

## ภาคผนวกที่ 44

เอกสารรับรองการสอบเทียบของเครื่องมือตรวจวัด





# Certificate of Calibration

Method 5 Pre-Test Calibration - Liters (L)

## UUT Meter Console Information

Model #: XC-572-V  
Serial #: A2001003  
DGM Model #: SK25EX  
DGM Serial #: 00005796

## Calibration Conditions

Bar. Pressure (mm Hg): 759.8  
Ambient Temperature (°C): 24.8  
Relative Humidity (%): 55.0  
Altitude (m): 1.83  
Bar. Pressure Corr. (mm Hg): 759.7

## Factors/Conversions

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

## Reference Equipment

Calibration Meter Model: DGM-200H  
Cal. Due Date: 25-Jul-24  
Serial No.: 0000026  
Gamma: 1.0000

## UUT Meter (DGM)

Run Time	Office, ΔH (mm H <sub>2</sub> O)	Volume			Meter Temperature (°C)		Meter Pressure (mm H <sub>2</sub> O)	Reference Meter (WTM)			Outlet Temperature (°C)	
		Initial (L)	Final (L)	Total (L)	Initial	Final		Initial	Final	Total	Initial	Final
0	P <sub>avg</sub>	V <sub>m</sub>	V <sub>m</sub>	V <sub>m</sub>	t <sub>m</sub>	t <sub>m</sub>	P <sub>w</sub>	V <sub>wf</sub>	V <sub>wf</sub>	V <sub>w</sub>	t <sub>wf</sub>	t <sub>wf</sub>
830.00	13.00	701219.2	701370.2	151.0	25.0	25.0	0.3	0.00	157.49	157.49	25.0	25.0
600.00	25.00	701370.2	701524.0	153.8	25.0	25.0	0.5	0.00	158.64	158.64	25.0	25.0
450.00	50.00	701524.0	701690.6	166.6	26.0	26.0	0.6	0.00	170.76	170.76	25.0	25.0
450.00	80.00	701690.6	701901.2	210.6	26.0	27.0	2.0	0.00	215.91	215.91	25.0	25.0
300.00	120.00	701901.2	702073.0	171.8	27.0	28.0	2.4	0.00	178.06	178.06	25.0	25.0

## Standardized Data

Reference Meter (L)		UUT Meter (L)		Correction Factor		ΔH @ (mm H <sub>2</sub> O)		Variance
Std. Vol	Std. Flow	Std. Vol.	Std. Flow	Value	Variation	0.0212 SCMM	ΔH@	
	Q <sub>std</sub>	V <sub>m(std)</sub>	V <sub>w(std)</sub>	Y	ΔY	ΔH@	ΔH@	
0	11.20	148.59	11.2	1.0425	0.0096	46.1	1.267	
1	15.61	151.52	15.6	1.0303	-0.0026	45.7	0.878	
6	22.41	163.98	22.4	1.0249	-0.0079	44.3	-0.486	
4	28.43	207.53	28.4	1.0275	-0.0054	44.4	-0.401	
3	35.21	169.38	35.2	1.0392	0.0064	43.6	-1.258	
				1.0329	= Y Avg.	44.8	= ΔH@ Avg.	Metric

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

Note: For ΔH@, on-line pressure differential that equates to 0.0212m<sup>3</sup>/min at standard temperature and pressure, acceptable tolerance of individual values from the average is  $\pm 0.2$  inches (5.1mm) H<sub>2</sub>O.

Pass/Fail Judgment : **Pass**

Calibrate By: *Patricia J. Langer*

Approved By: *Kevin*

Date: 14 Feb 24

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



## Nomenclature

- $P_b$  - Barometric Pressure
- DGM - Dry Gas Meter
- $K_1$  - Constant based on standard temp and press
- $t$  - Run time, in minutes
- $P_a$  -  $\Delta H$  (Meter Pressure, gauge)
- $V_m$  - Volume collected by test meter, corrected for STP
- $Q_{m, std}$  - Calculated flow rate of test meter
- $K$  - Critical orifice coefficient
- $P_{ref}$  - Measured pressure of reference meter
- $T_r$  - Temperature measured in reference meter

## Equations

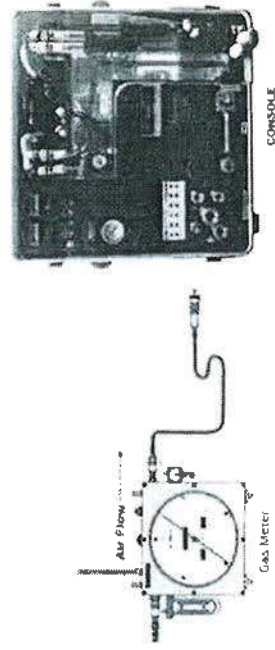
$$V_{m(std)} = V_m \cdot K_1 \cdot \frac{P_a \cdot (P_{bar} + \frac{\Delta H}{13.6})}{T_m}$$

$$K_1 = \frac{T_{std}}{P_{std}}$$

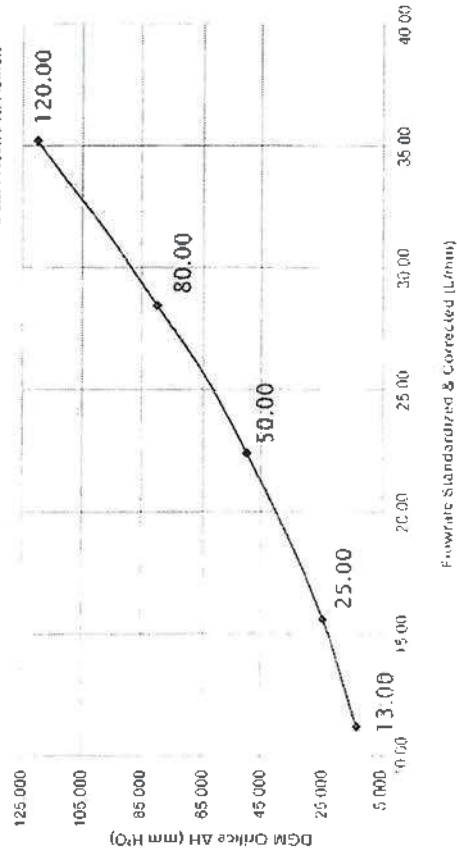
$$Q_{m(std)} = \frac{V_{m(std)}}{t}$$

$$\Delta H \text{ or } \Delta H_{ref} = \frac{P_{m,ref} \cdot (0.0011036 \cdot (P_{bar} + \frac{\Delta H_{ref}}{13.6}))}{T_m} \cdot \left( \frac{T_m \cdot \psi}{V_m \cdot P_{ref}} \right)^2$$

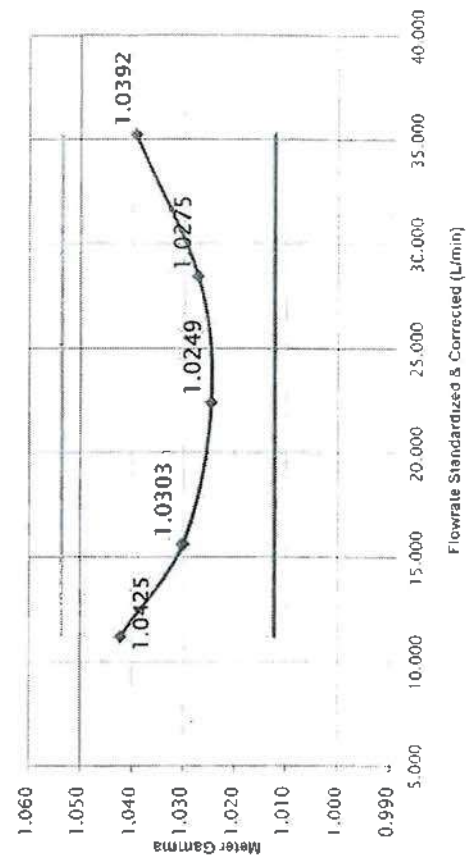
## Calibration Train



## Meter Pressure vs. Flowrate



## Meter Gamma vs. Flowrate





## Certificate of Calibration

Method 5 Console Sensor Calibration - Metric Units

### Console Information

Model #: XC-572-V  
Serial #: A2001003  
Units: Metnc

### Calibration Conditions

Pbar (mm. Hg): 759.8  
Humidity (%): 55  
Tamb (°C): 24.8  
Elevation (m): 1.8  
Corr. Pbar (mm. Hg): 759.7

### Reference Devices

TC Calibrator Model: CC-VTR-SH  
Reference #: 081109269  
Barometer Model: 736930  
Reference #: EBARODIALSPE01  
Pressure Model: 718 30G  
Reference #: 9543013

### Temperature Display Calibration Data

Reference Point <sup>1</sup>	Reference Temp.	Test Thermocouple Calibrations						Reference Point Status <sup>2</sup>
		Aux	Stack	Probe	Oven	Filter	Exit	
#	°C	°C	°C	°C	°C	°C	°C	Pass/Fail
1	-18	-17	-17	-17	-17	-17	-17	PASS
2	38	37	37	37	37	37	37	PASS
3	93	93	93	92	93	93	93	PASS
4	149	149	149	149	149	149	149	PASS
5	260	259	259	258	259	258	259	PASS
6	371	371	371	371	371	371	371	PASS
7	482	482	482	482	482	482	482	PASS
8	593	594	594	593	593	593	593	PASS
9	816	816	816	815	815	815	815	PASS
10	1038	1038	1038	1038	1038	1038	1038	PASS

Overall Audit Status

NIST Reference Thermocouple ID: 12702001

Ref Point	Theoretical Temp	DGM Thermocouple Sensor Reading	$\Delta T_{abs}$ <sup>4</sup>
#	°C	°C	°C
Ice Water	1	0.9	0.04%
Ambient <sup>3</sup>	2	24.8	0.04%

Maximum<sup>2</sup> 0.04%

Status PASS

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

Calibrate By :

*D. Thompson*

Approved By :

*Terrence*

Date

14 Feb 24

### Notes

<sup>1</sup> Suggested, minimum reference points are: 10 (0, 100, 200, 300, 500, 700, 900, 1100, 1300, 1500 °F) for test for more.

<sup>2</sup> For valid test results, the maximum difference between temperature and reference readings should be less than  $\pm 5.4$  F ( $\pm 3$  °C) for all thermocouples except for the stack thermocouple which should be less than  $\pm 1.5\%$  absolute temperature from the reference reading and the exit thermocouple which should be less than  $\pm 2$  F ( $\pm 1$  °C) from the reference reading. (EPA Method 2, Section 6.3 and EPA Method 3, Sections 6.1 & 7.6.1.1 d)

<sup>3</sup> Do not change this cell value. It is instead based on input from Cell H6 at the top of this sheet under "Calibration Conditions".

<sup>4</sup> Absolute temperature difference and other formulas are calculated based on unit input from cell C6 at the top of this sheet under "Meter Console Information".

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

<sup>6</sup> For valid test results, the maximum difference between console and reference vacuum readings should be less than  $\pm 0.3$  m. Hg ( $\pm 2.5$  mm Hg).

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

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# **neediss Console Sensor Calibration Data Sheet**

## Console Information

Model #: XC-572-V  
Serial #: A2001003  
Units: Metric  
Type: "English"

## Calibration Conditions

Pbar (mm. Hg): 759.8  
Humidity (%): 55.0  
Tamb (°C): 24.8  
Corr. Pbar (mm. Hg): 759.7

## Reference Devices

TC Simulator Model: CC-VTR-SH  
Reference #: 091109269  
Barometer Model: 736930  
Reference #: EBARODIALSPE01  
Digital Pressure Calibrator Model: 718 30G  
Reference #: 3891001

## Pressure Gauge / Manometer Calibration Data

Console Vacuum Calibration			
Reference Point	Reference Vacuum	Console Vacuum	Reference Point Status <sup>6</sup>
#	in. Hg	in. Hg	Pass/Fail
1	-5.0	-4.5	PASS
2	-15.0	-14.5	PASS
3	-20.0	-19.5	PASS

Reference Point <sup>1</sup>	ΔH Manometer Calibration			Reference Point Status <sup>2</sup>
	Reference	Positive (+) Pitot	Negative (-) Pitot	
#	mm H <sub>2</sub> O	mm H <sub>2</sub> O	mm H <sub>2</sub> O	Pass/Fail
1	-200.000	0.0	-200.0	PASS
2	-150.000	0.0	-150.0	PASS
3	-100.000	0.0	-100.0	PASS
4	-80.000	0.0	-80.0	PASS
5	-50.000	0.0	-50.0	PASS
6	0.000	0.0	0.0	PASS
7	50.000	50.0	0.0	PASS
8	80.000	80.0	0.0	PASS
9	100.000	100.0	0.0	PASS
10	150.000	150.0	0.0	PASS
11	200.000	200.0	0.0	PASS
ΔH Overall Audit Status				PASS

Reference Point <sup>1</sup>	ΔP Manometer Calibration			Reference Point Status <sup>2</sup>
	Reference	Positive (+) Pitot	Negative (-) Pitot	
#	mm H <sub>2</sub> O	mm H <sub>2</sub> O	mm H <sub>2</sub> O	Pass/Fail
1	-200.000	0.0	-200.0	PASS
2	-150.000	0.0	-150.0	PASS
3	-100.000	0.0	-100.0	PASS
4	-80.000	0.0	-80.0	PASS
5	-50.000	0.0	-50.0	PASS
6	0.000	0.0	0.0	PASS
7	50.000	50.0	0.0	PASS
8	80.000	80.0	0.0	PASS
9	100.000	100.0	0.0	PASS
10	150.000	150.0	0.0	PASS
11	200.000	200.0	0.0	PASS
ΔP Overall Audit Status				PASS

Calibrate By:

*Pattinson*

Approved By

*Tamir*

Date:

14 Feb 24

## Notes

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

<sup>2</sup> For valid test results, the maximum difference between temperature and reference readings should be less than ±5.0 (±3.3 °C) for all thermocouples except for the stack thermocouple which should be less than ±1.5% absolute temperature from the reference reading and for the thermocouple which should be less than ±2.0 (±1.1 °C) from the reference reading (EPA Method 2, Section 5.3 and EPA Method 5, Section 4.2.1).

<sup>3</sup> Do not change this cell. The value should be based on input from Cell B6 at the top of this sheet under "Calibration Conditions".

<sup>4</sup> Absolute temperature difference and difference should be calculated based on input from Cell C6 at the top of this sheet under "Meter Console Information".

<sup>5</sup> For valid test results, the maximum difference between positive and negative reference pressure readings should be less than ±0.1 in. Hg (±2.5 mm Hg) (EPA Method 5, Section 4.2.1).

<sup>6</sup> For valid test results, the maximum difference between positive and negative vacuum readings should be less than ±0.1 in. Hg (±2.5 mm Hg) (EPA Method 5, Section 4.2.1).

<sup>7</sup> For valid test results, the maximum difference between positive and negative vacuum readings should be less than ±0.1 in. Hg (±2.5 mm Hg) (EPA Method 5, Section 4.2.1).

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Neediss Supply Corporation



## Console Sensor Audit QA Sheet

### Meter Console Information (UUT)

Model #: XC-572-V  
Serial #: A2001003  
Units: Metric

### Calibration Conditions

Pbar (mm. Hg): 759.8  
Humidity (%): 55.0  
Amb. Temp. (°C): 24.8  
Altitude (m): 1.8  
Corrected Pbar (mm. Hg): 759.7

### Reference Devices

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

### Audit Data

Reference Point	Reference Temp.	Thermocouple Probe Audit						Reference Point Status <sup>1</sup>
		Aux	Stack	Probe	Oven	Filter	Exit	
	°C	°C	°C	°C	°C	°C	°C	Pass/Fail
Ambient	24.4	25	25	24	25	24	25	PASS
Ice Water	1.4	1	1	1	1	1	1	PASS

### Audit Data

Console Vacuum Audit			
Reference Point	Reference Vacuum	Console Vacuum	Reference Point Status <sup>3</sup>
#	in. Hg	in. Hg	Pass/Fail
1	-17.0	-16.5	PASS

Calibrate By: Pattanaiporn P. Approved By: Tamir Date: 14 Feb 24

### Notes

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

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

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

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

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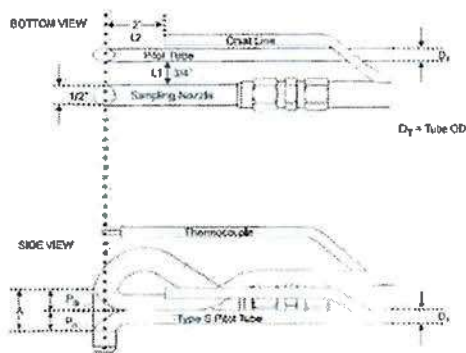
# neediss Sampling Probe and Pitot Validation

## Sampling System Equipment Information

Probe Sheat	Apex 1 in. , 5 ft.
Probe Number	w1906152
Pitot tube Number	A8777
Pitot tube Type	S Type 3/8 Inc.
Validation method	Standard Probe 1 in. and 1/2 in. Sampling Nozzle

## Valibration Conditions and Equipment

Digital Callipers	CD-15APX
Reference No.	A22070181
Digital Inclnometer	BASELINE
Reference No.	FEI 12-1057
Temperature	24.8 °C±3
Barometric Pressure	759.8 mm Hg



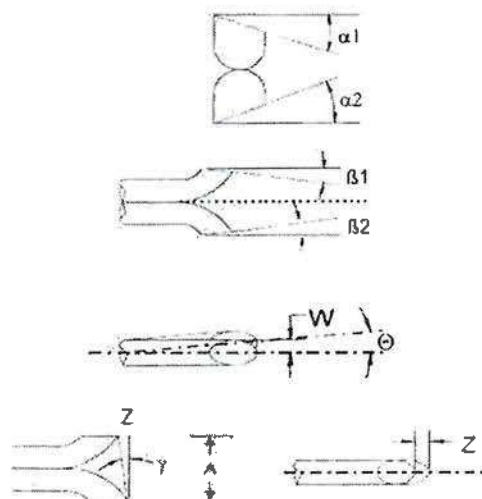
## Sampling Probe Validation with Tune up

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

Measured	Standard Range
$L_1 =$	1.91 cm. ( 1.905 cm. or 3/4 in. )
$L_2 =$	5.00 cm. ( 5.08 cm. or 2.0 in. )
$D_T =$	0.961 cm. ( 3/8 in. )
$A =$	2.05 cm. ( 2.1 $D_T \leq A \leq 3D_T$ )
$A/2D_T =$	1.067 cm. ( 1.05 $P_A / D_T \leq A \leq 1.5$ )

## Pitot Tube Validations and Engles measurement Result

☒ Measure Result after Maintanance and Adjustable



$P_B$ Size	Standard Range
$\alpha_1 =$	$2.30^\circ \leq 10^\circ$
$\beta_1 =$	$-2.10^\circ \leq 5^\circ$
$P_A$ Size	
$\alpha_2 =$	$-0.70^\circ \leq 10^\circ$
$\beta_2 =$	$-0.90^\circ \leq 5^\circ$

Engles measurement	Calculated Result	Standard Range
$W = 0.80^\circ$	0.029 cm.	$W < 0.08 \text{ cm ( 1/32 in. )}$
$Z = -0.40^\circ$	-0.014 cm.	$Z < 0.032 \text{ cm ( 1/8 in. )}$

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

Validation By: Pattangam P. Approved By: Tamir Date: 14 Feb 24



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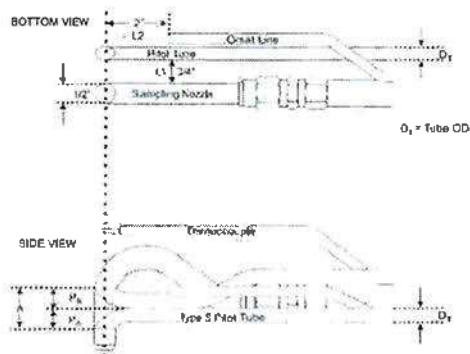
## Sampling Probe and Pitot Validation

## Sampling System Equipment Information

Probe Sheat	Apex 1 in. , 3 ft.
Probe Number	w2001490
Pitot tube Number	A8996
Pitot tube Type	S Type 3/8 Inc.
Validation method	Standard Probe 1 in. and 1/2 in. Sampling Nozzle

## Validation Conditions and Equipment

Digital Callipers	CD-15APX
Reference No.	A22070181
Digital Inclinator	BASELINE
Reference No.	FEI 12-1057
Temperature	24.8 °C ± 3
Barometric Pressure	759.8 mm Hg

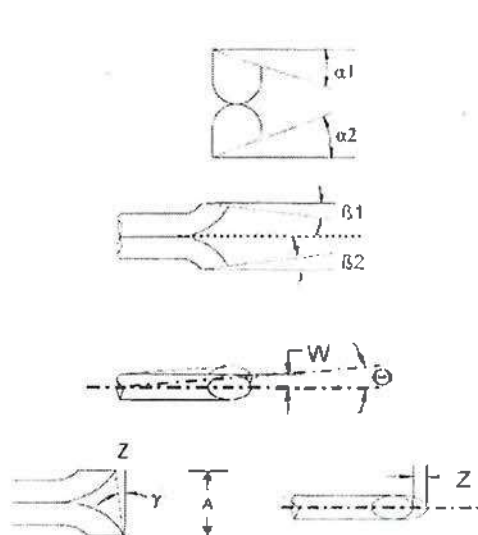


## Sampling Probe Validation with Tune up

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

Measured	Standard Range	
$L_1 =$	1.91 cm.	( 1.905 cm. or 3/4 in. )
$L_2 =$	4.99 cm.	( 5.08 cm. or 2.0 in. )
$D_1 =$	0.962 cm.	( 3/8 in. )
$A =$	2.08 cm.	( 2.1 $D_1 \leq A \leq 3 D_1$ )
$A/2 D_1 =$	1.081 cm.	( 1.05 $P_A / D_1 \leq A \leq 1.5$ )

## Pitot Tube Validations and Engles measurement Result

☒ : Measure Result after Maintenance and Adjustable

$P_A$ Size	Standard Range	
$\alpha_1 =$	-1.30 °	$\leq 10^\circ$
$\beta_1 =$	1.20 °	$\leq 5^\circ$
$P_A$ Size		
$\alpha_2 =$	3.60 °	$\leq 10^\circ$
$\beta_2 =$	1.90 °	$\leq 5^\circ$

Engles measurement	Calculated Result	Standard Range
$W =$ 0.40 °	0.015 cm.	$W < 0.08 \text{ cm ( 1/32 in. )}$
$Z =$ 1.10 °	0.040 cm.	$Z < 0.032 \text{ cm ( 1/8 in. )}$

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

Validation By:

*Dattaprasad P.*

Approved By:

*Tamir*

Date:

14 Feb 24



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## Nozzle Validation

### Samplig System Equipment Information

Console Model	XC-572-V
Console Number	A2001003
DGM Model	SK25EX
DGM Number	00005796

### Validation Conditions

Digital Calipers	CD-15APX
Reference No	A22070181
Temperatute	24.8 °C±3
Barometric Pressure	759.8 mm Hg

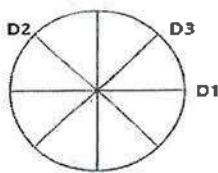
Validation Data					Results	
Nozzle ID	Nozzle Diameter				Different	$(D_1 + D_2 + D_3) / 3$
Sizes		D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	ΔD	D <sub>avg</sub>
	mm	mm	mm	mm	mm	mm
NS-5	3.96	3.96	3.96	3.97	0.006	3.963
NS-6	4.77	4.76	4.76	4.77	0.006	4.763
NS-10	7.92	6.35	6.36	6.36	0.006	6.357
NS-11	8.71	8.72	8.72	8.73	0.006	8.723
NS-13	10.31	10.32	10.32	10.31	0.006	10.317
NS-15	11.88	11.88	11.88	11.87	0.006	11.877
NS-17	13.48	13.48	13.47	13.48	0.006	13.477

Where :

D1, D2, D3 = There difference nozzle diamiters , mm ; diameter must be within 0.025 mm

Δ D = Maximum difference between any two diameters, must be ≤ 0.100 mm

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



Validation By:

*Pattaraporn P.*

Approved By:

*Tamir*

Date:

14 Feb 24



Needles Supply Instrument Co., Ltd.





## Certificate of Calibration

Method 5 Pre-Test Calibration - Liters (L)

### UUT Meter Console Information

Model #: 800-STACKS-5  
Serial #: 1837  
DGM Model #: GB/T6968-2011  
DGM Serial #: L1500033637

### Calibration Conditions

Bar. Pressure (mm Hg): 758.5  
Ambient Temperature (°C): 26.4  
Relative Humidity (%): 54  
Altitude (m): 1.83  
Bar. Pressure Corr. (mm Hg): 758.3

### Factors/Conversions

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

### Reference Equipment

Calibration Meter Model: DGM-R-200H  
Cal. Due Date: 25-Jul-24  
Serial No.: 0000026  
Gamma: 1.0000

### UUT Meter (DGM)

Run Time (seconds)	Orifice, ΔH (mm H <sub>2</sub> O)	Volume		Meter Temperature (°C)		Meter Pressure (mm H <sub>2</sub> O)	Reference Meter (WTM)		
		Initial (L)	Final (L)	Initial	Final		Initial	Final	Total
Θ	P <sub>mtg</sub>	V <sub>mt</sub>	V <sub>mf</sub>	t <sub>mt</sub>	t <sub>mf</sub>	P <sub>w</sub>	V <sub>wt</sub>	V <sub>wf</sub>	V <sub>w</sub>
840.00	13.00	605939.7	606104.2	26.0	26.0	0.3	0.00	153.63	153.63
630.00	25.00	606104.2	606274.7	25.0	26.0	0.5	0.00	158.84	158.84
450.00	50.00	606274.7	606446.5	26.0	26.0	0.6	0.00	161.39	161.39
360.00	80.00	606446.5	606620.4	26.0	26.0	2.0	0.00	164.05	164.05
318.00	120.00	606620.4	606801.0	26.0	26.0	2.4	0.00	172.35	172.35

### Standardized Data

Reference Meter (L)	UUT Meter (L)		Correction Factor		ΔH @ (mm H <sub>2</sub> O)	
	Std. Flow	Std. Vol.	Value	Variance	0.0212 SCMM	ΔH @
Q <sub>w</sub> (std)	V <sub>mt</sub> (std)	V <sub>mf</sub> (std)	Y	ΔY	ΔH @	ΔH @
10.74	161.05	10.7	0.9334	-0.0042	49.9	-0.781
14.81	167.39	14.8	0.9290	-0.0087	50.6	-0.044
21.07	168.79	21.1	0.9363	-0.0014	50.1	-0.592
26.86	171.35	26.9	0.9407	0.0030	49.8	-0.893
31.98	178.64	32.0	0.9489	0.0113	53.0	2.311
			0.9377	= Y Avg.	50.7	= ΔH @ Avg. Metric

Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is  $\pm 0.02$ .  
Note: For ΔH @, critical pressure differential that equates to 0.0212 m<sup>3</sup>/min at standard temperature and pressure, acceptable tolerance of individual values from the average is  $\pm 0.2$  inches (5.1 mm) H<sub>2</sub>O.

