High Volume Air Sampler Calibration Worksheet

Project Title: Design and Construction of Tsuen Wan Drainage Tunnel
Monitoring Location: Ho Fung College
Calibration Date: 08-Apr-09
Calibration Due Date 08-Jun-09
Time: 17:15

Sampler Model:	BM2000HX
Serial No.:	4994
Calibrator Orifice no.:	517N
Slope (m):	2.02953
Intercept (b):	-0.01939
Correction coeff. (r)	0.9999

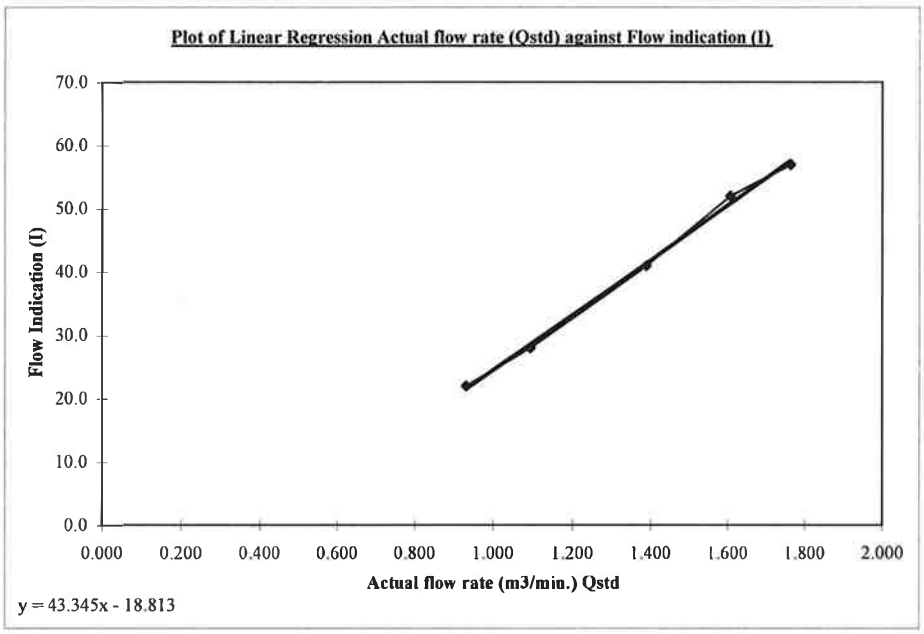
Standard pressure (mmHg) Pstd:	749.3
Standard temp. (K) Tstd:	296.0
Calibration pressure (mmHg) Pa:	762.4
Calibration temp. (K) Ta:	294.3

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

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

Sample no.	Pressure Drop (H), inch	Flow (corrcted), m^3/min	Actual flow rate (Qstd), m^3/min	Flow indication (I), arbitrary
1	12.3	3.560	1.764	57.0
2	10.2	3.242	1.607	52.0
3	7.6	2.798	1.388	41.0
4	4.7	2.201	1.094	28.0
5	3.4	1.872	0.932	22.0

Correlation Coefficient : 0.9987



Remark
1HPa = 0.750062 mmHg

Calibrated by: **Mak Kei Ho** **Date:** 16-4-09
( )

Checked by: **Tang Hiu Yeung** **Date:** 16-4-09
( )

High Volume Air Sampler Calibration Worksheet

Project Title: Design and Construction of Tsuen Wan Drainage Tunnel
Monitoring Location: Heng Hoi Chi Hong Ship Temple
Calibration Date: 08-Apr-09
Calibration Due Date 08-Jun-09
Time: 16:40

Sampler Model:	BM2000HX
Serial No.:	5875
Calibrator Orifice no.:	517N
Slope (m):	2.02953
Intercept (b):	-0.01939
Correction coeff. (r)	0.9999

