

Appendix C Calibration Certificates of Monitoring Equipment



RECALIBRATION DUE DATE:

February 13, 2019

Pertificate d alibration

Calibration Certification Information

Cal. Date: February 13, 2018

Calibration Model #: TE-5025A

Rootsmeter S/N: 438320

Ta: 293

°K

Operator: Jim Tisch

Calibrator S/N: 1612

Pa: 763.3 mm Hg

	Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H2O)
Г	1	1	2	1	1.3970	3.2	2.00
Г	2	3	4	1	1.0000	6.3	4.00
Г	3	5	6	1	0.8900	7.9	5.00
Г	4	7	8	1	0.8440	8.7	5.50
	5	9	10	1	0.7010	12.6	8.00

Data Tabulation						
Vstd	Qstd	$\sqrt{\Delta H \left(\frac{Pa}{Pstd}\right) \left(\frac{Tstd}{Ta}\right)}$		Qa	√∆H(Ta/Pa)	
(m3)	(x-axis)	(y-axis)	Va	(x-axis)	(y-axis)	
1.0172	0.7281	1.4293	0.9958	0.7128	0.8762	
1.0130	1.0130	2.0213	0.9917	0.9917	1.2392	
1.0109	1.1358	2.2599	0.9896	1.1120	1.3854	
1.0098	1.1964	2.3702	0.9886	1.1713	1.4530	
1.0046	1.4331	2.8586	0.9835	1.4030	1.7524	
	m=	2.02017		m=	1.26500	
QSTD	b=	-0.03691	QA	b=	-0.02263	
	r=	0.99988		r=	0.99988	

Calculations					
Vstd=	ΔVoI((Pa-ΔP)/Pstd)(Tstd/Ta)	Va=	ΔVol((Pa-ΔP)/Pa)		
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=	$1/m\left(\left(\sqrt{\Delta H(Ta/Pa)}\right)-b\right)$		

Standard Conditions					
Tstd: 298.15 °K					
Pstd:	760 mm Hg				
	Key				
	or 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

Tisch Environmental, Inc. 145 South Miami Avenue Village of Cleves, OH 45002 www.tisch-env.cor

TOLL FREE: (877)263-7610

FAX: (513)467-900

TSP Sampler Calibration

SITE

Location: Lian Tang 3
Sampler: TE-5170 MFC (Serial # : 2359) Date: January 6, 2018 Tech: Sam Wong

CONDITIONS Barometric Pressure (in Hg): 39.99 Corrected Pressure (mm Hg): 1016 Temperature (deg F): 70 Temperature (deg K): 294 Average Press. (in Hg): 39.99 Corrected Average (mm Hg): 1016 Average Temp. (deg F): Average Temp. (deg K): 294

CALIBRATION ORIFICE

Make: Tisch Qstd Slope: 2.11965 TE-5025A Qstd Intercept: -0.02696 Model: Serial#: Date Certified: February 28, 2017

CALIBRATIONS							
Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION		
1	12.00	1.915	56.0	65.17	Slope =	33.3004	
2	10.00	1.749	52.0	60.51	Intercept =	2.1322	
3	8.20	1.585	48.0	55.86	Corr. coeff.=	0.9987	
4	5.20	1.265	38.0	44.22			
5	3.20	0.995	30.0	34.91	# of Observations:	5	

Calculations

Qstd = 1/m[Sqrt(H2O(Pa/Pstd)(Tstd/Ta))-b]

IC = I[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)

Tstd = 298 deg K

Pstd = 760 mm Hg For subsequent calculation of sampler flow:

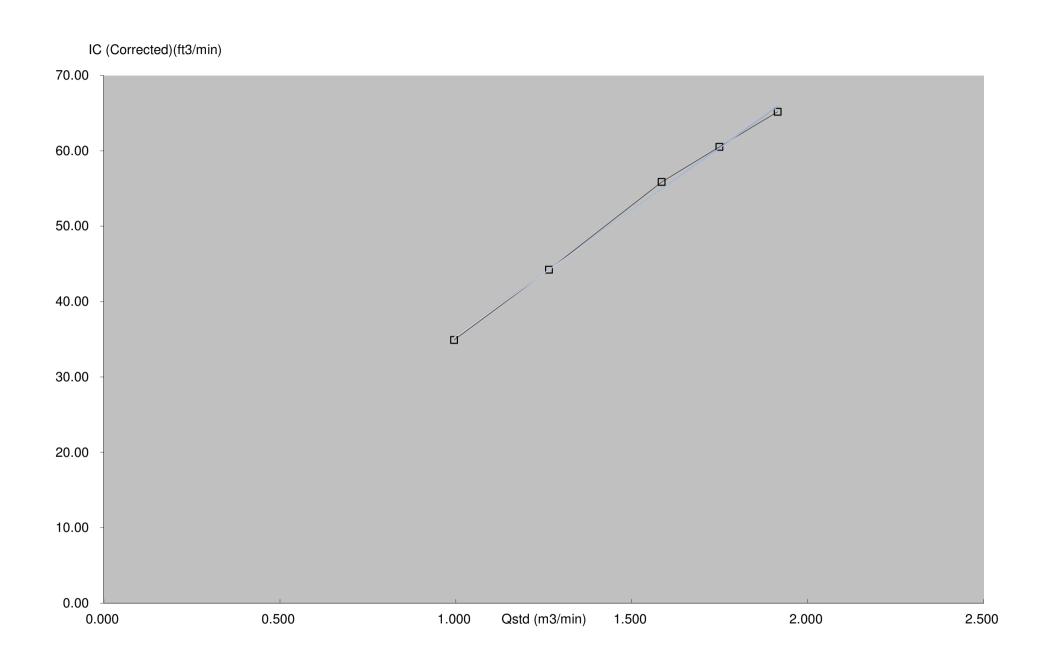
1/m((I)[Sqrt(298/Tav)(Pav/760)]-b)

= sampler slope = sampler intercept m

b

= chart response

Tav = daily average temperature Pav = daily average pressure



TSP Sampler Calibration

SITE

Location: Lian Tang 3 Date: March 6, 2018 Sampler: TE-5170 MFC (Serial # : 2359) Tech: Sam Wong

CONDITIONS Barometric Pressure (in Hg): 40.05 Corrected Pressure (mm Hg): 1017 Temperature (deg F): 70 Temperature (deg K): 294 Average Press. (in Hg): 40.05 Corrected Average (mm Hg): 1017

CALIBRATION ORIFICE Make: Tisch Qstd Slope: 1.99748 Model: TE-5025A Qstd Intercept: -0.00957 Serial#: 1941 Date Certified: May 19, 2017

Average Temp. (deg K):

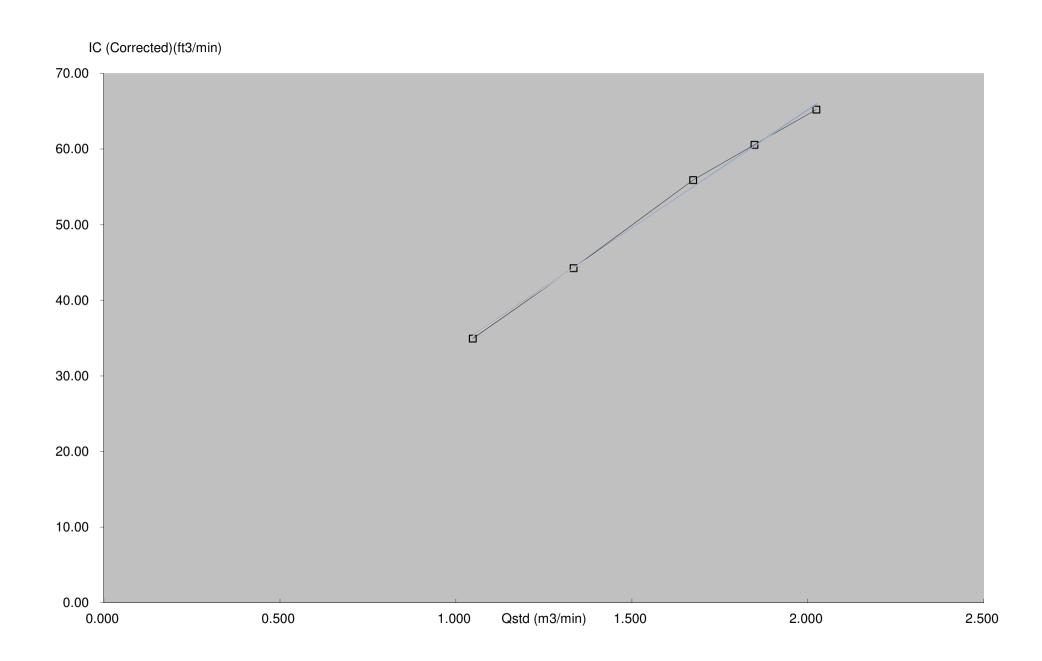
294

CALIBRATIONS							
Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION		
1	12.00	2.024	56.0	65.22	Slope =	31.3811	
2	10.00	1.848	52.0	60.56	Intercept =	2.4073	
3	8.20	1.674	48.0	55.90	Corr. coeff.=	0.9987	
4	5.20	1.334	38.0	44.25			
5	3.20	1.048	30.0	34.94	# of Observations:	5	