Pass/Fail Judgment : **Pass**

Calibrate By: *Dattangpan P.*

Approved By: *Toms*

Date: 9 Apr 24

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

**neediss**

For more information, contact us at 06-01-00

## Nomenclature

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

## Equations

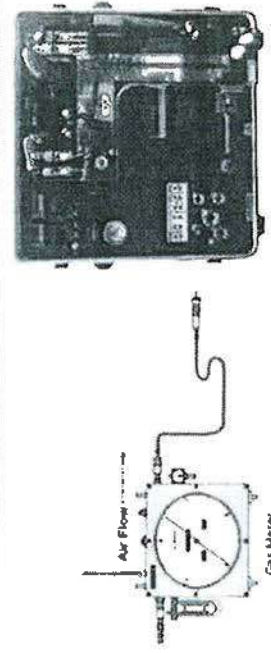
$$V_{m(std)} = V_r \times K_1 \frac{V_w \times (P_{bar} + \frac{P_{max}}{13.6})}{T_w}$$

$$K_1 \frac{V_r (P_{bar} + \frac{\Delta H}{13.6})}{T_w} = \frac{V_{m(std)}}{V_{m(std)}} \quad Q_{m(std)} = \frac{V_{m(std)}}{t}$$

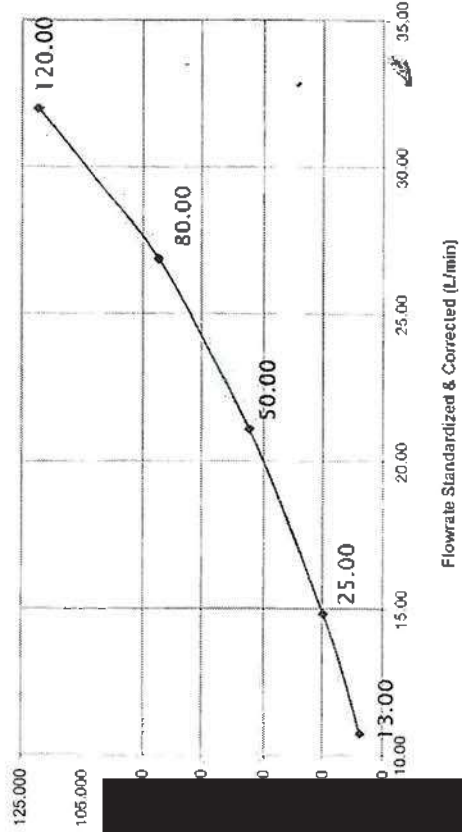
$$K_1 = \frac{T_{std}}{P_{std}} \quad Y = \frac{V_{m(std)}}{V_{m(std)}} \quad Q_{m(std)} = \frac{V_{m(std)}}{t}$$

$$Meter \Delta H_r = \frac{P_{m(r)} + 0.0011696 \times (P_{bar} + \frac{P_{max}}{13.6})}{T_w} \left( \frac{T_w \times t}{V_{m(r)} P_{m(r)}} \right)^2$$

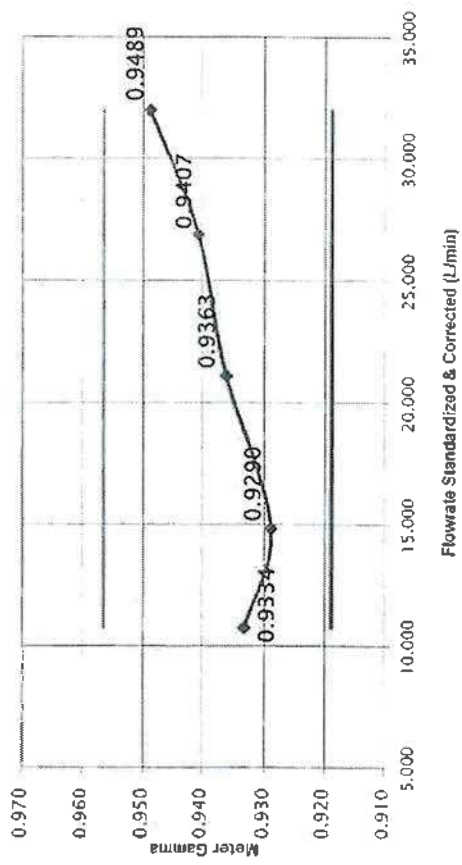
## Calibration Train



Meter Pressure vs. Flowrate



Meter Gamma vs. Flowrate







## Certificate of Calibration

Method 5 Console Sensor Calibration - Metric Units

### Console Information

Model #: 800-STACKS-5  
Serial #: 1837  
Units: Metric

### Calibration Conditions

Pbar (mm. Hg): 758.5  
Humidity (%): 54  
Tamb (°C): 26.4  
Elevation (m): 1.8  
Corr. Pbar (mm. Hg): 758.3

### Reference Devices

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

### Temperature Display Calibration Data

Reference Point <sup>1</sup>	Reference Temp.	Test Thermocouple Calibrations					Reference Point Status <sup>2</sup>
		Stack	Probe	Filter	Exit	Aux	
#	°C	°C	°C	°C	°C	°C	Pass/Fail
1	-18	-17	-17	-17	-17	-17	PASS
2	38	37	36	37	37	37	PASS
3	93	93	93	93	93	92	PASS
4	149	149	149	149	149	149	PASS
5	260	259	258	258	259	259	PASS
6	371	371	371	371	371	371	PASS
7	482	482	482	482	481	481	PASS
8	593	593	593	593	592	592	PASS
9	816	815	815	816	815	815	PASS
10	1038	1038	1037	1037	1037	1038	PASS

PASS

Overall Audit Status

NIST Reference Thermocouple ID:

12702001

	Ref Point	Theoretical Temp.	DGM Thermocouple Sensor Reading	$\Delta T_{abs}$ <sup>4</sup>
	#	°C	°C	°C
Ice Water	1	0.9	1	0.04%
Ambient <sup>3</sup>	2	26.4	25	0.29%

Maximum<sup>2</sup> 0.29%

Status PASS

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

Calibrate By:

*Pullman P*

Approved By:

*Towin*

Date:

9 Apr 24

### Notes

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

<sup>2</sup> For valid test results, the maximum difference between temperature and reference readings should be less than  $\pm 5.4$  °F ( $\pm 3$  °C), for all thermocouples except for the stack thermocouple which should be less than  $\pm 1.5$  % absolute temperature from the reference reading and the exit thermocouple which should be less than  $\pm 2$  °F ( $\pm 1$  °C) from the reference reading (EPA Method 2, Section 6.3 and EPA Method 5, Sections 5.1.1.7-5.1.1.8)

<sup>3</sup> Do not change this cell value, it is instead based on input from Cell H6 at the top of this sheet under "Calibration Conditions"

<sup>4</sup> Absolute temperature difference and other formulas are calculated based on unit input from cell C6 at the top of this sheet under "Meter Console Information"

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

<sup>6</sup> For valid test results, the maximum difference between console and reference vacuum readings should be less than  $\pm 0.1$  in. Hg ( $\pm 2.5$  mm Hg), (EPA Method 5, Section 6.1.2)

<sup>7</sup> For valid test results, the maximum difference between console and reference vacuum readings should be less than  $\pm 0.1$  in. Hg ( $\pm 2.5$  mm Hg), (EPA Method 5, Section 6.1.2)



Neediss Supply Instrument Co., Ltd.





# neediss Console Sensor Calibration Data Sheet

## Console Information

Model #: 800-STACKS-5  
Serial #: 1837  
Units: Metric  
Type: "English"

## Calibration Conditions

Pbar (mm. Hg): 758.5  
Humidity (%): 54.0  
Tamb (°C): 26.4  
Corr. Pbar (mm. Hg): 758.3

## Reference Devices

TC Simulator Model: CC-VTR-SH  
Reference #: 091109269  
Barometer Model: 736930  
Reference #: EBARODIALSPE01  
Digital Pressure Calibrator Model: 718 30G  
Reference #: 3891001

## Pressure Gauge / Manometer Calibration Data

Console Vacuum Calibration			
Reference Point	Reference Vacuum	Console Vacuum	Reference Point Status <sup>1</sup>
#	in. Hg	in. Hg	Pass/Fail
1	-5.0	-4.5	PASS
2	-15.0	-14.5	PASS
3	-20.0	-19.5	PASS

Reference Point <sup>1</sup>	ΔH Manometer Calibration			Reference Point Status <sup>2</sup>
	Reference mm H2O	Positive (+) Pitot mm H2O	Negative (-) Pitot mm H2O	
#				Pass/Fail
1	-200.000	0.0	-200.0	PASS
2	-150.000	0.0	-150.0	PASS
3	-100.000	0.0	-100.0	PASS
4	-80.000	0.0	-80.0	PASS
5	-50.000	0.0	-50.0	PASS
6	0.000	0.0	0.0	PASS
7	50.000	50.0	0.0	PASS
8	80.000	80.0	0.0	PASS
9	100.000	100.0	0.0	PASS
10	150.000	150.0	0.0	PASS
11	200.000	200.0	0.0	PASS
ΔH Overall Audit Status				PASS

Reference Point <sup>1</sup>	ΔP Manometer Calibration			Reference Point Status <sup>2</sup>
	Reference mm H2O	Positive (+) Pitot mm H2O	Negative (-) Pitot mm H2O	
#				Pass/Fail
1	-200.000	0.0	-200.0	PASS
2	-150.000	0.0	-150.0	PASS
3	-100.000	0.0	-100.0	PASS
4	-80.000	0.0	-80.0	PASS
5	-50.000	0.0	-50.0	PASS
6	0.000	0.0	0.0	PASS
7	50.000	50.0	0.0	PASS
8	80.000	80.0	0.0	PASS
9	100.000	100.0	0.0	PASS
10	150.000	150.0	0.0	PASS
11	200.000	200.0	0.0	PASS
ΔP Overall Audit Status				PASS

Calibrate By: Patricia P. Approved By: Terence Date: 9 Apr 24

## Notes

- <sup>1</sup> Suggested, minimum reference points are 10 (0, 100, 200, 300, 500, 700, 900, 1100, 1500, 1900 °F), can test for more.
- <sup>2</sup> For valid test results, the maximum difference between temperature and reference readings should be less than ±5.4 °F (±3 °C), for all thermocouples except for the stack thermocouple which should be less than ±1.5% absolute temperature from the reference reading and the exit thermocouple which should be less than ±2 °F (±1 °C) from the reference.
- <sup>3</sup> Do not change this cell value, it is instead based on input from Cell H8 at the top of this sheet under "Calibration Conditions".
- <sup>4</sup> Absolute temperature difference and other formulas are calculated based on unit input from cell C8 at the top of this sheet under "Meter Console Information".
- <sup>5</sup> For valid test results, the maximum difference between console and reference vacuum readings should be less than ±0.5 mm Hg.
- <sup>6</sup> For valid test results, the maximum difference between console and reference vacuum readings should be less than ±0.5 mm Hg.
- <sup>7</sup> I certify that the above Thermocouple Sensors were calibrated in accordance with US 10 CFR 201.61.



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neediss Supply International Inc.

# **neediss** Console Sensor Audit QA Sheet

## **Meter Console Information (UUT)**

Model #: 800-STACKS-5  
 Serial #: 1837  
 Units: Metric

## **Calibration Conditions**

Pbar (mm. Hg): 758.5  
 Humidity (%): 54  
 Amb. Temp. (°C): 26.4  
 Altitude (m): 1.8  
 Corrected Pbar (mm. Hg): 758.3

## **Reference Devices**

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

## **Audit Data**

Reference Point	Reference Temp.	Thermocouple Probe Audit					Reference Point Status <sup>1</sup>
		Stack	Probe	Filter	Exhl.	Aux.	
	°C	°C	°C	°C	°C	°C	Pass/Fail
Room	26.4	26	26	26	26	26	PASS
Ice Water	0.9	1	1	1	1	1	PASS

## **Console Vacuum Audit**

Reference Point	Reference Vacuum	Console Vacuum	Reference Point Status <sup>2</sup>
#	in. Hg	in. Hg	Pass/Fail
1	17.0	16.5	PASS

Calibrate By: Dhanan P. Approved By: Tavis Date: 9 Apr 24

## **Notes**

<sup>1</sup>For valid test results, the maximum difference between test and reference readings should be less than 5.4 °F (3 °C), for all thermocouples except for the stack thermocouple which should be less than 1.5% absolute temperature from the reference reading and the exit thermocouple which should be less than 2°F (1 °C) from the reference reading (EPA Method 2, Section 6.3 and EPA Method 5, Sections 6.1.1, 7-6, 1.1.6)

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

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

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

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



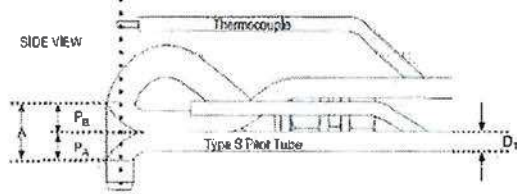
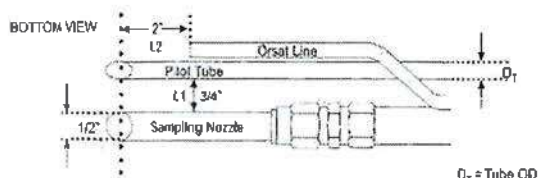
# neediss Sampling Probe and Pitot Validation

## Sampling System Equipment Information

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

## Validation Conditions and Equipment

Digital Calipers	CD-15APX
Reference No.	A22070181
Digital Inclinator	BASELINE
Reference No.	FEI 12-1057
Temperature	26.4 °C±3
Barometric Pressure	758.5 mm Hg



## Sampling Probe Validation with Tune up

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

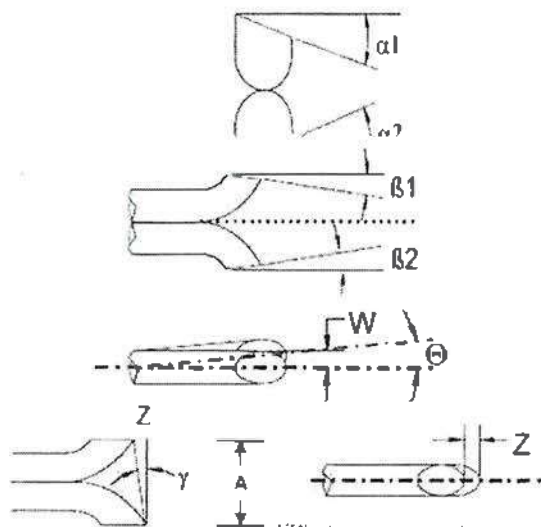
Measured	Standard Range
$L_1 =$ 1.92 cm.	( 1.905 cm or 3/4 in. )
$L_2 =$ 4.99 cm.	( 5.08 cm. or 2.0 in. )
$D_T =$ 0.961 cm.	( 3/8 in. )
$A =$ 2.16 cm.	( $2.1 D_T \leq A \leq 3D_T$ )
$A/2D_T =$ 1.134 cm.	( $1.05 P_A / D_T \leq A \leq 1.5$ )

## Pitot Tube Validations and Engles measurement Result

☒ : Measure Result after Maintenance and Adjustable

$P_B$ Size	Standard Range
$\alpha_1 =$ -0.30 °	$\leq 10^\circ$
$\beta_1 =$ 2.25 °	$\leq 5^\circ$
$P_A$ Size	Standard Range
$\alpha_2 =$ -0.50 °	$\leq 10^\circ$
$\beta_2 =$ 1.70 °	$\leq 5^\circ$

Engles measurement	Calculated Result	Standard Range
$W =$ 0.40 °	0.015 cm	$W < 0.08 \text{ cm ( 1/32 in. )}$
$Z =$ 1.60 °	0.061 cm	$Z < 0.032 \text{ cm ( 1/8 in. )}$



if the type or face-opening misalignment show above with not affect the base line value of  $C_p(s)$  Solong as standard range

Validation By:

*Rathnaman P.*

Approved By:

*Tamir*

Date:

9 Apr 24



## Nozzle Validation

### Sampling System Equipment Information

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

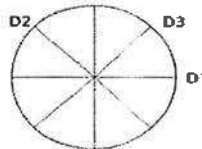
### Validation Conditions

Digital Calipers	CD-15APX
Reference No	A22070181
Temperature	24.8 °C ±3
Barometric Pressure	759.8 mm Hg

Validation Data					Results	
Nozzle ID	Nozzle Diameter				Different	$(D_1 + D_2 + D_3) / 3$
Sizes		D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	ΔD	D <sub>avg</sub>
	mm	mm	mm	mm	mm	mm
NS-4	3.17	3.18	3.18	3.17	0.006	3.177
NS-7	5.30	5.32	5.32	5.32	0.000	5.320
NS-9	7.13	7.11	7.12	7.12	0.006	7.117
NS-10	7.92	7.95	7.95	7.94	0.006	7.947
NS-12	9.52	9.53	9.52	9.53	0.006	9.527
NS-14	11.09	11.11	11.10	11.11	0.006	11.107
NS-16	12.70	12.70	12.68	12.70	0.012	12.693

Where :

- D<sub>1</sub>, D<sub>2</sub>, D<sub>3</sub> = There difference nozzle diameters . mm : diameter must be within 0.025 mm  
Δ D = Maximum difference between any two diameters, must be ≤ 0.100 mm  
D avg =  $(D_1 + D_2 + D_3) / 3$



Validation By:

*Pattamaporn P.*

Approved By:

*Teevins*

Date:

9 Apr 24



Neediss Supply Distribution Co., Ltd.







## Verification Test Report

### Instruments Information

Page:1/2

Analyzer Type: Flue Gas Analyser  
Model: Optima7

Manufacturer: MRU  
Serial No.: 320779

### Calibration Gas information

#### Standard Gas Mid Range

O2 Conc 2.2 %vol.  
Cd/Ex: 343014/Jul 24,2025  
CO Conc 99.94 ppm  
NO Conc 99.69 ppm  
NOX Conc 99.76 ppm  
SO2 Conc 100.5 ppm  
CO2 Conc 8.054 %  
Cd/Ex: ED5716/May 16,2030

#### Standard Gas High Range

O2 Conc 10.22 %vol.  
Cd/Ex: 343018/Jan 10,2025  
CO Conc 594.5 ppm  
NO Conc 197.2 ppm  
NOX Conc 197.2 ppm  
SO2 Conc 200.9 ppm  
CO2 Conc 16.02 %  
Cd/Ex: ND7514/Jun 21,2030

Environment: Temperature 25.8 °C Humidity: 47 %RH

#### SO2 calibration test

Set point	Std.gas (ppm)	Before Adj Reading(ppm)	After Adj Reading(ppm)	Difference	% error
Low/Zero	0.0	0	0	0.0	0.0
Mid	100.5	92	100	-0.5	-0.5
Hight	200.9	194	201	0.1	0.0

#### NO calibration test

Set point	Std.gas (ppm)	Before Adj Reading(ppm)	After Adj Reading(ppm)	Difference	% error
Low/Zero	0.0	0	0	0.0	0.0
Mid	99.69	90	100	0.3	0.3
Hight	197.2	182	200	2.8	1.4

#### NOX calibration test

Set point	Std.gas (ppm)	Before Adj Reading(ppm)	After Adj Reading(ppm)	Difference	% error
Low/Zero	0.0	0	0	0.0	0.0
Mid	99.76	91	100	0.2	0.2
Hight	197.2	190	200	2.8	1.4

#### CO2 calibration test

Set point	Std.gas (ppm)	Before Adj Reading(ppm)	After Adj Reading(ppm)	Difference	% error
Low/Zero	0.0	0	0	0.0	0.0
Mid	8.054	9.05	8.07		
Hight	16.0	17.68	15.97		



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

536 ซอยบางพลี 7 แขวงบางพลี เขตบางพลี กรุงเทพมหานคร 10160 536 Soi Bangkhoe 7 Bangkhoe Bangkok  
Tel: 02-801-5910-2 Fax: 02-802-7988 E-mail: info@neediss.com



## Verification Test Report

### Instruments Information

Page:2/2

Analyzer Type: Flue Gas Analyser  
Model: Optima7

Manufacturer: MRU  
Serial No.: 320779

### Calibration Gas information

#### Standard Gas Mid Range

O2 Conc 2.2 %vol.  
Cd/Ex: 343014/Jul 24,2025  
CO Conc 99.94 ppm  
NO Conc 99.69 ppm  
NOX Conc 99.76 ppm  
SO2 Conc 100.5 ppm  
CO2 Conc 8.054 %  
Cd/Ex: ED5716/May 16,2030

#### Standard Gas High Range

O2 Conc 10.22 %vol.  
Cd/Ex: 343018/Jan 10,2025  
CO Conc 594.5 ppm  
NO Conc 197.2 ppm  
NOX Conc 197.2 ppm  
SO2 Conc 200.9 ppm  
CO2 Conc 16.02 %  
Cd/Ex: ND7514/Jun 21,2030

Environment: Temperature 25.8 °C Humidity: 47 %RH

#### CO calibration test

Set point	Std.gas (ppm)	Before Adj Reading(ppm)	After Adj Reading(ppm)	Difference	% error
Low/Zero	0.0	0	0	0.0	0.0
Mid	99.94	101	99	-0.9	-0.9
Hight	594.5	607	601	6.5	1.1

#### O2 calibration test

Set point	Std.gas (ppm)	Before Adj Reading(ppm)	After Adj Reading(ppm)	Difference	% error
Low/Zero	0.0	0	0	0.0	0.0
Mid	2.2	2.2	2.2	0.0	0.0
Hight	10.22	10.21	10.21	0.0	-0.1

#### Note

Technical Data Calibration results.:Calibration reading response discrepancy

O2 parameter  $\pm 0.2$  Vol-% at Range 0-21 Vol-%  
CO2 parameter  $\pm 0.3$  Vol-% at Range 0-CO2 Max  
CO parameter  $\pm 5$  % at Range 0-500  
NO parameter  $\pm 5$  % at Range 0-100  
NO2 parameter  $\pm 5$  % at Range 0-100  
SO2 parameter  $\pm 5$  % at Range 0-200

Calibrate By :

*Pattanasorn P.*

Approve By :

*PPH*

Date:

26 Feb 24

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## Certificate of Calibration

**Certificate No. :** 67-200060-1

**Page : 1 of 2**

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

**Equipment :** Electronic Balance

**Manufacturer :** Sartorius **Model :** SECURA125-1S  
**Serial No. :** 0034606552 **ID No. :** ELABBALANCEN05  
**Capacity :** 120 g **Resolution :** 0.0001 g

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

**Ambient Temperature :** (20.0 to 20.7) °C

**Relative Humidity :** (56.2 to 60.3) %

**Air Pressure :** 1013.0 mbar

**Date of Received :** 20 February 2024

**Date of Calibration :** 20 February 2024

**Date of Issue :** 21 February 2024

**Calibrated by :** Satja Sangkhum

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

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

Standard Weights

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

Approved by :

( 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

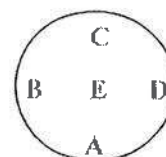
This result of calibration was found accurate as shown on date and place of calibration only.

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

- o o o -





# CAL

Calibratech Co.,Ltd.

7/106-7 Moo 2, Sukhaphrachasan 3 Rd., Bangpuod, 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. :** 67-410025-1

**Page : 1 of 2**

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

**Equipment :** Digital Thermo-Hygrometer

**Manufacturer :** Jedto

**Model :** HTC-1

**Range Temperature :** N/A °C

**Resolution :** 0.1 °C

**Range Humidity :** N/A %R.H.

**Resolution :** 1 %R.H.

**Serial No. :** PONPE5852094

**ID No. :** ELABTMITFC10003

**Environment :** Ambient Temperature : (23 ± 2) °C  
Relative Humidity : (50 ± 15) %

**Date of Received :** 20 February 2024

**Date of Calibration :** 22 February 2024

**Date of Issue :** 22 February 2024

**Calibrated by :** Chortip Samchusri

**Calibration Method :** This instrument was calibrated by In-house method comparison technique CAL-M4013 by compared with standard probe sensor humidity/temperature into humidity/temperature chamber.

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

Digital Indicator with Standard Probe Temp&Hum

ID No.	Cert. No.	Due Date	Traceability
400034 & 400035	SG-H-00020/67	05 Jul 2024	Success Gateway Co., Ltd., Accredited by TISI Calibration No.0268

Approved by :

( Surachai Promthong )

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full except with the prior written approval of the Calibratech Co.,Ltd.



## Certificate of Calibration

**Certificate No. :** 67-410025-1

**Page :** 2 of 2

**UUC Condition As-Received :** Good

**Result of Calibration :** Without Adjustment

**Function :** Temperature measurement

Reference Humidity @ 50 %R.H.

Standard Temperature ( $^{\circ}\text{C}$ )	UUC Reading ( $^{\circ}\text{C}$ )	Correction ( $^{\circ}\text{C}$ )	Uncertainty ( $\pm^{\circ}\text{C}$ )
24.98	25.0	0.0	0.46

**Result of Calibration :** Without Adjustment

**Function :** Humidity measurement

Reference Temperature @ 25  $^{\circ}\text{C}$

Standard Humidity (%R.H.)	UUC Reading (%R.H.)	Correction (%R.H.)	Uncertainty ( $\pm$ %R.H.)
50.03	50	0	2.2

### Remark

UUC : Unit Under Calibration

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

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

Calibratech



## Agilent CrossLab Start Up Services

# Agilent 5100 5110 ICP-OES Preventive Maintenance

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

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

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

## Introduction

### Customer Information

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

## Service Engineer's Responsibilities

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



## Instrument Maintenance

### System Information

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

Instrument System Name and ID
Instrument System Site and Location

5110 VDV ICP-OES

Envilab Company Limited

List System Component Product Numbers	List the Serial Numbers of each Component
1. G 8015 A	MY 17470002
2. G 8410 A	AU17393768
3. G 8481-80002	1709-06327
4.	
5.	
6.	
7.	
8.	
9.	

ICP-OES Configuration Table	Circle the type or write in the type if other
Nebulizer Type	SeaSpray   OneNeb   Conikal   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. *W:R*
- ☒ Ask the customer to remove any samples from the ICP-OES sample introduction area, auto sampler or around the ICP-OES.



## Preventive Maintenance Procedures

### Record Pre-PM instrument performance

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

### Clean and inspect ICP-OES system

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

### Agilent Water Recirculator

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

### SPS 3 Auto Sampler

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

### SPS 4 Auto sampler

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

### AVS 4, 6, 7 Advanced Valve System

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

## ICP-OES adjustment

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

## Record Post-PM instrument performance

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

## Restore Instrument

- ☐ For HF applications, ask the customer to reinstall their sample introduction system. N/A
- ☒ 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	1577.1	3382.6	2348.2	6129.9
Mn 257.610 nm SRBR	3945.3	16145.3	10168.1	39073.2
Al 396.152 nm SBR	7.0	16.3	8.5	25.7
K 766.491 nm SBR	8.2	67.3	4.7	83.6

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

### Instrument Test Results Table

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

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

**ICP-OES Status Results Table**

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

Measurement	Standby Mode		Plasma On	
Mains Voltage	219.371	VAC	217.484	VAC
Mains Current	0.082	A	0.098	A
Instrument Temperature	23.5	°C	23.1	°C
RF Air Flow (sensor speed)	13.0	Hz	19.0	Hz
Plasma Exhaust Temperature	No measurement		56.4	°C
Water Flow Oscillator	No measurement		1.51	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	-39.4	°C
Thermal Stabilizer	35.0	°C	35.0	°C
Argon Supply Pressure	619.13	kPa	560.32	kPa
Purge Gas Supply Pressure*1	616.63	kPa	597.43	kPa
Option Gas Supply Pressure*1	-	kPa	-	kPa
Nebulizer Flow	No measurement		0.70	L/min
Nebulizer Back Pressure	No measurement		283.17	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			A
RF Supply Voltage	No measurement			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	1
Purge Gas Filter	G8010-60136	All	1
Air inlet filter	G8000-68002	All	1
High Capacity Air Filter	G8010-60189	Optional	1
Rotor seal for 6-7 port valve for AVS6/7	G8494-60002	G8494A/G8495	1
Rotor seal for 4 port valve for AVS4	G8493-60002	G8493A	1
Rinse solution to rinse station 2.5mm id x 1m	G8410-80123	SPS4	1
Barb connector 2.5mm-1.5mm ID	G8410-80124	SPS4	1
PVC waste tubing, 8mm od x 5mm id, 2m	G8410-80122	SPS4	1
<b>Additional Parts may be required from engineer's stock:</b>			
X axis drive belt	5410047500	SPS3	1
Z axis drive belt	5410047400	SPS3	1
Peristaltic pump tubing, PVC SolvaFlex, 3 bridged,	3710049000	SPS4	1

Consumed Parts Reference  
(Purchased by customer, not included as part of PM)☐ Section Not Applicable.

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

## Signature Page

### Service Engineer Comments (optional)

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

## Service Verification

Service Request Number:

6006121636

Service Engineer Name:

Kanyakorn S.

Service Engineer Signature:

Kanyakorn S.

