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AIR POLLUTION MONITORING EQUIPMENT

ORIFICE TRANSFER STANDARD CERTIFICATION WORKSHEET TE-5025A

Date - Jul 11, 2011 Rootmeter S/N 0438320 Ta (K) - 298  
 Operator Tisch Orifice I.D. - 0005 Pa (mm) - 749.3

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	1.3710	3.2	2.00
2	NA	NA	1.00	0.9730	6.4	4.00
3	NA	NA	1.00	0.8690	7.9	5.00
4	NA	NA	1.00	0.8300	8.8	5.50
5	NA	NA	1.00	0.6860	12.8	8.00

DATA TABULATION

Vstd	(x axis) Qstd	(y axis)	Va	(x axis) Qa	(y axis)
0.9817	0.7160	1.4042	0.9957	0.7263	0.8919
0.9775	1.0046	1.9859	0.9915	1.0190	1.2613
0.9754	1.1225	2.2203	0.9894	1.1385	1.4101
0.9743	1.1739	2.3286	0.9882	1.1907	1.4790
0.9690	1.4126	2.8084	0.9829	1.4328	1.7837
Qstd slope (m) = 2.01593			Qa slope (m) = 1.26234		
intercept (b) = -0.03978			intercept (b) = -0.02526		
coefficient (r) = 0.99999			coefficient (r) = 0.99999		
y axis = SQRT[H2O(Pa/760)(298/Ta)]			y axis = SQRT[H2O(Ta/Pa)]		

CALCULATIONS

$$Vstd = \text{Diff. Vol} \left[ \frac{(Pa - \text{Diff. Hg})}{760} \right] \left( \frac{298}{Ta} \right)$$

$$Qstd = Vstd / \text{Time}$$

$$Va = \text{Diff Vol} \left[ \frac{(Pa - \text{Diff Hg})}{Pa} \right]$$

$$Qa = Va / \text{Time}$$

For subsequent flow rate calculations:

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

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



# Calibration Certificate

Certificate No. **13784**

Page 1 of 4 Pages

**Customer :** Lam Geotechnics Limited

**Address :** 11/F., Centre Point, 181-185 Gloucester Road, Wanchai, Hong Kong

**Order No. :** Q11569

**Date of receipt :** 6-Jul-11

## Item Tested

**Description :** Sound Level Meter

**Manufacturer :** B&K

**Model :** 2250

**Serial No. :** 2722311

## Test Conditions

**Date of Test :** 6-Jul-11

**Supply Voltage :** --

**Ambient Temperature :** (23 ± 3)°C

**Relative Humidity :** (50 ± 25) %

## Test Specifications

Calibration check.

Ref. Document/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:

<u>Equipment No.</u>	<u>Description</u>	<u>Cert. No.</u>	<u>Traceable to</u>
S017	Multi-Function Generator	C101623	SCL-HKSAR
S024	Sound Level Calibrator	04062	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 :** 

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:** 6-Jul-11



# Calibration Certificate

Certificate No. 13784

Page 2 of 4 Pages

Results :

## 1. SPL

UUT Setting				Applied Value (dB)	UUT Reading (dB)
Range	Freq. Wgt.	Time Const.	Center Freq.		
20 - 140	A (SPL)	Fast	--	94.0	93.9
		Slow	--		93.9
	C (SPL)	Fast	--	94.0	93.9
	A (SPL)	Fast	--	114.0	113.8
		Slow	--		113.8
	C (SPL)	Fast	--	114.0	113.8
	--	1/1 – Oct/Fast	1 kHz	94.0	93.8
				114.0	113.7
	--	1/3 – Oct/Fast	1 kHz	94.0	93.7
				114.0	113.6

IEC 651 Type 1 Spec. :  $\pm 0.7$  dB

Uncertainty :  $\pm 0.1$  dB

## 2. Level Stability : 0.0 dB

IEC 651 Type 1 Spec. :  $\pm 0.3$  dB

Uncertainty :  $\pm 0.01$  dB

## 3. Linearity

Differential level linearity

UUT Range (dB)	Applied Value (dB)	UUT Rdg (dB)	Variation (dB)	IEC 651 Type 1 Spec.
20~140	84.0	83.9	0.0	$\pm 0.4$ dB
	94.0	93.9 (Ref.)	--	
	95.0	95.0	+0.1	$\pm 0.2$ dB

Uncertainty :  $\pm 0.1$  dB



# Calibration Certificate

Certificate No. 13784

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## 4. Frequency Weighting

A weighting

Frequency	Attenuation (dB)	IEC 651 Type 1 Spec.
31.5 Hz	-39.8	- 39.4 dB, $\pm 1.5$ dB
63 Hz	-26.5	- 26.2 dB, $\pm 1.5$ dB
125 Hz	-16.5	- 16.1 dB, $\pm 1$ dB
250 Hz	-9.0	- 8.6 dB, $\pm 1$ dB
500 Hz	-3.5	- 3.2 dB, $\pm 1$ dB
1 kHz	0.0 (Ref)	0 dB, $\pm 1$ dB
2 kHz	+1.1	+ 1.2 dB, $\pm 1$ dB
4 kHz	+1.1	+ 1.0 dB, $\pm 1$ dB
8 kHz	-1.3	- 1.1 dB, + 1.5 dB $\sim -3$ dB
16 kHz	-5.9	- 6.6 dB, + 3 dB $\sim -\infty$

