



Certificate of Calibration

Method 5 Pre-Test Calibration - Liters (L)

UUT Meter Console Information

Model #: XC-572-V
Serial #: 1001003
DGM Model #: GB/T6968-2011
DGM Serial #: L1500033221

Calibration Conditions

Bar. Pressure (mm Hg): 759.8
Ambient Temperature (°C): 24.2
Relative Humidity (%): 60.0
Altitude (m): 1.83
Bar. Pressure Corr. (mm Hg): 759.7

Factors/Conversions

Std. Temp. (K): 293.15
Std. Press. (mm Hg): 760
K_t (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 (mm:ss)	Orifice, ΔH (mm H ₂ O)	Volume (L)		Meter Temperature (°C)		Water Pressure (kPa)		Volume (L)		Reference Meter (WTM)		Outlet Temperature (°C)	
		Initial (L)	Final (L)	Initial	Final	Initial	Final	Initial	Final	Initial	Total	Initial	Final
Θ	P _{m(g)}	V _m	V _{mf}	t _m	t _{mf}	P _w		V _w	V _{wf}	t _w	V _w	t _w	t _{wf}
870.00	13.00	483737.2	483897.2	25.0	25.0	0.3		0.00	161.44	25.0	161.44	25.0	25.0
630.00	25.00	483897.2	484059.0	25.0	25.0	0.5		0.00	164.16	25.0	164.16	25.0	25.0
450.00	50.00	484059.0	484223.5	26.0	26.0	0.6		0.00	167.88	25.0	167.88	25.0	25.0
360.00	80.00	484223.5	484391.4	26.0	27.0	2.0		0.00	171.91	25.0	171.91	25.0	25.0
300.00	120.00	484391.4	484561.5	27.0	27.0	2.4		0.00	174.74	25.0	174.74	25.0	25.0

Standardized Data

Reference Meter (L)		UUT Meter (L)		Correction Factor		ΔH@ (mm H ₂ O)	
Std. Vol.	Std. Flow	Std. Vol.	Std. Flow	Value	Variance	0.0242 SGMM	Variance
V _{w(Std)}	Q _{w(Std)}	V _{m(Std)}	V _{w(Std)}	Y	ΔY	ΔH@	ΔΔH@
158.78	10.95	157.44	11.0	1.0085	-0.0109	48.2	1.935
161.53	15.38	159.40	15.4	1.0134	-0.0060	47.1	0.802
165.23	22.03	161.91	22.0	1.0205	0.0001	45.9	-0.385
169.78	28.30	165.46	28.3	1.0261	0.0068	44.9	-1.407
172.75	34.55	167.99	34.5	1.0283	0.0090	45.3	-0.944
				1.0194	= Y Avg.	46.3	= 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 ± 0.02 .

Note: For $\Delta H_{@}$, orifice pressure differential that equates to 0.0212m³/min at standard temperature and pressure, acceptable tolerance of individual values from the average is ± 0.2 inches (5.1mm) H₂O.

Pass/Fail Judgment : **Pass**

Calibrate By: *Patagonia P.*

Approved By:

Date: 26 Feb 24

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

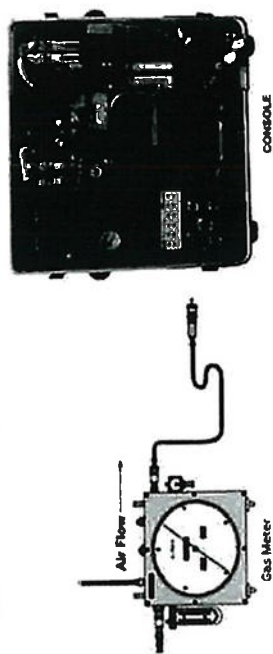


Neediss Supply Instrument Co., Ltd.



Certificate of Calibration - Supplemental

Calibration Train



Equations

$$V_{w(std)} = Y * K_1 \frac{V_w * (P_{bur} + \frac{P_{atm}}{13.6})}{T_w}$$

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

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

$$Y = \frac{V_{cr(std)}}{V_m(std)}$$

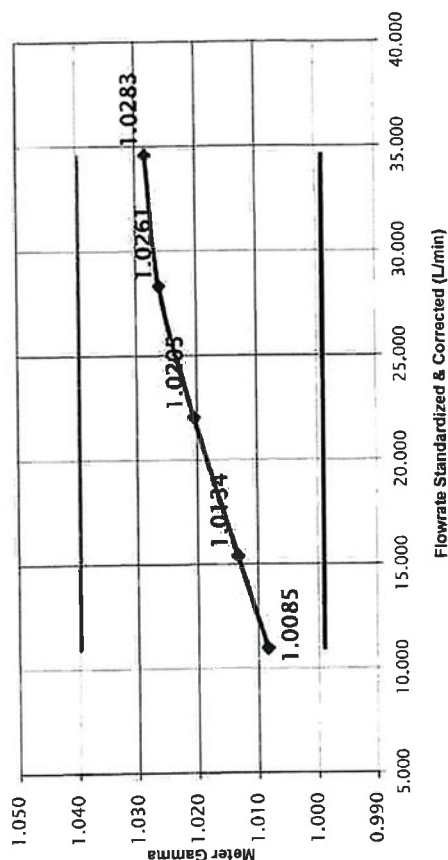
$$Q_{w(std)} = \frac{V_{w(std)}}{\Theta}$$

$$Metric \Delta H_{eq} = \frac{P_{m(t)} * 0.0011696 * (P_{bur} + \frac{P_{atm}}{13.6}) * (\frac{T_w * \Theta}{V_w * P_{bur}})^2}{T_m}$$

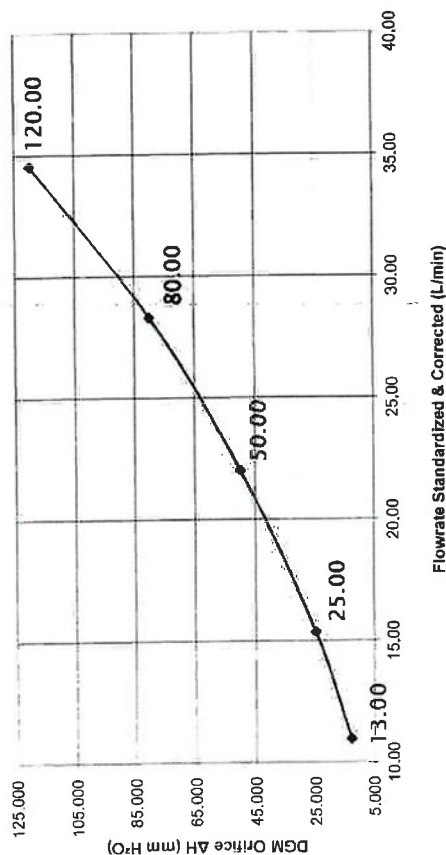
Nomenclature

- P_b - Barometric Pressure
- DGM - Dry Gas Meter
- K_1 - Constant based on standard temp and press
- Θ - Run time, in minutes
- P_m - ΔH (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_c - Measured pressure of reference meter
- T_c - Temperature measured in reference meter

Meter Gamma vs. Flowrate



Meter Pressure vs. Flowrate





Certificate of Calibration

Method 5 Console Sensor Calibration - Metric Units

Console Information

Model #: XC-572-V
Serial #: 1001003
Units: Metric

Calibration Conditions

Pbar (mm. Hg): 759.8
Humidity (%): 60
Tamb (°C): 24.2
Elevation (m): 1.8
Corr. Pbar (mm. Hg): 759.7

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 ¹	Reference Temp.	Test Thermocouple Calibrations						Reference Point Status ²
		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	93	93	93	93	PASS
4	149	150	149	149	149	149	149	PASS
5	260	260	260	260	260	260	260	PASS
6	371	372	372	372	372	372	372	PASS
7	482	483	482	483	483	482	482	PASS
8	593	594	594	594	594	593	593	PASS
9	816	817	817	817	817	817	817	PASS
10	1038	1039	1039	1039	1039	1039	1039	PASS

Overall Audit Status

NIST Reference Thermocouple ID:

12702001

NIST Reference Thermocouple #2				
	Ref Point	Thermocouple Temp	NIST Thermocouple Sensor Reading	ΔT_{abs} ⁴
	#	°C	°C	°C
Ice Water	1	1.8	2	0.07%
Ambient ³	2	24.2	24	0.04%
Maximum ²				0.07%
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:

[Signature]

Approved By:

[Signature]

Date:

26 Feb 24

Notes

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

² For valid test results, the maximum difference between temperature and reference readings should be less than ± 5.4 °F (± 3 °C), for all thermocouples except for the stack thermocouple which should be less than ± 1.5 % absolute temperature from the reference reading and the Exit thermocouple which should be less than ± 2 °F (± 1 °C) from the reference reading (EPA Method 2, Section 6.3 and EPA Method 5, Sections 6.1.1.7-6.1.1.9)

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

⁴ 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"

⁵ 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)

⁶ 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)

⁷ For valid test results, the maximum difference between console and reference vacuum readings should be less than ± 0.05 in. H₂O (± 1.25 mm H₂O), or 5% of full scale



Neediss Supply Instrument

neediss Console Sensor Calibration Data Sheet

Console Information

Model #: XC-572-V
Serial #: 1001003
Units: Metric
Type: "English"

Calibration Conditions

Pbar (mm. Hg): 759.8
Humidity (%): 60.0
Tamb (°C): 24.2
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 ¹
#	in. Hg	in. Hg	Pass/Fail
1	-5.0	-5.0	PASS
2	-15.0	-15.0	PASS
3	-20.0	-20.0	PASS

Reference Point ¹	ΔH Manometer Calibration			Reference Point Status ²
	Reference	Positive (+) Pitot	Negative (-) Pitot	
#	mm H2O	mm H2O	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 ¹	ΔP Manometer Calibration			Reference Point Status ²
	Reference	Positive (+) Pitot	Negative (-) Pitot	
#	mm H2O	mm H2O	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: Dattaraj P. Approved By: NA Date: 26 Feb 24

Notes

- ¹ Suggested, minimum reference points are 10 (0, 100, 200, 300, 500, 700, 900, 1100, 1500, 1900 °F), can test for more.
- ² For valid test results, the maximum difference between temperature and reference readings should be less than ±0.4 °F (±0.2 °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).
- ³ Do not change this cell value, it is instead based on input from Cell H8 at the top of this sheet under "Calibration Conditions".
- ⁴ 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".
- ⁵ 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).
- ⁶ 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).
- ⁷ For valid test results, the maximum difference between console and reference vacuum readings should be less than ±0.05 in. H2O (±1.25 mm H2O), or 5% of full scale.

I certify that the above Thermocouple Sensors were calibrated in accordance with US EPA Methods 2 and 5, CFR 40 Part 60



Console Sensor Audit QA Sheet

Meter Console Information (UUT)

Model #: XC-572-V
Serial #: 1001003
Units: Metric

Calibration Conditions

Pbar (mm. Hg): 759.8
Humidity (%): 60.0
Amb. Temp. (°C): 24.2
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. °C	Thermocouple Probe Audit						Reference Point Status ¹
		Aux °C	Stack °C	Probe °C	Oven °C	Filter °C	Exit °C	
Ambient	24.2	24	24	24	24	24	25	PASS
Ice Water	1.8	2	2	2	2	2	2	PASS

Audit Data

Console Vacuum Audit			
Reference Point	Reference Vacuum in. Hg	Console Vacuum in. Hg	Reference Point Status ²
#			Pass/Fail
1	-17.0	-17.0	PASS

Calibrate By: Pattanan P.

Approved By: HA

Date: 26 Feb 24

Notes

¹For 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)

²For 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)

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

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



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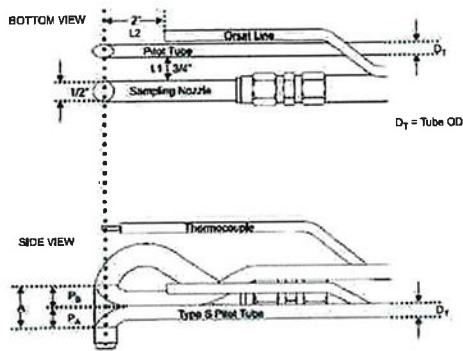
neediss Sampling Probe and Pitot Validation

Sampling System Equipment Information

Probe Sheat	Apex 1 in. , 5 ft.
Probe Number	1912498
Pitot tube Number	A8778
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	24.2 °C±3
Barometric Pressure	759.8 mm Hg



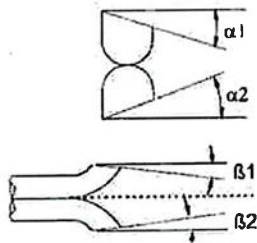
Sampling Probe Validation with Tune up

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

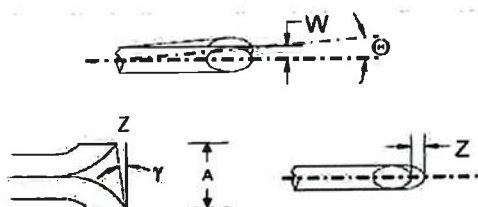
Measured	Standard Range
$L_1 =$ 1.90 cm.	(1.905 cm. or 3/4 in.)
$L_2 =$ 5.10 cm.	(5.08 cm. or 2.0 in.)
$D_T =$ 0.951 cm.	(3/8 in.)
$A =$ 2.16 cm.	(2.1 $D_T \leq A \leq 3D_T$)
$A/2D_T =$ 1.135 cm.	(1.05 $P_A / D_T \leq A \leq 1.5$)

Pitot Tube Validations and Engles measurement Result

☒ : Measure Result after Maintanance and Adjustable



P_B Size	Standard Range
$\alpha_1 =$ 0.70 °	$\leq 10^\circ$
$\beta_1 =$ -0.60 °	$\leq 5^\circ$
P_A Size	
$\alpha_2 =$ 1.20 °	$\leq 10^\circ$
$\beta_2 =$ -1.30 °	$\leq 5^\circ$



Engles measurement	Calculated Result	Standard Range
$W =$ -0.30 °	-0.011 cm.	$W < 0.08 \text{ cm (1/32 in.)}$
$Z =$ -1.10 °	-0.041 cm.	$Z < 0.032 \text{ cm (1/8 in.)}$

