

The page is decorated with various tropical leaves. In the top left, there is a large Monstera leaf with characteristic splits and a palm frond. On the left side, there is a smaller palm frond. On the right side, there is a small, narrow leaf. In the bottom right corner, there is a large Monstera leaf and a palm frond. In the bottom left corner, there is a small, rounded leaf.

เอกสารผลการสอบเทียบ เครื่องมือตรวจวัด



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



Envilab & Needless Supply Instrument

Verification Test Report

Report No.:

SO2300038-E014 -SLM 01

☒ PM ☐ Onsite UTM : 47P 1514458 654247

Calibrated Date: 1 December 2023

Site : บริษัท เอ็นไวแล็บ

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 44

Serial : 1842

Environment: Temperature 25 °C Humidity 62 %RH

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

Serial No.1351075

Date of Calibration : 16 March 2023

Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.78	93.65	-0.13	93.78

Calibrated By:

Date:

Approve By:

Date:

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รับรองสำเนาถูกต้อง
ผู้จัดการฝ่ายควบคุมคุณภาพ



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



Envilab & Needles Supply Instrument

Verification Test Report

Report No.:

SO2300038-E014 -SLM 02

☒ PM ☐ Onsite UTM : 47P 1514458 654247

Calibrated Date: 1 December 2023

Site : บริษัท เอ็นไวแล็บ

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 44

Serial : 1821

Environment: Temperature 25 °C Humidity 62 %RH

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

Serial No.1351075

Date of Calibration : 16 March 2023

Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.78	93.72	-0.06	93.78

Calibrated By:

Date:

Approve By:

Date:

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ผู้จัดการฝ่ายควบคุมคุณภาพ

CERTIFICATE OF CALIBRATION

ISSUED BY **Pulsar Instruments Plc**

DATE OF ISSUE **29 June 2023**

CERTIFICATE NUMBER **194449**



Pulsar Instruments Plc
Acoustic House
Bridlington Road
Hunmanby
North Yorkshire
YO14 0PH
United Kingdom

Page 1 of 2

Approved signatory

T. Goodrich

Electronically signed:

Sound Level Meter : IEC 61672-3:2013

Instrument information

Manufacturer: **Pulsar Instruments Plc**
Model: **Model 44**
Serial number: **PN1821**
Class: **2**
Firmware version: **2.6.0.328**

Notes:

Test summary

Date of calibration: **29 June 2023**

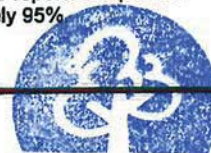
The calibration was performed respecting the requirements of ISO/IEC 17025:2017.
Periodic tests were performed in accordance with procedures from IEC 61672-3:2013.

The sound level meter submitted for testing successfully completed the class 2 periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed.

However, no general statement or conclusion can be made about conformance of the sound level meter to the full specifications of IEC 61672-1:2013 because (a) evidence was not publicly available, from an independent testing organisation responsible for pattern approvals, to determine that the model of sound level meter fully conformed to the class 2 specifications in IEC 61672-1:2013 or correction data for acoustical test of frequency weighting were not provided in the Instruction Manual and (b) because the periodic tests of IEC 61672-3:2013 cover only a limited subset of the specifications in IEC 61672-1:2013.

Notes

This certificate provides traceability of measurement to the SI system of units and/or to units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory. The results within this certificate relate only to the items calibrated. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $k=2$, providing a coverage probability of approximately 95%.



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ผู้จัดการฝ่ายควบคุมคุณภาพ

CERTIFICATE OF CALIBRATION

ISSUED BY Pulsar Instruments Plc

DATE OF ISSUE 28 June 2023 CERTIFICATE NUMBER 194448



Pulsar Instruments Plc
Acoustic House
Bridlington Road
Hunmanby
North Yorkshire
YO14 0PH
United Kingdom

Page 1 of 2

Test engineer:

D.Swalwell

Electronically signed:

Microphone

Microphone capsule

Manufacturer: Pulsar Instruments

Model: PM2

Serial Number: 022540E

Calibration procedure

Date of calibration: 28 June 2023

Open circuit: 50.3 mV/Pa

Sensitivity at 1 kHz: -26.0 dB rel 1 V/Pa

The microphone capsule detailed above has been calibrated to the published data as described in the operating manual of the associated sound level meter (where applicable).

The frequency response was measured using an electrostatic actuator in accordance with BS EN 61094-6:2005 with the free-field response derived via standard correction data traceable to a National Measurement Institute.

The absolute sensitivity at 1 kHz was measured using an acoustic calibrator conforming to IEC 60942:2003 Class 1.

Environmental conditions

Pressure: 100.70 kPa

Temperature: 21.0 °C

Humidity: 69.0 %



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ผู้จัดการฝ่ายควบคุมคุณภาพ



Service Report

Instrument Manufacturer: Pulsar Instruments Plc

Job Reference Number: 84203

Instrument Type: Model 44

Serial Number: PN1821

Customer Name: Neediss Supply Instrument Co., Ltd.

Customer Address: 536, Soi Bangkhae 7

Bangkhae

Thailand

10160

Issue	Action	Result	Engineer
Recal & repair LCD problem and microphone failure. Keypad top right key failure, incorrect pre amp s/n programmed 1768. Actually fitted s/n 1899.	Reprogrammed correct pre amp s/n. New PM2 microphone s/n 022540E fitted. Replaced "blotchy" display. Replaced the keypad.	Recal ok tag	Terry Goodrich

Engineer:

T. A. Goodrich

Date: 29 June 2023

We hope that you are satisfied with the service you have received from Pulsar Instruments plc.
If you have any concerns, would like further information or have any feedback do not hesitate to contact us.

Pulsar Instrument Plc, Acoustic House, Bridlington Road, Hunmanby, YO14 0PH

Telephone: +44 (0) 1723 518011 Fax: +44 (0) 1723 518043

Email: sales@pulsarinstruments.com



Envilab Co., Ltd.



รับรองสำเนาถูกต้อง
ผู้จัดการฝ่ายควบคุมคุณภาพ



**ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT**

975 Moo 4, Bangpoo Industrial Estate, Soi 8, Sukhumvit Road km 37,

Phraek Sa, Mueang Samut Prakan, Samut Prakan 10280

Tel: +66 2709 4860 Fax: +66 2324 0917



Certificate No.: CP20230179EA

Operation No.: CP2023030029

Certificate of Calibration

Equipment: Sound Level Meter

Manufacturer: Pulsar Instruments Plc

Model/Type: 44 (Meter), PM2 (Microphone), PA40 (Preamplifier)

Serial No.: PN1842 (Meter), 022722D (Microphone), 1769 (Preamplifier)

ID No.: NSMPUMD44N1842

Customer: Envilab Co., Ltd.

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

Received Date: 16 March 2023

Calibrated Date: 29 March 2023 - 4 April 2023

Issued Date: 5 April 2023

Calibrated by: Ms. Juntaporn Kunhakom

Approved by: _____

(Mr. Sittichai Swaksuriyawong)
Group Manager

This report was prepared electronically using applicable electronic signature. Printing or copy of file are considered as a copy of the document.

The reported uncertainty of measurement was based on standard uncertainty multiplied by a coverage factor (k) providing a level of confidence of approximately 95%. This certificate may not be reproduced other than in full except with the prior written approval of the Electrical and Electronics Institute, Foundation for Industrial Development.