Uncertainty :  $\pm 0.1$  dB

## 5. Time Averaging

Applied Burst duty Factor	Applied Leq Value (dB)	UUT Reading (dB)	IEC 804 Type 1 Spec.
continuous	40.0	--	--
1/10	40.0	40.1	$\pm 0.5$ dB
1/10 <sup>2</sup>	40.0	40.0	
1/10 <sup>3</sup>	40.0	40.0	$\pm 1.0$ dB
1/10 <sup>4</sup>	40.0	40.0	

Uncertainty :  $\pm 0.1$  dB



# Calibration Certificate

Certificate No. 13784

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## 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	-44.9	< - 42
500 Hz	-21.1	< - 17.5
707 Hz	-3.8	- 2 ~ - 5
1 kHz (Ref)	--	--
1.414 kHz	-3.6	- 2 ~ - 5
2 kHz	-20.9	< - 17.5
4 kHz	-56.0	< - 42
8 kHz	-86.0	< - 61

Uncertainty :  $\pm 0.25$  dB

### 6.2 1/3 – Octave Filter

Frequency	Attenuation (dB)	IEC 1260 Class 1 Spec.(dB)
326 Hz	-64.9	< - 61
530 Hz	-48.1	< - 42
772 Hz	-23.6	< - 17.5
891 Hz	-3.9	+ 0.3 ~ - 5.0
1 kHz (Ref)	--	--
1.122 kHz	-3.9	+ 0.3 ~ - 5.0
1.296 kHz	-23.7	< - 17.5
1.887 kHz	-48.8	< - 42
3.070 kHz	-70.4	< - 61

Uncertainty :  $\pm 0.25$  dB

Remarks : 1. UUT : Unit-Under-Test

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

3. Atmospheric pressure : 996 hPa.

----- END -----



# Calibration Certificate

Certificate No. 13813

Page 1 of 4 Pages

**Customer :** Lam Geotechnics Limited

**Address :** 11/F., Centre Point, 181-185 Gloucester Road, Wanchai, Hong Kong

**Order No. :** Q11569

**Date of receipt :** 7-Jul-11

## Item Tested

**Description :** Sound Level Meter

**Manufacturer :** B&K

**Model :** 2250

**Serial No. :** 2722310

## Test Conditions

**Date of Test :** 8-Jul-11

**Supply Voltage :** --

**Ambient Temperature :** (23 ± 3)°C

**Relative Humidity :** (50 ± 25) %

## Test Specifications

Calibration check.

Ref. Document/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:

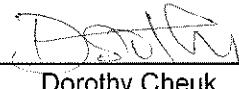
<u>Equipment No.</u>	<u>Description</u>	<u>Cert. No.</u>	<u>Traceable to</u>
S017A	Multi-Function Generator	07279	SCL-HKSAR
S024	Sound Level Calibrator	04062	NIM-PRC & SCL-HKSAR

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.

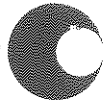
The test equipment used for calibration are traceable to International System of Units (SI).

The test results apply to the above Unit-Under-Test only

**Calibrated by :**   
P. F. Wong

**Approved by :**   
Dorothy Cheuk

**Date:** 8-Jul-11



# Calibration Certificate

Certificate No. **13813**

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Results :

## 1. SPL

UUT Setting				Applied Value (dB)	UUT Reading (dB)
Range	Freq. Wgt.	Time Const.	Center Freq.		
20 - 140	A (SPL)	Fast	--	94.0	93.8
		Slow	--		93.8
	C (SPL)	Fast	--	94.0	93.9
	A (SPL)	Fast	--	114.0	113.7
		Slow	--		113.7
	C (SPL)	Fast	--	114.0	113.7
	--	1/1 - Oct/Fast	1 kHz	94.0	93.8
				114.0	113.7
	--	1/3 - Oct/Fast	1 kHz	94.0	93.8
				114.0	113.7

IEC 651 Type 1 Spec. :  $\pm 0.7$  dB

Uncertainty :  $\pm 0.2$  dB

## 2. Level Stability : 0.0 dB

IEC 651 Type 1 Spec. :  $\pm 0.3$  dB

Uncertainty :  $\pm 0.01$  dB

## 3. Linearity

Differential level linearity

UUT Range (dB)	Applied Value (dB)	UUT Rdg (dB)	Variation (dB)	IEC 651 Type 1 Spec.
120	84.0	83.8	0.0	$\pm 0.4$ dB
	94.0	93.8 (Ref.)	--	
	95.0	94.8	0.0	$\pm 0.2$ dB

Uncertainty :  $\pm 0.1$  dB



# Calibration Certificate

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## 4. Frequency Weighting

A weighting

Frequency	Attenuation (dB)	IEC 651 Type 1 Spec.
31.5 Hz	-39.9	- 39.4 dB, $\pm 1.5$ dB
63 Hz	-26.6	- 26.2 dB, $\pm 1.5$ dB
125 Hz	-16.5	- 16.1 dB, $\pm 1$ dB
250 Hz	-9.0	- 8.6 dB, $\pm 1$ dB
500 Hz	-3.5	- 3.2 dB, $\pm 1$ dB
1 kHz	0.0 (Ref)	0 dB, $\pm 1$ dB
2 kHz	+1.4	+ 1.2 dB, $\pm 1$ dB
4 kHz	+1.2	+ 1.0 dB, $\pm 1$ dB
8 kHz	-1.2	- 1.1 dB, + 1.5 dB $\sim$ -3 dB
16 kHz	-5.8	- 6.6 dB, + 3 dB $\sim$ - $\infty$

