

A collection of various tropical leaves, including a large Monstera leaf with prominent splits and several palm fronds, arranged in the top-left corner of the page.

เอกสารสอบเทียบเครื่องมือ

A small, single green leaf positioned vertically on the right edge of the page.



MIRACLE INTERNATIONAL TECHNOLOGY CO.,LTD

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



CALIBRATION CERTIFICATE

Certificate No. : L202208342-001

Date Issued : 22-Sep-22

“Supplement to Calibration Certificate No. L202208342-001 , date issued 07-Sep-22, page 1 of 3”

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

Equipment : DryCal

Manufacturer : MesaLabs Bios

Model : Defender 510

Serial No. : 200368

ID No./Tag No. : -

Date Received : 31-Aug-22

Date Calibrated : 02-Sep-22

Calibrated by : Mr. Jame Khaothong

Calibration Method or Calibration Procedure Used

In-house method : CP-26 ,CP-44 by comparison against Piston Prover.

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

Result of Calibration

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

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

Approved by:



Page 1 of 3



รับรองสำเนาถูกต้อง
ผู้จัดการฝ่ายควบคุมคุณภาพ

Certificate No. : L202208342-001

Environment : Ambient temperature : (23 ± 2)°C
Relative humidity : (50 ± 15)%RH

Capacity Range : 5000 cc/min

Calibration Media : Air

Type : Volumetric Flowmeter

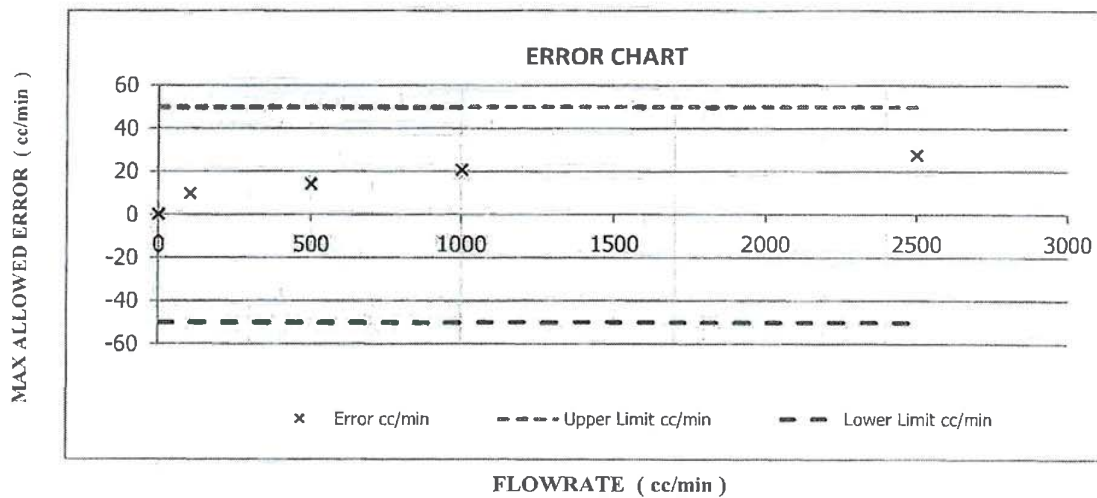
UUC Reference Condition : At atmospheric pressure and room temperature condition

Measurement Gas Flow rate function

Temperature (° C)	Pressure (kPa)	UUC (cc/min)	STD (cc/min)	Error (cc/min)	Uncertainty (± cc/min)
23.01	100.74	0.00	0.00 *	0.00	0.58
23.76	101.51	100.26	90.454	9.806	1.0
22.89	101.12	500.12	486.0	14.12	2.5
22.75	101.36	1000.9	980.1	20.8	3.5
22.76	101.76	2500.7	2472.9	27.8	6.5

Error = Unit Under Calibration - Standard

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



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

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

where Q = Flow rate P = Absolute pressure T = Absolute temperature

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

Subscript "Meas" = Measurement condition

Subscript "Standard" = Standard condition

Certificate No. : L202208342-001

Condition As-Received : Used Item

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

Measurement Standards Used & Traceability :

The International System of Units (SI) through

MIT Calibration Certificate No. AD2205-312-0001 for Piston Prover Volume Serial No. 85, Due 20-May-24

MIT Calibration Certificate No. AD2202-261-0002 for Piston Prover Timer Serial No. 122199, Due 03-Mar-24

MIT Calibration Certificate No. AD2202-261-0003 for Absolute Pressure (Piston Prover) Serial No. 220368, Due 22-Feb-24

MIT Calibration Certificate No. AD2202-261-0004 for Temperature Indicator with Sensor (Piston Prover) Serial No. MIT-STD-258, Due 02-Mar-24

MIT Calibration Certificate No. AD2204-030-0002 for Bell Prover Volume (60L) Serial No. 9511HC028626, Due 11-Apr-24

MIT Calibration Certificate No. L2022-08263-001 for Bell Prover Timer Serial No. 9511HC028626, Due 09-Aug-23

MIT Calibration Certificate No. AD2205-300-0001 for Temperature Transmitter with probe Serial No. MIT-STD-122, Due 04-Jun-23

MIT Calibration Certificate No. AD2205-300-0002 for Pressure Transmitter with indicator Serial No. MIT-STD-123, Due 04-Jun-23

End of Certificate

Page 3 of 3




บริษัท ล.วี. จำกัด (มหาชน)
ผู้จัดการฝ่ายควบคุมคุณภาพ

Mettler-Toledo (Thailand) Ltd.
846/4 - 846/5 Lasalle Rd., Bangna Tai Sub-District
Bangna District, Bangkok 10260
+662 723 0382
MT-TH.ServiceSupport@mt.com



Accuracy Calibration Certificate

Customer

Company: Envilab Co., Ltd.
Address: 540, 540/1 Soi Bang Khae 7, Bang Khae
City: Bang Khae Contact: Ngarmthip Sampanpuang
Zip / Postal: 10160
State / Province: Bangkok
Order Number: 
* 0 3 3 1 9 0 7 2 4 8 *

Weighing Device

Manufacturer: Mettler Toledo Instrument Type: Weighing Instrument
Model: XSR205DU Asset Number: N/A
Serial No.: B911363567 Terminal Model: SRAT
Building: N/A Terminal Serial No.: B911363567
Floor: 3 Terminal Asset No.: N/A
Room: B304

Range	Max. Capacity	Readability (d)
1	81 g	0.00001 g
2	220 g	0.0001 g

Procedure

Calibration Guideline: EURAMET cg-18 v. 4.0 (11/2015)
METTLER TOLEDO Work Instruction: CPW002/20

This calibration certificate contains measurements for As Found calibration. No As Left calibration was performed because the device was not modified after As Found calibration. Therefore, results for As Left correspond to As Found.

The sensitivity/span of the weighing instrument was adjusted before calibration with a built-in weight.

In accordance with EURAMET cg-18 (11/2015), the test loads were selected to reflect the specific use of the weighing device or to accommodate specific calibration conditions.

As Found	Temperature		Humidity	
	Start: 22.2 °C	End: 22.6 °C	Start: 58.3 %	End: 59.7 %

As Found Calibration Date: 02-Mar-2022
As Left Calibration Date: N/A
Issue Date: 03-Mar-2022

Calibrator:

Approved Signatory:

☒
☐
☐



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Measurement Results

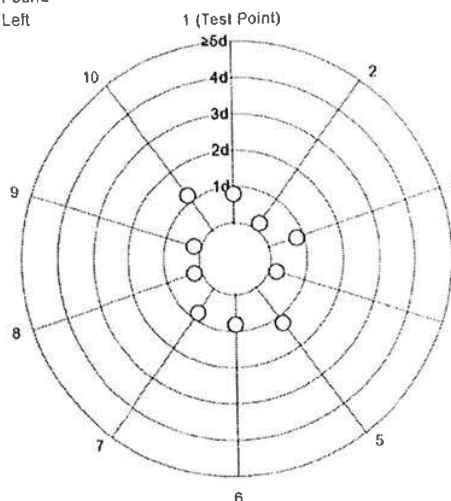
Repeatability

Test Load: 70 g

	As Found	As Left
1	70.00001 g	N/A
2	70.00002 g	N/A
3	70.00001 g	N/A
4	70.00002 g	N/A
5	70.00003 g	N/A
6	70.00001 g	N/A
7	70.00001 g	N/A
8	70.00002 g	N/A
9	70.00002 g	N/A
10	70.00003 g	N/A

Standard Deviation	0.000008 g	N/A
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○ As Found
◆ As Left



The "d" in the graph represents the readability of the range/interval in which the test was performed.

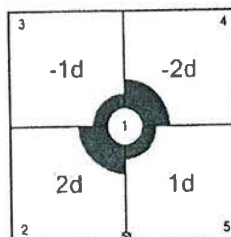
The results of this graph are based upon the absolute values of the differences from the mean value.

Eccentricity

Test Load: 100 g

Position	As Found	As Left
1	100.0000 g	N/A
2	100.0002 g	N/A
3	99.9999 g	N/A
4	99.9998 g	N/A
5	100.0001 g	N/A

Maximum Deviation	0.0002 g	N/A
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As Found

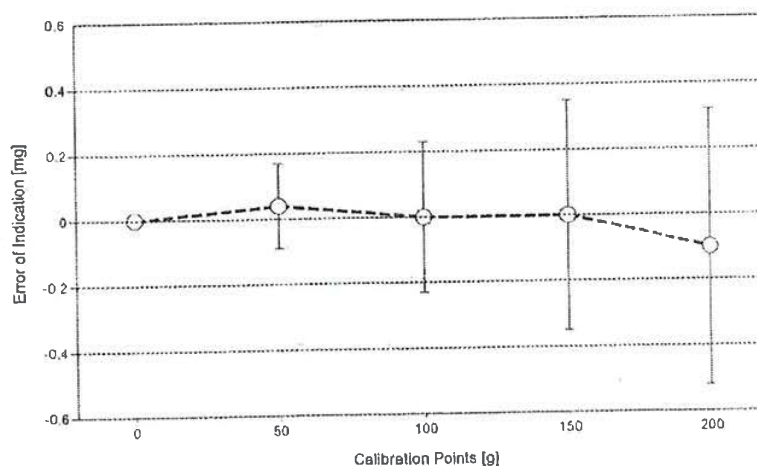
The "d" in the graph represents the readability of the range/interval in which the test was performed.



Error of Indication

As Found

	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.00000 g	0.00000 g	0.00000 g	0.017 mg	2
2	0.10000 g	0.10000 g	0.00000 g	0.023 mg	2
3	0.50000 g	0.50001 g	0.00001 g	0.028 mg	2
4	0.99999 g	0.99999 g	0.00000 g	0.032 mg	2
5	1.99999 g	2.00000 g	0.00001 g	0.040 mg	2
6	5.00001 g	5.00001 g	0.00000 g	0.048 mg	2
7	10.00001 g	10.00002 g	0.00001 g	0.062 mg	2
8	49.99998 g	50.00002 g	0.00004 g	0.13 mg	2
9	100.0000 g	100.0000 g	0.0000 g	0.23 mg	2
10	150.0000 g	150.0000 g	0.0000 g	0.35 mg	2
11	199.9999 g	199.9998 g	-0.0001 g	0.42 mg	2



○ As Found

◆ As Left

For improved legibility of the graphics only increasing measurement points are shown and measurement points close to zero are not displayed.

The uncertainty stated is the expanded uncertainty at calibration obtained by multiplying the standard combined uncertainty by the coverage factor k – which can be larger than 2 according to EURAMET cg-18. The value of the measurand lies within the assigned range of values with a probability of approximately 95%.

The user is responsible for maintaining environmental conditions and the settings of the weighing instrument when it was calibrated.



รับรองสำเนาถูกต้อง
ผู้จัดการฝ่ายควบคุมคุณภาพ

Test Equipment

All weights used for metrological testing are traceable to national or international standards. The weights were calibrated and certified by an accredited calibration laboratory.

Weight Set 1: OIML E2

Weight Set No.:	WS22	Date of Issue:	06-Jan-2022
Certificate Number:	177036	Calibration Due Date:	03-Jul-2023

Weight Set 2: OIML E2

Weight Set No.:	WS76	Date of Issue:	31-Jan-2022
Certificate Number:	C205470237	Calibration Due Date:	12-Jul-2023

Thermo Hygrometer

Equipment No.:	IN193	Date of Issue:	14-Jun-2021
Certificate Number:	21H1221	Calibration Due Date:	01-Jun-2022

Remarks

FACT adjustment functionality activated
Equipment condition: Good
Next calibration according to customer's procedure

End of Accredited Section

The information below and any attachments to this calibration certificate are not part of the accredited calibration.



Measurement Uncertainty of the Weighing Instrument in Use

Stated is the expanded uncertainty with $k=2$ in use. The formula shall be used for the estimation of the uncertainty under consideration of the errors of indication. The value R represents the net load indication in the unit of measure of the device.