Certificate No.: CP20230179EA

Calibration Report

Equipment: Sound Level Meter
Manufacturer: Pulsar Instruments Plc
Model/Type: 44 (Meter), PM2 (Microphone), PA40 (Preamplifier)
Serial No.: PN1842 (Meter), 022722D (Microphone), 1769 (Preamplifier)
ID No.: NSMPUMD44N1842
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 15) %
Pressure: (101.3 ± 1.5) kPa
Method of Calibration :-
IEC 61672-3:2013.

Condition of this result of calibration

1. Reference standards instrument :-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Standard microphone	4180	2787490	AA-1024-22	6 November 2023
2) Arbitrary Function Generator	AFG2021	C010063	CK20220059EA	19 June 2023
3) Programmable Attenuator	PA5	2755	EF-0034-22	30 October 2023
4) 6.5 Digit precision multimeter	8846A	9610014	CB20220223EA	14 November 2023
5) Pressure humidity and Temperature Transmitter	PTU301	F0640002	CL1-P230024 CD20220164EA	20/3/20224 24 July 2023
6) Performance Audio Analyzer	U8903B	MY56510003	CB20230038EA CK20220080EA	14 February 2024 8 September 2023

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

3. This certification is traceable to the international system of unit maintained at :-

Reference standards instrument for Acoustic function

- National Institute of Metrology (Thailand)

Reference standards instrument for Electrical function

- National Institute of Metrology (Thailand)

- Electrical and Electronics Institute; NSC Accredited Calibration No.0119

Result of Calibration:-

Function : 1. Indication at the calibration check frequency

Reference Acoustic Signal (dB)	Measured value (dB)	Deviation (dB)	Acceptance limits (dB)
-	-	-	-

Certificate No.: CP20230179EA

Calibration Report

Function : 2. Self-generated Noise

2.1 Microphone Installed

Measured value (dB)
17.0

2.2 Microphone replaced by the electrical input signal device

Frequency Weighting	Measured value (dB)
A-weighting	Under-range
C-weighting	18.1
Z-weighting	26.6

Function : 3. Acoustical signal tests of frequency weightings (Without Windscreen)

Meter free-field acoustic response at a level of 84 dB.

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve			
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance limits (dB)
125	0.5	0.3	0.3	±1.5
1000	0.3	0.3	0.4	±1.0
8000	1.0	1.0	0.9	±5.0

Function : 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve			
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance limits (dB)
63	0.0	0.0	0.0	±2.0
125	0.0	-0.1	0.0	±1.5
250	0.0	-0.1	0.0	±1.5
500	0.0	-0.1	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.1	0.1	0.1	±2.0
4000	0.1	0.1	0.1	±3.0
8000	0.4	0.4	0.3	±5.0

Function : 5. Frequency and time weighting at 1 kHz

5.1 Frequency weighting at 1 kHz

Frequency Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
C-weighting	94.0	0.0	±0.2
A-weighting	94.0	0.0	±0.2
Z-weighting	94.0	0.0	±0.2

Certificate No.: CP20230179EA

Calibration Report

5.2 Time weighting at 1 kHz

Time Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	94.0	0.0	±0.1
Slow	94.0	0.0	±0.1
LAeq	94.0	0.0	±0.1

Function : 6. Long-Term Stability

Long-term stability over 30 minutes, with steady 1 kHz signal at reference level.

Time Period to Apply Signal (min)	Reference SPL (dB)	Record SPL at Conclusion of Time Period (dB)	Deviated value (dB)	Acceptance limits (dB)
30	94.0	94.0	0.0	±0.3

Function : 7. Level Linearity on the reference level range

7.1 Level Linearity on the reference level range, Upper

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±1.1
99.0	99.0	0.0	±1.1
104.0	104.0	0.0	±1.1
109.0	109.0	0.0	±1.1
114.0	114.0	0.0	±1.1
119.0	119.0	0.0	±1.1
124.0	124.0	0.0	±1.1
129.0	129.0	0.0	±1.1
134.0	134.0	0.0	±1.1

7.2 Level Linearity on the reference level range, Lower

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1

Certificate No.: CP20230179EA

Calibration Report

7.2 Level Linearity on the reference level range, Lower (Cont.)

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	38.8	-0.2	±1.1
34.0	33.8	-0.2	±1.1
29.0	28.9	-0.1	±1.1

Function : 8. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	200	136.0	0.0	±1.0
	2	118.9	-0.1	+1.0 ; -2.5
	0.25	109.8	-0.2	+1.5 ; -5.0
Slow	200	129.6	0.0	±1.0
	2	110.0	0.0	+1.0 ; -5.0
LAE	200	130.0	0.0	±1.0
	2	110.0	0.0	+1.0 ; -2.5
	0.25	100.9	-0.1	+1.5 ; -5.0

Function : 9. Peak C sound level

Number of cycles in test signal	Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Complete cycle	135.4	135.1	-0.3	±3.0
Positive half cycle	134.4	134.1	-0.3	±2.0
Negative half cycle	134.4	134.1	-0.3	±2.0

Function : 10. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limits (dB)
Positive one-half cycle	Negative one-half cycle		
142.8	142.8	0.0	±1.5

Certificate No.: CP20230179EA

Calibration Report

Function : 11. High-Level Stability

High-level stability over 5 minutes, with steady 1 kHz signal, 1 dB below upper boundary.

Time Period to Apply Signal (min)	Reference SPL (dB)	Record SPL at Conclusion of Time Period (dB)	Deviated value (dB)	Acceptance limits (dB)
5	139.0	139.0	0.0	±0.3

Uncertainty of measurement

Function	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1) Indication at the calibration check frequency	0.30	Not applicable
2) Self-generated Noise	0.10	Not applicable
3) Acoustical signal tests of frequency weightings - Free-field sound pressure response level	0.30	0.60 (10Hz to 4kHz) 0.70 (>4kHz to 10kHz)
4) Electrical signal tests of frequency weightings	0.20	0.20
5) Frequency and time weighting at 1 kHz	0.20	0.20
6) Long-Term Stability	0.10	0.10
7) Level Linearity on the reference level range	0.30	0.30
8) Tone burst response	0.20	0.30
9) Peak C sound level	0.20	0.35
10) Overload indication	0.20	0.25
11) High-Level Stability	0.10	0.10

- Remarks:
1. Indication at the calibration check frequency can not measured because customer does not provide a sound calibrator.
 2. The acceptance limit is for the deviated value.
 3. Acceptance limits was IEC61672-3:2013 Class 2.
 4. The coverage factor $k = 2.00$

-- End of Report --

CAL

Calibratech Co.,Ltd.

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

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



NSC-TISI-TIS17025
CALIBRATION 0030

Certificate of Calibration

Certificate No. : 66-400056-1

Page : 1 of 2

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

Equipment : Water Bath
Manufacturer : Memmert Model : WNB29
Range : N/A °C Resolution : 0.1 °C
Serial No. : L617.0156 ID No. : ELABWBWNB29N01

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

Ambient Temperature : (22.5 to 23.0) °C

Relative Humidity : (45 to 50) %

Line Voltage : (224.0 to 225.0) V

Date of Received : 02 February 2023

Date of Calibration : 02 February 2023

Date of Issue : 04 February 2023

Calibrated by : Permpon Chanpu

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
400029 & 400031	65-400549-1	22 Apr 2023	National Institute of Metrology Thailand (NIMT)

Approved by :

(Bunjerd Masri)

Supervisor



Envilab Co., Ltd.

