



เอกสารผลการสอบเทียบ
เครื่องมือตรวจวัด



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	0.0114

Remarks

UUC - Unit Under Calibration

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

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

- 0.013 -

Certificate of Calibration

Certificate No. : 67-420034-1

Page : 1 of 2

Submitted by :

Envilab Co., Ltd.

540, 540/1 Soi Bangkhue7, Bangkhue, Bangkok 10160

Equipment :

pH Meter with electrode

pH meter

Manufacturer : Horiba

Model : F-74BW-G

Range : N/A

Resolution : 0.001 pH

Serial No. : B41J0001

ID No. : ELABP111B74BW01

Electrode

Model : 96155

Serial No. : 9XIK0003

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 : Permon 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-0030766	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

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 66-400546-1

Page : 2 of 2

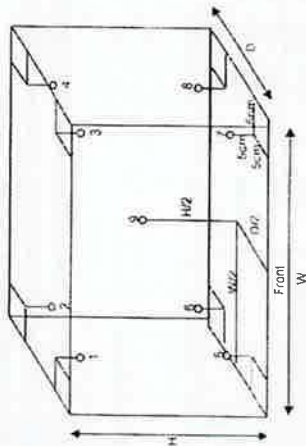
Result of Calibration : Without Adjustment

ULUC Condition As-Received : Good

Function : Temperature measurement

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

Inside of Chamber
W ~ 0.38 m
D ~ 0.35 m
H ~ 1.15 m
Capacity ~ 0.15 m³



Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) @ Sensor No									Uncertainty (± °C)
			1	2	3	4	5	6	7	8	9	
20.0	20.0	20.0	20.18	19.98	20.08	19.97	20.19	20.16	20.20	20.18	20.28	0.30

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

Remark The uncertainty is not combine uniformity of the air chamber

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

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

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Certificate of Calibration

Certificate No. : 66-400546-1

Page : 1 of 2

Submitted by :

Envilab Co., Ltd.

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

Equipment :

Air Chamber (Incubator)

Manufacturer : M-LAB

Model : HIC-140

Range : N/A °C

Resolution : 0.1 °C

Serial No. : 100613-1

ID No. : ELABBODC140N01

Environment :

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

Ambient Temperature : (25.0 to 26.0) °C

Relative Humidity : (50 to 55) %

Line Voltage : (224.0 to 225.0) V

Date of Received : 03 October 2023

Date of Calibration : 03 October 2023

Date of Issue : 06 October 2023

Calibrated by :

Pernipon Chianpu

Calibration Method :

CAL-M4004, ILAS G-20

The temperature scale used was based on ITS-90

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

Standard Digital Thermometer with RTD Probe

ID No. Cert. No. Due Date

Traceability

400029 & 400048 66-400454-1 05 Feb 2024

National Institute of Metrology Thailand (NIMT)

Approved by

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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CAL 66-400546-1

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



Calibration Results:

Electrode Serial No. KC3N05V1R
Model : H176409
Brand : HANNA

Electrode Test

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

Sample Test

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

Temperature Electrode

Dimension of Probe:
Length 140 mm
Diameter 21 mm
Immersion Depth 80 mm

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

The End of Certificate

บริษัท ยานิมก ดัณฑ์ (SCIMET CO., LTD.)
1194 Soi Wachirathamsathit 57, Bangchak, Phrakhanong, Bangkok 10260 Thailand
Email: scimet2022@gmail.com, Tel: 095 552 4939



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

Calibration Certificate

Equipment: DO METER
Model: H19147
Serial No.(or ID): H00007030
Manufacturer: HANNA
Condition: In Condition
Job No.: KSMT2400445
Received Date: 04 March 2024
Issued Date: 14 March 2024
Page: 1 of 2

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

Calibration Place
Environment Laboratory, SCIMET Co., Ltd.
1194 Soi Wachirathamsathit 57, Bangchak, Phrakhanong, Bangkok 10260 Thailand

Calibration Date
14 March 2024
Environment Condition
Temperature: 23 °C ± 2 °C
Humidity: 50 %RH ± 15 %RH

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

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



Mr Dumrong Boonsopon
Person in charge

Mr Thalangkeat Pongngarm
Authorized signatory



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

Certificate No. : S2024080486-0002

Environment : Ambient Temperature : Start record 25.3 °C, Stop record 25.4 °C

Relative Humidity : Start record 51.2 %RH, Stop record 52.3 %RH

Calibration Temperature (°C)	Settling Temperature (°C)	Indicating Temperature (°C)	Measured Stability (°C)	Measured Uniformity ² (°C)	Overall Variation ³ (°C)
150	150	150	0.80	1.65	2.24

Calibration Temperature (°C)	Standard Reading (°C), Probe No. 13 is Reference Probe										Uncertainty ^a (±°C)
	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	No. 10	
150	150.12	150.28	150.43	149.66	150.03						1.4
	No. 6	No. 7	No. 8	No. 9	No. 10						
	149.74	149.98	149.83	150.77	150.60						
	No. 11	No. 12	No. 13	No. 14	No. 15						
	150.01	150.49	150.19	150.13	150.20						
	No. 16	No. 17	No. 18	No. 19	No. 20						
	150.80	149.98	150.21	149.52	149.44						
	No. 21	No. 22	No. 23	No. 24	No. 25						
	150.16	150.32	149.97	149.96	150.11						
	with Client Hand										
Decision Rule											
Calibration											
Temperature (°C)											
Pass / Fail											

Decision Rule	with Guard Band					MPE (±°C)
	Pass / Fail					
Calibration Temperature (°C)	No. 1	No. 2	No. 3	No. 4	No. 5	2
150	Pass	Pass	Pass	Pass	Pass	
	No. 6	No. 7	No. 8	No. 9	No. 10	
	Pass	Pass	Pass	Failed	Pass	
	No. 11	No. 12	No. 13	No. 14	No. 15	
	Pass	Pass	Pass	Pass	Pass	
	No. 16	No. 17	No. 18	No. 19	No. 20	
	Failed	Pass	Pass	Pass	Pass	
	No. 21	No. 22	No. 23	No. 24	No. 25	
	Pass	Pass	Pass	Pass	Pass	

Pass / Fail										Top view position				
No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	No. 10	No. 11	No. 12	No. 13	No. 14	No. 15
No. 16	No. 17	No. 18	No. 19	No. 20	No. 21	No. 22	No. 23	No. 24	No. 25					

Condition As-Received : Used Item

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

Measurement Standards Used & Traceability :

The International System of Units (SI) through

MIT Certificate No. L202403007-0011 for Digital Thermometer with Probe (Agilent) Module 2 (73) TC Serial No.

