

High Volume Air Sampler Calibration Worksheet

Project Title: Design and Construction of Tsuen Wan Drainage Tunnel
Monitoring Location: Ho Fung College (ASR 1)
Calibration Date: 23-Feb-12
Calibration Due Date: 22-Apr-12
Time: 08:00

Sampler Model:	BM2000HX
Serial No.:	4994
Calibrator Orifice no.:	1785
Slope (m):	2.00506
Intercept (b):	-0.02062
Correction coeff. (r)	0.99998

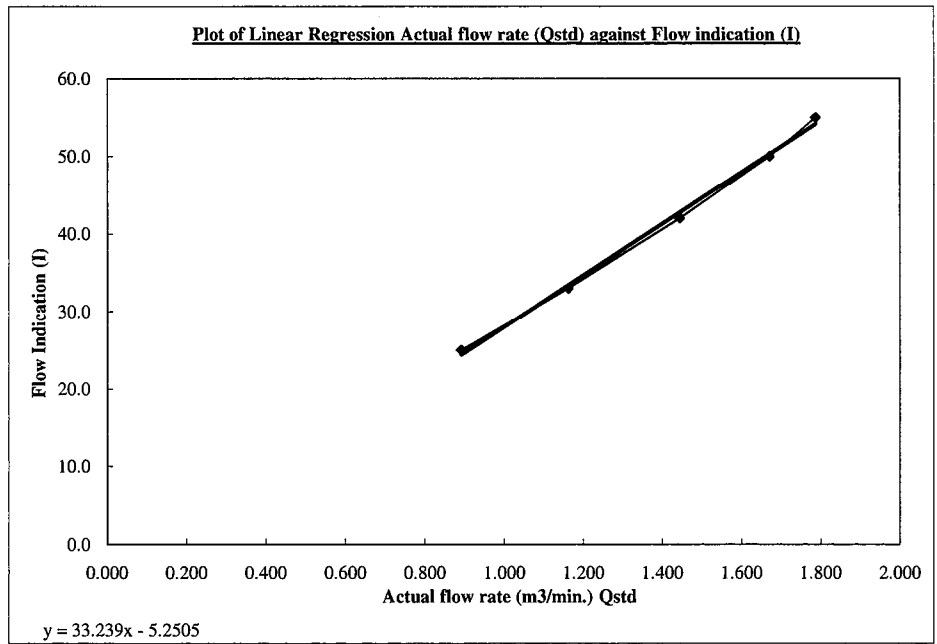
Standard pressure (mmHg) Pstd:	763.9
Standard temp. (K) Tstd:	290.8
Calibration pressure (mmHg) Pa:	756.7
Calibration temp. (K) Ta:	292.9

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

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

Sample no.	Pressure Drop (H), inch	Flow (corrected), m ³ /min	Actual flow rate (Qstd), m ³ /min	Flow indication (I), arbitrary
1	12.6	3.564	1.788	55.0
2	11.0	3.330	1.671	50.0
3	8.2	2.875	1.444	42.0
4	5.3	2.311	1.163	33.0
5	3.1	1.768	0.892	25.0

Correlation Coefficient : 0.9984



Remark
 1HPa = 0.750062 mmHg

Calibrated by: Arthur Chiu
 (*Arthur Chiu*)

Date: 23/2/2012

Checked by: F.C. Tsang
 (*F.C. Tsang*)

Date: 23/2/2012

High Volume Air Sampler Calibration Worksheet

Project Title: Design and Construction of Tsuen Wan Drainage Tunnel
 Monitoring Location: Hong Hoi Chi Hong Ship Temple (ASR 3)
 Calibration Date: 23-Feb-12
 Calibration Due Date: 22-Apr-12
 Time: 08:15

Sampler Model:	BM2000HX
Serial No.:	5875
Calibrator Orifice no.:	1785
Slope (m):	2.00506
Intercept (b):	-0.02062
Correction coeff. (r)	0.99998

