



Certificate of Calibration

Method 5 Pre-Test Console Pulse Calibration - Liters (L)

UUT Meter Console Information

Model #:	XD-502-MV
Serial #:	1810007
DGM Model #:	SK-25-EX
DGM Serial #:	20229137
Bar. Pressure (mb):	1012.9
Ambient Temperature (°C):	25.6
Relative Humidity (%):	65
Altitude (m):	1.8
Bar. Pressure Corr. (mm Hg):	759.6

Calibration Conditions

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

Factors/Conversions

Reference Equipment	
Calibration Meter Model:	DGMR-200H
Cal Due Date:	25 Jun 24
Serial #:	0000026
Gamma:	1.0000

UUT Meter (DGM)

Run Time (seconds)	Orifice, ΔH (mm H ₂ O)	Pulse Count			Meter Temperature (°C)		Meter Pressure (in H ₂ O)	Volume (L)			Outlet Temperature (°C)	
		Initial	Final	Total	Initial	Final		Initial	Final	Total	Initial	Final
Θ	P _{m(g)}	C _{int}	C _{final}	C _{total}	t _{mi}	t _{mf}	P _w	V _{wi}	V _{wf}	V _w	t _{wi}	t _{wf}
280.76	120.00	0	94121	94121	25.0	26.0	-14.0	0.0	168.5	168.5	25.0	25.0
340.80	80.00	0	93862	93862	26.0	27.0	-10.0	0.0	166.9	166.9	25.0	25.0
430.60	50.00	0	93695	93695	27.0	28.0	-7.0	0.0	165.8	165.8	25.0	25.0
621.57	25.00	0	94406	94406	28.0	28.0	-4.0	0.0	164.6	164.6	25.0	25.0
860.84	13.00	0	92975	92975	28.0	29.0	-2.0	0.0	161.1	161.1	25.0	25.0

Reference Meter

Standardized Data

Reference Meter	Std. Volume	Std. Flow Rate	Test Meter	Scaling Factor			Calibration Results		
				Volume Conversion	Correction Factor	ΔH @ (mm H ₂ O)	0.0212 SCMH	Variance	ΔH @
	V _{w,add} (L)	Q _{w,add} (L/min)	Counts _(add)	Y _{sc}	Y	ΔY	ΔH@	ΔH@	ΔH@
	159.895	34.170	93410	1.71E-03	0.9874	-0.0126	42.9	-1.182	42.9
	159.996	28.168	92487	1.73E-03	0.9979	-0.0021	42.6	-1.440	42.9
	160.089	22.307	91760	1.74E-03	1.0065	0.0085	42.9	-1.208	45.1
	160.121	15.456	92071	1.74E-03	1.0032	0.0032	45.1	1.057	48.9
	157.515	10.979	90420	1.74E-03	1.0049	0.0049	44.08	2.773	44.08
				1.73E-03	1.0000	Y Avg.	Metric		
				= Avg.			= ΔH@ Avg.		

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 ΔH_o, orifice pressure differential that equates to 0.0212m³/min at standard temperature and pressure, acceptable tolerance of individual values from the average is ±0.2inches (5.1mm) H₂O.

Pass/Fail Result: **Pass**

Console Input Value: **1.7335** Metric

Calibrate By:

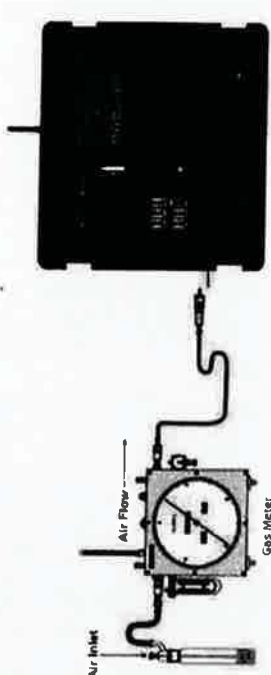
Date: 4 Mar 24



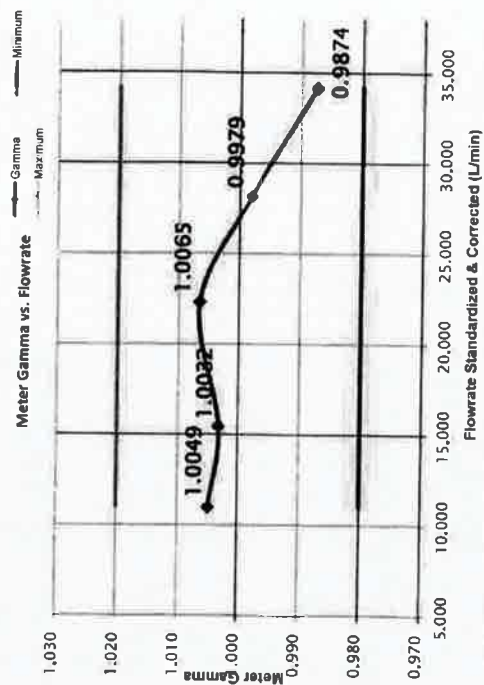
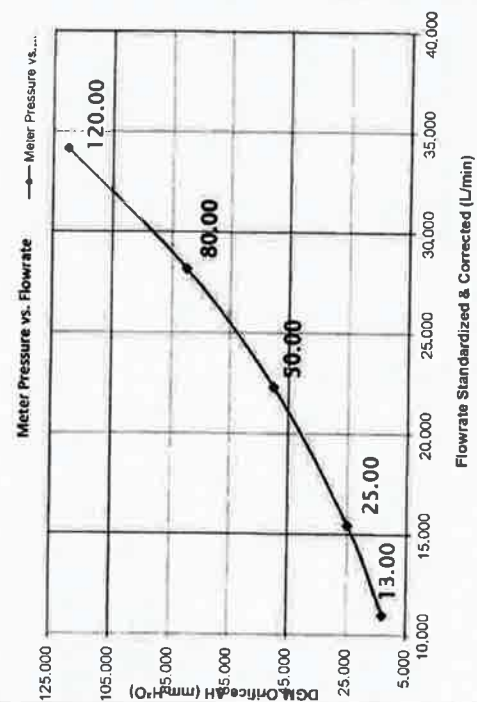
The instruments listed and described on this certificate have been calibrated against standards traceable to the National Institute of Standards and Technology (NIST) and in reference to EPA Method 5, Section 10.3.1.

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Nomenclature	Equations	Calibration Train
<p>P_b - Barometric Pressure</p> <p>DGM - Dry Gas Meter</p> <p>K_1 - Constant based on standard temp and press</p> <p>Θ - Run time, in minutes</p> <p>P_m - ΔH (Meter Pressure, gauge)</p> <p>V_m - Volume collected by test meter, corrected for STP</p> <p>Q_{mstd} - Calculated flow rate of test meter</p> <p>K - Critical orifice coefficient</p> <p>P_w - Measured pressure of reference meter</p> <p>T_w - Temperature measured in reference meter</p> <p>T_m - Temperature measured in test meter</p> <p>Y - Ratio of volume collected from test meter and orifice</p> <p>sc - Scaling Factor</p> <p>Counts_{std} - Number of pulse counts, standardized</p> <p>Counts - Number of raw pulse counts of a calibration run</p>	$V_{u(std)} = Y * K_1 * \frac{P_w * (P_{bar} + \frac{P_{m(std)}}{13.6})}{T_w}$ $V_{m(std)} = Counts_{std} * V_{sc(aug)}$ $Counts_{std} = K_1 * \frac{Q_{mstd} * (P_{bar} + \frac{P_{m(std)}}{13.6})}{T_m}$ $Q_{u(std)} = \frac{V_{u(std)}}{\Theta}$ $Y = \frac{V_{m(std)}}{V_{m(std)}}$ $K_1 = \frac{T_{std}}{P_{std}}$ $Altitude \Delta H_f = \frac{P_{avg} * 0.001806 * (P_{bar} + \frac{P_{m(std)}}{13.6})}{T_m} * (T_w * T)$	

Calibration Graphs





Certificate of Calibration

Method 5 Console Temperature Calibration - Metric Units

Console Information

Model #: XD-502-MV
Serial #: 1810007
Units: Metric

Calibration Conditions

Pbar (mm. Hg): 759.6
Humidity (%): 65
Tamb (°C): 25.6
Elevation (m): 1.8
Corr. Pbar (mm. Hg): 759.6

Reference Devices

TC Calibrator Model: CC-VTR-SH Reference #: 91109269
Pressure Calibrator Model: 718 30G Reference #: 9543013
Barometer Model: 736930 Reference #: EBARODIALSPE01

Temperature Sensors 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	-18	-18	-18	-18	-18	-18	PASS
2	38	38	38	38	38	38	38	PASS
3	93	92	93	93	93	93	93	PASS
4	149	149	149	149	149	149	149	PASS
5	260	260	260	260	260	260	260	PASS
6	371	371	371	371	371	371	371	PASS
7	482	482	482	482	482	482	482	PASS
8	593	593	593	593	593	592	593	PASS
9	816	816	816	816	816	816	816	PASS
10	1038	1038	1038	1038	1038	1038	1038	PASS

TC Measure Overall Audit Status

PASS

NIST Reference Temperature Probe ID: 12702001

Ref Point	Theoretical Temp.	DGM Thermocouple Sensor Reading	ΔT_{std} ⁴
#	°C	°C	°C
Ice Water	1	1.1	0.04%
Ambient ³	2	25.6	0.08%
Maximum ²			0.08%
Status			PASS

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

Vacuum Gauge Calibration Data

Console Vacuum Calibration			
Reference Point	Reference Vacuum	Console Vacuum	Reference Point Status ²
#	mm. Hg	mm. Hg	Pass/Fail
1	50.0	50.0	PASS
2	100.0	100.0	PASS

Dual Inclined/Vertical Manometer

Reference Pressure	Pressure audit with Console System testing for Inclined Range of 0-25 and Vertical Range of 25-150mm H ₂ O			
	ΔH Loop (Backside)		Δp Loop (Frontside)	
mm H ₂ O	mm H ₂ O	Pass/Fail	mm H ₂ O	Pass/Fail
0.0	0.0	PASS	-0.7	PASS
50.0	50.4	PASS	50.2	PASS
70.0	70.0	PASS	70.2	PASS
80.0	80.0	PASS	80.4	PASS
90.0	90.2	PASS	90.1	PASS
100.0	100.4	PASS	100.2	PASS
110.0	110.1	PASS	110.1	PASS
120.0	120.2	PASS	120.1	PASS
130.0	130.1	PASS	130.4	PASS
140.0	140.2	PASS	140.4	PASS
150.0	150.2	PASS	150.2	PASS

ΔH Overall Audit Status

PASS

Δp Overall Audit Status

PASS

Calibrate By:

Approved By:

Date:

4 Mar 24

Notes

¹ Suggested, minimum reference points are 10 (0, 100, 200, 300, 500, 700, 900, 1100, 1500, 1800 °F), can test for more.

² For valid test results, the maximum difference between test temperature and reference readings should be less than $\pm 0.1^\circ\text{F}$ ($\pm 0.1^\circ\text{C}$) for all thermocouples except for the stack thermocouple which should be less than $\pm 1.5\%$ absolute temperature from the reference reading. For all thermocouples other than the stack thermocouple, the maximum difference between test temperature and reference readings should be less than $\pm 0.1^\circ\text{F}$ ($\pm 0.1^\circ\text{C}$) from the reference reading (EPA Method 2, Section 6.3 and EPA Method 5, Sections 1.1.1 and 1.1.2).

³ Do not change test value, it is a calculated value from test results and should be used 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 ± 0.05 in. H₂O (± 1.25 mm Hg).