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

Validation By: Pattananan P. Approved By: [Signature] Date: 26 Feb 24

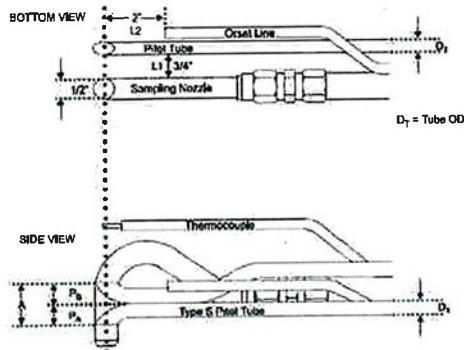
neediss Sampling Probe and Pitot Validation

Sampling System Equipment Information

Probe Sheat	Apex 1 in. , 3 ft.
Probe Number	1809992
Pitot tube Number	A3601
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 Inclinator	BASELINE
Reference No.	FEI 12-1057
Temperatute	24.2 °C±3
Barometric Pressure	759.8 mm Hg



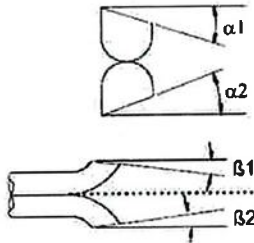
Sampling Probe Validation with Tune up

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

Measured	Standard Range
$L_1 =$	1.92 cm. (1.905 cm. or 3/4 in.)
$L_2 =$	5.56 cm. (5.08 cm. or 2.0 in.)
$D_T =$	0.96 cm. (3/8 in.)
$A =$	2.09 cm. ($2.1 D_T \leq A \leq 3D_T$)
$A/2D_T =$	1.089 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

$\alpha_1 =$	-3.60 °	$\leq 10^\circ$
$\beta_1 =$	0.00 °	$\leq 5^\circ$

P_A Size

$\alpha_2 =$	-2.40 °	$\leq 10^\circ$
$\beta_2 =$	-2.00 °	$\leq 5^\circ$

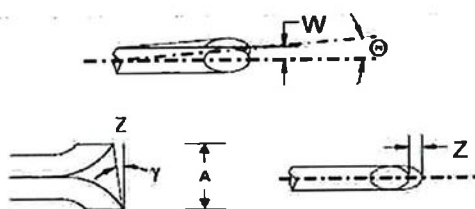
Engles measurement

Calculated Result

Standard Range

$W =$ 1.20 ° 0.044 cm. $W < 0.08 \text{ cm (} 1/32 \text{ in.)}$

$Z =$ -0.90 ° -0.033 cm. $Z < 0.032 \text{ cm (} 1/8 \text{ in.)}$



Can be use 0.64 for Cp(s) if the type of face-opening misalignmnet show above with not affect the base line value of Cp(s) Solong as standard range

Validation By: Dattaraj P. Approved By: [Signature] Date: 26 Feb 24

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Nozzle Validation

Samplig System Equipment Information

Console Model	XC-572-V
Console Number	1001003
DGM Model	GB/T6968-2011
DGM Number	L1500033221

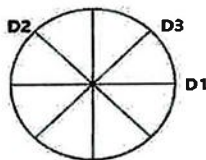
Validation Conditions

Digital Calipers	CD-15APX
Reference No	A22070181
Temperatute	24.2 °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 ₁	D ₂	D ₃	ΔD	Davg
	mm	mm	mm	mm	mm	mm
NS-4	3.17	3.17	3.17	3.16	0.006	3.167
NS-8	6.35	6.35	6.34	6.35	0.006	6.347
NS-9	7.13	7.14	7.12	7.12	0.012	7.127
NS-12	9.52	9.52	9.52	9.51	0.006	9.517
NS-14	11.09	11.07	11.09	11.09	0.012	11.083
NS-16	12.70	12.70	12.71	12.70	0.006	12.703
NS-18	14.17	14.16	14.17	14.18	0.010	14.170

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 = (D₁ + D₂ + D₃) / 3



Validation By:

Pattananan P.

Approved By:

K.

Date:

26 Feb 24



Neediss Supply Instrument Co.,Ltd.



neediss

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

536 ซอยบางแค 7 แขวงบางแค เขตบางแค กรุงเทพฯ 10160 536 Soi Bangkhoe 7 Bangkhoe Bangkok Bangkok
Tel. 02-802-3780-2 Fax. 02-802-3788 E info@neediss.com



Verification Test Report

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Instruments Information

Analyzer Type:	Flue Gas Analyser	Manufacturer:	MRU
Model:	Optima7	S/N:	332604

Calibration Gas information

Calibrator Unit	Standard Gas Mid Range			Standard Gas High Range		
ZERO AIR Gen:	O2 Conc	2.2	%vol.	O2 Conc	10.22	%vol.
Ecotech8301	Cd/Ex:	343014/Jul 24,2025		Cd/Ex:	343018/Jan 10,2025	
Dilutor Model:	CO Conc	99.94	ppm	CO Conc	594.5	ppm
EcotechGasCal1100	NO Conc	99.69	ppm	NO Conc	197.2	ppm
	NOX Conc	99.76	ppm	NOX Conc	197.2	ppm
	SO2 Conc	100.5	ppm	SO2 Conc	200.9	ppm
	Cd/Ex:	ED5716/May 16,2030		Cd/Ex:	ND7514/Jun 21,2030	

Environment: Temperature 31.6 °C Humidity: 35 %RH

SO2 calibration test

Before Adj					Reading (After Adj)
Set point	Std.gas (ppm)	Reading (ppm)	Difference	% error	Reading (ppm)
Low/Zero	0.0	0	0.0	0.0	0
Mid	100.5	99	-1.5	-1.5	99
Hight	200.9	198	-2.9	-1.4	198

NO calibration test

Before Adj					Reading (After Adj)
Set point	Std.gas (ppm)	Reading (ppm)	Difference	% error	Reading (ppm)
Low/Zero	0.0	0	0.0	0.0	0
Mid	99.69	99	-0.7	-0.7	99
Hight	197.2	199	1.8	0.9	199

NOX calibration test

Before Adj					Reading (After Adj)
Set point	Std.gas (ppm)	Reading (ppm)	Difference	% error	Reading (ppm)
Low/Zero	0.0	0	0.0	0.0	0
Mid	99.76	99.0	-0.8	-0.8	99
Hight	197.2	199.0	1.8	0.9	199

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ผู้จัดการฝ่ายควบคุมคุณภาพ



Verification Test Report

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Instruments Information

Analyzer Type: Flue Gas Analyser	Manufacturer: MRU
Model: Optima7	S/N: 332604

Calibration Gas information

Calibrator Unit	Standard Gas Mid Range	Standard Gas High Range
ZERO AIR Gen:	O2 Conc 2.2 %vol.	O2 Conc 10.22 %vol.
Ecotech8301	Cd/Ex: 343014/Jul 24,2025	Cd/Ex: 343018/Jan 10,2025
Dilutor Model:	CO Conc 99.94 ppm	CO Conc 594.5 ppm
EcotechGasCal1100	NO Conc 99.69 ppm	NO Conc 197.2 ppm
	NOX Conc 99.76 ppm	NOX Conc 197.2 ppm
	SO2 Conc 100.5 ppm	SO2 Conc 200.9 ppm
	Cd/Ex: ED5716/May 16,2030	Cd/Ex: ND7514/Jun 21,2030

Environment: Temperature 31.6 °C Humidity: 35 %RH

CO calibration test					
Before Adj					Reading (After Adj)
Set point	Std.gas (ppm)	Reading (ppm)	Difference	% error	Reading (ppm)
Low/Zero	0.0	0.0	0.0	0.0	0
Mid	99.69	100.0	0.3	0.3	100
High	594.5	603	8.5	1.4	601

O2 calibration test					
Before Adj					Reading (After Adj)
Set point	Std.gas (ppm)	Reading (ppm)	Difference	% error	Reading (ppm)
Low/Zero	0.0	0.2	0.2	0.2	0.2
Mid	2.20	2.2	0.0	0.0	2.2
High	10.22	10.2	0.0	-0.2	10.2

Note

Technical Data Calibration results.:Calibration reading response discrepancy

O2 parameter	± 0.2 Vol-% at Range 0-21 Vol-%
CO2 parameter	± 0.3 Vol-% at Range 0-CO2 Max
CO parameter	± 5 % at Range 0-500 PPM
NO parameter	± 5 % at Range 0-1000 PPM
NO2 parameter	± 5 % at Range 0-1000 PPM
SO2 parameter	± 5 % at Range 0-2000 PPM

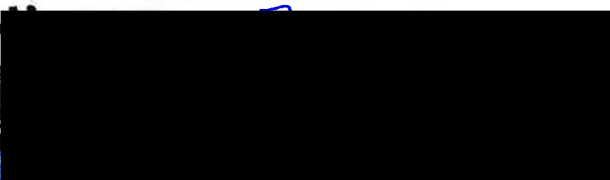
Calibrate By : Pattana P.

Approve By : [Signature]

Date: 30 Mar 23

Date: 30 Mar 23

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www.neediss.com




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



Envilab: A Newborn Supply Instrument

PM10 High Volume Sampler Calibration

Verification Report No.

SO2400004-E001 -PM 01

☐ PM ☒ Onsite

Site: วัดบ้านกล้วย

UTM: 47P 1468209 589002

Sampler: EPM#29

Recorder: ECRDS01618127

Date: 15 Mar 24

Technical: Amonthep K.

Approval: Wisan R.

CONDITIONS

Barometric Press. (hPa): 1005.0

Temperature (deg C): 33.0

Average Press. (hPa): 1013.0

Average Temp. (deg C): 30.0

Corrected Pressure (mm Hg): 753.8

Temperature (deg K): 306.0

Corrected Avg. Press. (mm Hg): 759.8

Average Temp. (deg K): 303.0

CALIBRATION ORIFICE

Brand: Tisch Environmental, Inc

Model: TE-5025A

Serial#: 759

Slope: 1.27576

Intercept: -0.02337

Date Certified: 18 Jan 24

CALIBRATIONS

Plate or Test #	H2O (in)	Qa (m3/min)	I (chart)	IC (corrected)
1	12.10	1.756	56.0	35.68
2	9.60	1.566	52.0	33.13
3	7.20	1.358	46.0	29.31
4	4.50	1.078	36.0	22.94
5	2.82	0.857	28.0	17.84

LINEAR REGRESSION

Slope = 20.1875

Intercept = 1.0737

Corr. coeff. = 0.9957

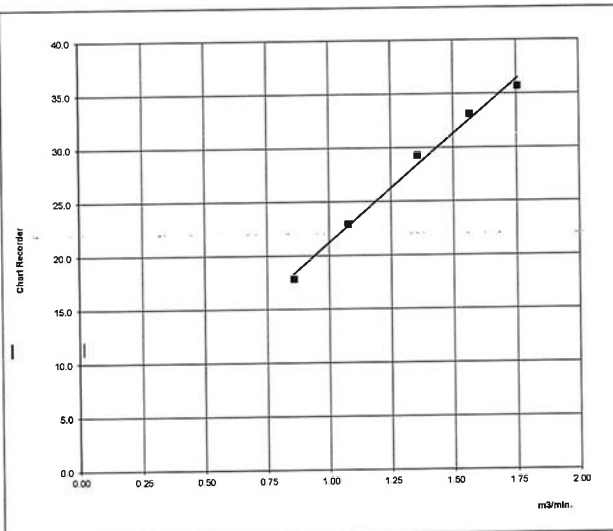
SFR = 1.150

SSP = 38.13

of Observations: 5

Range of Chart 35

at SFR $\pm 10\%$ 41



Calibrated by :

(Wuttipong Klangprapun)

15 March 2024

Approved by :

(Wisan Ritthikamon)

15 March 2024

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Environmental responsibility with accuracy measurement

FE-MNT-29 Rev.00:01/08/63



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Envilab Co., Ltd. 540.540/1 Soi Bangkhoe 7 Bangkhoe Bangkok Bangkok 10160
Tel : 02-802-3577-8 Fax: 02-802-3773 E-mail : info@evltesting.com



Envilab & Nandor Supply Instrument

PM10 High Volume Sampler Calibration

Verification Report No.

SO2400004-E001 -PM 02

☐ PM ☒ Onsite

Site: บ้านเนิน

UTM: 47P 1468262 588334

Sampler: EPM#28

Recorder: ECRDS01618126

Date: 15 Mar 24

Technical: Amonthep K.

Approval: Wisan R.

CONDITIONS

Barometric Press. (hPa): 1005.0

Temperature (deg C): 33.0

Average Press. (hPa): 1013.0

Average Temp. (deg C): 30.0

Corrected Pressure (mm Hg): 753.8

Temperature (deg K): 306.0

Corrected Avg. Press. (mm Hg): 759.8

Average Temp. (deg K): 303.0

CALIBRATION ORIFICE

Brand: Tisch Environmental, Inc

Model: TE-5025A

Serial#: 759

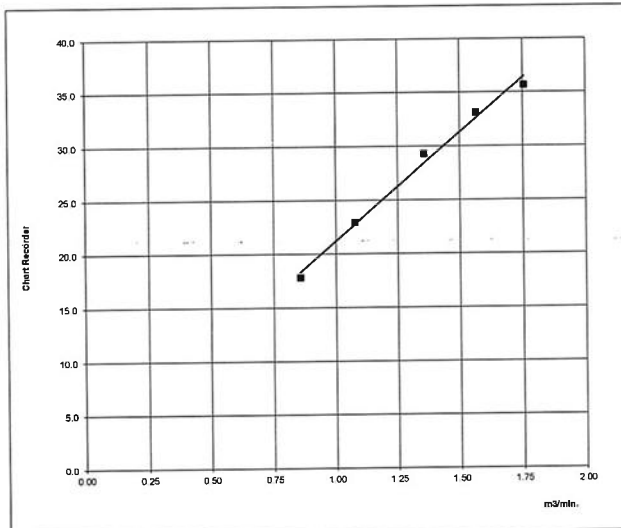
Slope: 1.27576

Intercept: -0.02337

Date Certified: 18 Jan 24

CALIBRATIONS

Plate or Test #	H2O (in)	Qa (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION
1	11.89	1.740	52.0	33.13	Slope = 18.3343
2	9.53	1.560	50.0	31.86	Intercept = 1.8964
3	7.42	1.379	42.0	26.76	Corr. coeff. = 0.9913
4	4.25	1.048	32.0	20.39	SFR = 1.150
5	2.74	0.845	28.0	17.84	SSP = 36.08
					# of Observations: 5
					Range of Chart at SFR $\pm 10\%$
					34
					38



Calibrated by :

(Wuttipong Klangprapun)
15 March 2024

Approved by :

(Wisan Ritthikamon)
15 March 2024

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Environmental responsibility with accuracy measurement

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

FE-MNT-29 Rev.00:01/08/63



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



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PM10 High Volume Sampler Calibration

Verification Report No.

