

### RECALIBRATION **DUE DATE:**

January 11, 2020

# ertificate d libration

**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	Qstd	$\sqrt{\Delta H \left(\frac{Pa}{Pstd}\right) \left(\frac{Tstd}{Ta}\right)}$		Qa	$\sqrt{\Delta H(Ta/Pa)}$						
(m3)	(x-axis)	(y-axis)	Va	(x-axis)	(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						
	m=	1.99861		m=	1.25149						
QSTD[	b=	-0.00882	QA	b=	-0.00543						
	r=	0.99997		r=	0.99997						

Calculations								
Vstd=	ΔVol((Pa-ΔP)/Pstd)(Tstd/Ta)	Va=	ΔVol((Pa-ΔP)/Pa)					
Qstd=	Vstd/ΔTime	Qa=	Va/ΔTime					
	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=	$1/m\left(\left(\sqrt{\Delta H\left(Ta/Pa\right)}\right)-b\right)$					

Standard Conditions								
Tstd:	298.15 °K							
Pstd:	760 mm Hg							
Key								
ΔH: calibrator manometer reading (in H2O)								
ΔP: rootsme	ter manometer reading (mm Hg)							
	solute temperature (°K)							
Pa: actual ba	rometric pressure (mm Hg)							
b: intercept	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

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Location :		CMA1b				Calbratio	on Date	: 10-Dec-19	
Equipment no.	ŀ	HVS001				Calbratio	on Due Date	: 9-Feb-20	
CALIBRATION OF CON	TINUOUS	S FLOW R	ECORDER						
				Ambient C	Condition				
Temperature, T <sub>a</sub>		291		Kelvin	Pressure, P	a	1	019 mmHg	
			Orifice Tr	ansfer Sta	ndard Inforr	mation			
Equipment No.		0005		Slope, m <sub>c</sub>	1.9986	61	Intercept, bc	-0.00882	
Last Calibration Date	11-Jan-19				(Нх	P <sub>a</sub> / 101	3.3 x 298 /	$T_a$ ) 1/2	
Next Calibration Date	$= m_c \times Q_{std} + b_c$								
				Calibratio	n of TSP				
Calibration	Man	nometer R	eading	C	) <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	1.9	1.9	3.8	0.9	9942	24		24.3552	
2	2.4	2.4	4.8	1.1	1168	31		31.4587	
3	3.1	3.1	6.2	1.2	2687	36		36.5327	
4	4.4	4.4	8.8	1.5	5106	48		48.7103	
5	5.0	5.0	10.0	1.6	6101		54	54.7991	
By Linear Regression of	Y on X								
	Slope, m	=	47.96	646	Inte	ercept, b =	-23	.1872	
Correlation Co	pefficient*	=	0.99	73					
Calibration	Accepted	=	Yes/	<del>\o</del> **					
* if Correlation Coefficien	nt < 0.990,	check and	recalibration	again.					
** Delete as appropriate.									
Remarks :									
		.,				<u> </u>			
Calibrated by		rance Yun	<del></del>			Checked	БУ	: James Chu	
Date :	10	0-Dec-19				Date		: 10-Dec-19	



Location :		CMA2a				Calbratio	on Date	:	10-Dec-19
Equipment no.	ŀ	HVS002				Calbratio	on Due Date	:	9-Feb-20
CALIBRATION OF CON	ITINUOUS	FLOW R	ECORDER						
				Ambient C	ondition				
Temperature, T <sub>a</sub>		291		Kelvin	Pressure, P	a	1	019	mmHg
			Orifice Tr	ansfer Sta	ndard Inform	nation			
Equipment No.		0005		Slope, m <sub>c</sub>	1.998	61	Intercept, bc	Т	-0.00882
Last Calibration Date	11-Jan-19				(Hx	P <sub>a</sub> / 101	3.3 x 298 /	T <sub>a</sub> ) 1	/2
Next Calibration Date		11-Jan-2	20		=	m <sub>c</sub> x	$Q_{std} + b_c$		
				Calibratio	n of TSP				
Calibration	Mar	ometer R	eading	C	std	Continu	ious Flow		IC
Point	<b>H</b> (i	inches of	water)	(m <sup>3</sup> / min.)		Reco	rder, W	(W(P <sub>a</sub> /1	013.3x298/T <sub>a</sub> ) <sup>1/2</sup> /35.31)
	(up)	(down)	(difference)	X-axis		(C	FM)		Y-axis
1	2.3	2.3	4.6	1.0	0934	28			28.4144
2	2.7	2.7	5.4	1.	1843	34			34.5031
3	3.6	3.6	7.2	1.3	3669	40			40.5919
4	4.2	4.2	8.4	1.4	1760	46			46.6807
5	4.9	4.9	9.8	1.	5939		51		51.7547
By Linear Regression of	Y on X								
	Slope, m	=	45.14	480	Int	ercept, b =	-20	).2407	
Correlation Co	pefficient*	=	0.99	57					
Calibration	Accepted	=	Yes/P	<del>lo</del> **					
* if Correlation Coefficien	nt < 0.990,	check and	I recalibration	again.					
** Delete ee ee ee eiete									
** Delete as appropriate.									
Remarks :									
Calibrated by	Lau	rance Yun	g			Checked	by	:	James Chu
Date :	10	0-Dec-19				Date		:	10-Dec-19