MY 440710472, 10e-10-Sep-24

- Notes :
1. The temperature stability is the smallest of greatest maximum difference of measured temperatures at any one probe
 2. The temperature uniformity is the maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time.
 3. Overall variation is the difference of maximum and minimum measured temperatures throughout observation time.
 4. The uncertainty of measurement is included temperature stability

End of Certificate

Page 2 of 2

EnviLab Co., Ltd. กรุงเทพมหานคร



MIRACLE INTERNATIONAL TECHNOLOGY CO.,LTD
214 Bangwaek Rd. Bangpai Bangkue Bangkok 10160
Tel.: 0-2865-4647-8 Fax: 0-2865-4649 http://www.mit.in.th



CALIBRATION CERTIFICATE

Certificate No. : S2024080486-0002

Date Issued : 27-Aug-24

Customer : EnviLab Co., Ltd.
540, 540/1 Soi Hongkhue 7, Hongkhue, Bangkok, Thailand 10160

Equipment : COD test tube heater with 25 vial

Manufacturer : IIAANNA
Model : I11839800
Serial No. : 6480043101
ID No./Tag No. : ELABH183980002
Date Received : 23-Aug-24
Date Calibrated : 23-Aug-24
Calibrated by : Akaledej Numnuan

Calibration Method or Calibration Procedure Used

In-house method : CP-49 base on TLAS G-20 by comparing against Standard Thermometer

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

Result of Calibration

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

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Approved by: **Sorayuth T.**
(Sorayuth Toehua)

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EnviLab Co., Ltd. กรุงเทพมหานคร

Certificate of Calibration

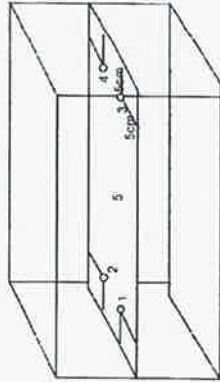
Certificate No. : 67-400054-1

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 No.					Uncertainty (± °C)	Measured Uniformity (°C)	Measured Stability (°C)
			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

Remarks 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%.

- o o -

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. : L6170156

ID No. : ELABW3WNH29N01

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 : Kittsak Kokaeo

Calibration Method :

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

Reference Standard Instruments :

This certification is traceable to the International System of Units

Standard Digital Thermometer with RTD probe

ID No.

Cert. No.

Due Date

Traceability

400046 & 400024

66-400547-2

02 Apr 2024

National Institute of Metrology Thailand (NIMT)

Approved by

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 67-200060-2

Page : 2 of 2

Page : 1 of 2

Result of Calibration :

Submitted by :

Finvilab Co., Ltd.

Finvilab Co., Ltd.
540, 540/1 Soi Bangkhue7, Bangkhue, Bangkok 10160

THE EDITORIAL AS-RECEIVED: COUNCIL

Dependence of reduction from nominal value

Normal Value (g ¹)	Correction (g ¹)	Uncertainty \pm (μ)
0.1	0.00000	0.000015
0.5	0.00004	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%

Leads test :	50	8
A	0.00000	0.00000
B	0.00000	0.00000
C	0.00000	0.00000
D	0.00000	0.00000
E	0.00000	0.00000

Repeatability

repeatability

Repeatability	Load (cN)	Δ (mm)	200
1	10	0.00	0.00
2	20	0.00	0.00
3	30	0.00	0.00
4	40	0.00	0.00
5	50	0.00	0.00
6	60	0.00	0.00
7	70	0.00	0.00
8	80	0.00	0.00
9	90	0.00	0.00
10	100	0.00	0.00
11	110	0.00	0.00
12	120	0.00	0.00
13	130	0.00	0.00
14	140	0.00	0.00
15	150	0.00	0.00
16	160	0.00	0.00
17	170	0.00	0.00
18	180	0.00	0.00
19	190	0.00	0.00
20	200	0.00	0.00
21	210	0.00	0.00
22	220	0.00	0.00
23	230	0.00	0.00
24	240	0.00	0.00
25	250	0.00	0.00
26	260	0.00	0.00
27	270	0.00	0.00
28	280	0.00	0.00
29	290	0.00	0.00
30	300	0.00	0.00
31	310	0.00	0.00
32	320	0.00	0.00
33	330	0.00	0.00
34	340	0.00	0.00
35	350	0.00	0.00
36	360	0.00	0.00
37	370	0.00	0.00
38	380	0.00	0.00
39	390	0.00	0.00
40	400	0.00	0.00
41	410	0.00	0.00
42	420	0.00	0.00
43	430	0.00	0.00
44	440	0.00	0.00
45	450	0.00	0.00
46	460	0.00	0.00
47	470	0.00	0.00
48	480	0.00	0.00
49	490	0.00	0.00
50	500	0.00	0.00
51	510	0.00	0.00
52	520	0.00	0.00
53	530	0.00	0.00
54	540	0.00	0.00
55	550	0.00	0.00
56	560	0.00	0.00
57	570	0.00	0.00
58	580	0.00	0.00
59	590	0.00	0.00
60	600	0.00	0.00
61	610	0.00	0.00
62	620	0.00	0.00
63	630	0.00	0.00
64	640	0.00	0.00
65	650	0.00	0.00
66	660	0.00	0.00
67	670	0.00	0.00
68	680	0.00	0.00
69	690	0.00	0.00
70	700	0.00	0.00
71	710	0.00	0.00
72	720	0.00	0.00
73	730	0.00	0.00
74	740	0.00	0.00
75	750	0.00	0.00
76	760	0.00	0.00
77	770	0.00	0.00
78	780	0.00	0.00
79	790	0.00	0.00
80	800	0.00	0.00
81	810	0.00	0.00
82	820	0.00	0.00
83	830	0.00	0.00
84	840	0.00	0.00
85	850	0.00	0.00
86	860	0.00	0.00
87	870	0.00	0.00
88	880	0.00	0.00
89	890	0.00	0.00
90	900	0.00	0.00
91	910	0.00	0.00
92	920	0.00	0.00

Side

Sidev. 0.000032 g

100

Approved by :

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

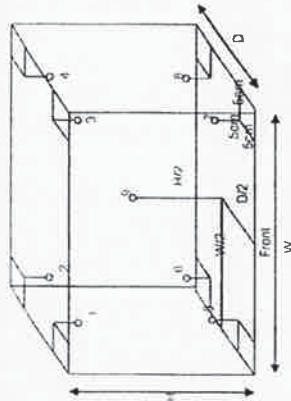
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Certificate of Calibration

Certificate No. : 67-400166-1

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
			Measured Uniformity (°C)			Measured Stability (°C)			Overall Variation (°C)			
104.0	103.5		0.7			0.1			1.0			
110.0	109.5		1.1			0.1			1.2			
180.0	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%

(0.0)

Certificate of Calibration

Certificate No. : 67-400166-1

Submitted by : Envilab Co., Ltd.

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

Equipment : Temperature controlled enclosure (Oven)

Manufacturer : Memmert

Range : N/A °C

Serial No. : H319,0600

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

Ambient Temperature : (29.0 to 30.0) °C

Relative Humidity : (60 to 65) %

Line Voltage : (224.2 to 225.2) V

Date of Received : 20 March 2024

Date of Calibration : 20 March 2024

Date of Issue : 22 March 2024

Calibrated by : Kittisak Kokato

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.

Certi. No.

400046 & 400028

Due Date

05 Apr 2024

Traceability

National Institute of Metrology Thailand (NIMT)

Approved by

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 67-410025-1

Page : 2 of 2

UUC Condition As-Received : Good

Result of Calibration : Without Adjustment
Function : Temperature measurement

Reference Humidity @ 50 %RH II.

Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
24.9K	25.0	0.0	0.4G

Result of Calibration : Without Adjustment
Function : Humidity measurement

Reference Temperature @ 25 °C

Standard Humidity (%RH II)	UUC Reading (%RH II)	Correction (%RH II)	Uncertainty (± %RH II)
50.03	50	0	2.2

Remark

UUC Unit Under Calibration

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

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

-003-

Certificate of Calibration

Certificate No. : 67-410025-1

Page : 1 of 2

Submitted by : Envilab Co., Ltd.