SO2400004-E001 -PM 03

☐ PM ☒ Onsite

Site: อบต.หนองปรือ

UTM : 47P 1469390 588063

Sampler: EPM#46

Recorder: ECRAN000004577

Date: 15 Mar 24

Technical: Amonthep K.

Approval: Wisan R.

CONDITIONS

Barometric Press. (hPa): 1005.0

Temperature (deg C): 33.0

Average Press. (hPa): 1013.0

Average Temp. (deg C): 30.0

Corrected Pressure (mm Hg): 753.8

Temperature (deg K): 306.0

Corrected Avg. Press. (mm Hg): 759.8

Average Temp. (deg K): 303.0

CALIBRATION ORIFICE

Brand: Tisch Environmental, Inc

Model: TE-5025A

Serial#: 759

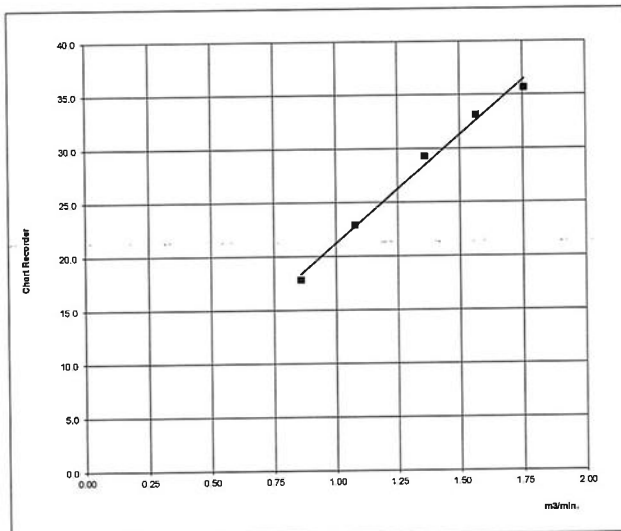
Slope: 1.27576

Intercept: -0.02337

Date Certified: 18 Jan 24

CALIBRATIONS

Plate or Test #	H2O (in)	Qa (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION
1	10.43	1.631	54.0	34.41	Slope = 18.4950
2	8.42	1.467	50.0	31.86	Intercept = 4.0663
3	6.52	1.294	42.0	26.76	Corr. coeff. = 0.9931
4	3.46	0.947	34.0	21.66	SFR = 1.150
5	2.87	0.864	32.0	20.39	SSP = 39.77
					# of Observations: 5
					Range of Chart at SFR $\pm 10\%$
					37
					42



Calibrated by :

(Wutipong Klangrapun)

15 March 2024

Approved by :

(Wisan Ritthikamon)

15 March 2024

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



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



Envilab & Needles Supply Instrument

TSP High Volume Sampler Calibration

Verification Report No.

SO2400004-E001 -TSP 01

☐ PM ☒ Onsite

Site: วัดป่าแก้ว

UTM: 47P 1468209 589002

Sampler: ETSP#38

Recorder: ECRDCPR4169242

Date: 15 Mar 24

Technical: Amonthep K.

Approval: Wisan R.

CONDITIONS

Barometric Press. (hPa): 1005.0

Temperature (deg C): 33.0

Average Press. (hPa): 1013.0

Average Temp. (deg C): 30.0

Corrected Pressure (mm Hg): 753.8

Temperature (deg K): 306.0

Corrected Avg. Press. (mm Hg): 759.8

Average Temp. (deg K): 303.0

CALIBRATION ORIFICE

Brand: Tisch Environmental, Inc

Model: TE-5025A

Serial#: 759

Qstd Slope: 2.03736

Qstd Intercept: -0.03733

Date Certified: 18 Jan 24

CALIBRATIONS

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)
1	13.25	1.774	54.0	53.07
2	10.70	1.596	50.0	49.14
3	8.33	1.411	44.0	43.24
4	5.32	1.131	36.0	35.38
5	3.32	0.897	32.0	31.45

LINEAR REGRESSION

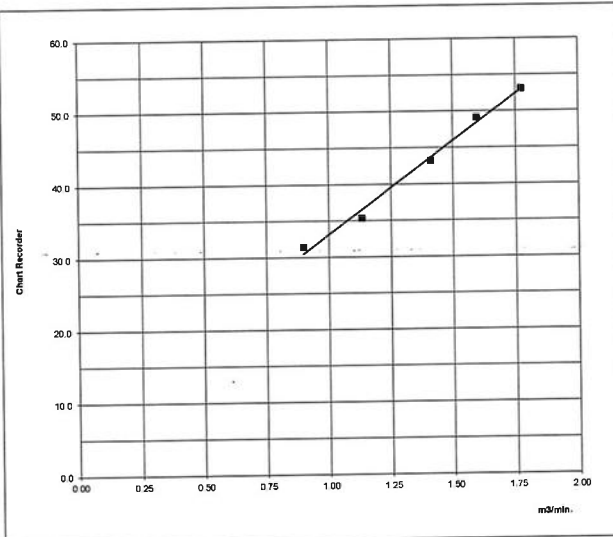
Slope = 25.6373

Intercept = 7.5426

Corr. coeff. = 0.9957

of Observations: 5

Range of Chart at 1.1 - 1.7 m3/min. 37 52



Calibrated by :

(Wuttipong Klangrapun)
15 March 2024

Approved by :

(Wisan Ritthikamon)
15 March 2024

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



EnviLab & Associates Supply Instrument

TSP High Volume Sampler Calibration

Verification Report No.

SO2400004-E001 -TSP 02

☐ PM ☒ Onsite

Site: บ้านเนิน

UTM : 47P 1468262 588334

Sampler: NTSP#38

Recorder: ECRANG15315115

Date: 15 Mar 24

Technical: Amonthep K.

Approval: Wisan R.

CONDITIONS

Barometric Press. (hPa): 1005.0

Temperature (deg C): 33.0

Average Press. (hPa): 1013.0

Average Temp. (deg C): 30.0

Corrected Pressure (mm Hg): 753.8

Temperature (deg K): 306.0

Corrected Avg. Press. (mm Hg): 759.8

Average Temp. (deg K): 303.0

CALIBRATION ORIFICE

Brand: Tisch Environmental, Inc

Model: TE-5025A

Serial#: 759

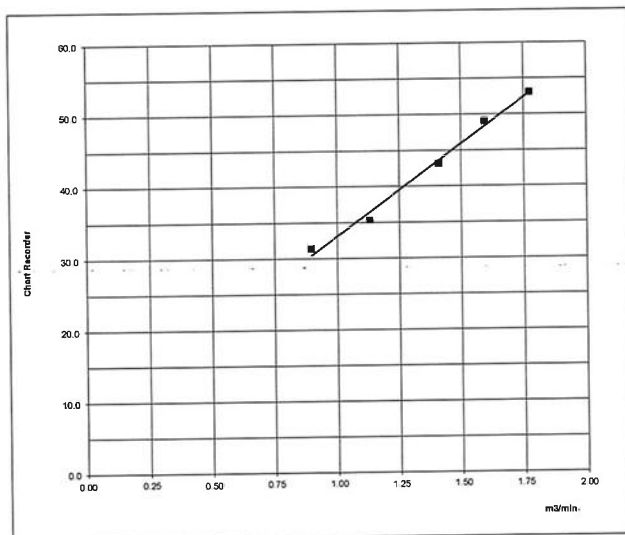
Qstd Slope: 2.03736

Qstd Intercept: -0.03733

Date Certified: 18 Jan 24

CALIBRATIONS

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION Slope = 22.9373 Intercept = 11.1569 Corr. coeff. = 0.9983 # of Observations: 5 Range of Chart at 1.1 - 1.7 m3/min. 38 51
1	12.70	1.737	52.0	51.11	
2	10.20	1.559	48.0	47.18	
3	8.29	1.407	44.0	43.24	
4	4.91	1.087	36.0	35.38	
5	3.05	0.861	32.0	31.45	



Calibrated by :

(Wuttipong Klangprapun)
15 March 2024

Approved by :

(Wisan Ritthikamon)
15 March 2024

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



EnviLab is a member of the Supply Instrument

TSP High Volume Sampler Calibration

Verification Report No.

SO2400004-E001 -TSP 03

☐ PM ☒ Onsite

Site: อดต.หนองนพผล

UTM : 47P 1469390 588063

Sampler: NTSP#37

Recorder: ECRANG15315289

Date: 15 Mar 24

Technical: Amonthep K.

Approval: Wisan R.

CONDITIONS

Barometric Press. (hPa): 1005.0

Temperature (deg C): 33.0

Average Press. (hPa): 1013.0

Average Temp. (deg C): 30.0

Corrected Pressure (mm Hg): 753.8

Temperature (deg K): 306.0

Corrected Avg. Press. (mm Hg): 759.8

Average Temp. (deg K): 303.0

CALIBRATION ORIFICE

Brand: Tisch Environmental, Inc

Model: TE-5025A

Serial#: 759

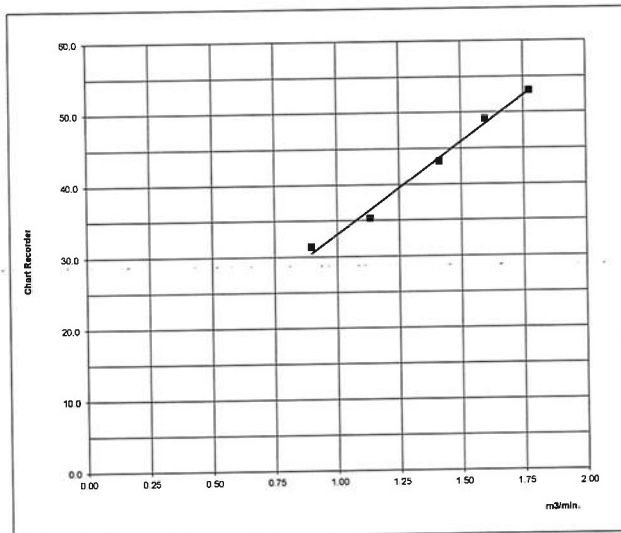
Qstd Slope: 2.03736

Qstd Intercept: -0.03733

Date Certified: 18 Jan 24

CALIBRATIONS

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION
1	12.87	1.749	54.0	53.07	
2	10.12	1.553	50.0	49.14	Slope = 20.0377 Intercept = 17.8191 Corr. coeff. = 0.9982 # of Observations: 5 Range of Chart at 1.1 - 1.7 m3/min. 41 52
3	8.04	1.386	46.0	45.21	
4	5.01	1.098	40.0	39.31	
5	2.99	0.852	36.0	35.38	



Calibrated by :

(Wuttipong Klangprapun)
15 March 2024

Approved by :

(Wisan Ritthikamon)
15 March 2024

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

Environmental responsibility with accuracy measurement



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

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

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



MIRACLE INTERNATIONAL TECHNOLOGY CO.,LTD

214 Bangwaek Rd. Bangpai Bangkae 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 Bangkhac 7, Bangkhac, Bangkhac, 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.

This certificate may not be reproduced other than in full except with the prior written approval of the Miracle International Technology Company Limited.

Approved by:

Sarayuth T.
(Sarayuth Tochua)



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.

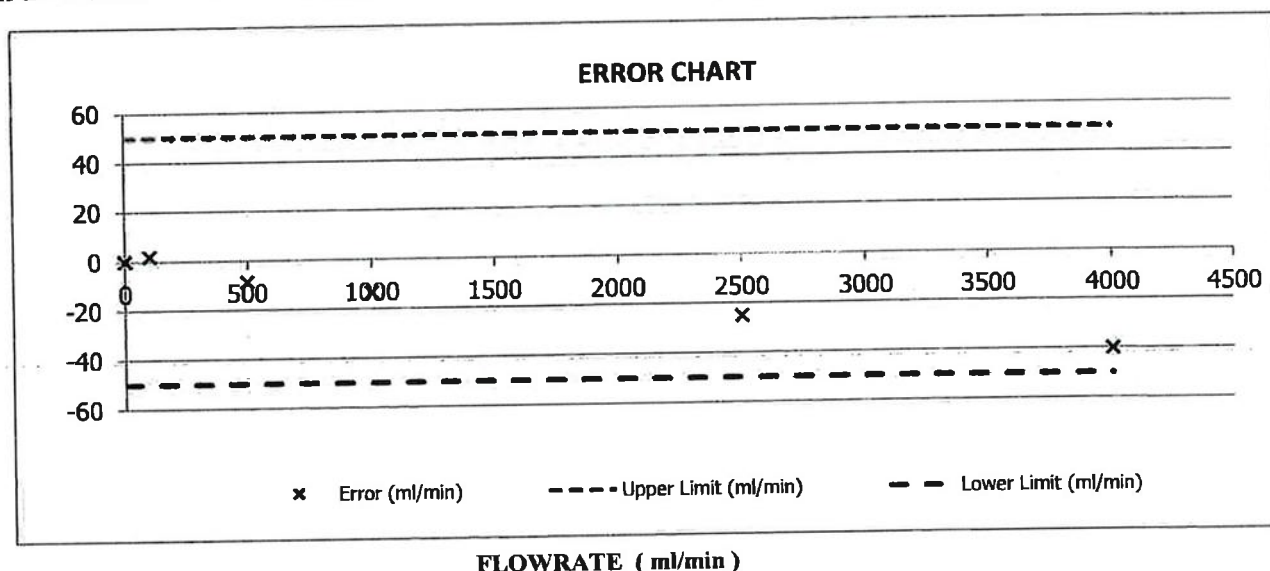
Error = Unit Under Calibration - Standard

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 atmosphere and room temperature and room

