

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: 19-Jan-07
 Time: 13:30

Sampler Model:	GBM2000H1
Calibrator Orifice no.:	517N
Slope (m):	2.01069
Intercept (b):	-0.00482
Correction coeff. (r)	0.9999
Serial No.:	1062

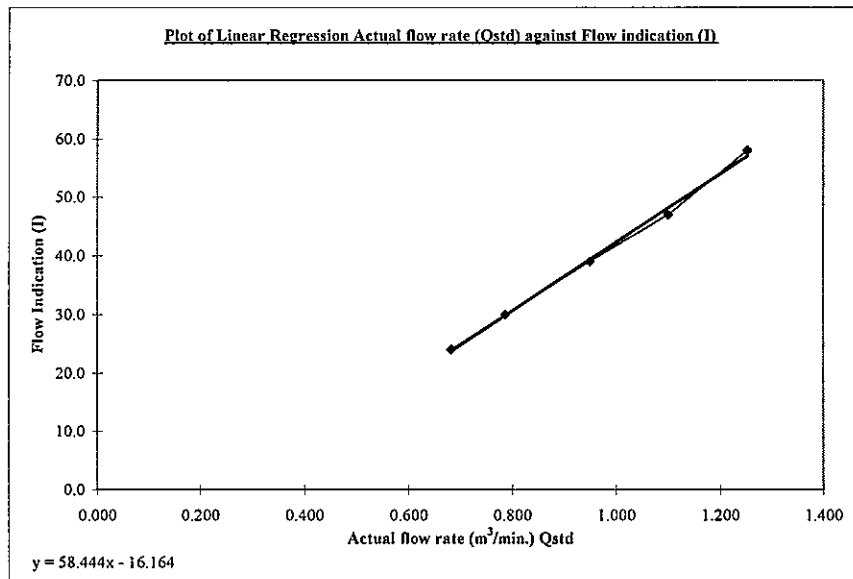
$$Flow(\text{corrected}) = \sqrt{H \times \frac{Pa}{Pstd} \times \frac{Tstd}{Ta}}$$

Standard pressure (mmHg) Pstd:	760.0
Standard temp. (K) Tstd:	297.18
Calibration pressure (mmHg) Pa:	765.9
Calibration temp. (K) Ta:	289.8

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

Sample no.	Pressure Drop (H), inch	Flow (corrected), m ³ /min	Actual flow rate (Qstd), m ³ /min	Flow indication (I), arbitrary
1	6.1	2.514	1.253	58.0
2	4.7	2.207	1.100	47.0
3	3.5	1.904	0.950	39.0
4	2.4	1.577	0.787	30.0
5	1.8	1.366	0.682	24.0

Correlation Coefficient : 0.9983



Remark
 Qstd Range 0.6 - 1.7
 1HPa = 0.750062 mmHg

Calibrated by: Hui Chun Ming (*HC*) Date: 19-Jan-07

Checked by: Hiu Yeung Tang (*HY*) Date: 19/1/07

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: 28-Feb-07
 Time: 09:30

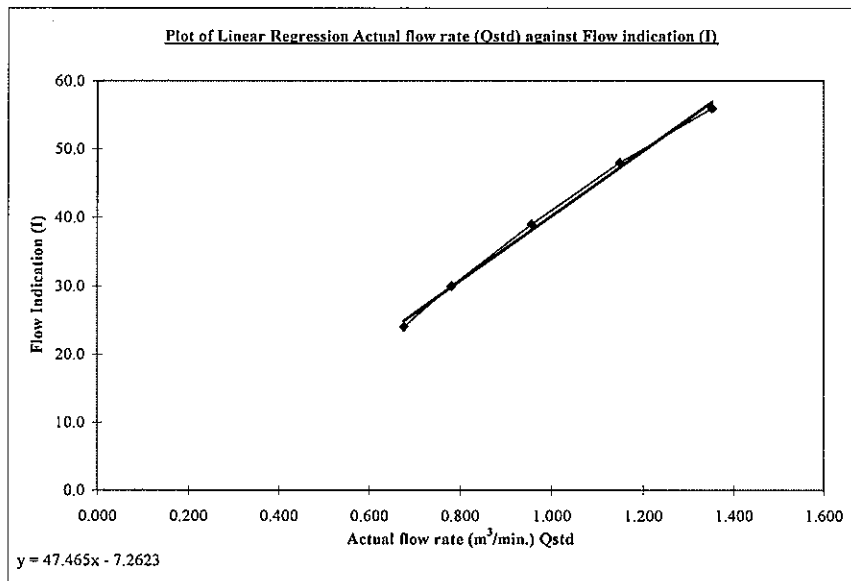
Sampler Model:	GBM2000H1
Calibrator Orifice no.:	517N
Slope (m):	2.01069
Intercept (b):	-0.00482
Correction coeff. (r)	0.9999
Serial No.:	1062
Standard pressure (mmHg) Pstd:	760.0
Standard temp. (K) Tstd:	297.18
Calibration pressure (mmHg) Pa:	763.8
Calibration temp. (K) Ta:	293.0