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

Equipment :

Digital Thermo-Hygrometer

Manufacturer : Jello

Model : HTC I

Range Temperature : N/A °C

Resolution : 0.1 °C

Range Humidity : N/A %RH

Resolution : 1 %RH

Serial No. : PONPE5852094

ID No. : FLA31MHTC10K 03

Environment :

Ambient Temperature : (23 ± 2) °C

Relative Humidity : (50 ± 15) %

Date of Received : 20 February 2024

Date of Calibration : 22 February 2024

Date of Issue : 22 February 2024

Calibrated by : Chortip Samchusri

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

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

Digital Indicator with Standard Probe Temp&Hum

ID No. Cert. No. Due Date Traceability

400014 & 400035 SC-II-00021067 05 Jul 2024 Success Gateway Co., Ltd. Accredited by TISI Calibration No.7268

Approved by :

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%.

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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	250.35

The uncertainty of measurement with $k = 2$ is 0.047 ml

The 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%.

of

Certificate of Calibration

Certificate No. : 67-300147-4

Page : 1 of 2

Submitted by : Eivlab Co.,Ltd.

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

Equipment : Cylinder
Manufacturer : PYREX
Capacity : 250 ml
Class : A
Graduation : 2 ml
ID No. : C-WW-003725

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 : Arcenit 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	66-2003MR-1	02 Jun 2024	National Institute of Metrology (Thailand) (NIMT)

Approved by :

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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CAL-0031403

CAL-0031403

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

UTC Condition As-Received : Good

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

Uncertainty of measurement with in

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-

Certificate of Calibration

Certificate No. : 67-300147-2

Page : 1 of 2

Submitted by : Envilab Co.,Ltd.

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

Equipment : Cylinder

Manufacturer : PYREX Class : A

Capacity : 50 ml Graduation : ml

ID No. : C-WW-011/23

Environment : Ambient Temperature : (20 ± 3) °CRelative 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 : Arceat 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 Uncertainty

211002 66-2001388-1 02 Jun 2024

National Institute of Metrology (Thailand) (NIMT)

Approved by :

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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CAL-F0031-03

CAL-F0031-03

Envilab Co.,Ltd. ผู้ให้บริการการสอบเทียบ

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 ± 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 (95%).
providing a level of confidence of approximately 95%

-o0o-

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 : Arscat 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 Jan 2024

National Institute of Metrology (Thailand) (NIM1)

Approved by

Signature

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 67-300147-5

Page : 2 of 2

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

111 Condition As-received : Good

Nominal Volume (ml)	Measuring Volume (ml)
250	250.57
500	500.25

Uncertainty of measurement with in ± 0.12 ml

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

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

-o0o-

Certificate of Calibration

Certificate No. : 67-300147-5

Page : 1 of 2

Submitted by : Envlab Co.,Ltd.

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

Equipment : Cylinder

Manufacturer : PYREX Class : A
Capacity : 500 ml Graduation : 5 ml
ID No. : C-WW-005/21Environment : 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 : Arcent 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

741002 66-260388-1 02 Jun 2024

National Institute of Metrology (Thailand) (NIMT)

Approved by

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 66-400622-1

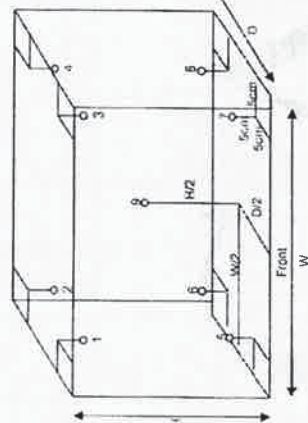
Page : 2 of 2

Result of Calibration : Without Adjustment

QUC Condition As-Received : Good

Function : Temperature measurement

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



Inside of Chamber
W = 0.18 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
			Measured Uniformity (°C)			Measured Stability (°C)			Overall Variation (°C)			
			4.0			0.44			0.03			0.82

Remarks 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%.

: 0/0 -

Certificate of Calibration

Certificate No. : 66-400622-1

Page : 1 of 2

Submitted by :

Envilab Co., Ltd.

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

Equipment :

Air Chamber (Refrigerator)

Manufacturer : M-LAB

Model : R1C-140

Range : N/A °C

Resolution : 0.1 °C

Serial No. : 1011

ID No. : ELABRODC14UN03

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 :

Pempoon Chumpu

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

31 Jan 2024

National Institute of Metrology (NIMT)

Approved by

Laboratory Manager

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Certificate of Calibration

Certificate No. : 66-400546-3

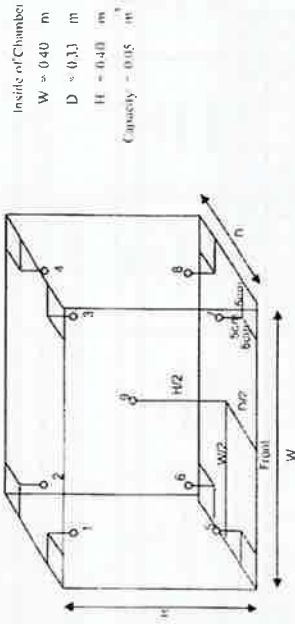
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

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



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	
85.0	85.0	85.0	85.7	85.8	85.3	85.6	84.9	84.7	84.5	84.3	85.0	0.73
104.0	104.0	104.0	104.7	105.1	104.3	104.6	104.4	104.2	104.1	103.7	104.6	0.74
183.0	183.0	183.0	180.8	181.6	180.7	181.6	179.9	181.2	179.2	179.7	179.7	1.1

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured			Overall Variation (°C)
			Uniformity (°C)	Stability (°C)	Variation (°C)	
85.0	85.0	85.0	1.1	0.2	1.9	
104.0	104.0	104.0	1.1	0.2	1.8	
183.0	183.0	183.0	2.2	0.4	2.9	

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%

- olo -

Approved by :

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 66-400546-3

Page : 1 of 2

Submitted by :

Envilab Co., Ltd.

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

Equipment :

Air Chamber (Oven)

Manufacturer : Binder

Model : ED 53

Range : N/A °C

Resolution : 0.1 °C

Serial No. : 13-02277

ID No. : ELARHAOVEN2277

Environment :

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

Ambient Temperature : (30.5 to 32.0) °C

Relative Humidity : (50 to 55) %

Line Voltage : (224.0 to 226.0) V

Date of Received : 03 October 2023

Date of Calibration : 03 October 2023

Date of Issue : 06 October 2023

Calibrated by : Penmon Chumpu

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. : 400029 & 400030

Cert. No. : 66-400227-1

Due Date : 24 Oct 2023

Incapability

National Institute of Metrology Thailand (NIMT)



Introduction

Customer Information

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



Agilent CrossLab Start Up Services

Agilent 5100 5110 ICP-OES Preventive Maintenance



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

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

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



Service Engineer's Responsibilities

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

Important Customer Web Links

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

Preparation

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

Instrument Maintenance

System Information

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

Instrument System Name and ID
Instrument System Site and Location

5110 VDI ICP-OES
Envulab Company Limited

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

- | | | |
|----|-----------------|--------------|
| 1. | G 8015 A | MY 17490002 |
| 2. | G 8410 A | 9U17393768 |
| 3. | G 8451 - 5000 Z | 1309 - 05327 |
| 4. | | |
| 5. | | |
| 6. | | |
| 7. | | |
| 8. | | |
| 9. | | |

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

SPS 3 Auto Sampler

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

SPS 4 Auto sampler

- ☐ Service not applicable
- ☒ Clean the spill tray, rack location mat, end frames and chassis with a damp soft cloth and diluted mild detergent
- ☒ 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 PFC 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