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





Console Sensor Audit QA Sheet

Meter Console Information (UUT)

Model #: XD-502-MV
Serial #: 1810007
Units: Metric

Calibration Conditions

Pbar (mm. Hg): 759.6
Humidity (%): 65
Amb. Temp. (°C): 25.6
Altitude (m): 1.8
Corrected Pbar (mm. Hg): 759.6

Reference Devices

TC Calibrator Model: CC-VTR-SH
TC Calibrator Reference #: 91109269
Barometer Model: 736930
Barometer Serial #: EBARODIALSPE01

Audit Data

Reference Point #	Reference Temp. °C	Console Thermocouple Audit						Reference Point Status ¹
		Aux °C	Stack °C	Probe °C	Oven °C	Filter °C	Exit °C	
1	25.6	25	26	26	25	25	25	PASS

Console Barometric Audit			
Reference Point #	Reference Bar. Press. mm. Hg	Console Bar. Press. mm. Hg	Reference Point Status ¹
1	759.6	758.9	PASS

Console Vacuum Audit			
Reference Point #	Reference Vacuum mm. Hg	Console Vacuum mm. Hg	Reference Point Status ¹
1	75.0	75.00	PASS

Calibrate By:

Approved By:

Date:

4 Mar 24

Notes

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

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)

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Sampling Probe and Pitot Validation

Samplig System Equipment Information

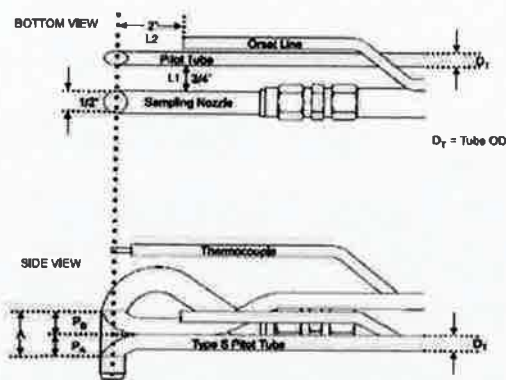
Probe Sheat:	Apex 1 in. , 3 ft.
Probe Number:	W2001490
Pitot tube Number:	A8996
Pitot tube Type:	S Type 3/8 Inc.
Validation method:	Standard Probe 1 in. and 1/2 in. Sampling Nozzle

Validation Conditions and Equipment

Digital Calipers:	ET123456
Reference No:	A22070181
Digital Inclnometer:	BASLINE
Reference No:	12-1057
Temperatute:	25.6 °C±3
Barometric Pressure:	759.6 mm Hg

Sampling Probe Validation with Tune up

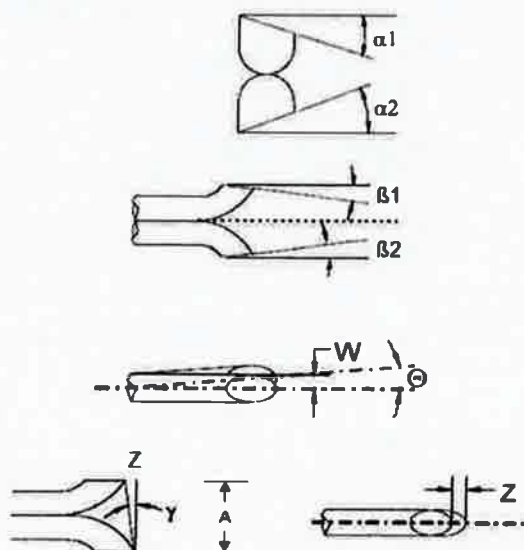
☒ Measure and Alinment with 1/2" Sampling Nozzle(12.7 mm)



Measured	Standard Range
$L_1 =$	1.91 cm. (1.905 cm. or 3/4 in.)
$L_2 =$	5.08 cm. (5.08 cm. or 2.0 in.)
$D_T =$	0.952 cm. (3/8 in.)
$A =$	2.11 cm. (2.1 $D_T \leq A \leq 3D_T$)
$A/2D_T =$	1.106 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

α_1	=	-1.70 °	≤ 10°
β_1	=	1.90 °	≤ 5°

P_A Size

$\alpha_2 =$	2.10 ° ≤ 10°
$\beta_2 =$	-1.20 ° ≤ 5°

Engles measurement

Calculated Result	Standard Range
$W =$	0.10 ° 0.004 cm. $W < 0.08 \text{ cm (1/32 in.)}$
$Z =$	0.20 ° 0.007 cm. $Z < 0.032 \text{ cm (1/8 in.)}$

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

Validation By;

Approved By;

Date;

4 Mar 24

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neediss Nozzle Validation

Samplig System Equipment Information

Console Model Number XD-502-MV
 Console Serial Number 1810007
 DGM Model Number SK-25-EX
 DGM Serial Number 20229137

Valibration Conditions

Digital Calipers CD-15APX
 Reference No A22070181
 Temperatute 25.6 °C±3
 Barometric Pressure 759.6 mm Hg

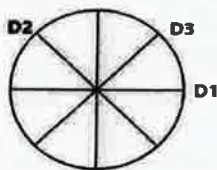
Calibration Data					Results	
Nozzle ID	Nozzle Diameter				Different	$(D_1 + D_2 + D_3) / 3$
Sizes		D ₁	D ₂	D ₃	ΔD	D _{avg}
	mm	mm	mm	mm	mm	mm
NS-4	3.17	3.18	3.17	3.17	0.006	3.173
NS-6	4.77	4.77	4.77	4.77	0.000	4.770
NS-8	6.35	6.35	6.35	6.35	0.000	6.350
NS-10	7.92	7.91	7.92	7.93	0.010	7.920
NS-12	9.52	9.53	9.53	9.52	0.006	9.527
NS-14	11.09	7.13	7.13	7.13	0.000	7.130
NS-16	12.70	12.71	12.69	12.70	0.010	12.700

Where :

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

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

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



Validation By;

[Redacted Signature]

Approved By;

[Redacted Signature]

Date:

4 Mar 24

 neediss
 Neediss Supply Instrument Co., Ltd


 Envilab Co.

[Redacted Signature]



บริษัท นีดีส ซัพพลาย อินสตรูเมนต์ จำกัด
Neediss Supply Instrument Co., Ltd.
536 ซอยบางแค 7 แขวงบางแค เขตบางแค กรุงเทพฯ 10160 536 Sol Bangkhoe 7 Bangkhoe Bangkok Bangkok
Tel. 02-802-3980-2 Fax. 02-802-3988 E.info@neediss.com



Verification Test Report

Instruments Information

Page:1/2

Analyzer Type: Flue Gas Analyser
Model: Optima7

Manufacturer: MRU
Serial No.: 320779

Calibration Gas information

Standard Gas Mid Range

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

Standard Gas High Range

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

Environment: Temperature 25.8 °C Humidity: 47 %RH

SO2 calibration test

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

NO calibration test

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

NOX calibration test

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

CO2 calibration test

Set point	Std.gas (ppm)	Before Adj Reading(ppm)	After Adj Reading(ppm)	Difference	% error
Low/Zero	0.0	0	0	0.0	0.0
Mid	8.054	9.05	8.07	0.0	0.2
Hight	16.0	17.68	15.97	0.0	-0.3



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ผู้จัดการฝ่ายควบคุมคุณภาพ
Envilab Co.,Ltd.

**needliss**บริษัท นีดิส ซัพพลาย อินสตรูमेंท์ จำกัด
Needliss Supply Instrument Co., Ltd.536 ซอยบางแค 7 แขวงบางแค เขตบางแค กรุงเทพฯ 10160 536 Soi Bangkhoe 7 Bangkhoe Bangkok
Tel. 02-802-3780-2 Fax. 02-802-3988 E:info@needliss.com

Verification Test Report

Instruments Information

Analyzer Type: Flue Gas Analyser
Model: Optima7Manufacturer: MRU
Serial No.: 320779

Page:2/2

Calibration Gas information

Standard Gas Mid Range

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

Standard Gas High Range

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

Environment: Temperature 25.8 °C Humidity: 47 %RH

CO calibration test

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

O2 calibration test

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

Note

Technical Data Calibration results.:Calibration reading response discrepancy

O2 parameter	± 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 :

Approve By :

Date: 26 Feb 24

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Envilab Co.,Ltd.

ผู้จัดการฝ่ายควบคุมคุณภาพ

CAL

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

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



NSC-TISI-TIS17025
CALIBRATION 0030

Certificate of Calibration

Certificate No. : 67-200034-1

Page : 1 of 2

Submitted by : Envilab Co.,Ltd.

540, 540/1 Soi Bangkhao 7, Bangkhao, 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%

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CAL-F0031-03

Envilab Co.,Ltd.

ผู้จัดการฝ่ายควบคุมคุณภาพ



CAL

Calibratech Co.,Ltd.

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

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

Certificate of Calibration

Certificate No. : 67-200034-1

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Departure of indication from nominal value

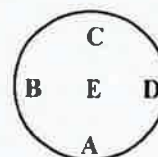
Nominal Value (g)	Correction (g)	Uncertainty \pm (g)
0.01	0.0001	0.00012
0.1	0.0001	0.00012
1	0.0000	0.00013
2	0.0001	0.00013
5	0.0000	0.00013
10	0.0000	0.00013
20	-0.0001	0.00014
50	-0.0001	0.00015
100	-0.0001	0.00020
200	-0.0001	0.00038

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

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

Eccentric error

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



Repeatability

Load test : 200 g
Stdev. : 0.00005 g

- o0o -



บริษัท เอ็นวิลแล็บ จำกัด 540.540/1 ซอยบางแค 7 แขวงบางแค เขตบางแค กรุงเทพฯ 10160
Envilab Co., Ltd. 540.540/1 Soi Bangkhae 7 Bangkhae Bangkok Bangkok 10160
Tel : 02-802-3577-8 Fax. 02-802-3773 E-mail : info@evltesting.com



Envilab & Needles Supply Instrument

TSP High Volume Sampler Calibration

Verification Report No.

SO2400004-E001/R01 -TSP 01

☐ PM ☒ Onsite

Site: อบต.หนองชุมพล

UTM : 47P 1469390 588063

Sampler: ETSP#35

Recorder: ECRAN000031073

Date: 10 Oct 24

Technical: Amonthep Konklee

Approval: Wisan Ritthikamon

CONDITIONS

Barometric Press. (hPa): 989.0

Temperature (deg C): 38.0

Average Press. (hPa): 1013.0

Average Temp. (deg C): 30.0

Corrected Pressure (mm Hg): 741.8

Temperature (deg K): 311.0

Corrected Avg. Press. (mm Hg): 759.8

Average Temp. (deg K): 303.0

CALIBRATION ORIFICE

Brand: Tisch Environmental, Inc

Model: TE-5025A

Serial#: 5411

Qstd Slope: 2.02024

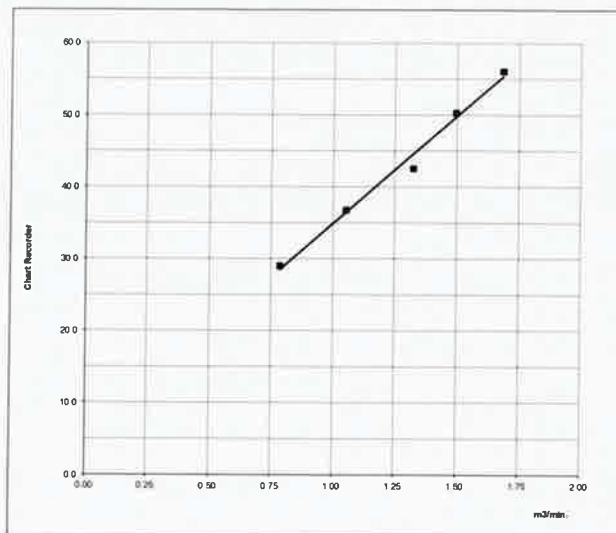
Qstd Intercept: -0.02667

Date Certified: 9 Feb 2024

Due Date : 08-Feb-25

CALIBRATIONS

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION Slope = 29.8465 Intercept = 5.0821 Corr. coeff. = 0.9942 # of Observations: 5 Range of Chart at 1.1 - 1.7 m3/min. 40 57
1	12.20	1.685	58.0	56.09	
2	9.60	1.496	52.0	50.29	
3	7.50	1.324	44.0	42.55	
4	4.70	1.051	38.0	36.75	
5	2.60	0.785	30.0	29.01	



Calibrated by :

Amonthep Konklee
10 October 2024

Approved by :

Wisan Ritthikamon
10 October 2024

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





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



Envilab & Hometek Supply Instrument

PM10 High Volume Sampler Calibration

Verification Report No.

SO2400004-E001/R01 -PM 01

L PM

Onsite

Site: อบต.หนองชุมพล

UTM : 47P 1469390 588063

Sampler: EPM10#44

Recorder: ECRDS016431075

Date: 10 Oct 24

Technical: Amonthep Konklee

Approval: Wisan Ritthikamon

CONDITIONS

Barometric Press. (hPa): 989.0

Temperature (deg C): 38.0

Average Press. (hPa): 1013.0

Average Temp. (deg C): 30.0

Corrected Pressure (mm Hg): 741.8

Temperature (deg K): 311.0

Corrected Avg. Press. (mm Hg): 759.8

Average Temp. (deg K): 303.0

CALIBRATION ORIFICE

Brand: Tisch Environmental, Inc

Model: TE-5025A

Serial#: 5411

Qstd Slope: 1.2654

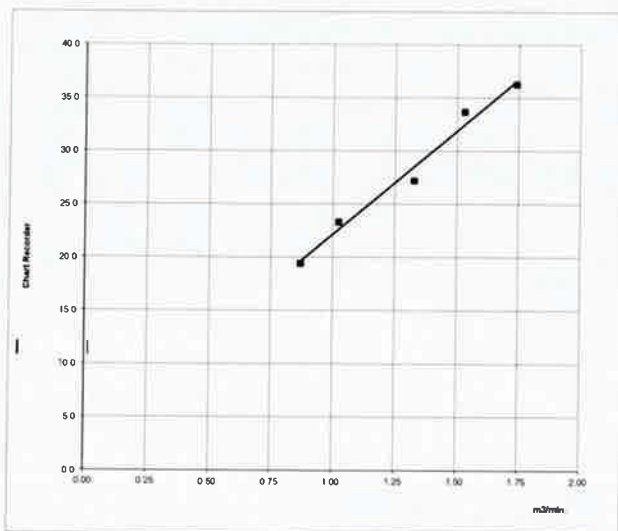
Qstd Intercept: -0.01667

Date Certified: 9 Feb 2024

Due Date : 08-Feb-25

CALIBRATIONS

Plate or Test #	H2O (in)	Qa (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION
1	11.40	1.741	56.0	36.26	Slope = 19.4354
2	8.80	1.531	52.0	33.67	Intercept = 2.7339
3	6.60	1.328	42.0	27.19	Corr. coeff. = 0.9903
4	3.90	1.024	36.0	23.31	SFR = 1.188
5	2.80	0.869	30.0	19.42	SSP = 39.88
					# of Observations: 5
					Range of Chart at SFR $\pm 10\%$
					37
					42