Location :		CMA3a				Calbratio	on Date	:	10-Dec-19
Equipment no.	ŀ	HVS012				Calbratio	on Due Date	:	9-Feb-20
CALIBRATION OF CON	TINUOUS	FLOW R	ECORDER						
				Ambient C	Condition				
Temperature, T <sub>a</sub>		291		Kelvin	Pressure, P	a	1	019	mmHg
			Orifice Tr	ansfer Sta	ndard Inform	nation			
Equipment No.		0005		Slope, m <sub>c</sub>	1.998	61	Intercept, bc		-0.00882
Last Calibration Date	11-Jan-19				(Hx	P <sub>a</sub> / 101	3.3 x 298 /	T <sub>a</sub> ) 1	1/2
Next Calibration Date		11-Jan-2	:0		=	m <sub>c</sub> x	$Q_{std} + b_c$		
				Calibratio	n of TSP				
Calibration	Man	ometer R	eading	C	std	Continu	ious Flow		IC
Point	H (i	inches of	water)	(m <sup>3</sup> / min.)		Reco	rder, W	(W(P <sub>a</sub> /1	013.3x298/T <sub>a</sub> ) <sup>1/2</sup> /35.31)
	(up)	(down)	(difference)	X-axis		(C	(CFM)		Y-axis
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	1.3	3089	38			38.5623
4	3.8	3.8	7.6	1.4	1042	43			43.6363
5	4.5	4.5	9.0	1.	5277		48		48.7103
By Linear Regression of	Y on X								
	Slope, m	=	33.50	341	Int	ercept, b =	-3	.4912	
Correlation Co	efficient*	=	0.99	13					
Calibration	Accepted	=	Yes/P	<del>10</del> **					
* if Correlation Coefficien	it < 0.990,	check and	I recalibration	again.					
				_					
** Delete as appropriate.									
Remarks :									
Calibrated by	Lau	rance Yun	g			Checked	by	:	James Chu
Date :	10	0-Dec-19				Date		:	10-Dec-19



				•		•	•	
Location :		CMA4a			Calbratio	on Date	:	10-Dec-19
Equipment no.	ŀ	HVS004			Calbratio	on Due Date	:	9-Feb-20
CALIBRATION OF CON	ITINUOUS	FLOW R	ECORDER					
				Ambient Condition				
Temperature, T <sub>a</sub>		291		Kelvin Pressure, P	a	1	019	mmHg
			Orifice Tr	ransfer Standard Infor	mation			
Equipment No.		0005		<b>Slope</b> , m <sub>c</sub> 1.998		Intercept, bc		-0.00882
Last Calibration Date		11-Jan-1				3.3 x 298 /	T ) 1/2	
Next Calibration Date		11-Jan-2		(11)		$Q_{std} + b_c$	'a/	
						- sta · · · · · ·		
2 11 1				Calibration of TSP				
Calibration		nometer R	•	Q <sub>std</sub>		ious Flow	l	IC
Point	,	inches of	,	(m <sup>3</sup> / min.)		rder, W	(W(P <sub>a</sub> /101	3.3x298/T <sub>a</sub> ) <sup>1/2</sup> /35.31)
	(up)	(down)	(difference)		(CFM)			Y-axis
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			40.44	200			7004	
Completion C	Slope, m	=	46.16		ercept, b =	-22	2.7324	
Correlation Co		=	0.99 Yes/					
Calibration	Accepted	=	- Tes/P	<del>40</del>				
* if Correlation Coefficier	nt < 0.990,	check and	d recalibration	again.				
** Delete as appropriate.								
Remarks :								
					<u> </u>			
Calibrated by		rance Yun	g 		Checked	by	:	James Chu
Date :	10	0-Dec-19			Date		:	10-Dec-19