Preventive Maintenance Procedures

Record Pre-PM Instrument performance

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

Clean and inspect ICP-OES system

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

Agilent Water Recirculator

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

Restore Instrument

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

Service Review

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

ICP-OES adjustment

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

Record Post-PM instrument performance

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

ICP-OES Status Results Table

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

Measurement	Standby Mode	Plasma On
Mains Voltage	219.371	VAC 217.484
Mains Current	0.082	A 0.098
Instrument Temperature	23.5	°C 23.1
RF Ar Flow (sensor speed)	13.0	Hz 19.0
Plasma Exhaust Temperature	No measurement	°C 56.4
Water Flow Oscillator	No measurement	L/min 1.51
Water Flow Detector	1.09	L/min 1.06
Water Inlet Temperature	16.9	°C 16.3
Polychromator Temperature	36.0	°C 35.0
CCD Temperature	-39.6	°C -39.4
Thermal Stabilizer	65.0	°C 35.0
Argon Supply Pressure	619.13	kPa 500.32
Purge Gas Supply Pressure*1	616.63	kPa 593.43
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 195.1
RF Supply Current	No measurement	A 8.190
RF Supply Voltage	No measurement	V 194.557

*1 If option installed

Test Results

Instrument Performance Test Results Table

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

	Pre PM Sensitivity Check		Post PM Sensitivity Check	
	Radial	Axial*	Radial	Axial*
Zn 213.857 nm SRBR	1377.1	3382.6	2348.2	6124.9
Mn 257.610 nm SRBR	5945.3	16145.3	10764.1	39073.2
Al 396.152 nm SBR	7.0	16.3	8.5	25.3
K 766.491 nm SBR	0.2	67.3	4.7	83.6

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

Instrument Test Results Table

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

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

Signature Page

Service Engineer Comments (optional)

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

Service Verification

Service Request Number:
6006121636

Service Engineer Name:
Kanyaworn S.

Service Engineer Signature:
Kanyaworn S.

Total number of pages in this document:
14

Date Service Completed:
31 May 2023

Customer Name:
Kanyaworn S.

Customer Signature:
Kanyaworn S.

Consumed PM Parts

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

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

☐ Section Not Applicable

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

Pass

Resolution Test

Element Wavelength	Specification	Width
N (174.213 nm)	≤ 9.40	6.72
As (188.980 nm)	≤ 8.20	6.49
C (193.027 nm)	≤ 11.50	8.01
Mo (202.032 nm)	≤ 8.20	6.43
Cr (206.198 nm)	≤ 13.40	8.50
Zn (213.857 nm)	≤ 8.70	7.16
Pb (220.353 nm)	≤ 9.50	7.51
Co (228.615 nm)	≤ 17.20	11.32
Ba (230.424 nm)	≤ 9.40	7.80
Mn (257.610 nm)	≤ 13.30	9.78
Mn (260.568 nm)	≤ 20.30	13.88
Cr (267.716 nm)	≤ 11.00	9.09
Cu (324.754 nm)	≤ 25.00	18.88
Cu (327.395 nm)	≤ 14.20	12.41
Sr (338.071 nm)	≤ 33.50	24.27
Ba (455.403 nm)	≤ 44.00	34.07
Sr (460.733 nm)	≤ 36.00	22.56
Ba (493.408 nm)	≤ 36.00	27.79
Ba (614.171 nm)	≤ 42.00	27.97
Ar (675.283 nm)	≤ 74.00	62.41
K (766.491 nm)	≤ 80.00	65.95

Report Summary

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

Result Summary

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

Subsystem Communications Test

Pass

Optics Test

Pass

	Radial	Axial
Intensity	339/602	2923418
Wavelength	737.212	737.212

Prochlon 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

Sensitivity Test

Pass

Radial

Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 46.0	SRBR	108.0	934.0	64.8
Se (196.026 nm)	≥ 41.0	SRBR	110.2	1159.4	93.6
Zn (213.857 nm)	≥ 1421.0	SRBR	2348.2	23551.0	99.8
Pb (220.353 nm)	≥ 46.0	SRBR	98.7	1075.1	98.0
Mn (257.610 nm)	≥ 35.8.0	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)	≥ 5 C	SBR	25.7	268775.7	10073.7
Ba (493.408 nm)	≥ 50.0	SBR	293.9	8244793.3	27957.8
K (766.491 nm)	≥ 24.0	SBR	83.6	3030541.1	35817.8

Gas Flows Test

Pass

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

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

RF Generator Test

Pass

RF Power Supply Test	Passed
RF Power Supply (V)	147.418

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

Camera Test

Pass

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

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	Kanyakom 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:			
Air Flow Test	Pass		
Water Flow Test	Pass		
Gas Flows Test	Pass		
RF Generator Test	Pass		
Camera Test	Pass		
Optics Test	Skipped		
Advanced Valve System Test	Skipped		
Resolution Test	Skipped		
Sensitivity Test	Skipped		
Precision Test	Skipped		
Subsystem Communications Test			
Pass			
Air Flow Test			
Pass			
30% Air Flow (relative speed)			
12.00			
75% Air Flow (relative speed)			
18.00			
Water Flow Test			
Pass			
RF Water Flow (L/min)			
Camera Water Flow (L/min)			
Water Inlet Temperature (°C)			
1.45			
1.06			
16.78			



PinAAcle 900F Preventive Maintenance Report

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

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

Part Number	Release	Publication Date
09370145 Rev 9	A	January 2018

Scope
The purpose of this PM is to ensure the continued functionality of the PinAAcle 900F by inspecting and reducing 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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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 EDT Drive	1	03030997
N1016045	As System 2 EDT	1	16148
N3050121	Cu Lumina HCL	1	092216-010130
N3050109	Ba Lumina HCL	1	102416-040160
N4050139	K Lumina HCL	1	110716-010060
N3050152	Ni Lumina HCL	1	100516-030190

Component List

Component / Specific Model	Serial #	Configuration Notes

Parts Lists

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

Additional Reagents and Standards Required for PM			
Part Number (if applicable)	Description	Quantity	Expired Date (MM/YY)
N9300183	1,000 mg/L Copper Standard	AR	27-86CLY1
			30-Jan-2024

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



EnviroLab Co.

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

Procedure Checklist

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

1. General:

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

2. PC Instrument Software:

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

3. Mechanical:

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

4. Electrical:

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

5. Optics:

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

6. Gasses:

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

Additional Comments

Additional Comments Regarding the PM

Review

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

This PinAAcle 900F Passes ☒ 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>132531</i>	Date 05-Oct-2023 (DD-MMM-YYYY)

8.4 D₂ Background Compensation with Copper

Description: Verifies the instrument's 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

Component List

Component / Specific Model	Serial #	Firmware Version	Configuration Notes

Parts Lists

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

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

Atomic Absorption/FIAS 100/400 Preventive Maintenance (PM)				
Company Name:	ENVILAB CO., LTD			
Address (Instrument Location):	5-0-5-0/1, SOI BANGKHAE 7, BANGKHAE, BANGKOK, 10160,			
Room Number:	-			
Asset Number (if applicable):		Customer System ID:	K.JENJIRA	
Service Engineer Name:	K DUANG	Service Order Number:	-	
Date PM Performed: (DD-MM-YYYY)	05-Oct-2023	Next PM Due Date: (DD-MM-YYYY)	05-Apr-2024	

Part Number	Release	Publication Date	
09370005	C	January 2013	 PerkinElmer

Scope

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

The customer should save their method before the PM begins.

General Instructions:

Always check with the customer before making any changes that may affect the customer's analysis or calibration.

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

Update the PM sticker and instrument logbook as required.

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4. Cell, Cell Windows, Transfer Line:

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

5. Operational Tests:

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

6. Review:

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

Procedure Checklist

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

1. General:

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

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

NO

☒ Visual Damage (if yes, describe)

NO

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

2. Instrument components

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

3. Mixing/Separation Assembly & Pump Tubing:

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

Document History

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

Additional Comments

Additional Comments Regarding the PM

Review

The preventive maintenance checks and if applicable performance tests for FIAS 100/400 have been completed.