Temperature coefficient for the evaluation of the measurement uncertainty in use: $1.5 \cdot 10^{-6} / K$

Temperature range on site for the evaluation of the measurement uncertainty in use: $3 K$

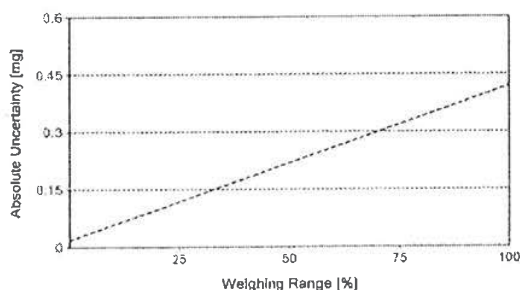
Linearization of Uncertainty Equation

	Range		As Found	As Left
	d	Max		
1	0.00001 g	81 g	$U_1 = 0.018 \text{ mg} + 0.00497 \text{ mg/g} \cdot R$	N/A
2	0.0001 g	220 g	$U_2 = 0.06 \text{ mg} + 0.00492 \text{ mg/g} \cdot R$	N/A

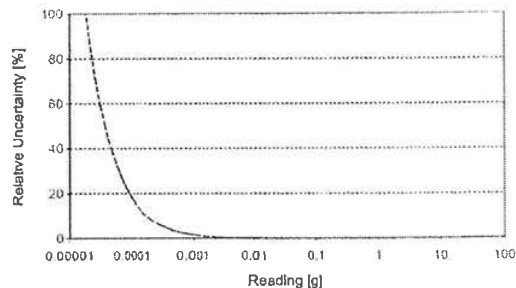
To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

Absolute and Relative Measurement Uncertainty In Use for Various Net Indications (Examples)

Net indication	As Found		As Left	
0.00220 g	0.018 mg	0.82%	N/A	N/A
0.02200 g	0.018 mg	0.082%	N/A	N/A
0.22000 g	0.019 mg	0.0087%	N/A	N/A
2.20000 g	0.029 mg	0.0013%	N/A	N/A
220.0000 g	1.1 mg	0.00052%	N/A	N/A



As Found



As Left

The weighing range shown in the absolute uncertainty graph refers to the first interval/range of the device.



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ผู้จัดการฝ่ายควบคุมคุณภาพ

Certificate of Calibration

Certificate No. : 66-200066-2

Page : 1 of 2

Submitted by : Envilab Co., Ltd.

540, 540/1 Soi Bangkhæ7, Bangkhæ, 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 :



Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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CAL

Calibratech Co.,Ltd.

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

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

Certificate of Calibration

Certificate No. : 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

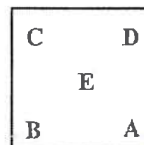
This result of calibration was found accurate as shown on date and place of calibration only.

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

- o0o -





MIRACLE INTERNATIONAL TECHNOLOGY CO.,LTD

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



CALIBRATION CERTIFICATE

Certificate No. : L202208342-001

Date Issued : 22-Sep-22

"Supplement to Calibration Certificate No. L202208342-001 , date issued 07-Sep-22, page 1 of 3"

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

Equipment : DryCal

Manufacturer : MesaLabs Bios

Model : Defender 510

Serial No. : 200368

ID No./Tag No. : -

Date Received : 31-Aug-22

Date Calibrated : 02-Sep-22

Calibrated by : Mr. Jame Khaothong

Calibration Method or Calibration Procedure Used

In-house method : CP-26 ,CP-44 by comparison against Piston Prover.

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

Result of Calibration

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

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

Approved by:



Page 1 of 3



รับรองสำเนาถูกต้อง
ผู้จัดการฝ่ายควบคุมคุณภาพ

Certificate No. : L202208342-001

Environment : Ambient temperature : (23 ± 2) °C
Relative humidity : (50 ± 15) %RH

Capacity Range : 5000 cc/min

Calibration Media : Air

Type : Volumetric Flowmeter

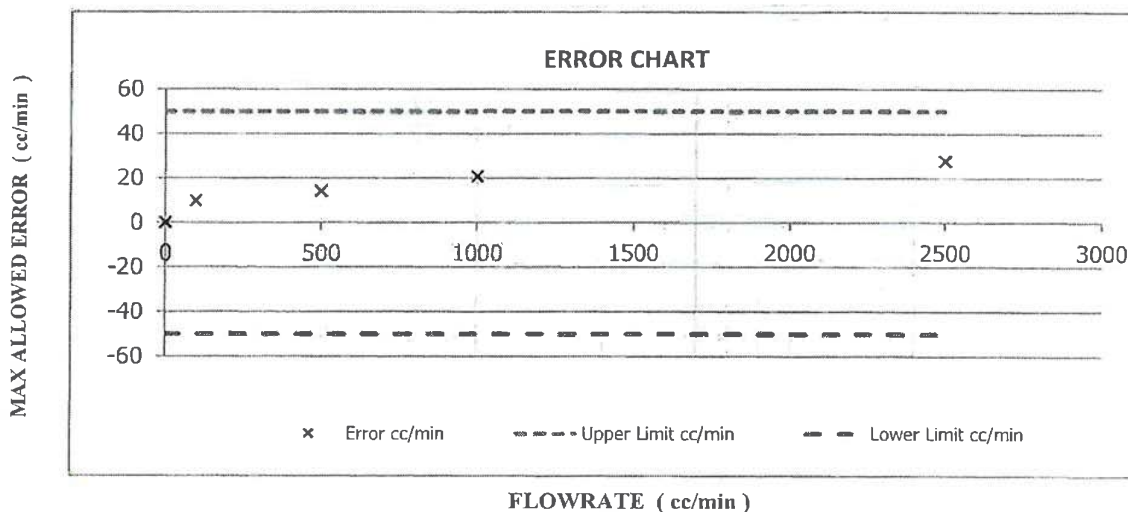
UUC Reference Condition : At atmospheric pressure and room temperature condition

Measurement Gas Flow rate function

Temperature (° C)	Pressure (kPa)	UUC (cc/min)	STD (cc/min)	Error (cc/min)	Uncertainty (± cc/min)
23.01	100.74	0.00	0.00 *	0.00	0.58
23.76	101.51	100.26	90.454	9.806	1.0
22.89	101.12	500.12	486.0	14.12	2.5
22.75	101.36	1000.9	980.1	20.8	3.5
22.76	101.76	2500.7	2472.9	27.8	6.5

Error = Unit Under Calibration - Standard

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



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

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

where Q = Flow rate P = Absolute pressure T = Absolute temperature

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

Subscript "Meas" = Measurement condition

Subscript "Standard" = Standard condition



Certificate No. : L202208342-001

Condition As-Received : Used Item

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

Measurement Standards Used & Traceability :

The International System of Units (SI) through

MIT Calibration Certificate No. AD2205-312-0001 for Piston Prover Volume Serial No. 85, Due 20-May-24

MIT Calibration Certificate No. AD2202-261-0002 for Piston Prover Timer Serial No. 122199, Due 03-Mar-24

MIT Calibration Certificate No. AD2202-261-0003 for Absolute Pressure (Piston Prover) Serial No. 220368, Due 22-Feb-24

MIT Calibration Certificate No. AD2202-261-0004 for Temperature Indicator with Sensor (Piston Prover) Serial No. MIT-STD-258, Due 02-Mar-24

MIT Calibration Certificate No. AD2204-030-0002 for Bell Prover Volume (60L) Serial No. 9511HC028626, Due 11-Apr-24

MIT Calibration Certificate No. L2022-08263-001 for Bell Prover Timer Serial No. 9511HC028626, Due 09-Aug-23

MIT Calibration Certificate No. AD2205-300-0001 for Temperature Transmitter with probe Serial No. MIT-STD-122, Due 04-Jun-23

MIT Calibration Certificate No. AD2205-300-0002 for Pressure Transmitter with indicator Serial No. MIT-STD-123, Due 04-Jun-23

End of Certificate

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รับรองสำเนาถูกต้อง

กรมการมาตรฐานคุณภาพ



Request No. 22-65 / 0346

MTC No. PSL-H 0158 / 65

Certificate of Calibration

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

Equipment : Thermo-Hygrometer (Area Heat Stress Monitor)

Model /Type : hs-32

Serial Number : MCE010015

Maker : METROSONICS

Date of Request : 23 February 2022

Date of Calibration : 4 March 2022

This certificate is traceable to International System of Units (SI Units) through Photometry and Temperature Standards Laboratory, Industrial Metrology and Testing Service Centre, Thailand Institute of Scientific and Technology Research (TISTR), NSC-ONSC accredited Calibration No. 0015.

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

Calibrated by :



Approved by :



(M

Director

Photometry and Temperature Standards Laboratory

Ref. No : 2012265022300851002

Issued Date : 18 March 2022

Page 1 of 4

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

Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

FM,BL,MTC,002 Rev.4

Head Office
35 Mu 3 Tambon Klong Ha, Amphoe Klong Luang,
Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail : rumpai@tistr.or.th Website:www.tistr.or.th

Office/Laboratory
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
Fax. (66) 0 2323 9165
E-mail : mtc@tistr.or.th

Office
196 Phahonyothin Road, Chatuchak, Bangkok 10900,
Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
Fax. (66) 0 2579 8582
E-mail : sumalee@tistr.or.th



รับรองสถานะถูกต้อง
ผู้จัดการฝ่ายควบคุมคุณภาพ



Request No. 22-65 / 0346

MTC No. PSL-H 0158 / 65

Description of Unit Under Calibration :

Customer : Envilab Co.,Ltd.
Address : 540, 540/1 Soi Bangkhae7 , Bangkhae ,Bangkok ,10160
Equipment : Thermo-Hygrometer (Area Heat Stress Monitor)
Serial Number : MCE010015
Calibration Required : Temperature at (20, 30, 40) °C
Ambient Condition : Ambient temperature (23 ± 3) °C
Relative humidity (55 ± 20) %
Laboratory Address : Photometry and Temperature Standards Laboratory
Soi 1, Bangpoo Industrial Estate, Sukhumvit Rd., Samutprakan

Reference Standard :

Digital Thermometer with Sensor, Model : F250H, S/N : 9345 008 2331, Sensor RTD Probe No. RTD-01 and RTD-02 which was calibrated by Industrial Metrology and Testing Service Centre, Certificate No. PSL-T 1081/64.

The temperature scale in use of this laboratory is the International Temperature Scale of 1990,

Calibration Procedure :

The certifies the above equipment was calibrated according to procedure no. WI.CP.18.

Support Equipment :

Temperature & Humidity Controlled Chamber, Model : 9145-5116-00AA, S/N : 1403041

Adjustments : NONE

Head Office
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail : rumpa@tistr.or.th Website:www.tistr.or.th

Office/Laboratory
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
Fax. (66) 0 2323 9165
E-mail : mtc@tistr.or.th

Office
196 Phahonyothin Road, Chatuchak, Bangkok 10900,
Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
Fax. (66) 0 2579 8592
E-mail : sumalee@tistr.or.th



บริษัท อีนิแลบ จำกัด
ผู้ให้บริการฝ่ายควบคุมคุณภาพ

Request No. 22-65 / 0346

MTC No. PSL-H 0158 / 65

Results of Calibration :-

Table : Temperature Measurement @ Wet Bulb

Average Measured Temperature (°C)	Average Displayed of UUC (°C)	Correction Measured of UUC (°C)	Expanded Uncertainty of Measurement (± °C)
19.9	20.0	-0.1	0.50
30.0	29.8	0.2	0.50
40.0	39.6	0.4	0.50

Table : Temperature Measurement @ Dry Bulb

Average Measured Temperature (°C)	Average Displayed of UUC (°C)	Correction Measured of UUC (°C)	Expanded Uncertainty of Measurement (± °C)
19.9	20.0	-0.1	0.53
30.0	29.9	0.1	0.50
40.0	39.6	0.4	0.50



Request No. 22-65 / 0346

MTC No. PSL-H 0158 / 65

Results of Calibration :-

Table : Temperature Measurement @ Globe Bulb

Average Measured Temperature (°C)	Average Displayed of UUC (°C)	Correction Measured of UUC (°C)	Expanded Uncertainty of Measurement (± °C)
19.9	20.1	-0.2	0.53
30.0	29.8	0.2	0.50
40.0	39.4	0.6	0.50

- Note :**
1. This calibration was done without removing reservoir cover, white plates and blackened copper sphere of the instrument.
 2. The calibration data for instrument in this report is reported within the condition existing at the time of measurement only.

...end of certificate...

Request No. 22-65 / 0346

MTC No. PSL-H 0165 / 65

Certificate of Calibration

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

Equipment : Thermo-Hygrometer (Area Heat Stress Monitor)

Model /Type : hs-32

Serial Number : MCH110028

Maker : METROSONICS

Date of Request : 23 February 2022

Date of Calibration : 9 March 2022

This certificate is traceable to International System of Units (SI Units) through Photometry and Temperature Standards Laboratory, Industrial Metrology and Testing Service Centre, Thailand Institute of Scientific and Technology Research (TISTR), NSC-ONSC accredited Calibration No. 0015.

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

Calibrated by :



Approved by



(M

Director

Photometry and Temperature Standards Laboratory

Ref. No : 2012265022300851009

Issued Date : 18 March 2022

Page 1 of 4

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FM.BL.MTC.002 Rev.4

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รับรองสำเนาถูกต้อง
ผู้อำนวยการควบคุมคุณภาพ



Request No. 22-65 / 0346

MTC No. PSL-H 0165 / 65

Description of Unit Under Calibration :

Customer : Envilab Co.,Ltd.
Address : 540, 540/1 Soi Bangkhae7 , Bangkhae ,Bangkok ,10160
Equipment : Thermo-Hygrometer (Area Heat Stress Monitor)
Serial Number : MCH110028
Calibration Required : Temperature at (20, 30, 40) °C
Ambient Condition : Ambient temperature (23 ± 3) °C
Relative humidity (55 ± 20) %
Laboratory Address : Photometry and Temperature Standards Laboratory
Soi 1, Bangpoo Industrial Estate, Sukhumvit Rd., Samutprakan

Reference Standard :

Digital Thermometer with Sensor, Model : F250H, S/N : 9345 008 2331, Sensor RTD Probe No. RTD-01 and RTD-02 which was calibrated by Industrial Metrology and Testing Service Centre, Certificate No. PSL-T 1081/64.

