

# RECALIBRATION DUE DATE:

January 24, 2019

# Certificate of Calibration

Calibration Certification Information

Cal. Date: January 24, 2018

Rootsmeter S/N: 438320

Ta: 293 Pa: 756.9 °K

Operator: Jim Tisch

Calibration Model #: TE-5025A

Calibrator S/N: 3166

mm Hg

Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H2O)
1	1	2	1	1.4430	3.2	2.00
2	3	4	1	1.0270	6.4	4.00
3	5	6	1	0.9220	7.9	5.00
4	7	8	1	0.8780	8.7	5.50
5	9	10	1	0.7270	12.6	8.00

		Data Tabulat	ion		
Vstd (m3)	Qstd (x-axis)	$\sqrt{\Delta H \left( \frac{Pa}{Pstd} \right) \left( \frac{Tstd}{Ta} \right)}$ (y-axis)	Va	Qa (x-axis)	√∆H(Ta/Pa)
1.0087	0.6990	1.4233	0.9958	0.6901	0.8799
1.0044	0.9780	2.0129	0.9915	0.9655	1.2443
1.0024	1.0872	2.2505	0.9896	1.0733	1.3912
1.0013	1.1404	2.3603	0.9885	1.1259	1.4591
0.9961	1.3701	2.8467	0.9834	1.3526	1.7598
CARGON 1/2-1	m=	2.12231		m=	1.32895
QSTD	b=	-0.06016	QA	b=	-0.03719
	r=	0.99999	~ .	r=	0.99999

	Calculation	ns	
Vstd=	ΔVol((Pa-ΔP)/Pstd)(Tstd/Ta)	Va=	ΔVol((Pa-ΔP)/Pa)
Qstd=	Vstd/∆Time		Va/ΔTime
	For subsequent flow ra	te calculatio	ns:
Qstd=	$1/m\left(\left(\sqrt{\Delta H\left(\frac{Pa}{Pstd}\right)\left(\frac{Tstd}{Ta}\right)}\right)-b\right)$	Qa=	1/m(( √ΔH(Ta/Pa))-t

	Standard Conditions
Tstd:	298.15 °K
Pstd:	760 mm Hg
	Key
ΔH: calibrator	manometer reading (in H2O)
ΔP: rootsmete	er manometer reading (mm Hg)
Ta: actual abs	olute temperature (°K)
Pa: actual bar	ometric 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

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

Location	:	CMA1b	Calbration Date :	19-Dec-18
Equipment no.	:	HVS001	Calbration Due Date:	18-Feb-19
CALIBRATION OF	CONTIL	NUOUS FLOW RECORDE	<u>R</u>	
			Ambient Condition	

Orifice Transfer Standard Information									
Equipment No.         Ori3166         Slope, mc         2.12231         Intercept, bc         -0.06016									
Last Calibration Date	24-Jan-18		(HxP <sub>a</sub> /10	13.3 x 298 / T	a) <sup>1/2</sup>				
Next Calibration Date	24-Jan-19		= m <sub>c</sub>	$x Q_{std} + b_c$					

Kelvin Pressure, Pa

1020

mmHg

293

Calibration of TSP											
Calibration	Ма	nometer	Reading	Q <sub>std</sub>	Continuous Flow	IC					
Point	H (inches of water)		(m <sup>3</sup> / min.)	Recorder, W	W(P <sub>a</sub> /1013.3x298/T <sub>a</sub> ) <sup>1/2</sup> /35.3 <sup>1</sup>						
	(up)	(down)	(difference)	X-axis	(CFM)	Y-axis					
1	1.6	1.6	3.2	0.8812	26	26.3074					
2	2.7	2.7	5.4	1.1362	34	34.4020					
3	4.0	4.0	8.0	1.3768	45	45.5321					
4	5.2	5.2	10.4	1.5658	48	48.5676					
5	6.3	6.3	12.6	1.7207	54	54.6385					
5 11 5 1 11					_						

By Linear Regression of Y on X

Temperature, T<sub>a</sub>

Slope, m = 33.7706 Intercept, b = -3.2329

Correlation Coefficient\* = 0.9933

Calibration Accepted = Yes/Ne\*\*

Remarks :			

Calibrated by : Henry Lau Checked by : Chan Ka Chun

 $<sup>\</sup>ensuremath{^{*}}$  if Correlation Coefficient < 0.990, check and recalibration again.

<sup>\*\*</sup> Delete as appropriate.

