

Appendix C Calibration Certificates of Monitoring Equipment

Certificate of Calibration

Calibration Certification Information			
Cal. Date: February 13, 2018	Rootsmeter S/N: 438320	Ta: 293	°K
Operator: Jim Tisch		Pa: 763.3	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	1.3970	3.2	2.00
2	3	4	1	1.0000	6.3	4.00
3	5	6	1	0.8900	7.9	5.00
4	7	8	1	0.8440	8.7	5.50
5	9	10	1	0.7010	12.6	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)
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
QSTD	m=	2.02017	QA	m=	1.26500
	b=	-0.03691		b=	-0.02263
	r=	0.99988		r=	0.99988

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

TSP Sampler Calibration

SITE

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

CONDITIONS

Barometric Pressure (in Hg): 40.02 Corrected Pressure (mm Hg): 1017
Temperature (deg F): 81 Temperature (deg K): 300
Average Press. (in Hg): 40.02 Corrected Average (mm Hg): 1017
Average Temp. (deg F): 81 Average Temp. (deg K): 300

CALIBRATION ORIFICE

Make: Tisch Qstd Slope: 2.02017
Model: TE-5025A Qstd Intercept: -0.03691
Serial#: 1612 Date Certified: February 13, 2018

CALIBRATIONS

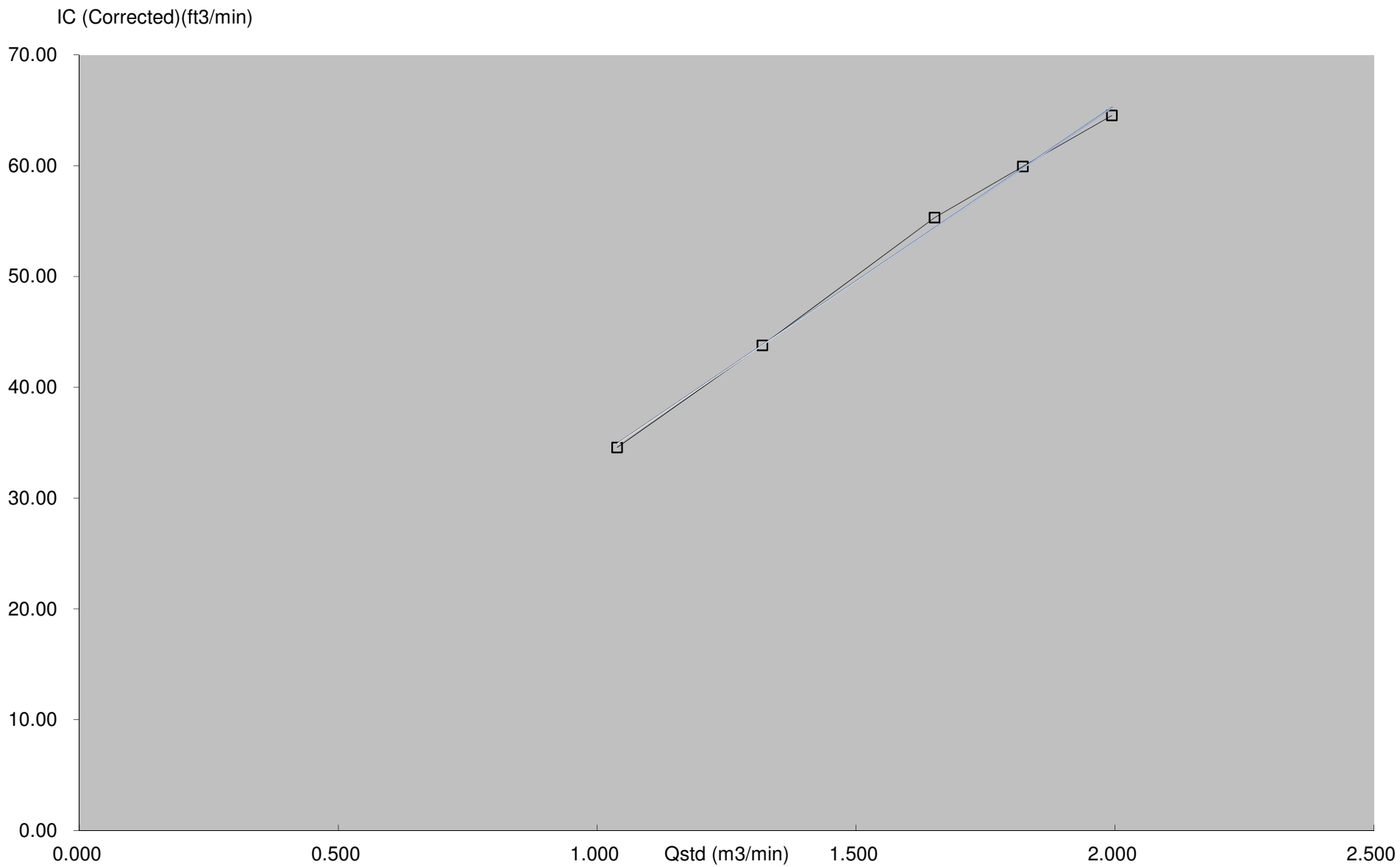
Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION
1	12.00	1.994	56.0	64.52	Slope = 31.7376 Intercept = 1.9507 Corr. coeff.= 0.9987 # of Observations: 5
2	10.00	1.822	52.0	59.92	
3	8.20	1.652	48.0	55.31	
4	5.20	1.319	38.0	43.78	
5	3.20	1.039	30.0	34.57	