Calculations

Qstd = 1/m[Sqrt(H2O(Pa/Pstd)(Tstd/Ta))-b]IC = I[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) Tstd = 298 deg KPstd = 760 mm Hg For subsequent calculation of sampler flow: 1/m((I)[Sqrt(298/Tav)(Pav/760)]-b) = sampler slope = sampler intercept m b = chart response Tav = daily average temperature Pav = daily average pressure

Average Temp. (deg F):





Certificate No. 708774 Page 1 of 2 Pages

Customer: Enovative Environmental Service Limited

Address: Flat 6, 3/F, Block E, Wah Lok Industrial Centre, 31-35 Shan Mei Street, Shatin, N.T., Hong Kong.

Order No.: Q73499 Date of receipt: 1-Sep-17

Item Tested

Description: Sound Level Calibrator

 Manufacturer : Rion
 I.D.
 : 2159O1

 Model
 : NC-74
 Serial No.
 : 34857296

Test Conditions

Date of Test: 4-Sep-17 Supply Voltage: --

Ambient Temperature : $(23 \pm 3)^{\circ}$ C Relative Humidity : (50 ± 25) %

Test Specifications

Calibration check.

Ref. Document/Procedure: F21, Z02, IEC 60942.

Test Results

All results were within the IEC 60942 Class 1 specification.

The results are shown in the attached page(s).

Main Test equipment used:

Equipment No.	Description	Cert. No.	Traceable to
S014	Spectrum Analyzer	707126	NIM-PRC & SCL-HKSAR
S240	Sound Level Calibrator	703741	NIM-PRC & SCL-HKSAR
S041	Universal Counter	707135	SCL-HKSAR
S206	Sound Level Meter	707129	SCL-HKSAR

The values given in this Calibration 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 environmental changes, vibration and shock during transportation, overloading, mis-handling, or the capability of any other laboratory to repeat the measurement. Hong Kong Calibration Ltd. shall not be liable for any loss or damage resulting from the use of the equipment.

The test equipment used for calibration are traceable to International System of Units (SI), or by reference to a natural constant. The test results apply to the above Unit-Under-Test only

Calibrated by :		Approved by :	H. C.
	Elva Chong	•	Alan Chu

Date:

4-Sep-17

This Certificate is issued by:

Hong Kong Calibration Ltd.

Unit 8B, 24/F., Well Fung Industrial Centre, No. 58-76, Ta Chuen Ping Street, Kwai Chung, NT, Hong Kong.

Tel: 2425 8801 Fax: 2425 8646

Certificate No. 708774

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Results:

1. Level Accuracy (at 1 kHz)

UUT Nominal Value	Measured Value	Mfr's Spec.
94 dB	94.1 dB	± 1 dB

Uncertainty : \pm 0.2 dB

2. Frequency Accuracy

UUT Nominal Value	Measured Value	Mfr's Spec.	
1 kHz	0.998 kHz	± 2 %	

Uncertainty: ± 0.1 %

3. Level Stability: 0.0 dB Uncertainty: ± 0.01 dB

4. Total Harmonic Distortion: < 1.5%

Mfr's Spec. : < 3 %

Uncertainty: ± 2.3 % of reading

Remarks: 1. UUT: Unit-Under-Test

2. The uncertainty claimed is for a confidence probability of not less than 95%.

3. Atmospheric Pressure: 1 025 hPa

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Certificate No. 70877	3		Page	e 1 of 3 Pages
Customer: Enovative	e Environmental Serv	ice Limited		
Address : Flat 6, 3/	F, Block E, Wah Lok	Industrial Centre, 3	31-35 Shan Mei Str	reet, Shatin, N.T., Hong Kong.
Order No. : Q73499			Date of receip	pt : 1-Sep-17
Item Tested				
Description : Sound Le	evel Meter			
Manufacturer : Rion			I.D.	:
Model : NL-52			Serial No.	: 00821072
Test Conditions				
Date of Test: 5-Sep-	17		Supply Voltag	ge :
Ambient Temperature :	(23 ± 3)°C		Relative Hum	nidity: (50 ± 25) %
Test Specifications				
Calibration check. Ref. Document/Procedure	e: Z01, IEC 61672.			
Test Results	-			
All results were within the The results are shown in	• •		pecification.	
Main Test equipment use	d:			
Equipment No. Descripti	<u>on</u>	Cert. No.		Traceable to
S017 Multi-Fur	nction Generator	C170120		SCL-HKSAR
S240 Sound Lo	evel Calibrator	703741		NIM-PRC & SCL-HKSAR
	e equipment long term drif e capability of any other la	t, variations with enviro aboratory to repeat the	nmental changes, vibra	and any uncertainties quoted ation and shock during transportation, (ong Calibration Ltd. shall not be liable
The test equipment used for ca		nternational System of	Units (SI), or by referer	nce to a natural constant.

Calibrated by : _____ Elva Chong

Approved by : _ Alan Chu

5-Sep-17

Date:

This Certificate is issued by:

Hong Kong Calibration Ltd.

Unit 8B, 24/F., Well Fung Industrial Centre, No. 58-76, Ta Chuen Ping Street, Kwai Chung, NT, Hong Kong.

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Results:

1. Self-generated noise: 16.4 dBA (Mfr's Spec ≤ 17 dBA)

2. Acoustical signal test

	UUT S				
	Frequency	Time	Octave	Applied	UUT
Range (dB)	Weighting	Weighting	Filter	Value (dB)	Reading (dB)
20-130	A	F	OFF	94.0	94.1
		S	OFF		94.1
	С	F	OFF		94.1
	Z	F	OFF		94.1
	A	F	OFF	114.0	114.1
		S	OFF		114.1
	С	F	OFF		114.1
	Z	F	OFF		114.1

IEC 61672 Type 1 Spec. : ± 1.1 dB

Uncertainty: $\pm 0.1 \text{ dB}$

3 Electrical signal tests of frequency weightings (A weighting)

Frequency		Attenuation (dB)		IEC 61672 Type 1 Spec.	
31.5	Hz	-39.7		- 39.4 dB, ± 2 dB	
63	Hz	-26.2		- 26.2 dB, ± 1.5 dB	
125	Hz	-16.2		- 16.1 dB, ± 1.5 dB	
250	Hz	-8.7		- 8.6 dB, ± 1 dB	
500	Hz	-3.2		- 3.2 dB, \pm 1.4 dB	
1	kHz	0.0	(Ref)	$0 \text{ dB}, \pm 1.1 \text{ dB}$	
2	kHz	+1.2		$+$ 1.2 dB, \pm 1.6 dB	
4	kHz	+1.0		+ 1.0 dB, ± 1.6 dB	
8	kHz	-1.1		- 1.1 dB, + 2.1 dB \sim -3.1 dB	
16	kHz	-8.0		- 6.6 dB , $+3.5 \text{ dB} \sim -17.0 \text{ dB}$	

Uncertainty: $\pm 0.1 \text{ dB}$

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4. Frequency & Time weightings at 1 kHz

4.1 Frequency Weighting (Fast)

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UUT	Applied	UUT	Difference	IEC 61672		
Setting	Value (dB)	Reading (dB)	(dB)	Type 1 Spec.		
A	94.0	94.0 (Ref.)		± 0.4 dB		
С	94.0	94.0	0.0			
Z	94.0	94.0	0.0			

4.2 Time Weighting (A-weighted)

UUT	Applied	UUT	Difference	IEC 61672
Setting	Value (dB)	Reading (dB)	(dB)	Type 1 Spec.
Fast	94.0	94.0 (Ref.)		± 0.3 dB
Slow	94.0	94.0	0.0	
Time-averaging	94.0	94.0	0.0	

Uncertainty: ± 0.1 dB

Remarks: 1. UUT: Unit-Under-Test

- 2. The uncertainty claimed is for a confidence probability of not less than 95%.
- 3. Atmospheric Pressure: 1 028hPa.
- 4. Preamplifier model : NH-25 , S/N : 10553
- 5. Microphone model: UC-59, S/N: 07040
- 6. Power Supply Check: OK
- 7. The UUT was adjusted with the supplied sound calibrator at the reference sound pressure level before the calibration.

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