

**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: 01-Jun-12  
 Calibration Due Date: 31-Jul-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

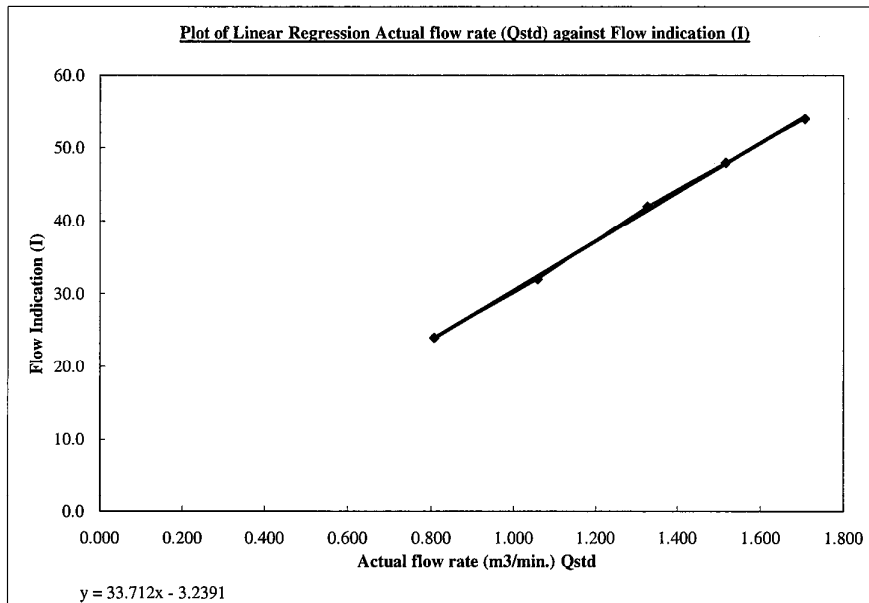
Standard pressure (mmHg) Pstd:	763.9
Standard temp. (K) Tstd:	290.8
Calibration pressure (mmHg) Pa:	753.1
Calibration temp. (K) Ta:	299.7

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

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

Sample no.	Pressure Drop (H), inch	Flow (corrected), m <sup>3</sup> /min	Actual flow rate (Qstd), m <sup>3</sup> /min	Flow indication (I), arbitrary
1	11.8	3.401	1.707	54.0
2	9.3	3.019	1.516	48.0
3	7.1	2.638	1.326	42.0
4	4.5	2.100	1.058	32.0
5	2.6	1.596	0.807	24.0

Correlation Coefficient : 0.9995



Remark  
 1HPa = 0.750062 mmHg

Calibrated by: **Edwin CHAN**  
 ( *Edwin Chan* )

Date: 1 June 2012

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

Date: 1 June 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:** 01-Jun-12  
**Calibration Due Date:** 31-Jul-12  
**Time:** 08:30

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

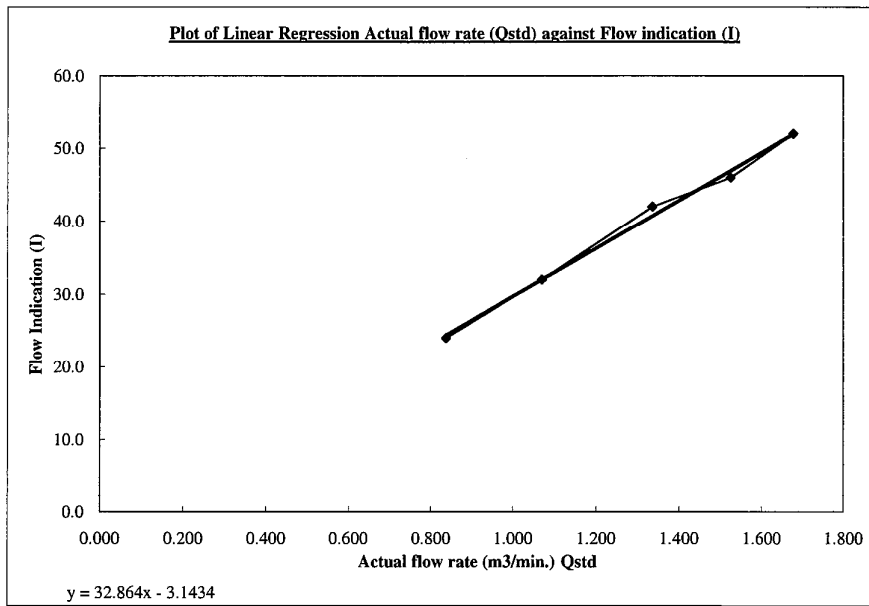
Standard pressure (mmHg) Pstd:	763.9
Standard temp. (K) Tstd:	290.8
Calibration pressure (mmHg) Pa:	753.2
Calibration temp. (K) Ta:	299.8

