	Labour Details	Start Date	Quantity
SV000013	Preventative maintenance	Preventative maintenance	04/10/2024	4
SV000004	Service F.O.C. Travel	Service F.O.C. Travel	04/10/2024	1





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
UltravioletRadiation 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.

Mr. Watcharin Tavera
Authorized Signatory

AIR FM - SV - 08 : 01 Sep 2021

51/104 Moo 9, Ladsawai, Lamukha Phatunthani 12150 Thailand
Tel : 0 2152 8350 , 0 2152 8348 , 0 2152 8070 .08 4360 2558 . 09 2265 3175 Fax : 0 2152 8348
[http:// www.airflow-calibration.com](http://www.airflow-calibration.com) E-mail : bm.airflow@gmail.com , nop.airflow@gmail.com



AIRFLOW CALIBRATION CO.,LTD.

Continuation of the Certificate of Test Report Number: B224051

Page 2 of 7 Pages

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.



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

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

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

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

AIR-EM-SV-08 : 01 Sep 2021

Airflow Co.,Ltd.

บริษัท แอร์โฟว์ แคลิเบรชัน จำกัด

ผู้จัดการฝ่ายควบคุมคุณภาพ
147/160



AIRFLOW CALIBRATION CO.,LTD.

Continuation of the Certificate of Test Report Number : B224051

Page 3 of 7 Pages

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

Damper

✓

No Change

✓

No Change

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

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

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

AIR FM - SV - 08 : 01 Sep 2021

Envilab Co., Ltd.

ผู้จัดการฝ่ายควบคุมคุณภาพ
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AIRFLOW CALIBRATION CO.,LTD.

Continuation of the Certificate of Test Report Number : B224051

Page 4 of 7 Pages

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

AIR FM - SV - 08 : 01 Sep 2021

51/104 Moo 9, Ladsewai, Lamthukha Phatumthani 12150 Thailand

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

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



Envilab Co.,Ltd.

ผู้จัดการฝ่ายควบคุมคุณภาพ



AIRFLOW CALIBRATION CO.,LTD.

Continuation of the Certificate of Test Report Number : B224051

Page 5 of 7 Pages

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	Pass
View Screen Retention Test	Pass
Work Opening Edge Retention Test	Pass
Sash/Window Seal Test	Pass

51/104 Moo 9, Ladsawai, Lamukha Phatumbani 12150 Thailand

Tel : 0 2152 8350 , 0 2152 8348 , 0 2152 8070 , 08 4360 2538 , 09 2265 3175 Fax : 0 2152 8348

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

AIR FM - SV - 08 : 01 Sep 2021

Envilab Co.,Ltd.

ผู้จัดการฝ่ายควบคุมคุณภาพ



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

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

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

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



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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

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/m^2 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

51/104 Moo 9, Ladsawai, Lamukha Phatumthani 12150, Thailand

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

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



AIR FM - SV - 08 : 01 Sep 2021

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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. : 67-400054-2

Page : 1 of 2

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

<u>ID No.</u>	<u>Cert. No.</u>	<u>Due Date</u>	<u>Traceability</u>
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)

Approved by :

(Surachai Promthong)

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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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

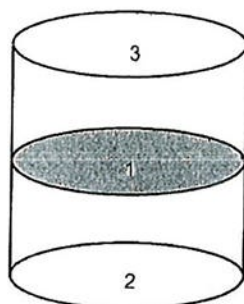
Certificate No. 67-400054-2

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%

- o0o -



Envilab Co.,Ltd.

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ผู้จัดการฝ่ายคุณภาพ



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. : 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 :

(Wipa Tovadec)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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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

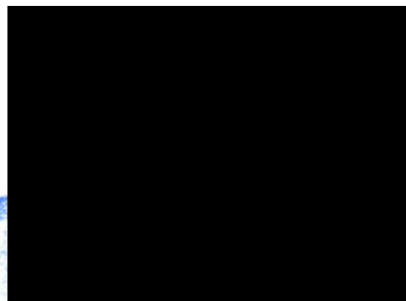
UUC Calibrated to delivery (Ex) by using : White Tip

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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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. : 67-400101-1

Page : 1 of 2

Submitted by : Envilab Co., Ltd.

