

## ภาคผนวกที่ 4

ใบรับรองการสอบเทียบเครื่องมือ

Envi Equipment Service Co., Ltd.  
110/254 Moo 3, Tumbon Bang Rak Phatthana, Amphur Bang Bua Thong, Nonthaburi 11110  
Tel. 098 362 9152, 089 478 7885  
E-mail: sales@envi-ees.com

Certificate No. : E23-02023  
Page : 1 of 6

## CERTIFICATE OF CALIBRATION

Customer : M E T COMPANY LIMITED  
Address : 36/659 Moo 6, Bangrakpatthana, Bangbuathong, Nonthaburi 11110  
Description of Equipment : Console meter  
Manufacturer : Apex Instrument  
Model Number : TMC-572-V  
Serial Number : A2202103  
ID./Control No. : -  
Environment Conditions : Temperature (25 ± 2) °C  
Humidity (50 ± 15) % RH  
Cal. Date : 08/02/2023  
Issue Date : 08/02/2023

### Calibration Method or Calibration Procedure Used

US EPA Method (United State Environmental Protection Agency)

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

### Result of Calibration

This certificate may not be reproduced other than in full except with prior Written approval of the Technical Manager, Envi Equipment Service Company Limited.

These reported uncertainties of measurement are expanded by a coverage factor of k=2, providing a 95% confidence level

Calibrated by :

Approved by :

Technical Manger

Certificate No. : E23-02023  
Page : 2 of 6

## METHOD 5 CONSOLE CALIBRATION USING REFERENCE WET GAS METER W-NK-2.5-B-Z No.547425 5-POINT METRIC UNIT

Meter Console Information		Calibration Conditions				Factors/Conversions		
Console Model Number	TMC-572-V	Date	Time	08/02/2023	10:35 AM	Std Temp	293	K
Console Serial Number	A2202103	Calibration Reference No.	SER23-02008			Std Press	760	mm Hg
DGM Model Number	SK25EX	Barometric Pressure	758.99		mmHg	K <sub>1</sub>	0.386	
DGM Serial Number	00006345	Calibration Meter Gamma	0.999			Console Leak Check	PASS	

Calibration Data									
Run Time	Metering Console					Calibration Meter			
Elapsed	DGM Orifice DH	Volume Initial	Volume Final	Outlet Temp Initial	Outlet Temp Final	Volume Initial	Volume Final	Outlet Temp Initial	Outlet Temp Final
(Q)	(P <sub>m</sub> )	(V <sub>mi</sub> )	(V <sub>mf</sub> )	(t <sub>mi</sub> )	(t <sub>mf</sub> )	(V <sub>wi</sub> )	(V <sub>wf</sub> )	(t <sub>wi</sub> )	(t <sub>wf</sub> )
min	mm H <sub>2</sub> O	m <sup>3</sup>	m <sup>3</sup>	°C	°C	m <sup>3</sup>	m <sup>3</sup>	°C	°C
12.22	13.0	77.3070	77.4470	26	26	120.73646	120.87858	26	26
12.25	13.0	77.4470	77.5870	26	26	120.87858	121.02010	26	26
8.53	26.0	77.5960	77.7360	26	26	121.03000	121.17082	26	26
8.57	26.0	77.7360	77.8760	26	26	121.17082	121.31170	26	26
13.73	40.0	77.8830	78.1630	26	26	121.31866	121.60020	26	26
13.68	40.0	78.1630	78.4430	27	27	121.60020	121.88084	26	26
10.37	70.0	78.4510	78.7310	27	27	121.88882	122.16980	26	26
10.40	70.0	78.7310	79.0110	28	28	122.16980	122.44980	25	25
9.25	90.0	79.0250	79.3050	28	28	122.46346	122.74206	25	25
9.25	90.0	79.3050	79.5850	29	29	122.74206	123.01956	25	25

**METHOD 5 CONSOLE CALIBRATION**  
**USING REFERENCE WET GAS METER W-NK-2.5-B-Z No.547425**  
**5-POINT METRIC UNIT**

Meter Console Information		Calibration Conditions				Factors/Conversions		
Console Model Number	TMC-572-V	Date	Time	07/02/2023	10:35 AM	Std Temp	293	K
Console Serial Number	A2202103	Calibration Reference No.	SER23-02008			Std Press	760	mm Hg
DGM Model Number	SK25EX	Barometric Pressure	758.99	mmHg	K <sub>1</sub>	0.386		
DGM Serial Number	00006345	Calibration Meter Gamma	0.999			Console Leak Check	PASS	

Calibration Data									
Results									
Standardized Data				Dry Gas Meter					
Dry Gas Meter		Calibration Meter		Calibration Factor		Flowrate			
(V <sub>m(std)</sub> )	(Q <sub>m(std)</sub> )	(V <sub>w(std)</sub> )	(Q <sub>w(std)</sub> )	Value (Y)	Variation (ΔY)	Std & Corr (Q <sub>m(std)(corr)</sub> )	.0212 m <sup>3</sup> <sub>std</sub> /min (ΔH <sub>@</sub> )	Variation (ΔH <sub>@</sub> )	
m <sup>3</sup>	m <sup>3</sup> /min	m <sup>3</sup>	m <sup>3</sup> /min			m <sup>3</sup> /min	mm H <sub>2</sub> O		
0.137	0.011	0.139	0.011	1.013	0.015	0.011	44.460	-0.528	
0.137	0.011	0.138	0.011	1.009	0.011	0.011	45.083	0.095	
0.137	0.016	0.138	0.016	1.002	0.004	0.016	44.301	-0.687	
0.137	0.016	0.138	0.016	1.003	0.005	0.016	44.609	-0.379	
0.275	0.020	0.275	0.020	1.001	0.003	0.020	44.283	-0.705	
0.275	0.020	0.274	0.020	0.997	-0.001	0.020	44.243	-0.745	
0.276	0.027	0.275	0.026	0.996	-0.002	0.026	44.590	-0.398	
0.277	0.027	0.275	0.026	0.992	-0.006	0.026	45.041	0.053	
0.277	0.030	0.273	0.030	0.985	-0.013	0.030	46.451	1.463	
0.277	0.030	0.272	0.029	0.982	-0.016	0.029	46.820	1.832	
				0.998	Y Average		44.988	ΔH@ Average	

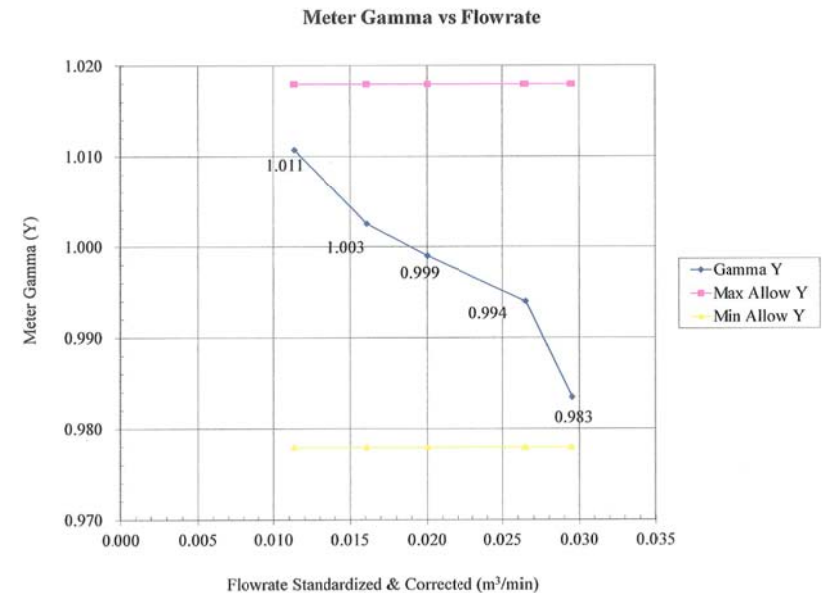
**Note:** For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is ±0.02.

For ΔH<sub>@</sub>, orifice pressure differential that equates to 0.75 cfm (0.0212 m<sup>3</sup>/min) at standard temperature and pressure, acceptable tolerance of individual values from the average is ±0.2 inches (5.1mm) H<sub>2</sub>O.

Meter Console Information		Calibration Conditions				Factors/Conversions		
Console Model Number	TMC-572-V	Date	Time	08/02/2023	10:35 AM	Std Temp	293	K
Console Serial Number	A2202103	Calibration Reference No.	SER23-02008			Std Press	760	mm Hg
DGM Model Number	SK25EX	Barometric Pressure	758.99	mmHg	K <sub>1</sub>	0.386		
DGM Serial Number	00006345	Calibration Meter Gamma	0.999			Console Leak Check	PASS	

Calibration Date: 8-2-2023

Calibration Reference No: SER23-02008



Console Serial: A2202103

Console Model: TMC-572-V

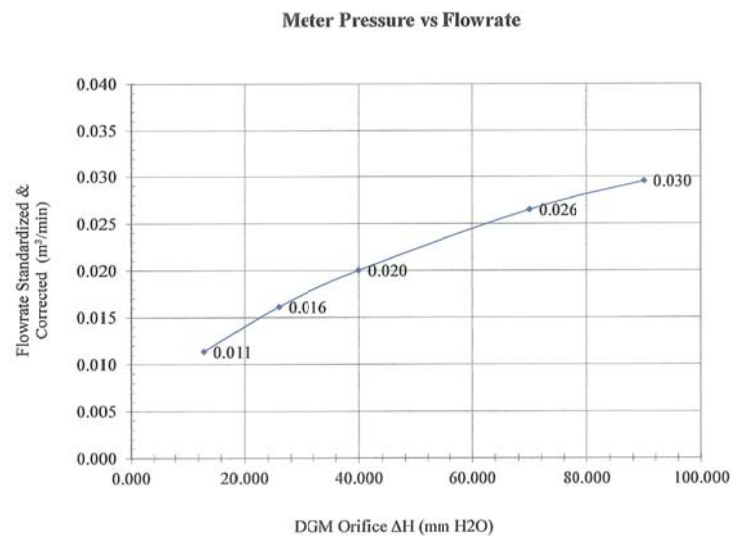
Meter Console Information	
Console Model Number	TMC-572-V
Console Serial Number	A2202103
DGM Model Number	SK25EX
DGM Serial Number	00006345

Calibration Conditions			
Date	Time	08/02/2023	10:35 AM
Calibration Reference No.	SER23-02008		
Barometric Pressure	758.99	mmHg	
Calibration Meter Gamma	0.999		

Factors/Convertors		
Std Temp	293	K
Std Press	760	mm Hg
K <sub>1</sub>	0.386	
Console Leak Check	PASS	

Calibration Date: 8-2-2023

Calibration Reference No: SER23-02008



Console Serial: A2202103

Console Model: TMC-572-V

## THERMOCOUPLES SYSTEM CALIBRATION

Sampling System Equipment Information	
Console Model Number	TMC-572-V
Console Serial Number	A2202103
DGM Model Number	SK25EX
DGM Serial Number	00006345
Meter Box Model Number	JENCO 765 KF
Meter Box Serial Number	JC 18920

Calibration Conditions			
Date	Time	08/02/2023	12:40 PM
Calibration Reference No.	SER23-02008		
Reference Thermometer	DIGICON		
Serial Number	183169105		

Results											
Console Thermocouple Simulator											
Channel and test point	Meter Box Channel Temperature Reading ( °C )										
	-18.0	25.0	38.0	93.0	149.0	260.0	371.0	482.0	593.0	816.0	1038.0
Stack	-19.0	24.0	35.0	91.0	147.0	256.0	368.0	480.0	591.0	814.0	1036.0
Aux	-18.0	22.0	35.0	91.0	146.0						
Probe	-19.0	22.0	35.0	90.0	147.0						
Filter	-19.0	22.0	35.0	90.0	147.0						
Exit	-19.0	23.0	35.0								

Stack ± 1.50% Absolute  
Probe ± 3.0 °C  
Filter ± 3.0 °C

### Tolerance Range

Meter ± 3.0 °C  
Exit ± 2.0 °C



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Certificate No. : E23-02025

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## CERTIFICATE OF CALIBRATION

**Customer** : M E T COMPANY LIMITED  
**Address** : 36/659 Moo 6, Bangrakpatthana, Bangbua Thong, Nonthaburi 11110  
**Description of Equipment** : Nozzle  
**Manufacturer** : Apex Instrument  
**Model Number** : NS-SET  
**Serial Number** : -  
**ID/Control No.** : -  
**Environment Conditions** : **Temperature** (25 ± 2) °C  
: **Humidity** (50 ± 15) % RH  
**Cal. Date** : 10/02/2023  
**Issue Date** : 10/02/2023

### Calibration Method or Calibration Procedure Used

US EPA Method (United State Environmental Protection Agency)

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

### Result of Calibration

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## CALIBRATION RESULTS

### Sampling System Equipment Information

**Nozzle Model** : NS-SET  
**Nozzle Number** : -  
**Nozzle Type** : Stainless Steel

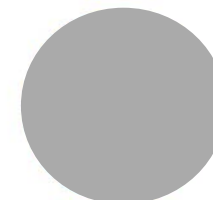
### Calibration Condition

**Date** : 10 February 2023  
**Barometric Pressure** : 759.74 mm Hg  
**Calibration Device** : Vernier, 0-150 mm  
**Method Reference** : US. EPA Method

Nozzle ID	Nozzle Diameter				Different	(D1 + D2 + D3) / 3
Size		D1	D2	D3	ΔD	Davg
	mm	mm	mm	mm	mm	mm
NS-4	3.18	3.07	3.06	3.06	0.006	3.063
NS-5	3.97	3.85	3.85	3.85	0.000	3.850
NS-6	4.76	4.04	4.05	4.06	0.010	4.050
NS-7	5.56	5.43	5.44	5.43	0.006	5.433
NS-8	6.22	6.02	6.04	6.02	0.012	6.027
NS-9	6.98	6.24	6.24	6.24	0.000	6.240
NS-10	7.62	7.20	7.19	7.22	0.015	7.203

### Remark:

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



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Certificate No. : E23-02024

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## CERTIFICATE OF CALIBRATION

**Customer** : M E T COMPANY LIMITED

**Address** : 36/659 Moo 6, Bangrakpatthana, Bangbuathong, Nonthaburi 11110

**Description of Equipment** : Standard Probe Method 5

**Manufacturer** : Apex Instrument

**Model Number** : PS-3HV

**Serial Number** : -

**ID./Control No.** : -

**Environment Conditions** : Temperature (25 ± 2) °C  
Humidity (50 ± 15) % RH

**Cal. Date** : 08/02/2023

**Issue Date** : 08/02/2023

### Calibration Method or Calibration Procedure Used

US EPA Method (United State Environmental Protection Agency)

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### Result of Calibration

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Calibrated by : \_\_\_\_\_

Approved by : \_\_\_\_\_

Technical Manger

Certificate No. : E23-02024

Page : 2 of 3

## CALIBRATION RESULTS S-Type Geometric Pitot Tube Calibration

### Sampling System Equipment Information

**Probe Model** : PS-3HV

**Probe Number** : -

**Pitot Number** : A10664

**Pitot Tube Type** : S-type

### Calibration Condition

**Date** : 8 February 2023

**Barometric Pressure** : 758.99 mm Hg

**Digital Caliper** : CD-6" ASX

**Serial number** : A18008059

Pitot tube/Probe: # PS-3HV			
Parameter	Value	Allowable Range	Check
Assembly level?	Yes	Yes	Pass
Ports Damage?	No	No	Pass
$\alpha 1$	0	$-10^\circ < \alpha 1 < +10^\circ$	Pass
$\alpha 2$	1	$-10^\circ < \alpha 2 < +10^\circ$	Pass
$\beta 1$	0	$-5^\circ < \beta 1 < +5^\circ$	Pass
$\beta 2$	0	$-5^\circ < \beta 2 < +5^\circ$	Pass
$\gamma$	0	N/A	-
$\theta$	0	N/A	-
Dt	0.375	.188" to .375"	Pass
A	0.8745	$2.1Dt \leq A \leq 3Dt$	Pass
A/2Dt	1.166	$1.05 \leq A/Dt \leq 1.5$	Pass
$Z = A \tan \gamma$	0.047	$Z \leq .125"$	Pass
$W = A \tan \theta$	0.019	$W \leq .031"$	Pass

### Remark:

I certified that probe model: **PS-3HV** and Pitot tube number **A10664** meets or exceeds all specifications, criteria and/or applicable design and is hereby assigned a pitot tube certification factor of **0.84**. See 40 CFR Pt. 60, App. A, EPA Method 2.

## THERMOCOUPLES SYSTEM CALIBRATION

Sampling System Equipment Information	
Probe Model Number	PS-3HV
Probe Serial Number	-
Meter Box Model Number	JENCO 765 KF
Meter Box Serial Number	JC 18920

Calibration Conditions			
Date	Time	08/02/2023	01:30 PM
Calibration Reference No.	SER23-02008		
Reference Thermometer	DIGICON		
Serial Number	183169105		

Thermocouple of Standard Probe method 5 = length 3 foot			
Set Point	Reference Thermocouple	Probe Thermocouple	Difference
100	100.0	98.0	0.54
250	250.0	249.0	0.19
300	300.0	297.0	0.52
350	350.0	349.0	0.16

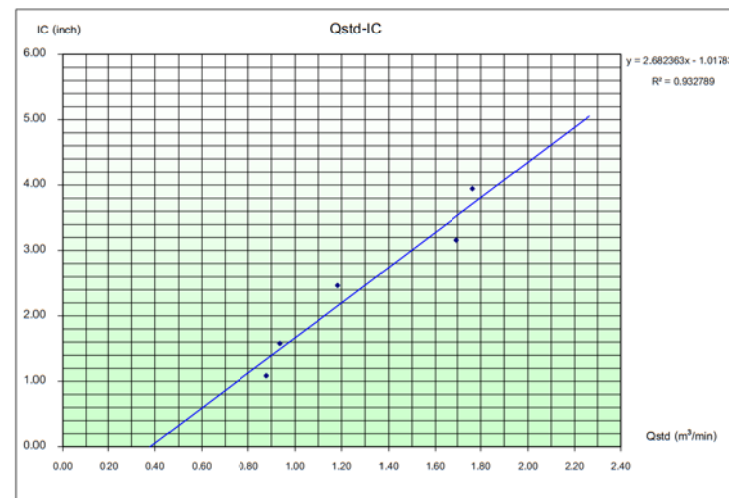
## TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Sampler Location				Date	March 16, 2023
Project Site				Start Time	8:25 AM
Sampler Number	TSP No.1	Transfer Standard Type	Orifice	Stop Time	8:30 AM
Motor Serial Number	BL-04	Calibrator Model	TE-6025A	Person	Mr. Preecha Sriouk
Recorder Serial Number	-	Calibrator Serial Number	1		

