High Volume Air Sampler Calibration Worksheet

Project Title: Design and Construction of Tsuen Wan Drainage Tunnel
Monitoring Location: Greenview Terrance
Calibration Date: 09-Dec-08
Calibration Due Date 09-Feb-09
Time: 16:57

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

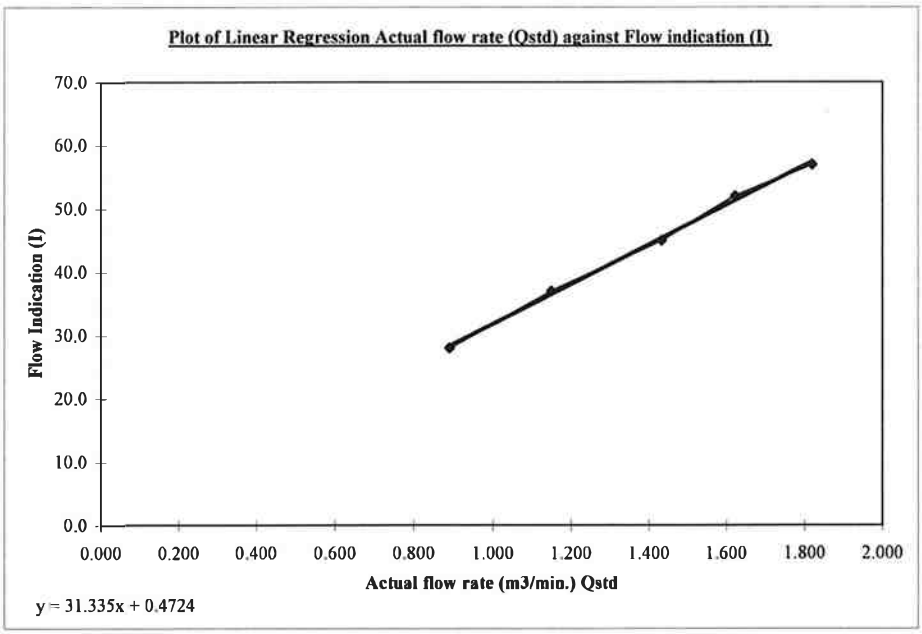
Standard pressure (mmHg) Pstd:	756.9
Standard temp. (K) Tstd:	297.18
Calibration pressure (mmHg) Pa:	764.0
Calibration temp. (K) Ta:	292.1

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

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

Sample no.	Pressure Drop (H), inch	Flow (corrcted), m^3/min	Actual flow rate (Qstd), m^3/min	Flow indication (I), arbitrary
1	13.1	3.673	1.819	57.0
2	10.4	3.273	1.622	52.0
3	8.1	2.888	1.433	45.0
4	5.2	2.314	1.150	37.0
5	3.1	1.787	0.890	28.0

Correlation Coefficient : 0.9989



Remark
1HPa = 0.750062 mmHg

Calibrated by: **Mak Kei Ho** **Date:** 11-12-08
(Ho)

Checked by: **Tang Hiu Yeung** **Date:** 11-12-08
( )

High Volume Air Sampler Calibration Worksheet

Project Title: **Design and Construction of Tsuen Wan Drainage Tunnel**
Monitoring Location: **Ho Fung College**
Calibration Date: **09-Dec-08**
Calibration Due Date **09-Feb-09**
Time: **17:59**

