

**Annex 2 High Volume Air Sampler Calibration Worksheet**

Project Title: Expansion of Shek Wu Hui Sewage Treatment Works  
 Monitoring Location: Sewage Pumping Station at j/o San Po Street and Po Wan Road (CAM1a)  
 Date: 27-Apr-07  
 Time: 09:30

Sampler Model:	GBM2000H1
Calibrator Orifice no.:	517N
Slope (m):	2.02842
Intercept (b):	-0.01789
Correction coeff. (r)	0.99998
Serial No.:	1062

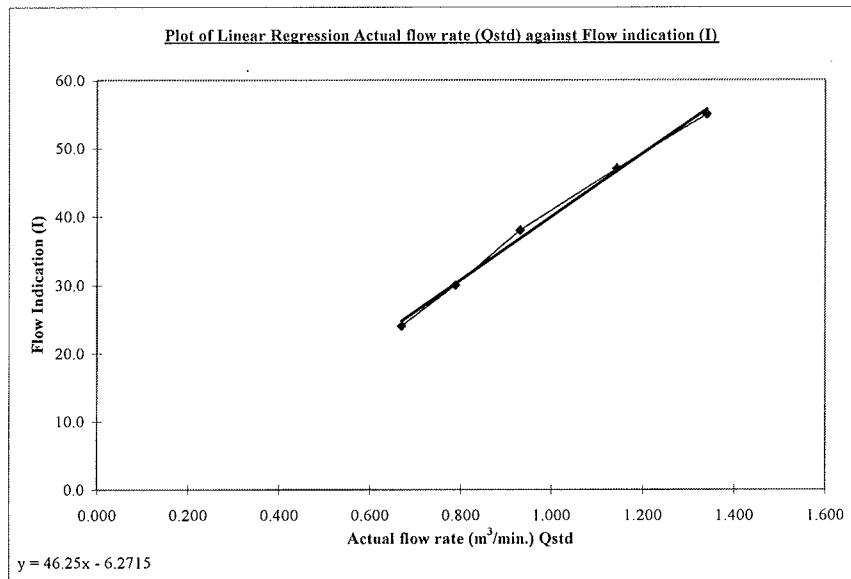
$$Flow(\text{corrected}) = \sqrt{H \times \frac{Pa}{Pstd} \times \frac{Tstd}{Ta}}$$

Standard pressure (mmHg) Pstd:	760.0
Standard temp. (K) Tstd:	297.18
Calibration pressure (mmHg) Pa:	751.8
Calibration temp. (K) Ta:	295.0


$$Qstd = \frac{1}{m} \times \left( \sqrt{H \times \frac{Pa}{Pstd} \times \frac{Tstd}{Ta}} - b \right)$$

Sample no.	Pressure Drop (H), inch	Flow (corrected), m <sup>3</sup> /min	Actual flow rate (Qstd), m <sup>3</sup> /min	Flow indication (I), arbitrary
1	7.3	2.701	1.340	55.0
2	5.3	2.301	1.143	47.0
3	3.5	1.870	0.931	38.0
4	2.5	1.581	0.788	30.0
5	1.8	1.341	0.670	24.0


Correlation Coefficient : 0.9978



Remark  
 Qstd Range 0.6 - 1.7  
 IHPa = 0.750062 mmHg

Calibrated by: **Hui Chun Ming**  
 (  )

Date: 27-Apr-07

Checked by: **Hui Yeung Tang**  
 (  )

Date: 27-Apr-07

**Annex 2 High Volume Air Sampler Calibration Worksheet**

Project Title: Expansion of Shek Wu Hui Sewage Treatment Works  
 Monitoring Location: Flood Balancing Pumping Station at Po Wan Road near Wai Loi Tsuen (CAM2a)  
 Date: 27-Apr-07  
 Time: 15:30

Sampler Model:	GBM2000H1
Calibrator Orifice no.:	517N
Slope (m):	2.02842
Intercept (b):	-0.01789
Correction coeff. (r):	0.99998
Serial No.:	1097

