

High-Volume TSP Sampler
5-Point Calibration Record

Location : AM1 (ICC)
 Calibrated by : K. T. Ho
 Date : 20/09/2020

Sampler

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

Calibration Orifice and Standard Calibration Relationship

Serial Number : 2454
 Service Date : 18 February 2020
 Slope (m) : 2.07134
 Intercept (b) : -0.04091
 Correlation Coefficient(r) : 0.99999

Standard Condition

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

Calibration Condition

Pa (hpa) : 1009
 Ta(K) : 303

Resistance Plate	dH [green liquid] (inch water)	Z	X=Qstd (cubic meter/min)	IC (chart)	Y (corrected)
1 18 holes	10.2	3.161	1.546	60	59.39
2 13 holes	7.6	2.729	1.337	50	49.49
3 10 holes	6.0	2.424	1.190	40	39.59
4 7 holes	4.0	1.980	0.975	28	27.71
5 5 holes	2.6	1.596	0.790	18	17.82

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

Sampler Calibration Relationship (Linear Regression)

Slope(m): 55.925

Intercept(b): -26.508

Correlation Coefficient(r): 0.9991

Checked by: Magnum Fan

Date: 26/09/2020

High-Volume TSP Sampler
5-Point Calibration Record

Location : AM2B(Gammon Office)
 Calibrated by : K. T. Ho
 Date : 20/09/2020

Sampler

Model : TE-5170
 Serial Number : S/N 8919

Calibration Orifice and Standard Calibration Relationship

Serial Number : 2454
 Service Date : 18 February 2020
 Slope (m) : 2.07134
 Intercept (b) : -0.04091
 Correlation Coefficient(r) : 0.99999

Standard Condition

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

Calibration Condition

Pa (hpa) : 1009
 Ta(K) : 303

Resistance Plate	dH [green liquid] (inch water)	Z	X=Qstd (cubic meter/min)	IC (chart)	Y (corrected)
1 18 holes	12.6	3.513	1.716	62	61.36
2 13 holes	8.2	2.834	1.388	50	49.49
3 10 holes	5.8	2.384	1.171	38	37.61
4 7 holes	3.4	1.825	0.901	28	27.71
5 5 holes	2.2	1.468	0.728	18	17.82

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

Sampler Calibration Relationship (Linear Regression)

Slope(m): 43.924

Intercept(b): -13.006

Correlation Coefficient(r): 0.9972

Checked by: Magnum Fan

Date: 26/09/2020



RECALIBRATION DUE DATE: February 18, 2021

Certificate of Calibration

Calibration Certification Information			
Cal. Date: February 18, 2020	Rootmeter S/N: 438320	Ta: 29.4 °K	
Operator: Jim Tisch		Pa: 753.1 mm Hg	
Calibration Model #: TE-5025A	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	1.4190	3.2	2.00
2	3	4	1	1.0100	6.4	4.00
3	5	6	1	0.9020	7.9	5.00
4	7	8	1	0.8600	8.8	5.50
5	9	10	1	0.7110	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)	$\sqrt{\Delta H (Ta/Pa)}$ (y-axis)
1.0001	0.7048	1.4173	0.9958	0.7017	0.8836
0.9959	0.9860	2.0044	0.9915	0.9817	1.2496
0.9939	1.1019	2.2410	0.9895	1.0970	1.3971
0.9927	1.1543	2.3504	0.9883	1.1492	1.4653
0.9875	1.3889	2.8347	0.9831	1.3828	1.7672
QSTD	m=	2.07134	QA	m=	1.29704
	b=	-0.04091		b=	-0.02551
	r=	0.99999		r=	0.99999

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

Standard Conditions	
Tstd	298.15 °K
Pstd	760 mm Hg
Key	
ΔH	calibrator manometer reading (in H2O)
ΔP	rootmeter 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



ALS Laboratory Group

ANALYTICAL CHEMISTRY & TESTING SERVICES

SUB-CONTRACTING REPORT

CONTACT	: MR K.W. FAN	WORK ORDER	: HK1950885
CLIENT	: ENVIROTECH SERVICES CO.		
ADDRESS	: RM113, 1/F, MY LOFT, 9 HOI WING ROAD, TUEN MUN, N.T. HONG KONG	SUB-BATCH	: 1
		DATE RECEIVED	: 3-DEC-2019
		DATE OF ISSUE	: 13-DEC-2019
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., if any) is provided by client.
- Calibration was subcontracted to and analysed by Action United Enviro Services.