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

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

Sample no.	Pressure Drop (H), inch	Flow (corrected), m <sup>3</sup> /min	Actual flow rate (Qstd), m <sup>3</sup> /min	Flow indication (I), arbitrary
1	11.4	3.343	1.677	52.0
2	9.4	3.035	1.524	46.0
3	7.2	2.656	1.335	42.0
4	4.6	2.123	1.069	32.0
5	2.8	1.657	0.836	24.0

Correlation Coefficient : 0.9974



Remark  
 1HPa = 0.750062 mmHg

**Calibrated by:** Edwin Chan  
 ( *Edwin Chan* )

**Date:** 1 June 2012

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

**Date:** 1 June 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:** 01-Jun-12  
**Calibration Due Date:** 31-Jul-12  
**Time:** 09:00

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

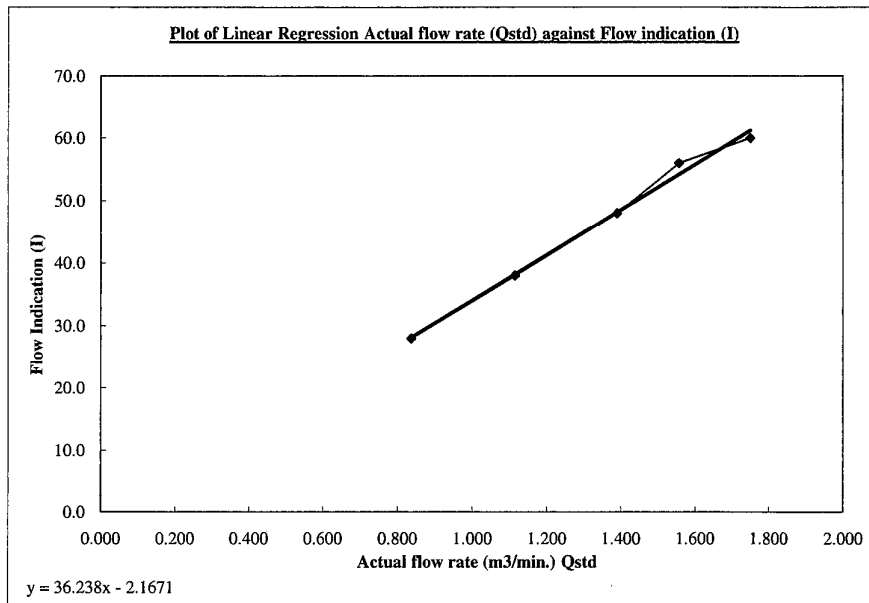
Standard pressure (mmHg) Pstd:	763.9
Standard temp. (K) Tstd:	290.8
Calibration pressure (mmHg) Pa:	753.2
Calibration temp. (K) Ta:	299.7

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

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

Sample no.	Pressure Drop (H), inch	Flow (corrected), m <sup>3</sup> /min	Actual flow rate (Qstd), m <sup>3</sup> /min	Flow indication (I), arbitrary
1	12.4	3.487	1.749	60.0
2	9.8	3.100	1.556	56.0
3	7.8	2.765	1.389	48.0
4	5.0	2.214	1.115	38.0
5	2.8	1.657	0.837	28.0

Correlation Coefficient : 0.9965



Remark  
 1HPa = 0.750062 mmHg

**Calibrated by:** Edwin Chan  
 ( *Edwin Chan* )

**Date:** 1 June 2012

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

**Date:** 1 June 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: 01-Jun-12  
 Calibration Due Date: 31-Jul-12  
 Time: 09:30