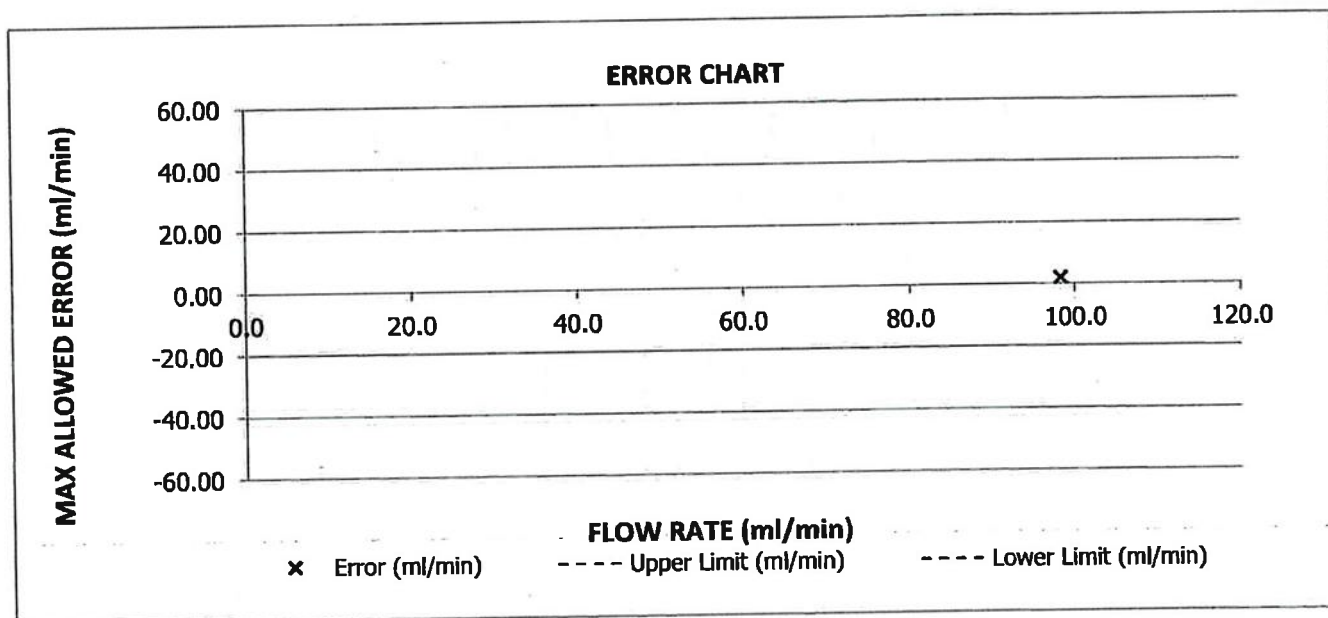
Temperature (°C)	Pressure (kPa)	Flow Rate Reading (ml/min)		Error (ml/min)	Uncertainty \pm (ml/min)	MPE \pm (ml/min)	Pass / Fail
		UUC Reading	STD Reading				Simple Acceptance
22.733	101.00	100.34	98.395	1.95	1.1	50	Pass

Error = Unit Under Calibration - Standard

Pass = |error| \leq |MPE|

MPE = Maximum Permissible Error

Fail = |error| > |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, Sukhprachasan 3 Rd., Bangpood, Pakkred, Nonthaburi 11120

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



NSC-TISI-TIS17025
CALIBRATION 0030

Certificate of Calibration

Certificate No. : 67-410025-1

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. : ELABTMHTC10003

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 permission

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. : 67-410025-1

Page : 2 of 2

UUC Condition As-Received : Good

Result of Calibration : Without Adjustment

Function : Temperature measurement

Reference Humidity @ 50 %R.H.

Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
24.98	25.0	0.0	0.46

Result of Calibration : Without Adjustment

Function : Humidity measurement

Reference Temperature @ 25 °C

Standard Humidity (%R.H.)	UUC Reading (%R.H.)	Correction (%R.H.)	Uncertainty (± %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%

- o0o -

Certificate of Calibration

Certificate No. : 67-200034-1

Page : 1 of 2

Submitted by : Envilab Co.,Ltd.

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

Equipment : Electronic Balance

Manufacturer : Sartorius

Model : SECURA224-1S

Serial No. : 0034803270

ID No. : ELABBALANCEN04

Capacity : 220 g

Resolution : 0.0001 g

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

Ambient Temperature : (22.8 to 23.6) °C

Relative Humidity : (44.6 to 45.3) %

Air Pressure : 1014.0 mbar

Date of Received : 01 February 2024

Date of Calibration : 01 February 2024

Date of Issue : 06 February 2024

Calibrated by : Akaradath Thippichai

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

Edition 7 - November 2022

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

Standard Weights

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

Approved by :



(Surachai Promthong)

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

CAL

Calibratech Co.,Ltd.

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

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

Certificate of Calibration

Certificate No. : 67-200034-1

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Departure of indication from nominal value

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

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

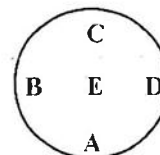
This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2.06$, providing a level of confidence of approximately 95%

Eccentric error

Load test : 50 g

A	B	C	D	E
-0.0001	-0.0001	-0.0001	0.0001	0.0000

g



Repeatability

Load test : 200 g

Stdev. : 0.00005 g

- oOo -

A handwritten signature in black ink, appearing to be 'AB' or similar, located in the bottom right area of the page.

CAL

Calibratech Co.,Ltd.

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

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



NSC-TISI-TIS17025
CALIBRATION 0030

Certificate of Calibration

Certificate No. : 67-200060-2

Page : 1 of 2

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

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

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

Date of Received : 20 February 2024

Date of Calibration : 20 February 2024

Date of Issue : 21 February 2024

Calibrated by : Satja Sangkhum

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

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

Standard Weights

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

Approved by :

(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

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.

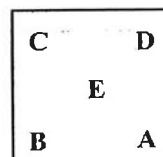
This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2.00$, providing a level of confidence of approximately 95%

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

- o0o -



THAI METEOROLOGICAL DEPARTMENT

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

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue : 6 April, 2024

Certification No. 168/24

Page : 1 of 6

Object : เครื่องมือตรวจวัดอุตุนิยมวิทยา

Manufacturer : DYACON

Type : Data Logger MS-100

Serial No. : 130148 ID No. : EWSDCMS1200148

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

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1008.2 hPa

NATIONAL STANDARD WIND TUNNEL : Wind Aloft Plotting Board
: Micromanometer Theodor Friedrichs FC014 Serial No. 9310119 : HOOK GAGE NO 1425

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

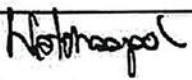
: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)
Serial Number 110730029 (sensor 120629586)

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

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

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

STANDARD BAROMETER : Digital Barometer Vaisala Type PTB220 No. 11220045

Calibrated by : 

Mr. Watcharapol Subwat
Mechanical Engineer

Signed :

Mr. Pisood Promsut

(Authorised Signatory)



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

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

6 April, 2024

Serial No. 1222

Page : 2 of 6

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

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

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 Pressure Model TPH-1 C

Serial No. 6273

Certification No. 168/24

6 April, 2024

Page : 3 of 6

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

Average

0.51

Calibrated by :

Watcharapol Subwat

Mr. Watcharapol Subwat

Mechanical Engineer





THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Sensor Temperature Model TPH-1 C

Certification No. 168/24

6 April, 2024

Serial No. 6273

Page : 4 of 6

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

Calibrated by :

Watchapol

Mr. Watchapol Subwat

Mechanical Engineer





THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Sensor Humidity Model TPH-1 C

Certification No. 168/24

6 April, 2024

Serial No. 6273

Page : 5 of 6

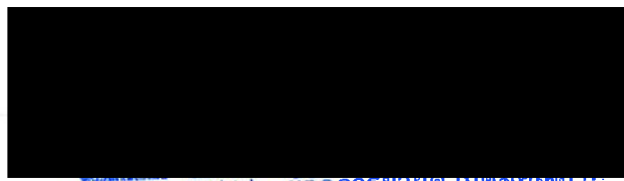
Standard Humidity % R.H.	Relative Humidity Sensor Reading	
	Reading % R.H.	Correction % R.H.
85.2	87.8	-2.6
62.4	65.2	-2.8
41.5	43.1	-1.6

Calibrated by :

Watcharapol

Mr. Watcharapol Subwat

Mechanical Engineer





Date of Issue 6 April, 2024

Certification No. 168/24

Page: 6 of 6

ใบรับรอง

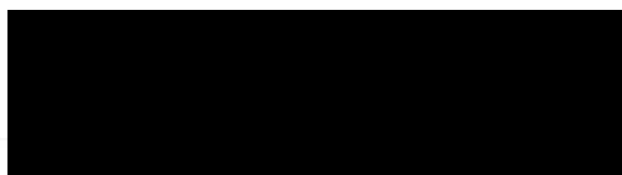
หนังสือฉบับนี้ขอรับรองว่า เครื่องวัดฝน ยี่ห้อ Davis Instruments แบบ TIPPING BUCKET Product No. #7852 Mfg. Code. EWSDCMS1200148 ทำการสอบเทียบกับแก้ววัดฝน แบบแก้วดวง GAUGE DIAMETER 8.0 INCHES, NEGRETTI & ZAMBRA LONDON No. 71082 และสามารถนำไปใช้ได้ มีค่าถูกต้องตามรายละเอียดของเครื่องมือ (0.2 mm./TIP)



ลงชื่อ.....

(นายวัชรพล ทรัพย์วัฒน์)

วิศวกรชำนาญการ





THAI METEOROLOGICAL DEPARTMENT

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

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 6 April, 2024

Certification No. 169/24

Page : 1 of 6

Object : เครื่องมือตรวจวัดอุณหภูมิ

Manufacturer : DYACON

Type : Data Logger MS-100

Serial No. : 130149 ID No. : EWSDCMS1200149

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

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1008.5 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

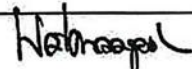
: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)
Serial Number 110730029 (sensor 120629586)

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 : 

Signed :

Mr. Watcharapol Subwat

Mr. Pisob Promsut

Mechanical Engineer

(Authorised Signatory)

for the Chief

Sub-Standard Instrument



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Sensor Wind Speed & Wind Direction Model WSD-1 F Certification No. 169/24

6 April, 2024

Serial No. 1223

Page : 2 of 6

Standard Ultrasonic Anemometer m/sec	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure inches H2O	Vacumm inches H2O	Velocity m/sec	Velocity m/sec	Correction m/sec
1.00	-	-	-	1.0	0.00
3.02	-	-	-	3.0	0.02
5.00	-	-	-	5.0	0.00
7.04	-	-	-	7.0	0.04
9.02	-	-	-	9.0	0.02
11.01	-	-	-	11.0	0.01
13.01	-	-	-	13.0	0.01
15.01	-	-	-	15.0	0.01
17.02	-	-	-	17.0	0.02
20.02	-	-	-	20.0	0.02

Wind Aloft Plotting Board.	
US.DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRETION	TESTED WIND DIRECTION
0	0
90	89
180	18
270	

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 Pressure Model TPH-1 C

Serial No. 6274

Certification No. 169/24

6 April, 2024

Page : 3 of 6

Standard Barometer Pressure	Tested Barometer Pressure	Correction
1009.59	1009.5	0.09
1009.45	1009.4	0.05
1010.10	1010.0	0.10
1010.94	1010.8	0.14
1011.46	1011.4	0.06
1011.84	1011.9	-0.06
1012.06	1012.0	0.06
1013.04	1013.0	0.04
1013.18	1013.1	0.08
1012.89	1012.8	0.09
1013.20	1013.1	0.10
1013.44	1013.4	0.04
1013.81	1013.9	-0.09
1014.19	1014.1	0.09
1015.96	1015.9	0.06
1016.23	1016.1	0.13
1015.64	1015.6	0.04
1015.23	1015.1	0.13
1012.87	1012.8	0.07
1013.63	1013.6	0.03

Average

Calibrated by :

Watchapol

Mr. Watchapol Subwat

Mechanical Engineer



Meteorological Instruments Bureau



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Sensor Temperature Model TPH-1 C

Certification No. 169/24

6 April, 2024

Serial No. 6274

Page : 4 of 6

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.6	45.7	-0.1
30.1	30.1	0.0
15.4	15.5	-0.1

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 Humidity Model TPH-1 C

Certification No. 169/24

6 April, 2024

Serial No. 6274

Page : 5 of 6

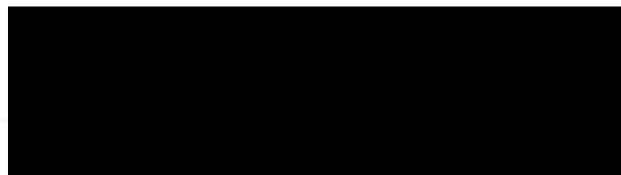
Standard Humidity % R.H.	Relative Humidity Sensor Reading	
	Reading % R.H.	Correction % R.H.
85.2	82.8	2.4
62.4	60.6	1.8
41.5	40.3	1.2

Calibrated by :

Watcharapol

Mr. Watcharapol Subwat

Mechanical Engineer





Date of Issue 6 April, 2024

Certification No. 169/24

Page: 6 of 6

ใบรับรอง

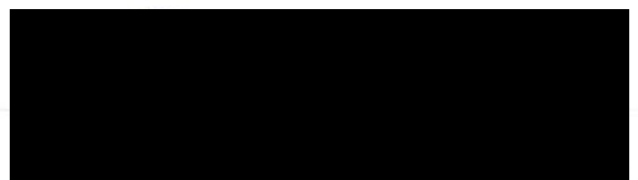
หนังสือฉบับนี้ขอรับรองว่า เครื่องวัดฝน ยี่ห้อ Davis Instruments แบบ TIPPING BUCKET Product No. #7852 Mfg. Code. EWSDCMS1200149 ทำการสอบเทียบกับแก้ววัดฝน แบบแก้วดวง GAUGE DIAMETER 8.0 INCHES, NEGRETTI & ZAMBRA LONDON No. 71082 และสามารถนำไปใช้ได้ มีค่าถูกต้องตามรายละเอียดของเครื่องมือ (0.2 mm./TIP)



ลงชื่อ.....