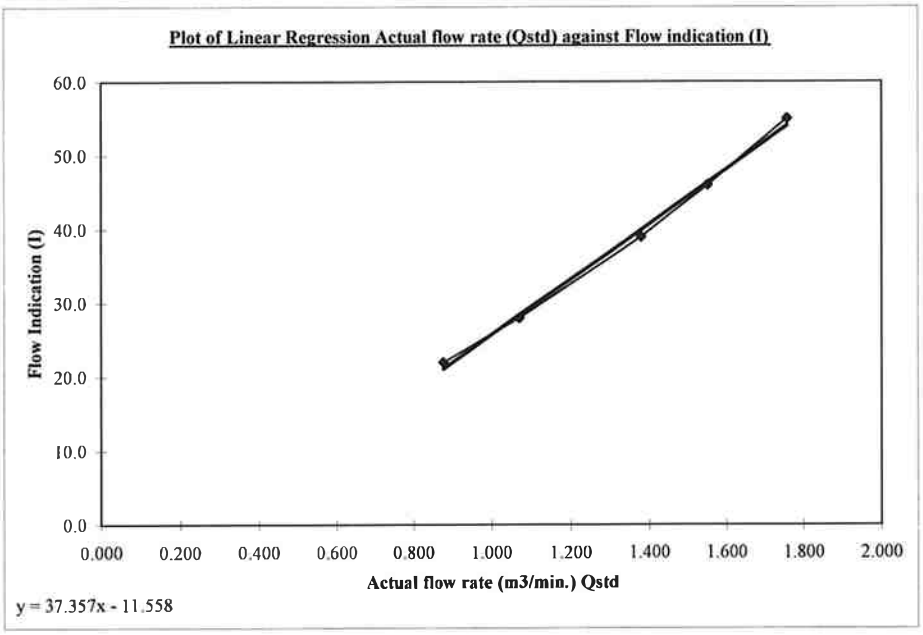
Standard pressure (mmHg) Pstd:	749.3
Standard temp. (K) Tstd:	296.0
Calibration pressure (mmHg) Pa:	762.4
Calibration temp. (K) Ta:	294.3

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

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

Sample no.	Pressure Drop (H), inch	Flow (corrcted), m^3/min	Actual flow rate (Qstd), m^3/min	Flow indication (I), arbitrary
1	12.2	3.545	1.756	55.0
2	9.5	3.129	1.551	46.0
3	7.5	2.780	1.379	39.0
4	4.5	2.153	1.070	28.0
5	3.0	1.758	0.876	22.0

Correlation Coefficient : 0.9980



Remark
1HPa = 0.750062 mmHg

Calibrated by: **Mak Kei Ho** **Date:** 16-4-09
(Ho)

Checked by: **Tang Hiu Yeung** **Date:** 16.4.09
( )

High Volume Air Sampler Calibration Worksheet

Project Title: Design and Construction of Tsuen Wan Drainage Tunnel
Monitoring Location: Greenview Terrance
Calibration Date: 08-Apr-09
Calibration Due Date 08-Jun-09
Time: 12:20

Sampler Model:	TE5005X
Serial No.:	0646
Calibrator Orifice no.:	517N
Slope (m):	2.02953
Intercept (b):	-0.01939
Correction coeff. (r)	0.9999

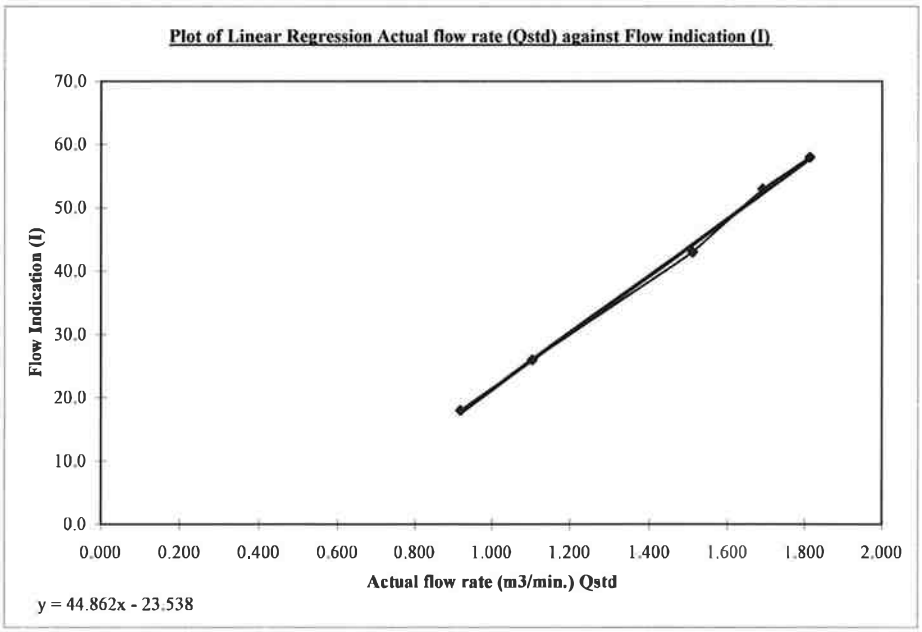
$$Flow(corrected) = \sqrt{H \times \frac{Pa}{Pstd} \times \frac{Tstd}{Ta}}$$

