



Certificate of Calibration

Method 5 Pre-Test Calibration - Liters (L)

UUT Meter Console Information

Model #: XC-572-V
Serial #: A2001003
DGM Model #: SK25EX
DGM Serial #: 00005796

Calibration Conditions

Bar. Pressure (mm Hg): 759.8
Ambient Temperature (°C): 24.8
Relative Humidity (%): 55.0
Altitude (m): 1.83
Bar. Pressure Corr. (mm Hg): 759.7

Factors/Conversions

Std. Temp. (K): 293.15
Std. Press. (mm Hg): 760
K₁ (K/mm Hg): 0.3857

Reference Equipment

Calibration Meter Model: DGM-200H
Cal. Due Date: 25-Jul-24
Serial No.: 0000026
Gamma: 1.0000

UUT Meter (DGM)

Run Time	Offset, ΔH (mm H ₂ O)	Volume		Meter Temperature (°C)		Meter Pressure (mm H ₂ O)	Reference Meter (WTM)		Outlet Temperature (°C)	
		Initial (L)	Final (L)	Initial	Final		Initial	Final	Initial	Final
θ	$P_{m(g)}$	$V_{m(i)}$	$V_{m(f)}$	$t_{m(i)}$	$t_{m(f)}$	P_w	$V_{w(i)}$	$V_{w(f)}$	$t_{w(i)}$	$t_{w(f)}$
830.00	13.00	701219.2	701370.2	25.0	25.0	0.3	0.00	157.49	25.0	25.0
600.00	25.00	701370.2	701524.0	25.0	25.0	0.5	0.00	158.64	25.0	25.0
450.00	50.00	701524.0	701690.6	26.0	26.0	0.6	0.00	170.76	25.0	25.0
450.00	80.00	701690.6	701901.2	26.0	27.0	2.0	0.00	215.91	25.0	25.0
300.00	120.00	701901.2	702073.0	27.0	28.0	2.4	0.00	178.06	25.0	25.0

Standardized Data

Reference Meter (L)		UUT Meter (L)		Correction Factor		ΔH @ (mm H ₂ O)	
Std. Vol	Std. Flow	Std. Vol.	Std. Flow	Value	Variance	ΔH @	Variance
$V_{w(Std)}$	$Q_{w(Std)}$	$V_{m(Std)}$	$V_{w(Std)}$	Y	ΔY	ΔH @	$\Delta \Delta H$ @
154.90	11.20	148.59	11.2	1.0425	0.0096	46.1	1.267
156.11	15.61	151.52	15.6	1.0303	-0.0026	45.7	0.878
168.06	22.41	163.98	22.4	1.0249	-0.0079	44.3	-0.486
213.24	28.43	207.53	28.4	1.0275	-0.0054	44.4	-0.401
176.03	35.21	169.38	35.2	1.0392	0.0064	43.6	-1.258
				1.0329	= Y Avg.	44.8	= ΔH @ Avg.

Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is ± 0.02 .

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

Pass/Fail Judgment : **Pass**

Calibrate By : [Redacted]

Approved By : [Redacted]

Date: 14 Feb 24

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

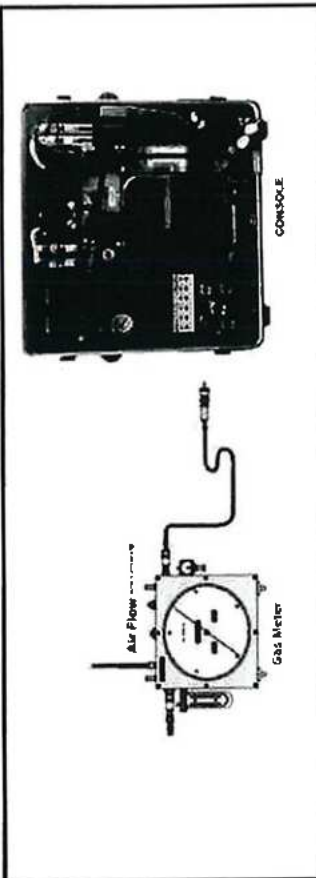


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Calibration Train



Equations

$$V_{to(std)} = Y * K_1 * \frac{V_w * (P_{bar} + \frac{P_{m(sld)}}{13.6})}{T_{to}}$$

$$V_{w(sld)} = \frac{K_1 V_m (P_{bar} + \frac{\Delta H}{13.6})}{T_{to}}$$

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

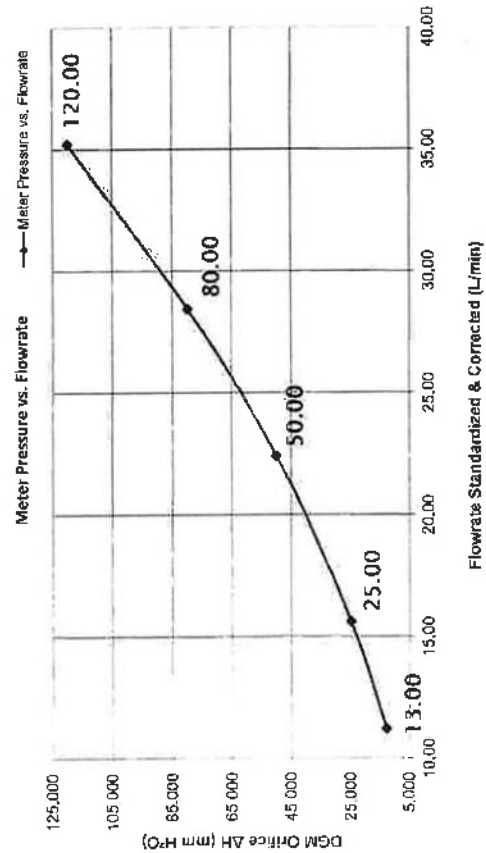
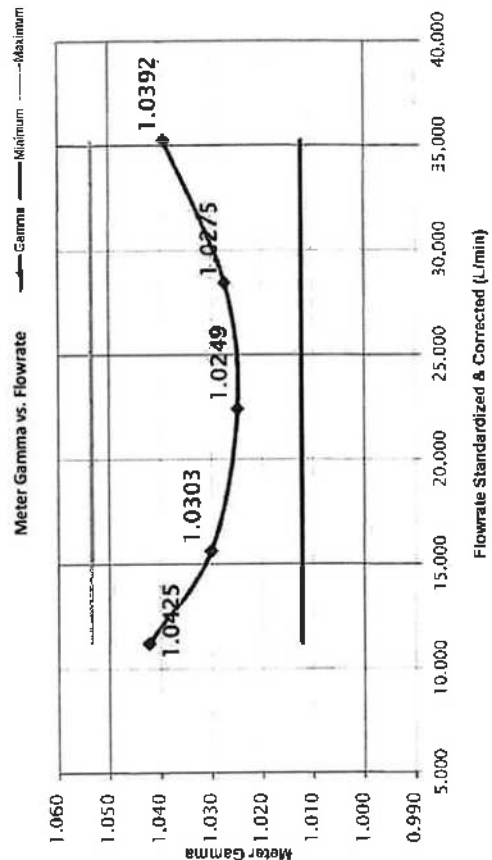
$$Y = \frac{V_{cr(std)}}{V_{m(std)}}$$

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

$$\Delta H_{cr} = \frac{P_{m(sld)} * 0.0011696 * (P_{bar} + \frac{P_{m(sld)}}{13.6})}{T_{m}} * \left(\frac{T_{to} * \Theta}{V_w * P_{bar}} \right)^2$$

Nomenclature

P_b - Barometric Pressure
 DGM - Dry Gas Meter
 K_1 - Constant based on standard temp and press
 t - Run time, in minutes
 P_{m} - ΔH (Meter Pressure, gauge)
 V_m - Volume collected by test meter, corrected for STP
 $Q_{m(sld)}$ - Calculated flow rate of test meter
 K' - Critical orifice coefficient
 P_w - Measured pressure of reference meter
 t_w - Temperature measured in reference meter





Certificate of Calibration

Method 5 Console Sensor Calibration - Metric Units

Console Information

Model #: XC-572-V
Serial #: A2001003
Units: Metric

Calibration Conditions

Pbar (mm. Hg): 759.8
Humidity (%): 55
Tamb (°C): 24.8
Elevation (m): 1.8
Corr. Pbar (mm. Hg): 759.7

Reference Devices

TC Calibrator Model: CC-VTR-SH
Reference #: 091109269
Barometer Model: 736930
Reference #: EBARODIALSPE01
Pressure Model: 718 30G
Reference #: 9543013

Temperature Display Calibration Data

Reference Point ¹	Reference Temp.	Test Thermocouple Calibrations						Reference Point Status ²
		Aux	Stack	Probe	Oven	Filter	Exit	
#	°C	°C	°C	°C	°C	°C	°C	Pass/Fail
1	-18	-17	-17	-17	-17	-17	-17	PASS
2	38	37	37	37	37	37	37	PASS
3	93	93	93	92	93	93	93	PASS
4	149	149	149	149	149	149	149	PASS
5	260	259	259	258	259	258	259	PASS
6	371	371	371	371	371	371	371	PASS
7	482	482	482	482	482	482	482	PASS
8	593	594	594	593	593	593	593	PASS
9	816	816	816	815	815	815	815	PASS
10	1038	1038	1038	1038	1038	1038	1038	PASS

Overall Audit Status

NIST Reference Thermocouple ID:

12702001

Ref Point	Theoretical Temp	DGM Thermocouple Sensor Reading	ΔT_{abs} ⁴
#	°C	°C	°C
Ice Water	1	0.9	0.04%
Ambient ³	2	24.8	0.04%
Maximum ²			0.04%
Status			PASS

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

Calibrate By :

Approved By:

Date: 14 Feb 24

Notes

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

² For valid test results, the maximum difference between temperature and reference readings should be less than ± 5.4 °F (± 3 °C), for all thermocouples except for the slack thermocouple which should be less than ± 1.5 absolute temperature from the reference reading and the exit thermocouple which should be less than ± 2 °F (± 1 °C) from the reference reading (EPA Method 2, Section 5.3 and EPA Method 5, Sections 6.1.1-6.1.1.8)

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

⁴ Absolute temperature difference and other formulas are calculated based on unit input from cell C8 at the top of this sheet under "Meter Console Information"

⁵ For valid test results, the maximum difference between console and reference barometric pressure readings should be less than ± 0.1 in. Hg (± 2.5 mm Hg), (EPA Method 5, Section 6.1.2)

⁶ For valid test results, the maximum difference between console and reference vacuum readings should be less than ± 0.5 in. Hg (± 12.5 mm Hg)

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

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neediss Console Sensor Calibration Data Sheet

Console Information

Model #: XC-572-V
Serial #: A2001003
Units: Metric
Type:
"English"

Calibration Conditions

Pbar (mm. Hg): 759.8
Humidity (%): 55.0
Tamb (°C): 24.8
Corr. Pbar (mm. Hg): 759.7

Reference Devices

TC Simulator Model: CC-VTR-SH
Reference #: 091109289
Barometer Model: 736930
Reference #: EBARODIALSPE01
Digital Pressure Calibrator Model: 718 30G
Reference #: 3691001


Pressure Gauge / Manometer Calibration Data

Console Vacuum Calibration			
Reference Point	Reference Vacuum	Console Vacuum	Reference Point Status ⁶
#	in. Hg	in. Hg	Pass/Fail
1	-5.0	-4.5	PASS
2	-15.0	-14.5	PASS
3	-20.0	-19.5	PASS

Reference Point ¹	ΔH Manometer Calibration			Reference Point Status ²
	Reference	Positive (+) Pitot	Negative (-) Pitot	
#	mm H2O	mm H2O	mm H2O	Pass/Fail
1	-200.000	0.0	-200.0	PASS
2	-150.000	0.0	-150.0	PASS
3	-100.000	0.0	-100.0	PASS
4	-80.000	0.0	-80.0	PASS
5	-50.000	0.0	-50.0	PASS
6	0.000	0.0	0.0	PASS
7	50.000	50.0	0.0	PASS
8	80.000	80.0	0.0	PASS
9	100.000	100.0	0.0	PASS
10	150.000	150.0	0.0	PASS
11	200.000	200.0	0.0	PASS
ΔH Overall Audit Status				PASS

Reference Point ¹	ΔP Manometer Calibration			Reference Point Status ²
	Reference	Positive (+) Pitot	Negative (-) Pitot	
#	mm H2O	mm H2O	mm H2O	Pass/Fail
1	-200.000	0.0	-200.0	PASS
2	-150.000	0.0	-150.0	PASS
3	-100.000	0.0	-100.0	PASS
4	-80.000	0.0	-80.0	PASS
5	-50.000	0.0	-50.0	PASS
6	0.000	0.0	0.0	PASS
7	50.000	50.0	0.0	PASS
8	80.000	80.0	0.0	PASS
9	100.000	100.0	0.0	PASS
10	150.000	150.0	0.0	PASS
11	200.000	200.0	0.0	PASS
ΔP Overall Audit Status				PASS

Calibrate By: 

Approved By: 