Calculations

$Q_{std} = 1/m[\sqrt{H_2O(P_a/P_{std})}(T_{std}/T_a)] - b$
 $IC = I[\sqrt{P_a/P_{std}}(T_{std}/T_a)]$

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:
 $1/m((I)[\sqrt{298/T_{av}}(P_{av}/760)] - b)$

m = sampler slope
b = sampler intercept
I = chart response
Tav = daily average temperature
Pav = daily average pressure





Calibration Certificate

Certificate No. **803615**

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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. : Q81437

Date of receipt : 13-Apr-18

Item Tested

Description : Sound Level Calibrator

Manufacturer : Rion

I.D. : 217656

Model : NC-74

Serial No. : 34678506

Test Conditions

Date of Test : 20-Apr-18

Supply Voltage : --

Ambient Temperature : (23 ± 3)°C

Relative Humidity : (50 ± 25) %

Test Specifications

Calibration check.

Ref. Document/Procedure : F21, Z02.

Test Results

All results were within the IEC 60942 Class 1 specifications.

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

Main Test equipment used:

<u>Equipment No.</u>	<u>Description</u>	<u>Cert. No.</u>	<u>Traceable to</u>
S014	Spectrum Analyzer	707126	NIM-PRC & SCL-HKSAR
S240	Sound Level Calibrator	703741	NIM-PRC & SCL-HKSAR
S041	Universal Counter	802061	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 : 
Elva Chong

Approved by : 
Kin Wong

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

Date: 20-Apr-18



Calibration Certificate

Certificate No. 803615

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Results :

1. Generated Sound Pressure Level

UUT Nominal Value (dB)	Measured Value (dB)	IEC 60942 Class 1 Spec.
94.0	94.2	± 0.4 dB

Uncertainty : ± 0.2 dB

2. **Short-term Level Fluctuation** : 0.0 dB
IEC 60942 Class 1 Spec. : ± 0.1 dB
Uncertainty : ± 0.01 dB

3. Frequency

UUT Nominal Value (kHz)	Measured Value (kHz)	IEC 60942 Class 1 Spec.
1	0.999	± 1 %

Uncertainty : $\pm 3.6 \times 10^{-6}$

4. **Total Distortion** : < 1.1 %
IEC 60942 Class 1 Spec. : < 4 %
Uncertainty : ± 2.3 % of reading

Remark : 1. UUT : Unit-Under-Test
2. The uncertainty claimed is for a confidence probability of not less than 95%.
3. Atmospheric Pressure : 1 016 hPa.

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Calibration Certificate

Certificate No. **804605**

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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. : Q81807

Date of receipt : 9-May-18

Item Tested

Description : Sound Level Meter

Manufacturer : Rion

I.D. : --

Model : NL-52

Serial No. : 01143484

Test Conditions

Date of Test : 15-May-18

Supply Voltage : --

Ambient Temperature : (23 ± 3)°C

Relative Humidity : (50 ± 25) %

Test Specifications

Calibration check.

Ref. Document/Procedure: Z01, IEC 61672.

Test Results

All results were within the IEC 61672 Type1 or manufacturer's specification.

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

Main Test equipment used:

<u>Equipment No.</u>	<u>Description</u>	<u>Cert. No.</u>	<u>Traceable to</u>
S017	Multi-Function Generator	C170120	SCL-HKSAR
S240	Sound Level Calibrator	803357	NIM-PRC & 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 : 
Elva Chong

Approved by : 
Kin Wong



Calibration Certificate

Certificate No. 804605

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Results :

1. Self-generated noise: 16.0 dBA (Mfr's Spec ≤ 17 dBA)

2. Acoustical signal test

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

IEC 61672 Type 1 Spec. : ± 1.1 dB

Uncertainty : ± 0.1 dB

3 Electrical signal tests of frequency weightings (A weighting)

Frequency	Attenuation (dB)	IEC 61672 Type 1 Spec.
31.5 Hz	-39.6	- 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, ± 1.4 dB
1 kHz	0.0 (Ref)	0 dB, ± 1.1 dB
2 kHz	+1.0	+ 1.2 dB, ± 1.6 dB
4 kHz	+0.7	+ 1.0 dB, ± 1.6 dB
8 kHz	-1.2	- 1.1 dB, + 2.1 dB ~ -3.1 dB
16 kHz	-8.6	- 6.6 dB, + 3.5 dB ~ - 17.0 dB

Uncertainty : ± 0.1 dB



Calibration Certificate

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4. Frequency & Time weightings at 1 kHz

4.1 Frequency Weighting (Fast)

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

4.2 Time Weighting (A-weighted)

UUT Setting	Applied Value (dB)	UUT Reading (dB)	Difference (dB)	IEC 61672 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 : 1 009 hPa.

4. Preamplifier model : NH-25 , S/N : 21113

5. Firmware Version: 1.8

6. Power Supply Check: OK

7. The UUT was adjusted with the laboratory's sound calibrator at the reference sound pressure level before the calibration.

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