The temperature scale in use of this laboratory is the International Temperature Scale of 1990.

Calibration Procedure :

The certifies the above equipment was calibrated according to procedure no. WI.CP.18.

Support Equipment :

Temperature & Humidity Controlled Chamber, Model : 9145-5116-00AA, S/N : 1403041

Adjustments : NONE

Page 2 of 4

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รับรองสำเนาถูกต้อง
ผู้จัดการฝ่ายควบคุมคุณภาพ

Request No. 22-65 / 0346

MTC No. PSL-H 0165 / 65

Results of Calibration :-

Table : Temperature Measurement @ Wet Bulb

Average Measured Temperature (°C)	Average Displayed of UUC (°C)	Correction Measured of UUC (°C)	Expanded Uncertainty of Measurement (± °C)
20.0	20.1	-0.1	0.50
29.9	30.0	-0.1	0.50
40.0	39.8	0.2	0.50

Table : Temperature Measurement @ Dry Bulb

Average Measured Temperature (°C)	Average Displayed of UUC (°C)	Correction Measured of UUC (°C)	Expanded Uncertainty of Measurement (± °C)
20.0	20.0	0.0	0.50
29.9	30.0	-0.1	0.50
40.0	40.0	0.0	0.50



Request No. 22-65 / 0346

MTC No. PSL-H 0165 / 65

Results of Calibration :-

Table : Temperature Measurement @ Globe Bulb

Average Measured Temperature (°C)	Average Displayed of UUC (°C)	Correction Measured of UUC (°C)	Expanded Uncertainty of Measurement (± °C)
20.0	20.4	-0.4	0.50
29.9	30.0	-0.1	0.50
40.0	39.8	0.2	0.50

- Note :**
1. This calibration was done without removing reservoir cover, white plates and blackened copper sphere of the instrument.
 2. The calibration data for instrument in this report is reported within the condition existing at the time of measurement only.

...end of certificate...



Request No. 22-65 / 0346

MTC No. PSL-H 0158 / 65

Certificate of Calibration

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

Equipment : Thermo-Hygrometer (Area Heat Stress Monitor)

Model /Type : hs-32

Serial Number : MCE010015

Maker : METROSONICS

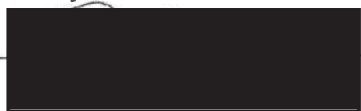
Date of Request : 23 February 2022

Date of Calibration : 4 March 2022

This certificate is traceable to International System of Units (SI Units) through Photometry and Temperature Standards Laboratory, Industrial Metrology and Testing Service Centre, Thailand Institute of Scientific and Technology Research (TISTR), NSC-ONSC accredited Calibration No. 0015.

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

Calibrated by :



Approved by



Director

Photometry and Temperature Standards Laboratory

Ref. No : 2012265022300851002

Issued Date : 18 March 2022

Page 1 of 4

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รับรองสำเนาถูกต้อง
การให้ข้อมูลเฉพาะ



Request No. 22-65 / 0346

MTC No. PSL-H 0158 / 65

Description of Unit Under Calibration :

Customer : Envilab Co.,Ltd.
Address : 540, 540/1 Soi Bangkhae7 , Bangkhae ,Bangkok ,10160
Equipment : Thermo-Hygrometer (Area Heat Stress Monitor)
Serial Number : MCE010015
Calibration Required : Temperature at (20, 30, 40) °C
Ambient Condition : Ambient temperature (23 ± 3) °C
Relative humidity (55 ± 20) %
Laboratory Address : Photometry and Temperature Standards Laboratory
Soi 1, Bangpoo Industrial Estate, Sukhumvit Rd., Samutprakan

Reference Standard :

Digital Thermometer with Sensor, Model : F250H, S/N : 9345 008 2331, Sensor RTD Probe No. RTD-01 and RTD-02 which was calibrated by Industrial Metrology and Testing Service Centre, Certificate No. PSL-T 1081/64.

The temperature scale in use of this laboratory is the International Temperature Scale of 1990.

Calibration Procedure :

The certifies the above equipment was calibrated according to procedure no. WI.CP.18.

Support Equipment :

Temperature & Humidity Controlled Chamber, Model : 9145-5116-00AA, S/N : 1403041

Adjustments : NONE

Page 2 of 4



รับรองสำเนาถูกต้อง
ผู้จัดการฝ่ายควบคุมคุณภาพ

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Request No. 22-65 / 0346

MTC No. PSL-H 0158 / 65

Results of Calibration :-

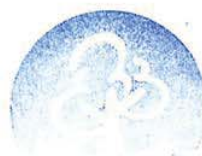
Table : Temperature Measurement @ Wet Bulb

Average Measured Temperature (°C)	Average Displayed of UUC (°C)	Correction Measured of UUC (°C)	Expanded Uncertainty of Measurement (± °C)
19.9	20.0	-0.1	0.50
30.0	29.8	0.2	0.50
40.0	39.6	0.4	0.50

Table : Temperature Measurement @ Dry Bulb

Average Measured Temperature (°C)	Average Displayed of UUC (°C)	Correction Measured of UUC (°C)	Expanded Uncertainty of Measurement (± °C)
19.9	20.0	-0.1	0.53
30.0	29.9	0.1	0.50
40.0	39.6	0.4	0.50

Page 3 of 4



รับรองสำเนาถูกต้อง
เพื่อการเผยแพร่ความถูกต้อง

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Request No. 22-65 / 0346

MTC No. PSL-H 0158 / 65

Results of Calibration :-

Table : Temperature Measurement @ Globe Bulb

Average Measured Temperature (°C)	Average Displayed of UUC (°C)	Correction Measured of UUC (°C)	Expanded Uncertainty of Measurement (± °C)
19.9	20.1	-0.2	0.53
30.0	29.8	0.2	0.50
40.0	39.4	0.6	0.50

- Note :**
1. This calibration was done without removing reservoir cover, white plates and blackened copper sphere of the instrument.
 2. The calibration data for instrument in this report is reported within the condition existing at the time of measurement only.

...end of certificate...



รับรองสำเนาถูกต้อง
ผู้จัดการฝ่ายควบคุมคุณภาพ

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Request No. 22-66 / 0307

MTC No. PSL-H 0132 / 66

Certificate of Calibration

Customer : Envilab Co.,Ltd.
540, 540/1 Soi Bangkhae7, Bangkhae, Bangkok, 10160
Item : Thermo-Hygrometer (Area Heat Stress Monitor)
Model /Type : hs-32
Serial Number : MCH110039
Manufacturer : METROSONICS
Date of Request : 6 February 2023
Date of Calibration : 22 February 2023

The certifies the above equipment was calibrated in accordance with the recognised International Standard ISO/IEC 17025:2017 and the operation according to procedure no. WI.CP.18.

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

Calibrated by :



Approved by



Director

Photometry and Temperature Standards Laboratory

Ref. No : 2012266020600526002

Issued Date : 8 March 2023

Page 1 of 4



รับรองสำเนาถูกต้อง

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E-mail : sumalee@tistr.or.th



Request No. 22-66 / 0307

MTC No. PSL-H 0132 / 66

Description of Unit Under Calibration :

Customer : Envilab Co.,Ltd.
Address : 540, 540/1 Soi Bangkhae7, Bangkhae, Bangkok, 10160
Item : Thermo-Hygrometer (Area Heat Stress Monitor)
Serial Number : MCH110039
Calibration Required : Temperature at (20, 30, 40) °C
Ambient Condition : Ambient temperature (23 ± 3) °C
Relative humidity (55 ± 20) %
Laboratory Address : Photometry and Temperature Standards Laboratory
Soi 1, Bangpoo Industrial Estate, Sukhumvit Rd., Samutprakan

Reference Standard :

Digital Thermometer with Sensor, Model : F250H, S/N : 9345 008 2331, Sensor RTD Probe No. RTD-01 and RTD-02 which was calibrated by Industrial Metrology and Testing Service Centre, Certificate No. PSL-T 0786/65.

The temperature scale in use of this laboratory is the International Temperature Scale of 1990.

Calibration Procedure :

The certifies the above equipment was calibrated according to procedure no. WI.CP.18.

Support Equipment :

Temperature & Humidity Controlled Chamber, Model : 9141-5110, S/N : 1205101

Adjustments : NONE

Page 2 of 4



รับรองสำเนาถูกต้อง
ผู้จัดการฝ่ายควบคุมคุณภาพ

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Request No. 22-66 / 0307

MTC No. PSL-H 0132 / 66

Results of Calibration :- (/) Without Adjustment () After Adjustment

Table : Temperature Measurement @ Wet Bulb

Average Measured Temperature (°C)	Average Displayed of UUC (°C)	Correction Measured of UUC (°C)	Expanded Uncertainty of Measurement (± °C)
19.9	20.1	-0.2	0.50
30.0	30.0	0.0	0.51
40.0	40.2	-0.2	0.50

Table : Temperature Measurement @ Dry Bulb

Average Measured Temperature (°C)	Average Displayed of UUC (°C)	Correction Measured of UUC (°C)	Expanded Uncertainty of Measurement (± °C)
19.9	19.9	0.0	0.50
30.0	29.9	0.1	0.51
40.0	40.1	-0.1	0.50

Request No. 22-66 / 0307

MTC No. PSL-H 0132 / 66

Results of Calibration :-

Table : Temperature Measurement @ Globe Bulb

Average Measured Temperature (°C)	Average Displayed of UUC (°C)	Correction Measured of UUC (°C)	Expanded Uncertainty of Measurement (± °C)
19.9	20.3	-0.4	0.50
30.0	29.8	0.2	0.51
40.0	40.1	-0.1	0.50

- Note :**
1. This calibration was done without removing reservoir cover, white plates and blackened copper sphere of the instrument.
 2. The calibration data for instrument in this report is reported within the condition existing at the time of measurement only.

...end of certificate...

Page 4 of 4



รับรองสำเนาถูกต้อง
ผู้จัดการฝ่ายควบคุมคุณภาพ

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**INTERNATIONAL TESTING SERVICE CO., LTD**

1213/388 Ladprao 94 Ladprao Rd. Wangtonglang Bangkok 10310

Tel 0-2559-2095 Fax 0-2559-2096

E-mail : sale@itest-lab.com web site : www.itest-lab.comNSC-TISI-TIS 17025
CALIBRATION 129

CALIBRATION CERTIFICATE

Issued date : 21 March 2022

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

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

Request No : **C-2203 - 141**Laboratory No.: **CAL- 141**

Date of Request : 17 March 2022.

Date of Calibration : 28 March 2022.

1. Unit Under Calibration (UUC) :**Nomenclature** : Digital Light Meter**Serial No.** : 190600385**Maker** : TENMARS**Model** : TM - 720**2. Place of Calibration** : Photometry Standard Laboratory, INTERNATIONAL TESTING SERVICE CO., LTD.**3. Range of Calibration** : 1 Range**4. Condition of Laboratory** : Ambient temperature : $(25 \pm 2) ^\circ\text{C}$ and relative humidity $(60 \pm 20) \%$.

5. Reference Standard : Standard Tungsten Halogen Lamp , Serial No.: 504010, which was calibrated on 14 September 2021, can be traceable to International System of Unit (SI) through Electrical and Electronics Institute Foundation for Industrial development, Certificate No.: 0117LI21.

6. Support Equipment :

1. Photometric bench , 6,3 meter long.
2. DC. power supply, Serial No.: EJ 19A 009, Model : GPR-25H 300 , Maker : GW INSTEK.
3. Digital Multimeter , Model : 34401A , S/N : MY44011212 and MY44011215.
4. Foot Candle / Lux Meter , Model : 407026, S/N : Q 558437, Maker : EXTECH.

7. Calibration Procedure :

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

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

Page 1 of 2

รับรองสาเหตุดังกล่าว
ผู้จัดการฝ่ายควบคุมคุณภาพ

**INTERNATIONAL TESTING SERVICE CO., LTD**

1213/388 Ladprao 94 Ladprao Rd. Wangtonglang Bangkok 10310

Tel 0-2559-2095 Fax 0-2559-2096

E-mail : sale@itest-lab.com web site : www.itest-lab.comRequest No : **C-2203 - 141**

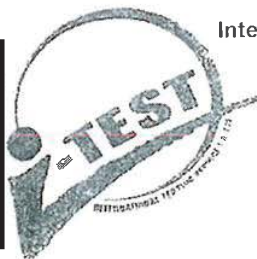
Serial No. : 190600385

Laboratory No.: **CAL - 141****Results :**

UUC Range	Standard (lx)	UUC Reading (lx)		Correction (lx)	Uncertainty of Measurement (\pm lx)
		Before adjust	After adjust		
Auto	0	0.0	0.0	0.0	0.1
	100	80.0	103.8	- 3.8	2.1 % of Reading
	500	390.9	509.9	- 9.9	
	1000	770.4	1002	- 2	
	1500	1148	1508	- 8	
	2000	1518	2005	- 5	

Note : Zero adjust before used.

Calibration result approved by

Approved on behalf of
International Testing Service Co., Ltd

Managing Director

Page 2 of 2

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



Envilab Co., Ltd.

บริษัท อีวิลแลบ จำกัด
ผู้จัดการฝ่ายควบคุมคุณภาพ



Certificate of Calibration

Certificate Number : SPR22030405-1

Page : 1 of 3

Customer : Envilab Co., Ltd.