Location :		CMA5b				Calbratio	on Date	:	10-Dec-19
Equipment no.	ŀ	HVS010				Calbratio	on Due Date	:	9-Feb-20
CALIBRATION OF CON	TINUOUS	FLOW R	ECORDER						
				Ambient C	Condition				
Temperature, T <sub>a</sub>		291		Kelvin	Pressure, P	a	1	019	mmHg
			Orifice Tr	ansfer Sta	ndard Inforr	mation			
Equipment No.		0005		Slope, m <sub>c</sub>	1.9986	61	Intercept, bc	Т	-0.00882
Last Calibration Date	11-Jan-19				(Hx	P <sub>a</sub> / 101	3.3 x 298 /	T <sub>a</sub> ) 1	/2
Next Calibration Date		11-Jan-2	20		=	$m_c x$	$Q_{std} + b_c$		
				Calibratio	n of TSP				
Calibration	Mar	nometer R	eading	C	std	Continu	ious Flow		IC
Point	<b>H</b> (i	inches of	water)	(m <sup>3</sup> / min.)		Reco	rder, W	(W(P <sub>a</sub> /1	013.3x298/T <sub>a</sub> ) <sup>1/2</sup> /35.31)
	(up)	(down)	(difference)	X-axis		(C	(CFM)		Y-axis
1	1.7	1.7	3.4	0.9407		27			27.3996
2	2.3	2.3	4.6	1.0	0934	35			35.5179
3	3.0	3.0	6.0	1.2	2481	39			39.5771
4	3.6	3.6	7.2	1.3	3669	44			44.6511
5	4.1	4.1	8.2	1.4	1584		49		49.7251
By Linear Regression of	Y on X								
	Slope, m	=	40.87	780	Inte	ercept, b =	-10	).5581	
Correlation Co	efficient*	=	0.99	35					
Calibration	Accepted	=	Yes/	<del>\0</del> **					
* if Correlation Coefficien	ıt < 0.990,	check and	I recalibration	again.					
				Ü					
** Delete as appropriate.									
Remarks :									
Calibrated by	Lau	rance Yun	g			Checked	by	:	James Chu
Date :	10	0-Dec-19				Date		:	10-Dec-19



Location :		MA1e				Calbratio	on Date	: 10-Dec-19	
Equipment no.	ŀ	HVS007				Calbratio	on Due Date	: 9-Feb-20	
CALIBRATION OF CON	ITINUOUS	S FLOW R	ECORDER						
				Ambient C	Condition				
Temperature, T <sub>a</sub>		291		Kelvin	Pressure, P	1	10	019 mmHg	
			Orifice Tr	ansfer Sta	ndard Inform	nation			
Equipment No.		0005		Slope, m <sub>c</sub>	1.9986	61	Intercept, bc	-0.00882	
Last Calibration Date		11-Jan-1	9	(HxP <sub>a</sub> /1013.			3.3 x 298 /	$T_a)^{1/2}$	
Next Calibration Date		11-Jan-2	.0		=	$m_c x$	$Q_{std} + b_c$		
				Calibratio	n of TSP				
Calibration	Mar	nometer R	eading	C	std	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	1.8	1.8	3.6	0.9	9678	23		23.3404	
2	2.6	2.6	5.2	1.1	1623		31	31.4587	
3	3.2	3.2	6.4	1.2	2889	39		39.5771	
4	3.8	3.8	7.6	1.4	1042	46		46.6807	
5	4.4	4.4	8.8	1.5	5106		51	51.7547	
By Linear Regression of	Y on X								
	Slope, m	=	53.8	569	Inte	ercept, b =	-29	.6619	
Correlation Co	pefficient*	=	0.99	66					
Calibration	Accepted	=	Yes/	<del>lo</del> **					
* if Correlation Coefficier	nt < 0.990,	check and	I recalibration	again.					
** Delete as appropriate.									
Remarks :									
Calibrated by	Lau	rance Yun	g			Checked	by	: James Chu	
Date :	10	0-Dec-19				Date		: 10-Dec-19	



