

ภาคผนวกที่ 37

เอกสารรับรองการสอบเทียบของเครื่องมือตรวจวัด





Certificate of Calibration

Method 5 Pre-Test Calibration - Liters (L)

UUT Meter Console Information

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

Calibration Conditions

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

Factors/Conversions

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

Reference Equipment

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

UUT Meter (DGM)

Run Time	Orifice, ΔH (mm H ₂ O)	Volume		Meter Temperature (°C)		Meter Pressure (mm H ₂ O)	Volume (L)		Reference Meter (WTM)	
		Initial (L)	Final (L)	Initial	Final		Initial	Final	Initial	Final
Θ	P _{m(g)}	V _m	V _m	t _m	t _m	P _w	V _{wi}	V _{wf}	t _{wi}	t _{wf}
830.00	13.00	701219.2	701370.2	25.0	25.0	0.3	0.00	157.49	25.0	25.0
600.00	25.00	701370.2	701524.0	25.0	25.0	0.5	0.00	158.64	25.0	25.0
450.00	50.00	701524.0	701690.6	26.0	26.0	0.6	0.00	170.76	25.0	25.0
450.00	80.00	701690.6	701901.2	26.0	27.0	2.0	0.00	215.91	25.0	25.0
300.00	120.00	701901.2	702073.0	27.0	28.0	2.4	0.00	178.06	25.0	25.0

Standardized Data

Reference Meter (L)		UUT Meter (L)		Correction Factor		ΔH @ (mm H ₂ O)	
Std. Vol	Std. Flow	Std. Vol.	Std. Flow	Value	Variance	0.0212 SCMM	Variance
V _{wi(Std)}	Q _{wi(Std)}	V _{m(Std)}	V _{w(Std)}	Y	ΔY	ΔH@	ΔΔH@
154.90	11.20	148.59	11.2	1.0425	0.0096	46.1	1.267
156.11	15.61	151.52	15.6	1.0303	-0.0026	45.7	0.878
168.06	22.41	163.98	22.4	1.0249	-0.0079	44.3	-0.486
215.24	28.43	207.53	28.4	1.0275	-0.0054	44.4	-0.401
176.03	35.21	169.38	35.2	1.0392	0.0064	43.6	-1.258
		= Y Avg.		1.0329		44.8	
						= ΔH@ Avg. Metric	

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 ΔH₉₀, orifice pressure differential that equates to 0.0212m³/min at standard temperature and pressure, acceptable tolerance of individual values from the average is ±0.2 inches (5.1 mm) H₂O.

Pass/Fail Judgment : **Pass**

Calibrate By: *[Signature]*

Approved By: *[Signature]*

Date: 14 Feb 24

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





Certificate of Calibration - Supplemental

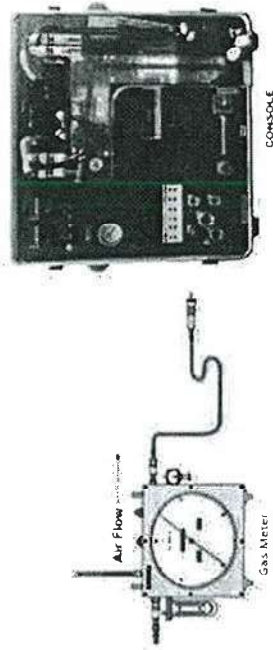
Nomenclature

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

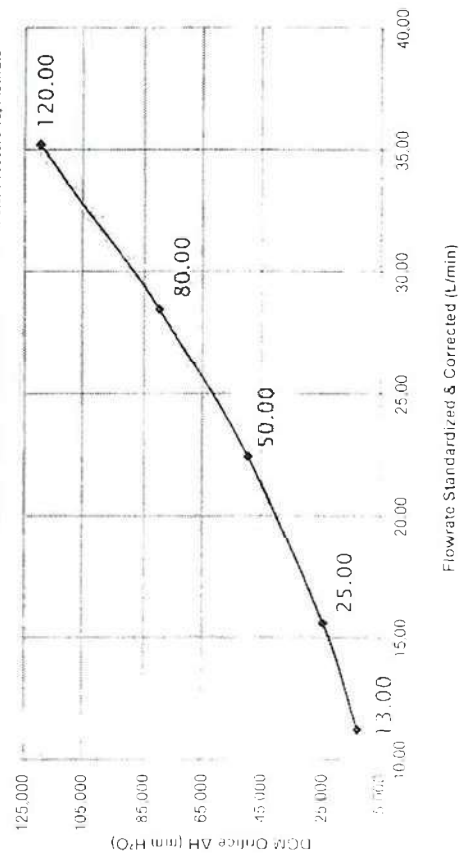
Equations

$$V_{ref(std)} = Y' * K_1 \frac{V_{ref} * (P_{bar} + \frac{P_{ref(std)}}{13.6})}{T_{ref}}$$
$$K_1 V_{ref} (P_{bar} + \frac{\Delta H}{13.6})}{T_{ref}} \quad Q_{ref(std)} = \frac{V_{ref(std)}}{t}$$
$$K_1 = \frac{T_{ref}}{P_{std}} \quad Y' = \frac{V_{ref(std)}}{V_{m(std)}} \quad Q_{ref(std)} = \frac{V_{m(std)}}{t}$$
$$Meter \Delta H = \frac{P_{std} * 0.001896 * (P_{bar} + \frac{P_{ref}}{13.6})}{T_{ref}} * \left(\frac{T_{ref} * \theta}{V_{ref} * P_{ref}} \right)^2$$

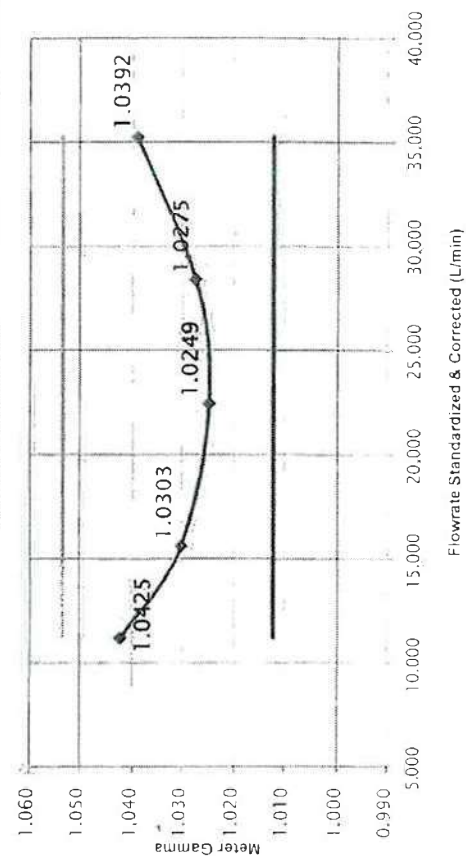
Calibration Train



Meter Pressure vs. Flowrate



Meter Gamma vs. Flowrate





Certificate of Calibration

Method 5 Console Sensor Calibration - Metric Units

Console Information

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

Calibration Conditions

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

Reference Devices

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

Temperature Display Calibration Data

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

Overall Audit Status

NIST Reference Thermocouple ID: 12702001

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

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

Calibrate By:

[Signature]

Approved By

[Signature]

Date:

14 Feb 24

Notes

¹ Suggested, minimum reference points are 10 (0, 100, 200, 300, 500, 700, 900, 1100, 1300, 1500 °F), can test for more.

² For valid test results, the maximum difference between temperature and reference readings should be less than ± 0.5 °F (± 0.3 °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 % (± 1 °C) from the reference reading (EPA Method 2, Section 6.3 and EPA Method 5, Sections 6.1.1, 7-5, 1-1.8)

³ Do not change this cell value, it is instead based on input from Cell H6 at the top of this sheet under "Calibration Conditions"

⁴ Absolute temperature difference and other formulas are calculated based on input from Cell C6 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 H₂O readings should be less than ± 0.05 in. H₂O (± 1.25 mm H₂O)

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

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Neediss Supply Instrument Co., Ltd.



neediss Console Sensor Calibration Data Sheet

Console Information

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

Calibration Conditions

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

Reference Devices

TC Simulator Model: CC-VTR-SH
Reference #: 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 ⁶
#	in. Hg	in. Hg	Pass/Fail
1	-5.0	-4.5	PASS
2	-15.0	-14.5	PASS
3	-20.0	-19.5	PASS

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

Reference Point ¹	ΔP Manometer Calibration			Reference Point Status ²
	Reference	Positive (+) Pitot	Negative (-) Pitot	
#	mm H ₂ O	mm H ₂ O	mm H ₂ O	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: Patterson P. Approved By: Tennie Date: 14 Feb 24

Notes

- ¹ Suggested minimum reference points are 10, 100, 200, 300, 500, 700, 900, 1100, 1500, 1900 (°F); can less for more.
- ² For valid test results, the maximum difference between reference and console readings should be less than ±5.0 °F (±3 °C), for all thermocouples except for the slack thermocouple which should be less than ±1.5% absolute temperature from the reference reading and the slack thermocouple which should be less than ±2 °F (±1 °C) from the reference reading (EPA Method 2, Section 5.3 and EPA Method 5).
- ³ Console readings should be based on input from Cell H8 at the top of this sheet under "Calibration Conditions".
- ⁴ Absolute temperature, pressure and relative humidity are calculated based on unit input from cell C9 at the top of this sheet under "Meter Console Information".
- ⁵ For valid test results, the maximum difference between reference and console readings should be less than ±0.1 in. Hg (±2.5 mm Hg) (EPA Method 5, Section 5.1.2).
- ⁶ For valid test results, the maximum difference between reference and console vacuum readings should be less than ±0.5 in. Hg (±12.5 mm Hg).
- ⁷ For valid test results, the maximum difference between reference and console pressure readings should be less than ±0.05 in. H₂O (±1.25 mm H₂O) or 5% of full scale, whichever is greater.
- ⁸ Console readings were calculated in accordance with US EPA Methods 2 and 5.



Console Sensor Audit QA Sheet

Meter Console Information (UUT)

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

Calibration Conditions

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

Reference Devices

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

Audit Data

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

Audit Data

Console Vacuum Audit			
Reference Point	Reference Vacuum	Console Vacuum	Reference Point Status ³
#	in. Hg	in. Hg	Pass/Fail
1	-17.0	-16.5	PASS

Calibrate By:

Pattaraporn P.

Approved By:

Tanin

Date:

14 Feb 24

Notes

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

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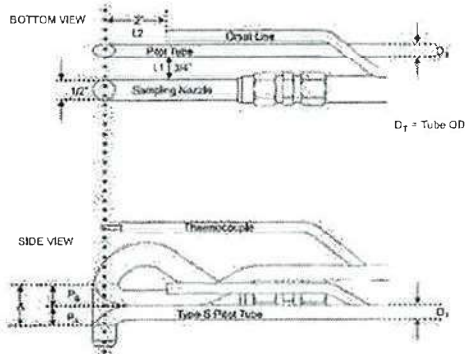
neediss Sampling Probe and Pitot Validation

Sampling System Equipment Information

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

Valibration Conditions and Equipment

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



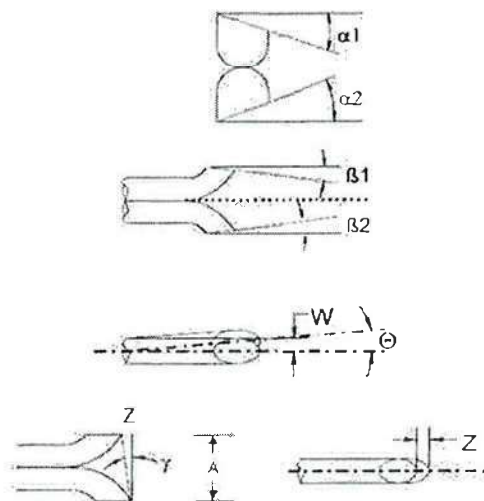
Sampling Probe Validation with Tune up

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

Measured	Standard Range
$L_1 =$	1.91 cm. (1.905 cm. or 3/4 in.)
$L_2 =$	5.00 cm. (5.08 cm., or 2.0 in.)
$D_T =$	0.961 cm. (3/8 in.)
$A =$	2.05 cm. ($2.1 D_T \leq A \leq 3D_T$)
$A/2D_T =$	1.067 cm. ($1.05 P_A / D_T \leq A \leq 1.5$)

Pitot Tube Validations and Engles measurement Result

☒ : Measure Result after Maintanance and Adjustable



P_B Size	Standard Range
$\alpha_1 =$	2.30 ° $\leq 10^\circ$
$\beta_1 =$	-2.10 ° $\leq 5^\circ$
P_A Size	
$\alpha_2 =$	-0.70 ° $\leq 10^\circ$
$\beta_2 =$	-0.90 ° $\leq 5^\circ$

Engles measurement	Calculated Result	Standard Range
$W =$	0.90 °	0.029 cm. $W < 0.08 \text{ cm (} 1/32 \text{ in.)}$
$Z =$	-0.40 °	-0.014 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:

Pattanasorn P.

Approved By:

Tavis

Date:

14 Feb 24.

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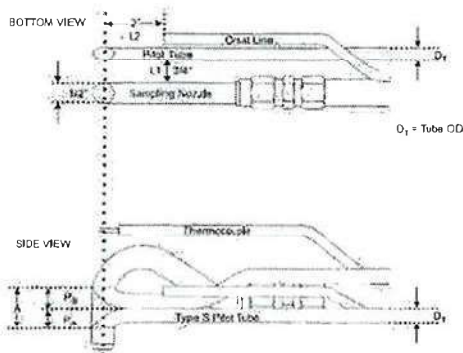
Sampling Probe and Pitot Validation

Sampling System Equipment Information

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

Valibration Conditions and Equipment

Digital Callpers	CD-15APX
Reference No.	A22070181
Digital Incllnometer	BASLINE
Reference No.	FEI 12-1057
Temperatute	24.8 °C±3
Barometric Pressure	759.8 mm Hg



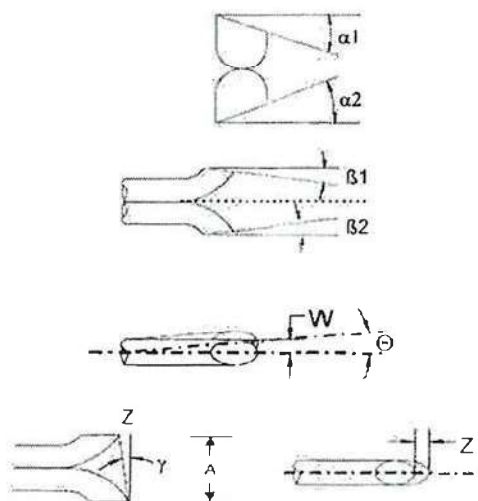
Sampling Probe Validation with Tune up

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

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

Pitot Tube Validations and Engles measurement Result

☒ : Measure Result after Maintanance and Adjustable



P_B Size

α_1	=	-1.30 °	$\leq 10^\circ$
β_1	=	1.20 °	$\leq 5^\circ$

P_A Size

α_2	=	3.50 °	$\leq 10^\circ$
β_2	=	1.90 °	$\leq 5^\circ$

Engles measurement

Calculated Result	Standard Range
$W =$	0.40 ° 0.015 cm. $W < 0.08 \text{ cm (1/32 in.)}$
$Z =$	1.10 ° 0.040 cm. $Z < 0.032 \text{ cm (1/8 in.)}$

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

Validation By:

Dattaraj P.

Approved By:

Tamir

Date:

14 Feb 24

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Neediss Supply Instrument Co.,Ltd.



Nozzle Validation

Samplig System Equipment Information

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

Validation Conditions

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

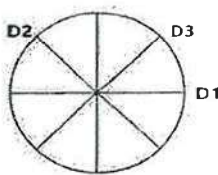
Validation Data					Results	
Nozzle ID	Nozzle Diameter				Different	(D ₁ + D ₂ + D ₃) / 3
Sizes		D ₁	D ₂	D ₃	ΔD	D _{avg}
	mm	mm	mm	mm	mm	mm
NS-5	3.96	3.96	3.96	3.97	0.006	3.963
NS-6	4.77	4.76	4.76	4.77	0.006	4.763
NS-10	7.92	6.35	6.36	6.36	0.006	6.357
NS-11	8.71	8.72	8.72	8.73	0.006	8.723
NS-13	10.31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

Where :

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

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

D avg = (D₁ + D₂ + D₃) / 3



Validation By:

Pattana P.

Approved By:

Tamir

Date:

14 Feb 24



neediss Supply Instrument Co., Ltd.



Certificate of Calibration

Method 5 Pre-Test Calibration - Liters (L)

UUT Meter Console Information

Model #	XC-572-V
Serial #	1108048
DGM Model #	GB/T6968-2011
DGM Serial #	L1500033220

Calibration Conditions

Bar. Pressure (mm Hg):	759.8
Ambient Temperature (°C):	25.3
Relative Humidity (%):	52
Altitude (m):	1.83
Bar. Pressure Corr. (mm Hg):	759.7

Factors/Conversions

Std. Temp. (K):	293.15
Std. Press. (mm Hg):	760
K ₁ (K/mm Hg):	0.3857

Reference Equipment

Calibration Meter Model:	DGMR-200H
Cal. Date:	25 Jun 23
Serial No.:	0000026
Gamma:	1.0000

UUT Meter (DGM)

Run Time (sec/min)	Orifice, ΔH (mm H ₂ O)	Volume			Meter Temperature (°C)		Meter Pressure (at 15°C)	Volume (L)		Reference Meter (WTM)		Outlet Temperature (°C)	
		Initial (L)	Final (L)	Total (L)	Initial	Final		Initial	Final	Total	Initial	Final	Initial
Θ	P _{m(g)}	V _m	V _{mf}	V _m	t _{mf}	t _{mf}	P _w	V _w	V _{mf}	V _w	t _{wf}	t _{wf}	t _{wf}
840.00	13.00	295908.5	296063.5	155.0	25.0	25.0	0.3	0.00	156.39	156.39	25.0	25.0	25.0
630.00	25.00	296063.5	296227.0	163.5	26.0	27.0	0.5	0.00	164.53	164.53	25.0	25.0	25.0
450.00	50.00	296227.0	296391.0	164.0	27.0	28.0	0.6	0.00	164.36	164.36	25.0	25.0	25.0
360.00	80.00	296391.0	296559.8	168.8	28.0	29.0	2.0	0.00	169.18	169.18	25.0	25.0	25.0
300.00	120.00	296559.8	296733.7	173.9	29.0	30.0	2.4	0.00	176.25	176.25	25.0	25.0	25.0

Standardized Data

Reference Meter (L)		UUT Meter (L)		Correction Factor		ΔH @ (mm H ₂ O)	
Std. Vol.	Std. Flow	Std. Vol.	Std. Flow	Value	Variance	0.0212 SCMM	Variance
V _{ref(Std)}	Q _{u(Std)}	V _{u(Std)}	V _{u(Std)}	Y	ΔY	ΔH@	ΔΔH@
153.81	10.99	152.52	11.0	1.0084	-0.0036	47.9	1.421
161.90	15.42	160.27	15.4	1.0102	-0.0018	46.6	0.155
161.77	21.57	160.61	21.6	1.0072	-0.0048	47.6	1.161
167.09	27.85	165.24	27.8	1.0112	-0.0008	46.0	-0.455
174.24	34.85	170.32	34.8	1.0230	0.0110	44.2	-2.282
		= Y Avg.		1.0120		46.5	
						= 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**

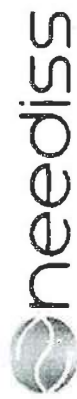
Calibrate By: *Pattaraporn P.*

Approved By: *[Signature]*

Date: 9 Jan 24

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

neediss
Needles Supply Instrument Co., Ltd.