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

Standard pressure (mmHg) Pstd:	749.3
Standard temp. (K) Tstd:	296.0
Calibration pressure (mmHg) Pa:	762.4
Calibration temp. (K) Ta:	294.3

Sample no.	Pressure Drop (H), inch	Flow (corrcted), m^3/min	Actual flow rate (Qstd), m^3/min	Flow indication (I), arbitrary
1	13.0	3.660	1.813	58.0
2	11.3	3.412	1.691	53.0
3	9.0	3.045	1.510	43.0
4	4.8	2.224	1.105	26.0
5	3.3	1.844	0.918	18.0

Correlation Coefficient : 0.9991



Remark
1HPa = 0.750062 mmHg

Calibrated by: **Mak Kei Ho** **Date:** 16-4-09
(Ho)

Checked by: **Tang Hiu Yeung** **Date:** 16.4.09
( )

High Volume Air Sampler Calibration Worksheet

Project Title: Design and Construction of Tsuen Wan Drainage Tunnel
Monitoring Location: Long Beach Gardan
Calibration Date: 08-Apr-09
Calibration Due Date 08-Jun-09
Time: 11:55

Sampler Model:	TE5005X
Serial No.:	0390
Calibrator Orifice no.:	517N
Slope (m):	2.02953
Intercept (b):	-0.01939
Correction coeff. (r)	0.9999

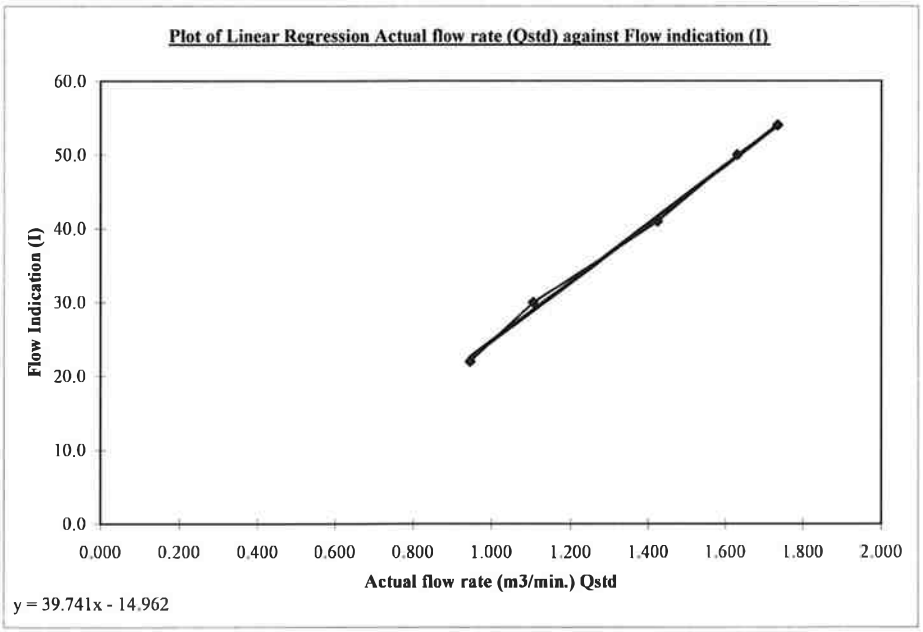
$$Flow(corrected) = \sqrt{H \times \frac{Pa}{Pstd} \times \frac{Tstd}{Ta}}$$

