

High-Volume TSP Sampler
5-Point Calibration Record

Location : AM1(ICC)
 Calibrated by : K.T.Ho
 Date : 10/09/2023

Sampler

Model : TE-5170
 Serial Number : S/N 0767

Calibration Orifice and Standard Calibration Relationship

Serial Number : 2454
 Service Date : 15 December 2022
 Slope (m) : 2.06918
 Intercept (b) : -0.04220
 Correlation Coefficient(r) : 0.99997

Standard Condition

Pstd (hpa) : 1013
 Tstd (K) : 298.18

Calibration Condition

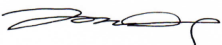
Pa (hpa) : 1008
 Ta(K) : 300

Resistance Plate	dH [green liquid] (inch water)	Z	X=Qstd (cubic meter/min)	IC (chart)	Y (corrected)
1 18 holes	10.2	3.176	1.555	58	57.67
2 13 holes	8.4	2.882	1.413	50	49.72
3 10 holes	6.2	2.476	1.217	44	43.75
4 7 holes	4.4	2.086	1.028	36	35.80
5 5 holes	2.6	1.603	0.795	22	21.88

Notes: $Z=\text{SQRT}\{dH(Pa/Pstd)(Tstd/Ta)\}$, $X=Z/m-b$, $Y(\text{Corrected Flow})=IC*\{\text{SQRT}(Pa/Pstd)(Tstd/Ta)\}$

Sampler Calibration Relationship

Slope(m):45.063 Intercept(b):-12.329 Correlation Coefficient(r):0.9933

Checked by: 

 Magnum Fan

Date: 12/09/2023

High-Volume TSP Sampler
5-Point Calibration Record

Location : AM1(ICC)
 Calibrated by : K.T.Ho
 Date : 10/11/2023

Sampler

Model : TE-5170
 Serial Number : S/N 0767

Calibration Orifice and Standard Calibration Relationship

Serial Number : 2454
 Service Date : 15 December 2022
 Slope (m) : 2.06918
 Intercept (b) : -0.04220
 Correlation Coefficient(r) : 0.99997

Standard Condition

Pstd (hpa) : 1013
 Tstd (K) : 298.18

Calibration Condition

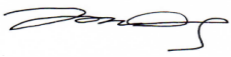
Pa (hpa) : 1016
 Ta(K) : 299

Resistance Plate	dH [green liquid] (inch water)	Z	X=Qstd (cubic meter/min)	IC (chart)	Y (corrected)
1 18 holes	11.2	3.346	1.638	56	56.00
2 13 holes	8.6	2.932	1.438	48	48.00
3 10 holes	6.4	2.530	1.243	40	40.00
4 7 holes	4.4	2.097	1.034	32	32.00
5 5 holes	2.6	1.612	0.800	20	20.00

Notes: $Z = \sqrt{dH(Pa/Pstd)(Tstd/Ta)}$, $X = Z/m - b$, $Y(\text{Corrected Flow}) = IC * \{\sqrt{Pa/Pstd}(Tstd/Ta)\}$

Sampler Calibration Relationship

Slope(m): 42.393 Intercept(b): -12.961 Correlation Coefficient(r): 0.9985

Checked by: 

 Magnum Fan

Date: 13/11/2023



Certificate of Calibration

Calibration Certification Information			
Cal. Date:	December 15, 2022	Rootsmer S/N:	438320
Operator:	Jim Tisch	Ta:	295 °K
Calibration Model #:	TE-5025A	Pa:	742.4 mm Hg
		Calibrator S/N:	2454

Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H2O)
1	1	2	1	1.4060	3.2	2.00
2	3	4	1	0.9980	6.4	4.00
3	5	6	1	0.8900	7.9	5.00
4	7	8	1	0.8520	8.8	5.50
5	9	10	1	0.7040	12.7	8.00

Data Tabulation					
Vstd (m3)	Qstd (x-axis)	$\sqrt{\Delta H \left(\frac{Pa}{Pstd} \right) \left(\frac{Tstd}{Ta} \right)}$ (y-axis)	Va	Qa (x-axis)	$\sqrt{\Delta H \left(\frac{Ta}{Pa} \right)}$ (y-axis)
0.9826	0.6988	1.4049	0.9957	0.7082	0.8914
0.9783	0.9803	1.9868	0.9914	0.9934	1.2607
0.9763	1.0970	2.2213	0.9894	1.1116	1.4095
0.9751	1.1445	2.3297	0.9881	1.1598	1.4783
0.9700	1.3778	2.8097	0.9829	1.3962	1.7829
QSTD	m=	2.06918	QA	m=	1.29568
	b=	-0.04220		b=	-0.02677
	r=	0.99997		r=	0.99997

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

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

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



SUB-CONTRACTING REPORT

CONTACT	: MR MAGNUM FAN	WORK ORDER	: HK2317764
CLIENT	: ENVIROTECH SERVICES CO.		
ADDRESS	: RM 712, 7/F, MY LOFT 9 HOI WING ROAD, TUEN MUN, N.T., HK	SUB-BATCH	: 1
		DATE RECEIVED	: 8-MAY-2023
		DATE OF ISSUE	: 17-MAY-2023
PROJECT	: —	NO. OF SAMPLES	: 1
		CLIENT ORDER	: —

General Comments

- Sample information (Project name, Sample ID, Sampling date/time, etc.) is provided by client.
 - Result(s) of sample(s) is/are reported on as received basis, unless otherwise specified. The result(s) is/are related only to the item(s) tested.
 - No sample is received in this Work Order. The report presents non-laboratory testing data only.
 - Calibration was subcontracted to and analysed by Envirotech Services Co.
-

Signatories

This document has been signed by those names that appear on this report and are the authorised signatories

Signatories

Position

Richard Fung

Managing Director

This report supersedes any previous report(s) with the same work order number.