The Uncertainties are for a confidence probability of approximately 95%

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Calibratech Co.,Ltd.

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

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

Certificate of Calibration

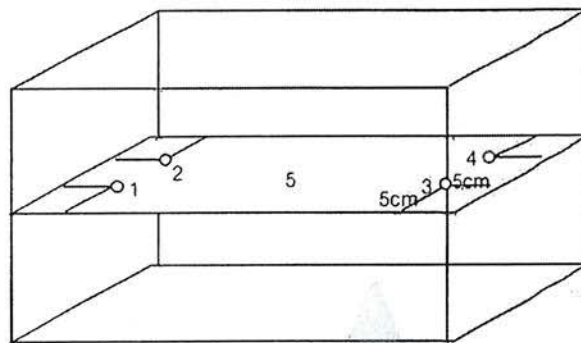
Certificate No. : 66-400056-1

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement



Front

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) @ Sensor					Uncertainty (± °C)	Measured Uniformity (°C)	Measured Stability (°C)
			No.							
			1	2	3	4	5			
95.0	95.0	95.0	95.41	95.41	95.68	95.62	95.57	0.22	0.33	0.10

Remark The uncertainty is not combine uniformity of the water bath

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

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

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3 : EQUIPMENT CALIBRATION AND TESTING SERVICES

534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250

TEL. 0-2717-3000 FAX. 0-2719-9484

Cert.No.: 23TW79

Page.: 1 of 2

Certificate of Testing

Equipment : DO Meter
Manufacturer : Hanna
Model : HI9146-04
Serial No. : G00007931
ID No. : ELABDOHI914601
Received Date : 17 March 2023
Test Date : 20 March 2023
Reference : 2303-0651DN-1
Submitted by : Envilab Co.,Ltd (Head office)
540, 540/1 Soi Bangkhae 7,
Bangkhae, Bangkhae, Bangkok 10160
Laboratory Condition : Temperature (25 ± 5) °C
Humidity (50 ± 20) %
Test Procedure : In - house method : CP-CH9
by Comparison Technique with Azide Modification Method
Tested by : Walalak Sirithean

Approved by :

Malee

Approved Signatory

- (/) Malee Butkruea
() Saithip Meangmai
() Warakorn Lerngagtrakul

Issue Date :

23 March 2023



Envilab Co.,Ltd.

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ผู้จัดการฝ่ายควบคุมคุณภาพ

B 0310344



Cert.No.: 23TW79

Page.: 2 of 2

Condition of this result of calibration

1. Reference Standard Instruments :

This certification is traceable to the International System of Unit through the reference standards laboratory of Industrial Calibration Center, Technology Promotion Association (Thailand-Japan).

<u>Instruments</u>	<u>Serial No.</u>	<u>ID No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1) Burette	-	130BU10	21CG1389	25 Mar 2023
2) Balance	1126143764	140RC004	22MM50	20 Sep 2023

2. Standard Material :-

<u>Material</u>	<u>Manufacturer</u>	<u>Lot.No.</u>	<u>Assay</u>
Sodium Thiosulfate pentahydrate	Merck	AM1763316	100.2%

Result : Dissolved Oxygen Meter Adjustment With Air 100 %

Dissolved Oxygen Probe No.: KC1A01TAF

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.14	8.16	0.0084

This report was certified only for the instrument we tested. It is allowable to use for study the system efficiency, The environmental impact control and present to organization it may concerned. Intend to use for advertising and referral purpose is prohibited. This report may not be reproduced other in full, without written approval of the laboratory

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ผู้จัดการฝ่ายควบคุมคุณภาพ

Malu.

a 1154259

CAL

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



NSC-TISI-TIS17025
CALIBRATION 0030

Certificate of Calibration

Certificate No. : 66-400546-2

Page : 1 of 2

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

Equipment : Air Chamber (Incubator)
Manufacturer : M-LAB Model : BIC-140
Range : N/A °C Resolution : 0.1 °C
Serial No. : 100613-0 ID No. : ELABBODC140N02

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 : Permpon Chanpu

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

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

ID No.	Cert. No.	Due Date	Traceability
400029 & 400043	66-400226-1	27 Oct 2023	National Institute of Metrology Thailand (NIMT)

Approved by :

(Surachai Promthong)

Laboratory Manager



The Uncertainties are for a confidence probability of approximately 95%

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Calibratech Co.,Ltd.

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

Certificate of Calibration

Certificate No. :66-400546-2

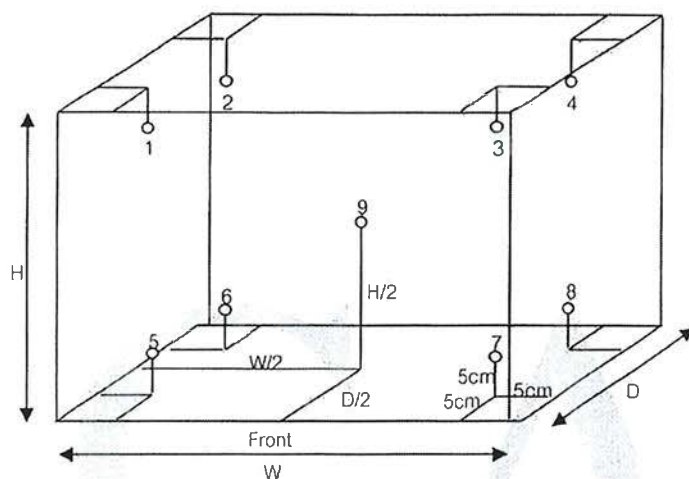
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

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



Inside of Chamber

W = 0.38 m

D = 0.35 m

H = 1.15 m

Capacity = 0.15 m³

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) @ Sensor No.									Uncertainty (± °C)
			1	2	3	4	5	6	7	8	9	
20.0	20.0	20.0	19.71	19.66	19.71	19.77	20.28	20.22	20.26	19.90	20.27	0.33

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
20.0	20.0	20.0	0.64	0.04	0.65

Remark The uncertainty is not combine uniformity of the air chamber

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

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

- o0o -



EnviLab Co.,Ltd.

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QUALITY CALIBRATION CO.,LTD.

235 Petchkasem 63/2 Road, Laksong, Bangkhae, Bangkok 10160

Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584

www.qcalibration.com

CERTIFICATE No : 23T3851

REFERENCE No : 68967-2

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : COD TESTER
MANUFACTURER : HANNA
MODEL : HI839800
SERIAL No : 6480043101
ID No : ELABH183980002
SUBMITTED BY : ENVILAB CO.,LTD.
540, 540/1 SOI BANGKHAE 7, BANGKHAE,
BANGKHAE, BANGKOK 10160

CALIBRATED BY : CHAICHARN CH.

CALIBRATION DATE : 03-May-23

APPROVED BY : PONGSAK J.