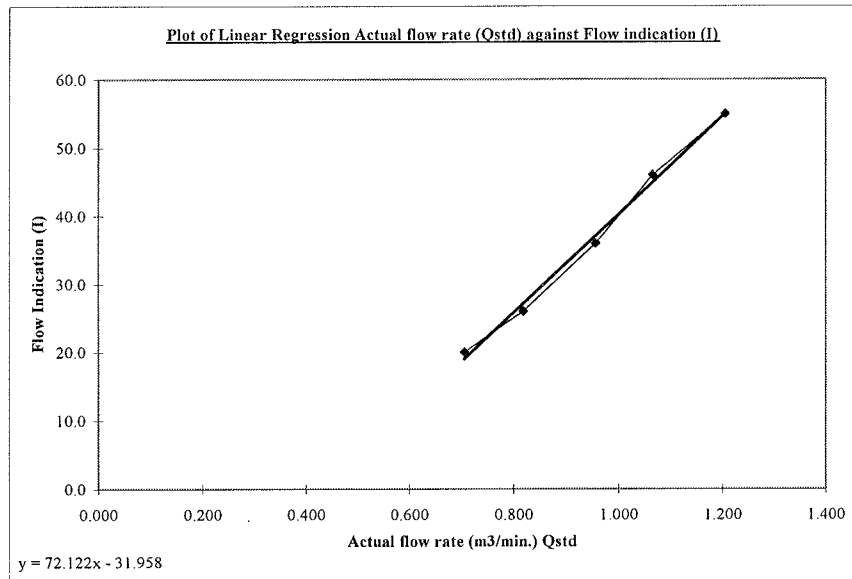
$$Flow(\text{corrected}) = \sqrt{H \times \frac{Pa}{Pstd} \times \frac{Tstd}{Ta}}$$

Standard pressure (mmHg) Pstd:	760.0
Standard temp. (K) Tstd:	297.18
Calibration pressure (mmHg) Pa:	751.8
Calibration temp. (K) Ta:	295.0


$$Qstd = \frac{1}{m} \times \left( \sqrt{H \times \frac{Pa}{Pstd} \times \frac{Tstd}{Ta}} - b \right)$$

Sample no.	Pressure Drop (H), inch	Flow (corrected), m <sup>3</sup> /min	Actual flow rate (Qstd), m <sup>3</sup> /min	Flow indication (I), arbitrary
1	5.9	2.428	1.206	55.0
2	4.6	2.144	1.066	46.0
3	3.7	1.923	0.957	36.0
4	2.7	1.643	0.819	26.0
5	2.0	1.414	0.706	20.0


Correlation Coefficient : 0.9972



Remark  
 Qstd Range 0.6 - 1.7  
 1HPa = 0.750062 mmHg

Calibrated by: **Hui Chun Ming**  
 (  )

Date: 27-Apr-07

Checked by: **Hui Yeung Tang**  
 (  )

Date: 30-Apr-07



TISCH ENVIRONMENTAL, INC.  
 145 SOUTH MIAMI AVE.  
 VILLAGE OF CLEVELAND, OH 45002  
 513.467.9000  
 877.263.7610 TOLL FREE  
 513.467.9009 FAX  
 WWW.TISCH-ENV.COM

AIR POLLUTION MONITORING EQUIPMENT

ORIFICE TRANSFER STANDARD CERTIFICATION WORKSHEET TE-5025A

Date - Apr 23, 2007 Roots-meter S/N 9833620 Ta (K) - 295  
 Operator Tisch Orifice I.D. - 517N Pa (mm) - 751.84

PLATE OR Run #	VOLUME START (m3)	VOLUME STOP (m3)	DIFF VOLUME (m3)	DIFF TIME (min)	METER DIFF Hg (mm)	ORIFICE DIFF H2O (in.)
1	NA	NA	1.00	1.4100	3.2	2.00
2	NA	NA	1.00	0.9950	6.3	4.00
3	NA	NA	1.00	0.8910	7.9	5.00
4	NA	NA	1.00	0.8490	8.7	5.50
5	NA	NA	1.00	0.7000	12.7	8.00

DATA TABULATION

Vstd	(x axis) Qstd	(y axis)	Va	(x axis) Qa	(y axis)
0.9951	0.7057	1.4137	0.9957	0.7062	0.8859
0.9910	0.9959	1.9993	0.9916	0.9966	1.2528
0.9887	1.1097	2.2353	0.9894	1.1104	1.4007
0.9877	1.1634	2.3444	0.9884	1.1642	1.4690
0.9824	1.4034	2.8275	0.9831	1.4044	1.7717
Qstd slope (m) = 2.02842			Qa slope (m) = 1.27016		
intercept (b) = -0.01789			intercept (b) = -0.01121		
coefficient (r) = 0.99998			coefficient (r) = 0.99998		
y axis = SQRT[H2O(Pa/760) (298/Ta)]			y axis = SQRT[H2O(Ta/Pa)]		