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

Equipment Name : Sound Level Meter

Manufacturer : Pulsar

Model : 44

Serial Number : PN1807

ID. Number : N/A

Environmental Conditions

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

Received Date : 25 Mar 2022

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

Calibration Date : 29 Mar 2022

Location of Calibration : In-Lab

Recommend Due Date : 29 Mar 2023

Calibration Procedure : SP-CPE-04-01

Date of Issue : 30 Mar 2022

Method of Calibration

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

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

Calibrated by :



Calibration Officer

Approved by :



Authorized Signatory

SP-FM-04-15 rev.0



รับรองสำเนาถูกต้อง
ผู้จัดการฝ่ายควบคุมคุณภาพ



Calibration Report

Certificate Number : SPR22030405-1

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	SC-942	B014059	EEL.BP. 34/1264	22 Dec 2022

Traceability

This certification is traceable to the International System of Unit maintained at :

TISTR - Thailand Institute of Scientific and Technological Research





Result of Calibration

Certificate No. : SPR22030405-1

Page : 3 of 3

Range : 94 to 114 dB

Function : @1kHz

Select A

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	113.9	113.9	-0.1	-0.1	0.15

Select C

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.1	94.1	0.1	0.1	0.15
114	114.0	114.0	0.0	0.0	0.15

Select Z

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.1	94.1	0.1	0.1	0.15
114	114.1	114.1	0.1	0.1	0.15

Note:

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

Measurement Uncertainty

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

- End of Certificate -





Certificate of Calibration

Certificate Number : SPR22030023-1

Page : 1 of 3

Customer : Envilab Co., Ltd.

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

Equipment Name : Noise Dosimeter
 Manufacturer : Quest Technologies
 Model : NoisePro DLX Dosimeter
 Serial Number : NXC120053
 ID. Number : N/A

Environmental Conditions

Ambient Temperature	: 23 °C ± 3 °C	Received Date	: 02 Mar 2022
Relative Humidity	: 50 % ± 15 %	Calibration Date	: 04 Mar 2022
Location of Calibration	: In-Lab	Recommend Due Date	: 04 Mar 2023
Calibration Procedure	: SP-CPE-04-01	Date of Issue	: 05 Mar 2022

Method of Calibration

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

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

Calibrated by : Mr.Chumpon Dokpikul

Approved by :

Calibration Officer

Authorized Signatory

SP-FM-04-15 rev.0



รับรองสำเนาถูกต้อง
 ผู้จัดการฝ่ายควบคุมคุณภาพ



Calibration Report

Certificate Number : SPR22030023-1

Page : 2 of 3

Reference Standards

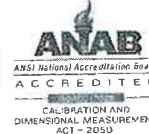
Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	SC-942	B014059	EEL.BP. 34/1264	22 Dec 2022

Traceability

This certification is traceable to the International System of Unit maintained at :

TISTR - Thailand Institute of Scientific and Technological Research





Result of Calibration

Certificate No. : SPR22030023-1

Page : 3 of 3

Range : 94 to 114 dB

Function : @1kHz

Select A Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	93.8	93.8	-0.2	-0.2	0.15
114	113.8	113.8	-0.2	-0.2	0.15

Select C Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.2	94.2	0.2	0.2	0.15
114	114.2	114.2	0.2	0.2	0.15

Note:

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

Measurement Uncertainty

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

- End of Certificate -



MIRACLE INTERNATIONAL TECHNOLOGY CO.,LTD

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



CALIBRATION CERTIFICATE

Certificate No. : L202208342-001

Date Issued : 22-Sep-22

“Supplement to Calibration Certificate No. L202208342-001 , date issued 07-Sep-22, page 1 of 3”

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

Equipment : DryCal

Manufacturer : MesaLabs Bios

Model : Defender 510

Serial No. : 200368

ID No./Tag No. : -

Date Received : 31-Aug-22

Date Calibrated : 02-Sep-22

Calibrated by : Mr. Jame Khaothong

Calibration Method or Calibration Procedure Used

In-house method : CP-26 ,CP-44 by comparison against Piston Prover.

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

Result of Calibration

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

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

Approved by:



Page 1 of 3



รับรองสถานะถูกต้อง
ผู้จัดการฝ่ายควบคุมคุณภาพ

Certificate No. : L202208342-001

Environment : Ambient temperature : (23 ± 2)°C
Relative humidity : (50 ± 15)%RH

Capacity Range : 5000 cc/min

Calibration Media : Air

Type : Volumetric Flowmeter

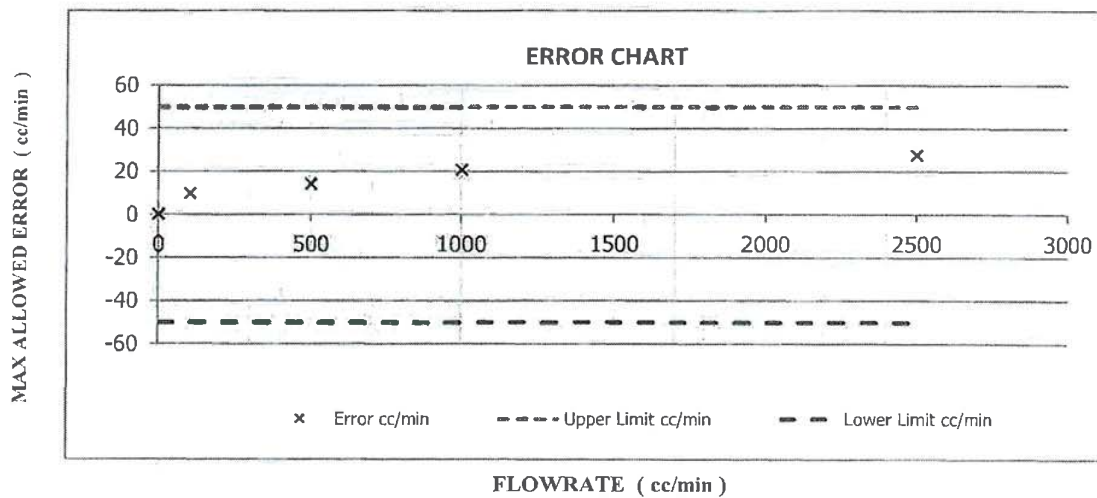
UUC Reference Condition : At atmospheric pressure and room temperature condition

Measurement Gas Flow rate function

Temperature (° C)	Pressure (kPa)	UUC (cc/min)	STD (cc/min)	Error (cc/min)	Uncertainty (± cc/min)
23.01	100.74	0.00	0.00 *	0.00	0.58
23.76	101.51	100.26	90.454	9.806	1.0
22.89	101.12	500.12	486.0	14.12	2.5
22.75	101.36	1000.9	980.1	20.8	3.5
22.76	101.76	2500.7	2472.9	27.8	6.5

Error = Unit Under Calibration - Standard

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



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

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

where Q = Flow rate P = Absolute pressure T = Absolute temperature

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

Subscript "Meas" = Measurement condition

Subscript "Standard" = Standard condition

Certificate No. : L202208342-001

Condition As-Received : Used Item

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

Measurement Standards Used & Traceability :

The International System of Units (SI) through

MIT Calibration Certificate No. AD2205-312-0001 for Piston Prover Volume Serial No. 85, Due 20-May-24

MIT Calibration Certificate No. AD2202-261-0002 for Piston Prover Timer Serial No. 122199, Due 03-Mar-24

MIT Calibration Certificate No. AD2202-261-0003 for Absolute Pressure (Piston Prover) Serial No. 220368, Due 22-Feb-24

MIT Calibration Certificate No. AD2202-261-0004 for Temperature Indicator with Sensor (Piston Prover) Serial No. MIT-STD-258, Due 02-Mar-24

MIT Calibration Certificate No. AD2204-030-0002 for Bell Prover Volume (60L) Serial No. 9511HC028626, Due 11-Apr-24

MIT Calibration Certificate No. L2022-08263-001 for Bell Prover Timer Serial No. 9511HC028626, Due 09-Aug-23

MIT Calibration Certificate No. AD2205-300-0001 for Temperature Transmitter with probe Serial No. MIT-STD-122, Due 04-Jun-23

MIT Calibration Certificate No. AD2205-300-0002 for Pressure Transmitter with indicator Serial No. MIT-STD-123, Due 04-Jun-23

End of Certificate

Page 3 of 3



บริษัท เอ็ม.วี. จำกัด
ผู้จัดการฝ่ายควบคุมคุณภาพ



Certificate of Calibration

Certificate Number : SPR22030405-13

Page : 1 of 3

Customer : Envilab Co., Ltd.

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

Equipment Name : Sound Level Meter

Manufacturer : Pulsar

Model : 44

Serial Number : PN1883

ID. Number : N/A

Environmental Conditions

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

Received Date : 25 Mar 2022

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

Calibration Date : 29 Mar 2022

Location of Calibration : In-Lab

Recommend Due Date : 29 Mar 2023

Calibration Procedure : SP-CPE-04-01

Date of Issue : 30 Mar 2022

Method of Calibration

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

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

Calibrated by :



Calibration Officer

Approved by :



Authorized Signatory



รับรองสำเนาถูกต้อง
ผู้จัดการฝ่ายควบคุมคุณภาพ

SP-FM-04-15 rev.0



Calibration Report

Certificate Number : SPR22030405-13

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	SC-942	B014059	EEL.BP. 34/1264	22 Dec 2022

Traceability

This certification is traceable to the International System of Unit maintained at :

TISTR - Thailand Institute of Scientific and Technological Research





Result of Calibration

Certificate No. : SPR22030405-13

Page : 3 of 3

Range : 94 to 114 dB

Function : @1kHz

Select A Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	93.9	93.9	-0.1	-0.1	0.15
114	113.9	113.9	-0.1	-0.1	0.15

Select C Unit : dB

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

Select Z Unit : dB

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

Note:

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

Measurement Uncertainty

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

- End of Certificate -





Certificate of Calibration

Certificate Number : SPR22030023-2

Page : 1 of 3

Customer : Envilab Co., Ltd.

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

Equipment Name : Noise Dosimeter
 Manufacturer : Quest Technologies
 Model : NoisePro DLX Dosimeter
 Serial Number : NXC120104
 ID. Number : N/A

Environmental Conditions

Ambient Temperature	: 23 °C ± 3 °C	Received Date	: 02 Mar 2022
Relative Humidity	: 50 % ± 15 %	Calibration Date	: 04 Mar 2022
Location of Calibration	: In-Lab	Recommend Due Date	: 04 Mar 2023
Calibration Procedure	: SP-CPE-04-01	Date of Issue	: 05 Mar 2022

Method of Calibration

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

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

Calibrated by : 
 Calibration Officer

Approved by : 
 Authorized Signatory



รับรองสำเนาถูกต้อง
 ผู้จัดการฝ่ายควบคุมคุณภาพ



Calibration Report

Certificate Number : SPR22030023-2

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	SC-942	B014059	EEL.BP. 34/1264	22 Dec 2022

Traceability

This certification is traceable to the International System of Unit maintained at :

TISTR - Thailand Institute of Scientific and Technological Research



รับรองสถานะถูกต้อง
ผู้จัดการฝ่ายควบคุมคุณภาพ



Result of Calibration

Certificate No. : SPR22030023-2

Page : 3 of 3

Range : 94 to 114 dB

Function : @1kHz

Select A

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	93.8	93.8	-0.2	-0.2	0.15
114	113.8	113.8	-0.2	-0.2	0.15

Select C

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.2	94.2	0.2	0.2	0.15
114	114.2	114.2	0.2	0.2	0.15

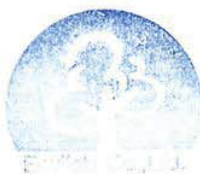
Note:

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

Measurement Uncertainty

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

- End of Certificate -



Certificate of Calibration

Certificate No. : 65-420020-1

Page : 1 of 2

Submitted by : Envilab Co., Ltd.

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

Equipment : pH Meter with electrode

pH meter

Manufacturer : Horiba

Model : F-74BW-G

Range : N/A pH

Resolution : 0.001 pH

Serial No. : B41J0001

ID No. : ELABPHHB74BW01

Electrode

Model : 9615S

Serial No. : 9X1K0003

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

Ambient Temperature : (23.5 to 24.8)°C

Relative Humidity : (50 to 55) %

Date of Received : 02 March 2022

Date of Calibration : 02 March 2022

Date of Issue : 05 March 2022

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	61235182	795894	14 Feb 2024	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
6.985	61223875	769927	15 May 2022	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
10.008	61244986	795895	25 Feb 2023	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025

Approved by :

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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



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ผู้จัดการฝ่ายควบคุมคุณภาพ



Certificate of Calibration

Certificate No. : 65-420020-1

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	-177.5	0.0	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	4.005	0.003	0.0084
	6.985	7.001	-0.016	0.010
	10.008	10.009	-0.001	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%

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รับรองสำเนาถูกต้อง

ผู้ดูแลระบบควบคุมคุณภาพ



Certificate of Calibration

Certificate No. : 65-400577-1

Page : 1 of 2

Submitted by : Envilab Co., Ltd.