ISSUED DATE : 04-May-23

RECEIVED DATE : 03-May-23



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F-G010 REV : 02



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CERTIFICATE No.: 23T3851

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : COD TESTER
MANUFACTURER : HANNA
ID NUMBER : ELABH183980002
RECEIVED DATE : 03-May-23
AMBIENT TEMPERATURE : $31^{\circ}\text{C} \pm 1^{\circ}\text{C}$
MODEL : H1839800
SERIAL NUMBER : 6480043101
CALIBRATION DATE : 03-May-23
RELATIVE HUMIDITY : $55\% \text{RH} \pm 10\% \text{RH}$

CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED BY DIRECT MEASUREMENT METHOD WITH CALIBRATED THERMOCOUPLE TYPE K UNDER NO LOAD CONDITION. THE THERMOCOUPLES WERE PLACED ON POINTS AND LOCATED AS THE PICTURE.

2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) DATA LOGGER WITH TC TYPE K	HYDRA 2635A	7903007	22T7508	10-Jul-23

3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.

4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.

5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH QUALITY CALIBRATION CO.,LTD.

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT



TEMPERATURE MEASUREMENT ACCURACY TEST

Controller temperature ($^{\circ}\text{C}$)		150.0
Indicating Temperature		150.0
Measured Temperature ($^{\circ}\text{C}$) at Spread Locations	1	151.4
	2	151.7
	3	151.6
	4	151.6
	5	150.7
	6	152.2
	7	152.1
	8	152.4
	9	151.7
	10	151.9
	11	153.4
	12	153.6
	13	153.7
	14	153.9
	15	152.2
	16	151.8
	17	153.0
	18	152.9
	19	153.0
	20	152.0
	21	151.7
	22	152.2
	23	152.0
	24	152.3
	25	151.4
Uncertainty of Measurement ($\pm^{\circ}\text{C}$)		1.7

NOTE 1 : THE UNCERTAINTY OF MEASUREMENT EXCLUDED TEMPERATURE UNIFORMITY OF THE CHAMBER.

NOTE 2 : LOCATION 10 WAS REFERENCE LOCATION.

NOTE 3 : THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA.

THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR $k=2$, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT



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F-G010 REV 3.2

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Certificate of Calibration

Certificate No. : 66-410024-1

Page : 1 of 2

Submitted by : Envilab Co., Ltd.

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

Equipment : Digital Thermo-Hygrometer

Manufacturer : Jedto

Model : HTC-1

Range Temperature : N/A °C

Resolution : 0.1 °C

Range Humidity : N/A %R.H.

Resolution : 1 %R.H.

Serial No. : PONPE5852094

ID No. : ELABTMHTC10003

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

Relative Humidity : (50 ± 15) %

Date of Received : 08 March 2023

Date of Calibration : 09 March 2023

Date of Issue : 09 March 2023

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
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400034 & 400036	SG-H-00021/66	11 Jul 2023	Success Gateway Co., Ltd., Accredited by TISI Calibration No.0268
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Approved by :

(Bunjeđ Masri)

Supervisor



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Certificate of Calibration

Certificate No. : 66-410024-1

Page : 2 of 2

UUC Condition As-Received : Good

Result of Calibration : Without Adjustment

Function : Temperature measurement

Reference Humidity @ 50 %R.H.

Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
25.01	25.0	0.0	0.46

Result of Calibration : Without Adjustment

Function : Humidity measurement

Reference Temperature @ 25 °C

Standard Humidity (%R.H.)	UUC Reading (%R.H.)	Correction (%R.H.)	Uncertainty (± %R.H.)
50.00	49	1	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%

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B



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NSC-TISI-TIS17025
CALIBRATION 0030

Certificate of Calibration

Certificate No. : 66-430010-1

Page : 1 of 2

Submitted by : Envilab Co., Ltd.

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

Equipment : Digital Conductivity meter with probe

Manufacturer : Horiba Model : F-74BW-G

Serial No. : B41J0001 ID No. : ELABPHHB74BW01

Electrode

Model : 3552 Serial No. : 3G1J0088

ID No. : ELABPHHB74BW01

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

Ambient Temperature (23.8 to 24.8) °C

Relative Humidity (54 to 57) %

Date of Received : 23 March 2023

Date of Calibration : 23 March 2023

Date of Issue : 24 March 2023

Calibrated by : Bunjerd Masri

Calibration Method : In-house method CAL-M4301 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
25 µS/cm	879326	13 March 2024	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
147 µS/cm	879327	13 March 2024	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
1413 µS/cm	879328	13 March 2024	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
12.88 mS/cm	879329	14 March 2024	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025

Approved by :

(Bunjerd Masri)

Supervisor



The Uncertainties are for a confidence probability of approximately 95%

Envilab Co.,Ltd.

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Certificate of Calibration

Certificate No. : 66-430010-1

Page : 2 of 2

Result of Calibration :

UUC Condition As-Received : Good

Function : Conductivity measurement

Before Adjustment

Standard Conductivity Solution	UUC Reading	Correction	Uncertainty (±)	Unit
25.0	56.0	-31.0	0.20	µS/cm
147.0	122.0	25.0	2.1	µS/cm
1.413	1.329	0.084	0.0090	mS/cm
12.88	12.77	0.11	0.082	mS/cm

After Adjustment : at 25.00, 147, 1413 µS/cm 12.880 mS/cm

Standard Conductivity Solution	UUC Reading	Correction	Uncertainty (±)	Unit
25.0	25.0	0.0	0.20	µS/cm
147.0	147.0	0.0	2.1	µS/cm
1.413	1.413	0.000	0.0090	mS/cm
12.88	12.88	0.00	0.082	mS/cm

Remark

UUC : Unit Under Calibration

* This parameter 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%

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NSC-TISI-TIS 17025
CALIBRATION 0030

Certificate of Calibration

Certificate No. : 66-300140-3

Page : 1 of 2

Submitted by : Envilab Co.,Ltd.

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

Equipment : Cylinder

Manufacturer : PYREX

Class : A

Capacity : 100 ml

Graduation : 1 ml

ID No. : C-WW-002/22

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

Relative Humidity : (50 ± 15) %

Air Pressure : 1009.9 mbar.

Date of Received : 15 March 2023

Date of Calibration : 20 March 2023

Date of Issue : 20 March 2023

Calibrated by : Areerat Sombun

Calibration Method : In-house method CAL-M3001 based on ASTM E 542-01

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

Electronic Balance

ID No.

Cert. No.

Due Date

Tracability

241002

65-200370-1

02 Jun 2023

National Institute of Metrology (Thailand) (NIMT)

Approved by :

(Wipa Tovadee)

Supervisor



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Certificate of Calibration

Certificate No. : 66-300140-3

Page : 2 of 2

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

UUC Condition As-Received : Good

Nominal Volume (ml)	Measuring Volume (ml)
50	49.82
100	99.84

Uncertainty of measurement with in \pm 0.063 ml

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

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

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D.