Certificate of Calibration - Supplemental

Nomenclature

- P_{bar} - Barometric Pressure
- DSM - Dry Gas Meter
- K_1 - Constant based on standard temp and press
- t - Run time, in minutes
- P_m - ΔH (Meter Pressure, gauge)
- V_m - Volume collected by test meter, corrected for STP
- Q_{std} - 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

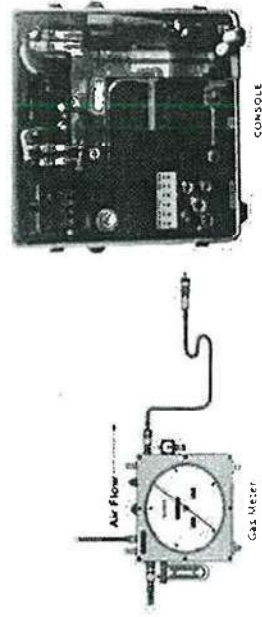
$$V_{m(std)} = V_m \cdot K_1 \cdot \frac{P_w \cdot (P_{bar} + \frac{P_{m(std)}}{13.6})}{T_w}$$

$$P_{m(std)} = \frac{K' \cdot V_m \cdot (P_{bar} + \frac{\Delta H}{13.6})}{T_m}$$

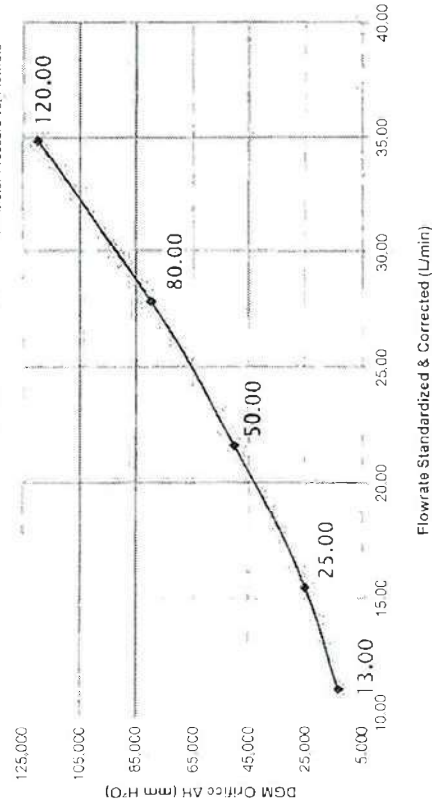
$$K_1 = \frac{V_{std}}{P_{std}} \quad Y = \frac{V_{m(std)}}{V_{std}} \quad Q_{std} = \frac{V_{m(std)}}{t}$$

$$Meter \Delta H_w = \frac{P_{std} \cdot 0.001096 \cdot (P_w + \frac{P_{std}}{13.6})}{T_w} \cdot \left(\frac{T_w \cdot \theta}{V_w \cdot P_w} \right)^2$$

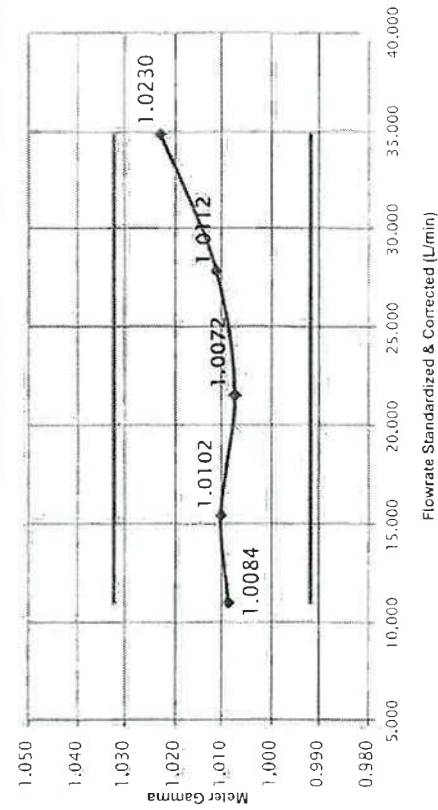
Calibration Train



Meter Pressure vs. Flowrate



Meter Gamma vs. Flowrate





Certificate of Calibration

Method 5 Console Sensor Calibration - Metric Units

Console Information

Model #: XC-572-V
Serial #: 1108048
Units: Metric

Calibration Conditions

Pbar (mm. Hg): 759.8
Humidity (%): 52
Tamb (°C): 25.3
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 Sensors Calibration Data

Reference Point ¹	Reference Temp.	Test Thermocouple Calibrations						Reference Point Status ²
		Aux	Stack	Probe	Oven	Filter	Exit	
#	°C	°C	°C	°C	°C	°C	°C	Pass/Fail
1	-18	-17	-16	-17	-18	-17	-17	PASS
2	38	37	38	38	38	38	37	PASS
3	93	93	93	94	93	93	93	PASS
4	149	149	150	149	148	148	149	PASS
5	260	259	259	260	259	259	259	PASS
6	371	372	372	372	372	371	372	PASS
7	482	482	483	483	483	483	483	PASS
8	593	594	594	594	594	593	594	PASS
9	816	816	816	816	816	816	816	PASS
10	1038	1039	1039	1039	1039	1039	1039	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	1	0.15%
Ambient ³	25.3	25	0.06%
Maximum ²			0.15%
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:

Dattaraj P.

Approved By:

[Signature]

Date:

9 Jan 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)

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



Neediss Supply Instrument Co., Ltd.



Console Sensor Calibration Data Sheet

Console Information

Model #: XC-572-V
Serial #: 1108048
Units: Metric
Type:
"English"

Calibration Conditions

Pbar (mm. Hg): 759.8
Humidity (%): 52.0
Tamb (°C): 25.3
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 ⁶
#	in. Hg	in. Hg	Pass/Fail
1	-5.0	-5.1	PASS
2	-15.0	-15.0	PASS
3	-20.0	-20.0	PASS

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

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

Calibrate By:

Pattampan P.

Approved By:

[Signature]

Date:

9 Jan 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 15.4 °F (±3 °C), for all thermocouples except for the slack thermocouple which should be less than ±1.5% absolute temperature from the reference reading and the slack thermocouple which should be less than ±2°F (±1 °C) from the reference reading (EPA

³ Do not change the cell value, it is instead based on input from Cell Heat the top of this sheet

⁴ Absolute temperature difference and other formulas are calculated based on the input from the top of this sheet

⁵ For valid test results, the maximum difference between console and reference pressure readings should be less than

⁶ For valid test results, the maximum difference between console and reference vacuum readings should be less than

⁷ For valid test results, the maximum difference between console and reference vacuum readings should be less than

I certify that the above Thermocouple Sensors were calibrated in accordance with US EPA Method



Console Sensor Audit QA Sheet

Meter Console Information (UUT)

Model #: XC-572-V
Serial #: 1108048
Units: Metric

Calibration Conditions

Pbar (mm. Hg): 759.8
Humidity (%): 70%
Amb. Temp. (°C): 24.7
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
Room	24.7	24	25	25	25	25	24	PASS
Ice Water	1	0	1	1	1	0	0	PASS

Console Vacuum Audit

Reference Point	Reference Vacuum	Console Vacuum	Reference Point Status ³
#	in. Hg	in. Hg	Pass/Fail
1	17.0	17.0	PASS

Calibrate By:

Pattanasorn P.

Approved By:

[Signature]

Date:

9 Jan 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)

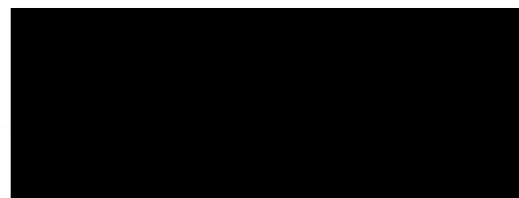
²For valid test results, the maximum difference between console and reference barometric pressure readings should be less than 0.1 in. Hg (2.5 mm Hg), (EPA Method 5 Section 6.1.2)

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



Needles Supply Instrument Co., Ltd





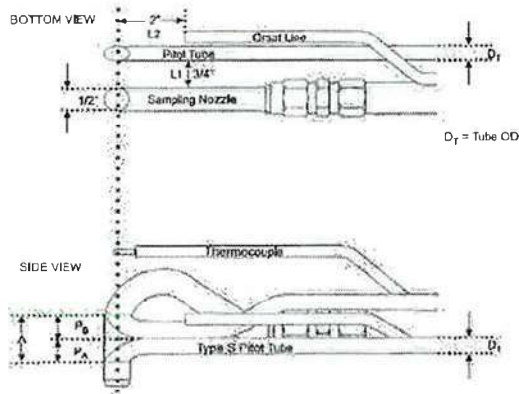
Sampling Probe and Pitot Validation

Samplig System Equipment Information

Probe Sheat	Apex 1 in. , 3 ft.
Probe Number	W1906153
Pitot tube Number	-
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 Inclinator	BASELINE
Reference No.	FEI 12-1057
Temperatute	25.3 °C±3
Barometric Pressure	759.8 mm Hg



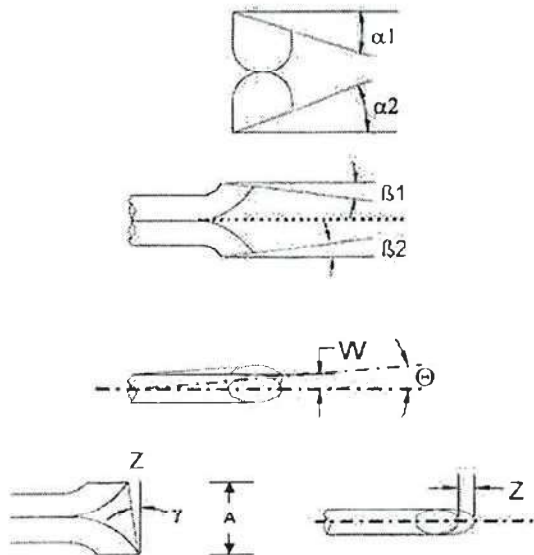
Sampling Probe Validation with Tune up

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

Measured	Standard Range
$L_1 =$	1.94 cm. (1.905 cm. or 3/4 in.)
$L_2 =$	5.08 cm. (5.08 cm. or 2.0 in.)
$D_T =$	0.948 cm. (3/8 in.)
$A =$	2.44 cm. ($2.1 D_T \leq A \leq 3 D_T$)
$A/2D_T =$	1.289 cm. ($1.05 P_A / D_T \leq A \leq 1.5$)

Pitot Tube Validations and Engles measurement Result

☒ : Measure Result after Maintanance and Adjustable



P_B Size

Standard Range

$\alpha_1 = -2.70^\circ \leq 10^\circ$

$\beta_1 = 1.80^\circ \leq 5^\circ$

P_A Size

$\alpha_2 = 2.80^\circ \leq 10^\circ$

$\beta_2 = -1.90^\circ \leq 5^\circ$

Engles measurement

Calculated Result

Standard Range

$W = 0.20^\circ$ 0.009 cm $W < 0.08 \text{ cm (1/32 in.)}$

$Z = 0.59^\circ$ 0.025 cm $Z < 0.032 \text{ cm (1/8 in.)}$

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

Validation By:

Pattingan P.

Approved By:

[Signature]

Date

9 Jan 24



Neediss Supply Instrument Co., Ltd



Nozzle Validation

Samplig System Equipment Information

Console Model XC-572-V
Console Number 1108048
DGM Model GB/T6968-2011
DGM Number L1500033220

Validation Conditions

Digital Calipers CD-15APX
Reference No A22070181
Temperature 25.2 °C±3
Barometric Pressure 759.8 mm Hg

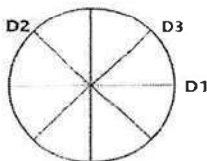
Validation Data					Results	
Nozzle ID	Nozzle Diameter				Different	$(D_1 + D_2 + D_3) / 3$
Sizes		D ₁	D ₂	D ₃	ΔD	D _{avg}
	mm	mm	mm	mm	mm	mm
4	3.17	3.17	3.17	3.17	0.000	3.170
6	4.77	4.77	4.77	4.77	0.000	4.770
8	6.35	6.34	6.35	6.36	0.010	6.350
10	7.92	7.92	7.92	7.92	0.000	7.920
12	9.52	9.52	9.51	9.51	0.006	9.513
14	11.09	11.05	11.05	11.06	0.006	11.053
16	12.70	12.70	12.71	12.71	0.006	12.707

Where :

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

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

D avg = $(D_1 + D_2 + D_3) / 3$



Validation By:

Pattamaporn P.

Approved By:

[Signature]

Date:

9 Jan 24



Neediss Supply Instrument Co., Ltd



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
K ₁ (K/mm Hg)	0.3857

Reference Equipment

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

UUT Meter (DGM)

Run Time	Orifice, ΔH mm H ₂ O	Volume		Meter Temperature (°C)		Meter Pressure mm H ₂ O	Reference Meter (WTM)		Outlet Temperature (°C)	
		Initial (L)	Final (L)	Initial	Final		Initial	Total	Initial	Final
Θ	P _{m(g)}	V _{m1}	V _{m2}	T _{m1}	T _{m2}	P _w	V _{w1}	V _{w2}	T _{w1}	T _{w2}
870.00	13.00	483737.2	483897.2	25.0	25.0	0.3	0.00	161.44	25.0	25.0
630.00	25.00	483897.2	484059.0	25.0	25.0	0.5	0.00	164.16	25.0	25.0
450.00	50.00	484059.0	484223.5	26.0	26.0	0.6	0.00	167.88	25.0	25.0
360.00	80.00	484223.5	484391.4	26.0	27.0	2.0	0.00	171.91	25.0	25.0
300.00	120.00	484391.4	484561.5	27.0	27.0	2.4	0.00	174.74	25.0	25.0

Standardized Data

Reference Meter (L)		UUT Meter (L)		Correction Factor		ΔH @ (mm H ₂ O)	
Std. Vol	Std. Flow	Std. Vol.	Std. Flow	Value	Variance	ΔH@	Variance
V _{w(Std)}	Q _{w(Std)}	V _{m(Std)}	V _{w(Std)}	Y	ΔY	ΔH@	ΔΔH@
58.78	10.95	157.44	11.0	1.0085	-0.0109	48.2	1.935
61.53	15.38	159.40	15.4	1.0134	-0.0060	47.1	0.802
65.23	22.03	161.91	22.0	1.0205	0.0011	45.9	-0.385
69.78	28.30	165.46	28.3	1.0261	0.0068	44.9	-1.407
72.75	34.55	167.99	34.5	1.0283	0.0090	45.3	-0.944
				1.0194	= Y Avg.	46.3	= 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 ± 0.2 inches (5.1mm) H₂O.

Pass/Fail Judgment : **Pass**

Calibrate By: *Patagonia P.*

Approved By: *[Signature]*

Date: 26 Feb 24

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



neediss Supply Instrument Co. Ltd.



Certificate of Calibration - Supplemental

Nomenclature

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

Equations

$$V_{ul(std)} = Y * K_1 \frac{V_w * (P_{bur} + \frac{P_{std}}{13.6})}{T_w}$$

$$V_{m(std)} = \frac{K' V_m (P_{bur} + \frac{\Delta H}{13.6})}{T_m}$$

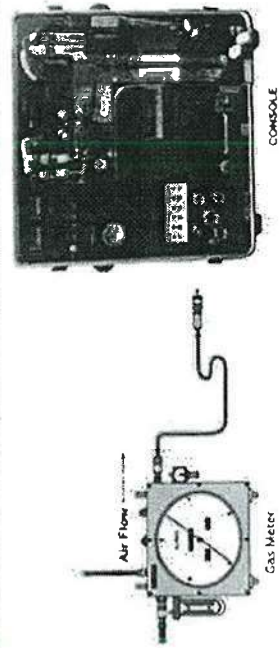
$$K_1 = \frac{T_{std}}{P_{std}}$$

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

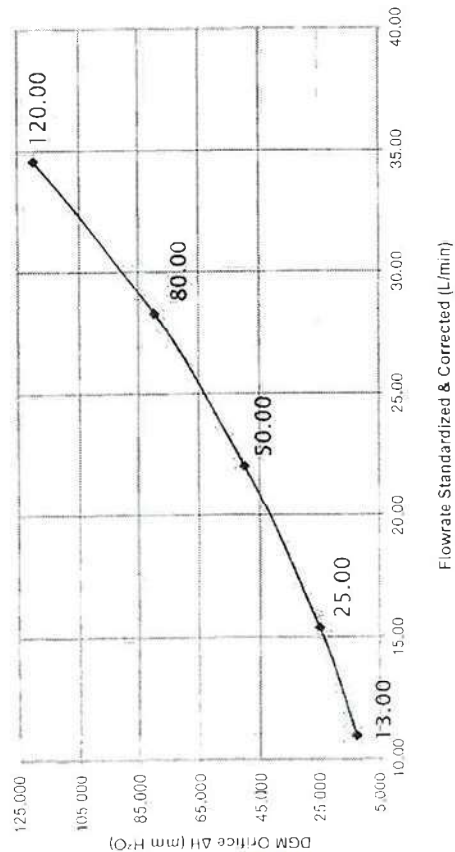
$$Q_{ul(std)} = \frac{V_{ul(std)}}{t}$$

$$Metric \Delta H_{(k)} = \frac{P_{m(g)} * 0.0011696 * (P_{bur} + \frac{P_{std}}{13.6})}{T_m} * (\frac{T_w * \theta}{V_w * P_{bur}})^2$$

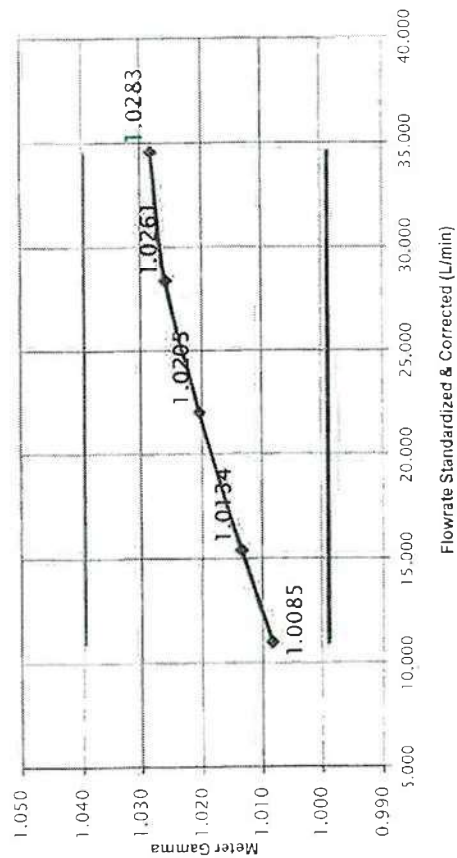
Calibration Train



Meter Pressure vs. Flowrate



Meter Gamma vs. Flowrate



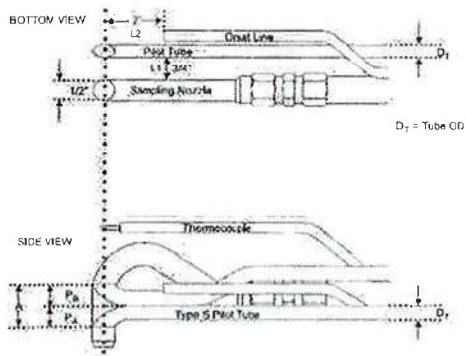
neediss Sampling Probe and Pitot Validation

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 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



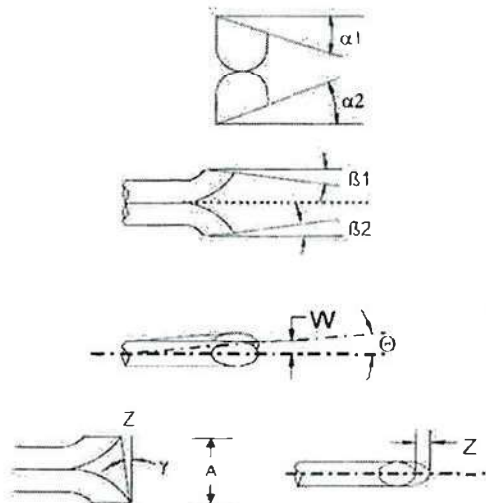
Sampling Probe Validation with Tune up

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

Measured	Standard Range
$L_1 =$	1.90 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 Maintanance and Adjustable



P_B Size

Standard Range
$\alpha_1 =$ 0.70 ° $\leq 10^\circ$
$\beta_1 =$ -0.60 ° $\leq 5^\circ$

P_A Size

Standard Range
$\alpha_2 =$ 1.20 ° $\leq 10^\circ$
$\beta_2 =$ -1.30 ° $\leq 5^\circ$

Engles measurement

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

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

Validation By: Pattananan P. Approved By: [Signature] Date: 26 Feb 24

neediss
Neediss Supply Instrument Co.,Ltd.