All pages of this report have been checked and approved for release.

ALS Technichem (HK) Pty Ltd
Part of the **ALS Laboratory Group**

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Tel. +852 2610 1044 Fax. +852 2610 2021 www.alsglobal.com

WORK ORDER : HK2317764
SUB-BATCH : 1
CLIENT : ENVIROTECH SERVICES CO.
PROJECT : —



ALS Lab ID	Client's Sample ID	Sample Type	Sample Date	External Lab Report No.
HK2317764-001	SIBATA (841274)	Equipments	08-May-2023	S/N: 841724



Equipment Verification Report (TSP)

Equipment Calibrated:

Type: Laser Dust Monitor
Manufacturer: Sibata LD-5R
Serial No.: 841724
Equipment Ref.: N/A
ALS Job Order: HK2316019

Standard Equipment

Standard Equipment: High Volume Sampler (TSP)
Location & Location ID: Envirotech Room (Calibration Room)
Equipment Ref.: HVS 8162
Last Calibration Date: 28-Feb-2023

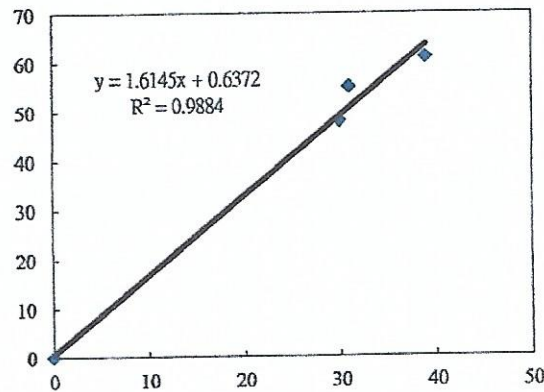
Equipment Verification Results:

Verification Date: 21, 22 & 24 April 2023

Hour	Time	Mean Temp °C	Mean Pressure (hpa)	Concentration in µg/m³ (Standard Equipment)	Total Count (Calibrated Equipment)	Count /Minute (Total Count/min)
1hr 00mins	1410-1510	27.1	1006.1	61	2357	39
1hr 00mins	1500-1600	23.2	1005.7	55	1861	31
1hr 00mins	1400-1500	25.0	1015.6	48	1802	30

Linear Regression of Y or X

Slope (K-factor): 1.6145(µg/m³)/CPM
Correlation Coefficient (R): 0.9942
Date of Issue: 2-May-2023



Remarks:

- 1. Strong Correlation (>0.8)
- 2. Factor 1.6145 (µg/m³)/CPM should be applied for TSP monitoring

*If R<0.5, repair or verification is required for the equipment

Operator: P.F.Yeung Signature *Fai* Date: 2 May 2023

QC Reviewer: K.F.Ho Signature *Fat* Date: 2 May 2023

TSP SAMPLER CALIBRATION CALCULATION SPREADSHEET

Location : Rm. 712, My Loft, Tuen Mun	Date of Calibration:	28-Feb-23
HVS ID: 8162	Next Calibration Date:	28-Apr-23
Name and Model : TISCH HVS Model TE-5170	Operator:	K.F.Ho

CONDITIONS

Sea Level Pressure (hpa)	1021	Corrected Pressure (mm Hg)	764.3
Temperature (°C)	22.0	Temperature (K)	295

CALIBRATION ORIFICE

Make:	TISCH	Qstd Slope	2.06918
Model:	TE-5025A	Qstd Intercept	-0.04220
Serial#:	2454		

CALIBRATION

Plate No.	H2O(L) (in)	H2O(R) (in)	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION
18	6.7	6.6	13.3	1.797	62	62.51	Slope= 31.428 Intercept= 5.569 Corr. Coeff.= 0.9990
13	5.2	5.1	10.3	1.584	55	55.45	
10	4.0	3.9	7.9	1.390	48	48.39	
7	2.5	2.5	5.0	1.110	40	40.33	
5	1.4	1.4	2.8	0.836	32	32.26	

Calculations:

$$Qstd = 1/m[\text{Sqrt}(H2O(Pa/Pstd)(Tstd/Ta))-b]$$

$$IC = I[\text{Sqrt}(Pa/Pstd)(Tstd/Ta)]$$

Qstd = standard flow rate

IC = corrected chart response

I = actual chart response

m = calibrator Qstd slope

b = calibrator Qstd intercept

Ta = actual temperature during calibration (deg K)

Pa = actual pressure during calibration (mm Hg)