(นายวัชรพล ทรัพย์วัฒน์)

วิศวกรชำนาญการ





THAI METEOROLOGICAL DEPARTMENT

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

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 6 April, 2024

Certification No. 170/24

Page : 1 of 6

Object : เครื่องมือตรวจวัดอุณหภูมิมหาวิทยาลัย

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)

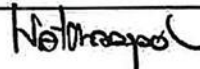
Serial Number 110730029 (sensor 120629586)

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 : 

Signed : 

Mr. Watcharapol Subwat

Mr. Pisood Promsut

Mechanical Engineer

(Authorised Signatory)

for the Chief

Sub-Standard Instrument



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Sensor 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	Vacumm inches H2O	Velocity m/sec	Velocity m/sec	Correction m/sec
1.00	-	-	-	1.0	0.00
3.02	-	-	-	2.9	0.12
5.00	-	-	-	5.0	0.00
7.04	-	-	-	7.0	0.04
9.02	-	-	-	9.0	0.02
11.01	-	-	-	11.0	0.01
13.01	-	-	-	12.9	0.11
15.01	-	-	-	15.0	0.01
17.02	-	-	-	17.0	0.02
20.02	-	-	-	20.0	0.02

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

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 Pressure 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

Calibrated by :

Watchapol

Mr. Watchapol Subwat

Mechanical Engineer





THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Sensor 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





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 % R.H.	Correction % R.H.
85.2	82.5	2.7
62.4	60.2	2.2
41.5	40.1	1.4

Calibrated by :

Watcharapol

Mr. Watcharapol Subwat

Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau





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Envilab & Neediss Supply Instrument

Verification Test Report

Report No.:

SO2400004-E001 -SLM 03

☐ PM ☒ Onsite UTM : 47P N1468513 E588447

Calibrated Date: 15 March 2024

Site : บริเวณริมรั้วด้านทิศเหนือของโครงการ

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 44

Serial : 1966

Environment: Temperature 33 °C Humidity 72 %RH

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

Serial No.1351075

Date of Calibration : 16 March 2024

Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.78	93.79	0.01	93.78

Calibrated By:

(Amonthep KonkleeB)

Date:

15 March 2024

Approve By:

(Wisan Ritthikamon)

Date:

15 March 2024

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



Envilab & Neediss Supply Instrument

Verification Test Report

Report No.:

SO2400004-E001 -SLM 04

☐ PM ☒ Onsite UTM : 47P N1468276 E588631

Calibrated Date: 15 March 2024

Site : บริเวณริมรั้วด้านทิศใต้ของโครงการ

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 44

Serial : 1921

Environment: Temperature 33 °C Humidity 72 %RH

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

Serial No.1351075

Date of Calibration : 16 March 2024

Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.78	93.77	-0.01	93.78

Calibrated By:

(Amonthep Konkleeab)

Date:

15 March 2024

Approve By:

(Wisan Ritthikamon)

Date:

15 March 2024

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Envilab & Needss Supply Instrument

Verification Test Report

Report No.:

SO2400004-E001 -SLM 05

☐ PM ☒ Onsite UTM : 47P N1468275 E588741

Calibrated Date: 15 March 2024

Site : บริเวณริมรั้วด้านทิศตะวันออกของโครงการ

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 44

Serial : 1969

Environment: Temperature 33 °C Humidity 72 %RH

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

Serial No.1351075

Date of Calibration : 16 March 2024

Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.78	93.68	-0.10	93.78

Calibrated By:

(Amonthep KonkleeB)

Date:

15 March 2024

Approve By:

(Wisan Ritthikamon)

Date:

15 March 2024

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Envilab & Needis Supply Instrument

Verification Test Report

Report No.:

SO2400004-E001 -SLM 02

☐ PM

☒ Onsite UTM : 47P 1468495 E588254

Calibrated Date: 15 March 2024

Site : บริเวณริมรั้วด้านทิศตะวันตกของโครงการ

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 44

Serial : 1967

Environment: Temperature 33 °C Humidity 72 %RH

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

Serial No.1351075

Date of Calibration : 16 March 2024

Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.78	93.71	-0.07	93.78

Calibrated By:

(Amonthep KonkleeB)

Date:

15 March 2024

Approve By:

(Wisan Ritthikamon)

Date:

15 March 2024

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Envilab & Neediss Supply Instrument

Verification Test Report

Report No.:

SO2400004-E001 -SLM 01

☐ PM

☒ Onsite UTM :

47P N1468255 E588327

Calibrated Date: 15 March 2024

Site : ชุมชนบ้านเนิน

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 44

Serial : 2206

Environment: Temperature 33 °C Humidity 72 %RH

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

Serial No.1351075

Date of Calibration : 16 March 2024

Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.78	93.74	-0.04	93.78

Calibrated By:

(Amonthep KonkleeB)

Date:

15 March 2024

Approve By:

(Wisan Ritthikamon)

Date:

15 March 2024

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0381

MTC No. EEL. BP. 70/0366

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/N 4106495.
7. Condenser Microphone Bruel&Kjaer 4180 S/N 2889871.

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

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

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

Date of Receipt : 14 Mar. 2023

Date of Calibration : 16 Mar. 2023

1/2
W

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

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FM.BL.MTC.002 Rev.4

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Amphoe Muang, Changwat Samutpraka
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E-mail : mtc@tistr.or.th





THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0381

MTC No. EEL. BP. 70/0366

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

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

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

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	93.78	-0.22	± 0.10	± 0.40 dB

2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	999.0	-1.0	± 1.5	$\pm 1.0\%$

3. Total distortion

Standard Microphone Type	Measured Total distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	1.05	± 0.50	$\pm 3.0\%$

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :

(Mr. Weerachai Deechaiyae)

Approved by :

(Mr. Prawate Klunypa)
Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 16 Mar. 2023

Date of Issue : 17 Mar. 2023

Ref : 2011266031401056001

End of Certificate

2 / 2

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FM.BL.MTC.002 Rev.4

Envilab Co.,Ltd. ผู้จัดการฝ่ายควบคุมคุณภาพ



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Envilab & Needles Supply Instrument

Verification Test Report

Report No.:

SO2400004-E001 -PU 01

Calibrated Date: 19-Mar-24

Equipment: Air Sampling Pump

Manufacturer: AP BUCK

Model: LP-5

Serial or ID No. 5426

Environment: Temperature 25 °C Humidity 62 %RH

Reference Standard: Primary Flow Calibrator Model Defender 520 H, MESALABS

Serial No. 164578

Date of Calibration : 16 March 2024

Result of Test			
Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
2000	1	1998.0	2000.2
	2	1999.0	
	3	2001.0	
	4	2002.0	
	5	2001.0	

Calibrated By:

มานุสนันท์

(Manutsanun Koomket)

Date:

19-Mar-24

Approve By:

วิสัน ฤทธิคามอน

(Wisan Ritthikamon)

Date:

19-Mar-24

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Envilab & Neediss Supply Instrument

Verification Test Report

Report No.:

SO2400004-E001 -PU 02

Calibrated Date: 19-Mar-24

Equipment: Air Sampling Pump

Manufacturer: AP BUCK

Model: LP-5

Serial or ID No. 5427

Environment: Temperature 25 °C Humidity 62 %RH

Reference Standard: Primary Flow Calibrator Model Defender 520 H, MESALABS

Serial No. 164578

Date of Calibration : 16 March 2024

Result of Test			
Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
1000	1	1001.0	1000.8
	2	1004.0	
	3	998.0	
	4	999.0	
	5	1002.0	

Calibrated By:

2017/03/19

(Manutsanun Koomket)

Date:

19-Mar-24

Approve By:

(Wisan Ritthikamon)

Date:

19-Mar-24

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



Envilab & Needles Supply Instrument

Verification Test Report

Report No.:

SO2400004-E001 -PU 03

Calibrated Date: 19-Mar-24

Equipment: Air Sampling Pump

Manufacturer: AP BUCK

Model: LP-5

Serial or ID No. 5428

Environment: Temperature 25 °C Humidity 62 %RH

Reference Standard: Primary Flow Calibrator Model Defender 520 H, MESALABS

Serial No. 164578

Date of Calibration : 16 March 2024

Result of Test			
Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
1700	1	1697.0	1700.4
	2	1699.0	
	3	1702.0	
	4	1703.0	
	5	1701.0	

Calibrated By: Manutsanun Koomket
(Manutsanun Koomket)

Date: 19-Mar-24

Approve By: Wisan Ritthikamon
(Wisan Ritthikamon)

Date: 19-Mar-24

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Envilab & Needless Supply Instrument

Verification Test Report

Report No.:

SO2400004-E001 -PU 04

Calibrated Date: 19-Mar-24

Equipment: Air Sampling Pump

Manufacturer: AP BUCK

Model: LP-5

Serial or ID No. 5429

Environment: Temperature 25 °C Humidity 62 %RH

Reference Standard: Primary Flow Calibrator Model Defender 520 H, MESALABS

Serial No. 164578

Date of Calibration : 16 March 2024

Result of Test			
Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
1000	1	999.0	1000.6
	2	1003.0	
	3	1002.0	
	4	998.0	
	5	1001.0	

Calibrated By:

(Manutsanun Koomket)

Date:

19-Mar-24

Approve By:

(Wisan Ritthikamon)

Date:

19-Mar-24

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



Envilab & Needos Supply Instrument

Verification Test Report

Report No.:

SO2400004-E001 -PU 05

Calibrated Date: 19-Mar-24

Equipment: Air Sampling Pump

Manufacturer: AP BUCK

Model: LP-5

Serial or ID No. 5430

Environment: Temperature 25 °C Humidity 62 %RH

Reference Standard: Primary Flow Calibrator Model Defender 520 H, MESALABS

Serial No. 164578

Date of Calibration : 16 March 2024

Result of Test			
Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
1700	1	1701.0	1700.4
	2	1702.0	
	3	1697.0	
	4	1699.0	
	5	1703.0	

Calibrated By:

Manutsanun Koomket

(Manutsanun Koomket)

Date:

19-Mar-24

Approve By:

Wisan Ritthikamon

(Wisan Ritthikamon)

Date:

19-Mar-24

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



Envilab & Needles Supply Instrument

Verification Test Report

Report No.:

SO2400004-E001 -PU 06

Calibrated Date: 19-Mar-24

Equipment: Air Sampling Pump

Manufacturer: AP BUCK

Model: LP-5

Serial or ID No. 5445

Environment: Temperature 25 °C Humidity 62 %RH

Reference Standard: Primary Flow Calibrator Model Defender 520 H, MESALABS

Serial No. 164578

Date of Calibration : 16 March 2024

Result of Test			
Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
1700	1	1699.0	1700.4
	2	1698.0	
	3	1701.0	
	4	1703.0	
	5	1701.0	

Calibrated By: Manutsanun Koomket
(Manutsanun Koomket)

Date: 19-Mar-24

Approve By: Wisana Ritthikamon
(Wisana Ritthikamon)

Date: 19-Mar-24

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



Envilab & Neediss Supply Instrument

Verification Test Report

Report No.:

SO2400004-E001 -PU 07

Calibrated Date: 19-Mar-24

Equipment: Air Sampling Pump

Manufacturer: AP BUCK

Model: LP-5

Serial or ID No. 5446

Environment: Temperature 25 °C Humidity 62 %RH

Reference Standard: Primary Flow Calibrator Model Defender 520 H, MESALABS

Serial No. 164578

Date of Calibration : 16 March 2024

Result of Test			
Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
1700	1	1698.0	1700.2
	2	1697.0	
	3	1703.0	
	4	1701.0	
	5	1702.0	

Calibrated By: มานุสนันท์
(Manutsanun Koomket)

Date: 19-Mar-24

Approve By: วิสัน ฤทธิกามอน
(Wisan Ritthikamon)

Date: 19-Mar-24

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ประกาศใช้ 01/02/2566

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En



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



Envilab & Needless Supply Instrument

Verification Test Report

Report No.:

SO2400004-E001 -PU 08

Calibrated Date: 19-Mar-24

Equipment: Air Sampling Pump

Manufacturer: AP BUCK

Model: LP-5

Serial or ID No. 5447

Environment: Temperature 25 °C Humidity 62 %RH

Reference Standard: Primary Flow Calibrator Model Defender 520 H, MESALABS

Serial No. 164578

Date of Calibration : 16 March 2024

Result of Test			
Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
1700	1	1699.0	1700.6
	2	1703.0	
	3	1701.0	
	4	1698.0	
	5	1702.0	

Calibrated By:

Manutsanun Koomket

(Manutsanun Koomket)

Date:

19-Mar-24

Approve By:

Wisan Ritthikamon

(Wisan Ritthikamon)

Date:

19-Mar-24

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Envilab Co., Ltd. ผู้ตรวจวัดและสอบเทียบ



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



Envilab & Needless Supply Instrument

Verification Test Report

Report No.:

SO2400004-E001 -PU 09

Calibrated Date: 19-Mar-24

Equipment: Air Sampling Pump

Manufacturer: AP BUCK

Model: LP-5

Serial or ID No. 5448

Environment: Temperature 25 °C Humidity 62 %RH

Reference Standard: Primary Flow Calibrator Model Defender 520 H, MESALABS

Serial No. 164578

Date of Calibration : 16 March 2024

Result of Test			
Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
1700	1	1702.0	1700.6
	2	1703.0	
	3	1699.0	
	4	1698.0	
	5	1701.0	

Calibrated By: Manutsanun Koomket
(Manutsanun Koomket)

Date: 19-Mar-24

Approve By: Wisan Ritthikamon
(Wisan Ritthikamon)

Date: 19-Mar-24

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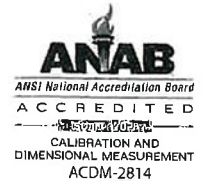
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Envilab Co.,Ltd. ผู้จัดการฝ่ายควบคุมคุณภาพ



CALIBRATION LABORATORY Co., LTD.

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



CERTIFICATE OF CALIBRATION FOR

NOMENCLATURE : HEAT STRESS MONITOR
MANUFACTURER : METROSONICS
MODEL / TYPE : hs-32
SERIAL NO. : MCH110039[EHEMTHS3211039]
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 realize the units of measurement according to the International System of Units (SI)

Certificate No. Q24021068

F3-011-05/12-23

page 1 of 3



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CALIBRATION LABORATORY Co., LTD.