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

Equipment : Air Chamber (Refrigerator)

Manufacturer : M-LAB

Model : BIC-140

Range : N/A °C

Resolution : 0.1 °C

Serial No. : 1011

ID No. : ELABBODC140N03

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

Ambient Temperature : (22.0 to 23.0) °C

Relative Humidity : (55 to 58) %

Line Voltage : (224.0 to 226.0) V

Date of Received : 11 November 2022

Date of Calibration : 11 November 2022

Date of Issue : 12 November 2022

Calibrated by : Bunjerd Masri

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

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

ID No.	Cert. No.	Due Date	Traceability
400046 & 400028	65-400522-3	03 Apr 2023	National Institute of Metrology Thailand (NIMT)

Approved by :

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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รับรองสาเนาถูกต้อง

ผู้จัดการฝ่ายควบคุมคุณภาพ



Certificate of Calibration

Certificate No. : 65-400577-1

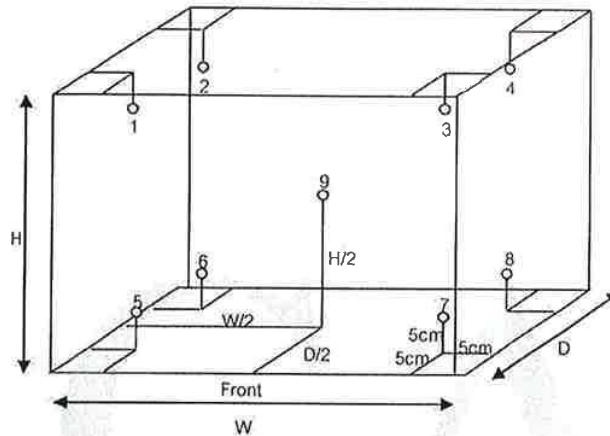
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

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



Inside of Chamber

W = 0.38 m

D = 0.35 m

H = 1.15 m

Capacity = 0.15 m³

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) @ Sensor No.									Uncertainty (± °C)
			1	2	3	4	5	6	7	8	9	
4.0	4.0	4.0	3.9	3.9	4.1	3.5	4.1	4.1	4.1	3.8	4.2	0.56

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
4.0	4.0	4.0	0.7	0.1	0.7

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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รับรองสำเนาถูกต้อง

ผู้จัดการฝ่ายควบคุมคุณภาพ



Certificate of Calibration

Certificate No. : 65-400527-3

Page : 1 of 2

Submitted by : Envilab Co., Ltd.

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

Equipment : Air Chamber (Oven)

Manufacturer : Binder

Model : ED 53

Range : N/A °C

Resolution : 1 °C

Serial No. : 13-02277

ID No. : ELABHAAOVEN2277

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

Ambient Temperature : (28.0 to 28.8) °C

Relative Humidity : (60 to 65) %

Line Voltage : (224.0 to 226.0) V

Date of Received : 08 October 2022

Date of Calibration : 08 October 2022

Date of Issue : 12 October 2022

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 & 400032	65-400274-1	25 Nov 2022	National Institute of Metrology Thailand (NIMT)

Approved by

(Bunjerd Masri)

ervisor

The Uncertainties are for a confidence probability of approximately 95%

Envilab Co.,Ltd.

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Certificate of Calibration

Certificate No. : 65-400527-3

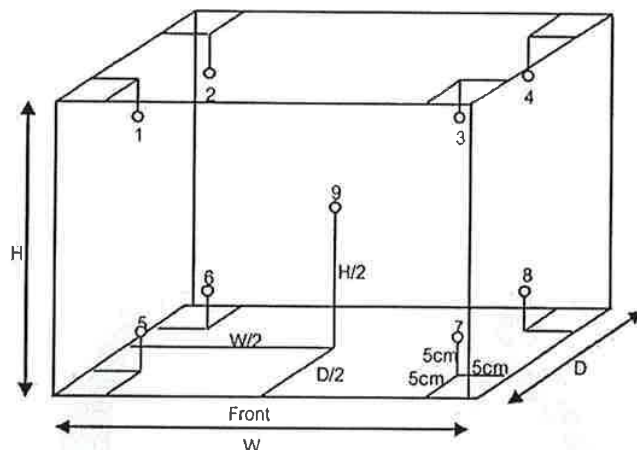
Page : 2 of 2

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	87	87	85.6	86.0	85.7	86.0	85.0	85.1	84.9	84.7	85.3	0.91
104	106	106	104.6	105.0	104.7	105.0	103.9	104.0	103.9	103.6	104.2	0.95
180	181	181	181.0	181.4	181.1	181.2	180.3	181.1	180.3	179.8	180.5	1.2

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
85	87	87	0.9	0.2	1.6
104	106	106	1.1	0.2	1.9
180	181	181	1.3	0.5	2.1

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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กรมการมาตรฐานแห่งชาติ

ศูนย์มาตรฐานกลาง



Certificate of Calibration

Certificate No. : 65-400577-2

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 : UF55

Range : N/A °C

Resolution : 0.1 °C

Serial No. : B215.1147

ID No. : ELABHAOVEN1147

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

Ambient Temperature : (28.0 to 29.0) °C

Relative Humidity : (50 to 55) %

Line Voltage : (224.0 to 225.0) V

Date of Received : 11 November 2022

Date of Calibration : 11 November 2022

Date of Issue : 12 November 2022

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 & 400032	65-400550-1	28 Apr 2023	National Institute of Metrology Thailand (NIMT)

Approved by :



Supervisor



The Uncertainties are for a confidence probability of approximately 95%

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รับรองสำเนาถูกต้อง

ผู้จัดการฝ่ายควบคุมคุณภาพ



Certificate of Calibration

Certificate No. : 65-400577-2

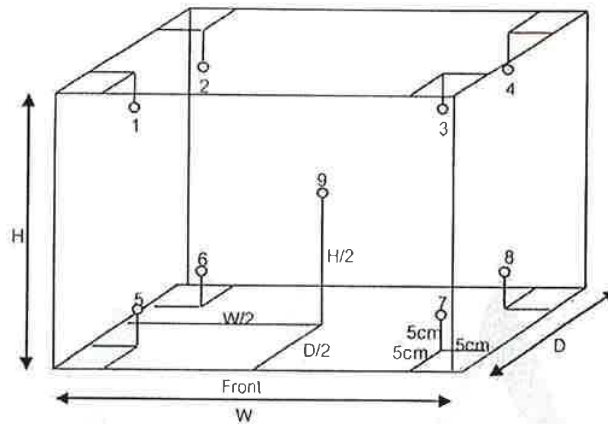
Page : 2 of 2

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 = 0.34 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	
104.0	104.0	104.0	103.9	103.7	103.9	103.7	104.0	104.1	103.7	103.7	104.2	0.69
110.0	110.0	110.0	110.0	109.8	110.0	109.7	110.1	110.1	109.7	109.7	110.2	0.69
180.0	180.0	180.0	179.5	179.4	180.1	180.0	180.2	180.1	179.1	179.6	180.6	0.99

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
104.0	104.0	104.0	0.6	0.1	0.7
110.0	110.0	110.0	0.6	0.1	0.7
180.0	180.0	180.0	1.8	0.3	1.9

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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รับรองสาเหตูกดตอง

Co.,Ltd.

ผู้จัดการฝ่ายควบคุมคุณภาพ



Certificate of Calibration

Certificate No. : 65-300146-10

Page : 1 of 2

Submitted by : Envilab Co.,Ltd.

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

Equipment : Cylinder

Manufacturer : PYREX

Class : A

Capacity : 50 ml

Graduation : 1 ml

ID No. : C-WW-020/18

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

Relative Humidity : (50 ± 15) %

Air Pressure : 1002.0 mbar.

Date of Received : 09 March 2022

Date of Calibration : 21 March 2022

Date of Issue : 21 March 2022

Calibrated by : [Redacted]

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	Traceability
241002	64-200354-I	02 Jun 2022	National Institute of Metrology (Thailand) (NIMT)

Approved by :



Supervisor



The Uncertainties are for a confidence probability of approximately 95%

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รับรองสำเนาถูกต้อง

ผู้จัดการฝ่ายควบคุมคุณภาพ



CAL

Calibratech Co.,Ltd.

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

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

Certificate of Calibration

Certificate No. : 65-300146-10

Page : 2 of 2

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

UUC Condition As-Received : Good

Nominal Volume (ml)	Measuring Volume (ml)
30	29.79
50	49.73

Uncertainty of measurement with in \pm 0.054 ml

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

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

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EnviLab Co., Ltd.

รับรองสำเนาถูกต้อง
ผู้จัดการฝ่ายควบคุมคุณภาพ



Certificate of Calibration

Certificate No. : 65-400053-1

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 : (22.7 to 23.5) °C

Relative Humidity : (45 to 50) %

Line Voltage : (224.0 to 225.0) V

Date of Received : 02 February 2022

Date of Calibration : 02 February 2022

Date of Issue : 07 February 2022

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	64-400588-1	24 May 2022	National Institute of Metrology Thailand (NIMT)

Approved by :

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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รับรองสำเนาถูกต้อง



Certificate of Calibration

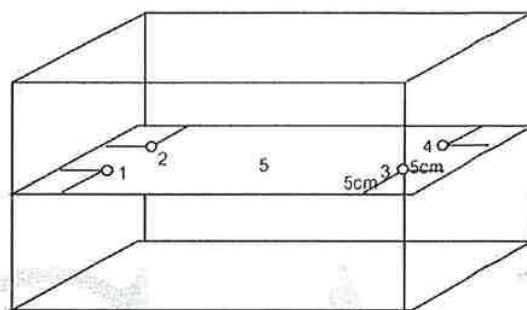
Certificate No. : 65-400053-1

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) @					Uncertainty (± °C)	Measured Uniformity (°C)	Measured Stability (°C)
			Sensor No.							
			1	2	3	4	5			
95.0	95.0	95.0	95.35	95.45	95.51	95.66	95.56	0.19	0.27	0.06

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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Calibratech Co., Ltd.

รับรองสำเนาถูกต้อง
ผู้จัดการฝ่ายควบคุมคุณภาพ



Certificate of Calibration

Certificate No. : 65-400138-2

Page : 1 of 2

Submitted by : Envilab Co., Ltd.

540,540/1 Soi Bangkhao7, Bangkhao, Bangkok 10160

Equipment : COD Reactor

Manufacturer : Hanna

Model : HI839800

Range : N/A °C

Resolution : 0.1 °C

Serial No. : 06480043101

ID No. : N/A

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

Relative Humidity : (50 ± 15) %

Date of Received : 09 March 2022

Date of Calibration : 03 May 2022

Date of Issue : 03 May 2022

Calibrated by : Permpon Chanpu

Calibration Method : This instrument was calibrated by In-house method direct measurement with Standard Digital Thermometer with TC Type T probe

The temperature scale used was based on ITS-90

Reference Standard Instruments :

Standard Digital Thermometer with TC Probe

ID No.	Cert. No.	Due Date	Traceability
400029 & 400030	64-400587-1	23 May 2022	National Institute of Metrology Thailand (NIMT)
400029 & 400032	64-400589-1	25 May 2022	National Institute of Metrology Thailand (NIMT)

Approved by :

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Envilab Co.,Ltd.

รับรองสาขาถูกต้อง

ผู้ตรวจฝ่ายควบคุมคุณภาพ



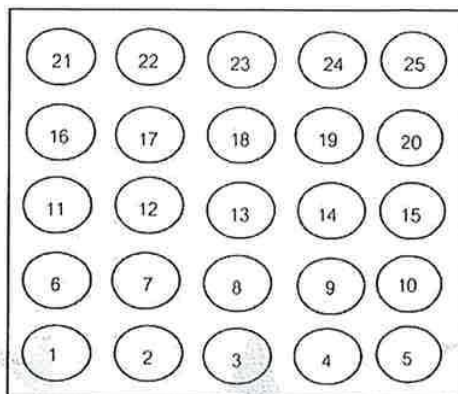
Certificate of Calibration

Certificate No. : 65-400138-2

Page : 2 of 2

Result of Calibration : Without Adjustment

Function : Temperature measurement



Controller

Test Point (°C)	UUC Setting (°C)	UUC Reading (°C)	Standard Reading at Position (°C)									
			1	2	3	4	5	6	7	8	9	10
150.0	150.0	150.0	149.1	150.1	150.5	150.5	149.2	150.5	151.0	151.1	150.0	150.0

Test Point (°C)	UUC Setting (°C)	UUC Reading (°C)	Standard Reading at Position (°C)									
			11	12	13	14	15	16	17	18	19	20
150.0	150.0	150.0	149.8	150.0	151.2	151.1	149.9	150.9	151.1	151.2	149.8	149.8

Test Point (°C)	UUC Setting (°C)	UUC Reading (°C)	Standard Reading at Position (°C)					Uncertainty (± °C)
			21	22	23	24	25	
150.0	150.0	150.0	150.3	150.0	150.0	150.8	150.4	0.80

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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รับรองสำเนาถูกต้อง
ผู้จัดการฝ่ายควบคุมคุณภาพ





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.: 22TW265

Page.: 1 of 2

Certificate of Testing

Equipment : DO Meter
Manufacturer : Hanna
Model : HI 5421
Serial No. : 04490038101
ID No. : ELABDOHI5421N1
Received Date : 25 November 2022
Test Date : 29 November 2022
Reference : 2211-0870DN-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 :

[Redacted Signature]

Approved by :

[Redacted Signature]
Approved Signatory

(✓)
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[Redacted Signature]

Issue Date :

1 December 2022



[Redacted Signature]
รับรองสำเนาถูกต้อง
Envilab Co.,Ltd. ผู้จัดการควบคุมคุณภาพ

B 0302782



Cert.No.: 22TW265

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.: TH123022

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.12	8.08	0.0055

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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รับรองและถูกต้อง
สำหรับการค้าขายควบคุมคุณภาพ

a 1138092

Certificate of Calibration

Certificate No. : 65-430009-1

Page : 1 of 2

Submitted by : Envilab Co., Ltd.

540, 540/1 Soi Bangkhac 7, Bangkhac, 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 (25.0 to 25.5) °C

Relative Humidity (50 to 55) %R.H.