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 Pass/Fail
		Aux °C	Stack °C	Probe °C	Oven °C	Filter °C	Exit °C	
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

Overall Audit Status

NIST Reference Thermocouple ID: 12702001

Ref Point	Theoretical Temp. °C	NIST Thermocouple Sensor Reading °C	ΔT_{abs} ⁴ °C
#	°C	°C	°C
1	1.8	2	0.07%
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:

Puttananon P.

Approved By:

HA

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 ± 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 C.3 and EPA Method 5, Sections 6.1.1.30, 1.1.0).

³ Do not change this cell value, it is instead based on input from Cell H9 at the top of this sheet under "Calibration Conditions".

⁴ Absolute temperature difference and other formulas are calculated based on unit input from cell C6 at the top of this sheet under "Meter Console Information".

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

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

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



Neediss Supply Instrument Co., Ltd.



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

Reference Point ¹	ΔP Manometer Calibration			Reference Point Status ²
	Reference	Positive (+) Pitot	Negative (-) Pitot	
#	mm H ₂ O	mm H ₂ O	mm H ₂ O	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: Pattananan P. Approved By: [Signature] Date: 26 Feb 24

Notes

¹ Suggested minimum reference points are 10, 0, 100, 200, 300, 500, 700, 900, 1000, 1500, 1900. 5% non test for 1900.

² For valid test results, the maximum difference between temperature and reference readings should be less than 15.4 °F (±0.0 °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 (±1.1 °C) from the reference reading (EPA Method 2, Section 6.3 and EPA Method 5, Section 6.1.4.3).

³ Do not change this cell value; it is instead based on input from Cell H9 at the top of this sheet under "Calibration Conditions".

⁴ Absolute temperature difference and other formulas are calculated based on unit input from cell C3 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 0.5 mm Hg (±0.5 in. Hg) (EPA Method 2, 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 0.5% (±0.0125 in. Hg (±0.25 mm Hg)) or 5% of full scale.

I certify that the above Thermocouple Sensors were calibrated in accordance with US EPA Method



Needles Supply Instrument Co. Ltd



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:

Lathaparan P.

Approved By:

MA

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.



Neediss Supply Instrument Co., Ltd

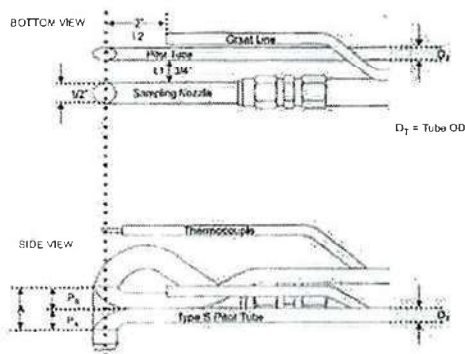
neediss Sampling Probe and Pitot Validation

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

Validation Conditions and Equipment

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



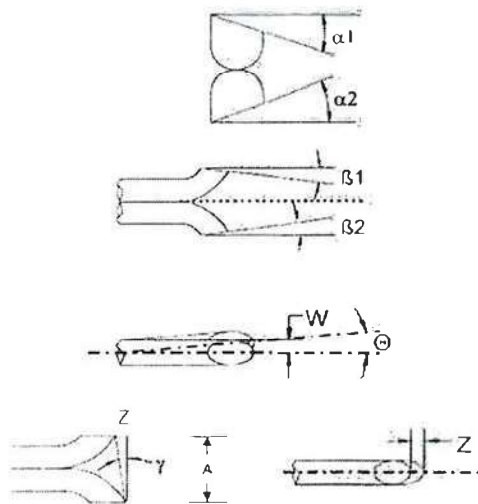
Sampling Probe Validation with Tune up

☒ 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 $D_T \leq A \leq 3D_T$)
$A/2D_T =$	1.089 cm. (1.05 $P_A / D_T \leq A \leq 1.5$)

Pitot Tube Validations and Engles measurement Result

☒ Measure Result after Maintanance 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. $W < 0.08 \text{ cm (1/32 in.)}$
$Z =$	-0.90 °	-0.033 cm. $Z < 0.032 \text{ cm (1/8 in.)}$

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

Validation By

Signature

Approved By:

Signature

Date:

26 Feb 24

neediss
Neediss Supply Instrument Co., Ltd



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

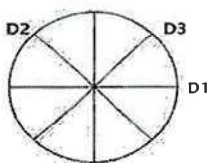
Validation Data					Results	
Nozzle ID	Nozzle Diameter				Different	(D ₁ + D ₂ + D ₃) / 3
Sizes		D ₁	D ₂	D ₃	ΔD	Davg
	mm	mm	mm	mm	mm	mm
NS-4	3.17	3.17	3.17	3.16	0.006	3.167
NS-8	6.35	6.35	6.34	6.35	0.006	6.347
NS-9	7.13	7.14	7.12	7.12	0.012	7.127
NS-12	9.52	9.52	9.52	9.51	0.006	9.517
NS-14	11.09	11.07	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:

Pattanan P.

Approved By:

HK

Date:

26 Feb 24



Neediss Supply Instrument Co., Ltd.



Certificate of Calibration

Method 5 Pre-Test Console Pulse Calibration - Liters (L)

UUT Meter Console Information

Model #: XD-502-MV
Serial #: 1810007
DGM Model #: SK-25-EX
DGM Serial #: 20229137
Bar. Pressure (mb): 1012.9
Ambient Temperature (°C): 25.6
Relative Humidity (%): 65
Altitude (m): 1.8
Bar. Pressure Corr. (mm Hg): 759.6

Calibration Conditions

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 Jun 24
Serial #: 0000026
Gamma: 1.0000

UUT Meter (DGM)

Run Time (seconds)	Orifice, ΔH (mm H ₂ O)	Pulse Count			Meter Temperature (°C)	
		Initial	Final	Total	Initial	Final
Θ	P _{m(g)}	C _{init}	C _{final}	C _{total}	t _{mi}	t _{mf}
280.76	120.00	0	94121	94121	25.0	26.0
340.80	80.00	0	93862	93862	26.0	27.0
430.60	50.00	0	93695	93695	27.0	28.0
621.57	25.00	0	94406	94406	28.0	28.0
860.84	13.00	0	92975	92975	28.0	29.0

Reference Meter

Meter Pressure (in H ₂ O)	Volume (L)			Outlet Temperature (°C)	
	Initial	Final	Total	Initial	Final
P _w	V _{wi}	V _{wf}	V _w	t _{wi}	t _{wf}
-14.0	0.0	168.5	168.5	25.0	25.0
-10.0	0.0	166.9	166.9	25.0	25.0
-7.0	0.0	165.8	165.8	25.0	25.0
-4.0	0.0	164.6	164.6	25.0	25.0
-2.0	0.0	161.1	161.1	25.0	25.0

Standardized Data

Reference Meter	Std. Flow Rate	Test Meter	Scaling Factor		Correction Factor	
			Y _{sc}	Y _{sc}	Y	ΔY
Std. Volume	Q _{w,slid} (L/min)	Totalizer	Counts _(slid)	Vol. Conversion	Value	Variation
V _{w,slid} (L)	Q _{w,slid} (L/min)	Counts _(slid)	Y _{sc}	Vol. Conversion	Value	Variation
159.895	34.170	93410	1.71E-03	161.9	0.9874	-0.0126
159.996	28.168	92487	1.73E-03	160.3	0.9979	-0.0021
160.089	22.307	91750	1.74E-03	159.1	1.0065	0.0065
160.121	15.456	92071	1.74E-03	159.6	1.0032	0.0032
157.515	10.979	90420	1.74E-03	156.7	1.0049	0.0049
			1.73E-03	≠ Avg.	1.0000	≠ Y Avg.

Calibration Results

ΔH @ (mm H ₂ O)	Variance
	ΔH @
0.0212 SCMM	ΔH @
42.9	-1.182
42.6	-1.440
42.9	-1.208
45.1	1.057
46.9	2.773
44.08	≠ ΔH @ Avg.

Pass

Pass/Fail Result:

Console Input Value: 1.7335 Metric

Calibrate By:

Dattaraj P. Dattaraj

Date: 4 Mar 24

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

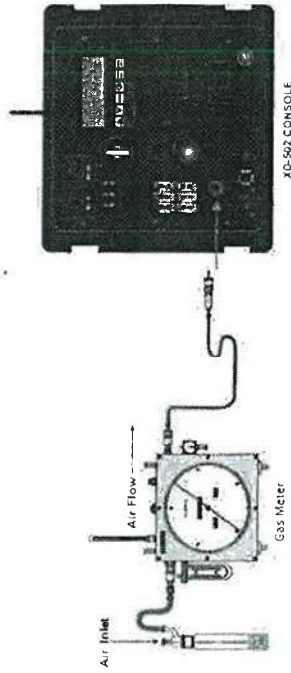
neediss Supply Instrument Co. Ltd



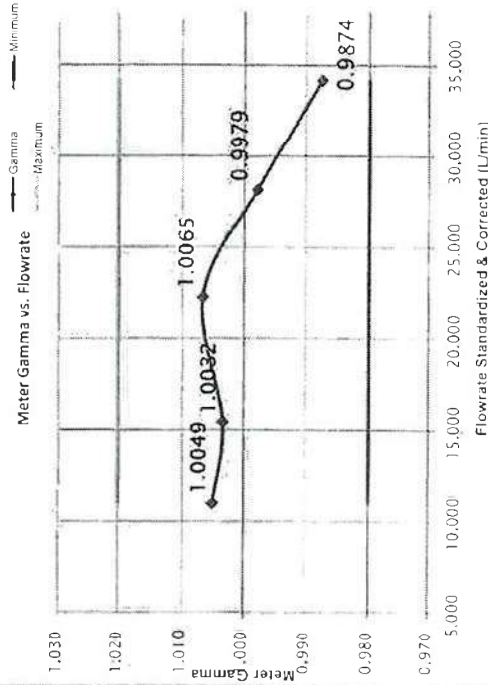
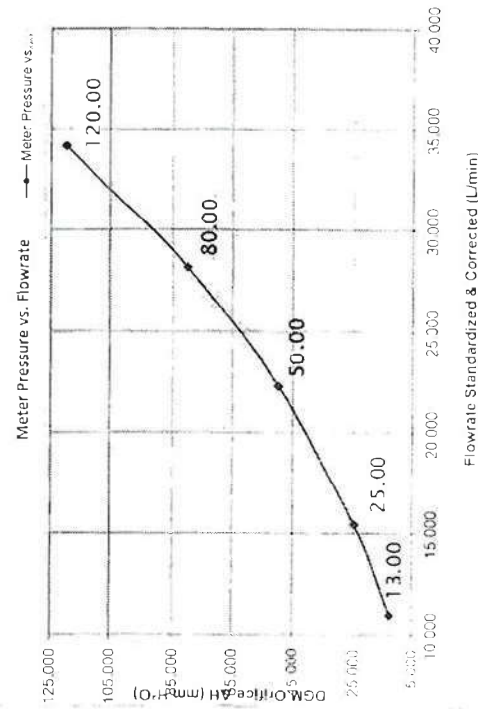
Certificate of Calibration - Supplemental

METHOD 5 PRE-TEST CONSOLE CALIBRATION

Nomenclature	Equations	Calibration Train
P_b - Barometric Pressure		
DGM - Dry Gas Meter		
K_1 - Constant based on standard temp and press	$V_{sc(std)} = Y * K_1 * \frac{V_w * (P_{bar} + \frac{P_{std}}{13.6})}{T_w}$	
θ - Run time, in minutes	$V_{ni(std)} = Counts_{std} * Y_{sc(std)}$	
P_m - ΔH (Meter Pressure, gauge)	$Counts_{std} = K_1 * \frac{C_{total} * (P_{bar} + \frac{P_{std}}{13.6})}{T_m}$	
V_m - Volume collected by test meter, corrected for STP	$Q_{std} = \frac{V_{w(std)}}{\theta}$	
$Q_{ni(std)}$ - Calculated flow rate of test meter	$Y_{sc} = \frac{V_{sc(std)}}{Counts_{std}}$	
K_1 - Critical orifice coefficient	$Y = \frac{V_{sc(std)}}{V_{ni(std)}}$	
P_s - Measured pressure of reference meter	$K_1 = \frac{T_{std}}{P_{std}}$	
T_w - Temperature measured in reference meter		
T_m - Temperature measured in test meter		
Y - Ratio of volume collected from test meter and orifice	$Metric \Delta H = \frac{P_{std} * 0.0011696 * (P_{bar} + \frac{P_{std}}{13.6})}{T_m} * (T_w * \theta) * \left(\frac{T_w * P_{std}}{V_w * P_{bar}} \right)$	
sc - Scaling Factor		
Counts _{std} - Number of pulse counts, standardized		
C _{raw} - Number of raw pulse counts of a calibration run		



Calibration Graphs



Certificate of Calibration

Method 5 Console Temperature Calibration - Metric Units

Console Information

Model #:	XD-502-MV
Serial #:	1810007
Units:	Metric

Calibration Conditions

Pbar (mm. Hg):	759.6
Humidity (%):	65
Tamb (°C):	25.6
Elevation (m):	1.8
Corr. Pbar (mm. Hg):	759.6

Reference Devices

TC Calibrator Model:	CC-VTR-SH	Reference #	91109269
Pressure Calibrator Model:	718 30G	Reference #	9543013
Barometer Model:	736930	Reference #	EBARODIALSPE01

Temperature Sensors Calibration Data

Reference Point ¹	Reference Temp.	Test Thermocouple Calibrations						Reference Point Status ²
		Aux	Stack	Probe	Oven	Filter	Exit	
#	°C	°C	°C	°C	°C	°C	°C	Pass/Fail
1	-18	-18	-18	-18	-18	-18	-18	PASS
2	38	38	38	38	38	38	38	PASS
3	93	92	93	93	93	93	93	PASS
4	149	149	149	149	149	149	149	PASS
5	260	260	260	260	260	260	260	PASS
6	371	371	371	371	371	371	371	PASS
7	482	482	482	482	482	482	482	PASS
8	593	593	593	593	593	592	593	PASS
9	816	816	816	816	816	816	816	PASS
10	1038	1038	1038	1038	1038	1038	1038	PASS
TC Measure Overall Audit Status								PASS

TC Measure Overall Audit Status

PASS

NIST Reference Temperature Probe ID: 12702001

	Ref Point	Theoretical Temp	DGM Thermocouple Sensor Reading	ΔT_{abs}^4
	#	°C	°C	°C
Ice Water	1	1.1	1	0.04%
Ambient ³	2	25.6	26	0.08%
			Maximum ²	0.08%
			Status	PASS

 MaxEPRUC^2

0.08%

Status

PASS

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

Vacuum Gauge Calibration Data

Vacuum Gauge Calibration Data			
Console Vacuum Calibration			
Reference Point	Reference Vacuum	Console Vacuum	Reference Point Status ^a
#	mm. Hg	mm. Hg	Pass/Fail
1	50.0	50.0	PASS
2	100.0	100.0	PASS

Dual Inclined/Vertical Manometer

Reference Pressure	Pressure audit with Console System testing for Inclined Range of 0-26 and Vertical Range of 26-150mm H ₂ O			
	ΔH Loop (Backside)		Δp Loop (Frontside)	
mm H ₂ O	mm H ₂ O	Pass/Fail	mm H ₂ O	Pass/Fail
0.0	0.0	PASS	-0.7	PASS
50.0	50.4	PASS	50.2	PASS
70.0	70.0	PASS	70.2	PASS
80.0	80.0	PASS	80.4	PASS
90.0	90.2	PASS	90.1	PASS
100.0	100.4	PASS	100.2	PASS
110.0	110.1	PASS	110.1	PASS
120.0	120.2	PASS	120.1	PASS
130.0	130.1	PASS	130.4	PASS
140.0	140.2	PASS	140.4	PASS
150.0	150.2	PASS	150.2	PASS
ΔH Overall Audit Status		PASS	Δp Overall Audit Status	
		PASS		

4H Overall Audit Status

Overall Audit Status

PASS

Calibrate By:

Approved By:

Date:

4 Mar 24

Notes

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

²For valid test results, the maximum difference between temperature and reference readings should be less than $\pm 3^\circ\text{F}$ ($\pm 3^\circ\text{C}$) for all thermocouples except for the slack thermocouple which should be less than $\pm 1.5\%$ absolute temperature from the reference reading and the exhaust thermocouple which should be less than $\pm 2^\circ\text{F}$ ($\pm 1^\circ\text{C}$) from the reference reading (EPA Method 2, Section 6.3 and EPA Method 5, Sections 2.2.1 and 2.2.2).

² Do not change this cell value. It is instead based on input from Cell 10 at the top of this sheet under "Calibration Conditions"

* Absolute temperature difference and other formulas are calculated based on unit input from cell C3 at the top of this sheet under "Meter Console Information"

¹For valid test results, the maximum difference between console and reference barometric pressure readings should be less than 20 mmHg.

⁶ For valid test results, the maximum difference between console and reference vacuum readings should be less than ± 0.0 .