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

Location :	ioratio	CMA2a	a ror ring	ii voidiii	io odini	•	ation Date	:	19-Dec-18
Equipment no. :		HVS002				Calbr	ation Due Dat	( :	18-Feb-19
CALIBRATION OF CONTI	NUOUS F	LOW RE	CORDER						
	<u> </u>		An	nbient Cond	lition		1		
Temperature, T <sub>a</sub>		29	93	Kelvin	Pressure,	Pa		1020	mmHg
			Orifice Tran	sfer Standa	rd Informat	ion			
Equipment No.		Ori31	66	Slope, m <sub>c</sub>	2.122	31	Intercept,	bc	-0.06016
Last Calibration Date		24-Jan	-18		(HxF	P <sub>a</sub> / 10	13.3 x 298	/ T a	) 1/2
Next Calibration Date		24-Jan	-19		=	m c	x Q <sub>std</sub> + b	С	
			Ca	libration of	TSP				
Calibration	Ma	nometer	Reading	Q.	std	Conti	nuous Flow		IC
Point	н	(inches c	of water)	(m <sup>3</sup> /	min.)	Red	order, W	(W(P <sub>a</sub> /	/1013.3x298/T <sub>a</sub> ) <sup>1/2</sup> /35.31)
	(up)	(down)	(difference)	X-a	xis		(CFM)		Y-axis
1	1.5	1.5	3.0	0.85	541		28		28.3311
2	2.2	2.2	4.4	1.02	284		32		32.3784
3	3.7	3.7	7.4	1.32	253		40		40.4730
4	4.5	4.5	9.0	1.45	586		44		44.5203
5	6.0	6.0	12.0	1.67	799		52		52.6149
By Linear Regression of Y	on X								
	Slope, m	=	29.0	948	Inte	rcept, b	= 2	2.7348	
Correlation Co	efficient*	=	0.99	063					
Calibration A	Accepted	=	Yes/f	<del>\0</del> **	•				
* if Correlation Coefficient <	< 0.990, c	heck and	recalibration a	ıgain.					
** Delete as appropriate.									
Remarks :									
Calibrated by	F	Henry Lau				Checl	ked by	:	Chan Ka Chun
Date :	1	9-Dec-18				Date		:	19-Dec-18

Date

# Calibration Data for High Volume Sampler (TSP Sampler)

C	alibra	ט ווסוו	ata for Hi	gn volume	Sample	er (13P	Sample	r)	
Location :		СМАЗа				Calbrat	ion Date	:	19-Dec-18
Equipment no.		HVS012				Calbrat	ion Due Dat	: .	18-Feb-19
CALIBRATION OF CONTIN	NUOUS F	LOW RE	CORDER						
				Ambient Condition	on		Ī		
Temperature, T <sub>a</sub>			293	Kelvin	Pressure,	Pa		1020	mmHg
			Orifice Tr	ansfer Standard	Information	า			
Equipment No.		Ori31	66	Slope, m <sub>c</sub>	2.122	31	Intercept, b	эс	-0.06016
Last Calibration Date		24-Jan	-18		( H x P <sub>a</sub>	/ 1013.	3 x 298 / 7	Γ <sub>a</sub> ) <sup>1</sup>	/2
Next Calibration Date		24-Jan	-19		=	m <sub>c</sub> x	$Q_{std} + b$	С	
				Calibration of TS	SP .				
Calibration	Ма	nometer	Reading	Q <sub>std</sub>		Continu	ous Flow		IC
Point	н	(inches c	of water)	(m³ / mii	ո.)	Reco	rder, W	(W(P <sub>a</sub> /	(1013.3x298/T <sub>a</sub> ) <sup>1/2</sup> /35.31)
	(up)	(down)	(difference)	X-axis	;	(C	FM)		Y-axis
1	1.2	1.2	2.4	0.7669	)		20		20.2365
2	2.0	2.0	4.0	0.9819	)		28		28.3311
3	3.5	3.5	7.0	1.2897	7		37		37.4375
4	4.5	4.5	9.0	1.4586	5		41		41.4848
5	5.5	5.5	11.0	1.6096	3		50		50.5912
By Linear Regression of Y	on X								
\$	Slope, m	=	33	3.7811	Inte	rcept, b =		5.6420	
Correlation Co	efficient*	=	0	.9918	-				
Calibration A	ccepted	=	Ye	es/ <del>No</del> **	-				
* if Correlation Coefficient <	0.990, c	heck and	recalibration a	ıgain.					
** 5									
** Delete as appropriate.									
Remarks :									
Calibrated by	H	lenry Lau				Checke	d by	: -	Chan Ka Chun
Data :	1	9-Dec-18				Date		:	19-Dec-18

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

Location	:	CMA4a	Calbration Date :	19-Dec-18
Equipment no.	:	HVS004	Calbration Due Date :	18-Feb-19

## CALIBRATION OF CONTINUOUS FLOW RECORDER

Ambient Condition									
Temperature, T <sub>a</sub>	Temperature, T <sub>a</sub> 293 Kelvin Pressure, P <sub>a</sub> 1020 mmH								

Orifice Transfer Standard Information								
Equipment No.	Ori3166	Slope, m <sub>c</sub>	2.12231	Intercept, bc	-0.06016			
Last Calibration Date	24-Jan-18	(HxP <sub>a</sub> /1013.3 x 298/T <sub>a</sub> ) <sup>1/2</sup>						
Next Calibration Date	24-Jan-19	$=$ $m_c \times Q_{std} + b_c$						

	Calibration of TSP										
Calibration	Ма	nometer	Reading	Q <sub>std</sub>	Continuous Flow	IC					
Point	H (inches of water)		(m <sup>3</sup> / min.)	Recorder, W	(W(P <sub>a</sub> /1013.3x298/T <sub>a</sub> ) <sup>1/2</sup> /35.31)						
	(up)	(down)	(difference)	X-axis	(CFM)	Y-axis					
1	1.5	1.5	3.0	0.8541	24	24.2838					
2	2.0	2.0	4.0	0.9819	31	31.3666					
3	3.6	3.6	7.2	1.3076	40	40.4730					
4	4.2 4.2 8.4		1.4101	47	47.5558						
5	5.7	5.7 11.4		1.6381	56	56.6622					