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

Standard pressure (mmHg) Pstd:	749.3
Standard temp. (K) Tstd:	296.0
Calibration pressure (mmHg) Pa:	762.4
Calibration temp. (K) Ta:	294.3

Sample no.	Pressure Drop (H), inch	Flow (corrcted), m^3/min	Actual flow rate (Qstd), m^3/min	Flow indication (I), arbitrary
1	11.9	3.501	1.735	54.0
2	10.5	3.289	1.630	50.0
3	8.0	2.871	1.424	41.0
4	4.8	2.224	1.105	30.0
5	3.5	1.899	0.945	22.0

Correlation Coefficient : 0.9987



Remark
1HPa = 0.750062 mmHg

Calibrated by: **Mak Kei Ho** **Date:** 16-4-09
(Ho)

Checked by: **Tang Hiu Yeung** **Date:** 16-4-09
( )

Hong Kong Calibration Ltd.
香 港 校 正 有限公司

Calibration Certificate

Certificate No. **83174**

Customer : Hyder Consulting Limited

Address : 47/F., Hopewell Centre, 183 Queens Road East, Wanchai, Hong Kong

Order No. : Q81258 **Date of receipt :** 9-Jul-08

Item Tested

Description : Sound Level Meter

Manufacturer : B&K

Model : 2238 **Serial No. :** 2448529

Test Conditions

Date of Test : 9-Jul-08 **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).

Main Test equipment used:

Equipment No.	Description	Cert. No.	Due Date	Traceable to
S017	Multi-Function Generator	C081456	18-Mar-09	SCL-HKSAR
S024	Sound Level Calibrator	71791	16-Jul-08	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 : Alan Chu

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: 10-Jul-08

Calibration Certificate

Results :

1. SPL Accuracy

UUT Setting				Applied Value (dB)	UUT Reading (dB)
Range	Freq. Wgt.	Bandwith	Center Freq.		
20 ~ 100	A	BB/F	--	94.03	93.9
	A	BB/S	--		93.9
	C	BB/F	--		93.9
40 ~ 120	A	BB/F	--	94.03	94.0
	A	BB/F	--	113.97	113.8
40 ~ 120	--	1/3 - Oct./F	1 kHz	94.03	94.0
				113.97	113.8
40 ~ 120	--	1/1 - Oct./F	1 kHz	94.03	94.0
				113.97	113.8

IEC 651 Type 1 Spec. : ± 0.7 dB
Uncertainty : ± 0.1 dB

2. Level Stability : 0.0 dB

IEC 651 Type 1 Spec. : ± 0.3 dB
Uncertainty : ± 0.01 dB

3. Linearity

3.1 Level Linearity

UUT Range (dB)	Applied Value (dB)	UUT Reading (dB)	Variation (dB)	IEC 651 Type 1 Spec. (Primary Indicator Range)
130	114.0	114.2	0.2	± 0.7 dB
130	104.0	104.2	0.2	
120	94.0	94.0 (Ref.)	- -	
110	84.0	83.8	0.2	
100	74.0	73.9	0.1	
90	64.0	63.9	0.1	
80	54.0	54.0	0.0	

Uncertainty : ± 0.1 dB

Calibration Certificate

3.2 Differential level linearity

UUT Range (dB)	Applied Value (dB)	UUT Reading (dB)	Variation (dB)	IEC 651 Type 1 Spec.
120	84.0	83.8	0.2	± 0.4 dB
	94.0	94.0 (Ref.)	- -	
	95.0	95.0	0.0	± 0.2 dB
	104.0	104.2	0.2	± 0.3 dB
	105.0	105.2	0.2	± 1.0 dB

Uncertainty : ± 0.1 dB

4. Frequency Weighting

A weighting

Frequency	Attenuation (dB)	IEC 651 Type 1 Spec.
31.5 Hz	- 39.5	- 39.4 dB, ± 1.5 dB
63 Hz	- 26.4	- 26.2 dB, ± 1.5 dB
125 Hz	- 16.5	- 16.1 dB, ± 1 dB
250 Hz	- 9.0	- 8.6 dB, ± 1 dB
500 Hz	- 3.5	- 3.2 dB, ± 1 dB
1 kHz	0.0 (Ref)	0 dB, ± 1 dB
2 kHz	+ 1.4	+ 1.2 dB, ± 1 dB
4 kHz	+ 1.2	+ 1.0 dB, ± 1 dB
8 kHz	- 0.8	- 1.1 dB, + 1.5 dB ~ -3 dB
16 kHz	- 6.3	- 6.6 dB, + 3 dB ~ - ∞

