



# Certificate of Calibration

Calibration Certification Information			
Cal. Date: January 11, 2019	Rootsmeter S/N: 438320	Ta: 293	°K
Operator: Jim Tisch		Pa: 760.7	mm Hg
Calibration Model #: TE-5025A	Calibrator S/N: 0005		

Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H2O)
1	1	2	1	1.4090	3.2	2.00
2	3	4	1	0.9980	6.4	4.00
3	5	6	1	0.8900	7.8	5.00
4	7	8	1	0.8450	8.7	5.50
5	9	10	1	0.6990	12.6	8.00

Data Tabulation					
Vstd (m3)	Qstd (x-axis)	$\sqrt{\Delta H \left( \frac{Pa}{Pstd} \right) \left( \frac{Tstd}{Ta} \right)}$ (y-axis)	Va	Qa (x-axis)	$\sqrt{\Delta H \left( \frac{Ta}{Pa} \right)}$ (y-axis)
1.0138	0.7195	1.4269	0.9958	0.7067	0.8777
1.0095	1.0115	2.0180	0.9916	0.9936	1.2412
1.0076	1.1321	2.2561	0.9897	1.1121	1.3877
1.0064	1.1910	2.3663	0.9886	1.1699	1.4555
1.0012	1.4323	2.8538	0.9834	1.4069	1.7553
<b>QSTD</b>	m=	<b>1.99861</b>	<b>QA</b>	m=	<b>1.25149</b>
	b=	<b>-0.00882</b>		b=	<b>-0.00543</b>
	r=	<b>0.99997</b>		r=	<b>0.99997</b>

Calculations			
$Vstd = \Delta Vol \left( \frac{Pa - \Delta P}{Pstd} \right) \left( \frac{Tstd}{Ta} \right)$	$Va = \Delta Vol \left( \frac{Pa - \Delta P}{Pa} \right)$		
$Qstd = Vstd / \Delta Time$	$Qa = Va / \Delta Time$		
For subsequent flow rate calculations:			
$Qstd = 1/m \left( \left( \sqrt{\Delta H \left( \frac{Pa}{Pstd} \right) \left( \frac{Tstd}{Ta} \right)} \right) - b \right)$		$Qa = 1/m \left( \left( \sqrt{\Delta H \left( \frac{Ta}{Pa} \right)} \right) - b \right)$	

Standard Conditions	
Tstd:	298.15 °K
Pstd:	760 mm Hg
Key	
ΔH: calibrator manometer reading (in H2O)	
ΔP: rootsmeter manometer reading (mm Hg)	
Ta: actual absolute temperature (°K)	
Pa: actual barometric pressure (mm Hg)	
b: intercept	
m: slope	

RECALIBRATION
US EPA recommends annual recalibration per 1998 40 Code of Federal Regulations Part 50 to 51, Appendix B to Part 50, Reference Method for the Determination of Suspended Particulate Matter in the Atmosphere, 9.2.17, page 30



Lam Environmental Services Limited

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

Location : CMA1b  
 Equipment no. : HVS001

Calibration Date : 10-Dec-19  
 Calibration Due Date : 9-Feb-20

**CALIBRATION OF CONTINUOUS FLOW RECORDER**

Ambient Condition			
Temperature, T <sub>a</sub>	291	Kelvin	Pressure, P <sub>a</sub>
			1019 mmHg

Orifice Transfer Standard Information					
Equipment No.	0005	Slope, m <sub>c</sub>	1.99861	Intercept, b <sub>c</sub>	-0.00882
Last Calibration Date	11-Jan-19	$(H \times P_a / 1013.3 \times 298 / T_a)^{1/2}$ $= m_c \times Q_{std} + b_c$			
Next Calibration Date	11-Jan-20				

Calibration of TSP						
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	1.9	1.9	3.8	0.9942	24	24.3552
2	2.4	2.4	4.8	1.1168	31	31.4587
3	3.1	3.1	6.2	1.2687	36	36.5327
4	4.4	4.4	8.8	1.5106	48	48.7103
5	5.0	5.0	10.0	1.6101	54	54.7991

By Linear Regression of Y on X

Slope, m = 47.9646      Intercept, b = -23.1872  
 Correlation Coefficient\* = 0.9973  
 Calibration Accepted = Yes/No\*\*

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

\*\* Delete as appropriate.

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

Calibrated by : Laurance Yung  
 Date : 10-Dec-19

Checked by : James Chu  
 Date : 10-Dec-19



Lam Environmental Services Limited

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

Location : CMA2a  
 Equipment no. : HVS002

Calibration Date : 10-Dec-19  
 Calibration Due Date : 9-Feb-20

**CALIBRATION OF CONTINUOUS FLOW RECORDER**

Ambient Condition			
Temperature, T <sub>a</sub>	291	Kelvin	Pressure, P <sub>a</sub>
			1019 mmHg

Orifice Transfer Standard Information					
Equipment No.	0005	Slope, m <sub>c</sub>	1.99861	Intercept, b <sub>c</sub>	-0.00882
Last Calibration Date	11-Jan-19	$(H \times P_a / 1013.3 \times 298 / T_a)^{1/2}$ $= m_c \times Q_{std} + b_c$			
Next Calibration Date	11-Jan-20				

Calibration of TSP						
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	2.3	2.3	4.6	1.0934	28	28.4144
2	2.7	2.7	5.4	1.1843	34	34.5031
3	3.6	3.6	7.2	1.3669	40	40.5919
4	4.2	4.2	8.4	1.4760	46	46.6807
5	4.9	4.9	9.8	1.5939	51	51.7547

By Linear Regression of Y on X

Slope, m = 45.1480      Intercept, b = -20.2407  
 Correlation Coefficient\* = 0.9957  
 Calibration Accepted = Yes/No\*\*

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

\*\* Delete as appropriate.

