



Certificate of Calibration

Method 5 Pre-Test Calibration - Liters (L)

UUT Meter Console Information

Model #: XC-572-V
Serial #: 1001003
DGM Model #: GB/T6968-2011
DGM Serial #: L1500033221

Calibration Conditions

Bar. Pressure (mm Hg): 759.8
Ambient Temperature (°C): 24.2
Relative Humidity (%): 60.0
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	Office, ΔH (mm Hg)	Volume			Meter Temperature (°C)		Mean Pressure (mm Hg)	Volume (L)		Outlet Temperature (°C)	
		Initial (L)	Final (L)	Total (L)	Initial	Final		Initial	Final	Initial	Final
Θ	P _{m(g)}	V _{mi}	V _{mf}	V _m	t _{mi}	t _{mf}	P _w	V _{mi}	V _{mf}	t _{mi}	t _{mf}
870.00	13.00	483737.2	483897.2	160.0	25.0	25.0	0.3	0.00	161.44	25.0	25.0
630.00	25.00	483897.2	484059.0	161.8	25.0	25.0	0.5	0.00	164.16	25.0	25.0
450.00	50.00	484059.0	484223.5	164.5	26.0	26.0	0.6	0.00	167.88	25.0	25.0
360.00	80.00	484223.5	484391.4	167.9	26.0	27.0	2.0	0.00	171.91	25.0	25.0
300.00	120.00	484391.4	484561.5	170.1	27.0	27.0	2.4	0.00	174.74	25.0	25.0

Reference Meter (WTM)

Run Time	Office, ΔH (mm Hg)	Volume			Meter Temperature (°C)		Mean Pressure (mm Hg)	Volume (L)		Outlet Temperature (°C)	
		Initial (L)	Final (L)	Total (L)	Initial	Final		Initial	Final	Initial	Final
Θ	P _{m(g)}	V _{mi}	V _{mf}	V _m	t _{mi}	t _{mf}	P _w	V _{mi}	V _{mf}	t _{mi}	t _{mf}
870.00	13.00	483737.2	483897.2	160.0	25.0	25.0	0.3	0.00	161.44	25.0	25.0
630.00	25.00	483897.2	484059.0	161.8	25.0	25.0	0.5	0.00	164.16	25.0	25.0
450.00	50.00	484059.0	484223.5	164.5	26.0	26.0	0.6	0.00	167.88	25.0	25.0
360.00	80.00	484223.5	484391.4	167.9	26.0	27.0	2.0	0.00	171.91	25.0	25.0
300.00	120.00	484391.4	484561.5	170.1	27.0	27.0	2.4	0.00	174.74	25.0	25.0

Standardized Data

Standardized Data												
Reference Meter (L)				UUT Meter (L)				Correction Factor		ΔH @ (mm H ₂ O)		
Std. Vol.	Std. Flow			Std. Vol.	Std. Flow	Std. Flow	Variance	Value	Variance	ΔH@	ΔH@	Variance
V _{w(Std)}	Q _{w(Std)}			V _{m(Std)}	V _{w(Std)}			Y	ΔY			
158.78	10.95			157.44	11.0			1.0085	-0.0109	48.2		1.935
161.53	15.38			159.40	15.4			1.0134	-0.0060	47.1		0.802
165.23	22.03			161.91	22.0			1.0205	0.0011	45.9		-0.385
169.78	28.30			165.46	28.3			1.0261	0.0068	44.9		-1.407
172.75	34.55			167.99	34.5			1.0283	0.0090	45.3		-0.944
								1.0194	= Y Avg.	46.3		= ΔH@ Avg.

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

Pass/Fail Judgment : **Pass**

Calibrate By : [Redacted]

Approved By : [Redacted]

Date: 26 Feb 24

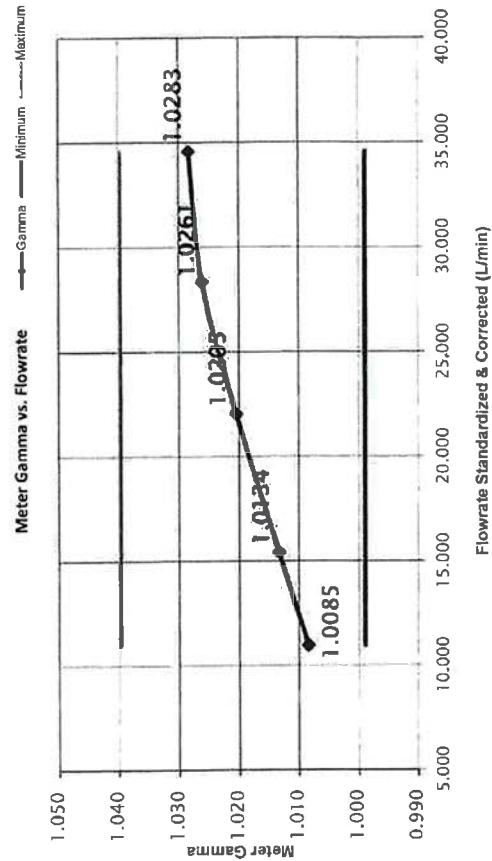
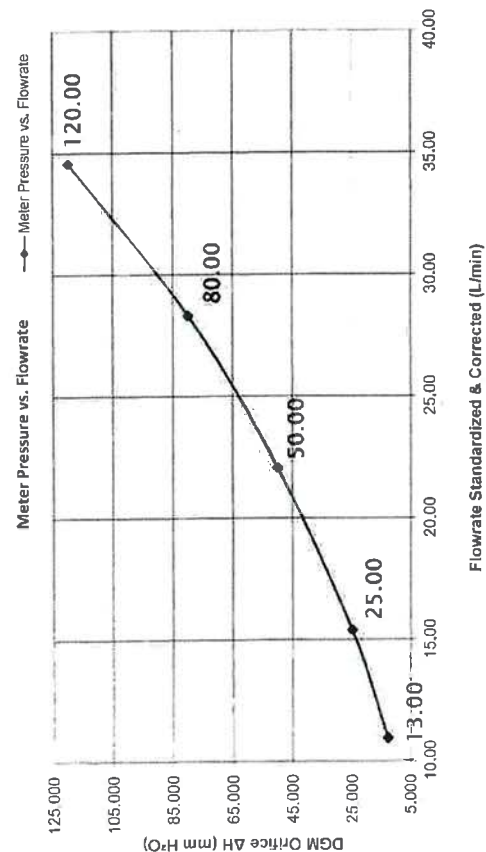
have been calibrated against standards traceable to the National Institute of Standards and Technology (NIST), and in reference to EPA Method 5, Section 10.3.1.

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Certificate of Calibration - Supplemental

Nomenclature	Equations	Calibration Train
<p>P_b - Barometric Pressure</p> <p>DGM - Dry Gas Meter</p> <p>K_1 - Constant based on standard temp and press</p> <p>t - Run time, in minutes</p> <p>P_m - ΔH (Meter Pressure, gauge)</p> <p>V_m - Volume collected by test meter, corrected for STP</p> <p>Q_{std} - Calculated flow rate of test meter</p> <p>K' - Critical orifice coefficient</p> <p>P_r - Measured pressure of reference meter</p> <p>t_r - Temperature measured in reference meter</p>	$V_{u(std)} = Y * K_1 * \frac{V_w * (P_{bur} + \frac{P_{std}}{13.6})}{T_w}$ $V_{m(std)} = \frac{K_1 * V_m * (P_{bur} + \frac{\Delta H}{13.6})}{T_m}$ $K_1 = \frac{T_{std}}{P_{std}}$ $Y = \frac{V_{cr(std)}}{V_{m(std)}}$ $Q_{u(std)} = \frac{V_{u(std)}}{\Theta}$ $Metric \Delta H_{ls} = \frac{P_{m(r)} * 0.0011696 * (P_{bur} + \frac{P_{std}}{13.6})}{T_m} * \left(\frac{T_w * \Theta}{V_w * P_{bur}} \right)^2$	





Certificate of Calibration

Method 5 Console Sensor Calibration - Metric Units

Console Information

Model #: XC-572-V
Serial #: 1001003
Units: Metric

Calibration Conditions

Pbar (mm. Hg): 759.8
Humidity (%): 60
Tamb (°C): 24.2
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. °C	Test Thermocouple Calibrations						Reference Point Status ²
		Aux °C	Stack °C	Probe °C	Oven °C	Filter °C	Exit °C	
#	°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	93	93	93	93	PASS
4	149	150	149	149	149	149	149	PASS
5	260	260	260	260	260	260	260	PASS
6	371	372	372	372	372	372	372	PASS
7	482	483	482	483	483	482	482	PASS
8	593	594	594	594	594	593	593	PASS
9	816	817	817	817	817	817	817	PASS
10	1038	1039	1039	1039	1039	1039	1039	PASS
								PASS

Overall Audit Status

NIST Reference Thermocouple ID:

12702001

	Ref Point	Thermocouple Temp	NIST Thermocouple Sensor Reading	ΔT_{TS} ⁴
	#	°C	°C	°C
Ice Water	1	1.8	2	0.07%
Ambient ³	2	24.2	24	0.04%
Maximum ²				0.07%
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: 26 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 stack thermocouple which should be less than $\pm 1.5\%$ absolute temperature from the reference reading and the Aux thermocouple which should be less than ± 2 °F (± 1 °C) from the reference reading (EPA Method 2, Section 6.3 and EPA Method 5, Sections 6.1.1.7-6.1.1.10)

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 #: 1001003
Units: Metric
Type: "English"

Calibration Conditions

Pbar (mm. Hg): 759.8
Humidity (%): 60.0
Tamb (°C): 24.2
Corr. Pbar (mm. Hg): 759.7

Reference Devices

TC Simulator Model: CC-VTR-SH
Reference #: 091109269
Barometer Model: 736930
Reference #: EBARODIALSPE01
Digital Pressure Calibrator Model: 718 30G
Reference #: 3891001

Pressure Gauge / Manometer Calibration Data

Console Vacuum Calibration			
Reference Point	Reference Vacuum	Console Vacuum	Reference Point Status ⁵
#	in. Hg	in. Hg	Pass/Fail
1	-5.0	-5.0	PASS
2	-15.0	-15.0	PASS
3	-20.0	-20.0	PASS

Reference Point ¹	ΔH ² 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 ² 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

ed By:

Date: 26 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 ±0.4 °C (±0.7 °F), for all thermocouples except for the stack thermocouple which should be less than ±1.5% absolute temperature from the reference reading and the exit thermocouple which should be less than ±2 °F (±1 °C) from the reference reading (EPA Method 2 Section 6.3 and EPA Method 5 Section 6.1.1.1).

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 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

I certify that the above Thermocouple Sensors were calibrated in accordance with US EPA Methods 2 and 5, CFR 40 Part 50



Console Sensor Audit QA Sheet

Meter Console Information (UUT)

Model #: XC-572-V
Serial #: 1001003
Units: Metric

Calibration Conditions

Pbar (mm. Hg): 759.8
Humidity (%): 60.0
Amb. Temp. (°C): 24.2
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	24.2	24	24	24	24	24	25	PASS
Ice Water	1.8	2	2	2	2	2	2	PASS

Audit Data

Console Vacuum Audit			
Reference Point	Reference Vacuum	Console Vacuum	Reference Point Status ²
#	in. Hg	in. Hg	Pass/Fail
1	-17.0	-17.0	PASS

Calibrate By: [REDACTED]

Approved By: [REDACTED]

Date: 26 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 6.3 and EPA Method 5, Sections 6.1.1.7-8, 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 8.1.2)

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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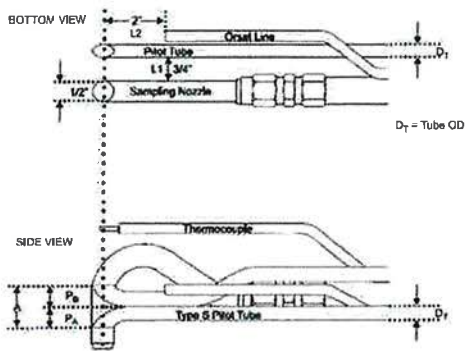
neediss Sampling Probe and Pitot Validation

Samplig System Equipment Information

Probe Sheat	Apex 1 in. , 5 ft.
Probe Number	1912498
Pitot tube Number	A8778
Pitot tube Type	S Type 3/8 Inc.
Validation method	Standard Probe 1 in. and 1/2 in; Sampling Nozzle

Valibration Conditions and Equipment

Digital Callpers	CD-15APX
Reference No.	A22070181
Digital Inclinator	BASELINE
Reference No.	FEI 12-1057
Temperatute	24,2 °C±3
Barometric Pressure	759,8 mm Hg



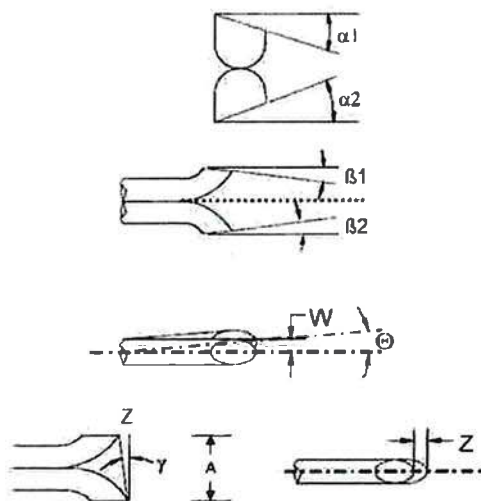
Sampling Probe Validation with Tune up

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

Measured	Standard Range
$L_1 =$	1.90 cm. (1.905 cm. or 3/4 in.)
$L_2 =$	5.10 cm. (5.08 cm. or 2.0 in.)
$D_T =$	0.951 cm. (3/8 in.)
$A =$	2.16 cm. ($2.1 D_T \leq A \leq 3D_T$)
$A/2D_T =$	1.135 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_B Size	Standard Range
$\alpha_1 =$	0.70 ° $\leq 10^\circ$
$\beta_1 =$	-0.60 ° $\leq 5^\circ$
P_A Size	
$\alpha_2 =$	1.20 ° $\leq 10^\circ$
$\beta_2 =$	-1.30 ° $\leq 5^\circ$

Engles measurement	Calculated Result	Standard Range
$W =$	-0.30 °	-0.011 cm. $W < 0.08 \text{ cm (} 1/32 \text{ in.)}$
$Z =$	-1.10 °	-0.041 cm. $Z < 0.032 \text{ cm (} 1/8 \text{ in.)}$

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

Validation By:

pproved By:

Date: 26 Feb 24

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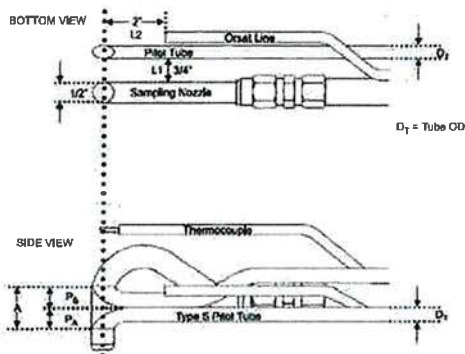
neediss Sampling Probe and Pitot Validation

Sampling System Equipment Information

Probe Sheat	Apex 1 in. , 3 ft.
Probe Number	1809992
Pitot tube Number	A3601
Pitot tube Type	S Type 3/8 Inc.
Validation method	Standard Probe 1 in. and 1/2 in. Sampling Nozzle

Valibration Conditions and Equipment

Digital Calipers	CD-15APX
Reference No.	A22070181
Digital Inclnometer	BASELINE
Reference No.	FEI 12-1057
Temperatute	24.2 °C±3
Barometric Pressure	759.8 mm Hg



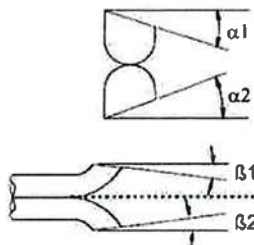
Sampling Probe Validation with Tune up

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

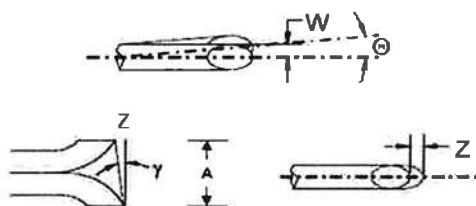
Measured	Standard Range
$L_1 =$	1.92 cm. (1.905 cm, or 3/4 in.)
$L_2 =$	5.56 cm. (5.08 cm. or 2.0 in.)
$D_T =$	0.96 cm. (3/8 in.)
$A =$	2.09 cm. ($2.1 D_T \leq A \leq 3 D_T$)
$A/2D_T =$	1.089 cm. ($1.05 P_A / D_T \leq A \leq 1.5$)

Pitot Tube Validations and Engles measurement Result

☒ : Measure Result after Maintenance and Adjustable



P_B Size	Standard Range
$\alpha_1 =$	-3.60 ° $\leq 10^\circ$
$\beta_1 =$	0.00 ° $\leq 5^\circ$
P_A Size	Standard Range
$\alpha_2 =$	-2.40 ° $\leq 10^\circ$
$\beta_2 =$	-2.00 ° $\leq 5^\circ$



Engles measurement	Calculated Result	Standard Range
$W =$	1.20 °	0.044 cm. $W < 0.08 \text{ cm (} 1/32 \text{ in.)}$
$Z =$	-0.90 °	-0.033 cm. $Z < 0.032 \text{ cm (} 1/8 \text{ in.)}$

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

Validation By:

Approved By:

Date: 26 Feb 24

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Nozzle Validation

Samplig System Equipment Information

Console Model	XC-572-V
Console Number	1001003
DGM Model	GB/T6968-2011
DGM Number	L1500033221

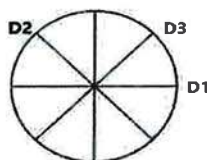
Validation Conditions

Digital Calipers	CD-15APX
Reference No	A22070181
Temperatute	24.2 °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	D _{avg}
	mm	mm	mm	mm	mm	mm
NS-4	3.17	3.17	3.17	3.16	0.006	3.167
NS-8	6.35	6.35	6.34	6.35	0.006	6.347
NS-9	7.13	7.14	7.12	7.12	0.012	7.127
NS-12	9.52	9.52	9.52	9.51	0.006	9.517
NS-14	11.09	11.07	11.09	11.09	0.012	11.083
NS-16	12.70	12.70	12.71	12.70	0.006	12.703
NS-18	14.17	14.16	14.17	14.18	0.010	14.170

Where :

- D1, D2, D3 = There difference nozzle diamiters , mm ; diameter must be within 0.025 mm
Δ D = Maximum difference between any two diameters, must be ≤ 0.100 mm
D avg = (D₁ + D₂ + D₃) / 3



Validation By:

oved By:

26 Feb 24



Neediss Supply Instrument Co.,Ltd.



Envilab Co.,Ltd



Certificate of Calibration

Method 5 Pre-Test Calibration - Liters (L)

UUT Meter Console Information

Model #: 800-STACKS-5
Serial #: 1837
DGM Model #: GB/T6968-2011
DGM Serial #: L1500033637

Calibration Conditions

Bar. Pressure (mm Hg): 758.5
Ambient Temperature (°C): 26.4
Relative Humidity (%): 54
Altitude (m): 1.83
Bar. Pressure Corr. (mm Hg): 758.3

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 (seconds)	Office, ΔH (mm H2O)	Volume		Meter Temperature (°C)		Meter Pressure (mm H2O)	Reference Meter (WTM)		
		Initial (L)	Final (L)	Initial	Final		Initial	Final	Outlet Temperature (°C)
Θ	P _{mf} (g)	V _{mf}	V _{mf}	t _{mf}	t _{mf}	P _w	V _w	V _w	t _{wf}
840.00	13.00	605939.7	606104.2	26.0	26.0	0.3	0.00	153.63	26.0
630.00	25.00	606104.2	606274.7	25.0	26.0	0.5	0.00	158.84	26.0
450.00	50.00	606274.7	606446.5	26.0	26.0	0.6	0.00	161.39	26.0
360.00	80.00	606446.5	606620.4	26.0	26.0	2.0	0.00	164.05	26.0
318.00	120.00	606620.4	606801.0	26.0	26.0	2.4	0.00	172.35	26.0

Standardized Data

Reference Meter (L)		UUT Meter (L)		Correction Factor		ΔH @ (mm H2O)	
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 @	ΔΔH @
150.33	10.74	161.05	10.7	0.9334	-0.0042	49.9	-0.781
155.50	14.81	167.39	14.8	0.9290	-0.0087	50.6	-0.044
158.04	21.07	168.79	21.1	0.9363	-0.0014	50.1	-0.592
161.19	26.86	171.35	26.9	0.9407	0.0030	49.8	-0.893
169.52	31.98	178.64	32.0	0.9489	0.0113	53.0	2.311
				0.9377	= Y Avg.	50.7	= 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, orifice pressure differential that equates to 0.0212 m³/min at standard temperature and pressure, acceptable tolerance of individual values from the average is ±0.2 inches (5.1 mm) H₂O.