I certify that the above Thermocouple Sensors were calibrated in accordance with NIST 86-36 Verifying



Console Sensor Audit QA Sheet

Meter Console Information (UUT)

Model #: XD-502-MV
Serial #: 1810007
Units: Metric

Calibration Conditions

Pbar (mm. Hg): 759.6
Humidity (%): 65
Amb. Temp. (°C): 25.6
Altitude (m): 1.8
Corrected Pbar (mm. Hg): 759.6

Reference Devices

TC Calibrator Model: CC-VTR-SH
TC Calibrator Reference #: 91109269
Barometer Model: 736930
Barometer Serial #: EBARODIALSPE01

Audit Data

Reference Point #	Reference Temp. °C	Console Thermocouple Audit						Reference Point Status ¹
		Aux °C	Stack °C	Probe °C	Oven °C	Filter °C	Exit °C	
1	25.6	25	26	26	25	25	25	PASS

Console Barometric Audit			
Reference Point #	Reference Bar. Press. mm. Hg	Console Bar. Press. mm. Hg	Reference Point Status ²
1	759.6	758.9	PASS

Console Vacuum Audit			
Reference Point #	Reference Vacuum mm. Hg	Console Vacuum mm. Hg	Reference Point Status ³
1	75.0	75.00	PASS

Calibrate By: Dattanapa P. Approved By: VH Date: 4 Mar 24

Notes

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

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 6.1.1-6.1.8)

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)



Thermaply Instrument Co., Ltd



Sampling Probe and Pitot Validation

Sampling System Equipment Information

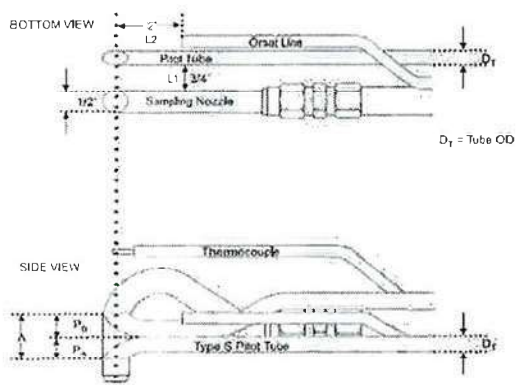
Probe Sheat:	Apex 1 in., 3 ft.
Probe Number:	W2001490
Pitot tube Number:	A8996
Pitot tube Type:	S Type 3/8 Inc.
Validation method:	Standard Probe 1 in. and 1/2 in. Sampling Nozzle

Validation Conditions and Equipment

Digital Calipers:	ET123456
Reference No:	A22070181
Digital Inclinator:	BASELINE
Reference No:	12-1057
Temperature:	25.6 °C±3
Barometric Pressure:	759.6 mm Hg

Sampling Probe Validation with Tune up

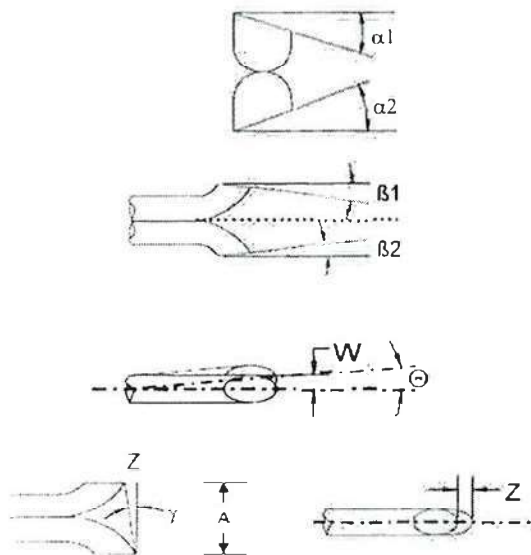
☒ Measure and Alinment with 1/2" Sampling Nozzle(12.7 mm)



Measured	Standard Range
$L_1 =$	1.91 cm. (1.905 cm. or 3/4 in.)
$L_2 =$	5.06 cm. (5.08 cm. or 2.0 in.)
$D_T =$	0.952 cm. (3/8 in.)
$A =$	2.11 cm. (2.1 $D_T \leq A \leq 3D_T$)
$A/2D_T =$	1.106 cm. (1.05 $P_A / D_T \leq A \leq 1.5$)

Pitot Tube Validations and Engles measurement Result

☒ : Measure Result after Maintanance and Adjustable



P_B Size

$\alpha_1 =$	-1.70 °	$\leq 10^\circ$
$\beta_1 =$	1.90 °	$\leq 5^\circ$

P_A Size

$\alpha_2 =$	2.10 °	$\leq 10^\circ$
$\beta_2 =$	-1.20 °	$\leq 5^\circ$

Engles measurement

Engles measurement	Calculated Result	Standard Range
$W =$	0.10 °	0.004 cm, $W < 0.08 \text{ cm (1/32 in.)}$
$Z =$	0.20 °	0.007 cm, $Z < 0.032 \text{ cm (1/8 in.)}$

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

Solong as standard range.

Validation By,

Pattanan P.

Approved By,

h

Date;

4 Mar 24



Neediss Supply Instrument Co., Ltd

neediss Nozzle Validation

Sampling System Equipment Information

Console Model Number XD-502-MV
 Console Serial Number 1810007
 DGM Model Number SK-25-EX
 DGM Serial Number 20229137

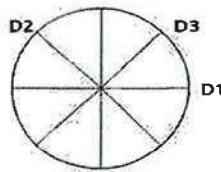
Validation Conditions

Digital Calipers CD-15APX
 Reference No A22070181
 Temperature 25.6 °C±3
 Barometric Pressure 759.6 mm Hg

Calibration 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	3.18	3.17	3.17	0.006	3.173
NS-6	4.77	4.77	4.77	4.77	0.000	4.770
NS-8	6.35	6.35	6.35	6.35	0.000	6.350
NS-10	7.92	7.91	7.92	7.93	0.010	7.920
NS-12	9.52	9.53	9.53	9.52	0.006	9.527
NS-14	11.09	7.13	7.13	7.13	0.000	7.130
NS-16	12.70	12.71	12.69	12.70	0.010	12.700

Where :

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



Validation By;


Dattaprasad P.

Approved By;

M.

Date:

4 Mar 24

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 Neediss Supply Instrument Co., Ltd





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Neediss Supply Instrument Co., Ltd.

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Tel. 02-802-3980-2 Fax. 02-802-3988 6 info@neediss.com



Verification Test Report

Page:1/2

Instruments Information

Analyzer Type:	Flue Gas Analyser	Manufacturer:	MRU
Model:	Optima7	S/N:	332604

Calibration Gas information

Calibrator Unit	Standard Gas Mid Range			Standard Gas High Range		
ZERO AIR Gen: Ecotech8301 Dilutor Model: EcotechGasCal1100	O2 Conc	2.2	%vol.	O2 Conc	10.22	%vol.
	Cd/Ex:	343014/Jul	24,2025	Cd/Ex:	343018/Jan	10,2025
	CO Conc	99.94	ppm	CO Conc	594.5	ppm
	NO Conc	99.69	ppm	NO Conc	197.2	ppm
	NOX Conc	99.76	ppm	NOX Conc	197.2	ppm
	SO2 Conc	100.5	ppm	SO2 Conc	200.9	ppm
	Cd/Ex:	ED5716/May	16,2030	Cd/Ex:	ND7514/Jun	21,2030

Environment: Temperature 31.6 °C Humidity: 35 %RH

SO2 calibration test

Before Adj					Reading (After Adj)
Set point	Std.gas (ppm)	Reading (ppm)	Difference	% error	Reading (ppm)
Low/Zero	0.0	0	0.0	0.0	0
Mid	100.5	99	-1.5	-1.5	99
Hight	200.9	198	-2.9	-1.4	198

NO calibration test

Before Adj					Reading (After Adj)
Set point	Std.gas (ppm)	Reading (ppm)	Difference	% error	Reading (ppm)
Low/Zero	0.0	0	0.0	0.0	0
Mid	99.69	99	-0.7	-0.7	99
Hight	197.2	199	1.8	0.9	199

NOX calibration test

Before Adj					Reading (After Adj)
Set point	Std.gas (ppm)	Reading (ppm)	Difference	% error	Reading (ppm)
Low/Zero	0.0	0	0.0	0.0	0
Mid	99.76	99.0	-0.8	-0.8	99
Hight	197.2	199.0	1.8	0.9	199

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Tel: 02-802-3780-2 Fax: 02-802-0988 E: info@neediss.com



Verification Test Report

Page:2/2

Instruments Information

Analyzer Type:	Flue Gas Analyser	Manufacturer:	MRU
Model:	Optima7	S/N:	332604

Calibration Gas information

Calibrator Unit	Standard Gas Mid Range	Standard Gas High Range
ZERO AIR Gen:	O2 Conc 2.2 %vol.	O2 Conc 10.22 %vol.
Ecotech8301	Cd/Ex: 343014/Jul 24,2025	Cd/Ex: 343018/Jan 10,2025
Dilutor Model:	CO Conc 99.94 ppm	CO Conc 594.5 ppm
EcotechGasCal1100	NO Conc 99.69 ppm	NO Conc 197.2 ppm
	NOX Conc 99.76 ppm	NOX Conc 197.2 ppm
	SO2 Conc 100.5 ppm	SO2 Conc 200.9 ppm
	Cd/Ex: ED5716/May 16,2030	Cd/Ex: ND7514/Jun 21,2030

Environment: Temperature 31.6 °C Humidity: 35 %RH

CO calibration test					
Before Adj					Reading (After Adj)
Set point	Std.gas (ppm)	Reading (ppm)	Difference	% error	Reading (ppm)
Low/Zero	0.0	0.0	0.0	0.0	0
Mid	99.69	100.0	0.3	0.3	100
Hight	594.5	603	8.5	1.4	601

O2 calibration test					
Before Adj					Reading (After Adj)
Set point	Std.gas (ppm)	Reading (ppm)	Difference	% error	Reading (ppm)
Low/Zero	0.0	0.2	0.2	0.2	0.2
Mid	2.20	2.2	0.0	0.0	2.2
Hight	10.22	10.2	0.0	-0.2	10.2

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 : Pattana P.

Approve By : [Signature]

Date: 30 Mar 23

Date: 30 Mar 23

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Tel. 02-802-3780-2 Fax. 02-802-3788 E info@neediss.com



Verification Test Report

Instruments Information

Analyzer Type: Flue Gas Analyser	Manufacturer: Sprint
Model: V2	S/N: NFGTGSPV238606

Calibration Gas information

Calibrator Unit	Standard Gas Mid Range	Standard Gas High Range
ZERO AIR Gen: Ecotech8301	O2 Conc 18.09 %vol. Cd/Ex: CC515499/Dec 17,2023	O2 Conc - %vol. Cd/Ex: -
Dilutor Model: EcotechGasCal1100	CO Conc 100.1 ppm NO Conc - ppm NOX Conc - ppm SO2 Conc - ppm Cd/Ex: CC515499/Dec 17,2023	CO Conc - ppm NO Conc - ppm NOX Conc - ppm SO2 Conc - ppm Cd/Ex: -

Environment: Temperature 24.4 °C	Humidity: 45 %RH
----------------------------------	------------------

O2 calibration test

Before Adj					Reading (After Adj)
Set point	Std.gas (ppm)	Reading (ppm)	Difference	% error	Reading (ppm)
Low/Zero	0.0	0	0.0	0.0	-
Mid	18.09	18.3	0.2	1.2	18.3
Hight	-	-	-	-	-

CO calibration test

Before Adj					Reading (After Adj)
Set point	Std.gas (ppm)	Reading (ppm)	Difference	% error	Reading (ppm)
Low/Zero	0.0	0.0	0.0	0.0	-
Mid	100	100	0.0	0.0	100
Hight	-	-	-	-	-



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Neediss Supply Instrument Co.,Ltd.

Calibrate By :

Pattanasak P.

Approve By :

[Signature]

Date:

20 Mar 23

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CAL

Calibratech Co.,Ltd.

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

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



Certificate of Calibration

Certificate No. : 67-200060-1

Page : 1 of 2

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

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

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

Date of Received : 20 February 2024

Date of Calibration : 20 February 2024

Date of Issue : 21 February 2024

Calibrated by : Satja Sangkhum

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

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

Standard Weights

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

Approved by :

(Surachai Promthong)

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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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.

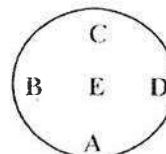
This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2.00$, providing a level of confidence of approximately 95%

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

Sdev. : 0.00004 g

- o0o -

Handwritten signature

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-I
Range Temperature :	N/A °C	Resolution :	0.1 °C
Range Humidity :	N/A %R.H.	Resolution :	1 %R.H.
Serial No. :	PONPE5852094	ID No. :	ELABTMHTC10003

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

Date of Received : 20 February 2024

Date of Calibration : 22 February 2024

Date of Issue : 22 February 2024

Calibrated by : Chortip Samchusri

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

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

Digital Indicator with Standard Probe Temp&Hum

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

Approved by :

(Surachai Promthong)

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 67-410025-1

Page : 2 of 2

UUC Condition As-Received : Good

Result of Calibration : Without Adjustment

Function : Temperature measurement

Reference Humidity @ 50 %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%

- 000 -



Agilent CrossLab Start Up Services

Agilent 5100 5110 ICP-OES Preventive Maintenance

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

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

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

Introduction

Customer Information

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

Important Customer Web Links

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

Service Engineer's Responsibilities

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

Instrument Maintenance

System Information

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

Instrument System Name and ID

5110 VDV ICP-OES

Instrument System Site and Location

Envilab Company limited

List System Component Product Numbers	List the Serial Numbers of each Component
1. G 8015 A	MY 17490002
2. G 8410 A	AU17393768
3. G 8481-8000 2	1709-06327
4.	
5.	
6.	
7.	
8.	
9.	

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

Preparation

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

Preventive Maintenance Procedures

Record Pre-PM instrument performance

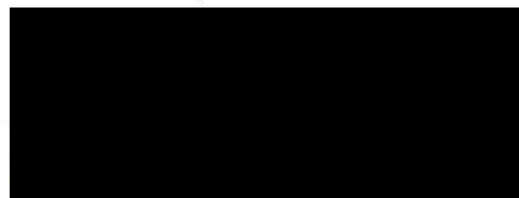
- ☒ Run Instrument Performance test.
- ☒ Record results in Instrument Performance Test Results Table – Pre-PM.

Clean and inspect ICP-OES system

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

Agilent Water Recirculator

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



SPS 3 Auto Sampler

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

SPS 4 Auto sampler

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

AVS 4, 6, 7 Advanced Valve System

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

ICP-OES adjustment

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

Record Post-PM instrument performance

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

Restore Instrument

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

Service Review

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

Test Results

Instrument Performance Test Results Table

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

	Pre PM Sensitivity Check		Post PM Sensitivity Check	
	Radial	Axial *	Radial	Axial*
Zn 213.857 nm SRBR	1577.1	3382.6	2348.2	6129.9
Mn 257.610 nm SRBR	8945.3	16145.3	10768.1	39073.2
Al 396.152 nm SBR	7.0	16.3	8.5	25.7
K 766.491 nm SBR	8.2	67.3	4.7	88.6

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

Instrument Test Results Table

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

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

ICP-OES Status Results Table

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

Measurement	Standby Mode		Plasma On	
Mains Voltage	219.371	VAC	217.484	VAC
Mains Current	0.082	A	0.098	A
Instrument Temperature	23.5	°C	23.1	°C
RF Air Flow (sensor speed)	13.0	Hz	11.0	Hz
Plasma Exhaust Temperature	No measurement		56.4	°C
Water Flow Oscillator	No measurement		1.51	L/min
Water Flow Detector	1.09	L/min	1.06	L/min
Water Inlet Temperature	16.9	°C	16.7	°C
Polychromator Temperature	35.0	°C	35.0	°C
CCD Temperature	-39.6	°C	-39.4	°C
Thermal Stabilizer	35.0	°C	35.0	°C
Argon Supply Pressure	679.13	kPa	500.32	kPa
Purge Gas Supply Pressure*1	676.63	kPa	597.43	kPa
Option Gas Supply Pressure*1	-	kPa	-	kPa
Nebulizer Flow	No measurement		0.70	L/min
Nebulizer Back Pressure	No measurement		283.17	kPa
Plasma Gas Flow	No measurement		11.98	L/min
Auxiliary Gas Flow	No measurement		1.00	L/min
RF Power	No measurement		1195.1	W
RF Supply Current	No measurement		8.190	A
RF Supply Voltage	No measurement		194.557	V

*1 If option installed

Consumed PM Parts

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

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

☐ Section Not Applicable.

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

Signature Page

Service Engineer Comments (optional)

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

Service Verification

Service Request Number:

6006121636

Service Engineer Name:

Kanyakorn S.

Service Engineer Signature:

Kanyakorn S.