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

Calibrated by : Laurance Yung  
 Date : 10-Dec-19

Checked by : James Chu  
 Date : 10-Dec-19



Lam Environmental Services Limited

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

Location : CMA3a  
 Equipment no. : HVS012

Calibration Date : 10-Dec-19  
 Calibration Due Date : 9-Feb-20

**CALIBRATION OF CONTINUOUS FLOW RECORDER**

Ambient Condition			
Temperature, T <sub>a</sub>	291	Kelvin	Pressure, P <sub>a</sub>
			1019 mmHg

Orifice Transfer Standard Information					
Equipment No.	0005	Slope, m <sub>c</sub>	1.99861	Intercept, b <sub>c</sub>	-0.00882
Last Calibration Date	11-Jan-19	$(H \times P_a / 1013.3 \times 298 / T_a)^{1/2}$ $= m_c \times Q_{std} + b_c$			
Next Calibration Date	11-Jan-20				

Calibration of TSP						
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	1.6	1.6	3.2	0.9127	27	27.3996
2	2.4	2.4	4.8	1.1168	34	34.5031
3	3.3	3.3	6.6	1.3089	38	38.5623
4	3.8	3.8	7.6	1.4042	43	43.6363
5	4.5	4.5	9.0	1.5277	48	48.7103

By Linear Regression of Y on X

Slope, m = 33.5341      Intercept, b = -3.4912  
 Correlation Coefficient\* = 0.9913  
 Calibration Accepted = Yes/No\*\*

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

\*\* Delete as appropriate.

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

Calibrated by : Laurance Yung  
 Date : 10-Dec-19

Checked by : James Chu  
 Date : 10-Dec-19



Lam Environmental Services Limited

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

Location : CMA4a  
 Equipment no. : HVS004

Calibration Date : 10-Dec-19  
 Calibration Due Date : 9-Feb-20

**CALIBRATION OF CONTINUOUS FLOW RECORDER**

Ambient Condition			
Temperature, T <sub>a</sub>	291	Kelvin	Pressure, P <sub>a</sub>
			1019 mmHg

Orifice Transfer Standard Information					
Equipment No.	0005	Slope, m <sub>c</sub>	1.99861	Intercept, b <sub>c</sub>	-0.00882
Last Calibration Date	11-Jan-19	$\left( H \times P_a / 1013.3 \times 298 / T_a \right)^{1/2}$ $= m_c \times Q_{std} + b_c$			
Next Calibration Date	11-Jan-20				

Calibration of TSP						
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	2.1	2.1	4.2	1.0450	25	25.3700
2	2.6	2.6	5.2	1.1623	31	31.4587
3	3.2	3.2	6.4	1.2889	36	36.5327
4	3.7	3.7	7.4	1.3856	40	40.5919
5	4.3	4.3	8.6	1.4934	46	46.6807

By Linear Regression of Y on X

Slope, m = 46.1620      Intercept, b = -22.7324  
 Correlation Coefficient\* = 0.9981  
 Calibration Accepted = Yes/No\*\*

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

\*\* Delete as appropriate.

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

Calibrated by : Laurance Yung  
 Date : 10-Dec-19

Checked by : James Chu  
 Date : 10-Dec-19



Lam Environmental Services Limited

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

Location : CMA5b  
 Equipment no. : HVS010

Calibration Date : 10-Dec-19  
 Calibration Due Date : 9-Feb-20

**CALIBRATION OF CONTINUOUS FLOW RECORDER**

Ambient Condition			
Temperature, T <sub>a</sub>	291	Kelvin	Pressure, P <sub>a</sub>
			1019 mmHg

Orifice Transfer Standard Information					
Equipment No.	0005	Slope, m <sub>c</sub>	1.99861	Intercept, b <sub>c</sub>	-0.00882
Last Calibration Date	11-Jan-19	$\left( H \times P_a / 1013.3 \times 298 / T_a \right)^{1/2}$ $= m_c \times Q_{std} + b_c$			
Next Calibration Date	11-Jan-20				

Calibration of TSP						
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	1.7	1.7	3.4	0.9407	27	27.3996
2	2.3	2.3	4.6	1.0934	35	35.5179
3	3.0	3.0	6.0	1.2481	39	39.5771
4	3.6	3.6	7.2	1.3669	44	44.6511
5	4.1	4.1	8.2	1.4584	49	49.7251

By Linear Regression of Y on X

Slope, m = 40.8780      Intercept, b = -10.5581  
 Correlation Coefficient\* = 0.9935  
 Calibration Accepted = Yes/No\*\*

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

\*\* Delete as appropriate.