Rv	Linear	Regression	of \	/ on	¥
DУ	Lilleai	Regression	UI I	OH	$^{\wedge}$

Calibration Accepted = 0.9932

Yes/Ne\*\*

19-Dec-18

Date

Remarks :					
Calibrated by	:	Henry Lau	Checked by	:	Chan Ka Chun

Date

19-Dec-18

 $<sup>\</sup>ensuremath{^{*}}$  if Correlation Coefficient < 0.990, check and recalibration again.

<sup>\*\*</sup> Delete as appropriate.

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

Location	:	CMA5b	Calbration Date	:	19-Dec-18	
Equipment no.	: _	HVS010	Calbration Due Date	:	18-Feb-19	_

## CALIBRATION OF CONTINUOUS FLOW RECORDER

Ambient Condition						
Temperature, T <sub>a</sub>	293	Kelvin	Pressure, P <sub>a</sub>	1020	mmHg	

Orifice Transfer Standard Information								
Equipment No.	Ori3166	Slope, m <sub>c</sub>	2.12231	Intercept, bc	-0.06016			
Last Calibration Date	24-Jan-18		(HxP <sub>a</sub> /1013.3 x 298/T <sub>a</sub> ) <sup>1/2</sup>					
Next Calibration Date	24-Jan-19	$= m_c \times Q_{std} + b_c$						

	Calibration of TSP										
Calibration	Manometer Reading		Q <sub>std</sub>	Continuous Flow	IC						
Point	H (inches of water)		(m <sup>3</sup> / min.)	Recorder, W	(W(P <sub>a</sub> /1013.3x298/T <sub>a</sub> ) <sup>1/2</sup> /35.31)						
	(up)	(down)	difference	X-axis	(CFM)	Y-axis					
1	1.5	1.5	3.0	0.8541	25	25.2956					
2	2.8	2.8	5.6	1.1566	34	34.4020					
3	3.6	3.6	7.2	1.3076	38	38.4493					
4	4.8	4.8	9.6	1.5055	46	46.5439					
5	6.0	6.0	12.0	1.6799	54	54.6385					

By Linear Regression of Y on X

Slope, m = 35.1088 Intercept, b = -5.8015

Correlation Coefficient\* = 0.9935

Calibration Accepted = Yes/Ne\*\*

Remarks :			
·			•
_			

Calibrated by : Henry Lau Checked by : Chan Ka Chun

<sup>\*</sup> if Correlation Coefficient < 0.990, check and recalibration again.

<sup>\*\*</sup> Delete as appropriate.



## Lam Environmental Services Limited

# Calibration Data for High Volume Sampler (TSP Sampler)

Location :		MA1e				Calbratio	on Date	:	19-Dec-18	
Equipment no.	ŀ	HVS007				Calbratio	on Due Date	:	18-Feb-19	
CALIBRATION OF CON	TINUOUS	FLOW RE	CORDER							
				Ambient C	ondition					
Temperature, T <sub>a</sub>		293		Kelvin	Pressure, P	a	1	020	mmHg	
			Orifice Tr	ansfer Sta	ndard Inforr	nation				
Equipment No.		Ori3166		Slope, m <sub>c</sub>	2.1223	31	Intercept, bc	Т	-0.06016	
Last Calibration Date		24-Jan-1	8	Į.	( H x	P <sub>a</sub> / 101	3.3 x 298 /	T <sub>a</sub> )	1/2	
Next Calibration Date	xt Calibration Date 24-Jan-19				$= m_c \times Q_{std} + b_c$					
				Calibratio	n of TSP					
Calibration	Manometer Reading		Q	Q <sub>std</sub> Con		Continuous Flow		IC		
Point	H (i	nches of v	water)	(m <sup>3</sup> / min.)		Reco	rder, W	(W(P <sub>a</sub> /1013.3x298/T <sub>a</sub> ) <sup>1/2</sup> /35.31)		
	(up)	(down)	(difference)	X-axis		(CFM)			Y-axis	
1	1.8	1.8	3.6	0.9	329	24			24.2838	
2	2.5	2.5	5.0	1.0	944	33		33.3902		
3	4.0	4.0	8.0	1.3	768	43			43.5085	
4	5.2	5.2	10.4	1.5	658		50	50.5912		
5	6.5	6.5	13.0	1.7	473		57		57.6740	
By Linear Regression of	Y on X									
	Slope, m	=	39.8	628	Inte	ercept, b =	-11 	.6647		
Correlation Co	pefficient*	=	0.99	73						
Calibration	Accepted	=	Yes/	<del>\0</del> **						
* if Correlation Coefficien	nt < 0.990.	check and	l recalibration	n again.						
				3.5						
** Delete as appropriate.										
Remarks :										
Calibrated by	Н	enry Lau				Checked	by	:	Chan Ka Chun	
Date :	19	9-Dec-18				Date		:	19-Dec-18	