Plate No.	(Delta H)		(A)	(X)	(I)	(Y)	Temperature	Barometric Pressure	Start Meter	Stop Meter
	Pressure Drop Across Orifice (inH <sub>2</sub> O)		$[\Delta H_O(Pa \cdot P_{atm}) / (T_{std}/T_a)]^{1/2}$	$Q_{std} = (1.19) [(A \cdot b)]$ (m <sup>3</sup> /min)	Sample Flow Rate Indicator (inch)	$C = [(Pa \cdot P_{std}) / (T_{std}/T_a)]^{1/2}$	(°K = °C + 273)	(mmHg)		
5	1.5	1.5	3.0	1.70668	0.87849	1.1	1.09	305.0	757.0	
7	1.7	1.7	3.4	1.81903	0.93616	1.6	1.58	305.0	757.0	
10	2.7	2.7	5.4	2.29043	1.16357	2.5	2.47	305.0	757.0	
13	5.5	5.5	11.0	3.27187	1.69544	3.2	3.16	305.0	757.0	
16	5.9	6.0	11.9	3.40306	1.76402	4.0	3.95	305.0	757.0	
Linear Regression: Y ON X: Y= mX + b							Average	305.0	757.0	
1	Slope ( m )		1.91345	Linear Equation			r <sup>2</sup>	0.978461	Pass/mnng	760.
2	Intercept ( b )		0.02773	Set Point Flow Rate ( X ) (m <sup>3</sup> /min)		1.133	r	0.9691719	T <sub>atm</sub>	296.
3	Correlation Coefficient ( r )		0.99996	Final Set Flow Rate = ( 1 )		0	( Pa/P <sub>std</sub> ) ( T <sub>std</sub> /T <sub>a</sub> )	0.973192467		
Result							C= ( Pa/P <sub>std</sub> ) ( T <sub>std</sub> /T <sub>a</sub> ) <sup>0.5</sup>	0.966055148		

### COMMENT

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Field Environmental

Approved By .....  
Division Manager

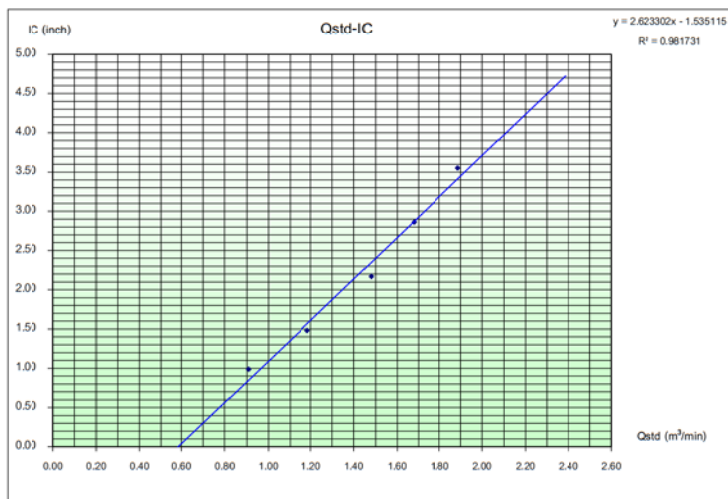
# PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Sampler Location				Date	March 16, 2023
Project Site				Start Time	11:00 AM
Sampler Number	PM-10 No.4	Transfer Standard Type	Office	Stop Time	11:05 AM
Motor Serial Number	HVL-04	Calibrator Model	TE-5025A		
Recorder Serial Number	-	Calibrator Serial Number	1	Person	Mr. Preecha Sriouk

Rate	(Delta H)			(A)	(X)	(I)	(Y)	Temperature	Barometric	Start	Stop
No.	Pressure Drop Across Orifice (mmH <sub>2</sub> O)			$\Delta H_{H_2O}(Pa/P_{atm}(T_{std}/T_a))^{1/2}$	$Q_{std} = (1/m) \cdot [(A \cdot b)]$	Sample Flow Rate Indicator	$C = [(Pa \cdot P_{std}) / (T_{std} \cdot T_a)]^{1/2}$	$T_K = ^\circ C + 273$	Pressure	Meter	Meter
	Positive	Negative	$\Delta H_{H_2O}$		(m <sup>3</sup> /min)	(inch)			(mmHg)		
5	1.6	1.6	3.2	1.76471	0.90778	1.0	0.99	305.0	757.0		
7	2.7	2.7	5.4	2.29243	1.18357	1.5	1.48	305.0	757.0		
10	4.2	4.2	8.4	2.85916	1.47975	2.2	2.17	305.0	757.0		
13	5.4	5.4	10.8	3.24199	1.67962	2.9	2.86	305.0	757.0		
18	6.8	6.8	13.6	3.63805	1.88681	3.6	3.55	305.0	757.0		
Linear Regression Y ON X: Y= mX + b							Average		305.0	757.0	
1	Slope ( m )			1.91345	Linear Equation			r <sup>2</sup>	0.942435	Passing	760.0
2	Intercept ( b )			0.02773	Set Point Flow Rate ( X ) (m <sup>3</sup> /min)		1.133	r	0.9707909	T <sub>std</sub>	296.0
3	Correlation Coefficient ( r )			0.99995	Final Set Flow Rate = ( I )		0	( Pa/Pstd)*(Tstd/Ta)	0.973192407		
Result								C=(Pa/Pstd)*(Tstd/Ta)*0.5		0.986505148	

## COMMENT

Andersen Instruments, Inc.



Calibrated By ....

Field Environmental

Approved By ....

Division Manager

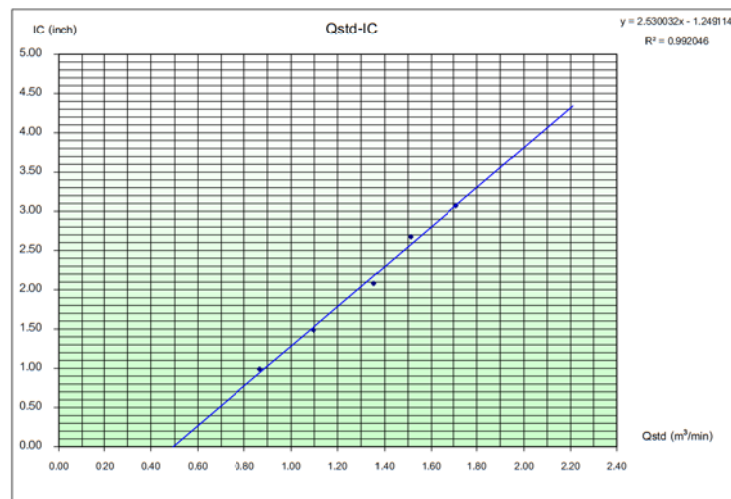
# PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Sampler Location				Date	March 16, 2023
Project Site				Start Time	10:35 AM
Sampler Number	PM-10 No.2	Transfer Standard Type	Office	Stop Time	10:40 AM
Motor Serial Number	HVL-02	Calibrator Model	TE-5025A		
Recorder Serial Number	-	Calibrator Serial Number	1	Person	Mr. Preecha Sriouk

Plate No.	(Delta H)			(A)	(X)	(I)	(Y)	Temperature	Barometric	Start	Stop	
	Pressure Drop Across Orifice (mmH <sub>2</sub> O)			$\Delta H_{H_2O} [(Pa/P_{atm}) \cdot (T_{std}/T_a)]^{1/2}$	$Q_{std} = (1/m) [(A \cdot b)]$	Sample Flow Rate Indicator	$C = [(Pa \cdot P_{std}) / (T_{std} \cdot T_a)]^{1/2}$	$^{\circ}K = ^{\circ}C + 273$	Pressure	Meter	Meter	
	Positive	Negative	$\Delta H_{H_2O}$		(m <sup>3</sup> /min)	(inch)			(mmHg)			
5	1.4	1.5	2.9	1.68661	0.86096	1.0	0.99	303.0	758.0			
7	2.3	2.3	4.6	2.12419	1.09664	1.5	1.49	303.0	758.0			
10	3.5	3.5	7.0	2.62038	1.35496	2.1	2.08	303.0	758.0			
13	4.3	4.4	8.7	2.92125	1.51222	2.7	2.67	303.0	758.0			
18	5.5	5.6	11.1	3.29971	1.70999	3.1	3.07	303.0	758.0			
Linear Regression Y ON X: Y= mX + b								Average	303.0	758.0		
1	Slope ( m )			1.91345	Linear Equation			r <sup>2</sup>	0.950727	Passing	760.0	
2	Intercept ( b )			0.02773	Set Point Flow Rate ( X ) (m <sup>3</sup> /min)			1.133	r	0.9750523	296.0	
3	Correlation Coefficient ( r )			0.99995	Final Set Flow Rate = ( I )			0	(Pa/Pstd)*(Tstd/Ta)	0.960910196		
Result									C=(Pa/Pstd)*(Tstd/Ta)*0.5	0.990409186		

## COMMENT

Andersen Instruments, Inc.



Calibrated By ....

Field Environmental

Approved By ....

Division Manager



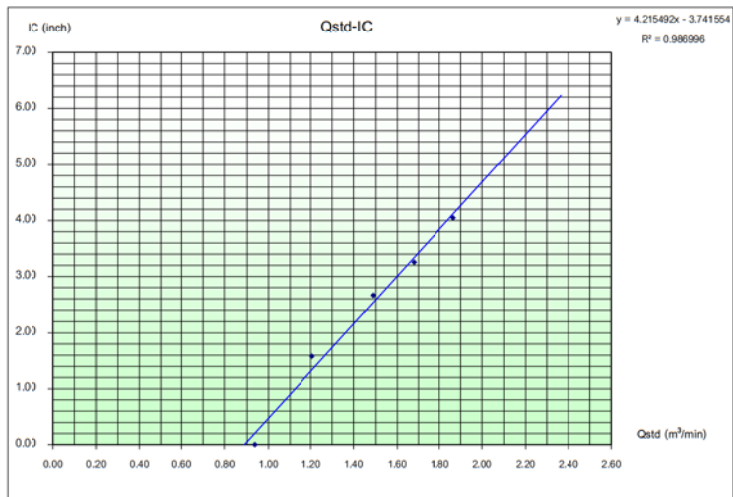
# TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Sampler Location				Date	March 16, 2023
Project Site				Start Time	9:05 AM
Sampler Number	TSP No.2	Transfer Standard Type	Office	Stop Time	9:10 AM
Motor Serial Number	BL-02	Calibrator Model	TE-5025A		
Recorder Serial Number	-	Calibrator Serial Number	1	Person	Mr. Preecha Sriouk

Rate	(Delta H)			(A)	(X)	(I)	(Y)	Temperature	Barometric	Start	Stop	
No.	Pressure Drop Across Orifice (mmHg)			$\Delta H_2O(Pa_{Pstd}(T_{std}/T_a))^{0.5}$	$Q_{std} = (1/m)[(A-b)]$	Sample Flow Rate Indicator	$C = ([Pa_{Pstd}(T_{std}/T_a)]^{0.5})$	$^{\circ}K = ^{\circ}C+273$	Pressure	Meter	Meter	
	Positive	Negative	$\Delta H_2O$		( m <sup>3</sup> /min )	( inch )	#VALUE!					
5	1.7	1.7	3.4	1.81903	0.93616	1.0		305.0	757.0			
7	2.8	2.8	5.6	2.33450	1.20555	1.6	1.58	305.0	757.0			
10	4.2	4.3	8.5	2.87613	1.48862	2.7	2.66	305.0	757.0			
13	5.4	5.4	10.8	3.24199	1.67962	3.3	3.26	305.0	757.0			
18	6.6	6.7	13.3	3.59770	1.86573	4.1	4.04	305.0	757.0			
Linear Regression Y ON X: Y= mX + b							Average		305.0	757.0		
1	Slope ( m )			1.91345	Linear Equation			r <sup>2</sup>	0.97164	Passing	760.0	
2	Intercept ( b )			0.02773	Set Point Flow Rate ( X ) ( m <sup>3</sup> /min )		1.133	r	0.9857185	T <sub>std</sub>	296.0	
3	Correlation Coefficient ( r )			0.99995	Final Set Flow Rate = ( I )		0	(Pa/Pstd)(Tstd/Ta)	0.973192407			
Result								C= (Pa/Pstd)(Tstd/Ta) <sup>0.5</sup>				
								0.986505148				

COMMENT

Andersen Instruments, Inc.



Calibrated By .....

Field Environmental

Approved By

Division Manager

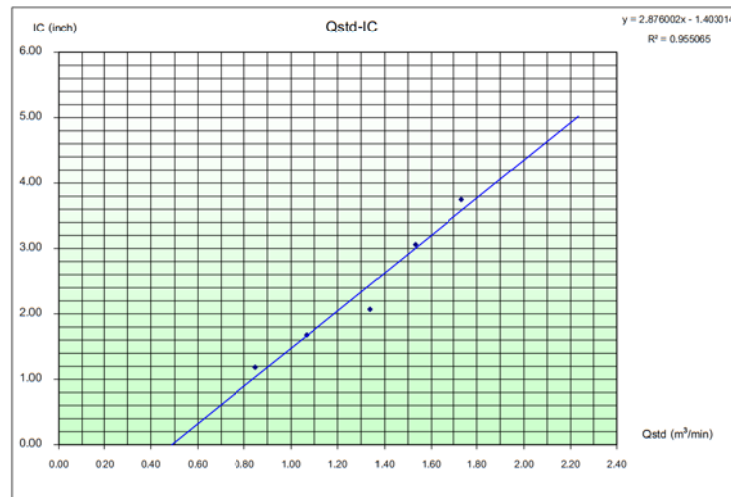
# PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Sampler Location				Date	March 16, 2023
Project Site				Start Time	10:25 AM
Sampler Number	PM-10 No.1	Transfer Standard Type	Office	Stop Time	10:30 AM
Motor Serial Number	HVL-01	Calibrator Model	TE-5025A		
Recorder Serial Number	-	Calibrator Serial Number	1	Person	Mr. Preecha Sriouk

Plate No.	(Delta H)			(A)	(X)	(I)	(Y)	Temperature	Barometric	Start	Stop
	Pressure Drop Across Orifice (mmHg)			$\left[\frac{\Delta H_2O}{(Pa/P_{std})(T_{std}/T_a)}\right]^{0.5}$	Qstd = (1/m)[(A-b)]	Simple Flow Rate Indicator	$C = \left[\frac{(Pa/P_{std})(T_{std}/T_a)}{T_a}\right]^{0.5}$	*K = °C+273	Pressure	Meter	Meter
	Positive	Negative	$\Delta H_2O$		(m <sup>3</sup> /min)	(inch)			(mmHg)		
5	1.4	1.4	2.8	1.65074	0.84821	1.2	1.18		305.0	757.0	
7	2.2	2.2	4.4	2.06931	1.06696	1.7	1.68		305.0	757.0	
10	3.4	3.5	6.9	2.59134	1.33978	2.1	2.07		305.0	757.0	
13	4.5	4.5	9.0	2.99592	1.53220	3.1	3.06		305.0	757.0	
18	5.7	5.8	11.5	3.34540	1.73387	3.8	3.75		305.0	757.0	
Linear Regression Y ON X: Y= mX + b								Average	305.0	757.0	
1	Slope ( m )			1.91345	Linear Equation			r <sup>2</sup>	0.987743	Passing	760.0
2	Intercept ( b )			0.02773	Set Point Flow Rate ( X ) ( m <sup>3</sup> /min )			1.133	r	0.9936526	T <sub>std</sub>
3	Correlation Coefficient ( r )			0.99995	Final Set Flow Rate = ( I )			0	(Pa/Pstd)(Tstd/Ta)	0.973192407	
Result									C= (Pa/Pstd)(Tstd/Ta) <sup>0.5</sup>	0.986505148	

COMMENT

Andersen Instruments, Inc.



Calibrated By .....

Field Environmental

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Division Manager

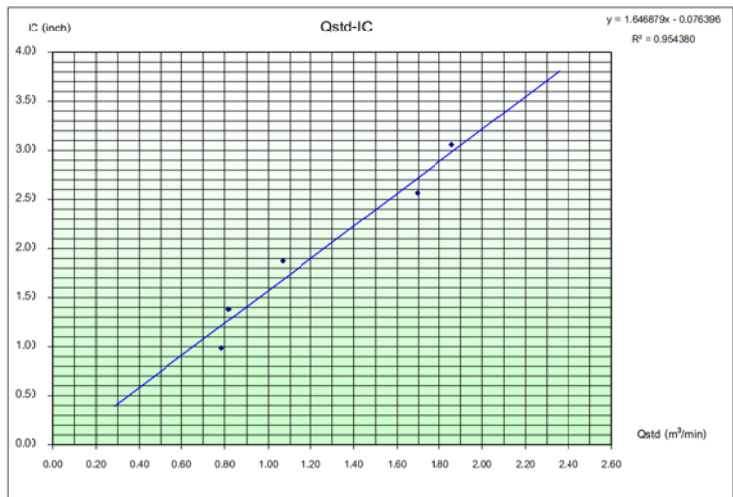
# TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Sampler Location				Date	March 16, 2023
Project Site				Start Time	9:00 AM
Sampler Number	TSP No.1	Transfer Standard Type	Office	Stop Time	9:05 AM
Motor Serial Number	BL-01	Calibrator Model	TE-5025A		
Recorder Serial Number	-	Calibrator Serial Number	1	Person	Mr. Preecha Sriouk

Rate	(Delta H)			(A)	(X)	(I)	(Y)	Temperature	Barometric	Start	Stop	
No.	Pressure Drop Across Orifice (inH <sub>2</sub> O)			$\Delta H_2O(Pa/P_{atm}(T_{atm}/T_{at})^{1/2})$	$Q_{std} = [(1in)/[(A-b)]]$	Sample Flow Rate Indicator		$C = [(P/P_{atm})(T_{atm}/T_{at})^{1/2}]$	Pressure	Meter	Meter	
	Positive	Negative	$\Delta H_2O$		( <sup>3</sup> m/min)	(inch)		<sup>o</sup> K = <sup>o</sup> C+273	( mmHg)			
5	1.2	1.2	2.4	1.52829	0.78422	1.0		0.99	305.0	757.0		
7	1.3	1.3	2.6	1.59069	0.81683	1.4		1.38	305.0	757.0		
10	2.2	2.2	4.4	2.06931	1.06996	1.9		1.87	305.0	757.0		
13	5.5	5.5	11.0	3.27187	1.69544	2.6		2.56	305.0	757.0		
18	6.6	6.6	13.2	3.58415	1.85864	3.1		3.06	305.0	757.0		
Linear Regression Y ON X: Y= mX + b								Average	305.0	757.0		
1	Slope ( m )			1.91345	Linear Equation			r <sup>2</sup>	0.992314	Passing	760.0	
2	Intercept ( b )			0.02773	Set Point Flow Rate ( X ) (m <sup>3</sup> /min)			1.133	r	0.9961496	T <sub>atm</sub>	298.0
3	Correlation Coefficient ( r )			0.99995	Final Set Flow Rate = ( I )			0	(Pa/P <sub>atm</sub> )(T <sub>atm</sub> /T <sub>at</sub> )	0.973192407		
Result									C=(Pa/P <sub>atm</sub> )(T <sub>atm</sub> /T <sub>at</sub> ) <sup>1/2</sup>	0.986505148		

## COMMENT

Andersen Instruments, Inc.