				•	• `	•	,	
Location :		MA1w			Calbratio	on Date	: 10-l	Dec-19
Equipment no.	ŀ	HVS008			Calbratio	on Due Date	: 9-F	eb-20
CALIBRATION OF CON	ITINUOUS	S FLOW R	ECORDER					
				Ambient Condition				
Temperature, T <sub>a</sub>		291		Kelvin Pressure, P	a	1	019	mmHg
			Orifice Tr	ansfer Standard Infor	mation			
Equipment No.		0005		<b>Slope</b> , <b>m</b> <sub>c</sub> 1.998		Intercept, bc	-0.	00882
Last Calibration Date		11-Jan-1	9			3.3 x 298 /		
Next Calibration Date		11-Jan-2		=		$Q_{std} + b_c$	· a/	
				Colibration of TCD	-	old 0		
Calibration	Mon	nometer R	anding	Calibration of TSP  Q std	Continu	ous Flow	IC	
Point		inches of				rder, W	(W(P <sub>a</sub> /1013.3x2	
Foint	(up)	(down)	(difference)	(m <sup>3</sup> / min.) <b>X-axis</b>		FM)	(W(F <sub>a</sub> /1013.3x2	
1	1.5	1.5	3.0	0.8839		25	25.3	
2	2.1	2.1	4.2	1.0450		34	34.5	
3	2.8	2.8	5.6	1.2060		42	42.6	
4	3.6	3.6	7.2	1.3669	49		49.7251	
5	4.3	4.3	8.6	1.4934		54	54.7	
By Linear Regression of								
, ,	Slope, m	=	48.1	833 Int	ercept, b =	-16	.3691	
Correlation Co	oefficient*	=	0.99	 178				_
Calibration	Accepted	=	Yes/P	<del>10</del> **				
* if Correlation Coefficier	nt < 0.990,	check and	I recalibration	again.				
** Delete as appropriate.								
Remarks :								
Calibrated I:	Lau	rance Yun	g		Checked	by	: Jam	es Chu
Calibrated by		0-Dec-19	<del>-</del>		Date	•		Dec-19
Date								



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



### CERTIFICATE OF CALIBRATION

Certificate No.:

19CA0222 02

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Item tested

Description:

Sound Level Meter (Type 1)

Microphone **B&K** 

Preamp

Manufacturer: Type/Model No.: **B&K** 2250

4950 2755097 **B&K** ZC0032 19223

Serial/Equipment No.: Adaptors used:

2701778

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: B&K 4226 Serial No.

**Expiry Date:** 

Traceable to:

Multi function sound calibrator Signal generator

DS 360

2288444

23-Aug-2019

CIGISMEC

Signal generator

DS 360

33873 61227

24-Apr-2019 26-Dec-2019 CEPREI CEPREI

**Ambient conditions** 

Temperature:

21 ± 1 °C

Relative humidity:

55 ± 10 %

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 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.

Fena Junai

Actual Measurement data are documented on worksheets.

**Approved Signatory:** 

Date:

26-Feb-2019

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.:

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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.

			Expanded	Coverage
Test:	Subtest:	Status:	Uncertanity (dB)	Factor
Self-generated noise	Α	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	
	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	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.

Calibrated by:

Date:

Fora C

Fong Chun Wai 25-Feb-2019 Checked by:

Date:

26-Feb-201

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

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#### CERTIFICATE OF CALIBRATION

Certificate No.:

19CA0905 02

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Item tested

Description:

Sound Level Meter (Type 1) B & K

Microphone B & K Preamp B & K

of

Manufacturer: Type/Model No.:

2250-L

4950 ZC0032

Serial/Equipment No.: Adaptors used:

3006790

2827240

21213

Item submitted by

Customer Name:

Lam Geotechnics Limited

Address of Customer:

ner:

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 ± 1 °C

Relative humidity: Air pressure:

55 ± 10 % 1000 ± 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%.

 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 Junqi

Approved Signatory:

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.