## Lam Environmental Services Limited

# Calibration Data for High Volume Sampler (TSP Sampler)

Location :		MA1w				Calbration Date :			: 19-Dec-18	
Equipment no.	ı	HVS008				Calbratio	on Due Date	:	18-Feb-19	
								<u> </u>		
CALIBRATION OF CON	ITINUOUS	FLOW RE	ECORDER							
				Ambient (	Condition					
Temperature, T <sub>a</sub>		293		Kelvin	Pressure, P	a	1	020	mmHg	
			Orifice Tr	ansfer Sta	ındard Inforr	nation				
Equipment No.		Ori3166	•	Slope, m <sub>c</sub>	2.1223	31	Intercept, bc		-0.06016	
Last Calibration Date		24-Jan-1	8		( H x	P <sub>a</sub> / 101	3.3 x 298 /	T <sub>a</sub> ) <sup>1/</sup>	2	
Next Calibration Date	xt Calibration Date 24-Jan-19				=		$Q_{std} + b_c$			
				Calibratio	n of TSP					
Calibration	Manometer Reading		C	Q <sub>std</sub> Continu		ious Flow		IC		
Point	H (i	inches of	water)	(m <sup>3</sup> / min.)		Reco	rder, W	(W(P <sub>a</sub> /1013.3x298/T <sub>a</sub> ) <sup>1/2</sup> /35.31)		
	(up)	(down)	(difference)	X-	axis	(CFM)			Y-axis	
1	1.7	1.7	3.4	0.0	9074	24			24.2838	
2	2.6	2.6	5.2	1.	1155	33		33.3902		
3	4.2	4.2	8.4	1.4	4101	43		43.5085		
4	5.3	5.3	10.6	1.5	5806	50		50.5912		
5	6.6	6.6	13.2	1.7	7605		57		57.6740	
By Linear Regression of	Y on X									
	Slope, m	=	38.5	875	Inte	ercept, b =	-10	.3897		
Correlation Co	oefficient*	=	0.99	93						
Calibration	Accepted	=	Yes/	<del>\0</del> **						
* if Correlation Coefficien	nt < 0 990	check and	l recalibration	n again						
		orioon ario	rocambration	r again.						
** Delete as appropriate.										
Remarks :										
Calibrated by	н	lenry Lau				Checked	l by	:	Chan Ka Chun	
Date :	19	9-Dec-18				Date		:	19-Dec-18	



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Tel: (852) 2873 6860 Fax: (852) 2555 7533



# CERTIFICATE OF CALIBRATION

Certificate No.:

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Item tested

Description:

Sound Level Meter (Type 1) Larson Davis

Manufacturer: Type/Model No.:

LxT1

Serial/Equipment No.: Adaptors used:

0004796

Microphone PCB

377B02 155507

Preamp PCB

PRMLxT1L 042621

Item submitted by

Customer Name:

Lam Geotechnics Ltd.

Address of Customer.

Request No. Date of receipt:

10-May-2018

Date of test:

11-May-2018

Reference equipment used in the calibration

Description:

Signal generator

Multi function sound calibrator

Model: B&K 4226 DS 360

Serial No.

2288444 61227

Expiry Date:

08-Sep-2018 23-Apr-2019

Traceable to:

CIGISMEC CEPREI

Ambient conditions

Temperature:

21 ± 1 °C 50 ± 10 %

Relative humidity: Air pressure:

1005 ± 5 hPa

Test specifications

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%

The acoustic calibration was performed using an B&K 4226 sound calibrator and corrections was applied for the difference 3. between the free-field and pressure responsess 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

Feno Jungi

Approved Signatory:

Date: 11-May-2018

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.

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Form No CARP152-186666 1/Rev Ci01/02/2007



# 綜合試驗有限公司

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# CERTIFICATE OF CALIBRATION

(Continuation Page)

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Page

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 Uncertanity (dB)	Coverag Factor
Self-generated noise	Α	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	6.6
	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	
	C	Pass	0.3	
	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 1/103 at 4kHz	Pass	0.3	
	1 ms burst duty factor 1/10 <sup>4</sup> at 4kHz	Pass		
Pulse range	Single burst 10 ms at 4 kHz	Pass	0.3	
Sound exposure level	Single burst 10 ms at 4 kHz	Pass	0.4	
Overload indication	SPL	Pass	0.4	
	Leq	Pass	0.3	
	204	F a 5 5	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 Uncertanity (dB)	Coverage Factor
Acoustic response	Weighting A at 125 Hz Weighting A at 8000 Hz	Pass Pass	0.3 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

Calibrated by:

Checked by:

Date:

1/1-May-2018

Date:

11-May-2018

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

C Sols & Materials Engineering Co., Ltd.

Form No CARP152-24ssue 1/Rev C/01/02/2007



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# CERTIFICATE OF CALIBRATION

Certificate No.:

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Item tested

Description

Sound Level Meter (Type 1)

Microphone

Manufacturer: Type/Model No.: Larson Davis

PCB

Serial/Equipment No.:

LxT1 0003737 377B02 171529

Adaptors used:

Item submitted by

Customer Name:

Lam Geotechnics Ltd.