Date of Received : 01 April 2022

Date of Calibration : 01 April 2022

Date of Issue : 02 April 2022

Calibrated by :

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
25 µS/cm	795889	24 February 2023	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
147 µS/cm	795890	14 February 2023	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
1413 µS/cm	795891	17 February 2023	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
12.88 mS/cm	795893	14 February 2023	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025

Approved by :

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Envilab Co.,Ltd. ผู้จัดการฝ่ายควบคุมคุณภาพ



Certificate of Calibration

Certificate No. : 65-430009-1

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
25.00	32.5	-7.5	0.20	μS/cm
147.0	113.1	34.0	2.1	μS/cm
1.413	1.406	0.007	0.0090	mS/cm
12.88	11.98	0.90	0.082	mS/cm

After Adjustment : at 25.00, 147.0, 1413 μS/cm 12.88 mS/cm

Standard Conductivity Solution	UUC Reading	Correction	Uncertainty (±)	Unit
25.00	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 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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รับรองสำเนาถูกต้อง

Co.,Ltd.

ผู้จัดการฝ่ายควบคุมคุณภาพ





S K SALES AND SERVICE CO.,LTD.
194/56, 194/57 Thakham Rd. Samoe Dam
Bang Khun Thien Bangkok 10150
Tel : 02-417-2144 Fax : 02-417-2155



Certificate of Calibration

Reference No. : 4182/2202-017 Certificate No. : L2203-290
Customer : Envilab Co., Ltd. (Head Office) Page 1 of 2
: 540, 540/1 Soi Bangkhuae 7, Bangkhuae,
: Bangkhuae Bangkok 10160.
Equipment : Digital Thermo-Hygrometer
Manufacturer : Testo
Model : 608-H1
Serial No. : 83353607
ID No. : -
Received Date : 7 March 2022
Calibrated Date : 9 March 2022
Issued Date : 15 March 2022

Environment	Start Calibration	Stop Calibration
Ambient Temperature (°C)	24.7	25.5
Relative Humidity (% RH)	51	52

Calibrated by : Mr. Nattawut Reangdech

Calibration Method

In-house method : by comparison with standard hygrometer for humidity measurement function
and comparison with standard thermometer for temperature measurement function into humidity/temperature chamber

Condition of this result of calibration

1. Reference standard instrument

	Instrument	Model	Serial No.	Certificate No.	Due Date
1)	Hygrometer	HL-NT2-D	61468576	QR21-0851	13 May 22
2)	Digital Thermometer With Probe	GT11	08000089	PSL-T 0072/65	14 November 2022

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

3. This certificate can be traceable to International System of Unit :

- Through Thailand Institute of Scientific And Technological Research (TISTR)
- Through Quality Reborn Co.,Ltd.

Approved by : _____

☐

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

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รองประธานกรรมการ
รองผู้อำนวยการ

Result of Calibration

Function : Humidity Measurement Reference Temperature at 25 °C

STD Reading (% RH)	UUC Reading (% RH)	UUC Error (% RH)	Measurement Uncertainty (\pm % RH)
50.00	49.0	-1.00	2.3

Function : Temperature Measurement

STD Reading (°C)	UUC Reading (°C)	UUC Error (°C)	Measurement Uncertainty (\pm °C)
25.012	25.0	-0.012	0.35

Resolution : 0.1 (°C) , 0.1 % RH

STD= Standard

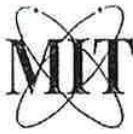
UUC= Unit Under Calibration

** End of Calibration Report **



Envilab Co.,Ltd.

รับรองสำเนาถูกต้อง
ผู้จัดการฝ่ายควบคุมคุณภาพ



MIRACLE INTERNATIONAL TECHNOLOGY CO.,LTD

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



CALIBRATION CERTIFICATE

Certificate No. : SS2202-154-0002

Date Issued : 24-Feb-22

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

Equipment : Incubator

Manufacturer : Memmert

Model : IF75

Serial No. : D319.0066

ID No./Tag No. : -

Date Received : 22-Feb-22

Date Calibrated : 22-Feb-22

Calibrated by :

Calibration Method or Calibration Procedure Used

Standard method : CP-05 TLAS G-20.

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 :



Page 1 of 2



Certificate No. : SS2202-154-0002

Environment : Ambient Temperature : Start record 25.3 °C, Stop record 25.1 °C
Relative Humidity : Start record 58.8 %RH, Stop record 58.5 %RH

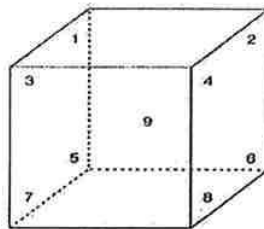
Calibration Temperature (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Stability ¹ (°C)	Measured Uniformity ² (°C)	Overall Variation ³ (°C)
35	35.0	35.0	0.05	0.07	0.15
37	37.0	37.0	0.04	0.11	0.16
44.5	44.5	44.5	0.08	0.12	0.24

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)	STD No. 6 (°C)	STD No. 7 (°C)	STD No. 8 (°C)	STD No. 9 (°C)	Uncertainty ⁴ ±°C
35	35.15	35.13	35.17	35.17	35.13	35.15	35.15	35.15	35.12	0.24
37	37.20	37.18	37.23	37.19	37.15	37.21	37.20	37.20	37.15	0.24
44.5	44.62	44.60	44.67	44.63	44.58	44.63	44.63	44.63	44.57	0.25

Note : Probe No. 9 is Reference Probe

Setting Air Fresh No. 0



Condition As-Received : New 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. AD2112-212-0001 for Temperature Indicator with Sensor Serial No. US37020317, Due 28-Jun-22

- 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.
 5. The temperature uniformity, stability, overall variation and indicating temperature is applicable to all air or gas filled temperature controlled enclosures at atmospheric pressure.

End of Certificate



รับรองสำเนาถูกต้อง

of 2

Mettler-Toledo (Thailand) Ltd.
846/4 - 846/5 Lasalle Rd., Bangna Tai Sub-District
Bangna District, Bangkok 10260
+662 723 0382
MT-TH.ServiceSupport@mt.com



Accuracy Calibration Certificate

Customer

Company: EnviLab Co., Ltd.
Address: 540, 540/1 Soi Bang Khae 7, Bang Khae
City: Bang Khae Contact: [REDACTED]
Zip / Postal: 10160
State / Province: Bangkok
Order Number: [Barcode]
* 0 3 3 1 9 0 7 2 4 6 *

Weighing Device

Manufacturer: Mettler Toledo Instrument Type: Weighing Instrument
Model: XSR205DU Asset Number: N/A
Serial No.: B911363567 Terminal Model: SRAT
Building: N/A Terminal Serial No.: B911363567
Floor: 3 Terminal Asset No.: N/A
Room: B304

Range	Max. Capacity	Readability (d)
1	81 g	0.00001 g
2	220 g	0.0001 g

Procedure

Calibration Guideline: EURAMET cg-18 v. 4.0 (11/2015)
METTLER TOLEDO Work Instruction: CPW002/20

This calibration certificate contains measurements for As Found calibration. No As Left calibration was performed because the device was not modified after As Found calibration. Therefore, results for As Left correspond to As Found.

The sensitivity/span of the weighing Instrument was adjusted before calibration with a built-in weight.

In accordance with EURAMET cg-18 (11/2015), the test loads were selected to reflect the specific use of the weighing device or to accommodate specific calibration conditions.

As Found	Temperature		Humidity	
	Start: 22.2 °C	End: 22.6 °C	Start: 58.3 %	End: 59.7 %

As Found Calibration Date: 02-Mar-2022 Callibrator: [REDACTED]
As Left Calibration Date: N/A
Issue Date: 03-Mar-2022
Approved Signatory: [REDACTED]

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รับรองสถานะลูกค้า
ผู้จัดการฝ่ายควบคุมคุณภาพ

Measurement Results

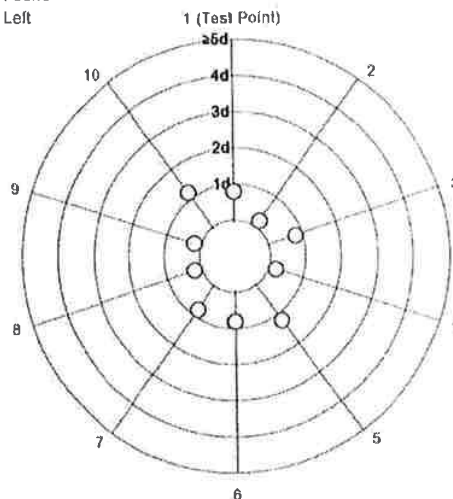
Repeatability

Test Load: 70 g

	As Found	As Left
1	70.00001 g	N/A
2	70.00002 g	N/A
3	70.00001 g	N/A
4	70.00002 g	N/A
5	70.00003 g	N/A
6	70.00001 g	N/A
7	70.00001 g	N/A
8	70.00002 g	N/A
9	70.00002 g	N/A
10	70.00003 g	N/A

Standard Deviation	0.000008 g	N/A
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○ As Found
◆ As Left



The "d" in the graph represents the readability of the range/interval in which the test was performed.

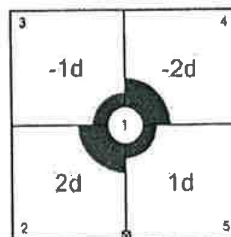
The results of this graph are based upon the absolute values of the differences from the mean value.

Eccentricity

Test Load: 100 g

Position	As Found	As Left
1	100.0000 g	N/A
2	100.0002 g	N/A
3	99.9999 g	N/A
4	99.9998 g	N/A
5	100.0001 g	N/A

Maximum Deviation	0.0002 g	N/A
-------------------	----------	-----



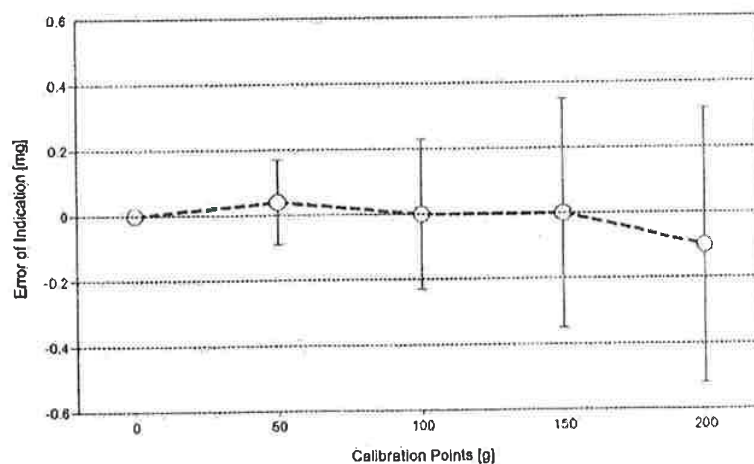
As Found

The "d" in the graph represents the readability of the range/interval in which the test was performed.

Error of Indication

As Found

	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.00000 g	0.00000 g	0.00000 g	0.017 mg	2
2	0.10000 g	0.10000 g	0.00000 g	0.023 mg	2
3	0.50000 g	0.50001 g	0.00001 g	0.028 mg	2
4	0.99999 g	0.99999 g	0.00000 g	0.032 mg	2
5	1.99999 g	2.00000 g	0.00001 g	0.040 mg	2
6	5.00001 g	5.00001 g	0.00000 g	0.048 mg	2
7	10.00001 g	10.00002 g	0.00001 g	0.062 mg	2
8	49.99998 g	50.00002 g	0.00004 g	0.13 mg	2
9	100.0000 g	100.0000 g	0.0000 g	0.23 mg	2
10	150.0000 g	150.0000 g	0.0000 g	0.35 mg	2
11	199.9999 g	199.9998 g	-0.0001 g	0.42 mg	2



○ As Found

◆ As Left

For improved legibility of the graphics only increasing measurement points are shown and measurement points close to zero are not displayed.

The uncertainty stated is the expanded uncertainty at calibration obtained by multiplying the standard combined uncertainty by the coverage factor k – which can be larger than 2 according to EURAMET cg-18. The value of the measurand lies within the assigned range of values with a probability of approximately 95%.

The user is responsible for maintaining environmental conditions and the settings of the weighing instrument when it was calibrated.



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Test Equipment

All weights used for metrological testing are traceable to national or international standards. The weights were calibrated and certified by an accredited calibration laboratory.

Weight Set 1: OIML E2

Weight Set No.:	WS22	Date of Issue:	06-Jan-2022
Certificate Number:	177036	Calibration Due Date:	03-Jul-2023

Weight Set 2: OIML E2

Weight Set No.:	WS76	Date of Issue:	31-Jan-2022
Certificate Number:	C205470237	Calibration Due Date:	12-Jul-2023

Thermo Hygrometer

Equipment No.:	IN193	Date of Issue:	14-Jun-2021
Certificate Number:	21H1221	Calibration Due Date:	01-Jun-2022

Remarks

FACT adjustment functionality activated
Equipment condition: Good
Next calibration according to customer's procedure

End of Accredited Section

The information below and any attachments to this calibration certificate are not part of the accredited calibration.



รับรองสำเนาถูกต้อง
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Measurement Uncertainty of the Weighing Instrument in Use

Stated is the expanded uncertainty with $k=2$ in use. The formula shall be used for the estimation of the uncertainty under consideration of the errors of indication. The value R represents the net load indication in the unit of measure of the device.