Total number of pages in this document:

14

Date Service Completed:

31 May 2023

Customer Name:

กานทิ

Customer Signature:

กานทิ

Report Summary

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

Result Summary

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

Subsystem Communications Test	Pass
-------------------------------	------

Optics Test	Pass
-------------	------

	Radial	Axial
Intensity	3397602	2923418
Wavelength	737.212	737.212

Resolution Test**Pass**

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

Sensitivity Test**Pass**

Radial

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

Axial

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

Precision Test**Pass**

Radial

Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 2.60	0.75
Se (196.026 nm)	≤ 2.60	0.69
Zn (213.857 nm)	≤ 1.50	0.27
Pb (220.353 nm)	≤ 2.60	1.06
Mn (257.610 nm)	≤ 1.50	0.30
Al (396.152 nm)	≤ 1.50	0.27
Ba (493.408 nm)	≤ 1.50	0.99
K (766.491 nm)	≤ 1.50	0.25

Axial

Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 1.50	0.54
Se (196.026 nm)	≤ 1.50	0.48
Zn (206.200 nm)	≤ 1.50	1.06
Zn (213.857 nm)	≤ 1.50	0.48
Cd (214.439 nm)	≤ 1.50	0.33
Pb (220.353 nm)	≤ 1.50	0.37
Mn (257.610 nm)	≤ 1.50	0.77
Cr (267.716 nm)	≤ 1.50	0.62
Cu (324.754 nm)	≤ 1.50	0.45
Al (396.152 nm)	≤ 1.50	0.45
Ba (493.408 nm)	≤ 1.50	0.80
K (766.491 nm)	≤ 1.50	0.91

Report Summary

Instrument Model	Agilent 5100/5110 VDV ICP-OES
Instrument ID	G8011A/G8015A
Instrument Serial Number	MY17490002
Software Version	7.4.0.10280
Firmware Version	3562
Tested By	Kanyakorn S.
Test Started On	5/31/2023 12:34:17 PM
Test Completed On	5/31/2023 12:46:55 PM

Result Summary

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

Subsystem Communications Test Pass

Air Flow Test Pass

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

Water Flow Test Pass

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

Gas Flows Test	Pass
----------------	------

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

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

RF Generator Test	Pass
-------------------	------

RF Power Supply Test	Passed
RF Power Supply (V)	147.418
RF Oscillator Test	Passed
RF Oscillator Frequency (MHz)	25.961
Work Coil Current (A)	45.326
RF Power Supply Current (A)	2.000

Camera Test	Pass
-------------	------

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

Stack Name/ID: Stack Boiler5

ANALYZER CALIBRATION ERROR TEST (SO₂)

EQUIPMENT : SO ₂ Analyzer		S/N: ESOAIT100H0461		
BRAND/MODEL: TELEDYND-API/T200H		TIME: 09:30-10:30		
DATE: 14 Apr 24				
Calibration Gas Level	Calibration concentration (ppm) Cs	Analyzer reading (ppm) CA	Absolute difference CA - Cs	Analyzer Calibration Error [(CA-Cs)/Cs] x 100
Low-level (or zero) calibration gas	0.00	0.02	0.02	0.02
Mid-level calibration gas	101.00	100.72	0.28	0.14
High-level calibration gas	203.70	203.72	0.02	0.01
Calibration Error test pass or not (no more than 2.0%)				Pass

ANALYZER CALIBRATION ERROR TEST (CO)

EQUIPMENT :		CO Analyzer		S/N: 404	
BRAND/MODEL:		TELEDYND-API/T300M		TIME: 09:30-10:30	
DATE:		14 Apr 24			
Calibration Gas Level	Calibration concentration (ppm) Cs	Analyzer reading (ppm) CA	Absolute difference CA - Cs	Analyzer Calibration Error [(CA-Cs)/Cs] x 100	
Low-level (or zero) calibration gas	0.00	0.28	0.28	0.05	
Mid-level calibration gas	98.95	97.89	1.06	0.18	
High-level calibration gas	601.60	600.75	0.85	0.14	
Calibration Error test pass or not (no more than 2.0%)				Pass	

ANALYZER CALIBRATION ERROR TEST (O₂)

EQUIPMENT :		O ₂ Analyzer	
BRAND/MODEL:		Teledyne-API/T803	
DATE:		14 Apr 24	
		S/N: EO2AIT80300085	
		TIME: 09:30-10:30	

Calibration Gas Level	Calibration concentration (%) Cs	Analyzer reading (%) CA	Absolute difference CA - Cs	Analyzer Calibration Error $[(CA - Cs) / Cs] \times 100$
Low-level (or zero) calibration gas	0.00	0.03	0.03	0.17
Mid-level calibration gas	7.79	7.76	0.03	0.17
High-level calibration gas	18.05	17.95	0.10	0.55
Calibration Error test pass or not (no more than 2.0%)				Pass

Stack Name/ID: Stack Boiler 5

ภาพ

SYSTEM BIAS TEST AND DRIFT (SO2)

Reference No: SO2400035-E004

Customer Name : บริษัท จี เมทรีเรียล เทคโนโลยี จำกัด

Stack Name/ID: Slack Boiler 5

EQUIPMENT:	SO2 Analyzer
BRAND/MODEL:	TELEDYND-API/T200H
S/N:	ESOAIT100H0461
Sampling Run No.	1
DATE:	14 Apr 24

Calibration Gas level	Initial		Final		Drift (Initial - Final System bias)
	Calibration concentration (ppm) Cs	Analyzer reading (ppm) CA	System Bias [(CA-Cs)/Cs] x 100	Analyzer reading (ppm) CA	System Bias [(CA-Cs)/Cs] x 100
Low-level (or zero) calibration gas	0.02	0.03	FALSE	0.04	0.01
High-level calibration gas	203.72	203.84	0.06	203.88	0.02
System bias pass or not (no more than 5.0%)					Pass
Drift pass or not (no more than 3.0%)					Pass

SYSTEM BIAS TEST AND DRIFT (CO)

Referee No: SO2400035-E004

Customer Name : บริษัท อุตสาหกรรม เทคโนโลยี จำกัด

Stack Name/ID: Stack Boiler 5

EQUIPMENT :	CO Analyzer
BRAND/MODEL :	TEI EDYNE-API/T300M
S/N:	404
Sampling Run No. 1	
DATE:	14 Apr 24

	Initial		Final		Drift (Initial - Final System bias)
	Analyzer reading (ppm)	System Bias [(CA-Cs)/Cs] x 100	Analyzer reading (ppm)	System Bias [(CA-Cs)/Cs] x 100	
Calibration Gas level					
Low-level (or zero) calibration gas	0	0.02	0.64	0.06	0.04
High-level calibration gas	600.82	0.01	601.44	0.11	0.10
System bias pass or not (no more than 5.0%)					Pass
Drift pass or not (no more than 3.0%)					Pass

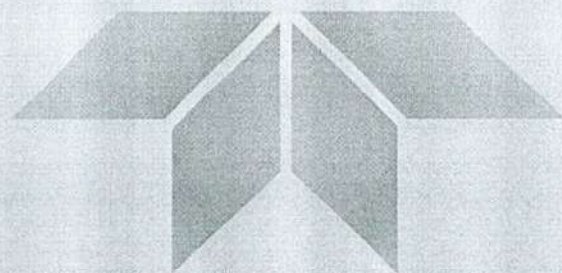
SYSTEM BIAS TEST AND DRIFT (O₂)

Referee No: SO2400035-I004

Customer Name : บริษัท อุตสาหกรรมปิโตรเลียม จำกัด

Stack Name/ID: Stack Boiler 5

EQUIPMENT : O2 Analyzer		S/N: EO2AIT80300085				
BRAND/MODEL: Teledyne-API/T803						
Sampling Run No. I						
DATE: 14 Apr 24						
Calibration Gas level	Calibration concentration (%) Cs	Initial		Final		Drift (Initial - Final System bias)
		Analyzer reading (%) CA	System Bias [(CA-Cs)/Cs] x 100	Analyzer reading (%) CA	System Bias [(CA-Cs)/Cs] x 100	
Low-level (or zero) calibration gas	0.03	0.03	0.00	0.05	0.11	0.11
High-level calibration gas	17.95	18.03	0.45	18.08	0.72	0.28
		System bias pass or not (no more than 5.0%)		Pass		
		Drift pass or not (no more than 3.0%)				Pass



The Model T100H High Range UV Fluorescence SO₂ Analyzer



The Model T100H High Range UV Fluorescence SO₂ analyzer uses the proven UV fluorescence principle and advanced electronics to allow accurate, dependable, continuous measurements for high concentration stack gas monitoring and other applications.

— With NumaView™ premium T Series software —

- Large, vivid, and durable color touchscreen display
- All other T Series instrument platform features
- Lifetime technical support by phone and email
- Standard two-year warranty
- Optional internal O₂ or CO₂ sensor



T100H Specifications

■ Ranges	Min: 0 - 10 ppm full scale Max: 0 - 5,000 ppm full scale (selectable with dual range supported)
■ Measurement Units	ppm, mg/m ³ (selectable)
■ Zero Noise	0.1 ppm (RMS)
■ Span Noise	< 1% of reading (RMS) above 10 ppm
■ Lower Detectable Limit	< 0.2 ppm
■ Zero Drift	< 1 ppm/24 hours
■ Span Drift	< 0.5% of full scale/24 hours
■ Response Time	< 40 seconds to 95%
■ Linearity	1% of full scale
■ Precision	0.5% of reading above 10 ppm
■ Sample Flow Rate	700 cc/min ±10%
■ Power Requirements	100V-120V, 220V-240V, 50/60 Hz
■ Analog Output Ranges	10V, 5V, 1V, 0.1V (selectable)
■ Recorder Offset	±10%
■ Included I/O	1 x Ethernet: 10/100Base-T 2 x RS232 (300-115,200 baud) 2 x USB device ports 8 x opto-isolated digital outputs 6 x opto-isolated digital inputs 4 x analog outputs
■ Optional I/O	1 x USB com port 1 x RS485 4 x digital alarm outputs Multidrop RS232 3 x 4-20mA current outputs
■ Operating Temperature Range	5 - 40°C
■ Dimensions (HxWxD)	7" x 17" x 23.5" (178 x 432 x 597 mm)
■ Weight	Analyzer: 31 lbs (16 kg) External pump: 15 lbs (7 kg)

Specifications subject to change without notice.
All specifications are based on constant conditions.



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(DCN 8120) 07.29.19



The Model T200H High Range Chemiluminescence NO/NO₂/NO_x Analyzer



The Model T200H High Range NO / NO₂ / NO_x analyzer uses the proven chemiluminescence detection principle and advanced electronics to allow accurate, dependable, continuous measurements for high concentration stack gas monitoring and other applications. A high-efficiency stainless steel thermal NO₂ converter provides durable and consistent operation under the harshest conditions (cold converter options also available). The T200H may be fitted with an optional, internal paramagnetic O₂ sensor or an infrared absorption CO₂ sensor, reducing integration and operating costs.

— With NumaView™ premium T Series software —

- Large, vivid, and durable color touchscreen display
- All other T Series instrument platform features
- Internal stainless steel converter
- Optional external single or dual converter
- Lifetime technical support by phone or email
- Standard two-year warranty
- Optional internal moisture separator
- Optional internal CO or CO₂ sensor



T200H Specifications

■ Ranges	Min: 0 - 5 ppm full scale Max: 0 - 5,000 ppm full scale (selectable, independent NO, NO ₂ , NO _x ranges with dual range supported)
■ Measurement Units	ppm, mg/m ³ (selectable)
■ Zero Noise	< 20 ppb (RMS)
■ Span Noise	< 0.2% of reading (RMS) above 20 ppm
■ Lower Detectable Limit	< 40 ppb
■ Zero Drift	< 20 ppb/24 hours
■ Span Drift	< 0.5% of reading/24 hours
■ Response Time	< 80 seconds to 95% (in switching mode)
■ Linearity	1% of full scale
■ Precision	0.5% of reading above 5 ppm
■ Sample Flow Rate	290 cc/min ±10%
■ Power Requirements	100V-120V, 220V-240V, 50/60 Hz, Typical power 160W
■ Analog Output Ranges	10V, 5V, 1V, 0.1V (selectable)
■ Recorder Offset	±10%
■ Included I/O	1 x Ethernet 10/100Base-T 2 x RS232 (300-115,200 baud) 2 x USB device ports 8 x opto-isolated digital outputs 6 x opto-isolated digital inputs 4 x analog outputs
■ Optional I/O	1 x USB com port 1 x RS485 4 x digital alarm outputs Multidrop RS232 3 x 4-20mA current outputs
■ Operating Temperature Range	5 - 40°C
■ Dimensions (HxWxD)	7" x 17" x 23.5" (178 x 432 x 597 mm)
■ Weight	Analyzer: 40 lbs (18 kg) External pump: 22 lbs (10 kg)

Specifications subject to change without notice.
All specifications are based on constant conditions



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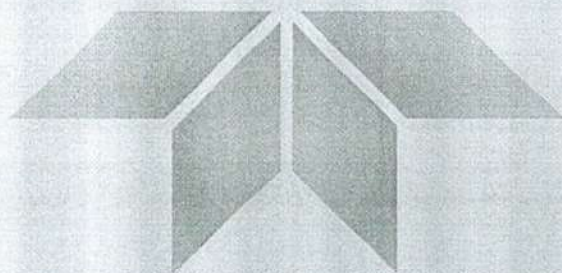
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(DCN 8120) 07.15.19





The Model T300M Mid-Range Gas Filter Correlation CO Analyzer



Using IR Gas Filter Correlation technology, the Model T300M Mid-Range Gas Filter Correlation CO analyzer produces excellent zero and span stability, high signal-to-noise ratio, and provides advanced electronics to allow accurate, dependable, continuous measurements for mid-range stack gas monitoring or other applications.

— Available with NumaView™ premium T Series software —

- Large, vivid, rugged, durable touchscreen display
- All other T Series instruments it offers features
- Lifetime technical support by phone and email
- Standard two-year warranty and five years on the GFC wheel



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T300M Specifications

■ Ranges	Min: 0 - 5 ppm full scale Max: 0 - 5,000 ppm full scale (selectable, dual range supported)
■ Measurement Units	ppm, mg/m ³ (selectable)
■ Zero Noise	< 0.1 ppm (RMS)
■ Span Noise	< 0.5% of reading (RMS) above 20 ppm
■ Lower Detectable Limit	0.2 ppm
■ Zero Drift	< 0.5 ppm/24 hours
■ Span Drift	< 0.5% of reading/24 hours
■ Lag Time	10 seconds
■ Rise/Fall Time	< 60 seconds to 95%
■ Linearity	±1% of full scale
■ Precision	1% of reading
■ Sample Flow Rate	800 cm ³ /min ±10%
■ Power Requirements	100V - 120V, 220V - 240V, 50/60 Hz
■ Analog Output Ranges	10V, 5V, 1V, 0.1V (selectable)
■ Recorder Offset	±10%
■ Included I/O	1 x Ethernet: 10/100Base-T 2 x RS232 (300-115,200 baud) 2 x USB device ports 8 x opto-isolated digital outputs 6 x opto-isolated digital inputs 4 x analog outputs
■ Optional I/O	1 x USB com port 1 x RS485 8 x analog inputs (0-10V, 12-bit) 4 x digital alarm outputs Multidrop RS232 3 x 4-20mA current outputs
■ Operating Temperature Range	5 - 40°C
■ Dimensions (HxWxD)	7" x 17" x 23.5" (178 x 432 x 597 mm)
■ Weight	40 lbs (18.1 kg)

Specifications subject to change without notice.
All specifications are based on constant conditions.

NumaView® software is available as a no-charge option that must be specified at the time of purchase.



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EnviLab Co., Ltd. 540.540/1 Soi Bangkhoe 7 Bangkhoe Bangkok 10160
Tel : 02-802-3577-8 Fax: 02-802-1773 E-mail : info@evltesting.com



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TSP High Volume Sampler Calibration

Verification Report No.

SO2400035-E004 -TSP 01

<input type="checkbox"/> PM	<input checked="" type="checkbox"/> Onsite
Site: วัดเขาคันทรง	
UTM : 47P 735067 m E 1450922 m N	
Date: 8 Mar 24	
Sampler: ETSP#40	
Technical: Amonthep K.	
Recorder: ECRDCPR4169240	
Approval: Wisan R.	

CONDITIONS

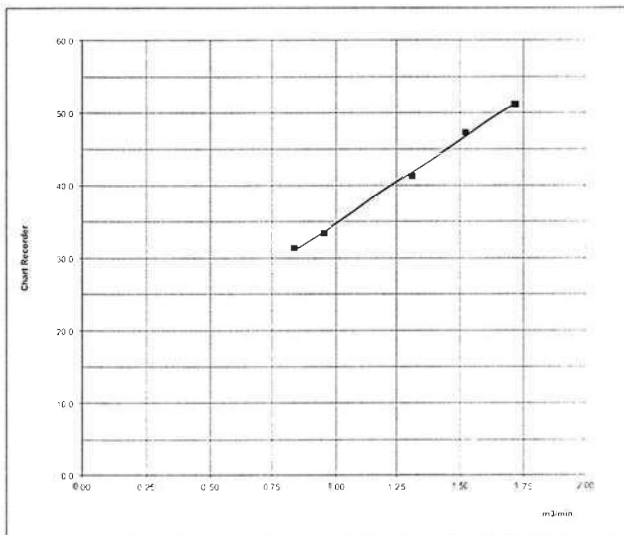
Barometric Press. (hPa): 1006.0	Corrected Pressure (mm Hg): 754.6
Temperature (deg C): 32.0	Temperature (deg K): 305.0
Average Press. (hPa): 1013.0	Corrected Avg.Press. (mm Hg): 759.8
Average Temp. (deg C): 30.0	Average Temp. (deg K): 303.0

CALIBRATION ORIFICE

Brand: Tisch Environmental, Inc	Qstd Slope: 2.03736
Model: TE-5025A	Qstd Intercept: -0.03733
Serial#: 759	Date Certified: 9 Feb 24

CALIBRATIONS

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION Slope = 22.9285 Intercept = 11.8814 Corr. coeff. = 0.9988 # of Observations: 5 Range of Chart at 1.1 - 1.7 m3/min. 38 51
1	12.37	1.719	52.0	51.22	
2	9.68	1.522	48.0	47.28	
3	7.12	1.308	42.0	41.37	
4	3.75	0.954	34.0	33.49	
5	2.89	0.840	32.0	31.52	



Calibrated by :

(Wutipong Klangrapun)
8 March 2024

Approved by :

(Wisan Ritthikamon)
8 March 2024

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Environmental responsibility with accuracy measurement

FE-MNT-29 Rev.00.01/08/63



บริษัท เอ็นวิล เทสติ้ง จำกัด 540.540/1 ถนนบางนา 7 แขวงบางนาแค เขตบางนา กรุงเทพมหานคร 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 Analytical Instrument

TSP High Volume Sampler Calibration

Verification Report No.

SQ2400035-E004 -TSP 02

☐ PM ☒ Onsite

Site: บ้านนาเกลือ

UTM : 47P 735067 m E 1450922 m N

Sampler: NTSP#21

Recorder: ECRANG15315224

Date: 8 Mar 24

Technical: Amonthep K.

Approval: Wisan R.

CONDITIONS

Barometric Press. (hPa): 1006.0

Temperature (deg C): 32.0

Average Press. (hPa): 1013.0

Average Temp. (deg C): 30.0

Corrected Pressure (mm Hg): 754.6

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#: 759

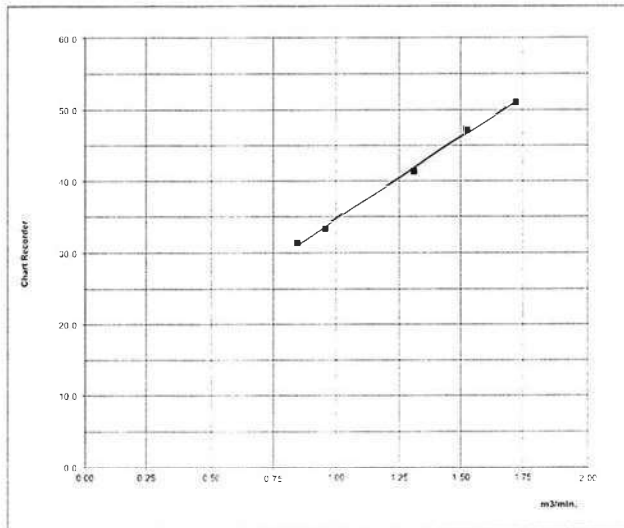
Qstd Slope: 2.03736

Qstd Intercept: -0.03733

Date Certified: 9 Feb 24

CALIBRATIONS

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION Slope = 27.1920 Intercept = 5.6525 Corr. coeff. = 0.9956 # of Observations: 5 Range of Chart at 1.1 - 1.7 m3/min: 37 52
1	12.02	1.694	52.0	51.22	
2	9.25	1.489	48.0	47.28	
3	7.32	1.326	42.0	41.37	
4	4.02	0.988	32.0	31.52	
5	2.98	0.853	30.0	29.55	



Calibrated by :

(Wuttipong Klangrapun)
8 March 2024

Approved by :

(Wisan Ritthikamon)
8 March 2024

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Environmental responsibility with accuracy measurement

EE-MNT-29 Rev.00 01/08/61



บริษัท เอ็นวิลแล็บ จำกัด: 510540/1 ซอยบางกะปิ 7 แขวงบางกะปิ เขตห้วยขวาง กรุงเทพฯ 10160
Envilab Co., Ltd.: 510540/1 Soi Bangkapi 7, Bangkapi, Bangkok 10160
Tel : 02-802-3577-8 Fax: 02-802-3773 E-mail : info@evltesting.com



PM10 High Volume Sampler Calibration

Verification Report No.
SO2400035-E004 -PM 01

☒ PM ☐ Onsite

Site: วัดเขาคันทรง
UTM : 47P 735067 m E 1450922 m N
Sampler: EPM#45
Recorder: ECRDS01618124

Date: 8 Mar 24
Technical: Amonthep K.
Approval: Wisan R.