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Field Environmental

Approved By

Division Manager

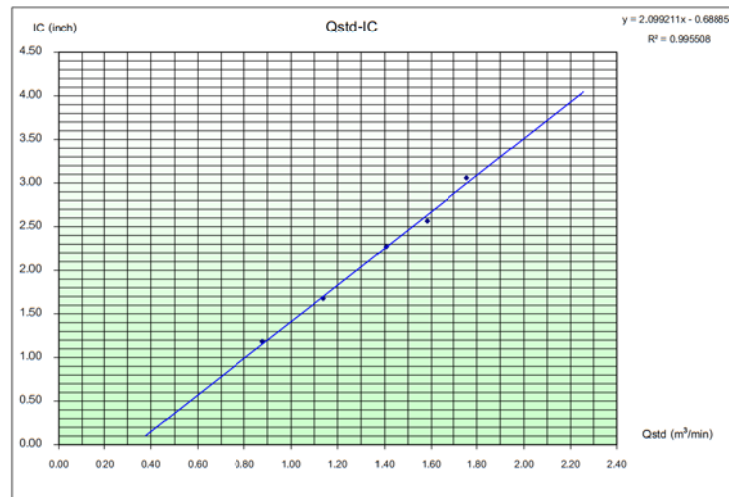
# PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Sampler Location				Date	March 16, 2023
Project Site				Start Time	11:10 AM
Sampler Number	PM-10 No.5	Transfer Standard Type	Office	Stop Time	11:15 AM
Motor Serial Number	HVL-05	Calibrator Model	TE-5025A		
Recorder Serial Number	-	Calibrator Serial Number	1	Person	Mr. Preecha Sriouk

Plate No.	(Delta H)			(A)	(X)	(I)	(Y)	Temperature	Barometric	Start	Stop	
	Pressure Drop Across Orifice (inH <sub>2</sub> O)			$[\Delta H_2O(Pa/P_{atm})(T_{atm}/T_{at})]^{1/2}$	Qstd = (1in)/[(A-b)]	Simple Flow Rate Indicator	$C = [(Pa/P_{atm})(T_{atm}/T_{at})]^{1/2}$		Pressure	Meter	Meter	
	Positive	Negative	$\Delta H_2O$		(m <sup>3</sup> /min)	(inch)		°K = °C+273	(mmHg)			
5	1.5	1.5	3.0	1.70668	0.87849	1.2	1.18	305.0	757.0			
7	2.5	2.5	5.0	2.20580	1.13834	1.7	1.68	305.0	757.0			
10	3.8	3.8	7.6	2.71961	1.40682	2.3	2.27	305.0	757.0			
13	4.8	4.8	9.6	3.05657	1.56292	2.6	2.56	305.0	757.0			
18	5.9	5.9	11.8	3.38876	1.75653	3.1	3.06	305.0	757.0			
Linear Regression Y ON X: Y= mX + b								Average	305.0	757.0		
1	Slope ( m )			1.91345	Linear Equation			r <sup>2</sup>	0.997347	Passing	760.0	
2	Intercept ( b )			0.02773	Set Point Flow Rate ( X ) (m <sup>3</sup> /min)			1.133	r	0.996726	T <sub>atm</sub>	298.0
3	Correlation Coefficient ( r )			0.99995	Final Set Flow Rate = ( I )			0	(Pa/P <sub>atm</sub> )(T <sub>atm</sub> /T <sub>at</sub> )	0.973192407		
Result									C=(Pa/P <sub>atm</sub> )(T <sub>atm</sub> /T <sub>at</sub> ) <sup>1/2</sup> 0.5	0.986505148		

## COMMENT

Andersen Instruments, Inc.



Calibrated By ....

Field Environmental

Approved By

Division Manager

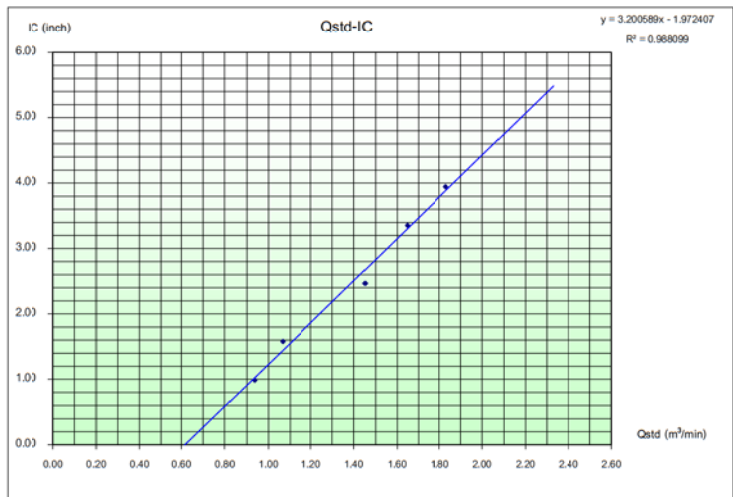
# TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Sampler Location		Date		March 16, 2023	
Project Site		Start Time		9:35 AM	
Sampler Number	TSP No.5	Transfer Standard Type	Office	Stop Time	9:40 AM
Motor Serial Number	BL-05	Calibrator Model	TE-5025A		
Recorder Serial Number	-	Calibrator Serial Number	1	Person	Mr. Preecha Sriouk

Rate	(Delta H)			(A)	(X)	(I)	(Y)	Temperature	Barometric	Start	Stop
No.	Pressure Drop Across Orifice (mmH <sub>2</sub> O)			$\Delta H_2O(Pa/P_{atm})(T_{atm}/T_{at})^{1/2}$	$Q_{std} = [1mm]([A-b])$	Sample Flow Rate Indicator	$C = [(Pa/P_{atm})(T_{atm}/T_{at})^{1/2}]^{1/2}$	°K = °C+273	Pressure	Meter	Meter
	Positive	Negative	$\Delta H_2O$		( m <sup>3</sup> /min )	( inch )					
5	1.7	1.7	3.4	1.81903	0.93616	1.0	0.99	305.0	757.0		
7	2.2	2.2	4.4	2.06931	1.06696	1.6	1.58	305.0	757.0		
10	4.0	4.1	8.1	2.80764	1.45283	2.5	2.47	305.0	757.0		
13	5.2	5.2	10.4	3.18138	1.64815	3.4	3.35	305.0	757.0		
18	6.4	6.4	12.8	3.52943	1.83004	4.0	3.95	305.0	757.0		
Linear Regression Y ON X: Y= mX + b							Average		305.0	757.0	
1	Slope ( m )			1.91345	Linear Equation		r <sup>2</sup>		0.994156	PassingmmHg	760.0
2	Intercept ( b )			0.02773	Set Point Flow Rate ( X ) (m <sup>3</sup> /min)		1.133	r	0.9970732	T <sub>atm</sub>	298.0
3	Correlation Coefficient ( r )			0.99995	Final Set Flow Rate = ( I )		0	(Pa/P <sub>atm</sub> )(T <sub>atm</sub> /T <sub>at</sub> )		0.973192407	
Result								C= (Pa/P <sub>atm</sub> )(T <sub>atm</sub> /T <sub>at</sub> ) <sup>0.5</sup>		0.986505148	

## COMMENT

Andersen Instruments, Inc.



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Field Environmental

Approved By .....

Division Manager

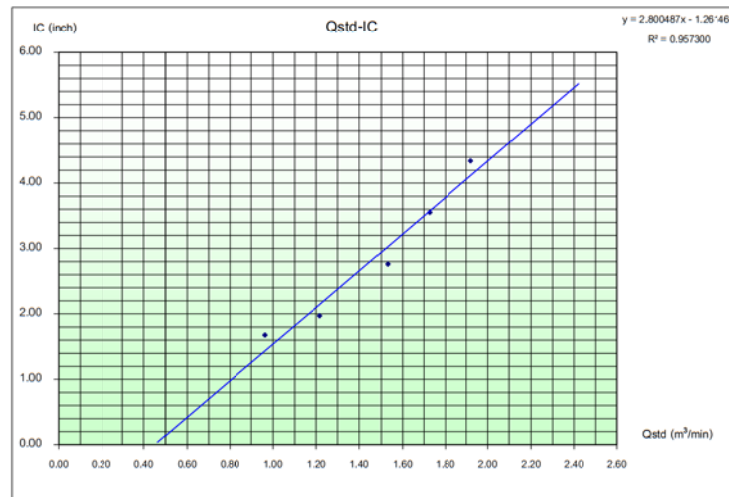
# PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Sampler Location		Date		March 16, 2023	
Project Site		Start Time		10:45 AM	
Sampler Number	PM-10 No.3	Transfer Standard Type	Office	Stop Time	10:50 AM
Motor Serial Number	HVL-03	Calibrator Model	TE-5025A		
Recorder Serial Number	-	Calibrator Serial Number	1	Person	Mr. Preecha Sriouk

Plate No.	(Delta H)			(A)	(X)	(I)	(Y)	Temperature	Barometric	Start	Stop
	Pressure Drop Across Orifice (mmH <sub>2</sub> O)			$[\Delta H_2O(Pa/P_{atm})(T_{atm}/T_{at})]^{1/2}$	Qstd = (1mm)[(A-b)]	Simple Flow Rate Indicator	$C = [(Pa/P_{atm})(T_{atm}/T_{at})]^{1/2}$	°K = °C+273	Pressure	Meter	Meter
	Positive	Negative	ΔH <sub>2</sub> O		(m <sup>3</sup> /min)	(inch)			(mmHg)		
5	1.8	1.8	3.6	1.87176	0.96372	1.7	1.68	305.0	757.0		
7	2.8	2.9	5.7	2.35528	1.21640	2.0	1.97	305.0	757.0		
10	4.5	4.5	9.0	2.99952	1.53220	2.8	2.76	305.0	757.0		
13	5.7	5.7	11.4	3.33062	1.72625	3.6	3.55	305.0	757.0		
18	7.0	7.1	14.1	3.70432	1.92145	4.4	4.34	305.0	757.0		
Linear Regression Y ON X: Y= mX + b								Average	305.0	757.0	
1	Slope ( m )			1.91345	Linear Equation			r <sup>2</sup>	0.942435	PassingmmHg	760.0
2	Intercept ( b )			0.02773	Set Point Flow Rate ( X ) (m <sup>3</sup> /min)		1.133	r	0.9707909	T <sub>atm</sub>	298.0
3	Correlation Coefficient ( r )			0.99995	Final Set Flow Rate = ( I )		0	(Pa/P <sub>atm</sub> )(T <sub>atm</sub> /T <sub>at</sub> )		0.973192407	
Result								C= (Pa/P <sub>atm</sub> )(T <sub>atm</sub> /T <sub>at</sub> ) <sup>0.5</sup>		0.986505148	

## COMMENT

Andersen Instruments, Inc.



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Field Environmental

Approved By .....

Division Manager

# TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

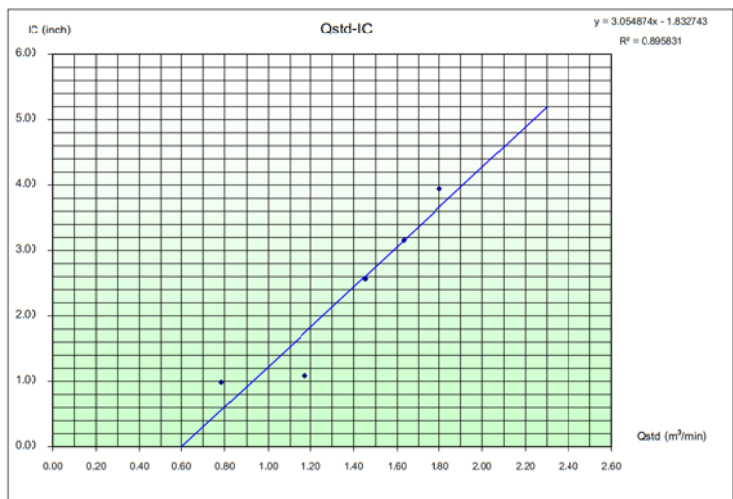
Sampler Location				Date	March 16, 2023
Project Site				Start Time	9:15 AM
Sampler Number	TSP No.3	Transfer Standard Type	Office	Stop Time	9:20 AM
Motor Serial Number	BL-03	Calibrator Model	TE-5025A		
Recorder Serial Number	-	Calibrator Serial Number	1	Person	Mr. Preecha Sitruk

Plots	(Delta H)	(A)	(X)	(I)	(Y)	Temperature	Barometric	Start	Stop
No.	Pressure Drop Across Orifice (inH <sub>2</sub> O)	$\Delta H_2O(Pa/P_{std}(T_{std}/T_a))^{1/2}$	$Q_{std} = [1 \text{ in}^3/(A \cdot b)]$	Sample Flow Rate Indicator (inches)	$IC = [(P/P_{std})(T_{std}/T_a)]^{1/2}$	"K" = "C" + 273.15	Pressure (mmHg)	Meter	Meter
	Positive	Negative	$\Delta H_2O$	(m <sup>3</sup> /min)	(inches)				
5	1.2	1.2	2.4	1.52829	0.78422	1.0	0.99	305.0	757.0
7	2.6	2.7	5.3	2.27111	1.17242	1.1	1.09	305.0	757.0
10	4.0	4.1	8.1	2.80764	1.45283	2.6	2.56	305.0	757.0
13	5.1	5.1	10.2	3.15064	1.63209	3.2	3.16	305.0	757.0
18	6.2	6.2	12.4	3.47394	1.80099	4.0	3.95	305.0	757.0

Linear Regression: Y ON X: Y = mX + b						Average	305.0	757.0	
1	Slope (m)	1.91345	Linear Equation			r <sup>2</sup>	0.990028	Passing	760.0
2	Intercept (b)	0.02773	Set Point Flow Rate (X) (m <sup>3</sup> /min)			1.133	0.9643796	T <sub>std</sub>	298.0
3	Correlation Coefficient (r)	0.99995	Final Set Flow Rate = (I)			0	(Pa/Pstd)(Tstd/Ta)	0.973192407	
Result						C = (Pa/Pstd)(Tstd/Ta) = 0.998555148			

## COMMENT

Andersen Instruments, Inc.



Calibrated By: [Signature]

Field Environmental

Approved By: [Signature]

Division Manager



บริษัท เอ็นไวร์ เซอร์วิส จำกัด

42 รามอินทรา 14 แยก 9 แขวงท่าแร้ง เขตบางเขน กรุงเทพฯ 10230 โทรศัพท์ 02-9435814-5 โทรสาร 02-9438201  
 42 Raminthra 14 yeak 9, Tha Rang, Bangkok, Bankok 10230 Tel : 02-9435814-5 Fax : 02-9438201

## Analyzer Performance Test

Calibrated Date: 16 March 2022

## Instruments Information

Analyzer Type: NO/NO <sub>2</sub> /NO <sub>x</sub> Analyzer	Manufacturer: Thermo Environmental
Model: 42C	S/N: 42C-33500-371

## Calibration System

Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008	NO Conc 55.47 PPM
S/N: 705	SO <sub>2</sub> Conc 55.11 PPM
ZERO AIR Generator API Model 701	CO Conc 4.535 PPM
S/N: 1924	Cylinder number EB0129027
	Expire Date: 29 Oct. 2027

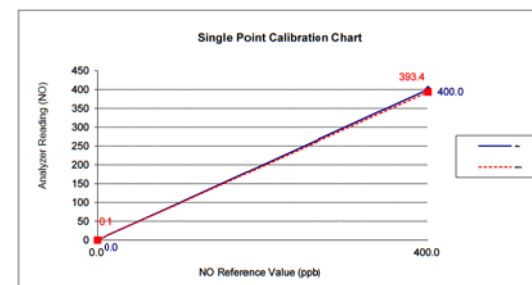
Environment: Temperature: 25.5 °C Humidity: 51 %RH

## Calibration Check ( Before adjust )

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.1	0.0	0.1	393.4	400.0	-1.7
NO <sub>x</sub>	0.1	0.0	0.1	396.7	400.0	-0.8

## Calibration Check ( After adjust )

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.0	0.0	0.0	400.0	400.0	0.0
NO <sub>x</sub>	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By: [Signature]





## บริษัท เอ็นไวร์ เซอร์วิส จำกัด

42 รามอินทรา 14 แยก 9 แขวงท่าแร้ง เขตบางเขน กรุงเทพฯ 10230 โทรศัพท์ 02-9435814-5 โทรสาร 02-9438201  
42 Raminthra 14 yeak 9, Tha Rang, Bangkhen, Bankok 10230 Tel : 02-9435814-5 Fax : 02-9438201

### Analyzer Performance Test

Calibrated Date: 16 March 2022

#### Instruments Information

Analyzer Type: NO/NO <sub>2</sub> /NO <sub>x</sub> Analyzer Model: 42C	Manufacturer Thermo Environmental S/N: 42C-601114773
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#### Calibration System

Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008 S/N: 705 ZERO AIR Generator API Model 701 S/N: 1924	NO Conc 55.47 PPM SO <sub>2</sub> Conc 55.11 PPM CO Conc 4.535 PPM Cylinder number EB0129027 Expire Date: 29 Oct. 2027

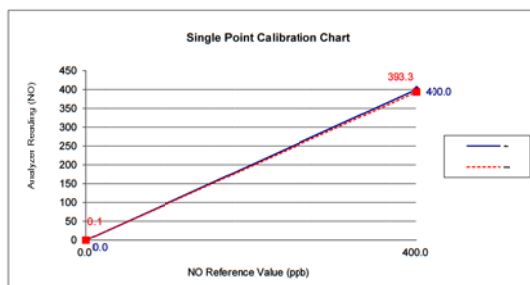
Environment: Temperature 25.5 °C Humidity: 51 %RH

#### Calibration Check ( Before adjust )

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.1	0.0	0.1	393.3	400.0	-1.7
NO <sub>x</sub>	0.1	0.0	0.1	396.4	400.0	-0.9

#### Calibration Check ( After adjust )

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.0	0.0	0.0	400.0	400.0	0.0
NO <sub>x</sub>	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By :



## บริษัท เอ็นไวร์ เซอร์วิส จำกัด

42 รามอินทรา 14 แยก 9 แขวงท่าแร้ง เขตบางเขน กรุงเทพฯ 10230 โทรศัพท์ 02-9435814-5 โทรสาร 02-9438201  
42 Raminthra 14 yeak 9, Tha Rang, Bangkhen, Bankok 10230 Tel : 02-9435814-5 Fax : 02-9438201

### Analyzer Performance Test

Calibrated Date: 16 March 2022

#### Instruments Information

Analyzer Type: NO/NO <sub>2</sub> /NO <sub>x</sub> Analyzer Model: 42C	Manufacturer Thermo Environmental S/N: 42C-601114783
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#### Calibration System

Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008 S/N: 705 ZERO AIR Generator API Model 701 S/N: 1924	NO Conc 55.47 PPM SO <sub>2</sub> Conc 55.11 PPM CO Conc 4.535 PPM Cylinder number EB0129027 Expire Date: 29 Oct. 2027

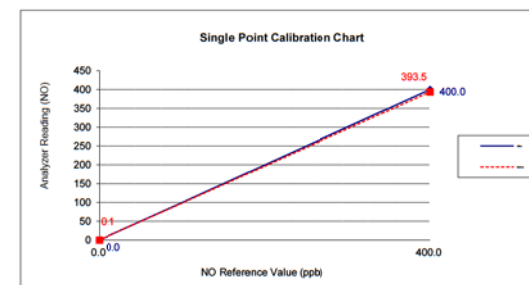
Environment: Temperature 25.5 °C Humidity: 51 %RH

#### Calibration Check ( Before adjust )

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.1	0.0	0.1	393.5	400.0	-1.6
NO <sub>x</sub>	0.1	0.0	0.1	396.2	400.0	-1.0

#### Calibration Check ( After adjust )

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.0	0.0	0.0	400.0	400.0	0.0
NO <sub>x</sub>	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By :

## บริษัท เอ็นไวร์ เซอร์วิส จำกัด

### Analyzer Performance Test

Calibrated Date: 16 March 2022

#### Instruments Information

Analyzer Type: <b>SO2 Analyzer</b>	Manufacturer: <b>Thermo Environmental</b>
Model: <b>43C</b>	S/N: <b>43C-33500-719</b>