Date: 14 Feb 24

Notes

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

² For valid test results, the maximum difference between temperature and reference readings should be less than ±5.4 °F (±3 °C) for all thermocouples except for the stack thermocouple which should be less than ±1.5% absolute temperature from the reference reading and the exit thermocouple which should be less than ±2 °F (±1 °C) from the reference reading (EPA Method 2, Section 5.3 and EPA Method 5, Section 4.1.7.5.1.1)

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

⁴ Absolute temperature difference and other formulas are calculated based on unit input from cell C9 at the top of this sheet under "Meter Console Information"

⁵ For valid test results, the maximum difference between console and reference barometric pressure readings should be less than ±0.1 in. Hg (±2.5 mm Hg) (EPA Method 5, Section 5.1.2)

⁶ For valid test results, the maximum difference between console and reference vacuum readings should be less than ±0.5 in. Hg (±12.5 mm Hg)

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

⁸ Verify that the above Thermocouple Sensors were calibrated in accordance with US EPA Methods 2 and 5, CFR 40. Part 60



Console Sensor Audit QA Sheet

Meter Console Information (UUT)

Model #: XC-572-V
Serial #: A2001003
Units: Metric

Calibration Conditions

Pbar (mm. Hg): 759.8
Humidity (%): 55.0
Amb. Temp. (°C): 24.8
Altitude (m): 1.8
Corrected Pbar (mm. Hg): 759.7

Reference Devices

TC Simulator Model: CC-VTR-SH
Reference #: 91109269
Barometer Model: 369307
Reference #: EBARODIALSPE01
Digital Pressure Calibrator Model: 718 30G
Reference #: 9543013

Audit Data

Reference Point	Reference Temp.	Thermocouple Probe Audit						Reference Point Status ¹
		Aux	Stack	Probe	Oven	Filter	Exit	
	°C	°C	°C	°C	°C	°C	°C	Pass/Fail
Ambient	24.4	25	25	24	25	24	25	PASS
Ice Water	1.4	1	1	1	1	1	1	PASS

Audit Data

Console Vacuum Audit			
Reference Point	Reference Vacuum	Console Vacuum	Reference Point Status ¹
#	in. Hg	in. Hg	Pass/Fail
1	-17.0	-16.5	PASS

Calibrate By: _____

Approved By: _____

Date: 14 Feb 24

Notes

¹For valid test results, the maximum difference between test and reference readings should be less than 5.4 °F (3 °C), for all thermocouples except for the stack thermocouple which should be less than 1.5% absolute temperature from the reference reading and the exit thermocouple which should be less than 2°F (1 °C) from the reference reading (EPA Method 2, Section 8.3 and EPA Method 5, Sections 6.1.1.7-6.1.1.8)

²For valid test results, the maximum difference between console and reference barometric pressure readings should be less than 0.1 in. Hg (2.5 mm Hg), (EPA Method 5, Section 6.1.2)

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

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

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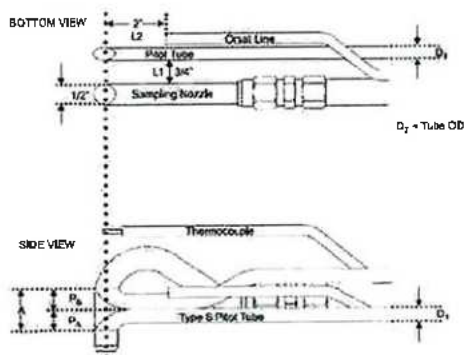
neediss Sampling Probe and Pitot Validation

Sampling System Equipment Information

Probe Sheet	Apex 1 in. , 5 ft.
Probe Number	w1906152
Pitot tube Number	A8777
Pitot tube Type	S Type 3/8 Inc.
Validation method	Standard Probe 1 in. and 1/2 in. Sampling Nozzle

Validation Conditions and Equipment

Digital Callipers	CD-15APX
Reference No.	A22070181
Digital Inclinator	BASELINE
Reference No.	FEI 12-1057
Temperature	24.8 °C±3
Barometric Pressure	759.8 mm Hg



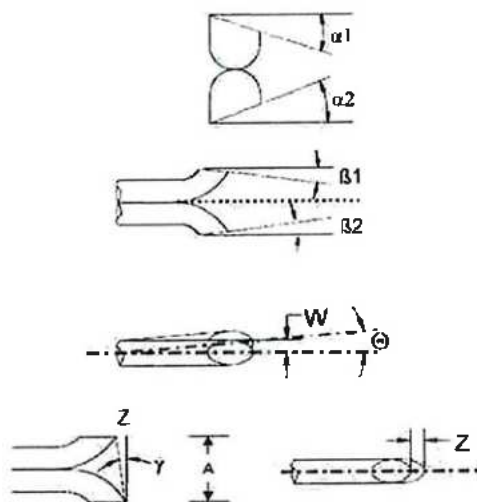
Sampling Probe Validation with Tune up

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

Measured	Standard Range
$L_1 = 1.91 \text{ cm.}$	(1.905 cm. or 3/4 in.)
$L_2 = 5.00 \text{ cm.}$	(5.08 cm. or 2.0 in.)
$D_1 = 0.951 \text{ cm.}$	(3/8 in.)
$A = 2.05 \text{ cm.}$	($2.1 D_1 \leq A \leq 3D_1$)
$A/2D_1 = 1.067 \text{ cm.}$	($1.05 F_A / D_1 \leq A \leq 1.5$)

Pitot Tube Validations and Engles measurement Result

☒ : Measure Result after Maintenance and Adjustable



P_B Size

Standard Range
$\alpha_1 = 2.30^\circ \leq 10^\circ$
$\beta_1 = -2.10^\circ \leq 5^\circ$

P_A Size

$\alpha_2 = -0.70^\circ \leq 10^\circ$
$\beta_2 = -0.90^\circ \leq 5^\circ$

Engles measurement

Calculated Result	Standard Range
$W = 0.80^\circ$	$0.029 \text{ cm. } W < 0.08 \text{ cm (1/32 in.)}$
$Z = -0.40^\circ$	$-0.014 \text{ cm. } Z < 0.032 \text{ cm (1/8 in.)}$

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

Validation By: _____

Approved By: _____

Date: 14 Feb 24

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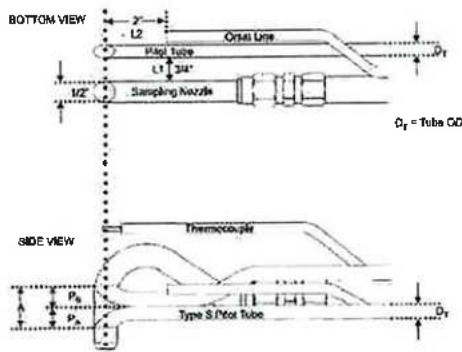
neediss Sampling Probe and Pitot Validation

Samplig System Equipment Information

Probe Sheat	Apex 1 in. , 3 ft.
Probe Number	w2001490
Pitot tube Number	A8996
Pitot tube Type	S Type 3/8 Inc.
Validation method	Standard Probe 1 in. and 1/2 in. Sampling Nozzle

Validation Conditions and Equipment

Digital Callipers	CD-15APX
Reference No.	A22070181
Digital Inclnometer	BASELINE
Reference No.	FEI 12-1057
Temperature	24.8 °C±3
Barometric Pressure	759.8 mm Hg



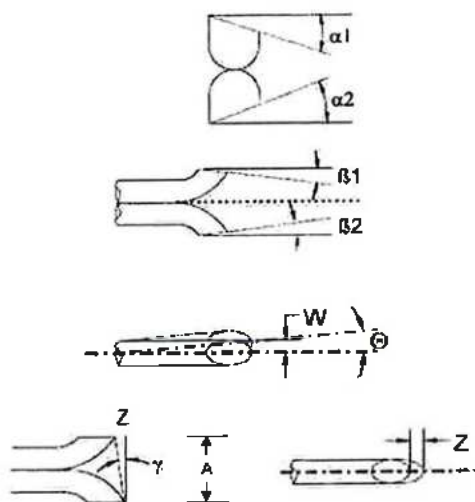
Sampling Probe Validation with Tune up

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

Measured	Standard Range
$L_1 = 1.91 \text{ cm.}$	(1.905 cm. or 3/4 in.)
$L_2 = 4.99 \text{ cm.}$	(5.08 cm. or 2.0 in.)
$D_T = 0.962 \text{ cm.}$	(3/8 in.)
$A = 2.08 \text{ cm.}$	($2.1 D_T \leq A \leq 3 D_T$)
$A/2D_T = 1.081 \text{ cm.}$	($1.05 P_A / D_T \leq A \leq 1.5$)

Pitot Tube Validations and Engles measurement Result

☒ : Measure Result after Maintenance and Adjustable



P_A Size Standard Range

$\alpha_1 = -1.30^\circ$	$\leq 10^\circ$
$\beta_1 = 1.20^\circ$	$\leq 5^\circ$

P_A Size

$\alpha_2 = 3.50^\circ$	$\leq 10^\circ$
$\beta_2 = 1.90^\circ$	$\leq 5^\circ$

Engles measurement Calculated Result Standard Range

$W = 0.40^\circ$	0.015 cm.	$W < 0.08 \text{ cm (1/32 in.)}$
$Z = 1.10^\circ$	0.040 cm.	$Z < 0.032 \text{ cm (1/8 in.)}$

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

Validation By:

Approved By:

Date: 14 Feb 24

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Nozzle Validation

Samplig System Equipment Information

Console Model	XC-572-V
Console Number	A2001003
DGM Model	SK25EX
DGM Number	00005796

Validation Conditions

Digital Calipers	CD-15APX
Reference No	A22070181
Temperature	24.8 °C±3
Barometric Pressure	759.8 mm Hg

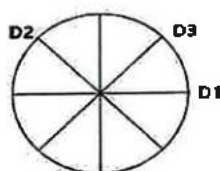
Validation Data					Results	
Nozzle ID	Nozzle Diameter				Different	(D ₁ + D ₂ + D ₃) / 3
Sizes		D ₁	D ₂	D ₃	ΔD	Davg
	mm	mm	mm	mm	mm	mm
NS-5	3.96	3.96	3.96	3.97	0.006	3.963
NS-6	4.77	4.76	4.76	4.77	0.006	4.763
NS-10	7.92	6.35	6.36	6.36	0.006	6.357
NS-11	8.71	8.72	8.72	8.73	0.006	8.723
NS-13	10.31	10.32	10.32	10.31	0.006	10.317
NS-15	11.88	11.88	11.88	11.87	0.006	11.877
NS-17	13.48	13.48	13.47	13.48	0.006	13.477

Where :

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

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

D avg = (D₁ + D₂ + D₃) / 3



Validation By:



Approved By:



Date:

14 Feb 24



Neediss Supply Instrument Co.,Ltd.



Envilab Co.,Ltd.

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บริษัท นีดีส ซัพพลาย อินสตรูเมนต์ จำกัด
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Verification Test Report

Instruments Information

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Analyzer Type: Flue Gas Analyser
Model: Optima7

Manufacturer: MRU
Serial No.: 320779

Calibration Gas information

Standard Gas Mid Range

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

Standard Gas High Range

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

Environment: Temperature 25.8 °C Humidity: 47 %RH

SO2 calibration test

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

NO calibration test

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

NOX calibration test

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

CO2 calibration test

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



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Neediss Supply Instrument Co., Ltd.
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Tel: 02-802-3980-2 Fax: 02-802-3988 E: info@neediss.com



Verification Test Report

Instruments Information

Page:2/2

Analyzer Type: Flue Gas Analyser
Model: Optima7

Manufacturer: MRU
Serial No.: 320779

Calibration Gas information

Standard Gas Mid Range

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

Standard Gas High Range

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

Environment: Temperature 25.8 °C Humidity: 47 %RH

CO calibration test

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

O2 calibration test

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

Note

Technical Data Calibration results: Calibration reading response discrepancy

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

Calibrate By :

Approve By :

Date: 26 Feb 24



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Envilab Co., Ltd. ผู้จัดการฝ่ายควบคุมคุณภาพ

Certificate of Calibration

Certificate No. : 67-200060-2

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 : (20.0 to 20.5) °C

Relative Humidity : (54.2 to 59.1) %

Air Pressure : 1013.0 mbar

Date of Received : 20 February 2024

Date of Calibration : 20 February 2024

Date of Issue : 21 February 2024

Calibrated by : Satja Sangkhum

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

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

Standard Weights

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

Approved by :

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 67-200060-2

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Departure of indication from nominal value

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

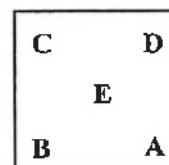
This result of calibration was found accurate as shown on date and place of calibration only.

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

Eccentric error

Load test : 50 g

A B C D E
0.00000 0.00000 0.00010 0.00000 0.00000 g



Repeatability

Load test : 200 g

Stdev. : 0.000032 g

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ผู้จัดการฝ่ายควบคุมคุณภาพ



CAL

Calibratech Co.,Ltd.

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

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



NSC-TISI-TIS17025
CALIBRATION 0030

Certificate of Calibration

Certificate No. : 67-410025-1

Page : 1 of 2

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

Equipment : Digital Thermo-Hygrometer

Manufacturer : Jedto

Model : HTC-1

Range Temperature : N/A °C

Resolution : 0.1 °C

Range Humidity : N/A %R.H.