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

Calibrated by : Laurance Yung  
 Date : 10-Dec-19

Checked by : James Chu  
 Date : 10-Dec-19



Lam Environmental Services Limited

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

Location : MA1e Calibration Date : 10-Dec-19  
 Equipment no. : HVS007 Calibration Due Date : 9-Feb-20

**CALIBRATION OF CONTINUOUS FLOW RECORDER**

Ambient Condition			
Temperature, T <sub>a</sub>	291	Kelvin	Pressure, P <sub>a</sub>
			1019 mmHg

Orifice Transfer Standard Information					
Equipment No.	0005	Slope, m <sub>c</sub>	1.99861	Intercept, b <sub>c</sub>	-0.00882
Last Calibration Date	11-Jan-19	$(H \times P_a / 1013.3 \times 298 / T_a)^{1/2}$ $= m_c \times Q_{std} + b_c$			
Next Calibration Date	11-Jan-20				

Calibration of TSP						
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	1.8	1.8	3.6	0.9678	23	23.3404
2	2.6	2.6	5.2	1.1623	31	31.4587
3	3.2	3.2	6.4	1.2889	39	39.5771
4	3.8	3.8	7.6	1.4042	46	46.6807
5	4.4	4.4	8.8	1.5106	51	51.7547

By Linear Regression of Y on X

Slope, m = 53.8569 Intercept, b = -29.6619  
 Correlation Coefficient\* = 0.9966  
 Calibration Accepted = Yes/No\*\*

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

\*\* Delete as appropriate.

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

Calibrated by : Laurance Yung Checked by : James Chu  
 Date : 10-Dec-19 Date : 10-Dec-19



Lam Environmental Services Limited

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

Location : MA1w  
 Equipment no. : HVS008

Calibration Date : 10-Dec-19  
 Calibration Due Date : 9-Feb-20

**CALIBRATION OF CONTINUOUS FLOW RECORDER**

Ambient Condition			
Temperature, T <sub>a</sub>	291	Kelvin	Pressure, P <sub>a</sub>
			1019 mmHg

Orifice Transfer Standard Information					
Equipment No.	0005	Slope, m <sub>c</sub>	1.99861	Intercept, b <sub>c</sub>	-0.00882
Last Calibration Date	11-Jan-19	$(H \times P_a / 1013.3 \times 298 / T_a)^{1/2}$ $= m_c \times Q_{std} + b_c$			
Next Calibration Date	11-Jan-20				

Calibration of TSP						
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	1.5	1.5	3.0	0.8839	25	25.3700
2	2.1	2.1	4.2	1.0450	34	34.5031
3	2.8	2.8	5.6	1.2060	42	42.6215
4	3.6	3.6	7.2	1.3669	49	49.7251
5	4.3	4.3	8.6	1.4934	54	54.7991

By Linear Regression of Y on X

Slope, m = 48.1833      Intercept, b = -16.3691  
 Correlation Coefficient\* = 0.9978  
 Calibration Accepted = Yes/No\*\*

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

\*\* Delete as appropriate.

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

Calibrated by : Laurance Yung  
 Date : 10-Dec-19

Checked by : James Chu  
 Date : 10-Dec-19





## CERTIFICATE OF CALIBRATION

Certificate No.: 19CA0222 02 Page 1 of 2

### Item tested

Description:	Sound Level Meter (Type 1)	Microphone	Preamp
Manufacturer:	B & K	B & K	B & K
Type/Model No.:	2250	4950	ZC0032
Serial/Equipment No.:	2701778	2755097	19223
Adaptors used:	-	-	-

### Item submitted by

Customer Name:	Lam Geotechnics Limited.
Address of Customer:	-
Request No.:	-
Date of receipt:	22-Feb-2019

Date of test: 25-Feb-2019

### Reference equipment used in the calibration

Description:	Model:	Serial No.	Expiry Date:	Traceable to:
Multi function sound calibrator	B&K 4226	2288444	23-Aug-2019	CIGISMEC
Signal generator	DS 360	33873	24-Apr-2019	CEPREI
Signal generator	DS 360	61227	26-Dec-2019	CEPREI

### Ambient conditions

Temperature:	21 ± 1 °C
Relative humidity:	55 ± 10 %
Air pressure:	1005 ± 5 hPa

### Test specifications

- 1, The Sound Level Meter has been calibrated in accordance with the requirements as specified in BS 7580: Part 1: 1997 and the lab calibration procedure SMTP004-CA-152.
- 2, The electrical tests were performed using an electrical signal substituted for the microphone which was removed and replaced by an equivalent capacitance within a tolerance of ±20%.
- 3, The acoustic calibration was performed using an B&K 4226 sound calibrator and corrections was applied for the difference between the free-field and pressure responsiveness of the Sound Level Meter.

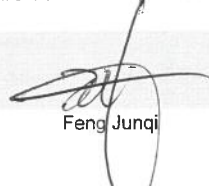
### Test results

This is to certify that the Sound Level Meter conforms to BS 7580: Part 1: 1997 for the conditions under which the test was performed.

Details of the performed measurements are presented on page 2 of this certificate.

Actual Measurement data are documented on worksheets.

Approved Signatory:



Feng Junqi

Date: 26-Feb-2019

Company Chop:



Comments: The results reported in this certificate refer to the condition of the instrument on the date of calibration and carry no implication regarding the long-term stability of the instrument.