#### Calibration System

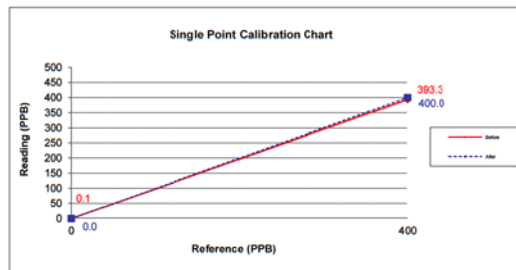
Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008 S/N: 705 ZERO AIR Generator API MODEL 701 S/N: 1924	NO Conc 55.47 PPM SO2 Conc 55.11 PPM CO Conc 4,535 PPM Cylinder number EB0129027 Expire Date: 29 Oct. 2027

Environment: Temperature 25.5 °C

Humidity: 51 %RH

#### Calibration Report

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
Before	0.0	0.1	0.1	400.0	393.3	-1.7
After	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By :



## บริษัท เอ็นไวร์ เซอร์วิส จำกัด

### Analyzer Performance Test

Calibrated Date: 16 March 2022

#### Instruments Information

Analyzer Type: <b>SO2 Analyzer</b>	Manufacturer: <b>Thermo Environmental</b>
Model: <b>43C</b>	S/N: <b>43C-71354-368</b>

#### Calibration System

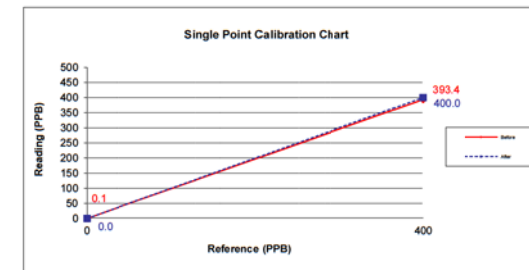
Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008 S/N: 705 ZERO AIR Generator API MODEL 701 S/N: 1924	NO Conc 55.47 PPM SO2 Conc 55.11 PPM CO Conc 4,535 PPM Cylinder number EB0129027 Expire Date: 29 Oct. 2027

Environment: Temperature 25.5 °C

Humidity: 51 %RH

#### Calibration Report

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
Before	0.0	0.1	0.1	400.0	393.4	-1.7
After	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By :



## บริษัท เอ็นไวร์ เซอร์วิส จำกัด

### Analyzer Performance Test

Calibrated Date: 16 March 2022

#### Instruments Information

Analyzer Type: SO2 Analyzer	Manufacturer API
Model: 100A	S/N: 193

#### Calibration System

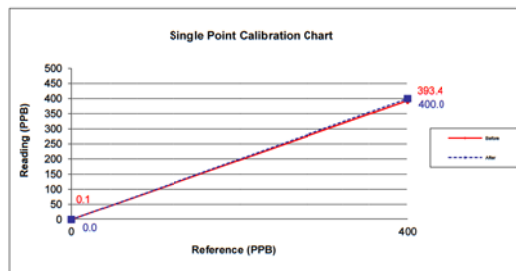
Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008	NO Conc 55.47 PPM
S/N: 705	SO2 Conc 55.11 PPM
ZERO AIR Generator API MODEL 701	CO Conc 4,535 PPM
S/N: 1924	Cylinder number EB0129027
	Expire Date: 29 Oct. 2027

Environment: Temperature 25.5 °C

Humidity: 51 %RH

#### Calibration Report

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
Before	0.0	0.1	0.1	400.0	393.4	-1.7
After	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By



## บริษัท เอ็นไวร์ เซอร์วิส จำกัด

### Analyzer Performance Test

Calibrated Date: 16 March 2022

#### Instruments Information

Analyzer Type: SO2 Analyzer	Manufacturer API
Model: 100A	S/N: 405

#### Calibration System

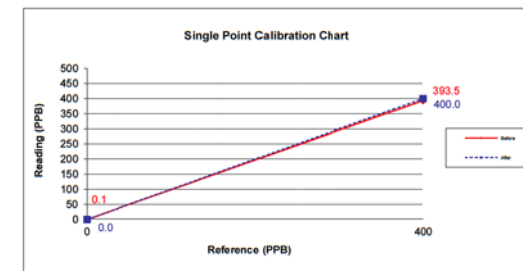
Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008	NO Conc 55.47 PPM
S/N: 705	SO2 Conc 55.11 PPM
ZERO AIR Generator API MODEL 701	CO Conc 4,535 PPM
S/N: 1924	Cylinder number EB0129027
	Expire Date: 29 Oct. 2027

Environment: Temperature 25.5 °C

Humidity: 51 %RH

#### Calibration Report

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
Before	0.0	0.1	0.1	400.0	393.5	-1.6
After	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By



## Certificate of Calibration

Certificate No. : 66-300003-1

Page : 1 of 2

Submitted by : M E T Company Limited

36/659 Moo 6 T. Bangrakpattana, A. Bangbuatong, Nonthaburi 11110

Equipment : Volumetric Flask

Manufacturer : ISOLAB

Class : A

Capacity : 1000 ml

ID No. : MET:VF1000:02/61

Environment : Ambient Temperature :  $(23 \pm 2)$  °C

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

Air Pressure : 1012.0 mbar.

Date of Received : 05 January 2023

Date of Calibration : 13 January 2023

Date of Issue : 13 January 2023

Calibrated by : Arcerat Sombun

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

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

Electronic Balance

ID No.	Cert. No.	Due Date	Traceability
241002	65-200370-1	02 Jun 2023	National Institute of Metrology (Thailand) (NIMT)

Approved by :



Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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



## Certificate of Calibration

Certificate No. : 66-300003-1

Page : 2 of 2

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

UUC Condition As-Received : Good

Nominal Volume ( ml )	Measuring Volume ( ml )
1000	1000.55

Uncertainty of measurement with in  $\pm$  0.14 ml

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

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

- oOo -





## Certificate of Calibration

Certificate No. : 66-420002-1

Page : 1 of 2

Submitted by : M E T Company Limited

36/659 Moo 6, T.Bangrakpattana, A.Bangbuatong, Nonthaburi 11110

Equipment : pH Meter with electrode

pH meter

Manufacturer : Eutech

Model : pH 150

Range : -2.00 to 16.00 pH

Resolution : 0.01 pH

Serial No. : 2657036

ID No. : MET-PH04/60

Electrode

Model : N/A

Serial No. : 66365

Environment : Ambient Temperature : (25 ± 2) °C

Relative Humidity : (50 ± 15) %

Date of Received : 05 January 2023

Date of Calibration : 11 January 2023

Date of Issue : 11 January 2023

Calibrated by : Bunjerd Masri

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

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

1. Multiproduct Calibrator

ID No. Cert. No. Due Date Traceability

440001 21E997 17 Mar 2023 National Institute of Metrology Thailand (NIMT)

2. Standard Buffer Solution

pH Cert. No. Lot No. Exp. Date Traceability

4.008 61235182 857394 11 Dec 2024 CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025

6.986 61267169 857395 11 Dec 2023 CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025

10.010 61260481 857396 11 Dec 2023 CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025

Approved by

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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## Certificate of Calibration

Certificate No. : 66-420002-1

Page : 2 of 2

Result of Calibration :

UUC Condition As-Received : Good

Function : Electrical measurement

pH meter

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

Adjustment Curve at nominal pH	Applied Voltage ( mV )	Nominal Value ( pH )	UUC Reading		Correction ( mV )	Uncertainty ( ± mV )
			( pH )	( mV )		
4, 7, 10	177.4800	4	4.00	177.1	0.4	0.060
	0.0000	7	6.99	-0.1	0.1	0.060
	-177.4800	10	10.00	-177.3	-0.2	0.060

Function : pH meter with electrode

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

Adjustment Curve at nominal pH	Standard Buffer ( pH )	UUC Reading ( pH )	Correction ( pH )	Uncertainty ( ± pH )
4, 7, 10	4.008	4.01	0.00	0.0097
	6.986	7.03	-0.01	0.011
	10.010	10.01	0.00	0.014

Remark

UUC : Unit Under Calibration

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

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

- ๐๐๐ -



## Certificate of Calibration

**Certificate No. :** 66-400012-1

**Page :** 1 of 2

**Submitted by :** M E T Company Limited  
6/659 Moo 6, T. Bangrakpattana, A. Bangbuatong, Nonthaburi 11110

**Equipment :** Digital Thermometer with Thermistor Probe  
Temperature Indicator

**Manufacturer :** Thermo Scientific **Model :** pH 150  
**Range :** N/A **Resolution :** 0.1 °C  
**Serial No. :** 2657036 **ID No. :** MET-PH04/60  
**Thermistor Probe**  
**Model :** PHWPTEM01W **Sheath Material :** Stainless  
**Diameter :** 3 mm. **Length :** 85 mm.  
**Serial No. :** 237 **ID No. :** MET-PH04/60

**Environment :** Ambient Temperature :  $(23 \pm 2)$  °C  
Relative Humidity :  $(50 \pm 15)$  %  
Line Voltage :  $(220 \pm 22)$  VAC

**Date of Received :** 05 January 2023

**Date of Calibration :** 11 January 2023

**Date of Issue :** 11 January 2023

**Calibrated by :** Bunjerd Masri

**Calibration Method :** This instrument was calibrated by In-house method comparison technique CAL-M4003 by compared with PRT in the liquid bath at the constant controlled temperature.

The temperature scale used was based on ITS-90

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

1. Platinum Resistance Thermometer (PRT)

ID No.	Cert. No.	Due Date	Traceability
400001	TT-0016-20	04 Mar 2022	National Institute of Metrology Thailand (NIMT)

2. Standard Digital Thermometer

ID No.	Cert. No.	Due Date	Traceability
400003	21E1850	14 Jun 2023	National Institute of Metrology Thailand (NIMT)
400004	21E1850	14 Jun 2023	National Institute of Metrology Thailand (NIMT)

Approved by

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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## Certificate of Calibration

**Certificate No. :** 66-400012-1

**Page :** 2 of 2

**Result of Calibration :** Without Adjustment

**UUC Condition As-Received :** Good

**Function :** Temperature measurement

Immersion Depth ( mm. )	Standard Reading ( °C )	UUC Reading ( °C )	Correction ( °C )	Uncertainty ( ± °C )
85	10.0035	9.8	0.2	0.11
85	50.0025	50.0	0.0	0.11

**Remark**

UUC : Unit Under Calibration

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

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

- o0o -



## Certificate of Calibration

Certificate No. : 64-400425-5

Page : 1 of 2

Submitted by : M E T Company Limited

36/659 Moo 6, T.Bangrakpattana, A.Bangbuatong, Nonthaburi 11110

Equipment : Air Chamber (Incubator)

Manufacturer : M-LAB

Model : BIC-140

Range : N/A °C

Resolution : 0.1 °C

Serial No. : 240412

ID No. : MET-BI01/55

Environment : On site calibration was carried out at the Laboratory, M E T Company Limited

Ambient Temperature : (27.0 to 28.0) °C

Relative Humidity : (50 to 55) %

Line Voltage : (210.0 to 210.8) V

Date of Received : 10 August 2022

Date of Calibration : 10 August 2022

Date of Issue : 13 August 2022

Calibrated by : Permpoon Chanpu

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

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

ID No. Cert. No. Due Date Traceability

400029 & 400032 65-400274-1 25 Nov 2022 National Institute of Metrology Thailand (NIMT)

Approved by :

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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## Certificate of Calibration

Certificate No. : 64-400425-5

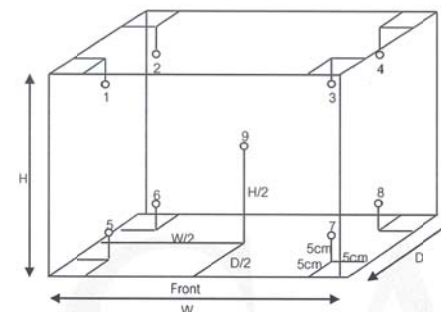
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

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



Inside of Chamber

W = 0.37 m

D = 0.33 m

H = 1.14 m

Capacity = 0.14 m<sup>3</sup>

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) @ Sensor No.									Uncertainty (± °C)
			1	2	3	4	5	6	7	8	9	
20.0	20.0	20.0	19.8	19.7	19.6	19.6	20.4	20.2	20.3	19.8	19.9	0.54

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
20.0	20.0	20.0	0.6	0.1	1.0

Remark The uncertainty is not combine uniformity of the air chamber

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

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

- o0o -





## Certificate of Calibration

**Certificate No. :** 65-400424-7

**Page :** 1 of 2

**Submitted by :** M E T Company Limited

36/659 Moo 6, T.Bangrakpattana, A.Bangbuatong, Nonthaburi 11110

**Equipment :** Air Chamber (Refrigerator)

Manufacturer : Sanden Intercool

Model : SRR3-0687 AR

Range : N/A °C

Resolution : 1 °C

Serial No. : SRR3675A-210400065 R

ID No. : MET-RE04/64

**Environment :** On site calibration was carried out at the Laboratory, M E T Company Limited

Ambient Temperature : (29.8 to 31.5) °C

Relative Humidity : (55 to 58) %

Line Voltage : (220.8 to 222.8) V

**Date of Received :** 10 August 2022

**Date of Calibration :** 10 August 2022

**Date of Issue :** 13 August 2022

**Calibrated by :** Bunjerd Masri

**Calibration Method :** CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

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

Standard Digital Thermometer with Thermocouple probe

**ID No.** **Cert. No.** **Due Date** **Traceability**

400046 & 400028 65-400157-3 04 Oct 2022

National Institute of Metrology Thailand (NIMT)

Approved by

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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



## Certificate of Calibration

**Certificate No. :** 65-400424-7

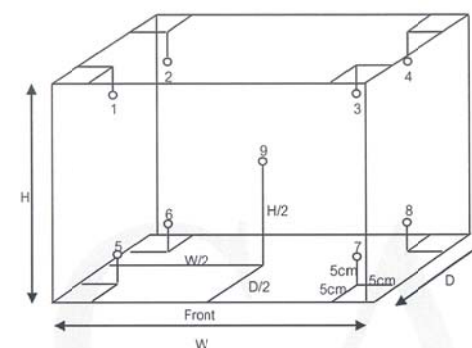
**Page :** 2 of 2

**Result of Calibration :** Without Adjustment

**UUC Condition As-Received :** Good

**Function :** Temperature measurement

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



Inside of Chamber

W = 0.58 m

D = 0.60 m

H = 1.45 m

Capacity = 0.50 m<sup>3</sup>

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) @ Sensor No.									Uncertainty (± °C)
			1	2	3	4	5	6	7	8	9	
3	3	3	3.7	3.7	3.6	3.0	2.6	3.2	2.6	2.5	3.0	0.85

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
3	3	3	0.8	0.3	1.5

**Remark** The uncertainty is not combine uniformity of the air chamber

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

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

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# Calibration Certificate

Cert. No. : CT-22-04-22785

Page : 1 of 4

Issued date : 01 April 2022

Equipment : COD Reactor , Manufacturer : MLAB , Model : DB1602

S/N = 0189 , Customer ID = -

Client : M E T COMPANY LIMITED.

36/659 M.6 Bang Rak Phatthana, Bang Bua Thong, Nonthaburi 11110

Received Date : 30 March 2022

Ref. Job No. : SO6503-00042

Calibrate by : Mr.Pramot Srisukum

Cert. prepare by : Ms.Pimlada Ittiprawet

Calibrated Date : 30 March 2022

Approved by : Mr.Montree Ruschasetkul

Calibration Place : Laboratory of Metrology Technical Co.,Ltd.

Environment Condition : Temperature  $27.1 \pm 0.1$  (°C) , Humidity  $35.5 \pm 4.5$  (%RH)

Calibration Method : Measure temperature distribution by 9 channel in flat level. , (MTEC WI No. # WICAL-02-005-R01)

## Reference Standard Instrument :

No	Instrument	code	Model	Due date
1	Thermo Hygrometer	MTEC-CE-0181	TH-03A	06-2022
2	Temperature Datalogger	MTEC-CE-0180	MLAB	10-2022

## Condition of certificate :

(1) This certificate is traceable to International System of units (SI Units). , (2) This certificate was certified only for the instrument we calibrated. , (3) This result of calibration was found accurate as show on date and place of calibration only. , (4) The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor  $k =$  (see result table) , providing a level of confidence of approximately 95%. , (5) This certificate may not be reproduced other than in full, except with the prior written approval of the head of Calibration Division, Metrology Technical Co.,Ltd.

Approved Signatory

CER04-R01-CF01

44 Soi ChokChai 4 Soi 40 ,LadPrao ,Bangkok ,Tel.: 0-2538-9205 ,0-2935-7096 ,Fax.: 0-2931-4015 ,Email : contact@mttec.co.th , www.mtec.co.th

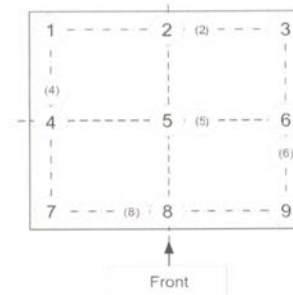
Certificate No. : CT-22-04-22785

Page : 2 of 4

## Calibration Result :

Condition of UUC :

- Without Adjustment
- Immersion : 1/2 of the depth of the hole



Pic 1 : Position of each sensor No.

- The quoted uncertainty include with " Stability".
- Stability = One-half of the greatest maximum difference of measured temperatures at any one sensors , for at least half an hour after reaching stated state.
- Uniformity = The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time.
- Overall variation = The difference of the maximum and the minimum measured temperature throughout observation time.

## Section 1 : Report of Temperature distribution

Unit : (°C)

Calibration Point	UUC Setting (*)	UUC Reading (*)	Measured Temperature @ Sensor No.									Uncertainty (±)	k (**)
			#1	#2	#3	#4	#5	#6	#7	#8	#9		
150	150	150	150.55	149.75	150.33	149.86	150.75	150.83	150.00	150.33	150.03	0.424	2

(\*) = The average of 30 values in each point , (\*\*) = Coverage factor (k) value

## Section 2 : Report of Chamber Performance

Unit : (°C)

Calibration Point	UUC Setting	UUC Reading (*)	Temperature Uniformity	Temperature Stability (± °C)	Temperature Overall Variation
150	150	150	0.9	0.1	1.2

(\*) = The average of 30 values in each point

Approved Signatory : ...

44 Soi ChokChai 4 Soi 40 ,LadPrao ,Bangkok ,Tel.: 0-2538-9205 ,0-2935-7096 ,Fax.: 0-2931-4015 ,Email : contact@mttec.co.th , www.mtec.co.th

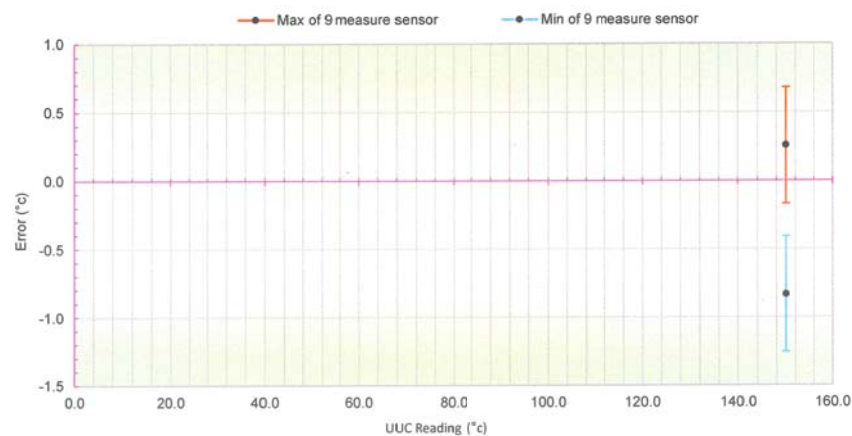
Section 3 : Possible of temperature. Show minimum and maximum of the average values and include with uncertainty of measurement. The average values is average of each position standard sensor throughout observation time.