Pass/Fail Judgment : **Pass**

Calibrate By : 
The Instruments

Approved By : 

Date: 9 Apr 24
in reference to EPA Method 5, Section 10.3.1.

Nomenclature

- P_b - Barometric Pressure
- DGM - Dry Gas Meter
- K_1 - Constant based on standard temp and press
- Θ - Run time, in minutes
- P_m - ΔH (Meter Pressure, gauge)
- V_m - Volume collected by test meter, corrected for STP
- $Q_{m(stp)}$ - Calculated flow rate of test meter
- K' - Critical orifice coefficient
- P_w - Measured pressure of reference meter
- t_w - Temperature measured in reference meter

Equations

$$V_{w(std)} = V \cdot K_1 \frac{V_w \cdot (P_{bar} + \frac{P_{m(std)}}{13.6})}{T_w}$$

$$V_{n(std)} = \frac{K_1 V_m (P_{bar} + \frac{\Delta H}{13.6})}{T_m}$$

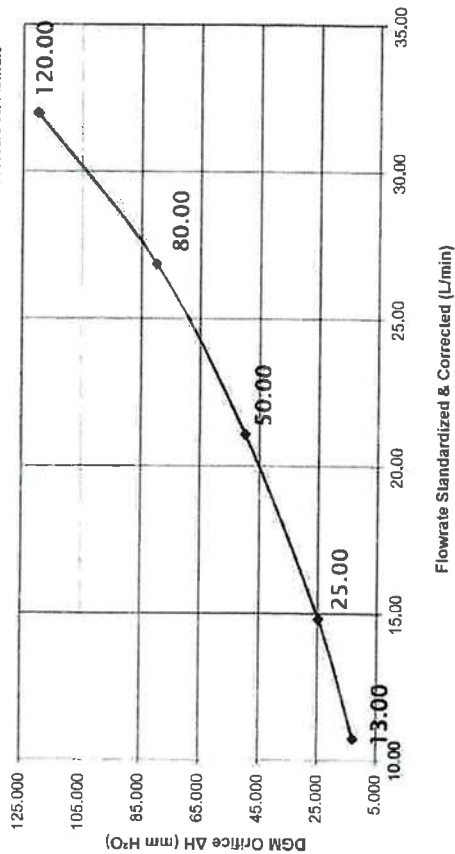
$$K_1 = \frac{T_{std}}{P_{std}} \quad Y = \frac{V_{m(std)}}{V_{m(std)}} \quad Q_{w(std)} = \frac{V_{w(std)}}{\Theta}$$

$$Metric \Delta H_0 = \frac{P_{m(std)} \cdot 0.0011696 \cdot (P_{bar} + \frac{P_{m(std)}}{13.6})}{T_m} \cdot \left(\frac{T_w \cdot \Theta}{V_w \cdot P_{bar}} \right)^2$$

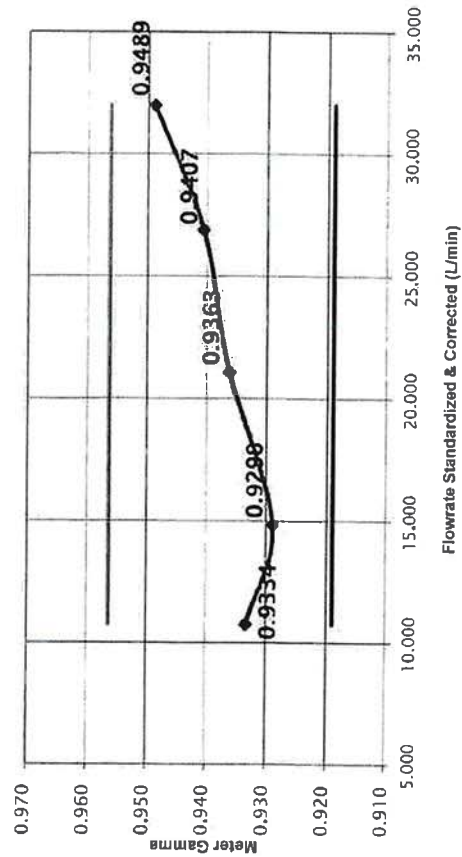
Calibration Train



Meter Pressure vs. Flowrate



Meter Gamma vs. Flowrate





Certificate of Calibration

Method 5 Console Sensor Calibration - Metric Units

Console Information

Model #: 800-STACKS-5
Serial #: 1837
Units: Metric

Calibration Conditions

Pbar (mm. Hg): 758.5
Humidity (%): 54
Tamb (°C): 26.4
Elevation (m): 1.8
Corr. Pbar (mm. Hg): 758.3

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
		Stack	Probe	Filter	Exit	Aux	
#	°C	°C	°C	°C	°C	°C	Pass/Fail
1	-18	-17	-17	-17	-17	-17	PASS
2	38	37	36	37	37	37	PASS
3	93	93	93	93	93	92	PASS
4	149	149	149	149	149	149	PASS
5	260	259	258	258	259	259	PASS
6	371	371	371	371	371	371	PASS
7	482	482	482	482	481	481	PASS
8	593	593	593	593	592	592	PASS
9	816	815	815	816	815	815	PASS
10	1038	1038	1037	1037	1037	1038	PASS
							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	1	0.04%
Ambient ³	2	26.4	25	0.29%

Maximum² 0.29%

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: 9 Apr 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 stack thermocouple which should be less than $\pm 1.5\%$ absolute temperature from the reference reading and the exit thermocouple which should be less than ± 2 °F (± 1 °C) from the reference reading (EPA Method 2, Section 6.3 and EPA Method 5, Sections 6.1.1.7-6.1.1.8)

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)

⁶ For valid test results, the maximum difference between console and reference vacuum readings should be less than ± 0.05 in. H₂O (± 1.25 mm H₂O), or 5% of full scale



neediss Console Sensor Calibration Data Sheet

Console Information

Model #: 800-STACKS-5
Serial #: 1837
Units: Metric
Type:
"English"

Calibration Conditions

Pbar (mm. Hg): 758.5
Humidity (%): 54.0
Tamb (°C): 26.4
Corr. Pbar (mm. Hg): 758.3

Reference Devices

TC Simulator Model: CC-VTR-SH
Reference #: 091109269
Barometer Model: 736930
Reference #: EBARODIALSPE01
Digital Pressure Calibrator Model: 718 30G
Reference #: 3891001

Pressure Gauge / Manometer Calibration Data

Console Vacuum Calibration			
Reference Point	Reference Vacuum	Console Vacuum	Reference Point
#	in. Hg	in. Hg	Status ⁵
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
	Reference	Positive (+) Pitot	Negative (-) Pitot	
#	mm H ₂ O	mm H ₂ O	mm H ₂ O	Status ²
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
	Reference	Positive (+) Pitot	Negative (-) Pitot	
#	mm H ₂ O	mm H ₂ O	mm H ₂ O	Status ²
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:

9 Apr 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 stack thermocouple which should be less than $\pm 1.5\%$ absolute temperature from the reference reading and the exit thermocouple which should be less than ± 2 °F (± 1 °C) from the reference

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

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



Neediss Supply Instrument Co., Ltd

Envilab Co

neediss Console Sensor Audit QA Sheet

Meter Console Information (UUT)

Model #: 800-STACKS-5
 Serial #: 1837
 Units: Metric

Calibration Conditions

Pbar (mm. Hg): 758.5
 Humidity (%): 54
 Amb. Temp. (°C): 26.4
 Altitude (m): 1.8
 Corrected Pbar (mm. Hg): 758.3

Reference Devices

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

Audit Data

Reference Point	Reference Temp.	Thermocouple Probe Audit					Reference Point Status ¹
		Stack	Probe	Filter	Exit	Aux	
	°C	°C	°C	°C	°C	°C	Pass/Fail
Room	26.4	26	26	26	26	26	PASS
Ice Water	0.9	1	1	1	1	1	PASS

Console Vacuum Audit			
Reference Point	Reference Vacuum	Console Vacuum	Reference Point Status ²
#	in. Hg	in. Hg	Pass/Fail
1	17.0	16.5	PASS

Calibrate By:  Approved By:  Date: 9 Apr 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 6.3 and EPA Method 5, Sections 6.1.1, 7-6, 1.1, 8)

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

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

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

 **neediss**
 Neediss Supply Instrument Co., Ltd



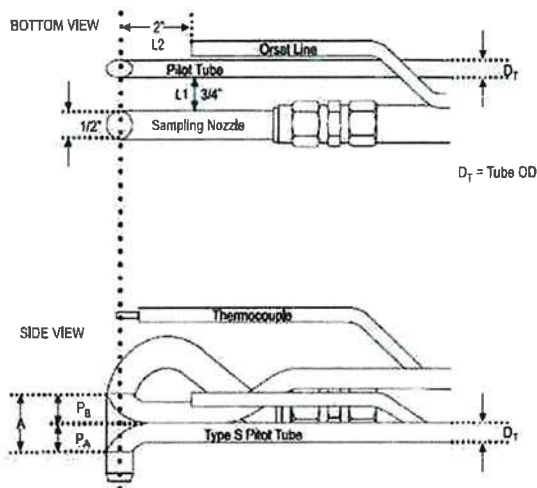
neediss Sampling Probe and Pitot Validation

Sampling System Equipment Information

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

Validation Conditions and Equipment

Digital Calipers	CD-15APX
Reference No.	A22070181
Digital Inclinator	BASELINE
Reference No.	FEI 12-1057
Temperature	26.4 °C±3
Barometric Pressure	758.5 mm Hg



Sampling Probe Validation with Tune up

☑ : Measure and Alinment with 1/2" Sampling Nozzle(12,7 mm)

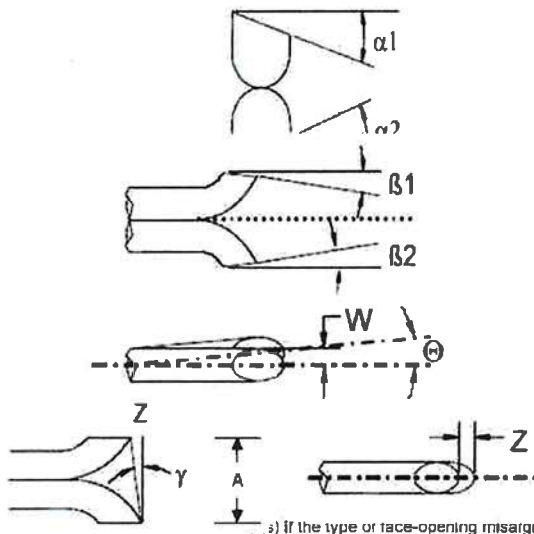
Measured	Standard Range
$L_1 = 1.92 \text{ cm.}$	(1.905 cm. or 3/4 in.)
$L_2 = 4.99 \text{ cm.}$	(5.08 cm. or 2.0 in.)
$D_T = 0.961 \text{ cm.}$	(3/8 in.)
$A = 2.18 \text{ cm.}$	($2.1 D_T \leq A \leq 3D_T$)
$A/2D_T = 1.134 \text{ cm.}$	($1.05 P_A / D_T \leq A \leq 1.5$)

Pitot Tube Validations and Engles measurement Result

☑ : Measure Result after Maintenance and Adjustable

P_B Size	Standard Range
$\alpha_1 = -0.30^\circ$	$\leq 10^\circ$
$\beta_1 = 2.20^\circ$	$\leq 5^\circ$
P_A Size	Standard Range
$\alpha_2 = -0.50^\circ$	$\leq 10^\circ$
$\beta_2 = 1.70^\circ$	$\leq 5^\circ$

Engles measurement	Calculated Result	Standard Range
$W = 0.40^\circ$	0.015 cm.	$W < 0.08 \text{ cm (1/32 in.)}$
$Z = 1.60^\circ$	0.061 cm.	$Z < 0.032 \text{ cm (1/8 in.)}$



3) If the type or race-opening misalignment show above with not affect the base line value of Cp(s) Solong as standard range

Validation By:

proved By:

Date:

9 Apr 24

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neediss Nozzle Validation

Samplig System Equipment Information

Console Model	XC-572-V
Console Number	A1912535
DGM Model	SK25EX
DGM Number	00006056

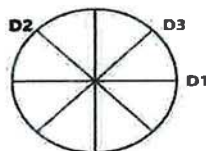
Validation Conditions

Digital Calipers	CD-15APX
Reference No	A22070181
Temperatute	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-4	3.17	3.18	3.18	3.17	0.006	3.177
NS-7	5.30	5.32	5.32	5.32	0.000	5.320
NS-9	7.13	7.11	7.12	7.12	0.006	7.117
NS-10	7.92	7.95	7.95	7.94	0.006	7.947
NS-12	9.52	9.53	9.52	9.53	0.006	9.527
NS-14	11.09	11.11	11.10	11.11	0.006	11.107
NS-16	12.70	12.70	12.68	12.70	0.012	12.693

Where :

- D₁, D₂, D₃ = There difference nozzle diamiters , mm ; diameter must be within 0.025 mm
 Δ D = Maximum difference between any two diameters, must be ≤ 0.100 mm
 D avg = (D₁ + D₂ + D₃) / 3



Validation By:

oved By:

9 Apr 24


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Verification Test Report

Instruments Information

Page:1/2

Analyzer Type: Flue Gas Analyser

Manufacturer: MRU

Model: Optima7

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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ผู้ให้บริการด้านความคุ้มครองคุณภาพ

**neediss**บริษัท นีดิส ซัพพลาย อินสตรูमेंท์ จำกัด
Neediss Supply Instrument Co., Ltd.535 ซอยบางแค 7 แขวงบางแค เขตบางแค กรุงเทพฯ 10160 536 Soi Bangkhoe 7 Bangkhoe Bangkok Bangkok
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

Manufacturer: MRU

Model: Optima7

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 :

26 Feb 24

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

✓



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Agilent CrossLab Start Up Services

Agilent 5100 5110 ICP-OES Preventive Maintenance



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

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

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

Service Engineer's Responsibilities

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

Important Customer Web Links

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



Preparation

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

Instrument Maintenance

System Information

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

Instrument System Name and ID	ICP 5110 VDV / MY17490002
Instrument System Site and Location	ENVILAB Company Limited / Laboratory

List System Component	Product Numbers	List the Serial Numbers of each Component
1. G8015A		MY17490002
2. G8481A		1709-05327
3. G8410A		AU17393768
4.		
5.		
6.		
7.		
8.		
9.		

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



SPS 3 Auto Sampler

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

SPS 4 Auto sampler

- ☐ **Service not applicable**
- ☒ Clean the spill tray, rack location mat, end frames and chassis with a damp soft cloth and diluted mild detergent.
- ☒ 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
- ☒ Test using customer's tray and move the sample probe to the sample vial 1, wash vial and rinse port and ensure that the probe is centered in the vial. If not use calibration wizard and calibrate the position.

AVS 4, 6, 7 Advanced Valve System

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

Preventive Maintenance Procedures

Record Pre-PM instrument performance

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

Clean and inspect ICP-OES system

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



Restore Instrument

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

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



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	VAC 217
Mains Current	0.082	A 0.098
Instrument Temperature	23.5	°C 24.5
RF Air Flow (sensor speed)	13.0	Hz 19.0
Plasma Exhaust Temperature	No measurement	°C 56.4
Water Flow Oscillator	No measurement	L/min 1.51
Water Flow Detector	1.09	L/min 1.06
Water Inlet Temperature	16.9	°C 16.7
Polychromator Temperature	35.0	°C 35.0
CCD Temperature	-39.6	°C -39.6
Thermal Stabilizer	35.0	°C 35.0
Argon Supply Pressure	619	kPa 560
Purge Gas Supply Pressure*1	616	kPa 597
Option Gas Supply Pressure*1	N/A	kPa N/A
Nebulizer Flow	No measurement	L/min 0.7
Nebulizer Back Pressure	No measurement	kPa 283
Plasma Gas Flow	No measurement	L/min 11.98
Auxiliary Gas Flow	No measurement	L/min 1.00
RF Power	No measurement	W 1195.1
RF Supply Current	No measurement	A 8.190
RF Supply Voltage	No measurement	V 194.557

*1 If option installed

Test Results

Instrument Performance Test Results Table

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

	Pre PM Sensitivity Check		Post PM Sensitivity Check	
	Radial	Axial *	Radial	Axial*
Zn 213.857 nm SRBR	1597.1	3382.6	3780.2	7240.8
Mn 257.610 nm SRBR	5945.3	16145.3	11049.1	24678.4
Al 396.152 nm SBR	7.0	16.3	6.8	17.0
K 766.491 nm SBR	5.2	67.3	3.5	56.3

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

Instrument Test Results Table

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

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

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.

Performed PM on date 31 May 2024 but sensitivity is still low in some wavelength on Axial view.
After replace mirror kit and Prism grating test performance again all pass result.

Service Verification

Date Service Completed:

3 July 2024

Customer Name:

K. Jeniira

Customer Signature: _____

number of pages in this document:

A 02, Issued: 21 January 2022
 Patent Number: G8014-90075
 at Technologies, Inc., 2022

Page __ of __



Agilent

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	5795-0037	Agilent Water Recirculator	
Purge Gas Filter	G8010-60136	All	1
Air Inlet Filter	G8000-68002	All	1
High Capacity Air Filter	G8010-60189	Optional	
Rotor seal for 6-7 port valve for AVS6/7	G8494-60002	G8494A/G8495	
Rotor seal for 4 port valve for AVS4	G8493-60002	G8493A	
Rinse solution to rinse station 2.5mm id x 1m	G8410-80123	SPS 4	
Barb connector 2.5mm-1.5mm ID	G8410-80124	SPS 4	
PVC waste tubing, 8mm od x 5mm id, 2m	G8410-80122	SPS 4	
Additional Parts may be required from engineer's stock:			
X axis drive belt	5410047500	SPS 3	
Z axis drive belt	5410047400	SPS 3	
Peristaltic pump tubing, PVC SolvaFlex, 3 bridged,	3710049000	SPS 4	

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

☒ **Section Not Applicable.**[illegible]

Revision: A 02, Issued: 21 January 2022
Document Number: G8014-90075
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Page _ of _



Agilent

CAL

Calibratech Co.,Ltd.

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

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



NSC-TISI-TIS17025
CALIBRATION 0030

Certificate of Calibration

Certificate No. : 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 ± 2) °C
Relative Humidity : (50 ± 15) %

Date of Received : 20 February 2024

Date of Calibration : 22 February 2024

Date of Issue : 22 February 2024

Calibrated by : Chortip Samchusri

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

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

<u>ID No.</u>	<u>Cert. No.</u>	<u>Due Date</u>	<u>Traceability</u>
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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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@ynhoo.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%

- o0o -

CAL

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



NSC-TISI-TIS17025
CALIBRATION 0030

Certificate of Calibration

Certificate No. : 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

<u>ID No.</u>	<u>Cert. No.</u>	<u>Due Date</u>	<u>Traceability</u>
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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Tel.(02) 964-6211 Fax.(02) 964-5155, e-mail : calibratech_cal@yahoo.com, calibratech_cal@hotmail.com

Certificate of Calibration

Certificate No. : 67-200060-1

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.

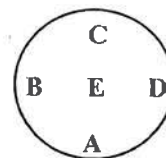
This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2.00$, providing a level of confidence of approximately 95%

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 -





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



EnviLab & EnviLab Supply Instrument

TSP High Volume Sampler Calibration

Verification Report No.