Calibrated by :

Amonthep Konklee
10 October 2024

Approved by :

Wisan Ritthikamon
10 October 2024

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FE-MNT-25 Rev.02.05/07/167





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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/R01 -TSP 02

☐ PM ☒ Onsite

Site: บ้านเนิน

UTM : 47P 1468262 588334

Sampler: ETSP#37

Recorder: ECRAN000031076

Date: 10 Oct 24

Technical: Amonthep Konklee

Approval: Wisan Ritthikamon

CONDITIONS

Barometric Press. (hPa): 989.0

Temperature (deg C): 38.0

Average Press. (hPa): 1013.0

Average Temp. (deg C): 30.0

Corrected Pressure (mm Hg): 741.8

Temperature (deg K): 311.0

Corrected Avg. Press. (mm Hg): 759.8

Average Temp. (deg K): 303.0

CALIBRATION ORIFICE

Brand: Tisch Environmental, Inc

Model: TE-5025A

Serial#: 5411

Qstd Slope: 2.02024

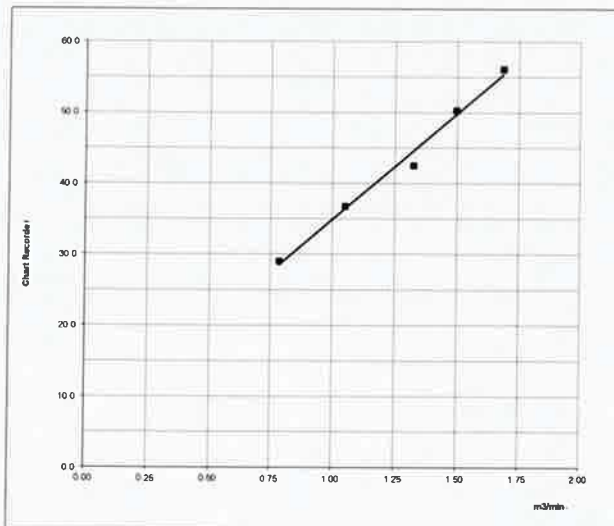
Qstd Intercept: -0.02667

Date Certified: 9 Feb 2024

Due Date : 08-Feb-25

CALIBRATIONS

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION	
1	12.20	1.685	56.0	54.16	Slope = 26.8160 Intercept = 9.1033 Corr. coeff.= 0.9955 # of Observations: 5	Range of Chart at 1.1 - 1.7 m3/min. 40 56
2	8.60	1.417	50.0	48.35		
3	6.40	1.224	42.0	40.62		
4	4.00	0.971	36.0	34.82		
5	2.20	0.723	30.0	29.01		



Calibrated by :

Amonthep Konklee
10 October 2024

Approved by :

Wisan Ritthikamon
10 October 2024

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FE-MNT-29 Rev 02:05/07/17





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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@envltesting.com



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PM10 High Volume Sampler Calibration

Verification Report No.

SO2400004-E001/R01 -PM 02

L PM	Onsite
Site: ภาณุ	
UTM : 47P 1468262 588334	
Sampler: EPM10#47	
Recorder: ECRDS016449814	
Date: 10 Oct 24	
Technical: Amonthep Konklee	
Approval: Wisan Ritthikamon	

CONDITIONS

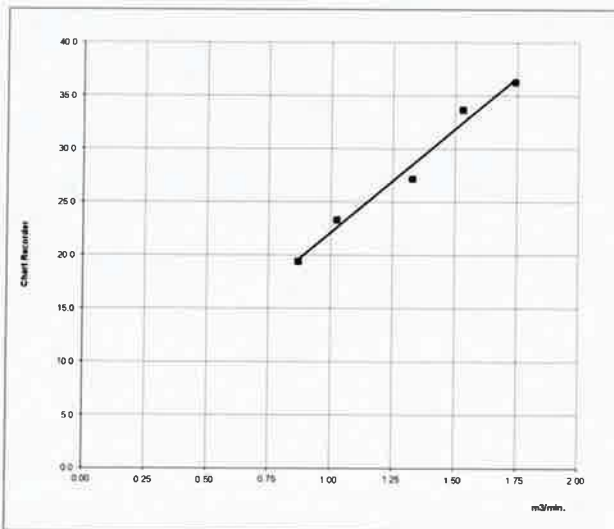
Barometric Press. (hPa): 989.0	Corrected Pressure (mm Hg): 741.8
Temperature (deg C): 38.0	Temperature (deg K): 311.0
Average Press. (hPa): 1013.0	Corrected Avg. Press. (mm Hg): 759.8
Average Temp. (deg C): 30.0	Average Temp. (deg K): 303.0

CALIBRATION ORIFICE

Brand: Tisch Environmental, Inc	Qstd Slope: 1.2654
Model: TE-5025A	Qstd Intercept: -0.01667
Serial#: 5411	Date Certified: 9 Feb 2024
	Due Date : 08-Feb-25

CALIBRATIONS

Plate or Test #	H2O (in)	Qa (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION
1	11.20	1.726	56.0	36.26	Slope = 19.1821
2	8.80	1.531	52.0	33.67	Intercept = 3.2407
3	6.60	1.328	42.0	27.19	Corr. coeff. = 0.9907
4	3.90	1.024	36.0	23.31	SFR = 1.188
5	2.60	0.838	30.0	19.42	SSP = 40.20
					# of Observations: 5
					Range of Chart 38
					at SFR $\pm 10\%$ 43



Calibrated by :

Amonthep Konklee
10 October 2024

Approved by :

Wisan Ritthikamon
10 October 2024

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

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FE-MNT-29 Rev.02:05/07/27





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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



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TSP High Volume Sampler Calibration

Verification Report No.

SO2400004-E001/R01 -TSP 03

<input type="checkbox"/> PM	<input checked="" type="checkbox"/> Onsite
Site: วัดบ้านกล้วย	
UTM : 47P 1468262 588334	
Date: 10 Oct 24	
Sampler: ETSP#36	
Technical: Amonthep Konklee	
Recorder: ECRAN000031073	
Approval: Wisan Ritthikamon	

CONDITIONS

Barometric Press. (hPa): 989.0	Corrected Pressure (mm Hg): 741.8
Temperature (deg C): 38.0	Temperature (deg K): 311.0
Average Press. (hPa): 1013.0	Corrected Avg.Press. (mm Hg): 759.8
Average Temp. (deg C): 30.0	Average Temp. (deg K): 303.0

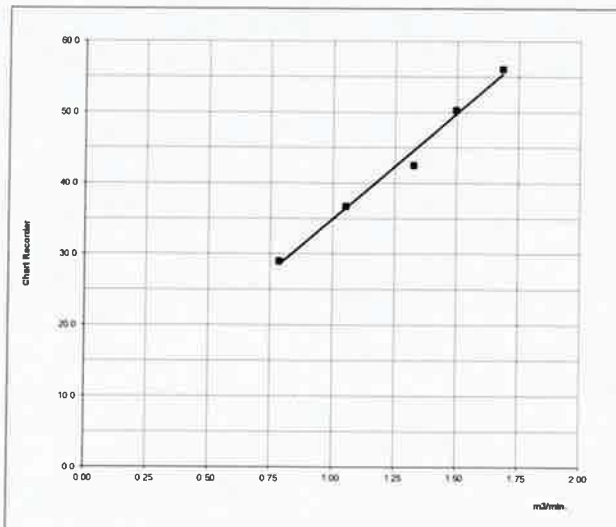
CALIBRATION ORIFICE

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

Qstd Slope: 2.02024
Qstd Intercept: -0.02667
Date Certified: 9 Feb 2024
Due Date : 08-Feb-25

CALIBRATIONS

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION
1	12.00	1.671	56.0	54.16	
2	8.60	1.417	50.0	48.35	Slope = 28.8165 Intercept = 6.3870 Corr. coeff.= 0.9970 # of Observations: 5 Range of Chart at 1.1 - 1.7 m3/min, 40 57
3	6.40	1.224	42.0	40.62	
4	4.00	0.971	36.0	34.82	
5	2.20	0.723	28.0	27.08	



Calibrated by :

Amonthep Konklee
10 October 2024

Approved by :

Wisan Ritthikamon
10 October 2024

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





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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 is a Harsco Supply Instrument

PM10 High Volume Sampler Calibration

Verification Report No.

SO2400004-E001/R01 -PM 03

L PM

Onsite

Site: วัดม้านกล้วย

UTM : 47P 1468262 588334

Sampler: EPM10#11

Recorder: ECRDS016431079

Date: 10 Oct 24

Technical: Amonthep Konklee

Approval: Wisan Ritthikamon

CONDITIONS

Barometric Press. (hPa): 989.0

Temperature (deg C): 38.0

Average Press. (hPa): 1013.0

Average Temp. (deg C): 30.0

Corrected Pressure (mm Hg): 741.8

Temperature (deg K): 311.0

Corrected Avg. Press. (mm Hg): 759.8

Average Temp. (deg K): 303.0

CALIBRATION ORIFICE

Brand: Tisch Environmental, Inc

Model: TE-5025A

Serial#: 5411

Qstd Slope: 1.2654

Qstd Intercept: -0.01667

Date Certified: 9 Feb 2024

Due Date : 08-Feb-25

CALIBRATIONS

Plate or Test #	H2O (in)	Qa (m3/min)	I (chart)	IC (corrected)
1	11.40	1.741	56.0	36.26
2	8.80	1.531	52.0	33.67
3	6.60	1.328	42.0	27.19
4	3.90	1.024	36.0	23.31
5	2.80	0.869	30.0	19.42

LINEAR REGRESSION

Slope = 19.4354

Intercept = 2.7339

Corr. coeff. = 0.9903

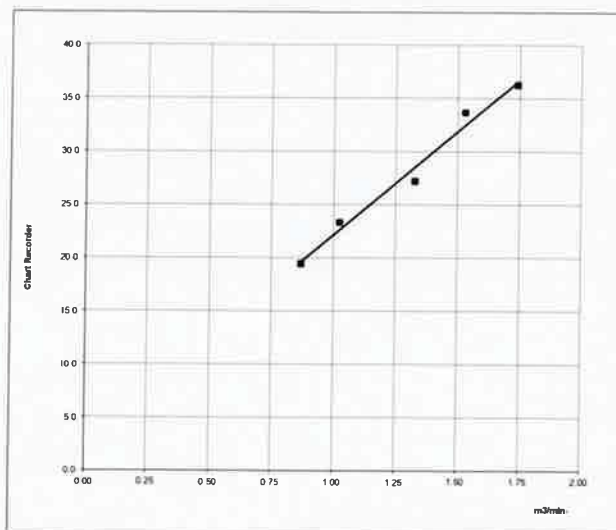
SFR = 1.188

SSP = 39.88

of Observations: 5

Range of Chart 37

at SFR $\pm 10\%$ 42



Calibrated by :

Amonthep Konklee
10 October 2024

Approved by :

Wisan Ritthikamon
10 October 2024

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Environmental responsibility with accuracy measurement

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THAI METEOROLOGICAL DEPARTMENT

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

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue : 6 April, 2024

Certification No. 168/24

Page : 1 of 6

Object : เครื่องมือตรวจวัดอุตุนิยมวิทยา

Manufacturer : DYACON

Type : Data Logger MS-100

Serial No. : 130148 ID No. : EWSDCMS1200148

Customer : ENVILAB Co.,Ltd.
540,540/1 Soi Bangkhuae 7, Bangkhuae, Bangkhuae,
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. 11220015

Calibrated by :

Mr. Watcharapol Subwat

Mechanical Engineer

Si

M



Envilab Co.,Ltd.

ผู้จัดการฝ่ายควบคุมคุณภาพ



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 :

Mr. Watchapol Subwat

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau



Envilab Co.,Ltd.

ผู้จัดการฝ่ายควบคุมคุณภาพ



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Sensor Pressure Model TPH-1 C

Serial No. 6273

Certification No. 168/24

6 April, 2024

Page : 3 of 6

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

Average

Calibrated by :

Mr. Watchapol Subwat

Mechanical Engineer



Envislab Co., Ltd.

ผู้ตรวจการฝ่ายควบคุมคุณภาพ



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 :

Mr. Watcharapol Subwat
Mechanical Engineer



Envilab Co., Ltd. ผู้จัดการฝ่ายควบคุมคุณภาพ



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Sensor Humidity Model TPH-1 C

Certification No. 168/24

6 April, 2024

Serial No. 6273

Page : 5 of 6

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

Calibrated by :



Mr. Watcharapol Subwat

Mechanical Engineer



Envirolab Co., Ltd.