CONDITIONS

Barometric Press. (hPa): 1006.0 Corrected Pressure (mm Hg): 754.6
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#: 759

Slope: 1.27576
Intercept: -0.02337
Date Certified: 18 Jan 23

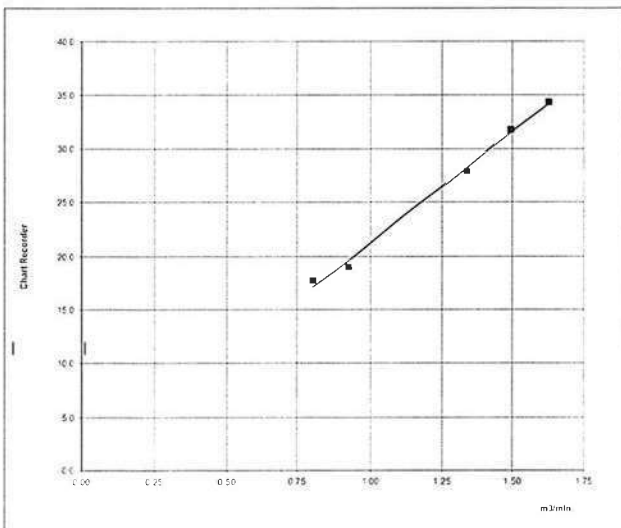
CALIBRATIONS

Plate or Test #	H2O (in)	Qa (m3/min)	I (chart)	IC (corrected)
1	10.37	1.623	54.0	34.33
2	8.79	1.496	50.0	31.79
3	7.01	1.338	44.0	27.97
4	3.28	0.921	30.0	19.07
5	2.48	0.803	28.0	17.80

LINEAR REGRESSION

Slope = 20.7261
Intercept = 0.5736
Corr. coeff. = 0.9981
SFR = 1.145
SSP = 38.24
of Observations: 5

Range of Chart at SFR $\pm 10\%$
35
41



Calibrated by :

(Wuttipong Klangprapun)
8 March 2024

Approved by :

(Wisan Ritthikamon)
8 March 2024

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Environmental responsibility with accuracy measurement

TE-MNT-29 Rev 00 01/08/63



บริษัท เอวิลเทสติ้ง จำกัด : 580/547 หมู่ 5 ต.บางพลีใหญ่ อ.บางพลี จ.สมุทรปราการ 10560
EnviLab Co., Ltd. : 580/547/1 ต.บางพลีใหญ่ อ.บางพลี จ.สมุทรปราการ 10560
Tel : 02-802-3577-8 / Fax: 02-802-3773 / E-mail : info@evltesting.com



EnviLab & EnviLab Such Information

PM10 High Volume Sampler Calibration

Verification Report No.

SO2400035-E004 -PM 02

<input type="checkbox"/> PM	<input checked="" type="checkbox"/> Onsite
Site: บ้านบางเลน	
UTM : 47P 735067 m E 1450922 m N	
Date: 8 Mar 24	
Sampler: NPM#18	
Technical: Amonthep K.	
Recorder: ECRDS01618125	
Approval: Wisan R.	

CONDITIONS

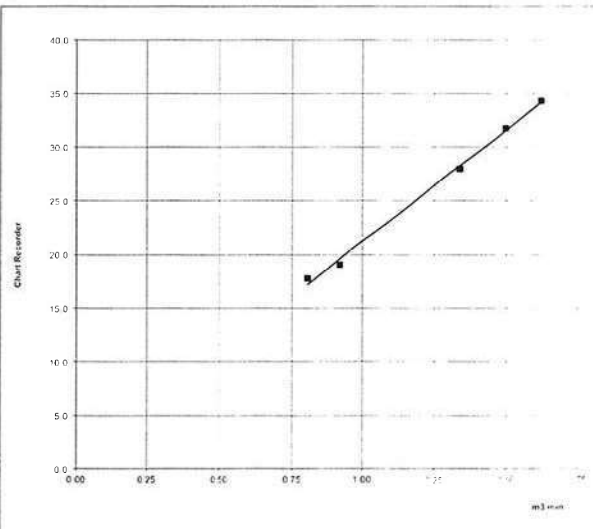
Barometric Press. (hPa): 1004.0	Corrected Pressure (mm Hg): 753.1
Temperature (deg C): 34.0	Temperature (deg K): 307.0
Average Press. (hPa): 1013.0	Corrected Avg. Press. (mm Hg): 759.8
Average Temp. (deg C): 30.0	Average Temp. (deg K): 303.0

CALIBRATION ORIFICE

Brand: Tisch Environmental, Inc	Slope: 1.27576
Model: TE-5025A	Intercept: -0.02337
Serial#: 759	Date Certified: 18 Jan 23

CALIBRATIONS

Plate or Test #	H2O (in)	Qa (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION	
1	10.23	1.619	52.0	33.20	Slope =	19.6197
2	8.74	1.498	50.0	31.92	Intercept =	1.4865
3	6.99	1.342	42.0	26.82	Corr. coeff. =	0.9902
4	3.46	0.949	30.0	19.15	SFR =	1.155
5	2.36	0.787	28.0	17.88	SSP =	37.82
					# of Observations:	5
					Range of Chart at SFR ±10%	35 40



Calibrated by :
(Wuttipong Klangprapun)
8 March 2024

Approved by :
(Wisan Ritthikamon)
8 March 2024

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Environmental responsibility with accuracy measurement

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

ENV-PM10-29 Rev.00.01/06/61

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)	$\sqrt{\Delta H \left(\frac{Ta}{Pa} \right)}$ (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= $\Delta Vol \left(\frac{Pa - \Delta P}{Pstd} \right) \left(\frac{Tstd}{Ta} \right)$	Va= $\Delta Vol \left(\frac{Pa - \Delta P}{Pa} \right)$
Qstd= $Vstd / \Delta Time$	Qa= $Va / \Delta Time$
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= $1/m \left(\left(\sqrt{\Delta H \left(\frac{Ta}{Pa} \right)} \right) - b \right)$

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



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

536 ซอยนาคราช 7 แขวงบางนาแค เขตภาษีเจริญ กรุงเทพฯ 10150 E-Box: 02-402-3325 E-mail: info@neediss.com
TEL: 02-502-5740 Fax: 02-402-3325 Line: @neediss.com



SO2 Analyzer Verification Test Report

Calibration Report No.: AP-S6703011

Calibrated Date: 1-Mar-24

☒ PM ☐ Onsite

Instruments Information

Page:1/2

Analyzer Type: SO2 Analyzer Model: T100	Manufacturer API S/N: ESOAIT10002033
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Calibration System

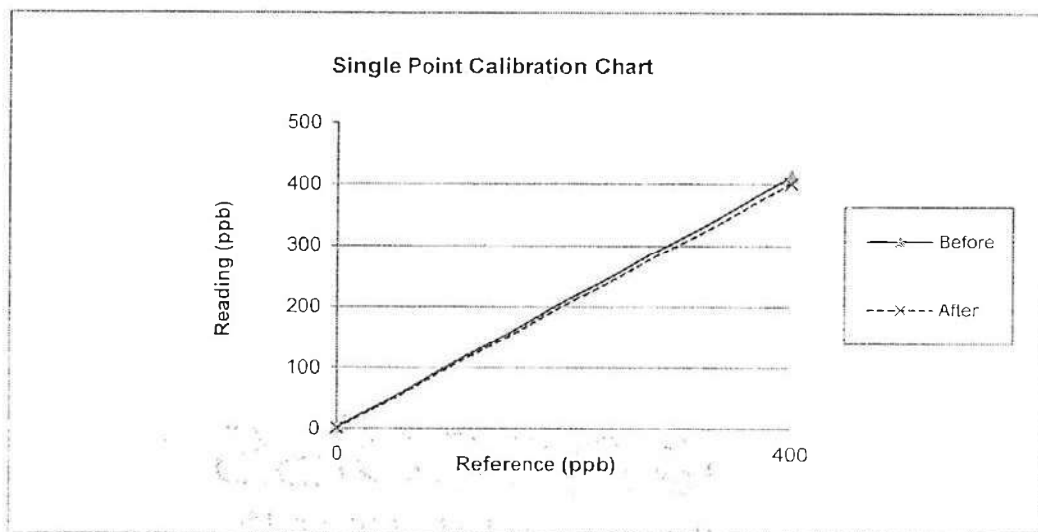
Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792 ZERO AIR Generator ZAG7001 S/N: 644	NOx Conc 45.50 PPM NO Conc 45.50 PPM SO2 Conc 45.59 PPM CO Conc 4500 PPM Expire Date: Mar 31,2026 EB0160267

Environment: Temperature 24.8 °C

Humidity: 58 %RH

Calibration Report

Status	Zero			Span		
	Reference (ppb)	Reading (ppb)	Drift (ppb)	Reference (ppb)	Reading (ppb)	Drift%
Before	0.0	2.5	2.5	400.0	412.0	1.5
After	0.0	0.7	0.7	400.0	401.0	0.1





S02 Analyzer Verification Test Report

Calibration Report No.: AP-S6703011

Calibrated Date: 1-Mar-24

☒ PM ☐ Onsite

Page:2/2

Test Function Value	Norminal range	Unit	Before	After	Note
Date	1-Mar-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)	Degree C	50	50	
BOX TEMP	20-40	Degree C	34.1	32.7	
PMT TEMP	7 (+/-1)	Degree 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	2.5	0.7	
Span Gas (400 PPB)	400	ppb	412.0	401.0	± 5% of Range

Calibrate By :



Sirirat Poonlak

Date:

1-Mar-24

Approve By :



Sarawut Keawsrinal

Date:

1-Mar-24



SO2 Analyzer Verification Test Report

Calibration Report No.: ES-S6703007

Calibrated Date: 1-Mar-24

☒ PM ☐ Onsite

Instruments Information

Page:1/2

Analyzer Type: SO2 Analyzer Model: AF22e	Manufacturer: Environnement SA., France S/N: NSOESA32E453
---	--

Calibration System

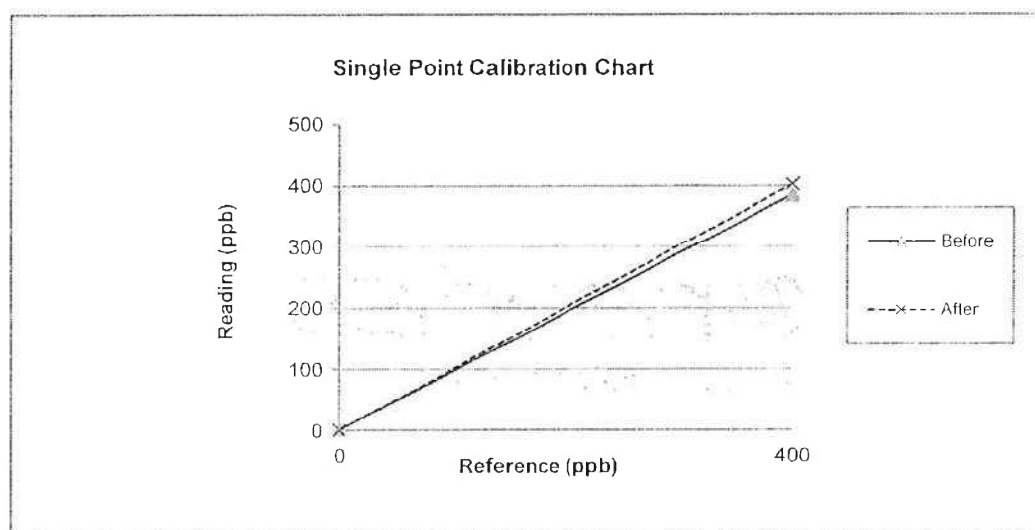
Calibrator Unit	Standard Gas
Dilutor Model: ESA MGC101 S/N: 792 ZERO AIR Generator: ZAG7001 S/N: 644	NOx Conc: 45.50 PPM NO Conc: 45.50 PPM SO2 Conc: 45.59 PPM CO Conc: 4500 PPM Expire Date: Mar 31,2026 EB0160267

Environment: Temperature: 24.8 °C

Humidity: 60 %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	386.0	-1.8
After	0.0	0.7	0.7	400.0	402.6	0.3





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Neediss Supply Instrument Co., Ltd.

536 ซอยรามคำแหง 7 แขวงรามคำแหง เขตรามคำแหง กรุงเทพมหานคร 10123 SO2 Sol Bangkok 7 Bangkok Bangkok Bangkok
Tel. 02-202-6760-2 Fax. 02-202-3938 E-mail: neediss.com



SO2 Analyzer Verification Test Report

Calibration Report No.: ES-S6703007

Calibrated Date: 1-Mar-24

☒ PM ☐ Onsite

Page:2/2

Analyzer Signal Values					
Date	1-Mar-24	Time	13:11:00		
Power Supplies					
Option	0.00	mV	+5 V Sensor	5	V
+4 V	4068	mV	+3.3 V	3.3	V
+24 V	24.1	V	+12 V	11.9	V
+5 V	5	V	I UV lamp	44.3	mA
I+24 V	1.2	A			
Optical Bench					
Dark UV sig.	0	mV	Dark PM sig.	88	mV
UV ref.	0	mV	PM ref.	0	mV
UV sig.	24.1	mV	PM sig.	138.6	mV
Ref.ratio	0		Meas ratio	0.34	
Mean sig.	0.7		Raw trend	11	
Raw sig.	24.4	ppb	inst.meas.	22.8	ppb
I UV Lamp	44.7	mA	HV PM	2626.80	mV
Sample					
Internal Temp.	31.9	deg.C	Chamber T.	50	deg.C
Gas Pr.	970	hPa	Pump Pr.	355.5	hPa
Flow	18.7	l/h			

Calibrate By : Sirirat Poonlak

Date: 1-Mar-24

Approve By : Sarawut Keawsrinual

Date: 1-Mar-24

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Neediss Supply Instrument Co., Ltd



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

330 หมู่ 7 แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10110
Tel. 02-562-5981-2 Fax. 02-562-5210 E-mail: neediss@neediss.com



NOx Analyzer Verification Test Report

Calibration Report No.: AP-N6703012

Page:1/1

Calibrated Date: 1-Mar-24

☒ PM ☐ Onsite

Instruments Information

Analyzer Type: NO/NO2/NOx Analyzer Model: 200E	Manufacturer API S/N: ENOAI200E03407
---	---

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 24.5 °C

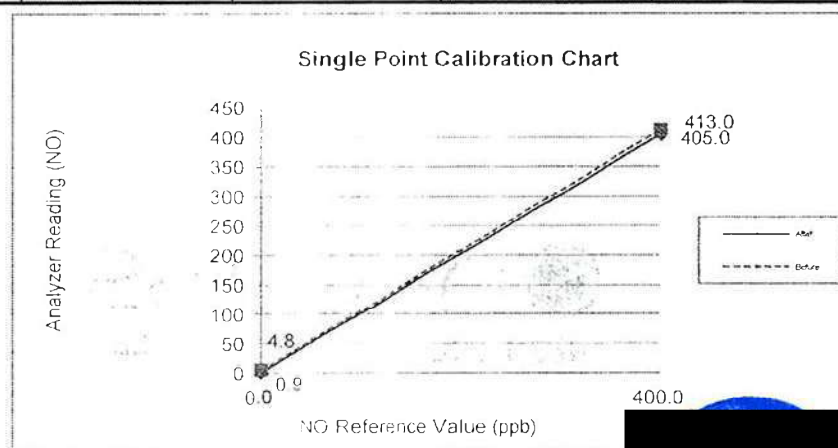
Humidity: 54 %RH

Calibration Check (Before adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	3.6	0.0	3.6	408.0	400.0	1.0
NO ₂	1.2	0.0	1.2	5.0	0.0	0.6
NOx	4.8	0.0	4.8	413.0	400.0	1.6

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	403.0	400.0	0.4
NO ₂	0.3	0.0	0.3	2.0	0.0	0.2
NOx	0.9	0.0	0.9	405.0	400.0	0.6





NOx Analyzer Verification Test Report

Calibration Report No.: AP-N6703012

Page:1/1

Calibrated Date: 1-Mar-24

☒ PM
 ☐ Onsite

Page:2/2

Test Function Value	Normal range	Unit	Before	After	Note
Date	1-Mar-24				
Time	10:10				
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	511	532	
Ozone Flow	60-90	cc/min	80	80	
PMT Detector	0-5000	mV	27.4	16.4	
AZERO	-20-150	mV	54.2	54.2	
HVPS	400-900 constant	V	819	819	
DCPS	2500 +/- 200	mV	-	-	
RCELL TEMP	50 +/- 1	Dreegee C	50	50	
BOX TEMP	20-35	Dreegee C	33.7	32.9	
PMT TEMP	7 +/- 1	Dreegee C	7.1	7.1	
IZS TEMP	50 +/- 4	Dreegee C	-	-	
MOLY Temp	315 +/- 5	Dreegee C	314.4	315.0	
RCEL PRES	4-10 contant	IN-Hg-A	10	10	
SAMP PRES	20-30 contant	IN-Hg-A	29.0	29.4	
NO Slope	1 +/- 0.3		0.820	0.801	
Nox Slope	1 +/- 0.3		0.848	0.813	
NO Offset	-10 to + 150	mV	10.2	15.3	
NOx Offset	-10 to + 150	mV	-2.0	-3.4	
Span and Cal Values					
Zero Value	NO	0	ppb	3.6	0.6
	NOx	0	ppb	4.8	0.9
Span Value	NO	400	ppb	408.0	403.0
	NOx	400	ppb	413.0	405.0

Calibrate By :

Sirirat Poonlak

Date:

Sirirat Poonlak
1-Mar-24

Approve By :

Sarawut Keawsrinual

Date:

Sarawut Keawsrinual
1-Mar-24



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Neediss Supply Instrument Co., Ltd.
533 ซอยวิเศษ 7 แขวงคลองเตย เขตคลองเตย กรุงเทพฯ 10110 533 Soi Rangkhos 7 Bangkhos Rangkhos Bangkok
Tel. 02-802-8980 Fax. 02-802-8986



NOx Analyzer Verification Test Report

Calibration Report No.: AP-N6703010

Page:1/1

Calibrated Date: 1-Mar-24

☒ PM ☐ Onsite

Instruments Information

Analyzer Type: NO/NO2/NOx Analyzer Model: 200A	Manufacturer API S/N: ENOAI200A02243
---	---