Temperature coefficient for the evaluation of the measurement uncertainty in use: $1.5 \cdot 10^{-6} / K$

Temperature range on site for the evaluation of the measurement uncertainty in use: 3 K

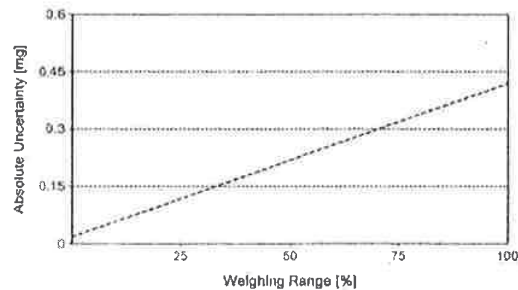
Linearization of Uncertainty Equation

	Range		As Found	As Left
	d	Max		
1	0.00001 g	81 g	$U_1 = 0.018 \text{ mg} + 0.00497 \text{ mg/g} \cdot R$	N/A
2	0.0001 g	220 g	$U_2 = 0.06 \text{ mg} + 0.00492 \text{ mg/g} \cdot R$	N/A

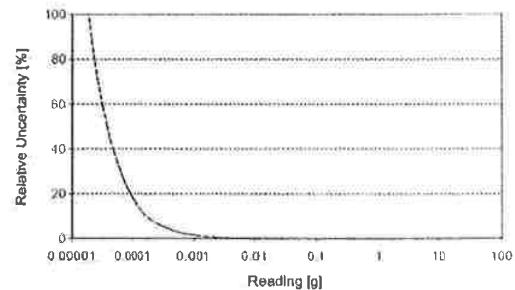
To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

Absolute and Relative Measurement Uncertainty in Use for Various Net Indications (Examples)

Net Indication	As Found		As Left	
0.00220 g	0.018 mg	0.82%	N/A	N/A
0.02200 g	0.018 mg	0.082%	N/A	N/A
0.22000 g	0.019 mg	0.0087%	N/A	N/A
2.20000 g	0.029 mg	0.0013%	N/A	N/A
220.0000 g	1.1 mg	0.00052%	N/A	N/A



As Found



As Left

The weighing range shown in the absolute uncertainty graph refers to the first interval/range of the device.

Agilent CrossLab Start Up Services

Agilent 5100 5110 ICP-OES Preventive Maintenance



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

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

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



Introduction

Customer Information

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



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Important Customer Web Links

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

Service Engineer's Responsibilities

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



รับรองสำเนาถูกต้อง

ฝ่ายควบคุมคุณภาพ

Instrument Maintenance

System Information

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

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

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

1.	G 8016A	MY 13440002
2.	G 8410A	AU 13393368
3.		
4.		
5.		
6.		
7.		
8.		
9.		

ICP-OES Configuration Table	Circle the type or write in the type if other
Nebulizer Type	See Spray, One Neb 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 0.8mm 1.4mm 0.8mm Other
Injector Material	Quartz Ceramic Other



รับรองสำเนาถูกต้อง
ผู้จัดการฝ่ายควบคุมคุณภาพ



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

Restore Instrument

- ☐ For HF applications, ask the customer to reinstall their sample introduction system. **NA**
- ☐ 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.



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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	1446.2	3461.3	2264.4	5922.0
Mn 257.610 nm SRBR	4871.9	14136.4	6478.6	19499.3
Al 396.152 nm SBR	5.9	14.9	8.1	19.6
K 766.491 nm SBR	5.2	35.8	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
Mains Current	0.088	A
Instrument Temperature	21.8	°C
RF Air Flow (sensor speed)	13.0	Hz
Plasma Exhaust Temperature	No measurement	
Water Flow Oscillator	No measurement	
Water Flow Detector	1.09	L/min
Water Inlet Temperature	18.9	°C
Polychromator Temperature	35.0	°C
CCD Temperature	-39.6	°C
Thermal Stabilizer	35.0	°C
Argon Supply Pressure	612.23	kPa
Purge Gas Supply Pressure*1	609.30	kPa
Option Gas Supply Pressure*1	-	kPa
Nebulizer Flow	No measurement	L/min
Nebulizer Back Pressure	No measurement	kPa
Plasma Gas Flow	No measurement	L/min
Auxiliary Gas Flow	No measurement	L/min
RF Power	No measurement	W
RF Supply Current	No measurement	A
RF Supply Voltage	No measurement	V

*1 If option installed

Consumed PM Parts

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

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

☐ Section Not Applicable

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



Signature Page

Service Engineer Comments (optional)

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

Service Verification

Service Request Number:	6005309412	Date Service Completed:	02 June 2022
Service Engineer Name:	Kanyakorn S.	Customer Name:	Savale C.
Service Engineer Signature:	Kanyakorn S.	Customer Signature:	Savale C.
Total number of pages in this document:		14	



รับรองสำเนาถูกต้อง
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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	
Subsystem Communications Test	
Intensity	3732284
Wavelength	737.212
Radial	3041677
Axial	737.212

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	(206.158 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	(675.283 nm)	≤ 74.00	61.89
K	(766.491 nm)	≤ 80.00	66.27



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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	286.3	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

Agilent 5100/5110 VDV ICP-OES		
Instrument Model	G8011A/G8015A	
Instrument ID	MY17490002	
Instrument Serial Number	7.4.0.10280	
Software Version	3562	
Firmware Version	Kanyakorn S.	
Tested By	02-Jun-22 12:13:54 PM	
Test Started On	02-Jun-22 12:26:36 PM	
Test Completed On		
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	
Air Flow Test		
30% Air Flow (relative speed)	75% Air Flow (relative speed)	
13.00	18.00	
Water Flow Test		
RF Water Flow(L/min)	Camera Water Flow (L/min)	Water Inlet Temperature (°C)
1.49	1.06	18.51

Nebulizer		
Target Flow	Actual Flow	Back Pressure
0.70	0.70	300.66
Auxiliary		
Target Flow	Actual Flow	Back Pressure
2.00	1.99	91.37
Makeup		
Target Flow	Actual Flow	Back Pressure
2.00	2.00	93.50
Plasma		
Target Flow	Actual Flow	Back Pressure
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)		
RF Power Supply Current (A)	45.108	1.999
Integration Time		
Electronic Offset Test	Standard Deviation	Status
1000	5.174	Passed
Array Test	5	0.015
Linearity Test	0.123	Passed

Certificate of Calibration

Certificate No. : 66-420018-1

Page : 1 of 2

Submitted by : Envilab Co., Ltd.

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

Equipment : pH Meter with electrode

pH meter

Manufacturer : Adwa

Model : AD 12

Range : -2.00 to 16.00 pH

Resolution : 0.01 pH

Serial No. : 11004090402

ID No. : ELABPHADWA1201

Environment : Ambient Temperature : $(25 \pm 2) ^\circ \text{C}$

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

Date of Received : 08 February 2023

Date of Calibration : 13 February 2023

Date of Issue : 13 February 2023

Calibrated by : [REDACTED]

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

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

Standard Buffer Solution

pH	Cert. No.	Lot No.	Exp. Date	Traceability
4.008	61235182	857394	11 Dec 2024	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
6.986	61267169	857395	11 Dec 2023	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
10.010	61260481	857396	11 Dec 2023	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025

Approved by

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 66-420018-1

Page : 2 of 2

Result of Calibration :

UUC Condition As-Received : Good

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 (\pm pH)
4, 7	4.008	4.01	0.00	0.0097
	6.986	7.00	-0.01	0.011
7,10	6.986	7.00	-0.01	0.011
	10.010	10.01	0.00	0.014

Remark

1 UUC : Unit Under Calibration

2 pH meter does not have voltage mode because the plug can not BNC socket

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

This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2$,

providing a level of confidence of approximately 95%

- o0o -



Certificate of Calibration

Certificate No. : 65-400577-1

Page : 1 of 2

Submitted by : Envilab Co., Ltd.

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

Equipment : Air Chamber (Refrigerator)

Manufacturer : M-LAB

Model : BIC-140

Range : N/A °C

Resolution : 0.1 °C

Serial No. : 1011

ID No. : ELABBODCI40N03

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

Ambient Temperature : (22.0 to 23.0) °C

Relative Humidity : (55 to 58) %

Line Voltage : (224.0 to 226.0) V

Date of Received : 11 November 2022

Date of Calibration : 11 November 2022

Date of Issue : 12 November 2022

Calibrated by : [REDACTED]

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

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

ID No.

Cert. No.

Due Date

Traceability

400046 & 400028

65-400522-3

03 Apr 2023

National Institute of Metrology Thailand (NIMT)

Approved by : [REDACTED]

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 65-400577-1

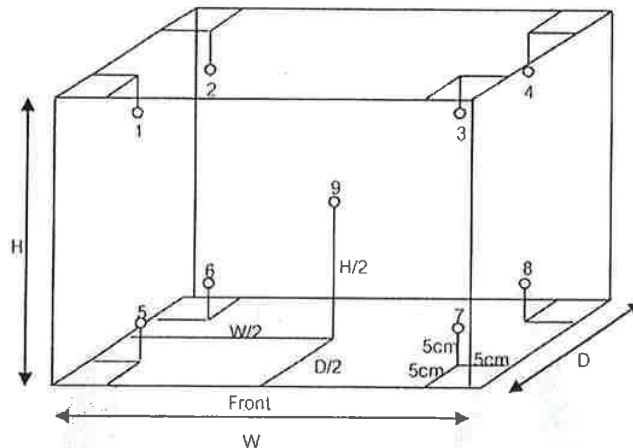
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

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



Inside of Chamber

W = 0.38 m

D = 0.35 m

H = 1.15 m

Capacity = 0.15 m³

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) @ Sensor No.									Uncertainty (± °C)
			1	2	3	4	5	6	7	8	9	
4.0	4.0	4.0	3.9	3.9	4.1	3.5	4.1	4.1	4.1	3.8	4.2	0.56

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
4.0	4.0	4.0	0.7	0.1	0.7

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 -



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NSC-TISI-TIS 17025
CALIBRATION 0030

Certificate of Calibration

Certificate No. : 66-400156-2

Page : 1 of 2

Submitted by : Envilab Co., Ltd.

540, 540/1 Soi Bangkhae 7, Bangkhae, 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 :

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 :

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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CAL-F0031-03



Envilab Co., Ltd.

ผู้ตรวจสอบและควบคุมคุณภาพ

Certificate of Calibration

Certificate No. : 66-400156-2

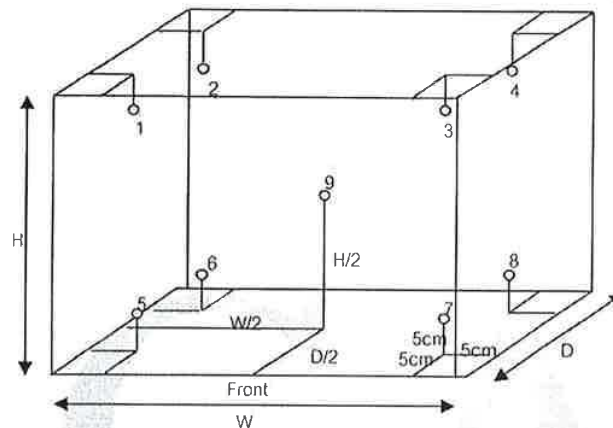
Page : 2 of 2

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 -



Certificate of Calibration

Certificate No. : 65-400527-3

Page : 1 of 2

Submitted by : Envilab Co., Ltd.

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

Equipment : Air Chamber (Oven)

Manufacturer : Binder

Model : ED 53

Range : N/A °C

Resolution : 1 °C

Serial No. : 13-02277

ID No. : ELABHAOVEN2277

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

Ambient Temperature : (28.0 to 28.8) °C

Relative Humidity : (60 to 65) %

Line Voltage : (224.0 to 226.0) V

Date of Received : 08 October 2022

Date of Calibration : 08 October 2022

Date of Issue : 12 October 2022

Calibrated by :

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

<u>ID No.</u>	<u>Cert. No.</u>	<u>Due Date</u>	<u>Traceability</u>
400029 & 400032	65-400274-1	25 Nov 2022	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. : 65-400527-3

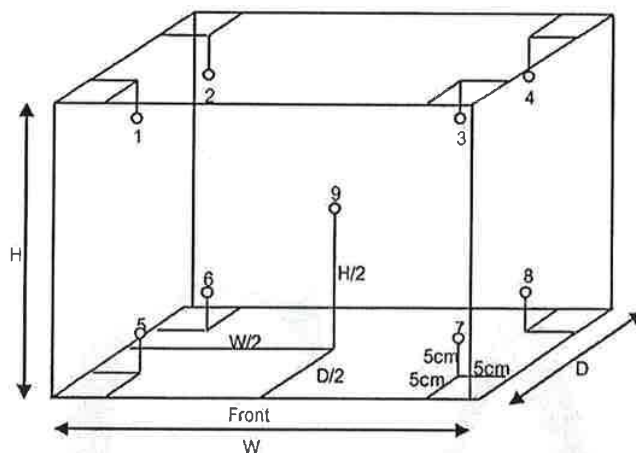
Page : 2 of 2

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	87	87	85.6	86.0	85.7	86.0	85.0	85.1	84.9	84.7	85.3	0.91
104	106	106	104.6	105.0	104.7	105.0	103.9	104.0	103.9	103.6	104.2	0.95
180	181	181	181.0	181.4	181.1	181.2	180.3	181.1	180.3	179.8	180.5	1.2

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
85	87	87	0.9	0.2	1.6
104	106	106	1.1	0.2	1.9
180	181	181	1.3	0.5	2.1

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 -



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NSC-TISI-TIS17025
CALIBRATION 0030

Certificate of Calibration

Certificate No. : 66-200066-2

Page : 1 of 2

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

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

Environment : On site calibration was carried out at the B304 Balance Room, Envilab Co., Ltd.
Ambient Temperature : (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 : [Redacted]

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 :



Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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CAL-F0031-03



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ผู้ตรวจการฝ่ายควบคุมคุณภาพ

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

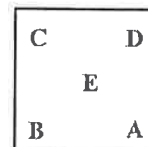
This result of calibration was found accurate as shown on date and place of calibration only.