CALCULATIONS

$$Vstd = \text{Diff. Vol} [(Pa - \text{Diff. Hg}) / 760] (298 / Ta)$$

$$Qstd = Vstd / \text{Time}$$

$$Va = \text{Diff Vol} [(Pa - \text{Diff Hg}) / Pa]$$

$$Qa = Va / \text{Time}$$

For subsequent flow rate calculations:

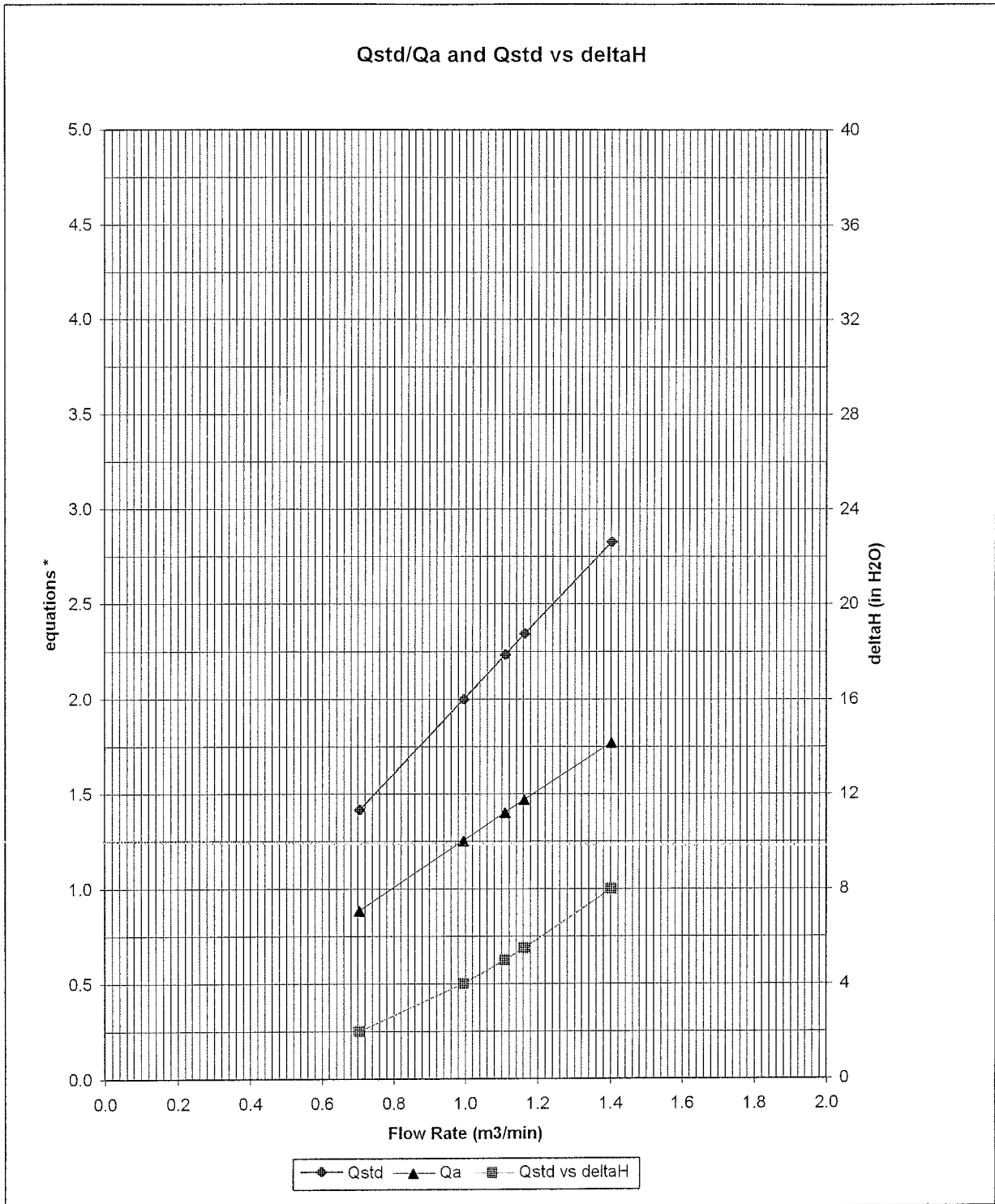
$$Qstd = 1/m \{ [\text{SQRT}(H2O(Pa/760) (298/Ta))] - b \}$$