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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.	:	MCH110039[EHEMTHS3211039]
DATE OF CALIBRATION	:	28 February 2024

ENVIRONMENT CONDITIONS :

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

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

PROCEDURE USED :

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

REFERENCE STANDARD USED :

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

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

TRACEABILITY :

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

UNCERTAINTY :

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

Certificate No. Q24021068

F3-011-05/12-23

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	19.9	+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 ± (° 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 ± (° 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

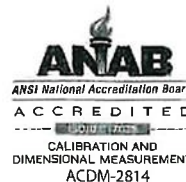
F3-011-05/12-23

page 3 of 3



CALIBRATION LABORATORY CO., LTD.

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



CERTIFICATE OF CALIBRATION FOR

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

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

DATE OF RECEIVED : 27 February 2024

DATE OF ISSUED : 29 February 2024

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

Calibrated By :

Tanawan Seenam-Ngoen
Calibration Engineer

Approved By :

Mongkol Yotsoontorn
Authorized Signatory
29 February 2024



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

Certificate No. Q24021069

F3-011-05/12-23

page 1 of 3



CALIBRATION LABORATORY CO., LTD.

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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 :

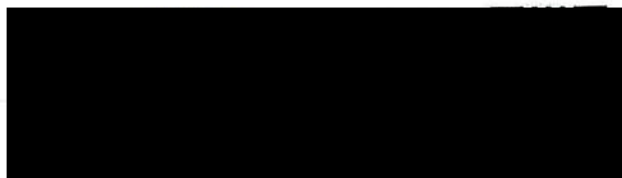
The measurements are traceable to International System of Units (SI) , through Thunder Scientific Corporation.
Certificate No. 21594, Due Date 06 July 2024.

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

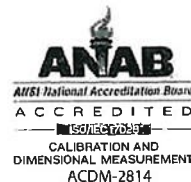
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CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION

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	

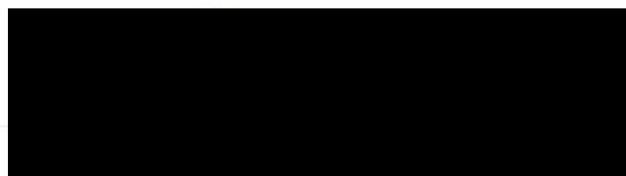
Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 012 Page 59 of 67

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

End of Certificate

Certificate No. Q24021069

F3-011-05/12-23





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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. : MCH110041[EHEMTHS3211041]
CLID. NO. : 232400813
JOB CONTROL NO. : 240227021070
CALIBRATION SERVICE : ☒ IN-LABORATORY ☐ ON-SITE

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

DATE OF RECEIVED : 27 February 2024

DATE OF ISSUED : 29 February 2024

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

Calibrated By : Tanawan Seenam-Ngoen

Calibration Engineer

Approved By :

Mongkol Yotsoontorn

Authorized Signatory

29 February 2024



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

Certificate No. Q24021070

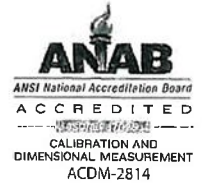
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page 1 of 3



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REPORT OF CALIBRATION FOR

NOMENCLATURE : HEAT STRESS MONITOR
MANUFACTURER : METROSONICS
MODEL / TYPE : hs-32
SERIAL NO. : MCH110041[EHEMTHS3211041]
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. Q24021070

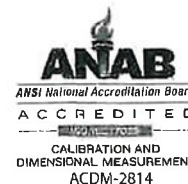
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Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



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	20.0	0.00	0.27
30.0	30.00	30.0	0.00	
40.0	39.99	40.2	-0.21	

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	30.0	0.00	
40.0	39.99	40.4	-0.41	

3. CORRECTION OF TEMPERATURE : GLOBE

Test point (° C)	Actual Temperature (° C)	DUC Reading (° C)	Correction (° C)	Uncertainty \pm (° C)
20.0	20.00	20.0	0.00	0.27
30.0	30.00	30.0	0.00	
40.0	39.99	39.9	+0.09	

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. Q24021070

F3-011-05/12-23





INTERNATIONAL TESTING SERVICE CO., LTD

1213/388 Ladprao 94 Ladprao Rd. Wangtonglang Bangkok 10310
Tel 0-2559-2095 Fax 0-2559-2096

E-mail : sale@itest-lab.com web site : www.itest-lab.com



NSC-TISI-TIS 17025
CALIBRATION 129

CALIBRATION CERTIFICATE

Issued date: 18 April 2023

Client Name : **ENVILAB CO., LTD.**

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

Request No : **C-2304 - 169**

Laboratory No.: **CAL- 169**

Date of Request: 12 April 2023.

Date of Calibration: 17 April 2023.

1. Unit Under Calibration (UUC) :

Nomenclature : Digital Lux Meter

Serial No.: 190600470

Maker : TENMARS

Model : TM-720

2. Place of Calibration: Photometry Standard Laboratory, INTERNATIONAL TESTING SERVICE CO., LTD.

3. Range of Calibration: 1 Range

4. Condition of Laboratory: Ambient temperature: $(25 \pm 2) ^\circ\text{C}$ and relative humidity $(60 \pm 20) \%$.

5. Reference Standard: Standard Tungsten Halogen Lamp, Serial No.: 504011, which was calibrated on 5 October 2022, can be traceable to International System of Unit (SI) through National Institute of Metrology (Thailand), Certificate No.: TP-1024-22.

6. Support Equipment:

1. Photometric bench, 6.3 meter long.

2. DC. power supply, Serial No.: EJ 19A 009, Model: GPR-25H 300, Maker: GW INSTR.

3. Digital Multimeter, Model: 34401A, S/N: MY44011212 and MY44011215.

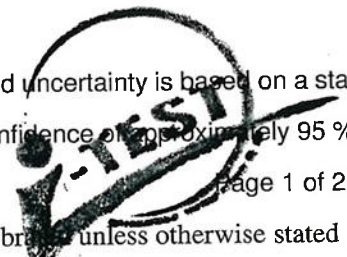
4. Foot Candle / Lux Meter, Model: 407026, S/N: Q 558437, Maker: EXTECH.

7. Calibration Procedure:

The measurement was done in accordance with WI-CP-01. The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95 %.

Page 1 of 2

The Results shown in this certification report refer only to the equipment(s) calibrated unless otherwise stated
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**INTERNATIONAL TESTING SERVICE CO., LTD**

1213/388 Ladprao 94 Ladprao Rd. Wangtonglang Bangkok 10310
Tel 0-2559-2095 Fax 0-2559-2096

E-mail : sale@itest-lab.com web site : www.itest-lab.com



Request No: **C-2304 - 169**

Serial No.: 190600470


Laboratory No.: **CAL - 169**

Results :

UUC Range	Standard (Ix)	UUC Reading (Ix)		Correction (Ix)	Uncertainty of Measurement (\pm Ix)
		Before adjust	After adjust		
Auto	0	0.0	0.0	0.0	0.1
	100	81.9	103.8	- 3.8	2.0 % of Reading
	500	393.2	506.9	- 6.9	
	1000	779.4	1003	- 3	
	1500	1160	1490	+ 10	
	2000	1531	1972	+ 28	

Note: 1. The results relate only to the items calibrated.
2. Zero adjust before used.

Calibration result approved by


(Mr. Yuttana Tholueng)



Approved on behalf of
International Testing Service Co., Ltd


(Mr. Pichit Vivat-Anant)
Managing Director

Page 2 of 2

The Results shown in this certification report refer only to the equipment(s) calibrated unless otherwise stated
This Calibration Certificate cannot be reproduced, except in full, without permission of company.



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



Envilab & Needless Supply Instrument

Verification Test Report

Report No.:

SO2400004-E001 -SLM 01

☒ PM ☐ Onsite UTM : 47P 1514458 654247

Calibrated Date: 19 March 2024

Site : บริษัท เอ็นไวแล็บ

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 44

Serial : 1811

Environment: Temperature 25 °C Humidity 68 %RH

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

Serial No.1351075

Date of Calibration : 18 Dec 2023

Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.78	93.87	0.09	93.78

Calibrated By:

มานุสนันท์

(Manutsanun Koomket)

Date:

19 March 2024

Approve By:

วิสัน ฤทธิกามอน

(Wisan Ritthikamon)

Date:

19 March 2024

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



Envilab & Neediss Supply Instrument

Verification Test Report

Report No.:

SO2400004-E001 -SLM 02

☒ PM ☐ Onsite UTM : 47P 1514458 654247

Calibrated Date: 19 March 2024

Site : บริษัท เอ็นไวแล็บ

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 44

Serial : 1812

Environment: Temperature 25 °C Humidity 68 %RH

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

Serial No.1351075

Date of Calibration : 18 Dec 2023

Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.78	93.62	-0.16	93.78

Calibrated By: มานุสนันท์
(Manutsanun Koomket)

Date: 19 March 2024

Approve By: วิสัน รัตนิกามอน
(Wisan Ritthikamon)

Date: 19 March 2024

This report shall not be reproduced except in full, without the written approval of Envilab Co., Ltd.



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



Envilab & Needss Supply Instrument

Verification Test Report

Report No.:

SO2400004-E001 -SLM 03

☒ PM ☐ Onsite UTM : 47P 1514458 654247

Calibrated Date: 19 March 2024

Site : บริษัท เอ็นไวแล็บ

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 44

Serial : 1883

Environment: Temperature 25 °C Humidity 68 %RH

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

Serial No.1351075

Date of Calibration : 18 Dec 2023

Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.78	93.84	0.06	93.78

Calibrated By:

(Manutsanun Koomket)

Date:

19 March 2024

Approve By:

(Wisan Ritthikamon)

Date:

19 March 2024

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Certificate of Calibration

Page : 1 of 3

Certificate Number : SPR23040182-6

Customer : Envilab Co., Ltd.

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

Equipment Name : Sound Level Meter

Manufacturer : Pulsar

Model : 44

Serial Number : PN1883

ID. Number : N/A

Environmental Conditions

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

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

Location of Calibration : In-Lab

Calibration Procedure : SP-CPE-04-01

Received Date : 19 Apr 2023

Calibration Date : 20 Apr 2023

Recommend Due Date : 20 Apr 2024

Date of Issue : 21 Apr 2023

Method of Calibration

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

All calibrations are performed within manufacture's specifications. The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by : Mr. Prayoon Topart

Calibration Officer

Approved by :

(Mr. Nirut Loha)

Authorized Signatory



Calibration Report

Page : 2 of 3

Certificate Number : SPR23040182-6

Reference Standards

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

Traceability

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



Result of Calibration

Page : 3 of 3

Certificate No. : SPR23040182-6

Range : 20 to 140 dB

Function : @1kHz

Unit : dB

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

Unit : dB

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

Unit : dB

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

Note:

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

Measurement Uncertainty

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

- End of Certificate -



Certificate of Calibration

Certificate Number : SPR23040182-8

Page : 1 of 3

Customer : Envilab Co., Ltd.

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

Equipment Name : Sound Level Meter

Manufacturer : Pulsar

Model : 44

Serial Number : PN1812

ID. Number : N/A

Environmental Conditions

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

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

Location of Calibration : In-Lab

Calibration Procedure : SP-CPE-04-01

Received Date : 19 Apr 2023

Calibration Date : 20 Apr 2023

Recommend Due Date : 20 Apr 2024

Date of Issue : 21 Apr 2023

Method of Calibration

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

All calibrations are performed within manufacture's specifications. The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by : Mr. Prayoon Topart

Calibration Officer

Approved by :

(Mr. Nirut Loha)



Calibration Report

Certificate Number : SPR23040182-8

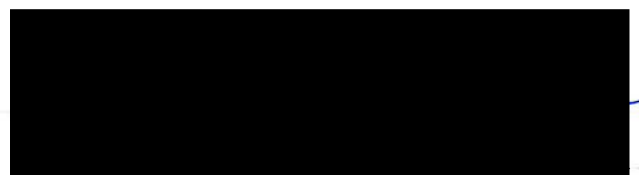
Page : 2 of 3

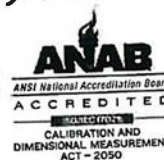
Reference Standards

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

Traceability

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





Result of Calibration

Page : 3 of 3

Certificate No. : SPR23040182-8

Range : 20 to 140 dB

Function : @1kHz

Unit : dB

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

Unit : dB

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

Unit : dB

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

Note:

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

Measurement Uncertainty

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

- End of Certificate -



Certificate of Calibration

Page : 1 of 3

Certificate Number : SPR23040182-7

Customer : Envilab Co., Ltd.

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

Equipment Name : Sound Level Meter

Manufacturer : Pulsar

Model : 44

Serial Number : PN1811

ID. Number : N/A

Environmental Conditions

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

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

Location of Calibration : In-Lab

Calibration Procedure : SP-CPE-04-01

Received Date : 19 Apr 2023

Calibration Date : 20 Apr 2023

Recommend Due Date : 20 Apr 2024

Date of Issue : 21 Apr 2023

Method of Calibration

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

All calibrations are performed within manufacture's specifications. The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by : Mr. Prayoon Topart

Calibration Officer

Approved by :

(Mr. Nirut Loha)

Authorized Signatory



Calibration Report

Page : 2 of 3

Certificate Number : SPR23040182-7

Reference Standards

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

Traceability

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



Result of Calibration

Page : 3 of 3

Certificate No. : SPR23040182-7

Range : 20 to 140 dB

Function : @1kHz

Unit : dB

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

Unit : dB

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

Unit : dB

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

Note:

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

Measurement Uncertainty

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

- End of Certificate -

Certificate of Calibration

Certificate No. : 67-420034-1

Page : 1 of 2

Submitted by : Envilab Co., Ltd.

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

Equipment : pH Meter with electrode

pH meter

Manufacturer : Horiba

Model : F-74BW-G

Range : N/A pH

Resolution : 0.001 pH

Serial No. : B41J0001

ID No. : ELABPHHB74BW01

Electrode

Model : 9615S

Serial No. : 9X1K0003

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

Ambient Temperature : (22.0 to 23.0)^o C

Relative Humidity : (50 to 55) %

Date of Received : 20 March 2024

Date of Calibration : 20 March 2024

Date of Issue : 23 March 2024

Calibrated by : Permpon Chanpu

Calibration Method : In-house method CAL-M4201 direct measurement by using standard voltage calibrator and using certified reference material (CRM)

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

1. Multiproduct Calibrator

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

2. Standard Buffer Solution

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

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. : 67-420034-1

Page : 2 of 2

Result of Calibration :

UUC Condition As-Received : Good

Function : Electrical measurement

pH meter

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

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

Function : pH meter with electrode

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

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

Remark

UUC : Unit Under Calibration

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

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

- o0o -

CAL

Calibratech Co.,Ltd.