For subsequent calculation of sampler flow:

$$1/m((I[\text{Sqrt}(298/Tav)(Pav/760)]-b)$$

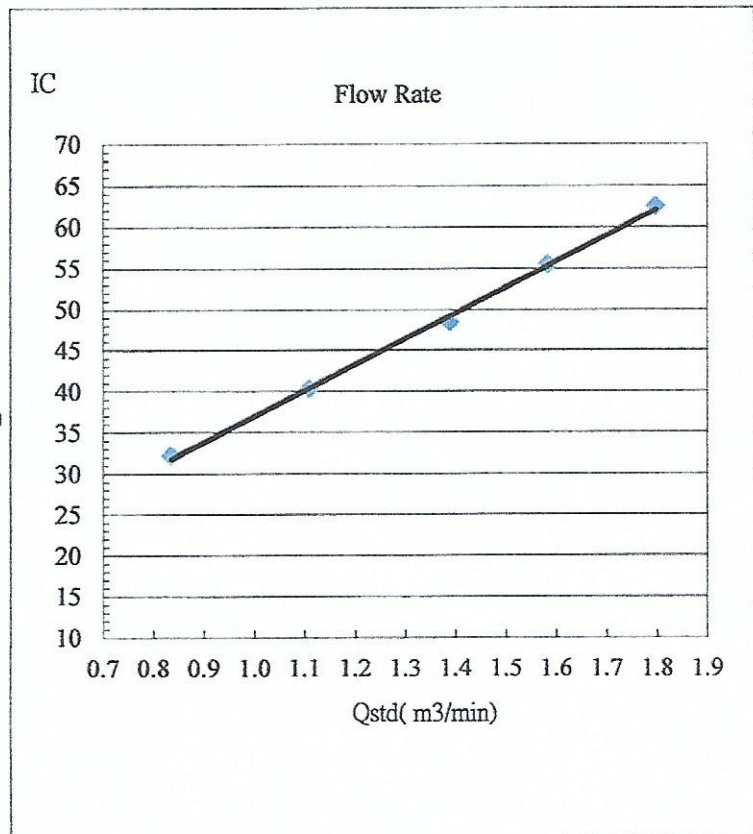
m = sampler slope

b = sampler intercept

I = chart response

Tav = daily average temperature

Pav = daily average pressure



Certificate of Calibration

Calibration Certification Information			
Cal. Date: December 15, 2022	Rootsmeter S/N: 438320	Ta: 295	°K
Operator: Jim Tisch		Pa: 748.0	mm Hg
Calibration Model #: TE-5025A	Calibrator S/N: 4064		

Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H2O)
1	1	2	1	1.4430	3.2	2.00
2	3	4	1	1.0210	6.4	4.00
3	5	6	1	0.9170	7.9	5.00
4	7	8	1	0.8730	8.8	5.50
5	9	10	1	0.7210	12.8	8.00

Data Tabulation					
Vstd (m3)	Qstd (x-axis)	$\sqrt{\Delta H \left(\frac{Pa}{Pstd} \right) \left(\frac{Tstd}{Ta} \right)}$ (y-axis)	Va	Qa (x-axis)	$\sqrt{\Delta H \left(\frac{Ta}{Pa} \right)}$ (y-axis)
0.9900	0.6861	1.4101	0.9957	0.6900	0.8881
0.9858	0.9655	1.9943	0.9914	0.9711	1.2560
0.9838	1.0728	2.2296	0.9894	1.0790	1.4042
0.9826	1.1255	2.3385	0.9882	1.1320	1.4728
0.9772	1.3554	2.8203	0.9829	1.3632	1.7762
QSTD	m=	2.10977	QA	m=	1.32110
	b=	-0.03782		b=	-0.02382
	r=	0.99998		r=	0.99998

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

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

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



SUB-CONTRACTING REPORT

CONTACT	: MR K.W. FAN	WORK ORDER	: HK2247804
CLIENT	: ENVIROTECH SERVICES CO.		
ADDRESS	: RM 712, 7/F, MY LOFT 9 HOI WING ROAD, TUEN MUN, N.T., HK	SUB-BATCH	: 1
		DATE RECEIVED	: 30-NOV-2022
		DATE OF ISSUE	: 9-DEC-2022
PROJECT	: ----	NO. OF SAMPLES	: 1
		CLIENT ORDER	: ----

General Comments

- Sample(s) was/ were submitted by client. Sample(s) arrived laboratory in ambient condition. The result(s) related only to the item(s) tested.
 - Sample information (Project name, Sample ID, Sampling date/time, etc.) is provided by client.
 - Result(s) of sample(s) is/are reported on as received basis, unless otherwise specified.
 - Calibration was subcontracted to and analysed by Action-United Environmental Services & Consulting.
-

Signatories

This document has been signed by those names that appear on this report and are the authorised signatories

Signatories

Position

Richard Fung

Managing Director

This report supersedes any previous report(s) with the same work order number.

All pages of this report have been checked and approved for release.