Total number of pages in this document:

14

Date Service Completed:

31 May 2023

Customer Name:

กมล

Customer Signature:

กมล



## Report Summary

Instrument Model	Agilent 5100/5110 VDV ICP-OES
Instrument ID	G8011A/G8015A
Instrument Serial Number	MY17490002
Software Version	7.4.0.10280
Firmware Version	3562
Tested By	Kanyakorn S.
Test Started On	5/31/2023 12:22:01 PM
Test Completed On	5/31/2023 12:26:21 PM

## Result Summary

Subsystem Communications Test	Pass
Air Flow Test	Skipped
Water Flow Test	Skipped
Gas Flows Test	Skipped
RF Generator Test	Skipped
Camera Test	Skipped
Optics Test	Pass
Advanced Valve System Test	Skipped
Resolution Test	Pass
Sensitivity Test	Pass
Precision Test	Pass

Subsystem Communications Test	Pass
-------------------------------	------

Optics Test	Pass
-------------	------

	Radial	Axial
Intensity	3397602	2923418
Wavelength	737.212	737.212



**Resolution Test****Pass**

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

**Sensitivity Test****Pass****Radial**

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

**Axial**

Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 208.0	SRBR	267.6	3134.3	126.3
Se (196.026 nm)	≥ 159.0	SRBR	284.6	4158.5	194.0
Zn (206.200 nm)	≥ 234.0	SRBR	495.4	1165.9	5.5
Zn (213.857 nm)	≥ 1743.0	SRBR	6129.9	92298.3	225.6
Cd (214.439 nm)	≥ 4227.0	SRBR	16998.9	48382.7	8.1
Pb (220.353 nm)	≥ 320.0	SRBR	416.4	6520.1	228.4
Mn (257.610 nm)	≥ 10625.0	SRBR	39073.2	1331904.8	1159.9
Cr (267.716 nm)	≥ 1048.0	SRBR	5986.5	203686.5	1144.7
Cu (324.754 nm)	≥ 19.0	SBR	77.1	389900.7	4991.6
Al (396.152 nm)	≥ 6.0	SBR	25.7	268775.7	10073.7
Ba (493.408 nm)	≥ 60.0	SBR	293.9	8244793.3	27957.8
K (766.491 nm)	≥ 24.0	SBR	83.6	3030541.1	35817.8

**Precision Test****Pass****Radial**

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

**Axial**

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

## Report Summary

Instrument Model	Agilent 5100/5110 VDV ICP-OES
Instrument ID	G8011A/G8015A
Instrument Serial Number	MY17490002
Software Version	7.4.0.10280
Firmware Version	3562
Tested By	Kanyakorn S.
Test Started On	5/31/2023 12:34:17 PM
Test Completed On	5/31/2023 12:46:55 PM

## Result Summary

Subsystem Communications Test	Pass
Air Flow Test	Pass
Water Flow Test	Pass
Gas Flows Test	Pass
RF Generator Test	Pass
Camera Test	Pass
Optics Test	Skipped
Advanced Valve System Test	Skipped
Resolution Test	Skipped
Sensitivity Test	Skipped
Precision Test	Skipped

## Subsystem Communications Test Pass

## Air Flow Test Pass

30% Air Flow (relative speed)	75% Air Flow (relative speed)
12.00	18.00

## Water Flow Test Pass

RF Water Flow(L/min)	Camera Water Flow (L/min)	Water Inlet Temperature (°C)
1.45	1.06	16.78



**Gas Flows Test****Pass**

Nebulizer Target Flow	Actual Flow	Back Pressure	Auxiliary Target Flow	Actual Flow	Back Pressure
0.70	0.71	280.77	2.00	2.00	93.84
Makeup Target Flow	Actual Flow	Back Pressure	Plasma Target Flow	Actual Flow	Back Pressure
2.00	1.99	95.26	18.00	17.94	23.27

**RF Generator Test****Pass**

RF Power Supply Test	Passed
RF Power Supply (V)	147.418
RF Oscillator Test	Passed
RF Oscillator Frequency (MHz)	25.961
Work Coil Current (A)	45.326
RF Power Supply Current (A)	2.000

**Camera Test****Pass**

	Integration Time (ms)	Standard Deviation	Status
Electronic Offset Test	1000	5.120	Passed
Array Test	5	0.015	Passed
Linearity Test		0.122	Passed



## TSP High Volume Sampler Calibration

Verification Report No.

SO2400035-E009 -TSP 01

<input type="checkbox"/> PM	<input checked="" type="checkbox"/> Onsite
Site: วัดเขาคันทรง	
UTM: N 1450918 E 736059	
Sampler: ETSP#26	
Recorder: EVFCDPR02TC013	
Date: 24 Aug 24	
Technical: PANLOP PROMMEE	
Approval: Wisan Ritthikamon	

### CONDITIONS

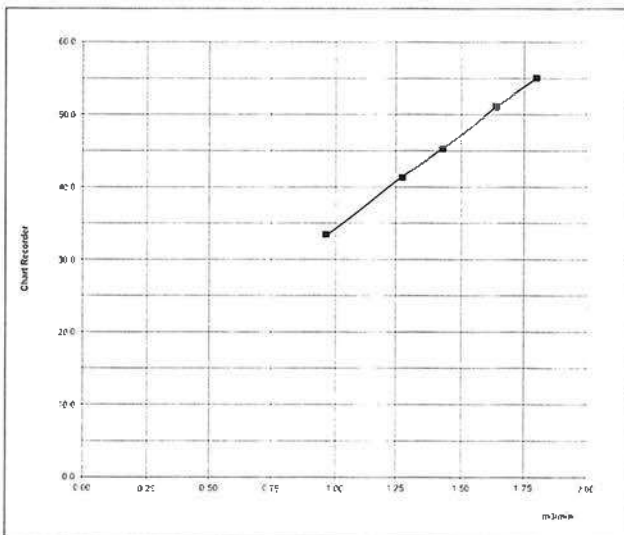
Barometric Press. (hPa): 997.1	Corrected Pressure (mm Hg): 747.9
Temperature (deg C): 30.0	Temperature (deg K): 303.0
Average Press. (hPa): 978.0	Corrected Avg. Press. (mm Hg): 733.6
Average Temp. (deg C): 32.0	Average Temp. (deg K): 305.0

### 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  Slope = 26.0630 Intercept = 8.2479 Corr. coeff. = 0.9999  # of Observations: 5  Range of Chart at 1.1 - 1.7 m3/min. 38 53
1	13.40	1.796	56.0	55.09	
2	11.20	1.643	52.0	51.16	
3	8.40	1.425	46.0	45.25	
4	6.70	1.274	42.0	41.32	
5	3.80	0.962	34.0	33.45	



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www.evltesting.com

Environmental responsibility with accuracy measurement



### TSP High Volume Sampler Calibration

Verification Report No.

SO2400035-E009 -TSP 02

☐ PM ☒ Onsite

Site: บริเวณท่าอากาศยานดอนเมือง

UTM: N 1448651 E 731798

Sampler: ETSP#30

Recorder: ECRDS016339505

Date: 24 Aug 24

Technical: PANLOP PROMMEE

Approval: Wisan Ritthikamon

### CONDITIONS

Barometric Press. (hPa): 993.3

Temperature (deg C): 32.0

Average Press. (hPa): 979.0

Average Temp. (deg C): 32.0

Corrected Pressure (mm Hg): 745.0

Temperature (deg K): 305.0

Corrected Avg. Press. (mm Hg): 734.3

Average Temp. (deg K): 305.0

### CALIBRATION ORIFICE

Brand: Tisch Environmental, Inc

Model: TE-5025A

Serial#: 5411

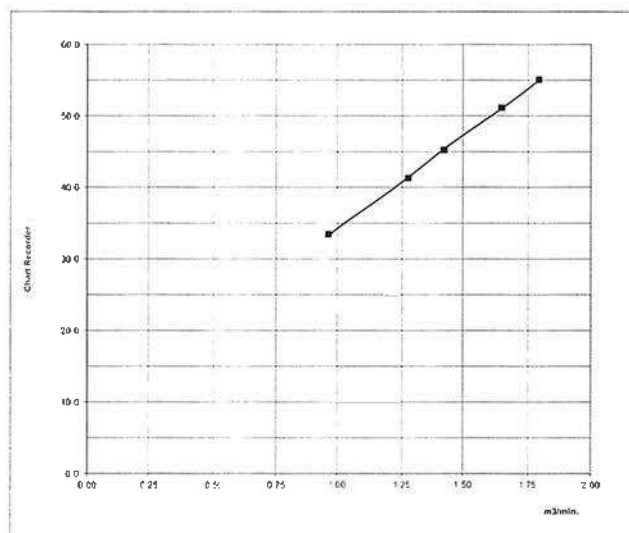
Qstd Slope: 2.02024

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	13.00	1.760	56.0	54.81	Slope = 32.2628
2	11.40	1.649	52.0	50.89	Intercept = -2.4841
3	8.80	1.450	44.0	43.06	Corr. coeff = 0.9979
4	6.20	1.219	38.0	37.19	# of Observations: 5
5	3.50	0.919	28.0	27.40	Range of Chart at 1.1 - 1.7 m3/min: 34
					53



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41 4451 19 Rev.01 05/02/67



Environmental Engineering Laboratory Co., Ltd.  
EVL Co., Ltd. 54/501 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10110  
Tel: 02-267-8111 Fax: 02-267-8112



## PM10 High Volume Sampler Calibration

Verification Report No.

SO2400035-E009 -PM 01

<input type="checkbox"/> PM	<input checked="" type="checkbox"/> Onsite
Site: วัดเขาคันทรง	
UTM: N 1450918 E 736059	
Sampler: EPM10#27	
Recorder: EVFCDPR02TC014	
Date: 24 Aug 24	
Technical: PANLOP PROMMEE	
Approval: Wisan Rithikamon	

### CONDITIONS

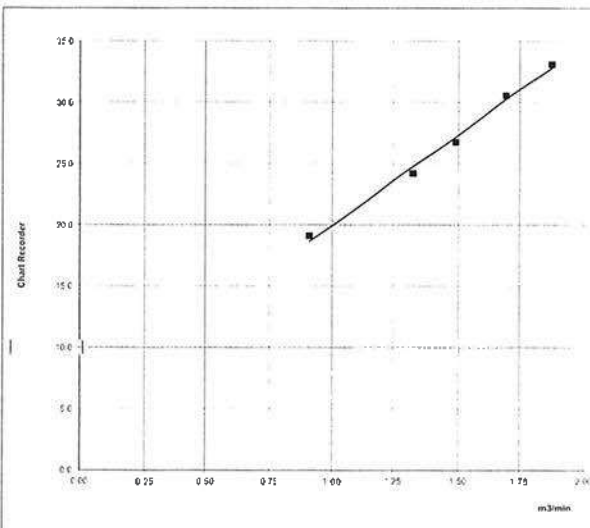
Barometric Press. (hPa): 997.1	Corrected Pressure (mm Hg): 747.9
Temperature (deg C): 30.0	Temperature (deg K): 303.0
Average Press. (hPa): 978.0	Corrected Avg. Press. (mm Hg): 733.6
Average Temp. (deg C): 32.0	Average Temp. (deg K): 305.0

### 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
1	13.60	1.868	52.0	33.10	
2	11.20	1.697	48.0	30.55	Slope = 14.8356 Intercept = 5.1004 Corr. coeff. = 0.9963 SFR = 1.101 SSP = 33.68 # of Observations: 5
3	8.60	1.488	42.0	26.73	
4	6.80	1.325	38.0	24.19	
5	3.20	0.913	30.0	19.10	
					Range of Chart at SFR $\pm 10\%$
					32
					36



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FORMET-29 Rev:07/05/07/07



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



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

### Standard Conditions

Tstd: 298.15 °K  
 Pstd: 760 mm Hg

### Key

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

### RECALIBRATION

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



## SO2 Analyzer Verification Test Report

Calibration Report No.: AP-S6708001

Calibrated Date: 1-Aug-24

☒ PM ☐ Onsite

### Instruments Information

Page:1/2

Analyzer Type: SO2 Analyzer Model: 100U	Manufacturer API S/N: ESOAI100U0056
--	--

### Calibration System

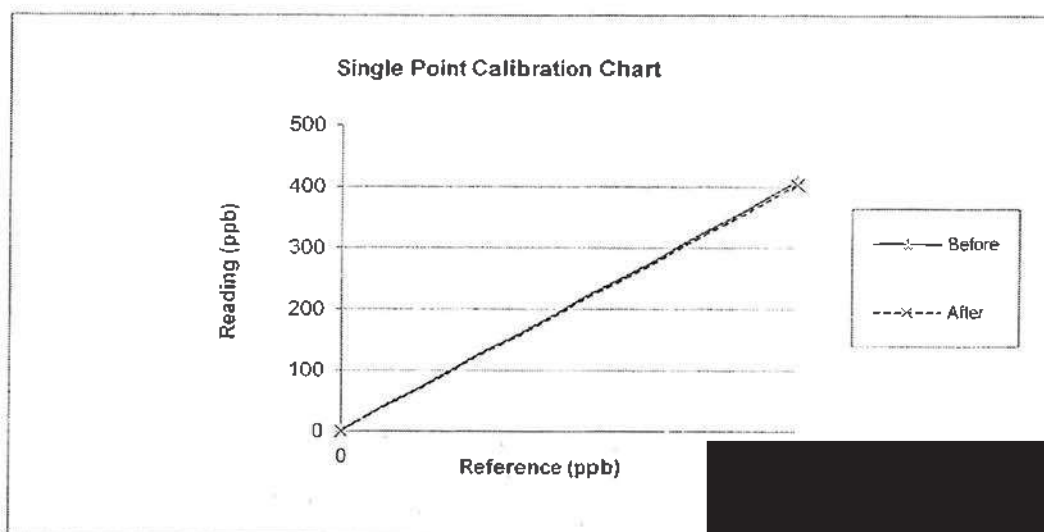
Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792 ZERO AIR Generator ZAG7001 S/N: 644	NOx Conc 45.50 PPM NO Conc 45.50 PPM SO2 Conc 45.59 PPM CO Conc 4500 PPM Expire Date: Mar 31,2026 EB0160267

Environment: Temperature 26.1 °C

Humidity: 65 %RH

### Calibration Report

Status	Zero			Span		
	Reference (ppb)	Reading (ppb)	Drift (ppb)	Reference (ppb)	Reading (ppb)	Drift%
Before	0.0	1.7	1.7	400.0	408.7	1.1
After	0.0	0.5	0.5	400.0	403.0	0.4







## SO2 Analyzer Verification Test Report

Calibration Report No.: AP-S6708002

Calibrated Date: 1-Aug-24

☒ PM ☐ Onsite

### Instruments Information

Page:1/2

Analyzer Type: SO2 Analyzer Model: T100	Manufacturer API S/N: ESOAIT10002033
--	---

### Calibration System

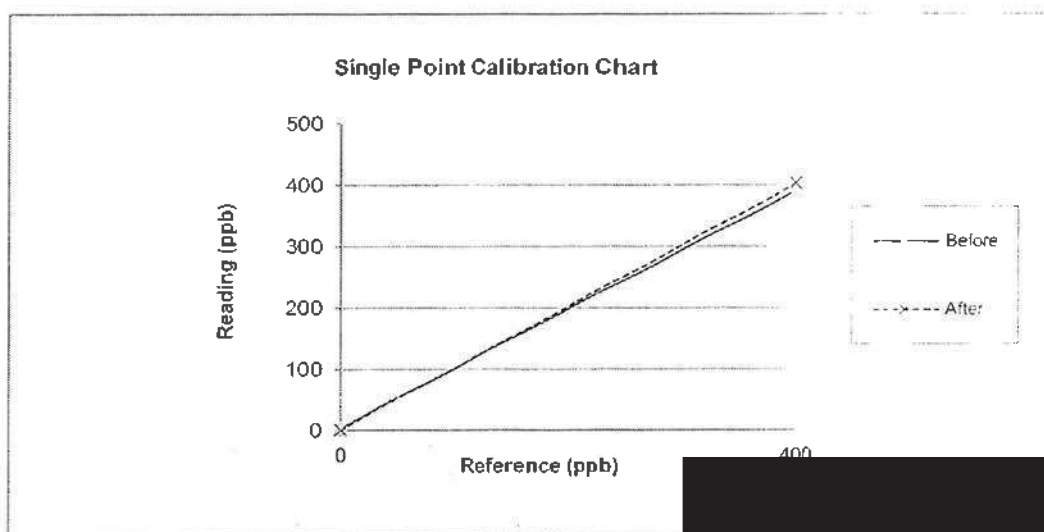
Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792 ZERO AIR Generator ZAG7001 S/N: 644	NOx Conc 45.50 PPM NO Conc 45.50 PPM SO2 Conc 45.59 PPM CO Conc 4500 PPM Expire Date: Mar 31,2026 EB0160267

Environment: Temperature 26.1 °C

Humidity: 65 %RH

### Calibration Report

Status	Zero			Span		
	Reference (ppb)	Reading (ppb)	Drift (ppb)	Reference (ppb)	Reading (ppb)	Drift%
Before	0.0	3.8	3.8	400.0	391.2	-1.1
After	0.0	0.6	0.6	400.0	403.0	0.4







neediss  
Needles Supply Instrument Co., Ltd.



## SO2 Analyzer Verification Test Report

Calibration Report No.: AP-S6708002

Calibrated Date: 1-Aug-24

☒ PM ☐ Onsite

Page:2/2

Test Function Value	Normal range	Unit	Before	After	Note
Date	1-Aug-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)	Dreeger C	50	50	
BOX TEMP	20-40	Dreeger C	34.1	32.7	
PMT TEMP	7 (+/-1)	Dreeger 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 constant	IN-Hg-A	28.1	27.8	
<b>Electric Test/Optic Test</b>					
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	
<b>Gas Test Response</b>					
Zero Gas (0.00 PPB)	0	ppb	3.8	0.6	
Span Gas (400 PPB)	400	ppb	391.2	403.0	± 5% of Range

Calibrate By :

Sirirat Poonlak

Date:

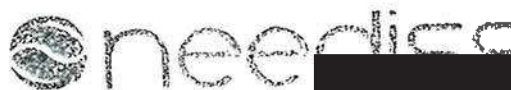
1-Aug-24

Approve By :

Sarawut Keawsrinual

Date:

1-Aug-24



Neediss Supply Instrument Co., Ltd.





## NOx Analyzer Verification Test Report

Calibration Report No.: AP-N6708001

Page:1/1

Calibrated Date: 1-Aug-24

☒ PM ☐ Onsite

### Instruments Information

Analyzer Type: NO/NO <sub>2</sub> /NO <sub>x</sub> Analyzer Model: T200	Manufacturer API S/N: ENOAIT20003573
--	---

### Calibration System

Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792 ZERO AIR Generator ZAG7001 S/N: 644	NO <sub>x</sub> Conc 46.50 PPM NO Conc 46.50 PPM So <sub>2</sub> Conc 45.59 PPM Co Conc 4507 PPM Expire Date: Mar 31,2026 EB0160267

Environment: Temperature 25.5 °CHumidity: 62 %RH

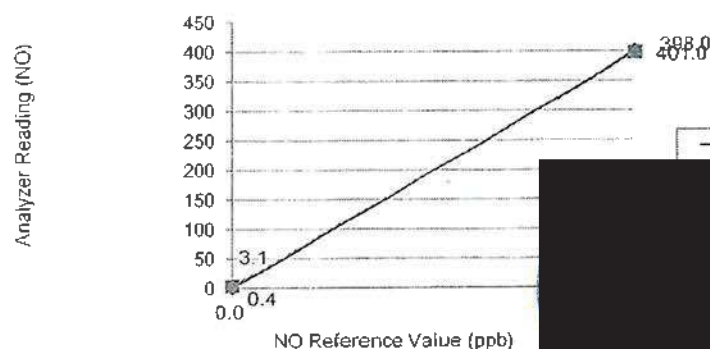
### Calibration Check ( Before adjust )

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	2.0	0.0	2.0	395.3	400.0	-0.6
NO <sub>2</sub>	1.1	0.0	1.1	2.7	0.0	0.3
NO <sub>x</sub>	3.1	0.0	3.1	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	0.2	0.0	0.2	400.0	400.0	0.0
NO <sub>2</sub>	0.2	0.0	0.2	1.0	0.0	0.1
NO <sub>x</sub>	0.4	0.0	0.4	401.0	400.0	0.1

Single Point Calibration Chart



# ***NOx Analyzer Verification Test Report***

Page:1/1

Calibrated Date: 1-Aug-24

☒ PM ☐ Onsite

Page:2/2

Test Function Value		Normal range	Unit	Before	After	Note
Date		1-Aug-24				
Time		9:25				
Range		0.00 - 500.00 PPB	PPB	500	500	
Stability (Zero Gas)		< 0.2	PPB	0.5	0.2	
Sample Flow		500+/- 50	cc/min	491	485	
Ozone Flow		60-90	cc/min	80	80	
PMT Detector		0-5000	mV	85.0	25.0	
AZERO		-20-150	mV	94.1	14.5	
HVPS		400-900 constant	V	734	734	
DCPS		2500 +/- 200	mV	-	-	
RCELL TEMP		50+/- 1	Dreegee C	50	50	
BOX TEMP		20-35	Dreegee C	34.7	33.6	
PMT TEMP		7 +/-1	Dreegee C	7.0	7.0	
IZS TEMP		50+/- 4	Dreegee C	-	-	
MOLY Temp		315 +/- 5	Dreegee C	314.0	314.0	
RCEL PRES		4-10 contant	IN-Hg-A	5.0	5.0	
SAMP PRES		20-30 contant	IN-Hg-A	28.8	27.9	
NO Slope		1 +/- 0.3		1.135	1.197	
NOx Slope		1 +/- 0.3		1.260	1.114	
NO Offset		-10 to + 150	mV	0.8	-3.6	
NOx Offset		-10 to + 150	mV	-2.6	6.1	
<b>Span and Cal Values</b>						
Zero Value	NO	0	ppb	2.0	0.2	
	NOx	0	ppb	3.1	0.4	
Span Value	NO	400	ppb	395.3	400.0	
	NOx	400	ppb	398.0	401.0	

**Calibrate By :**

Date:

---

Sirirat Poonlak

1-Aug-24

Approve By :

Date:

Sarawut Keawsrinual

1-Aug-24

**needs**  
Needs Supply Institute



## NOx Analyzer Verification Test Report

Calibration Report No.: AP-N6708002

Page:1/1

Calibrated Date: 1-Aug-24

☒ PM ☐ Onsite

### Instruments Information

Analyzer Type: NO/NO2/NOx Analyzer Model: 200A	Manufacturer API S/N: ENOAI200E01170
---	---

### 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

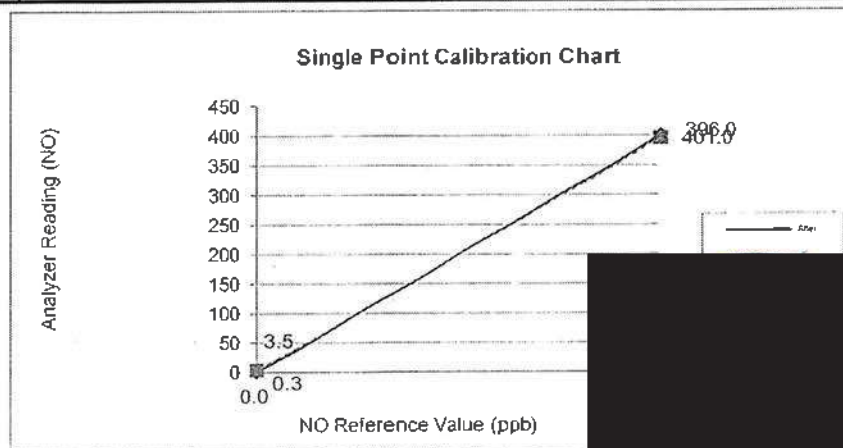
Environment: Temperature 25.6 °CHumidity: 65 %RH

### Calibration Check ( Before adjust )

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	3.0	0.0	3.0	389.0	400.0	-1.4
NO <sub>2</sub>	0.5	0.0	0.5	7.0	0.0	0.9
NOx	3.5	0.0	3.5	396.0	400.0	-0.5

### Calibration Check ( After adjust )

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.3	0.0	0.3	400.0	401.0	-0.1
NO <sub>2</sub>	0.0	0.0	0.0	1.0	0.0	-0.1
NOx	0.3	0.0	0.3	401.0	403.0	-0.2







## NOx Analyzer Verification Test Report

Calibration Report No.: AP-N6708002

Page: 1/1

Calibrated Date: 1-Aug-24

☒ PM    ☐ Onsite

Page: 2/2

Test Function Value	Normal range	Unit	Before	After	Note
Date	1-Aug-24				
Time	10:10				
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	482	494	
Ozone Flow	60-90	cc/min	74	77	
PMT Detector	0-5000	mV	51	26	
AZERO	-20-150	mV	53.3	33.3	
HVPS	400-900 constant	V	821	821	
DCPS	2500 +/- 200	mV	2556	2556	
RCELL TEMP	50 +/- 1	Dreegee C	50	50	
BOX TEMP	20-35	Dreegee C	30.2	32.8	
PMT TEMP	7 +/- 1	Dreegee C	7.5	7.5	
IZS TEMP	50 +/- 4	Dreegee C	-	-	
MOLY Temp	315 +/- 5	Dreegee C	315.0	314.5	
RCEL PRES	4-10 constant	IN-Hg-A	8.8	8.8	
SAMP PRES	20-30 constant	IN-Hg-A	30.2	31.8	
NO Slope	1 +/- 0.3		0.820	0.822	
Nox Slope	1 +/- 0.3		0.854	0.858	
NO Offset	-10 to + 150	mV	17.8	17.8	
NOx Offset	-10 to + 150	mV	5.0	5.0	
Span and Cal Values					
Zero Value	NO	0	ppb	3.0	0.3
	NOx	0	ppb	3.5	0.3
Span Value	NO	400	ppb	389.0	400.0
	NOx	400	ppb	396.0	401.0

Calibrate By: \_\_\_\_\_

Date: \_\_\_\_\_

 Sinrat Poonlak  
1-Aug-24

Approve By: \_\_\_\_\_

Date: \_\_\_\_\_

 Sarawut Keawsrinual  
1-Aug-24

Neediss Supply Instrument Co., Ltd.

Envilab Co., Ltd.