Uncertainty :  $\pm 0.1$  dB

## 5. Time Averaging

Applied Burst duty Factor	Applied Leq Value (dB)	UUT Reading (dB)	IEC 804 Type 1 Spec.
continuous	40.0	--	--
1/10	40.0	40.0	$\pm 0.5$ dB
1/10 <sup>2</sup>	40.0	39.9	
1/10 <sup>3</sup>	40.0	40.0	$\pm 1.0$ dB
1/10 <sup>4</sup>	40.0	40.0	

Uncertainty :  $\pm 0.1$  dB





# Calibration Certificate

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## 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	-44.9	< - 42
500 Hz	-21.0	< - 17.5
707 Hz	-3.8	- 2 ~ - 5
1 kHz (Ref)	--	--
1.414 kHz	-3.5	- 2 ~ - 5
2 kHz	-20.8	< - 17.5
4 kHz	-55.9	< - 42
8 kHz	-85.7	< - 61

Uncertainty :  $\pm 0.25$  dB

### 6.2 1/3 – Octave Filter

Frequency	Attenuation (dB)	IEC 1260 Class 1 Spec.(dB)
326 Hz	-63.6	< - 61
530 Hz	-47.9	< - 42
772 Hz	-23.5	< - 17.5
891 Hz	-3.7	+ 0.3 ~ - 5.0
1 kHz (Ref)	--	--
1.122 kHz	-3.6	+ 0.3 ~ - 5.0
1.296 kHz	-23.4	< - 17.5
1.887 kHz	-48.1	< - 42
3.070 kHz	-69.8	< - 61

Uncertainty :  $\pm 0.25$  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 -----



Lam Geotechnics Limited

**Calibration Data for High Volume Sampler (TSP Sampler)**

Location : MA1w  
 Equipment no. : EL080

Calibration Date : 17-Apr-12  
 Calibration Due Date : 17-Jun-12

**CALIBRATION OF CONTINUOUS FLOW RECORDER**

Ambient Condition			
Temperature, T <sub>a</sub>	298	Kelvin	Pressure, P <sub>a</sub>
			1015 mmHg

Orifice Transfer Standard Information			
Equipment No.	EL086	Slope, m <sub>c</sub>	2.01593
		Intercept, b <sub>c</sub>	-0.03978
Last Calibration Date	11-Jul-11	$\left( H \times P_a / 1013.3 \times 298 / T_a \right)^{1/2}$ $= m_c \times Q_{std} + b_c$	
Next Calibration Date	11-Jul-12		

Calibration of RSP						
Calibration Point	Manometer Reading			Q <sub>std</sub> (m <sup>3</sup> / min.) X-axis	Continuous Flow Recorder, W (CFM)	IC (W(P <sub>a</sub> /1013.3x298/T <sub>a</sub> ) <sup>1/2</sup> /35.31) Y-axis
	(up)	(down)	(difference)			
1	6.1	6.1	12.2	1.7538	55	55.0461
2	5.0	5.0	10.0	1.5897	46	46.0386
3	3.7	3.7	7.4	1.3703	40	40.0335
4	2.4	2.4	4.8	1.1074	26	26.0218
5	1.5	1.5	3.0	0.8796	17	17.0143

By Linear Regression of Y on X

Slope, m = 43.0956      Intercept, b = -20.9244  
 Correlation Coefficient\* = 0.9964  
 Calibration Accepted = Yes/No\*\*

\* if Correlation Coefficient &lt; 0.990, check and recalibration again.

\*\* Delete as appropriate.

Remarks : \_\_\_\_\_

Calibrated by : Sam Lam  
 Date : 17-Apr-12

Checked by : Derek Lo  
 Date : 17-Apr-12



Lam Geotechnics Limited

**Calibration Data for High Volume Sampler (TSP Sampler)**

Location : MA1w  
 Equipment no. : EL080

Calibration Date : 15-Jun-12  
 Calibration Due Date : 15-Aug-12

**CALIBRATION OF CONTINUOUS FLOW RECORDER**

Ambient Condition			
Temperature, T <sub>a</sub>	303	Kelvin	Pressure, P <sub>a</sub>
			1010 mmHg

Orifice Transfer Standard Information			
Equipment No.	EL086	Slope, m <sub>c</sub>	2.01593
		Intercept, b <sub>c</sub>	-0.03978
Last Calibration Date	11-Jul-11	$\left( H \times P_a / 1013.3 \times 298 / T_a \right)^{1/2}$ $= m_c \times Q_{std} + b_c$	
Next Calibration Date	11-Jul-12		

Calibration of RSP						
Calibration Point	Manometer Reading			Q <sub>std</sub> (m <sup>3</sup> / min.) X-axis	Continuous Flow Recorder, W (CFM)	IC (W(P <sub>a</sub> /1013.3x298/T <sub>a</sub> ) <sup>1/2</sup> /35.31) Y-axis
	(up)	(down)	(difference)			
1	6.1	6.1	12.2	1.7352	58	57.4257
2	5.0	5.0	10.0	1.5728	48	47.5247
3	3.6	3.6	7.2	1.3376	38	37.6237
4	2.4	2.4	4.8	1.0958	25	24.7525
5	1.4	1.4	2.8	0.8416	14	13.8614

By Linear Regression of Y on X

Slope, m = 48.3881      Intercept, b = -27.4698  
 Correlation Coefficient\* = 0.9987  
 Calibration Accepted = Yes/No\*\*

\* if Correlation Coefficient &lt; 0.990, check and recalibration again.