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 is the Final Report and supersedes any preliminary report with this batch number.

Results apply to sample(s) as submitted. All pages of this report have been checked and approved for release.

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

11/F, Chung Shun Knitting Centre 1 - 3 Wing Yip Street Kwai Chung N.T. Hong Kong
Tel. +852 2610 1044 Fax. +852 2610 2021 www.alsglobal.com

WORK ORDER : HK1950885
SUB-BATCH : 1
CLIENT : ENVIROTECH SERVICES CO.
PROJECT : ----



ALS Lab ID	Client's Sample ID	Sample Type	Sample Date	External Lab Report No.
HK1950885-001	S/N: 235780	Equipments	03-Dec-2019	235780

Equipment Verification Report (TSP)

Equipment Calibrated:

Type: Laser Dust monitor
 Manufacturer: Sibata LD-3B
 Serial No. 235780
 Equipment Ref: Nil
 Job Order HK1950885

Standard Equipment:

Standard Equipment: Higher Volume Sampler (TSP)
 Location & Location ID: AUES office (calibration room)
 Equipment Ref: HVS 018
 Last Calibration Date: 3 December 2019

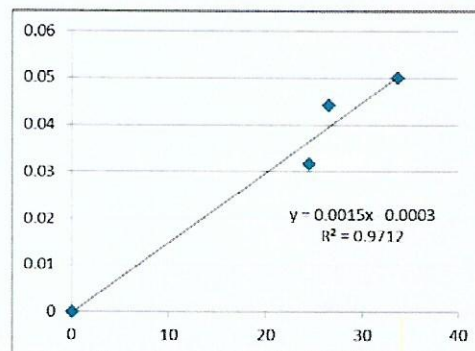
Equipment Verification Results:

Verification Date: 10 December 2019

Hour	Time	Mean Temp °C	Mean Pressure (hPa)	Concentration in mg/m ³ (Standard Equipment)	Total Count (Calibrated Equipment)	Count/Minute (Total Count/min)
2hr02min	09:08 ~ 11:10	18.4	1018.6	0.032	2989	24.5
2hr01min	11:15 ~ 13:16	18.4	1018.6	0.044	3203	26.6
2hr01min	13:22 ~ 15:23	18.4	1018.6	0.050	4060	33.7

Linear Regression of Y or X

Slope (K-factor): 0.0015
 Correlation Coefficient 0.9855
 Date of Issue 13 December 2019



Remarks:

1. **Strong Correlation (R>0.8)**
2. Factor 0.0015 should be applied for TSP monitoring

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

Operator : Fai So Signature : [Signature] Date : 13 December 2019

QC Reviewer : Ben Tam Signature : [Signature] Date : 13 December 2019



SUB-CONTRACTING REPORT

CONTACT	: MR K.W. FAN	WORK ORDER	: HK1950891
CLIENT	: ENVIROTECH SERVICES CO.		
ADDRESS	: RM113, 1/F, MY LOFT, 9 HOI WING ROAD, TUEN MUN, N.T. HONG KONG	SUB-BATCH	: 1
		DATE RECEIVED	: 3-DEC-2019
		DATE OF ISSUE	: 13-DEC-2019
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., if any) is provided by client.
- Calibration was subcontracted to and analysed by Action United Enviro Services.

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 is the Final Report and supersedes any preliminary report with this batch number.

Results apply to sample(s) as submitted. All pages of this report have been checked and approved for release.

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Part of the ALS Laboratory Group

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

WORK ORDER : HK1950891
SUB-BATCH : 1
CLIENT : ENVIROTECH SERVICES CO.
PROJECT : ---



ALS Lab ID	Client's Sample ID	Sample Type	Sample Date	External Lab Report No.
HK1950891-001	S/N: 6Z7784	Equipments	03-Dec-2019	6Z7784

Equipment Verification Report (TSP)

Equipment Calibrated:

Type: Laser Dust monitor
 Manufacturer: Sibata LD-3B
 Serial No. 6Z7784
 Equipment Ref: Nil
 Job Order HK1950891

Standard Equipment:

Standard Equipment: Higher Volume Sampler (TSP)
 Location & Location ID: AUES office (calibration room)
 Equipment Ref: HVS 018
 Last Calibration Date: 3 December 2019