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

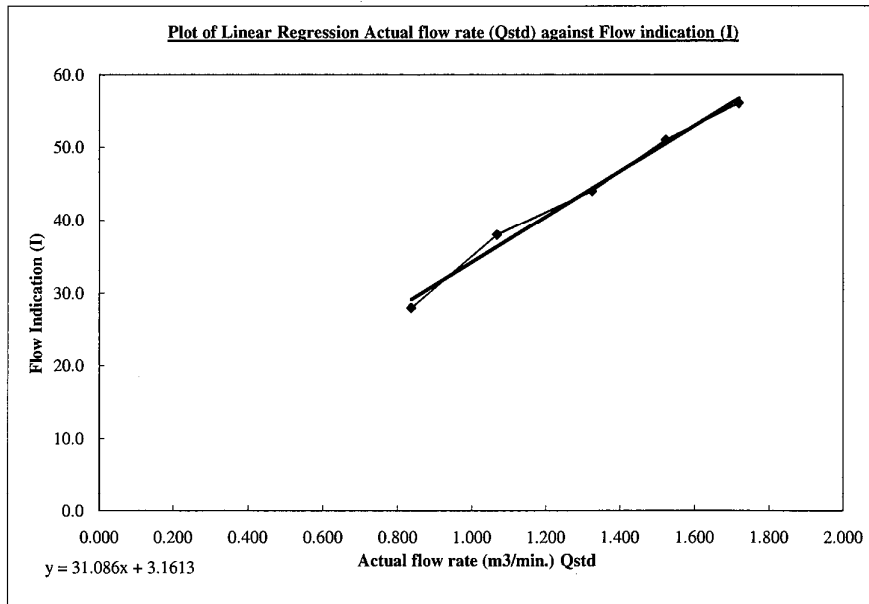
Standard pressure (mmHg) Pstd:	763.9
Standard temp. (K) Tstd:	290.8
Calibration pressure (mmHg) Pa:	753.2
Calibration temp. (K) Ta:	300.2

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

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

Sample no.	Pressure Drop (H), inch	Flow (corrected), m <sup>3</sup> /min	Actual flow rate (Qstd), m <sup>3</sup> /min	Flow indication (I), arbitrary
1	12.0	3.427	1.720	56.0
2	9.4	3.033	1.523	51.0
3	7.1	2.636	1.325	44.0
4	4.6	2.122	1.069	38.0
5	2.8	1.655	0.836	28.0

Correlation Coefficient : 0.9951



Remark  
 1HPa = 0.750062 mmHg

Calibrated by: **Edwin Chan**  
 ( *[Signature]* )

Date: 1 June 2012

Checked by: **F.C. Tsang**  
 ( *[Signature]* )

Date: 1 June 2012



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

ORIFICE TRANSFER STANDARD CERTIFICATION WORKSHEET TE-5025A

Date - May 04, 2012 Rootsmeter S/N 0438320 Ta (K) - 297  
 Operator Tisch Orifice I.D. - 1785 Pa (mm) - 751.84

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	1.3940	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	0.8360	8.8	5.50
5	NA	NA	1.00	0.6920	12.7	8.00

DATA TABULATION

Vstd	(x axis) Qstd	(y axis)	Va	(x axis) Qa	(y axis)
0.9884	0.7090	1.4090	0.9957	0.7143	0.8889
0.9842	1.0012	1.9926	0.9915	1.0087	1.2570
0.9821	1.1185	2.2278	0.9894	1.1269	1.4054
0.9810	1.1734	2.3365	0.9883	1.1822	1.4740
0.9758	1.4101	2.8179	0.9831	1.4206	1.7777
Qstd slope (m) = 2.00815			Qa slope (m) = 1.25747		
intercept (b) = -0.01705			intercept (b) = -0.01076		
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:

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

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



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

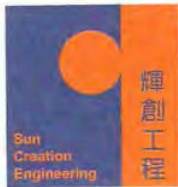
c/o 4/F, Tsing Shan Wan Exchange Building, 1 Hing On Lane, Tuen Mun, New Territories, Hong Kong

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.  
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