ALS Technichem (HK) Pty Ltd
Part of the **ALS Laboratory Group**

WORK ORDER : HK2247804
SUB-BATCH : 1
CLIENT : ENVIROTECH SERVICES CO.
PROJECT : ---



ALS Lab ID	Client's Sample ID	Sample Type	Sample Date	External Lab Report No.
HK2247804-001	S/N: 235780	Equipments	30-Nov-2022	S/N: 235780

Equipment Verification Report (TSP)

Equipment Calibrated:

Type: Laser Dust monitor
Manufacturer: Sibata LD – 3B
Serial No. 235780
Equipment Ref: NA
Job Order HK2247804

Standard Equipment:

Standard Equipment: Higher Volume Sampler (TSP)
Location & Location ID: AUES office (calibration room)
Equipment Ref: HVS 018
Last Calibration Date: 13 September 2022

Equipment Verification Results:

Verification Date: 6 December 2022

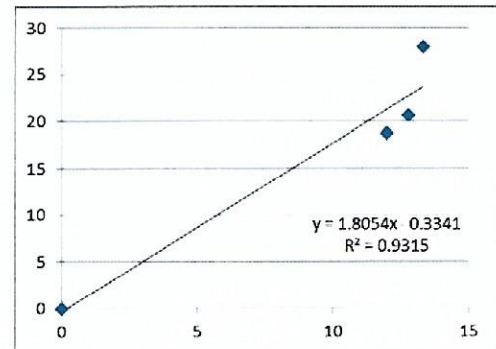
Hour	Time	Mean Temp °C	Mean Pressure (hPa)	Concentration in $\mu\text{g}/\text{m}^3$ (Standard Equipment)	Total Count (Calibrated Equipment)	Count/Minute (Total Count/min)
2hr01mins	09:37 ~ 11:38	17.1	1019.7	18.8	1451	12.0
2hr01mins	11:42 ~ 13:43	17.1	1019.7	20.7	1543	12.8
2hr01mins	13:48 ~ 15:49	17.1	1019.7	28.0	1605	13.3

Linear Regression of Y or X

Slope (K-factor): 1.8054 ($\mu\text{g}/\text{m}^3$)/CPM

Correlation Coefficient (R) 0.9651

Date of Issue 7 December 2022



Remarks:

1. **Strong** Correlation ($R > 0.8$)
2. Factor 1.8054 ($\mu\text{g}/\text{m}^3$)/CPM should be applied for TSP monitoring

*If $R < 0.5$, repair or re-verification is required for the equipment

Operator : Fai So Signature :  Date : 7 December 2022

QC Reviewer : Ben Tam Signature :  Date : 7 December 2022

TSP SAMPLER CALIBRATION CALCULATION SPREADSHEET

Location : Gold King Industrial Building, Kwai Chung
 Location ID : Calibration Room

Date of Calibration: 13-Sep-22
 Next Calibration Date: 13-Dec-22

CONDITIONS

Sea Level Pressure (hPa)	1007.3	Corrected Pressure (mm Hg)	755.475
Temperature (°C)	31.7	Temperature (K)	305

CALIBRATION ORIFICE

Make->	TISCH	Qstd Slope ->	1.99838
Model->	5025A	Qstd Intercept ->	-0.00903
Calibration Date->	27-Dec-21	Expiry Date->	27-Dec-22

CALIBRATION

Plate No.	H2O (L) (in)	H2O (R) (in)	H2O (in)	Qstd (m3/min)	I (chart)	IC corrected	LINEAR REGRESSION		
							Slope =	Intercept =	Corr. coeff. =
18	6	6	12.0	1.714	54	53.24	30.1792	1.5486	0.9961
13	4.9	4.9	9.8	1.549	48	47.33			
10	3.7	3.7	7.4	1.347	44	43.38			
8	2.5	2.5	5.0	1.108	36	35.50			
5	1.6	1.6	3.2	0.887	28	27.61			

Calculations :

$$Qstd = 1/m[\text{Sqrt}(H2O(Pa/Pstd)(Tstd/Ta))-b]$$

$$IC = I[\text{Sqrt}(Pa/Pstd)(Tstd/Ta)]$$

Qstd = standard flow rate

IC = corrected chart responses

I = actual chart response

m = calibrator Qstd slope

b = calibrator Qstd intercept

Ta = actual temperature during calibration (deg K)

Pstd = actual pressure during calibration (mm Hg)

For subsequent calculation of sampler flow:

$$1/m((I)[\text{Sqrt}(298/Tav)(Pav/760)]-b)$$

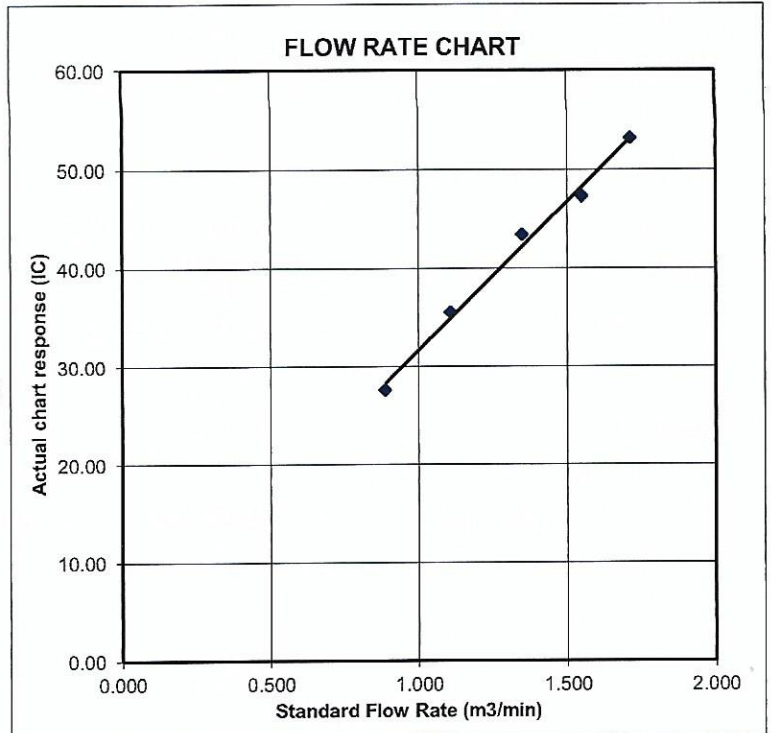
m = sampler slope

b = sampler intercept

I = chart response

Tav = daily average temperature

Pav = daily average pressure



Certificate of Calibration

Calibration Certification Information			
Cal. Date: December 27, 2021	Rootsmeter S/N: 438320	Ta: 295	°K
Operator: Jim Tisch		Pa: 740.4	mm Hg
Calibration Model #: TE-5025A	Calibrator S/N: 1612		

Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H2O)
1	1	2	1	1.3890	3.2	2.00
2	3	4	1	0.9760	6.4	4.00
3	5	6	1	0.8740	7.9	5.00
4	7	8	1	0.8320	8.8	5.50
5	9	10	1	0.6870	12.7	8.00

Data Tabulation					
Vstd (m3)	Qstd (x-axis)	$\sqrt{\Delta H \left(\frac{Pa}{Pstd} \right) \left(\frac{Tstd}{Ta} \right)}$ (y-axis)	Va	Qa (x-axis)	$\sqrt{\Delta H \left(\frac{Ta}{Pa} \right)}$ (y-axis)
0.9799	0.7055	1.4029	0.9957	0.7168	0.8927
0.9756	0.9996	1.9841	0.9914	1.0157	1.2624
0.9736	1.1140	2.2183	0.9893	1.1320	1.4114
0.9724	1.1688	2.3265	0.9881	1.1876	1.4803
0.9673	1.4079	2.8059	0.9828	1.4306	1.7853
QSTD	m=	1.99838	QA	m=	1.25135
	b=	-0.00903		b=	-0.00574
	r=	0.99999		r=	0.99999

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

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

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



SUB-CONTRACTING REPORT

CONTACT : MR MAGNUM FAN
CLIENT : ENVIROTECH SERVICES CO.
ADDRESS : RM 712, 7/F, MY LOFT 9 HOI WING ROAD,
TUEN MUN, N.T., HK

WORK ORDER : **HK2312358**

SUB-BATCH : 1
DATE RECEIVED : 31-MAR-2023
DATE OF ISSUE : 11-APR-2023

PROJECT : ---

NO. OF SAMPLES : 1
CLIENT ORDER : ---

General Comments

- Sample(s) was/ were submitted by client. Sample(s) arrived laboratory in ambient condition. The result(s) related only to the item(s) tested.
- Sample information (Project name, Sample ID, Sampling date/time, etc.) is provided by client.
- Result(s) of sample(s) is/are reported on as received basis, unless otherwise specified.
- Calibration was subcontracted to and analysed by Envirotech Services Company

Signatories

This document has been signed by those names that appear on this report and are the authorised signatories

Signatories

Position

Richard Fung

Managing Director

This report supersedes any previous report(s) with the same work order number.

All pages of this report have been checked and approved for release.

ALS Technichem (HK) Pty Ltd
Part of the **ALS Laboratory Group**

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WORK ORDER : HK2312358
SUB-BATCH : 1
CLIENT : ENVIROTECH SERVICES CO.
PROJECT : ---



ALS Lab ID	Client's Sample ID	Sample Type	Sample Date	External Lab Report No.
HK2312358-001	Sibata (326285)	Equipments	18-Mar-2023	S/N: 326285



Equipment Verification Report (TSP)

Equipment Calibrated:

Type: Laser Dust Monitor
Manufacturer: Sibata LD-3B
Serial No.: 326285
Equipment Ref.: N/A
Job Order: HK2311344

Standard Equipment

Standard Equipment: High Volume Sampler (TSP)
Location & Location ID: Envirotech Room (Calibration Room)
Equipment Ref.: HVS 8162
Last Calibration Date: 28-Feb-2023

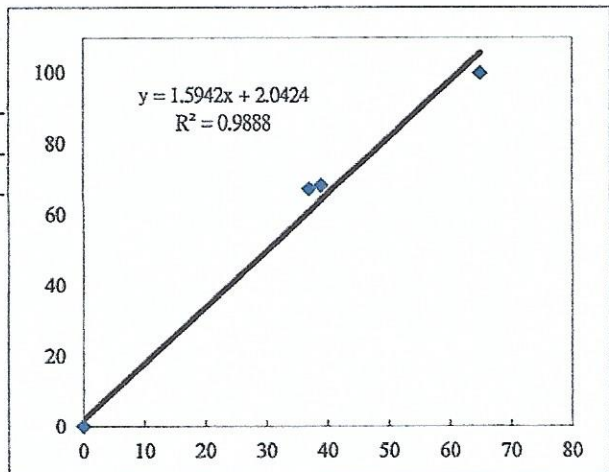
Equipment Verification Results:

Verification Date: 17 & 18 March 2023

Hour	Time	Mean Temp °C	Mean Pressure (hpa)	Concentration in µg/m³ (Standard Equipment)	Total Count (Calibrated Equipment)	Count /Minute (Total Count/min)
1hr 00mins	1410-1510	24.2	1018.2	100	3910	65
1hr 00mins	0810-0910	22.2	1021.5	67	2218	37
1hr 00mins	1510-1610	25.0	1022.4	68	2350	39

Linear Regression of Y or X

Slope (K-factor): 1.5942(µg/m³)/CPM
Correlation Coefficient (R): 0.9944
Date of Issue: 29-Mar-2023



Remarks:

- 1. Strong Correlation (>0.8)
- 2. Factor 1.5942 (µg/m³)/CPM should be applied for TSP monitoring

*If R<0.5, repair or verification is required for the equipment

Operator: P.F.Yeung Signature *Fai* Date: 29 March 2023

QC Reviewer: K.F.Ho Signature *Fat* Date: 29 March 2023

TSP SAMPLER CALIBRATION CALCULATION SPREADSHEET

Location : Rm. 712, My Loft, Tuen Mun	Date of Calibration:	28-Feb-23
HVS ID: 8162	Next Calibration Date:	28-Apr-23
Name and Model : TISCH HVS Model TE-5170	Operator:	K.F.Ho

CONDITIONS

Sea Level Pressure (hpa)	1021	Corrected Pressure (mm Hg)	764.3
Temperature (°C)	22.0	Temperature (K)	295

CALIBRATION ORIFICE

Make:	TISCH	Qstd Slope	2.06918
Model:	TE-5025A	Qstd Intercept	-0.04220
Serial#:	2454		

CALIBRATION

Plate No.	H2O(L) (in)	H2O(R) (in)	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION
18	6.7	6.6	13.3	1.797	62	62.51	Slope= 31.428 Intercept= 5.569 Corr. Coeff.= 0.9990
13	5.2	5.1	10.3	1.584	55	55.45	
10	4.0	3.9	7.9	1.390	48	48.39	
7	2.5	2.5	5.0	1.110	40	40.33	
5	1.4	1.4	2.8	0.836	32	32.26	

Calculations:

$$Qstd = 1/m[\text{Sqrt}(H2O(Pa/Pstd)(Tstd/Ta))-b]$$

$$IC = I[\text{Sqrt}(Pa/Pstd)(Tstd/Ta)]$$

Qstd = standard flow rate

IC = corrected chart response

I = actual chart response

m = calibrator Qstd slope

b = calibrator Qstd intercept

Ta = actual temperature during calibration (deg K)

Pa = actual pressure during calibration (mm Hg)

For subsequent calculation of sampler flow:

$$1/m((I[\text{Sqrt}(298/Tav)(Pav/760)]-b)$$

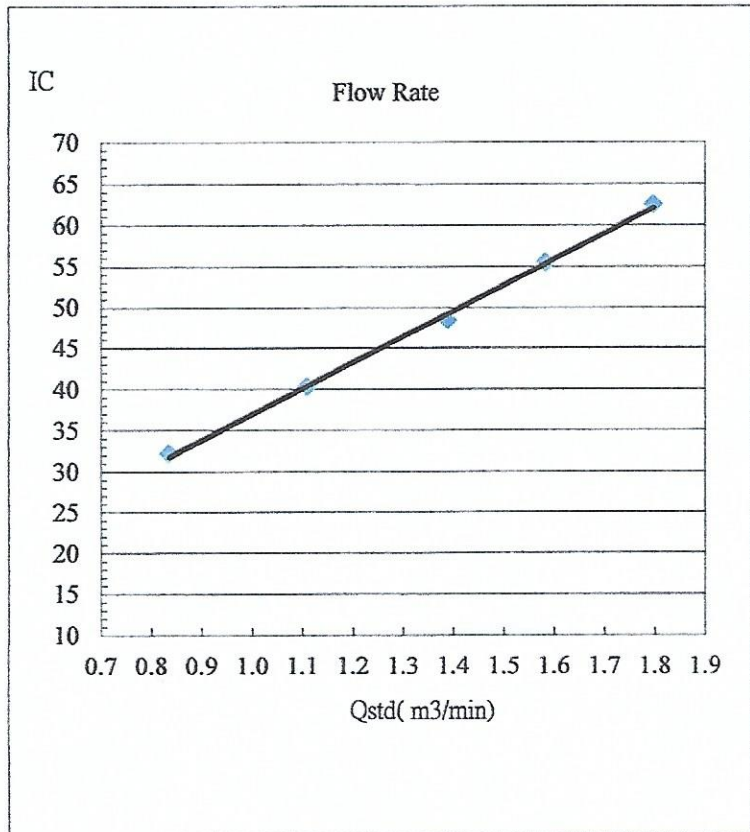
m = sampler slope

b = sampler intercept

I = chart response

Tav = daily average temperature

Pav = daily average pressure



Certificate of Calibration

Calibration Certification Information			
Cal. Date: December 15, 2022	Rootsmeter S/N: 438320	Ta: 295	°K
Operator: Jim Tisch		Pa: 748.0	mm Hg
Calibration Model #: TE-5025A	Calibrator S/N: 4064		

Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H2O)
1	1	2	1	1.4430	3.2	2.00
2	3	4	1	1.0210	6.4	4.00
3	5	6	1	0.9170	7.9	5.00
4	7	8	1	0.8730	8.8	5.50
5	9	10	1	0.7210	12.8	8.00

Data Tabulation					
Vstd (m3)	Qstd (x-axis)	$\sqrt{\Delta H \left(\frac{Pa}{Pstd} \right) \left(\frac{Tstd}{Ta} \right)}$ (y-axis)	Va	Qa (x-axis)	$\sqrt{\Delta H \left(\frac{Ta}{Pa} \right)}$ (y-axis)
0.9900	0.6861	1.4101	0.9957	0.6900	0.8881
0.9858	0.9655	1.9943	0.9914	0.9711	1.2560
0.9838	1.0728	2.2296	0.9894	1.0790	1.4042
0.9826	1.1255	2.3385	0.9882	1.1320	1.4728
0.9772	1.3554	2.8203	0.9829	1.3632	1.7762
QSTD	m=	2.10977	QA	m=	1.32110
	b=	-0.03782		b=	-0.02382
	r=	0.99998		r=	0.99998

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

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

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



Certificate of Calibration

for

Description: *Sound Level Meter*
Manufacturer: *RION*
Type No.: *NL-52 (Serial No.: 00131627)*
Microphone: *UC-59 (Serial No.: 04870)*
Preamplifier: *NH-25 (Serial No.: 10403)*

Submitted by:

Customer: *Envirotech Services Co.*
Address: *Rm.113, 1/F., My Loft, 9 Hoi Wing Road,
Tuen Mun, Hong Kong*

Upon receipt for calibration, the instrument was found to be:

- Within (31.5Hz – 8kHz)**
- Outside**

the allowable tolerance.

The test equipment used for calibration are traceable to National Standards via:

- The Government of The Hong Kong Special Administrative Region Standard & Calibration Laboratory

Date of receipt: 07 June 2023

Date of calibration: 08 June 2023

Date of NEXT calibration: 07 June 2024

Calibrated by: _____
Calibration Technician

Certified by: _____
*Mr. Ng Yan Wa
Laboratory Manager*

Date of issue: 08 June 2023

Certificate No.: APJ23-029-CC001



1. Calibration Precaution:

- The unit-under-test (UUT) was allowed to stabilize in the laboratory for over 24 hours, and switched on to warm up for over 10 minutes before the commencement of the test.
- The results presented are the mean of 3 measurements at each calibration point.

2. Calibration Conditions:

Air Temperature: 22.5 °C
 Air Pressure: 1006 hPa
 Relative Humidity: 64.5 %

3. Calibration Equipment:

	Type	Serial No.	Calibration Report Number	Traceable to
Multifunction Calibrator	B&K 4226	2288467	AV220061	HOKLAS

4. Calibration Results

Sound Pressure Level

Reference Sound Pressure Level

Setting of Unit-under-test (UUT)			Applied value		UUT Reading, dB	IEC 61672 Class 1 Specification, dB
Range, dB	Freq. Weighting	Time Weighting	Level, dB	Frequency, Hz		
30-130	dBA SPL	Fast	94	1000	94.0	±0.4

Linearity

Setting of Unit-under-test (UUT)			Applied value		UUT Reading, dB	IEC 61672 Class 1 Specification, dB
Range, dB	Freq. Weighting	Time Weighting	Level, dB	Frequency, Hz		
30-130	dBA SPL	Fast	94	1000	94.0	Ref
			104		104.0	±0.3
			114		114.0	±0.3

Time Weighting

Setting of Unit-under-test (UUT)			Applied value		UUT Reading, dB	IEC 61672 Class 1 Specification, dB
Range, dB	Freq. Weighting	Time Weighting	Level, dB	Frequency, Hz		
30-130	dBA SPL	Fast	94	1000	94.0	Ref
		Slow			94.0	±0.3

Certificate No.: APJ23-029-CC001



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Frequency Response

Linear Response

Setting of Unit-under-test (UUT)			Applied value		UUT Reading, dB	IEC 61672 Class 1 Specification, dB	
Range, dB	Freq. Weighting	Time Weighting	Level, dB	Frequency, Hz			
30-130	dB	SPL	94	Fast	31.5	93.9	±2.0
					63	93.9	±1.5
					125	94.0	±1.5
					250	94.0	±1.4
					500	94.0	±1.4
					1000	94.0	Ref.
					2000	93.9	±1.6
					4000	94.0	±1.6
					8000	92.2	+2.1; -3.1

A-weighting

Setting of Unit-under-test (UUT)			Applied value		UUT Reading, dB	IEC 61672 Class 1 Specification, dB	
Range, dB	Freq. Weighting	Time Weighting	Level, dB	Frequency, Hz			
30-130	dBA	SPL	94	Fast	31.5	54.4	-39.4±2.0
					63	67.7	-26.2±1.5
					125	77.9	-16.1±1.5
					250	85.3	-8.6±1.4
					500	90.7	-3.2±1.4
					1000	94.0	Ref
					2000	95.1	+1.2±1.6
					4000	95.0	+1.0±1.6
					8000	91.2	-1.1+2.1; -3.1

C-weighting

Setting of Unit-under-test (UUT)			Applied value		UUT Reading, dB	IEC 61672 Class 1 Specification, dB	
Range, dB	Freq. Weighting	Time Weighting	Level, dB	Frequency, Hz			
30-130	dBC	SPL	94	Fast	31.5	90.8	-3.0±2.0
					63	93.1	-0.8±1.5
					125	93.8	-0.2±1.5
					250	93.9	-0.0±1.4
					500	94.0	-0.0±1.4
					1000	94.0	Ref
					2000	93.7	-0.2±1.6
					4000	93.2	-0.8±1.6
					8000	89.3	-3.0+2.1; -3.1

Certificate No.: APJ23-029-CC001



Page 3 of 4

5. Calibration Results Applied

The results apply to the particular unit-under-test only. All calibration points are within manufacture's specification as IEC 61672 Class 1.