## CERTIFICATE OF CALIBRATION

(Continuation Page)

Certificate No.: 19CA0222 02 Page 2 of 2

### 1, Electrical Tests

The electrical tests were performed using an equivalent capacitance substituted for the microphone. The results are given in below with test status and the estimated uncertainties. The "Pass" means the result of the test is inside the tolerances stated in the test specifications. The "-" means the result of test is outside these tolerances.

Test:	Subtest:	Status:	Expanded Uncertainty (dB)	Coverage Factor
Self-generated noise	A	Pass	0.3	
	C	Pass	0.8	
	Lin	Pass	1.6	
Linearity range for Leq	At reference range, Step 5 dB at 4 kHz	Pass	0.3	
	Reference SPL on all other ranges	Pass	0.3	
	2 dB below upper limit of each range	Pass	0.3	
	2 dB above lower limit of each range	Pass	0.3	
Linearity range for SPL	At reference range, Step 5 dB at 4 kHz	Pass	0.3	
	A	Pass	0.3	
	C	Pass	0.3	
Frequency weightings	Lin	Pass	0.3	
	Time weightings	Single Burst Fast	Pass	0.3
	Single Burst Slow	Pass	0.3	
Peak response	Single 100µs rectangular pulse	Pass	0.3	
	R.M.S. accuracy	Crest factor of 3	Pass	0.3
Time weighting I	Single burst 5 ms at 2000 Hz	Pass	0.3	
	Repeated at frequency of 100 Hz	Pass	0.3	
Time averaging	1 ms burst duty factor 1/10 <sup>3</sup> at 4kHz	Pass	0.3	
	1 ms burst duty factor 1/10 <sup>4</sup> at 4kHz	Pass	0.3	
Pulse range	Single burst 10 ms at 4 kHz	Pass	0.4	
Sound exposure level	Single burst 10 ms at 4 kHz	Pass	0.4	
Overload indication	SPL	Pass	0.3	
	Leq	Pass	0.4	

### 2, Acoustic tests

The complete sound level meter was calibrated on the reference range using a B&K 4226 acoustic calibrator with 1000Hz and SPL 94 dB. The sensitivity of the sound level meter was adjusted. The test result at 125 Hz and 8000 Hz are given in below with test status and the estimated uncertainties.

Test:	Subtest	Status	Expanded Uncertainty (dB)	Coverage Factor
Acoustic response	Weighting A at 125 Hz	Pass	0.3	
	Weighting A at 8000 Hz	Pass	0.5	

### 3, Response to associated sound calibrator

N/A

The expanded uncertainties have been calculated in accordance with the ISO Publication "Guide to the expression of uncertainty in measurement", and gives an interval estimated to have a level of confidence of 95%. A coverage factor of 2 is assumed unless explicitly stated.

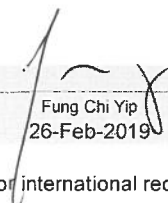
- End -

Calibrated by:

  
Fong Chun Wai

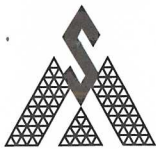
Date: 25-Feb-2019

Checked by:

  
Fung Chi Yip

Date: 26-Feb-2019

The standard(s) and equipment used in the calibration are traceable to national or international recognised standards and are calibrated on a schedule to maintain the required accuracy level.



## CERTIFICATE OF CALIBRATION

Certificate No.: 19CA0905 02 Page 1 of 2

### Item tested

Description:	Sound Level Meter (Type 1)	Microphone	Preamp
Manufacturer:	B & K	B & K	B & K
Type/Model No.:	2250-L	4950	ZC0032
Serial/Equipment No.:	3006790	2827240	21213
Adaptors used:	-	-	-

### Item submitted by

Customer Name: Lam Geotechnics Limited  
Address of Customer: -  
Request No.: -  
Date of receipt: 05-Sep-2019

Date of test: 06-Sep-2019

### Reference equipment used in the calibration

Description:	Model:	Serial No.	Expiry Date:	Traceable to:
Multi function sound calibrator	B&K 4226	2288444	23-Aug-2020	CIGISMEC
Signal generator	DS 360	61227	26-Dec-2019	CEPREI

### Ambient conditions

Temperature:  $21 \pm 1$  °C  
Relative humidity:  $55 \pm 10$  %  
Air pressure:  $1000 \pm 5$  hPa

### Test specifications

- 1, The Sound Level Meter has been calibrated in accordance with the requirements as specified in BS 7580: Part 1: 1997 and the lab calibration procedure SMTP004-CA-152.
- 2, The electrical tests were performed using an electrical signal substituted for the microphone which was removed and replaced by an equivalent capacitance within a tolerance of  $\pm 20\%$ .
- 3, The acoustic calibration was performed using an B&K 4226 sound calibrator and corrections was applied for the difference between the free-field and pressure response of the Sound Level Meter.

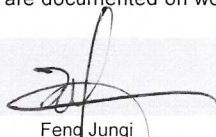
### Test results

This is to certify that the Sound Level Meter conforms to BS 7580: Part 1: 1997 for the conditions under which the test was performed.

Details of the performed measurements are presented on page 2 of this certificate.

Actual Measurement data are documented on worksheets.

Approved Signatory:



Feng Junqi

Date: 06-Sep-2019

Company Chop:



Comments: The results reported in this certificate refer to the condition of the instrument on the date of calibration and carry no implication regarding the long-term stability of the instrument.