ผู้จัดการฝ่ายควบคุมคุณภาพ



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



Envilab Co., Ltd. ผู้จัดการฝ่ายควบคุมคุณภาพ



THAI METEOROLOGICAL DEPARTMENT

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

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 6 April, 2024

Certification No. 171/24

Page : 1 of 6

Object : เครื่องมือตรวจวัดอุตุนิยมวิทยา

Manufacturer : NovaLynx

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

Serial No. : EWSNV110WS2501

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

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1008.9 hPa

NATIONAL STANDARD WIND TUNNEL : Wind Aloft Plotting Board

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

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

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

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

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

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

STANDARD BAROMETER : Digital Barometer Vaisala Type PTB220 No. V1220015

Calibrated by :

Mr. Watcharapol Subwat

Mechanical Engineer

Si

M

(Authorised Signatory)

for the Chief

Sub-Standard Instrument





THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Sensor model

EWSNV110WS2501

Certification No. 171/24

6 April, 2024

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	-	-	-	0.3	0.70
3.02	-	-	-	2.4	0.62
5.00	-	-	-	4.9	0.10
7.04	-	-	-	6.9	0.14
9.02	-	-	-	8.8	0.22
11.01	-	-	-	10.8	0.21
13.01	-	-	-	12.8	0.21
15.01	-	-	-	14.8	0.21
17.02	-	-	-	17.1	-0.08
20.02	-	-	-	19.9	0.12

Wind Aloft Plotting Board.	
US.DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRETION	TESTED WIND DIRECTION
0	0
90	92
180	181
270	289

Calibrated by :

Mr. Watcharapol Subwat

Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Sensor model

EWSNV110WS2501

Certification No. 171/24

6 April, 2024

Page : 3 of 6

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

Average

Calibrated by :

Mr. Watcharapol Subwat

Mechanical Engineer





THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Sensor model

EWSNV110WS2501

Certification No. 171/24

6 April, 2024

Page : 4 of 6

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

Calibrated by :



Mr. Watcharapol Subwat

Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau



Envilab Co.,Ltd. ผู้จัดการฝ่ายควบคุมคุณภาพ



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Sensor model EWSNV110WS2501 Certification No. 171/24

6 April, 2024

Page : 5 of 6

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

Calibrated by :



Mr. Watcharapol Subwat
Mechanical Engineer



Envilab Co.,Ltd.

ผู้จัดการฝ่ายควบคุมคุณภาพ



Date of Issue 6 April, 2024

Certification No. 171/24

Page: 6 of 6

ใบรับรอง

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



ลงชื่อ 

(นายวัชรพล ทรัพย์วัฒน์)

วิศวกรชำนาญการ



Envilab Co., Ltd.  ผู้จัดการฝ่ายควบคุมคุณภาพ



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0391

MTC No. EEL. BP. 30/0467

CALIBRATION CERTIFICATE

Submitted by : Envilab Co.,Ltd.

Address : 540, 540/1 Soi Bangkhac 7, Bangkhac, 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 :

Ambient Environment

Description : Sound Level Calibrator

Temperature : (23 + 3) °C

Manufacturer : Bruel & Kjaer

Relative Humidity : (50 ± 15) %

Model : 4230

Ambient Pressure : (101.325 ± 1.500) kPa

Serial No. : 1351075

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

Calibration Procedure: CP-102-04 based on IEC 60942-2003; The sound pressure level generated by sound calibrator under test shall be measured by standard microphone using an insert voltage technique.

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

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

Date of Receipt : 9 Apr. 2024

Date of Calibration : 10 Apr. 2024

1 / 2

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

Head Office

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Fax. (66) 0 2577 9009

Office/Laboratory

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Changwat Samutprakan 10280, Thailand
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(66) 08 3219 9440
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196 Phahonyothin Road, Ladyao, Chatuchak,
Bangkok 10900, Thailand

FM.BL.MTC.002 Rev.5

Envilab Co.,Ltd.

ผู้จัดการฝ่ายควบคุมคุณภาพ



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0391

MTC No. EEL. BP. 30/0467

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

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

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

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	93.72	-0.28	± 0.10	± 0.40 dB

2. Frequency

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

3. Total Distortion

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

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by



(Mr. Weerachai Deechaiyae)

Approved by :



(Mr. Prawate Kluapka)

Director
TISTR

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Calibration : 10 Apr. 2024

Date of Issue : 11 Apr. 2024

Ref : 2011267040901374001

End of Certificate

2 / 2

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Envilab & Needles Supply Instrument

Verification Test Report

Report No.:

SO240004-E002/R01 -SLM 01

☒ PM ☐ Onsite UTM : 47P 1514458 654247

Calibrated Date: 16 October 2024

Site : บริษัท เอ็นไวแล็บ จำกัด

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 44

Serial : 1575

Environment: Temperature 25 °C Humidity 65 %RH

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

Serial No.1351075

Date of Calibration : 10 Apr 2024

Uncertainty : 0.10 dB

Result of Test

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

Calibrated By:

(Siriyos Sriyonyong)

Date:

16 October 2024

Approve By:

(Wisan Ritthikamon)

Date:

16 October 2024

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



Envilab & Naree Supply Instrument

Verification Test Report

Report No.:

SO240004-E002/R01 -SLM 02

☒ PM ☐ Onsite UTM : 47P 1514458 654247

Calibrated Date: 16 October 2024

Site : บริษัท เอ็นไวแล็บ จำกัด

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 44

Serial : 1804

Environment: Temperature 25 °C Humidity 65 %RH

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

Serial No.1351075

Date of Calibration : 10 Apr 2024

Uncertainty : 0.10 dB

Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.72	93.70	-0.02	93.72
Error After Adjust (dB)	Totar Error (dB)	Acceptant value	Pass/Fail Judgment
0.00	0.10	±1.0 dB	Pass

Calibrated By:

(Sิริยอส ศรีบุญยง)

Date:

16 October 2024

Approve By:

(Wisan Ritthikamon)

Date:

16 October 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 & Needles Supply Instrument

Verification Test Report

Report No.:

SO240004-E002/R01 -SLM WC

☒ PM

☐ Onsite UTM :

47P 1514458 654247

Calibrated Date: 16 October 2024

Site : บริษัท เอ็นไวแล็บ จำกัด

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 44

Serial : 1796

Environment: Temperature 25 °C Humidity 65 %RH

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

Serial No.1351075

Date of Calibration : 10 Apr 2024

Uncertainty : 0.10 dB

Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.72	93.69	-0.03	93.72
Error After Adjust (dB)	Total Error (dB)	Acceptant value	Pass/Fail Judgment
0.00	0.10	±1.0 dB	Pass

Calibrated By:

(Sิริยอส ศรีบุญยง)

Date:

16 October 2024

Approve By:

(Wisan Ritthikamon)

Date:

16 October 2024

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Envilab & Needless Supply Instrument

Verification Test Report

Report No.:

SO240004-E002/R01 -PU 01

Calibrated Date: 16-Oct-24

Equipment: Air Sampling Pump

Manufacturer: AP BUCK

Model: LP-5

Serial or ID No. 5426

Environment: Temperature 25 °C Humidity 65 %RH

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

Serial No. 200368

Date of Calibration : 17 July 2024

Result of Test			
Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
2500	1	2503.0	2499.6
	2	2505.0	
	3	2500.0	
	4	2496.0	
	5	2494.0	

Calibrated By:

(Sิริยอส ศรีบุญยง)

Date: 16-Oct-24

Approve By:

(Wisan Ritthikamon)

Date: 16-Oct-24



ประกาศใช้ 01/02/2566

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Verification Test Report

Report No.:

SO240004-E002/R01 -PU 02

Calibrated Date: 16-Oct-24

Equipment: Air Sampling Pump

Manufacturer: AP BUCK

Model: LP-5

Serial or ID No. 5429

Environment: Temperature 25 °C Humidity 65 %RH

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

Serial No. 200368

Date of Calibration : 17 July 2024

Result of Test			
Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
1000	1	1005.0	1000.0
	2	999.0	
	3	997.0	
	4	1001.0	
	5	998.0	

Calibrated By:

[Redacted Signature]

(Siriyos Sriyonyong)

Date:

16-Oct-24

Approve By:

[Redacted Signature]

(Wisan Ritthikamon)



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Envilab & Needras Supply Instrument

Verification Test Report

Report No.:

SO240004-E002/R01 -PU 03

Calibrated Date: 16-Oct-24

Equipment: Air Sampling Pump

Manufacturer: AP BUCK

Model: LP-5

Serial or ID No. 5428

Environment: Temperature 25 °C Humidity 65 %RH

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

Serial No. 200368

Date of Calibration : 17 July 2024

Result of Test			
Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
2500	1	2500.0	2500.6
	2	2505.0	
	3	2493.0	
	4	2498.0	
	5	2507.0	

Calibrated By:

(Siriyos Sriyonyong)

Date: 16-Oct-24

Approve By:

(Wisan Ritthikamon)

Date: 16-Oct-24



ประกาศใช้ 01/02/2566

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Verification Test Report

Report No.:

SO240004-E002/R01 -PU 04

Calibrated Date: 16-Oct-24

Equipment: Air Sampling Pump

Manufacturer: AP BUCK

Model: LP-5

Serial or ID No. 5447

Environment: Temperature 25 °C Humidity 65 %RH

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

Serial No. 200368

Date of Calibration : 17 July 2024

Result of Test			
Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
1000	1	999.0	1000.8
	2	996.0	
	3	996.0	
	4	1008.0	
	5	1005.0	

Calibrated By:

(Sิริยอสรีบุญยง)

Date:

16-Oct-24

Approve By:

(Wisan Ritthikamon)



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Envilab & Needlab Supply Instrument

Date: 16-Oct-24

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Verification Test Report

Report No.:

SO240004-E002/R01 -PU 05

Calibrated Date: 16-Oct-24

Equipment: Air Sampling Pump

Manufacturer: AP BUCK

Model: LP-5

Serial or ID No. 5430

Environment: Temperature 25 °C Humidity 65 %RH

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

Serial No. 200368

Date of Calibration : 17 July 2024

Result of Test			
Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
2500	1	2503.0	2500.2
	2	2501.0	
	3	2498.0	
	4	2494.0	
	5	2505.0	

Calibrated By:

(Siriyos Sriyonyong)

Date: 16-Oct-24

Approve By:



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Envilab & Needless Supply Instrument

Verification Test Report

Report No.:

SO240004-E002/R01 -PU 06

Calibrated Date: 16-Oct-24

Equipment: Air Sampling Pump

Manufacturer: AP BUCK

Model: LP-5

Serial or ID No. 5427

Environment: Temperature 25 °C Humidity 65 %RH

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

Serial No. 200368

Date of Calibration : 17 July 2024

Result of Test			
Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
2500	1	2500.0	2500.4
	2	2506.0	
	3	2496.0	
	4	2498.0	
	5	2502.0	

Calibrated By:

(Sิริยอสริยุนยง)

Date: 16-Oct-24

Approve By:

(Wisan Ritthikamon)

Date: 16-Oct-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-E002/R01 -PU 01

Calibrated Date: 16-Oct-24

Equipment: Air Sampling Pump

Manufacturer: Gillian

Model: HFS-513A

Serial or ID No. 26897

Environment: Temperature 25 °C Humidity 65 %RH

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

Serial No. 200368

Date of Calibration : 17 July 2024

Result of Test			
Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
2500	1	2501.0	2499.4
	2	2503.0	
	3	2495.0	
	4	2498.0	
	5	2500.0	

Calibrated By:

(Sิริยอส ศรีบุญยง)

Date: 16-Oct-24

Approve By:

(Wisan Ritthikamon)

Date: 16-Oct-24



บริษัท เอ็นไวแล็บ จำกัด 540.540/1 ซอยบางแค 7 แขวงบางแค เขตบางแค กรุงเทพฯ 10160
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 & Mesalabs Supply Instrument

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Verification Test Report

Report No.:

SO2400004-E002/R01 -PU 02

Calibrated Date: 16-Oct-24

Equipment: Air Sampling Pump

Manufacturer: Gillian

Model: HFS-513A

Serial or ID No. 16765

Environment: Temperature 25 °C Humidity 65 %RH

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

Serial No. 200368

Date of Calibration : 17 July 2024

Result of Test			
Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
2500	1	2504.0	2501.6
	2	2508.0	
	3	2496.0	
	4	2497.0	
	5	2503.0	

Calibrated By:

(Siriyos Sriyonyong)

Date:

16-Oct-24

Approve By:

(Wisan Ritthikamon)



ประกาศใช้ 01/02/2566

www.evltesting.com

Environmental responsibility with all



Envilab Co., Ltd.