Address of Customer:

Request No.

Date of receipt:

22-Mar-2018

Date of test:

28-Mar-2018

Reference equipment used in the calibration

Description:

Model:

Serial No.

Expiry Date:

Traceable to:

Multi function sound calibrator Signal generator

B&K 4226 DS 360

2288444 61227

08-Sep-2018 01-Apr-2018

CIGISMEC CEPREL

Ambient conditions

Temperature:

21 ± 1 °C

Relative humidity: Air pressure:

50 ± 10 % 1005 ± 5 hPa

Test specifications

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 responsess 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.

Feng Jun Qi

Actual Measurement data are documented on worksheets

Approved Signatory:

Date:

06-Apr-2018

Company Chop:

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.

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Form No CARP157-1/Issue 1/Rev C/01/02/2007



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# CERTIFICATE OF CALIBRATION

(Continuation Page)

Certificate No.:

18CA0322 01

Page

#### 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 Uncertanity (dB)	Coverage Factor
Self-generated noise	Α	Pass	0.3	
	A 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	
Frequency weightings	A	Pass	0.3	
	A C	Pass	0.3	
	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 1/103 at 4kHz	Pass	0.3	
	1 ms burst duty factor 1/104 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 Uncertanity (dB)	Coverage Factor
Acoustic response	Weighting A at 125 Hz Weighting A at 8000 Hz	Pass Pass	0.3 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

Calibrated by:

End

Fung Chi Yip

Checked by:

Lam Tze Wai

Date: 28-Mar-2018

Date:

06-Apr-2018

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.

C Soils & Materials Engineering Co. Ltd.

Form No CARP 152-2/16 sue 1/Rev C/01/02/2007



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# CERTIFICATE OF CALIBRATION

Certificate No.:

18CA0309 01

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Item tested

Description:

Sound Level Meter (Type 1)

Microphone

Preamp B & K

Manufacturer: Type/Model No.: B & K 2250-L B & K 4950

B & K ZC0032

Serial/Equipment No.: Adaptors used: 2722310

2698702

13318

Item submitted by

Customer Name:

Lam Geotechnics Ltd.

Address of Customer.

Request No.:

i i

Date of receipt:

09-Mar-2018

Date of test:

10-Mar-2018

## Reference equipment used in the calibration

Description:

on: Model:

5

Serial No.

Expiry Date:

Traceable to:

Multi function sound calibrator Signal generator Signal generator

B&K 4226 DS 360 DS 360 2288444 33873 61227 08-Sep-2018 25-Apr-2018 01-Apr-2018 CIGISMEC CEPREI CEPREI

Ambient conditions

Temperature:

21 ± 1 °C

Relative humidity:

50 ± 10 %

Air pressure:

1000 ± 5 hPa

#### Test specifications

 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.

 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%.

 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 responsess 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.

Feng

Approved Signatory:

Date:

12-Mar-2018

Company Chop:

SENGIMERA 解合試驗 COMMON 有限公司 多705米〇)

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.

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# CERTIFICATE OF CALIBRATION

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Certificate No.:

18CA0309 01

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#### 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 Uncertanity (dB)	Coverage Factor
Self-generated noise	A	Pass	0.3	
	С	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	
	С	Pass	0.3	
	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 1/103 at 4kHz	Pass	0.3	
	1 ms burst duty factor 1/104 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 Uncertanity (dB)	Coverage Factor
Acoustic response	Weighting A at 125 Hz Weighting A at 8000 Hz	Pass Pass	0.3 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.

Calibrated by:

- End

.....

Date:

Fung Chi Yip \ 10-Mar-2018 Checked by:

Date:

Lam Tze War

12-Mar-2018

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.

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# CERTIFICATE OF CALIBRATION

Certificate No.:

18CA0413 02

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Item tested

Description:

Sound Level Meter (Type 1)

Microphone

Preamp

Manufacturer:

B & K

**B&K** 

**B&K** 

Type/Model No.: Serial/Equipment No.:

2250-L 2722311

4950 2698703 ZC0032 13321

Adaptors used

Item submitted by

Customer Name:

Lam Geotechnics Ltd.

Address of Customer:

Request No.

Date of receipt:

13-Apr-2018

Date of test:

18-Apr-2018

## Reference equipment used in the calibration

Multi function sound calibrator

Model:

Serial No.

Expiry Date:

Traceable to:

Signal generator

B&K 4226 DS 360

2288444 33873

08-Sep-2018 25-Apr-2018

CIGISMEC CEPREI

Ambient conditions

Temperature: Air pressure:

20 ± 1 °C

Relative humidity:

50 ± 10 % 1000 ± 5 hPa

Test specifications

The Sound Level Meter has been calibrated in accordance with the requirements as specified in BS 7580: Part 1: 1997 1 and the lab calibration procedure SMTP004-CA-152.

The electrical tests were performed using an electrical signal substituted for the microphone which was removed and 2 replaced by an equivalent capacitance within a tolerance of ±20%.