Unit : (°C)

Calibration Point	UUC Setting (*)	UUC Reading (*)	Possible of Minimum temperature	Possible of Maximum temperature
150	150	150	149.32	151.26

(\*) = The average of 30 values in each point

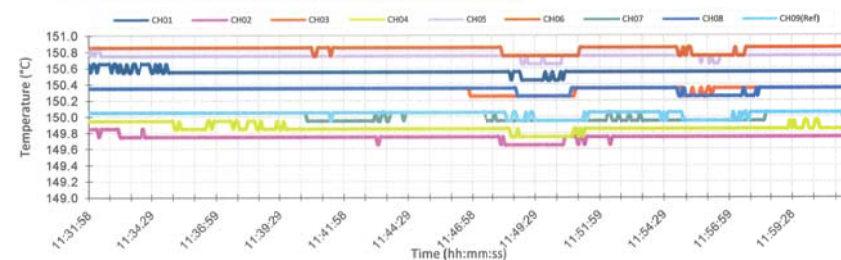
#### Section 4 : Trend of accuracy



Approved Signatory :

#### Section 5 : Graph report for Temperature distribution , not include uncertainty of measurement

##### (5.1) Temperature Distribution at UUC Reading 150 °C



Approved Signatory :



CERT.No.: HS-T078K

Harikul Science Co.,Ltd.  
694 Soi Ratchadanivet 24, Pracharatbamphen,  
Samsaennok, Huaikhwang, Bangkok 10310  
Tel: 0-2274-2456 Fax: 0-2274-2443  
Email: info@harikul.com www.harikul.com  
Certificate of Calibration

Calibration Date : 25 Nov 22

Submitted by : MET CO.,LTD

36/659 Moo. 6, Bang Rak Phatthana,

Bang Bua Thong, Nonthaburi 11110

Avg Room Temp : 20 °C

Avg Water Temp : 20 °C

Air Pressure : 760.00 mmHg

Salinity : 0 ppt

Model : YSI 5000

S/N : 15G103969

Probe : YSI 5010

S/N : 15K100353

ID NO. :

Air Temp ref : S/N. E00522

Barometric ref : S/N. E00522

Water Temp ref : S/N. 11431

Technician : Kittipong M.

#### Calibration Details

Calibration Point	100% air sat. (@20 °C, DO = 9.09 mg/l)	(status)	(status)
Measurement 1 (mg/l)	9.09	(PASS)	-
Measurement 2 (mg/l)	9.09	(PASS)	-
Measurement 3 (mg/l)	9.09	(PASS)	-
Measurement 4 (mg/l)	9.09	(PASS)	-
Measurement 5 (mg/l)	9.09	(PASS)	-
Measurement 6 (mg/l)	9.09	(PASS)	-
Measurement 7 (mg/l)	9.09	(PASS)	-
Measurement 8 (mg/l)	9.09	(PASS)	-
Measurement 9 (mg/l)	9.10	(PASS)	-
Measurement 10 (mg/l)	9.09	(PASS)	-

Mean Measurement	9.09	mg/l	-	-
Inaccuracy	0.00	mg/l	-	-

Overall Status (PASS)

#### Manufacturer Specification

Accuracy = +/- 0.02 mg/l

- 1) This certificate is issued based on the result that are found as shown on date and place of test only.
- 2) The calibration procedure followed in accordance with Harikul Science Co., Ltd.
- 3) This result shall not be used for advertising purpose.

.....

Technician Signature

.....

Laboratory Manager

# CAL

Calibratech Co.,Ltd.

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

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



NSC-TISI-TIS17025  
CALIBRATION 0030

## Certificate of Calibration

Certificate No. : 65-400424-2

Page : 1 of 2

Submitted by : M E T Company Limited

36/659 Moo 6, T.Bangrakpattana, A.Bangbuaatong, Nonthaburi 11110

Equipment : Air Chamber (Oven)

Manufacturer : Binder

Model : ED53

Range : N/A °C

Resolution : 1 °C

Serial No. : 13-07419

ID No. : MET-OV02/57

Environment : On site calibration was carried out at the Laboratory, M E T Company Limited

Ambient Temperature : (27.0 to 28.0) °C

Relative Humidity : (50 to 55) %

Line Voltage : (210.0 to 210.8) V

Date of Received : 10 August 2022

Date of Calibration : 10 August 2022

Date of Issue : 13 August 2022

Calibrated by : Permon Chanpu

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

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

Standard Digital Thermometer with Thermocouple probe

ID No. Cert. No. Due Date Traceability

400029 & 400030 65-400272-1 24 Nov 2022

National Institute of Metrology Thailand (NIMT)

Approved by : .....

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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CAL-F0031-03





## Certificate of Calibration

Certificate No. : 65-400424-2

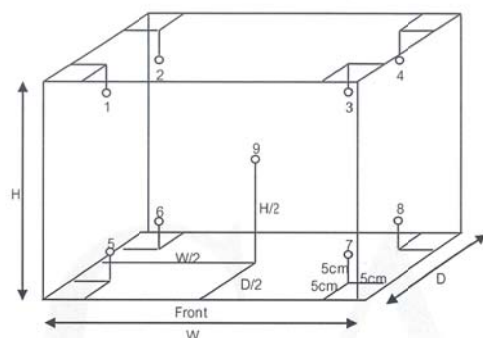
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

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



Inside of Chamber  
W = 0.40 m  
D = 0.33 m  
H = 0.40 m  
Capacity = 0.05 m<sup>3</sup>

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) @ Sensor No.									Uncertainty (± °C)
			1	2	3	4	5	6	7	8	9	
104	110	110	105.0	105.0	104.7	105.0	104.4	104.5	104.0	103.7	104.2	0.95
180	184	184	180.8	182.0	179.4	180.8	180.8	180.8	180.3	180.0	180.0	1.2

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
104	110	110	1.0	0.2	1.7
180	184	184	2.3	0.3	3.0

Remark The uncertainty is not combine uniformity of the air chamber

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

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

- o0o -



## Certificate of Calibration

Certificate No. : 65-400424-1

Page : 1 of 2

Submitted by : M E T Company Limited

36/659 Moo 6, T.Bangrakpattana, A.Bangbuatong, Nonthaburi 11110

Equipment : Air Chamber (Oven)

Manufacturer : Memmert

Model : UM 100

Range : N/A °C

Resolution : 0.1 °C

Serial No. : b197.0985

ID No. : MET-OV01/46

Environment : On site calibration was carried out at the Laboratory, M E T Company Limited

Ambient Temperature : (27.0 to 28.0) °C

Relative Humidity : (50 to 55) %

Line Voltage : (210.0 to 210.8) V

Date of Received : 10 August 2022

Date of Calibration : 10 August 2022

Date of Issue : 13 August 2022

Calibrated by : Permpon Chanpu

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

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

Standard Digital Thermometer with Thermocouple probe

ID No. Cert. No. Due Date Traceability

400029 & 400032 65-400274-1

25 Nov 2022

National Institute of Metrology Thailand (NIMT)

Approved by :



Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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## Certificate of Calibration

Certificate No. : 65-400424-1

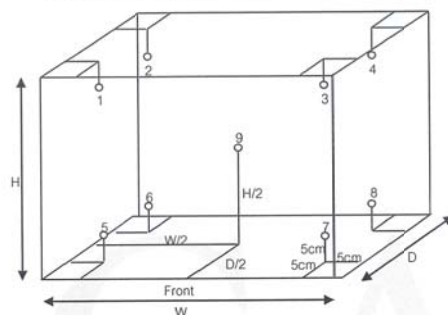
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

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



Inside of Chamber  
W = 0.32 m  
D = 0.18 m  
H = 0.24 m  
Capacity = 0.01 m<sup>3</sup>

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) @ Sensor No.									Uncertainty (± °C)
			1	2	3	4	5	6	7	8	9	
180.0	180.0	180.0	181.2	181.3	180.6	180.4	179.9	181.0	179.5	179.1	180.0	0.95

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
180.0	180.0	180.0	1.4	0.3	2.5

Remark The uncertainty is not combine uniformity of the air chamber

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

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

- o0o -



## Certificate of Calibration

Certificate No. : 65-200253-1

Page : 1 of 2

Submitted by : M E T Company Limited

36/659 Moo 6, T.Bangrakpattana, A.Bangbuatong, Nonthaburi 11110

Equipment : Electronic Balance

Manufacturer : Sartorius Model : BSA224S-CW

Serial No. : 35090472 ID No. : MET-EB 02/60

Capacity : 220 g Resolution : 0.0001 g

Environment : On site calibration was carried out at the Laboratory, M E T Company Limited

Ambient Temperature : (25.6 to 25.8) °C

Relative Humidity : (57.3 to 57.8) %

Air Pressure : 1005.0 mbar

Date of Received : 10 August 2022

Date of Calibration : 10 August 2022

Date of Issue : 11 August 2022

Calibrated by : Akaradath Thippichai

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

Edition 5, July 2015

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

Standard Weights

ID No.	Cert. No.	Due Date	Traceability
E261-E2624	C02213103	18 Nov 2022	National Institute of Metrology (Thailand), (NIMT)

Approved by :

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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# CAL

Calibratech Co.,Ltd.

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

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

## Certificate of Calibration

Certificate No. : 65-200253-1

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

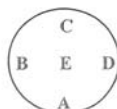
Departure of indication from nominal value

Nominal Value (g)	Correction (g)	Uncertainty ± (g)
0.05	0.0000	0.00011
0.1	0.0000	0.00013
0.5	0.0000	0.00013
1	0.0000	0.00011
5	0.0000	0.00011
10	0.0001	0.00011
50	0.0001	0.00013
100	0.0000	0.00020
150	0.0000	0.00038
200	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  $k = 2.11$ , providing a level of confidence of approximately 95%

Eccentric error Load test : 50 g  
A B C D E  
0.0001 0.0001 0.0001 0.0000 0.0000 g



Repeatability Load test : 200 g  
Stdev. : 0.00005 g

- o0o -



## Packing List

Unit : K-446 Kjeldigester standard



151111112791000281006111

Serial Number 1000281006

Page 1(1)

Item	Pieces	Description		
11059833	1.0000	Packing parts Kjeldigester K-446/K-449 Beipackteile K-446/K-449		✓ OK
037377	5.0000	Sample tubes 300 ml (set of 4) Probengläser 300 ml (Set à 4 Stück)		✓ OK
11059754	1.0000	Rack 20 cpl. Rack 20 kpl.		✓ OK
11058955	1.0000	Aspiration device Kjeldigester K-446/K-449 cpl. Absaugeinheit K-446/K-449		✓ OK
040444	1.0000	Weighing boat 20pcs. Wägeschiffchen 20 Stk.		✓ OK
010020	1.0000	Power cable type USA, 3 pole 120V Anschlusskabel USA W 120V		✓ OK
11058825	1.0000	Fume collection tube with ball joint Dampfsammelrohr mit Kugelschiff		✓ OK
11592548	1.0000	Kjeldahl Practice Guide en Kjeldahl Pracice Guide en		✓ OK
11593546	1.0000	Operation Manual K-446/K-449 english Bedienungsanleitung K-446/K-449 englisch		✓ OK
11593635	1.0000	Supplemantary sheet Kjeldigester K-446/K-449 Beiblatt K-446/K-449		✓ OK

Packed by





## BUCHI Certificate

### Final Test Inspection

Unit : BÜCHI Kjeldigester K-446

Serial number : 1000281006

#### Examination Procedure

1. **Visual control of the glass parts and the unit** ✓ OK
  - No scratches on the coated surface
  - Mounted in accordance to the specific drawing
2. **Security tests** ✓ OK
  - High voltage test in accordance with EN 61010-1 (IEC 1010)
  - Ground connection test in accordance with EN 61010-1 (IEC 1010)
3. **Functional tests** ✓ OK
  - Operating panel**
    - All buttons are working
    - Cooling system is working after the instrument has been switched on
  - Connector plugs** ✓ OK
    - Scrubber connector is working
  - Heating element** ✓ OK
    - Heating-up temperature 420 °C is reached after 40 minutes
    - Temperature calibration at 420 °C (3 measuring points)
4. **Completeness of order checked** ✓ OK

BÜCHI Labortechnik AG hereby declares that this unit is in accordance with the specifications



Signature, Date:



## Packing List

Unit : K-415 TripleScrub 230V



151111112781000281005111

Serial Number : 1000281005

Page 1(1)

Item	Pieces	Description	
11057332	1.0000	Tray for adsorption storage Ablage für Adsorption	✓ OK
048355	1.0000	Silicone hose D6/9 L=3m Silikonschlauch D6/9 L=3.0m	✓ OK
033701	1.0000	Glass wool 30g Glaswolle 30g	✓ OK
028737	2.0000	Hose clamp Anschlussklemme	✓ OK
11064971	1.0000	Activated Charcoal 2-6mm, 150g Aktivkohle 2-6mm, 150g	✓ OK
010020	1.0000	Power cable type USA, 3 pole 120V Anschlusskabel USA W 120V	✓ OK
11593505	1.0000	Operation Manual K-415 english Bedienungsanleitung K-415 english	✓ OK

Packed by





## BUCHI Certificate

### Final Test Inspection

Unit : BÜCHI Scrubber K-415

Serial number 1000281005

#### Examination Procedure

1. **Visual control of the glass parts and the unit** ✓ OK
  - No scratches or splinters on the glass parts
  - Mounted in accordance to the specific drawing
2. **Security tests** ✓ OK
  - High voltage test in accordance with EN 61010-1 (IEC 1010)
  - Ground connection test in accordance with EN 61010-1 (IEC 1010)
3. **Functional tests** ✓ OK
  - Vacuum test**
  - Bypass valve open: Pressure is 0 - 65 mbar below the atmospheric pressure
  - Bypass valve closed: Pressure is 400 mbar (+/- 10 %) below the atmospheric pressure
4. **Completeness of order checked** ✓ OK

BÜCHI Labortechnik AG hereby declares that this unit is in accordance with the specifications

H.-P. Gohn, Quality Manager

Signature, Date:

## Packing List

Unit : K-360 Plastik Basic



151111113001C00281014111

Serial Number

1000281014

Page 1(1)

Item	Pieces	Description		
043410	3.0000	Canister 10L thin-walled Kanister 10L dünnwandig	✓	OK
043603	1.0000	Packing parts K-360 Beipackteile K-360	✓	OK
047871	1.0000	Suppl. sheet distillation unit Beiblatt Distillation Unit	✓	OK
010020	1.0000	Power cable type USA, 3 pole 120V Anschlusskabel USA W 120V	✓	OK
11592548	1.0000	Kjeldahl Practice Guide en Kjeldahl Practice Guide en	✓	OK
093176	1.0000	Operation Manual K-360 english Bedienungsanleitung K-360 englisch	✓	OK

Packed by



## BUCHI Certificate Final Test Inspection

Unit : BÜCHI BÜCHI KjelFlex K-360

Serial number 1000281014

### Examination Procedure

1. **Visual control of the glass parts and the unit** ✓ OK  
- No scratches on the coated surface or splinters on the glass parts  
- Mounted in accordance to the specific drawing
2. **Security tests** ✓ OK  
- High voltage test in accordance with EN 61010-1:2002 (IEC 61010-1, VDE 0411)  
- Ground connection test in accordance with EN 61010-1:2002 (IEC 61010-1, VDE 0411)  
- Safety door sensor checked
3. **Functional tests** ✓ OK  
**Electronics**  
- Electronic modul is tested with the checking device PG157  
- Connector plugs are working  
**Operating panel**  
- Display is working  
- All buttons of the keypad are working  
**Pump testing**  
- All pumps are working  
- All pumps (exception: water pump of the steam generator) are precalibrated  
**Valve testing**  
- All valves are working  
**Steam generator testing**  
- The steam generator is filled with water  
- The steam generator valve is working  
- The amount of distillate corresponds to specifications  
**Further testing**  
- Beeper is working
4. **Unit configuration and completeness of order checked** ✓ OK

BÜCHI Labortechnik AG hereby declares that this unit is in accordance with the specifications



Signature, Date:



## Optima8000 Preventive Maintenance Report

Company Name: MET Company Limited.


Instrument Location: 36 659 Soi Mu Ban Monwadi Park 6,  
Bang Rak Phatthana, Bang Bua Thong District, Nonthaburi 11110

Instrument Serial No.: 078S1407053C

Date: 8-Dec-2022

### ICP-OES/Optima8000 Preventive Maintenance (PM)

Company Name:	MET Company Limited.		
Address (Instrument Location):	Bang Rak Phatthana, Bang Bua Thong District, Nonthaburi 11110		
Serial Number:	07851407053C	PM Number:	1 of 2
Customer Name (if applicable):		Telephone Number:	
Service Engineer Name:		Service Order Number:	WO-01877169
Date PM Performed: (DD-MMM-YYYY)	8-Dec-2022	Next PM Due Date: (DD-MMM-YYYY)	8-June-2023
Standard Labor Hours to Complete PM :		4 hours	

Part Number	Release	Publication Date	
09370140 Rev.5	A	January 2018	

#### Scope

The purpose of this PM is to ensure the continued functionality of the PerkinElmer/Optima8000 by inspecting and replacing any worn or damaged parts. This service should only be performed by a trained representative of PerkinElmer.

The customer should save their method before the PM begins.

#### General Instructions:

The customer must provide the engineer operational data to demonstrate recent instrument performance prior to starting the PM. Always check with the customer before making any changes that may affect the customer's analysis or calibration, including a current back-up of system software and/or data files. The completed document should be signed by an authorized PerkinElmer and customer representative and left with the customer. Update the PM sticker and instrument logbook as required.

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### Component List

Component / Specific Model	Serial #	Configuration Notes
Optima8000	07851407053C	Winlab V 5.5.0.0714
S10 Autosampler		

### Parts Lists

Parts Included with the PM		
Part Number (if applicable)	Description	Quantity
09995098	Air Filter-Spectrometer	1
N077520	Air Filter-RF Generator	1
09992731	Axial Window	1
B0810377	Radial Window	1
N0770438	O-ring kit, injector support adapter	1
N0780437	O-ring kit, torch	1

Additional Reagents and Standards Required for PM				
Part Number (if applicable)	Description	Quantity	Batch/Lot #	Expiration Date: (MM/YY)
N0691579	Multi-Element Standard (N069-1579 diluted 10X)	1	58-146CRX1	Oct-2023
N9300221	Instrument Calibration-4 (N9300221 diluted 100X)	1	58-169CRY1	Nov-2023



## Procedure Checklist

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

### 1. General:

- ☒ Ask customer about unit's performance since last visit.
- ☒ Check incoming AC line voltage under load for proper levels and grounding.
- ☒ Is the instrument operational?

### 2. Mechanical:

- ☒ Inspect and clean all fans and filters.
- ☒ Inspect and replace torch components and necessary.

Torch Components Replaced: ☒ Yes ☐ No

If yes, list components replaced:

- ☒ Inspect all tubing for signs of cracking or leaking and replace as necessary.