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

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

Sample no.	Pressure Drop (H), inch	Flow (corrected), m ³ /min	Actual flow rate (Qstd), m ³ /min	Flow indication (I), arbitrary
1	7.2	2.713	1.352	56.0
2	5.2	2.305	1.149	48.0
3	3.6	1.918	0.956	39.0
4	2.4	1.566	0.781	30.0
5	1.8	1.356	0.677	24.0

Correlation Coefficient : 0.9979



Remark
 Qstd Range 0.6 - 1.7
 1HPa = 0.750062 mmHg

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

Date: 28/2/07

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

Date: 5/3/07

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: 19-Jan-07
 Time: 14:00

Sampler Model:	GBM2000H1
Calibrator Orifice no.:	517N
Slope (m):	2.01069
Intercept (b):	-0.00482
Correction coeff. (r)	0.9999
Serial No.:	1097

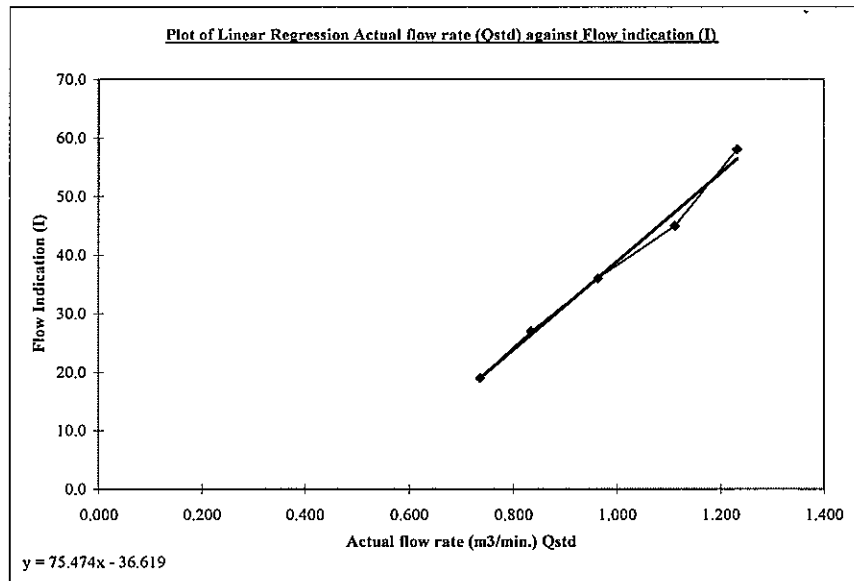
$$\text{Flow (corrected)} = \sqrt{H \times \frac{Pa}{Pstd} \times \frac{Tstd}{Ta}}$$

Standard pressure (mmHg) Pstd:	760.0
Standard temp. (K) Tstd:	297.18
Calibration pressure (mmHg) Pa:	765.9
Calibration temp. (K) Ta:	289.8

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

Sample no.	Pressure Drop (H), inch	Flow (corrected), m ³ /min	Actual flow rate (Qstd), m ³ /min	Flow indication (I), arbitrary
1	5.9	2.473	1.232	58.0
2	4.8	2.230	1.112	45.0
3	3.6	1.931	0.963	36.0
4	2.7	1.673	0.834	27.0
5	2.1	1.475	0.736	19.0

Correlation Coefficient : 0.9956



Remark
 Qstd Range 0.6 - 1.7
 1HPa = 0.750062 mmHg

Calibrated by: Hui Chun Ming
 (*HC*)

Date: 19-Jan-07

Checked by: Hiu Yeung Tang
 (*HY*)

Date: 19/1/07

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: 17-Mar-07
Time: 15:30

Sampler Model:	GBM2000H1
Calibrator Orifice no.:	517N
Slope (m):	2.01069
Intercept (b):	-0.00482
Correction coeff. (r)	0.9999
Serial No.:	1097