ผู้จัดการฝ่ายควบคุมคุณภาพ



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



Envilab & Needless Supply Instrument

Verification Test Report

Report No.:

SO2400004-E002/R01 -PU 03

Calibrated Date: 16-Oct-24

Equipment: Air Sampling Pump

Manufacturer: Gillian

Model: HFS-513A

Serial or ID No. 16766

Environment: Temperature 25 °C Humidity 65 %RH

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

Serial No. 200368

Date of Calibration : 17 July 2024

Result of Test

Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
2000	1	1998.0	2000.2
	2	1999.0	
	3	2003.0	
	4	2000.0	
	5	2001.0	

Calibrated By:

(Sิริยอส ศรีบุญยง)

Date: 16-Oct-24

Approve By:

(Wisan Ritthikamon)

Date: 16-Oct-24



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



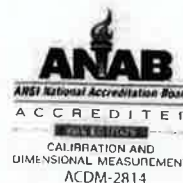
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REPORT OF CALIBRATION

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-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. Q24021068

F3-011-05/12-23

page 2 of 3



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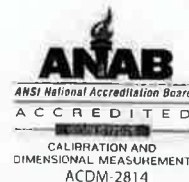


calibration



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



CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION

MEASUREMENT RESULTS : (X) without adjustment () adjustment

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

CALIBRATION DATA

1. CORRECTION OF TEMPERATURE : WET

Test point (° C)	Actual Temperature (° C)	DUC Reading (° C)	Correction (° C)	Uncertainty ± (° C)
20.0	20.00	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



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clccalibration



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



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

F3-011-05/12-23

page 1 of 3



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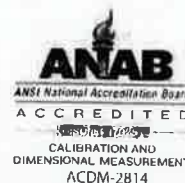


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REPORT OF CALIBRATION

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

F3-011-05/12-23

page 2 of 3



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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 ± (° 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 ± (° 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 ± (° 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

page 3 of 3



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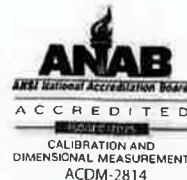




CLC
Accredited
ISO/IEC 17025

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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. : MCE030014[EHEMTHS3230014]
CLID. NO. : 232400048
JOB CONTROL NO. : 240110002414
CALIBRATION SERVICE : ☒ IN-LABORATORY ☐ ON-SITE

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

DATE OF RECEIVED : 10 January 2024

DATE OF ISSUED : 17 January 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

17 January 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. Q24002414

F3-011-05/12-23

page 1 of 3



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REPORT OF CALIBRATION

FOR

NOMENCLATURE : HEAT STRESS MONITOR
MANUFACTURER : METROSONICS
MODEL / TYPE : hs-32
SERIAL NO. : MCE030014[EHEMTHS3230014]
DATE OF CALIBRATION : 16 January 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 and Temperature & Humidity Chamber 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. Q24002414

F3-011-05/12-23

page 2 of 3



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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 ± (° C)
20.0	20.01	20.1	-0.09	0.40
30.0	30.00	29.8	+0.20	
40.0	39.99	39.8	+0.19	

2. CORRECTION OF TEMPERATURE : DRY

Test point (° C)	Actual Temperature (° C)	DUC Reading (° C)	Correction (° C)	Uncertainty ± (° C)
20.0	20.01	20.1	-0.09	0.40
30.0	30.00	29.9	+0.10	
40.0	39.99	39.9	+0.09	

3. CORRECTION OF TEMPERATURE : GLOBE

Test point (° C)	Actual Temperature (° C)	DUC Reading (° C)	Correction (° C)	Uncertainty ± (° C)
20.0	20.01	20.3	-0.29	0.40
30.0	30.00	29.8	+0.20	
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. Q24002414

F3-011-05/12-23

page 3 of 3



Envilab Co., Ltd.

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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



N80-T181-T1817025
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

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

Approved by :

(Surachai Promthong)

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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CAL-F0031-03

Envilab Co.,Ltd.

รับรองสำเนาถูกต้อง
ผู้จัดการฝ่ายควบคุมคุณภาพ

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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. : 67-200060-2

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Departure of indication from nominal value

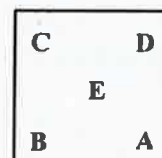
Nominal Value (g)	Correction (g)	Uncertainty \pm (g)
0.1	0.00000	0.000015
0.5	0.00001	0.000022
1	0.00000	0.000026
2	0.00001	0.000034
5	-0.00001	0.000043
10	0.00000	0.000053
50	0.00003	0.00011
100	0.0001	0.00020
150	0.0001	0.00038
200	0.0002	0.00038

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

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

Eccentric error

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



Repeatability

Load test : 200 g
Stdev. : 0.000032 g

- o o o -

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Calibratech Co.,Ltd.

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

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



Certificate of Calibration

Certificate No. : 67-420034-1

Page : 1 of 2

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

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

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

Date of Received : 20 March 2024

Date of Calibration : 20 March 2024

Date of Issue : 23 March 2024

Calibrated by : Permpon Chanpu

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

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

1. Multiproduct Calibrator

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%

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

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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. : 67-420034-1

Page : 2 of 2

Result of Calibration :

UUC Condition As-Received : Good

Function : Electrical measurement

pH meter

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

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

Function : pH meter with electrode

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

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

Remark

UUC : Unit Under Calibration

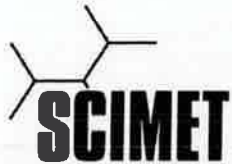
This result of calibration was found accurate as shown on date and place of calibration only.

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

- oOo -

ABJ





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



Certificate No. C17240307

Calibration Certificate

Equipment: Cooled Incubator
Model: BIC-140
Serial No.(or ID): 100813-1 (ELABBODC140NO1)
Manufacturer: M-LAB
Condition: In Condition
Ventilation Valve: None **Shelves(pc.):** 5

Job No.: KSMT2402653
Received Date: 27 September 2024
Issued Date: 30 September 2024
Page: 1 of 3

Customer

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

Calibration Place

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

Calibration Date

27 September 2024

Environment Condition

Temperature: 20.8 °C ± 1.0 °C
Humidity: 54.8 %RH ± 2.6 %RH

The Method used

In-house method, W117, based on TLAS-G20

Traceability

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

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

The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor ($k=2$) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).

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

(Mongkolwat Hasanon)
Person in charge

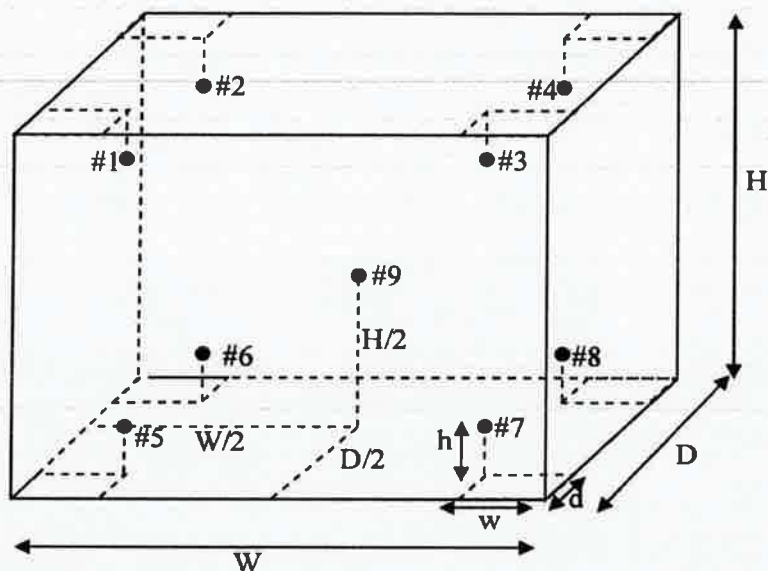


(Mr. Thalerngkeat Pongngam)
Authorized signatory



Envilab Co.,Ltd.

รับรองว่าเอกสารนี้ถูกต้อง
ผู้จัดการฝ่ายควบคุมคุณภาพ



Standard Installation Locations

Volume (Calibration Zone)= 58 (Liters)

Inside chamber: $W = 38 \text{ (cm)}$ $D = 32 \text{ (cm)}$ $H = 114 \text{ (cm)}$

Standard Locations (#1, #2, #3, #4): $w = 5 \text{ (cm)}$ $d = 5 \text{ (cm)}$ $h = 10 \text{ (cm)}$

Standard Locations (#5, #6, #7, #8): $w = 5 \text{ (cm)}$ $d = 5 \text{ (cm)}$ $h = 10 \text{ (cm)}$

#9: Geometric center of the chamber

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

Definitions

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

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

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

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

Overall Variation: The difference of maximum and minimum measured temperatures throughout observation time.

Calibration Results:

Without adjustment

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

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

Temperature Distribution

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

Chamber Characterization

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

Note: * Maximum uncertainty of the each position

The End of Certificate

Statements of conformity:

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

The correction of indication determined during calibration are under given measurement and environmental conditions and considering the expanded measurement uncertainty (coverage probability 95%) within the specification. The given measurement uncertainty already includes other all effects by according to the standard method, TLAS-G20. Therefore, those parameters have not

Tolerance and Decision rules:

Assessment of the conformity of the measurement device are done based on direct comparison of the relevant measurement results with the tolerances and decision rule are prescribed by the customer.

- Decision rule :** ☐ Choice A Binary Statement for Simple Acceptance Rule ($w = 0$), Specific Risk $< 50\%$ PFA.
- ☒ Choice B Non-binary statement with guard band ($w = 1$ U), Pass or Fail Specific Risk $< 2.5\%$ PFA and Condition Pass or Condition Fail Specific Risk $< 50\%$ PFA.
- ☐ Choice C Customer defined, Customers may define arbitrary multiple of r to have applied as guard band ($w = r$ U) .
- ; PFA: Probability of False Accept




(Mr. Thalerngkeat Pongngam)
Authorized signatory

Without adjustment

Desired Temperature : 20.0°C

Tolerances : 1.0 °C

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

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

Correction of UUC.* = Measured Temperature - Desired Temperature

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

The End of Statements of Conformity

บริษัท ชัยนิเทศ จำกัด (SCIMET CO., LTD.)

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



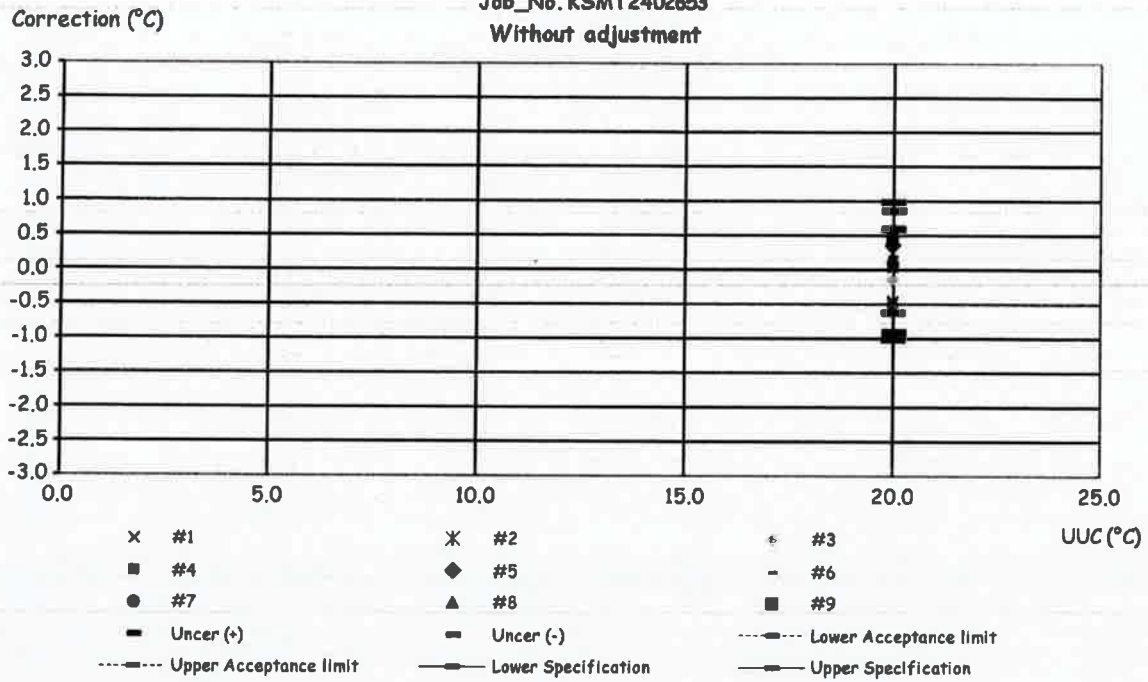
EnviLab Co., Ltd.