## CERTIFICATE OF CALIBRATION

(Continuation Page)

Certificate No.: 19CA0905 02 Page 2 of 2

### 1, Electrical Tests

The electrical tests were performed using an equivalent capacitance substituted for the microphone. The results are given in below with test status and the estimated uncertainties. The "Pass" means the result of the test is inside the tolerances stated in the test specifications. The "-" means the result of test is outside these tolerances.

Test:	Subtest:	Status:	Expanded Uncertainty (dB)	Coverage Factor
Self-generated noise	A	Pass	0.3	
	C	Pass	0.8	
	Lin	Pass	1.6	
Linearity range for Leq	At reference range, Step 5 dB at 4 kHz	Pass	0.3	
	Reference SPL on all other ranges	Pass	0.3	
	2 dB below upper limit of each range	Pass	0.3	
	2 dB above lower limit of each range	Pass	0.3	
Linearity range for SPL	At reference range, Step 5 dB at 4 kHz	Pass	0.3	
	A	Pass	0.3	
	C	Pass	0.3	
Frequency weightings	Lin	Pass	0.3	
	Single Burst Fast	Pass	0.3	
	Single Burst Slow	Pass	0.3	
Peak response	Single 100µs rectangular pulse	Pass	0.3	
	R.M.S. accuracy	Crest factor of 3	Pass	0.3
Time weighting I	Single burst 5 ms at 2000 Hz	Pass	0.3	
	Repeated at frequency of 100 Hz	Pass	0.3	
Time averaging	1 ms burst duty factor 1/10 <sup>3</sup> at 4kHz	Pass	0.3	
	1 ms burst duty factor 1/10 <sup>4</sup> at 4kHz	Pass	0.3	
Pulse range	Single burst 10 ms at 4 kHz	Pass	0.4	
Sound exposure level	Single burst 10 ms at 4 kHz	Pass	0.4	
Overload indication	SPL	Pass	0.3	
	Leq	Pass	0.4	

### 2, Acoustic tests

The complete sound level meter was calibrated on the reference range using a B&K 4226 acoustic calibrator with 1000Hz and SPL 94 dB. The sensitivity of the sound level meter was adjusted. The test result at 125 Hz and 8000 Hz are given in below with test status and the estimated uncertainties.

Test:	Subtest	Status	Expanded Uncertainty (dB)	Coverage Factor
Acoustic response	Weighting A at 125 Hz	Pass	0.3	
	Weighting A at 8000 Hz	Pass	0.5	

### 3, Response to associated sound calibrator

N/A

The expanded uncertainties have been calculated in accordance with the ISO Publication "Guide to the expression of uncertainty in measurement", and gives an interval estimated to have a level of confidence of 95%. A coverage factor of 2 is assumed unless explicitly stated.

- End -

Calibrated by:

Date:

Fung Chi Yip  
06-Sep-2019

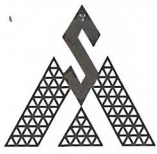
Checked by:

Date:

Shek Kwong Tat  
06-Sep-2019

The standard(s) and equipment used in the calibration are traceable to national or international recognised standards and are calibrated on a schedule to maintain the required accuracy level.





## CERTIFICATE OF CALIBRATION

Certificate No.: 19CA0329 02 Page 1 of 2

### Item tested

Description:	Sound Level Meter (Type 1)	Microphone	Preamp
Manufacturer:	B & K	B & K	B & K
Type/Model No.:	2250-L	4950	ZC0032
Serial/Equipment No.:	2722310	2698702	13318
Adaptors used:	-	-	-

### Item submitted by

Customer Name: Lam Geotechnics Ltd.  
Address of Customer: -  
Request No.: -  
Date of receipt: 29-Mar-2019

Date of test: 02-Apr-2019

### Reference equipment used in the calibration

Description:	Model:	Serial No.	Expiry Date:	Traceable to:
Multi function sound calibrator	B&K 4226	2288444	23-Aug-2019	CIGISMEC
Signal generator	DS 360	33873	24-Apr-2019	CEPREI
Signal generator	DS 360	61227	26-Dec-2019	CEPREI

### Ambient conditions

Temperature:  $21 \pm 1$  °C  
Relative humidity:  $55 \pm 10$  %  
Air pressure:  $1005 \pm 5$  hPa

### Test specifications

- 1, The Sound Level Meter has been calibrated in accordance with the requirements as specified in BS 7580: Part 1: 1997 and the lab calibration procedure SMTPO04-CA-152.
- 2, The electrical tests were performed using an electrical signal substituted for the microphone which was removed and replaced by an equivalent capacitance within a tolerance of  $\pm 20\%$ .
- 3, The acoustic calibration was performed using an B&K 4226 sound calibrator and corrections was applied for the difference between the free-field and pressure responses of the Sound Level Meter.

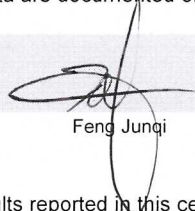
### Test results

This is to certify that the Sound Level Meter conforms to BS 7580: Part 1: 1997 for the conditions under which the test was performed.

Details of the performed measurements are presented on page 2 of this certificate.

Actual Measurement data are documented on worksheets.

Approved Signatory:



Feng Junqi

Date: 02-Apr-2019

Company Chop:



**Comments:** The results reported in this certificate refer to the condition of the instrument on the date of calibration and carry no implication regarding the long-term stability of the instrument.