 รับรองสำเนาถูกต้อง  
ผู้จัดการฝ่ายควบคุมคุณภาพ

## CERTIFICATE OF ANALYSIS

### Grade of Product: EPA PROTOCOL STANDARD

Customer:	BANGKOK INDUSTRIAL		
	GAS CO LTD		
Part Number:	E04NI99E15A00V3	Reference Number:	160-402685487-1
Cylinder Number:	EB0160267	Cylinder Volume:	144.0 CF
Laboratory:	124 - Plumsteadville - PA	Cylinder Pressure:	2015 PSIG
PGVP Number:	A12023	Valve Outlet:	660
Gas Code:	CO,NO,NOX,SO2,BALN	Certification Date:	Mar 31, 2023
<b>Expiration Date: Mar 31, 2026</b>			

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				

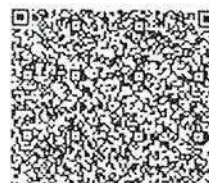
CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	210607-22	CC708067	48.41 PPM NITRIC OXIDE/NITROGEN	+/- 1.2%	Sep 21, 2025
PRM	12395	D887660	9.91 PPM NITROGEN DIOXIDE/AIR	+/- 2.0%	Feb 22, 2022
GMIS	124206889104	CC322509	4.326 PPM NITROGEN DIOXIDE/AIR	+/- 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



*[Signature]*  
Approved for Release







# THAI METEOROLOGICAL DEPARTMENT

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

## Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue : 6 April, 2024

Certification No. 170/24

Page : 1 of 6

Object : เครื่องมือตรวจวัดอุตุนิยมวิทยา

Manufacturer : DYACON

Type : Data Logger MS-100

Serial No. : 130150 ID No. : EWSDCMS1200150

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

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1008.7 hPa

NATIONAL STANDARD WIND TUNNEL : Wind Aloft Plotting Board

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

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

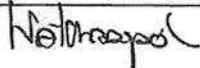
: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)  
Serial Number 110730029 (sensor 120629586)

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

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

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

STANDARD BAROMETER : Digital Barometer Vaisala Type PTB220 No. V1220015

Calibrated by : 

Mr. Watcharapol Subwat

Mechanical Engineer

Signed :

  
Mr. Pisood Promsut

(Authorised Signatory)

for the Chief



## THAI METEOROLOGICAL DEPARTMENT

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

### The Result of Calibration

Sensor Wind Speed & Wind Direction Model WSD-1 F Certification No. 170/24

6 April, 2024

Serial No. 1224

Page : 2 of 6

Standard Ultrasonic Anemometer m/sec	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure inches H2O	Vacuum 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	-	-	-	7.0	0.04
9.02	-	-	-	9.0	0.02
11.01	-	-	-	11.0	0.01
13.01	-	-	-	12.9	0.11
15.01	-	-	-	15.0	0.01
17.02	-	-	-	17.0	0.02
20.02	-	-	-	20.0	0.02

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

Calibrated by :

*Watcharapol*

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 Presure Model TPH-1 C

Serial No. 6275

Certification No. 170/24

6 April, 2024

Page : 3 of 6

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

Average

0.47

Calibrated by :

*Watchapol*

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 Temperature Model TPH-1 C

Certification No. 170/24

6 April, 2024

Serial No. 6275

Page : 4 of 6

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

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 Humidity Model TPH-1 C

Certification No. 170/24

6 April, 2024

Serial No. 6275

Page : 5 of 6

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

Calibrated by :

Mr. Watcharapol Subwat

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau







Date of Issue 6 April, 2024

Certification No. 170/24

Page: 6 of 6

## ใบรับรอง

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



วิศวกรชำนาญการ





บริษัท เอ็นวีแอล จำกัด (มหาชน) \* 2507 ถนนพหลโยธิน แขวงจตุจักร เขตปทุมธานี 10160  
Envilab Co., Ltd. \* 2507 ถนนพหลโยธิน แขวงจตุจักร เขตปทุมธานี 10160  
Tel : 02-801 4771 Fax : 02-801 3799 E-mail : info@evltesting.com



## Verification Test Report

Report No.:

SO2400035-E009 -SLM 01

☐ PM ☒ Onsite UTM : N 1448430 E 733987

Calibrated Date: 24 August 2024

Site : บริเวณริมรั้วโครงการด้านทิศใต้ (N4)

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 44

Serial : 1914

Environment: Temperature 32 °C Humidity 73 %RH

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

Serial No.1351075

Date of Calibration : 10 Apr 2024

### Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.72	93.80	0.08	93.72

Calib

Ap

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Invaluable Co., Ltd. 540,540/7 Soi Bangkhoe 7 Bangkhoe Bangkhoe Bangkok 10130  
Tel: 02-2577-111 Fax: 02-602-3773 E-mail: info@evltesting.com



Image X Barcode: 00000000000000000000000000000000

## Verification Test Report

Report No.:

SO2400035-E009 -SLM 02

☐ PM ☒ Onsite UTM: N 1448839 E 733739

Calibrated Date: 24 August 2024

Site : บริเวณริมรั้วโครงการด้านทิศตะวันตก (N5)

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 44

Serial : 1974

Environment: Temperature 32 °C Humidity 73 %RH

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

Serial No.1351075

Date of Calibration : 10 Apr 2024

### Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.72	93.70	-0.02	93.72

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Envilab Co., Ltd. 54/540/1 Soi Bang Na 7 Bang Na Bang Khua Bangkok 10760  
Tel : 02-802-3577-8 Fax : 02-802-3773 E-mail : info@evltesting.com



www.envilab.com

## Verification Test Report

Report No.:

SO2400035-E009 -SLM 03

☐ PM ☒ Onsite UTM : N 1449162 E 733913

Calibrated Date: 24 August 2024

Site : บริเวณริมรั้วโครงการด้านทิศเหนือ (N2)

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 44

Serial : 1862

Environment: Temperature 32 °C Humidity 73 %RH

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

Serial No.1351075

Date of Calibration : 10 Apr 2024

### Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.72	93.90	0.18	93.72

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Tel : 02-2512-3577-8 Fax : 02-2512-3712 E-mail : info@evltesting.com



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## Verification Test Report

Report No.:

SO2400035-E009 -SLM 04

☐ PM ☒ Onsite UTM : N 1448872 E 733993

Calibrated Date: 24 August 2024

Site : บริเวณริมรั้วโครงการด้านทิศตะวันออก (N3)

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 44

Serial : 1860

Environment: Temperature 32 °C Humidity 73 %RH

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

Serial No.1351075

Date of Calibration : 10 Apr 2024

### Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.72	94.00	0.28	93.72

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EnviLab Co., Ltd. 540543/1 Soi Bangkhae 7 Bangkok Bangkok Bangkok Bangkok  
Tel : 02-892-7377-8 Fax : 02-892-3773 E-mail : info@evltesting.com



## Verification Test Report

Report No.:

SO2400035-E009 -SLM 05

☐ PM ☒ Onsite UTM: N 1448635 E 731784

Calibrated Date: 24 August 2024

Site : บ้านบางแสนสุข (จุดใกล้เคียง)

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 44

Serial : 2122

Environment: Temperature 32 °C Humidity 73 %RH

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

Serial No.1351075

Date of Calibration : 10 Apr 2024

### Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.72	94.10	0.38	93.72

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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

### Ambient Environment

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

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

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

- Standards used :
1. Digital Function Synthesizer NF Electronic DF-193A S/N 122037.
  2. Measuring Amplifier Bruel&Kjaer 2636 S/N 1537484.
  3. Programmable Attenuator Tamagawa TPA-303A S/N OF 2214.
  4. Digital Multimeter Agilent 34401A S/N MY44005560.
  5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.
  6. Audio Analyzer Keithley 2015-P S/N4106495.
  7. Condenser Microphone B&K 4180 S/N 2889871.

**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

The results relate only to the items tested/calibrated. A 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

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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 1121-30 ext. 5219, 5225, 5217  
(66) 08 1889 6827



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 $\mu$ Pa at 1000 Hz

Acoustic Output in dB re 20 $\mu$ 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 Briel&Kjaer 4180	93.72	-0.28	$\pm 0.10$	$\pm 0.40$ dB

2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Briel&Kjaer 4180	994.9	-5.1	$\pm 1.5$	$\pm 1.0\%$

3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Briel&Kjaer 4180	1.25	$\pm 0.50$	$\pm 3.0\%$

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :

(Mr. Weerachai Deechaiyao)

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

End of Certificate

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(66) 08 3219 9440  
E-mail: [mtc@tistr.or.th](mailto:mtc@tistr.or.th) Website : [www.tistr.or.th](http://www.tistr.or.th)

Office  
196 Phahonyothin Road, Ladyao, Chatuchak,  
Bangkok 10900, Thailand  
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217  
(66) 08 1889 6827



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EVL Lab Co., Ltd. 540.540/1 Soi Bangy 11-7 Bangplue Bangplue Bangkok 10160  
Tel: 02-801-3577-8 Fax: 02-802-3772 E-mail: info@evltesting.com



## Verification Test Report

Report No.:

SO2400035-E009 -PU 01

Calibrated Date: 29-Aug-24

Equipment: Air Sampling Pump

Manufacturer: Gillian

Model: HFS-113A

Serial or ID No. 0235

Environment: Temperature 25 °C Humidity 60 %RH

Reference Standard: Primary Flow Calibrator Model Defender 510, MESALABS

Serial No. 200368

Date of Calibration : 17 July 2024

### Result of Test

Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
200	1	200.3	200.3
	2	200.6	
	3	200.0	
	4	199.8	
	5	200.8	

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Evinltes Co., Ltd. 540,540/1 Soi Banglamphu 7 Banglamphu Bangkok Bangkok 10160  
Tel : 02-802-3211-8 Fax: 02-802-3772 E-mail : info@evltesting.com



## Verification Test Report

Report No.:

SO2400035-E009 -PU 02

Calibrated Date: 29-Aug-24

Equipment: Air Sampling Pump

Manufacturer: Gillian

Model: HFS-113A

Serial or ID No. 0236

Environment: Temperature 25 °C Humidity 60 %RH

Reference Standard: Primary Flow Calibrator Model Defender 510, MESALABS

Serial No. 200368

Date of Calibration : 17 July 2024

### Result of Test

Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
200	1	200.4	200.6
	2	200.7	
	3	200.0	
	4	201.2	
	5	200.8	

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Evltest Co., Ltd. 5/1540/1 ซ. บาง-หมี 7 บางกะปิ กรุงเทพฯ 10160  
Tel. 02-802-1277-8 Fax. 02-802-3773 E-mail: info@evltesting.com



Thailand Standard Tag 00000000000000000000

## Verification Test Report

Report No.:

SO2400035-E009 -PU 03

Calibrated Date: 29-Aug-24

Equipment: Air Sampling Pump

Manufacturer: Gillian

Model: HFS-113A

Serial or ID No. 3346

Environment: Temperature 25 °C Humidity 60 %RH

Reference Standard: Primary Flow Calibrator Model Defender 510, MESALABS

Serial No. 200368

Date of Calibration : 17 July 2024

Result of Test			
Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
200	1	200.4	200.5
	2	201.2	
	3	200.1	
	4	200.3	
	5	200.5	

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EVL Co., Ltd. 540,540/1 Soi Bangkhoe 7 Bangkhoe Bangkok 10140  
Tel: 02-602-3771-8 Fax: 02-602-3772 E-mail: info@evltesting.com



## Verification Test Report

Report No.:

SO2400035-E009 -PU 04

Calibrated Date: 29-Aug-24

Equipment: Air Sampling Pump

Manufacturer: AP BUCK

Model: LP-5

Serial or ID No. 5449

Environment: Temperature 25 °C Humidity 60 %RH

Reference Standard: Primary Flow Calibrator Model Defender 510, MESALABS

Serial No. 200368

Date of Calibration : 17 July 2024

### Result of Test

Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
2000	1	2000.1	2000.4
	2	2000.9	
	3	1999.7	
	4	2000.7	
	5	2000.6	

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EVL Co., Ltd. 540,540/1 หมู่ 11 ต.บางพลีใหญ่ อ.บางพลี จ.สมุทรปราการ 10540  
Tel : 02-802-3577-8 Fax : 02-802-3577 E-mail : evl@evl-testing.com



## Verification Test Report

Report No.:

SO2400035-E009 -PU 05

**Calibrated Date:** 29-Aug-24

**Equipment:** Air Sampling Pump

**Manufacturer:** AP BUCK

**Model:** LP-5

**Serial or ID No.** 5445

**Environment:** Temperature 25 °C Humidity 60 %RH

**Reference Standard:** Primary Flow Calibrator Model Defender 510, MESALABS

Serial No. 200368

Date of Calibration : 17 july 2024

### Result of Test

Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
2000	1	2000.8	2000.5
	2	2000.9	
	3	2001.2	
	4	1999.8	
	5	1999.9	

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Evltech Co., Ltd. 540540/1 So Phangkhao Phangkhao Bangkok Bangkok 10110  
Tel: 02-3777-8 Fax: 02-3777-3 Email: info@evltesting.com



## Verification Test Report

Report No.:

SO2400035-E009 -PU 07

Calibrated Date: 29-Aug-24

Equipment: Air Sampling Pump

Manufacturer: AP BUCK

Model: LP-5

Serial or ID No. 5447

Environment: Temperature 25 °C Humidity 60 %RH

Reference Standard: Primary Flow Calibrator Model Defender 510, MESALABS

Serial No. 200368

Date of Calibration : 17 July 2024

Result of Test			
Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
500	1	499.8	500.0
	2	499.9	
	3	500.2	
	4	500.0	
	5	500.2	

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Private Co., Ltd. 540/540/1 Soi Bangna #7 Bang Na District Bangkok 10150  
Tel. 02-882-3577-8 Fax. 02-882-3772 E-mail : info@evltesting.com



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## Verification Test Report

Report No.:

SO2400035-E009 -PU 08

Calibrated Date: 29-Aug-24

Equipment: Air Sampling Pump

Manufacturer: AP BUCK

Model: LP-5

Serial or ID No. 5448

Environment: Temperature 25 °C Humidity 60 %RH

Reference Standard: Primary Flow Calibrator Model Defender 510, MESALABS

Serial No. 200368

Date of Calibration : 17 july 2024

### Result of Test

Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
200	1	200.2	200.2
	2	199.9	
	3	200.2	
	4	200.1	
	5	200.7	

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Evinlabs Co., Ltd. 540/49/1 Soi Sukhumvit 7 Bangkok Bangkok Bangkok 10110  
Tel : 02-2577788 Fax: 02-862 3773 E-mail : info@evltesting.com



## Verification Test Report

Report No.:

SO2400035-E009 -PU 09

**Calibrated Date:** 29-Aug-24

**Equipment:** Air Sampling Pump

**Manufacturer:** Gillian

**Model:** HFS-113A

**Serial or ID No.** 0510

**Environment:** Temperature 25 °C Humidity 60 %RH

**Reference Standard:** Primary Flow Calibrator Model Defender 510, MESALABS

Serial No. 200368

Date of Calibration : 17 july 2024

### Result of Test

Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
1000	1	1000.3	1000.8
	2	1000.7	
	3	1001.2	
	4	1001.3	
	5	1000.5	

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



01/02/2024 10:02 AM

## Verification Test Report

Report No.:

SO2400035-E009 -PU 10

Calibrated Date: 29-Aug-24

Equipment: Air Sampling Pump

Manufacturer: Gillian

Model: HFS-113A

Serial or ID No. 0138

Environment: Temperature 25 °C Humidity 60 %RH

Reference Standard: Primary Flow Calibrator Model Defender 510, MESALABS

Serial No. 200368

Date of Calibration : 17 July 2024

Result of Test			
Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
1000	1	1000.5	1000.6
	2	1000.3	
	3	1000.2	
	4	1001.4	
	5	1000.6	

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EnviLab Co., Ltd. 540,500 333 ซ.สุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10110  
Tel: 02-832-2577 B Fax: 02-832-2578 E: info@evltesting.com



## Verification Test Report

Report No.:

SO2400035-E009 -PU 01

**Calibrated Date:** 29-Aug-24

**Equipment:** Air Sampling Pump

**Manufacturer:** SKC

**Model:** AirCheck 52

**Serial or ID No.** 5608

**Environment:** Temperature 25 °C Humidity 60 %RH

**Reference Standard:** Primary Flow Calibrator Model Defender 510, MESALABS

Serial No. 200368

Date of Calibration : 17 July 2024

### Result of Test

Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
1700	1	1700.4	1700.4
	2	1700.6	
	3	1700.2	
	4	1699.8	
	5	1700.8	

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โทร. 02-640 1111 โทร. 02-640 1111 Bangkok 7 Bangkok Bangkok Bangkok 10150  
www.evltesting.com E-mail: info@evltesting.com



## Verification Test Report

Report No.:

SO2400035-E009 -PU 02

Calibrated Date: 29-Aug-24

Equipment: Air Sampling Pump

Manufacturer: SKC

Model: AirCheck 52

Serial or ID No. 9267

Environment: Temperature 25 °C Humidity 60 %RH

Reference Standard: Primary Flow Calibrator Model Defender 510, MESALABS

Serial No. 200368

Date of Calibration : 17 July 2024

Result of Test			
Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
1700	1	1700.5	1700.3
	2	1700.4	
	3	1700.1	
	4	1699.8	
	5	1700.5	

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บริษัท เอวิล เทสติ้ง จำกัด 540/541 หมู่ 7 ถนนพหลโยธิน แขวงจตุจักร กรุงเทพฯ 10110  
EVL Co., Ltd. 540/541 Moo 7 Amphoe Chue Chue Bangkok 10110  
Tel: 02-802-2577-8 Fax: 02-802-3773 E-mail: info@evltesting.com



Rev. 01 2566

## Verification Test Report

Report No.:

SO2400035-E009 -PU 03

Calibrated Date: 29-Aug-24

Equipment: Air Sampling Pump

Manufacturer: SKC

Model: AirCheck 52

Serial or ID No. 8201

Environment: Temperature 25 °C Humidity 60 %RH

Reference Standard: Primary Flow Calibrator Model Defender 510, MESALABS

Serial No. 200368

Date of Calibration : 17 July 2024

### Result of Test

Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
200	1	200.1	200.4
	2	200.4	
	3	200.7	
	4	200.2	
	5	200.4	

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บริษัท เอวิลแล็บ จำกัด 501540/1 ซอย 13 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพฯ 10110  
EVL Lab Co., Ltd. 501540/1 St. Songkhro 13 Bangkok Bang Sue Bangkok 10160  
Tel: 02-607-3777-8 Fax: 02-607-3773 E-mail: info@evltesting.com



www.evltesting.com

## Verification Test Report

Report No.:

SO2400035-E009 -PU 04

Calibrated Date: 29-Aug-24

Equipment: Air Sampling Pump

Manufacturer: AP BUCK

Model: LP-5

Serial or ID No. 5426

Environment: Temperature 25 °C Humidity 60 %RH

Reference Standard: Primary Flow Calibrator Model Defender 510, MESALABS

Serial No. 200368

Date of Calibration : 17 July 2024

### Result of Test

Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
200	1	200.3	200.6
	2	200.5	
	3	200.6	
	4	200.5	
	5	200.9	

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Evolab Co., Ltd. 540,540/1 Soi Bangphoe 7 Bangkhoe Bangkok 10110  
Tel: 02-861 3577-9 Fax: 02 607-3174 E-mail: info@evltesting.com



## Verification Test Report

Report No.:

SO2400035-E009 -PU 05

Calibrated Date: 29-Aug-24

Equipment: Air Sampling Pump

Manufacturer: AP BUCK

Model: LP-5

Serial or ID No. 5427

Environment: Temperature 25 °C Humidity 60 %RH

Reference Standard: Primary Flow Calibrator Model Defender 510, MESALABS

Serial No. 200368

Date of Calibration : 17 july 2024

### Result of Test

Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
200	1	200.1	200.3
	2	200.8	
	3	200.9	
	4	199.9	
	5	199.8	

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EVL Co., Ltd. 540.540/1 Soi Bangkhoe 7 Bangkok Bangkhoe 10710  
Tel : 02-802-3571-8 Fax: 02-802-3773 E-mail : info@evl-testing.com



02-802-3571-8

## Verification Test Report

Report No.:

SO2400035-E009 -PU 06

Calibrated Date: 29-Aug-24

Equipment: Air Sampling Pump

Manufacturer: AP BUCK

Model: LP-5

Serial or ID No. 5428

Environment: Temperature 25 °C Humidity 60 %RH

Reference Standard: Primary Flow Calibrator Model Defender 510, MESALABS

Serial No. 200368

Date of Calibration : 17 July 2024

### Result of Test

Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
200	1	200.4	200.1
	2	199.6	
	3	199.9	
	4	200.1	
	5	200.5	

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EnviLab Co., Ltd. 403,547 ถนนพหลโยธิน แขวงจตุจักร กรุงเทพฯ 10160  
Tel: 02-852-8577-8 Fax: 02-852-8577-9 info@evl-testing.com



## Verification Test Report

Report No.:

SO2400035-E009 -PU 07

Calibrated Date: 29-Aug-24

Equipment: Air Sampling Pump

Manufacturer: AP BUCK

Model: LP-5

Serial or ID No. 5429

Environment: Temperature 25 °C Humidity 60 %RH

Reference Standard: Primary Flow Calibrator Model Defender 510, MESALABS

Serial No. 200368

Date of Calibration : 17 July 2024

### Result of Test

Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
200	1	200.4	200.8
	2	200.5	
	3	200.9	
	4	201.2	
	5	200.8	

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E-mail : info@evl-testing.com  
Tel : 02-802-3773 Fax : 02-802-3773 E-mail : info@evl-testing.com



## Verification Test Report

Report No.:

SO2400035-E009 -PU 08

Calibrated Date: 29-Aug-24

Equipment: Air Sampling Pump

Manufacturer: AP BUCK

Model: LP-5

Serial or ID No. 5430

Environment: Temperature 25 °C Humidity 60 %RH

Reference Standard: Primary Flow Calibrator Model Defender 510, MESALABS

Serial No. 200368

Date of Calibration : 17 july 2024

Result of Test			
Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
200	1	200.3	200.4
	2	200.4	
	3	200.7	
	4	200.7	
	5	200.1	

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E-nvlab Co., Ltd. 503,507/1 หมู่ 10 ตำบล บางคูเวียง อำเภอบางบัวทอง จังหวัดนนทบุรี 11000  
Tel : 02-802-3577-8 Fax : 02-802-3771 E-mail : info@evl-testing.com



## Verification Test Report

Report No.:

SO2400035-E009 -PU 09

Calibrated Date: 29-Aug-24

Equipment: Air Sampling Pump

Manufacturer: SKC

Model: AirCheck 52

Serial or ID No. 1N08

Environment: Temperature 25 °C Humidity 60 %RH

Reference Standard: Primary Flow Calibrator Model Defender 510, MESALABS

Serial No. 200368

Date of Calibration : 17 july 2024

### Result of Test

Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
1000	1	1000.4	1000.4
	2	1000.6	
	3	1000.2	
	4	999.9	
	5	1000.8	

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Evinlab Co., Ltd. 540.5171 Soi Ramadee 7 Bangkok 10110  
Tel : 02-802-3577-8 Fax : 0-1602-3713 E-mail : info@evltesting.com



Check for real quality information

## Verification Test Report

Report No.:

SO2400035-E009 -PU 10

Calibrated Date: 29-Aug-24

Equipment: Air Sampling Pump

Manufacturer: SKC

Model: AirCheck 52

Serial or ID No. 1N13

Environment: Temperature 25 °C Humidity 60 %RH

Reference Standard: Primary Flow Calibrator Model Defender 510, MESALABS

Serial No. 200368

Date of Calibration : 17 july 2024

### Result of Test

Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
1000	1	1000.5	1000.3
	2	1000.4	
	3	1000.1	
	4	1000.0	
	5	1000.7	

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MIRACLE INTERNATIONAL TECHNOLOGY CO.,LTD

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



## CALIBRATION CERTIFICATE

Certificate No. : L202407194-0001

Date Issued : 18-Jul-24

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

**Equipment** : Bios Flow Calibrator

**Manufacturer** : MesaLabs

**Model** : 510-M

**Serial No.** : 200368

**ID No./Tag No.** : NCALBI510M0368

**Date Received** : 12-Jul-24

**Date Calibrated** : 17-Jul-24

**Calibrated by** : Jame Khaothong

### Calibration Method or Calibration Procedure Used

In-house method : CP-26 by comparison against Bell Prover.

In-house method : CP-44 by comparison against Piston Prover.

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 Tothua*  
(Sarayuth Tothua)



Certificate No. : L202407194-0001

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

Relative humidity : ( 50 ± 15)%RH

Capacity Range : 5000 ml/min

Calibration Media : Air

Type : Volumetric Flowmeter

UUC Reference Condition : At atmospheric pressure and room temper

**Measurement Gas Flow rate function**

Temperature ( ° C )	Pressure ( kPa )	UUC (ml/min)	STD (ml/min)	Error (ml/min)	Uncertainty (± ml/min)	MPE ±(ml/min)	Pass / Fail Simple Acceptance
22.30	100.38	0.00	0.00 *	0.00	0.58	50	Pass
22.73	101.00	100.340	98.3950	1.945	1.9	50	Pass
20.90	100.83	499.99	508.6	-8.61	2.3	50	Pass
21.50	100.95	1000.4	1013.8	-13.4	3.6	50	Pass
21.56	101.46	2499.8	2524.9	-25.1	7.1	50	Pass
21.51	102.04	3999.8	4040	-40.2	12	50	Pass

Marked \* are not included in the NSC-ONSC accreditation schedule for our laboratory.

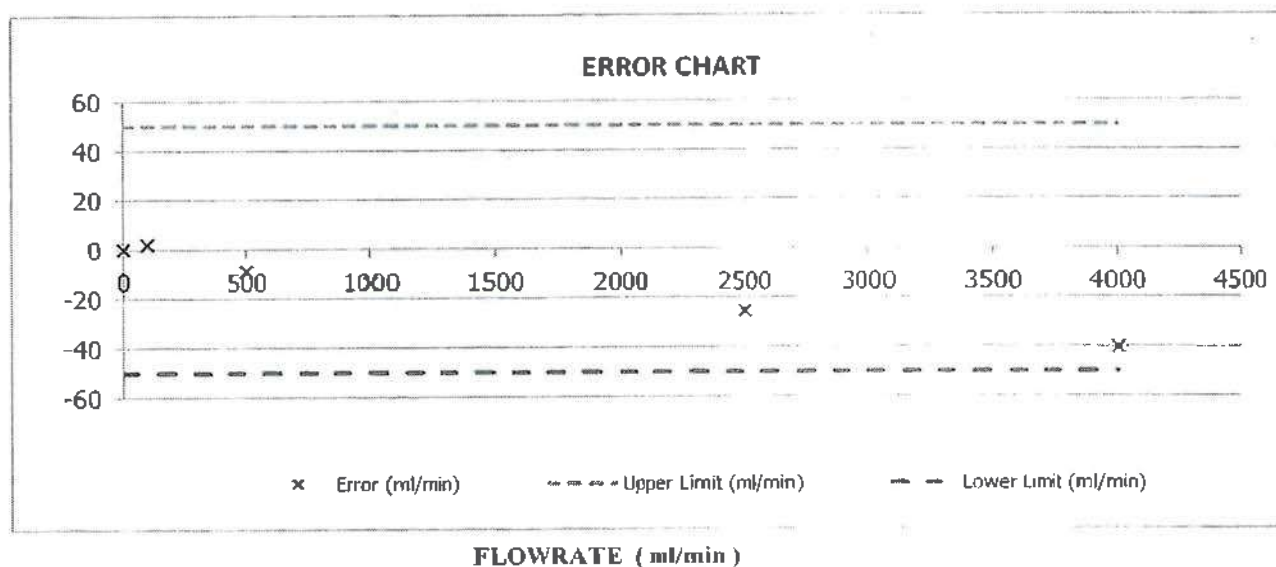
Error = Unit Under Calibration - Standard

Pass = |error| ≤ |MPE|

MPE = Maximum Permissible Error

Fail = |error| > |MPE|

MAX ALLOWED ERROR ( ml/min )



Note :Flow Rate was corrected for non-standard operating condition by using equation :

$$Q_{Meas} = Q_{Ref} \times \frac{P_{Ref}}{P_{Meas}} \times \frac{T_{Meas}}{T_{Ref}}$$

where Q = Flow rate

P = Absolute pressure

T = Absolute temperature

M = Gas molecular weight , Mstandard ( Air ) = 28.9646431 g/mol

Subscript "Meas" = Measurement condition

Subscript "Standard" = Standard condition



Certificate No. : L202407194-0001

Environment : Ambient temperature : ( 23  $\pm$  2 ) °C

Relative humidity : ( 50  $\pm$  15 ) % RH

Capacity Range : 5000 ml/min

Calibration Media : Air

UUC Reference Condition : At atmos and room and room and room

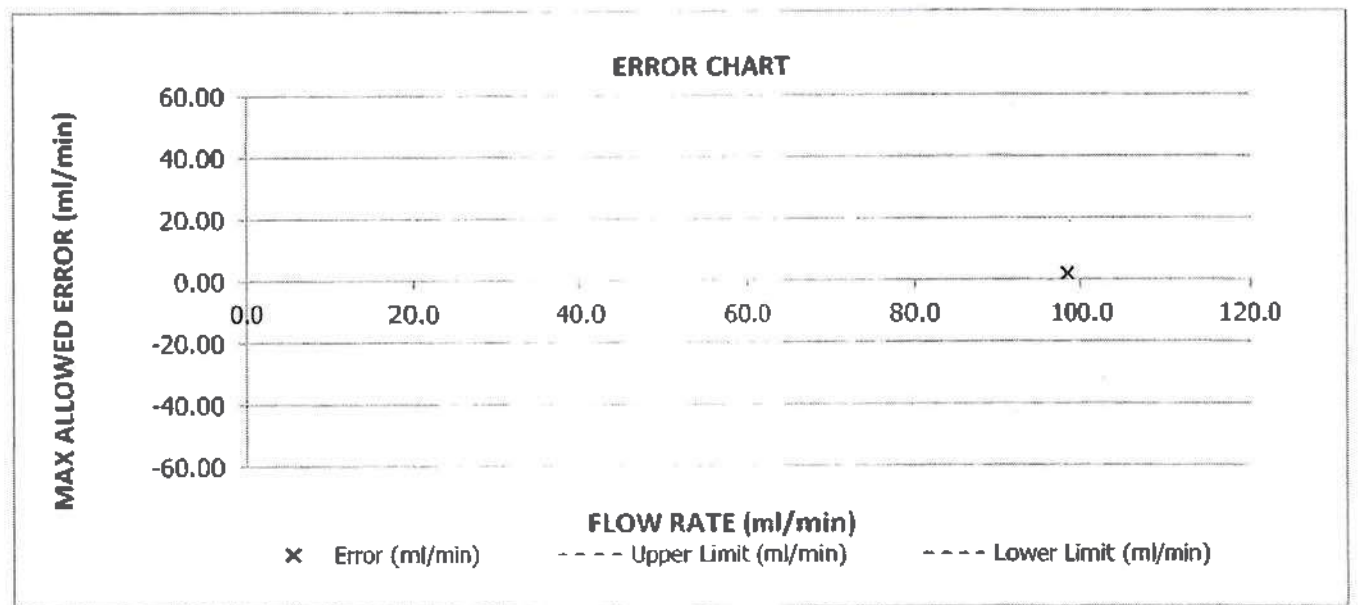
Temperature (°C)	Pressure (kPa)	Flow Rate Reading (ml/min)		Error (ml/min)	Uncertainty $\pm$ (ml/min)	MPE $\pm$ (ml/min)	Pass / Fail
		UUC Reading	STD Reading				Simple Acceptance
22.733	101.00	100.34	98.395	1.95	1.1	50	Pass

Error = Unit Under Calibration - Standard

Pass =  $|\text{error}| \leq |\text{MPE}|$

MPE = Maximum Permissible Error

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



Certificate No. :

L202407194-0001

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 Calibration Certificate No. L202403371-0002 for Bell Prover Volume (60L) Serial No. 9511HC028626, Due 12-Apr-26

MIT Calibration Certificate No. L202405041-0002 for Temperature Transmitter with probe Serial No. MIT-STD-122,  
Due 13-May-25

MIT Calibration Certificate No. L202405041-0003 for Pressure Transmitter with indicator Serial No. MIT-STD-123,  
Due 24-May-25

MIT Calibration Certificate No. L202307322-0007 for Bell Prover Timer Serial No. 9511HC028626, Due 09-Aug-24

MIT Calibration Certificate No. L202405039-0005 for Piston Prover Volume Serial No. 85, Due 30-May-25

MIT Calibration Certificate No. L202403007-0026 for Piston Prover Timer Serial No. 122199, Due 06-Mar-26

MIT Certificate No. L202403007-0026 for Piston Prover Timer Serial No. 122199, Due 06-Mar-26

MIT Calibration Certificate No. L202403007-0025 for Temperature Indicator with Sensor (Piston Prover)  
Serial No. MIT-STD-258, Due 01-Mar-25

**End of Certificate**



# CAL

Calibratech Co., Ltd.