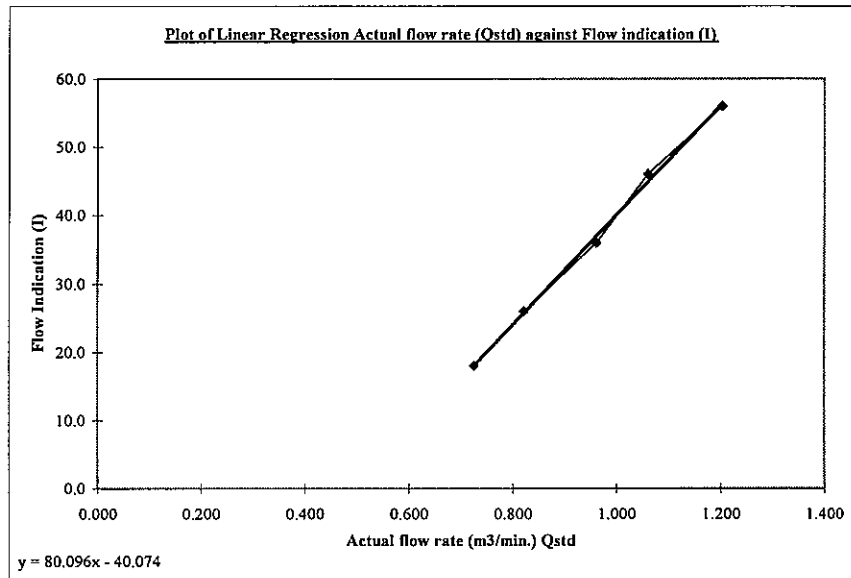
$$\text{Flow (corrected)} = \sqrt{H \times \frac{Pa}{Pstd} \times \frac{Tstd}{Ta}}$$

Standard pressure (mmHg) Pstd:	760.0
Standard temp. (K) Tstd:	297.18
Calibration pressure (mmHg) Pa:	762.1
Calibration temp. (K) Ta:	297.0


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

Sample no.	Pressure Drop (H), inch	Flow (corrected), m ³ /min	Actual flow rate (Qstd), m ³ /min	Flow indication (I), arbitrary
1	5.8	2.416	1.204	56.0
2	4.5	2.128	1.061	46.0
3	3.7	1.929	0.962	36.0
4	2.7	1.648	0.822	26.0
5	2.1	1.454	0.725	18.0


Correlation Coefficient : 0.9987



Remark
 Qstd Range 0.6 - 1.7
 1HPa = 0.750062 mmHg

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

Date: 17/3/07

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

Date: 19/3/07



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 26, 2006 Rootsmeter S/N 9833620 Ta (K) - 294
 Operator Tisch Orifice I.D. - 517N Pa (mm) - 750.57

PLATE OR Run #	VOLUME START (m3)	VOLUME STOP (m3)	DIFF VOLUME (m3)	DIFF TIME (min)	METER DIFF Hg (mm)	ORFICE DIFF H2O (in.)
1	NA	NA	1.00	1.4140	3.2	2.00
2	NA	NA	1.00	0.9910	6.3	4.00
3	NA	NA	1.00	0.8890	7.8	5.00
4	NA	NA	1.00	0.8480	8.7	5.50
5	NA	NA	1.00	0.6980	12.5	8.00

DATA TABULATION

Vstd	(x axis) Qstd	(y axis)	Va	(x axis) Qa	(y axis)
0.9967	0.7049	1.4149	0.9957	0.7042	0.8851
0.9926	1.0016	2.0010	0.9916	1.0006	1.2517
0.9905	1.1142	2.2372	0.9895	1.1131	1.3995
0.9894	1.1667	2.3464	0.9884	1.1656	1.4678
0.9843	1.4102	2.8299	0.9833	1.4087	1.7702
Qstd slope (m) = 2.01069			Qa slope (m) = 1.25906		
intercept (b) = -0.00482			intercept (b) = -0.00301		
coefficient (r) = 0.99990			coefficient (r) = 0.99990		
y axis = SQRT[H2O(Pa/760) (298/Ta)]			y axis = SQRT[H2O(Ta/Pa)]		