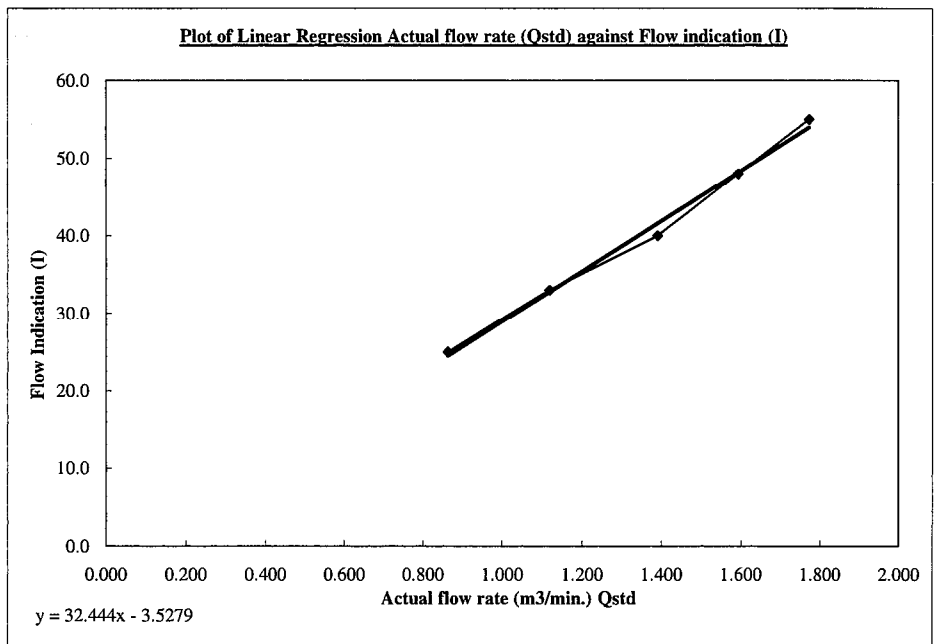
Standard pressure (mmHg) Pstd:	763.9
Standard temp. (K) Tstd:	290.8
Calibration pressure (mmHg) Pa:	756.7
Calibration temp. (K) Ta:	292.9

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

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

Sample no.	Pressure Drop (H), inch	Flow (corrected), m ³ /min	Actual flow rate (Qstd), m ³ /min	Flow indication (I), arbitrary
1	12.4	3.535	1.773	55.0
2	10.0	3.175	1.594	48.0
3	7.6	2.768	1.391	40.0
4	4.9	2.222	1.119	33.0
5	2.9	1.710	0.863	25.0

Correlation Coefficient : 0.9966



Remark
 1HPa = 0.750062 mmHg

Calibrated by: Arthur Chiu
 (*Arthur Chiu*)

Date: 23/2/2012

Checked by: F.C. Tsang
 (*F.C. Tsang*)

Date: 23/2/2012

High Volume Air Sampler Calibration Worksheet

Project Title: Design and Construction of Tsuen Wan Drainage Tunnel
Monitoring Location: Long Beach Garden (ASR 8)
Calibration Date: 23-Feb-12
Calibration Due Date: 22-Apr-12
Time: 08:30

Sampler Model:	TE5005X
Serial No.:	1059
Calibrator Orifice no.:	1785
Slope (m):	2.00506
Intercept (b):	-0.02062
Correction coeff. (r)	0.99998