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

Tel:(02) 964-6211 Fax:(02) 964-5455, e-mail : calibratech.cal@gmail.com, calibratech.cal@hotmail.com



NSC-TISI-TIS 17025  
CALIBRATION 0030

## Certificate of Calibration

**Certificate No. :** 67-200060-2

**Page : 1 of 2**

**Submitted by :** Envilab Co., Ltd.

540, 540/1 Soi Bangkhac7, Bangkhac, 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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## Certificate of Calibration

Certificate No. : 67-200060-2

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Departure of indication from nominal value

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

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

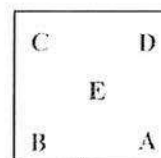
This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor  $k = 2.00$ , providing a level of confidence of approximately 95%

Eccentric error

Load test : 50 g

A	B	C	D	E
0.00000	0.00000	0.00010	0.00000	0.00000

g



Repeatability

Load test : 200 g

Stdev. : 0.000032 g

- o o o -

11/80





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

Received Date : 30 Mar 2024

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

Calibration Date : 18 Apr 2024

Location of Calibration : In-Lab

Recommend Due Date : 18 Apr 2025

Calibration Procedure : SP-CPE-04-32

Date of Issue : 19 Apr 2024

### Method of Calibration

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

The calibration certificate shall not be reproduced except in full  
System (Thailand).

Calibrated by : Mr.Nanthawat Wanasit

Ap

Calibration Officer

( 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 28 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230  
Tel: 02-578-0553-4 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. : MCH110028[EHEMTHS3211028]  
CLID. NO. : 232400815  
JOB CONTROL NO. : 240227021071  
CALIBRATION SERVICE : ☒ IN-LABORATORY ☐ ON-SITE

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

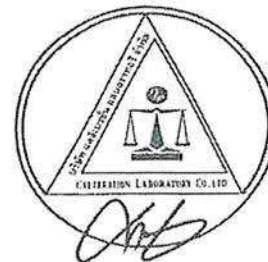
DATE OF RECEIVED : 27 February 2024

DATE OF ISSUED : 29 February 2024

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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,  
the International System of Units

Certificate No. Q24021071

F3-011-05/12-23



calibration



# CALIBRATION LABORATORY Co., LTD.

2/10-11, 14, 55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrae, 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.	:	MCH110028[EHEMTHS3211028]
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 Meas

Certificate No. Q24021071

F3-011-05/12-23



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# CALIBRATION LABORATORY CO., LTD.

2/10-11,14,56 Soi Prasert Manukit 29 Yek 4, Prasert Manukit Rd., Ladprao, Bangkok 10230  
Tel: 02-578-0353-4 Fax: 02-578-2672 www.cclaboratory.com E-mail:sala@ccl-laboratory.com



**CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION**

**MEASUREMENT RESULTS : ( X ) without adjustment ( ) adjustment**

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

## CALIBRATION DATA

### 1. CORRECTION OF TEMPERATURE : WET

Test point ( ° C )	Actual Temperature ( ° C )	DUC Reading ( ° C )	Correction ( ° C )	Uncertainty ± ( ° C )
20.0	20.00	19.8	+0.20	0.27
30.0	30.00	29.8	+0.20	
40.0	39.99	39.9	+0.09	

### 2. CORRECTION OF TEMPERATURE : DRY

Test point ( ° C )	Actual Temperature ( ° C )	DUC Reading ( ° C )	Correction ( ° C )	Uncertainty ± ( ° C )
20.0	20.00	19.8	+0.20	0.27
30.0	30.00	29.9	+0.10	
40.0	39.99	40.2	-0.21	

### 3. CORRECTION OF TEMPERATURE : GLOBE

Test point ( ° C )	Actual Temperature ( ° C )	DUC Reading ( ° C )	Correction ( ° C )	Uncertainty ± ( ° C )
20.0	20.00	19.9	+0.10	0.27
30.0	30.00	29.8	+0.20	
40.0	39.99	39.8	+0.19	

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. Q24021071

R3-011-05/12-23



@cclcalibration



# 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. : MCH110039[EHETHS3211039]  
CLID. NO. : 232400807  
JOB CONTROL NO. : 240227021068  
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  
the International System of Units (SI)

Certificate No. Q24021068

F3-011-05/12-23



getcalibration



CLC  
Accredited  
ISO/IEC 17025

# CALIBRATION LABORATORY Co., LTD.

210-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrae Bangkok 10230  
Tel: 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail: sales@cal-laboratory.com



## REPORT OF CALIBRATION

### FOR

NOMENCLATURE	:	HEAT STRESS MONITOR
MANUFACTURER	:	METROSONICS
MODEL / TYPE	:	hs-32
SERIAL NO.	:	MCH110039 EHMTHS3211039
DATE OF CALIBRATION	:	28 February 2024

#### ENVIRONMENT CONDITIONS :

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

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

#### PROCEDURE USED :

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

#### REFERENCE STANDARD USED :

Chilled Mirror Hygrometer, Edgetech Model Dew Master S/N. 44602.

Temperature & Humidity Chamber, PGC Model 9141-5116 S/N. 1304261.

#### TRACEABILITY :

The measurements are traceable to International System of Units (SI) , through Thunder Scientific Corporation.

Certificate No. 21594, Due Date 06 July 2024.

#### UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor  $k = 2,00$  which for a normal distribution corresponds to a confidence level of 95%.

It has been evaluated according to the "Evaluation of the Uncertainty of Measurement" (GUM) 1995.

Certificate No. Q24021068

F3-011-05/12-23

page 2 of 3



@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



**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	19.9	+0.10	0.27
30.0	30.00	29.9	+0.10	
40.0	39.99	40.1	-0.11	

### 2. CORRECTION OF TEMPERATURE : DRY

Test point ( ° C )	Actual Temperature ( ° C )	DUC Reading ( ° C )	Correction ( ° C )	Uncertainty $\pm$ ( ° C )
20.0	20.00	19.8	+0.20	0.27
30.0	30.00	29.8	+0.20	
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. Q24021068

F3-011-05/12-23



@clcalibration



# 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. : MCE010015[EHEMTHS3210015]  
CLID. NO. : 232400805  
JOB CONTROL NO. : 240227021067  
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 real  
the International System of Units ( SI )

Certificate No. Q24021067

F3-011-05/12-23



www.calibration



# CALIBRATION LABORATORY Co., LTD.

2/10-11, 4, 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: info@cal-laboratory.com



## REPORT OF CALIBRATION

### FOR

**NOMENCLATURE** : **HEAT STRESS MONITOR**  
**MANUFACTURER** : **METROSONICS**  
**MODEL / TYPE** : **hs-32**  
**SERIAL NO.** : **MCE010015[EHEMTHS3210015]**  
**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-CPTII-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 confidence level of 95%.  
It has been evaluated according to the "Evaluation of the Uncertainty of Measurement".

Certificate No. Q24021067

F3-011-05/12-23

page 2 of 3



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**CLC**  
Accredited  
ISO/IEC 17025

# CALIBRATION LABORATORY Co., LTD.

2/10-11,14,55 Soi Prasert Manukit 29 Yakk 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230  
Tel. 02-578-0353-4 Fax: 02-578-2872 www.cal-lab.co.th 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	19.8	+0.20	0.27
30.0	30.00	29.8	+0.20	
40.0	39.99	39.8	+0.19	

### 2. CORRECTION OF TEMPERATURE : DRY

Test point ( ° C )	Actual Temperature ( ° C )	DUC Reading ( ° C )	Correction ( ° C )	Uncertainty $\pm$ ( ° C )
20.0	20.00	19.8	+0.20	0.27
30.0	30.00	29.8	+0.20	
40.0	39.99	39.8	+0.19	

### 3. CORRECTION OF TEMPERATURE : GLOBE

Test point ( ° C )	Actual Temperature ( ° C )	DUC Reading ( ° C )	Correction ( ° C )	Uncertainty $\pm$ ( ° C )
20.0	20.00	19.8	+0.20	0.27
30.0	30.00	29.7	+0.30	
40.0	39.99	39.6	+0.39	

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. Q24021067

F3-011-05/12-23

page 3 of 3



@clccalibration



# CALIBRATION LABORATORY CO., LTD.

210-11,14 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 real  
the International System of Units (SI)

Certificate No. Q24021069

E3-011-05:12-23



for calibration

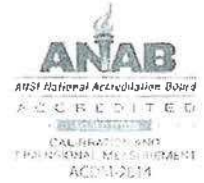




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Accredited  
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# CALIBRATION LABORATORY CO., LTD.

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



## REPORT OF CALIBRATION

### FOR

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

#### ENVIRONMENT CONDITIONS :

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

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

#### PROCEDURE USED :

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

#### REFERENCE STANDARD USED :

Chilled Mirror Hygrometer, Edgetech Model Dew Master S/N. 44602.

Temperature & Humidity Chamber, PGC Model 9141-5116 S/N. 1304261.

#### TRACEABILITY :

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

#### UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor  $k = 2,00$  which for a normal distribution corresponds to a coverage probability of approximately 95 %.  
It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2022)"

Certificate No. Q24021069

F3-011-05/12-23



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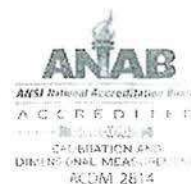




**CLC**  
Accredited  
ISO/IEC 17025

# CALIBRATION LABORATORY CO., LTD.

2/10-11,14,55 Soi Prasert Manukil 29 Yaek 4, Prasert Manukil 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



@clcalibration



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 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 with the approval of SP Metrology System (Thailand).

Calibrated by : Mr.Nanthawat Wanasit

Calibration Officer

( 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 -





บริษัท เอ็นไวเลบ จำกัด 540,540/1 ซอยบางเขน 7 บางเขน กรุงเทพฯ 10160  
Envilab Co., Ltd. 540,540/1 Soi Bangkhe 7 Bangkok 10160  
Tel: 02-802-3777-8 Fax: 02-802-3777 E-mail: info@evltesting.com



Envilab Co., Ltd.

## Verification Test Report

Report No.:

SO2400035-E009 -SLM 01

☒ PM ☐ Onsite UTM : 47P 1514458 N 654247 E

Calibrated Date: 29 August 2024

Site : บริษัท เอ็นไวเลบ จำกัด

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 44

Serial : 1807

Environment: Temperature 26 °C Humidity 60 %RH

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

Serial No.1351075

Date of Calibration : 10 Apr 2024

### Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.72	93.99	0.27	93.72

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บริษัท เอ็นไวเทส จำกัด 5435-71 ซอย 7 แขวง 7 เขต บางนา กรุงเทพมหานคร 10710  
Envirotec Co., Ltd. 5435-71 Soi 7, Phase 7, Bangkharungjith - Bangkok 10710  
Tel: 02-552-3571-8 Fax: 02-552-3772 E-mail: info@evltesting.com



www.evltesting.com

## Verification Test Report

Report No.:

SO2400035-E009 -SLM 02

☒ PM ☐ Onsite UTM : 47P 1514458 N 654247 E

Calibrated Date: 29 August 2024

Site : บริษัท เอ็นไวเทส จำกัด

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 44

Serial : 1842

Environment: Temperature 26 °C Humidity 60 %RH

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

Serial No.1351075

Date of Calibration : 10 Apr 2024

### Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.72	93.56	-0.16	93.72

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บริษัท เอ็นไวแล็บ จำกัด 1362-4021108 แขวงบางพลี เขตบางพลี กรุงเทพมหานคร 10160  
EnviLab Co., Ltd. 1362-4021108 Bang Phlee 7 Bangkhoe Bangkok Bangkok 10160  
Tel : 02-800-7777-8 Fax : 02-802-3777 E-mail : info@evltesting.com



## Verification Test Report

Report No.:

SO2400035-E009 -SLM 03

☒ PM ☐ Onsite UTM : 47P 1514458 N 654247 E

Calibrated Date: 29 August 2024

Site : บริษัท เอ็นไวแล็บ จำกัด

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 44

Serial : 1877

Environment: Temperature 26 °C Humidity 60 %RH

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

Serial No.1351075

Date of Calibration : 10 Apr 2024

### Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.72	93.98	0.26	93.72

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EnviLab Co., Ltd. 540,543/1 Soi Bang-plee 7 Bangplie Sub-town, Bangplie District, Bangkok 10710  
Tel: 02-832-2577-8 Fax: 02-832-3773 E-mail: info@evl.com



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## Verification Test Report

Report No.:

SO2400035-E009 -SLM 04

☒ PM ☐ Onsite UTM : 47P 1514458 N 654247 E

Calibrated Date: 29 August 2024

Site : บริษัท เอ็นไวแล็บ จำกัด

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 44

Serial : 1843

Environment: Temperature 26 °C Humidity 60 %RH

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

Serial No.1351075

Date of Calibration : 10 Apr 2024

### Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.72	93.34	-0.38	93.72

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Envilab Co., Ltd.  
Tel: 02-802-8577-8  
www.evltesting.com



## Verification Test Report

Report No.:

SO2400035-E009 -SLM 05

☒ PM ☐ Onsite UTM : 47P 1514458 N 654247 E

Calibrated Date: 29 August 2024

Site : บริษัท เอ็นไวแล็บ จำกัด

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 44

Serial : 1883

Environment: Temperature 26 °C Humidity 60 %RH

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

Serial No.1351075

Date of Calibration : 10 Apr 2024

### Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.72	93.62	-0.10	93.72

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บริษัท เอ็นวีที จำกัด (มหาชน) เลขที่ 7 ถนนวิภาวดี พหลโยธิน แขวงจตุจักร กรุงเทพฯ 10140  
E-mail : info@evltesting.com โทร : 02-562-3443 E-mail : info@evltesting.com



เอกสารนี้เป็นเอกสารของบริษัทฯ

## Verification Test Report

Report No.:

SO2400035-E009 -SLM 06

☒ PM ☐ Onsite UTM : 47P 1514458 N 654247 E

Calibrated Date: 29 August 2024

Site : บริษัท เอ็นไวแล็บ จำกัด

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 44

Serial : 1841

Environment: Temperature 26 °C Humidity 60 %RH

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

Serial No.1351075

Date of Calibration : 10 Apr 2024

### Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.72	93.79	0.07	93.72

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บริษัท เอ็นไวแล็บ จำกัด SO240071 โทร : 02-602-3577 Fax : 02-602-3573 E-mail : info@evl-testing.com  
Envilab Co., Ltd. SO240071 911 Rangkhoei 11 Rangkhoei Rangkhoei Bangkok 10110  
Tel : 02-602-3577-8 Fax : 02-602-3573 E-mail : info@evl-testing.com



## Verification Test Report

Report No.:

SO2400035-E009 -SLM 07

☒ PM ☐ Onsite UTM: 47P 1514458 N 654247 E

Calibrated Date: 29 August 2024

Site : บริษัท เอ็นไวแล็บ จำกัด

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 44

Serial : 1805

Environment: Temperature 26 °C Humidity 60 %RH

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

Serial No.1351075

Date of Calibration : 10 Apr 2024

### Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.72	93.88	0.16	93.72

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Envilab Co., Ltd. 10150 10150  
Tel : 02-02-2577-5 Fax : 02-02-2577-3 E-mail : info@evltesting.com



6/10/2024 10:00:00 AM

## Verification Test Report

Report No.:

SO2400035-E009-SLM 08

☒ PM

☐ Onsite UTM :

47P 1514458 N 654247 E

**Calibrated Date:** 29 August 2024

**Site :** บริษัท เอ็นไวแล็บ จำกัด

**Equipment:** Sound Level Meter

**Manufacturer:** PULSAR

**Model:** 44

**Serial :** 1810

**Environment:** Temperature 26 °C Humidity 60 %RH

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

Serial No.1351075

Date of Calibration : 10 Apr 2024

### Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.72	93.54	-0.18	93.72

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EnviTest Co., Ltd. 515-40/1 Soi Sukhumvit 7, Bangkok/Bangkok Bangkok, 10160  
Tel: 02-107-3572-8 Fax: 02-637-3773 E-mail: info@evltesting.com



## Verification Test Report

Report No.:

SO2400035-E009 -SLM 09

☒ PM ☐ Onsite UTM: 47P 1514458 N 654247 E

Calibrated Date: 29 August 2024

Site : บริษัท เอ็นไวเทสティング จำกัด

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 44

Serial : 1812

Environment: Temperature 26 °C Humidity 60 %RH

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

Serial No.1351075

Date of Calibration : 10 Apr 2024

### Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.72	93.91	0.19	93.72

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EnviLab Co., Ltd. 540,540/1 Soi Bangna 7 Bang Na Bang Na Bangkok 10760  
Tel: 02-802-2577-8 Fax: 02-802-3773 E-mail: info@envilab.com



www.envilab.com

## Verification Test Report

Report No.:

SO2400035-E009 -SLM 10

☒ PM

☐ Onsite UTM :

47P 1514458 N 654247 E

Calibrated Date: 29 August 2024

Site : บริษัท เอ็นไวแล็บ จำกัด

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 44

Serial : 1796

Environment: Temperature 26 °C Humidity 60 %RH

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

Serial No.1351075

Date of Calibration : 10 Apr 2024

### Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.72	93.67	-0.05	93.72

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EnviLab Co., Ltd. 10760  
Tel.: 02-802-3511 Fax: 02-802-3512 E-mail: info@evltesting.com



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## Verification Test Report

Report No.:

SO2400035-E009 -SLM 01

☒ PM

☐ Onsite UTM:

47P 1514458 N 654247 E

Calibrated Date: 29 August 2024

Site : บริษัท เอ็นไวแล็บ จำกัด

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 44

Serial : 1804

Environment: Temperature 26 °C Humidity 60 %RH

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

Serial No.1351075

Date of Calibration : 10 Apr 2024

### Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.72	93.88	0.16	93.72

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E-mail: info@evltesting.com Tel: 02-5401121 Fax: 02-5401122 E-mail: info@evltesting.com



## Verification Test Report

Report No.:

SO2400035-E009 -SLM 02

☒ PM

☐ Onsite UTM:

47P 1514458 N 654247 E

Calibrated Date: 29 August 2024

Site : บริษัท เอ็นไวเทสท์ จำกัด

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 44

Serial : 1844

Environment: Temperature 26 °C Humidity 60 %RH

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

Serial No.1351075

Date of Calibration : 10 Apr 2024

### Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.72	93.63	-0.09	93.72

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Envilab Co., Ltd. 540.540.540 Soi Dampradee 7 Amphoe Suanphoo Bangkok 10110  
Tel: 02-802-3577-8 Fax: 02-802-3773 E-mail: info@evltesting.com



THE EVL LABS QUALITY SYSTEM

## Verification Test Report

Report No.:

SO2400035-E009 -SLM 03

☒ PM ☐ Onsite UTM : 47P 1514458 N 654247 E

Calibrated Date: 29 August 2024

Site : บริษัท เอ็นไวแล็บ จำกัด

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 44

Serial : 1575

Environment: Temperature 26 °C Humidity 60 %RH

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

Serial No.1351075

Date of Calibration : 10 Apr 2024

### Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.72	93.57	-0.15	93.72

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# PinAAcle 900F Preventive Maintenance Report

Company Name:

Envilab Co.,Ltd

Instrument Location: 540/1 ซอยบางแค 7, แขวงบางแค เขตบางแค

กรุงเทพมหานคร 10160

Instrument Serial No.:

PFBS20011403


Date: 05-Apr-2024





## 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:	4/4
Customer Name (if applicable):	K.Janjira	Telephone Number:	095-550-0510
Customer Support Engineer Name:	Khwanchai	Service Order Number:	WO-02707812
Date PM Performed: (DD-MMM-YYYY)	05-Apr-2024	Next PM Due Date: (DD-MMM-YYYY)	05-Oct-2024
Standard Labor Hours to Complete PM :		5 hours	

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

### Scope

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

The customer should save their method before the PM begins.

### General Instructions:

The customer must provide the engineer operational data to demonstrate recent instrument performance prior to starting the PM.

Always check with the customer before making any changes that may affect the customer's analysis or calibration, including a current back-up of system software and/or data files.

The completed document should be signed by an authorized PerkinElmer and customer representative and left with the customer.

Update the PM sticker and instrument logbook as required.

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## Component List

Component / Specific Model	Serial #	Configuration Notes

## Parts Lists

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

Additional Reagents and Standards Required for PM				
Part Number (if applicable)	Description	Quality	Batch/Lot #	Expired Date (MM/YY)
N9300183	1000 mg/L Copper Standard	AR	27-39CUY1	04/25

Additional Reagents and Standards Required for PM (Customer Support Solution)				
Part Number (if applicable)	Description	Quantity	Batch/Lot #	Expiration Date (MM/YY)
N/A	DI Water	250 ml.	AR	AR
N/A	0.5% HNO <sub>3</sub>	250 ml.	AR	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 sloth width. Replace if out of specification
- ☒ Check the condition of the end cap, burner head, and nebulizer O-rings. Replace if necessary.
- ☒ Check the drain system for signs of wear. Replace worn or damaged parts.
- ☒ Visually check for proper flame conditions when igniting the Air-C<sub>2</sub>H<sub>2</sub> and N<sub>2</sub>O-C<sub>2</sub>H<sub>2</sub> 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 <sub>2</sub> H <sub>2</sub> Flame correctly shuts down	Active	Passed
Drain Sensor	Air/C <sub>2</sub> H <sub>2</sub> Flame correctly shuts down	Active	Passed
Nebulizer Sensor	Air/C <sub>2</sub> H <sub>2</sub> Flame correctly shuts down	Active	Passed
C <sub>2</sub> H <sub>2</sub> Pressure Sensor	Air/C <sub>2</sub> H <sub>2</sub> Flame correctly shuts down	Active	Passed
Air Pressure Sensor	Air/C <sub>2</sub> H <sub>2</sub> 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	1.0606	Passed
0.2 A ND Filter	± 5% from Cert.	0.1806	0.1840	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	0.0020	Passed

### 8.3 AA Baseline Noise with Copper

Description: Check baseline noise.

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



#### 8.4 D<sub>2</sub> Background Compensation with Copper

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

Parameter	Specification	Results	Pass/Fail
Standard Deviation	$\leq 0.010$	0.0069	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	$\leq 0.005$	0.0005	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	$\leq 0.005$	0.0003	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
2 mg/L Sensitivity HS Neb (if applicable)	> 0.250 Abs.	0.3090	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

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:

KLS

Date:

05-Apr-2024  
(DD-MMM-YYYY)

Authorized Customer Representative:


6926<sup>4</sup>357

Date:

05-Apr-2024  
(DD-MMM-YYYY)



<b>Atomic Absorption/FIAS 100/400 Preventive Maintenance (PM)</b>			
<b>Company Name:</b>	Envilab Co.,Ltd		
<b>Address (Instrument Location):</b>	540/1 ซอยบางแค 7, แขวงบางแค เขตบางแค กรุงเทพมหานคร 10160		
<b>Room Number:</b>	-		
<b>Asset Number (if applicable):</b>	100S20010501	<b>Customer System ID:</b>	
<b>Service Engineer Name:</b>	Patrayut W.	<b>Service Order Number:</b>	WO-02707811
<b>Date PM Performed: (DD-MMM-YYYY)</b>	05-Apr-2024	<b>Next PM Due Date: (DD-MMM-YYYY)</b>	05-Oct-2024

Part Number	Release	Publication Date	
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 Nafion 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:**


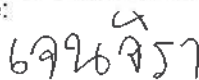
- ☒ Review with the customer PM work performed.
- ☒ Review with the customer routine maintenance procedures.
- ☒ Discuss recommended customer-supplied materials to have on hand.
- ☒ Attach PM sticker.
- ☒ Update Logbook.



## Additional Comments

Additional Comments Regarding the PM

## Review

<i>The preventive maintenance checks and if applicable performance tests for FIAS 100/400 have been completed.</i>	
<i>This FIAS 100/400 Passes <input checked="" type="checkbox"/> Fails <input type="checkbox"/> the preventive maintenance.</i>	
<b>Review of Preventive Maintenance:</b>	
Authorized PerkinElmer Representative: 	Date: 05-Apr-2024 (DD-MMM-YYYY)
Authorized Customer Representative: 	Date: 05-Apr-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 TruQ

PerkinElmer Number: N9300183  
Element and Matrix: 1000 µg/mL Copper in 2% HNO<sub>3</sub>  
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 30 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	Element	µg/mL
Ag	0.001	Dy	<0.001	Li	<0.001	Pt	<0.001	Tb	<0.001
Al	0.003	Er	<0.001	Lu	<0.001	Rb	<0.005	Te	<0.001
As	<0.001	Eu	<0.001	Mg	0.002	Re	<0.001	Th	<0.001
Au	<0.001	Fe	0.02	Mn	<0.001	Rh	0.002	Ti	<0.001
B	<0.001	Ga	<0.001	Mo	<0.001	Ru	<0.001	Tl	<0.001
Ba	<0.001	Gd	<0.001	Na	<0.001	Sb	0.004	Tm	<0.001
Be	<0.001	Ge	<0.001	Nb	<0.001	Sc	<0.001	U	<0.001
Bi	<0.001	Hf	<0.001	Nd	<0.001	Se	<0.006	V	<0.001
Ca	<0.01	Hg	<0.001	Ni	<0.002	Si	<0.1	W	<0.001
Cd	<0.001	Ho	<0.001	P	<0.5	Sm	<0.001	Y	<0.001
Ce	<0.001	In	<0.001	Pb	0.004	Sn	0.002	Yb	<0.001
Co	<0.001	Ir	<0.001	Pd	<0.001	Sr	<0.001	Zn	<0.02
Cr	<0.001	K	0.5	Pr	<0.001	Ta	<0.001	Zr	<0.001
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(NO<sub>3</sub>)<sub>2</sub> 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:

Y. Parikh  
Yogesh Parikh, Senior Spectroscopist

# 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	Number	Ordinate Reading (Absorbance) at the following wavelengths:							
Wavelength		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  $\pm 0.003 A$  at the given wavelengths.