## CERTIFICATE OF CALIBRATION

(Continuation Page)

Certificate No.: 19CA0329 02 Page 2 of 2

### 1, Electrical Tests

The electrical tests were performed using an equivalent capacitance substituted for the microphone. The results are given in below with test status and the estimated uncertainties. The "Pass" means the result of the test is inside the tolerances stated in the test specifications. The "-" means the result of test is outside these tolerances.

Test:	Subtest:	Status:	Expanded Uncertainty (dB)	Coverage Factor
Self-generated noise	A	Pass	0.3	
	C	Pass	0.8	
	Lin	Pass	1.6	
Linearity range for Leq	At reference range, Step 5 dB at 4 kHz	Pass	0.3	
	Reference SPL on all other ranges	Pass	0.3	
	2 dB below upper limit of each range	Pass	0.3	
	2 dB above lower limit of each range	Pass	0.3	
Linearity range for SPL	At reference range, Step 5 dB at 4 kHz	Pass	0.3	
	Frequency weightings	A	Pass	0.3
Time weightings	C	Pass	0.3	
	Lin	Pass	0.3	
	Single Burst Fast	Pass	0.3	
Peak response	Single Burst Slow	Pass	0.3	
	Single 100µs rectangular pulse	Pass	0.3	
R.M.S. accuracy	Crest factor of 3	Pass	0.3	
	Time weighting I	Single burst 5 ms at 2000 Hz	Pass	0.3
Time averaging	Repeated at frequency of 100 Hz	Pass	0.3	
	1 ms burst duty factor 1/10 <sup>3</sup> at 4kHz	Pass	0.3	
	1 ms burst duty factor 1/10 <sup>4</sup> at 4kHz	Pass	0.3	
Pulse range	Single burst 10 ms at 4 kHz	Pass	0.4	
	Sound exposure level	Single burst 10 ms at 4 kHz	Pass	0.4
Overload indication	SPL	Pass	0.3	
	Leq	Pass	0.4	

### 2, Acoustic tests

The complete sound level meter was calibrated on the reference range using a B&K 4226 acoustic calibrator with 1000Hz and SPL 94 dB. The sensitivity of the sound level meter was adjusted. The test result at 125 Hz and 8000 Hz are given in below with test status and the estimated uncertainties.

Test:	Subtest	Status	Expanded Uncertainty (dB)	Coverage Factor
Acoustic response	Weighting A at 125 Hz	Pass	0.3	
	Weighting A at 8000 Hz	Pass	0.5	

### 3, Response to associated sound calibrator

N/A

The expanded uncertainties have been calculated in accordance with the ISO Publication "Guide to the expression of uncertainty in measurement", and gives an interval estimated to have a level of confidence of 95%. A coverage factor of 2 is assumed unless explicitly stated.

- End -

Calibrated by:

Date: 02-Apr-2019

Checked by:

Date: 02-Apr-2019

The standard(s) and equipment used in the calibration are traceable to national or international recognised standards and are calibrated on a schedule to maintain the required accuracy level.



## CERTIFICATE OF CALIBRATION

Certificate No.: 19CA0425 02 Page 1 of 2

### Item tested

Description:	Sound Level Meter (Type 1)	Microphone	Preamp
Manufacturer:	B & K	B & K	B & K
Type/Model No.:	2250-L	4950	ZC0032
Serial/Equipment No.:	2722311	2698703	13321
Adaptors used:	-	-	-

### Item submitted by

Customer Name: Lam Geotechnics Ltd.  
Address of Customer: -  
Request No.: -  
Date of receipt: 25-Apr-2019

Date of test: 02-May-2019

### Reference equipment used in the calibration

Description:	Model:	Serial No.	Expiry Date:	Traceable to:
Multi function sound calibrator	B&K 4226	2288444	23-Aug-2019	CIGISMEC
Signal generator	DS 360	61227	26-Dec-2019	CEPREI

### Ambient conditions

Temperature:  $22 \pm 1$  °C  
Relative humidity:  $55 \pm 10$  %  
Air pressure:  $1005 \pm 5$  hPa

### Test specifications

- 1, The Sound Level Meter has been calibrated in accordance with the requirements as specified in BS 7580: Part 1: 1997 and the lab calibration procedure SMTP004-CA-152.
- 2, The electrical tests were performed using an electrical signal substituted for the microphone which was removed and replaced by an equivalent capacitance within a tolerance of  $\pm 20\%$ .
- 3, The acoustic calibration was performed using an B&K 4226 sound calibrator and corrections was applied for the difference between the free-field and pressure responsiveness of the Sound Level Meter.

### Test results

This is to certify that the Sound Level Meter conforms to BS 7580: Part 1: 1997 for the conditions under which the test was performed.

Details of the performed measurements are presented on page 2 of this certificate.

Actual Measurement data are documented on worksheets.

Approved Signatory:



Feng Junqi

Date: 03-May-2019

Company Chop:



Comments: The results reported in this certificate refer to the condition of the instrument on the date of calibration and carry no implication regarding the long-term stability of the instrument.