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

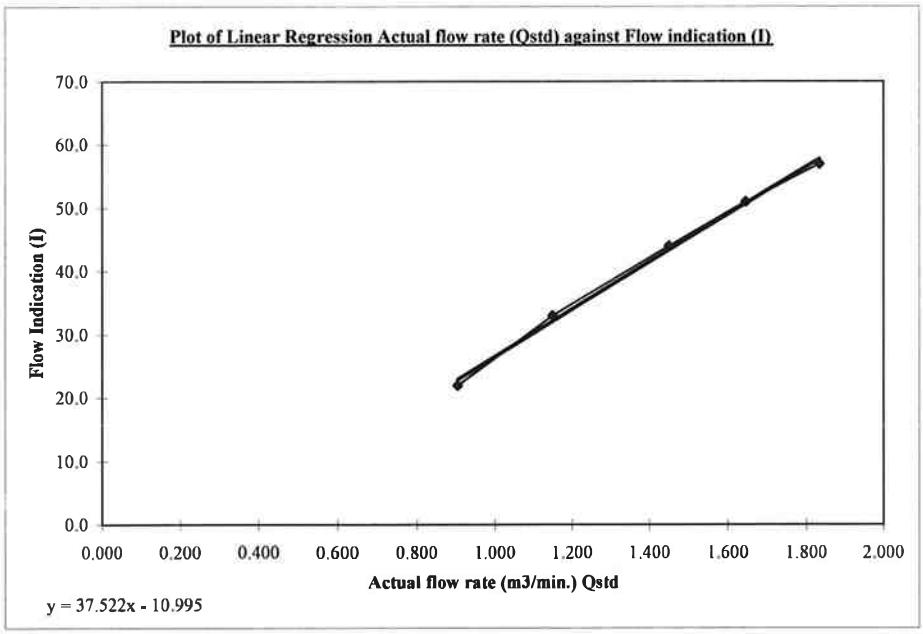
Standard pressure (mmHg) Pstd:	756.9
Standard temp. (K) Tstd:	297.18
Calibration pressure (mmHg) Pa:	764.0
Calibration temp. (K) Ta:	292.1

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

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

Sample no.	Pressure Drop (H), inch	Flow (corrcted), m^3/min	Actual flow rate (Qstd), m^3/min	Flow indication (I), arbitrary
1	13.3	3.701	1.833	57.0
2	10.7	3.319	1.645	51.0
3	8.3	2.924	1.450	44.0
4	5.2	2.314	1.150	33.0
5	3.2	1.815	0.904	22.0

Correlation Coefficient : 0.9983



Remark
1HPa = 0.750062 mmHg

Calibrated by: **Mak Kei Ho** **Date:** 11-12-08
(HO)

Checked by: **Tang Hiu Yeung** **Date:** 11-12-08
( )

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: **09-Dec-08**
Calibration Due Date **09-Feb-09**
Time: **12:30**

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

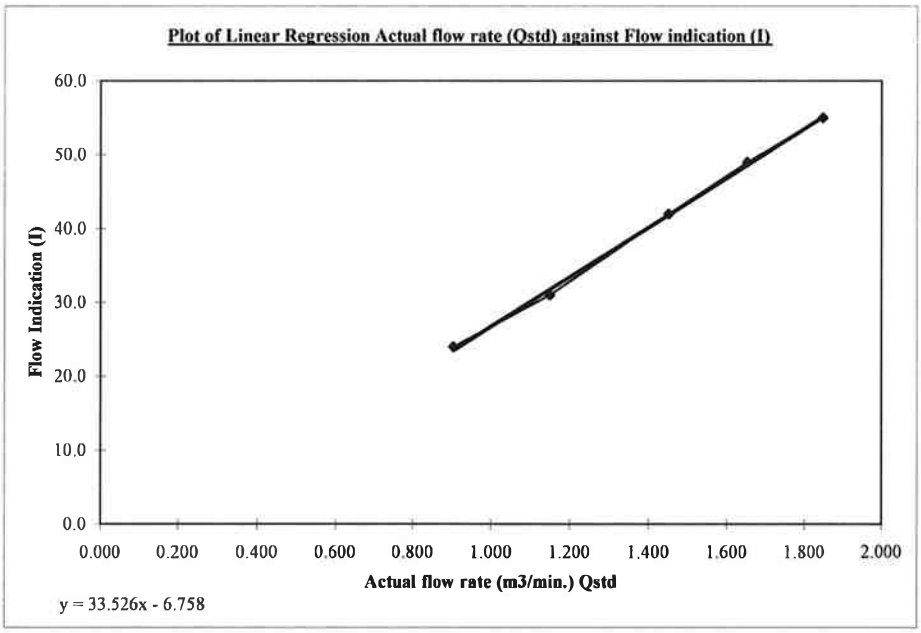
Standard pressure (mmHg) Pstd:	756.9
Standard temp. (K) Tstd:	297.18
Calibration pressure (mmHg) Pa:	764.0
Calibration temp. (K) Ta:	292.1