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Certificate of Calibration

Certificate No. : 66-200066-2

Page : 1 of 2

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

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

Environment : On site calibration was carried out at the B304 Balance Room, Envilab Co., Ltd.
Ambient Temperature : (24.6 to 24.9) °C
Relative Humidity : (57.0 to 67.8) %
Air Pressure : 1015.0 mbar

Date of Received : 01 March 2023

Date of Calibration : 01 March 2023

Date of Issue : 04 March 2023

Calibrated by : Akaradath Thippichai

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

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

Standard Weights

ID No.	Cert. No.	Due Date	Traceability
E261-E2624	C02222345	10 Nov 2023	National Institute of Metrology (Thailand), (NIMT)

Approved by :

(Surachai Promthong)

Laboratory Manager



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Certificate of Calibration

Certificate No. : 66-200066-2

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Departure of indication from nominal value

Nominal Value (g)	Correction (g)	Uncertainty \pm (g)
0.1	0.00000	0.000014
0.5	0.00002	0.000022
1	0.00000	0.000026
2	0.00001	0.000034
5	-0.00001	0.000043
10	0.00000	0.000053
50	0.00004	0.00011
100	-0.0001	0.00020
150	-0.0001	0.00038
200	-0.0002	0.00038

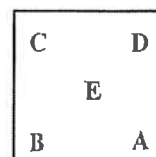
This result of calibration was found accurate as shown on date and place of calibration only.

This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2.07$, providing a level of confidence of approximately 95%

Eccentric error

Load test : 50 g

A B C D E
0.00000 0.00000 0.00001 0.00001 0.00000 g



Repeatability

Load test : 200 g

Stdev. : 0.000042 g

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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. : ELABHAOVEN2277

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

Ambient Temperature : (30.5 to 32.0) °C

Relative Humidity : (50 to 55) %

Line Voltage : (224.0 to 226.0) V

Date of Received : 03 October 2023

Date of Calibration : 03 October 2023

Date of Issue : 06 October 2023

Calibrated by : Permpon Chanpu

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

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

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

Approved by :

(Surachai Promthong)

Laboratory Manager



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Certificate of Calibration

Certificate No. : 66-400546-3

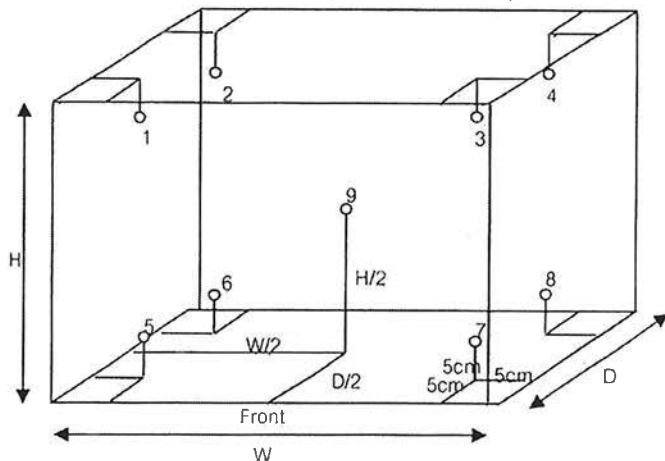
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

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



Inside of Chamber

W = 0.40 m

D = 0.33 m

H = 0.40 m

Capacity = 0.05 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	
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
180.0	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 Uniformity (° C)	Measured Stability (° C)	Overall 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
180.0	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%

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Certificate of Calibration

Certificate No. : 66-400156-2

Page : 1 of 2

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

Equipment : Air Chamber (Oven)
Manufacturer : Memmert
Model : UF 75
Range : N/A °C
Resolution : 0.1 °C
Serial No. : B319.0600
ID No. : ELABHAOVEN0600

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

Ambient Temperature : (30.0 to 30.8) °C

Relative Humidity : (60 to 65) %

Line Voltage : (224.2 to 225.2) V

Date of Received : 23 March 2023

Date of Calibration : 23 March 2023

Date of Issue : 25 March 2023

Calibrated by : Permpoon Chanpu

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

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

ID No.	Cert. No.	Due Date	Traceability
400029 & 400030	65-400548-1	26 Apr 2023	National Institute of Metrology Thailand (NIMT)

Approved by :

(Bunjerd Masri)

Supervisor



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Calibratech Co.,Ltd.

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

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

Certificate of Calibration

Certificate No. : 66-400156-2

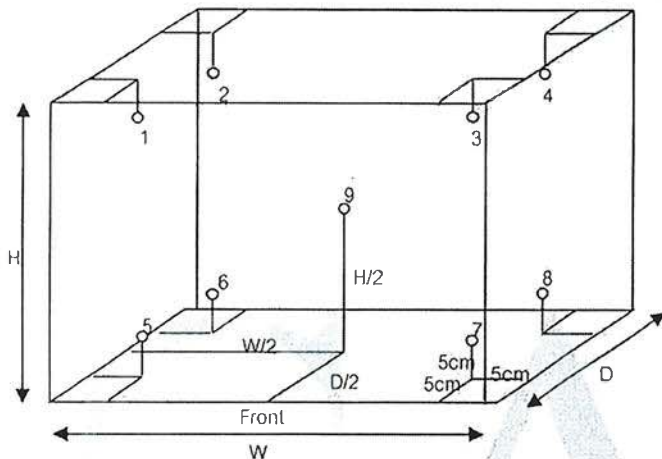
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

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



Inside of Chamber

W = 0.40 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	104.3	104.3	104.3	104.2	104.3	104.1	103.7	104.0	104.3	0.70
110.0	109.5	109.5	110.3	110.3	110.3	110.3	110.3	110.1	109.7	110.0	110.3	0.71
180.0	179.0	179.0	179.4	180.1	180.3	180.1	180.6	179.9	179.2	179.6	180.4	0.95

Test Point (° C)	Setting Temperature (° C)	Indicating Temperature (° C)	Measured Uniformity (° C)	Measured Stability (° C)	Overall Variation (° C)
104.0	103.5	103.5	0.7	0.1	0.8
110.0	109.5	109.5	0.8	0.1	1.0
180.0	179.0	179.0	1.4	0.2	1.5

Remark The uncertainty is not combine uniformity of the air chamber

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

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

- o0o -

B.



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ผู้จัดการฝ่ายควบคุมคุณภาพ



**QUALITY CALIBRATION CO.,LTD.**

235 Petchkasem 63/2 Road, Laksong, Bangkhae, Bangkok 10160

Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584

www.qcalibration.com



CERTIFICATE No.: 2313852

REFERENCE No.: 68967-3

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : REFRIGERATOR

MANUFACTURER : THERMO SCIENTIFIC

MODEL : PLR221

SERIAL No : 2210M319042801

ID No : ELABREFRIGEN02

CONDITION AS RECEIVED : USED ITEM

SUBMITTED BY : ENVILAB CO.,LTD.
540, 540/1 SOI BANGKHAE 7, BANGKHAE,
BANGKHAE, BANGKOK 10160

CALIBRATED BY : CHAICHARN CH.CALIBRATION DATE : 03-May-23APPROVED BY : 
PONGSAK J.ISSUED DATE : 04-May-23RECEIVED DATE : 03-May-23รับรองมาตรฐานถูกต้อง
ผู้จัดการฝ่ายควบคุมคุณภาพTHIS CERTIFICATE MAY NOT BE REPRODUCED OTHER THAN IN FULL EXCEPT WITH THE PRIOR WRITTEN APPROVAL OF
QUALITY CALIBRATION CO., LTD.

F-G010 REV : 02



QUALITY CALIBRATION CO.,LTD.