Resolution : 1 %R.H.

Serial No. : PONPE5852094

ID No. : ELABTMHTC10003

Environment : Ambient Temperature : $(23 \pm 2) ^\circ\text{C}$
Relative Humidity : $(50 \pm 15) \%$

Date of Received : 20 February 2024

Date of Calibration : 22 February 2024

Date of Issue : 22 February 2024

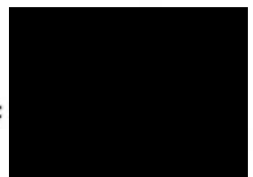
Calibrated by : Chortip Samchusri

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

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

ID No.	Cert. No.	Due Date	Traceability
400034 & 400035	SG-H-00020/67	05 Jul 2024	Success Gateway Co., Ltd., Accredited by TISI Calibration No.0268

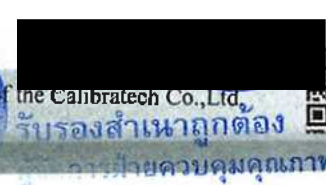
Approved by :



Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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

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

Certificate of Calibration

Certificate No. : 67-410025-1

Page : 2 of 2

UUC Condition As-Received : Good

Result of Calibration : Without Adjustment

Function : Temperature measurement

Reference Humidity @ 50 %R.H.

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

Result of Calibration : Without Adjustment

Function : Humidity measurement

Reference Temperature @ 25 °C

Standard Humidity (%R.H.)	UUC Reading (%R.H.)	Correction (%R.H.)	Uncertainty (± %R.H.)
50.03	50	0	2.2

Remark

UUC : Unit Under Calibration

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

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

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Calibration Report

Certificate Number : SPR23050051-1

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Mass Flow Calibrator	AFC-COMplete-10	12532	AD2207-177-0001	17 Jul 2023
Standard Flow Meter	520-H	200353	MW-0071-22	25 Aug 2023

Traceability

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

MIT - Miracle International Technology Co.,Ltd.

MesaLabs - Mesa Laboratories, Inc.NVLEP Lab Code 200661-0 (ISO17025)





Result of Calibration

Certificate No. : SPR23050051-1

Page : 3 of 3

Range : 0 to 30 L/Min

Resolution : 0.0001 L/Min

Function : Air Flow Measurement

Unit : L/Min

Calibration Point	UUC Reading	Standard Reading	UUC Error	K Factor Value	Uncertainty (±)
5.0	4.9722	4.9752	-0.0030	1.00060	0.050
10.0	10.296	10.325	-0.029	1.00282	0.10
15.0	15.076	15.037	0.039	0.99741	0.20
20.0	20.331	20.274	0.057	0.99720	0.20

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 $k = 2$, providing a level of confidence approximately 95 %

- End of Certificate -

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.



Envilab Co., Ltd.

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Introduction

Customer Information

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



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Service Engineer's Responsibilities

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



Instrument Maintenance

System Information

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

Instrument System Name and ID	5110 VOW ICP-OES
Instrument System Site and Location	Envilab Co.,Ltd

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

1. G 9013 A MY 17490002
2. G 9410 A AU17393768
3. G 9431-80002 1709-05327
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.

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

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. With
- ☒ 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 only checked, passed
- ☒ Test using customer's tray and move the sample probe to the sample vial 1, wash vial and rinse port and ensure that the probe is centered in the vial. If not use calibration wizard and calibrate the position.

AVS 4, 6, 7 Advanced Valve System

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

ICP-OES adjustment

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

Record Post-PM Instrument performance

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

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

- ☒ Record the result in the Instrument Test Results Table



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Restore Instrument

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

Service Review

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

Test Results

Instrument Performance Test Results Table

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

	Pre PM Sensitivity Check		Post PM Sensitivity Check	
	Radial	Axial *	Radial	Axial *
Zn 213.857 nm SRR	1897.1	3382.6	2348.2	6129.9
Mn 257.610 nm SRR	8945.3	16145.3	10762.1	39073.2
Al 396.152 nm SRR	7.0	16.3	8.5	25.7
K 766.491 nm SRR	8.2	67.3	4.7	83.6

* Axial result is not applicable for G6016AA, G8012AA Radial View instruments.

Instrument Test Results Table

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

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

ICP-OES Status Results Table

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

Measurement	Standby Mode	Plasma On
Mains Voltage	219.371	VAC 217.434
Mains Current	0.0%2	A 0.093
Instrument Temperature	23.5	°C 23.1
RF Air Flow (sensor speed)	13.0	Hz 99.0
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	55.0	°C 55.0
CCD Temperature	-39.6	°C -39.4
Thermal Stabilizer	55.0	°C 55.0
Argon Supply Pressure	619.13	kPa 550.32
Purge Gas Supply Pressure*1	616.63	kPa 597.43
Option Gas Supply Pressure*1	-	kPa -
Nebulizer Flow	No measurement	L/min 0.70
Nebulizer Back Pressure	No measurement	kPa 283.17
Plasma Gas Flow	No measurement	L/min 11.98
Auxiliary Gas Flow	No measurement	L/min 1.00
RF Power	No measurement	W 1199.1
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	5799-0087	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
Ballo 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 bridgast,	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
------------------	-------------	------------------------------	-------------------



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Signature Page

Service Engineer Comments (optional)

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

Service Verification

Service Request Number:
6006121636

Service Engineer Name:

Service Engineer Signature:

Total number of pages in this document:

14

Date Service Completed:
31 May 2023

Customer Name:

Customer Signature:



Report Summary

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

Result Summary

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

Optics Test

	Radial	Axial
Intensity	3397602	2923418
Wavelength	737.212	737.212

Resolution Test

Element Wavelength	Specification	Width
N (174.213 nm)	≤ 9.40	8.72
As (188.950 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)	≤ 8.40	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
Ar (675.283 nm)	≤ 74.00	62.41
K (766.491 nm)	≤ 80.00	65.95

Pass



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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	82288.3	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	288775.7	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

Pass

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

Water Flow Test

Pass

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

Gas Flows Test

Pass

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

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

RF Generator Test

Pass

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

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

Camera Test

Pass

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



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 ผู้จัดการฝ่ายควบคุมคุณภาพ

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.
- 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.

Important Customer Web Links

- For more information about **Agilent Technologies services**, please visit our website using the following URL: <http://www.agilent.com/en-us/products/crosslab-instrument-services/service-repair>
- 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>.
- 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.
- A useful **Agilent Resource Center** web page is available, which includes short videos on maintenance, quick lists of consumables for new instruments, and other valuable information. Check out the **Resource Page** here: <https://www.agilent.com/en-us/agilentresources>.
- Need technical support, FAQs, supplies? - visit our **Support Home page** <http://www.agilent.com/search/support>
- Videos about specific preparation requirements for your instrument can be found by searching the **Agilent YouTube** channel at <https://www.youtube.com/user/agilent>
- **7890B Manuals** are also available on Agilent.com:
 - **Safety** https://www.agilent.com/cs/library/usermanuals/public/7890B_Safety.pdf
 - **Installation and First Startup** https://www.agilent.com/cs/library/usermanuals/public/7890B_Installation.pdf
 - **Operation Manual** https://www.agilent.com/cs/library/usermanuals/public/7890B_Operation.pdf
 - **Maintaining Your GC** https://www.agilent.com/cs/library/usermanuals/public/G3430-90052%207890B_Maintaining%20Guide.pdf

Revision: 2.00, Issued: December 30, 2020
 Agile Document Number: D0007063
 DE number: 44166.7597222222
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Agilent CrossLab Start Up Services Agilent 7890 Gas Chromatograph Preventive Maintenance Checklist

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 everything you need to reduce unplanned downtime and keep your systems operating at their peak. This checklist will be completed at the end of the service and provided to you as a record of the preventive maintenance activities.



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System Information

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

Instrument System Name and ID	7890B GC System / ELAB GC 7890B001
Instrument System Site and Location	ENVILAB CO., LTD.

List System Component Product Numbers	List the Serial Numbers of each Component
1. 63440B	CN11403094
2. G4513A	CN16450342
3. G4514A	CN16440018
4. N/A	N/A
5. N/A	N/A
6. N/A	N/A
7. N/A	N/A
8. N/A	N/A
9. N/A	N/A
10. N/A	N/A

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, settings as defined by current Service Notes.
- ☒ Check for required firmware updates and verify with customers if they would like them installed.
- ☒ Before starting the following procedures, record the Detector Signal Output(s) in the results table. If the GC is turned OFF or in a service mode, comparing the detector outputs before and after the service is not possible.

Revision: 2.00, Issued: December 30, 2020
 Agile Document Number: D0007063
 DE number: 44166.759722222
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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 "Section not applicable" check boxes to indicate services/tasks not delivered, as appropriate.
- Complete the Preventive Maintenance 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
- Complete the total number of pages field in the Service Completion section
- Ask the customer to sign the Service Completion section including the customer's and your signature.

Additional Instruction Notes

- Check for any active service notes for this unit. If there are any applicable "Safety" or "Modification Recommended" Service notes, plan to implement the changes on this unit before doing any qualification service.
- Do not implement firmware updates, unless you get approval from the customer and are sure that they are compatible with this instrument control software.

Preventive Maintenance Procedure

Clean and inspect GC

- ☒ Unplug power cord from the power source.
- ☒ Open GC covers and vacuum/remove any dust/debris. Pay particular attention to cooling fans.
- ☒ Inspect internal connectors for proper contact and placement.
- ☒ Reconnect Power to the GC. Power the GC on and verify the power on self-test passed.
- ☒ Verify oven motor spins freely and turns on with the oven door closed; off when the door is opened.
- ☒ Verify operation of all other fans - the Inlet and EPC cooling fans.
- ☒ Verify oven intake/outlet flap assembly is operating smoothly while heating and cooling the oven

Inlet and detector consumable replacement

- ☒ For the Inlets installed, perform Inlet maintenance as defined in the 7890 manual - "Maintaining Your GC" - for the inlet(s) installed.
- ☒ Replace the split vent trap cartridge filter on units with these Inlets: Split/Spillless Capillary (SSL), Multi-Mode Inlet (MMI), Programmed Temperature Vaporizer (PTV), Volatiles Interface (VI).
- ☒ If the inlet system is used in Split Mode with viscous samples, inspect and clean the split vent tube on the inlet and flush or replace the tubing between the inlet and the split vent trap.
- ☒ If the GC includes a Flame Ionization Detector (FID), replace the jet. If the Ignitor shows any buildup of sample or corrosion, replace the Ignitor. Examine the FID collector and castle assemblies for contamination - clean as necessary.

Zero Sensors and Leak test

- ☒ Zero all pressure sensors per the procedure in the 7890 "Advanced User Guide".
- ☒ Perform Inlet pressure decay test(s) as defined in the 7890 "Troubleshooting Manual".
- ☒ If the PM is done in preparation for an Operational Qualification, then the pressure decay test defined within that protocol can be used for the PM.
- ☒ Record if test passed or failed in the results table.



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ALS Maintenance

- ☐ Section NOT applicable
- ☒ Check all cabling and configuration settings between GC, tray, and injectors.
- ☒ Vacuum or remove any dust, especially around fans.
- ☒ Check operation of all fans.
- ☒ Check syringe for smooth plunger operation.
- ☒ Check for smooth operation of the needle support - clean if necessary

Restore Instrument

- ☒ Restore the normal operating conditions or customer method using the Browser interface or Data System.
- ☒ Purge the system with carrier flow for 15 minutes
- ☒ Bake out the system, then restore the normal operating conditions
- ☒ After equilibration, check and record the post PM detector signal output values. Results should be similar or lower than the detector outputs recorded prior to PM.
- ☒ Perform a chemical checkout. If this is a routine PM, inject the customer's sample using the ALS if applicable. This will act as a final checkout of both the ALS and the GC.

Note: 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.

7890 Parts List Table

The following kits are recommended for capillary and purged packed inlets. If this is a general PM and the customer has a preferred set of consumables, you may use the customer's consumables.