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

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

Sample no.	Pressure Drop (H), inch	Flow (corrcted), m^3/min	Actual flow rate (Qstd), m^3/min	Flow indication (I), arbitrary
1	13.5	3.729	1.847	55.0
2	10.8	3.335	1.653	49.0
3	8.3	2.924	1.450	42.0
4	5.2	2.314	1.150	31.0
5	3.2	1.815	0.904	24.0

Correlation Coefficient : 0.9992



Remark
1HPa = 0.750062 mmHg

Calibrated by: **Mak Kei Ho** (Ho) **Date:** 11-12-08

Checked by: **Tang Hiu Yeung** ( ) **Date:** 11-12-08

High Volume Air Sampler Calibration Worksheet

Project Title: Design and Construction of Tsuen Wan Drainage Tunnel
Monitoring Location: Long Beach Gardan
Calibration Date: 09-Dec-08
Calibration Due Date 09-Feb-09
Time: 15:45

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

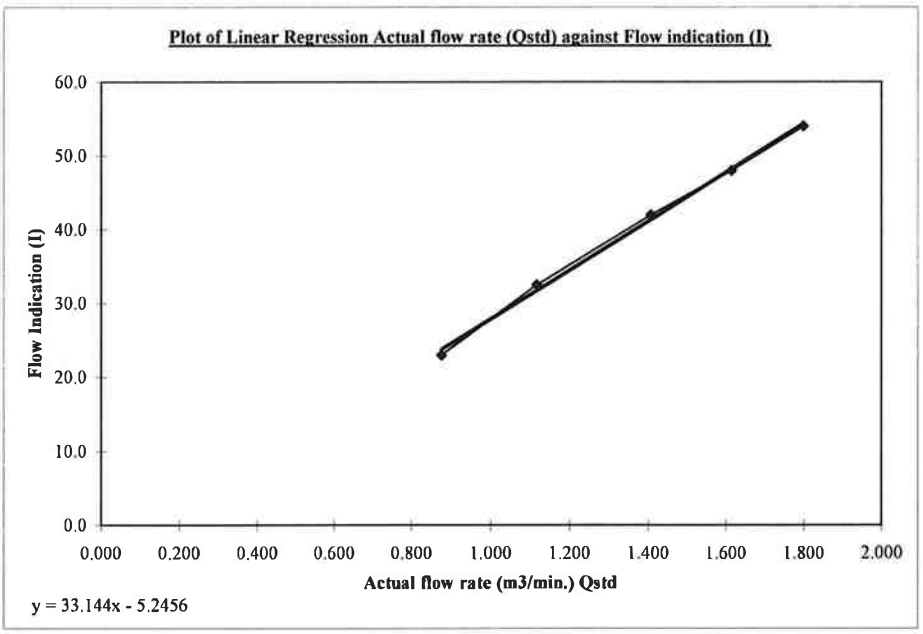
Standard pressure (mmHg) Pstd:	756.9
Standard temp. (K) Tstd:	297.18
Calibration pressure (mmHg) Pa:	764.0
Calibration temp. (K) Ta:	292.1

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

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

Sample no.	Pressure Drop (H), inch	Flow (corrcted), m^3/min	Actual flow rate (Qstd), m^3/min	Flow indication (I), arbitrary
1	12.8	3.631	1.798	54.0
2	10.3	3.257	1.614	48.0
3	7.8	2.834	1.406	42.0
4	4.9	2.246	1.116	32.5
5	3.0	1.758	0.876	23.0

Correlation Coefficient : 0.9985



Remark
1HPa = 0.750062 mmHg

Calibrated by: **Mak Kei Ho** **Date:** 11-12-08
(MK)

Checked by: **Tang Hiu Yeung** **Date:** 11-12-08
( )

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

Calibration Certificate

Certificate No. **83174** 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 : 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

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	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. **80484** 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. : Q72325 **Date of receipt :** 31-Jan-08

Item Tested

Description : Sound Level Calibrator

Manufacturer : B & K

Model : Type 4230 **Serial No. :** 1639065

Test Conditions

Date of Test : 1-Feb-08 **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).