Tubing Replaced: ☒ Yes ☐ No

If yes, list tubing replaced:

- ☒ Inspect the peristaltic pump for proper operation.
- ☒ Check and adjust if necessary, the external nitrogen, argon shear gas and water supply pressures.
- ☒ Check and adjust if necessary, the internal nitrogen, main argon, torch argon and shear gas pressures

Regulator	Measured Pressure	Set Pressure
Nitrogen	N/A	NA (calibrated in Factory)
Main Argon	76	76psig
Torch Argon	67	67psig
Shear Gas	65	65psig
Water	35	35psi

- ☒ Check the shear gas nozzle for blockages and proper, uniform flow.
- ☒ Inspect nitrogen Hi/Low purge and shear gas solenoids for proper function.
- ☒ Inspect the function of all spectrometer motors. Drive the motors from the Spectrometer DCM. Check all motors, couplings, set screws, gears or drive assembly located on the spectrometer (prism/grating wavelength drives, slits, shutter, DV mirror, X/Y mirror) if problems are found.
- ☒ Perform preventative maintenance on the chiller as required. Make the customer aware of the importance of maintaining the chiller fluid level and filter replacement.
- ☒ Drain air compressor surge tank.
- ☒ Clean exterior of instrument.

### 3. Electrical:

- ☒ Visually inspect all PC boards for cleanliness and signs of corrosion.
- ☒ Check all RF generator and spectrometer power supply voltages.
- ☒ Run instrument diagnostic checks from the appropriate Device Control Module.

#### RF Generator:

- ☒ Check the RF generator status screens.
- ☒ Check the function of all interlocks.

#### Spectrometer:

- ☒ Check the spectrometer status screens.
- ☒ Check for proper function of all motors from the Motor Control window.

### 4. Optical:

- ☒ Check the neon lamp for proper operation.
- ☒ Ensure that neon initialization passes at power up.
- ☒ Ensure that there is a single, well defined peak of sufficient intensity (approximately 15,000 to 60,000 cts.) for the 703.241nm neon line viewed in the DCM Collect Spectra window. Re-generate the neon correction table if problems are encountered. If problems are still exhibited after the table is re-generated, replace the neon lamp assembly.

Neon Lamp Replaced: ☐ Yes ☒ No

- ☒ Perform the Initialize Optics routine from the Spectrometer Control window.
- ☒ Insure that the routine passes with no error codes. If it fails, run a manual prism scan from the spectrometer DCM.
- ☒ Insure the Dark Current measurement (Detector Calibration) passes at initialization.
- ☒ Check the shutter home sensor position.
- ☒ Check prism/electronics temperature sensor readback values from the DCM. It is normal for these readings to be shown in red. A typical prism temperature is approximately 29.5 degree C. A typical electronics temperature is approximately 35 degree C.
- ☒ Check the detector temperature from the DCM for -7.0 to -8.5 degree C. If outside of this range the detector cooling fan may not be operational. Further inspection may be necessary.
- ☒ Inspect for proper function of the transfer optics. 1) shutter 2) DV mirror 3) X/Y mirror.
- ☒ Clean or replace the axial and radial view windows as necessary.

Axial Window Replaced: ☒ Yes ☐ No

Radial Window Replaced: ☒ Yes ☐ No

### 5. Post PM Performance Tests:

- ☒ Perform View Align.

#### 5.1 Spectral Resolution:

- ☒ Measure the spectrometers ability to separate two adjacent wavelengths.

Parameter	Specification	Test Result	Pass/Fail
As 193.696 - Resolution	≤0.009	0.007	Passed
Ni 231.604 - Resolution	≤0.011	0.008	Passed
Ni 341.476 - Resolution	≤0.015	0.012	Passed
Ba 455.403 - Resolution	≤0.020	0.015	Passed

### 5.2 Precision:

☒ Test for reproducibility of a set of measurement.

Parameter	Specification	Test Result	Pass/Fail
Zn 213.856	%RSD ≤ 1 %	0.35	Passed
Mg 280.856	%RSD ≤ 1 %	0.46	Passed
Mg 285.207	%RSD ≤ 1 %	0.65	Passed
Ba 455.403	%RSD ≤ 1 %	0.38	Passed

### 5.3 Mn BEC:

☒ Run Axial and Radial BEC according to the A&T spec, or the commissioning test procedure.

#### Mn Background Equivalent Concentration:

Method "MnBEC" For Samples "IB (2%HNO3)" and "IS (N069-1579/10)", record intensities.

Calculated BEC:  $BEC = (IB * Conc\ of\ Std) / (IS - IB)$ . Where Conc of Std = 1,000 PPB

Element	Mode	Conc.	IB	IS	
Mn 257.610	Radial	1,000 ppb	5123.3	409288.2	
Mn 257.610	Axial	1,000 ppb	10397.4	1879864.3	
Mn 257.610	IB*Conc.	IS - IB	BEC	Spec	Pass/Fail
Radial	5123300	404164.9	12.67	<30 PPB	Passed
Axial	10397400	1869466.9	5.56	<30 PPB	Passed

### 6. Review:

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

## Additional Comments

### Additional Comments Regarding the PM

## Review

*The preventive maintenance checks and if applicable performance tests for ICP-OES/Optima8000 have been completed.*

*This ICP-OES/Optima8000 Passes ☒ Fails ☐ the preventive maintenance.*

### Review of Preventive Maintenance:

Authorized PerkinElmer Representative:	Date: 8-Dec-2022 (DD-MMM-YYYY)
Authorized Customer F	Date: 8-Dec-2022 (DD-MMM-YYYY)



# PinAAcle 900T Preventive Maintenance Report

Company Name: SPS CONSULTING SERVICE CO.,LTD.

Instrument Location: 7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN  
JOMPOL, CHATUCHAK, BANGKOK, 10900

Instrument Serial No.: PTCS14111103

Date: 06-Jan-2023

## PinAAcle 900T Preventive Maintenance (PM)

Company Name:	SPS CONSULTING SERVICE CO.,LTD.		
Address (Instrument Location):	7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD. JOMPOL, CHATUCHAK, BANGKOK		
Serial Number:	PTCS14111103	PM Number:	1-2
Customer Name (if applicable):		Telephone Number:	
Customer Support Engineer Name:		Service Order Number:	WO-02044564
Date PM Performed: (DD-MMM-YYYY)	06-Jan-2023	Next PM Due Date: (DD-MMM-YYYY)	06-Jul-2023
Standard Labor Hours to Complete PM :		5 hours	

Part Number	Release	Publication Date	
09370143 Rev.9	A	January 2018	

### Scope

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

The customer should save their method before the PM begins.

### General Instructions:

The customer must provide the engineer operational data to demonstrate recent instrument performance prior to starting the PM. Always check with the customer before making any changes that may affect the customer's analysis or calibration, including a current back-up of system software and/or data files. The completed document should be signed by an authorized PerkinElmer and customer representative and left with the customer. Update the PM sticker and instrument logbook as required.

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## Component List

Component / Specific Model	Serial #	Configuration Notes
AS900	AS9514B1002	WINLAB 32

## Parts Lists

Parts Included with the PM		
Part Number (if applicable)	Description	Quantity
B0501696	Fan Filters	2
B3002013	THGA Contact Cylinders	1
B3141064	Glycerol for THGA Cooling	N/A
N3160156	O-Ring Kits for Sampling Introduction ( Stainless Steels Nebulizer)	N/A
N3160157	O-Ring Kits for Sampling Introduction ( Plastic Nebulizer)	2
N9301714	Replacement Acetylene Filter Cartridge	1
TH001022	Replacement Air Filter Cartridge	2

Additional Reagents and Standards Required for PM				
Part Number (if applicable)	Description	Quality	Batch/Lot #	Expired Date (MM/YY)
N9300183	1000 mg/L Copper Standard	AR	26-87CUY1	30-Jan-2024
N9300244	GFAAS Mixed Standard	AR	56-021CRY1	30-Jun-2023

Additional Reagents and Standards Required for PM (Customer Support Solution)				
Part Number (if applicable)	Description	Quantity	Batch/Lot #	Expiration Date (MM/YY)
N/A	DI Water	250 ml.	AR	AR
N/A	0.5% HNO <sub>3</sub>	250 ml.	AR	AR

## Additional Tools Required for PM

Part Number (if applicable)	Description	Quantity	Serial #
N1013000	0.2A Neutral density filter	1	MG0-252
N1013002	1.0A Neutral density filter	1	MG2-358
E3100652 Or N9307029	Electronic Flow Meter	1	NA
E0505495	Test Jig	1	NA
C3030997	System 2 EDL Driver	1	03030997
N3050605	As System 2 EDL	1	16148
N3050121	Cu Lumina HCL	1	092216-010130
N3050109	Ba Lumina HCL	1	102416-040160
N3050139	K Lumina HCL	1	110716-010060
N3050152	Ni Lumina HCL	1	100516-030190
N3050119	Cr Lumina HCL	1	091911-020150

## Procedure Checklist

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

### 1. General:

- ☒ Review the instrument performance with the customer and document any recent problems.
- ☒ Inspect the customer log book and make any appropriate PM entries.
- ☒ Perform general inspection of system for cleanliness.

### 2. PC Instrument Software:

- ☒ Instrument Software user files/databases archived, packed, and/or deleted as needed.

### 3. Mechanical:

- ☒ Inspect and clean all fans and filters. Replace filters if necessary
- ☒ Inspect all gas and water lines for leaks and/or wear. Replace if needed. Thoroughly inspect all quick connects. Replace the Y connector, P/N 09921079, if needed.
- ☒ Clean exterior of the instrument.

#### 3.1 Flame Technique

- ☒ Inspect the burner head, burner chamber, and nebulizer. Clean if needed as stated in the Hardware Guide.
- ☒ Check burner head dimensions with the feeler gauge as stated in the Hardware Guide in the Maintenance chapter section on cleaning the burner head and checking sloth width. Replace if out of specification
- ☒ Check the condition of the end cap, burner head, and nebulizer O-rings. Replace if necessary.
- ☒ Check the drain system for signs of wear. Replace worn or damaged parts.
- ☒ Visually check for proper flame conditions when igniting the Air-C<sub>2</sub>H<sub>2</sub> and N<sub>2</sub>O-C<sub>2</sub>H<sub>2</sub> flames (if applicable).

#### 3.2 THGA Technique

- ☒ Inspect the pole pieces and clean where the pole pieces contact the furnace. Replace the pole piece p-rings as needed, P/N's B0501018 & B0501250. Grease the O-rings as needed with Apiezon L grease, P/N 09905148
- ☒ Inspect the four insulation pads on the front contact housing of the THGA in furnace. If the pads are missing replace the THGA furnace or replace the insulator pads on the furnace.
- ☒ Inspect the graphite tube and clean the contact cylinders. Replace if necessary.
- ☒ Check internal and external gas flows with the Electronic Gas Flow Meter and the Gas Flow Test Probe as described in the Service Manual. Correct if necessary.
- ☒ Check furnace open/close function.
- ☒ Verify the operation of the GFTV Camera for proper operation and viewing alignment in the furnace camera Tube View window. Align if needed.
- ☒ Check the operation of the Halogen Light ASSY for the GFTV Camera. Replace if needed.
- ☒ Check the water level/quality in the recirculation (if applicable). Add distilled water if necessary.
- ☒ Check the cooling system fluid flow rate with the FCS In-Line Flow Meter for proper levels if needed. Refer to SDB# COSY008.STN

- ☒ Perform Cooling System maintenance if needed per SDB# COSY005.STN.
- ☒ Check auto sampler operation.
- ☒ Perform an auto sampler check valve test as described in the Service Manual.
- ☒ Lubricate the spindles of the auto sampler pumps and all moving parts of the tray mechanics as described in the Service Manual.
- ☒ Inspect the auto sampler sampling capillary as described in the Service Manual. Replace if necessary.

### 4. Electrical:

- ☒ Inspect PC boards. Clean if necessary.
- ☒ Carefully check all internal and external cable connections.
- ☒ Check instrument firmware revisions upgrade to current levels (if necessary)
- ☒ Run Diagnostics Test within the Advanced function of the Spectrometer page. Check the results in the service log folder in the Spectrometer BM Log Viewer.

### 5. Optics:

- ☒ Inspect and clean the sample compartment windows, if needed.
- ☒ Inspect and clean the furnace windows, if needed.
- ☒ Inspect and clean the GFTV camera lens, if needed.
- ☒ Inspect optics. Clean or replace if necessary,

### 6. Gasses:

- ☒ Verify that the Gasses supplied to the instrument are within the pressure and purity specifications found in the PinAAcle 900 Series Pre-installation Checklist SDB.
- ☒ Verify that the air filter element is dry. Replace if necessary.

### 7. Flame Interlock Check:

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

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



## 8. After PM Performance tests [Flame]:

### 8.1 Detector Linearity with Barium

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

Parameter	Specification	Certificate Value at 553.6 nm (Abs.)	Test Results	Pass/Fail
1.0 A ND Filter	± 5% from Cert.	0.9798	0.1982	Passed
0.2 A ND Filter	± 5% from Cert.	0.2042	0.9942	Passed

### 8.2 Baseline Noise at 1.0 Absorbance with Barium

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

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

### 8.3 AA Baseline Noise with Copper

Description: Check baseline noise.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.001	0.0001	Passed

### 8.4 D<sub>2</sub> Background Compensation with Copper

Description: Verifies the instruments ability to compensate for Background absorption.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.010	0.0083	Passed

### 8.5 AA-BG Baseline Noise with Copper

Description: Ensures that background correction does not produce excessive noise.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.005	0.0002	Passed

### 8.6 AA-BG Baseline Noise with Arsenic

Description: Ensures that background correction does not produce excessive noise at a low wavelength.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.005	0.0021	Passed

### 8.7 Flame Sensitivity

Description: Instrument Sensitivity checked against Copper standard.

Standard Copper Sensitivity	Specification	Results (Abs.)	Pass/Fail
5 mg/L Sensitivity SS Neb (if applicable)	> 0.250 Abs.	NA	Not Applicable
2 mg/L Sensitivity HS Neb (if applicable)	> 0.250 Abs.	0.3281	Passed

## 9. After PM Performance tests [THGA]:

### 9.1 Furnace Gas Flows

Description: Ensures the flow rates are within specification.

Parameter	Specification	Test Results	Pass/Fail
Internal Flow Rate	250 mL/min ± 25 mL/min	255	Passed
External Flow Rate	100 mL/min ± 10 mL/min	105	Passed

### 9.2 Chromium Baseline Noise

Description: Signal to noise check.

Parameter	Specification	Results	Pass/Fail
Baseline Noise	≤ 0.005 Abs.	0.0000	Passed
Standard Deviation	≤ 0.005	0.0002	Passed

### 9.3 Chromium Characteristic Mass and Precision

Description: Calculate the characteristic mass using the characteristic mass tool and precision from the integrated absorbance values.

Parameter	Specification	Results	Pass/Fail
Cr m <sub>0</sub> Results	≤ 7.0 pg/0.0044 A-s	5.7	Passed
Precision	≤ 2.0 %	0.74	Passed

#### 9.4 Copper Characteristic Mass and Zeeman Ratio

Description: Calculate the characteristic mass using the characteristic mass tool and check the Zeeman Ratio.

Parameter	Specification	Results	Pass/Fail
Cu m <sub>0</sub> Result	≤ 16.5 pg/0.0044 A-s	12.3	Passed
Zeeman Ratio	0.52 ± 0.04	0.54	Passed

#### 10. Review:

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

### Additional Comments

#### Additional Comments Regarding the PM

$$\begin{aligned}\text{Zeeman Ratio} &= \frac{\text{Atomic Signal (Peak area)}}{\text{Atomic Signal (Peak area)} + \text{Background Signal (Peak area)}} \\ &= \frac{0.1855}{0.1855 + 0.1563} \\ &= 0.54\end{aligned}$$

REPLACE PM KIT

### Review

*The preventive maintenance checks and if applicable performance tests for PinAAcle 900T have been completed.*

*This PinAAcle 900T Passes ☒ Fails ☐ the preventive maintenance.*

#### Review of Preventive Maintenance:

Authorized PerkinElmer Representative:		Date: 06-Jan-2023 (DD-MMM-YYYY)
Authorized Customer Representative:		Date: 06-Jan-2023 (DD-MMM-YYYY)

## Certificate of System Qualification

GC-OQ + GCMS-OQ

System ID: CN10925120  
Organization Name: S.P.S Consulting service  
Organization Location: 7 Soi Phaholyothin Road, Ladyao, Khet Jatujak, Bangkok 10900  
Date: March 29, 2022 3:56:41 PM  
EQP Name: AgilentRecommended , AgilentRecommended  
EQP Revision: GC.02.50, GCMS.02.50  
Overall Qualification Status: Pass

## System Inspection and Basic Safety and Operation

Name: 7890

Setpoint Status: Pass

## Overall System Inspection and Basic Safety and Operation Test Status

Pass

## Inlet Pressure Decay

Name: 7890

Back SSL

Setpoint Status: Pass

Pressure: 25.0 psi

Pressure Change: -0.2 psi /5 minutes

Agilent Recommended:  $\geq -2.0$  and  $\leq 0.5$ 

## Overall Inlet Pressure Decay Test Status

Pass

## Inlet Pressure Accuracy

Name: 7890

Back SSL

Date: March 29, 2022 3:56:41 PM  
System ID: CN10925120

Setpoint Status: Pass

Inlet Pressure: Setpoint 25.0 psi Actual 25.0 psi  
Accuracy: 0.0 psi  
Agilent Recommended:  $\leq 1.2$

## Overall Inlet Pressure Accuracy Test Status

Pass

## Inlet Pressure Accuracy

Name: 7890

Front SSL

Setpoint Status: Pass

Inlet Pressure: Setpoint 25.0 psi Actual 25.0 psi  
Accuracy: 0.0 psi  
Agilent Recommended:  $\leq 1.2$

## Overall Inlet Pressure Accuracy Test Status

Pass

## Detector Flow Accuracy

Name: 7890

Front FID

Setpoint Status: Pass

Flow Type: Fuel

Setpoint: 30.0 mL/min Measured Flow: 30.4 mL/min

Accuracy: 0.4 mL/min

Agilent Recommended:  $\leq 10.0$  % setpoint ( 3.0 mL/min )

Limit is percentage of setpoint or 0.5 mL/minute, whichever is largest.

Date: March 29, 2022 3:56:41 PM  
System ID: CN10925120

## Setpoint Status:

Pass

Flow Type:

Oxidizer

Setpoint:

400.0 mL/min

Measured Flow:

392.6 mL/min

Accuracy:

7.4 mL/min

Agilent Recommended:

&lt;= 10.0 % setpoint

( 40.0 mL/min )

Limit is percentage of setpoint or 0.5 ml/minute, whichever is largest.

## Setpoint Status:

Pass

Flow Type:

Makeup

Setpoint:

25.0 mL/min

Measured Flow:

25.4 mL/min

Accuracy:

0.4 mL/min

Agilent Recommended:

&lt;= 10.0 % setpoint

( 2.5 mL/min )

Limit is percentage of setpoint or 0.5 ml/minute, whichever is largest.