CALCULATIONS

Vstd = Diff. Vol [(Pa-Diff. Hg)/760] (298/Ta)
 Qstd = Vstd/Time

Va = Diff Vol [(Pa-Diff Hg)/Pa]
 Qa = Va/Time

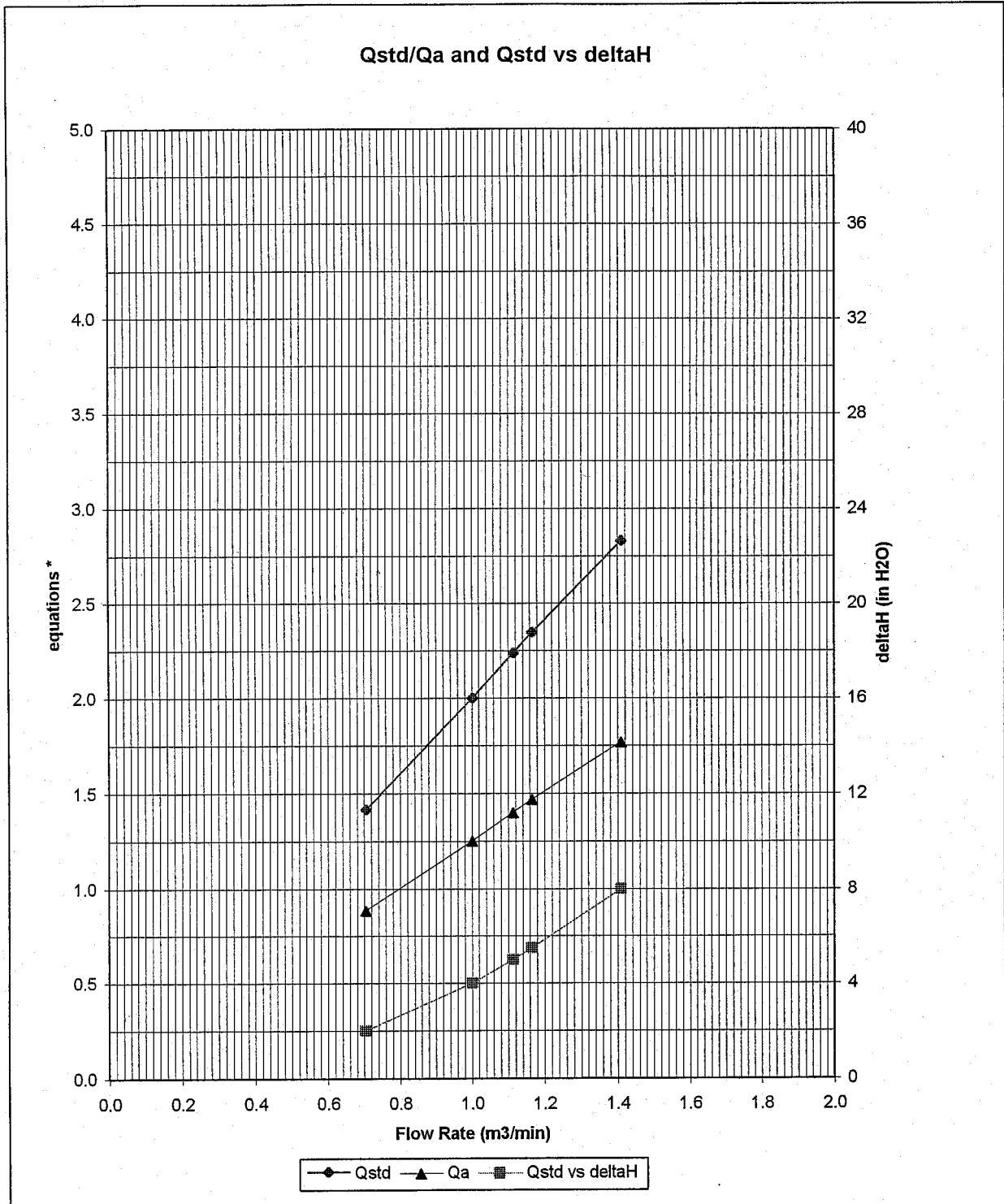
For subsequent flow rate calculations:

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



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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.

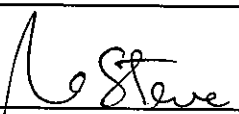
The test equipment used for calibration are traceable to International System of Units (SI).

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

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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 10⁻⁶

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 -----



輝創工程有限公司

Sun Creation Engineering Limited Calibration and Testing Laboratory

Certificate No. : C062778

Certificate of Calibration

This is to certify that the equipment

Description : Precision Integrating Sound Level Meter

Manufacturer : Bruel & Kjaer

Model No. : 2236

Serial No. : 1774423


*has been calibrated for the specific items and ranges.
The results are shown in the Calibration Report No. C062778.*

The equipment is supplied by

Co. Name : Hyder Consulting Limited

*Address : 47/F., Hopewell Centre, 183 Queen's Road East,
Wanchai, Hong Kong*

Date of Issue : 22 June 2006

Certified by : 
C F Leung

The test equipment used for testing are traceable to the National Standards as specified in this report.
This report shall not be reproduced except in full and with prior written approval from this laboratory.