SO2400208-E001 -TSP 01

<input type="checkbox"/> PM	<input checked="" type="checkbox"/> Onsite
Site: โรงเรียนเซนต์แมรี	
UTM : 47P E 676551 N 1582248	
Sampler: ETSP#41	
Recorder: 0	
Date: 11 Oct 24	
Technical: Amonthep Konklee	
Approval: Wisan Ritthikamon	

CONDITIONS

Barometric Press. (hPa): 1005.0	Corrected Pressure (mm Hg): 753.8
Temperature (deg C): 32.0	Temperature (deg K): 305.0
Average Press. (hPa): 1013.0	Corrected Avg.Press. (mm Hg): 759.8
Average Temp. (deg C): 30.0	Average Temp. (deg K): 303.0

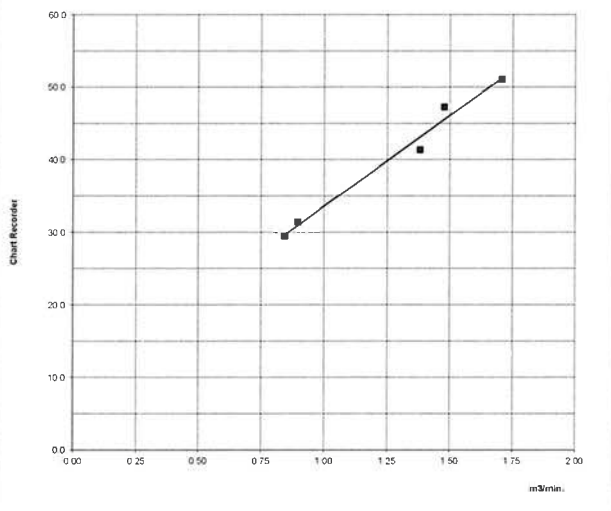
CALIBRATION ORIFICE

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

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

CALIBRATIONS

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION
1	12.08	1.707	52.0	51.19	
2	9.02	1.477	48.0	47.25	Slope = 24.9409 Intercept = 8.7520 Corr. coeff.= 0.9912 # of Observations: 5 Range of Chart at 1.1 - 1.7 m3/min. 37 51
3	7.86	1.379	42.0	41.35	
4	3.26	0.893	32.0	31.50	
5	2.89	0.842	30.0	29.53	



Calibrated by :

11 October 2024

Approved by :

11 October 2024

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





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EnviLab Co., Ltd. 540,540/1 Soi Bangkhae 7 Bangkhae Bangkok Bangkok 10160
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EnviLab & Monitor Supply Instrument

TSP High Volume Sampler Calibration

Verification Report No.

SO2400208-E001 -TSP 04

<input type="checkbox"/> PM	<input checked="" type="checkbox"/> Onsite
Site: วัดโดนด้าย	
UTM : 47P E 680230 N 1586144	
Sampler: ETSP#42	
Recorder: 0	
Date: 11 Oct 24	
Technical: Amonthep Konklee	
Approval: Wisan Ritthikamon	

CONDITIONS

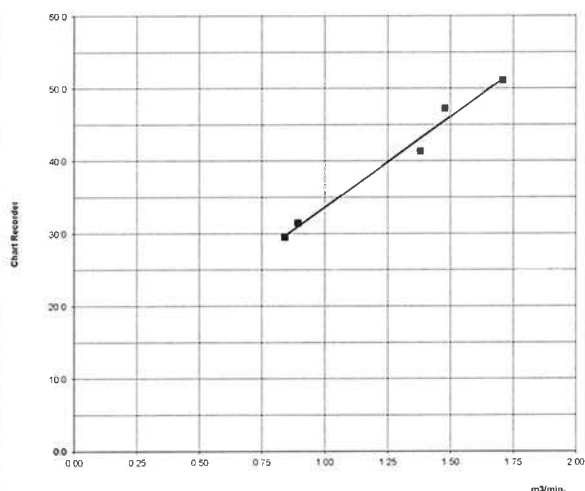
Barometric Press. (hPa): 1005.0	Corrected Pressure (mm Hg): 753.8
Temperature (deg C): 32.0	Temperature (deg K): 305.0
Average Press. (hPa): 1013.0	Corrected Avg. Press. (mm Hg): 759.8
Average Temp. (deg C): 30.0	Average Temp. (deg K): 303.0

CALIBRATION ORIFICE

Brand: Tisch Environmental, Inc	Qstd Slope: 2.02024
Model: TE-5025A	Qstd Intercept: -0.02667
Seria#: 5411	Date Certified: 9 Feb 2024
	Due Date : 08-Feb-25

CALIBRATIONS

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION
1	12.46	1.733	54.0	53.16	
2	10.02	1.556	50.0	49.22	Slope = 30.0266 Intercept = 1.4428 Corr. coeff.= 0.9976 # of Observations: 5 Range of Chart at 1.1 - 1.7 m3/min. 36 53
3	8.25	1.413	44.0	43.31	
4	4.87	1.089	34.0	33.47	
5	2.98	0.854	28.0	27.56	



Calibrated by :

11 October 2024

Approved by :

11 October 2024

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



Envilab & Enviro Supply Resources

TSP High Volume Sampler Calibration

Verification Report No.

SO2400208-E001 -TSP 03

<input type="checkbox"/> PM	<input checked="" type="checkbox"/> Onsite
Site: วัดโคกมเหยม	
UTM : 47P E 677553 N 1585212	
Sampler: ETSP#44	
Recorder: 0	
Date: 11 Oct 24	
Technical: Amonthep Konklee	
Approval: Wisan Ritthikamon	

CONDITIONS

Barometric Press. (hPa): 1005.0	Corrected Pressure (mm Hg): 753.8
Temperature (deg C): 32.0	Temperature (deg K): 305.0
Average Press. (hPa): 1013.0	Corrected Avg.Press. (mm Hg): 759.8
Average Temp. (deg C): 30.0	Average Temp. (deg K): 303.0

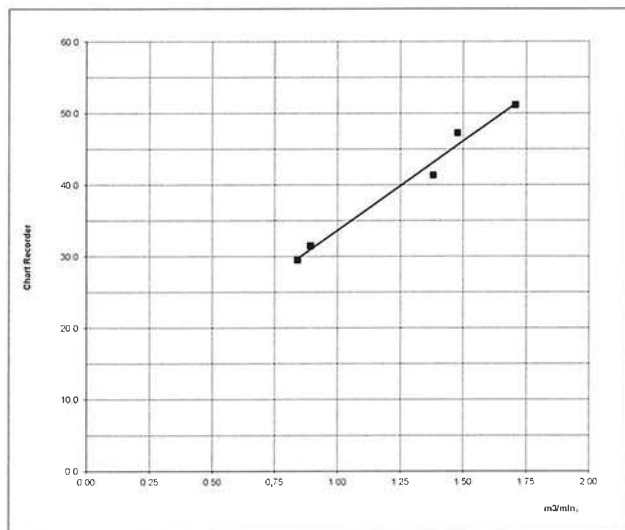
CALIBRATION ORIFICE

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

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

CALIBRATIONS

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION
1	12.24	1.718	52.0	51.19	
2	9.97	1.552	50.0	49.22	Slope = 24.2086 Intercept = 10.3068 Corr. coeff.= 0.9957 # of Observations: 5 Range of Chart at 1.1 - 1.7 m3/min. 38 52
3	7.85	1.378	44.0	43.31	
4	4.63	1.062	36.0	35.44	
5	2.49	0.782	30.0	29.53	



Calibrated by :

11 October 2024

Approved by :

11 October 2024

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



Envilab Co., Ltd. 540,540/1 ซอยบางแค 7 แขวงบางแค เขตบางแค กรุงเทพฯ 10160



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



Envilab & Envilab Supply Instrument

TSP High Volume Sampler Calibration

Verification Report No.

SO2400208-E001 -TSP 05

<input type="checkbox"/> PM	<input checked="" type="checkbox"/> Onsite
Site: บ้านหนองไผ่	
UTM : 47P E 677784 N 1582555	
Sampler: ETSP#27	
Recorder: 0	
Date: 11 Oct 24	
Technical: Amonthep Konklee	
Approval: Wisan Ritthikamon	

CONDITIONS

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

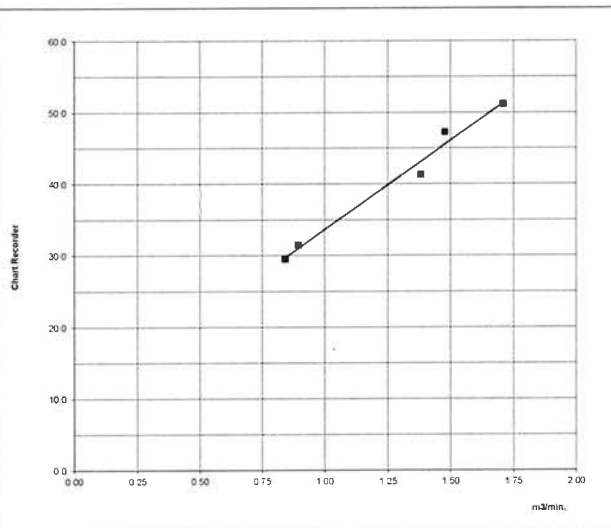
CALIBRATION ORIFICE

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

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

CALIBRATIONS

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION
1	12.98	1.738	52.0	50.29	
2	10.20	1.542	48.0	46.42	Slope = 28.8924 Intercept = 0.9351 Corr. coeff.= 0.9925 # of Observations: 5 Range of Chart at 1.1 - 1.7 m3/min.: 34 51
3	8.43	1.403	44.0	42.55	
4	5.75	1.161	34.0	32.88	
5	3.35	0.889	28.0	27.08	



Calibrated by :

11 October 2024

Approved by :

11 October 2024

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Environmental responsibility with accuracy measurement

FE-MNT-27 Rev.00 (01/08/63)

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



Envilab Co., Ltd. ผู้จัดการฝ่ายควบคุมคุณภาพ



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



Envilab & Related Supply Instrument

TSP High Volume Sampler Calibration

Verification Report No.

SO2400208-E001 -TSP 02

☐ PM ☒ Onsite

Site: บ้านสุขสิริ

UTM : 47P E 677962 N 1584137

Sampler: ETSP#28

Recorder: 0

Date: 11 Oct 24

Technical: Amonthep Konklee

Approval: Wisan Ritthikamon

CONDITIONS

Barometric Press. (hPa): 1005.0

Temperature (deg C): 32.0

Average Press. (hPa): 1013.0

Average Temp. (deg C): 30.0

Corrected Pressure (mm Hg): 753.8

Temperature (deg K): 305.0

Corrected Avg.Press. (mm Hg): 759.8

Average Temp. (deg K): 303.0

CALIBRATION ORIFICE

Brand: Tisch Environmental, Inc

Model: TE-5025A

Serial#: 5411

Qstd Slope: 2.02024

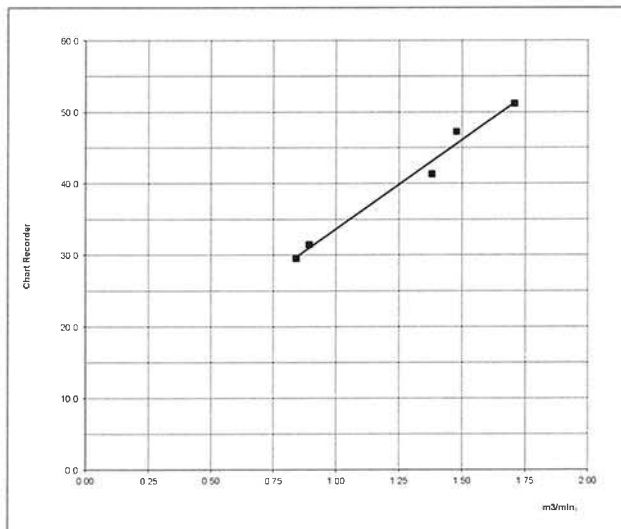
Qstd Intercept: -0.02667

Date Certified: 9 Feb 2024

Due Date : 08-Feb-25

CALIBRATIONS

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION Slope = 30.8599 Intercept = 0.8582 Corr. coeff.= 0.9967 # of Observations: 5 Range of Chart at 1.1 - 1.7 m3/min. 36 54
1	12.24	1.718	54.0	53.16	
2	9.57	1.521	50.0	49.22	
3	7.98	1.390	44.0	43.31	
4	4.73	1.073	34.0	33.47	
5	3.01	0.859	28.0	27.56	



Calibrated by :

11 October 2024

Approved by :

11 October 2024

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



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



Envilab & Analytical Supply International

PM10 High Volume Sampler Calibration

Verification Report No.

SO2400208-E001 -PM 01

☐ PM

☒ Onsite

Site: โรงเรียนเซนต์แมรี

UTM : 47P E 676551 N 1582248

Sampler: EPM10#33

Recorder: 0

Date: 11 Oct 24

Technical: Amonthep Konklee

Approval: Wisan Ritthikamon

CONDITIONS

Barometric Press. (hPa): 1005.0

Temperature (deg C): 32.0

Average Press. (hPa): 1013.0

Average Temp. (deg C): 30.0

Corrected Pressure (mm Hg): 753.8

Temperature (deg K): 305.0

Corrected Avg.Press. (mm Hg): 759.8

Average Temp. (deg K): 303.0

CALIBRATION ORIFICE

Brand: Tisch Environmental, Inc

Model: TE-5025A

Serial#: 5411

Qstd Slope: 1.2654

Qstd Intercept: -0.01667

Date Certified: 9 Feb 2024

Due Date : 08-Feb-25

CALIBRATIONS

Plate or Test #	H2O (in)	Qa (m3/min)	I (chart)	IC (corrected)
1	11.59	1.724	52.0	33.08
2	8.86	1.509	48.0	30.53
3	7.37	1.378	42.0	26.72
4	3.29	0.925	32.0	20.35
5	2.58	0.821	28.0	17.81

LINEAR REGRESSION

Slope = 16.7787

Intercept = 4.3645

Corr. coeff. = 0.9951

SFR = 1.147

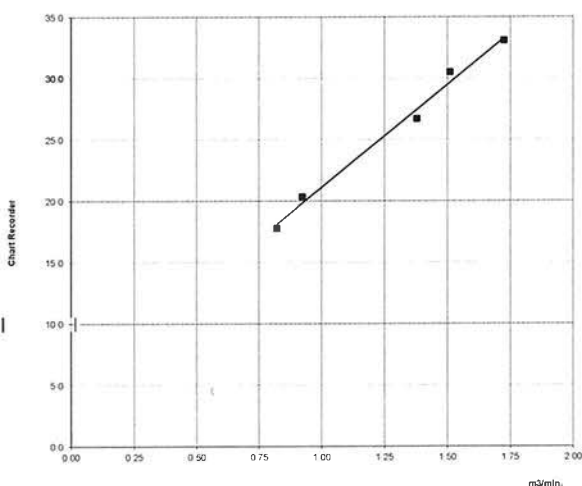
SSP = 37.10

of Observations: 5

Range of Chart
at SFR $\pm 10\%$

35

39



Calibrated by

11 October 2024

Approved by :

11 October 2024

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



Envilab & Products Supply Instrument

PM10 High Volume Sampler Calibration

Verification Report No.

SO2400208-E001 -PM 04

☐ PM

☐ Onsite

Site: วัดโดนด้าย

UTM : 47P E 680230 N 1586144

Sampler: EPM10#27

Recorder: 0

Date: 11 Oct 24

Technical: Amonthep Konkleeb

Approval: Wisan Ritthikamon

CONDITIONS

Barometric Press. (hPa): 1005.0

Temperature (deg C): 32.0

Average Press. (hPa): 1013.0

Average Temp. (deg C): 30.0

Corrected Pressure (mm Hg): 753.8

Temperature (deg K): 305.0

Corrected Avg.Press. (mm Hg): 759.8

Average Temp. (deg K): 303.0

CALIBRATION ORIFICE

Brand: Tisch Environmental, Inc

Model: TE 5025A

Serial#: 5411

Qstd Slope: 1.2654

Qstd Intercept: 0.01667

Date Certified: 9 Feb 2024

Due Date : 08-Feb-25

CALIBRATIONS

Plate or Test #	H2O (in)	Qa (m3/min)	I (chart)	IC (corrected)
1	11.98	1.753	52.0	33.08
2	9.53	1.565	50.0	31.80
3	7.32	1.373	42.0	26.72
4	4.34	1.060	34.0	21.63
5	3.02	0.887	28.0	17.81

LINEAR REGRESSION

Slope = 18.2109

Intercept = 2.0288

Corr. coeff = 0.9920

SFR = 1.147

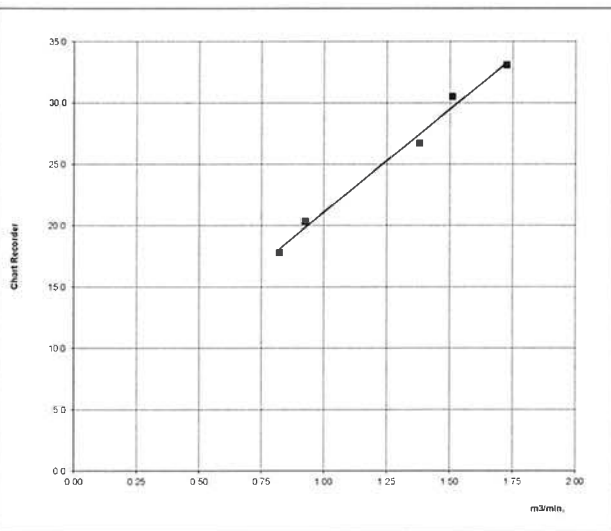
SSP = 36.01

of Observations: 5

Range of Chart
at SFR $\pm 10\%$

34

38



Calibrated by :



11 October 2024

Approved by :



11 October 2024

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

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



Envilab & Needed Supply Instrument

PM10 High Volume Sampler Calibration

Verification Report No.

SO2400208-E001 -PM 03

L PM

Onsite

Site: วัดโคกมะขาม

UTM : 47P E 677553 N 1585212

Sampler: NPM10#18

Recorder: 0

Date: 11 Oct 24

Technical: Amonthep Konklee

Approval: Wisan Ritthikamon

CONDITIONS

Barometric Press. (hPa): 1005.0

Temperature (deg C): 32.0

Average Press. (hPa): 1013.0

Average Temp. (deg C): 30.0

Corrected Pressure (mm Hg): 753.8

Temperature (deg K): 305.0

Corrected Avg.Press. (mm Hg): 759.8

Average Temp. (deg K): 303.0

CALIBRATION ORIFICE

Brand: Tisch Environmental, Inc

Model: TE-5025A

Serial#: 5411

Qstd Slope: 1.2654

Qstd Intercept: -0.01667

Date Certified: 9 Feb 2024

Due Date : 08-Feb-25

CALIBRATIONS

Plate or Test #	H2O (in)	Qa (m3/min)	I (chart)	IC (corrected)
1	11.79	1.739	54.0	34.35
2	9.14	1.533	50.0	31.80
3	7.36	1.377	44.0	27.99
4	4.65	1.097	34.0	21.63
5	2.89	0.868	30.0	19.08

LINEAR REGRESSION

Slope = 18.6811

Intercept = 2.2594

Corr. coeff. = 0.9922

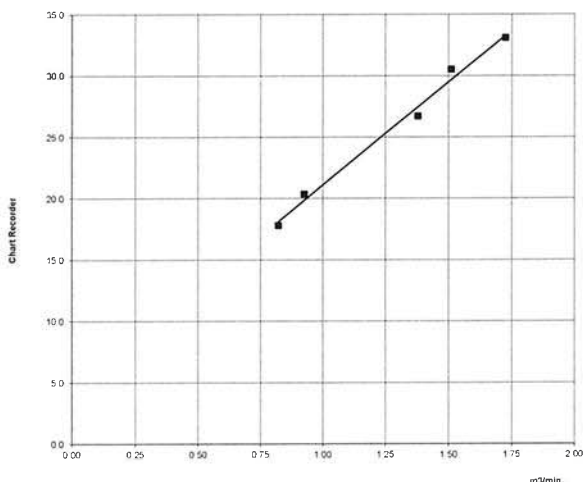
SFR = 1.147

SSP = 37.22

of Observations: 5

Range of Chart 35

at SFR $\pm 10\%$ 40



Calibrated by :

11 October 2024

Approved by :

11 October 2024

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



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PM10 High Volume Sampler Calibration

Verification Report No.