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

## Conditions of Calibration

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

### Measurement of Calibration

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

The 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 Standard 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**

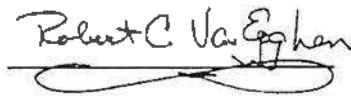
The Reference Standard was found to meet its functional and performance specification prior to shipment. To support this declaration, the following Engineering, Production and Test Documents are held by PerkinElmer and are available for reference upon request in justified cases and to an appropriate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

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

*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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Quality Manager PKI RMCL  
PerkinElmer Instruments  
Shelton, CT. USA

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

# Secondary Spectrometric Calibration Standards

## Certificate of Calibration

### Ordinate Calibration

Calibration Data for Secondary Calibration Standards:

Wavelength / Absorbance	Number	Ordinate Reading (Absorbance) at the following wavelengths:							
Wavelength		193.70	324.80	553.60	766.50				
Standard 1	MG0-058	0.2483	0.1857	0.1806	0.1674				

The tolerance of the given absorbance values is  $\pm 0.006 A$  in the ultra violet and visible range, and  $\pm 0.010 A$  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 mode UV/Vis	Fix	Slit UV/Vis	1 nm
Integration time UV/Vis	5 s		
Slit mode NIR	Servo	Slit NIR	Servo
Integration time NIR	5 s	Gain	2

The 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: 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 S/N 155 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 / 1:46:28 PM

Operator: Cam Le Horvath

Signature: 

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

**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**

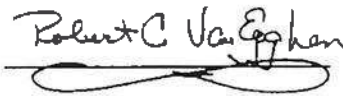
The Reference Standard was found to meet its functional and performance specification prior to shipment. To support this declaration, the following Engineering, Production and Test Documents are held by PerkinElmer and are available for reference upon request in justified cases and to an appropriate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

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



# 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

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*

**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.



## Verification Test Report

Report No.:

SO2400082-E002 -PU 01

**Calibrated Date:** 8-Aug-24

**Equipment:** Air Sampling Pump

**Manufacturer:** AP BUCK

**Model: LP-5**

Serial or ID No. 5430

**Environment:** Temperature 25 °C Humidity 60 %RH

**Reference Standard:** Primary Flow Calibrator Model Defender 510, MESALABS

Serial No. 200363

Date of Calibration : 17 july 2024

Result of Test			
Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
200	1	200.3	200.4
	2	200.4	
	3	200.7	
	4	200.7	
	5	200.1	

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EVL Testing Co., Ltd. 510/5-71 หมู่ 7 แขวงคลองจั่น เขตจตุจักร กรุงเทพมหานคร 10710  
Tel : 02-502-3577-8 Fax: 02-502-1773 E-mail : info@evltesting.com



## Verification Test Report

Report No.:

SO2400082-E002 -PU 02

Calibrated Date: 8-Aug-24

Equipment: Air Sampling Pump

Manufacturer: AP BUCK

Model: LP-5

Serial or ID No. 5449

Environment: Temperature 25 °C Humidity 60 %RH

Reference Standard: Primary Flow Calibrator Model Defender 510, MESALABS

Serial No. 200368

Date of Calibration : 17 july 2024

### Result of Test

Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
2000	1	2000.1	2000.4
	2	2000.9	
	3	1999.7	
	4	2000.7	
	5	2000.6	

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บริษัท (Co., Ltd.) 540 หมู่ 7 ถนนพหลโยธิน แขวงจตุจักร กรุงเทพฯ 10110  
Tel: 02-817-3577 Fax: 02-807-8773 E-mail: info@evltesting.com



## Verification Test Report

Report No.:

SO2400082-E002 -PU 04

Calibrated Date: 8-Aug-24

Equipment: Air Sampling Pump

Manufacturer: AP BUCK

Model: LP-5

Serial or ID No. 5429

Environment: Temperature 25 °C Humidity 60 %RH

Reference Standard: Primary Flow Calibrator Model Defender 510, MESALABS

Serial No. 200368

Date of Calibration : 17 July 2024

Result of Test			
Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
200	1	200.4	200.8
	2	200.5	
	3	200.9	
	4	201.2	
	5	200.8	

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EVL Co., Ltd. 540.540/1 Moo 7, Bangpliyai Bang Phli, Samut Prakan  
Tel: 02-802-3777-8 Fax: 02-802-3773 E-mail: info@evl.co.th



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## Verification Test Report

Report No.:

SO2400082-E002 -PU 05

Calibrated Date: 8-Aug-24

Equipment: Air Sampling Pump

Manufacturer: AP BUCK

Model: LP-5

Serial or ID No. 5428

Environment: Temperature 25 °C Humidity 60 %RH

Reference Standard: Primary Flow Calibrator Model Defender 510, MESALABS

Serial No. 200368

Date of Calibration : 17 July 2024

### Result of Test

Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
200	1	200.4	200.1
	2	199.6	
	3	199.9	
	4	200.1	
	5	200.5	

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EVL Co., Ltd. 540/5 หมู่ 5 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10110  
Tel: 02-852-9577 Fax: 02-852-9578 Email: info@evltesting.com



## Verification Test Report

Report No.:

SO2400082-E002 -PU 06

**Calibrated Date:** 8-Aug-24

**Equipment:** Air Sampling Pump

**Manufacturer:** AP BUCK

**Model:** LP-5

**Serial or ID No.** 5446

**Environment:** Temperature 25 °C Humidity 60 %RH

**Reference Standard:** Primary Flow Calibrator Model Defender 510, MESALABS

Serial No. 200368

Date of Calibration : 17 July 2024

### Result of Test

Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
500	1	500.6	500.3
	2	500.7	
	3	500.2	
	4	500.1	
	5	499.9	

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โทร : 02-015-5411 โทรสาร : 02-015-5412 อีเมล : info@evltesting.com  
เว็บไซต์ : www.evtesting.com



## Verification Test Report

Report No.:

SO2400082-E002 -PU 07

Calibrated Date: 8-Aug-24

Equipment: Air Sampling Pump

Manufacturer: AP BUCK

Model: LP-5

Serial or ID No. 5427

Environment: Temperature 25 °C Humidity 60 %RH

Reference Standard: Primary Flow Calibrator Model Defender 510, MESALABS

Serial No. 200368

Date of Calibration : 17 July 2024

Result of Test			
Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
200	1	200.1	200.3
	2	200.8	
	3	200.9	
	4	199.9	
	5	199.8	

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**Report No.:**

**Calibrated Date:** 8-Aug-24

**Equipment:** Air Sampling Pump

**Manufacturer:** Gillian

**Model:** HFS-113A

Serial or ID No. 0510

**Environment:** Temperature 25 °C Humidity 60 %RH

**Reference Standard:** Primary Flow Calibrator Model Defender 510, MESALABS

Serial No. 200368

Date of Calibration : 17 july 2024

Result of Test			
Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
1000	1	1000.3	1000.8
	2	1000.7	
	3	1001.2	
	4	1001.3	
	5	1000.5	

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EVL Co., Ltd. 101 Moo 10, Bang Phli Yai, Bang Phli, Samut Prakan 10540  
Tel: 02-802-2566 Fax: 02-802-2723 E-mail: info@evltesting.com



Quality Management System

## Verification Test Report

Report No.:

SO2400082-E002 -PU 09

**Calibrated Date:** 8-Aug-24

**Equipment:** Air Sampling Pump

**Manufacturer:** AP BUCK

**Model:** LP-5

**Serial or ID No.** 5426

**Environment:** Temperature 25 °C Humidity 60 %RH

**Reference Standard:** Primary Flow Calibrator Model Defender 510, MESALABS

Serial No. 200368

Date of Calibration : 17 july 2024

### Result of Test

Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
200	1	200.3	200.6
	2	200.5	
	3	200.6	
	4	200.5	
	5	200.9	

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EVL Lab. Co., Ltd. 840,540/1 หมู่ที่ 18 ตำบล บางกะปิ กรุงเทพมหานคร 10160  
Tel. 02-902 3771-3 Fax. 02-902-3773 E-mail : info@evltesting.com



## Verification Test Report

Report No.:

SO2400082-E002 -PU 10

**Calibrated Date:** 8-Aug-24

**Equipment:** Air Sampling Pump

**Manufacturer:** AP BUCK

**Model:** LP-5

**Serial or ID No.** 5447

**Environment:** Temperature 25 °C Humidity 60 %RH

**Reference Standard:** Primary Flow Calibrator Model Defender 510, MESALABS

Serial No. 200368

Date of Calibration : 17 July 2024

### Result of Test

Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
500	1	499.8	500.0
	2	499.9	
	3	500.2	
	4	500.0	
	5	500.2	

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Evinlab Co., Ltd. 540,547/1 St. Bangplai Yai  
Tel.: 02-802-3577-8 Fax: 02-802-3473 E-mail: info@evltesting.com



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## Verification Test Report

Report No.:

SO2400082-E002 -PU 01

Calibrated Date: 28-Aug-24

Equipment: Air Sampling Pump

Manufacturer: SKC

Model: AirCheck 52

Serial or ID No. 8201

Environment: Temperature 25 °C Humidity 60 %RH

Reference Standard: Primary Flow Calibrator Model Defender 510, MESALABS

Serial No. 200368

Date of Calibration : 17 july 2024

### Result of Test

Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
200	1	200.1	200.4
	2	200.4	
	3	200.7	
	4	200.2	
	5	200.4	

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EVL Co., Ltd. 10130  
Tel: 02-807-1271-3 Fax: 02-807-1271-4 mail: info@evl-testing.com



## Verification Test Report

Report No.:

SO2400082-E002 -PU 02

Calibrated Date: 28-Aug-24

Equipment: Air Sampling Pump

Manufacturer: Gillian

Model: HFS-113A

Serial or ID No. 0138

Environment: Temperature 25 °C Humidity 60 %RH

Reference Standard: Primary Flow Calibrator Model Defender 510, MESALABS

Serial No. 200368

Date of Calibration : 17 july 2024

### Result of Test

Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
1000	1	1000.5	1000.6
	2	1000.3	
	3	1000.2	
	4	1001.4	
	5	1000.6	

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EVL (Co., Ltd.) 540,540/1 Soi Tesabalan 7 Khlongthae Subphoe Bangkok 10110  
Tel : +66-2-602-3773 Fax: 02-602-3773 E-mail : info@evltesting.com



Q1318-001-00000000000000000000

## Verification Test Report

Report No.:

SO2400082-E002 -SLM 01

☒ PM

☐ Onsite UTM :

47P 1514458 N 654247 E

Calibrated Date: 29 August 2024

Site : บริษัท เอ็นไวแล็บบ์ จำกัด

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 22

Serial : B721

Environment: Temperature 26 °C Humidity 60 %RH

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

Serial No.1351075

Date of Calibration : 10 Apr 2024

### Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.72	93.65	-0.07	93.72

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Envilab Co., Ltd. 5-02402/LSU Bangkhuae 1 Bangkok bangkhuae1@envilab.com  
Tel : 02-802-3377-8 Fax : 02-802-3773 E-mail : n.s.@envilab.com



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## Verification Test Report

Report No.:

SO2400082-E002 -SLM 02

☒ PM ☐ Onsite UTM : 47P 1514458 N 654247 E

Calibrated Date: 29 August 2024

Site : บริษัท เอ็นไวแล็บ จำกัด

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 22

Serial : B723

Environment: Temperature 26 °C Humidity 60 %RH

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

Serial No.1351075

Date of Calibration : 10 Apr 2024

### Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.72	93.86	0.14	93.72

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Tel: 02-5577111 Fax: 02-507-3713 E-mail: info@evltesting.com



## Verification Test Report

Report No.:

SO2400082-E002 -SLM 03

☒ PM ☐ Onsite UTM : 47P 1514458 N 654247 E

Calibrated Date: 29 August 2024

Site : บริษัท เอ็นไวแลม จำกัด

Equipment: Sound Level Meter

Manufacturer: #REF!

Model: 22

Serial : B722

Environment: Temperature 26 °C Humidity 60 %RH

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

Serial No. 1351075

Date of Calibration : 10 Apr 2024

### Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.72	93.56	-0.16	93.72

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EnviLab Co., Ltd. 50/50/1 Soi Sukhumvit 7, Bangkok Bangkok 10110  
Tel : 07-6007 4577-8 Fax : 02-602-3773 E-mail : info@evltesting.com



## Verification Test Report

Report No.:

SO2400082-E002 -SLM 04

☒ PM ☐ Onsite UTM : 47P 1514458 N 654247 E

Calibrated Date: 29 August 2024

Site : บริษัท เอ็นไวแลบ จำกัด

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 22

Serial : 8724

Environment: Temperature 26 °C Humidity 60 %RH

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

Serial No.1351075

Date of Calibration : 10 Apr 2024

### Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.72	93.99	0.27	93.72

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บริษัท เอ็นไวแล็บ จำกัด 540,540/1 ถนนพหลโยธิน แขวงสามยุค เขตเมืองใหม่ กรุงเทพฯ 10110  
Ervilab Co., Ltd. 540,540/1 Soi Bang Sue 75 Bang Sue Urban Estate 10110  
Tel : 02-2627-3577-8 Fax : 02-607-3771 E-mail : evl@evl.co.th



www.evllab.com

## Verification Test Report

Report No.:

SO2400082-E002 -SLM 05

☒ PM ☐ Onsite UTM : 47P 1514458 N 654247 E

Calibrated Date: 29 August 2024

Site : บริษัท เอ็นไวแล็บ จำกัด

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 22

Serial : B711

Environment: Temperature 26 °C Humidity 60 %RH

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

Serial No.1351075

Date of Calibration : 10 Apr 2024

### Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.72	93.67	-0.05	93.72

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บริษัท เอ็นไวเลบ จำกัด  
Envilab Co., Ltd. 87 หมู่ 7 ถนนพหลโยธิน แขวงจตุจักร กรุงเทพฯ 10110  
THailand Tel : +662-012-473 E-mail : info@evltesting.com



## Verification Test Report

Report No.:

SO2400082-E002 -SLM 06

☒ PM ☐ Onsite UTM : 47P 1514458 N 654247 E

**Calibrated Date:** 29 August 2024

**Site :** บริษัท เอ็นไวเลบ จำกัด

**Equipment:** Sound Level Meter

**Manufacturer:** Quest

**Model:** DLX

**Serial :** 20104

**Environment:** Temperature 26 °C Humidity 60 %RH

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

Serial No.1351075

Date of Calibration : 10 Apr 2024

### Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.72	93.41	-0.31	93.72

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บริษัท เอ็นไวเลบ จำกัด 540547 ถนนพหลโยธิน แขวงจตุจักร กรุงเทพฯ 102  
Envilab Co., Ltd. 540547 Soi 29-41/22 Thongkhlo Bangkok 102  
Tel: 02-007-3571-8 Fax: 02-007-3571-3 E-mail: info@evltesting.com



ISO 9001:2015 CERTIFIED

## Verification Test Report

Report No.:

SO2400082-E002 -SLM 08

☒ PM

☐ Onsite UTM :

47P 1514458 N 654247 E

Calibrated Date: 29 August 2024

Site : บริษัท เอ็นไวเลบ จำกัด

Equipment: Sound Level Meter

Manufacturer: Quest

Model: DLX

Serial : 20106

Environment: Temperature 26 °C Humidity 60 %RH

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

Serial No.1351075

Date of Calibration : 10 Apr 2024

### Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.72	93.94	0.22	93.72

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บริษัท เอ็นไวโวลต์ จำกัด (EVL) 140/1 ถนนวิภาวดีรังสิต แขวงจตุจักร เขตจตุจักร กรุงเทพฯ 10160  
Evolab Co., Ltd. 140/1 ถนนวิภาวดีรังสิต แขวงจตุจักร กรุงเทพฯ Bangkok 10160  
โทร: 02-8925 772-3 โทรสาร: 02-8925 7723 E-mail: info@evltesting.com



## Verification Test Report

Report No.:

SO2400082-E002 -SLM 09

☒ PM

☐ Onsite UTM:

47P 1514458 N 654247 E

**Calibrated Date:** 29 August 2024

**Site :** บริษัท เอ็นไวโวลต์ จำกัด

**Equipment:** Sound Level Meter

**Manufacturer:** Quest

**Model:** DLX

**Serial :** 20107

**Environment:** Temperature 26 °C Humidity 60 %RH

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

Serial No.1351075

Date of Calibration : 10 Apr 2024

### Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.72	93.53	-0.19	93.72

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บริษัท เอ็นไวอิง-ทีบี จำกัด 543,547 ถนนบางนาแคว แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10110  
EVL Testing Co., Ltd. 543,547/1 Soi Bangkhoe 7 Bangkhoe Bangkok Bangkok 10110  
Tel: 02-4724-3573-5 Fax: 02-02-3772 E-mail: info@evltesting.com



## Verification Test Report

Report No.:

SO2400082-E002 -SLM 10

☒ PM

☐ Onsite UTM :

47P 1514458 N 654247 E

**Calibrated Date:** 29 August 2024

**Site :** บริษัท เอ็นไวอิง จำกัด

**Equipment:** Sound Level Meter

**Manufacturer:** Quest

**Model:** DLX

**Serial :** 0053

**Environment:** Temperature 26 °C Humidity 60 %RH

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

Serial No.1351075

Date of Calibration : 10 Apr 2024

### Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.72	93.55	-0.17	93.72

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บริษัท เอ็นไวเลบ จำกัด 50540/1 หมู่ 10 ต.บางพลีใหญ่ อ.บางพลี จ.สมุทรปราการ 105  
Envileb Co., Ltd. 50540/1 S. Bang Phli Sub-township Bang Phli District Bangkok 105  
Tel : 02-802-2573-8 Fax : 02-802-2573-9 Email : info@evltesting.com



## Verification Test Report

Report No.:

SO2400082-E002 -SLM 01

☒ PM

☐ Onsite UTM:

47P 1514458 N 654247 E

Calibrated Date: 29 August 2024

Site : บริษัท เอ็นไวเลบ จำกัด

Equipment: Sound Level Meter

Manufacturer: Quest

Model: DLX

Serial : 0036

Environment: Temperature 26 °C Humidity 60 %RH

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

Serial No.1351075

Date of Calibration : 10 Apr 2024

### Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.72	93.34	-0.38	93.72

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บริษัท เอ็นไวเล็ท จำกัด 553-4071 หมู่ 10 ต.บางพลีใหญ่ อ.บางพลี จ.สมุทรปราการ  
Envielt Co., Ltd. 553-4071 Mu. Bangkhuae 10-tungkla Bangkhuae Bangkok 10130  
Tel : 02-022-3577-8 Fax : 02-022-3773 E-mail : info@evltesting.com



## Verification Test Report

Report No.:

SO2400082-E002 -SLM 03

☒ PM ☐ Onsite UTM : 47P 1514458 N 654247 E

Calibrated Date: 29 August 2024

Site : บริษัท เอ็นไวเล็ท จำกัด

Equipment: Sound Level Meter

Manufacturer: Quest

Model: DLX

Serial : 0032

Environment: Temperature 26 °C Humidity 60 %RH

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

Serial No.1351075

Date of Calibration : 10 Apr 2024

### Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.72	93.92	0.20	93.72

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## Certificate of Calibration

**Certificate No. :** 67-420034-1

**Page : 1 of 2**

**Submitted by :** Envilab Co., Ltd.

540,540/1 Soi Bangkhac7, Bangkhac, Bangkok 10160

**Equipment :** pH Meter with electrode

pH meter

Manufacturer : Horiba

Model : F-74BW-G

Range : N/A pH

Resolution : 0.001 pH

Serial No. : B41J0001

ID No. : 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 :



The Uncertainties are for a confidence probability of approximately 95%

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## Certificate of Calibration

Certificate No. : 67-420034-1

Page : 2 of 2

### Result of Calibration :

UUC Condition As-Received : Good

Function : Electrical measurement

pH meter

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

Adjustment Curve at nominal pH	Applied Voltage ( mV )	Nominal Value ( pH )	UUC Reading		Correction ( mV )	Uncertainty ( ± mV )
			( pH )	( mV )		
4, 7, 10	177.4800	4	3.998	177.5	0.0	0.12
	0.0000	7	7.000	0.0	0.0	0.086
	-177.4800	10	10.000	-177.4	-0.1	0.12

Function : pH meter with electrode

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

Adjustment Curve at nominal pH	Standard Buffer ( pH )	UUC Reading ( pH )	Correction ( pH )	Uncertainty ( ± pH )
4, 7, 10	4.008	4.009	-0.001	0.0084
	6.986	7.000	-0.014	0.0092
	9.997	10.008	-0.011	0.014

### Remark

UUC : Unit Under Calibration

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

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

- 0(0) -

AB





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. C17240307

## Calibration Certificate

Equipment:	Cooled Incubator	Job No.:	KSMT2402653
Model:	BIC-140	Received Date:	27 September 2024
Serial No.(or ID):	100613-1 ( ELABBODC140NO1 )	Issued Date:	30 September 2024
Manufacturer:	M-LAB	Page:	1 of 3
Condition:	In Condition		
Ventilation Valve:	None	Shelves(pc.):	5

### Customer

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

### Calibration Place

Envilab Co., Ltd. ( B300 CH1 ROOM )  
540, 540/1 Soi Bangkhuae 7, Bangkhuae, Bangkhuae, Bangkok 10160

### Calibration Date

27 September 2024

### Environment Condition

Temperature: 20.8 °C  $\pm$  1.0 °C  
Humidity: 54.8 %RH  $\pm$  2.6 %RH

### The Method used

In-house method, WI17, based on TLAS-G20

### Traceability

This certificate is traceable to the SI Units maintained by  
National Institute of Metrology (NIMT), Thailand through  
SCIMET Co.,Ltd.Certificate No. C23240083

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).

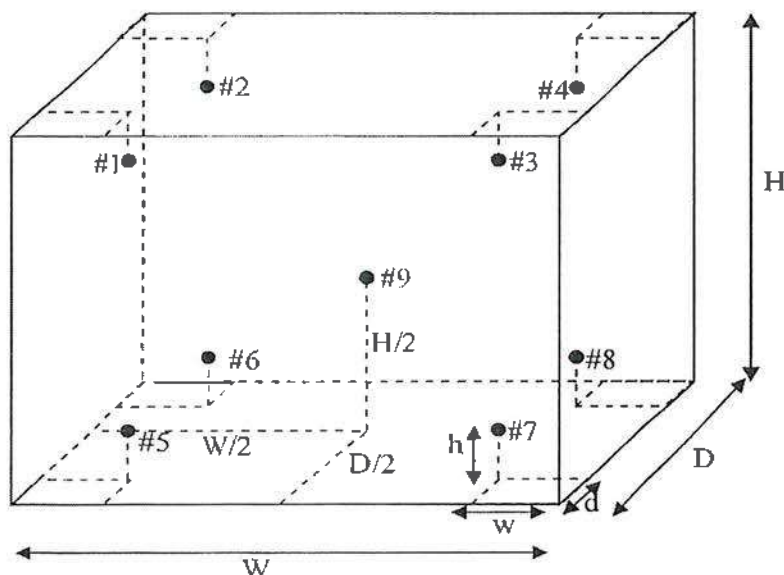
These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of SCIMET Co., Ltd.

(Mongkolwat Hasanon)  
Person in charge



(Mr. Thalerngkeat Pongngam)





### Standard Installation Locations

Volume (Calibration Zone)= 58 (Liters)

Inside chamber:  $W = 38 \text{ (cm)}$   $D = 32 \text{ (cm)}$   $H = 114 \text{ (cm)}$   
 Standard Locations (#1, #2, #3, #4):  $w = 5 \text{ (cm)}$   $d = 5 \text{ (cm)}$   $h = 10 \text{ (cm)}$   
 Standard Locations (#5, #6, #7, #8):  $w = 5 \text{ (cm)}$   $d = 5 \text{ (cm)}$   $h = 10 \text{ (cm)}$

#9: Geometric center of the chamber

Position of Std	#1	#2	#3	#4	#5	#6	#7	#8	#9
Channel of Logger	201	202	203	204	205	206	207	208	209

### Definitions

**Indicating Temperature:** The average reading of indicating device which forms the integral part of the enclosure.

**Measured Temperature:** The average reading of standards at any positions or location.

**Measured Uniformity:** The maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time or at close observation time as possible to determine the temperature pattern or homogeneity with the chamber at steady-state. The reference probe is preferably located in the geometric center of the chamber.

**Measured Stability:** The one-half of greatest maximum difference of measured temperatures at any one probe.

**Overall Variation:** The difference of maximum and minimum measured

### Calibration Results:

#### Without adjustment

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 20.0 °C

Locations	Measured Temperature (°C)	Correction (°C)	Uncertainty (± °C)
#1	19.54	-0.46	0.38
#2	19.49	-0.51	0.39
#3	19.87	-0.13	0.39
#4	20.04	0.04	0.37
#5	20.36	0.36	0.36
#6	20.21	0.21	0.37
#7	20.10	0.10	0.36
#8	20.19	0.19	0.37
#9	20.48	0.48	0.35

#### Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
			#1	#2	#3	#4	#5	#6	#7	#8	#9	
20.0	20.0	20.0	19.54	19.49	19.87	20.04	20.36	20.21	20.10	20.19	20.48	0.39

#### Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
20.0	1.07	0.18	1.26

Note: \* Maximum uncertainty of the each position

The End of Certificate

## 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 correction of indication 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, TLAS-G20. Therefore, those parameters have not

### 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

### Without adjustment

Desired Temperature : 20.0°C

Tolerances : 1.0 °C

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 20.0 °C

Locations	Measured (°C)	Correction of UUC. (°C)	Guard band (W) (± °C)	Tolerance (± °C)	Conformity
#1	19.54	-0.46	0.38	1.0	Pass
#2	19.49	-0.51	0.39	1.0	Pass
#3	19.87	-0.13	0.39	1.0	Pass
#4	20.04	0.04	0.37	1.0	Pass
#5	20.36	0.36	0.36	1.0	Pass
#6	20.21	0.21	0.37	1.0	Pass
#7	20.10	0.10	0.36	1.0	Pass
#8	20.19	0.19	0.37	1.0	Pass
#9	20.48	0.48	0.35	1.0	Pass

Correction of UUC.\* = Measured Temperature - Desired Temperature

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

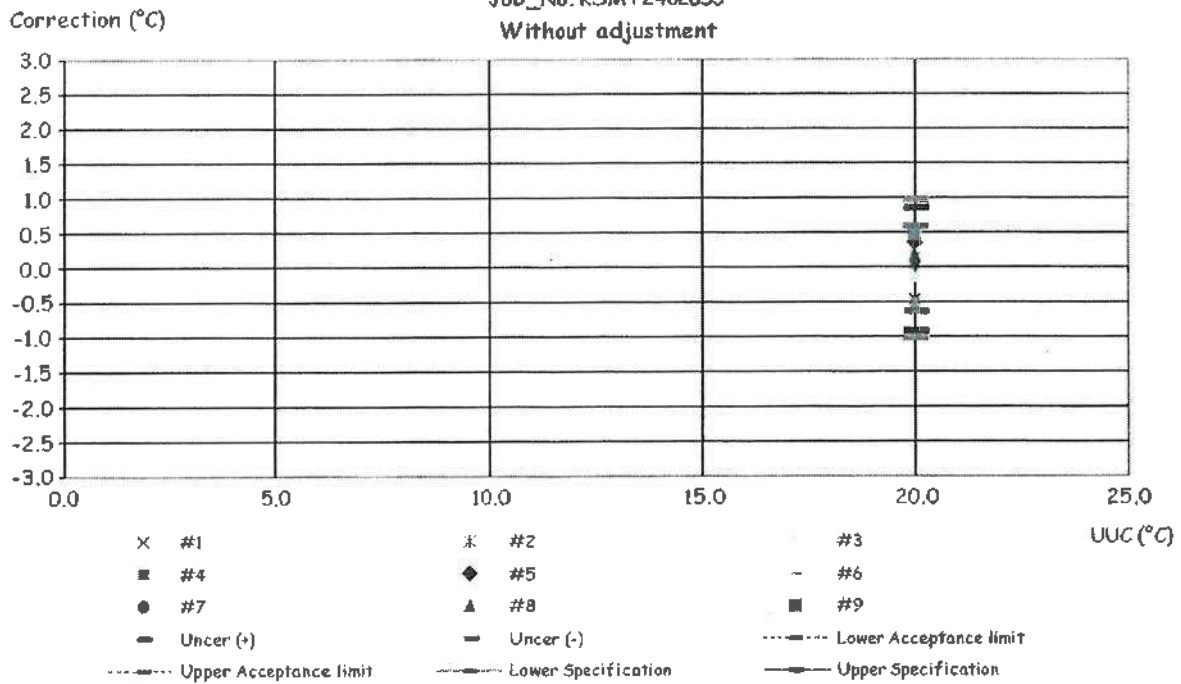
บริษัท ชายันเมท จำกัด (SCIMET CO., LTD.)