540, 540/1 Soi Bangkhuae 7, Bangkhuae, 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)

Approved by :

(Surachai Promthong)

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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CAL-F0031-03

ภาคผนวก 3-16-2

157/160

Certificate of Calibration

Certificate No. : 67-400101-1

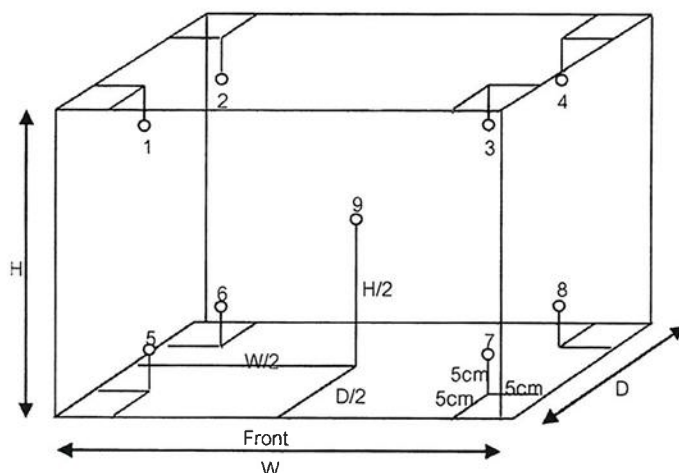
Page : 2 of 2

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%

- o0o -



EnviLab Co.,Ltd.

รับรองสำเนาถูกต้อง
ผู้จัดการฝ่ายค





MIRACLE INTERNATIONAL TECHNOLOGY CO.,LTD

214 Bangwack Rd. Bangpai Bangkae Bangkok 10160
Tel.: 0-2865-4647-8 Fax: 0-2865-4649 <http://www.mit.in.th>



CALIBRATION CERTIFICATE

Certificate No. : S2024080486-0001

Date Issued : 27-Aug-24

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

Equipment : Hydro Water Bath

Manufacturer : LAUDA

Model : -

Serial No. : CN21001882

ID No./Tag No. : ELABWBALPHA241

Date Received : 23-Aug-24

Date Calibrated : 23-Aug-24

Calibrated by : Akaladej Numnuan

Calibration Method or Calibration Procedure Used

In-house method : CP-14 base on ASTM E 715-80 (Reapproved 2011).

This certificate is traceable to national standards, which realize the units of measurement according to the International System of Units (SI).

Result of Calibration

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

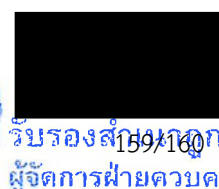
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Approved by:

Sarayuth T.
(Sarayuth Tochua)



Page 1 of 2



Certificate No. : S2024080486-0001

Environment : Ambient Temperature : Start record 25.4 °C, Stop record 25.5 °C
Relative Humidity : Start record 51.1 %RH, Stop record 51.2 %RH

Calibration Temperature (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Stability ¹ (°C)	Measured Uniformity ² (°C)	Overall Variation ³ (°C)
44.5	44.5	44.5	0.01	0.01	0.02

Without adjustment

Calibration Temperature (°C)	STD No. 1 (°C)	STD No. 2 (°C)	STD No. 3 (°C)	STD No. 4 (°C)	STD No. 5 (°C)	Uncertainty ⁴ (±°C)
44.5	44.51	44.50	44.50	44.51	44.51	0.18

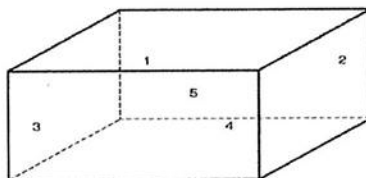
Decision Rule with Guard Band

Calibration Temperature (°C)	STD No. 1	STD No. 2	STD No. 3	STD No. 4	STD No. 5	MPE (±°C)
44.5	Pass	Pass	Pass	Pass	Pass	0.2

Pass = $|\text{error}| + |\text{uncertainty}| \leq |\text{MPE}|$ MPE = Maximum Permissible Error

Fail = $|\text{error}| + |\text{uncertainty}| > |\text{MPE}|$

Note : Probe No. 5 is Reference Probe



Condition As-Received : Used Item

The measurement results and statements of conformity with specification only relate to the item calibrated.

Measurement Standards Used & Traceability :

The International System of Units (SI) through

MIT Certificate No. L202403007-0010 for Digital Thermometer with Probe (Agilent) Module 1 (73) NTC, Pt1000 Serial No. MY44024042, Due 10-Sep-24

Notes : 1. The temperature stability is the one-half of greatest maximum difference of measured temperatures at any one probe.

2. The temperature uniformity is the maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time.

3. Overall variation is the difference of maximum and minimum measured temperatures throughout observation time.

4. The uncertainty of measurement is included temperature stability.

End of Certificate

Page 2 of 2