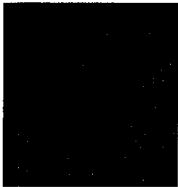
c/o 4/F, Tsing Shan Wan Exchange Building, 1 Hing On Lane, Tuen Mun, New Territories, Hong Kong

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. : 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*

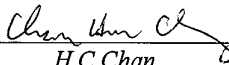
*has been calibrated for the specific items and ranges.  
The results are shown in the Calibration Report No. C116230.*

*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:


<u>Equipment No.</u>	<u>Description</u>	<u>Cert. No.</u>	<u>Traceable to</u>
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

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<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 : < 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:** HK1216159  
**Date of Issue:** 22/06/2012  
**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:** 21 June, 2012      **Date of next Calibration:** 21 September, 2012

**Parameters:**

**Conductivity**

**Ref: APHA (21st edition), 2510B**

Expected Reading (uS/cm)	Displayed Reading (uS/cm)	Tolerance (%)
142.6	140.9	-1.2
6667	6297	-5.5
12890	12602	-2.2
58670	54173	-7.7
Tolerance Limit (±%)		10.0

**Dissolved Oxygen**

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

Expected Reading (mg/L)	Displayed Reading (mg/L)	Tolerance (mg/L)
3.00	3.08	0.08
4.92	4.96	0.04
8.22	8.20	-0.02
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	4.17	0.17
7.0	7.18	0.18
10.0	10.01	0.01
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	11.2	0.2
21.0	20.7	-0.3
40.0	40.1	0.1
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

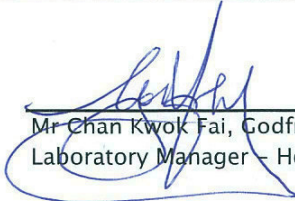
Method Ref: APHA (21st edition), 4500H:B

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:** HK1213813  
**Date of Issue:** 29/05/2012  
**Client:** HYDER CONSULTING LTD



**Description:** DO Meter  
**Brand Name:** YSI  
**Model No.:** 55/12  
**Serial No.:** 95J38390  
**Equipment No.:** --  
**Date of Calibration:** 29 May, 2012

**Date of next Calibration:** 29 August, 2012

**Parameters:**

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

Expected Reading (mg/L)	Displayed Reading (mg/L)	Tolerance (mg/L)
2.65	2.72	0.07
5.14	5.20	0.06
8.40	8.24	-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)
10.5	12.1	1.6
21.5	20.3	-1.2
41.0	39.7	-1.3
Tolerance Limit (°C)		2.0

  
 \_\_\_\_\_  
 Mr Chan Kwok Fai, Godfrey  
 Laboratory Manager - Hong Kong

# REPORT OF EQUIPMENT PERFORMANCE CHECK/CALIBRATION

Work Order: HK1212851  
Date of Issue: 18/05/2012  
Client: HYDER CONSULTING LTD



Description: Turbidimeter  
Brand Name: Eutech  
Model No.: Eutech Instruments TN-100  
Serial No.: 215619  
Equipment No.: --  
Date of Calibration: 18 May, 2012      Date of next Calibration: 18 August, 2012

## Parameters:

### Turbidity

Method Ref: APHA (21st edition), 2130B

Expected Reading (NTU)	Displayed Reading (NTU)	Tolerance (%)
0	0.24	--
4	3.81	-4.8
40	38.9	-2.8
80	75.8	-5.3
400	417	4.3
800	759	-5.1
	Tolerance Limit ( $\pm\%$ )	10.0

A handwritten signature in blue ink, appearing to read 'Richard Fung', written over a horizontal line.

Mr. Fung Lim Chee, Richard  
General Manager -  
Greater China & Hong Kong

# REPORT OF EQUIPMENT PERFORMANCE CHECK/CALIBRATION

Work Order: HK1208662  
Date of Issue: 02/04/2012  
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: 02 April, 2012

Date of next Calibration: 02 July, 2012

## Parameters:

### pH Value

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

Expected Reading (pH Unit)	Displayed Reading (pH Unit)	Tolerance (pH unit)
4.0	4.08	0.08
7.0	7.13	0.13
10.0	10.00	0.00
	Tolerance Limit ( $\pm$ unit)	0.20