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 24.6 °C

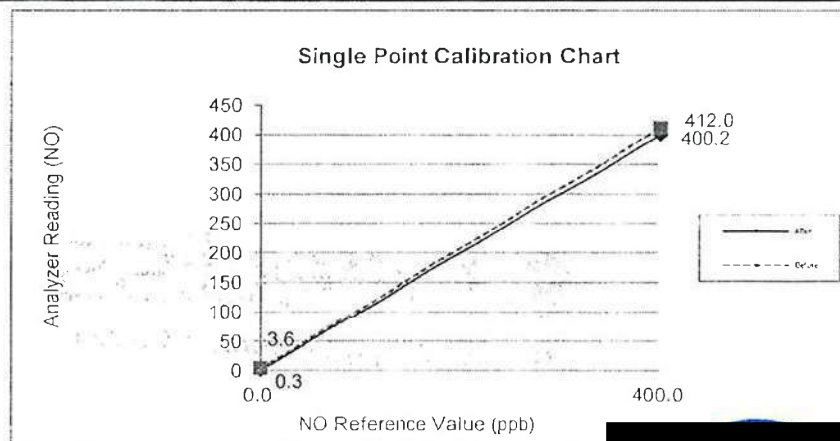
Humidity: 55 %RH

Calibration Check (Before adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	2.7	0.0	2.7	410.0	400.0	1.2
NO ₂	0.9	0.0	0.9	2.0	0.0	0.2
NOx	3.6	0.0	3.6	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	0.2	0.0	0.2	400.1	400.0	0.0
NO ₂	0.1	0.0	0.1	0.1	0.0	0.0
NOx	0.3	0.0	0.3	400.2	400.0	0.0





NOx Analyzer Verification Test Report

Calibration Report No.: AP-N6703010

Page:1/1

Calibrated Date: 1-Mar-24

☒ PM ☐ Onsite

Page:2/2

Test Function Value	Normal range	Unit	Before	After	Note
Date	1-Mar-24				
Time	10:10				
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	494	
Ozone Flow	60-90	cc/min	74	77	
PMT Detector	0-5000	mV	51	26	
AZERO	-20-150	mV	53.3	33.3	
HVPS	400-900 constant	V	821	821	
DCPS	2500 +/- 200	mV	2556	2556	
RCELL TEMP	50 +/- 1	Dreegee C	50	50	
BOX TEMP	20-35	Dreegee-C	30.2	32.8	
PMT TEMP	7 +/-1	Dreegee C	7.5	7.5	
IZS TEMP	50 +/- 4	Dreegee C	-	-	
MOLY Temp	315 +/- 5	Dreegee C	315.0	314.5	
RCEL PRES	4-10 constant	IN-Hg-A	8.8	8.8	
SAMP PRES	20-30 constant	IN-Hg-A	30.2	31.8	
NO Slope	1 +/- 0.3		0.820	0.822	
Nox Slope	1 +/- 0.3		0.854	0.858	
NO Offset	-10 to + 150	mV	17.8	17.8	
NOx Offset	-10 to + 150	mV	5.0	5.0	
Span and Cal Values					
Zero Value	NO	0	ppb	2.7	0.2
	NOx	0	ppb	3.6	0.3
Span Value	NO	400	ppb	410.0	400.1
	NOx	400	ppb	412.0	400.2

Calibrate By :



Sirirat Poonlak
1-Mar-24

Approve By :



Sarawut Keawsrinual
1-Mar-24

 **neediss**
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



[Signature]
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 2 October, 2023

Certification No. 340/23

Page : 1 of 6

Object : เครื่องมือตรวจวัดอุณหภูมิตามวิทยา

Manufacturer : DYACON

Type : Data Logger CM-1

Serial No. : 130129 ID No. : NWSDCMS1200129

Customer : Neediss Supply Instrument Co., Ltd.
536 Soi Bangkhao 7, Bangkhao, Bangkhao,
Bangkok 10160, Thailand.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1008.7 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

STANDARD BAROMETER : Digital Barometer Vaisala Type RTB220 No. V1220015

Calibrated by : *Watcharapol*

Signed :

Mr. Watcharapol Subwat

Mr. Pisood Pomsut

Mechanical Engineer

(Authorised Signatory)

for the Chief

Sub-Standard Instrumentation



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Sensor model

NWSDCMS1200129

Certification No. 340/23

2 October, 2023

Serial No. 1198

Page : 2 of 6

Standard Ultrasonic Anemometer	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacuum	Velocity	Velocity	Correction
m/sec	inches H ₂ O	inches H ₂ O	m/sec	m/sec	m/sec
1.00	-	-	-	1.0	0.00
3.02	-	-	-	2.9	0.12
5.00	-	-	-	5.0	0.00
7.04	-	-	-	6.9	0.14
9.02	-	-	-	9.0	0.02
11.01	-	-	-	11.0	0.01
13.01	-	-	-	13.0	0.01
15.01	-	-	-	15.0	0.01
17.02	-	-	-	17.0	0.02
20.02	-	-	-	20.0	0.02

Wind Aloft Plotting Board.	
US.DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRECTION	TESTED WIND DIRECTION
0	0
90	91
180	180
270	272

Calibrated by :

Watcharapol

Mr. Watcharapol Subwat

Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau





THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Sensor Pressure Model TPH-1 C

Serial No. 6235

Certification No. 340/23

2 October, 2023

Page : 3 of 6

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	
1005.63	1005.30	0.33
1006.25	1005.90	0.35
1006.22	1005.90	0.32
1006.54	1006.20	0.34
1006.88	1006.50	0.38
1007.36	1007.00	0.36
1007.58	1007.20	0.38
1007.52	1007.20	0.32
1005.60	1005.30	0.30
1005.84	1005.50	0.34
1006.28	1005.90	0.38
1006.60	1006.30	0.30
1007.07	1006.70	0.37
1007.26	1006.90	0.36
1007.38	1007.00	0.38
1005.50	1005.20	0.30
1005.83	1005.50	0.33
1006.55	1006.20	0.35
1007.31	1007.00	0.31
1007.01	1006.70	0.31

Average

0.34

Calibrated by :

Wacharapol

Mr. Wacharapol Subwat

Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau





THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Sensor Temperature Model TPH-1 C

Certification No. 340/23

2 October, 2023

Serial No. 6235

Page : 4 of 6

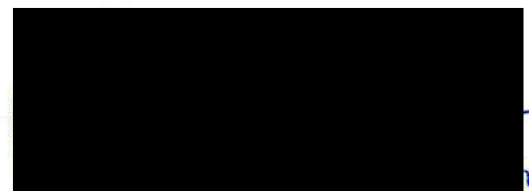
Standard Temp. °C	Temperature Sensor Reading	
	Reading	Correction
	°C	°C
45.2	45.2	0.0
31.1	31.1	0.0
15.8	15.9	-0.1

Calibrated by :

Watcharapol

Mr. Watcharapol Subwat

Mechanical Engineer





THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Sensor Humidity Model TPH-1 C

Certification No. 340/23

2 October, 2023

Serial No. 6235

Page : 5 of 6

Standard Humidity % R.H.	Relative Humidity Sensor Reading	
	Reading	Correction
	% R.H.	% R.H.
86.2	85.6	0.6
62.4	62.1	0.3
45.6	45.4	0.2

Calibrated by :

Watcharapol

Mr. Watcharapol Subwat

Mechanical Engineer





Date of Issue 2 October, 2023

Certification No. 340/23

Page: 6 of 6

ใบรับรอง

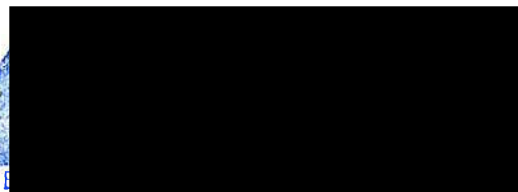
หนังสือฉบับนี้ขอรับรองว่า เครื่องวัดฝน ยี่ห้อ Davis Instruments แบบ TIPPING
BUCKET Product No. 7342.026 Mfg. Code. NWSDCMS1200129 ทำการสอบเทียบกับแก้ววัด
ฝนแบบแก้วตวง GAUGE DIAMETER 8.0 INCHES, NEGRETTI & ZAMBRA LONDON
No. 71082 และสามารถนำไปใช้ได้ มีค่าถูกต้องตามรายละเอียดของเครื่องมือ (0.2 mm/TIP)



ลงชื่อ..... วิธสง วัชรพล

(นายวัชรพล ทรัพย์วัฒน์)

วิศวกรชำนาญการ





บริษัท เอ็นวิลเล็บ จำกัด 540,540/1 ซอยบางเขน 7 แขวงบางพลัด เขตบางพลัด กรุงเทพฯ 10160
Envilab Co., Ltd. 540,540/1 Soi Bangkhoe 7 Bangkhoe Bangkok 10160
Tel : 02-802-3577-8 Fax: 02-802-3713 E-mail: info@evltesting.com



Envilab & Evltest Apply Instrument

Verification Test Report

Report No.:

SO2400035-E004 -SLM 01

☐ PM

☒ Onsite UTM :

47P 733913 m E 1449218 m N

Calibrated Date: 8 March 2024

Site : ริมรั้วโครงการด้านทิศเหนือ

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 44

Serial : 2197

Environment: Temperature 25 °C Humidity 72 %RH

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

Serial No.1351075

Date of Calibration : 16 March 2023

Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.78	93.57	-0.21	93.78

Calibrated By:

(Wuttipong Klangrapun)

Date:

8 March 2024

Approve By:

(Wisan Ritthikamon)

Date:

8 March 2024

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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 & Evltest Supply Instrument

Verification Test Report

Report No.:

SO2400035-E004 -SLM 02

☐ PM

☒ Onsite UTM :

47P 733983 m E 1448433 m N

Calibrated Date: 8 March 2024

Site : รื่นรู้โครงการด้านทิศใต้

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 44

Serial : 1969

Environment: Temperature 25 °C Humidity 72 %RH

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

Serial No.1351075

Date of Calibration : 16 March 2023

Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.78	93.52	-0.26	93.78

Calibrated By:

(Wutipong Klangprapun)

Date:

8 March 2024

Approve By:

(Wisan Ritthikamon)

Date:

8 March 2024

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



Envilab Co., Ltd. Support Department

Verification Test Report

Report No.:

SO2400035-E004 -SLM 03

☐ PM

☒ Onsite UTM :

47P 734018 m E 1448814 m N

Calibrated Date: 8 March 2024

Site : ริมรั้วโครงการด่านทิศตะวันออก

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 44

Serial : 2205

Environment: Temperature 25 °C Humidity 72 %RH

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

Serial No.1351075

Date of Calibration : 16 March 2023

Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.78	93.59	-0.19	93.78

Calibrated By:

(Wuttipong Klangrapun)

Date:

8 March 2024

Approve By:

(Wisan Ritthikamon)

Date:

8 March 2024

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Envilab & Hensley Supply Instruments

Verification Test Report

Report No.:

SO2400035-E004 -SLM 04

☐ PM

☒ Onsite UTM :

47P 733746 m E 1448779 m N

Calibrated Date: 8 March 2024

Site : ริมรั้วโครงการด้านทิศตะวันตก

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 44

Serial : 1970

Environment: Temperature 25 °C Humidity 72 %RH

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

Serial No.1351075

Date of Calibration : 16 March 2023

Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.78	93.56	-0.22	93.78

Calibrated By:

(Wuttipong Klangrapun)

Date:

8 March 2024

Approve By:

(Wisan Ritthikamon)

Date:

8 March 2024

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Envilab & Evltest Supply Installation

Verification Test Report

Report No.:

SO2400035-E004 -SLM 05

☐ PM

☒ Onsite UTM :

47P 733308 m E 1448684 m N

Calibrated Date: 8 March 2024

Site : บ้านมาบแสนสุข

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 45

Serial : 27

Environment: Temperature 25 °C Humidity 72 %RH

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

Serial No.1351075

Date of Calibration : 16 March 2023

Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.78	93.51	-0.27	93.78

Calibrated By:

(Wuttipong Klangprapun)

Date:

8 March 2024

Approve By:

(Wisan Ritthikamon)

Date:

8 March 2024

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0381

MTC No. EEL. BP. 70/0366

CALIBRATION CERTIFICATE

Submitted by : Envilab Co.,Ltd.

Address : 540, 540/1 Soi Bangkhae 7, 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/N 4106495.

7. Condenser Microphone Bruel&Kjaer 4180 S/N 2889871.

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

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

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

Date of Receipt : 14 Mar. 2023

Date of Calibration : 16 Mar. 2023

1/2

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

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

FM.BL.MTC.002 Rev.4

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Fax. (66) 0 2577 9009
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Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
Fax. (66) 0 2323 9165
E-mail : mtc@tistr.or.th

Office
196 Phatthanaburi Road, Chatuchak, Bangkok 10900



Office



บริษัท เอวิเทสติ้ง 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@evitestng.com



Envilab 8, Bangkhae 7, Bangkok 10160

Verification Test Report

Report No.:

SO2400035-E004 -PU 01

Calibrated Date: 12-Mar-24

Equipment: Air Sampling Pump

Manufacturer: Gillian

Model: HFS-513A

Serial or ID No. 16766

Environment: Temperature 25 °C Humidity 62 %RH

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

Serial No. 164578

Date of Calibration : 04 May 2023

Result of Test

Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
2000	1	1998.0	2000.2
	2	1999.0	
	3	2001.0	
	4	2002.0	
	5	2001.0	

Calibrated By:

Manutsanun Koomket

(Manutsanun Koomket)

Date:

12-Mar-24

Approve By:

Wisan Ritthikamon

(Wisan Ritthikamon)

Date:

12-Mar-24

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Envilab Co., Ltd. 540,540/1 Soi Bangkhoe 7 Bangkhoe Bangkok Bangkok 10150
Tel : 02-802-3577-8 Fax. 02-802-3773 E-mail : info@evltesting.com



Provider & Supplier Supply Instruments

Verification Test Report

Report No.:

SO2400035-E004 -PU 02

Calibrated Date: 12-Mar-24

Equipment: Air Sampling Pump

Manufacturer: Gillian

Model: HFS-113A

Serial or ID No. 6897

Environment: Temperature 25 °C Humidity 62 %RH

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

Serial No. 164578

Date of Calibration : 04 May 2023

Result of Test			
Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
2500	1	2501.0	2500.8
	2	2504.0	
	3	2498.0	
	4	2499.0	
	5	2502.0	

Calibrated By:

(Manutsanun Koomket)

Date:

12-Mar-24

Approve By:

(Wisan Ritthikamon)

Date:

12-Mar-24

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Envilab Co., Ltd. 540,540/1 Soi Bangkhoe 7 Bangkhoe Bangkhoe Bangkok 10160
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Envilab & Newline Supply Instrument

Verification Test Report

Report No.:

SO2400035-E004 -PU 03

Calibrated Date: 12-Mar-24

Equipment: Air Sampling Pump

Manufacturer: SKC

Model: Air Check 52

Serial or ID No. 08267

Environment: Temperature 25 °C Humidity 62 %RH

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

Serial No. 164578

Date of Calibration : 04 May 2023

Result of Test			
Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
200	1	197.0	200.4
	2	199.0	
	3	202.0	
	4	203.0	
	5	201.0	

Calibrated By: Manutsanun Koomket

(Manutsanun Koomket)

Date: 12-Mar-24

Approve By: Wisana Ritthikamon

(Wisana Ritthikamon)

Date: 12-Mar-24

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



(EnviLab & EnviLab App) Scan QR code

Verification Test Report

Report No.:

SO2400035-E004 -PU 04

Calibrated Date: 12-Mar-24

Equipment: Air Sampling Pump

Manufacturer: SKC

Model: Air Check 52

Serial or ID No. 15608

Environment: Temperature 25 °C Humidity 62 %RH

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

Serial No. 164578

Date of Calibration : 04 May 2023

Result of Test			
Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
1000	1	999.0	1000.6
	2	1003.0	
	3	1002.0	
	4	998.0	
	5	1001.0	

Calibrated By:

20/3/2567

(Manutsanun Koomket)

Date:

12-Mar-24

Approve By:

(Wisan Ritthikamon)

Date:

12-Mar-24

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Served A Higher Quality of Air

Verification Test Report

Report No.:

SO2400035-E004 -PU 05

Calibrated Date: 12-Mar-24

Equipment: Air Sampling Pump

Manufacturer: Gillian

Model: HFS-113A

Serial or ID No. 10510

Environment: Temperature 25 °C Humidity 62 %RH

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

Serial No. 164578

Date of Calibration : 04 May 2023

Result of Test			
Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
500	1	501.0	500.4
	2	502.0	
	3	497.0	
	4	499.0	
	5	503.0	

Calibrated By: 2012/24/1
(Manutsanun Koomket)

Date: 12-Mar-24

Approve By: [Signature]
(Wisan Ritthikamon)

Date: 12-Mar-24

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Product & Facilities Supply Instrument

Verification Test Report

Report No.:

SO2400035-E004 -PU 06

Calibrated Date: 12-Mar-24

Equipment: Air Sampling Pump

Manufacturer: Gillian

Model: HFS-113A

Serial or ID No. 0138

Environment: Temperature 25 °C Humidity 62 %RH

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

Serial No. 164578

Date of Calibration : 04 May 2023

Result of Test

Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
500	1	499.0	500.4
	2	498.0	
	3	501.0	
	4	503.0	
	5	501.0	

Calibrated By:

25/2/2566

(Manutsanun Koomket)

Date:

12-Mar-24

Approve By:

(Wisan Ritthikamon)

Date:

12-Mar-24

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Envilab & Evltest Supply Instruments

Verification Test Report

Report No.:

SO2400035-E004 -PU 07

Calibrated Date: 12-Mar-24

Equipment: Air Sampling Pump

Manufacturer: Gillian

Model: HFS-113A

Serial or ID No. 10513

Environment: Temperature 25 °C Humidity 62 %RH

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

Serial No. 164578

Date of Calibration : 04 May 2023

Result of Test			
Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
1000	1	998.0	1000.2
	2	997.0	
	3	1003.0	
	4	1001.0	
	5	1002.0	

Calibrated By: มนุสสันันท์ กุ่มกิต
(Manutsanun Koomket)

Date: 12-Mar-24

Approve By: วิสัน ฤทธิกามอน
(Wisan Ritthikamon)

Date: 12-Mar-24

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Envilab Co. Limited Supply Instruments

Verification Test Report

Report No.:

SO2400035-E004 -PU 08

Calibrated Date: 12-Mar-24

Equipment: Air Sampling Pump

Manufacturer: Gillian

Model: HFS-513A

Serial or ID No. 16768

Environment: Temperature 25 °C Humidity 62 %RH

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

Serial No. 164578

Date of Calibration : 04 May 2023

Result of Test			
Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
2000	1	1999.0	2000.6
	2	2003.0	
	3	2001.0	
	4	1998.0	
	5	2002.0	

Calibrated By:

(Manutsanun Koomket)

Date:

12-Mar-24

Approve By:

(Wisan Ritthikamon)

Date:

12-Mar-24

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Envilab - A Need-to-Know Laboratory

Verification Test Report

Report No.:

SO2400035-E004 -PU 09

Calibrated Date: 12-Mar-24

Equipment: Air Sampling Pump

Manufacturer: Gillian

Model: HFS-513A

Serial or ID No. 16767

Environment: Temperature 25 °C Humidity 62 %RH

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

Serial No. 164578

Date of Calibration : 04 May 2023

Result of Test			
Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
1700	1	1702.0	1700.6
	2	1703.0	
	3	1699.0	
	4	1698.0	
	5	1701.0	

Calibrated By:

มานุสนันท์

(Manutsanun Koomket)

Date:

12-Mar-24

Approve By:

วิสัน ฤทธิคามอน

(Wisan Ritthikamon)

Date:

12-Mar-24

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Envilab & Needles Supply Instrument

Verification Test Report

Report No.:

SO2400035-E004 -PU 10

Calibrated Date: 12-Mar-24

Equipment: Air Sampling Pump

Manufacturer: Gillian

Model: HFS-113A

Serial or ID No. 20236

Environment: Temperature 25 °C Humidity 62 %RH

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

Serial No. 164578

Date of Calibration : 04 May 2023

Result of Test			
Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
200	1	198.0	200.6
	2	199.0	
	3	203.0	
	4	201.0	
	5	202.0	

Calibrated By: Manutsanun Koomket
(Manutsanun Koomket)

Date: 12-Mar-24

Approve By: Wisani Riithukamon
(Wisani Riithukamon)

Date: 12-Mar-24

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Calibration & Periodic Supply Instrument

Verification Test Report

Report No.:

SO2400035-E004 -PU 01

Calibrated Date: 12-Mar-24

Equipment: Air Sampling Pump

Manufacturer: Gillian

Model: HFS-113A

Serial or ID No. 23346

Environment: Temperature 25 °C Humidity 62 %RH

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

Serial No. 164578

Date of Calibration : 04 May 2023

Result of Test

Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
200	1	198.0	200.2
	2	199.0	
	3	201.0	
	4	202.0	
	5	201.0	

Calibrated By: Manutsanun Koomket

(Manutsanun Koomket)

Date: 12-Mar-24

Approve By: Wisana Ritthikamon

(Wisana Ritthikamon)

Date: 12-Mar-24

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Envilab & Envilab Testing Services

Verification Test Report

Report No.:

SO2400035-E004 -PU 02

Calibrated Date: 12-Mar-24

Equipment: Air Sampling Pump

Manufacturer: SKC

Model: Air Check 52

Serial or ID No. 08201

Environment: Temperature 25 °C Humidity 62 %RH

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

Serial No. 164578

Date of Calibration : 04 May 2023

Result of Test			
Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
200	1	201.0	200.8
	2	204.0	
	3	198.0	
	4	199.0	
	5	202.0	

Calibrated By: Manutsanun Koomket
(Manutsanun Koomket)

Date: 12-Mar-24

Approve By: Wisarn Ritthikamon
(Wisarn Ritthikamon)

Date: 12-Mar-24

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Envilab & Envilab Society Thailand

Verification Test Report

Report No.:

SO2400035-E004 -PU 03

Calibrated Date: 12-Mar-24

Equipment: Air Sampling Pump

Manufacturer: Gillian

Model: HFS-513A

Serial or ID No. 16765

Environment: Temperature 25 °C Humidity 62 %RH

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

Serial No. 164578

Date of Calibration : 04 May 2023

Result of Test

Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
200	1	199.0	200.6
	2	202.0	
	3	201.0	
	4	198.0	
	5	203.0	

Calibrated By: มณีนุช คุ้มภัย

(Manutsanun Koomket)

Date: 12-Mar-24

Approve By: วิสัน ฤทธิคามอน

(Wisan Ritthikamon)

Date: 12-Mar-24

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Verification Test Report

Report No.:

SO2400082-E001 -PU 01

Calibrated Date: 12-Mar-24

Equipment: Air Sampling Pump

Manufacturer: Gillian

Model: HFS-513A

Serial or ID No. 16766

Environment: Temperature 25 °C Humidity 62 %RH

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

Serial No. 164578

Date of Calibration : 04 May 2023

Result of Test

Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
2000	1	1998.0	2000.2
	2	1999.0	
	3	2001.0	
	4	2002.0	
	5	2001.0	

Calibrated By: Manutsanun Koomket

(Manutsanun Koomket)

Date: 12-Mar-24

Approve By: Wisana Ritthikamon

(Wisana Ritthikamon)

Date: 12-Mar-24

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Verification Test Report

Report No.:

SO2400082-E001 -PU 02

Calibrated Date: 12-Mar-24

Equipment: Air Sampling Pump

Manufacturer: Gillian

Model: HFS-113A

Serial or ID No. 6897

Environment: Temperature 25 °C Humidity 62 %RH

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

Serial No. 164578

Date of Calibration : 04 May 2023

Result of Test			
Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
2500	1	2501.0	2500.8
	2	2504.0	
	3	2498.0	
	4	2499.0	
	5	2502.0	

Calibrated By: Manutsanun Koomket
(Manutsanun Koomket)

Date: 12-Mar-24

Approve By: Wisarn Ritthikamon
(Wisarn Ritthikamon)

Date: 12-Mar-24

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Envilab Co., Ltd. (4-0007) (10160)

Verification Test Report

Report No.:

SO2400082-E001 -PU 03

Calibrated Date: 12-Mar-24

Equipment: Air Sampling Pump

Manufacturer: SKC

Model: Air Check 52

Serial or ID No. 08267

Environment: Temperature 25 °C Humidity 62 %RH

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

Serial No. 164578

Date of Calibration : 04 May 2023

Result of Test

Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
200	1	197.0	200.4
	2	199.0	
	3	202.0	
	4	203.0	
	5	201.0	

Calibrated By: มณัฐมน โกมกิต

(Manutsamun Koomket)

Date: 12-Mar-24

Approve By: วิสาร ริตธิคามอน

(Wisan Ritthikamon)

Date: 12-Mar-24

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Verification Test Report

Report No.:

SO2400082-E001 -PU 04

Calibrated Date: 12-Mar-24

Equipment: Air Sampling Pump

Manufacturer: SKC

Model: Air Check 52

Serial or ID No. 15608

Environment: Temperature 25 °C Humidity 62 %RH

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

Serial No. 164578

Date of Calibration : 04 May 2023

Result of Test

Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
1000	1	999.0	1000.6
	2	1003.0	
	3	1002.0	
	4	998.0	
	5	1001.0	

Calibrated By:

(Manutsanun Koomket)

Date:

12-Mar-24

Approve By:

(Wisan Ritthikamon)

Date:

12-Mar-24

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Verification Test Report

Report No.:

SO2400082-E001 -PU 05

Calibrated Date: 12-Mar-24

Equipment: Air Sampling Pump

Manufacturer: Gillian

Model: HFS-113A

Serial or ID No. 10510

Environment: Temperature 25 °C Humidity 62 %RH

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

Serial No. 164578

Date of Calibration : 04 May 2023

Result of Test			
Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
500	1	501.0	500.4
	2	502.0	
	3	497.0	
	4	499.0	
	5	503.0	

Calibrated By:

Manutsanun Koomket

(Manutsanun Koomket)

Date:

12-Mar-24

Approve By:

Wisana Ritthikamon

(Wisana Ritthikamon)

Date:

12-Mar-24

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Envilab Member: 0000000000000000

Verification Test Report

Report No.:

SO2400082-E001 -PU 06

Calibrated Date: 12-Mar-24

Equipment: Air Sampling Pump

Manufacturer: Gillian

Model: HFS-113A

Serial or ID No. 0138

Environment: Temperature 25 °C Humidity 62 %RH

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

Serial No. 164578

Date of Calibration : 04 May 2023

Result of Test			
Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
500	1	499.0	500.4
	2	498.0	
	3	501.0	
	4	503.0	
	5	501.0	

Calibrated By: Manutsanun Koomket
(Manutsanun Koomket)

Date: 12-Mar-24

Approve By: Wisani Ritthikamon
(Wisani Ritthikamon)

Date: 12-Mar-24

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Envilab S. Institute Quality Instrument

Verification Test Report

Report No.:

SO2400082-E001 -PU 07

Calibrated Date: 12-Mar-24

Equipment: Air Sampling Pump

Manufacturer: Gillian

Model: HFS-113A

Serial or ID No. 10513

Environment: Temperature 25 °C Humidity 62 %RH

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

Serial No. 164578

Date of Calibration : 04 May 2023

Result of Test

Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
1000	1	998.0	1000.2
	2	997.0	
	3	1003.0	
	4	1001.0	
	5	1002.0	

Calibrated By: Manutsanun Koomket
(Manutsanun Koomket)

Date: 12-Mar-24

Approve By: Wisana Ritthikamon
(Wisana Ritthikamon)

Date: 12-Mar-24

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Envilab & Needles Supply Instrument

Verification Test Report

Report No.:

SO2400082-X001 -PU 01

Calibrated Date: 20-Mar-24

Equipment: Air Sampling Pump

Manufacturer: Gillian

Model: HFS-113A

Serial or ID No. 20235

Environment: Temperature 25 °C Humidity 62 %RH

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

Serial No. 164578

Date of Calibration : 04 May 2023

Result of Test

Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
2000	1	2000.4	2000.6
	2	2000.3	
	3	2000.7	
	4	2000.9	
	5	2000.6	

Calibrated By:

(Worapon Narongsaksiri)

Date: 20-Mar-24

Approve By:

(Wisan Ritthikamon)

Date: 20-Mar-24

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Envilab & Evltest Supply Instrument

Verification Test Report

Report No.:

SO2400082-X001 -PU 02

Calibrated Date: 20-Mar-24

Equipment: Air Sampling Pump

Manufacturer: Gillian

Model: HFS-113A

Serial or ID No. 20236

Environment: Temperature 25 °C Humidity 62 %RH

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

Serial No. 164578

Date of Calibration : 04 May 2023

Result of Test

Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
2000	1	2000.8	2000.7
	2	2000.7	
	3	2000.9	
	4	2000.5	
	5	2000.4	

Calibrated By:

(Worapon Narongsakiri)

Date: 20-Mar-24

Approve By:

(Wisan Ritthikamon)

Date: 20-Mar-24

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บริษัท เอ็นวิลแล็บ จำกัด 540,540/1 ซอยบางแค 7 แขวงบางแค เขตบางแค กรุงเทพมหานคร 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 & Newdex Supply Instruments

Verification Test Report

Report No.:

SO2400082-X001 -PU 03

Calibrated Date: 20-Mar-24

Equipment: Air Sampling Pump

Manufacturer: Gillian

Model: HFS-113A

Serial or ID No. 10513

Environment: Temperature 25 °C Humidity 62 %RH

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

Serial No. 164578

Date of Calibration : 04 May 2023

Result of Test

Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
2000	1	2000.4	2000.5
	2	2001.5	
	3	1999.8	
	4	2000.6	
	5	2000.3	

Calibrated By:

(Worapon Narongsaksiri)

Date: 20-Mar-24

Approve By:

(Wisan Ritthikamon)

Date: 20-Mar-24

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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



Produce & Transfer Quality Information

Verification Test Report

Report No.:

SO2400082-Xool -PU 04

Calibrated Date: 20-Mar-24

Equipment: Air Sampling Pump

Manufacturer: Gillian

Model: HFS-113A

Serial or ID No. 10510

Environment: Temperature 25 °C Humidity 62 %RH

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

Serial No. 164578

Date of Calibration : 04 May 2023

Result of Test

Reference Flow (ml/min)	Test No.	Reading (ml/min)	Average (ml/min)
200	1	0.0	0.0
	2	0.0	
	3	0.0	
	4	0.0	
	5	0.0	

Calibrated By:

(Worapon Narongsaksiri)

Date: 20-Mar-24

Approve By:

(Wisan Ritthikamon)

Date: 20-Mar-24

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Certificate of Calibration

Certificate Number : SPR23050051-1

Page : 1 of 3

Customer : Envilab Co., Ltd.

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

Equipment Name : Primary Flow Meter (Drycal)

Manufacturer : MesaLabs

Model : Defender 520-H

Serial Number : 164578

ID. Number : N/A

Environmental Conditions

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

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

Location of Calibration : In-Lab

Calibration Procedure : SP-CPM-04-13

Received Date : 04 May 2023

Calibration Date : 04 May 2023

Recommend Due Date : 04 May 2024

Date of Issue : 05 May 2023

Method of Calibration

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

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

Calibrated by : Mr. Jirasak Pumbut

Calibration Officer

Approved by :

(Mr. Prayoon Topart)

Authorized Signatory





Calibration Report

Certificate Number : SPR23050051-1

Page : 2 of 3

Reference Standards

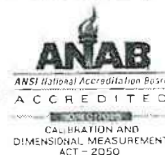
Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Mass Flow Calibrator	AFC-COMPLETE-10	12532	AD2207-177-0001	17 Jul 2023
Standard Flow Meter	520-H	200353	MW-0071-22	25 Aug 2023

Traceability

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

MIT - Miracle International Technology Co.,Ltd.

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



Result of Calibration

Certificate No. : SPR23050051-1

Page : 3 of 3

Range : 0 to 30 L/Min

Resolution : 0.0001 L/Min

Function : Air Flow Measurement

Unit : L/Min

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

Note:

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

Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor $k = 2$, providing a level of confidence approximately 95 %

- End of Certificate -

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

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

Approved by :



(Surachai Promthong)

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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

Certificate of Calibration

Certificate No. : 67-200060-2

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

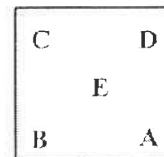
This result of calibration was found accurate as shown on date and place of calibration only.

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 -



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2/10-11,14, 55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel: 02-578-0353-4 Fax: 02-575-2672 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. : MCE010015[EHEMTHS3210015]
CLID. NO. : 232400805
JOB CONTROL NO. : 240227021067
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 : Mongkol Yotsoontorn
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. Q24021067

F3-011-05/12-23

page 1 of 3



calibration
การวัด



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.	:	MCE010015[EHEMTHS3210015]
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 :

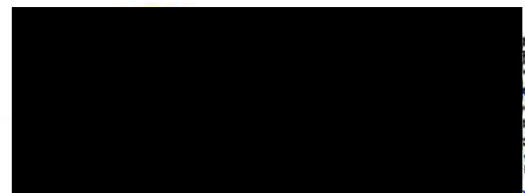
The measurements are traceable to International System of Units (SI), through Thunder Scientific Corporation.
Certificate No. 21594, Due Date 06 July 2024.

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. Q24021067

F3-011-05/12-23





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



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 \pm (° C)
20.0	20.00	19.8	+0.20	0.27
30.0	30.00	29.8	+0.20	
40.0	39.99	39.8	+0.19	

2. CORRECTION OF TEMPERATURE : DRY

Test point (° C)	Actual Temperature (° C)	DUC Reading (° C)	Correction (° C)	Uncertainty \pm (° C)
20.0	20.00	19.8	+0.20	0.27
30.0	30.00	29.8	+0.20	
40.0	39.99	39.8	+0.19	

3. CORRECTION OF TEMPERATURE : GLOBE

Test point (° C)	Actual Temperature (° C)	DUC Reading (° C)	Correction (° C)	Uncertainty \pm (° C)
20.0	20.00	19.8	+0.20	0.27
30.0	30.00	29.7	+0.30	
40.0	39.99	39.6	+0.39	

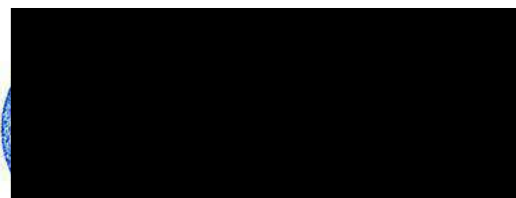
Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 012 Page 59 of 67

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

End of Certificate

Certificate No. Q24021067

F3-011-05/12-23





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 : Mongkol Yotsoontorn
Authorized Signatory

29 February 2024

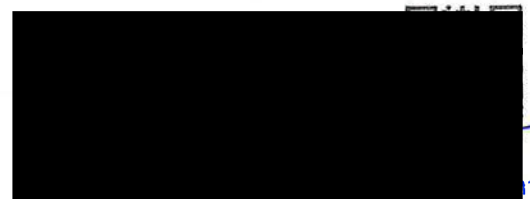


This Calibration Certificate documents the traceability to national standards, which realize the units of measurement according to the International System of Units (SI)

Certificate No. Q24021071

F3-011-05/12-23

page 1 of 3





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

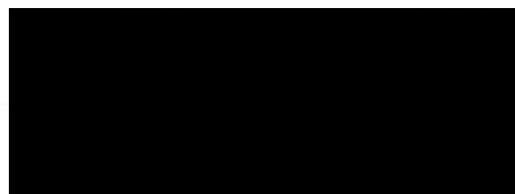
The measurements are traceable to International System of Units (SI), through Thunder Scientific Corporation.
Certificate No. 21594, Due Date 06 July 2024.

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





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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





INTERNATIONAL TESTING SERVICE CO., LTD

1213/388 Ladprao 94 Ladprao Rd. Wangtonglang Bangkok 10310
Tel 0-2559-2095 Fax 0-2559-2096

E-mail : sale@itest-lab.com web site : www.itest-lab.com



NSC-TISI-TIS 17025
CALIBRATION 129

CALIBRATION CERTIFICATE

Issued date: 18 April 2023

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

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

Request No : **C-2304 - 167**

Laboratory No.: **CAL- 167**

Date of Request: 12 April 2023.

Date of Calibration: 17 April 2023.

1. Unit Under Calibration (UUC) :

Nomenclature : Digital Lux Meter

Serial No.: 190600485

Maker : TENMARS

Model : TM-720

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

3. Range of Calibration: 1 Range

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

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

6. Support Equipment:

1. Photometric bench, 6.3 meter long.
2. DC. power supply, Serial No.: EJ 19A 009, Model: GPR-25H 300, Maker: GW INSTEK.
3. Digital Multimeter, Model: 34401A, S/N: MY44011212 and MY44011215.
4. Foot Candle / Lux Meter, Model: 407026, S/N: Q 558437, Maker: EXTECH.

7. Calibration Procedure:

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

Page 1 of 2

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

**INTERNATIONAL TESTING SERVICE CO., LTD**1213/388 Ladprao 94 Ladprao Rd. Wangtonglang Bangkok 10310
Tel 0-2559-2095 Fax 0-2559-2096E-mail : sale@itest-lab.com web site : www.itest-lab.comRequest No: **C-2304 - 167**

Serial No.: 190600485

Laboratory No.: **CAL - 167****Results :**

UUC Range	Standard (Ix)	UUC Reading (Ix)		Correction (Ix)	Uncertainty of Measurement (\pm Ix)
		Before adjust	After adjust		
Auto	0	0.0	0.0	0.0	0.1
	100	94.1	103.7	- 3.7	2.0 % of Reading
	500	453.5	506.0	- 6.0	
	1000	895.0	1002	- 2	
	1500	1327	1489	+ 11	
	2000	1758	1966	+ 34	

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

Calibration result approved by

(Mr. Yuttana Tholueng)Approved on behalf of
International Testing Service Co., Ltd
(Mr. Pichit Vivat-Anant)
Managing Director

Page 2 of 2

The Results shown in this certification report refer only to the equipment(s)
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Envilab Co., Ltd. 540,540/1 Soi Bangkhoe 7 Bangkhoe Bangkhoe Bangkok 10160
Tel : 02-802-3577-8 Fax: 02-802-3773 E-mail : info@evltesting.com



Envilab is a member of the Supply chain network

Verification Test Report

Report No.:

SO2400035-E004 -SLM 01

☒ PM ☐ Onsite UTM : 47P 1514458 654247

Calibrated Date: 12 March 2024

Site : บริษัท เอ็นไวเทสティング

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 44

Serial : 1812

Environment: Temperature 25 °C Humidity 68 %RH

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

Serial No.1351075

Date of Calibration : 16 March 2024

Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.78	93.87	0.09	93.78

Calibrated By:

มานุสนันท์

(Manutsanun Koomket)

Date:

12 March 2024

Approve By:

(Wisan Ritthikamon)

Date:

12 March 2024

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