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

- o0o -



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Certificate of Calibration

Certificate No. : 66-300140-2

Page : 1 of 2

Submitted by : Envilab Co.,Ltd.

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

Equipment : Cylinder

Manufacturer : PYREX

Class : A

Capacity : 50 ml

Graduation : 1 ml

ID No. : C-WW-003/23

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 : 

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	Traceability
241002	65-200370-1	02 Jun 2023	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



Envilab Co.,Ltd.

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ผู้จัดการฝ่ายควบคุมคุณภาพ

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Certificate of Calibration

Certificate No. : 66-300140-2

Page : 2 of 2

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

UUC Condition As-Received : Good

Nominal Volume (ml)	Measuring Volume (ml)
30	29.98
50	50.12

Uncertainty of measurement with in \pm 0.054 ml

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

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

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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. : 66-430010-1

Page : 1 of 2

Submitted by : Envilab Co., Ltd.

540, 540/1 Soi Bangkhuae 7, Bangkhuae, 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 : [Redacted]

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 [Redacted]

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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CAL-F0031-03



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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%

- o0o -

CAL

Calibratech Co.,Ltd.

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

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



Certificate of Calibration

Certificate No. : 66-410024-1

Page : 1 of 2

Submitted by : Envilab Co., Ltd.
540, 540/1 Soi Bangkhuae 7, Bangkhuae, 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 :** $(23 \pm 2) ^\circ\text{C}$
Relative Humidity : $(50 \pm 15) \%$

Date of Received : 08 March 2023

Date of Calibration : 09 March 2023

Date of Issue : 09 March 2023

Calibrated by : [Redacted]

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

Reference Standard Instruments : This certification is traceable to the International System of Units
Digital Indicator with Standard Probe Temp&Hum

ID No.	Cert. No.	Due Date	Traceability
400034 & 400036	SG-H-00021/66	11 Jul 2023	Success Gateway Co., Ltd., Accredited by TISI Calibration No.0268

Approved by :

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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CAL-F0031-03



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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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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 : 

CALIBRATION DATE : 03-May-23

APPROVED BY : 

ISSUED DATE : 04-May-23

RECEIVED DATE : 03-May-23

THIS CERTIFICATE MAY NOT BE REPRODUCED OTHER THAN IN FULL EXCEPT WITH THE PRIOR WRITTEN APPROVAL OF
QUALITY CALIBRATION CO., LTD.

F-G010 REV : 02



บริษัท อย่ง ๑๑๑ จำกัด
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QUALITY CALIBRATION CO.,LTD.

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

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

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°C ± 1°C
MODEL : HI839800
SERIAL NUMBER : 6480043101
CALIBRATION DATE : 03-May-23
RELATIVE HUMIDITY : 55% RH ± 10% 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 (°C)		150.0
Indicating Temperature		150.0
Measured Temperature (°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 (± °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



Envlab Co.,Ltd.

บริษัท อีแลบ จำกัด

ผู้จัดการฝ่ายควบคุมคุณภาพ

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



NSC-TISI-TIS17025
CALIBRATION 0030

Certificate of Calibration

Certificate No. : 66-400101-1

Page : 1 of 2

Submitted by : Envilab Co., Ltd.

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

Equipment : Air Chamber (Incubator)

Manufacturer : Memmert

Model : IF 110

Range : N/A °C

Resolution : 0.1 °C

Serial No. : D419.0525

ID No. : ELABINCUBATOR1

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

Ambient Temperature : (24.0 to 24.6) °C

Relative Humidity : (55 to 60) %

Line Voltage : (224.5 to 226.0) V

Date of Received : 21 February 2023

Date of Calibration : 21 February 2023

Date of Issue : 21 February 2023

Calibrated by :

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

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

<u>ID No.</u>	<u>Cert. No.</u>	<u>Due Date</u>	<u>Traceability</u>
400046 & 400042	66-400066-1	02 Aug 2023	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



Certificate of Calibration

Certificate No. : 66-400101-1

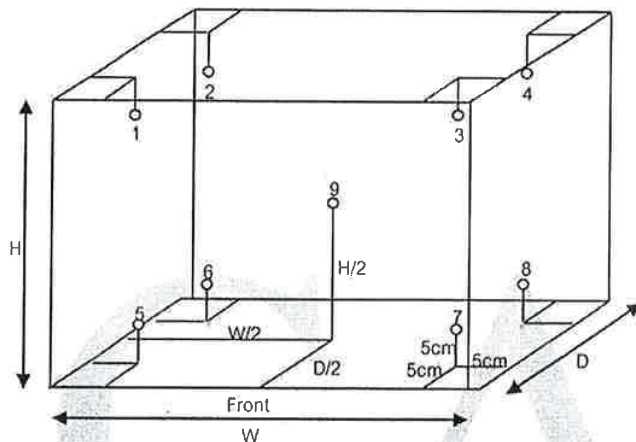
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

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



Inside of Chamber

W = 0.56 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	35.01	35.09	35.15	35.13	35.16	35.11	34.98	35.03	35.12	0.30
37.0	37.0	37.0	37.04	37.11	37.17	37.16	37.18	37.14	36.99	37.04	37.14	0.30

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
35.0	35.0	35.0	0.16	0.02	0.2
37.0	37.0	37.0	0.18	0.03	0.2

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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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 Bangkhæ 7,
Bangkhæ, Bangkhæ, 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 : [Redacted]
Approved by : [Redacted]
[Redacted]
[Redacted]
Issue Date : 23 March 2023

Approved Signatory

B 0310344



องค์การมาตรฐาน

สมาคมส่งเสริมเทคโนโลยี (ไทย-ญี่ปุ่น)



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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a 1154259



Envisab Co., Ltd.

รับรองสาขาถูกต้อง
ผู้จัดการฝ่ายควบคุมคุณภาพ

CAL

Calibratech Co.,Ltd.

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

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



NSC-TISI-TIS 17025
CALIBRATION 0030

Certificate of Calibration

Certificate No. : 66-400056-1

Page : 1 of 2

Submitted by : Envilab Co., Ltd.

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

Equipment : Water Bath

Manufacturer : Memmert

Model : WNB29

Range : N/A °C

Resolution : 0.1 °C

Serial No. : L617.0156

ID No. : ELABWBWNB29N01

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

Ambient Temperature : (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 : [REDACTED]

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

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

<u>ID No.</u>	<u>Cert. No.</u>	<u>Due Date</u>	<u>Traceability</u>
400029 & 400031	65-400549-1	22 Apr 2023	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



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Envilab Co., Ltd. ผู้จัดการฝ่ายควบคุมคุณภาพ

Certificate of Calibration

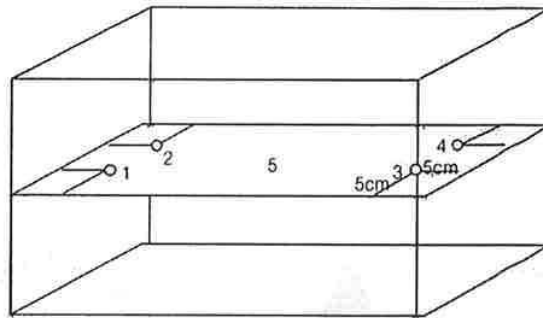
Certificate No. : 66-400056-1

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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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.



รับรองสำเนาถูกต้อง
ผู้พิจารณาความคุณคุณภาพ

Introduction

Customer Information

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



Important Customer Web Links

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

Service Engineer's Responsibilities

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



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Instrument Maintenance

System Information

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

Instrument System Name and ID
Instrument System Site and Location

5110 VDV ICP-OES
Envilab Company Limited

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

1 G 8015 A MY 17420002
2 G 8410 A AU17393769
3 G 8451-80002 1709-05324
4
5
6
7
8
9

ICP-OES Configuration Table	Circle the type or write in the type if other
Nebulizer Type	SeaSpray OneNeo 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 1.0mm Other
Injector Material	Quartz Ceramic Other

Preparation

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

Preventive Maintenance Procedures

Record Pre-PM Instrument performance

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

Clean and inspect ICP-OES system

- ☒ Look for any obvious external damage or problems.
- ☒ Inspect water cooling hoses, gas lines and power cord for excessive wear or damage.
- ☒ Perform a general internal inspection of the system for excessive dust accumulation, clean if necessary.
- ☒ Inspect sample introduction components and record any required maintenance in the Service Engineer Comments and notify the customer as the required actions required.
- ☒ Record the instrument operating conditions in the ICP-OES Status Results Table.
- ☒ Replace the polychromator purge filter.
- ☒ Replace the radial pre-optics window
- ☒ Replace the axial pre-optics window for SVDV and VDV instruments.
- ☒ Check exhaust flow for the correct positive extraction at the exhaust duct to insure they meet minimum specifications.
- ☒ Replace air inlet dust filter.
- ☐ Replace high capacity air inlet dust filter element if installed 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. *checked; passed*
- ☒ Test using customer's tray and move the sample probe to the sample vial 1, wash vial and rinse port and ensure that the probe is centered in the vial. If not use calibration wizard and calibrate the position.

AVS 4, 6, 7 Advanced Valve System

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



ICP-OES adjustment

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

Record Post-PM instrument performance

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

- ☒ Record the result in the Instrument Test Results Table

Restore Instrument

- ☐ For HF applications, ask the customer to reinstall their sample introduction system, N18
- ☒ 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.



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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 SRBR	1577.1	3332.6	2344.2	6129.9
Mn 257.610 nm SRBR	3945.3	16143.3	10315.1	39073.2
Al 396.152 nm SBR	7.0	16.3	8.5	25.7
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

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 211.424
Mains Current	0.082	A 0.097
Instrument Temperature	23.5	°C 23.1
RF Air Flow (sensor speed)	13.0	Hz 11.0
Plasma Exhaust Temperature	No measurement	°C 56.4
Water Flow Oscillator	No measurement	L/min 1.31
Water Flow Detector	1.09	L/min 1.06
Water Inlet Temperature	16.9	°C 16.7
Polychromator Temperature	33.0	°C 33.0
CCD Temperature	-39.6	°C -39.4
Thermal Stabilizer	33.0	°C 33.0
Argon Supply Pressure	619.13	kPa 500.32
Purge Gas Supply Pressure*1	616.63	kPa 597.43
Option Gas Supply Pressure*1	-	kPa -
Nebulizer Flow	No measurement	L/min 0.30
Nebulizer Back Pressure	No measurement	kPa 283.13
Plasma Gas Flow	No measurement	L/min 11.98
Auxiliary Gas Flow	No measurement	L/min 1.00
RF Power	No measurement	W 1145.1
RF Supply Current	No measurement	A 8.190
RF Supply Voltage	No measurement	V 194.557

*1 If option installed

Consumed PM Parts

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

Consumed Parts Reference

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

☐ Section Not Applicable.

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

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: G06121636
Service Engineer Name: Kanyakorn S.
Service Engineer Signature: Kanyakorn S.
Date Service Completed: 31 May 2023
Customer Name: ภาณุ
Customer Signature: ภาณุ
Total number of pages in this document: 14

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		
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		
Pass		
Optics Test		
Pass		
</		

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



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 10/1 หมู่ 10 ตำบล คลองเตย อำเภอ คลองเตย จังหวัด สงขลา 90110
 โทรศัพท์ 09-0909-8888 โทรสาร 09-0909-8889

Sensitivity Test

Pass

Radial

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

Axial

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

Precision Test

Pass

Radial

Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 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

Report Summary	
Instrument Model	Agilent 5100/5110 VDV ICP-OES
Instrument ID	G8011A/G8015A
Instrument Serial Number	MY17490002
Software Version	7.4.0.10280
Firmware Version	3562
Tested By	Kanyakorn S.
Test Started On	5/31/2023 12:34:17 PM
Test Completed On	5/31/2023 12:46:55 PM
Result Summary	
Subsystem Communications Test	Pass
Air Flow Test	Pass
Water Flow Test	Pass
Gas Flows Test	Pass
RF Generator Test	Pass
Camera Test	Pass
Optics Test	Skipped
Advanced Valve System Test	Skipped
Resolution Test	Skipped
Sensitivity Test	Skipped
Precision Test	Skipped
Subsystem Communications Test	
Pass	
Air Flow Test	
30% Air Flow (relative speed)	12.00
75% Air Flow (relative speed)	18.00
Water Flow Test	
RF Water Flow(L/min)	1.45
Camera Water Flow (L/min)	1.06
Water Inlet Temperature (°C)	16.78

Gas Flows Test			
Nebulizer Target Flow	Actual Flow	Back Pressure	Pass
0.70	0.71	280.77	
Makeup Target Flow	Actual Flow	Back Pressure	
2.00	1.99	95.26	
Plasma Target Flow	Actual Flow	Back Pressure	
18.00	17.94	23.27	
RF Generator Test			
Pass			
RF Power Supply Test	Passed		
RF Power Supply (V)	147.418		
RF Oscillator Test	Passed		
RF Oscillator Frequency (MHz)	25.961		
Work Coil Current (A)	45.326		
RF Power Supply Current (A)	2.000		
Camera Test			
Pass			
Integration Time (ms)	Standard Deviation	Status	
1000	5.120	Passed	
Array Test	5	0.015	Passed
Linearity Test	0.122		Passed