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

FNGIA



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#### CERTIFICATE OF CALIBRATION

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**Electrical Tests** 1,

> 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	
generated noise	C	Pass	0.8	
	Lin	Pass	1.6	
Linearity range for Leg	At reference range, Step 5 dB at 4 kHz	Pass	0.3	
3 - 2 - 1	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 1/10 <sup>3</sup> 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	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:

Shek Kwong Tat

Date:

Fung Chi Yip 06-Sep-2019

Date:

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.

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#### CERTIFICATE OF CALIBRATION

Certificate No.:

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of

Item tested

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

Microphone **B&K** 4950

Preamp B & K ZC0032

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

2250-L 2722310

2698702

**Expiry Date:** 

13318

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:

Multi function sound calibrator Signal generator

B&K 4226 DS 360 DS 360

Model:

Serial No. 2288444

23-Aug-2019 33873 24-Apr-2019 61227 26-Dec-2019

Traceable to:

CIGISMEC CEPREI **CEPREI** 

Ambient conditions

Temperature: Relative humidity: Air pressure:

Signal generator

21 ± 1 °C 55 ± 10 % 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%

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.

Fend Juna

Approved Signatory:

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.

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#### CERTIFICATE OF CALIBRATION

(Continuation Page)

Certificate No.:

19CA0329 02

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#### 1, **Electrical Tests**

The electrical tests were perfomed 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	
-	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 1/10 <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 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:

Fong Chun Wai

Checked by:

Fung Chi Yip 02-Apr-2019

Date:

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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#### CERTIFICATE OF CALIBRATION

Certificate No.:

19CA0425 02

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Item tested

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

Microphone **B&K** 

Preamp **B&K** 

of

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:

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 ± 1 °C

Relative humidity: Air pressure:

55 ± 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 1, 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 Junqi

Actual Measurement data are documented on worksheets.

Approved Signatory:

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.

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#### CERTIFICATE OF CALIBRATION

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19CA0425 02

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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	
	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 1/10 <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 Uncertanity (dB)	Coverage Factor
1031.	Gubiest	Otatus	Officertainty (db)	1 actor
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.

Calibrated by:

Date:

Fung Chi Yip 02-May-2019

Checked by:

Date:

03-May-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.

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#### CERTIFICATE OF CALIBRATION

Certificate No.:

19CA0314 01

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Item tested

Description:

Sound Level Meter (Type 1)

Microphone

of

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 .:

14-Mar-2019

Date of receipt:

Date of test:

18-Mar-2019

Reference equipment used in the calibration

Description:

Multi function sound calibrator

Model:

Serial No.

**Expiry Date:** 

Traceable to:

Signal generator

B&K 4226 DS 360

2288444 61227

23-Aug-2019 26-Dec-2019 CIGISMEC CEPREI

Ambient conditions

Temperature:

21 ± 1 °C 55 ± 10 %

Relative humidity: 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 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/Junqi

Approved Signatory:

19-Mar-2019

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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#### 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.

Test:	Subtest:	Status:	Expanded Uncertanity (dB)	Coverage Factor
Solf generated noise	۸	Pass	0.3	
Self-generated noise	A C			0.4
		Pass	0.8	2.1
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	Α	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	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	
3 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.

_			Expanded	Coverage
Test:	Subtest	Status	Uncertanity (dB)	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.

Calibrated by:

Date:

Fong Chun Wai 18-Mar-2019 Checked by:

Fung Chi Yi 19-Mar-2019

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

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#### CERTIFICATE OF CALIBRATION

Certificate No.:

19CA0617 03-02

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Item tested

Description: Manufacturer: Acoustical Calibrator (Class 1)

Honglim Co., Ltd. HLES-02

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

2016611465

Adaptors used:

Item submitted by

Curstomer:

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 ± 1 °C

Relative humidity:

55 ± 10 %

Air pressure:

1005 ± 5 hPa

#### **Test specifications**

- 1, 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 3. 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.

Feng Junqi

Approved Signatory:

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.

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#### CERTIFICATE OF CALIBRATION

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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 Shown	Output Sound Pressure Level Setting	Measured Output Sound Pressure Level	Estimated Expanded Uncertainty
Hz	dB	dB	dB
1000	94.00	93.85	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 = 0.012 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 = 1003.6 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 = 0.3 %

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

andrated by.

g Chi Yip

19-Jun-2019

\_ .

Shek Kwong Tat

Date:

Date:

Checked by:

19-Jun-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.

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