\*\* Delete as appropriate.

Remarks : \_\_\_\_\_

Calibrated by : Sam Lam  
 Date : 15-Jun-12

Checked by : Derek Lo  
 Date : 15-Jun-12



Lam Geotechnics Limited

**Calibration Data for High Volume Sampler (TSP Sampler)**

Location : MA1e Calibration Date : 17-Apr-12  
 Equipment no. : EL455 Calibration Due Date : 17-Jun-12

**CALIBRATION OF CONTINUOUS FLOW RECORDER**

Ambient Condition			
Temperature, T <sub>a</sub>	298	Kelvin	Pressure, P <sub>a</sub>
			1015 mmHg

Orifice Transfer Standard Information			
Equipment No.	EL086	Slope, m <sub>c</sub>	2.01593
		Intercept, b <sub>c</sub>	-0.03978
Last Calibration Date	11-Jul-11	$\left( \frac{H \times P_a}{1013.3 \times 298 / T_a} \right)^{1/2}$ $= m_c \times Q_{std} + b_c$	
Next Calibration Date	11-Jul-12		

Calibration of RSP						
Calibration Point	Manometer Reading			Q <sub>std</sub> (m <sup>3</sup> / min.) X-axis	Continuous Flow Recorder, W (CFM)	IC (W(P <sub>a</sub> /1013.3x298/T <sub>a</sub> ) <sup>1/2</sup> /35.31) Y-axis
	(up)	(down)	(difference)			
1	6.2	6.2	12.4	1.7680	61	61.0511
2	5.1	5.1	10.2	1.6053	52	52.0436
3	4.0	4.0	8.0	1.4239	43	43.0361
4	2.5	2.5	5.0	1.1299	30	30.0252
5	1.6	1.6	3.2	0.9078	21	21.0176

By Linear Regression of Y on X

Slope, m = 46.2523 Intercept, b = -21.7915  
 Correlation Coefficient\* = 0.9984  
 Calibration Accepted = Yes/No\*\*

\* if Correlation Coefficient &lt; 0.990, check and recalibration again.

\*\* Delete as appropriate.

Remarks : \_\_\_\_\_

Calibrated by : Sam Lam Checked by : Derek Lo  
 Date : 17-Apr-12 Date : 17-Apr-12



Lam Geotechnics Limited

**Calibration Data for High Volume Sampler (TSP Sampler)**

Location : MA1e Calibration Date : 15-Jun-12  
 Equipment no. : EL455 Calibration Due Date : 15-Aug-12

**CALIBRATION OF CONTINUOUS FLOW RECORDER**

Ambient Condition			
Temperature, T <sub>a</sub>	303	Kelvin	Pressure, P <sub>a</sub>
			1010 mmHg

Orifice Transfer Standard Information			
Equipment No.	EL086	Slope, m <sub>c</sub>	2.01593
		Intercept, b <sub>c</sub>	-0.03978
Last Calibration Date	11-Jul-11	$\left( H \times P_a / 1013.3 \times 298 / T_a \right)^{1/2}$ $= m_c \times Q_{std} + b_c$	
Next Calibration Date	11-Jul-12		

Calibration of RSP						
Calibration Point	Manometer Reading			Q <sub>std</sub> (m <sup>3</sup> / min.) X-axis	Continuous Flow Recorder, W (CFM)	IC (W(P <sub>a</sub> /1013.3x298/T <sub>a</sub> ) <sup>1/2</sup> /35.31) Y-axis
	(up)	(down)	(difference)			
1	6.2	6.2	12.4	1.7492	61	60.3960
2	5.1	5.1	10.2	1.5883	53	52.4752
3	4.0	4.0	8.0	1.4089	43	42.5742
4	2.6	2.6	5.2	1.1397	30	29.7030
5	1.6	1.6	3.2	0.8983	20	19.8020

By Linear Regression of Y on X

Slope, m = 48.1600 Intercept, b = -24.3572  
 Correlation Coefficient\* = 0.9988  
 Calibration Accepted = Yes/No\*\*

\* if Correlation Coefficient &lt; 0.990, check and recalibration again.

\*\* Delete as appropriate.