235 Petchkasem 63/2 Road, Laksong, Bangkoe, Bangkok 10160

Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584

CERTIFICATE No.: 23T3852

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : REFRIGERATOR
MANUFACTURER : THERMO SCIENTIFIC
MODEL : PLR221
ID No : ELABREFRIGEN02 S/N : 2210M319042801
RECEIVED DATE : 03-May-23 CALIBRATION DATE : 03-May-23
AMBIENT TEMPERATURE : 31 °C ± 1 °C RELATIVE HUMIDITY : 57 %RH ± 10 %RH

CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO TLA S/G-20 BY COMPARISON WITH CALIBRATED THERMOCOUPLE TYPE K UNDER NO LOAD CONDITION. THE THERMOCOUPLES WERE PLACED ON NINE POINTS AND LOCATED ONE THERMOCOUPLE IN EACH OF THE EIGHT CORNERS OF THE CHAMBER AND WAS AWAY FROM THE EACH WALL OF 5 cm TO 10 cm. AND PLACED THE NINTH THERMOCOUPLE WITHIN 2.5 cm. OF THE GEOMETRIC CENTER OF THE CHAMBER. THE UNIFORMITY WAS MEASURED BETWEEN REFERENCE PROBE AND OTHER PROBES AT THE SAME TIME.

2. REFERENCE STANDARD INSTRUMENTS :-

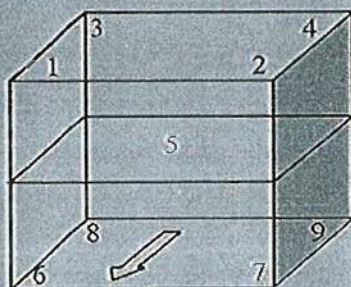
INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) DATA LOGGER WITH TC TYPE K	HYDRA 2635A	8009008	22T7511	10-Jul-23

3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.

4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.

5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH QUALITY CALIBRATION CO., LTD.

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT



FRONT

GENERAL INFORMATION

Overall Ambient Temperature around the Chamber (°C) variation : 2

Overall Line Voltage (V) variation : 0

Instrument Condition : Normal

CHAMBER PERFORMANCE

Controller Temperature (°C)	Indicating Temperature (°C)	Temperature Stability (±°C)	Temperature Uniformity (°C)	Overall Variation (°C)
4	4	1.59	2.96	5.39

TEMPERATURE MEASUREMENT ACCURACY TEST

Controller Temp (°C)	Indicating Temp (°C)	Measured Temperature (°C) at Spread Locations									Uncertainty (±°C)
		#1	#2	#3	#4	Ref. 5	#6	#7	#8	#9	
4	4	5.31	6.22	4.95	5.15	3.77	3.48	3.77	4.37	3.88	2.2

NOTE 1: THE UNCERTAINTY OF MEASUREMENT EXCLUDED TEMPERATURE UNIFORMITY OF THE CHAMBER.

NOTE 2: LOCATION 5 WAS REFERENCE LOCATION.

NOTE 3: THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA.

THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR k =2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT



Envilab Co., Ltd.

ผู้รับรองสำเนาถูกต้อง

ผู้จัดการฝ่ายควบคุมคุณภาพ

F-G010 REV : 02

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.



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Introduction

Customer Information

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



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/web/home>
- Videos about specific preparation requirements for your instrument can be found by searching the Agilent YouTube channel at <https://www.youtube.com/user/agilent>
- Need to place a service call? Flexible Repair Options | Agilent

Service Engineer's Responsibilities

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

Instrument Maintenance

System Information

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

Instrument System Name and ID	5110 VDU ICP-OES
Instrument System Site and Location	Envilab Company Limited

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

1. G 8016A
2. G 8410A
3.
4.
5.
6.
7.
8.
9.

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



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Preparation

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

Preventive Maintenance Procedures

Record Pre-PM instrument performance

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

Clean and inspect ICP-OES system

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

Agilent Water Recirculator

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

SPS 3 Auto Sampler

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

SPS 4 Auto sampler

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

AVS 4, 6, 7 Advanced Valve System

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

ICP-OES adjustment

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

Record Post-PM instrument performance

- ☒ Run Instrument Performance test
- ☒ Record results in Instrument Performance Test Results Table - Post PM
- ☒ For systems using ICP Expert version 7.3 and above, run the following Instrument tests

- ☒ Subsystem Communications Test
- ☒ Air Flow
- ☒ Water Flow
- ☐ Gas Flows
- ☐ RF Generator
- ☐ Camera Test
- ☒ Optics Test
- ☒ Nebulizer Test

- ☒ Record the result in the Instrument Test Results Table



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Restore Instrument

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

Service Review

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

Test Results

Instrument Performance Test Results Table

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

	Pre PM Sensitivity Check		Post PM Sensitivity Check	
	Radial	Axial*	Radial	Axial*
Zn 213.657 nm SRRR	1446.2	3961.3	2264.4	5922.0
Mn 257.610 nm SRRR	4831.9	14136.4	6478.6	13499.7
Al 396.152 nm SBR	5.9	14.9	8.1	19.8
K 766.491 nm SBR	5.2	75.8	5.6	77.2

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

Instrument Test Results Table

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

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

ICP-OES Status Results Table

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

Measurement	Standby Mode		Plasma On	
Mains Voltage	218.616	VAC	219.484	VAC
Mains Current	0.088	A	0.103	A
Instrument Temperature	21.8	°C	22.4	°C
RF Air Flow (sensor speed)	13.0	Hz	19.0	Hz
Plasma Exhaust Temperature	No measurement		54.8	°C
Water Flow Oscillator	No measurement		1.31	L/min
Water Flow Detector	1.09	L/min	1.06	L/min
Water Inlet Temperature	18.9	°C	18.3	°C
Polychromator Temperature	35.0	°C	34.9	°C
CCD Temperature	-39.6	°C	-39.5	°C
Thermal Stabilizer	35.0	°C	34.9	°C
Argon Supply Pressure	612.23	kPa	550.19	kPa
Purge Gas Supply Pressure*1	609.70	kPa	594.00	kPa
Option Gas Supply Pressure*1	-	kPa	-	kPa
Nebulizer Flow	No measurement		0.70	L/min
Nebulizer Back Pressure	No measurement		303.18	kPa
Plasma Gas Flow	No measurement		11.99	L/min
Auxiliary Gas Flow	No measurement		1.00	L/min
RF Power	No measurement		1198.7	W
RF Supply Current	No measurement		8.214	A
RF Supply Voltage	No measurement		194.576	V

*1 If option installed

Consumed PM Parts

Part Description	Part Number	Product or Model# where used	Quantity consumed
Axial Pre-Optic Window	G8010-68014	G8010A, G8011A, G8014A/G8015A	1
Radial Pre-Optic Window	G8010-68015	All	1
Agilent Cool Clear Coolant Fluid	5799-0037	Agilent Water Recirculator	-
Purge Gas Filler	G8010-60136	All	1
Air inlet filter	G8000-68002	All	1
High Capacity Air Filter	G8010-60189	Optional	-
Rotor seal for 6-7 port valve for AVS6/7	G8494-60002	G8404A/G8495	-
Rotor seal for 4 port valve for AVS4	G8493-60002	G8493A	-
Rinse solution to rinse station 2.5mm id x 1in	G8410-80123	SPS 4	-
Barb connector 2.5mm-1.5mm ID	G8410-80124	SPS 4	-
PVC waste tubing, 8mm od x 5mm id, 2m	G8410-80172	SPS 4	-
Additional Parts may be required from engineer's stock:			
X axis drive belt	541004/500	SPS 3	-
Z axis drive belt	541004/400	SPS 3	-
Pneumatic pump tubing, PVC SolvaFlex, 3 bridged,	3710049000	SPS 4	-

Consumed Parts Reference

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

1.) Section Not Applicable.