The acoustic calibration was performed using an B&K 4226 sound calibrator and corrections was applied for the difference 3. between the free-field and pressure responsess 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:

Date:

18-Apr-2018

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

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# CERTIFICATE OF CALIBRATION

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Certificate No.:

18CA0413 02

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#### 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 Uncertanity (dB)	Coverage Factor
Self-generated noise	A C	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	
	С	Pass	0.3	
	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	
100 A 144 CHAN 200 TA 150 A 10	Repeated at frequency of 100 Hz	Pass	0.3	
Time averaging	1 ms burst duty factor 1/103 at 4kHz	Pass	0.3	
	1 ms burst duty factor 1/104 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	SPĽ	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 Uncertanity (dB)	Coverage Factor
Acoustic response	Weighting A at 125 Hz Weighting A at 8000 Hz	Pass Pass	0.3 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.

Calibrated by:

.

Checked by:

Lam Tze Wa

Date:

Fong Chi Yip 18-Apr-2018

Date:

18-Apr-2018

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.

End

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# CERTIFICATE OF CALIBRATION

Certificate No.:

17CA0119 01

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of

Item tested

Description: Manufacturer

Type/Model No.: Serial/Equipment No.: Adaptors used:

**B&K** 2250-L

3002695

B&K 4950 2940839

Microphone

Preamp **B&K** ZC0032 18582

Item submitted by

Customer Name:

Lam Geotechnics Limited

Sound Level Meter (Type 1)

Address of Customer: Request No.

Date of receipt:

19-Jan-2017

Date of test:

20-Jan-2017

#### Reference equipment used in the calibration

Description:

Multi function sound calibrator Signal generator Signal generator

Model: B&K 4226 DS 360

DS 360

Serial No. 2288444

33873 61227

Expiry Date: 18-Jun-2017

18-Apr-2017 18-Apr-2017 Traceable to:

CIGISMEC CEPREI CEPRE

#### Ambient conditions

Temperature Relative humidity: 21 ± 1 °C 40 ± 10 %

Air pressure:

1010 ± 5 hPa

#### Test specifications

- 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.
- The electrical tests were performed using an electrical signal substituted for the microphone which was removed and 2. replaced by an equivalent capacitance within a tolerance of +20%.
- The acoustic calibration was performed using an B&K 4226 sound calibrator and corrections was applied for the difference 3. between the free-field and pressure responsess 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.

Min/Feng Jun Qi

Actual Measurement data are documented on worksheets.

Huang Jir

Approved Signatory:

Date:

23-Jan-2017

Company Chop:

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

Soils & Materials Engineering Co., Ltd.

Form No CARP152-1/Issue 1/Rev C/01/02/2007



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# CERTIFICATE OF CALIBRATION

(Continuation Page)

Certificate No.:

17CA0119 01

Page

#### 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 Uncertanity (dB)	Coverage Factor
Self-generated noise	A	Pass	0.3	
	С	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	
	С	Pass	0.3	
	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 1/103 at 4kHz	Pass	0.3	
70. E	1 ms burst duty factor 1/104 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	
	Lea	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 Uncertanity (dB)	Coverage Factor
Acoustic response	Weighting A at 125 Hz	Pass	0.3	
	Weighting A at 8000 Hz	Pass	0.5	

#### Response to associated sound calibrator 3,

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

Calibrated by:

End

Checked by:

Lam Tze War

Date:

Fung Chi Yip 20-Jan-2017

Date:

23-Jan-2017

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.

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# CERTIFICATE OF CALIBRATION

Certificate No.:

18CA0116 01

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of

2

Item tested

Description: Manufacturer: Sound Level Meter (Type 1) B & K

Microphone B&K

Preamp BAK ZC0032

Type/Model No.: Serial/Equipment No.: 2250L 3002695

4950 2940839

18582

Adaptors used:

Item submitted by

Lam Geotechnics Ltd.

Customer Name: Address of Customer: Request No.

Date of receipt:

16-Jan-2018

Date of test:

18-Jan-2018

Reference equipment used in the calibration

Description:

Multi function sound calibrator

Model: B&K 4226 Serial No.

Expiry Date: 08-Sep-2018

Traceable to:

Signal generator Signal generator

DS 360 DS 360

2288444 33873 61227

25-Apr-2018 01-Apr-2018 CIGISMEC CEPRE CEPRE

Ambient conditions

Temperature:

21 ± 1 °C

Relative humidity: Air pressure:

50 ± 10 %

1005 ± 5 hPa

#### Test specifications

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 responsess 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.

Feng Jun Qi

Actual Measurement data are documented on worksheets

Approved Signatory:

Date:

18-Jan-2018

Company Chop:

Comments: The results reported in his 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.

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## CERTIFICATE OF CALIBRATION

(Continuation Page)

Certificate No.:

18CA0116 01

Page

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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 Uncertanity (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	
	C	Pass	0.3	
	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 1/103 at 4kHz	Pass	0.3	
	1 ms burst duty factor 1/104 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 Uncertanity (dB)	Coverage Factor
Acoustic response	Weighting A at 125 Hz Weighting A at 8000 Hz	Pass Pass	0.3 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.

Calibrated by:

Date:

Fung Chi Yip 18-Jan-2018 Checked by

onou by.

Date:

Lam Tze Wai 18-Jan-2018

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.