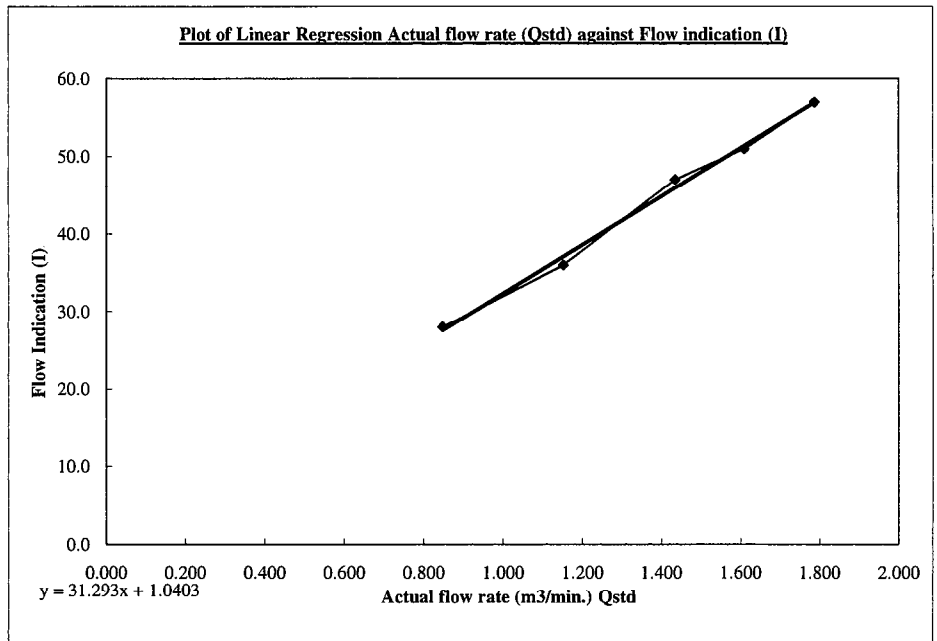
Standard pressure (mmHg) Pstd:	763.9
Standard temp. (K) Tstd:	290.8
Calibration pressure (mmHg) Pa:	756.7
Calibration temp. (K) Ta:	292.9

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

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

Sample no.	Pressure Drop (H), inch	Flow (corrected), m ³ /min	Actual flow rate (Qstd), m ³ /min	Flow indication (I), arbitrary
1	12.6	3.564	1.788	57.0
2	10.2	3.206	1.609	51.0
3	8.1	2.857	1.435	47.0
4	5.2	2.289	1.152	36.0
5	2.8	1.680	0.848	28.0

Correlation Coefficient : 0.9976



Remark
 1HPa = 0.750062 mmHg

Calibrated by: Arthur Chiu
 (*Arthur Chiu*)

Date: 23/2/2012

Checked by: F.C. Tsang
 (*F.C. Tsang*)

Date: 23/2/2012

High Volume Air Sampler Calibration Worksheet

Project Title: Design and Construction of Tsuen Wan Drainage Tunnel
 Monitoring Location: Greenview Terrace (ASR 9)
 Calibration Date: 23-Feb-12
 Calibration Due Date: 22-Apr-12
 Time: 08:45

Sampler Model:	TE5005X
Serial No.:	1713
Calibrator Orifice no.:	1785
Slope (m):	2.00506
Intercept (b):	-0.02062
Correction coeff. (r)	0.99998

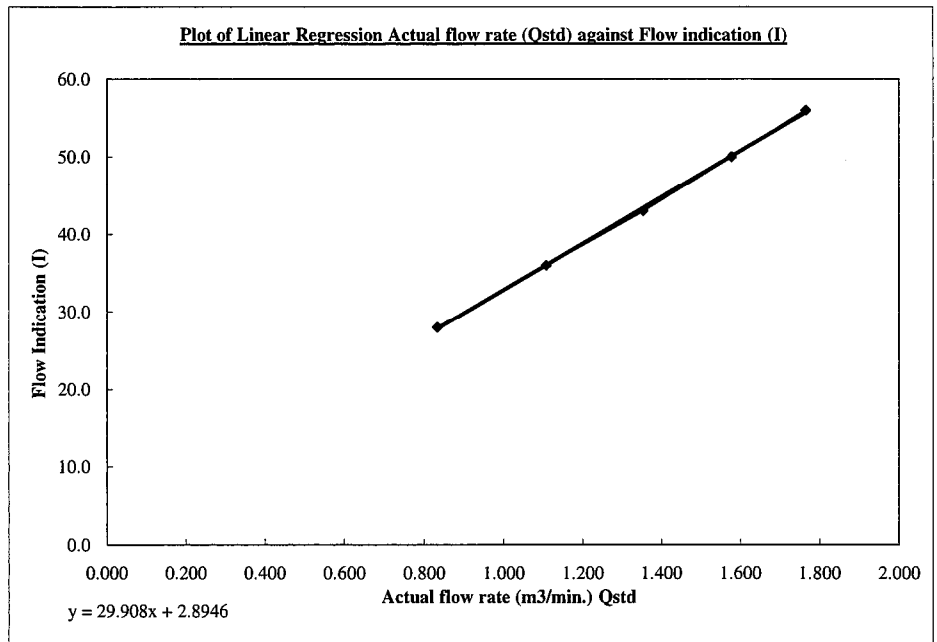
Standard pressure (mmHg) Pstd:	763.9
Standard temp. (K) Tstd:	290.8
Calibration pressure (mmHg) Pa:	756.7
Calibration temp. (K) Ta:	292.9