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

Service Verification

Service Request Number:

6005309412

Service Engineer Name:

Kanyakorn S.

Service Engineer Signature:

Kanyakorn S.

Total number of pages in this document:

14

Date Service Completed:

02 June 2022

Customer Name:

Savale C.

Customer Signature:

Savale C.

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.

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	02-Jun-22 12:07:14 PM		
Test Completed On	02-Jun-22 12:12:43 PM		
Subsystem Communications Test			
Air Flow Test	Pass		
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			

Agilent		Radial		Axial	
Intensity	3732264			3041677	
Wavelength	737.212			737.212	



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Element	Wavelength	Specification	Width
N	(174.213 nm)	≤ 9.40	6.92
As	(188.980 nm)	≤ 8.20	6.41
C	(193.027 nm)	≤ 11.50	8.11
Mo	(202.032 nm)	≤ 8.20	6.46
Cr	(206.159 nm)	≤ 13.40	8.74
Zn	(213.857 nm)	≤ 8.70	7.40
Pb	(220.353 nm)	≤ 9.50	7.67
Co	(228.615 nm)	≤ 17.20	11.53
Ba	(230.424 nm)	≤ 9.40	7.67
Mn	(257.610 nm)	≤ 13.30	9.78
Mn	(260.568 nm)	≤ 20.30	14.17
Cr	(267.716 nm)	≤ 11.00	8.96
Cu	(324.754 nm)	≤ 25.00	18.99
Cu	(327.395 nm)	≤ 14.20	12.32
Sr	(338.071 nm)	≤ 33.50	24.47
Ba	(455.403 nm)	≤ 44.00	33.57
Sr	(460.733 nm)	≤ 36.00	22.90
Ba	(493.408 nm)	≤ 36.00	27.36
Ba	(614.171 nm)	≤ 42.00	28.54
Ar	(675.293 nm)	≤ 74.00	61.89
K	(766.491 nm)	≤ 80.00	66.27

Radial

Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 46.0	SRBR	120.9	1011.2	61.7
Se (196.026 nm)	≥ 41.0	SRBR	105.8	1093.4	90.0
Zn (213.857 nm)	≥ 1421.0	SRBR	2264.4	24492.0	115.9
Pb (220.353 nm)	≥ 46.0	SRBR	102.1	1134.5	102.2
Mn (257.610 nm)	≥ 3518.0	SRBR	6478.6	196673.9	913.0
Al (396.152 nm)	≥ 3.4	SBR	8.1	36739.9	4028.4
Ba (493.408 nm)	≥ 34.0	SBR	123.4	1396546.2	11229.2
K (766.491 nm)	≥ 1.8	SBR	5.6	96663.7	14753.5

Axial

Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 208.0	SRBR	322.0	4628.7	190.0
Se (196.026 nm)	≥ 159.0	SRBR	288.3	5343.5	305.4
Zn (206.200 nm)	≥ 234.0	SRBR	309.6	3308.1	106.9
Zn (213.857 nm)	≥ 1743.0	SRBR	5922.0	119344.4	403.4
Cd (214.439 nm)	≥ 4227.0	SRBR	4839.9	71577.5	217.4
Pb (220.353 nm)	≥ 320.0	SRBR	412.9	7912.4	336.6
Mn (257.610 nm)	≥ 10625.0	SRBR	17999.7	1252685.0	4806.4
Cr (267.716 nm)	≥ 1048.0	SRBR	5188.3	203333.0	1513.2
Cu (324.754 nm)	≥ 19.0	SBR	60.1	369203.2	6040.7
Al (396.152 nm)	≥ 6.0	SBR	19.8	257169.6	12334.3
Ba (493.408 nm)	≥ 60.0	SBR	266.7	8912441.0	33294.2
K (766.491 nm)	≥ 24.0	SBR	77.2	3013664.7	38559.1

Radial

Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 2.60	0.97
Se (196.026 nm)	≤ 2.60	1.30
Zn (213.857 nm)	≤ 1.50	0.41
Pb (220.353 nm)	≤ 2.60	0.82
Mn (257.610 nm)	≤ 1.50	0.46
Al (396.152 nm)	≤ 1.50	0.29
Ba (493.408 nm)	≤ 1.50	0.67
K (766.491 nm)	≤ 1.50	0.23

Axial

Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 1.50	0.55
Se (196.026 nm)	≤ 1.50	0.40
Zn (206.200 nm)	≤ 1.50	0.37
Zn (213.857 nm)	≤ 1.50	0.50
Cd (214.439 nm)	≤ 1.50	0.34
Pb (220.353 nm)	≤ 1.50	0.39
Mn (257.610 nm)	≤ 1.50	1.20
Cr (267.716 nm)	≤ 1.50	0.38
Cu (324.754 nm)	≤ 1.50	0.40
Al (396.152 nm)	≤ 1.50	0.41
Ba (493.408 nm)	≤ 1.50	0.99
K (766.491 nm)	≤ 1.50	0.54

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	02-Jun-22 12:13:54 PM		
Test Completed On	02-Jun-22 12:26:36 PM		
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			
Air Flow Test			
36% Air Flow (relative speed)	75% Air Flow (relative speed)	Pass	
13.00	18.00		
Water Flow Test			
Camera Water Flow (L/min)	Water Inlet Temperature (°C)	Pass	
RF Water Flow (L/min)			
1.49	18.51		

Nebulizer Target Flow	Actual Flow	Back Pressure	Auxiliary Target Flow	Actual Flow	Back Pressure
10.70	0.70	300.66	2.00	1.99	91.37
Makeup Target Flow	Actual Flow	Back Pressure	Plasma Target Flow	Actual Flow	Back Pressure
2.00	2.00	93.50	18.00	17.93	22.57
RF Power Supply Test					
RF Power Supply (V)	Passed				
	147.408				
RF Oscillator Test					
RF Oscillator Frequency (MHz)	Passed				
	25.962				
Work Coil Current (A)	45.108				
RF Power Supply Current (A)	1.999				
Electronic Offset Test					
Integration Time (ms)	Standard Deviation				
1000	5.174				
Array Test	Passed				
5	0.015				
Linearity Test	Passed				
	0.123				

CAL

Calibratech Co.,Ltd.

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

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



Certificate of Calibration

Certificate No. : 66-420026-1

Page : 1 of 2

Submitted by : Envilab Co., Ltd.

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

Equipment : pH Meter with electrode

pH meter

Manufacturer : Horiba

Model : F-74BW-G

Range : N/A pH

Resolution : 0.001 pH

Serial No. : B41J0001

ID No. : ELABPHHB74BW01

Electrode

Model : 9615S

Serial No. : 9X1K0003

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

Ambient Temperature : (23.8 to 24.8)°C

Relative Humidity : (54 to 57) %

Date of Received : 23 March 2023

Date of Calibration : 23 March 2023

Date of Issue : 24 March 2023

Calibrated by : Bunjerd Masri

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-00473/64	27 Aug 2023	National Institute of Metrology Thailand (NIMT)

2. Standard Buffer Solution

pH	Cert. No.	Lot No.	Exp. Date	Traceability
4.008	61270213	879344	13 Mar 2025	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
6.986	61267169	879345	13 Mar 2024	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
10.010	61260481	879346	13 Mar 2024	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025

Approved by :

(Bunjerd Masri)

Supervisor



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

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



Certificate of Calibration

Certificate No. : 66-420026-1

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	4.00	177.5	0.0	0.12
	0.0000	7	7.00	0.0	0.0	0.086
	-177.4800	10	10.00	-177.6	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	4.006	0.002	0.0084
	6.986	7.000	-0.014	0.0094
	10.010	10.008	0.002	0.014

Remark

UUC : Unit Under Calibration

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

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

- ๐0๐ -



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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

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ผู้จัดการฝ่ายควบคุมคุณภาพ

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

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

Scope

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

The customer should save their method before the PM begins.