Calibration and Testing Laboratory of Sun Creation Engineering Limited

c/o 4/F, Tsing Shan Wan Exchange Building, 1 Hing On Lane, Tuen Mun, New Territories, Hong Kong

Tel: 2927 2606

Fax: 2744 8986

E-mail: callab@suncreation.com

Website: www.suncreation.com

Calibration Report

ITEM TESTED

DESCRIPTION : Precision Integrating Sound Level Meter
MANUFACTURER : Bruel & Kjaer
MODEL NO. : 2236
SERIAL NO. : 1774423

TEST CONDITIONS

AMBIENT TEMPERATURE : (23 ± 2)°C
RELATIVE HUMIDITY : (55 ± 20)%
LINE VOLTAGE : ---

TEST SPECIFICATIONS

Calibration check

DATE OF TEST : 22 June 2006


JOB NO. : IC06-1471

TEST RESULTS

The results apply to the particular unit-under-test only.
All results are within 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 Bruel & Kjaer Calibration Laboratory, Denmark

Tested by :


S K Ho

Date : 22 June 2006

The test equipment used for testing are traceable to the National Standards as specified in this report.
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Calibration Report

1. 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.
2. Self calibration using laboratory acoustic calibrator was performed before test.
3. 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>
CL281	Multifunction Acoustic Calibrator	I4428

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 651 Type 1 Spec. (dB)
Range (dB)	Parameter	Freq. Weight	Response	Level (dB)	Freq. (kHz)	Before self-calibration	After self-calibration	
20 - 100	SPL	A	F	94.00	1	95.0	94.1	± 0.7

6.1.2 Linearity

UUT Setting				Applied Value		UUT Reading (dB)
Range (dB)	Parameter	Freq. Weight	Response	Level (dB)	Freq. (kHz)	
40 - 120	SPL	A	F	94.00	1	94.1 (Ref.)
				104.00		104.1
				114.00		114.1

IEC 651 Type 1 Spec. : ±0.4 dB per 10 dB step and ±0.7 dB for overall different.

6.2 Time Weighting

UUT Setting				Applied Value		UUT Reading (dB)	IEC 651 Type 1 Spec. (dB)
Range (dB)	Parameter	Freq. Weight	Response	Level (dB)	Freq. (kHz)		
20 - 100	SPL	A	F	94.00	1	94.1	Ref.
			S			94.2	± 0.1
			I			94.2	± 0.1

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Calibration Report

6.3 Frequency Weighting

6.3.1 A-Weighting

UUT Setting				Applied Value		UUT Reading (dB)	IEC 651 Type I Spec. (dB)
Range (dB)	Parameter	Freq. Weight	Response	Level (dB)	Freq.		
20 - 100	SPL	A	F	94.00	31.5 Hz	54.9	-39.4 ± 1.5
					63 Hz	68.0	-26.2 ± 1.5
					125 Hz	77.9	-16.1 ± 1.0
					500 Hz	90.7	-3.2 ± 1.0
					1 kHz	94.1	Ref.
					2 kHz	95.2	+1.2 ± 1.0
					4 kHz	95.1	+1.0 ± 1.0
					8 kHz	92.9	-1.1 (+1.5 ; -3.0)
					12.5 kHz	88.9	-4.3 (+3.0 ; -6.0)

6.3.2 C-Weighting

UUT Setting				Applied Value		UUT Reading (dB)	IEC 651 Type I Spec. (dB)
Range (dB)	Parameter	Freq. Weight	Response	Level (dB)	Freq.		
20 - 100	SPL	C	F	94.00	31.5 Hz	91.4	-3.0 ± 1.5
					63 Hz	93.4	-0.8 ± 1.5
					125 Hz	94.0	-0.2 ± 1.0
					500 Hz	94.0	0.0 ± 1.0
					1 kHz	94.1	Ref.
					2 kHz	93.8	-0.2 ± 1.0
					4 kHz	93.3	-0.8 ± 1.0
					8 kHz	91.1	-3.0 (+1.5 ; -3.0)
					12.5 kHz	87.0	-6.2 (+3.0 ; -6.0)

Remarks : - Mfr's Spec. : IEC 651 Type I

- Uncertainties of Applied Value : 94 dB : 31.5 Hz - 125 Hz : ± 0.40 dB
- 500 Hz : ± 0.30 dB
- 1 kHz : ± 0.20 dB
- 2 kHz : ± 0.40 dB
- 4 kHz : ± 0.50 dB
- 8 kHz : ± 0.70 dB
- 12.5 kHz : ± 1.20 dB
- 104 dB : 1 kHz : ± 0.30 dB
- 114 dB : 1 kHz : ± 0.30 dB

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

Note :

The values given in this Calibration Report 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.

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