รับรองสำเนาถูกต้อง
ผู้จัดการฝ่ายควบคุมคุณภาพ

Corr_Distribution & Max_Measurement Uncertainty

Job_No. KSMT2402653

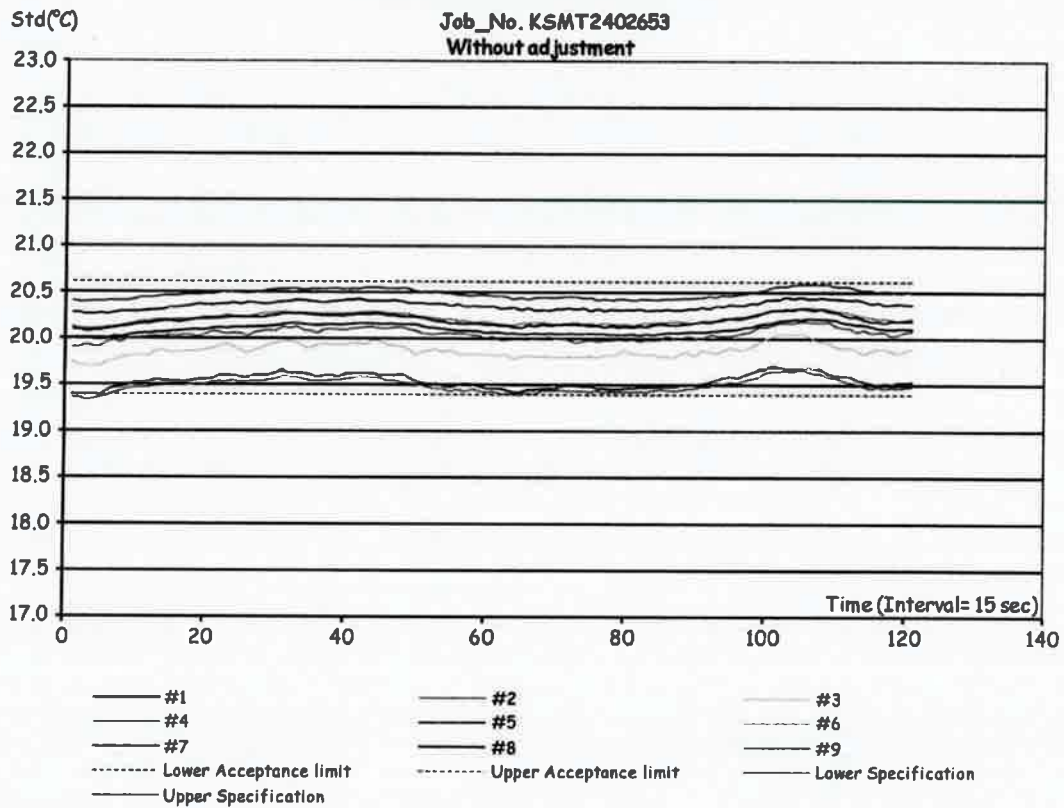
Without adjustment

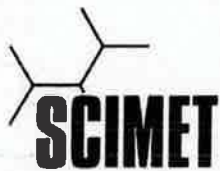


Temperature Distribution @ 20.0°C

Job_No. KSMT2402653

Without adjustment





ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

เลขที่ใบงาน: KSMT2402653

ชนิดเครื่องมือ: Cooled Incubator

รุ่น: BIC-140

หมายเลขเครื่อง: 100613-1 (ELABBODC140NO1)

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

ข้อแนะนำ :

Mr. Mongkolwat Hasanon
Service Engineer

บริษัท ชายนันเมท จำกัด (SCIMET CO., LTD.)

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



Envilab Co., Ltd.

ผู้จัดการฝ่ายควบคุมคุณภาพ

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. : 67-400054-1

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

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

(Surachai Promthong)

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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CAL/F0031-03

Envilab Co.,Ltd. ผู้จัดการฝ่ายควบคุมคุณภาพ

Certificate of Calibration

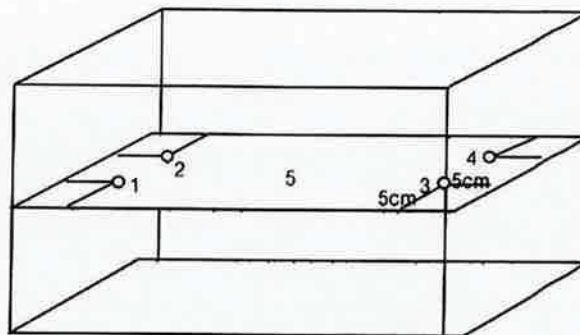
Certificate No. : 67-400054-1

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 -



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. : 67-400166-1

Page : 1 of 2

Submitted by : Envilab Co., Ltd.

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

Equipment : Temperature controlled enclosure (Oven)

Manufacturer : Memmert

Model : UF 75

Range : N/A °C

Resolution : 0.1 °C

Serial No. : B319.0600

ID No. : ELABHAOVEN0600

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

Ambient Temperature : (29.0 to 30.0) °C

Relative Humidity : (60 to 650 %

Line Voltage : (224.2 to 225.2) V

Date of Received : 20 March 2024

Date of Calibration : 20 March 2024

Date of Issue : 22 March 2024

Calibrated by : Kittisak Kokaeo

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

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

Standard Digital Thermometer with Thermocouple probe

ID No.

Cert. No.

Due Date

Traceability

400046 & 400028

66-400547-3

05 Apr 2024

National Institute of Metrology Thailand (NIMT)

Approved by :

(Surachai Promthong)

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 67-400166-1

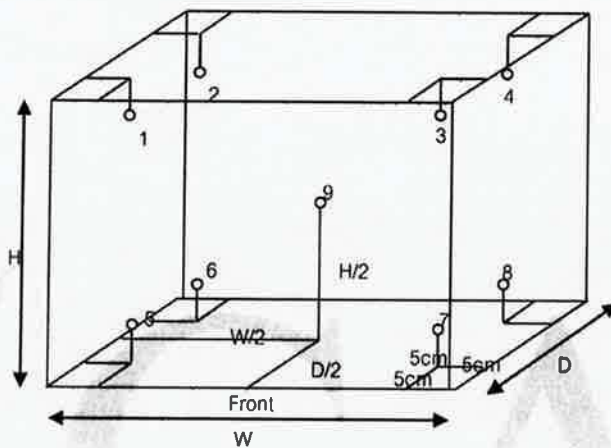
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

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



Inside of Chamber

W = 0.40 m

D = 0.33 m

H = 0.56 m

Capacity = 0.07 m³

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

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

Remark The uncertainty is not combine uniformity of the air chamber

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

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

- o0o -

CAL

Calibratech Co.,Ltd.

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Tel.(02) 964-6211 Fax.(02) 964-5153, e-mail : calibratech.cal@yahoo.com, calibratech.cal@hotmail.com



NSC-TISI-TIS17025
CALIBRATION 0030

Certificate of Calibration

Certificate No. : 67-300147-4

Page : 1 of 2

Submitted by : Envilab Co.,Ltd.

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

Equipment : Cylinder

Manufacturer : PYREX

Class : A

Capacity : 250 ml

Graduation : 2 ml

ID No. : C-WW-007/23

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

Relative Humidity : (50 ± 10) %

Air Pressure : 1009.4 mbar.

Date of Received : 13 March 2024

Date of Calibration : 19 March 2024

Date of Issue : 19 March 2024

Calibrated by : Areerat Sombun

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

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

Electronic Balance

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

Approved by :

(Wipa Tovadee)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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CAL-F0031-03

Envilab Co.,Ltd.

รับรองสำเนาถูกต้อง

ผู้จัดการฝ่ายควบคุมคุณภาพ

CAL

Calibratech Co.,Ltd.

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

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

Certificate of Calibration

Certificate No. : 67-300147-4

Page : 2 of 2

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

UUC Condition As-Received : Good

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

Uncertainty of measurement with in \pm 0.087 ml

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

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

- o0o -

CAL

Calibratech Co.,Ltd.

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

Tel.(02) 964-6211 Fax.(02) 964-3155, e-mail : calibratech.cal@yahoo.com, callibratech.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 Bangkhae 7, Bangkhae, 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 Tovadec)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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CAL-F0031-03

Envilab Co.,Ltd.

รับรองสำเนาถูกต้อง
ผู้จัดการฝ่ายควบคุมคุณภาพ



CAL

Calibratech Co.,Ltd.

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

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

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%

- oOo -



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



NBC-T181-T1817025
CALIBRATION 0030

Certificate of Calibration

Certificate No. : 67-300147-6

Page : 1 of 2

Submitted by : Envilab Co.,Ltd.

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

Equipment : Cylinder

Manufacturer : PYREX

Class : A

Capacity : 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

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

Approved by :

(Wipa Tovadee)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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CAL-F0031-03

Envilab Co.,Ltd.

รับรองสำเนาถูกต้อง

ผู้จัดการฝ่ายควบคุมคุณภาพ



CAL

Calibratech Co.,Ltd.

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

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

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%

- oOo -

CAL

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

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



NSC-TISI-TIS17025
CALIBRATION 0030

Certificate of Calibration

Certificate No. : 66-400622-1

Page : 1 of 2

Submitted by : Envilab Co., Ltd.
540, 540/1 Soi Bangkhac 7, Bangkhac, 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 : Pernpon 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
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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CAL-F0031-03

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ผู้จัดการฝ่ายควบคุมคุณภาพ

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Certificate of Calibration

Certificate No. : 66-400622-1

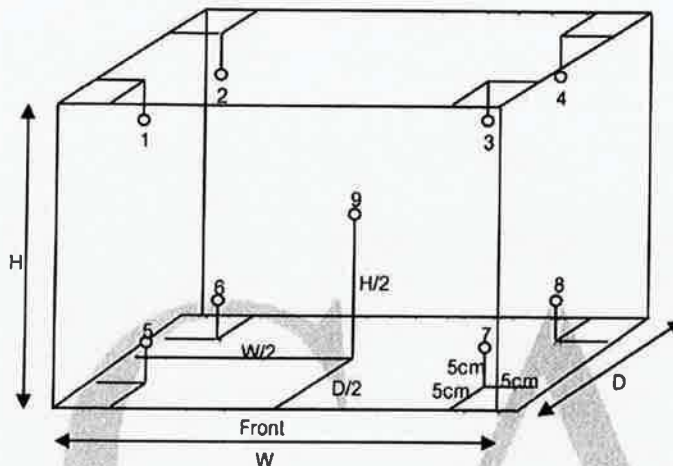
Page : 2 of 2

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

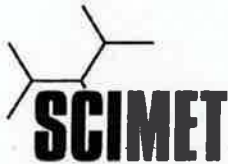
Remark The uncertainty is not combine uniformity of the air chamber

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 -

401



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



Certificate No. C17240309

Calibration Certificate

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

Customer

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

Calibration Place

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

Calibration Date

27 September 2024

Environment Condition

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

The Method used

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

Traceability

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

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

The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor ($k=2$) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).

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



(Mongkolwat Hasanon)
Person in charge

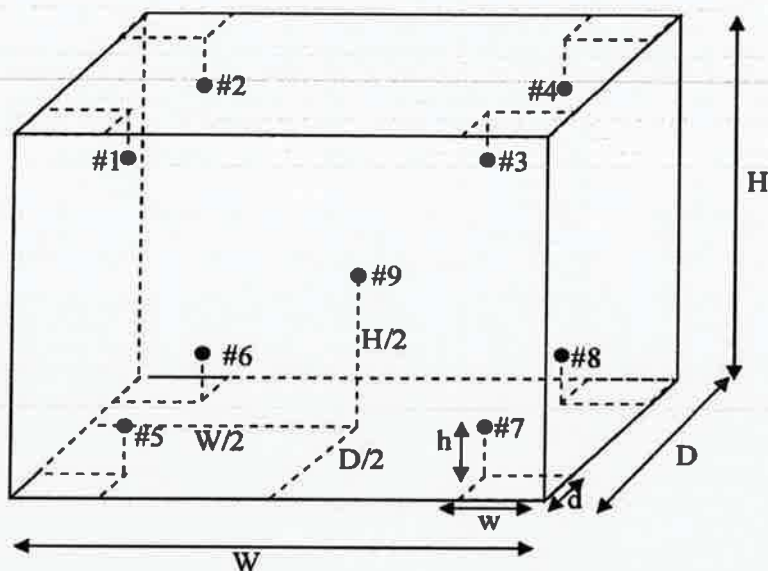


(Mr. Thalerngkeat Pongngam)
Authorized signatory



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Standard Installation Locations

Volume (Calibration Zone)= 21 (Liters)

Inside chamber: $W = 40 \text{ (cm)}$ $D = 33 \text{ (cm)}$ $H = 40 \text{ (cm)}$

Standard Locations (#1, #2, #3, #4): $w = 5 \text{ (cm)}$ $d = 5 \text{ (cm)}$ $h = 5 \text{ (cm)}$

Standard Locations (#5, #6, #7, #8): $w = 5 \text{ (cm)}$ $d = 5 \text{ (cm)}$ $h = 5 \text{ (cm)}$

#9: Geometric center of the chamber

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

Definitions

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

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

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

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

Overall Variation: The difference of maximum and minimum measured temperatures throughout observation time.

Calibration Results:

Before adjustment

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

After adjustment

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

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

Temperature Distribution

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

Chamber Characterization

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

Note: * Maximum uncertainty of the each position

After adjustment (Cont.)

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

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

Temperature Distribution

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

Chamber Characterization

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

Note: * Maximum uncertainty of the each position

After adjustment (Cont.)

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

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

Temperature Distribution

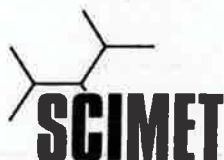
Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
			#1	#2	#3	#4	#5	#6	#7	#8	#9	
180.0	182.5	182.5	181.12	183.67	181.80	181.92	179.84	180.90	179.77	179.38	179.75	1.3

Chamber Characterization

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

Note: * Maximum uncertainty of the each position

The End of Certificate



Refer to Certificate No.: C17240309

Page: 1 of 2

Statements of conformity:

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

The correction of indication determined during calibration are under given measurement and environmental conditions and considering the expanded measurement uncertainty (coverage probability 95%) within the specification. The given measurement uncertainty already includes other all effects by according to the standard method, TLAS-G20. Therefore, those parameters have not

Tolerance and Decision rules:

Assessment of the conformity of the measurement device are done based on direct comparison of the relevant measurement results with the tolerances and decision rule are prescribed by the customer.