Remarks : \_\_\_\_\_

Calibrated by : Sam Lam Checked by : Derek Lo  
 Date : 15-Jun-12 Date : 15-Jun-12



Lam Geotechnics Limited

**Calibration Data for High Volume Sampler (TSP Sampler)**

Location : CMA5a Calibration Date : 17-Apr-12  
 Equipment no. : EL380 Calibration Due Date : 17-Jun-12

**CALIBRATION OF CONTINUOUS FLOW RECORDER**

Ambient Condition			
Temperature, T <sub>a</sub>	298	Kelvin	Pressure, P <sub>a</sub>
			1015 mmHg

Orifice Transfer Standard Information			
Equipment No.	EL086	Slope, m <sub>c</sub>	2.01593
		Intercept, b <sub>c</sub>	-0.03978
Last Calibration Date	11-Jul-11	$(H \times P_a / 1013.3 \times 298 / T_a)^{1/2}$ $= m_c \times Q_{std} + b_c$	
Next Calibration Date	11-Jul-12		

Calibration of RSP						
Calibration Point	Manometer Reading			Q <sub>std</sub> (m <sup>3</sup> / min.) X-axis	Continuous Flow Recorder, W (CFM)	IC (W(P <sub>a</sub> /1013.3x298/T <sub>a</sub> ) <sup>1/2</sup> /35.31) Y-axis
	(up)	(down)	(difference)			
1	6.1	6.1	12.2	1.7538	57	57.0478
2	4.9	4.9	9.8	1.5739	52	52.0436
3	3.7	3.7	7.4	1.3703	45	45.0377
4	2.4	2.4	4.8	1.1074	35	35.0293
5	1.5	1.5	3.0	0.8796	27	27.0226

By Linear Regression of Y on X

Slope, m = 34.9050 Intercept, b = -3.4321  
 Correlation Coefficient\* = 0.9989  
 Calibration Accepted = Yes/No\*\*

\* if Correlation Coefficient &lt; 0.990, check and recalibration again.

\*\* Delete as appropriate.

Remarks : \_\_\_\_\_

Calibrated by : Sam Lam Checked by : Derek Lo  
 Date : 17-Apr-12 Date : 17-Apr-12



Lam Geotechnics Limited

**Calibration Data for High Volume Sampler (TSP Sampler)**

Location : CMA5a Calibration Date : 15-Jun-12  
 Equipment no. : EL380 Calibration Due Date : 15-Aug-12

**CALIBRATION OF CONTINUOUS FLOW RECORDER**

Ambient Condition			
Temperature, T <sub>a</sub>	303	Kelvin	Pressure, P <sub>a</sub>
			1010 mmHg

Orifice Transfer Standard Information			
Equipment No.	EL086	Slope, m <sub>c</sub>	2.01593
		Intercept, b <sub>c</sub>	-0.03978
Last Calibration Date	11-Jul-11	$\left( H \times P_a / 1013.3 \times 298 / T_a \right)^{1/2}$ $= m_c \times Q_{std} + b_c$	
Next Calibration Date	11-Jul-12		

Calibration of RSP						
Calibration Point	Manometer Reading			Q <sub>std</sub> (m <sup>3</sup> / min.) X-axis	Continuous Flow Recorder, W (CFM)	IC (W(P <sub>a</sub> /1013.3x298/T <sub>a</sub> ) <sup>1/2</sup> /35.31) Y-axis
	(up)	(down)	(difference)			
1	6.0	6.0	12.0	1.7211	58	57.4257
2	5.0	5.0	10.0	1.5728	52	51.4851
3	3.7	3.7	7.4	1.3558	44	43.5643
4	2.4	2.4	4.8	1.0958	35	34.6535
5	1.4	1.4	2.8	0.8416	26	25.7426

By Linear Regression of Y on X

Slope, m = 35.7743 Intercept, b = -4.5550  
 Correlation Coefficient\* = 0.9997  
 Calibration Accepted = Yes/No\*\*

\* if Correlation Coefficient &lt; 0.990, check and recalibration again.

\*\* Delete as appropriate.

Remarks : \_\_\_\_\_

Calibrated by : Sam Lam Checked by : Derek Lo  
 Date : 15-Jun-12 Date : 15-Jun-12



Lam Geotechnics Limited

**Calibration Data for High Volume Sampler (TSP Sampler)**

Location : CMA4a Calibration Date : 17-Apr-12  
 Equipment no. : EL390 Calibration Due Date : 17-Jun-12

**CALIBRATION OF CONTINUOUS FLOW RECORDER**

Ambient Condition			
Temperature, T <sub>a</sub>	528	Kelvin	Pressure, P <sub>a</sub>
			1015 mmHg

Orifice Transfer Standard Information			
Equipment No.	EL086	Slope, m <sub>c</sub>	2.01593
		Intercept, b <sub>c</sub>	-0.03978
Last Calibration Date	11-Jul-11	$\left( H \times P_a / 1013.3 \times 298 / T_a \right)^{1/2}$ $= m_c \times Q_{std} + b_c$	
Next Calibration Date	11-Jul-12		

Calibration of RSP						
Calibration Point	Manometer Reading			Q <sub>std</sub> (m <sup>3</sup> / min.) X-axis	Continuous Flow Recorder, W (CFM)	IC (W(P <sub>a</sub> /1013.3x298/T <sub>a</sub> ) <sup>1/2</sup> /35.31) Y-axis
	(up)	(down)	(difference)			
1	6.0	6.0	12.0	1.3118	60	45.1135
2	4.9	4.9	9.8	1.1873	53	39.8502
3	3.6	3.6	7.2	1.0205	44	33.0832
4	2.4	2.4	4.8	0.8369	35	26.3162
5	1.4	1.4	2.8	0.6438	27	20.3011

By Linear Regression of Y on X

Slope, m = 37.3022 Intercept, b = -4.3719  
 Correlation Coefficient\* = 0.9982  
 Calibration Accepted = Yes/No\*\*

\* if Correlation Coefficient &lt; 0.990, check and recalibration again.