## Overall Detector Flow Accuracy Test Status

Pass

## GC Oven Temperature Accuracy

Name:

7890

Setpoint Status:

Pass

Zone:

Oven

Setpoint/Actual

Temperature:

230.0 230.6 °C

Accuracy:

0.6 °C

Agilent Recommended:

&gt;= -1.0 % setpoint in K

( -5.0 °C )

&lt;= 1.0 % setpoint in K

( 5.0 °C )

Date: March 29, 2022 3:56:41 PM  
System ID: CN16025120

## Setpoint Status:

Pass

Zone:

Oven

Setpoint/Actual

Temperature:

100.0 100.3 °C

Accuracy:

0.3 °C

Agilent Recommended:

&gt;= -1.0 % setpoint in K

( -3.7 °C )

&lt;= 1.0 % setpoint in K

( 3.7 °C )

## Overall GC Oven Temperature Accuracy Test Status

Pass

## GC Oven Temperature Stability

Name:

7890

Setpoint Status:

Pass

Setpoint/Average

Temperature:

100.0 100.2333 °C

Stability:

0.1 °C

Agilent Recommended:

&lt;= 0.5

## Overall GC Oven Temperature Stability Test Status

Pass

## Scouting Run

Tested Combination1

Back

SSL

/ Front

FID

Manual Injection

Name:

Not applicable

Setpoint Status:

Completed

Injection Volume on Column:

1.0 uL

## Overall Scouting Run Status

Completed

## Noise and Drift

Tested Combination1

Back

SSL

/ Front

FID

Date: March 29, 2022 3:56:41 PM  
System ID: CN16025120



Name: 7890

Setpoint Status: Pass

Base Signal: 12.1 pA

	ASTM Noise counts	Drift counts/Hr
Agilent Recommended:	712.29	275.82
Status:	<= 768.00	<= 19200.00
	Pass	Pass

## Overall Noise and Drift Test Status

Pass

## Signal to Noise

Tested Combination1	Back	SSL	/ Front	FID
	Manual Injection			
Name:	7890			
Setpoint Status:	Pass			
Signal to Noise:	874687			
Agilent Recommended:	>= 300000			

## Overall Signal to Noise Test Status

Pass

## Log Amp

Tested Combination2	Front	SSL	/ External	SQ
Name:	5975C Inert XL with TAD			
Setpoint Status:	Pass			

## Overall Log Amp Test Status

Pass

## RFPA

Date: March 29, 2022 3:56:41 PM  
System ID: CN10025120

Tested Combination2 Front SSL / External SQ

Name: 5975C Inert XL with TAD

Setpoint Status: Pass

Amu:	1050	m/z	Drift After Five Minutes:	4	mV	RFPA Voltage:	485	mV
Agilent Recommended:	>=	-100	and	<=	100	<=	1100	

## Overall RFPA Test Status

Pass

## Tune EI

Tested Combination2 Front SSL / External SQ

Name: 5975C Inert XL with TAD

Setpoint Status: Pass

Filament: 1

Setpoint Status: Pass

Filament: 2

## Overall Tune EI Test Status

Pass

## Signal to Noise EI

Tested Combination2 Front SSL / External SQ

Name: 5975C Inert XL with TAD

Source: EI - Inert Filament: 1

Setpoint Status: Pass

Signal to Noise: 332

Agilent Recommended: &gt;= 320

Date: March 29, 2022 3:56:41 PM  
System ID: CN10025120

Source:	El - Inert	Filament:	2
Setpoint Status:	Pass		
Signal to Noise:	422		
Agilent Recommended:	>= 320		

Overall Signal to Noise EI Test Status

Pass
------

Instrument Details

Purpose

This section describes the as found system configuration.

Details

System	
System ID	CN10925120
Manufacturer	Agilent Technologies
Name	7890
Tested Combination1	
Injection Technique	Manual Injection
Sampler Identifier	Sampler 1
Inlet	Back
Detector	Front
LTM Included?	No
Tested Combination2	
Injection Technique	Manual Injection
Sampler Identifier	Sampler 2
Inlet	Front
Detector	External
LTM Included?	No
Sampler 1	
Manufacturer	Agilent Technologies
Type	Manual Injection
Usage	Sample Injection
Syringe Volume (µL)	10
Sampler 2	
Manufacturer	Agilent Technologies
Type	Manual Injection
Usage	Sample Injection
Syringe Volume (µL)	10

## Mainframe 1

Manufacturer	Agilent Technologies
Name	7890
Model Number	G3440A
Serial Number	CN10925120
Firmware Revision	A.01.10.3
Oven Type	Standard

## Inlet 1

Manufacturer	Agilent Technologies
Name	7890
Type	SSL
Location	Front
Carrier Gas	Helium
Control Type	Electronic Pressure Control (EPC)
Purged Inlet	Yes

## Inlet 2

Manufacturer	Agilent Technologies
Name	7890
Type	SSL
Location	Back
Carrier Gas	Helium
Control Type	Electronic Pressure Control (EPC)
Purged Inlet	Yes

## Detector 1

Manufacturer	Agilent Technologies
Name	7890
Type	FID
Adapter	Capillary
Control Type	Electronic Pressure Control (EPC)
Location	Front
Makeup Gas	Nitrogen

Date: March 29, 2022 3:56:41 PM  
System ID: CN10925120

## Detector 2

Manufacturer	Agilent Technologies
Name	Mass Spectrometer
Type	Mass Spectrometer
Location	External

## Mass Spectrometer 1

Manufacturer	Agilent Technologies
Type	SQ
Name	5975C inert XL with TAD
Serial Number	US91732743
Firmware Revision	5975 5.02.07
High Vacuum System	Turbo Pump
Scouting Run Standard	OFN Std

## MS EI Source 1

Manufacturer	Agilent Technologies
Source Type	EI - Inert
Number of filaments	2

Date: March 29, 2022 3:56:41 PM  
System ID: CN10925120

## Electronic Signature

### Purpose

This signature page was created and published because the ACE sign-off action was executed, which is valid for the entire document, including attachments. The ACE sign-off is an electronic signature that requires two distinct identification components: unique username and personal password. The Agilent representative who has delivered this service understands the meaning and legal status of an electronic signature. As a trained official operator, the Agilent representative has a unique password and logon to access ACE and electronically sign this document. (Other e-signatures can be applied to this document using a Document Content Management or other suitable method defined in your data access and control procedures.)

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Date: March 29, 2022 3:56:41 PM  
System ID: CN10925120

User Name: saenguthai.tarak  
Hostname: LAPTOP-Q3SKOMV

System Id: CN10925120  
Print Date: March 29, 2022 3:56:43 PM

### OQ\_GCMS\_SPS CN10925120 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 29, 2022 1:45:41 PM	Audit	SessionCreated	Session	None
March 29, 2022 1:45:41 PM	Start	Configuration	Session	None
March 29, 2022 1:45:41 PM	Audit	Entitlement	Licensing	User is Nonpaying and does not require an unlock code
March 29, 2022 1:46:18 PM	Audit	EqpLoaded	Session	EQP details for primary technique [Gc] - File path: [ProtocolPacks/Gc/Configurations/02.50/Gc.02.50.eqp], EQP File Name: [Gc.02.50.eqp], EQP Name: [AgilentRecommended] EQP details for hyphenated technique [GcMs] - File path: [ProtocolPacks/GcMs/Configurations/02.50/GcMs.02.50.eqp], EQP File Name: [GcMs.02.50.eqp], EQP Name: [AgilentRecommended]
March 29, 2022 1:46:20 PM	End	Configuration	Session	None
March 29, 2022 1:46:24 PM	Start	Qualification	Session	OQ
March 29, 2022 1:46:24 PM	Start	Execution	System Inspection and Basic Safety and Operation - 7890: - Qualitative Test - No setpoints associated	None
March 29, 2022 1:47:33 PM	End	Execution	System Inspection and Basic Safety and Operation - 7890: - Qualitative Test - No setpoints associated	Run Count : 1

Date: March 29, 2022 3:56:41 PM  
System ID: CN10925120

User Name: saenguthal.tarak  
 Hostname: LAPTOP-CQ3SK0WV

System Id: CN10925120  
 Print Date: March 29, 2022 3:56:43 PM

OQ\_GCMS\_SPS CN10925120 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 29, 2022 1:47:36 PM	Start	Execution	Inlet Pressure Decay - Back SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi	None
March 29, 2022 1:47:47 PM	End	Execution	Inlet Pressure Decay - Back SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi	Run Count : 1
March 29, 2022 1:47:48 PM	Start	Execution	Inlet Pressure Accuracy - Back SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	None
March 29, 2022 1:47:53 PM	End	Execution	Inlet Pressure Accuracy - Back SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	Run Count : 1
March 29, 2022 1:47:54 PM	Start	Execution	Inlet Pressure Accuracy - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	None
March 29, 2022 1:48:02 PM	End	Execution	Inlet Pressure Accuracy - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	Run Count : 1
March 29, 2022 1:48:04 PM	Start	Execution	Detector Flow Accuracy - Front FID: - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	None
March 29, 2022 1:48:18 PM	End	Execution	Detector Flow Accuracy - Front FID: - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
March 29, 2022 1:48:20 PM	Start	Execution	Detector Flow Accuracy - Front FID: - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	None
March 29, 2022 1:48:26 PM	End	Execution	Detector Flow Accuracy - Front FID: - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	Run Count : 1

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Date: March 29, 2022 3:56:41 PM  
 System ID: CN10925120

User Name: saenguthal.tarak  
 Hostname: LAPTOP-CQ3SK0WV

System Id: CN10925120  
 Print Date: March 29, 2022 3:56:43 PM

OQ\_GCMS\_SPS CN10925120 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 29, 2022 1:48:27 PM	Start	Execution	Detector Flow Accuracy - Front FID: - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	None
March 29, 2022 1:48:40 PM	End	Execution	Detector Flow Accuracy - Front FID: - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
March 29, 2022 1:48:42 PM	Start	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
March 29, 2022 1:49:00 PM	Audit	Data	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry
March 29, 2022 1:49:03 PM	End	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Run Count : 1
March 29, 2022 1:49:06 PM	Start	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
March 29, 2022 1:49:30 PM	Audit	Data	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry
March 29, 2022 1:49:31 PM	End	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Run Count : 1
March 29, 2022 1:49:33 PM	Start	Execution	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	None

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Date: March 29, 2022 3:56:41 PM  
 System ID: CN10925120



User Name: saenguthai.tarak  
 Hostname: LAPTOP-CQ3SKOMV

System Id: CN10925120  
 Print Date: March 29, 2022 3:56:43 PM

## OQ\_GCMS\_SPS C410925120 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 29, 2022 1:50:29 PM Audit		Data	GC Oven Temperature Stability - 7850: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Manual Data Entry
March 29, 2022 1:50:30 PM End		Execution	GC Oven Temperature Stability - 7850: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Run Count : 1
March 29, 2022 3:15:23 PM Start		Execution	GC Scouting Run - Manual Injection, Back SSL, Front FID: - Part of System Preparation - No limits associated	None
March 29, 2022 3:15:26 PM Start		Execution	Noise and Drift - Front FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	None
March 29, 2022 3:15:39 PM Start		Execution	GC Scouting Run - Manual Injection, Back SSL, Front FID: - Part of System Preparation - No limits associated	None
March 29, 2022 3:18:02 PM Audit		Data	GC Scouting Run - Manual Injection, Back SSL, Front FID: - Part of System Preparation - No limits associated	Data files Path : F:\PMOQ2022\SC_FID.D\FID 1A.ch
March 29, 2022 3:18:37 PM End		Execution	GC Scouting Run - Manual Injection, Back SSL, Front FID: - Part of System Preparation - No limits associated	Run Count : 1
March 29, 2022 3:16:39 PM Start		Execution	Noise and Drift - Front FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	None
March 29, 2022 3:25:39 PM Start		Execution	Noise and Drift - Front FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	None

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Date: March 29, 2022 3:56:41 PM  
 System ID: CN10925120

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User Name: saenguthai.tarak  
 Hostname: LAPTOP-CQ3SKOMV

System Id: CN10925120  
 Print Date: March 29, 2022 3:56:43 PM

## OQ\_GCMS\_SPS CN10925120 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 29, 2022 3:26:13 PM Audit		Data	Noise and Drift - Front FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	Data files Path : F:\PMOQ2022\ND_FID.D\FID 1A.ch
March 29, 2022 3:26:19 PM End		Execution	Noise and Drift - Front FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	Run Count : 1
March 29, 2022 3:27:37 PM Start		Execution	Signal to Noise - Manual Injection, Back SSL, Front FID: - Detector FID - L: >= 300000	None
March 29, 2022 3:27:49 PM Audit		Data	Signal to Noise - Manual Injection, Back SSL, Front FID: - Detector FID - L: >= 300000	Data files Path : F:\PMOQ2022\SN_FID.D\FID 1A.ch
March 29, 2022 3:28:16 PM End		Execution	Signal to Noise - Manual Injection, Back SSL, Front FID: - Detector FID - L: >= 300000	Run Count : 1
March 29, 2022 3:29:49 PM Audit		AccRestarted	Session	None
March 29, 2022 3:30:44 PM Audit		SessionReloaded	Session	None
March 29, 2022 3:30:47 PM Start		Qualification	Session	OQ
March 29, 2022 3:30:53 PM Start		Execution	Log Amp - 5975C Inert XL with TAD SQ: - Source: EI - Inert	None
March 29, 2022 3:31:02 PM End		Execution	Log Amp - 5975C Inert XL with TAD SQ: - Source: EI - Inert	Run Count : 1
March 29, 2022 3:31:05 PM Start		Execution	RFPA - 5975C Inert XL with TAD SQ: - Source: EI - Inert	None
March 29, 2022 3:33:09 PM End		Execution	RFPA - 5975C Inert XL with TAD SQ: - Source: EI - Inert	Run Count : 1
March 29, 2022 3:33:11 PM Start		Execution	Tune EI - 5975C Inert XL with TAD SQ: - Source: EI - Inert Filament 1 (Qualitative - No setpoints associated)	None

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Date: March 29, 2022 3:56:41 PM  
 System ID: CN10925120

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User Name: saenguthai.tarak  
 Hostname: LAPTOP-CQ3SKOMV

System Id: CN10925120  
 Print Date: March 29, 2022 3:56:43 PM

## OQ\_GCMS\_SPS CN10925120 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 29, 2022 3:33:43 PM	End	Execution	Tune EI - 5975C Inert XL with TAD SQ: - Source: - EI - Inert Filament 1 (Qualitative - No setpoints associated)	Run Count : 1
March 29, 2022 3:33:45 PM	Start	Execution	Tune EI - 5975C Inert XL with TAD SQ: - Source: - EI - Inert Filament 2 (Qualitative - No setpoints associated)	None
March 29, 2022 3:34:05 PM	End	Execution	Tune EI - 5975C Inert XL with TAD SQ: - Source: - EI - Inert Filament 2 (Qualitative - No setpoints associated)	Run Count : 1
March 29, 2022 3:34:37 PM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Inert using Filament 1 - L: >= 320	None
March 29, 2022 3:34:51 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Inert using Filament 1 - L: >= 320	Data files Path : F:\PMOQ2022\SN_F1_05.D\ DATASIM.MS
March 29, 2022 3:35:27 PM	End	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Inert using Filament 1 - L: >= 320	Run Count : 1
March 29, 2022 3:35:30 PM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Inert using Filament 2 - L: >= 320	None
March 29, 2022 3:35:58 PM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Inert using Filament 2 - L: >= 320	None

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Date: March 29, 2022 3:56:41 PM  
 System ID: CN10925120

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User Name: saenguthai.tarak  
 Hostname: LAPTOP-CQ3SKOMV

System Id: CN10925120  
 Print Date: March 29, 2022 3:56:43 PM

## OQ\_GCMS\_SPS CN10925120 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 29, 2022 3:36:32 PM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Inert using Filament 2 - L: >= 320	None
March 29, 2022 3:36:46 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Inert using Filament 2 - L: >= 320	Data files Path : F:\PMOQ2022\SN_F2_05.D\ DATASIM.MS
March 29, 2022 3:36:53 PM	End	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Inert using Filament 2 - L: >= 320	Run Count : 1
March 29, 2022 3:36:58 PM	End	Qualification	Session	OQ
March 29, 2022 3:36:58 PM	Start	Reporting	Session	None
March 29, 2022 3:50:19 PM	Audit	Reporting	Session	Report Generated : Certificate

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Date: March 29, 2022 3:56:41 PM  
 System ID: CN10925120

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## Factory Calibration Certificate

## Instrument information

Name **WET BULB GLOBE TEMPERATURE (WBGT) METER**  
 Series No **3522210130**  
 Type **JT2011-E2A**

## Integrity check of instrument

Appearance ✓  
 Parts integrity ✓  
 Screen display or touch ✓  
 Instrument button ✓  
 Power supply ✓  
 battery ✓  
 Data storage and export ✓  
 Deviation degree of comparison test with  
 standard instrument ✓

## Calibration Results

UUC Sensor	Standard Temperature ( °C )	UUC Reading ( °C )	Correction ( °C )	Uncertainty ( ± °C )
WET	25.0	25.2	-0.2	0.2
	30.0	29.9	0.1	0.2
	35.0	35.1	-0.1	0.2
	40.0	39.8	0.2	0.2
	45.0	44.9	0.1	0.2
DRY	25.0	24.8	0.2	0.2
	30.0	30.2	-0.2	0.2
	35.0	35.2	-0.2	0.2
	40.0	39.8	0.2	0.2
	45.0	44.9	0.1	0.2
GLOBE	25.0	24.8	0.2	0.2
	30.0	29.9	0.1	0.2
	35.0	34.8	0.2	0.2
	40.0	39.8	0.2	0.2
	45.0	44.9	0.1	0.2

Environmental conditions: temperature: 26 °C±2°C, relative humidity: 30% RH±10RH%

Reference Standard : Standard Mercury Thermometers , Manufacturer: BGRI, Model: STA, SN : 2-56,  
 Calibrated Date : 30 March 2021, Calibration Certificate No.: RA21H-AB1000009  
 This Certificate is traceable to NCMT North China, Certificate No.: RA20J-AK000073

Calibration Engineer

Date



## Factory Calibration Certificate

## Instrument information

Name **WET BULB GLOBE TEMPERATURE (WBGT) METER**  
 Series No **3522210131**  
 Type **JT2011-E2A**

## Integrity check of instrument

Appearance ✓  
 Parts integrity ✓  
 Screen display or touch ✓  
 Instrument button ✓  
 Power supply ✓  
 battery ✓  
 Data storage and export ✓  
 Deviation degree of comparison test with  
 standard instrument ✓

## Calibration Results

UUC Sensor	Standard Temperature ( °C )	UUC Reading ( °C )	Correction ( °C )	Uncertainty ( ± °C )
WET	25.0	25.2	-0.2	0.2
	30.0	30.2	-0.2	0.2
	35.0	34.8	0.2	0.2
	40.0	40.1	-0.1	0.2
	45.0	44.9	0.1	0.2
DRY	25.0	24.8	0.2	0.2
	30.0	30.2	-0.2	0.2
	35.0	35.2	-0.2	0.2
	40.0	40.2	-0.2	0.2
	45.0	45.2	-0.2	0.2
GLOBE	25.0	24.8	0.2	0.2
	30.0	29.9	0.1	0.2
	35.0	35.1	-0.1	0.2
	40.0	39.9	0.1	0.2
	45.0	44.9	0.1	0.2

Environmental conditions: temperature: 26 °C±2°C, relative humidity: 30% RH±10RH%

Reference Standard : Standard Mercury Thermometers , Manufacturer: BGRI, Model: STA, SN : 2-56,  
 Calibrated Date : 30 March 2021, Calibration Certificate No.: RA21H-AB1000009  
 This Certificate is traceable to NCMT North China, Certificate No.: RA20J-AK000073

Calibration Engineer

Date



## Factory Calibration Certificate

## Instrument information

Name **WET BULB GLOBE TEMPERATURE (WBGT) METER**  
Series No **3522210132**  
Type **JT2011-E2A**

## Integrity check of instrument

Appearance	✓
Parts integrity	✓
Screen display or touch	✓
Instrument button	✓
Power supply	✓
battery	✓
Data storage and export	✓
Deviation degree of comparison test with standard instrument	✓