End

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# CERTIFICATE OF CALIBRATION

Certificate No.:

18CA1114 02

Page

Item tested

Description:

Sound Level Meter (Type 1)

Microphone

Manufacturer: Type/Model No.: B&K 2236

B&K 4188

Serial/Equipment No.:

2100736

2288941

Adaptors used:

Item submitted by

Customer Name:

Lam Environmental Service Ltd.

Address of Customer. Request No.:

Date of receipt:

14-Nov-2018

Date of test:

15-Nov-2018

Reference equipment used in the calibration

Description:

Model: B&K 4228 Serial No.

Expiry Date:

Traceable to: CIGISMEC

Multi function sound calibrator Signal generator Signal generator

DS 360 DS 360

2288444 33873 61227

23-Aug-2019 24-Apr-2019 23-Apr-2019

CEPREI CEPREI

Ambient conditions

Temperature:

20 ± 1 °C 50 ± 10 %

Relative humidity: Air pressure:

1000 ± 5 hPa

#### Test specifications

The Sound Level Meter has been calibrated in accordance with the requirements as specified in BS 7580; Part 1: 1997 1, and the lab calibration procedure SMTP004-CA-152.

The electrical tests were performed using an electrical signal substituted for the microphone which was removed and 2, 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 responsess 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.

Feng Junqi

Actual Measurement data are documented on worksheets.

Approved Signatory:

Date: 15-Nov-2018

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.

O Soils & Materials Engineering Co., Ltd.

Form No CARP153-1/Issue 1/flow C/01/02/2007



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## CERTIFICATE OF CALIBRATION

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**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.

Self-generated noise	0.3 1.0 2.0 0.3	2.1
Lin Pass Linearity range for Leq At reference range , Step 5 dB at 4 kHz Pass Reference SPL on all other ranges Pass 2 dB below upper limit of each range Pass 2 dB above lower limit of each range Pass Linearity range for SPL At reference range , Step 5 dB at 4 kHz Pass Frequency weightings A Pass C Pass Lin Pass Time weightings Single Burst Fast Pass Single Burst Slow Pass Peak response Single 100 µs rectangular pulse Pass R.M.S. accuracy Crest factor of 3 Pass Time weighting I Single burst 5 ms at 2000 Hz Pass Repeated at frequency of 100 Hz Pass Time averaging 1 ms burst duty factor 1/10² at 4kHz Pass	2.0 0.3	
At reference range , Step 5 dB at 4 kHz	0.3	0.0
Reference SPL on all other ranges   Pass   2 dB below upper limit of each range   Pass   2 dB above lower limit of each range   Pass   Pass		2.2
Reference SPL on all other ranges   Pass   2 dB below upper limit of each range   Pass   2 dB above lower limit of each range   Pass   Elinearity range for SPL   At reference range   Step 5 dB at 4 kHz   Pass   Pass	0.0	
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           Frequency weightings         A         Pass           C         Pass           Lin         Pass           Time weightings         Single Burst Fast         Pass           Single Burst Slow         Pass           Peak response         Single 100µs rectangular pulse         Pass           R.M.S. accuracy         Crest factor of 3         Pass           Time weighting I         Single burst 5 ms at 2000 Hz         Pass           Repeated at frequency of 100 Hz         Pass           Time averaging         1 ms burst duty factor 1/10 <sup>3</sup> at 4kHz         Pass	0.3	
Frequency weightings         A         Pass           C         Pass         Lin         Pass           Time weightings         Single Burst Fast         Pass           Single Burst Slow         Pass           Peak response         Single 100µs rectangular pulse         Pass           R.M.S. accuracy         Crest factor of 3         Pass           Time weighting I         Single burst 5 ms at 2000 Hz         Pass           Repeated at frequency of 100 Hz         Pass           Time averaging         1 ms burst duty factor 1/10 <sup>3</sup> at 4kHz         Pass	0.3	
C Pass Lin Pass Time weightings Single Burst Fast Pass Single Burst Slow Pass Peak response Single 100µs rectangular pulse Pass R.M.S. accuracy Crest factor of 3 Pass Time weighting I Single burst 5 ms at 2000 Hz Pass Repeated at frequency of 100 Hz Pass Time averaging 1 ms burst duty factor 1/10 <sup>3</sup> at 4kHz Pass	0.3	
C Pass Lin Pass Time weightings Single Burst Fast Pass Single Burst Slow Pass Peak response Single 100µs rectangular pulse Pass R.M.S. accuracy Crest factor of 3 Pass Time weighting I Single burst 5 ms at 2000 Hz Pass Repeated at frequency of 100 Hz Pass Time averaging 1 ms burst duty factor 1/10² at 4kHz Pass	0.3	
Time weightings         Single Burst Fast Single Burst Slow         Pass Pass           Peak response         Single 100µs rectangular pulse         Pass Pass Pass           R.M.S. accuracy         Crest factor of 3         Pass Pass Pass Pass Pass Pass Pass Pass	0.3	
Single Burst Slow Pass Peak response Single 100µs rectangular pulse Pass R.M.S. accuracy Crest factor of 3 Pass Time weighting I Single burst 5 ms at 2000 Hz Pass Repeated at frequency of 100 Hz Pass Time averaging 1 ms burst duty factor 1/10 <sup>3</sup> at 4kHz Pass	0.3	
Peak response Single 100µs rectangular pulse Pass R.M.S. accuracy Crest factor of 3 Pass Time weighting I Single burst 5 ms at 2000 Hz Pass Repeated at frequency of 100 Hz Pass Time averaging 1 ms burst duty factor 1/10³ at 4kHz Pass	0.3	
R.M.S. accuracy Crest factor of 3 Pass Time weighting I Single burst 5 ms at 2000 Hz Pass Repeated at frequency of 100 Hz Pass Time averaging 1 ms burst duty factor 1/103 at 4kHz Pass	0.3	
Time weighting I Single burst 5 ms at 2000 Hz Pass Repeated at frequency of 100 Hz Pass Time averaging 1 ms burst duty factor 1/10 <sup>3</sup> at 4kHz Pass	0.3	
Repeated at frequency of 100 Hz. Pass Time averaging 1 ms burst duty factor 1/10 <sup>3</sup> at 4kHz Pass	0.3	
Time averaging 1 ms burst duty factor 1/10 <sup>3</sup> at 4kHz Pass	0.3	
	0.3	
2 : 10 3 m 10 20 20 20 20 20 20 20 20 20 20 20 20 20	0.3	
1 ms burst duty factor 1/104 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 Uncertanity (dB)	Coverage Factor
Acoustic response	Weighting A at 125 Hz	Pass	0.3	
	Weighting A at 8000 Hz	Pass	0.5	