$$Qa = 1/m \{ [\text{SQRT} H2O(Ta/Pa)] - b \}$$



TISCH ENVIROMENTAL, INC.  
 145 SOUTH MIAMI AVE.  
 VILLAGE OF CLEVES, OH 45002  
 513.467.9000  
 877.263.7610 TOLL FREE  
 513.467.9009 FAX  
 WWW.TISCH-ENV.COM

AIR POLLUTION MONITORING EQUIPMENT



\* y-axis equations:

Qstd series: 
$$\sqrt{\Delta H \left( \frac{P_a}{P_{std}} \right) \left( \frac{T_{std}}{T_a} \right)}$$

Qa series: 
$$\sqrt{(\Delta H (T_a / P_a))}$$

#517N



# Calibration Certificate

Certificate No. 70180

Page 1 of 2 Pages

Customer : Hyder Consulting Limited

Address : Room 3801., Hopewell Centre, 183 Queen's Road East, Wan Chai, Hong Kong

Order No. : Q70049

Date of receipt : 11-Jan-07

## Item Tested

Description : Sound Level Calibrator

Manufacturer : B&K

Model : Type 4231

Serial No. : 1770806

## Test Conditions

Date of Test : 12-Jan-07

Supply Voltage : --

Ambient Temperature : (23 ± 3)°C

Relative Humidity : (50 ± 25) %

## Test Specifications

Calibration check.

Calibration procedure : F21, Z02.

## Test Results

All results were within the IEC 942 Class 1 specification.

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

Test equipment used:

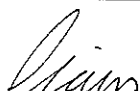
<u>Equipment No.</u>	<u>Description</u>	<u>Cert. No.</u>	<u>Due Date</u>	<u>Traceable to</u>
S014	Spectrum Analyzer	62914	7-Jul-07	NIM-PRC & SCL-HKSAR
S024	Sound Level Calibrator	62691	22-Apr-07	NIM-PRC & SCL-HKSAR
S041	Universal Counter	63839	22-Aug-07	SCL-HKSAR

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.

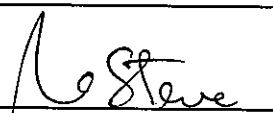
The test equipment used for calibration are traceable to International System of Units (SI).

The test results apply to the above Unit-Under-Test only

Calibrated by :

  
P.F. Wong

Approved by :

  
Steve Kwan

Date: 12-Jan-07

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 8846

The copyright of this certificate is owned by Hong Kong Calibration Ltd.. It may not be reproduced except in full.



# Calibration Certificate

Certificate No. 70180

Page 2 of 2 Pages

Results :

## 1. Level Accuracy

UUT Nominal Value (dB)	Measured Value (dB)	IEC 942 Class 1 Spec.
94	93.95	± 0.3 dB
114	113.82	

Uncertainty : ± 0.1 dB

## 2. Frequency

UUT Nominal Value	Measured Value	IEC 942 Class 1 Spec.
1 kHz	0.997 kHz	± 2 %

Uncertainty : ± 3.6 x 10<sup>-6</sup>

## 3. Level Stability : 0.0 dB

IEC 942 Class 1 Spec. : ± 0.1 dB

Uncertainty : ± 0.01 dB

## 4. Total Harmonic Distortion : < 1.0 %

IEC 942 Class 1 Spec. : < 3 %

Uncertainty : ± 2.3 % of reading

Remark : 1. UUT : Unit-Under-Test

2. The above measured values are the mean of 3 measurements.

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

4. Atmospheric Pressure : 1 016 hPa.

----- END -----



# Calibration Certificate

Certificate No. **70311**

Page **1** of **4** Pages

**Customer :** Hyder Consulting Limited

**Address :** Room 3801., Hopewell Centre, 183 Queen's Road East, Wan Chai, Hong Kong

**Order No. :** Q70049

**Date of receipt :** 17-Jan-07

## Item Tested

**Description :** Digital Sound Level Meter

**Manufacturer :** B&K

**Model :** Type 2236

**Serial No. :** 1785701

## Test Conditions

**Date of Test :** 19-Jan-07

**Supply Voltage :** --

**Ambient Temperature :** (23 ± 3)°C

**Relative Humidity :** (50 ± 25) %

## Test Specifications

Calibration check.