SO2400208-E001 -PM 05

L PM	Onsite
Site: บ้านหนองไผ่	
UTM : 47P E 677784 N 1582555	
Sampler: EPM10#26	
Recorder: 0	
Date: 11 Oct 24	
Technical: Amonthep Konklee	
Approval: Wisan Ritthikamon	

CONDITIONS

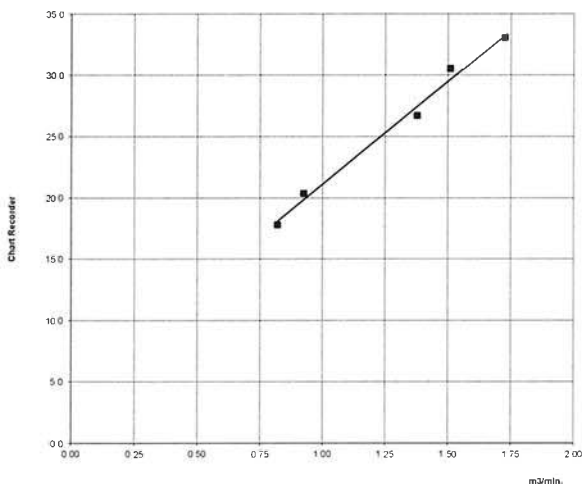
Barometric Press. (hPa): 989.0	Corrected Pressure (mm Hg): 741.8
Temperature (deg C): 38.0	Temperature (deg K): 311.0
Average Press. (hPa): 1013.0	Corrected Avg. Press. (mm Hg): 759.8
Average Temp. (deg C): 30.0	Average Temp. (deg K): 303.0

CALIBRATION ORIFICE

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

CALIBRATIONS

Plate or Test #	H2O (in)	Qa (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION
1	12.21	1.801	54.0	34.96	Slope = 18.8010
2	9.56	1.595	50.0	32.37	Intercept = 1.8130
3	7.23	1.389	44.0	28.49	Corr. coeff. = 0.9966
4	4.94	1.150	36.0	23.31	SFR = 1.188
5	2.89	0.883	28.0	18.13	SSP = 37.29
					# of Observations: 5
					Range of Chart at SFR $\pm 10\%$
					35
					40



Calibrated by :

11 October 2024

Approved by :

11 October 2024

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

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



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PM10 High Volume Sampler Calibration

Verification Report No.

SO2400208-E001 -PM 02

L PM

Onsite

Site: บ้านสุขสิริ

UTM : 47P E 677962 N 1584137

Sampler: EPM10#45

Recorder: 0

Date: 11 Oct 24

Technical: Amonthep Konklee

Approval: Wisan Ritthikamon

CONDITIONS

Barometric Press. (hPa): 1005.0

Temperature (deg C): 32.0

Average Press. (hPa): 1013.0

Average Temp. (deg C): 30.0

Corrected Pressure (mm Hg): 753.8

Temperature (deg K): 305.0

Corrected Avg. Press. (mm Hg): 759.8

Average Temp. (deg K): 303.0

CALIBRATION ORIFICE

Brand: Tisch Environmental, Inc

Model: TE-5025A

Serial#: 5411

Qstd Slope: 1.2654

Qstd Intercept: -0.01667

Date Certified: 9 Feb 2024

Due Date : 08-Feb-25

CALIBRATIONS

Plate or Test #	H2O (in)	Qa (m3/min)	I (chart)	IC (corrected)
1	11.86	1.744	52.0	33.08
2	9.21	1.539	48.0	30.53
3	6.32	1.277	42.0	26.72
4	3.45	0.947	32.0	20.35
5	2.64	0.830	28.0	17.81

LINEAR REGRESSION

Slope = 16.8049

Intercept = 4.4006

Corr. coeff. = 0.9956

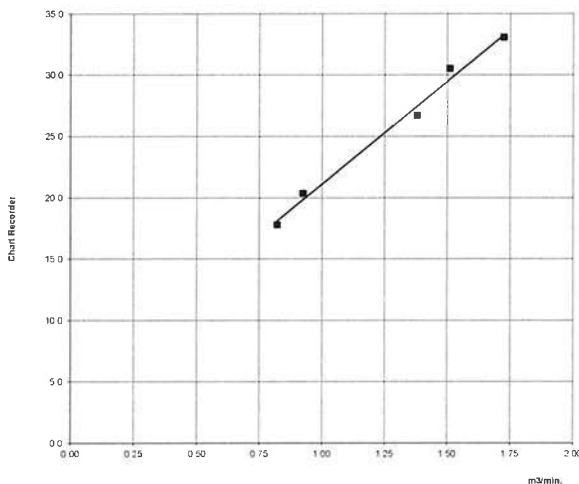
SFR = 1.147

SSP = 37.21

of Observations: 5

Range of Chart 35

at SFR $\pm 10\%$ 39



Calibrated by :

11 October 2024

Approved by :

11 October 2024

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

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



Envilab Co., Ltd.

Certificate of Calibration

Calibration Certification Information

Cal. Date: February 9, 2024 Rootsmeter S/N: 438320 Ta: 295 °K
 Operator: Jim Tisch Pa: 749.0 mm Hg
 Calibration Model #: TE-5025A Calibrator S/N: 5411

Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H2O)
1	1	2	1	1.3950	3.2	2.00
2	3	4	1	0.9840	6.4	4.00
3	5	6	1	0.8790	7.9	5.00
4	7	8	1	0.8430	8.8	5.50
5	9	10	1	0.6940	12.7	8.00

Data Tabulation

Vstd (m3)	Qstd (x-axis)	$\sqrt{\Delta H \left(\frac{Pa}{Pstd} \right) \left(\frac{Tstd}{Ta} \right)}$ (y-axis)	Va	Qa (x-axis)	$\sqrt{\Delta H \left(Ta/Pa \right)}$ (y-axis)
0.9914	0.7106	1.4111	0.9957	0.7138	0.8875
0.9871	1.0032	1.9956	0.9915	1.0076	1.2551
0.9851	1.1207	2.2312	0.9895	1.1257	1.4033
0.9839	1.1672	2.3401	0.9883	1.1723	1.4718
0.9787	1.4103	2.8222	0.9830	1.4165	1.7750
QSTD	m=	2.02024	QA	m=	1.26504
	b=	-0.02667		b=	-0.01677
	r=	0.99993		r=	0.99993

Calculations

Vstd=	$\Delta Vol \left((Pa - \Delta P) / Pstd \right) (Tstd / Ta)$	Va=	$\Delta Vol \left((Pa - \Delta P) / Pa \right)$
Qstd=	Vstd / ΔTime	Qa=	Va / ΔTime
For subsequent flow rate calculations:			
Qstd=	$1/m \left(\left(\sqrt{\Delta H \left(\frac{Pa}{Pstd} \right) \left(\frac{Tstd}{Ta} \right)} \right) - b \right)$	Qa=	$1/m \left(\left(\sqrt{\Delta H \left(Ta / Pa \right)} \right) - b \right)$

Standard Conditions

Tstd:	298.15 °K
Pstd:	760 mm Hg
Key	
ΔH: calibrator manometer reading (in H2O)	
ΔP: rootsmeter manometer reading (mm Hg)	
Ta: actual absolute temperature (°K)	
Pa: actual barometric pressure (mm Hg)	
b: intercept	
m: slope	

RECALIBRATION

US EPA recommends annual recalibration per 1998 40 Code of Federal Regulations Part 50 to 51, Appendix B to Part 50, Reference Method for the Determination of Suspended Particulate Matter in the Atmosphere, 9.2.17, page 30





SO2 Analyzer Verification Test Report

Calibration Report No.: AP-S6710002

Calibrated Date: 1-Oct-24

☒ PM ☐ Onsite

Instruments Information

Page: 1/2

Analyzer Type: SO2 Analyzer Model: 100E	Manufacturer API S/N: ESOAI100E01108
--	---

Calibration System

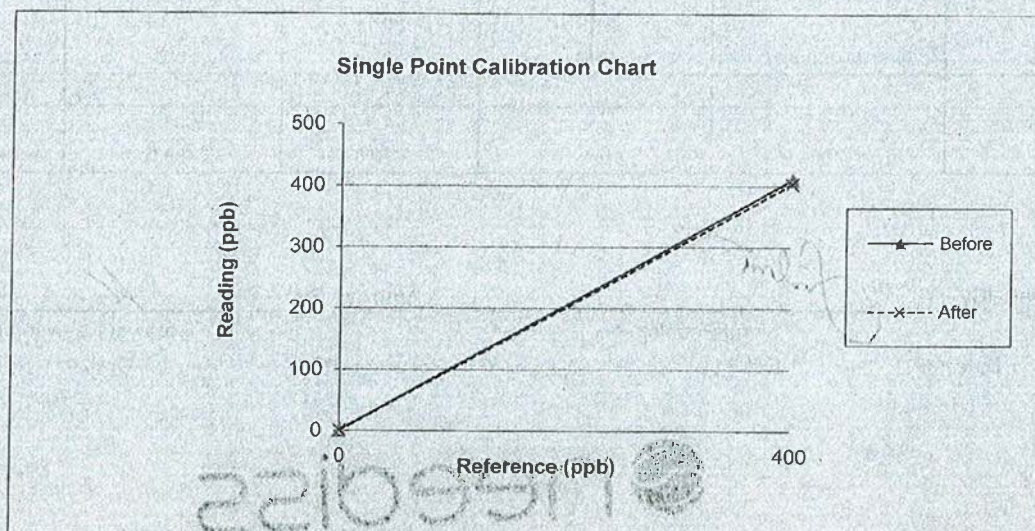
Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792 ZERO AIR Generator ZAG7001 S/N: 644	NOx Conc 45.50 PPM NO Conc 45.50 PPM SO2 Conc 45.59 PPM CO Conc 4500 PPM Expire Date: Mar 31, 2026 EB0160267

Environment: Temperature 24.3 °C

Humidity: 56 %RH

Calibration Report

Status	Zero			Span		
	Reference (ppb)	Reading (ppb)	Drift (ppb)	Reference (ppb)	Reading (ppb)	Drift%
Before	0.0	1.3	1.3	400.0	410.0	1.2
After	0.0	0.8	0.8	400.0	403.0	0.4





บริษัท นีดีส ซัพพลาย อินสตรูमेंท์ จำกัด
Neediss Supply Instrument Co., Ltd.

536 ซอยปิ่นเกล้า 7 แขวงปิ่นเกล้า เขตปิ่นเกล้า กรุงเทพฯ 10160 536 Soi Pongkhae 7 Bangkok Bangkok Bangkok
Tel: 02-502-33801-2 Fax: 02-502-3938 E-mail: neediss@neediss.com



SO2 Analyzer Verification Test Report

Calibration Report No.: AP-S6710002

Calibrated Date: 1-Oct-24

☒ PM ☐ Onsite

Page:2/2

Test Function Value	Normal range	Unit	Before	After	Note
Date	1-Oct-24				
Time	13:10				
Range	50 - 20000	PPB	500	500	
Stability (Zero Gas)	< 0.2	PPB	0.6	0.2	
Sample Flow	650 (+/- 50)	cc/min	663	659	
PMT Detector	0 - 5000	mV	36.5	34.5	
Norm PMT Detector	0 - 5000	mV	34.1	32.8	
HVPS	400-900 constant	V	719	648	
DCPS	2500 (+/- 200)	mV	-	-	
RCCELL TEMP	50 (+/- 1)	Dreegee C	50	50	
BOX TEMP	20-40	Dreegee C	34.1	32.7	
PMT TEMP	7 (+/-1)	Dreegee C	8.0	8.0	
UV lamp	1000-4900	mV	4034.0	4034.0	
Lamp Ratio	30-120	%	114.0	114.0	
STR. Light (Zero Gas)	<100	PPB	29	29	
Dark PMT	(-50) - (+200)	mV	44.7	44.7	
Dark lamp	(-50) - (+200)	mV	5.1	5.1	
SAMP PRES	20-30 constant	IN-Hg-A	28.1	27.8	
Electric Test/Optic Test					
PMT Volts	2000 (+/- 500)	mV	2004	2020	
SO2 Conc	1000 (+/- 250)	PPB	1002	1010	
SO2 Slope	1 (+/- 0.3)	-	0.920	0.866	
SO2 Offset	< 250	mV	65	130.1	
Stability at Zero	< 0.2	PPB	0.1	0.1	
Stability at Span	< 2 ppb @ 400 ppb	PPB	0.6	0.2	
Gas Test Response					
Zero Gas (0.00 PPB)	0	ppb	1.3	0.8	
Span Gas (400 PPB)	400	ppb	410.0	403.0	± 5% of Range

Calibrate By : _____

Date:

1-Oct-24

Approve By : _____

Date:

1-Oct-24



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Neediss Supply Instrument Co., Ltd.

SAC 388/1/19008 7 แขวงบางพลัด เขตบางพลัด (ตึกเพชรา 10100) 536 Soi Bangkhoe 7 Bangkhoe Bangkhoe Bangkok
Tel. 02-802-5220-2 Fax. 02-802-3236 E-mail: neediss@neediss.com



SO2 Analyzer Verification Test Report

Calibration Report No.: AP-S6710003

Calibrated Date: 1-Oct-24

☒ PM ☐ Onsite

Instruments Information

Page:1/2

Analyzer Type: SO2 Analyzer Model: 100A	Manufacturer API S/N: ESOAIT10002032
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Calibration System

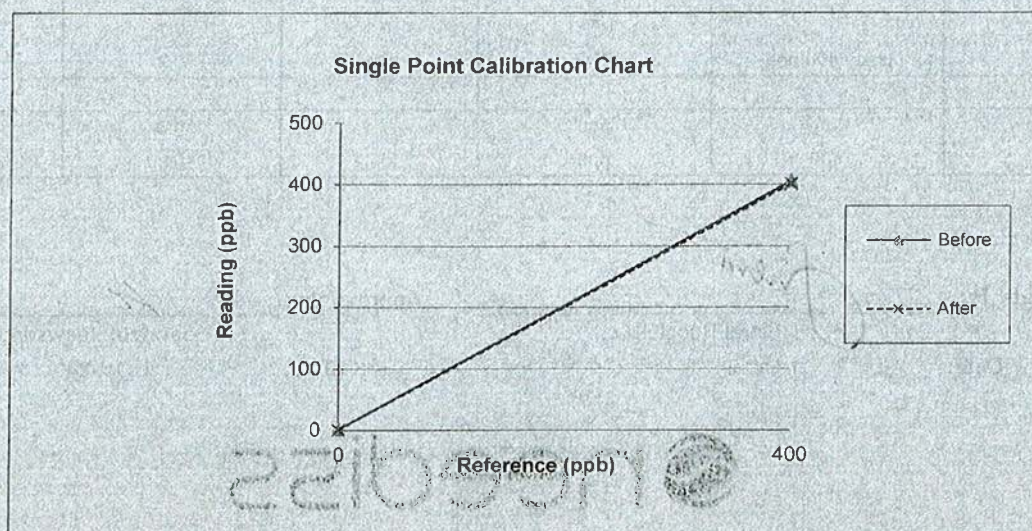
Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792	NOx Conc 46.50 PPM NO Conc 46.50 PPM SO2 Conc 45.59 PPM CO Conc 4507 PPM
ZERO AIR Generator ZAG7001 S/N: 644	Expire Date: Mar 31, 2026 EB0160267

Environment: Temperature 24.3 °C

Humidity: 57 %RH

Calibration Report

Status	Zero			Span		
	Reference (ppb)	Reading (ppb)	Drift (ppb)	Reference (ppb)	Reading (ppb)	Drift%
Before	0.0	1.4	1.4	400.0	405.2	0.6
After	0.0	0.6	0.6	400.0	401.0	0.1





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Needless Supply Instrument Co., Ltd.

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Tel: 02-802-3340-2 Fax: 02-602-3993 E: info@neediss.com



SO2 Analyzer Verification Test Report

Calibration Report No.: AP-S6710003

Calibrated Date: 1-Oct-24

☒ PM ☐ Onsite

Page:2/2

Test Function Value	Normal range	Unit	Before	After	Note
Date	1-Oct-24				
Time	8:30				
Range	50 - 20000	PPB	500	500	
Stability (Zero Gas)	< 0.2	PPB	0.4	0.2	
Sample Flow	650 (+/- 50)	cc/min	666	662	
PMT Detector	0 - 5000	mV	24.3	28.2	
Norm PMT Detector	0 - 5000	mV	31.4	34.3	
HVPS	400-900 constant	V	725	725	
DCPS	2500 (+/- 200)	mV	-	-	
RCELL TEMP	50 (+/- 1)	Dreegee C	50	50	
BOX TEMP	20-40	Dreegee C	32.6	35.1	
PMT TEMP	7 (+/-1)	Dreegee C	8.3	8.3	
UV lamp	1000-4900	mV	3251	3251	
Lamp Ratio	30-120	%	87.4	87.4	
STR. Light (Zero Gas)	<100	PPB	38.5	38.5	
Dark PMT	(-50) - (+200)	mV	27.6	27.6	
Dark lamp	(-50) - (+200)	mV	3.6	3.6	
SAMP PRES	20-30 constant	IN-Hg-A	26.9	27.3	
Electric Test/Optic Test					
PMT Volts	2000 (+/- 500)	mV	2010	2006	
SO2 Conc	1000 (+/- 250)	PPB	1005	1003	
SO2 Slope	1 (+/- 0.3)	-	1.054	1.053	
SO2 Offset	< 250	mV	94.7	90.4	
Stability at Zero	< 0.2	PPB	0.1	0.1	
Stability at Span	< 2 ppb @ 400 ppb	PPB	0.4	0.2	
Gas Test Response					
Zero Gas (0.00 PPB)	0	ppb	1.4	0.6	
Span Gas (400 PPB)	400	ppb	405.2	401.0	± 5% of Range

Calibrate By : _____

Date: _____

Approve By : _____

Date: _____

1-Oct-24

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SO2 Analyzer Verification Test Report

Calibration Report No.: AP-S6710004

Calibrated Date: 1-Oct-24

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Instruments Information

Page: 1/2

Analyzer Type: SO2 Analyzer Model: 100E	Manufacturer API S/N: ESOAI100E01218
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Calibration System

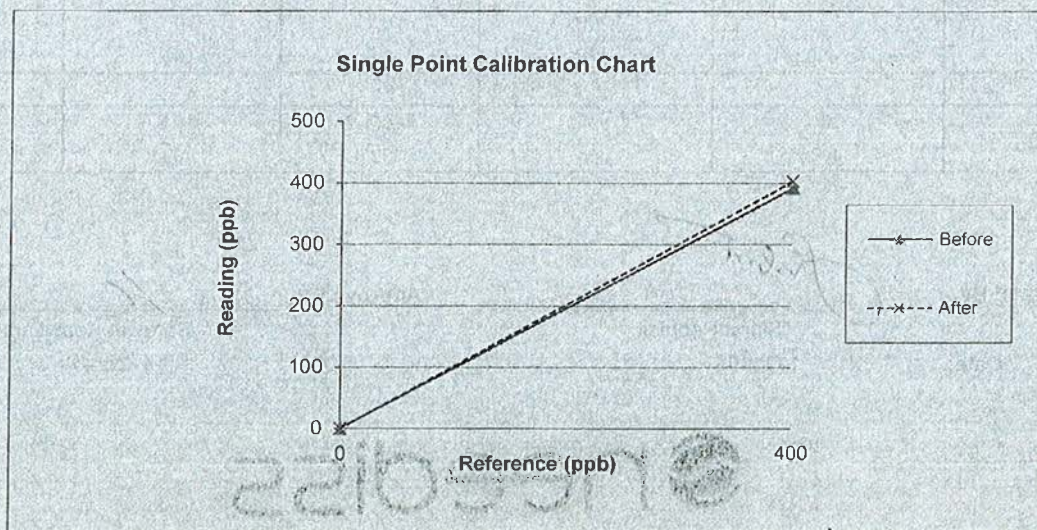
Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792 ZERO AIR Generator ZAG7001 S/N: 644	NOx Conc 45.50 PPM NO Conc 45.50 PPM SO2 Conc 45.59 PPM CO Conc 4500 PPM Expire Date: Mar 31, 2026 EB0160267