Response to associated sound calibrator 3,

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.

Calibrated by:

End

Checked by:

Date:

Fung Chi Yip 15-Nov-2018

Shek Kwong Tat

15-Nov-2018 Date:

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.

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Form No CARP152-2/Issue 1/frey C/01/02/2007



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# CERTIFICATE OF CALIBRATION

Certificate No.:

18CA1220 02

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Item tested

Description:

Acoustical Calibrator (Class 1)

Manufacturer: Type/Model No.: Larson Davis CAL200

Serial/Equipment No.:

13128

Adaptors used:

03

Item submitted by

Curstomer:

Lam Environmental Service Ltd.

Address of Customer:

Request No.: Date of receipt:

20-Dec-2018

Date of test:

28-Dec-2018

#### Reference equipment used in the calibration

Description:	Model:	Serial No.	Expiry Date:	Traceable to:
Lab standard microphone	B&K 4180	2412857	20-Apr-2019	SCL
Preamplifier	B&K 2673	2239857	27-Apr-2019	CEPREI
Measuring amplifier	B&K 2610	2346941	08-May-2019	CEPREI
Signal generator	DS 360	33873	24-Apr-2019	CEPREI
Digital multi-meter	34401A	US36087050	23-Apr-2019	CEPREI
Audio analyzer	8903B	GB41300350	23-Apr-2019	CEPREI
Universal counter	53132A	MY40003662	24-Apr-2019	CEPREI

#### Ambient conditions

Temperature:

20 ± 1 °C

Relative humidity:

50 ± 10 %

Air pressure:

1000 ± 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.
- 2. 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.

Fend Jungi

Approved Signatory:

Date:

29-Dec-2018

Company Chop:

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

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Form No. CARP15G-5/5ssue 1/Rev. 0101103/2007



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1. Measured Sound Pressure Level

The output Sound Pressure Level in the calibrator head was measured at the setting and frequency shown using a calibrated laboratory standard microphone and insert voltage technique. The results are given in below with the estimated uncertainties.

Frequency	Output Sound Pressure	Measured Output	Estimated Expanded
Shown	Level Setting	Sound Pressure Level	Uncertainty
Hz	dB	dB	dB
1000	94.00	93.84	0.10

#### 2, Sound Pressure Level Stability - Short Term Fluctuations

The Short Term Fluctuations was determined by measuring the maximum and minimum of the fast weighted DC output of the B&K 2610 measuring amplifier over a 20 second time interval as required in the standard. The Short Term Fluctuation was found to be:

At 1000 Hz

STF = 0.006 dB

Estimated expanded uncertainty

0.005 dB

#### 3, Actual Output Frequency

The determination of actual output frequency was made using a B&K 4180 microphone together with a B&K 2673 preamplifier connected to a B&K 2610 measuring amplifier. The AC output of the B&K 2610 was taken to an universal counter which was used to determine the frequency averaged over 20 second of operation as required by the standard. The actual output frequency at 1 KHz was:

At 1000 Hz

Actual Frequency = 999.4 Hz

Estimated expanded uncertainty

0.1 Hz

Coverage factor k = 2.2

#### 4, Total Noise and Distortion

For the Total Noise and Distortion measurement, the unfiltered AC output of the B&K 2610 measuring amplifier was connected to an Agilent Type 8903 B distortion analyser. The TND result at 1 KHz was:

At 1000 Hz

TND = 0.4%

Estimated expanded uncertainty

0.7 %

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.

Calibrated by:

End

canorated by

Checked by

D DANS D DOS

Shok Kwong Tat

Date: | 2

Fung Chi Yo 28-Dec-2018

Date: 29-Dec-2018

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.

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