\*\* Delete as appropriate.

Remarks : \_\_\_\_\_

Calibrated by : Sam Lam Checked by : Derek Lo  
 Date : 17-Apr-12 Date : 17-Apr-12





Lam Geotechnics Limited

**Calibration Data for High Volume Sampler (TSP Sampler)**

Location : CMA4a Calibration Date : 15-Jun-12  
 Equipment no. : EL390 Calibration Due Date : 15-Aug-12

**CALIBRATION OF CONTINUOUS FLOW RECORDER**

Ambient Condition			
Temperature, T <sub>a</sub>	303	Kelvin	Pressure, P <sub>a</sub>
			1010 mmHg

Orifice Transfer Standard Information			
Equipment No.	EL086	Slope, m <sub>c</sub>	2.01593
		Intercept, b <sub>c</sub>	-0.03978
Last Calibration Date	11-Jul-11	$\left( H \times P_a / 1013.3 \times 298 / T_a \right)^{1/2}$ $= m_c \times Q_{std} + b_c$	
Next Calibration Date	11-Jul-12		

Calibration of RSP						
Calibration Point	Manometer Reading			Q <sub>std</sub> (m <sup>3</sup> / min.) X-axis	Continuous Flow Recorder, W (CFM)	IC (W(P <sub>a</sub> /1013.3x298/T <sub>a</sub> ) <sup>1/2</sup> /35.31) Y-axis
	(up)	(down)	(difference)			
1	5.9	5.9	11.8	1.7068	60	59.4059
2	4.9	4.9	9.8	1.5572	53	52.4752
3	3.5	3.5	7.0	1.3192	44	43.5643
4	2.4	2.4	4.8	1.0958	35	34.6535
5	1.4	1.4	2.8	0.8416	26	25.7426

By Linear Regression of Y on X

Slope, m = 38.7214 Intercept, b = -7.3288  
 Correlation Coefficient\* = 0.9992  
 Calibration Accepted = Yes/No\*\*

\* if Correlation Coefficient &lt; 0.990, check and recalibration again.

\*\* Delete as appropriate.

Remarks : \_\_\_\_\_

Calibrated by : Sam Lam Checked by : Derek Lo  
 Date : 15-Jun-12 Date : 15-Jun-12



Lam Geotechnics Limited

**Calibration Data for High Volume Sampler (TSP Sampler)**

Location : CMA3a Calibration Date : 17-Apr-12  
 Equipment no. : EL888 Calibration Due Date : 17-Jun-12

**CALIBRATION OF CONTINUOUS FLOW RECORDER**

Ambient Condition			
Temperature, T <sub>a</sub>	298	Kelvin	Pressure, P <sub>a</sub>
			1015 mmHg

Orifice Transfer Standard Information			
Equipment No.	EL086	Slope, m <sub>c</sub>	2.01593
		Intercept, b <sub>c</sub>	-0.03978
Last Calibration Date	11-Jul-11	$(H \times P_a / 1013.3 \times 298 / T_a)^{1/2}$ $= m_c \times Q_{std} + b_c$	
Next Calibration Date	11-Jul-12		

Calibration of RSP						
Calibration Point	Manometer Reading			Q <sub>std</sub> (m <sup>3</sup> / min.) X-axis	Continuous Flow Recorder, W (CFM)	IC (W(P <sub>a</sub> /1013.3x298/T <sub>a</sub> ) <sup>1/2</sup> /35.31) Y-axis
	(up)	(down)	(difference)			
1	5.8	5.8	11.6	1.7106	47	47.0394
2	4.6	4.6	9.2	1.5256	41	41.0344
3	3.7	3.7	7.4	1.3703	35	35.0293
4	2.4	2.4	4.8	1.1074	24	24.0201
5	1.5	1.5	3.0	0.8796	14	14.0117

By Linear Regression of Y on X

Slope, m = 40.1015 Intercept, b = -20.6552  
 Correlation Coefficient\* = 0.9985  
 Calibration Accepted = Yes/No\*\*

\* if Correlation Coefficient &lt; 0.990, check and recalibration again.

\*\* Delete as appropriate.

Remarks : \_\_\_\_\_

Calibrated by : Sam Lam Checked by : Derek Lo  
 Date : 17-Apr-12 Date : 17-Apr-12



Lam Geotechnics Limited

**Calibration Data for High Volume Sampler (TSP Sampler)**

Location : CMA3a Calibration Date : 15-Jun-12  
 Equipment no. : EL888 Calibration Due Date : 15-Aug-12

**CALIBRATION OF CONTINUOUS FLOW RECORDER**

Ambient Condition			
Temperature, T <sub>a</sub>	303	Kelvin	Pressure, P <sub>a</sub>
			1010 mmHg

Orifice Transfer Standard Information			
Equipment No.	EL086	Slope, m <sub>c</sub>	2.01593
		Intercept, b <sub>c</sub>	-0.03978
Last Calibration Date	11-Jul-11	$\left( H \times P_a / 1013.3 \times 298 / T_a \right)^{1/2}$ $= m_c \times Q_{std} + b_c$	
Next Calibration Date	11-Jul-12		