Uncertainty : ± 0.1 dB

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	40.0	± 0.5 dB
$1/10^2$	40.0	40.0	
$1/10^3$	40.0	40.0	± 1.0 dB
$1/10^4$	40.0	39.5	

Uncertainty : ± 0.1 dB

Calibration Certificate

6. Filter Characteristics

6.1 1/1 – Octave Filter

Frequency	Attenuation (dB)	IEC 1260 Class 1 Spec. (dB)
125 Hz	- 64.2	< - 61
250 Hz	- 45.0	< - 42
500 Hz	- 21.1	< - 17.5
707 Hz	- 3.8	- 2 ~ - 5
1 kHz (Ref)	--	--
1.414 kHz	- 3.7	- 2 ~ - 5
2 kHz	- 20.8	< - 17.5
4 kHz	- 44.6	< - 42
8 kHz	- 63.8	< - 61

Uncertainty : ± 0.25 dB

6.2 1/3 – Octave Filter

Frequency	Attenuation (dB)	IEC 1260 Class 1 Spec.(dB)
326 Hz	- 64.7	< - 61
530 Hz	- 47.3	< - 42
772 Hz	- 22.5	< - 17.5
891 Hz	- 3.6	+ 0.3 ~ - 5.0
1 kHz (Ref)	--	--
1.122 kHz	- 3.5	+ 0.3 ~ - 5.0
1.296 kHz	- 22.4	< - 17.5
1.887 kHz	- 46.9	< - 42
3.070 kHz	- 65.2	< - 61

Uncertainty : ± 0.25 dB

Remarks : 1. UUT : Unit-Under-Test
2. The uncertainty claimed is for a confidence probability of not less than 95%.
3. Atmospheric pressure : 1 000 hPa.

---------- END ----------

Hong Kong Calibration Ltd.
香 港 校 正 有限公司

Calibration Certificate

Certificate No. **83175** Page 1 of 4 Pages

Customer : Hyder Consulting Limited

Address : 47/F., Hopewell Centre, 183 Queens Road East, Wanchai, Hong Kong

Order No. : Q81258 **Date of receipt :** 9-Jul-08

Item Tested

Description : Digital Sound Level Meter

Manufacturer : B&K

Model : Type 2236 **Serial No. :** 1774423

Test Conditions

Date of Test : 9-Jul-08 **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).

Main Test equipment used:

Equipment No.	Description	Cert. No.	Due Date	Traceable to
S017	Multi-Function Generator	C081456	18-Mar-09	SCL-HKSAR
S024	Sound Level Calibrator	71791	16-Jul-08	NIM-PRC & SCL-HKSAR
S031	6½ dgt. Multimeter	76189	28-Dec-08	NIM-PRC

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 : Alan Chu

Date: 10-Jul-08

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

Results :

1. SPL Accuracy

UUT Setting				Applied Value (dB)	UUT Reading (dB)
Range	Parameter	Frequency Wt.	Freq. Response		
20 - 100	SPL	dBA	F	94.03	94.0
			S		94.0
		dBC	F		94.1
		dBL	F		94.1
		1 kHz	F		94.0
40 - 120	SPL	dBA	F	94.03	94.0
		1 kHz	F		94.0
	SPL	dBA	F	113.97	114.0
			S		114.0
		dBC	F		114.0
		dBL	F		114.0
		1 kHz	F		114.0