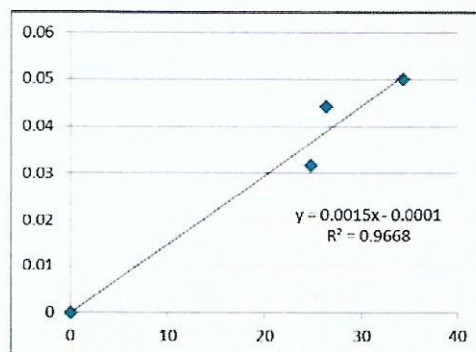
Equipment Verification Results:

Verification Date: 10 December 2019

Hour	Time	Mean Temp °C	Mean Pressure (hPa)	Concentration in mg/m ³ (Standard Equipment)	Total Count (Calibrated Equipment)	Count/Minute (Total Count/min)
2hr02min	09:08 ~ 11:10	18.4	1018.6	0.032	3020	24.8
2hr01min	11:15 ~ 13:16	18.4	1018.6	0.044	3185	26.4
2hr01min	13:22 ~ 15:23	18.4	1018.6	0.050	4141	34.3

Linear Regression of Y or X

Slope (K-factor): 0.0015
 Correlation Coefficient 0.9833
 Date of Issue 13 December 2019



Remarks:

1. **Strong Correlation (R>0.8)**
2. Factor 0.0015 should be applied for TSP monitoring

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

Operator : Fai So Signature : [Signature] Date : 13 December 2019

QC Reviewer : Ben Tam Signature : [Signature] Date : 13 December 2019

Certificate of Calibration

校正證書

Certificate No. : C203822

證書編號

ITEM TESTED / 送檢項目 (Job No. / 序引編號 : IC20-1389)

Date of Receipt / 收件日期 : 30 June 2020

Description / 儀器名稱 : Sound Level Meter

Manufacturer / 製造商 : Rion

Model No. / 型號 : NL-52

Serial No. / 編號 : 01010406

Supplied By / 委託者 : Envirotech Services Co.

Room 113, 1/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 : 9 July 2020

TEST RESULTS / 測試結果

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

The results do not exceed manufacturer's specification.


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
- The Bruel & Kjaer Calibration Laboratory, Denmark

Tested By

測試

: 

K P Cheuk

Assistant Engineer

Certified By

核證

: 

K C Lee

Engineer

Date of Issue

簽發日期

:

10 July 2020

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.

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Certificate of Calibration

校正證書

Certificate No. : C203822

證書編號

- The unit-under-test (UUT) was allowed to stabilize in the laboratory for over 12 hours, and switched on to warm up for over 10 minutes before the commencement of the test.
- Self-calibration was performed before the test.
- The results presented are the mean of 3 measurements at each calibration point.

4. Test equipment :

<u>Equipment ID</u>	<u>Description</u>	<u>Certificate No.</u>
CL280	40 MHz Arbitrary Waveform Generator	C200258
CL281	Multifunction Acoustic Calibrator	CDK1806821

5. Test procedure : MA101N.

6. Results :

6.1 Sound Pressure Level

6.1.1 Reference Sound Pressure Level

UUT Setting				Applied Value		UUT Reading (dB)	IEC 61672 Class 1 Spec. (dB)
Range (dB)	Function	Frequency Weighting	Time Weighting	Level (dB)	Freq. (kHz)		
30 - 130	L _A	A	Fast	94.00	1	93.8	± 1.1

6.1.2 Linearity

UUT Setting				Applied Value		UUT Reading (dB)
Range (dB)	Function	Frequency Weighting	Time Weighting	Level (dB)	Freq. (kHz)	
30 - 130	L _A	A	Fast	94.00	1	93.8 (Ref.)
				104.00		103.9
				114.00		113.8

IEC 61672 Class 1 Spec. : ± 0.6 dB per 10 dB step and ± 1.1 dB for overall different.

6.2 Time Weighting

UUT Setting				Applied Value		UUT Reading (dB)	IEC 61672 Class 1 Spec. (dB)
Range (dB)	Function	Frequency Weighting	Time Weighting	Level (dB)	Freq. (kHz)		
30 - 130	L _A	A	Fast	94.00	1	93.8	Ref.
			Slow			93.8	± 0.3

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.