Part description	Part number	Product or model# where used	Quantity consumed
SSL Capillary Inlet PM kit, Splitless	5188-6497	7890A/B	1
SSL Capillary Inlet PM kit, split	5188-6496	7890A/B	1
SSL Capillary Ultra Inert Inlet Gold Seal with Washer	5190-6144	7890A/B	N/A
SSL Capillary Ultra Inert Inlet Splitless Liner - Single taper with Glass Wool	5190-2293	7890A/B	N/A
SSL Capillary Ultra Inert Inlet Low Pressure Drop Split Liner - with Glass Wool	5190-2295	7890A/B	N/A
PP Inlet PM kit	5188-6498	7890A/B	N/A
Split vent trap PM kit, single cartridge (for MMI, PTV & V)	5188-6495	7890A/B	N/A
MMI Cleaning Kit	G3510-60820	7890A/B	N/A
PTV Septumless Head Rebuild Kit	5182-9747	7890A/B	N/A
PTV Septumless Head Teflon Guide	5182-9748	7890A/B	N/A
Ignitor (glow plug) assembly with O-ring	19231-60630	7890A/B	1
FID Collector Rebuild/Cleaning Kit	G1531-67000	7890A/B	N/A
Standard .011-inch FID Jet for capillary FID base	G1531-80560	7890A/B	N/A
High Temperature .018-inch FID Jet for capillary FID base	G1531-80620	7890A/B	N/A
Standard .018-inch FID Jet for packed column with packed FID base	18710-20119	7890A/B	N/A
Standard .011-inch FID Jet for capillary column with packed/adaptable FID base	19244-80560	7890A/B	N/A
High Temperature .018-inch FID Jet for capillary column with packed/adaptable FID base	19244-80620	7890A/B	N/A
NPD Jet, universal fit, .011-inch ID	G1534-80580	7890A/B	N/A
NPD Jet, universal fit, .011-inch ID Extended tip	G1534-80590	7890A/B	N/A
SSL Capillary Ultra Inert Inlet Gold Seal with Washer	5190-6144	7890A/B	N/A
SSL Capillary Ultra Inert Inlet Splitless Liner - Single taper with Glass Wool	5190-2293	7890A/B	N/A
**FID Collector Replacement Kit, if needed	G1531-67001	7890A/B	N/A

Signature Page

Service Review

- ☐ Attach available reports/printouts of all tests to this documentation.
- ☒ Record the Preventive Maintenance service activity in the customer's records/logbook.
- ☒ 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 with the customer this service, parts replaced, and test results obtained.
- ☐ If the instrument firmware was updated, record the details of the change in the Service Engineer's Comments box or if necessary, in the customer's IQ records.
- ☐ Supply the customer with a copy of the Smart Alerts flyer.
- ☐ Describe Smart Alerts to the customer.
- ☐ Install Smart Alerts if requested.

7890 GC Test Results Table

Detector/Signal Outputs	Before PM Service	After PM Service
Front detector output	14	14
Back detector output	N/A	N/A
AUX detector output	N/A	N/A
Pressure decay test	Pass	Pass
Front inlet pressure decay test	Pass	Pass
Back inlet pressure decay test	Pass	Pass

Service Engineer Comments

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

Service Completion

Service request number ๒๐๒๕๒๕๖๖ Date service completed 04 Jun 2024
Agilent signature [Signature] Customer signature [Signature]
Total number of pages in this document ๑



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Envilab & Keesco Supply Instrument

Verification Test Report

Report No.:

SO2400045-E002 -PU 01

Calibrated Date: 8-Apr-24

Equipment: Air Sampling Pump

Manufacturer: AP BUCK

Model: LP-5

Serial or ID No. 5612

Environment: Temperature 25 °C Humidity 60 %RH

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

Serial No. 164578

Date of Calibration : 04 May 2023

Result of Test			
Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
200	1	200.3	200.3
	2	200.7	
	3	200.2	
	4	200.5	
	5	199.9	

Calibrated By: _____

Date: 08-Apr-24

Approve By: _____

Date: 08-Apr-24

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Envilab & Needles Supply Instrument

Verification Test Report

Report No.:

SO2400045-E002 -PU 02

Calibrated Date: 8-Apr-24

Equipment: Air Sampling Pump

Manufacturer: AP BUCK

Model: LP-5

Serial or ID No. 5576

Environment: Temperature 25 °C Humidity 60 %RH

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

Serial No. 164578

Date of Calibration : 04 May 2023

Result of Test			
Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
200	1	200.3	200.4
	2	200.4	
	3	200.2	
	4	200.5	
	5	200.6	

Calibrated By: _____

Date: 08-Apr-24

Approve By: _____

Date: 08-Apr-24

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Envilab & Needles Supply Instrument

Verification Test Report

Report No.:

SO2400045-E002 -PU 03

Calibrated Date: 8-Apr-24

Equipment: Air Sampling Pump

Manufacturer: AP BUCK

Model: LP-5

Serial or ID No. 5568

Environment: Temperature 25 °C Humidity 60 %RH

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

Serial No. 164578

Date of Calibration : 04 May 2023

Result of Test			
Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
200	1	200.3	200.5
	2	200.7	
	3	200.2	
	4	200.6	
	5	200.7	

Calibrated By: _____

Date: 08-Apr-24

Approve By: _____

Date: 08-Apr-24

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Envilab & Needles Supply Instrument

Verification Test Report

Report No.:

SO2400045-E002 -PU 04

Calibrated Date: 8-Apr-24

Equipment: Air Sampling Pump

Manufacturer: AP BUCK

Model: LP-5

Serial or ID No. 5821

Environment: Temperature 25 °C Humidity 60 %RH

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

Serial No. 164578

Date of Calibration : 04 May 2023

Result of Test			
Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
200	1	200.1	200.6
	2	200.7	
	3	200.5	
	4	200.8	
	5	200.9	

Calibrated By: _____

Date: 08-Apr-24

Approve By: _____

Date: 08-Apr-24

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Envilab & Needles Supply Instrument

Verification Test Report

Report No.:

SO2400045-E002 -PU 05

Calibrated Date: 8-Apr-24

Equipment: Air Sampling Pump

Manufacturer: AP BUCK

Model: LP-5

Serial or ID No. 5611

Environment: Temperature 25 °C Humidity 60 %RH

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

Serial No. 164578

Date of Calibration : 04 May 2023

Result of Test			
Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
200	1	200.8	200.7
	2	200.7	
	3	200.9	
	4	200.6	
	5	200.5	

Calibrated By:

Date: 08-Apr-24

Approve By:

Date: 08-Apr-24

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



Envilab & Needles Supply Instrument

Verification Test Report

Report No.:

SO2400045-E002 -PU 06

Calibrated Date: 8-Apr-24

Equipment: Air Sampling Pump

Manufacturer: AP BUCK

Model: LP-4

Serial or ID No. 4829

Environment: Temperature 25 °C Humidity 60 %RH

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

Serial No. 164578

Date of Calibration : 04 May 2023

Result of Test			
Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
500	1	500.3	500.9
	2	501.2	
	3	501.0	
	4	501.1	
	5	501.0	

Calibrated By:

Date: 08-Apr-24

Approve By:

Date: 08-Apr-24

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Envilab R. Needles Supply Instrument

Verification Test Report

Report No.:

SO2400045-E002 -PU 07

Calibrated Date: 8-Apr-24

Equipment: Air Sampling Pump

Manufacturer: AP BUCK

Model: LP-4

Serial or ID No. 4830

Environment: Temperature 25 °C Humidity 60 %RH

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

Serial No. 164578

Date of Calibration : 04 May 2023

Result of Test			
Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
500	1	500.7	500.7
	2	500.9	
	3	500.6	
	4	500.7	
	5	500.6	

Calibrated By: _____

Date: 08-Apr-24

Approve By: _____

Date: 08-Apr-24

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Envilab & Needles Supply Instrument

Verification Test Report

Report No.:

SO2400045-E002 -PU 08

Calibrated Date: 8-Apr-24

Equipment: Air Sampling Pump

Manufacturer: AP BUCK

Model: LP-4

Serial or ID No. 4831

Environment: Temperature 25 °C Humidity 60 %RH

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

Serial No. 164578

Date of Calibration : 04 May 2023

Result of Test			
Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
2000	1	2000.9	2000.7
	2	2000.7	
	3	2000.6	
	4	2000.9	
	5	2000.4	

Calibrated By: _____

Date: 08-Apr-24

Approve By: _____

Date: 08-Apr-24

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Envilab & Needless Supply Instrument

Verification Test Report

Report No.:

SO2400045-E002 -PU 09

Calibrated Date: 8-Apr-24

Equipment: Air Sampling Pump

Manufacturer: AP BUCK

Model: LP-4

Serial or ID No. 4832

Environment: Temperature 25 °C Humidity 60 %RH

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

Serial No. 164578

Date of Calibration : 04 May 2023

Result of Test			
Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
2000	1	2000.9	2000.6
	2	2000.7	
	3	2000.8	
	4	2000.5	
	5	2000.2	

Calibrated By:

Date: 08-Apr-24

Approve By:

Date: 08-Apr-24

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Envilab R. Needles Supply Instrument

Verification Test Report

Report No.:

SO2400045-E002 -PU 10

Calibrated Date: 8-Apr-24

Equipment: Air Sampling Pump

Manufacturer: AP BUCK

Model: LP-4

Serial or ID No. 4834

Environment: Temperature 25 °C Humidity 60 %RH

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

Serial No. 164578

Date of Calibration : 04 May 2023

Result of Test			
Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
2000	1	2000.9	2000.8
	2	2000.7	
	3	2000.8	
	4	2000.5	
	5	2001.2	

Calibrated By:

Date: 08-Apr-24

Approve By:

Date: 08-Apr-24

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Envilab & Methods Supply Instruments

Verification Test Report

Report No.:

SO2400045-E002 -PU 01

Calibrated Date: 8-Apr-24

Equipment: Air Sampling Pump

Manufacturer: SKC

Model: 224 PC-3

Serial or ID No. 09939

Environment: Temperature 25 °C Humidity 60 %RH

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

Serial No. 164578

Date of Calibration : 04 May 2023

Result of Test			
Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
2000	1	2000.3	2000.3
	2	2000.7	
	3	2000.2	
	4	2000.5	
	5	1999.9	

Calibrated By:

Date:

08-Apr-24

Approve By:

Date:

08-Apr-24

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Envilab & Need to Supply Instruments

Verification Test Report

Report No.:

SO2400045-E002 -PU 02

Calibrated Date: 8-Apr-24

Equipment: Air Sampling Pump

Manufacturer: SKC

Model: 224 PC-3

Serial or ID No. 09940

Environment: Temperature 25 °C Humidity 60 %RH

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

Serial No. 164578

Date of Calibration : 04 May 2023

Result of Test			
Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
2000	1	2000.5	2000.4
	2	2000.6	
	3	2000.2	
	4	2000.5	
	5	2000.3	

Calibrated By:

Date: 08-Apr-24

Approve By:

Date: 08-Apr-24

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Envilab & Heredes Supply Instrument

Verification Test Report

Report No.:

SO2400045-E002 -PU 03

Calibrated Date: 8-Apr-24

Equipment: Air Sampling Pump

Manufacturer: SKC

Model: 224 PC-3

Serial or ID No. 09907

Environment: Temperature 25 °C Humidity 60 %RH

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

Serial No. 164578

Date of Calibration : 04 May 2023

Result of Test			
Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
2000	1	2000.3	2000.5
	2	2000.6	
	3	2000.2	
	4	2000.8	
	5	2000.7	

Calibrated By:

Date: 08-Apr-24

Approve By:

Date: 08-Apr-24

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Envilab is Needles Supply Instruments

Verification Test Report

Report No.:

SO2400045-E002 -PU 04

Calibrated Date: 8-Apr-24

Equipment: Air Sampling Pump

Manufacturer: SKC

Model: 224 PC-3

Serial or ID No. 09816

Environment: Temperature 25 °C Humidity 60 %RH

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

Serial No. 164578

Date of Calibration : 04 May 2023

Result of Test			
Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
2000	1	2000.3	2000.6
	2	2000.7	
	3	2000.5	
	4	2000.7	
	5	2000.9	

Calibrated By:

Date:

08-Apr-24

Approve By:

Date:

08-Apr-24

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Envilab & Needles Supply Instrument

Verification Test Report

Report No.:

SO2400045-E002 -PU 05

Calibrated Date: 8-Apr-24

Equipment: Air Sampling Pump

Manufacturer: SKC

Model: 224 PC-3

Serial or ID No. 09938

Environment: Temperature 25 °C Humidity 60 %RH

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

Serial No. 164578

Date of Calibration : 04 May 2023

Result of Test			
Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
2000	1	2000.8	2000.7
	2	2000.7	
	3	2000.8	
	4	2000.5	
	5	2000.8	

Calibrated By: _____

Date: 08-Apr-24

Approve By: _____

Date: 08-Apr-24

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Envilab & Need-to Supply Instrument

Verification Test Report

Report No.:

SO2400045-E002 -PU 06

Calibrated Date: 8-Apr-24

Equipment: Air Sampling Pump

Manufacturer: SKC

Model: 224 PC-3

Serial or ID No. 1424

Environment: Temperature 25 °C Humidity 60 %RH

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

Serial No. 164578

Date of Calibration : 04 May 2023

Result of Test			
Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
2000	1	2000.9	2000.8
	2	2000.8	
	3	2000.7	
	4	2000.7	
	5	2000.9	

Calibrated By:

Date: 08-Apr-24

Approve By:

Date: 08-Apr-24

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Envilab & Needles Supply Instrument

Verification Test Report

Report No.:

SO2400045-E002 -PU 07

Calibrated Date: 8-Apr-24

Equipment: Air Sampling Pump

Manufacturer: SKC

Model: 224 PC-3

Serial or ID No. 5768

Environment: Temperature 25 °C Humidity 60 %RH

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

Serial No. 164578

Date of Calibration : 04 May 2023

Result of Test			
Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
2000	1	200.9	200.9
	2	200.8	
	3	200.9	
	4	200.8	
	5	201.2	

Calibrated By:

Date:

08-Apr-24

Approve By:

Date:

08-Apr-24

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ผู้จัดทำรายงาน: 08-Apr-24



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Envilab & Needs Supply Instrument

Verification Test Report

Report No.:

SO2400045-E002 -SLM 06

☒ PM

☐ Onsite UTM :