IEC 651 Type 1 Spec. : ± 0.7 dB
Uncertainty : ± 0.1 dB

2. Level Stability : 0.0 dB

IEC 651 Type 1 Spec. : ± 0.3 dB
Uncertainty : ± 0.01 dB

3. Linearity

3.1 Level Linearity

UUT Range (dB)	Applied Value (dB)	UUT Reading (dB)	Variation (dB)	IEC 651 Type 1 Spec. (Primary Indicator Range)
130	114.0	114.1	0.1	± 0.7 dB
130	104.0	104.2	0.2	
120	94.0	94.0 (Ref.)	- -	
110	84.0	83.9	0.1	
100	74.0	73.8	0.2	
100	64.0	63.8	0.2	
100	54.0	53.9	0.1	

Uncertainty : ± 0.1 dB

Calibration Certificate

6. Filter Response

Filter Setting	Attenuation (dB)	IEC 1260 Class 1 Spec.
125 Hz	- 64.0	< - 61
250 Hz	- 44.8	< - 42
500 Hz	- 20.8	< - 17.5
707 Hz	- 3.5	- 2 ~ - 5
1 kHz (Ref.)	0.0 (Ref.)	--
1.414 kHz	- 4.0	- 2 ~ - 5
2 kHz	- 21.2	< - 17.5
4 kHz	- 45.0	< - 42
8 kHz	- 64.3	< - 61

Uncertainty : ± 0.2 dB

Remark : 1. UUT : Unit-Under-Test
2. The uncertainty claimed is for a confidence probability of not less than 95%.
3. Atmospheric Pressure : 1 000 hPa

---------- END ----------

Calibration Certificate

3.2 Differential level linearity

UUT Range (dB)	Applied Value (dB)	UUT Reading (dB)	Variation (dB)	IEC 651 Type 1 Spec.
120	84.0	83.8	0.2	± 0.4 dB
	94.0	94.0 (Ref.)	- -	
	95.0	95.1	0.1	± 0.2 dB
	104.0	104.2	0.2	± 0.3 dB
	105.0	105.0	0.0	± 1.0 dB

Uncertainty : ± 0.1 dB

4. Frequency Weighting

A weighting

Frequency	Attenuation (dB)	IEC 651 Type 1 Spec.
31.5 Hz	- 39.9	- 39.4 dB, ± 1.5 dB
63 Hz	- 26.6	- 26.2 dB, ± 1.5 dB
125 Hz	- 16.5	- 16.1 dB, ± 1 dB
250 Hz	- 8.9	- 8.6 dB, ± 1 dB
500 Hz	- 3.4	- 3.2 dB, ± 1 dB
1 kHz	0.0 (Ref)	0 dB, ± 1 dB
2 kHz	+ 1.3	+ 1.2 dB, ± 1 dB
4 kHz	+ 1.1	+ 1.0 dB, ± 1 dB
8 kHz	- 1.1	- 1.1 dB, + 1.5 dB ~ -3 dB
16 kHz	- 7.2	- 6.6 dB, + 3 dB ~ - ∞

Uncertainty : ± 0.1 dB

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	40.0	± 0.5 dB
$1/10^2$	40.0	39.9	
$1/10^3$	40.0	39.8	± 1.0 dB
$1/10^4$	40.0	39.2	

Uncertainty : ± 0.1 dB

輝創工程有限公司
Sun Creation Engineering Limited Calibration and Testing Laboratory

Certificate No. : C090563

Certificate of Calibration

This is to certify that the equipment

Description : Acoustical Calibrator

Manufacturer : Bruel & Kjaer

Model No. : 4231

Serial No. : 1770806

has been calibrated for the specific items and ranges.
The results are shown in the Calibration Report No. C090563.

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 : 6 February 2009

Certified by : C F Leung

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

1412 Honour Ind. Centre
6 Sun Yip St. Chai Wan
Hong Kong

CERTIFICATE OF CALIBRATION

IN - HOUSE

Date Of Issue :

Serial No : IC 42b / /EL

Item Being Calibrated : ***Turbidity Standards (Gelex)***

Date Of Calibration : 8/4/09

Item Stock No : Std1,2,3,4

Operator : K.K

Environment Temp. °C 22

Procedure No Used : ***IC 42 (Revision No. 0)***

Primary Standards use(20, 100 and 800 NTU Formazin standards prepared fr 03681

Ref. Equip.used/ Stock No : ***Serial No. 215619***

Gelex Standards	Turbidity of standard solution used (NTU)	Measured Value (NTU)	R^2	Requirement R^2
0 - 10 NTU	1	1.05	***1***	> 0.996
	5	5.23		
	10	10.47		
10 - 100 NTU	20	20.1	***0.9967***	> 0.996
	50	52.8		
	80	79.9		
100 - 1000 NTU	100	99.7	***0.993***	> 0.996
	400	452		
	800	807		