Calibration of RSP						
Calibration Point	Manometer Reading			Q <sub>std</sub> (m <sup>3</sup> / min.) X-axis	Continuous Flow Recorder, W (CFM)	IC (W(P <sub>a</sub> /1013.3x298/T <sub>a</sub> ) <sup>1/2</sup> /35.31) Y-axis
	(up)	(down)	(difference)			
1	6.0	6.0	12.0	1.7211	48	47.5247
2	4.7	4.7	9.4	1.5255	41	40.5940
3	3.8	3.8	7.6	1.3737	34	33.6634
4	2.4	2.4	4.8	1.0958	24	23.7624
5	1.6	1.6	3.2	0.8983	15	14.8515

By Linear Regression of Y on X

Slope, m = 39.5332 Intercept, b = -20.2184  
 Correlation Coefficient\* = 0.9991  
 Calibration Accepted = Yes/No\*\*

\* if Correlation Coefficient &lt; 0.990, check and recalibration again.

\*\* Delete as appropriate.

Remarks : \_\_\_\_\_

Calibrated by : Sam Lam Checked by : Derek Lo  
 Date : 15-Jun-12 Date : 15-Jun-12



Lam Geotechnics Limited

**Calibration Data for High Volume Sampler (TSP Sampler)**

Location : CMA2a  
 Equipment no. : EL449

Calibration Date : 17-Apr-12  
 Calibration Due Date : 17-Jun-12

**CALIBRATION OF CONTINUOUS FLOW RECORDER**

Ambient Condition			
Temperature, T <sub>a</sub>	298	Kelvin	Pressure, P <sub>a</sub>
			1015 mmHg

Orifice Transfer Standard Information			
Equipment No.	EL086	Slope, m <sub>c</sub>	2.01593
		Intercept, b <sub>c</sub>	-0.03978
Last Calibration Date	11-Jul-11	$\left( H \times P_a / 1013.3 \times 298 / T_a \right)^{1/2}$ $= m_c \times Q_{std} + b_c$	
Next Calibration Date	11-Jul-12		

Calibration of RSP						
Calibration Point	Manometer Reading			Q <sub>std</sub> (m <sup>3</sup> / min.) X-axis	Continuous Flow Recorder, W (CFM)	IC (W(P <sub>a</sub> /1013.3x298/T <sub>a</sub> ) <sup>1/2</sup> /35.31) Y-axis
	(up)	(down)	(difference)			
1	6.2	6.2	12.4	1.7680	52	52.0436
2	5.1	5.1	10.2	1.6053	44	44.0369
3	4.0	4.0	8.0	1.4239	37	37.0310
4	2.5	2.5	5.0	1.1299	26	26.0218
5	1.5	1.5	3.0	0.8796	14	14.0117

By Linear Regression of Y on X

Slope, m = 41.6997      Intercept, b = -22.1386  
 Correlation Coefficient\* = 0.9988  
 Calibration Accepted = Yes/No\*\*

\* if Correlation Coefficient &lt; 0.990, check and recalibration again.

\*\* Delete as appropriate.

Remarks : \_\_\_\_\_

Calibrated by : Sam Lam  
 Date : 17-Apr-12

Checked by : Derek Lo  
 Date : 17-Apr-12



Lam Geotechnics Limited

**Calibration Data for High Volume Sampler (TSP Sampler)**

Location : CMA2a Calibration Date : 15-Jun-12  
 Equipment no. : EL449 Calibration Due Date : 15-Aug-12

**CALIBRATION OF CONTINUOUS FLOW RECORDER**

Ambient Condition			
Temperature, T <sub>a</sub>	303	Kelvin	Pressure, P <sub>a</sub>
			1010 mmHg

Orifice Transfer Standard Information			
Equipment No.	EL086	Slope, m <sub>c</sub>	2.01593
		Intercept, b <sub>c</sub>	-0.03978
Last Calibration Date	11-Jul-11	$\left( H \times P_a / 1013.3 \times 298 / T_a \right)^{1/2}$ $= m_c \times Q_{std} + b_c$	
Next Calibration Date	11-Jul-12		

Calibration of RSP						
Calibration Point	Manometer Reading			Q <sub>std</sub> (m <sup>3</sup> / min.) X-axis	Continuous Flow Recorder, W (CFM)	IC (W(P <sub>a</sub> /1013.3x298/T <sub>a</sub> ) <sup>1/2</sup> /35.31) Y-axis
	(up)	(down)	(difference)			
1	6.2	6.2	12.4	1.7492	53	52.4752
2	5.1	5.1	10.2	1.5883	45	44.5544
3	4.0	4.0	8.0	1.4089	38	37.6237
4	2.5	2.5	5.0	1.1179	26	25.7426
5	1.6	1.6	3.2	0.8983	15	14.8515

By Linear Regression of Y on X

Slope, m = 43.2622 Intercept, b = -23.4638  
 Correlation Coefficient\* = 0.9991  
 Calibration Accepted = Yes/No\*\*

\* if Correlation Coefficient &lt; 0.990, check and recalibration again.

\*\* Delete as appropriate.