47P 1431697 729320

Calibrated Date: 8 April 2024

Site : ร่มรั้วโรงงานด้านทิศเหนือ

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 44

Serial : 1900

Environment: Temperature 25 °C Humidity 65 %RH

Reference Standard: Acoustic Calibrator Class 1 Model 103, Bruel&Kjaer

Serial No.98971

Date of Calibration : 18-Dec-23

Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
94.10	93.96	-0.14	94.10

Calibrated By:

Date:

8 April 2024

Approve By:

Date:

8 April 2024

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Envilab & Needless Supply Instrument

Verification Test Report

Report No.:

SO2400045-E002 -SLM 07

☒ PM ☐ Onsite UTM : 47P 1431598 729713

Calibrated Date: 8 April 2024

Site : ร่มรั้วโรงงานด้านทิศใต้

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 44

Serial : 1899

Environment: Temperature 25 °C Humidity 65 %RH

Reference Standard: Acoustic Calibrator Class 1 Model 103, Bruel&Kjaer

Serial No.98971

Date of Calibration : 18-Dec-23

Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
94.10	93.91	-0.19	94.10

Calibrated By:

Date:

8 April 2024

Approve By:

Date:

8 April 2024

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Envilab & Needless Supply Instrument

Verification Test Report

Report No.:

SO2400045-E002 -SLM 08

☒ PM ☐ Onsite UTM : 47P 1431760 729728

Calibrated Date: 8 April 2024

Site : รังวัดโรงงานด้านทิศตะวันออก

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 44

Serial : 1915

Environment: Temperature 25 °C Humidity 65 %RH

Reference Standard: Acoustic Calibrator Class 1 Model 103, Bruel&Kjaer

Serial No.98971

Date of Calibration : 18-Dec-23

Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
94.10	93.94	-0.16	94.10

Calibrated By:

Date: 8 April 2024

Approve By:

Date: 8 April 2024

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Envilab & Needss Supply Instrument

Verification Test Report

Report No.:

SO2400045-E002 -SLM 09

☒ PM ☐ Onsite UTM : 47P 1431506 729342

Calibrated Date: 8 April 2024

Site : ร่มรั้วโรงงานด้านทิศตะวันตก

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 44

Serial : 1862

Environment: Temperature 25 °C Humidity 65 %RH

Reference Standard: Acoustic Calibrator Class 1 Model 103, Bruel&Kjaer

Serial No.98971

Date of Calibration : 18-Dec-23

Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
94.10	93.90	-0.20	94.10

Calibrated By:

Date:

8 April 2024

Approve By:

Date:

8 April 2024

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Envilab & Noise Supply Instrument

Verification Test Report

Report No.:

SO2400045-E002 -SLM 01

☒ PM ☐ Onsite UTM : 47P 1514458 654247

Calibrated Date: 8 April 2024

Site : บริษัท เอ็นไวแล็บ จำกัด

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 44

Serial : 1805

Environment: Temperature 25 °C Humidity 65 %RH

Reference Standard: Acoustic Calibrator Class 1 Model 103, Bruel&Kjaer

Serial No.98971

Date of Calibration : 18-Dec-23

Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
94.10	93.98	-0.12	94.10

Calibrated By:

Date:

8 April 2024

Approve By:

Date:

8 April 2024

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Envilab & Needles Supply Instrument

Verification Test Report

Report No.:

SO2400045-E002 -SLM 02

☒ PM ☐ Onsite UTM : 47P 1514458 654247

Calibrated Date: 8 April 2024

Site : บริษัท เอ็นไวแล็บ จำกัด

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 44

Serial : 1807

Environment: Temperature 25 °C Humidity 65 %RH

Reference Standard: Acoustic Calibrator Class 1 Model 103, Bruel&Kjaer

Serial No.98971

Date of Calibration : 18-Dec-23

Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
94.10	93.91	-0.19	94.10

Calibrated By:

Date:

8 April 2024

Approve By:

Date:

8 April 2024

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



Envilab & Needs Supply Instrument

Verification Test Report

Report No.:

SO2400045-E002 -SLM 03

☒ PM

☐ Onsite UTM :

47P 1514458 654247

Calibrated Date: 8 April 2024

Site : บริษัท เอ็นไวแล็บ จำกัด

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 44

Serial : 1810

Environment: Temperature 25 °C Humidity 65 %RH

Reference Standard: Acoustic Calibrator Class 1 Model 103, Bruel&Kjaer

Serial No.98971

Date of Calibration : 18-Dec-23

Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
94.10	93.95	-0.15	94.10

Calibrated By:

Date:

8 April 2024

Approve By:

Date:

8 April 2024

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Envilab & Needss Supply Instrument

Verification Test Report

Report No.:

SO2400045-E002 -SLM 04

☒ PM ☒ Onsite UTM : 47P 1514458 654247

Calibrated Date: 8 April 2024

Site : บริษัท เอ็นไวแล็บ จำกัด

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 44

Serial : 1879

Environment: Temperature 25 °C Humidity 65 %RH

Reference Standard: Acoustic Calibrator Class 1 Model 103, Bruel&Kjaer

Serial No.98971

Date of Calibration : 18-Dec-23

Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
94.10	93.94	-0.16	94.10

Calibrated By:

Date:

8 April 2024

Approve By:

Date:

8 April 2024

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Envilab & Needas Supply Instrument

Verification Test Report

Report No.:

SO2400045-E002 -SLM 05

☒ PM

☐ Onsite UTM :

47P 1514458 654247

Calibrated Date: 8 April 2024

Site : บริษัท เอ็นไวแล็บ จำกัด

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 44

Serial : 1883

Environment: Temperature 25 °C Humidity 65 %RH

Reference Standard: Acoustic Calibrator Class 1 Model 103,Brue&Kjaer

Serial No.98971

Date of Calibration : 18-Dec-23

Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
94.10	93.97	-0.13	94.10

Calibrated By:

Date:

8 April 2024

Approve By:

Date:

8 April 2024

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



Envilab & Needles Supply Instrument

Verification Test Report

Report No.:

SO2400045-E002 -SLM 01

☒ PM

☐ Onsite UTM :

47P 1514458 654247

Calibrated Date: 8 April 2024

Site : บริษัท เอ็นไวแล็บ จำกัด

Equipment: Sound Level Meter

Manufacturer: Quest

Model: DLX

Serial : 0107

Environment: Temperature 25 °C Humidity 65 %RH

Reference Standard: Acoustic Calibrator Class 1 Model 103, Bruel&Kjaer

Serial No.98971

Date of Calibration : 18-Dec-23

Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
94.10	93.98	-0.12	94.10

Calibrated By:

Date:

8 April 2024

Approve By:

Date:

8 April 2024

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



Envilab & Needless Supply Instrument

Verification Test Report

Report No.:

SO2400045-E002 -SLM 02

☒ PM ☐ Onsite UTM : 47P 1514458 654247

Calibrated Date: 8 April 2024

Site : บริษัท เอ็นไวแล็บ จำกัด

Equipment: Sound Level Meter

Manufacturer: Quest

Model: DLX

Serial : 0104

Environment: Temperature 25 °C Humidity 65 %RH

Reference Standard: Acoustic Calibrator Class 1 Model 103, Bruel&Kjaer

Serial No.98971

Date of Calibration : 18-Dec-23

Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
94.10	93.91	-0.19	94.10

Calibrated By:

Date:

8 April 2024

Approve By:

Date:

8 April 2024

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Envilab & Needless Supply Instrument

Verification Test Report

Report No.:

SO2400045-E002 -SLM 03

☒ PM ☐ Onsite UTM : 47P 1514458 654247

Calibrated Date: 8 April 2024

Site : บริษัท เอ็นไวแล็บ จำกัด

Equipment: Sound Level Meter

Manufacturer: Quest

Model: DLX

Serial : 0053

Environment: Temperature 25 °C Humidity 65 %RH

Reference Standard: Acoustic Calibrator Class 1 Model 103, Bruel&Kjaer

Serial No.98971

Date of Calibration : 18-Dec-23

Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
94.10	93.79	-0.31	94.10

Calibrated By:

Date:

8 April 2024

Approve By:

Date:

8 April 2024

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



Envilab & Needless Supply Instrument

Verification Test Report

Report No.:

SO2400045-E002 -SLM 04

☒ PM ☒ Onsite UTM : 47P 1514458 654247

Calibrated Date: 8 April 2024

Site : บริษัท เอ็นไวแล็บ จำกัด

Equipment: Sound Level Meter

Manufacturer: Quest

Model: DLX

Serial : 0105

Environment: Temperature 25 °C Humidity 65 %RH

Reference Standard: Acoustic Calibrator Class 1 Model 103, Bruel&Kjaer

Serial No.98971

Date of Calibration : 18-Dec-23

Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
94.10	93.96	-0.14	94.10

Calibrated By:

Date:

8 April 2024

Approve By:

Date:

8 April 2024

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



Envilab's & Needless Supply Instrument

Verification Test Report

Report No.:

SO2400045-E002 -SLM 05

☒ PM ☐ Onsite UTM : 47P 1514458 654247

Calibrated Date: 8 April 2024

Site : บริษัท เอ็นไวแล็บ จำกัด

Equipment: Sound Level Meter

Manufacturer: Quest

Model: DLX

Serial : 0106

Environment: Temperature 25 °C Humidity 65 %RH

Reference Standard: Acoustic Calibrator Class 1 Model 103, Bruel&Kjaer

Serial No.98971

Date of Calibration : 18-Dec-23

Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
94.10	93.88	-0.22	94.10

Calibrated By:

Date:

8 April 2024

Approve By:

Date:

8 April 2024

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Certificate of Calibration

Page : 1 of 3

Certificate Number : SPR23070059-5

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 : PN1879
ID. Number : NSMPUMD44N1879

Environmental Conditions

Ambient Temperature	: $23^{\circ}\text{C} \pm 3^{\circ}\text{C}$	Received Date	: 05 Jul 2023
Relative Humidity	: $50\% \pm 15\%$	Calibration Date	: 06 Jul 2023
Location of Calibration	: In-Lab	Recommend Due Date	: 06 Jul 2024
Calibration Procedure	: SP-CPE-04-01	Date of Issue	: 07 Jul 2023

Method of Calibration

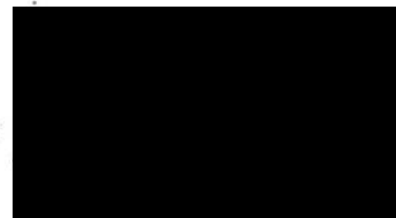
This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs. 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 : SPR23070059-5

Page : 2 of 3

Reference Standards

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

Traceability

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



รับรองสำเนาถูกต้อง
ผู้จัดการฝ่ายควบคุมคุณภาพ



Result of Calibration

Certificate No. : SPR23070059-5

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	94.1	94.1	0.1	0.1	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	94.1	94.1	0.1	0.1	0.15
114	113.8	113.8	-0.2	-0.2	0.15

Select Z

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.2	94.2	0.2	0.2	0.15
114	113.8	113.8	-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

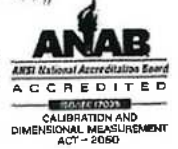
The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor $k = 2.00$, providing a level of confidence approximately 95%.

- End of Certificate -



Envilab Co., Ltd.

บริษัท เอ็นวิลแลบ จำกัด
ผู้จัดการฝ่ายควบคุมคุณภาพ



Certificate of Calibration

Certificate Number : SPR23080277-4

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 : NXC120106

ID. Number : N/A

Environmental Conditions

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

Received Date : 18 Aug 2023

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

Calibration Date : 22 Aug 2023

Location of Calibration : In-Lab

Recommend Due Date : 22 Aug 2024

Calibration Procedure : SP-CPE-04-01

Date of Issue : 23 Aug 2023

Method of Calibration

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

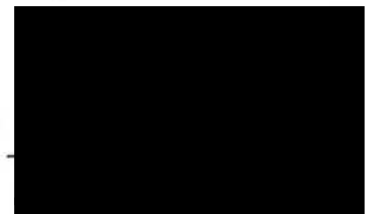
The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by :



Calibration Officer

Approved by :



Authorized Signatory



Envilab Co., Ltd.

SP-FM-04-15 rev.0
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ผู้จัดการฝ่ายควบคุมคุณภาพ



Calibration Report

Page : 2 of 3

Certificate Number : SPR23080277-4

Reference Standards

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

Traceability

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

TISTR - Thailand Institute of Scientific and Technological Research



Result of Calibration

Certificate No. : SPR23080277-4

Page : 3 of 3

Range : 94 to 114 dB

Function : @1kHz

Unit : dB

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

Unit : dB

Select C Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.2	94.2	0.2	0.2	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 : SPR23080277-5

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 : NXC120107

ID. Number : N/A

Environmental Conditions

Ambient Temperature : 23 °C \pm 3 °C

Received Date : 18 Aug 2023

Relative Humidity : 50 % \pm 15 %

Calibration Date : 22 Aug 2023

Location of Calibration : In-Lab

Recommend Due Date : 22 Aug 2024

Calibration Procedure : SP-CPE-04-01

Date of Issue : 23 Aug 2023

Method of Calibration

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

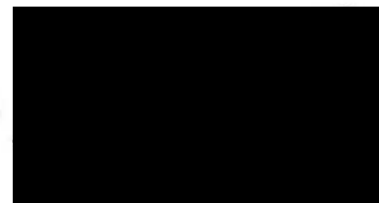
The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by :



Calibration Officer

Approved by :



Authorized Signatory



Envilab Co., Ltd.