## CERTIFICATE OF CALIBRATION

(Continuation Page)

Certificate No.: 19CA0425 02 Page 2 of 2

### 1, Electrical Tests

The electrical tests were performed using an equivalent capacitance substituted for the microphone. The results are given in below with test status and the estimated uncertainties. The "Pass" means the result of the test is inside the tolerances stated in the test specifications. The "-" means the result of test is outside these tolerances.

Test:	Subtest:	Status:	Expanded Uncertainty (dB)	Coverage Factor
Self-generated noise	A	Pass	0.3	
	C	Pass	0.8	
	Lin	Pass	1.6	
Linearity range for Leq	At reference range, Step 5 dB at 4 kHz	Pass	0.3	
	Reference SPL on all other ranges	Pass	0.3	
	2 dB below upper limit of each range	Pass	0.3	
	2 dB above lower limit of each range	Pass	0.3	
Linearity range for SPL	At reference range, Step 5 dB at 4 kHz	Pass	0.3	
	Frequency weightings			
Time weightings	A	Pass	0.3	
	C	Pass	0.3	
	Lin	Pass	0.3	
Peak response	Single Burst Fast	Pass	0.3	
	Single Burst Slow	Pass	0.3	
R.M.S. accuracy	Single 100µs rectangular pulse	Pass	0.3	
	Crest factor of 3	Pass	0.3	
Time weighting I	Single burst 5 ms at 2000 Hz	Pass	0.3	
	Repeated at frequency of 100 Hz	Pass	0.3	
Time averaging	1 ms burst duty factor 1/10 <sup>3</sup> at 4kHz	Pass	0.3	
	1 ms burst duty factor 1/10 <sup>4</sup> at 4kHz	Pass	0.3	
Pulse range	Single burst 10 ms at 4 kHz	Pass	0.4	
Sound exposure level	Single burst 10 ms at 4 kHz	Pass	0.4	
Overload indication	SPL	Pass	0.3	
	Leq	Pass	0.4	

### 2, Acoustic tests

The complete sound level meter was calibrated on the reference range using a B&K 4226 acoustic calibrator with 1000Hz and SPL 94 dB. The sensitivity of the sound level meter was adjusted. The test result at 125 Hz and 8000 Hz are given in below with test status and the estimated uncertainties.

Test:	Subtest	Status	Expanded Uncertainty (dB)	Coverage Factor
Acoustic response	Weighting A at 125 Hz	Pass	0.3	
	Weighting A at 8000 Hz	Pass	0.5	

### 3, Response to associated sound calibrator

N/A

The expanded uncertainties have been calculated in accordance with the ISO Publication "Guide to the expression of uncertainty in measurement", and gives an interval estimated to have a level of confidence of 95%. A coverage factor of 2 is assumed unless explicitly stated.

- End -

Calibrated by:

Date: 02-May-2019

Fung Chi Yip

Checked by:

Date: 03-May-2019

Shek Kwong Tat

The standard(s) and equipment used in the calibration are traceable to national or international recognised standards and are calibrated on a schedule to maintain the required accuracy level.





## CERTIFICATE OF CALIBRATION

Certificate No.: 19CA0314 01 Page 1 of 2

### Item tested

Description:	Sound Level Meter (Type 1)	,	Microphone
Manufacturer:	Larson Davis	,	PCB
Type/Model No.:	LxT1	,	377B02
Serial/Equipment No.:	0003737	,	171529
Adaptors used:	-	,	-

### Item submitted by

Customer Name: Lam Geotechnics Ltd.  
Address of Customer: -  
Request No.: -  
Date of receipt: 14-Mar-2019

Date of test: 18-Mar-2019

### Reference equipment used in the calibration

Description:	Model:	Serial No.	Expiry Date:	Traceable to:
Multi function sound calibrator	B&K 4226	2288444	23-Aug-2019	CIGISMEC
Signal generator	DS 360	61227	26-Dec-2019	CEPREI

### Ambient conditions

Temperature:  $21 \pm 1$  °C  
Relative humidity:  $55 \pm 10$  %  
Air pressure:  $1005 \pm 5$  hPa

### Test specifications

- 1, The Sound Level Meter has been calibrated in accordance with the requirements as specified in BS 7580: Part 1: 1997 and the lab calibration procedure SMTP004-CA-152.
- 2, The electrical tests were performed using an electrical signal substituted for the microphone which was removed and replaced by an equivalent capacitance within a tolerance of  $\pm 20\%$ .
- 3, The acoustic calibration was performed using an B&K 4226 sound calibrator and corrections was applied for the difference between the free-field and pressure responses of the Sound Level Meter.

### Test results

This is to certify that the Sound Level Meter conforms to BS 7580: Part 1: 1997 for the conditions under which the test was performed.

Details of the performed measurements are presented on page 2 of this certificate.

Actual Measurement data are documented on worksheets.

Approved Signatory:

Feng Junqi

Date: 19-Mar-2019

Company Chop:



Comments: The results reported in this certificate refer to the condition of the instrument on the date of calibration and carry no implication regarding the long-term stability of the instrument.



## CERTIFICATE OF CALIBRATION

(Continuation Page)

Certificate No.: 19CA0314 01 Page 2 of 2

### 1, Electrical Tests

The electrical tests were performed using an equivalent capacitance substituted for the microphone. The results are given in below with test status and the estimated uncertainties. The "Pass" means the result of the test is inside the tolerances stated in the test specifications. The "-" means the result of test is outside these tolerances.