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Certificate of Calibration

校正證書

Certificate No. : C203822

證書編號

6.3 Frequency Weighting

6.3.1 A-Weighting

UUT Setting				Applied Value		UUT Reading (dB)	IEC 61672 Class 1 Spec. (dB)
Range (dB)	Function	Frequency Weighting	Time Weighting	Level (dB)	Freq.		
30 - 130	L _A	A	Fast	94.00	63 Hz	67.5	-26.2 ± 1.5
					125 Hz	77.6	-16.1 ± 1.5
					250 Hz	85.1	-8.6 ± 1.4
					500 Hz	90.6	-3.2 ± 1.4
					1 kHz	93.8	Ref.
					2 kHz	95.1	+1.2 ± 1.6
					4 kHz	94.9	+1.0 ± 1.6
					8 kHz	92.8	-1.1 (+2.1 ; -3.1)
					12.5 kHz	89.4	-4.3 (+3.0 ; -6.0)

6.3.2 C-Weighting

UUT Setting				Applied Value		UUT Reading (dB)	IEC 61672 Class 1 Spec. (dB)
Range (dB)	Function	Frequency Weighting	Time Weighting	Level (dB)	Freq.		
30 - 130	L _C	C	Fast	94.00	63 Hz	92.9	-0.8 ± 1.5
					125 Hz	93.6	-0.2 ± 1.5
					250 Hz	93.8	0.0 ± 1.4
					500 Hz	93.8	0.0 ± 1.4
					1 kHz	93.8	Ref.
					2 kHz	93.7	-0.2 ± 1.6
					4 kHz	93.0	-0.8 ± 1.6
					8 kHz	90.9	-3.0 (+2.1 ; -3.1)
					12.5 kHz	87.5	-6.2 (+3.0 ; -6.0)

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Certificate of Calibration

校正證書

Certificate No. : C203822
證書編號

Remarks : - UUT Microphone Model No. : UC-59 & S/N : 04871

- Mfr's Spec. : IEC 61672 Class 1

- Uncertainties of Applied Value :

94 dB	: 63 Hz - 125 Hz	: ± 0.35 dB
	250 Hz - 500 Hz	: ± 0.30 dB
	1 kHz	: ± 0.20 dB
	2 kHz - 4 kHz	: ± 0.35 dB
	8 kHz	: ± 0.45 dB
	12.5 kHz	: ± 0.70 dB
104 dB	: 1 kHz	: ± 0.10 dB (Ref. 94 dB)
114 dB	: 1 kHz	: ± 0.10 dB (Ref. 94 dB)

- 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.



Certificate of Calibration 校正證書

Certificate No. : C196453
證書編號

ITEM TESTED / 送檢項目 (Job No. / 序引編號 : IC19-2418) Date of Receipt / 收件日期 : 18 November 2019

Description / 儀器名稱 : Precision Acoustic Calibrator
Manufacturer / 製造商 : LARSON DAVIS
Model No. / 型號 : CAL200
Serial No. / 編號 : 11334
Supplied By / 委託者 : Envirotech Services Co.
Room 113, 1/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

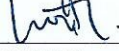
DATE OF TEST / 測試日期 : 30 November 2019

TEST RESULTS / 測試結果

The results apply to the particular unit-under-test only.
The results do not exceed manufacturer's specification & user's specified acceptance criteria.
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
- The Bruel & Kjaer Calibration Laboratory, Denmark
- Agilent Technologies / Keysight Technologies
- Fluke Everett Service Center, USA

Tested By : 
測試 : _____
H T Wong
Technical Officer

Certified By : 
核證 : _____
K C Lee
Engineer

Date of Issue : 3 December 2019
簽發日期

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

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Certificate of Calibration

校正證書

Certificate No. : C196453
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	C193756
CL281	Multifunction Acoustic Calibrator	CDK1806821
TST150A	Measuring Amplifier	C181288

- Test procedure : MA100N.

- Results :

5.1 Sound Level Accuracy

UUT Nominal Value	Measured Value (dB)	User's Spec. (dB)	Uncertainty of Measured Value (dB)
94 dB, 1 kHz	93.8	± 0.5	± 0.2
114 dB, 1 kHz	113.7		

5.2 Frequency Accuracy

UUT Nominal Value (kHz)	Measured Value (kHz)	Mfr's Spec.	Uncertainty of Measured Value (Hz)
1	1.000	1 kHz ± 1 %	± 1

Remarks : - The user's specified acceptance criteria (user's spec.) is a customer pre-defined operating tolerance of the UUT, suitable for one's own intended use.

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

Note :

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