รับรองสำเนาถูกต้อง
ผู้จัดการฝ่ายควบคุมคุณภาพ



Calibration Report

Certificate Number : SPR23080277-5

Page : 2, of 3

Reference Standards

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

Traceability

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



Result of Calibration

Certificate No. : SPR23080277-4

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	114.0	114.0	0.0	0.0	0.15

Select C

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.3	94.3	0.3	0.3	0.15
114	114.3	114.3	0.3	0.3	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 : SPR23080277-1

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

Received Date : 18 Aug 2023

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

Calibration Date : 22 Aug 2023

Location of Calibration : In-Lab

Recommend Due Date : 22 Aug 2024

Calibration Procedure : SP-CPE-04-01

Date of Issue : 23 Aug 2023

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system

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

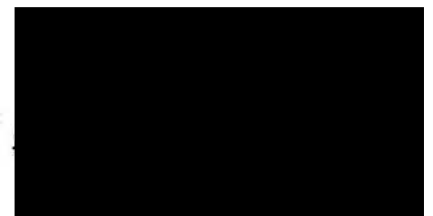
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Calibrated by :



Calibration Officer

Approved by :



Authorized Signatory



SP-FM-04-15 rev.0

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Calibration Report

Certificate Number : SPR23080277-1

Page : 2 of 3

Reference Standards

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

Traceability

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

TISTR - Thailand Institute of Scientific and Technological Research



Certificate of Calibration

Certificate Number : SPR23080277-3

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 : NXC120105

ID. Number : N/A

Environmental Conditions

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

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

Location of Calibration : In-Lab

Calibration Procedure : SP-CPE-04-01

Received Date : 18 Aug 2023

Calibration Date : 22 Aug 2023

Recommend Due Date : 22 Aug 2024

Date of Issue : 23 Aug 2023

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system

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

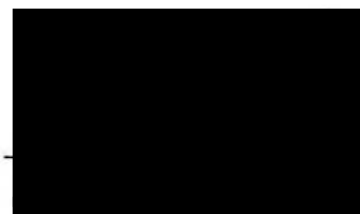
The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by :



Calibration Officer

Approved by :



Authorized Signatory



Envilab Co., Ltd.

ผู้จัดการฝ่ายควบคุมคุณภาพ



Calibration Report

Certificate Number : SPR23080277-3

Page : 2 of 3

Reference Standards

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

Traceability

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



Result of Calibration

Certificate No. : SPR23080277-3

Page : 3 of 3

Range : 94 to 114 dB

Function : @1kHz

Unit : dB

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

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.2	94.2	0.2	0.2	0.15
114	114.1	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 -



Enviab Co.,Ltd.

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ผู้จัดการฝ่ายควบคุมคุณภาพ



Calibration Report

Certificate Number : SPR23080277-2

Page : 2 of 3

Reference Standards

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

Traceability

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





Result of Calibration

Certificate No. : SPR23080277-2

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	94.0	94.0	0.0	0.0	0.15
114	113.7	113.7	-0.3	-0.3	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	113.8	113.8	-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 Number : SPR23070059-6

Page : 1 of 3

Customer : Envilab Co., Ltd.

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

Equipment Name : Sound Level Meter

Manufacturer : Pulsar

Model : 44

Serial Number : PN1877

ID. Number : NSMPUMD44N1877

Environmental Conditions

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

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

Location of Calibration : In-Lab

Calibration Procedure : SP-CPE-04-01

Received Date : 05 Jul 2023

Calibration Date : 06 Jul 2023

Recommend Due Date : 06 Jul 2024

Date of Issue : 07 Jul 2023

Method of Calibration

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

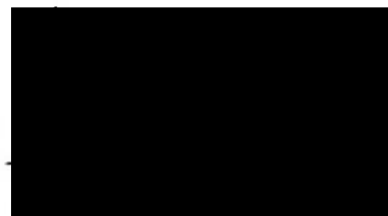
The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by :



Calibration Officer

Approved by :



Authorized Signatory



Envilab Co., Ltd.

SP-FM-04-15 rev.0

รับรองสำเนาถูกต้อง
ผู้จัดการฝ่ายควบคุมคุณภาพ



Calibration Report

Certificate Number : SPR23070059-6

Page : 2. of 3

Reference Standards

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

Traceability

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





Result of Calibration

Certificate No. : SPR23070059-6

Page : 3 of 3

Range : 94 to 114 dB

Function : @1kHz

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	114.3	114.3	0.3	0.3	0.15

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.1	94.1	0.1	0.1	0.15
114	114.3	114.3	0.3	0.3	0.15

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.1	94.1	0.1	0.1	0.15
114	114.3	114.3	0.3	0.3	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 -



Envilab Co.,Ltd.

ฉบับร่าง 118SPU-M-04-15 REV. 1
ผู้จัดการฝ่ายควบคุมคุณภาพ



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0148

MTC No. EEL. BP. 28/1266

CALIBRATION CERTIFICATE

Submitted by : Neediss Supply Instrument Co.,Ltd.

Address : 536 Soi Bangkhae 7, Bangkhae, Bangkok 10160 Thailand.

Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., Muang, Samutprakan 10280.

Instrument Calibrated :

Description : Acoustic Calibrator

Manufacturer : Pulsar

Model : 103

Serial No. : 98971

Ambient Environment

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

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

Ambient Pressure : $(101.325 \pm 1.500) \text{ kPa}$

Standards used : 1. Digital Function Synthesizer NF Electronic DF-193A S/N 122037.
2. Measuring Amplifier Bruel&Kjaer 2636 S/N 1537484.
3. Programmable Attenuator Tamagawa TPA-303A S/N OF 2214.
4. Digital Multimeter Agilent 34401A S/N MY44005560.
5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.
6. Audio Analyzer Panasonic VP-7722A S/N 041477D122.
7. Condenser Microphone B&K 4180 S/N 2889871.

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

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

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

Date of Receipt : 14 Dec. 2023

Date of Calibration : 18 Dec. 2023

1 / 3

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 Khlong Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9000
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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 : samalee@tistr.or.th



รับ
ผู้จัดการฝ่ายควบคุมคุณภาพ



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0148

MTC No. EEL. BP. 28/1266

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

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

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

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	94.10	0.10	± 0.10	± 0.40 dB

2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	1000.5	0.5	± 1.5	$\pm 1.0\%$

3. Total distortion

Standard Microphone Type	Measured Total distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	1.65	± 0.50	$\pm 3.0\%$

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Date of Calibration : 18 Dec. 2023

2 / 1

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

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รับรอง
ผลการวัดความดันเสียง



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0148

MTC No. EEL. BP. 28/1266

Nominal Output of Unit Under Test = 114 dB re 20 μ Pa at 1000 Hz

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

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	114.19	0.19	± 0.10	± 0.40 dB

2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	1000.3	0.3	± 1.5	$\pm 1.0\%$

3. Total Distortion

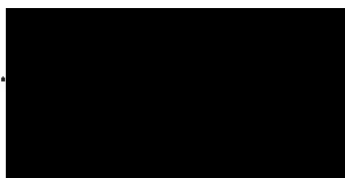
Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	1.12	± 0.50	$\pm 3.0\%$

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :



Approved by :



TISTR

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 18 Dec. 2023

Date of Issue : 20 Dec. 2023

Ref : 2011266121404935002

End of Certificate

3 / 3

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

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Fax. (66) 0 2323 9165
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Fax. (66) 0 2579 8592
E-mail : mtc@tistr.or.th



EnviLab Co., Ltd.

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.com



NSC-TISI-TIS 17025
CALIBRATION 129

CALIBRATION CERTIFICATE

Issued date: 18 April 2023

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

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

Request No : **C-2304 - 168**

Laboratory No.: **CAL- 168**

Date of Request: 12 April 2023.

Date of Calibration: 17 April 2023.

1. Unit Under Calibration (UUC) :

Nomenclature : Digital Lux Meter

Serial No.: 160300230

Maker : TENMARS

Model : TM-720

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

3. Range of Calibration: 1 Range

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

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

6. Support Equipment:

1. Photometric bench, 6.3 meter long.
2. DC. power supply, Serial No.: EJ 19A 009, Model: GPR-25H 300, Maker: GW 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 %.

Page 1 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.



รับ

Envilab Co., Ltd.

ผู้จัดการฝ่ายควบคุมคุณภาพ

**INTERNATIONAL TESTING SERVICE CO., LTD**1213/388 Ladprao 94 Ladprao Rd. Wangtonglang Bangkok 10310
Tel 0-2559-2095 Fax 0-2559-2096E-mail : sale@itest-lab.com web site : www.itest-lab.comRequest No: **C-2304 - 168**

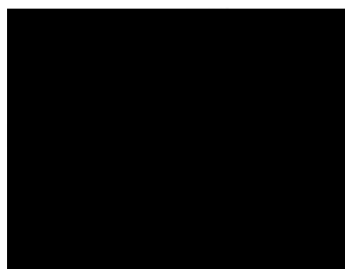
Serial No.: 160300230

Laboratory No.: **CAL - 168****Results :**

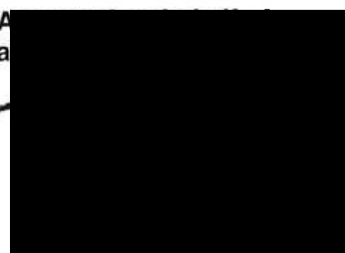
UUC Range	Standard (Ix)	UUC Reading (Ix)		Correction (Ix)	Uncertainty of Measurement (+ Ix)
		Before adjust	After adjust		
Auto	0	0.0	0.0	0.0	0.1
	100	86.2	102.0	- 2.0	2.0 % of Reading
	500	427.4	505.2	- 5.2	
	1000	842.2	1003	- 3	
	1500	1255	1493	+ 7	
	2000	1665	1979	+ 21	

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

Calibration result approved by



Internat



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.

รับรองมาตรฐาน
ผู้จัดการฝ่ายควบคุมคุณภาพ

Certificate of Calibration

Certificate No. : 67-420034-1

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 : (22.0 to 23.0)° C
Relative Humidity : (50 to 55) %

Date of Received : 20 March 2024

Date of Calibration : 20 March 2024

Date of Issue : 23 March 2024

Calibrated by : Permpon Chanpu

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

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

1. Multiproduct Calibrator

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

2. Standard Buffer Solution

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

Approved by

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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



Envilab Co., Ltd. ผู้จัดการฝ่ายควบคุมคุณภาพ

Certificate of Calibration

Certificate No. : 67-420034-1

Page : 2 of 2

Result of Calibration :

UUC Condition As-Received : Good

Function : Electrical measurement

pH meter

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

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

Function : pH meter with electrode

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

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

Remark

UUC : Unit Under Calibration

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

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

- ๐0๐ -

Certificate of Calibration

Certificate No. : 67-400101-1

Page : 1 of 2

Submitted by : Envilab Co., Ltd.

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

Equipment : Temperature controlled enclosure (Incubator)

Manufacturer : Memmert

Model : IF 75

Range : N/A °C

Resolution : 0.1 °C

Serial No. : D319.0066

ID No. : ELABINCUBATOR2

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

Ambient Temperature : (23.0 to 24.0) °C

Relative Humidity : (50 to 55) %

Line Voltage : (223.0 TO 225.0) V

Date of Received : 20 February 2024

Date of Calibration : 20 February 2024

Date of Issue : 22 February 2024

Calibrated by : Kittisak Kokaeo

Calibration Method : CAL-M4004, TLAS G-20

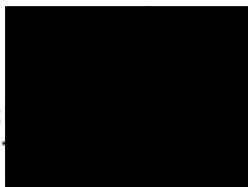
The temperature scale used was based on ITS-90

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

Standard Digital Thermometer with RTD Probe

ID No.	Cert. No.	Due Date	Traceability
400046 & 400047	67-400047-2	26 Jul 2024	National Institute of Metrology Thailand (NIMT)

Approved by :



Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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รับรองสำเนาถูกต้อง
ผู้จัดการฝ่ายควบคุมคุณภาพ

Certificate of Calibration

Certificate No. : 67-400101-1

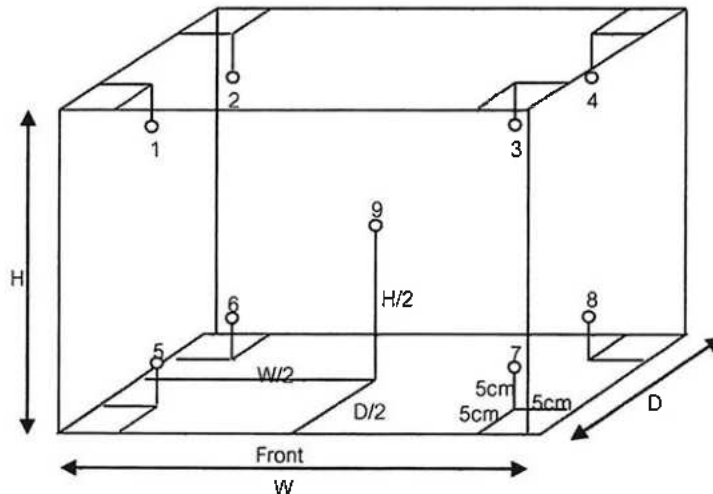
Page : 2 of 2

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 = 0.40 m

D = 0.56 m

H = 0.33 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	
35.0	35.3	35.3	34.99	35.13	35.15	35.11	35.08	35.01	34.92	34.91	35.09	0.30
37.0	37.3	37.3	36.96	37.09	37.13	37.08	37.04	36.99	36.90	36.88	37.07	0.30

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
35.0	35.3	35.3	0.2	0.0	0.3
37.0	37.3	37.3	0.2	0.0	0.3

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. : 67-400166-1

Page : 1 of 2

Submitted by : Envilab Co., Ltd.