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

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

Sample no.	Pressure Drop (H), inch	Flow (corrected), m ³ /min	Actual flow rate (Qstd), m ³ /min	Flow indication (I), arbitrary
1	12.3	3.521	1.766	56.0
2	9.8	3.143	1.578	50.0
3	7.2	2.694	1.354	43.0
4	4.8	2.199	1.107	36.0
5	2.7	1.650	0.833	28.0

Correlation Coefficient : 0.9997



Remark
 1HPa = 0.750062 mmHg

Calibrated by: Arthur Chiu
 (*Arthur Chiu*)

Date: 23/2/2012

Checked by: F.C. Tsang
 (*F.C. Tsang*)

Date: 23/2/2012



TISCH ENVIRONMENTAL, 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

ORIFICE TRANSFER STANDARD CERTIFICATION WORKSHEET TE-5025A

Date - Apr 25, 2011 Rootsmeter S/N 0438320 Ta (K) - 294
 Operator Tisch Orifice I.D. - 1785 Pa (mm) - 746.76

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	1.3870	3.2	2.00
2	NA	NA	1.00	0.9830	6.4	4.00
3	NA	NA	1.00	0.8780	7.9	5.00
4	NA	NA	1.00	0.8350	8.9	5.50
5	NA	NA	1.00	0.6900	12.9	8.00

DATA TABULATION

Vstd	(x axis) Qstd	(y axis)	Va	(x axis) Qa	(y axis)
0.9917	0.7150	1.4113	0.9957	0.7179	0.8874
0.9873	1.0044	1.9959	0.9913	1.0085	1.2549
0.9853	1.1222	2.2315	0.9893	1.1268	1.4030
0.9841	1.1785	2.3405	0.9881	1.1833	1.4715
0.9787	1.4184	2.8227	0.9827	1.4242	1.7747
Qstd slope (m) = 2.00506			Qa slope (m) = 1.25553		
intercept (b) = -0.02062			intercept (b) = -0.01297		
coefficient (r) = 0.99998			coefficient (r) = 0.99998		
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 }



輝創工程有限公司

Sun Creation Engineering Limited Calibration and Testing Laboratory

Certificate No. : C113270

Certificate of Calibration

This is to certify that the equipment

Description : Sound Level Meter

Manufacturer : Rion

Model No. : NL-31

Serial No. : 00410224

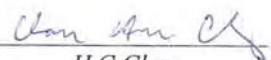
*has been calibrated for the specific items and ranges.
The results are shown in the Calibration Report No. C113270.*

The equipment is supplied by

Co. Name : Envirotech Services Co.

*Address : Shop 6, G/F., Casio Mansion, 209 Shaukeiwan Road,
Hong Kong*

Date of Issue : 10 June 2011

Certified by : 
H C Chan

The test equipment used for calibration 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



輝創工程有限公司

Sun Creation Engineering Limited Calibration and Testing Laboratory

Certificate No. : C116462

Certificate of Calibration

This is to certify that the equipment

Description : Sound Level Calibrator

Manufacturer : Rion

Model No. : NC-73

Serial No. : 10486660

*has been calibrated for the specific items and ranges.
The results are shown in the Calibration Report No. C116462.*

The equipment is supplied by

Co. Name : Envirotech Services Co.