- Decision rule :** ☐ Choice A Binary Statement for Simple Acceptance Rule ($w = 0$), Specific Risk < 50% PFA.
- ☒ Choice B Non-binary statement with guard band ($w = 1$ U), Pass or Fail Specific Risk < 2.5% PFA and Condition Pass or Condition Fail Specific Risk < 50% PFA.
- ☐ Choice C Customer defined, Customers may define arbitrary multiple of r to have applied as guard band ($w = r$ U) .
- ; PFA: Probability of False Accept



(Mr. Thalemgkeat Pongngam)

Authorized signatory

After adjustment

Desired Temperature : 85.0°C

Tolerances : 1.0 °C

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

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

Correction of UUC.* = Measured Temperature - Desired Temperature

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

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

EnviLab Co., Ltd.

ผู้จัดการฝ่ายควบคุมคุณภาพ

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

Desired Temperature : 104.0°C

Tolerances : 2.0 °C

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

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

Correction of UUC.* = Measured Temperature - Desired Temperature

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

After adjustment (Cont.)

Desired Temperature : 180.0°C

Tolerances : 2.0 °C

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

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

Correction of UUC.* = Measured Temperature - Desired Temperature

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

The End of Statements of Conformity
บริษัท ชัยนิเทศ จำกัด (SCIMET CO., LTD.)

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

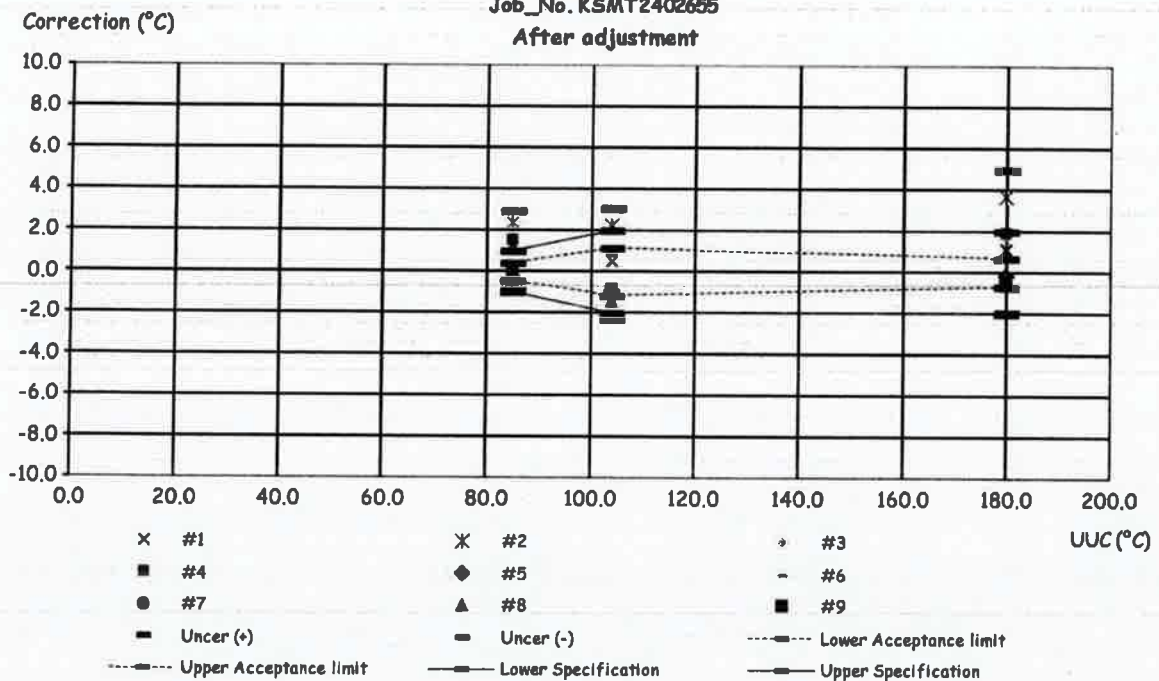

Envilab Co., Ltd.

ผู้จัดการฝ่ายควบคุมคุณภาพ

Corr_Distribution & Max_Measurement Uncertainty

Job_No. KSMT2402655

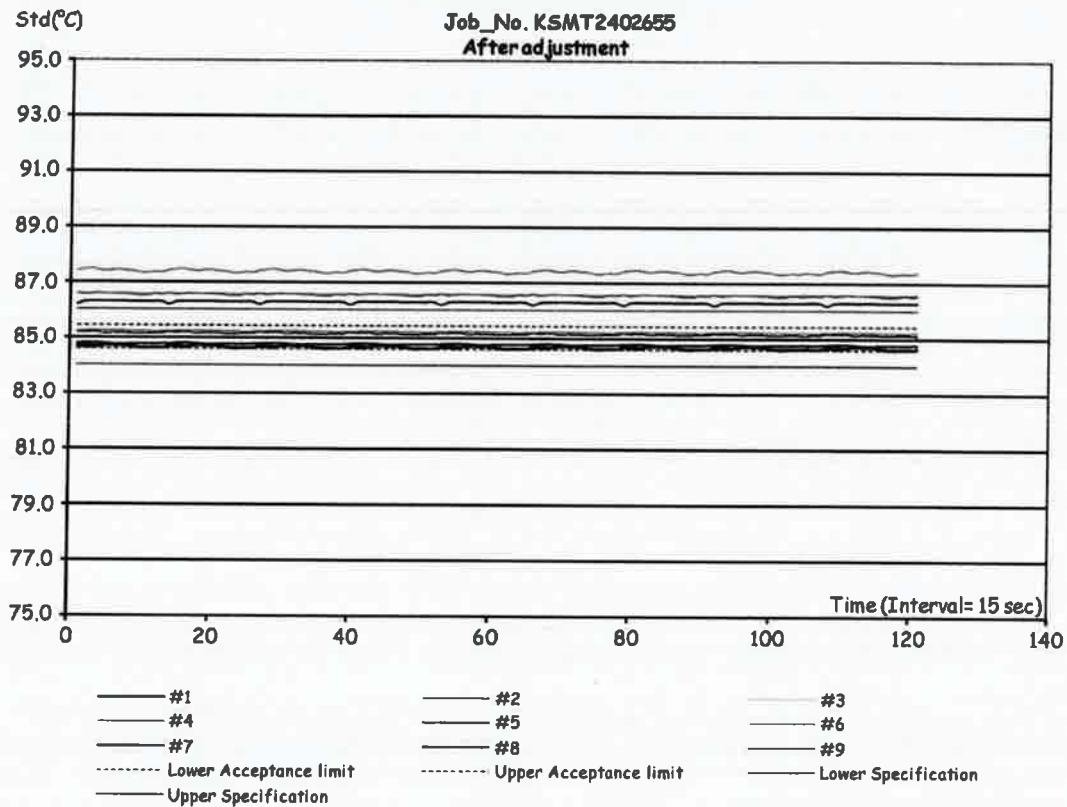
After adjustment



Temperature Distribution @ 85.0°C

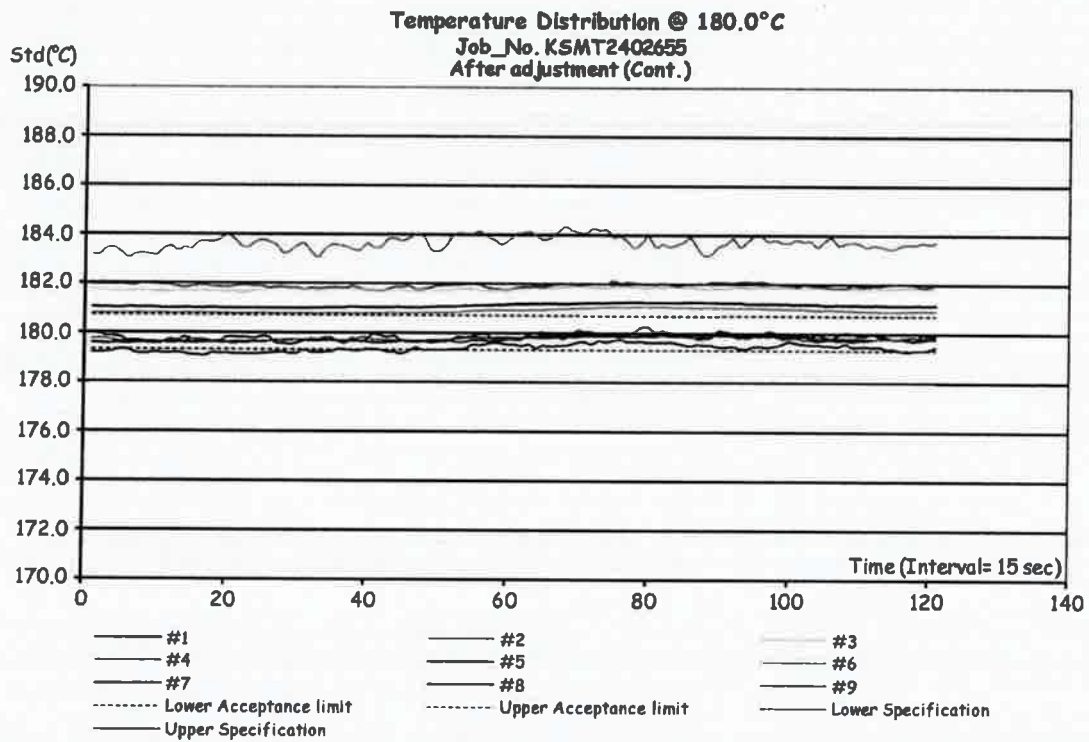
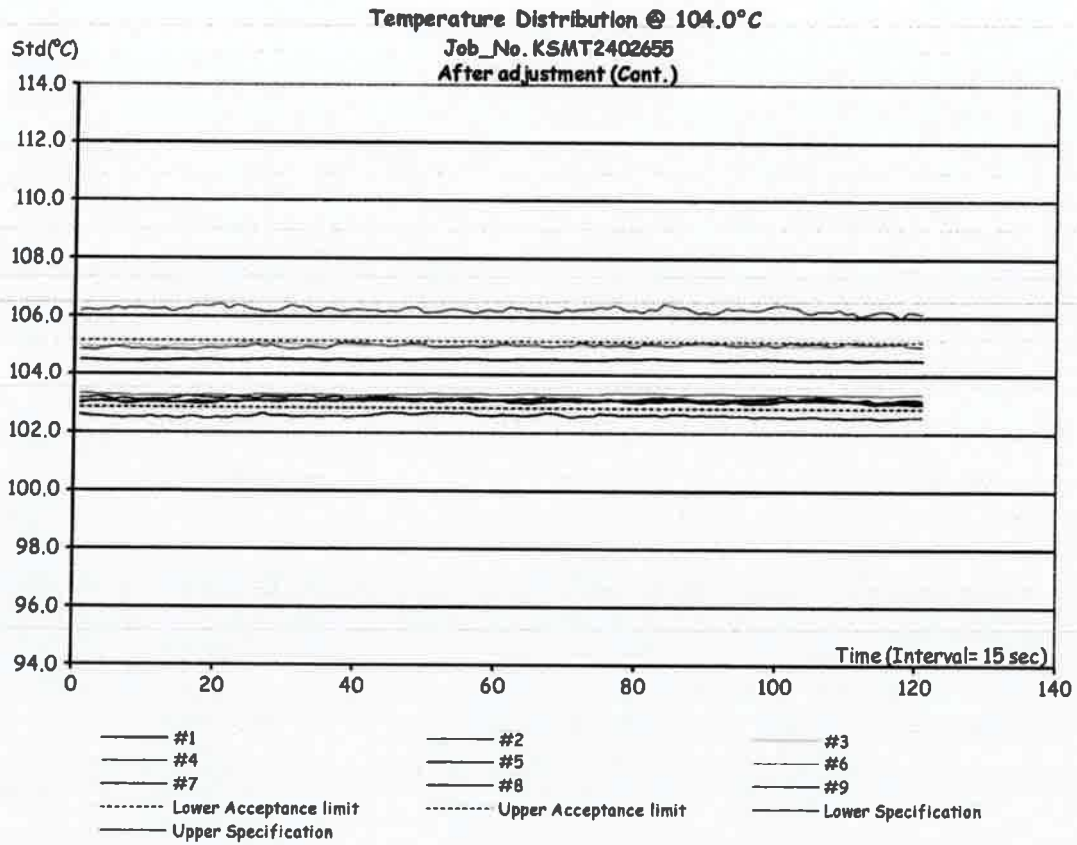
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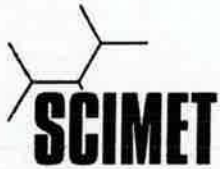
After adjustment



Envilab Co.,Ltd.

ผู้จัดการฝ่ายควบคุมคุณภาพ





ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

เลขที่ใบงาน: KSMT2402655

ชนิดเครื่องมือ: Oven

รุ่น: ED53

หมายเลขเครื่อง: 13-02277 (ELABHAOVEN2277)

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

ข้อแนะนำ : * Control Modify Brand M-LAB

Mr. Mongkolwat Hasanon

Service Engineer

บริษัท ชายนีเมก จำกัด (SCIMET CO., LTD.)

1194 Soi Wachirathamsathit 57, Bangchak, Phrakhanong, Bangkok 10260 Thailand
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Envilab Co., Ltd.