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

Equipment : Temperature controlled enclosure (Oven)

Manufacturer : Memmert

Model : UF 75

Range : N/A °C

Resolution : 0.1 °C

Serial No. : B319.0600

ID No. : ELABHAOVEN0600

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

Ambient Temperature : (29.0 to 30.0) °C

Relative Humidity : (60 to 650) %

Line Voltage : (224.2 to 225.2) V

Date of Received : 20 March 2024

Date of Calibration : 20 March 2024

Date of Issue : 22 March 2024

Calibrated by : Kittisak Kokaeo

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

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

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

Approved by :

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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Envilab Co.,Ltd.

รับรองสำเนาถูกต้อง
ผู้จัดการฝ่ายควบคุม



Certificate of Calibration

Certificate No. : 67-400166-1

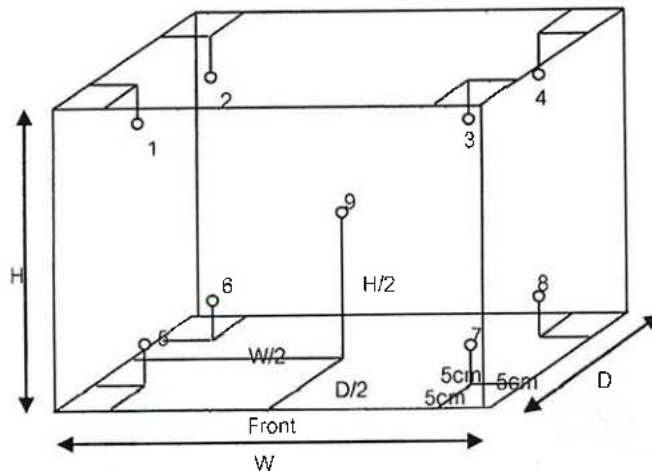
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

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



Inside of Chamber

W = 0.40 m

D = 0.33 m

H = 0.56 m

Capacity = 0.07 m³

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

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

Remark The uncertainty is not combine uniformity of the air chamber

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

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

- o0o -

Certificate of Calibration

Certificate No. : 67-400166-2

Page : 1 of 2

Submitted by : Envilab Co., Ltd.

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

Equipment : Water Bath

Manufacturer : Memmert

Model : WNB 14

Range : N/A °C

Resolution : 0.1 °C

Serial No. : L412.2222

ID No. : ELABWBWNB29N01

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

Ambient Temperature : (29.0 to 30.0) °C

Relative Humidity : (60 to 65) %

Line Voltage : (224.2 to 225.2) V

Date of Received : 20 March 2024

Date of Calibration : 20 March 2024

Date of Issue : 22 March 2024

Calibrated by : Kittisak Kokaeo

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

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

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

Approved

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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ผู้ดูแลฝ่ายควบคุมคุณภาพ

Certificate of Calibration

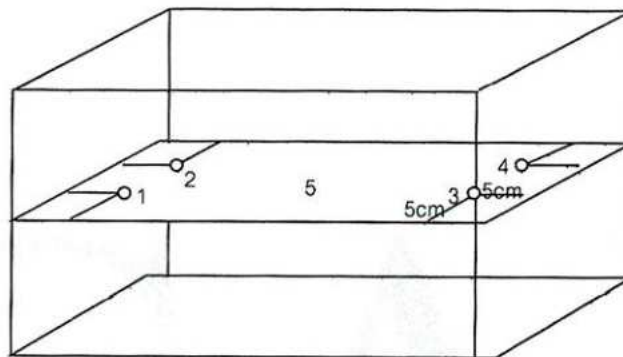
Certificate No. : 67-400166-2

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	94.5	94.5	95.12	95.18	95.11	95.02	95.17	0.23	0.26	0.12

Remark The uncertainty is not combine uniformity of the water bath

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

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

- o0o -

Certificate of Calibration

Certificate No. : 67-200060-1

Page : 1 of 2

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

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

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

Date of Received : 20 February 2024

Date of Calibration : 20 February 2024

Date of Issue : 21 February 2024

Calibrated by : Satja Sangkhum

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

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

Standard Weights

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

Approved by

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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รับรองสำเนาถูกต้อง
ผู้จัดการฝ่ายควบคุมคุณภาพ

Certificate of Calibration

Certificate No. : 67-200060-1

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Departure of indication from nominal value

Nominal Value (g)	Correction (g)	Uncertainty \pm (g)
0.1	0.0000	0.00011
0.5	0.0000	0.00011
1	0.0000	0.00011
2	0.0000	0.00011
5	0.0000	0.00011
10	0.0000	0.00011
20	0.0000	0.00013
50	0.0001	0.00014
100	0.0001	0.00020
120	0.0000	0.00038

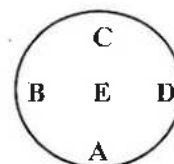
This result of calibration was found accurate as shown on date and place of calibration only.

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

Eccentric error

Load test : 20 g

A	B	C	D	E	
0.0001	0.0001	0.0000	0.0000	0.0000	g



Repeatability

Load test : 100 g

Stdev. : 0.00004 g

- o0o -

Certificate of Calibration

Certificate No. : 66-400320-1**Page : 1 of 2****Submitted by :** Envilab Co., Ltd.

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

Equipment : COD Reactor**Manufacturer :** Hanna**Model :** HI839800**Range :** N/A °C**Resolution :** 0.1 °C**Serial No. :** 06480040101**ID No. :** ELABHI83980001**Environment :** Ambient Temperature : (23 ± 2) °C

Relative Humidity : (50 ± 15) %

Date of Received : 02 June 2023**Date of Calibration :** 05 June 2023**Date of Issue :** 05 June 2023**Calibrated by :** Bunjerd Masri**Calibration Method :** This instrument was calibrated by In-house method direct measurement with

The temperature scale used was based on ITS-90

Reference Standard Instruments :

Standard Digital Thermometer with TC Type T probe

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

Approved by

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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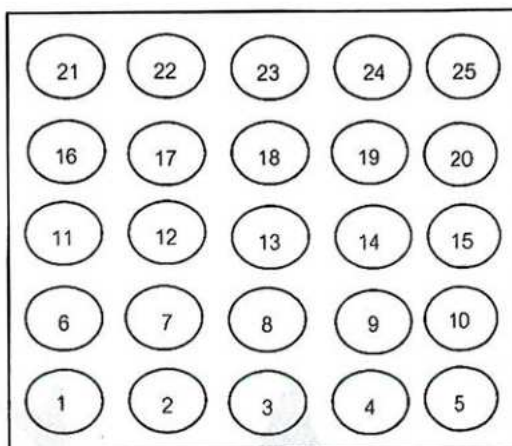
Certificate of Calibration

Certificate No. : 66-400320-1

Page : 2 of 2

Result of Calibration : Without Adjustment

Function : Temperature measurement



Controller

Test Point (°C)	UUC Setting (°C)	UUC Reading (°C)	Standard Reading at Position (°C)									
			1	2	3	4	5	6	7	8	9	10
150.0	150.0	150.0	149.7	150.1	150.0	149.8	149.5	150.1	151.2	152.1	150.9	150.4

Test Point (°C)	UUC Setting (°C)	UUC Reading (°C)	Standard Reading at Position (°C)									
			11	12	13	14	15	16	17	18	19	20
150.0	150.0	150.0	150.3	151.3	151.5	151.1	150.7	149.9	151.5	152.1	151.1	149.9

Test Point (°C)	UUC Setting (°C)	UUC Reading (°C)	Standard Reading at Position (°C)					Uncertainty (± °C)
			21	22	23	24	25	
150.0	150.0	150.0	149.6	150.5	150.8	150.3	149.8	0.78

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

- o0o -



Certificate of Calibration

Certificate No. : 67-400312-1

Page : 1 of 2

Submitted by : Envilab Co., Ltd.

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

Equipment : COD Reactor

Manufacturer : Hanna

Model : HI839800

Range : N/A °C

Resolution : 0.1 °C

Serial No. : 06480040101

ID No. : ELABHI83980001

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

Relative Humidity : (50 ± 15) %

Date of Received : 30 May 2024

Date of Calibration : 04 June 2024

Date of Issue : 04 June 2024

Calibrated by : Chortip Samchusri

Calibration Method : This instrument was calibrated by In-house method direct measurement with

The temperature scale used was based on ITS-90

Reference Standard Instruments :

Standard Digital Thermometer with TC Type T probe

<u>ID No.</u>	<u>Cert. No.</u>	<u>Due Date</u>	<u>Traceability</u>
400046 & 400023	67-400198-1	01 Oct 2024	National Institute of Metrology Thailand (NIMT)

Approved by

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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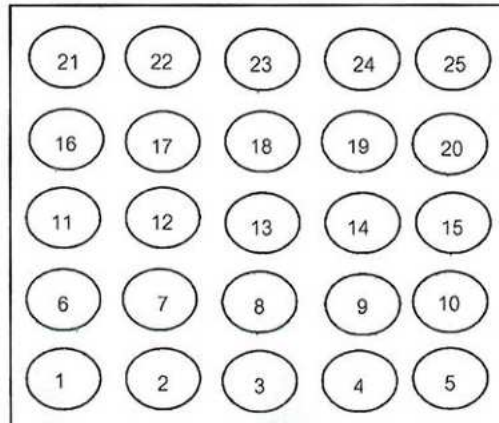
Certificate of Calibration

Certificate No. : 67-400312-1

Page : 2 of 2

Result of Calibration : Without Adjustment

Function : Temperature measurement



Controller

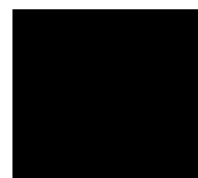
Test Point (°C)	UUC Setting (°C)	UUC Reading (°C)	Standard Reading at Position (°C)									
			1	2	3	4	5	6	7	8	9	10
150.0	150.0	150.0	148.9	149.1	149.4	148.4	148.3	148.5	149.8	148.8	148.9	149.5

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	149.2	150.3	149.7	149.8	148.2	149.4	148.7	148.8	151.7	149.6

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	148.8	149.3	149.2	148.7	149.3	0.78

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

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Certificate of Calibration

Certificate No. : 67-300147-2

Page : 1 of 2

Submitted by : Envilab Co.,Ltd.

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

Equipment : Cylinder

Manufacturer : PYREX

Class : A

Capacity : 50 ml

Graduation : 1 ml

ID No. : C-WW-011/23

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

Relative Humidity : (50 ± 10) %

Air Pressure : 1009.4 mbar.

Date of Received : 13 March 2024

Date of Calibration : 19 March 2024

Date of Issue : 19 March 2024

Calibrated by : Arcerat Sombun

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

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

Electronic Balance

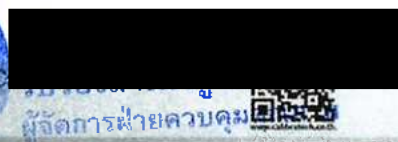
ID No.	Cert. No.	Due Date	Traceability
241002	66-200388-1	02 Jun 2024	National Institute of Metrology (Thailand) (NIMT)

Approved by :

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 67-300147-2

Page : 2 of 2

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

UUC Condition As-Received : Good

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

Uncertainty of measurement with in \pm 0.054 ml

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

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

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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



NSC-TISI-TIS17025
CALIBRATION 0030

Certificate of Calibration

Certificate No. : 67-300147-6

Page : 1 of 2

Submitted by : Envilab Co.,Ltd.

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

Equipment : Cylinder

Manufacturer : PYREX

Class : A

Capacity : 1000 ml

Graduation : 10 ml

ID No. : C-WW-001/24

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

Relative Humidity : (50 ± 10) %

Air Pressure : 1009.3 mbar.

Date of Received : 13 March 2024

Date of Calibration : 19 March 2024

Date of Issue : 19 March 2024

Calibrated by : Arcerat Sombun

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

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

Electronic Balance

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

Approved by :

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Envilab Co.,Ltd.