Uncertainties of Applied Value:

94 dB	31.5 Hz	± 0.05
	63 Hz	± 0.05
	125 Hz	± 0.05
	250 Hz	± 0.05
	500 Hz	± 0.05
	1000 Hz	± 0.05
	2000 Hz	± 0.05
	4000 Hz	± 0.05
	8000 Hz	± 0.10
104 dB	1000 Hz	± 0.05
114 dB	1000 Hz	± 0.05

The uncertainties are evaluated for a 95% confidence level.

Note:

The values given in this certification only related to the values measured at the time of the calibration and any uncertainties quoted will not allow for the equipment long-term drift, variations with environmental changes, vibration and shock during transportation, overloading, mis-handling, or the capability of any other laboratory to repeat the calibration. (A+A)*L shall not be liable for any loss or damage resulting from the use of the equipment.



輝創工程有限公司

Sun Creation Engineering Limited

Calibration & Testing Laboratory

Certificate of Calibration 校正證書

Certificate No. : C230386

證書編號

ITEM TESTED / 送檢項目 (Job No. / 序引編號 : IC23-0164)

Date of Receipt / 收件日期 : 27 January 2023

Description / 儀器名稱 : Precision Acoustic Calibrator

Manufacturer / 製造商 : LARSON DAVIS

Model No. / 型號 : CAL200

Serial No. / 編號 : 10227

Supplied By / 委託者 : Envirotech Services Co.

Room 712, 7/F, My Loft, 9 Hoi Wing Road, Tuen Mun,
New Territories, Hong Kong

TEST CONDITIONS / 測試條件

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

Relative Humidity / 相對濕度 : $(50 \pm 25)\%$

Line Voltage / 電壓 : ---

TEST SPECIFICATIONS / 測試規範

Calibration check

DATE OF TEST / 測試日期 : 28 January 2023

TEST RESULTS / 測試結果

The results apply to the particular unit-under-test only.

The results are detailed in the subsequent page(s).

The test equipment used for calibration are traceable to National Standards via :

- The Government of The Hong Kong Special Administrative Region Standard & Calibration Laboratory
- Agilent Technologies / Keysight Technologies
- Fluke Everett Service Center, USA

Tested By

測試

:

H T Wong

Assistant Engineer

Certified By

核證

:

K C Lee

Engineer

Date of Issue

簽發日期

:

30 January 2023

The test equipment used for calibration is traceable to the National Standards as specified in this certificate. This certificate shall not be reproduced except in full, without the prior written approval of this laboratory.

本證書所載校正用之測試器材均可溯源至國際標準。局部複印本證書需先獲本實驗室書面批准。

Sun Creation Engineering Limited - Calibration & Testing Laboratory

c/o 4/F, 1 Hing On Lane, Tuen Mun, New Territories, Hong Kong

輝創工程有限公司 - 校正及檢測實驗室

c/o 香港新界屯門興安里一號四樓

Tel/電話: (852) 2927 2606

Fax/傳真: (852) 2744 8986

E-mail/電郵: callab@suncreation.com

Website/網址: www.suncreation.com

Certificate of Calibration

校正證書

Certificate No. : C230386

證書編號

- The unit-under-test (UUT) was allowed to stabilize in the laboratory for over 12 hours before the commencement of the test.
- The results presented are the mean of 3 measurements at each calibration point.
- Test equipment :

<u>Equipment ID</u>	<u>Description</u>	<u>Certificate No.</u>
CL130	Universal Counter	C223647
CL281	Multifunction Acoustic Calibrator	AV210017
TST150A	Measuring Amplifier	C221750

- Test procedure : MA100N.

- Results :

5.1 Sound Level Accuracy

UUT Nominal Value	Measured Value (dB)	Uncertainty of Measured Value (dB)
94 dB, 1 kHz	93.9	± 0.2
114 dB, 1 kHz	113.9	

5.2 Frequency Accuracy

UUT Nominal Value (kHz)	Measured Value (kHz)	Uncertainty of Measured Value (Hz)
1	1.000	± 1

Remark : The uncertainties are for a confidence probability of not less than 95 %.

Note :

Only the original copy or the laboratory's certified true copy is valid.

The values given in this Certificate only relate to the values measured at the time of the test and any uncertainties quoted will not include allowance for the equipment long term drift, variations with environment changes, vibration and shock during transportation, overloading, mis-handling, or the capability of any other laboratory to repeat the measurement. Sun Creation Engineering Limited shall not be liable for any loss or damage resulting from the use of the equipment.