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

### Corr\_Distribution & Max\_Measurement Uncertainty

Job\_No. KSMT2402653

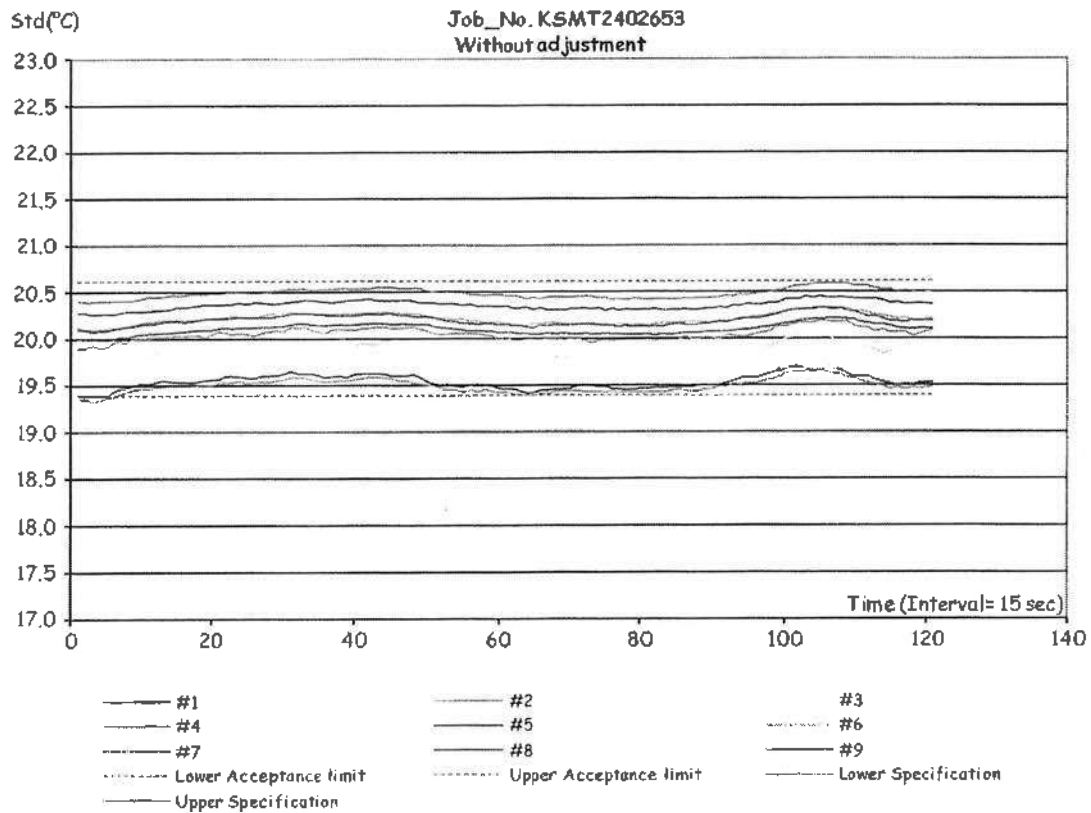
Without adjustment



### Temperature Distribution @ 20.0°C

Job\_No. KSMT2402653

Without adjustment





## ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

เลขที่ใบงาน: KSMT2402653

ชนิดเครื่องมือ: Cooled Incubator

รุ่น: BIC-140

หมายเลขเครื่อง: 100613-1 (ELABBODC140N01)

ตรวจสอบ (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
27 Sep 2024			27 Sep 2024		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
		General			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. สายไฟ	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. การทำงาน Main Switch	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. การทำงาน Selector Key	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. การแสดงผล Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. การทำงาน พัดลม	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	6. สภาพ Lever of Ventilation valve	<input type="checkbox"/>	<input type="checkbox"/>	-
<input checked="" type="checkbox"/>	<input type="checkbox"/>	7. สภาพ Lever door open / close	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. สภาพ Door seal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	9. การทำงานของระบบ Safety	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	10. การทำงานของระบบทำความเย็น	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	11. การทำงานของระบบทำความร้อน	<input type="checkbox"/>	<input type="checkbox"/>	-
<input checked="" type="checkbox"/>	<input type="checkbox"/>	12. สภาพตู้เครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	13. สภาพแวดล้อม ณ สถานที่ตั้งเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

ข้อแนะนำ :

Mr. Mongkolwat Hasanon

Service Engineer

บริษัท ชายนันเมก จำกัด (SCIMET CO., LTD.)

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

F117-00: 08 MAR 2023





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

Certificate No. C27240001

## Calibration Certificate

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

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

### Customer

Envilab Co., Ltd.  
540, 540/1 Soi Bangkhae 7, Bangkhae, Bangkhae, 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 ± 2 °C  
Humidity: 50 %RH ± 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





### Calibration Results:

Electrode Serial No. KC3N05V1R  
 Model : H176409  
 Brand : HANNA

### Electrode Test

Atmospheric pressure measured while calibrating. 755.54 mmHg  
 Temperature measured while calibrating. (  $\pm 0.2$  °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 ( <i>k</i> )	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 mm.  
 Diameter : 21 mm.  
 Immersion Depth 80 mm.

STD. Reading (°C)	UUC Reading (°C)	Correction of UUC (°C)	Coverage Factor ( <i>k</i> )	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. เชื้อนเซอร์อิเล็กโทรด	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	9. ขาจับอิเล็กโทรด (Stand)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

ข้อเสนอแนะ :

Mr.Dumrong Boonsopon

Service Engineer

บริษัท ชายนันเมก จำกัด (SCIMET CO., LTD.)

1194 Sanitachirapong Road, Sanitachirapong, Bangkok 10260 Thailand  
Email: scimet2022@gmail.com, Tel: 095 552 4939



# CAL

Calibratech Co.,Ltd.

7/106-7 Moo 2, Sukhprachasan 3 Rd., Bangpood, Pakkret, 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. :** 67-400312-1

**Page : 1 of 2**

**Submitted by :** Envilab Co., Ltd.

540,540/1 Soi Bangkhac7, Bangkhac, Bangkok 10160

**Equipment :** COD Reactor

**Manufacturer :** Hanna

**Model :** HI839800

**Range :** N/A °C

**Resolution :** 0.1 °C

**Serial No. :** 06480040101

**ID No. :** ELABHI83980001

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

Relative Humidity : (50 ± 15) %

**Date of Received :** 30 May 2024

**Date of Calibration :** 04 June 2024

**Date of Issue :** 04 June 2024

**Calibrated by :** Chortip Samchusri

**Calibration Method :** This instrument was calibrated by In-house method direct measurement with

The temperature scale used was based on ITS-90

### Reference Standard Instruments :

Standard Digital Thermometer with TC Type T probe

ID No.

Cert. No.

Due Date

Traceability

400046 & 400023

67-400198-1

01 Oct 2024

National Institute of Metrology Thailand (NIMT)

Approved by :

Promthong )

y Manager

The Uncertainties are for a confidence probability of approxin

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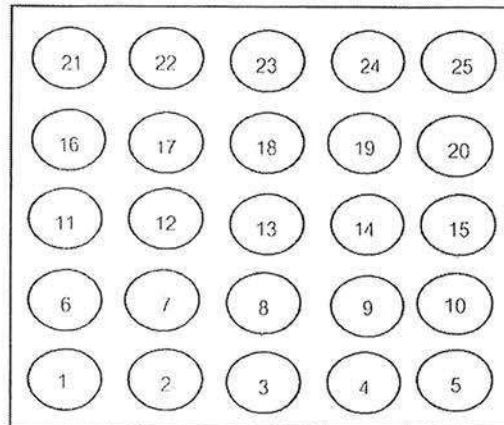
## Certificate of Calibration

Certificate No. : 67-400312-1

Page : 2 of 2

Result of Calibration : Without Adjustment

Function : Temperature measurement



Controller

Test Point (°C)	UUC Setting (°C)	UUC Reading (°C)	Standard Reading at Position (°C)									
			1	2	3	4	5	6	7	8	9	10
150.0	150.0	150.0	148.9	149.1	149.4	148.4	148.3	148.5	149.8	148.8	148.9	149.5

Test Point (°C)	UUC Setting (°C)	UUC Reading (°C)	Standard Reading at Position (°C)									
			11	12	13	14	15	16	17	18	19	20
150.0	150.0	150.0	149.2	150.3	149.7	149.8	148.2	149.4	148.7	148.8	151.7	149.6

Test Point (°C)	UUC Setting (°C)	UUC Reading (°C)	Standard Reading at Position (°C)					Uncertainty (± °C)
			21	22	23	24	25	
150.0	150.0	150.0	148.8	149.3	149.2	148.7	149.3	0.78

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

- o0o -



# CAL

Calibratech Co.,Ltd.

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

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



## Certificate of Calibration

**Certificate No. :** 67-400166-2

**Page :** 1 of 2

**Submitted by :** Envilab Co., Ltd.

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

**Equipment :** Water Bath

**Manufacturer :** Memmert

**Model :** WNB 14

**Range :** N/A °C

**Resolution :** 0.1 °C

**Serial No. :** 1412.2222

**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 65) %

**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 Kokaco

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

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

<u>ID No.</u>	<u>Cert. No.</u>	<u>Due Date</u>	<u>Traceability</u>
400046 & 400024	66-400547-2	02 Apr 2024	National Institute of Metrology Thailand (NIMT)

(romthong)  
Manager

The Uncertainties are for a confidence probability of approximately 95%

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## Certificate of Calibration

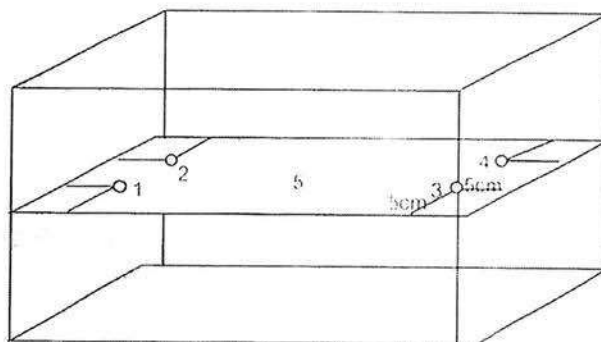
**Certificate No. : 67-400166-2**

**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%

- o0o -





# CAL

Calibratech Co., Ltd.

7/106-7 Moo 2, Sukhaphachan 3 Rd., Bangpoed, 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. :** 67-400166-1

Page : 1 of 2

**Submitted by :** Envilab Co., Ltd.

540, 540/1 Soi Bangkhac 7, Bangkhac, 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 65) %

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 Kokneo

**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)

Promthong )

ry Manager

The Uncertainties are for a confidence probability of approximately

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## Certificate of Calibration

Certificate No. : 67-400166-1

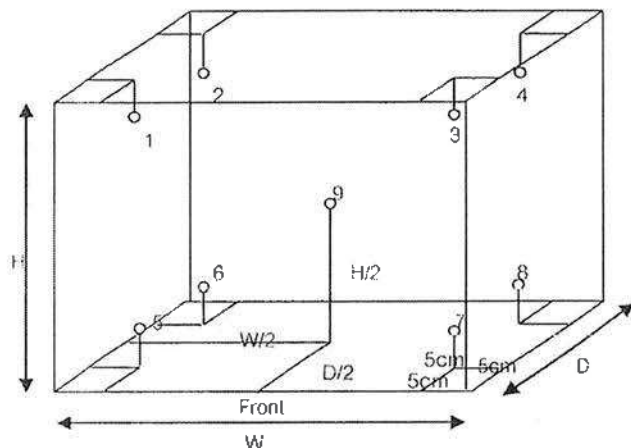
Page : 2 of 2

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 m<sup>3</sup>

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%

- 000 -



# CAL

Calibratech Co.,Ltd.

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

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NSC-TISI-TIS17025  
CALIBRATION 0030

## Certificate of Calibration

**Certificate No. :** 67-200060-2

**Page : 1 of 2**

**Submitted by :** Envilab Co., Ltd.

540, 540/1 Soi Bangkhac7, Bangkhac, Bangkok 10160

**Equipment :** Electronic Balance

**Manufacturer :** METTLER TOLEDO **Model :** XSR205DU

**Serial No. :** B911363567 **ID No. :** ELABBALANCEN06

**Capacity :** 220 g **Resolution :** 0.00001g/81g, 0.0001g/220g

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

**Ambient Temperature :** (20.0 to 20.5) °C

**Relative Humidity :** (54.2 to 59.1) %

**Air Pressure :** 1013.0 mbar

**Date of Received :** 20 February 2024

**Date of Calibration :** 20 February 2024

**Date of Issue :** 21 February 2024

**Calibrated by :** Satja Sangkhum

**Calibration Method :** In-house method CAL-M2001 based on UKAS Publication ref: LAB 14

Edition 7 - November 2022

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

Standard Weights

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

The Uncertainties are for a confidence probability of app

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## 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.

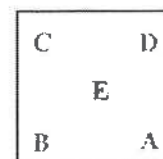
This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor  $k = 2.00$ , providing a level of confidence of approximately 95%

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

Sidev. : 0.000032 g

- o0o -

A handwritten signature or mark, possibly '170', in blue ink.



# CAL

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NSC-TISI-TIS 17025  
CALIBRATION 0030

## Certificate of Calibration

**Certificate No. :** 67-410025-1

**Page : 1 of 2**

**Submitted by :** Envilab Co., Ltd.

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

**Equipment :** Digital Thermo-Hygrometer

**Manufacturer :** Jedto

**Model :** HTC-1

**Range Temperature :** N/A °C

**Resolution :** 0.1 °C

**Range Humidity :** N/A %R.H.

**Resolution :** 1 %R.H.

**Serial No. :** PONPE5852094

**ID No. :** ELABTMIITC10003

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

Relative Humidity : (50 ± 15) %

**Date of Received :** 20 February 2024

**Date of Calibration :** 22 February 2024

**Date of Issue :** 22 February 2024

**Calibrated by :** Chortip Samchusri

**Calibration Method :** This instrument was calibrated by In-house method comparison technique CAL-M4013 by compared with standard probe sensor humidity/temperature into humidity/temperature chamber.

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

Digital Indicator with Standard Probe Temp&Hum

ID No.

Cert. No.

Due Date

Traceability

400034 & 400035 SG-H-00020/67

05 Jul 2024

Success Gateway Co., Ltd., Accredited by TISI Calibration No.0268

(nthong)

Manager

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## Certificate of Calibration

Certificate No. : 67-410025-1

Page : 2 of 2

UUC Condition As-Received : Good

Result of Calibration : Without Adjustment

Function : Temperature measurement

Reference Humidity @ 50 %R.H.

Standard Temperature ( $^{\circ}\text{C}$ )	UUC Reading ( $^{\circ}\text{C}$ )	Correction ( $^{\circ}\text{C}$ )	Uncertainty ( $\pm^{\circ}\text{C}$ )
24.98	25.0	0.0	0.46

Result of Calibration : Without Adjustment

Function : Humidity measurement

Reference Temperature @ 25  $^{\circ}\text{C}$

Standard Humidity (%R.H.)	UUC Reading (%R.H.)	Correction (%R.H.)	Uncertainty ( $\pm$ %R.H.)
50.03	50	0	2.2

### Remark

UUC : Unit Under Calibration

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

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

(Doc)

ABJ





# CAL

Calibratech Co.,Ltd.

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

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



NSC-TISI-TIS 17025  
CALIBRATION 0030

## Certificate of Calibration

Certificate No. : 67-300662-2

Page : 1 of 2

Submitted by : Envilab Co., Ltd.

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

Equipment : Measuring Pipette

Manufacturer : KIMAX

Capacity : 25 ml Graduation : 0.1 ml

ID No. : B-WW-001/15

Environment : Ambient Temperature :  $(20 \pm 3)$  °C

Relative Humidity :  $(50 \pm 10)$  %

Air Pressure : 1010.6 mbar.

Date of Received : 07 November 2024

Date of Calibration : 09 November 2024

Date of Issue : 09 November 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
241005	67-300210-4	02 Dec 2024	National Institute of Metrology (Thailand) (NIMT)

Approved by :

(Name, Title)

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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. : 67-300662-2

Page : 2 of 2

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

UUC Condition As-Received : Good

Delivery Time : 2.24 sec.

Nominal Volume ( ml )	Measuring Volume ( ml )
10	10.0133
25	24.9316

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 -



# CAL

Calibratech Co.,Ltd.

7/106-7 Moo 2, Sukhaprachasin 3 Rd., Bangpoed, 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.** : 67-300293-9

**Page** : 1 of 2

**Submitted by** : Envilab Co.,Ltd.

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

**Equipment** : Cylinder

**Manufacturer** : Witeg

**Class** : A

**Capacity** : 50 ml

**Graduation** : 1 ml

**ID No.** : C-HM-001/24

**Environment** : Ambient Temperature :  $(20 \pm 3)$  °C

Relative Humidity :  $(50 \pm 10)$  %

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

## Certificate of Calibration

Certificate No. : 67-300293-9

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	25.09
50	49.99

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 -

# CAL

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7/106-7 Moo 2, Sukhprachasri 3 Rd., Bangpoed, 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.** : 67-300293-12

**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** : 100 ml

**Graduation** : 1 ml

**ID No.** : C-HM-001/22

**Environment** : Ambient Temperature :  $(20 \pm 3)$  °C

Relative Humidity :  $(50 \pm 10)$  %

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 Tovadee )

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full except with the



# CAL

Calibratech Co.,Ltd.

7/106-7 Moo 2, Sukhprachasan 3 Rd., Bangpaed, 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. :** 67-300293-12

**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 -







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 ± 0.6 °C  
**Humidity:** 65.7 %RH ± 0.5 %RH

### The Method used

In-house method, W107, based on ASTM E 275-08 and  
ASTM E 387-04

### Traceability

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

The standard for Wavelength Certificate No. 108691 and 108692

The standard for Photometric Certificate No. 109010 , 114

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.

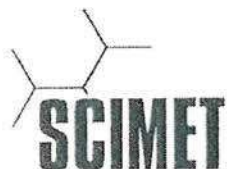
(Mr. Dumrong Boonsopon)

Person in charge



(Mr. Thalemgkeat Pongngam)

Authorized signatory

**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		

**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		

The End of Certificate

บริษัท สยามเมทริกซ์ จำกัด (SCIMET CO., LTD.)

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

FC07-03: 30 MAY 2023



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 ชายนันเมท จำกัด (SCIMET CO., LTD.)

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

FC07-03 30 MAY 2023



Refer to Certificate No.: C07240032

Page: 2 of 3

**Without Adjustment****Wavelength Accuracy (nm), The spectral bandwidth of Std at 1.5 nm and UUC at 1.5 nm**

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

**Photometric Accuracy (Absorbance)**

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

**บริษัท ชายันเมท จำกัด (SCIMET CO., LTD.)**1194 Soi Wachirathamsathit 57, Bangchak, Phrakhanong, Bangkok 10250 Thailand  
Email: scimet2022@gmail.com, Tel: 02 460 9239

FC07-03 30 MAY 2023



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.

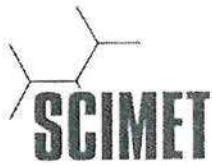
The End of Statements of Conformity

บริษัท ชายน์เมท จำกัด (SCIMET CO., LTD.)

1194 Soi Wachirathamsathit 57, Bangchak, Phraekhanong, Bangkok 10760, Thailand  
Email: scimet2022@gmail.com, Tel: 02-460 9239

PC07-03, 30 MAY 2023





## 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 ชายนัมเมท จำกัด (SCIMET CO., LTD.)

1194 Soi Wachirathani 11th Fl. 11th Floor, Phrakharong, Bangkok 10260 Thailand  
Email: scimet2022@gmail.com, Tel: 02 460 9239

FI07-01: 08 MAR 2023



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. C17240309

## Calibration Certificate

Equipment:	Oven	Job No.:	KSMT2402655
Model:	ED53	Received Date:	27 September 2024
Serial No.(or ID):	13-02277 ( ELABHAOVEN2277 )	Issued Date:	30 September 2024
Manufacturer:	Binder	Page:	1 of 5
Condition:	In Condition		
Ventilation Valve:	Closed	Shelves(pc.):	2

### Customer

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

### Calibration Place

Envilab Co., Ltd. ( B306 CH2 ROOM )  
540, 540/1 Soi Bangkhuae 7, Bangkhuae, Bangkhuae, Bangkok 10160

### Calibration Date

27 September 2024

### Environment Condition

Temperature: 30.4 °C  $\pm$  1.0 °C  
Humidity: 70.3 %RH  $\pm$  5.0 %RH

### The Method used

In-house method, WI17, based on TLAS-G20

### Traceability

This certificate is traceable to the SI Units maintained by  
National Institute of Metrology (NIMT), Thailand through  
SCIMET Co.,Ltd.Certificate No. C23240083

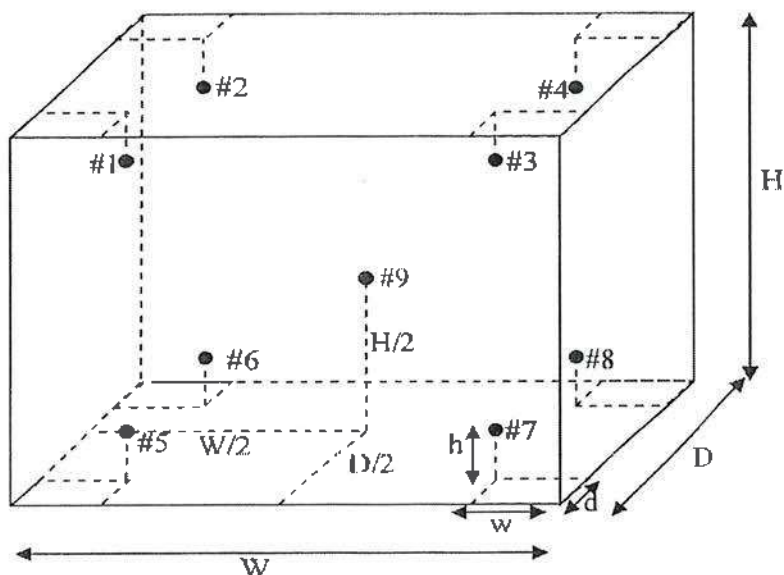
This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.

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.

(Mongkolwat Hasanon)  
Person in charge





### Standard Installation Locations

Volume (Calibration Zone)= 21 (Liters)

Inside chamber:  $W = 40$  (cm)  $D = 33$  (cm)  $H = 40$  (cm)  
 Standard Locations (#1, #2, #3, #4):  $w = 5$  (cm)  $d = 5$  (cm)  $h = 5$  (cm)  
 Standard Locations (#5, #6, #7, #8):  $w = 5$  (cm)  $d = 5$  (cm)  $h = 5$  (cm)  
 #9: Geometric center of the chamber

Position of Std	#1	#2	#3	#4	#5	#6	#7	#8	#9
Channel of Logger	101	102	103	104	105	106	107	108	109

### Definitions

**Indicating Temperature:** The average reading of indicating device which forms the integral part of the enclosure.

**Measured Temperature:** The average reading of standards at any positions or location.

**Measured Uniformity:** The maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time or at close observation time as possible to determine the temperature pattern or homogeneity with the chamber at steady-state. The reference probe is preferably located in the geometric center of the chamber.