ผู้จัดการฝ่ายควบคุม

Certificate of Calibration

Certificate No. : 67-300147-6

Page : 2 of 2

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

UUC Condition As-Received : Good

Nominal Volume (ml)	Measuring Volume (ml)
500	500.75
1000	1000.66

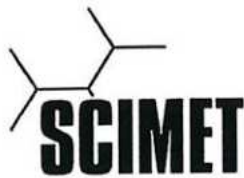
Uncertainty of measurement with in \pm 0.17 ml

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

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

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



Certificate No. C07240032

Calibration Certificate

Equipment:

SPECTROPHOTOMETER

Model:

CARY 60UV-VIS

Serial No.(or ID):

MY17490026 (ELABSPECTRO0002)

Manufacturer:

Agilent

Condition:

In Condition

Job No.:

KSMT2400444

Received Date:

04 March 2024

Issued Date:

04 March 2024

Page:

1 of 3

Customer

Envilab Co., Ltd.

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

Calibration Place

Envilab Co., Ltd.(B301 CO-THC ROOM)

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

Calibration Date

04 March 2024

Environment Condition

Temperature: 22.3 °C ± 0.6 °C

Humidity: 65.7 %RH ± 0.5 %RH

The Method used

In-house method, WI07, based on ASTM E 275-08 and
ASTM E 387-04

Traceability

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

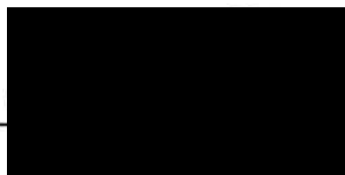
The standard for Wavelength Certificate No. 108691 and 108692

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

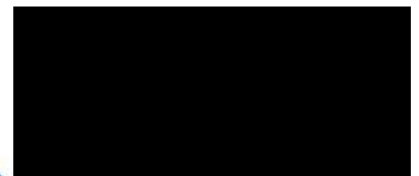
This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national laboratories.

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

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



Person in charge



รับ

ผู้จัดการฝ่ายควบคุมคุณภาพ

FC07-03: 30 MAY 2023

Calibration Results:

Without Adjustment

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

Standard Wavelength (nm)	Unit Under Calibration (nm)	Correction (nm)	Uncertainty of Measurement (± nm)
219.73	220.0	-0.27	0.14
241.55	241.8	-0.25	0.16
287.56	287.6	-0.04	0.14
333.77	333.7	0.07	0.19
360.45	360.1	0.35	0.14
417.59	417.0	0.59	0.14
472.50	472.3	0.20	0.14
513.47	513.4	0.07	0.14
528.88	528.9	-0.02	0.14
537.18	537.1	0.08	0.14
641.58	642.3	-0.72	0.16
740.72	741.3	-0.58	0.14
748.55	749.1	-0.55	0.14
807.03	807.4	-0.37	0.14
879.28	879.0	0.28	0.14

Photometric Accuracy (Absorbance)

Wavelength	Standard absorbance (Abs)	Unit Under Calibration (Abs)	Correction (Abs)	Uncertainty of Measurement(± Abs)
235 nm	0.0000	0.0000	0.0000	0.0080
	0.7293	0.7273	0.0020	0.0080
257 nm	0.0000	-0.0003	0.0003	0.0080
	0.8497	0.8457	0.0040	0.0080
313 nm	0.0000	0.0004	-0.0004	0.0080
	0.2833	0.2810	0.0023	0.0080
350 nm	0.0000	0.0001	-0.0001	0.0080
	0.6299	0.6259	0.0040	0.0080

Calibration Results:

Without Adjustment

Photometric Accuracy (Absorbance)

Wavelength	Standard absorbance (Abs)	Unit Under Calibration (Abs)	Correction (Abs)	Uncertainty of Measurement(\pm Abs)
420 nm	0.0000	0.0000	0.0000	0.0045
	0.2373	0.2386	-0.0013	0.0045
	0.5617	0.5637	-0.0020	0.0045
	0.7392	0.7382	0.0010	0.0045
	1.0550	1.0542	0.0008	0.0045
440 nm	0.0000	0.0000	0.0000	0.0045
	0.2335	0.2354	-0.0019	0.0045
	0.5513	0.5539	-0.0026	0.0045
	0.7230	0.7222	0.0008	0.0045
	1.0324	1.0343	-0.0019	0.0045
465 nm	0.0000	0.0000	0.0000	0.0045
	0.2126	0.2143	-0.0017	0.0045
	0.5036	0.5059	-0.0023	0.0045
	0.6735	0.6729	0.0006	0.0045
	0.9615	0.9638	-0.0023	0.0045
546.1 nm	0.0000	0.0000	0.0000	0.0045
	0.2201	0.2213	-0.0012	0.0045
	0.5176	0.5196	-0.0020	0.0045
	0.6930	0.6925	0.0005	0.0045
	0.9908	0.9925	-0.0017	0.0045
590 nm	0.0000	0.0000	0.0000	0.0045
	0.2443	0.2452	-0.0009	0.0045
	0.5530	0.5544	-0.0014	0.0045
	0.7196	0.7195	0.0001	0.0045
	1.0301	1.0316	-0.0015	0.0045
635 nm	0.0000	0.0000	0.0000	0.0045
	0.2646	0.2651	-0.0005	0.0045
	0.5370	0.5394	-0.0024	0.0045
	0.6862	0.6872	-0.0010	0.0045
	0.9822	0.9855	-0.0033	0.0045

The End of Certificate

Statements of conformity:

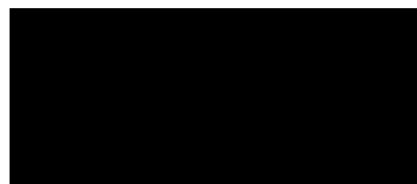
This conformity certificate documents the validity of the following statements of conformity based on the measurement results of corresponding calibration certificate:

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

Tolerance and Decision rules:

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

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



Authorized signatory

Without Adjustment

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

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

Photometric Accuracy (Absorbance)

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

Without Adjustment

Photometric Accuracy (Absorbance)

Wavelength	Unit Under Calibration	Correction	Guard Band (w)	Tolerance (\pm)	Conformity
420 nm	0.0000	0.0000	0.0045	0.015	Pass
	0.2386	-0.0013	0.0045	0.015	Pass
	0.5637	-0.0020	0.0045	0.015	Pass
	0.7382	0.0010	0.0045	0.015	Pass
	1.0542	0.0008	0.0045	0.015	Pass
440 nm	0.0000	0.0000	0.0045	0.015	Pass
	0.2354	-0.0019	0.0045	0.015	Pass
	0.5539	-0.0026	0.0045	0.015	Pass
	0.7222	0.0008	0.0045	0.015	Pass
	1.0343	-0.0019	0.0045	0.015	Pass
465 nm	0.0000	0.0000	0.0045	0.015	Pass
	0.2143	-0.0017	0.0045	0.015	Pass
	0.5059	-0.0023	0.0045	0.015	Pass
	0.6729	0.0006	0.0045	0.015	Pass
	0.9638	-0.0023	0.0045	0.015	Pass
546.1 nm	0.0000	0.0000	0.0045	0.015	Pass
	0.2213	-0.0012	0.0045	0.015	Pass
	0.5196	-0.0020	0.0045	0.015	Pass
	0.6925	0.0005	0.0045	0.015	Pass
	0.9925	-0.0017	0.0045	0.015	Pass
590 nm	0.0000	0.0000	0.0045	0.015	Pass
	0.2452	-0.0009	0.0045	0.015	Pass
	0.5544	-0.0014	0.0045	0.015	Pass
	0.7195	0.0001	0.0045	0.015	Pass
	1.0316	-0.0015	0.0045	0.015	Pass
635 nm	0.0000	0.0000	0.0045	0.015	Pass
	0.2651	-0.0005	0.0045	0.015	Pass
	0.5394	-0.0024	0.0045	0.015	Pass
	0.6872	-0.0010	0.0045	0.015	Pass
	0.9855	-0.0033	0.0045	0.015	Pass

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

The End of Statements of Conformity

บริษัท ชายนิเมท จำกัด (SCIMET CO., LTD.)

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


Envilab Co., Ltd.

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ผู้จัดการฝ่ายควบคุมคุณภาพ

FC07-03, 30 MAY 2023



MIRACLE INTERNATIONAL TECHNOLOGY CO.,LTD

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



CALIBRATION CERTIFICATE

Certificate No. : S2024040558-0002

Date Issued : 03-May-24

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

Equipment : Lab Refrigerator (TMF-PLR221)

Manufacturer : Thermo Scientific

Model : PLR221

Serial No. : 2210M319042801

ID No./Tag No. : ELABREFRIGEN02

Date Received : 02-May-24

Date Calibrated : 02-May-24

Calibrated by : Mr. Varuch Jearrajinda

Calibration Method or Calibration Procedure Used

Standard method : CP-05 TLAS G-20.

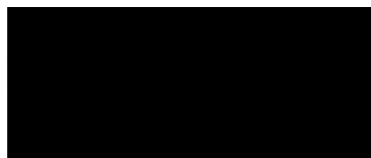
This certificate is traceable to national standards, which realize the units of measurement according to the International System of Units (SI).

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.

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

Approved



Page 1 of 2



รับรองสำเนาถูกต้อง
ผู้จัดการฝ่ายควบคุมคุณภาพ

Certificate No. : S2024040558-0002

Environment : Ambient Temperature : Start record 26.6 °C, Stop record 26.8 °C
Relative Humidity : Start record 54.1 %RH, Stop record 54.5 %RH

Calibration Temperature (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Stability ¹ (°C)	Measured Uniformity ² (°C)	Overall Variation ³ (°C)
4	4	4	0.88	0.69	1.94

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)
4	4.23	4.35	4.44	4.46	4.35	4.24	4.34	3.96	4.13	1.2

Decision Rule with Guard Band

Calibration Temperature (°C)	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	MPE (±°C)
4	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	2

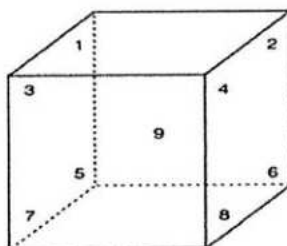
Pass = $|\text{error}| + |\text{uncertainty}| \leq |\text{MPE}|$

MPE = Maximum Permissible Error

Fail = $|\text{error}| + |\text{uncertainty}| > |\text{MPE}|$

Note : Probe No. 9 is Reference Probe

Setting Air Fresh No. 0



Condition As-Received : Used Item

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

Measurement Standards Used & Traceability :

The International System of Units (SI) through

MIT Certificate No. L202403007-0012 for Digital Thermometer with Probe (Agilent) Module I (93) Serial No. MY41008700, Due 10-Sep-24

Notes : 1. The temperature stability is the one-half of greatest maximum difference of measured temperatures at any one probe.

2. The temperature uniformity is the maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time.

3. Overall variation is the difference of maximum and minimum measured temperatures throughout observation time.

4. The uncertainty of measurement is included temperature stability.

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

Page 2 of 2



Envilab Co., Ltd.

รับรองสำเนาถูกต้อง
ผู้จัดการฝ่ายควบคุมคุณภาพ



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

www.qcalibration.com



CERTIFICATE No : 23T3852
REFERENCE No : 68967-3

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : REFRIGERATOR
MANUFACTURER : THERMO SCIENTIFIC
MODEL : PLR221
SERIAL No : 2210M319042801
ID No : ELABREFRIGEN02
CONDITION AS RECEIVED : USED ITEM
SUBMITTED BY : ENVILAB CO.,LTD.
540, 540/1 SOI BANGKHAE 7, BANGKHAE,
BANGKHAE, BANGKOK 10160

CALIBRATED BY : CHAICHARN CH.

CALIBRATION DATE : 03-May-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.



Envilab Co.,Ltd.

ผู้จัดการฝ่ายควบคุมคุณภาพ



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CERTIFICATE No : 23T3852

PAGE : 2 OF 2

Calibration Report

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

CONDITION OF THIS RESULTS OF CALIBRATION

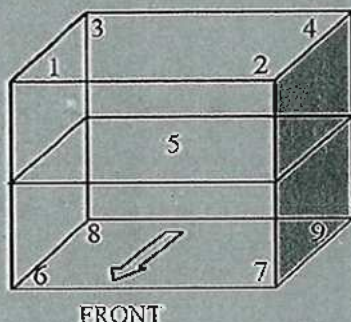
1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO TLAS G-20 BY COMPARISON WITH CALIBRATED THERMOCOUPLE TYPE K UNDER NO LOAD CONDITION. THE THERMOCOUPLES WERE PLACED ON NINE POINTS AND LOCATED ONE THERMOCOUPLE IN EACH OF THE EIGHT CORNERS OF THE CHAMBER AND WAS AWAY FROM THE EACH WALL OF 5 cm TO 10 cm. AND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

2. REFERENCE STANDARD INSTRUMENTS :-

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

3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH QUALITY CALIBRATION CO.,LTD.

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT



GENERAL INFORMATION

Overall Ambient Temperature around the Chamber (°C) variation : 2
Overall Line Voltage (V) variation : 0
Instrument Condition : Normal

CHAMBER PERFORMANCE

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

TEMPERATURE MEASUREMENT ACCURACY TEST

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

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

NOTE 2 : LOCATION 5 WAS REFERENCE LOCATION.

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

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

END OF CALIBRATION REPORT



รับรองสำเนาถูกต้อง
ผู้จัดการฝ่ายควบคุมคุณภาพ