This FIAS 100/400 Passes ☒ Fails ☐ the preventive maintenance.

Review of Preventive Maintenance:

Authorized Perkin Elmer Representative:	Ally	Date: 05-Oct-2023 (DD-MMM-YYYY)
Authorized Customer Representative:	192837	Date: 05-Oct-2023 (DD-MMM-YYYY)



PerkinElmer Co

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		191.70	232.00	324.75	553.56
Standard 1	MG2-358	0.9203	0.8992	0.9078	0.9653

The uncertainty of the given absorbance values is ± 0.002 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		
SLM mode UV/VIS	Fix	SLT UV/VIS	1 nm
Integration time UV/VIS	5 s		
SLM mode NIR	Servo	SLT NIR	Servo
Integration time NIR	5 s	Gain	2

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

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

Serial Number: 101N0089015

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

Date / Time: 1/14/2015

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

SK PG-1530 S/N 00038 Calibration Date 05/22/2014 National Research Council of Canada Calibration Report No. PAR 2014.3162

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

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

Signature: Cam Le Horvat

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

End of Report



PerkinElmer

PerkinElmer TruQ

PerkinElmer Number: N9300183
Element and Matrix: 100 µg/mL Copper in 2% HNO₃
Starting Material: Copper Metal
Starting Material Lot No.: 00201C
Density: 1.012 g/mL @ 20 °C
Lot No.: 26-8/CUY1
Certification Date: JUL - - 2022
Expiration Date: JAN 30 2024

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

Element	µg/mL	Element	µg/mL	Element	µg/mL	Element	µg/mL
Ag	0.002	Dy	<0.001	Li	<0.005	Pt	<0.001
Al	<0.003	Er	<0.001	Lu	<0.001	Re	<0.001
As	<0.002	Eu	<0.001	Mg	<0.002	Rh	<0.001
Au	<0.002	Fe	<0.004	Mn	<0.001	Ru	<0.001
B	<0.002	Ga	<0.001	Mo	<0.001	Sb	<0.001
Ba	<0.001	Ge	<0.001	Na	0.05	Se	<0.001
Be	<0.001	Gr	<0.002	Nb	<0.001	Si	<0.001
Bi	<0.001	Hf	<0.001	Nd	<0.001	Sm	<0.001
Ca	0.006	Hg	<0.001	P	<0.1	Sn	<0.001
Cd	<0.001	Ir	<0.001	Pb	0.001	Sr	<0.001
Ce	<0.001	K	<0.1	Pd	<0.001	Ta	<0.001
Co	<0.001	La	<0.001	Pr	<0.001	Tb	<0.001
Cs	<0.001					Ti	<0.001
						Tl	<0.001
						Tm	<0.001
						U	<0.001
						V	<0.001
						W	<0.001
						Y	<0.001
						Yb	<0.001
						Zn	<0.005
						Zr	<0.001

Traceability Documentation for Solution Standard:

Certified Value: 100.1 µg/mL ± 5 µg/mL (refer to side 2)

Certified Value is Traceable to: NIST SRM #3114

Classical Wet Assay: 100.0 µg/mL

Method: EDTA titration, end point PAN as indicator, EDTA standardized against Pb(NO₃)₂, NIST SRM #928

Instrument Analysis using ICP Spectrometer: 30.1 µg/mL

via NIST SRM #3114

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

Certifying Officer

Y. Parikh
Yogesh Parikh, Senior Spectroscopist

Secondary Spectrometric Calibration Standards

Certificate of Calibration

Ordinate Calibration

Calibration Data by Secondary Calibration Standards

Wavelength / Absorbance	Number	Ordinate Reading (Absorbance) at the following wavelengths:			
Wavelength		153.7C	324.76	653.55	765.49
Standard 1	MGO-252	1.27±1	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

Ordnate mode	Absorbance	
SIR mode UV/VIS	FX	SIR UV/VIS
Integration time UV/VIS	5 s	1 nm
SIR mode NIR	Servo	SIR NIR
Integration time NIR	5 s	Gain
		Servo
		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:

01N0099015

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

2/1/2014

Date / Time

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

NTR-PK1-1920 model filter set SIN 00398 Calibration Date 05/23/2014 NRC Calibration Report No. PAR 2014 3162

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

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

Operator: Cam Le Hovath

Signature:

PerkinElmer LAS, Inc., 110 Blydenwood Avenue, Shelton, CT 06484-4794, USA

Printed Report



CERTIFICATE OF COMPLETION

This is to certify that

Duang Hiransuk

has completed the course

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

26 October 2018

Vinny Maharaj - Sr. Manager Service Training

Date

Certified by

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



PerkinElmer Co., Ltd.



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

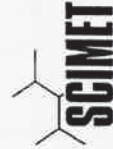
Date

Certified by

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



EnviLab Co. Ltd.



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



Certificate No.: C07240032 Page 2 of 3

Certificate No. C07240032

Calibration Results:
Without Adjustment

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

Standard Wavelength (nm)	Unit Under Calibration (nm)	Correction (nm)	Uncertainty of Measurement (\pm nm)
219.73	220.0	-0.27	0.14
241.55	241.8	-0.25	0.16
287.56	287.8	-0.04	0.14
333.77	333.7	0.07	0.19
360.45	360.1	0.35	0.14
417.59	417.0	0.60	0.14
472.50	472.3	0.20	0.14
513.47	513.4	0.07	0.14
528.88	528.9	-0.02	0.14
537.18	537.1	0.08	0.14
641.58	642.3	-0.72	0.16
740.72	741.3	-0.58	0.14
748.55	749.1	-0.55	0.14
807.03	807.4	-0.37	0.14
879.28	879.0	0.28	0.14

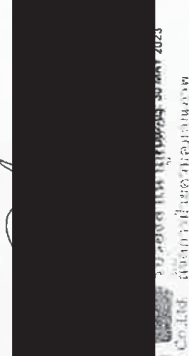
Photometric Accuracy (Absorbance)

Wavelength	Standard absorbance (Abs)	Unit Under Calibration (Abs)	Correction (Abs)	Uncertainty of Measurement (\pm Abs)
235 nm	0.0000 0.7293	0.0000 0.7273	0.0000 0.0020	0.0080 0.0080
257 nm	0.0000 0.8497	-0.0003 0.8457	0.0003 0.0040	0.0080 0.0080
313 nm	0.0000 0.2833	0.0004 0.2810	-0.0004 0.0023	0.0080 0.0080
450 nm	0.0000 0.6209	0.0001 0.6259	-0.0001 0.0050	0.0080 0.0080

บริษัท สยามเมทริกซ์ จำกัด (SCIMET CO., LTD.)

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

Person in charge



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 the Expression of Uncertainty in Measurement (GUM).

Those 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.

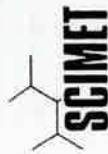
The Method used
In-house method, W107, based on ASTM E 275-08 and ASTM E 387-04

Traceability

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

The standard for Wavelength Certificate No. 108691 and 108692

The standard for Photometric Certificate No. 109010, 114655 and 109009



Statements of conformity:

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

The error of temperature determined during calibration are under given measurement and environmental conditions and considering the expanded measurement uncertainty (coverage probability 95%) within the specification. The given measurement uncertainty already includes other all effects by according to the standard method. ASTM E 275-08 and ASTM E 387-04. Therefore, those parameters have not been assessed separately.