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

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



NSC-TISI-TIS17025
CALIBRATION 0030

Certificate of Calibration

Certificate No. : 66-400546-1

Page : 1 of 2

Submitted by : Envilab Co., Ltd.

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

Equipment : Air Chamber (Incubator)

Manufacturer : M-LAB

Model : BIC-140

Range : N/A °C

Resolution : 0.1 °C

Serial No. : 100613-1

ID No. : ELABBODC140N01

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

Ambient Temperature : (25.0 to 26.0) °C

Relative Humidity : (50 to 55) %

Line Voltage : (224.0 to 225.0) V

Date of Received : 03 October 2023

Date of Calibration : 03 October 2023

Date of Issue : 06 October 2023

Calibrated by : Permpoon Chanpu

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

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

ID No.

Cert. No.

Due Date

Traceability

400029 & 400048

66-400454-1

05 Feb 2024

National Institute of Metrology Thailand (NIMT)

Approved by :

(Surachai Promthong)

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 66-400546-1

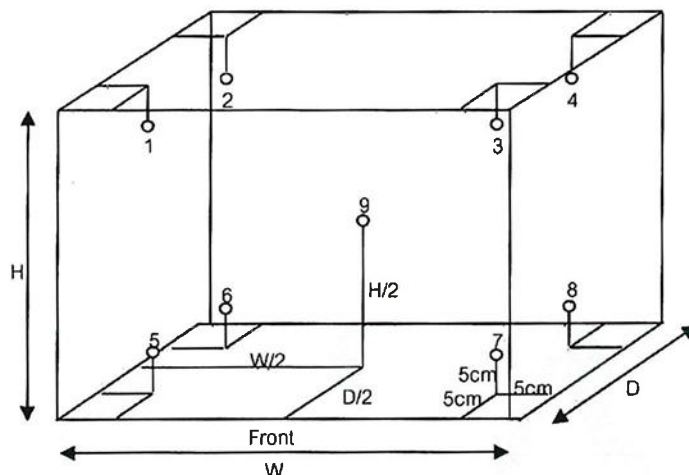
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

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



Inside of Chamber

W = 0.38 m

D = 0.35 m

H = 1.15 m

Capacity = 0.15 m³

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

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

Remark The uncertainty is not combine uniformity of the air chamber

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

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

- o0o -

CAL

Calibratech Co.,Ltd.

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

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

Certificate of Calibration

Certificate No. : 66-400320-1

Page : 1 of 2

Submitted by : Envilab Co., Ltd.

540,540/1 Soi Bangkhae7, Bangkhae, 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 : 02 June 2023

Date of Calibration : 05 June 2023

Date of Issue : 05 June 2023

Calibrated by : Bunjerd Masri

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

<u>ID No.</u>	<u>Cert. No.</u>	<u>Due Date</u>	<u>Traceability</u>
400029 & 400030	66-400227-1	24 Oct 2023	National Institute of Metrology Thailand (NIMT)

Approved by :



(Bunjerd Masri)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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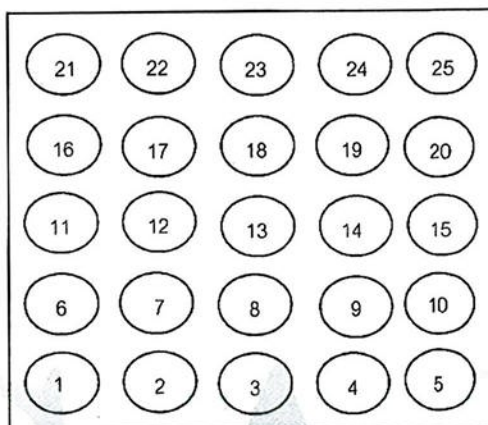
Certificate of Calibration

Certificate No. : 66-400320-1

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	149.7	150.1	150.0	149.8	149.5	150.1	151.2	152.1	150.9	150.4

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	150.3	151.3	151.5	151.1	150.7	149.9	151.5	152.1	151.1	149.9

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	149.6	150.5	150.8	150.3	149.8	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 -

Certificate of Calibration

Certificate No. : 67-400054-1

Page : 1 of 2

Submitted by : Envilab Co., Ltd.

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

Equipment : Water Bath

Manufacturer : Memmert

Model : WNB29

Range : N/A °C

Resolution : 0.1 °C

Serial No. : L617.0156

ID No. : ELABWBWNB29N01

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

Ambient Temperature : (25.0 to 26.0) °C

Relative Humidity : (45 to 50) %

Line Voltage : (224.0 to 225.0) V

Date of Received : 01 February 2024

Date of Calibration : 01 February 2024

Date of Issue : 03 February 2024

Calibrated by : Kittisak Kokaeo

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

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

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

Approved by :



(Surachai Promthong)

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

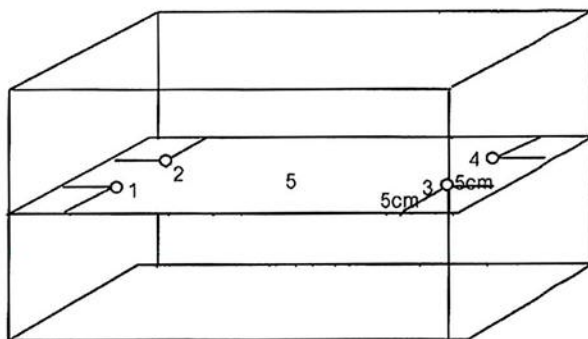
Certificate No. : 67-400054-1

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement



Front

Test Point (° C)	Setting Temperature (° C)	Indicating Temperature (° C)	Measured Temperature (° C) @ Sensor					Uncertainty (± ° C)	Measured Uniformity (° C)	Measured Stability (° C)
			No.							
			1	2	3	4	5			
95.0	95.0	95.0	95.38	95.52	95.56	95.74	95.55	0.20	0.27	0.07

Remark The uncertainty is not combine uniformity of the water bath

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

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

- o0o -

Certificate of Calibration

Certificate No. : 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 650) %
Line Voltage : (224.2 to 225.2) V

Date of Received : 20 March 2024

Date of Calibration : 20 March 2024

Date of Issue : 22 March 2024

Calibrated by : Kittisak Kokaeo

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

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

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

Approved by :



(Surachai Promthong)

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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

Certificate of Calibration

Certificate No. : 67-200060-1

Page : 1 of 2

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

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

Environment : On site calibration was carried out at the B304 Balance Room, Envilab Co., Ltd.
Ambient Temperature : (20.0 to 20.7) °C
Relative Humidity : (56.2 to 60.3) %
Air Pressure : 1013.0 mbar

Date of Received : 20 February 2024

Date of Calibration : 20 February 2024

Date of Issue : 21 February 2024

Calibrated by : Satja Sangkhum

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

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

Standard Weights

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

Approved by :



(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

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.

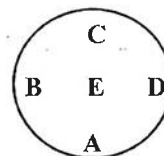
This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2.00$, providing a level of confidence of approximately 95%

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

- o0o -

Handwritten signature

CAL

Calibratech Co.,Ltd.

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

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



NSC-TISI-TIS17025
CALIBRATION 0030

Certificate of Calibration

Certificate No. : 67-300147-4

Page : 1 of 2

Submitted by : Envilab Co.,Ltd.

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

Equipment : Cylinder

Manufacturer : PYREX

Class : A

Capacity : 250 ml

Graduation : 2 ml

ID No. : C-WW-007/23

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

Relative Humidity : (50 ± 10) %

Air Pressure : 1009.4 mbar.

Date of Received : 13 March 2024

Date of Calibration : 19 March 2024

Date of Issue : 19 March 2024

Calibrated by : Areerat Sombun

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

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

Electronic Balance

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

Approved by :

(Wipa Tovadec)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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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. : 67-300147-4

Page : 2 of 2

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

UUC Condition As-Received : Good

Nominal Volume (ml)	Measuring Volume (ml)
150	150.31
250	250.38

Uncertainty of measurement with in \pm 0.087 ml

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

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

- o0o -



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



NSC-TISI-TIS17025
CALIBRATION 0030

Certificate of Calibration

Certificate No. : 67-300147-2

Page : 1 of 2

Submitted by : Envilab Co.,Ltd.

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

Equipment : Cylinder

Manufacturer : PYREX

Class : A

Capacity : 50 ml

Graduation : 1 ml

ID No. : C-WW-011/23

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

Relative Humidity : (50 ± 10) %

Air Pressure : 1009.4 mbar.

Date of Received : 13 March 2024

Date of Calibration : 19 March 2024

Date of Issue : 19 March 2024

Calibrated by : 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 :

(Wipa Tovadce)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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CAL-F0031-03

Envilab Co.,Ltd. ผู้จัดทำและควบคุมคุณภาพ

Certificate of Calibration

Certificate No. : 67-300147-2

Page : 2 of 2

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

UUC Condition As-Received : Good

Nominal Volume (ml)	Measuring Volume (ml)
30	29.69
50	49.87

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 -



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

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



NSC-TISI-TIS 17025
CALIBRATION 0030

Certificate of Calibration

Certificate No. : 67-300147-6

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 : 1000 ml

Graduation : 10 ml

ID No. : C-WW-001/24

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

Relative Humidity : (50 ± 10) %

Air Pressure : 1009.3 mbar.

Date of Received : 13 March 2024

Date of Calibration : 19 March 2024

Date of Issue : 19 March 2024

Calibrated by : Areerat Sombun

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

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

Electronic Balance

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

Approved by :

(Wipa Tovadee)

Supervisor

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Certificate of Calibration

Certificate No. : 67-300147-6

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)
500	500.75
1000	1000.66

Uncertainty of measurement with in \pm 0.17 ml

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

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

- o0o -



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Calibratech Co.,Ltd.

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

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



NSC-TISI-TIS17025
CALIBRATION 0030

Certificate of Calibration

Certificate No. : 66-400622-1

Page : 1 of 2

Submitted by : Envilab Co., Ltd.

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

Equipment : Air Chamber (Refrigerator)

Manufacturer : M-LAB

Model : BIC-140

Range : N/A °C

Resolution : 0.1 °C

Serial No. : 1011

ID No. : ELABBODC140N03

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

Ambient Temperature : (20.0 to 23.0) °C

Relative Humidity : (65 to 70) %

Line Voltage : (227.0 to 230.0) V

Date of Received : 10 November 2023

Date of Calibration : 10 November 2023

Date of Issue : 13 November 2023

Calibrated by : Permpon Chanpu

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

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

<u>ID No.</u>	<u>Cert. No.</u>	<u>Due Date</u>	<u>Traceability</u>
400046 & 400042	66-400453-1	31 Jan 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. :66-400622-1

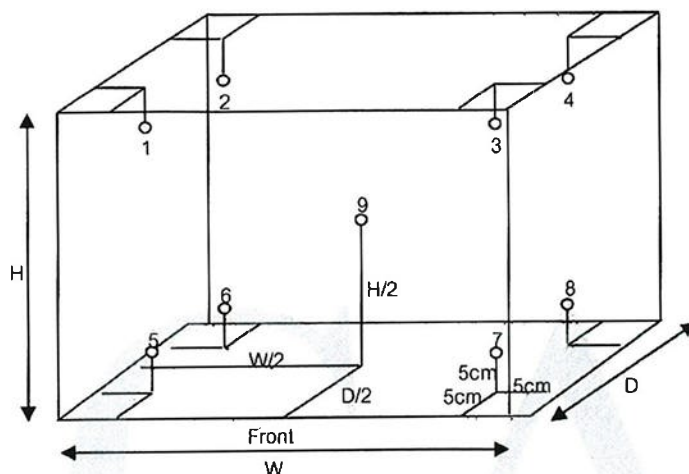
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

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



Inside of Chamber

W = 0.38 m

D = 0.35 m

H = 1.15 m

Capacity = 0.15 m³

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) @ Sensor No.									Uncertainty (± °C)
			1	2	3	4	5	6	7	8	9	
4.0	4.0	4.0	3.93	3.76	4.47	4.05	4.25	4.17	3.86	3.68	4.05	0.31

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
4.0	4.0	4.0	0.44	0.03	0.82

Remark The uncertainty is not combine uniformity of the air chamber

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

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

- o0o -

Signature

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Calibratech Co.,Ltd.

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

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



Certificate of Calibration

Certificate No. : 66-400546-3

Page : 1 of 2

Submitted by : Envilab Co., Ltd.

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

Equipment : Air Chamber (Oven)

Manufacturer : Binder

Model : ED 53

Range : N/A °C

Resolution : 0.1 °C

Serial No. : 13-02277

ID No. : ELABHAOVEN2277

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

Ambient Temperature : (30.5 to 32.0) °C

Relative Humidity : (50 to 55) %

Line Voltage : (224.0 to 226.0) V

Date of Received : 03 October 2023

Date of Calibration : 03 October 2023

Date of Issue : 06 October 2023

Calibrated by : Permpon Chanpu

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

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

Standard Digital Thermometer with Thermocouple probe

ID No.

Cert. No.

Due Date

Traceability

400029 & 400030

66-400227-1

24 Oct 2023

National Institute of Metrology Thailand (NIMT)

Approved by :

(Surachai Promthong)

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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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.

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.

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.**



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



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. N/A
- ☒ Ask the customer to remove any samples from the ICP-OES sample introduction area, auto sampler or around the ICP-OES.

Instrument Maintenance

System Information

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

Instrument System Name and ID
5110 VDV ICP-OES
Instrument System Site and Location
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 8491-8000 2 1709-05327
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.

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

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. *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

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.

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.