**Measured Stability:** The one-half of greatest maximum difference of measured temperatures at any one probe.

**Overall Variation:** The difference of maximum and minimum measured tem

### Calibration Results:

#### Before adjustment

Desired (°C)	Setting (°C)	Indicating (°C)	#1 (°C)	#2 (°C)	#3 (°C)	#4 (°C)	#5 (°C)	#6 (°C)	#7 (°C)	#8 (°C)	#9 (°C)
85.0	85.0	85.0	87.01	88.17	87.35	87.18	85.19	85.80	85.32	85.05	85.84

#### After adjustment

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 85.0 °C

Locations	Measured Temperature (°C)	Correction (°C)	Uncertainty (± °C)
#1	86.28	1.28	0.58
#2	87.39	2.39	0.58
#3	86.58	1.58	0.58
#4	86.54	1.54	0.58
#5	84.67	-0.33	0.58
#6	85.22	0.22	0.57
#7	84.76	-0.24	0.57
#8	84.63	-0.37	0.58
#9	85.14	0.14	0.58

#### Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
			#1	#2	#3	#4	#5	#6	#7	#8	#9	
85.0	85.0	85.0	86.28	87.39	86.58	86.54	84.67	85.22	84.76	84.63	85.14	0.58

#### Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
85.0	2.29	0.07	2.89

Note: \* Maximum uncertainty of the each position

### After adjustment (Cont.)

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 104.5 °C

Locations	Measured Temperature (°C)	Correction (°C)	Uncertainty (± °C)
#1	104.52	0.52	0.82
#2	106.25	2.25	0.85
#3	105.03	1.03	0.82
#4	105.00	1.00	0.83
#5	103.10	-0.90	0.82
#6	103.32	-0.68	0.82
#7	103.12	-0.88	0.82
#8	102.58	-1.42	0.82
#9	103.17	-0.83	0.82

### Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
			#1	#2	#3	#4	#5	#6	#7	#8	#9	
104.0	104.5	104.5	104.52	106.25	105.03	105.00	103.10	103.32	103.12	102.58	103.17	0.85

### Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
104.5	3.26	0.21	3.96

Note: \* Maximum uncertainty of the each position



### After adjustment (Cont.)

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 182.5 °C

Locations	Measured Temperature (°C)	Correction (°C)	Uncertainty (± °C)
#1	181.12	1.12	1.1
#2	183.67	3.67	1.3
#3	181.80	1.80	1.1
#4	181.92	1.92	1.1
#5	179.84	-0.16	1.2
#6	180.90	0.90	1.1
#7	179.77	-0.23	1.1
#8	179.38	-0.62	1.2
#9	179.75	-0.25	1.1

### Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
			#1	#2	#3	#4	#5	#6	#7	#8	#9	
180.0	182.5	182.5	181.12	183.67	181.80	181.92	179.84	180.90	179.77	179.38	179.75	1.3

### Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
182.5	4.48	0.64	5.29

Note: \* Maximum uncertainty of the each position

**The End of Certificate**

**บริษัท ชายันเทค จำกัด (SCIMET CO., LTD.)**

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

FC17-02. 30 MAY 2023



## 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 correction of indication 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, TLAS-G20. Therefore, those parameters have not

### 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

## After adjustment

Desired Temperature : 85.0°C

Tolerances : 1.0 °C

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 85.0 °C

Locations	Measured (°C)	Correction of UUC. (°C)	Guard band (W) (± °C)	Tolerance (± °C)	Conformity
#1	86.28	1.28	0.58	1.0	Condition Fail
#2	87.39	2.39	0.58	1.0	Fail
#3	86.58	1.58	0.58	1.0	Condition Fail
#4	86.54	1.54	0.58	1.0	Condition Fail
#5	84.67	-0.33	0.58	1.0	Pass
#6	85.22	0.22	0.57	1.0	Pass
#7	84.76	-0.24	0.57	1.0	Pass
#8	84.63	-0.37	0.58	1.0	Pass
#9	85.14	0.14	0.58	1.0	Pass

Correction of UUC.\* = Measured Temperature - Desired Temperature

The validity of the statements of conformity cannot be guaranteed for different place



Refer to Certificate No.: C17240309

Page: 2 of 2

**Statements of conformity:(Cont.)****After adjustment (Cont.)**

Desired Temperature : 104.0°C

Tolerances : 2.0 °C

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 104.5 °C

Locations	Measured (°C)	Correction of UUC. (°C)	Guard band (W) (± °C)	Tolerance (± °C)	Conformity
#1	104.52	0.52	0.82	2.0	Pass
#2	106.25	2.25	0.85	2.0	Condition Fail
#3	105.03	1.03	0.82	2.0	Pass
#4	105.00	1.00	0.83	2.0	Pass
#5	103.10	-0.90	0.82	2.0	Pass
#6	103.32	-0.68	0.82	2.0	Pass
#7	103.12	-0.88	0.82	2.0	Pass
#8	102.58	-1.42	0.82	2.0	Condition Pass
#9	103.17	-0.83	0.82	2.0	Pass

Correction of UUC.\* = Measured Temperature - Desired Temperature

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

**After adjustment (Cont.)**

Desired Temperature : 180.0°C

Tolerances : 2.0 °C

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 182.5 °C

Locations	Measured (°C)	Correction of UUC. (°C)	Guard band (W) (± °C)	Tolerance (± °C)	Conformity
#1	181.12	1.12	1.1	2.0	Condition Pass
#2	183.67	3.67	1.3	2.0	Fail
#3	181.80	1.80	1.1	2.0	Condition Pass
#4	181.92	1.92	1.1	2.0	Condition Pass
#5	179.84	-0.16	1.2	2.0	Pass
#6	180.90	0.90	1.1	2.0	Pass
#7	179.77	-0.23	1.1	2.0	Pass
#8	179.38	-0.62	1.2	2.0	Pass
#9	179.75	-0.25	1.1	2.0	Pass

Correction of UUC.\* = Measured Temperature - Desired Temperature

The validity of the statements of conformity cannot be guaranteed for different

The End of Statements of Co

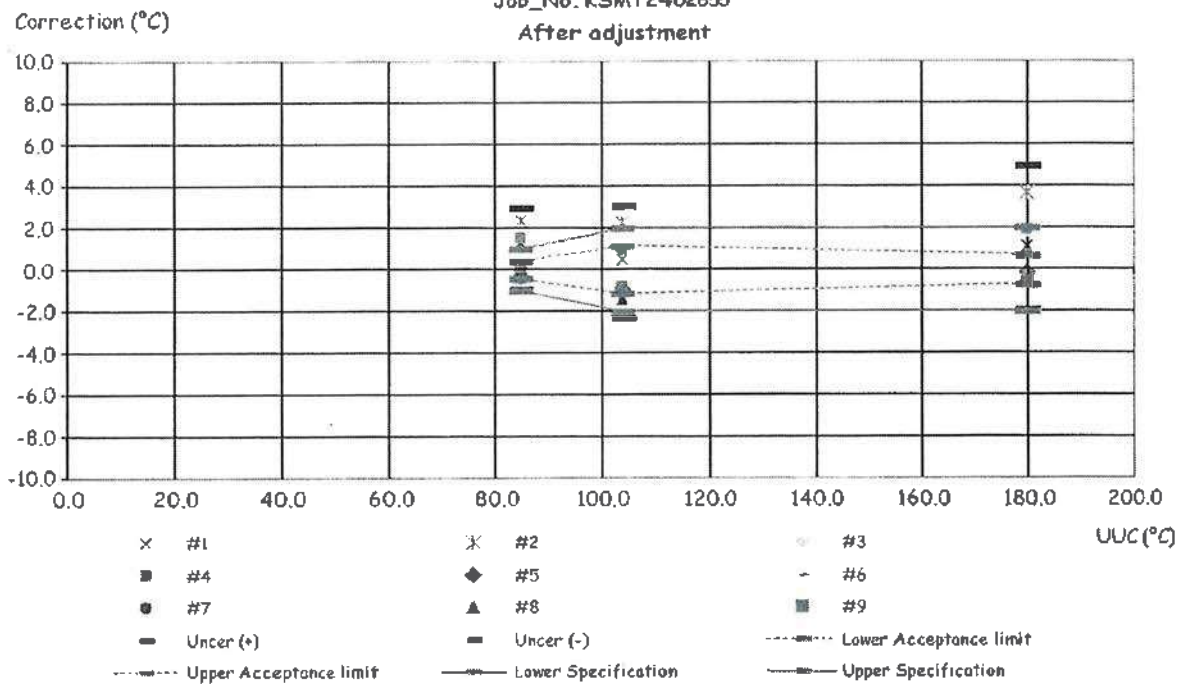
**บริษัท ชายนิเมท จำกัด (SCIMET CO., LTD.)**1194 Soi Wachirathamsathit 57, Bangchak, Phrakhanong, Bangkok 10260 Thailand  
Email: scimet2022@gmail.com, Tel: 02 460 9239

PC17-02: 30 MAY 2023

# Corr\_Distribution & Max\_Measurement Uncertainty

Job\_No. KSMT2402655

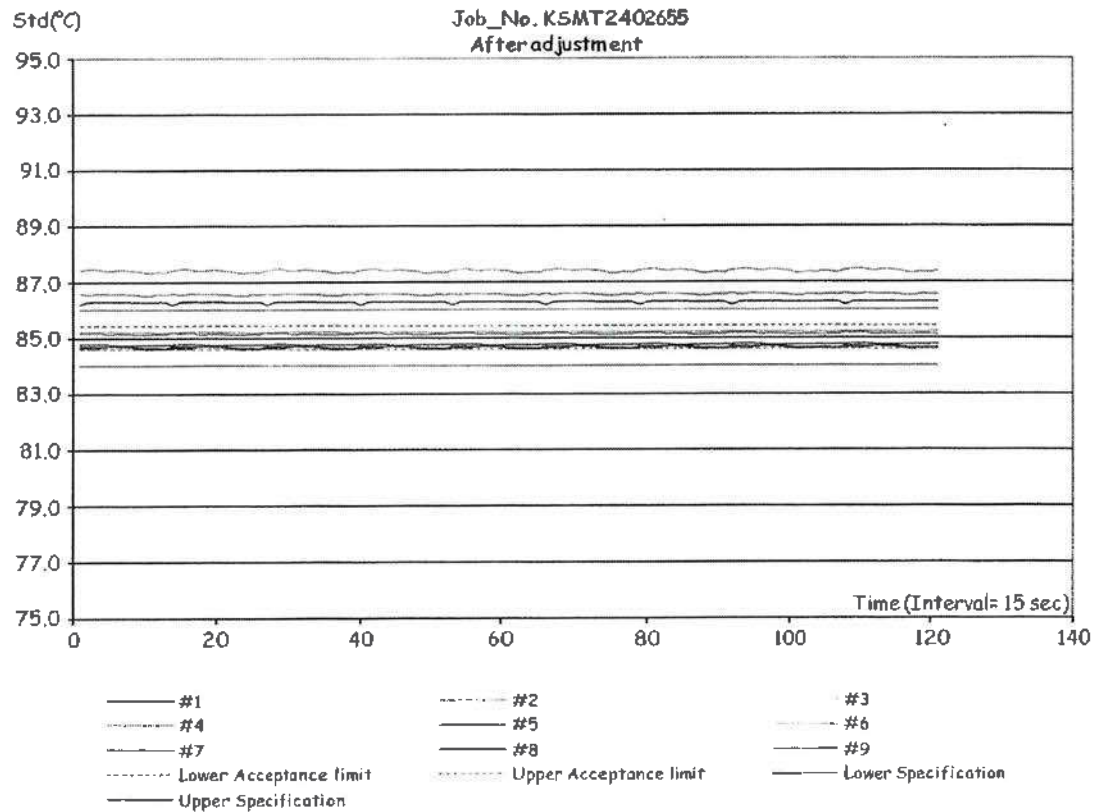
After adjustment

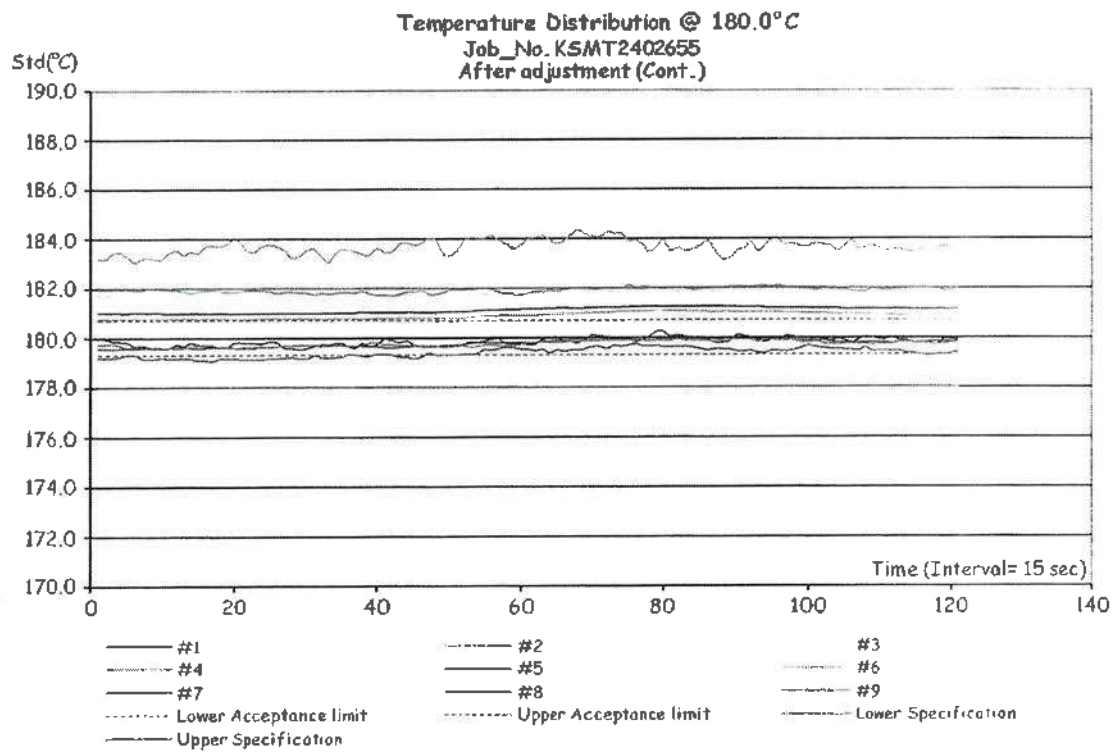
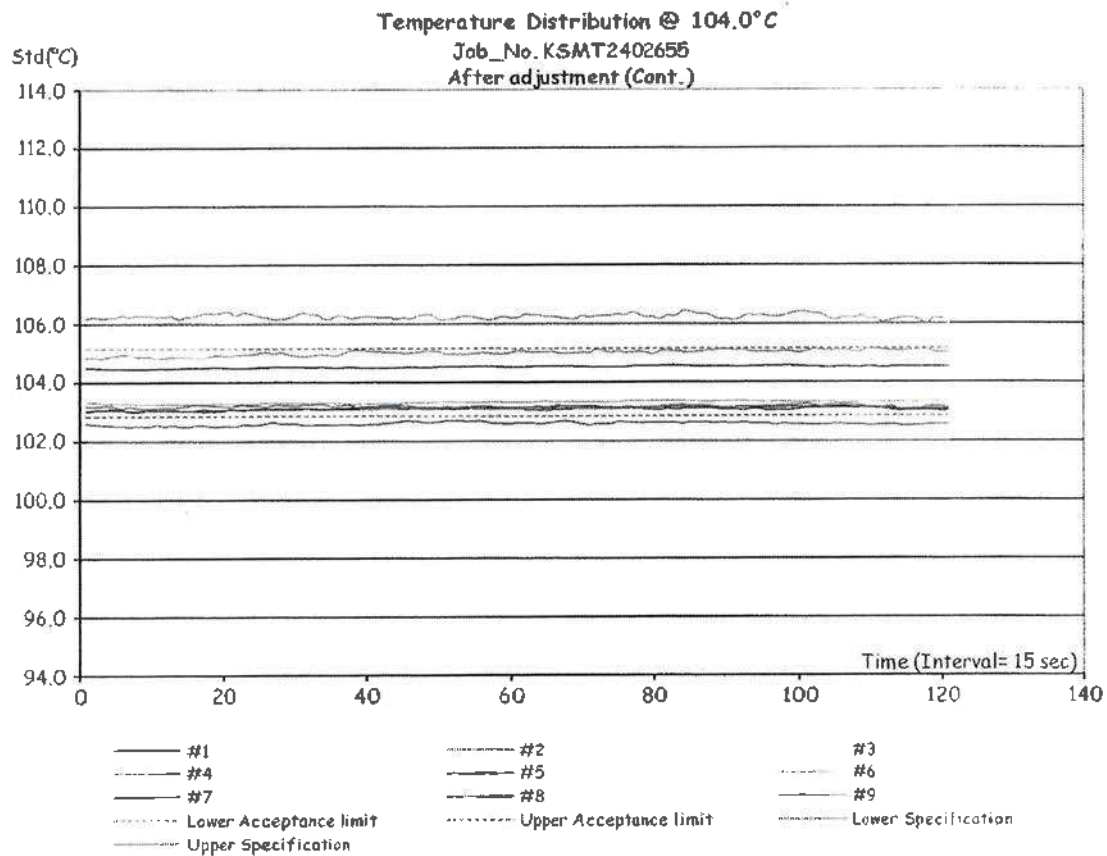


## Temperature Distribution @ 85.0°C

Job\_No. KSMT2402655

After adjustment







## ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

เลขที่ใบงาน: KSMT2402655

ชนิดเครื่องมือ: Oven

รุ่น: ED53

หมายเลขเครื่อง: 13-02277 ( ELABHAOVEN2277 )

ตรวจสอบ (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
27 Sep 2024			27 Sep 2024		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
		General			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. สายไฟ	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. การทำงาน Main Switch	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. การทำงาน Selector Key	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. การแสดงผล Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>	*
<input type="checkbox"/>	<input type="checkbox"/>	5. การทำงาน ฟัดลม	<input type="checkbox"/>	<input type="checkbox"/>	-
<input checked="" type="checkbox"/>	<input type="checkbox"/>	6. สภาพ Lever of Ventilation valve	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	7. สภาพ Lever door open / close	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. สภาพ Door seal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	9. การทำงานของระบบ Safety	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	10. การทำงานของระบบทำความเย็น	<input type="checkbox"/>	<input type="checkbox"/>	-
<input type="checkbox"/>	<input type="checkbox"/>	11. การทำงานของระบบทำความร้อน	<input type="checkbox"/>	<input type="checkbox"/>	-
<input checked="" type="checkbox"/>	<input type="checkbox"/>	12. สภาพตัวเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	13. สภาพแวดล้อม ณ สถานที่ตั้งเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

ข้อแนะนำ : \* Control Modify Brand M-LAB

Mr. Mongkolwat Hasanon

Service Engineer

บริษัท ชายนันเมก จำกัด (SCIMET CO., LTD.)

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

F117-00: 08 MAR 2023



## Agilent CrossLab Start Up Services

# Agilent 5100 5110 ICP-OES Preventive Maintenance

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

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

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



## Introduction

### Customer Information

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

## Service Engineer's Responsibilities

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

## Instrument Maintenance

### System Information

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

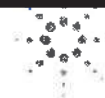
Instrument System Name and ID
Instrument System Site and Location

ICP 5110 VDV / MY17490002

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   Conikal   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 condens





### 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			

\*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	
<b>Additional Parts may be required from engineer's stock:</b>			
X axis drive belt	5410047500	SPS 3	
Z axis drive belt	5410047400	SPS 3	
Peristaltic pump tubing, PVC SolvaFlex, 3 bridged,	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

Date Service Completed:

3 July 2024

Service Engineer Name:

Worawit Timakul

Customer Name:

K Jenjira

Service Engineer Signature:

*[Signature]*

Customer Signature:

Total number of pages in this document:

14

# PinAAcle 900F Preventive Maintenance Report

Company Name:

Envilab Co.,Ltd

Instrument Location: 540/1 ซอยบางแค 7, แขวงบางแค เขตบางแค

กรุงเทพมหานคร 10160


Instrument Serial No.:

PFBS20011403

Date: 04-Oct-2024

### ***PinAAcle 900F Preventive Maintenance (PM)***

<b>Company Name:</b>	Envilab Co.,Ltd		
<b>Address (Instrument Location):</b>	540/1 ซอยบึงทอง 7, แขวงบางนาแค เขตบางนา กรุงเทพมหานคร 10160		
<b>Serial Number:</b>	PFBS20011403	<b>PM Number:</b>	1/2
<b>Customer Name (if applicable):</b>	K.Janjira	<b>Telephone Number:</b>	095-550-0510
<b>Customer Support Engineer Name:</b>	Khwanchai	<b>Service Order Number:</b>	WO-02944419
<b>Date PM Performed: (DD-MMM-YYYY)</b>	04-Oct-2024	<b>Next PM Due Date: (DD-MMM-YYYY)</b>	04-Apr-2025
<b>Standard Labor Hours to Complete PM :</b>		<b>5 hours</b>	

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 #	Expired Date (MM/YY)
N9300183	1000 mg/L Copper Standard	AR	27-39CUY1	04/25

Additional Reagents and Standards Required for PM (Customer Support Solution)				
Part Number (if applicable)	Description	Quantity	Batch/Lot #	Expiration Date (MM/YY)
N/A	DI Water	250 ml.	AR	AR
N/A	0.5% HNO <sub>3</sub>	250 ml.	AR	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 sloth width. Replace if out of specification
- ☒ Check the condition of the end cap, burner head, and nebulizer O-rings. Replace if necessary.
- ☒ Check the drain system for signs of wear. Replace worn or damaged parts.
- ☒ Visually check for proper flame conditions when igniting the Air-C<sub>2</sub>H<sub>2</sub> and N<sub>2</sub>O-C<sub>2</sub>H<sub>2</sub> 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 <sub>2</sub> H <sub>2</sub> Flame correctly shuts down	Active	Passed
Drain Sensor	Air/C <sub>2</sub> H <sub>2</sub> Flame correctly shuts down	Active	Passed
Nebulizer Sensor	Air/C <sub>2</sub> H <sub>2</sub> Flame correctly shuts down	Active	Passed
C <sub>2</sub> H <sub>2</sub> Pressure Sensor	Air/C <sub>2</sub> H <sub>2</sub> Flame correctly shuts down	Active	Passed
Air Pressure Sensor	Air/C <sub>2</sub> H <sub>2</sub> 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 D<sub>2</sub> Background Compensation with Copper

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

Parameter	Specification	Results	Pass/Fail
Standard Deviation	$\leq 0.010$	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	$\leq 0.005$	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	$\leq 0.005$	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
2 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

<i>The preventive maintenance checks and if applicable performance tests for PinAAcle 900F have been completed.</i>	
<i>This PinAAcle 900F Passes <input checked="" type="checkbox"/> Fails <input type="checkbox"/> the preventive maintenance.</i>	
<b>Review of Preventive Maintenance:</b>	
Authorized PerkinElmer Representative:	
	Date: 04-Oct-2024 (DD-MMM-YYYY)
Authorized Customer Representative:	
	Date: 04-Oct-2024 (DD-MMM-YYYY)

<b>Atomic Absorption/FIAS 100/400 Preventive Maintenance (PM)</b>			
<b>Company Name:</b>	Envilab Co.,Ltd		
<b>Address (Instrument Location):</b>	540/1 ซอยบางแค 7, แขวงบางแค เขตบางแค กรุงเทพมหานคร 10160		
<b>Room Number:</b>	-		
<b>Asset Number (if applicable):</b>	100S20010501	<b>Customer System ID:</b>	
<b>Service Engineer Name:</b>	Khwanchai	<b>Service Order Number:</b>	WO-02944418
<b>Date PM Performed: (DD-MMM-YYYY)</b>	04-Oct-2024	<b>Next PM Due Date: (DD-MMM-YYYY)</b>	04-Apr-2025

Part Number	Release	Publication Date	
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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PerkinElmer shall not be liable for incidental or consequential damages in connection with the furnishing or use of this document.



## 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 Nafion 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

<i>The preventive maintenance checks and if applicable performance tests for FIAS 100/400 have been completed.</i>	
<i>This FIAS 100/400 Passes <input checked="" type="checkbox"/> Fails <input type="checkbox"/> the preventive maintenance.</i>	
<b>Review of Preventive Maintenance:</b>	
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 Scientific (Thailand) Co., Ltd.  
290 Soi Soonvijai 4  
Khwang Bangkapi, Khel Huay Kwang  
Bangkok 10310  
Thailand  
Tel: 66 2719 6420 ; Fax: +66 2 319 7900  
<http://www.perkinelmer.com>

### Service Report

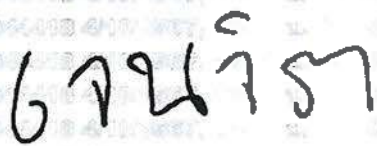
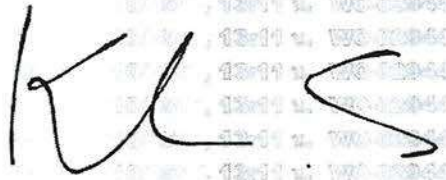
Work Order Number	Activity Code	Billing Type	Requested Start Date	Model	Serial Number
WO-02944418	Planned Maintenance	Contract	13/08/2567 10:13 น.	FIAS100	100S20010501
Service Representative Name	Contract Number	Expiry Date	Equipment ID	System ID	
Siangwong, Khwanchai	SC-0035621885	04/05/2025	N/A	N/A	
UDI Number					
N/A					
Equipment Location			Bill To Name		
บริษัท เอ็นไวแล็บ จำกัด แขวงบางแค เขตบางแค กรุงเทพฯ 51 10160 TH			บริษัท เอ็นไวแล็บ จำกัด แขวงบางแค เขตบางแค กรุงเทพมหานคร 51 10160 TH		
Customer Contact	Phone Number	Fax Number	Email	Purchase Order	
คุณสมลักษณ์ สาคัญะ	N/A	N/A	tec@evltesting.com	PO6500333	

Work Description		
- Clean sample introduction, valve, manifold, instrument exterior - Perform instrument operation - Instrument work normally		
Start Date	End Date	Work Description
04/10/2024	04/10/2024	
04/10/2024	04/10/2024	

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

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

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

Customer Signature	Technician Signature
	
4/10/2567 คุณสมลักษณ์ สาคัญะ	

Work Complete

Yes ☒ No ☐

PM/OQ/IPV Left with Customer

Yes ☒ No ☐

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.



PerkinElmer

# 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	Number	Ordinate Reading (Absorbance) at the following wavelengths:							
Wavelength		193.70	324.80	553.60	766.50				
Standard 1	MG0-058	0.2483	0.1857	0.1806	0.1674				

The tolerance of the given absorbance values is  $\pm 0.006$  A in the ultra violet and visible range, and  $\pm 0.010$  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 mode UV/Vis	Fix	Slit UV/Vis	1 nm
Integration time UV/Vis	5 s		
Slit mode NIR	Servo	Slit NIR	Servo
Integration time NIR	5 s	Gain	2

The 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: 9/16/2010

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

Date: NIST 1930 S/N 155 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



**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**

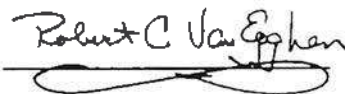
The Reference Standard was found to meet its functional and performance specification prior to shipment. To support this declaration, the following Engineering, Production and Test Documents are held by PerkinElmer and are available for reference upon request in justified cases and to an appropriate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

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

# 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	Number	Ordinate Reading (Absorbance) at the following wavelengths:							
Wavelength		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  $\pm 0.003 A$  at the given wavelengths.

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

## Conditions of Calibration

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

### Measurement of Calibration

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

The 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 Standard 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

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

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*Robert C. Van Egghen*

Quality Manager PKI RMCL  
PerkinElmer Instruments  
Shelton, CT. USA

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







## PerkinElmer TruQ

PerkinElmer Number: N9300183  
Element and Matrix: 1000 µg/mL Copper in 2% HNO<sub>3</sub>  
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 30 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	Element	µg/mL
Ag	0.001	Dy	<0.001	Li	<0.001	Pt	<0.001	Tb	<0.001
Al	0.003	Er	<0.001	Lu	<0.001	Rb	<0.005	Te	<0.001
As	<0.001	Eu	<0.001	Mg	0.002	Re	<0.001	Th	<0.001
Au	<0.001	Fe	0.02	Mn	<0.001	Rh	0.002	Ti	<0.001
B	<0.001	Ga	<0.001	Mo	<0.001	Ru	<0.001	Tl	<0.001
Ba	<0.001	Gd	<0.001	Na	<0.001	Sb	0.004	Tm	<0.001
Be	<0.001	Ge	<0.001	Nb	<0.001	Sc	<0.001	U	<0.001
Bi	<0.001	Hf	<0.001	Nd	<0.001	Se	<0.006	V	<0.001
Ca	<0.01	Hg	<0.001	Ni	<0.002	Si	<0.1	W	<0.001
Cd	<0.001	Ho	<0.001	P	<0.5	Sm	<0.001	Y	<0.001
Ce	<0.001	In	<0.001	Pb	0.004	Sn	0.002	Yb	<0.001
Co	<0.001	Ir	<0.001	Pd	<0.001	Sr	<0.001	Zn	<0.02
Cr	<0.001	K	0.5	Pr	<0.001	Ta	<0.001	Zr	<0.001
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(NO<sub>3</sub>)<sub>2</sub> 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:

Y. Parikh  
Yogesh Parikh, Senior Spectroscopist





PerkinElmer Scientific (Thailand) Co., Ltd.  
 290 Soi Soonvijai 4  
 Khwang Bangkokapi, 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-02944419	Planned Maintenance	Contract	20/08/2567 20:00 น.	AAN3200051	PFBS20011403
Service Representative Name	Contract Number	Expiry Date	Equipment ID	System ID	
Kanan, Chayanon	SC-0035621885	04/05/2025	N/A	N/A	
UDI Number					
N/A					
Equipment Location			Bill To Name		
บริษัท เอ็นไวเล็บ จำกัด แขวงบางแค เขตบางแค กรุงเทพฯ 51 10160 TH			บริษัท เอ็นไวเล็บ จำกัด แขวงบางแค เขตบางแค กรุงเทพฯ 51 10160 TH		
Customer Contact	Phone Number	Fax Number	Email	Purchase Order	
คุณสมลักษณ์ สาคิมะ	N/A	N/A	lec@evltesting.com	PO6500333	


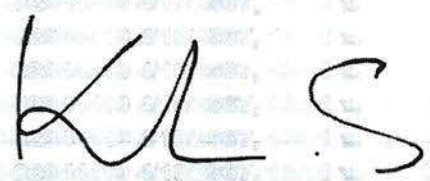
Work Description		
<ul style="list-style-type: none"> <li>- Clean sample introduction, mirrors, lens, instrument exterior</li> <li>- Perform WLCal and instrument test</li> <li>- Replaced PM Kits</li> <li>- Instrument work normally</li> </ul>		
Start Date	End Date	Work Description
04/10/2024	04/10/2024	
04/10/2024	04/10/2024	

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

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

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



	Customer Signature	Technician Signature
Work Complete		
Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>		
PM/OO/IPV Left with Customer		
Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	4/10/2567 คุณสมลักษณ์ สาคริยะ	4/10/2567 Kanan, Chayanan

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