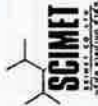
Tolerance and Decision rules:

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

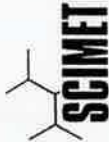
Decision rule : ☐ Choice A Binary Statement for Simple Acceptance Rule ($w \neq 0$). Specific Risk $\leq 50\%$ PFA.

☒ Choice B Non-binary statement with guard band ($w = 1$ U). Pass or Fail Specific Risk $\leq 2.5\%$ PFA and Cumulative Pass or Cumulative Fail Specific Risk $\leq 10\%$ PFA.

☐ Choice C Customer defined. Customers may define arbitrary multiple of r to have applied as guard band ($w = 1$ U).
PFA – Probability of False Accept



Authorized signatory



Calibration Results:
Without Adjustment

Photometric Accuracy (Absorbance)				
Wavelength	Standard absorbance (Abs)	Unit Under Calibration (Abs)	Correction (Abs)	Uncertainty of Measurement (\pm Abs)
420 nm	0.0000	0.0000	0.0000	0.0045
	0.2373	0.2366	-0.0013	0.0045
	0.6817	0.6837	0.0020	0.0045
	0.7382	0.7382	0.0010	0.0045
440 nm	1.0550	1.0542	0.0008	0.0045
	0.0000	0.0000	0.0000	0.0045
	0.2335	0.2354	-0.0019	0.0045
	0.6513	0.6539	-0.0026	0.0045
465 nm	0.7230	0.7222	0.0008	0.0045
	1.0324	1.0343	-0.0019	0.0045
	0.0000	0.0000	0.0000	0.0045
	0.2126	0.2143	-0.0017	0.0045
546.1 nm	0.5036	0.5059	-0.0023	0.0045
	0.6735	0.6729	0.0006	0.0045
	0.9615	0.9638	-0.0023	0.0045
	0.0000	0.0000	0.0000	0.0045
590 nm	0.2201	0.2213	-0.0012	0.0045
	0.5176	0.5196	-0.0020	0.0045
	0.6930	0.6925	0.0005	0.0045
	0.9908	0.9925	-0.0017	0.0045
635 nm	0.0000	0.0000	0.0000	0.0045
	0.2443	0.2452	-0.0009	0.0045
	0.5530	0.5544	-0.0014	0.0045
	0.7186	0.7185	0.0001	0.0045
	1.0301	1.0316	-0.0015	0.0045
	0.0000	0.0000	0.0000	0.0045
	0.2646	0.2651	-0.0005	0.0045
	0.5370	0.5384	-0.0024	0.0045
	0.6862	0.6872	-0.0010	0.0045
	0.9822	0.9855	-0.0033	0.0045

The End of Certificate



Without Adjustment

Refer to Certificate No.: C07240032

Page: 3 of 3

Photometric Accuracy (Absorbance)

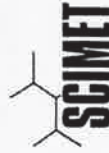
Wavelength	Unit Under Calibration	Correction	Guard Band (w)	Tolerance (±)	Conformity
420 nm	0.0000	0.0000	0.0045	0.015	Pass
	0.2386	-0.0013	0.0045	0.015	Pass
	0.5637	-0.0020	0.0045	0.015	Pass
	0.7382	0.0010	0.0045	0.015	Pass
	1.0542	0.0008	0.0045	0.015	Pass
440.1 nm	0.0000	0.0000	0.0045	0.015	Pass
	0.2354	0.0010	0.0045	0.015	Pass
	0.5639	-0.0028	0.0045	0.015	Pass
	0.7222	0.0008	0.0045	0.015	Pass
	1.0343	-0.0019	0.0045	0.015	Pass
465 nm	0.0000	0.0000	0.0045	0.015	Pass
	0.2143	-0.0017	0.0045	0.015	Pass
	0.5059	-0.0023	0.0045	0.015	Pass
	0.6729	0.0006	0.0045	0.015	Pass
	0.9638	-0.0023	0.0045	0.015	Pass
546.1 nm	0.0000	0.0000	0.0045	0.015	Pass
	0.2213	-0.0012	0.0045	0.015	Pass
	0.5196	-0.0020	0.0045	0.015	Pass
	0.6925	0.0005	0.0045	0.015	Pass
	0.8925	-0.0017	0.0045	0.015	Pass
590 nm	0.0000	0.0000	0.0045	0.015	Pass
	0.2452	-0.0009	0.0045	0.015	Pass
	0.5544	-0.0014	0.0045	0.015	Pass
	0.7195	0.0001	0.0045	0.015	Pass
	1.0316	-0.0015	0.0045	0.015	Pass
635 nm	0.0000	0.0000	0.0045	0.015	Pass
	0.2851	-0.0005	0.0045	0.015	Pass
	0.5394	-0.0024	0.0045	0.015	Pass
	0.6872	-0.0010	0.0045	0.015	Pass
	0.9855	-0.0033	0.0045	0.015	Pass

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

The End of Statements of Conformity

บริษัท สยาม สเคมิท จำกัด (SCIMET CO., LTD.)

1194 Soi Wachetansathit 57, Bangkok, Prakhong, Bangkok 10260 Thailand
Email: scimet2022@gmail.com, Tel: 02 460 9239



Refer to Certificate No.: C07240032

Page: 2 of 3

Without Adjustment

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

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

Photometric Accuracy (Absorbance)

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

บริษัท สยาม สเคมิท จำกัด (SCIMET CO., LTD.)

1194 Soi Wachetansathit 57, Bangkok, Prakhong, Bangkok 10260 Thailand
Email: scimet2022@gmail.com, Tel: 02 460 9239

Certificate of Calibration

Certificate No. : 67-430012-1

Page : 2 of 2

Result of Calibration :

UUC Condition As-Received : Good

Function : Conductivity measurement

Before Adjustment

Standard	UUC Reading	Correction	Uncertainty (k=1)	Unit
Conductivity Solution				
84.00	102.2	-18.2	1.1	µS/cm
141.3	103.8	0.375	0.0051	mS/cm
12.88	12.66	0.22	0.051	mS/cm
80.00	80.54	-0.54	0.21	mS/cm
111.8	106.7	5.1	0.41	mS/cm

After Adjustment : at 84.1413 µS/cm, 12.880, 80.11180 mS/cm

Standard	UUC Reading	Correction	Uncertainty (k=1)	Unit
Conductivity Solution				
84.00	84.00	0.00	1.1	µS/cm
141.3	141.3	0.000	0.0051	mS/cm
12.88	12.88	0.00	0.051	mS/cm
80.00	80.00	0.00	0.21	mS/cm
111.8	111.8	0.0	0.41	mS/cm

Remark

UUC : Unit Under Calibration

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

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

Date :

Approved by

(Suneechai Promthong)

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%.

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

Certificate of Calibration

Certificate No. : 67-430012-1

Page : 1 of 2

Submitted by :

EnviLab Co., Ltd.

540.540/1 Soi Bangkhne7, Bangkok, Bangkok 10160

Equipment :

Digital Conductivity meter with probe

Manufacturer : Hama

Model : HI 98192

Serial No. : G0026637

ID No. : FLAHC-0NH198191

Electrode

Model : HI763133

Serial No. : TH107212

ID No. : ELARCON1198191

Environment :

Ambient Temperature (25 ± 2) °C

Relative Humidity (50 ± 15) %

Date of Received :

20 March 2024

Date of Calibration :

22 March 2024

Date of Issue :

25 March 2024

Calibrated by :

Permpoo Chantap

Calibration Method :

This instrument was calibrated by in-house method direct measurement by conductivity buffer solution

Reference Standard Instruments :

This certification is traceable to the International System of Units

Standard Buffer Solution

Material	Lot No.	Exp. Date	Traceability
84 µS/cm	7854	16 June 2025	National Institute of Standards and Technology (NIST), U.S.A., S.R.M.
141.3 µS/cm	7781	01 May 2027	National Institute of Standards and Technology (NIST), U.S.A., S.R.M.
12.88 mS/cm	7455	18 February 2027	National Institute of Standards and Technology (NIST), U.S.A., S.R.M.
80.0 mS/cm	7602	01 March 2027	National Institute of Standards and Technology (NIST), U.S.A., S.R.M.
111.8 mS/cm	7610	04 April 2027	National Institute of Standards and Technology (NIST), U.S.A., S.R.M.