Test:	Subtest:	Status:	Expanded Uncertainty (dB)	Coverage Factor
Self-generated noise	A	Pass	0.3	
	C	Pass	0.8	2.1
	Lin	Pass	1.6	2.2
Linearity range for Leq	At reference range , Step 5 dB at 4 kHz	Pass	0.3	
	Reference SPL on all other ranges	Pass	0.3	
	2 dB below upper limit of each range	Pass	0.3	
	2 dB above lower limit of each range	Pass	0.3	
Linearity range for SPL	At reference range , Step 5 dB at 4 kHz	Pass	0.3	
	A	Pass	0.3	
	C	Pass	0.3	
Frequency weightings	Lin	Pass	0.3	
	Time weightings	Single Burst Fast	Pass	0.3
	Single Burst Slow	Pass	0.3	
Peak response	Single 100µs rectangular pulse	N/A	N/A	
	R.M.S. accuracy	Crest factor of 3	Pass	0.3
Time weighting I	Single burst 5 ms at 2000 Hz	Pass	0.3	
	Repeated at frequency of 100 Hz	Pass	0.3	
Time averaging	1 ms burst duty factor 1/10 <sup>3</sup> at 4kHz	Pass	0.3	
	1 ms burst duty factor 1/10 <sup>4</sup> at 4kHz	Pass	0.3	
Pulse range	Single burst 10 ms at 4 kHz	Pass	0.4	
	Sound exposure level	Single burst 10 ms at 4 kHz	Pass	0.4
Overload indication	SPL	Pass	0.3	
	Leq	Pass	0.4	

### 2, Acoustic tests

The complete sound level meter was calibrated on the reference range using a B&K 4226 acoustic calibrator with 1000Hz and SPL 94 dB. The sensitivity of the sound level meter was adjusted. The test result at 125 Hz and 8000 Hz are given in below with test status and the estimated uncertainties.

Test:	Subtest	Status	Expanded Uncertainty (dB)	Coverage Factor
Acoustic response	Weighting A at 125 Hz	Pass	0.3	
	Weighting A at 8000 Hz	Pass	0.5	

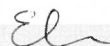
### 3, Response to associated sound calibrator

N/A

The expanded uncertainties have been calculated in accordance with the ISO Publication "Guide to the expression of uncertainty in measurement", and gives an interval estimated to have a level of confidence of 95%. A coverage factor of 2 is assumed unless explicitly stated.

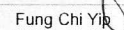
- End -

Calibrated by:



Date: 18-Mar-2019

Checked by:



Date: 19-Mar-2019

The standard(s) and equipment used in the calibration are traceable to national or international recognised standards and are calibrated on a schedule to maintain the required accuracy level.



## CERTIFICATE OF CALIBRATION

Certificate No.: 19CA0617 03-02

Page: 1 of 2

### Item tested

Description: Acoustical Calibrator (Class 1)  
Manufacturer: Honglim Co., Ltd.  
Type/Model No.: HLES-02  
Serial/Equipment No.: 2016611465  
Adaptors used: -

### Item submitted by

Customer: Lam Environmental Services Limited.  
Address of Customer: -  
Request No.: -  
Date of receipt: 17-Jun-2019

Date of test: 19-Jun-2019

### Reference equipment used in the calibration

Description:	Model:	Serial No.	Expiry Date:	Traceable to:
Lab standard microphone	B&K 4180	2341427	03-May-2020	SCL
Preamplifier	B&K 2673	2239857	17-May-2020	CEPREI
Measuring amplifier	B&K 2610	2346941	05-Jun-2020	CEPREI
Signal generator	DS 360	61227	10-May-2020	CEPREI
Digital multi-meter	34401A	US36087050	08-May-2020	CEPREI
Audio analyzer	8903B	GB41300350	13-May-2020	CEPREI
Universal counter	53132A	MY40003662	10-May-2020	CEPREI

### Ambient conditions

Temperature:  $22 \pm 1$  °C  
Relative humidity:  $55 \pm 10$  %  
Air pressure:  $1005 \pm 5$  hPa

### Test specifications

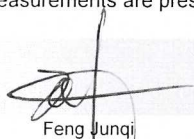
- The Sound Calibrator has been calibrated in accordance with the requirements as specified in IEC 60942 1997 Annex B and the lab calibration procedure SMTP004-CA-156.
- The calibrator was tested with its axis vertical facing downwards at the specific frequency using insert voltage technique.
- The results are rounded to the nearest 0.01 dB and 0.1 Hz and have not been corrected for variations from a reference pressure of 1013.25 hectoPascals as the maker's information indicates that the instrument is insensitive to pressure changes.

### Test results

This is to certify that the sound calibrator conforms to the requirements of annex B of IEC 60942: 1997 for the conditions under which the test was performed. This does not imply that the sound calibrator meets IEC 60942 under any other conditions.

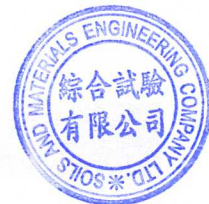
Details of the performed measurements are presented on page 2 of this certificate.

Approved Signatory:

  
Feng Junqi

Date: 19-Jun-2019

Company Chop:



Comments: The results reported in this certificate refer to the condition of the instrument on the date of calibration and carry no implication regarding the long-term stability of the instrument.