Environment: Temperature 24.3 °C

Humidity: 56 %RH

Calibration Report

Status	Zero			Span		
	Reference (ppb)	Reading (ppb)	Drift (ppb)	Reference (ppb)	Reading (ppb)	Drift%
Before	0.0	0.7	0.7	400.0	392.0	-1.0
After	0.0	0.5	0.5	400.0	403.0	0.4





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Tel: 02-302-3950-2 Fax: 02-302-3950 E-mail: neediss@neediss.com**SO2 Analyzer Verification Test Report**

Calibration Report No.: AP-S6710004

Calibrated Date: 1-Oct-24

☒ PM ☐ Onsite

Page:2/2

Test Function Value	Normal range	Unit	Before	After	Note
Date	1-Oct-24				
Time	13:10				
Range	50 - 20000	PPB	500	500	
Stability (Zero Gas)	< 0.2	PPB	0.6	0.2	
Sample Flow	650 (+/- 50)	cc/min	663	659	
PMT Detector	0 - 5000	mV	36.5	34.5	
Norm PMT Detector	0 - 5000	mV	34.1	32.8	
HVPS	400-900 constant	V	719	648	
DCPS	2500 (+/- 200)	mV	-	-	
RCELL TEMP	50 (+/- 1)	Dreegee C	50	50	
BOX TEMP	20-40	Dreegee C	34.1	32.7	
PMT TEMP	7 (+/-1)	Dreegee C	8.0	8.0	
UV lamp	1000-4900	mV	4034.0	4034.0	
Lamp Ratio	30-120	%	114.0	114.0	
STR. Light (Zero Gas)	<100	PPB	29	29	
Dark PMT	(-50) - (+200)	mV	44.7	44.7	
Dark lamp	(-50) - (+200)	mV	5.1	5.1	
SAMP PRES	20-30 constant	IN-Hg-A	28.1	27.8	
Electric Test/Optic Test					
PMT Volts	2000 (+/- 500)	mV	2004	2020	
SO2 Conc	1000 (+/- 250)	PPB	1002	1010	
SO2 Slope	1 (+/- 0.3)	-	0.920	0.866	
SO2 Offset	< 250	mV	65	130.1	
Stability at Zero	< 0.2	PPB	0.1	0.1	
Stability at Span	< 2 ppb @ 400 ppb	PPB	0.6	0.2	
Gas Test Response					
Zero Gas (0.00 PPB)	0	ppb	0.7	0.5	
Span Gas (400 PPB)	400	ppb	392.0	403.0	± 5% of Range

Calibrate By : _____

Date:

1-Oct-24

Approve By : _____

Date:

1-Oct-24

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SO2 Analyzer Verification Test Report

Calibration Report No.: AP-S6710005

Calibrated Date: 1-Oct-24

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Instruments Information

Page: 1/2

Analyzer Type: SO2 Analyzer Model: 100E	Manufacturer: API S/N: ESOAI100E01225
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Calibration System

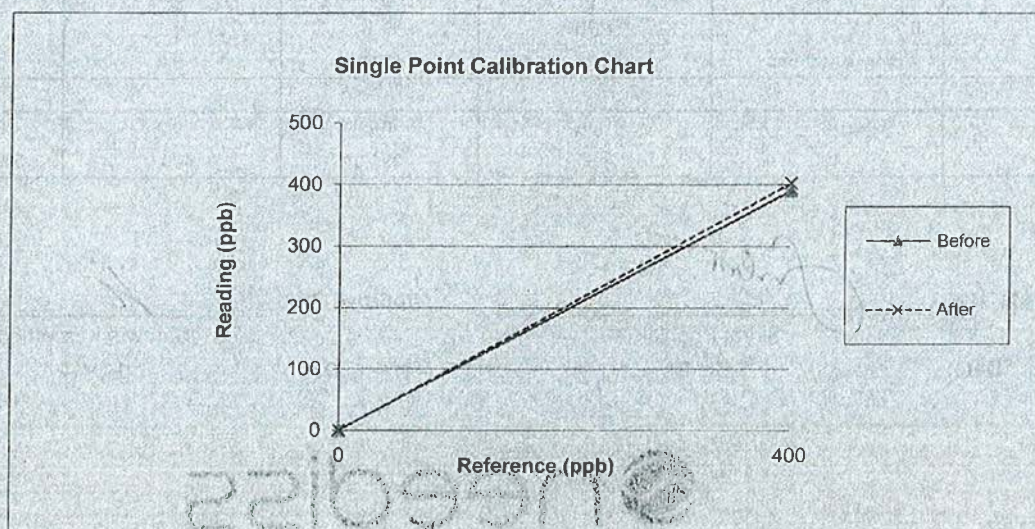
Calibrator Unit	Standard Gas
Dilutor Model: ESA MGC101 S/N: 792 ZERO AIR Generator: ZAG7001 S/N: 644	NOx Conc: 46.50 PPM NO Conc: 46.50 PPM SO2 Conc: 45.59 PPM CO Conc: 4507 PPM Expire Date: Mar 31, 2026 EB0160267

Environment: Temperature 24.3 °C

Humidity: 56 %RH

Calibration Report

Status	Zero			Span		
	Reference (ppb)	Reading (ppb)	Drift (ppb)	Reference (ppb)	Reading (ppb)	Drift%
Before	0.0	0.7	0.7	400.0	391.0	-1.1
After	0.0	0.3	0.3	400.0	403.0	0.4





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SO2 Analyzer Verification Test Report

Calibration Report No.: AP-S6710005

Calibrated Date: 1-Oct-24

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Test Function Value	Nominal range	Unit	Before	After	Note
Date	1-Oct-24				
Time	13:10				
Range	50 - 20000	PPB	500	500	
Stability (Zero Gas)	< 0.2	PPB	0.6	0.2	
Sample Flow	650 (+/- 50)	cc/min	663	659	
PMT Detector	0 - 5000	mV	36.5	34.5	
Norm PMT Detector	0 - 5000	mV	34.1	32.8	
HVPS	400-900 constant	V	719	648	
DCPS	2500 (+/- 200)	mV	-	-	
RCELL TEMP	50 (+/- 1)	Dreegee C	50	50	
BOX TEMP	20-40	Dreegee C	34.1	32.7	
PMT TEMP	7 (+/-1)	Dreegee C	8.0	8.0	
UV lamp	1000-4900	mV	4034.0	4034.0	
Lamp Ratio	30-120	%	114.0	114.0	
STR. Light (Zero Gas)	<100	PPB	29	29	
Dark PMT	(-50) - (+200)	mV	44.7	44.7	
Dark lamp	(-50) - (+200)	mV	5.1	5.1	
SAMP PRES	20-30 contant	IN-Hg-A	28.1	27.8	
Electric Test/Optic Test					
PMT Volts	2000 (+/- 500)	mV	2004	2020	
SO2 Conc	1000 (+/- 250)	PPB	1002	1010	
SO2 Slope	1 (+/- 0.3)	-	0.920	0.866	
SO2 Offset	< 250	mV	65	130.1	
Stability at Zero	< 0.2	PPB	0.1	0.1	
Stability at Span	< 2 ppb @ 400 ppb	PPB	0.6	0.2	
Gas Test Response					
Zero Gas (0.00 PPB)	0	ppb	0.7	0.3	
Span Gas (400 PPB)	400	ppb	391.0	403.0	± 5% of Range

Calibrate By : _____

Approve By : _____

Date: _____

1-Oct-24

Date: _____

1-Oct-24

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SO2 Analyzer Verification Test Report

Calibration Report No.: AP-S6710006

Calibrated Date: 1-Oct-24

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Instruments Information

Page:1/2

Analyzer Type: SO2 Analyzer Model: 100A	Manufacturer API S/N: ESOAI100E01002
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Calibration System

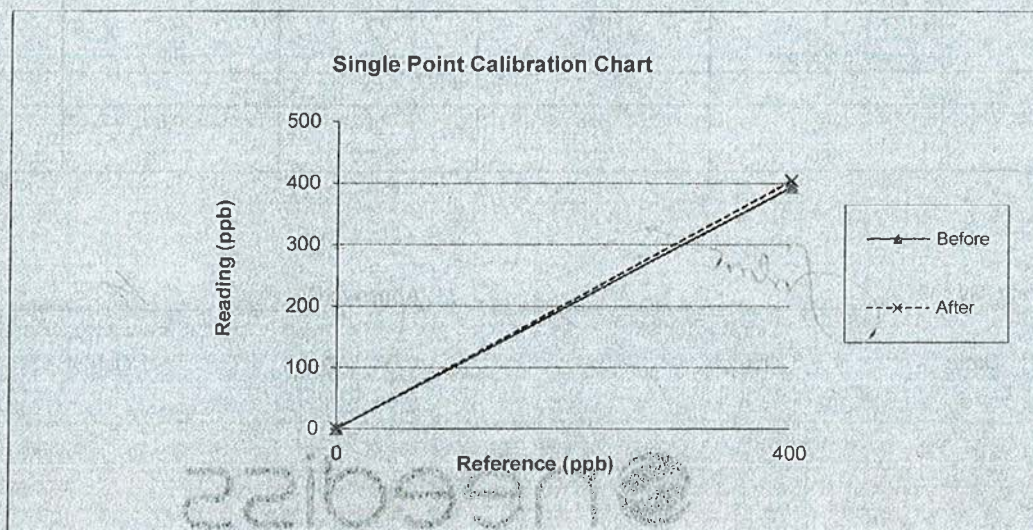
Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792 ZERO AIR Generator ZAG7001 S/N: 644	NOx Conc 45.50 PPM NO Conc 45.50 PPM SO2 Conc 45.59 PPM CO Conc 4500 PPM Expire Date: Mar 31,2026 EB0160267

Environment: Temperature 24.4 °C

Humidity: 57 %RH

Calibration Report

Status	Zero			Span		
	Reference (ppb)	Reading (ppb)	Drift (ppb)	Reference (ppb)	Reading (ppb)	Drift%
Before	0.0	1.0	1.0	400.0	394.0	-0.8
After	0.0	0.6	0.6	400.0	404.0	0.5





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SO2 Analyzer Verification Test Report

Calibration Report No.: AP-S6710006

Calibrated Date: 1-Oct-24

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Page: 2/2

Test Function Value	Normal range	Unit	Before	After	Note
Date	1-Oct-24				
Time	13:45				
Range	50 - 20000	PPB	500.0	500.0	
Stability (Zero Gas)	< 0.2	PPB	0.2	0.1	
Sample Flow	650 (+/- 50)	cc/min	592.0	591.0	
PMT Detector	0 - 5000	mV	255.6	61.0	
Norm PMT Detector	0 - 5000	mV	59.7	65.2	
HVPS	400-900 constant	V	607.0	607.0	
DCPS	2500 (+/- 200)	mV	-	-	
RCELL TEMP	50 (+/- 1)	Dreegee C	50.0	50.0	
BOX TEMP	20-40	Dreegee C	34.0	34.1	
PMT TEMP	7 (+/- 1)	Dreegee C	8.0	8.0	
UV lamp	1000-4900	mV	1981.0	1981.0	
Lamp Ratio	30-120	%	82.6	82.6	
STR. Light (Zero Gas)	<100	PPB	61.5	61.7	
Dark PMT	(-50) - (+200)	mV	3.8	3.6	
Dark lamp	(-50) - (+200)	mV	56.5	57.0	
SAMP PRES	20-30 constant	IN-Hg-A	29.3	29.3	
Electric Test/Optic Test					
PMT Volts	2000 (+/- 500)	mV	1682.0	2044.0	
SO2 Conc	1000 (+/- 250)	PPB	841.0	1022.0	
SO2 Slope	1 (+/- 0.3)	-	1.224	1.104	
SO2 Offset	< 250	mV	24.8	8.0	
Stability at Zero	< 0.2	PPB	0.2	0.2	
Stability at Span	< 2 ppb @ 400 ppb	PPB	0.2	0.2	
Gas Test Response					
Zero Gas (0.00 PPB)	0	ppb	1.0	0.6	
Span Gas (400 PPB)	400	ppb	394.0	404.0	± 5% of Range

Calibrate By :

Date:

1-Oct-24

Approve By :

Date:

1-Oct-24



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NOx Analyzer Verification Test Report

Calibration Report No.: AP-N6710001

Page:1/1

Calibrated Date: 1-Oct-24

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Instruments Information

Analyzer Type: NO/NO2/NOx Analyzer Model: 200E	Manufacturer API S/N: ENOAI200E00305
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Calibration System

Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792 ZERO AIR Generator ZAG7001 S/N: 644	NOx Conc 46.50 PPM NO Conc 46.50 PPM So2 Conc 45.59 PPM Co Conc 4507 PPM Expire Date: Mar 31,2026 EB0160267

Environment: Temperature 24.1 °C

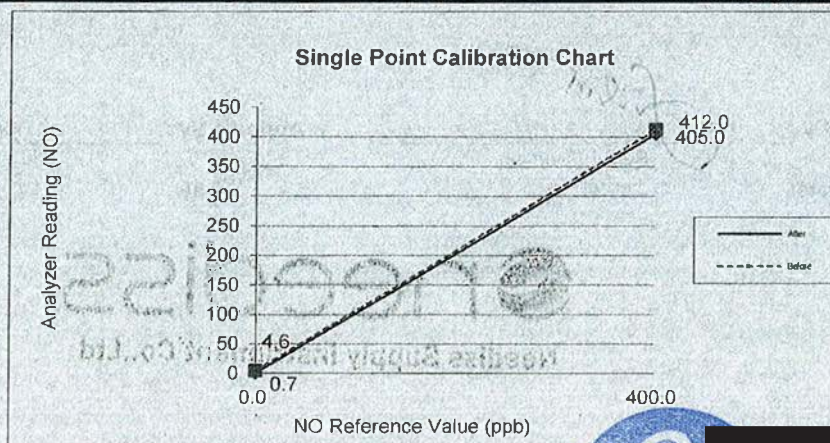
Humidity: 57 %RH

Calibration Check (Before adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	3.2	0.0	3.2	410.0	400.0	1.2
NO ₂	1.4	0.0	1.4	2.0	0.0	0.2
NOx	4.6	0.0	4.6	412.0	400.0	1.5

Calibration Check (After adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.4	0.0	0.4	403.0	400.0	0.4
NO ₂	0.3	0.0	0.3	2.0	0.0	0.2
NOx	0.7	0.0	0.7	405.0	400.0	0.6





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NOx Analyzer Verification Test Report

Calibration Report No.: AP-N6710001

Page:1/1

Calibrated Date: 1-Oct-24

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Page:2/2

Test Function Value	Normal range	Unit	Before	After	Note
Date	1-Oct-24				
Time	13:25				
Range	0.00 - 500.00 PPB	PPB	500.0	500.0	
Stability (Zero Gas)	≤ 0.2	PPB	0.5	0.2	
Sample Flow	500±/- 50	cc/min	474.0	441.0	
Ozone Flow	60-90	cc/min	76.0	76.0	
PMT Detector	0-5000	mV	24.5	62.2	
AZERO	-20-150	mV	8.6	67.5	
HVPS	400-900 constant	V	839.0	836.0	
DCPS	2500 +/- 200	mV	-	-	
RCCELL TEMP	50±/- 1	Dreegee C	50.0	50.0	
BOX TEMP	20-35	Dreegee C	34.5	30.5	
PMT TEMP	7 +/-1	Dreegee C	7.0	7.1	
IZS TEMP	50±/- 4	Dreegee C	-	-	
MOLY Temp	315 +/- 5	Dreegee C	315.0	314.4	
RCCEL PRES	4-10 contant	IN-Hg-A	4.20	7.90	
SAMP PRES	20-30 contant	IN-Hg-A	29.9	28.6	
NO Slope	1 +/- 0.3		1.256	1.032	
Nox Slope	1 +/- 0.3		1.232	1.048	
NO Offset	-10 to + 150	mV	4.50	6.90	
NOx Offset	-10 to + 150	mV	-5.00	-1.50	
Span and Cal Values					
Zero Value	NO	0	ppb	3.2	0.4
	NOx	0	ppb	4.6	0.7
Span Value	NO	400	ppb	410.0	403.0
	NOx	400	ppb	412.0	405.0

Calibrate By : _____

Approve By : _____

Date:

1-Oct-24

Date:

1-Oct-24

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NOx Analyzer Verification Test Report

Calibration Report No.: AP-N6710002

Page:1/1

Calibrated Date: 1-Oct-24

☒ PM ☐ Onsite

Instruments Information

Analyzer Type: NO/NO ₂ /NOx Analyzer Model: T200	Manufacturer API S/N: ENOAIT20002469
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Calibration System

Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792 ZERO AIR Generator ZAG7001 S/N: 644	NOx Conc 46.50 PPM NO Conc 46.50 PPM So ₂ Conc 45.59 PPM Co Conc 4507 PPM Expire Date: Mar 31,2026 EB0160267

Environment: Temperature 24.2 °C

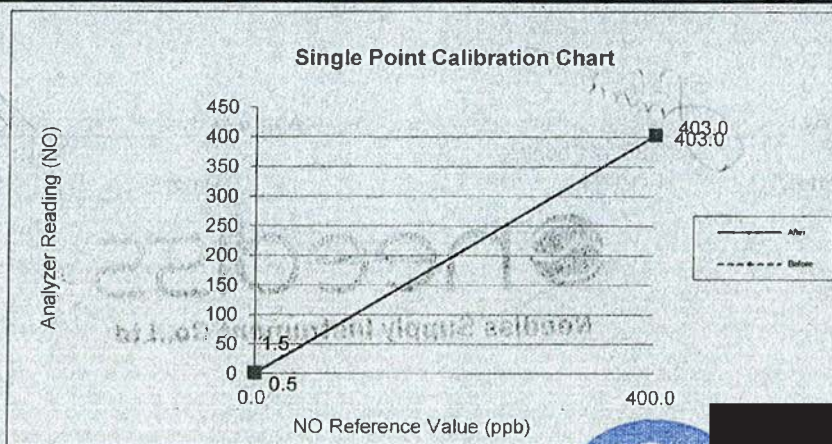
Humidity: 57 %RH

Calibration Check (Before adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	1.2	0.0	1.2	396.0	400.0	-0.5
NO ₂	0.3	0.0	0.3	7.0	0.0	0.9
NOx	1.5	0.0	1.5	403.0	400.0	0.4

Calibration Check (After adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.3	0.0	0.3	401.0	400.0	0.1
NO ₂	0.2	0.0	0.2	2.0	0.0	0.2
NOx	0.5	0.0	0.5	403.0	400.0	0.4





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NOx Analyzer Verification Test Report

Calibration Report No.: AP-N6710002

Page:1/1

Calibrated Date: 1-Oct-24

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Page:2/2

Test Function Value	Normal range	Unit	Before	After	Note
Date	1-Oct-24				
Time	13:30:00 AM				
Range	0.00 - 500.00 PPB	PPB	500	500	
Stability (Zero Gas)	< 0.2	PPB	0.5	0.2	
Sample Flow	500 +/- 50	cc/min	505	480	
Ozone Flow	60-90	cc/min	79	72	
PMT Detector	0-5000	mV	26.2	29.3	
AZERO	-20-150	mV	56.0	55.0	
HVPS	400-900 constant	V	755	755	
DCPS	2500 +/- 200	mV	-	-	
RCELL TEMP	50 +/- 1	Dreegee C	50	50	
BOX TEMP	20-35	Dreegee C	30.2	32.0	
PMT TEMP	7 +/- 1	Dreegee C	7.2	7.2	
IZS TEMP	50 +/- 4	Dreegee C	-	-	
MOLY Temp	315 +/- 5	Dreegee C	315.0	315.0	
RCEL PRES	4-10 contant	IN-Hg-A	4	5	
SAMP PRES	20-30 contant	IN-Hg-A	29	29	
NO Slope	1 +/- 0.3		0.890	1.118	
Nox Slope	1 +/- 0.3		0.911	1.046	
NO Offset	-10 to + 150	mV	12.9	2.2	
NOx Offset	-10 to + 150	mV	-2.4	9.1	
Span and Cal Values					
Zero Value	NO	0	ppb	1.2	0.3
	NOx	0	ppb	1.5	0.5
Span Value	NO	400	ppb	396.0	401.0
	NOx	400	ppb	403.0	403.0

Calibrate By :

Date:

1-Oct-24

Approve By :

Date:

1-Oct-24



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NOx Analyzer Verification Test Report

Calibration Report No.: AP-N6710003

Page: 1/1

Calibrated Date: 1-Oct-24

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Instruments Information

Analyzer Type: NO/NO ₂ /NO _x Analyzer Model: T200	Manufacturer API S/N: ENOAIT20002468
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Calibration System

Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792 ZERO AIR Generator ZAG7001 S/N: 644	Nox Conc 46.50 PPM NO Conc 46.50 PPM SO ₂ Conc 45.59 PPM CO Conc 4507 PPM Expire Date: Mar 31, 2026 EB0160267

Environment: Temperature 24.2 °C

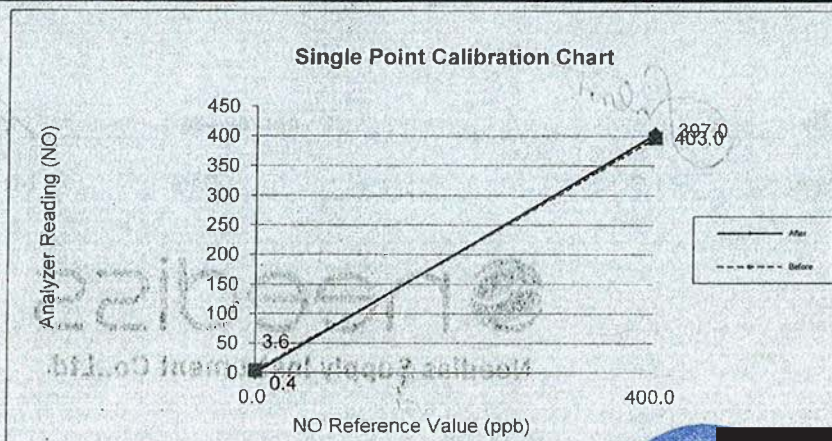
Humidity: 57 %RH

Calibration Check (Before adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	3.1	0.0	3.1	392.0	400.0	-1.0
NO ₂	0.5	0.0	0.5	5.0	0.0	0.6
NO _x	3.6	0.0	3.6	397.0	400.0	-0.4

Calibration Check (After adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.2	0.0	0.2	400.0	400.0	0.0
NO ₂	0.2	0.0	0.2	3.0	0.0	0.4
NO _x	0.4	0.0	0.4	403.0	400.0	0.4





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Neediss Supply Instrument Co., Ltd.