*Address : Shop 6, G/F., Casio Mansion, 209 Shaukeiwan Road,
Hong Kong*

Date of Issue : 22 November 2011

Certified by : 
H C Chan

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

輝創工程有限公司

Sun Creation Engineering Limited Calibration and Testing Laboratory

Certificate No. : C116230

Certificate of Calibration

This is to certify that the equipment

Description : Integrating Sound Level Meter

Manufacturer : Bruel & Kjaer

Model No. : 2238

Serial No. : 2448529

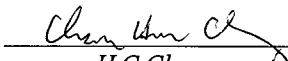
*has been calibrated for the specific items and ranges.
The results are shown in the Calibration Report No. C116230.*

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 : 11 November 2011

Certified by : 
H.C. Chan

The test equipment used for calibration 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 Certificate

Certificate No. 17675

Page 1 of 2 Pages

Customer : Hyder Consulting Limited

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

Order No. : Q12979

Date of receipt : 22-Dec-11

Item Tested

Description : Sound Level Calibrator

Manufacturer : B&K

Model : Type 4231

Serial No. : 2699361

Test Conditions

Date of Test : 4-Jan-12

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 942 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	13535	NIM-PRC & SCL-HKSAR
S024	Sound Level Calibrator	15136	NIM-PRC & SCL-HKSAR
S041	Universal Counter	15610	SCL-HKSAR
S206	Sound Level Meter	16338	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 : 
Dorothy Cheuk

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: 4-Jan-12



Calibration Certificate

Certificate No. 17675

Page 2 of 2 Pages

Results :

1. Level Accuracy

UUT Nominal Value (dB)	Measured Value (dB)	IEC 942 Class 1 Spec.
94	94.16	± 0.3 dB
114	114.18	

Uncertainty : ± 0.1 dB

2. Frequency

UUT Nominal Value	Measured Value	IEC 942 Class 1 Spec.
1 kHz	1.000 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 : < 0.4 %

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 measurement.

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

4. Atmospheric Pressure : 1016 hPa.

----- END -----

REPORT OF EQUIPMENT PERFORMANCE CHECK/CALIBRATION

Work Order: HK1200610
Date of Issue: 10/01/2012
Client: HYDER CONSULTING LTD



Description: YSI Multimeter
Brand Name: YSI
Model No.: YSI Professional Plus
Serial No.: 11J100824
Equipment No.: N/A
Date of Calibration: 10 January, 2012

Date of next Calibration: 10 April, 2012

Parameters:

Conductivity

Ref: APHA (21st edition), 2510B

Expected Reading (uS/cm)	Displayed Reading (uS/cm)	Tolerance (%)
146.9	149.8	2.0
6667	6604	-0.9
12890	13200	2.4
58670	58500	-0.3
Tolerance Limit (±%)		10.0

Dissolved Oxygen

Method Ref: APHA (21st edition), 4500O: G

Expected Reading (mg/L)	Displayed Reading (mg/L)	Tolerance (mg/L)
5.97	5.90	-0.07
6.82	6.88	0.06
8.56	8.47	-0.09
Tolerance Limit (±mg/L)		0.20

pH Value

Method Ref: APHA (21st edition), 4500H:B

Expected Reading (pH Unit)	Displayed Reading (pH Unit)	Tolerance (pH unit)
4.0	4.01	0.01
7.0	7.01	0.01
10.0	9.98	-0.02
Tolerance Limit (±unit)		0.20

Temperature

Method Ref: Section 6 of International Accreditation New Zealand Technical

Guide No. 3 Second edition March 2008: Working Thermometer Calibration Procedure.

Expected Reading (°C)	Displayed Reading (°C)	Tolerance (°C)
11.0	10.4	-0.6
22.0	21.1	-0.9
33.0	32.7	-0.3
Tolerance Limit (°C)		2.0


 Mr Chan Kwok Fai, Godfrey
 Laboratory Manager - Hong Kong

REPORT OF EQUIPMENT PERFORMANCE CHECK/CALIBRATION

Work Order: HK1208158
 Date of Issue: 30/03/2012
 Client: HYDER CONSULTING LTD



Description: YSI Multimeter
 Brand Name: YSI
 Model No.: YSI Professional Plus
 Serial No.: 11J100824
 Equipment No.: N/A
 Date of Calibration: 27 March, 2012 Date of next Calibration: 27 June, 2012

Parameters:

Conductivity

Ref: APHA (21st edition), 2510B

Expected Reading (uS/cm)	Displayed Reading (uS/cm)	Tolerance (%)
146.9	147.0	0.1
6667	6554	-1.7
12890	12900	0.1
58670	58074	-1.0
Tolerance Limit (±%)		10.0