Date :

Certificate of Calibration

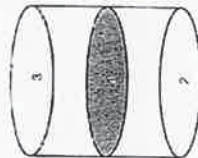
Certificate No. 67-400054-2

Result of Calibration Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

Page : 2 of 2



Front

Test Point	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) @ Sensor No.			Uncertainty (± °C)	Measured Uniformity (°C)	Measured Stability (°C)	Sterilizing Time (minute)	Pressure Gauge Reading (MPa)
			1	2	3					
121	121	121	121.4	121.4	121.4	1.0	1.0	0.5	1.5	0.11

Remarks

1. UUC : Unit Under Calibration

2. Pressure Gauge reading are out of accreditation's scope.

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

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

- o0o -



Approved by

(Surachai Prunthong)

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 67-400054-2

Submitted by :

Envilab Co., Ltd.

540,540/1 Soi Bangkokhae7, Bangkokhae, Bangkok 10160

Equipment :

Autoclave

Manufacturer : Tonny

Model : SX-500

Range : N/A °C

Resolution : 1 °C

Serial No. : 55133094

ID No. : N/A

Environment :

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

Ambient Temperature : (30.0 to 31.0) °C

Relative Humidity : (50 to 55) %

Line Voltage : (224.0 to 225.0) V

Date of Received :

01 February 2024

Date of Calibration :

01 February 2024

Date of Issue :

03 February 2024

Calibrated by :

Penmpoon Champu

Calibration Method :

This instrument was calibrated by in-house method CAL-M4007 based on

BS 2646 Part 1 : 2021

The temperature scale used was based on ITS-90

Reference Standard Instruments :

This certification is traceable to the International System of Units

Standard Temperature Data Logger with RTD pt 100

ID No.

Traceability

Due Date

400039

66-400707-1

27 Jun 2024

National Institute of Metrology Thailand (NIMT)

400040

66-400707-2

27 Jun 2024

National Institute of Metrology Thailand (NIMT)

400041

66-400707-3

27 Jun 2024

National Institute of Metrology Thailand (NIMT)



Approved by

(Surachai Prunthong)

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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Primary Test Results

I. Downflow Velocity Test

Test equipment used

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

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



Back		Front	
0.35	0.36	0.35	0.34
0.33	0.35	0.35	0.34

Characteristics of downflow velocities

Mean downflow velocity inside the product protection	0.35	0.36	0.33	0.38	0.42
: 0.25 m/s - 0.50 m/s. All measurements should be within ±20 % of mean values.					

Result Summary : Pass



CERTIFICATION OF TEST REPORT

Equipment : Biological Safety Cabinet (Class II)
Manufacturer : Heal Force
Model : HF-FC1200LC
Serial Number : EX042011LCS497
Identification Number : ELABMICROBSC01
Report Number : B224051
Issued Date : 1 March 2024
Job Number : B224051
Page : 1 of 7

Customer : ENVILAB CO.,LTD. (HEAD OFFICE)
540, 540/1 Soi Bangkhue 7, Bangkhue, Banghuae, Dang 10160

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

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

Test By : Mr.Achira Kaeprajoon
Test Date : 29 February 2024
Due Date : 28 February 2025
Test Procedure : EN 12469: 2000 Biotechnology performance criteria for microbiological safety cabinet
AS 1907.23: 2000 Determination of intensity of radiation from germicidal ultraviolet lamp

Traceability : Velocity test is traceable to TAT Certificate Number : TTH-0-86850
Leak test of HEPA filter is traceable to WK Certificate Number : WK2109-176-1
Illumination test is traceable to SP Certificate Number : SP21030030-1
Ultraviolet Radiation test is traceable to EEI Certificate Number : CO20230085EA
Sound test is traceable to SP Certificate Number : SPK23030030-2

This calibration certificate documents the traceability to national standards, which realize the unit of measurement according to the International System of Units (SI).
This certificate may not be reproduced other than in full except with the prior written approval of the Air Flow Calibration Company Limited.

Authorized Signatory

AIR FM - SV - 08 : 01 Sep 2021





3. Leak Test of HEPA Filters

Test equipment used

- Aerosol Photometer ● Brand: ATI ● Model: 2H
- Serial number: 20627 ● Calibration due: 20-Sep-2024
- Aerosol Generator ● Brand: ATI ● Model: 6C
- Serial number: 20554 ● Calibration due: -

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

Characteristic of PAO test

	34	µg/l
	0.001	%
	0.001	%

Main HEPA Filter

Leak position

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



2. Inflow Velocity Test

Test equipment used

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

Exhaust Measurement

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



1.29	1.28	1.29	1.31	1.32	1.31	1.32	1.31	1.32	1.32
------	------	------	------	------	------	------	------	------	------

Characteristic of air velocities in the work opening

Mean inflow velocity to achieve product protection : ≥ 0.40 m/s	0.40
--	------

Result Summary : Pass

Adjustments Required

Fan speed ☒ No Change ☐ Dampet ☐ No Change



5. Site Installation

- S.1 Suck Alarm
- S.2 Interlocks
- S.3 Exhaust System Alarm

Pass
N/A
N/A

6. Soap Solution

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

Result Summary : Absence of soap bubbles: N/A

Secondary Test Results

7. Illumination Test

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

Test equipment used

- Lux meter
- Brand: Dali
- Model: LM507
- Serial number: 130042151013
- Calibration due: 2-Mar-2024



Back			
819	923	944	1049
Front			

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

Result Summary : Pass



Exhaust HEPA Filter

Leak positions									

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

Result Summary : Pass

4. Airflow Patterns

Test equipment used

Smoke Generator

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

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

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

Result Summary :

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

CAL

Calibratech Co., Ltd.

2108/7 Moo 5, Sukapraditsakul 2 Rd., Bangpaed, Pathumthani 11120
(Tel:02) 964 6211 Fax: (02) 964 5155, email : calibratech.co.ltd@airflow.com, calibratech.co.ltd@gmail.com



AIRFLOW CALIBRATION CO., LTD.

Certificate of Calibration

Certificate No. : 67-300021-2

Submitted by : Livelihood Co., Ltd.

Page : 1 of 2

510, 510/1, Soi Bangkhong, Bangkhong, Bangkok 10760

Equipment : Piston Pipette

Manufacturer : Sartorius

Model : N/A

Serial No. : 4535801028

Capacity : 100 µl to 1000 µl

Resolution : 5 µl

Environment : Ambient Temperature : $(20 \pm 3) ^\circ\text{C}$

Relative Humidity : $(55 \pm 10) \%$

Air Pressure : $(1007.9 \text{ to } 1008.1) \text{ mbar}$

Date of Received : 18 January 2024

Date of Calibration : 20 January 2024

Date of Issue : 20 January 2024

Calibrated by : Wipa Towadee

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

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

Electronic Balance

ID No. : CEN_No

Traceability

241003 : 66-200388-2

02 Jun 2024 National Institute of Metrology (Thailand) (NIMT)

Approved by :

Super vision

The uncertainties are for a confidence probability of approximately 95%

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CAL00031-03

Calibratech Co., Ltd. 510, 510/1, Soi Bangkhong, Bangkok 10760



AIRFLOW CALIBRATION CO., LTD.