536 ถนนพหลโยธิน 7 แขวงบางเขน เขตบางเขน กรุงเทพฯ 10160 536 Soi Bophulchoe 7 Bangkade Bangkok
Tel: 02-802-3980-2 Fax: 02-802-3938 E-mail: neediss.com



NOx Analyzer Verification Test Report

Calibration Report No.: AP-N6710003

Page:1/1

Calibrated Date: 1-Oct-24



PM



Onsite

Page:2/2

Test Function Value	Normal range	Unit	Before	After	Note
Date	1-Oct-24				
Time	10:13				
Range	0.00 - 500.00 PPB	PPB	500	500	
Stability (Zero Gas)	< 0.2	PPB	0.4	0.2	
Sample Flow	500+/- 50	cc/min	482	486	
Ozone Flow	60-90	cc/min	80	80	
PMT Detector	0-5000	mV	33.2	25.1	
AZERO	-20-150	mV	23.4	23.0	
HVPS	400-900 constant	V	733	733	
DCPS	2500 +/- 200	mV	-	-	
RCELL TEMP	50+/- 1	Dreegee C	48.9	50.0	
BOX TEMP	20-35	Dreegee C	34.2	33.5	
PMT TEMP	7 +/-1	Dreegee C	7.0	7.0	
IZS TEMP	50+/- 4	Dreegee C	-	-	
MOLY Temp	315 +/- 5	Dreegee C	314.9	314.9	
RCEL PRES	4-10 contant	IN-Hg-A	4.5	4.5	
SAMP PRES	20-30 contant	IN-Hg-A	29.5	23.0	
NO Slope	1 +/- 0.3		0.850	1.095	
Nox Slope	1 +/- 0.3		0.973	0.977	
NO Offset	-10 to + 150	mV	7.1	4.1	
NOx Offset	-10 to + 150	mV	-5.9	15.3	
Span and Cal Values					
Zero Value	NO	0	ppb	3.1	0.2
	NOx	0	ppb	3.6	0.4
Span Value	NO	400	ppb	392.0	400.0
	NOx	400	ppb	397.0	403.0

Calibrate By :

Date:

Approve By :

Date:

1-Oct-24



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Neediss Supply Instrument Co., Ltd.



NOx Analyzer Verification Test Report

Calibration Report No.: AP-N6710004

Page: 1/1

Calibrated Date: 1-Oct-24

☒ PM
 ☐ Onsite

Instruments Information

Analyzer Type: NO/NO2/NOx Analyzer Model: T200	Manufacturer: API S/N: ENOAIT20003572
---	--

Calibration System

Calibrator Unit	Standard Gas
Dilutor Model: ESA MGC101 S/N: 792 ZERO AIR Generator: ZAG7001 S/N: 644	NOx Conc: 46.50 PPM NO Conc: 46.50 PPM So2 Conc: 45.59 PPM Co Conc: 4507 PPM Expire Date: Mar 31, 2026 EB0160267

Environment: Temperature 24.2 °C

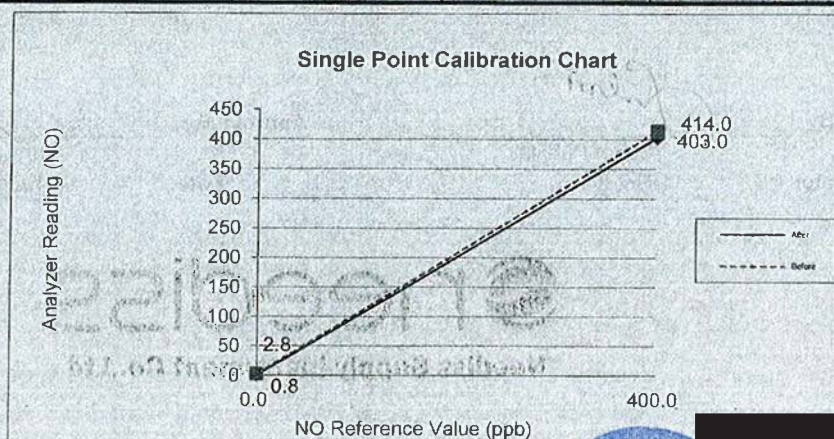
Humidity: 57 %RH

Calibration Check (Before adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	2.5	0.0	2.5	412.0	400.0	1.5
NO ₂	0.3	0.0	0.3	2.0	0.0	0.2
NOx	2.8	0.0	2.8	414.0	400.0	1.7

Calibration Check (After adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.6	0.0	0.6	400.0	400.0	0.0
NO ₂	0.2	0.0	0.2	3.0	0.0	0.4
NOx	0.8	0.0	0.8	403.0	400.0	0.4





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NOx Analyzer Verification Test Report

Calibration Report No.: AP-N6710004

Page:1/1

Calibrated Date: 1-Oct-24

☒ PM ☐ Onsite

Page:2/2

Test Function Value	Normal range	Unit	Before	After	Note
Date	1-Oct-24				
Time	11:25				
Range	0.00 - 500.00 PPB	PPB	500	500	
Stability (Zero Gas)	< 0.2	PPB	0.4	0.2	
Sample Flow	500 +/- 50	cc/min	500	490	
Ozone Flow	60-90	cc/min	89	80	
PMT Detector	0-5000	mV	50.9	20.4	
AZERO	-20-150	mV	48.3	49.1	
HVPS	400-900 constant	V	745	745	
DCPS	2500 +/- 200	mV	-	-	
RCELL TEMP	50 +/- 1	Dreegee C	50.0	50.0	
BOX TEMP	20-35	Dreegee C	33.2	32.6	
PMT TEMP	7 +/- 1	Dreegee C	7.2	7.2	
IZS TEMP	50 +/- 4	Dreegee C	-	-	
MOLY Temp	315 +/- 5	Dreegee C	313.3	314.5	
RCEL PRES	4-10 contant	IN-Hg-A	3.7	3.7	
SAMP PRES	20-30 contant	IN-Hg-A	28.3	28.7	
NO Slope	1 +/- 0.3		1.025	1.178	
Nox Slope	1 +/- 0.3		1.066	1.153	
NO Offset	-10 to + 150	mV	8.7	-1.6	
NOx Offset	-10 to + 150	mV	2.1	2.6	
Span and Cal Values					
Zero Value	NO	0	ppb	2.5	0.6
	NOx	0	ppb	2.8	0.8
Span Value	NO	400	ppb	412.0	400.0
	NOx	400	ppb	414.0	403.0

Calibrate By :

Approve By :

Date:

1-Oct-24

Date:

1-Oct-24

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NOx Analyzer Verification Test Report

Calibration Report No.: ES-N6710006

Page:1/1

Calibrated Date: 1-Oct-24

☒ PM
 ☐ Onsite

Instruments Information

Analyzer Type: NO/NO2/NOx Analyzer Model: AC32e	Manufacturer Environnement SA., France S/N: NNOESAAC32E277
--	---

Calibration System

Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792 ZERO AIR Generator ZAG7001 S/N: 644	NOx Conc 46.50 PPM NO Conc 46.50 PPM So2 Conc 45.59 PPM CO Conc 4507 PPM Expire Date: Mar 31,2026 EB0160267

Environment: Temperature 24.3 °C

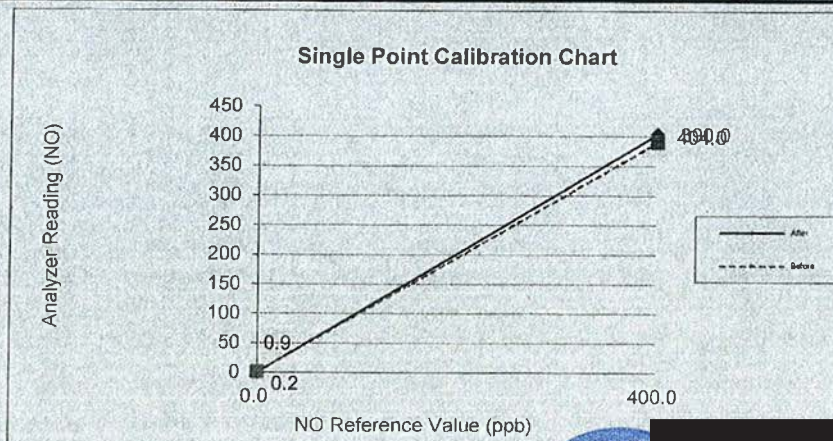
Humidity: 57 %RH

Calibration Check (Before adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.578	0.0	0.6	385.0	400.0	-1.9
NO ₂	0.356	0.0	0.4	5.0	0.0	0.6
NOx	0.934	0.0	0.9	390.0	400.0	-1.3

Calibration Check (After adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.196	0.0	0.2	403.0	400.0	0.4
NO ₂	-0.029	0.0	0.0	1.0	0.0	0.1
NOx	0.167	0.0	0.2	404.0	400.0	0.5





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Tel. 02-802-6780-2 Fax. 02-802-3236 E-mail: neediss.com



NOx Analyzer Verification Test Report

Calibration Report No.: ES-N6710006

Page:1/1

Calibrated Date: 1-Oct-24

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Page:2/2

Analyzer Signal Values					
Date	1-Oct-24	Time	14:14		
Power Supplies					
Option	-13.52	mV	+5 V Sensor	4.99	V
+3.3 V	3.3	V	+24 V	23.96	V
+12 V	11.88	V	+5 V	4.99	V
+4 V	3974.3	mV	+ 24V	2.4	A
I O3	82.74	mA			
Optical Bench					
Dark PM sig.	0.0	mV	PM NO sig.	84.28	mV
PM Nox sig.	107.0	mV	PM Ny sig.	86.71	mV
Sample					
Chamber T	60	deg.C	Internal Temp.	33.33	deg.C
Chamber P	1720.8	hPa	PM T.	1.46	deg.C
Flow	47.21	NI/h	Sample Pr.	993.2	hPa

Calibrate By : _____

Approve By : _____

Date: 1-Oct-24

Date: 1-Oct-24



Neediss Supply Instrument Co.,Ltd



CO Analyzer Verification Test Report

Calibration Report No.: AP-C6710001

Calibrated Date: 1-Oct-24

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Instruments Information

Page: 1/2

Analyzer Type: CO Analyzer Model: 300E	Manufacturer API S/N: ECOAI300E00449
---	---

Calibration System

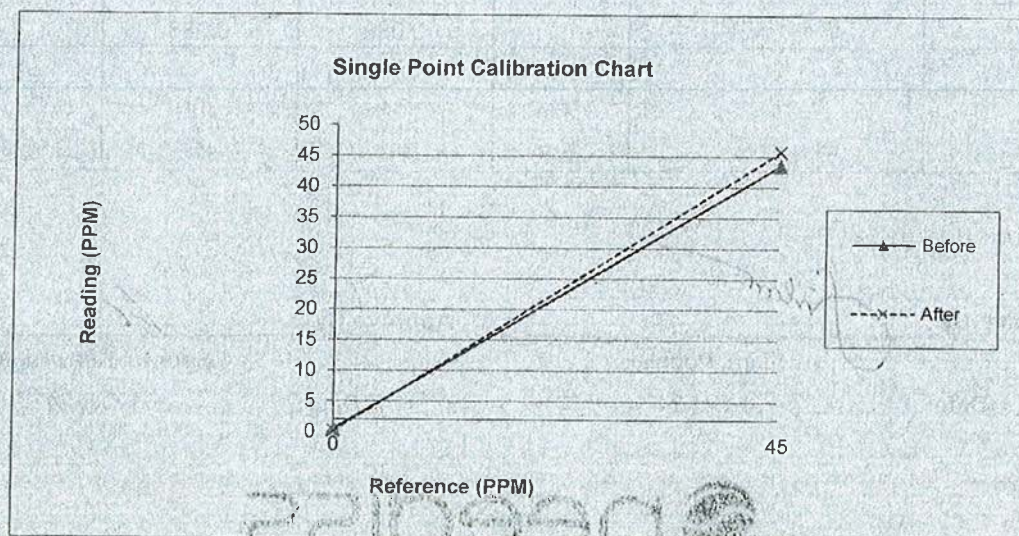
Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792 ZERO AIR Generator ZAG7001 S/N: 644	NOx Conc 46.50 PPM NO Conc 46.50 PPM So2 Conc 45.59 PPM Co Conc 4507 PPM Expire Date: Mar 31,2026 EB0160267

Environment: Temperature 21.4 °C

Humidity: 64 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Before	0.0	0.50	0.5	45.0	43.5	-1.7
After	0.0	0.14	0.1	45.0	45.7	0.8





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CO Analyzer Verification Test Report

Calibration Report No.: AP-C6710001

Calibrated Date: 1-Oct-24

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Page:2/2

Detail	Range	Unit	Before	After	Note
Date	1-Oct-24				
Time	11:00				
Range	0.1-1000 PPM	PPM	50	50	
Stability	(0.1-2PPB)	ppb	0.73	1.11	
CO Measure	2500 - 4800 mV.	mV	2913.3	2923.5	
CO Reference	2500 - 4800 mV.	mV	2444.3	2421.4	
MR Ratio	1.2 +/- 0.5		1.18	1.21	
Sample Pressure	26 - 30 in-Hg-A	in-Hg-A	29.1	29	
Sample Flow	720 - 880 cc/min	cc/min	890	886	
Sample Temp	44 - 52 deg.C	deg.C	50.3	50.4	
Bench Temp	47 - 49 deg.C	deg.C	48	48	
Wheel Temp	66 - 70 deg.C	deg.C	68.3	68.4	
Box Temp	27 - 50 deg.C	deg.C	35.2	35.1	
PHT drive	250 - 4750 mv.	mV	3323.4	3353.6	
Slope	0.800 - 1.200		1.051	1.112	
Offset	0.05 +/- 0.2		0.088	0.088	
Gas Test Response					
Zero Gas	0	PPM	0.5	0.1	
Span Gas	45	PPM	43.5	45.7	± 5% of Range

Calibrate By :



Date:

1-Oct-24

Approve By :



Date:

1-Oct-24



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Tel: 02-802-3980-2 Fax: 02-802-0935 Email: neediss@neediss.com



CO Analyzer Verification Test Report

Calibration Report No.: AP-C6710002

Calibrated Date: 1-Oct-24

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Instruments Information

Page:1/2

Analyzer Type: CO Analyzer Model: 300E	Manufacturer API S/N: ECOAI300E01034
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Calibration System

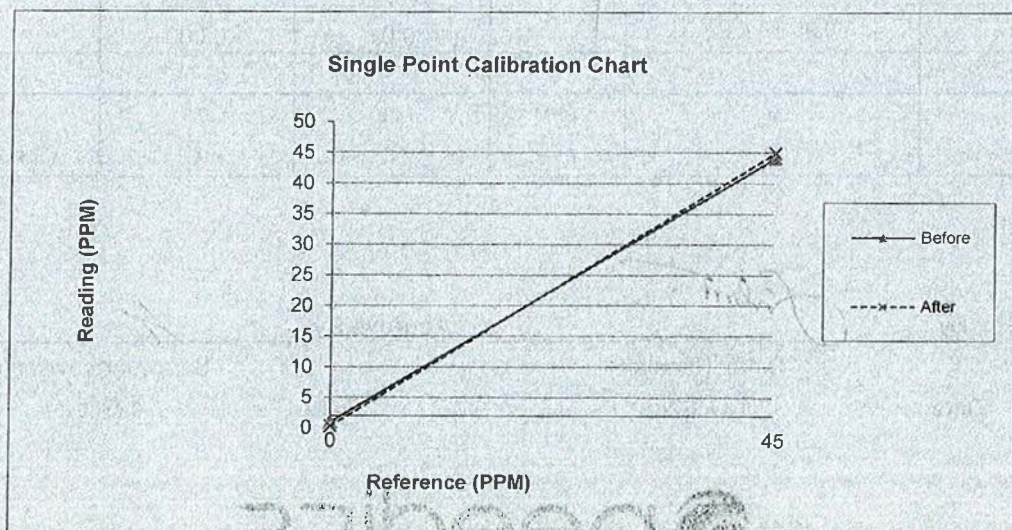
Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792 ZERO AIR Generator ZAG7001 S/N: 644	NOx Conc 46.50 PPM NO Conc 46.50 PPM So2 Conc 45.59 PPM Co Conc 4507 PPM Expire Date: Mar 31,2026 EB0160267

Environment: Temperature 21.5 °C

Humidity: 63 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Before	0.0	1.0	1.0	45.0	44.1	-1.0
After	0.0	0.3	0.3	45.0	44.9	-0.1





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Tel. 02-502-5960-2 Fax. 02-502-3988 E-mail: neediss.com



CO Analyzer Verification Test Report

Calibration Report No.: AP-C6710002

Calibrated Date: 1-Oct-24

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Page:2/2

Detail	Range	Unit	Before	After	Note
Date	1-Oct-24				
Time	16:06				
Range	0.1-1000 PPM	PPM	50	50	
Stability	(0.1-2PPB)	ppb	0.01	0.06	
CO Measure	2500 - 4800 MV.	mV	3426.3	3401.3	
CO Reference	2500 - 4800 MV.	mV	2850.7	2832.1	
MR Ratio	1:2 +/- 0.5		1.21	1.21	
Sample Pressure	26 - 30 in-Hg-A	in-Hg-A	28.5	28.4	
Sample Flow	720 - 880 cc/min	cc/min	790	783	
Sample Temp	44 - 52 deg.C	deg.C	48.2	48.2	
Bench Temp	47 - 49 deg.C	deg.C	48	48	
Wheel Temp	66 - 70 deg.C	deg.C	68	68	
Box Temp	27 - 50 deg.C	deg.C	35.2	35.4	
PHT drive	250 - 4750 mv.	mV	3114.8	3106.5	
Slope	0.800 - 1.200		0.972	0.981	
Offset	0.05 +/- 0.2		0.01	0.009	
Gas Test Response					
Zero Gas	0	PPM	1.0	0.3	
Span Gas	45	PPM	44.1	44.9	± 5% of Range