ผู้จัดการฝ่ายควบคุมคุณภาพ

CAL

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



Certificate of Calibration

Certificate No. : 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 : Areerat Sombun

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

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

Electronic Balance

ID No.	Cert. No.	Due Date	Traceability
241005	66-200388-4	02 Jun 2024	National Institute of Metrology (Thailand) (NIMT)

Approved by :

(Wipa Tovadce)

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 w

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รับรองสำเนาถูกต้อง
ผู้จัดการฝ่ายควบคุมคุณภาพ



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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. : 67-300147-11

Page : 2 of 2

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

UUC Condition As-Received : Good

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%

- o0o -

Agilent CrossLab Start Up Services

Agilent 5100 5110 ICP-OES Preventive Maintenance



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

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

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



Introduction

Customer Information

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



Important Customer Web Links

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



Service Engineer's Responsibilities

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



Instrument Maintenance

System Information

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

Instrument System Name and ID
Instrument System Site and Location

5110 VDV ICP-OES
Envilab Company limited

List System Component Product Numbers	List the Serial Numbers of each Component
1. G 8013 A	MY 17490002
2. G 8410 A	AU13393769
3. G 8491-80002	1309-05327
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

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.

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. **NA**
- ☒ Remove and clean instrument water inlet filter.

Agilent Water Recirculator

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

SPS 3 Auto Sampler

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

SPS 4 Auto sampler

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

AVS 4, 6, 7 Advanced Valve System

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

ICP-OES adjustment

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

Record Post-PM Instrument performance

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

- ☒ Record the result in the Instrument Test Results Table



Restore Instrument

- ☐ For I/F applications, ask the customer to reinstall their sample introduction system. N/A
- ☒ Leave system in an idle state: on and purging.
- ☒ Guidance: If the PM service is performed prior to a qualification service, then use the qualification procedure as a guide for final instrument set up and checkout.

Service Review

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



Test Results

Instrument Performance Test Results Table

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

	Pre PM Sensitivity Check		Post PM Sensitivity Check	
	Radial	Axial *	Radial	Axial*
Zn 213.857 nm SRBR	1577.1	3382.6	2549.2	6129.9
Mn 257.610 nm SRBR	8945.3	1645.9	10764.1	39073.2
Al 396.152 nm SBR	7.0	16.9	8.5	25.7
K 766.491 nm SBR	8.2	67.3	4.7	83.6

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

Instrument Test Results Table

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

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

ICP-OES Status Results Table

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

Measurement	Standby Mode	Plasma On
Mains Voltage	219.371	VAC 217.484
Mains Current	0.082	A 0.098
Instrument Temperature	23.5	°C 23.1
RF Air Flow (sensor speed)	13.0	Hz 19.0
Plasma Exhaust Temperature	No measurement	°C 36.4
Water Flow Oscillator	No measurement	L/min 1.51
Water Flow Detector	1.09	L/min 1.06
Water Inlet Temperature	16.9	°C 16.7
Polychromator Temperature	36.0	°C 36.0
CDD Temperature	-39.6	°C -39.4
Thermal Stabilizer	35.0	°C 35.0
Argon Supply Pressure	619.13	kPa 560.32
Purge Gas Supply Pressure*1	616.63	kPa 597.43
Option Gas Supply Pressure*1	-	kPa -
Nebulizer Flow	No measurement	L/min 0.70
Nebulizer Back Pressure	No measurement	kPa 293.17
Plasma Gas Flow	No measurement	L/min 11.98
Auxiliary Gas Flow	No measurement	L/min 1.00
RF Power	No measurement	W 199.1
RF Supply Current	No measurement	A 8.190
RF Supply Voltage	No measurement	V 194.557

*1 If option installed

Consumed PM Parts

Part Description	Part Number	Product or Model# where used	Quantity consumed
Axial Pre-Optic Window	G8010-68014	G8010A, G8011A, G8014A/G8015A	1
Radial Pre-Optic Window	G8010-68015	All	1
Agilent Cool Clear Coolant Fluid	5799-0037	Agilent Water Reduculator	-
Purge Gas Filter	G8010-60136	All	1
Air inlet filter	G8000-68002	All	1
High Capacity Air Filter	G8010-60189	Optional	-
Rotor seal for 6-7 port valve for AVS6/7	G8494-60002	G8494A/G8495	-
Rotor seal for 4 port valve for AVS4	G8493-60002	G8493A	-
Rinse solution to rinse station 2.5mm id x 1m	G8410-80123	SPS 4	-
Barb connector 2.5mm-1.5mm ID	G8410-80124	SPS 4	-
PVC waste tubing 8mm od x 5mm id, 2m	G8410-80122	SPS 4	-
Additional Parts may be required from engineer's stock:			
X axis drive belt	5410047500	SPS 3	-
Z axis drive belt	5410047400	SPS 3	-
Peristaltic pump tubing, PVC SolveFlex, 3 bridged,	3710049000	SPS 4	-

Consumed Parts Reference

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

☐ Section Not Applicable

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

Signature Page

Service Engineer Comments (optional)

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

Service Verification

Service Request Number:
6006121636

Service Engineer Name:

Kanyaporn S.

Service Engineer Signature:

Kanyaporn S.

Total number of pages in this document:

14

Date Service Completed:
21 May 2023

Customer Name:

พชร

Customer Signature:

พชร

Report Summary

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

Result Summary

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

Subsystem Communications Test

Pass

Optics Test

	Radial	Axial
Intensity	3397602	2923418
Wavelength	737.212	737.212

Pass

Resolution Test

Pass

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

Sensitivity Test

Pass

Radial

Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 46.0	SRBR	106.0	934.0	64.8
Se (196.026 nm)	≥ 41.0	SRBR	110.2	1159.4	93.6
Zn (213.857 nm)	≥ 1421.0	SRBR	2348.2	23561.0	99.8
Pb (220.353 nm)	≥ 46.0	SRBR	98.7	1075.1	98.0
Mn (257.610 nm)	≥ 3518.0	SRBR	10768.1	218704.5	411.0
Al (396.152 nm)	≥ 3.4	SBR	8.5	40909.0	4325.8
Ba (493.408 nm)	≥ 34.0	SBR	111.9	1396218.4	12367.4
K (766.491 nm)	≥ 1.8	SBR	4.7	108989.7	19076.8

Axial

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

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Precision Test

Pass

Radial

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

Axial

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

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Envilab Co., Ltd.

ผู้จัดการฝ่ายควบคุมคุณภาพ

Report Summary

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

Result Summary

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

Subsystem Communications Test

Air Flow Test

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

Water Flow Test

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

Gas Flows Test

Nebulizer Target Flow	Actual Flow	Back Pressure	Auxiliary Target Flow	Actual Flow	Back Pressure
0.70	0.71	280.77	2.00	2.00	93.84

Makeup Target Flow	Actual Flow	Back Pressure	Plasma Target Flow	Actual Flow	Back Pressure
2.00	1.99	95.26	18.00	17.94	23.27

RF Generator Test

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

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



PinAAcle 900F Preventive Maintenance Report

Company Name: ENVILAB CO.,LTD

Instrument Location: 540-540/1, SOI BANGKHAE 7, BANGKHAE

BANGKOK, 10160,

Instrument Serial No.:

PFBS20011403

Date: 05-Oct-2023

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

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

PerkinElmer

Scope

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

The customer should save their method before the PM begins.

General Instructions:

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

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

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

Update the PM sticker and instrument logbook as required.

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Component List

Component / Specific Model	Serial #	Configuration Notes

Parts Lists

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

Additional Reagents and Standards Required for PM			
Part Number (If applicable)	Description	Quality	Batch/Lot #
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

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



Procedure Checklist

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

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

7. Flame Interlock Check:

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

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

8. After PM Performance tests:

8.1 Detector Linearity with Barium

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

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

8.2 Baseline Noise at 1.0 Absorbance with Barium

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

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

8.3 AA Baseline Noise with Copper

Description: Check baseline noise.

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

8.4 D₂ Background Compensation with Copper

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

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

8.5 AA-BG Baseline Noise with Copper

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

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

8.6 AA-BG Baseline Noise with Arsenic

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

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

8.7 Flame Sensitivity

Description: Instrument Sensitivity checked against Copper standard.

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

10. Review:

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

Additional Comments

Additional Comments Regarding the PM

Review

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

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

Review of Preventive Maintenance:

Authorized PerkinElmer Representative:	<i>Any</i>	Date: 05-Oct-2023 (DD-MMM-YYYY)
Authorized Customer Representative:	<i>เจษฎา</i>	Date: 05-Oct-2023 (DD-MMM-YYYY)



Atomic Absorption/FIAS 100/400 Preventive Maintenance (PM)				
Company Name:	ENVILAB CO.,LTD			
Address (Instrument Location):	540-540/1, SOI BANGKHAIE 7, BANGKHAIE, 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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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)

Procedure Checklist

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

1. General:

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

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

NO

☒ Visual Damage (if yes, describe)

NO

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

2. Instrument components

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

3. Mixing/Separation Assembly & Pump Tubing:

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

4. Cell, Cell Windows, Transfer Line:

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

5. Operational Tests:

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

6. Review:

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

Additional Comments

Additional Comments Regarding the PM

Review

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

Document History

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



PerkinElmer TruQ

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

Lot No: 26-87CUIY1
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	Tb	<0.001
Al	<0.003	Er	<0.001	Lu	<0.001	Rb	<0.001	Te	<0.001
As	<0.002	Eu	<0.001	Mg	<0.002	Re	<0.001	Th	<0.001
Au	<0.002	Fe	<0.004	Mn	<0.001	Rh	0.002	Ti	<0.001
B	<0.002	Ga	<0.001	Mo	<0.001	Ru	<0.001	Tl	<0.001
Ba	<0.001	Gd	<0.001	Na	0.05	Sb	<0.001	Tm	<0.001
Be	<0.001	Ge	<0.002	Nb	<0.001	Sc	<0.001	U	<0.001
Bi	<0.001	Hf	<0.001	Nd	<0.001	Se	<0.003	V	<0.001
Ca	0.006	Hg	<0.001	Ni	<0.001	Si	<0.1	W	<0.001
Cd	<0.001	Ho	<0.001	P	<0.2	Sm	<0.001	Y	<0.001
Ce	<0.001	In	<0.001	Pb	0.001	Sn	<0.001	Yb	<0.001
Co	<0.001	Ir	<0.001	Pd	<0.001	Sr	<0.001	Zn	<0.005
Cr	<0.001	K	<0.1	Pr	<0.001	Ta	<0.001	Zr	<0.001
Cs	<0.001	La	<0.001						

Traceability Documentation for Solution Standard:

Certified Value: 1001 µg/mL ±5 µg/mL (refer to side 2)

Certified Value is Traceable to: NIST SRM #3114

Classical Wet Assay: 1000 µg/mL

Method: EDTA titration using PAN as Indicator, EDTA standardized against Pb(NO₃)₂ NIST SRM #628.

Instrument Analysis using ICP Spectrometer: 1001 µg/mL

NIST SRM #3114

We guarantee that our PerkinElmer TruQ Atomic Spectroscopy Standards are stable and accurate to ±0.5% of certified concentration over the stated shelf life. The standards are kept tightly capped and stored under normal laboratory conditions. This value is based on the analysis of the standards by the NIST Analytical Chemistry Division. For these solutions cumulative errors associated with the analytical determinations, pipetting, and diluting to final volume. For these solutions the purity acids, ASTM Type 1 water (18 megohm double deionized), and leached, triple-rinsed bottles. All glassware used is

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:				
Wavelength		193.70	232.00	324.75	553.55	766.49
Standard 1	MG2-358	0.9209	0.8992	0.9078	0.9798	0.9853

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	
SLI mode UV/VIS	Fix	1 nm
Integration time UV/VIS	5 s	SLI UV/VIS
SLI mode NIR	Servo	Servo
Integration time NIR	Gain	2

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

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

Serial Number: 101N0089016

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

Date / Time: 1/14/2015

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

NIST SRM PKI-1930 SRM 00038 Calibration Data 05/23/2014 National Research Council of Canada Calibration Report No. PAR 2014 3162

was used during this procedure. Measurements were performed at an ambient temperature of 22.1 °C and the humidity of 53.9 %

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

Operator: Cam Le Horvath

Signature:

PerkinElmer LAS, Inc., 710 Bridgeport Avenue, Shelton, CT 06484-4784, USA

End of Report

Secondary Spectrometric Calibration Standards

Certificate of Calibration

Ordinate Calibration

Calibration Data for Secondary Calibration Standards:

Wavelength / Absorbance	Number	Ordinate Reading (Absorbance) at the following wavelengths:			
Wavelength		193.70	232.00	324.75	553.55
Standard 1	MGO-252	0.2762	0.2469	0.2124	0.2042
				0.1912	

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

Conditions of Calibration

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

Measurement of Calibration

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

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 this instrument was performed on:

12/1/2014

Date / Time:

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

1930 model filter set SIN 00038 Calibration Date 05/23/2014 NRC Calibration Report No. PAR 2014 3162

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

12/28/2014 / 5:37:41 PM

Cam Le Horvath

Signature:

LAS, Inc., 710 Bridgeport Avenue, Shelton, CT 06484-4784, USA

End of Report



CERTIFICATE OF COMPLETION

This is to certify that

Duang Hiransuk

has completed the course

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

26 October 2018

Certified by
Viny Maharaj - Sr. Manager Service
Training

Date

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



Envilab Co.,Ltd.

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