General Instructions:

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

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

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

Update the PM sticker and instrument logbook as required.

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Component List

Component / Specific Model	Serial #	Configuration Notes

Parts Lists

Parts Included with the PM		
Part Number (if applicable)	Description	Quantity
B050169b	Fan Filters	N/A
N311C0156	O-Ring Kits for Sampling Introduction (Stainless Steels Nebulizer)	N/A
N3160157	O-Ring Kits for Sampling Introduction (Plastic Nebulizer)	N/A
N9301714	Replacement Acetylene Filter Cartridge	N/A
TH001022	Replacement Air Filter Cartridge	N/A

Additional Reagents and Standards Required for PM			
Part Number (if applicable)	Description	Quality	Batch/Lot #
N9300183	1000 mg/L Copper Standard	AR	27-86C0Y1
			30-Jan-2024

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

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



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

7. Flame Interlock Check:

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

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

8. After PM Performance tests:

8.1 Detector Linearity with Barium

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

Parameter	Specification	Certificate Value at 553.5 nm (Abs.)	Test Results	Pass/Fail
1.0 A ND Filter	± 5% from Cert.	0.9798	0.9915	Passed
0.2 A ND Filter	± 5% from Cert.	0.2042	0.2037	Passed

8.2 Baseline Noise at 1.0 Absorbance with Barium

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

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

8.3 AA Baseline Noise with Copper

Description: Check baseline noise.

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

8.4 D₂ Background Compensation with Copper

Description: Verifies the 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.



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Additional Comments

Additional Comments Regarding the PM:

Review

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

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

Review of Preventive Maintenance:

Authorized PerkinElmer Representative:	<i>Wuy</i>	Date: 05-Oct-2023 (DD-MM-YYYY)
Authorized Customer Representative:	เจริญรุ่ง	Date: 05-Oct-2023 (DD-MM-YYYY)

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

Part Number	Release	Publication Date	
09370005	C	January 2013	 PerkinElmer

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

General Instructions:
Always check with the customer before making any changes that may affect the customer's analysis or calibration.
The completed document should be signed by an authorized PerkinElmer and customer representative and left with the customer.
Update the PM sticker and instrument logbook as required.

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Component List

Component / Specific Model	Serial #	Firmware Version	Configuration Notes

Parts Lists

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

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

Additional Reagents and Standards Required for PM				
Part Number (if applicable)	Description	Quantity	Batch/Lot #	Expiration Date (MM/YY)

Procedure Checklist

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

1. General:

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

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

NO

☒ Visual Damage (if yes, describe)

NO

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

2. Instrument components

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

3. Mixing/Separation Assembly & Pump Tubing:

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

4. Cell, Cell Windows, Transfer Line:

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

5. Operational Tests:

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

6. Review:

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



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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 PerkinElmer Representative:	<i>(Signature)</i>	Date: 05-Oct-2023 (DD-MM-YYYY)
Authorized Customer Representative:	เจนจิรา	Date: 05-Oct-2023 (DD-MM-YYYY)



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Document History

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



PerkinElmer TruQ

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

Lot No: 26-87CUY1
Certification Date: JUL - - 2022
Expiration Date: JAN 3 0 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	Pb	<0.001
Al	<0.003	Er	<0.001	Lu	<0.001	Rb	<0.001
As	<0.002	Eu	<0.001	Mg	<0.002	Re	<0.001
Au	<0.002	Fa	<0.004	Mn	0.002	Rh	<0.001
B	<0.007	Ga	<0.001	Mo	<0.001	Ru	<0.001
Br	<0.001	Ge	<0.001	Na	0.05	Sb	<0.001
Ca	0.006	Hf	<0.001	Nb	<0.001	Sc	<0.001
Cd	<0.001	Ho	<0.001	Ni	<0.001	Se	<0.003
Ce	<0.001	In	<0.001	P	<0.2	Si	<0.1
Co	<0.001	Ir	<0.001	Pb	0.001	Sm	<0.001
Cr	<0.001	K	<0.1	Pd	<0.001	Sr	<0.001
Cs	<0.001	La	<0.001	Pr	<0.001	Ta	<0.001
						Tb	<0.001
						Te	<0.001
						Th	<0.001
						Ti	<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: 1001 µg/mL ±5 µg/mL (refer to side 2)

Certified Value is Traceable to: NIST SRM #3114

Classical Wet Assay: 1000 µg/mL

Method: EDTA titration using PAN as indicator EDTA standardized against Pb(NO₃)₂ NIST SRM #228.

*Instrument Analysis using ICP Spectrometer: 1001 µg/mL
via NIST SRM #3114

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



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Page 1 of 2
Rev. 0

Secondary Spectrometric Calibration Standards Certificate of Calibration

Ordinate Calibration
Calibration Data for Secondary Calibration Standards:

Wavelength / Absorbance	Number	Ordinate Reading (Absorbance) at the following wavelengths:			
Wavelength		193.70	232.00	324.75	553.55
Standard 1	MG2-356	0.9209	0.8992	0.8078	0.9798

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

Conditions of Calibration

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

Measurement of Calibration

Ordinate mode	Absorbance
Slit mode UV/VIS	Fix
Integration time UV/VIS	5 s
Slit mode NIR	Servo
Integration time NIR	5 s

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: 101N0089015

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

Date / Time: 1/14/2015

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

NTRM PKI-1930 SIN 00038 Calibration Date 05/23/2014 National Research Council of Canada Calibration Report No. PAR 2014 3162
was used during this procedure. Measurements were performed at an ambient temperature of 22.1 °C and the humidity of 53.9 %

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

Operator: Cam Le Horvath

Signature:

End of Report

Secondary Spectrometric Calibration Standards

Certificate of Calibration

Ordinate Calibration

Calibration Data for Secondary Calibration Standards:

Wavelength / Absorbance	Number	Ordinate Reading (Absorbance) at the following wavelengths:			
Wavelength		193.70	232.00	324.75	553.55
Standard 1	MGO-252	0.2762	0.2459	0.2124	0.2042
					0.1912

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

Conditions of Calibration

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

Measurement of Calibration

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

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

Serial Number: 101N0089015

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

Date / Time: 12/1/2014

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

930 model filler set S/N 00038 Calibration Date 05/23/2014 NRC Calibration Report No. PAR 2014 3162

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 Horvalh

Signature:

Cam Le Horvalh

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

End of Report



PerkinElmer

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

รับรองสำเนาถูกต้อง
ผู้จัดการฝ่ายควบคุมคุณภาพ



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



รับรองสำเนาถูกต้อง
ผู้จัดการฝ่ายควบคุมคุณภาพ