Calibrate By :

Approve By :

Date:

1-Oct-24

Date:

1-Oct-24



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CO Analyzer Verification Test Report

Calibration Report No.: ES-C6710003

Calibrated Date: 1-Oct-24

☒ PM ☐ Onsite

Instruments Information

Page: 1/2

Analyzer Type: CO Analyzer Model: CO12E	Manufacturer: Environnement SA., France S/N: ECOESACO12E203
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Calibration System

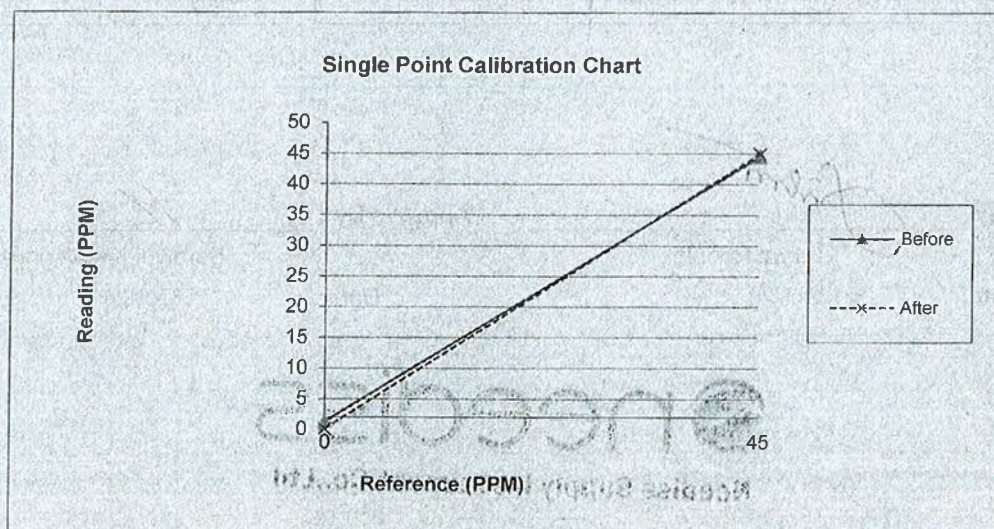
Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792 ZERO AIR Generator ZAG7001 S/N: 644	NOx Conc 46.50 PPM NO Conc 46.50 PPM SO2 Conc 45.59 PPM CO Conc 45.07 PPM Expire Date: Mar 31, 2026 EB0160267

Environment: Temperature 23.2 °C

Humidity: 52 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Before	0.0	1.354	1.4	45.0	44.54	-0.5
After	0.0	0.145	0.1	45.0	44.98	0.0





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CO Analyzer Verification Test Report

Calibration Report No.: ES-C6710004

Calibrated Date: 1-Oct-24

☒ PM ☐ Onsite

Instruments Information

Page: 1/2

Analyzer Type: CO Analyzer Model: CO12E	Manufacturer: Environnement SA., France S/N: ECOESACO12E204
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Calibration System

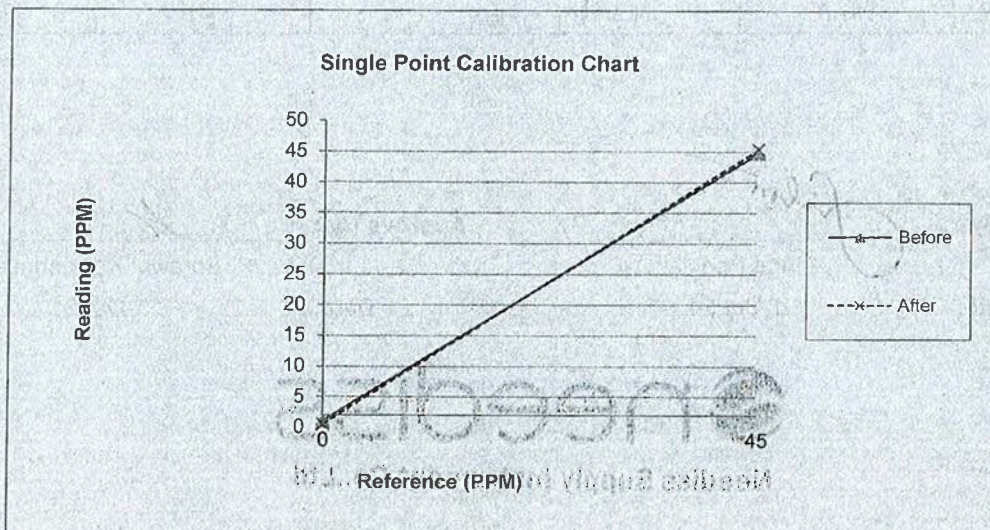
Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792 ZERO AIR Generator ZAG7001 S/N: 644	NOx Conc 46.50 PPM NO Conc 46.50 PPM So2 Conc 45.59 PPM Co Conc 4507 PPM Expire Date: Mar 31, 2026 EB0160267

Environment: Temperature 23.3 °C

Humidity: 52 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Before	0.0	1.093	1.1	45.0	44.75	-0.3
After	0.0	0.541	0.5	45.0	45.34	0.4



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CO Analyzer Verification Test Report

Calibration Report No.: ES-C6710004

Calibrated Date: 1-Oct-24

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Page:2/2

Analyzer Signal Values					
Date	1-Oct-24	Time	10:09:00		
Power Supplies					
Option	0.0	mV	+5 V Sensor	5	V
+3.3 V	3.3	V	+24 V	24.2	V
+12 V	11.8	V	+5 V	5.1	V
+24 V	1.1	mV			
Optical Bench					
IR current ratio	884.7	mA	Pbse current	618.2	mV
Optical T.	46.0	deg.C	Pbse T.	-24.2	deg.C
Measure sig.	506.4	mV	Refer Sig.	456.4	mV
Min sig.	945.0	mV	Max Sig.	2840	mV
Sample					
inst. Ratio	1.109		Ratio	1.105	
Ref. ratio	1.109		Internal Temp.	28.9	deg.C
Source Temp.	46.0	deg.C	Gas Pressure	997	hPa
Up Pressure	947.0	hPa	Flow	59	l/h

Calibrate By : _____

Date:

1-Oct-24

Approve By : _____

Date:

1-Oct-24

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Tel: 02-802-3980-2 Fax: 02-802-3985 E: info@neediss.com

CO Analyzer Verification Test Report

Calibration Report No.: ES-C6710005

Calibrated Date: 1-Oct-24

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Instruments Information

Page:1/2

Analyzer Type: CO Analyzer Model: CO12E	Manufacturer Environnement SA, France S/N: ECOESACO12E205
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Calibration System

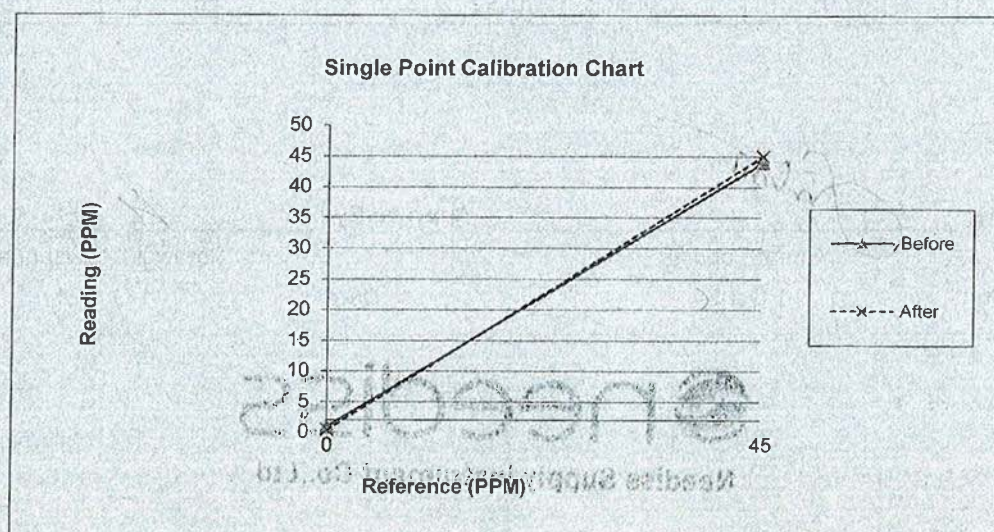
Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792 ZERO AIR Generator ZAG7001 S/N: 644	NOx Conc 46.50 PPM NO Conc 46.50 PPM So2 Conc 45.59 PPM Co Conc 4507 PPM Expire Date: Mar 31,2026 EB0160267

Environment: Temperature 23.3 °C

Humidity: 52 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Before	0.0	0.953	1.0	45.0	44.02	-1.1
After	0.0	0.402	0.4	45.0	45.03	0.0





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Neediss Supply Instrument Co., Ltd.
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CO Analyzer Verification Test Report

Calibration Report No.: ES-C6710005

Calibrated Date: 1-Oct-24

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Page:2/2

Analyzer Signal Values					
Date	1-Oct-24	Time	10:09:00		
Power Supplies					
Option	0.0	mV	+5 V Sensor	5	V
+3.3 V	3.3	V	+24 V	24.2	V
+12 V	11.8	V	+5 V	5.1	V
+24 V	1.1	mV			
Optical Bench					
IR current ratio	884.7	mA	Pbse current	618.2	mV
Optical T.	46.0	deg.C	Pbse T.	-24.2	deg.C
Measure sig.	506.4	mV	Refer Sig.	456.4	mV
Min sig.	945.0	mV	Max Sig.	2840	mV
Sample					
Inst. Ratio	1.109		Ratio	1.105	
Ref. ratio	1.109		Internal Temp.	28.9	deg.C
Source Temp.	46.0	deg.C	Gas Pressure	997	hPa
Up Pressure	947.0	hPa	Flow	59	l/h

Calibrate By :



Date:

1-Oct-24

Approve By :



Date:

1-Oct-24

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Neediss Supply Instrument Co.,Ltd



CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

Customer: BANGKOK INDUSTRIAL
GAS CO LTD
Part Number: E04NI99E15A00V3
Cylinder Number: EB0160267
Laboratory: 124 - Plumsteadville - PA
PGVP Number: A12023
Gas Code: CO,NO,NOX,SO2,BALN
Reference Number: 160-402685487-1
Cylinder Volume: 144.0 CF
Cylinder Pressure: 2015 PSIG
Valve Outlet: 660
Certification Date: Mar 31, 2023

Expiration Date: Mar 31, 2026

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted. The results relate only to the items tested. The report shall not be reproduced except in full without approval of the laboratory. Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	45.00 PPM	46.50 PPM	G1	+/- 1.4% NIST Traceable	03/24/2023, 03/31/2023
NITRIC OXIDE	45.00 PPM	46.50 PPM	G1	+/- 1.4% NIST Traceable	03/24/2023, 03/31/2023
SULFUR DIOXIDE	45.00 PPM	45.59 PPM	G1	+/- 1.0% NIST Traceable	03/24/2023, 03/31/2023
CARBON MONOXIDE	4500 PPM	4507 PPM	G1	+/- 1.4% NIST Traceable	03/24/2023
NITROGEN	Balance				

CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	210607-22	CC708067	48.41 PPM NITRIC OXIDE/NITROGEN	+/- 1.2%	Sep 21, 2025
PRM	12395	D887660	9.91 PPM NITROGEN DIOXIDE/AIR	+/- 2.0%	Feb 22, 2022
GMIS	124206889104	CC322509	4.326 PPM NITROGEN DIOXIDE/AIR	+/- 2.0%	Feb 21, 2025
NTRM	160610-01	CC473196	49.02 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Mar 22, 2028
GMIS	07212022B109	EB0141209	50.08 PPM SULFUR DIOXIDE/NITROGEN	+/- 1.0%	Dec 21, 2026
CO	220608	CC744768	2501.8 PPM CARBON MONOXIDE/NITROGEN	+/-0.5%	Sep 30, 2028

The SRM, NTRM, PRM, or RGM noted above is only in reference to the GMIS used in the assay and not part of the analysis.

ANALYTICAL EQUIPMENT		
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
SIEMENS ULTRAMAT 6 N1KD579	NDIR	Mar 07, 2023
Nicolet iS50 FTIR AUP2010245 NO	FTIR	Mar 09, 2023
Nicolet iS50 FTIR AUP2010245 NO2	FTIR	Mar 23, 2023
Nicolet iS50 FTIR AUP2010245 SO2	FTIR	Mar 16, 2023

Triad Data Available Upon Request

NOTES: Gross Weight: 27.8 Kg

Net Weight: 4.8 Kg

PO# 5223001123



Approved for Release





THAI METEOROLOGICAL DEPARTMENT

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

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 24 October, 2024

Certification No. 357/24

Page : 1 of 6

Object : เครื่องมือตรวจวัดอุณหภูมิตามวิทยา

Manufacturer : NovaLynx

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

Serial No. : EWSNV110WS2508

Customer : Envilab Co.,Ltd.(Head Office)
540.540/1 Soi Bangkhae 7, Bangkhae, Bangkhae
Bangkok 10160,Thailand.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1009.8 hPa

NATIONAL STANDARD WIND TUNNEL : Thermal Anemometer 642 S/N 91563

: HOOK GAGE NO 1425 : Wind Aloft Plotting Board

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

: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)

Serial Number 110730029 (sensor 120629586)

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

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

: Thermoschneider No.918802

Barometer Vaisala Type PTB220 No. 220015

Mechanical Engineer



Envilab Co.,Ltd. ผู้จัดการฝ่ายควบคุมคุณภาพ



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Sensor model

EWSNV110WS2508

Certification No. 357/24

24 October, 2024

Page : 2 of 6

Standard Ultrasonic Anemometer	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacuum	Velocity	Velocity	Correction
m/sec	inches H2O	inches H2O	m/sec	m/sec	m/sec
1.00	-	-	-	0.4	0.60
3.02	-	-	-	2.7	0.32
5.00	-	-	-	4.6	0.40
7.04	-	-	-	6.7	0.34
9.02	-	-	-	9.1	-0.08
11.01	-	-	-	10.7	0.31
13.01	-	-	-	13.1	-0.09
15.01	-	-	-	14.8	0.21
17.02	-	-	-	17.1	-0.08
20.02	-	-	-	20.3	-0.28

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

Calibrated by :

Mechanical Engineer



Envilab Co., Ltd.

ผู้จัดการฝ่ายควบคุมคุณภาพ



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Sensor model EWSNV110WS2508

Certification No. 357/24

24 October, 2024

Page : 3 of 6

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	
1010.12	1009.65	0.47
1010.35	1009.95	0.40
1010.56	1010.12	0.44
1010.85	1010.41	0.44
1011.05	1010.54	0.51
1011.46	1010.95	0.51
1011.82	1011.26	0.56
1011.95	1011.55	0.40
1012.15	1011.67	0.48
1012.54	1012.09	0.45
1012.81	1012.32	0.49
1010.25	1009.79	0.46
1010.14	1009.72	0.42
1009.95	1009.46	0.49
1009.84	1009.28	0.56
1009.45	1008.86	0.59
1009.32	1008.77	0.55
1009.11	1008.64	0.47
1009.56	1009.08	0.48
1009.86	1009.18	0.68

Average

Calibrated by :

Mechanical Engineer



Envilab Co.,Ltd. ผู้จัดการฝ่ายควบคุมคุณภาพ



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Sensor model

EWSNV110WS2508

Certification No. 357/24

24 October, 2024

Page : 4 of 6

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.6	45.4	0.2
30.2	30.4	-0.2
15.1	15.0	0.1

Calibrated by :



Mechanical Engineer



Envilab Co., Ltd. ผู้จัดการฝ่ายควบคุมคุณภาพ





THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Sensor model EWSNV110WS2508 Certification No. 357/24

24 October, 2024

Page : 5 of 6

Standard Humidity % R.H.	Relative Humidity Sensor Reading	
	Reading	Correction
	% R.H.	% R.H.
92.5	96.2	-3.7
65.4	68.1	-2.7
45.2	46.6	-1.4

Calibrated by :



Mechanical Engineer



Envilab Co., Ltd.





Date of Issue 24 October, 2024

Certification No. 357/24

Page: 6 of 6

ใบรับรอง

หนังสือฉบับนี้ขอรับรองว่า เครื่องวัดฝน ยี่ห้อ Davis Instruments แบบ TIPPING
BUCKET Product No. 7342.026 Code No. EWSNV110WS2508 ทำการสอบเทียบกับแก้ววัด
ฝนแบบแก้วดวง GAUGE DIAMETER 8.0 INCHES, NEGRETTI & ZAMBRA LONDON
No. 71082 และสามารถนำไปใช้ได้ มีค่าถูกต้องตามรายละเอียดของเครื่องมือ (0.2mm./TIP)



ลงชื่อ



วิศวกรชำนาญการ



Envilab Co.,Ltd. ผู้จัดการฝ่ายควบคุมคุณภาพ



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



Envilab & Needlab Supply Instrument

Verification Test Report

Report No.:

SO2400208-E001 -SLM 01

☐ PM ☒ Onsite UTM : 47P E 648546 N 323669

Calibrated Date: 11 October 2024

Site : ริมรั้วด้านทิศตะวันออกเฉียงใต้

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 45

Serial : 1973

Environment: Temperature 31 °C Humidity 69 %RH

Reference Standard: Acoustic Calibrator Class 1 Model 4230, Bruel&Kjaer
Serial No.1351075

Date of Calibration : 10 Apr 2024

Uncertainty : 0.10 dB

Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.72	94.10	0.38	93.72
Error After Adjust (dB)	Total Error (dB)	Acceptant value	Pass/Fail Judgment
0.00	0.10	±1.0 dB	Pass

Calibrated By:

Date:

11 October 2024

Approve By:

Date:

11 October 2024

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0391

MTC No. EEL. BP. 30/0467

CALIBRATION CERTIFICATE

Submitted by : Envilab Co.,Ltd.

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

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

Instrument Calibrated :

Description : Sound Level Calibrator

Manufacturer : Bruel & Kjaer

Model : 4230

Serial No. : 1351075

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 Keithley 2015-P S/N4106495.
 7. Condenser Microphone B&K 4180 S/N 2889871.

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

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

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

Date of Receipt : 9 Apr. 2024

Date of Calibration : 10 Apr. 2024

1 / 2

The results relate only to the items tested/calibrated or value assigned.
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Fax. (66) 0 2577 9009

Office/Laboratory

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Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
(66) 08 3219 9440
E-mail : mtc@tistr.or.th Website : www.tistr.or.th

Office

196 Phahonyothin Road, Ladyao, Chatuchak,
Bangkok 10900, Thailand

FM.BL.MTC.002 Rev.5



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0391

MTC No. EEL. BP. 30/0467

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

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

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

1. Sound Pressure Level

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

2. Frequency

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

3. Total Distortion

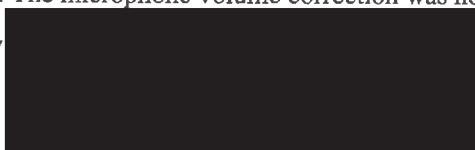
Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	1.25	± 0.50	$\pm 3.0\%$

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by



Approved by :



Director
ทวท. TISTR

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 10 Apr. 2024

Date of Issue : 11 Apr. 2024

Ref : 2011267040901374001

End of Certificate

2 / 2

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FM.BL.MTC.002 Rev.5

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Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
(66) 08 3219 9440
E-mail : mtc@tistr.or.th Website : www.tistr.or.th

Office



Envilab Co., Ltd.