Dissolved Oxygen

Method Ref: APHA (21st edition), 4500O: G

Expected Reading (mg/L)	Displayed Reading (mg/L)	Tolerance (mg/L)
5.95	5.82	-0.13
6.66	6.51	-0.15
8.76	8.70	-0.06
Tolerance Limit (±mg/L)		0.20

pH Value

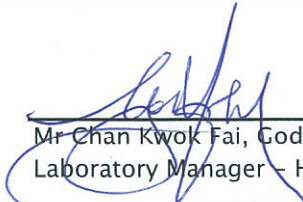
Method Ref: APHA (21st edition), 4500H:B

Expected Reading (pH Unit)	Displayed Reading (pH Unit)	Tolerance (pH unit)
4.0	3.95	-0.05
7.0	7.03	0.03
10.0	10.05	0.05
Tolerance Limit (±unit)		0.20

Temperature

Method Ref: Section 6 of International Accreditation New Zealand Technical Guide No. 3 Second edition March 2008: Working Thermometer Calibration Procedure.

Expected Reading (°C)	Displayed Reading (°C)	Tolerance (°C)
17.5	17.0	-0.5
26.0	25.8	-0.2
38.0	37.7	-0.3
Tolerance Limit (°C)		2.0


 Mr Chan Kwok Fai, Godfrey
 Laboratory Manager - Hong Kong

REPORT OF EQUIPMENT PERFORMANCE CHECK / CALIBRATION

Work Order: HK1205474
Date of Issue: 02/03/2012
Client: HYDER CONSULTING LTD



Description: DO Meter
Brand Name: YSI
Model No.: 55/12
Serial No.: 95J38390
Equipment No.: --
Date of Calibration: 01 March, 2012

Date of next Calibration: 01 June, 2012

Parameters:

Dissolved Oxygen **Method Ref: APHA (21st edition), 4500O: G**

Expected Reading (mg/L)	Displayed Reading (mg/L)	Tolerance (mg/L)
7.19	7.03	-0.16
7.79	7.60	-0.19
8.61	8.45	-0.16
Tolerance Limit (±mg/L)		0.20

Temperature

**Method Ref: Section 6 of International Accreditation New Zealand Technical
 Guide No. 3 Second edition March 2008: Working Thermometer Calibration Procedure.**

Reading of Ref. thermometer (°C)	Displayed Reading (°C)	Tolerance (°C)
11.0	11.1	0.1
22.0	21.5	-0.5
39.0	39.3	0.3
Tolerance Limit (°C)		2.0



 Mr Chan Kwok Fai, Godfrey
 Laboratory Manager - Hong Kong

REPORT OF EQUIPMENT PERFORMANCE CHECK/CALIBRATION

Work Order: HK1205106
Date of Issue: 23/02/2012
Client: HYDER CONSULTING LTD



Description: Turbidimeter
Brand Name: Eutech Instruments
Model No.: TN-100
Serial No.: 215619
Equipment No.: --
Date of Calibration: 23 February, 2012 Date of next Calibration: 23 May, 2012

Parameters:

Turbidity

Method Ref: ALPHA 21st Ed. 2130B

Expected Reading (NTU)	Displayed Reading (NTU)	Tolerance (%)
0	0.16	--
4	3.87	-3.3
40	39.2	-2.0
80	76.8	-4.0
400	425	6.3
800	761	-4.9
	Tolerance Limit ($\pm\%$)	10.0


Mr Chan Kwok Fai, Godfrey
Laboratory Manager - Hong Kong

REPORT OF EQUIPMENT PERFORMANCE CHECK/CALIBRATION

Work Order: HK1200236
Date of Issue: 05/01/2012
Client: HYDER CONSULTING LTD



Description: pH Meter
Brand Name: Hanna
Model No.: Hanna HI-8014
Serial No.: SN 08345212
Equipment No.: N/A
Date of Calibration: 05 January, 2012

Date of next Calibration: 05 April, 2012

Parameters:

pH Value

Method Ref: APHA (21st edition), 4500H:B

Expected Reading (pH Unit)	Displayed Reading (pH Unit)	Tolerance (pH unit)
4.00	4.01	0.01
7.00	7.11	0.11
10.00	10.08	0.08
	Tolerance Limit (\pm unit)	0.20