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

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	23.3	°C	23.1	°C
RF Air Flow (sensor speed)	13.0	Hz	19.0	Hz
Plasma Exhaust Temperature	No measurement		36.4	°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	500.32	kPa
Purge Gas Supply Pressure*1	616.63	kPa	597.43	kPa
Option Gas Supply Pressure*1	-	kPa	-	kPa
Nebulizer Flow	No measurement		0.70	L/min
Nebulizer Back Pressure	No measurement		293.19	kPa
Plasma Gas Flow	No measurement		11.98	L/min
Auxiliary Gas Flow	No measurement		1.00	L/min
RF Power	No measurement		1195.1	W
RF Supply Current	No measurement		8.190	A
RF Supply Voltage	No measurement		194.557	V

*1 If option installed

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	2344.2	6129.9
Mn 257.610 nm SRBR	5945.3	16145.3	10714.1	39073.2
Al 396.152 nm SBR	7.0	16.3	8.5	25.7
K 766.491 nm SBR	5.2	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

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:
21 May 2023

Customer Name:
Kanyakorn S.

Customer Signature:
Kanyakorn S.



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	SPS 4	1
Barb connector 2.5mm-1.5mm ID	G8410-80124	SPS 4	1
PVC waste tubing 8mm od x 5mm id, 2m	G8410-80122	SPS 4	1
Additional Parts may be required from engineer's stock:			
X axis drive belt	5410047500	SPS3	1
Z axis drive belt	5410047400	SPS3	1
Peristaltic pump tubing, PVC SolvaFlex, 3 bridged,	3710049000	SPS 4	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
------------------	-------------	------------------------------	-------------------



Pass

Resolution Test

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

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

Gas Flows Test

Pass

Nebulizer Target Flow	Actual Flow	Back Pressure
0.70	0.71	280.77

Auxiliary Target Flow	Actual Flow	Back Pressure
2.00	2.00	93.84

Makeup Target Flow	Actual Flow	Back Pressure
2.00	1.99	95.26

Plasma Target Flow	Actual Flow	Back Pressure
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

Report Summary		Agilent 5100/5110 VDV ICP-OES	
Instrument Model		G8011A/G8015A	
Instrument ID		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



รับรองสำเนาถูกต้อง
ผู้จัดการฝ่ายควบคุมคุณภาพ



PinAAcle 900F Preventive Maintenance Report

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

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

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

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

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

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

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

Component List

Component / Specific Model	Serial #	Configuration Notes

Parts Lists

Parts Included with the PM		
Part Number (if applicable)	Description	Quantity
80501696	Fan Filters	N/A
N3160156	O-Ring Kits for Sampling Introduction (Stainless Steels Nebulizer)	N/A
N3160157	O-Ring Kits for Sampling Introduction (Plastic Nebulizer)	N/A
N9301714	Replacement Acetylene Filter Cartridge	N/A
TH001022	Replacement Air Filter Cartridge	N/A

Additional Reagents and Standards Required for PM			
Part Number (if applicable)	Description	Quantity	Batch/Lot #
N9300183	1000 mg/L Copper Standard	AR	27-86CUY1
			30-Jan-2024

Additional Reagents and Standards Required for PM (Customer Support Solution)			
Part Number (if applicable)	Description	Quantity	Batch/Lot #
N/A	DI Water	250 mL	AR
N/A	0.5% HNO ₃	250 mL	AR

7. Flame Interlock Check:

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

Parameter	Specification	Test Results	Pass/Fail
Flame Sensor	Air/GH ₂ Flame correctly shuts down	Active	Passed
Drain Sensor	Air/GH ₂ Flame correctly shuts down	Active	Passed
Nebulizer Sensor	Air/GH ₂ Flame correctly shuts down	Active	Passed
GH ₂ Pressure Sensor	Air/GH ₂ Flame correctly shuts down	Active	Passed
Air Pressure Sensor	Air/GH ₂ Flame correctly shuts down	Active	Passed
Burner Head Sensor	Crossing Nitrogen 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 993.6nm (Abs.)	Test Results	Pass/Fail
10A NO Filter	± 5% from cert.	0.9798	0.9915	Passed
02A NO Filter	± 5% from cert.	0.2042	0.2037	Passed

8.2 Baseline Noise at 1.0 Absorbance with Barium

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

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

8.3 AA Baseline Noise with Copper

Description: Check baseline noise.

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

Procedure Checklist

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

1. General:

- ☒ Review the instrument performance with the customer and document any recent problems.
- ☒ Inspect the customer log book and make any appropriate PM entries.
- ☒ Perform general inspection of system for cleanliness.

2. PC Instrument Software:

- ☒ Instrument Software user files/databases archived, packed, and/or deleted as needed.

3. Mechanical:

- ☒ Inspect and clean all fans and filters. Replace filters if necessary
- ☒ Inspect all gas lines for leaks and/or wear. Replace if needed.
- ☒ Clean exterior of the instrument.
- ☒ Inspect the burner head, burner chamber, and nebulizer. Clean if needed as stated in the Hardware Guide.
- ☒ Check burner head dimensions with the feeler gauge as stated in the Hardware Guide in the Maintenance chapter section on cleaning the burner head and checking slot width. Replace if out of specification
- ☒ Check the condition of the end cap, burner head, and nebulizer O-rings. Replace if necessary.
- ☒ Check the drain system for signs of wear. Replace worn or damaged parts.
- ☒ Visually check for proper flame conditions when igniting the Air-C2H2 and N2O-C2H2 flames (if applicable).

4. Electrical:

- ☒ Inspect PC boards. Clean if necessary.
- ☒ Carefully check all internal and external cable connections.
- ☒ Check instrument firmware revisions upgrade to current levels (if necessary)
- ☒ Run Diagnostics Test within the Advanced function of the Spectrometer page. Check the results in the service log folder in the Spectrometer BM Log Viewer.

5. Optics:

- ☒ Inspect and clean the sample compartment windows, if needed.
- ☒ Inspect optics. Clean or replace if necessary.

6. Gasses:

- ☒ Verify that the Gasses supplied to the instrument are within the pressure and purity specifications found in the PinAAcle 900 Series Pre-Installation Checklist SDB.
- ☒ Verify that the acetylene filter and air filter element is dry. Replace if necessary.

Additional Comments



Additional Comments Regarding the PM

Review

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

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

Review of Preventive Maintenance

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

8.4 D₁ Background Compensation with Copper

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

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

8.5 AA-BG Baseline Noise with Copper

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

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

8.6 AA-BG Baseline Noise with Arsenic

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

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

8.7 Flame Sensitivity

Description: Instrument Sensitivity checked against Copper standard.

Standard Copper Sensitivity	Specification	Results (Abs)	Pass/Fail
5 mg/L Sensitivity (SS Neb, (H ₂ O, Inert Gas))	≤ 0.250 Abs.	NA	Not Applicable
2 mg/L Sensitivity (HS Neb, (H ₂ O, Inert Gas))	> 0.250 Abs.	0.3421	Passed

10. Review:

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

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		

Additional Tools Required for PM				
Part Number (if applicable)	Description	Quantity	Serial #	Calibration Due Date (MM/YY)
	Digital Volt Meter	1		
Additional Reagents and Standards Required for PM				
Part Number (if applicable)	Description	Quantity	Batch/Lot #	Expiration Date (MM/YY)

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

Part Number	Release	Publication Date
09370005	C	January 2013
 PerkinElmer		

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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4. Cell, Cell Windows, Transfer Line:

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

5. Operational Tests:

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

6. Review:

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

Procedure Checklist

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

1. General:

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

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

NO

- ☒ Visual Damage (if yes, describe)

NO

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

2. Instrument components

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

3. Mixing/Separation Assembly & Pump Tubing:

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

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

Additional Comments

Additional Comments Regarding the PM

Review

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

Secondary Spectrometric Calibration Standards

Certificate of Calibration

Ordinate Calibration

Calibration Data for Secondary Calibration Standards:

Wavelength / Absorbance	Number	Ordinate Reading (Absorbance) at the following wavelengths:			
Wavelength		193.70	232.00	324.76	553.65
Standard 1	MG2-358	0.9209	0.8982	0.9078	0.8653

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

Conditions of Calibration

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

Measurement of Calibration

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

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

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

Serial Number: 101N0089016

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

Date / Time: 1/14/2015

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

41-1930 S/N 00038 Calibration Date 05/23/2014 National Research Council of Canada Calibration Report No. PAR 2014.3162

g this procedure. Measurements were performed at an ambient temperature of 22.1 °C and the humidity of: 53.9 %

6/17/2015 / 8:21:03 AM

Cam Le Hovath

Signature:

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

End of Report



PerkinElmer TruQ

PerkinElmer Number: N9300183

Element and Matrix: 1000 µg/mL Copper in 2% HNO₃

Starting Material: Copper Metal

Starting Material Lot No: 06201C

Density: 1.012 g/mL @ 20°C

Lot No: 26-87CUY1

Certification Date: JUL -- 2022

Expiration Date:

JAN 30 2024

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

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

Traceability Documentation for Solution Standard:

1001 µg/mL ±5 µg/mL (refer to slide 2)

Certified Value:

Certified Value is Traceable to: NIST SRM #3114

* Classical Wet Assay: 1000 µg/mL

Method: EDTA titration using PAN as indicator. EDTA standardized against Pb(NO₃)₂, NIST SRM #528.

*Instrument Analyze using ICP Spectrometer: 1001 µg/mL

via NIST SRM #3114

We guarantee that our PerkinElmer TruQ Atomic Spectroscopy Standards are stable and accurate to $\pm 0.5\%$ 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

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:					
		193.70	232.00	324.75	553.55	786.49	
Standard 1	MGO-252	0.2762	0.2469	0.2124	0.2042	0.1812	

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

Conditions of Calibration

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

Measurement of Calibration

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

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

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

Serial Number: 101N0089015

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

Date / Time: 12/1/2014

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

NTR-PK-1931 model filler set SIN 00039 Calibration Date 05/23/2014 NRC Calibration Report No. PAR 2014 3162 was used during this procedure. Measurements were performed at an ambient temperature of 24.1 °C and the humidity of 19.3 %

Date / Time: 12/26/2014 / 5:37:41 PM

Operator: Cam Le Horvalh

Signature:

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

End of Report



CERTIFICATE OF COMPLETION

This is to certify that

Duang Hiransuk

has completed the course

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

26 October 2018

Vinny Maharaj - Sr. Manager Service Training

Date

Certified by

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



CERTIFICATE OF COMPLETION

This is to certify that

Duang Hiransuk

has completed the course

AA Theory, Operation and WinLab 32 and Syngistix Software

12 October 2018

Vinny Maharaj - Sr. Manager Service
Training

Date

Certified by

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

Certificate of Calibration

Certificate No. : 67-430012-1

Page : 1 of 2

Submitted by : Envilab Co., Ltd.

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

Equipment : Digital Conductivity meter with probe

Manufacturer : Hanna

Model : HI 98192

Serial No. : G0026637

ID No. : ELABCONHI98191

Electrode

Model : HI763133

Serial No. : TH107212

ID No. : ELABCONHI98191

Environment : Ambient Temperature (25 ± 2) °C

Relative Humidity (50 ± 15) %

Date of Received : 20 March 2024

Date of Calibration : 22 March 2024

Date of Issue : 25 March 2024

Calibrated by : Permpon Chanpu

Calibration Method : This instrument was calibrated by In-house method direct measurement by conductivity buffer solution

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

Standard Buffer Solution

<u>Material</u>	<u>Lot No.</u>	<u>Exp. Date</u>	<u>Traceability</u>
84 µS/cm	7824	16 June 2025	National Institute of Standards and Technology (NIST), U.S.A., S.R.M.
1413 µS/cm	7781	01 May 2027	National Institute of Standards and Technology (NIST), U.S.A., S.R.M.
12.88 mS/cm	7455	18 February 2027	National Institute of Standards and Technology (NIST), U.S.A., S.R.M.
80.0 mS/cm	7602	01 March 2027	National Institute of Standards and Technology (NIST), U.S.A., S.R.M.
111.8 mS/cm	7610	04 April 2027	National Institute of Standards and Technology (NIST), U.S.A., S.R.M.

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. : 67-430012-1

Page : 2 of 2

Result of Calibration :

UUC Condition As-Received : Good

Function : Conductivity measurement

Before Adjustment

Standard Conductivity Solution	UUC Reading	Correction	Uncertainty (±)	Unit
84.00	102.2	-18.2	1.1	µS/cm
1.413	1.038	0.375	0.0051	mS/cm
12.88	12.66	0.22	0.051	mS/cm
80.0	80.54	-0.54	0.21	mS/cm
111.8	106.7	5.1	0.41	mS/cm

After Adjustment : at 84,1413 µS/cm, 12.880, 80, 111.80 mS/cm

Standard Conductivity Solution	UUC Reading	Correction	Uncertainty (±)	Unit
84.00	84.00	0.00	1.1	µS/cm
1.413	1.413	0.000	0.0051	mS/cm
12.88	12.88	0.00	0.051	mS/cm
80.00	80.00	0.00	0.21	mS/cm
111.8	111.8	0.0	0.41	mS/cm

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%

- ๐0๐ -



CAL

Calibratech Co.,Ltd.

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

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



Certificate of Calibration

Certificate No. : 67-300147-11

Page : 1 of 2

Submitted by : Envilab Co.,Ltd.

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

Equipment : Measuring Pipette

Manufacturer : Witeg

Class : A

Capacity : 25 ml

Graduation : 0.1 ml

ID No. : G-HM-013/23

Environment : Ambient Temperature : (20 ± 3) °C
Relative Humidity : (50 ± 10) %
Air Pressure : 1006.8 mbar.

Date of Received : 13 March 2024

Date of Calibration : 19 March 2024

Date of Issue : 19 March 2024

Calibrated by : Arcerat Sombun

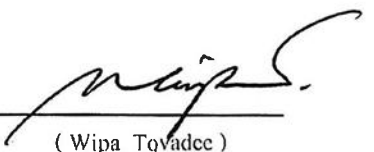
Calibration Method : In-house method CAL-M3001 based on ASTM E 542-22

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>Tracability</u>
241005	66-200388-4	02 Jun 2024	National Institute of Metrology (Thailand) (NIMT)

Approved by :


(Wipa Tovadec)

Supervisor

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 permission

CAL

Calibratech Co.,Ltd.

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

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

Certificate of Calibration

Certificate No. : 67-300147-11

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

UUC Condition As-Received : Good

Delivery Time : 14.28 sec.

Nominal Volume (ml)	Measuring Volume (ml)
1	1.0304
10	9.9852
25	24.9764

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%

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