ผู้จัดการฝ่ายควบคุมคุณภาพ



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



Envilab & Needles Supply Instrument

Verification Test Report

Report No.:

SO2400208-E001 -PU 02

Calibrated Date: 15-Oct-24

Equipment: Air Sampling Pump

Manufacturer: Gillian

Model: HFS 513A

Serial or ID No. 6765

Environment: Temperature 25 °C Humidity 60 %RH

Reference Standard: Primary Flow Calibrator Model Defender 510, MESALABS

Serial No. 200368

Date of Calibration : 17 july 2024

Result of Test			
Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
2000	1	2000.3	2000.4
	2	2000.5	
	3	2001.2	
	4	2000.4	
	5	1999.5	

Calibrated By

Date: 15-Oct-24

Approve By:

Date: 15-Oct-24

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ประกาศใช้ 01/02/2566

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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 & Needless Supply Instrument

Verification Test Report

Report No.:

SO2400208-E001 -PU 01

Calibrated Date: 15-Oct-24

Equipment: Air Sampling Pump

Manufacturer: Gillian

Model: HFS 513A

Serial or ID No. 6766

Environment: Temperature 25 °C Humidity 60 %RH

Reference Standard: Primary Flow Calibrator Model Defender 510, MESALABS

Serial No. 200368

Date of Calibration : 17 july 2024

Result of Test			
Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
2000	1	2000.5	2000.3
	2	2000.5	
	3	2000.6	
	4	1999.8	
	5	2000.2	

Calibrated By:

Date: 15-Oct-24

Approve By:

Date: 15-Oct-24

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



Envilab & Needass Supply Instrument

Verification Test Report

Report No.:

SO2400208-E001 -PU 03

Calibrated Date: 15-Oct-24

Equipment: Air Sampling Pump

Manufacturer: Gillian

Model: HFS 513A

Serial or ID No. 6768

Environment: Temperature 25 °C Humidity 60 %RH

Reference Standard: Primary Flow Calibrator Model Defender 510, MESALABS

Serial No. 200368

Date of Calibration : 17 july 2024

Result of Test			
Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
1700	1	1700.4	1700.6
	2	1700.5	
	3	1702.0	
	4	1699.7	
	5	1700.5	

Calibrated By:

Date: 15-Oct-24

Approve By:

Date: 15-Oct-24

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



Envilab & Neediss Supply Instrument

Verification Test Report

Report No.:

SO2400208-E001 -PU 04

Calibrated Date: 15-Oct-24

Equipment: Air Sampling Pump

Manufacturer: Gillian

Model: GilAir-3

Serial or ID No. 4590

Environment: Temperature 25 °C Humidity 60 %RH

Reference Standard: Primary Flow Calibrator Model Defender 510, MESALABS

Serial No. 200368

Date of Calibration : 17 july 2024

Result of Test			
Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
1700	1	1700.8	1700.2
	2	1701.5	
	3	1701.3	
	4	1698.7	
	5	1698.9	

Calibrated By:

Date: 15-Oct-24

Approve By:

Date: 15-Oct-24

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MIRACLE INTERNATIONAL TECHNOLOGY CO.,LTD

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



CALIBRATION CERTIFICATE

Certificate No. : L202407194-0001

Date Issued : 18-Jul-24

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

Equipment : Bios Flow Calibrator

Manufacturer : MesaLabs

Model : 510-M

Serial No. : 200368

ID No./Tag No. : NCALBI510M0368

Date Received : 12-Jul-24

Date Calibrated : 17-Jul-24

Calibrated by : Jame Khaothong

Calibration Method or Calibration Procedure Used

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

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

Result of Calibration

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

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Approved



Page 1 of 4



Envilab Co., Ltd.



Certificate No. : L202407194-0001

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

Capacity Range : 5000 ml/min

Calibration Media : Air

Type : Volumetric Flowmeter

UUC Reference Condition : At atmospheric pressure and room temper

Measurement Gas Flow rate function

Temperature (° C)	Pressure (kPa)	UUC (ml/min)	STD (ml/min)	Error (ml/min)	Uncertainty (± ml/min)	MPE ±(ml/min)	Pass / Fail Simple Acceptance
22.30	100.38	0.00	0.00 *	0.00	0.58	50	Pass
22.73	101.00	100.340	98.3950	1.945	1.9	50	Pass
20.90	100.83	499.99	508.6	-8.61	2.3	50	Pass
21.50	100.95	1000.4	1013.8	-13.4	3.6	50	Pass
21.56	101.46	2499.8	2524.9	-25.1	7.1	50	Pass
21.51	102.04	3999.8	4040	-40.2	12	50	Pass

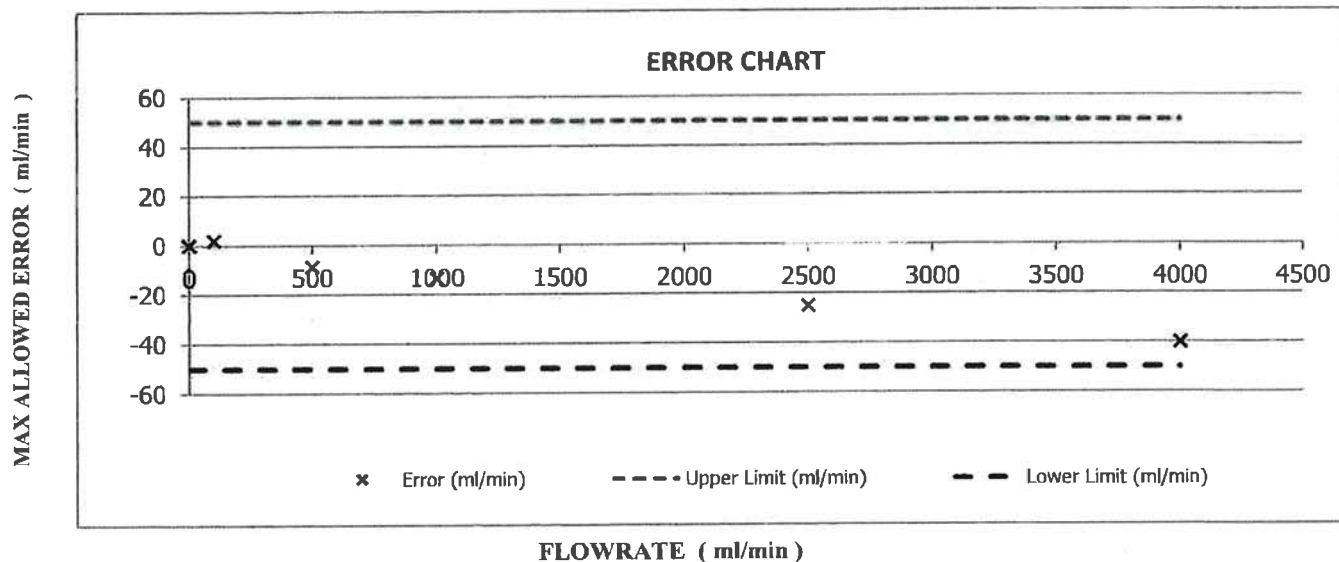
Marked * are not included in the NSC-ONSC accreditation schedule for our laboratory.

Error = Unit Under Calibration - Standard

Pass = |error| ≤ |MPE|

MPE = Maximum Permissible Error

Fail = |error| > |MPE|



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

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

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

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

Subscript "Meas" = Measurement condition

Subscript "Standard" = Standard condition



Envilab Co.,Ltd.

บริษัท อีวิลแลบ จำกัด
ผู้จัดการฝ่ายควบคุมคุณภาพ

Certificate No. : L202407194-0001

Environment : Ambient temperature : (23 \pm 2) °C

Relative humidity : (50 \pm 15) % RH

Capacity Range : 5000 ml/min

Calibration Media : Air

UUC Reference Condition : At atmosphere and room temperature and room

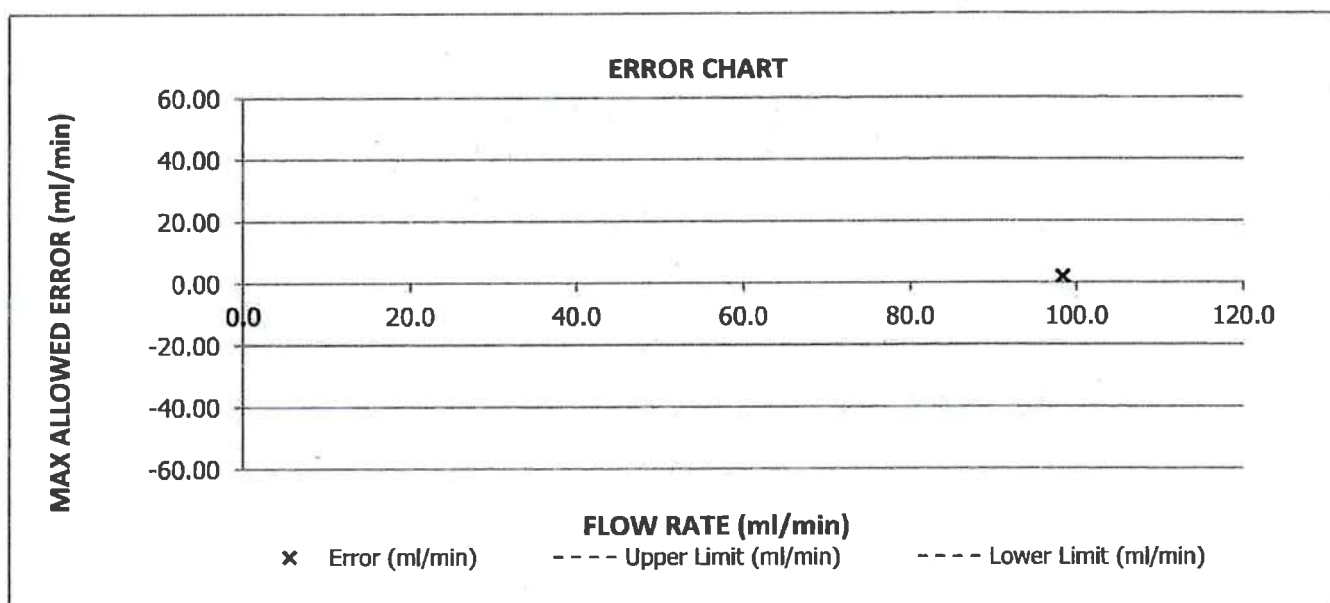
Temperature	Pressure	Flow Rate Reading (ml/min)		Error	Uncertainty	MPE	Pass / Fail
(°C)	(kPa)	UUC Reading	STD Reading	(ml/min)	\pm (ml/min)	\pm (ml/min)	Simple Acceptance
22.733	101.00	100.34	98.395	1.95	1.1	50	Pass

Error = Unit Under Calibration - Standard

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

MPE = Maximum Permissible Error

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



Certificate No. :

L202407194-0001

Condition As-Received : Used Item

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

Measurement Standards Used & Traceability :

The International System of Units (SI) through

MIT Calibration Certificate No. L202403371-0002 for Bell Prover Volume (60L) Serial No. 9511HC028626, Due 12-Apr-26

MIT Calibration Certificate No. L202405041-0002 for Temperature Transmitter with probe Serial No. MIT-STD-122,
Due 13-May-25

MIT Calibration Certificate No. L202405041-0003 for Pressure Transmitter with indicator Serial No. MIT-STD-123,
Due 24-May-25

MIT Calibration Certificate No. L202307322-0007 for Bell Prover Timer Serial No. 9511HC028626, Due 09-Aug-24

MIT Calibration Certificate No. L202405039-0005 for Piston Prover Volume Serial No. 85, Due 30-May-25

MIT Calibration Certificate No. L202403007-0026 for Piston Prover Timer Serial No. 122199, Due 06-Mar-26

MIT Certificate No. L202403007-0026 for Piston Prover Timer Serial No. 122199, Due 06-Mar-26

MIT Calibration Certificate No. L202403007-0025 for Temperature Indicator with Sensor (Piston Prover)
Serial No. MIT-STD-258, Due 01-Mar-25

End of Certificate

Page 4 of 4



บริษัท อีนิลาบ จำกัด
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



Certificate of Calibration

Certificate No. : 67-200060-2

Page : 1 of 2

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

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

Environment : On site calibration was carried out at the B304 Balance Room, Envilab Co., Ltd.
Ambient Temperature : (20.0 to 20.5) °C
Relative Humidity : (54.2 to 59.1) %
Air Pressure : 1013.0 mbar

Date of Received : 20 February 2024

Date of Calibration : 20 February 2024

Date of Issue : 21 February 2024

Calibrated by : Satja Sangkhum

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

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

Standard Weights

<u>ID No.</u>	<u>Cert. No.</u>	<u>Due Date</u>	<u>Traceability</u>
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%

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

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

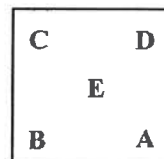
Nominal Value (g)	Correction (g)	Uncertainty \pm (g)
0.1	0.00000	0.000015
0.5	0.00001	0.000022
1	0.00000	0.000026
2	0.00001	0.000034
5	-0.00001	0.000043
10	0.00000	0.000053
50	0.00003	0.00011
100	0.0001	0.00020
150	0.0001	0.00038
200	0.0002	0.00038

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

- o0o -



Accredited
ISO/IEC 17025

CALIBRATION LABORATORY CO., LTD.

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



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : HEAT STRESS MONITOR
MANUFACTURER : METROSONICS
MODEL / TYPE : hs-32
SERIAL NO. : MCH110028[EHEMTHS3211028]
CLID. NO. : 232400815
JOB CONTROL NO. : 240227021071
CALIBRATION SERVICE : ☒ IN-LABORATORY ☐ ON-SITE

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

DATE OF RECEIVED : 27 February 2024

DATE OF ISSUED : 29 February 2024

The report of calibration shall not be reproduced except in full without approval of the Calibration Laboratory Co., Ltd.

Calibrated By : Tanawan Seenam-Ngoen

Calibration Engineer

Approved By :

Authorized Signatory

29 February 2024



This Calibration Certificate documents the traceability to national standards, which realize the units of measurement according to the International System of Units (SI)

Certificate No. Q24021071

F3-011-05/12-23

page 1 of 3



Envilab Co., Ltd.



CLC
Accredited
ISO/IEC 17025

CALIBRATION LABORATORY CO., LTD.

2/10-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230

Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



REPORT OF CALIBRATION

FOR

NOMENCLATURE : HEAT STRESS MONITOR
MANUFACTURER : METROSONICS
MODEL / TYPE : hs-32
SERIAL NO. : MCH110028[EHEMTHS3211028]
DATE OF CALIBRATION : 28 February 2024

ENVIRONMENT CONDITIONS :

Temperature : $(23 \pm 2) ^\circ\text{C}$

Relative Humidity : $(55 \pm 10) \% \text{RH}$

PROCEDURE USED :

This instrument was calibrated under procedure No. **CLC-CPTH-11**. The calibration was performed by using Chilled Mirror Hygrometer which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

Chilled Mirror Hygrometer, Edgetech Model Dew Master S/N. 44602.

Temperature & Humidity Chamber, PGC Model 9141-5116 S/N. 1304261.

TRACEABILITY :

The measurements are traceable to International System of Units (SI), through Thunder Scientific Corporation.
Certificate No. 21594, Due Date 06 July 2024.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2,00$ which for a normal distribution corresponds to a coverage probability of approximately 95 %.
It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2022)"

Certificate No. Q24021071

F3-011-05/12-23



Envilab Co., Ltd.

ผู้จัดทำรายงานควบคุมคุณภาพ

@clcalibration

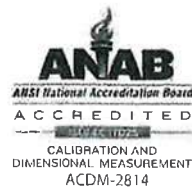


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Accredited
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CALIBRATION LABORATORY CO., LTD.

2/10-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230

Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION

MEASUREMENT RESULTS : (X) without adjustment () adjustment

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

CALIBRATION DATA

1. CORRECTION OF TEMPERATURE : WET

Test point (° C)	Actual Temperature (° C)	DUC Reading (° C)	Correction (° C)	Uncertainty ± (° C)
20.0	20.00	19.8	+0.20	0.27
30.0	30.00	29.8	+0.20	
40.0	39.99	39.9	+0.09	

2. CORRECTION OF TEMPERATURE : DRY

Test point (° C)	Actual Temperature (° C)	DUC Reading (° C)	Correction (° C)	Uncertainty ± (° C)
20.0	20.00	19.8	+0.20	0.27
30.0	30.00	29.9	+0.10	
40.0	39.99	40.2	-0.21	

3. CORRECTION OF TEMPERATURE : GLOBE

Test point (° C)	Actual Temperature (° C)	DUC Reading (° C)	Correction (° C)	Uncertainty ± (° C)
20.0	20.00	19.9	+0.10	0.27
30.0	30.00	29.8	+0.20	
40.0	39.99	39.8	+0.19	

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 012 Page 59 of 67

This report is valid for the above stated instrument/s only.

End of Certificate

Certificate No. Q24021071

F3-011-05/12-23



Envilab Co., Ltd.

ผู้จัดทำรายงานควบคุมคุณภาพ

@clccalibration



ID LINE : IEC17025



Certificate of Calibration

Certificate Number : SPR24030525-1

Page : 1 of 3

Customer : Envilab Co., Ltd.

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

Equipment Name : Light Meter

Manufacturer : Tenmars

Model : TM-720

Serial Number : 190600485

ID. Number : N/A

Environmental Conditions

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

Received Date : 30 Mar 2024

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

Calibration Date : 18 Apr 2024

Location of Calibration : In-Lab

Recommend Due Date : 18 Apr 2025

Calibration Procedure : SP-CPE-04-32

Date of Issue : 19 Apr 2024

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 : Mr.Nanthawat Wanasit

Approved by :

Calibration Officer



Authorized Signatory



ID LINE : IEC17025



Calibration Report

Certificate Number : SPR24030525-1

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Digital Light Meter	LX-73	Q842777	23PH462	05 Sep 2024

Traceability

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

TPA - Technology Promotion Association (Thailand-Japan)





ID LINE : IEC17025



Result of Calibration

Certificate No. : SPR24030525-1

Page : 3 of 3

Function: Illumination Measurement

Unit : Lux

Calibration Point	Standard Reading	UUC Reading	Error	Uncertainty (±)
100	100.0	93.0	-7.0	1.3
500	500	457.7	-42.3	6.6
1000	1000	912.2	-87.8	13
1500	1500	1357	-143	20
2000	2000	1810	-190	26

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 -





บริษัท เอ็นไวแล็บ จำกัด 540,540/1 ซอยบางแค 7 แขวงบางแค เขตบางแค กรุงเทพฯ 10160
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.:

SO2400208-E001 -SLM 01

☒ PM ☐ Onsite UTM : 47P 1514458 654247

Calibrated Date: 15 October 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 4230, Bruel&Kjaer

Serial No.1351075

Date of Calibration : 10 Apr 2024

Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.72	93.69	-0.03	93.72

Calibrated By:

Date:

Approve By:

Date:

15 October 2024

This report shall not be reproduced except in full, without the written approval of Envilab Co., Ltd.



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



Envilab & Needris Supply Instrument

Verification Test Report

Report No.:

SO2400208-E001 -SLM 01

☒ PM ☐ Onsite UTM : 47P 1514458 N 654247 E

Calibrated Date: 15 October 2024

Site : บริษัท เอ็นไวแล็บ จำกัด

Equipment: Sound Level Meter

Manufacturer: Sound Tek

Model: ST-130

Serial : 0030

Environment: Temperature 25 °C Humidity 65 %RH

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

Serial No.1351075

Date of Calibration : 10 Apr 2024

Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.72	93.73	0.01	93.72

Calibrated By:

Date:

15 October 2024

Approve By:

Date:

15 October 2024

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ID LINE : IEC17025



Certificate of Calibration

Certificate Number : SPR24080006-2

Page : 1 of 3

Customer : Envilab Co., Ltd.

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

Equipment Name : Noise Dosimeter

Manufacturer : Soundtek

Model : ST-130

Serial Number : 190500030

ID. Number : NNDTMST1300030

Environmental Conditions

Ambient Temperature : 23 °C \pm 3 °C

Received Date : 01 Aug 2024

Relative Humidity : 50 % \pm 15 %

Calibration Date : 05 Aug 2024

Location of Calibration : In-Lab

Recommend Due Date : 05 Aug 2025

Calibration Procedure : SP-CPE-04-01

Date of Issue : 06 Aug 2024

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





ID LINE : IEC17025



Calibration Report

Certificate Number : SPR24080006-2

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	ST-120	211203773	EEL.BP. 140/0167	26 Jan 2025

Traceability

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



Enviab Co., Ltd.



ID LINE : IEC17025



Result of Calibration

Certificate Number : SPR24080006-2

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	114.3	114.3	0.3	0.3	0.15

Select C

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	114.1	114.1	0.1	0.1	0.15

Select F

Unit : dB

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

Note :

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

Measurement Uncertainty

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

- End of Certificate -



EnviLab Co., Ltd. ผู้จัดการฝ่ายควบคุมคุณภาพ