## Calibration Results

UUC Sensor	Standard Temperature ( °C )	UUC Reading ( °C )	Correction ( °C )	Uncertainty ( ± °C )
WET	25.0	24.9	0.1	0.2
	30.0	29.9	0.1	0.2
	35.0	35.1	-0.1	0.2
	40.0	40.1	-0.1	0.2
	45.0	45.2	-0.2	0.2
DRY	25.0	25.1	-0.1	0.2
	30.0	30.1	-0.1	0.2
	35.0	34.8	0.2	0.2
	40.0	40.1	-0.1	0.2
	45.0	44.9	0.1	0.2
GLOBE	25.0	24.9	0.2	0.2
	30.0	29.9	0.1	0.2
	35.0	34.8	0.2	0.2
	40.0	40.1	-0.1	0.2
	45.0	45.2	-0.2	0.2

Environmental conditions: temperature: 26 °C±2°C, relative humidity: 30% RH±10RH%

Reference Standard : Standard Mercury Thermometers , Manufacturer: BGRI, Model: STA, SN : 2-56,  
Calibrated Date : 30 March 2021, Calibration Certificate No.: RA21H-AB1000009

This Certificate is traceable to NCMT North China, Certificate No.: RA20J-AK000073

Calibration Engineer : \_\_\_\_\_

Date : \_\_\_\_\_



## Factory Calibration Certificate

## Instrument information

Name **WET BULB GLOBE TEMPERATURE (WBGT) METER**  
Series No **3522210133**  
Type **JT2011-E2A**

## Integrity check of instrument

Appearance	✓
Parts integrity	✓
Screen display or touch	✓
Instrument button	✓
Power supply	✓
battery	✓
Data storage and export	✓
Deviation degree of comparison test with standard instrument	✓

## Calibration Results

UUC Sensor	Standard Temperature ( °C )	UUC Reading ( °C )	Correction ( °C )	Uncertainty ( ± °C )
WET	25.0	25.1	-0.1	0.2
	30.0	30.2	-0.2	0.2
	35.0	34.9	0.1	0.2
	40.0	39.8	0.2	0.2
	45.0	45.2	-0.2	0.2
DRY	25.0	24.9	0.1	0.2
	30.0	29.8	0.2	0.2
	35.0	34.9	0.1	0.2
	40.0	40.2	-0.2	0.2
	45.0	45.1	-0.1	0.2
GLOBE	25.0	25.2	-0.2	0.2
	30.0	29.9	0.1	0.2
	35.0	34.8	0.2	0.2
	40.0	39.8	0.2	0.2
	45.0	44.9	0.1	0.2

Environmental conditions: temperature: 26 °C±2°C, relative humidity: 30% RH±10RH%

Reference Standard : Standard Mercury Thermometers , Manufacturer: BGRI, Model: STA, SN : 2-56,  
Calibrated Date : 30 March 2021, Calibration Certificate No.: RA21H-AB1000009

This Certificate is traceable to NCMT North China, Certificate No.: RA20J-AK000073

Calibration Engineer : \_\_\_\_\_

Date : \_\_\_\_\_



## Factory Calibration Certificate

## Instrument information

Name **WET BULB GLOBE TEMPERATURE (WBGT) METER**  
Series No **3522210134**  
Type **JT2011-E2A**

## Integrity check of instrument

Appearance	✓
Parts integrity	✓
Screen display or touch	✓
Instrument button	✓
Power supply	✓
battery	✓
Data storage and export	✓
Deviation degree of comparison test with standard instrument	✓

## Calibration Results

UUC Sensor	Standard Temperature ( °C )	UUC Reading ( °C )	Correction ( °C )	Uncertainty ( ± °C )
WET	25.0	25.1	-0.1	0.2
	30.0	29.8	0.2	0.2
	35.0	34.9	0.1	0.2
	40.0	40.1	-0.1	0.2
	45.0	44.8	0.2	0.2
DRY	25.0	24.8	0.2	0.2
	30.0	29.8	0.2	0.2
	35.0	34.9	0.1	0.2
	40.0	40.2	-0.2	0.2
	45.0	45.1	-0.1	0.2
GLOBE	25.0	24.9	0.1	0.2
	30.0	29.9	0.1	0.2
	35.0	34.8	0.2	0.2
	40.0	40.2	-0.2	0.2
	45.0	45.1	-0.1	0.2

Environmental conditions: temperature: 26 °C±2°C, relative humidity: 30% RH±10RH%

Reference Standard : Standard Mercury Thermometers , Manufacturer: BGRI, Model: STA, SN : 2-56,  
Calibrated Date : 30 March 2021, Calibration Certificate No.: RA21H-AB1000009

This Certificate is traceable to NCMT North China, Certificate No.: RA20J-AK000073

Calibration Engineer : \_\_\_\_\_

Date : \_\_\_\_\_



## Factory Calibration Certificate

## Instrument information

Name **WET BULB GLOBE TEMPERATURE (WBGT) METER**  
Series No **3522210135**  
Type **JT2011-E2A**

## Integrity check of instrument

Appearance	✓
Parts integrity	✓
Screen display or touch	✓
Instrument button	✓
Power supply	✓
battery	✓
Data storage and export	✓
Deviation degree of comparison test with standard instrument	✓

## Calibration Results

UUC Sensor	Standard Temperature ( °C )	UUC Reading ( °C )	Correction ( °C )	Uncertainty ( ± °C )
WET	25.0	24.9	0.1	0.2
	30.0	30.2	-0.2	0.2
	35.0	34.8	0.2	0.2
	40.0	39.8	0.2	0.2
	45.0	45.1	-0.1	0.2
DRY	25.0	24.8	0.2	0.2
	30.0	30.1	-0.1	0.2
	35.0	34.9	0.1	0.2
	40.0	39.8	0.2	0.2
	45.0	44.9	0.1	0.2
GLOBE	25.0	25.2	-0.2	0.2
	30.0	30.1	-0.1	0.2
	35.0	35.2	-0.2	0.2
	40.0	39.8	0.2	0.2
	45.0	44.9	0.1	0.2

Environmental conditions: temperature: 26 °C±2°C, relative humidity: 30% RH±10RH%

Reference Standard : Standard Mercury Thermometers , Manufacturer: BGRI, Model: STA, SN : 2-56,  
Calibrated Date : 30 March 2021, Calibration Certificate No.: RA21H-AB1000009

This Certificate is traceable to NCMT North China, Certificate No.: RA20J-AK000073

Calibration Engineer : \_\_\_\_\_

Date : \_\_\_\_\_





National Institute of Metrology (Thailand)

## Certificate of Calibration

Certificate No. : AA-2018-22  
Issued by : Acoustics Laboratory  
Acoustics and Vibration Group



Page 1 of 5 pages

MEASUREMENT ITEM : Sound Calibrator

MANUFACTURER : RION

MODEL/TYPE : NC-75

SERIAL NUMBER : 34480442

CUSTOMER : MET Co., Ltd.  
36/659 Moo 6, T. Bangrakphatthana,  
A. Bangbuathong, Nonthaburi 11110

MEASUREMENT DATE : 28 September 2022

*The reported measurement result relates only to the measurand and applies only at the time of measurement.*

*The calibration results only marked with an asterisk \* in this certificate are not included in the scope of accreditation.*

The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor  $k=2$ , providing a level of confidence of approximately 95%. This calibration certificate may not be reproduced other than in full except with the permission of the Director of National Institute of Metrology (Thailand).

Reference	Date	Authorized Signatory	Person in charge
AUVC844-01/22	29 September 2022		

This certificate is consistent with the capabilities that are included in Appendix C of the MRA drawn up by the CIPM. Under the MRA, all participating institutes recognize the validity of each other's calibration and measurement certificates for the quantities, ranges and measurement uncertainties specified in Appendix C (for details see <http://www.bipm.org>).

National Institute of Metrology (Thailand)

Ministry of Higher Education, Science, Research and Innovation  
3/4-5 Moo 3, Klong 5, Klong Luang, Pathumthani 12120, Thailand. Tel: (66) 2577 5100, Fax: (66) 2577 3659  
75/7 Rama VI Road, Rachathewi, Bangkok 10400, Thailand. Tel: (66) 2354 3700, Fax: (66) 2354 3692



National Institute of Metrology (Thailand)

NIMT  
Continuation of Certificate of Calibration Number AA-2018-22

Page 2 of 5 pages

### UNCERTAINTY OF MEASUREMENT

The stated uncertainty is the expanded uncertainty obtained by multiplying the standard uncertainty by the coverage factor  $k=2$ . It has been determined in accordance with EA publication EA-4/02 M:2013 "Evaluation of the Uncertainty of Measurement in Calibration" and JCGM 100:2008 "Evaluation of measurement data --Guide to the Expression of Uncertainty in Measurement (GUM 1995 with minor corrections)". The value of the measured lies within the assigned range of value with a probability of 95 %.

Parameter	Uncertainty at SPL94 dB	Maximum-permitted uncertainty of measurement for a coverage probability of 95%
1.Sound Pressure level	0.08	0.15
2. Frequency	0.1	0.2
3. THD+N	0.1	0.5

### TRACEABILITY

This certificate provides traceability of measurement to recognized national standards, and to the realization of the International System of Units (SI).





## ENVIRONMENTAL CONDITIONS

Ambient condition in the laboratory are as follows :

Temperature :  $(23.0 \pm 1.0)$  °C  
Pressure :  $(101.325 \pm 1.500)$  kPa  
Relative Humidity :  $(50.0 \pm 15.0)$  %

Reference Condition : 101.325 kPa , 23.0 °C and 50.0 %RH.

## Calibration Condition

Preconditionings : 16 hours at ambient conditions.  
Measurement Conditions : The average values during measurement are  
 $(100.313 \pm 0.014)$  kPa,  $(22.0 \pm 0.3)$  °C and  $(57.0 \pm 2.1)$  %RH

## MEASUREMENT METHOD

The sound pressure level, frequency and total distortion of the sound calibrator was measured using the reference microphone. The insert voltage technique was employed and the measurement procedure was based on IEC 60942-2017.

## Reference Microphone

4180 serial no.1395446

## TABULATION OF RESULTS

The following tables give the calibration results and associated measurement uncertainties at 95% of confidence level. The calibration results of sound pressure level which quoted in dB with reference to 20 µPa are corrected to the values under the reference environmental conditions.

The calibration results exclude the calibrator pressure correction but include the microphone volume correction, which was obtained from the manufacturer instruction manual of the sound calibrator, at the level of 94 dB.



## MEASUREMENT RESULTS

### 1. Sound pressure level

Specified sound pressure level (dB)	Measured value (dB)*	Deviated value <sup>[1]</sup> (dB)	Acceptance Limit (dB)
Microphone 4180 Serial No.1395446			
94	94.15	0.15	0.25

Note <sup>[1]</sup> : The deviated value is the absolute value of the difference between the measured value and the corresponding specified sound pressure level.

### 2. Frequency\*

Specified Frequency (Hz)	Measured value (Hz)	Deviated value <sup>[2]</sup> (%)	Acceptance Limit (%)
At the sound pressure level of 94 dB			
1000	1000.0	0.0	0.7

Note <sup>[2]</sup> : The deviated value is the absolute value of the difference in percent between the measured value and the corresponding specified frequency.





## Calibration Report

Certificate Number : SPR23010249-5

Page : 2 of 3

### Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	SC-942	B014059	EEL.BP. 34/1264	22 Dec 2023

### Traceability

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



## Result of Calibration

Certificate No. : SPR23010249-5

Page : 3 of 3

Range : 94 to 114 dB

Function : @1kHz

Select A Unit : dB

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

Select C Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty ( ± )
	Fast	Slow	Fast	Slow	
94	94.3	94.2	0.3	0.2	0.15
114	114.1	114.1	0.1	0.1	0.15

### Note:

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

### Measurement Uncertainty

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

- End of Certificate -





## Certificate of Calibration

Certificate Number : SPR23010249-6

Page : 1 of 3

Customer : MET CO.,LTD.

36/659 Moo. 6 Tambol Bangragpattana, Amphur Bangbuatong,  
Nonthaburi 11110

Equipment Name : Sound Level Meter

Manufacturer : ACO

Model : 6236

Serial Number : 222065

ID. Number : SLM-32

### Environmental Conditions

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

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

Location of Calibration : In-Lab

Calibration Procedure : SP-CPE-04-01

Received Date : 19 Jan 2023

Calibration Date : 23 Jan 2023

Recommend Due Date : 23 Jan 2024

Date of Issue : 24 Jan 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 :

Calibration Officer

Approved by :

Authorized Signatory



## Calibration Report

Certificate Number : SPR23010249-6

Page : 2 of 3

### Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	SC-942	B014059	EEL.BP. 34/1264	22 Dec 2023

### Traceability

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



## Result of Calibration

Certificate No. : SPR23010249-6

Page : 3 of 3

Range : 94 to 114 dB

Function : @1kHz

Select A

Unit : dB

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

Select C

Unit : dB

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

### Note:

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

### Measurement Uncertainty

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

- End of Certificate -



## Certificate of Calibration

Certificate Number : SPR23010249-4

Page : 1 of 3

Customer : MET CO.,LTD.

36/659 Moo.6 Tambol Bangragpattana, Amphur Bangbuatong,  
Nonthaburi 11110

Equipment Name : Sound Level Meter

Manufacturer : ACO

Model : 6236

Serial Number : 222066

ID. Number : SLM-46

### Environmental Conditions

Ambient Temperature :  $23^{\circ}\text{C} \pm 3^{\circ}\text{C}$  Received Date : 19 Jan 2023

Relative Humidity :  $50\% \pm 15\%$  Calibration Date : 23 Jan 2023

Location of Calibration : In-Lab Recommend Due Date : 23 Jan 2024

Calibration Procedure : SP-CPE-04-01 Date of Issue : 24 Jan 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 :

Calibration Officer

Approved by :

Authorized Signatory





## Calibration Report

Certificate Number : SPR23010249-4

Page : 2 of 3

### Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	SC-942	B014059	EEL.BP. 34/1264	22 Dec 2023

### Traceability

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



## Result of Calibration

Certificate No. : SPR23010249-4

Page : 3 of 3

Range : 94 to 114 dB

Function : @1kHz

Select A					Unit : dB
Standard Setting	UUC Reading		Error		Uncertainty ( ± )
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	114.0	114.0	0.0	0.0	0.15

Select C					Unit : dB
Standard Setting	UUC Reading		Error		Uncertainty ( ± )
	Fast	Slow	Fast	Slow	
94	94.1	94.1	0.1	0.1	0.15
114	114.1	114.1	0.1	0.1	0.15

### Note:

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

### Measurement Uncertainty

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

- End of Certificate -





## Certificate of Calibration

Certificate Number : SPR23010249-2

Page : 1 of 3

Customer : MET CO.,LTD.

36/659 Moo. 6 Tambol Bangragpattana, Amphur Bangbuatong,  
Nonthaburi 11110

Equipment Name : Sound Level Meter

Manufacturer : ACO

Model : 6236

Serial Number : 222067

ID. Number : SLM-34

### Environmental Conditions

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

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

Location of Calibration : In-Lab

Calibration Procedure : SP-CPE-04-01

Received Date : 19 Jan 2023

Calibration Date : 23 Jan 2023

Recommend Due Date : 23 Jan 2024

Date of Issue : 24 Jan 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 :

Calibration Officer

Approved by :

Authorized Signatory



## Calibration Report

Certificate Number : SPR23010249-2

Page : 2 of 3

### Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	SC-942	B014059	EEL.BP. 34/1264	22 Dec 2023

### Traceability

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



## Result of Calibration

Certificate No. : SPR23010249-2

Page : 3 of 3

Range : 94 to 114 dB

Function : @1kHz

Select A		Unit : dB			
Standard Setting	UUC Reading		Error		Uncertainty ( ± )
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	114.0	114.0	0.0	0.0	0.15

Select C		Unit : dB			
Standard Setting	UUC Reading		Error		Uncertainty ( ± )
	Fast	Slow	Fast	Slow	
94	94.4	94.4	0.4	0.4	0.15
114	114.4	114.4	0.4	0.4	0.15

### Note:

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

### Measurement Uncertainty

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

- End of Certificate -



## Certificate of Calibration

Certificate Number : SPR23010249-9

Page : 1 of 3

Customer : MET CO.,LTD.

36/659 Moo. 6 Tambol Bangragpattana, Amphur Bangbuatong,  
Nonthaburi 11110

Equipment Name : Sound Level Meter

Manufacturer : ACO

Model : 6236

Serial Number : 222068

ID. Number : SLM-35

### Environmental Conditions

Ambient Temperature :  $23^{\circ}\text{C} \pm 3^{\circ}\text{C}$  Received Date : 19 Jan 2023

Relative Humidity :  $50\% \pm 15\%$  Calibration Date : 23 Jan 2023

Location of Calibration : In-Lab Recommend Due Date : 23 Jan 2024

Calibration Procedure : SP-CPE-04-01 Date of Issue : 24 Jan 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 :   
Calibration Officer

Approved by :   
Authorized Signatory





## Calibration Report

Certificate Number : SPR23010249-9

Page : 2 of 3

### Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	SC-942	B014059	EEL.BP. 34/1264	22 Dec 2023

### Traceability

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



## Result of Calibration

Certificate No. : SPR23010249-9

Page : 3 of 3

Range : 94 to 114 dB

Function : @1kHz

Select A		Unit : dB			
Standard Setting	UUC Reading		Error		Uncertainty ( ± )
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	114.0	114.0	0.0	0.0	0.15

Select C		Unit : dB			
Standard Setting	UUC Reading		Error		Uncertainty ( ± )
	Fast	Slow	Fast	Slow	
94	94.1	94.1	0.1	0.1	0.15
114	114.1	114.1	0.1	0.1	0.15

### Note:

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

### Measurement Uncertainty

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

- End of Certificate -



## Page : 1 of 3

Customer : MET CO.,LTD.

36/659 Moo. 6 Tambol Bangragpattana, Amphur Bangbuatong,  
Nonthaburi 11110

Equipment Name : Sound Level Meter

Manufacturer : ACO

Model : 6236

Serial Number : 222069

ID. Number : SLM-36

### Environmental Conditions

Ambient Temperature : 23 °C ± 3 °C      Received Date : 19 Jan 2023

Relative Humidity : 50 %  $\pm$  15 %      Calibration Date : 23 Jan 2023

Location of Calibration : In-Lab      Recommend Due Date : 23 Jan 2024

Calibration Procedure : SP-CPE-04-01 Date of Issue : 24 Jan 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 :

Calibration Officer

Approved by :

Authorized Signatory

SP-FM-04-15 rev.0



# Calibration Report

Certificate Number : SPR23010249-10

Page : 2 of 3

### Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	SC-942	B014059	EEL.BP. 34/1264	22 Dec 2023

## Traceability

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

69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 ( Thailand ) Tel: (662) 193-2220 5 คู่สาย [www.สอบเทียบเครื่องมือวัด.com](http://www.สอบเทียบเครื่องมือวัด.com)

69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 ( Thailand ) Tel: (662) 193-2220 5 คู่มือขาย [www.สอบเทียบบเครื่องมือวัด.com](http://www.สอบเทียบบเครื่องมือวัด.com)



## Result of Calibration

Certificate No. : SPR23010249-10

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Range : 94 to 114 dB

Function : @1kHz

Select A

Unit : cB

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

Select C

Unit : dB

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

### Note:

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

### Measurement Uncertainty

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

- End of Certificate -