Remarks : \_\_\_\_\_

Calibrated by : Sam Lam Checked by : Derek Lo  
 Date : 15-Jun-12 Date : 15-Jun-12



Lam Geotechnics Limited

**Calibration Data for High Volume Sampler (TSP Sampler)**

Location : CMA1b  
 Equipment no. : EL452

Calibration Date : 17-Apr-12  
 Calibration Due Dat : 17-Jun-12

**CALIBRATION OF CONTINUOUS FLOW RECORDER**

Ambient Condition			
Temperature, T <sub>a</sub>	298	Kelvin	Pressure, P <sub>a</sub>
			1015 mmHg

Orifice Transfer Standard Information			
Equipment No.	EL086	Slope, m <sub>c</sub>	2.01593
		Intercept, b <sub>c</sub>	-0.03978
Last Calibration Date	11-Jul-11	$\left( H \times P_a / 1013.3 \times 298 / T_a \right)^{1/2}$ $= m_c \times Q_{std} + b_c$	
Next Calibration Date	11-Jul-12		

Calibration of RSP						
Calibration Point	Manometer Reading			Q <sub>std</sub> (m <sup>3</sup> / min.) X-axis	Continuous Flow Recorder, W (CFM)	IC (W(P <sub>a</sub> /1013.3x298/T <sub>a</sub> ) <sup>1/2</sup> /35.31) Y-axis
	(up)	(down)	(difference)			
1	6.0	6.0	12.0	1.7395	62	62.0520
2	5.0	5.0	10.0	1.5897	54	54.0453
3	3.9	3.9	7.8	1.4063	47	47.0394
4	2.5	2.5	5.0	1.1299	36	36.0302
5	1.5	1.5	3.0	0.8796	25	25.0210

By Linear Regression of Y on X

Slope, m = 42.1038      Intercept, b = -11.9605  
 Correlation Coefficient\* = 0.9990  
 Calibration Accepted = Yes/No\*\*

\* if Correlation Coefficient &lt; 0.990, check and recalibration again.

\*\* Delete as appropriate.

Remarks : \_\_\_\_\_

Calibrated by : Sam Lam  
 Date : 17-Apr-12

Checked by : Derek Lo  
 Date : 17-Apr-12



Lam Geotechnics Limited

**Calibration Data for High Volume Sampler (TSP Sampler)**

Location : CMA1b Calibration Date : 15-Jun-12  
 Equipment no. : EL452 Calibration Due Date : 15-Aug-12

**CALIBRATION OF CONTINUOUS FLOW RECORDER**

Ambient Condition			
Temperature, T <sub>a</sub>	303	Kelvin	Pressure, P <sub>a</sub>
			1010 mmHg

Orifice Transfer Standard Information			
Equipment No.	EL086	Slope, m <sub>c</sub>	2.01593
		Intercept, b <sub>c</sub>	-0.03978
Last Calibration Date	11-Jul-11	$\left( H \times P_a / 1013.3 \times 298 / T_a \right)^{1/2}$ $= m_c \times Q_{std} + b_c$	
Next Calibration Date	11-Jul-12		

Calibration of RSP						
Calibration Point	Manometer Reading			Q <sub>std</sub> (m <sup>3</sup> / min.) X-axis	Continuous Flow Recorder, W (CFM)	IC (W(P <sub>a</sub> /1013.3x298/T <sub>a</sub> ) <sup>1/2</sup> /35.31) Y-axis
	(up)	(down)	(difference)			
1	6.1	6.1	12.2	1.7352	62	61.3861
2	5.0	5.0	10.0	1.5728	54	53.4653
3	3.9	3.9	7.8	1.3914	45	44.5544
4	2.4	2.4	4.8	1.0958	35	34.6535
5	1.5	1.5	3.0	0.8704	26	25.7426

By Linear Regression of Y on X

Slope, m = 40.4856 Intercept, b = -10.0119  
 Correlation Coefficient\* = 0.9970  
 Calibration Accepted = Yes/No\*\*

\* if Correlation Coefficient &lt; 0.990, check and recalibration again.

\*\* Delete as appropriate.

Remarks : \_\_\_\_\_

Calibrated by : Sam Lam Checked by : Derek Lo  
 Date : 15-Jun-12 Date : 15-Jun-12



# Calibration Certificate

Certificate No. **20138**

Page 1 of 2 Pages

**Customer :** Lam Geotechnics Limited

**Address :** 11/F., Centre Point, 181-185 Gloucester Road, Wanchai, Hong Kong

**Order No. :** Q13147

**Date of receipt :** 10-Jan-12

## Item Tested

**Description :** Sound Level Calibrator (EL469)

**Manufacturer :** ACO

**Model :** --

**Serial No. :** 050213

## Test Conditions

**Date of Test :** 11-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:** 11-Jan-12

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

Certificate No. 20138

Page 2 of 2 Pages

Results :

## 1. Level

UUT Nominal Value (dB)	Measured Value (dB)	IEC 942 Class 1 Spec.
94	94.20	± 0.3 dB

The above measured values are the mean of 3 measurements.

Uncertainty : ± 0.1 dB

## 2. Frequency

UUT Nominal Value	Measured Value	IEC 942 Class 1 Spec.
1 kHz	0.984 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 : < 2.8 %

IEC 942 Class 1 Spec. : < 3 %

Uncertainty : ± 2.3 % of reading

Remark : 1. UUT : Unit-Under-Test

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

3. Atmospheric Pressure : 1 020 hPa.

----- END -----