Main Test equipment used:

Equipment No.	Description	Cert. No.	Due Date	Traceable to
S014	Spectrum Analyzer	73602	7-Jul-08	NIM-PRC & SCL-HKSAR
S024	Sound Level Calibrator	71791	16-Jul-08	NIM-PRC & SCL-HKSAR
S041	Universal Counter	73453	22-Aug-08	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: 1-Feb-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

TEST REPORT

Report No. : 107244N
Project Name : Calibration of Field measurement equipment
Customer : Hyder Consulting Limited
Address : 47/F, Hopewell Centre, 183 Queen's Road East, Wanchai, Hong Kong

Lab Job No.	: J651	**Lab Sample No.**	: 21456/1
Sample Description	: One Turbidimeter and four turbidity standards.		
Sample Receipt Date	: 13-10-2008	**Test Period**	: 14-10-2008

Test Information

Test Parameter	Test Procedure
Calibraion of Turbidimeter and Turbidity Standard	In-house Method IC 42

Notes : 1. This report shall not be reproduced, except in full, without prior written approval from Lam Laboratories Limited.
2. Results related to sample(s) as received.
3. Results satisfy all in-house QA/QC protocols as attached.

Authorized Signatory : WONG Yau Tim (Operation Manager)

Issue Date : 14-10-2008

TEST REPORT

Report No. : 107244N
Project Name : Calibration of Field measurement equipment
Customer : Hyder Consulting Limited
Lab Job No. : J651 **Lab Sample No.** : 21456/1

Test Results

Value re-assigmnemt for Turbidity Standards:

Customer Ref.	Measured value (NTU)
STD 1	0.00
STD 2	17.74
STD 3	102
STD 4	893

Linearity check for Turbidimeter:

Serial No.	Linearity range (NTU)
215619	0-100

- End of Report -

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

21723/1

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

Date Of Calibration : 13/1/09

Item Stock No : Std1,2,3,4

Operator : K.K

Environment Temp. °C 21

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

Primary Standards use(20, 100 and 800 NTU Formazin standards prepared fı 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	17.74	16.86	*-4.96*	± 5
100 - 1000 NTU	102	100	*-1.96*	± 5
100 - 1000 NTU	893	891	*-0.22*	± 5

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 42b / /EL

Item Being Calibrated : ***Turbidity Standards (Gelex)*** Date Of Calibration : 13/1/09

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

Environment Temp. °C 21 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	Turbidity of standard solution used (NTU)	Measured Value (NTU)	R^2	Requirement R^2
0 - 10 NTU	1	1.08	*1*	> 0.996
	5	5.25		
	10	10.52		
10 - 100 NTU	20	20.1	***0.998***	> 0.996
	50	52.5		
	80	80.5		
100 - 1000 NTU	100	99.2	***0.989***	> 0.996
	400	462		
	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

CERTIFICATE OF ANALYSIS

Date of Issue: 23/01/2009
Client: HYDER CONSULTING LTD
Client Reference:

Calibration of DO System

Item : YSI Mulitimeter

Model No. : YSI 85

Serial No. : 98A0725AB

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

Date of Calibration : 12 November, 2008

Testing Results :

Expected Reading	Recording Reading
4.82 mg/L 6.84 mg/L 7.92 mg/L	4.71 mg/L 6.68 mg/L 7.75 mg/L
Allowing Deviation	±0.2 mg/L

Ms Wong Wai Man, Alice
Laboratory Manager - Hong Kong

CERTIFICATE OF ANALYSIS

Date of Issue: 23/01/2009
Client: HYDER CONSULTING LTD
Client Reference:

Calibration of Thermometer

Item : YSI Mulitimeter

Model No. : YSI 85

Serial No. : 98A0725AB

Calibration Method : In-house Method

Date of Calibration : 12 November, 2008

Testing Results :

Reference Temperature (^{0}C)	Recorded Temperature (^{0}C)
24.6 °C 29.2 °C	24.7 °C 29.4 °C
Allowing Deviation	±2.0^{0}C

Ms Wong Wai Man, Alice
Laboratory Manager - Hong Kong

CERTIFICATE OF ANALYSIS

Batch: HK0900035
Date of Issue: 02/01/2009
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 : 02 January, 2009

Testing Results :

Expected Reading	Recording Reading
4.00	4.11
7.00	6.99
10.0	9.80
Allowing Deviation	± 0.2

Ms Wong Wai Man, Alice
Laboratory Manager - Hong Kong