Comments : *The equipment and Gelex Standards complies / ~~does not comply~~ with the Manufacturer's recommendation.*

Input data checked by :

Certified by:

Operations Manager

Lam

1412 Honour Ind. Centre
6 Sun Yip St. Chai Wan
Hong Kong

CERTIFICATE OF CALIBRATION

IN - HOUSE

Date Of Issue : Serial No : IC 42a / / EL

21977/1

Item Being Calibrated : ***Turbidity Standards (Gelex)*** Date Of Calibration : 8/4/09

Item Stock No : Std1,2,3,4 Operator : K.K

Environment Temp. °C 22 Procedure No Used : ***IC 42 (Revision No. 0)***

Primary Standards usec 20, 100 and 800 NTU Formazin standards prepared fr 03681

Ref. Equip.used/ Stock No : *Serial No. 215619*

* *

Gelex Standards	Last assigned value Date: (NTU)	New measured value (NTU)	Agreement %	Requirement %
0 - 10 NTU	0	0	***0***	± 5
10 - 100 NTU	16.86	16.51	***-2.08***	± 5
100 - 1000 NTU	100	95.7	***-4.30***	± 5
100 - 1000 NTU	861	868	***0.81***	± 5

Comments : *The equipment and Gelex Standards complies / ~~does not comply~~ with the Manufacturer's recommendation.*

Input data checked by : ____________

Certified by: ____________
Operations Manager

CERTIFICATE OF ANALYSIS

Batch: HK0906207
Date of Issue: 06/04/2009
Client: HYDER CONSULTING LTD
Client Reference:

Calibration of DO System

Item : Multi-parameter Instrument / Mehrparameter-MeBgerat

Model No. : WTW pH / Oxi 340i

Serial No. : 08101283

Equipment No.: --

Calibration Method : This meter was calibrated in accordance with standard method APHA (18th Ed.) 4500-0C & G

Date of Calibration : 06 April, 2009

Testing Results :

Expected Reading	Recording Reading
4.70 mg/L	4.87 mg/L
6.64 mg/L	6.70 mg/L
8.52 mg/L	8.68 mg/L
Allowing Deviation	±0.2 mg/L

Ms Wong Wai Man, Alice
Laboratory Manager - Hong Kong

CERTIFICATE OF ANALYSIS

Batch: HK0906207
Date of Issue: 06/04/2009
Client: HYDER CONSULTING LTD
Client Reference:

Calibration of pH System

Item : Multi-parameter Instrument / Mehrparameter-MeBgerat

Model No. : WTW pH / Oxi 340i

Serial No. : 08101283

Equipment No. : --

Calibration Method : This meter was calibrated in accordance with standard method APHA (19th Ed.) 4500-H^+B

Date of Calibration : 06 April, 2009

Testing Results :

Expected Reading	Recording Reading
4.00	4.11
7.00	7.02
10.0	9.85
Allowing Deviation	± 0.2

Ms Wong Wai Man, Alice
Laboratory Manager - Hong Kong

CERTIFICATE OF ANALYSIS

Batch: HK0906207
Date of Issue: 06/04/2009
Client: HYDER CONSULTING LTD
Client Reference:

Calibration of Thermometer

Item : Multi-parameter Instrument / Mehrparameter-MeBgerat

Model No. : WTW pH / Oxi 340i

Serial No. : 08101283

Equipment No. : --

Calibration Method : In-house Method

Date of Calibration : 06 April, 2009

Testing Results :

Reference Temperature (^{0}C)	Recorded Temperature (^{0}C)
22.0 ^{0}C	22.3 ^{0}C
33.0 ^{0}C	33.5 ^{0}C
Allowing Deviation	±2.0^{0}C

Ms Wong Wai Man, Alice
Laboratory Manager - Hong Kong