Calibration procedure : Z01.

## Test Results

All results were within the IEC 651 Type 1, IEC 804 Type 1 & IEC 1260 Class 1 specification.

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

Test equipment used:

<u>Equipment No.</u>	<u>Description</u>	<u>Cert. No.</u>	<u>Due Date</u>	<u>Traceable to</u>
S017	Function Generator	C051022	21-Mar-07	SCL-HKSAR
S024	Sound Level Calibrator	62691	22-Apr-07	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).

The test results apply to the above Unit-Under-Test only

**Calibrated by :** 

P.F. Wong

**Approved by :** 

Steve Kwan

**Date:** 19-Jan-07

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



# Calibration Certificate

Certificate No. **70311**

Page 2 of 4 Pages

Results :

## 1. SPL Accuracy

UUT Setting				Applied Value (dB)	UUT Reading (dB)
Range	Parameter	Frequency Wt.	Freq. Response		
20 - 100	SPL	dBA	F	94.07	94.0
			S		94.0
		dBC	F		94.0
		dBL	F		94.0
40 - 120	SPL	dBA	F	94.07	94.0
	SPL	dBA	F	113.95	113.9
			S		113.9
		dBC	F		113.9
		dBL	F		113.9

IEC 651 Type 1 Spec. :  $\pm 0.7$  dB

Uncertainty :  $\pm 0.1$  dB

## 2. Level Stability : 0.0 dB

IEC 651 Type 1 Spec. :  $\pm 0.3$  dB

Uncertainty :  $\pm 0.01$  dB

## 3. Linearity

### 3.1 Level Linearity

UUT Range	Applied Value (dB)	UUT Rdg (dB)	IEC 651 Type 1 Spec. (inside Primary)
140	114.0	114.0	$\pm 0.7$ dB
130	104.0	104.0	
120	94.0	94.0	
110	84.0	84.0	
100	74.0	74.0	
100	64.0	64.0	
100	54.0	54.0	





# Calibration Certificate

Certificate No. 70311

Page 3 of 4 Pages

## 3.2 Differential level linearity

UUT Range	Applied Value (dB)	UUT Rdg (dB)	IEC 651 Type 1 Spec.
120	84.0	84.0	± 0.4
	94.0	94.0	
	95.0	95.0	± 0.2
	104.0	104.0	± 0.3
	105.0	105.0	± 1.0

Uncertainty : ± 0.1 dB

## 4. Frequency Weighting

A weighting

Frequency	Attenuation (dB)	IEC 651 Type 1 Spec.
31.5 Hz	- 39.6	- 39.4 dB, ± 1.5 dB
63 Hz	- 26.3	- 26.2 dB, ± 1.5 dB
125 Hz	- 16.3	- 16.1 dB, ± 1 dB
250 Hz	- 8.7	- 8.6 dB, ± 1 dB
500 Hz	- 3.3	- 3.2 dB, ± 1 dB
1 kHz	0.0 (Ref)	0 dB, ± 1 dB
2 kHz	+ 1.2	+ 1.2 dB, ± 1 dB
4 kHz	+ 0.9	+ 1.0 dB, ± 1 dB
8 kHz	- 1.3	- 1.1 dB, + 1.5 dB ~ -3 dB
16 kHz	- 7.2	- 6.6 dB, + 3 dB ~ - ∞

Uncertainty : ± 0.1 dB



# Calibration Certificate

Certificate No. 70311

Page 4 of 4 Pages

## 5. Time Averaging

Applied Burst duty Factor	Applied Leq Value (dB)	UUT Reading (dB)	IEC 804 Type 1 Spec.
continuous	40.0	40.0	--
1/10	40.0	39.9	± 0.5 dB
1/10 <sup>2</sup>	40.0	39.8	
1/10 <sup>3</sup>	40.0	39.6	± 1.0 dB
1/10 <sup>4</sup>	40.0	39.1	

Uncertainty : ± 0.1 dB

Remark : 1. UUT : Unit-Under-Test

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

3. Atmospheric Pressure : 1 010 hPa

----- END -----