Continuation of the Certificate of Test Report Number : B224031

Page 7 of 7 Pages

8. Ultraviolet Radiation Test

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

Test equipment used

● UVC Light Meter ● Brand: Lutron ● Model: UVC-254SD
● Serial number: Q833539 ● Calibration due: 26-Sep-2024



Back			
2100	2920	3350	1960
Front			

Ultraviolet radiation where UV lamps are fitted, the intensity of radiation at a wave length of 254 nm shall be at least 400 mW/m² when measured at the work floor surface.

Result Summary : Pass

9. Sound levels Test

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

Test equipment used

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

* Sound pressure level of the background: 50.6 dBA
* Sound levels: 59.2 dBA

Result Summary : Pass

End of Certificate of Test Report

AIR PM - SV - 08 - 01 Sep 2021

51/04 Moo 9, Ladawan, Lumutka Phraumhai 1150 Thailand
Tel : 0 2155 8350 - 0 2157 8346 - 0 2157 8070 08 4369 2258 - 09 2245 317

http://www.airflow-calibration.com E-mail : kwan@airflow-cal.com

Calibratech Co., Ltd. 510, 510/1, Soi Bangkhong, Bangkok 10760

CAL

Calibratech Co., Ltd.

7/106-7 Moo 2, Sukhaphrachasun 3 Rd., Bangpood, Pakkred, Nonthaburi 11120
Tel: (02) 964-6211 Fax: (02) 964-5155 e-mail: calibratech.co@yahoocom, calibratech.co@hotmail.comNSG-TIS-1157/0224
CALIBRATION 0030

Certificate of Calibration

Page : 1 of 2

Certificate No. : 67-400101-1

Submitted by : Envilab Co., Ltd.

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

Equipment :

Temperature controlled enclosure (Incubator)

Manufacturer : Memmert

Model : IF 110

Range : N/A °C

Resolution : 0.1 °C

Serial No. : D419.0525

ID No. : ELABINCUBA1UK1

Environment :

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

Ambient Temperature : (23.0 to 24.0) °C

Relative Humidity : (50 to 55) %

Line Voltage : (223.0 TO 225.0) V

Date of Receipt : 20 February 2024

Date of Calibration : 20 February 2024

Date of Issue : 22 February 2024

Calibrated by : Komsak Kiatan

Calibration Method : CAL-M4004, ILAS 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.

400046 & 400042 67-400047-1

Traceability

National Institute of Metrology Thailand (NIMT)

Due Date

25 Jul 2024

Approved by

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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

CAL-F0031-03

Envilab Co., Ltd.

ผู้ให้บริการมาตรฐานการ

CAL

Calibratech Co., Ltd.

7/106-7 Moo 2, Sukhaphrachasun 3 Rd., Bangpood, Pakkred, Nonthaburi 11120
Tel: (02) 964-6211 Fax: (02) 964-5155 e-mail: calibratech.co@yahoocom, calibratech.co@hotmail.com

Certificate of Calibration

Certificate No. : 67-300021-2

Page : 2 of 2

Result of Calibration : Without Adjustment

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

Setting Volume (μl)	Measuring Volume (μl)	e_s (μl)	η_s (%)	S_p (μl)	C_V (%)	Uncertainty ($\pm \mu\text{l}$)	Coverage Factor (k)
100	99.47	-0.53	0.53	0.10	0.10	3.1	2.00
500	498.36	-1.64	0.33	0.06	0.01	3.2	2.00
1000	997.93	-2.07	0.21	0.07	0.01	3.3	2.00

Note : e_s : Systematic error (μl), η_s : Relative systematic error (%) S_p : Standard deviation (μl), C_V : Coefficient of variation (%)

The formula used to convert weighing values into volume is

$$V_{\text{as}} = M \times Z$$

 V_{sp} is the water volume at standard temperature of 20 °C M is the balance reading of delivered water Z is the combined factor for buoyancy correction and conversion from mass to volume

UUC Condition As-Received : Good

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

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

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

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MIRACLE INTERNATIONAL TECHNOLOGY CO., LTD
214 Banguek Rd. Bangaei Bangkok 10160
Tel. (0-2) 655-4047-8 Fax (0-2) 655-4659 <http://www.mit.in.th>



CALIBRATION CERTIFICATE

Certificate No. : S2024080486-0001
Date Issued : 27-Aug-24

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

Equipment : Hydro Water Bath

Manufacturer : LAUDA

Model : -

Serial No. : CN21001882

ID No./Tag No. : F1ABWBALPHA241

Date Received : 23-Aug-24

Date Calibrated : 23-Aug-24

Calibrated by : Akaladej Numtuan

Calibration Method or Calibration Procedure Used

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

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

Result of Calibration

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

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

Approved by:

Sorayuth T.
(Sorayuth Tochua)



CAL

Calibratech Co., Ltd.

7106-7 Moo 2, Sukkaprachasri 3 Rd., Banggood, Pakkred, Nonthaburi 11120
Tel.(02) 961-6211 Fax.(02) 964-5155 e-mail : calibratech_cal@ yahoo.com, calibratech_cal@hotmail.com

Certificate of Calibration

Certificate No. : 67-400101-1

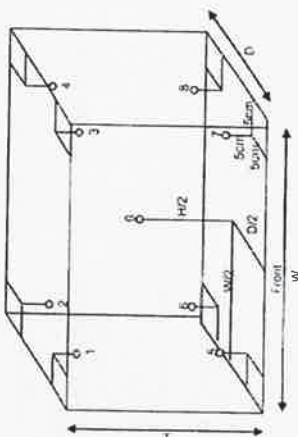
Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

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

Inside of Chamber
W = 0.56 m
D = 0.48 m
H = 0.40 m
Capacity = 0.11 m³



Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) @ Sensor No.									Uncertainty (± °C)
			1	2	3	4	5	6	7	8	9	
35.0	35.0	35.0	35.00	35.10	35.16	35.14	35.15	35.14	35.03	35.00	35.12	0.30
37.0	37.0	37.0	37.01	37.11	37.17	37.15	37.16	37.15	37.04	37.01	37.13	0.30
Test Point (°C)			Indicating Temperature (°C)		Measured Uniformity (°C)		Measured Stability (°C)		Overall Variation (°C)			
35.0			35.0		0.1		0.0		0.2			
37.0			37.0		0.1		0.0		0.2			

Remarks The uncertainty is not combine uniformity of the air chamber

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

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

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Certificate No. : S20240804R6-0001

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

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

Without adjustment

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

Decision Rule with Guard Band

Calibration Temperature (°C)	Pass / Fail	MPE
44.5	Pass	0.2

Pass = $|\text{error} + |\text{uncertainty}| \leq |\text{MPE}|$
Fail = $|\text{error} + |\text{uncertainty}| > |\text{MPE}|$
Note : Probe No. 5 is Reference Probe



Condition As-Received : Used Item

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

Measurement Standards Used & Traceability :

The International System of Units (SI) through
MIT Certificate No. L202403007-0010 for Digital Thermometer with Probe (Agilent) Module I (73) NTC, Pt1000 Serial No. MY44024042, Due 10-Sep-24

- Notes : 1 The temperature stability is the one-half of greatest maximum difference of measured temperatures at any one probe.
2 The temperature uniformity is the maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time.
3 Overall variation is the difference of maximum and minimum measured temperatures throughout observation time.
4 The uncertainty of measurement is included temperature stability.

End of Certificate

