

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
CARCON - VI-	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	Qa= 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((√∆H(Ta/Pa))-b

	Standard Conditions
Tstd:	298.15 °K
Pstd:	760 mm Hg
	Key
ΔH: calibrator	manometer reading (in H2O)
	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		CMA5b				Calibra	ation Date	88	19-Oct-18
Equipment no.	HVS010				Calibra	ation Due Date	1	19-Dec-18	
CALIBRATION OF CONTIN	NUOUS FL	OW RECO	RDER						
				Ambient C	Condition				
Temperature, T _a		297.	2	Kelvin	Pressure, P			1017	mmHg
Market 1			Orifice	Transfer Sta	ndard Inform	nation	HILLE		
Equipment No.		Ori002		Slope, m _e	2.122	31	Intercept, bo		-0.08016
Last Calibration Date		19-Jan-1	3		(F	1xP,/1	013.3 x 298/	(Ta) 15	t.
Next Calibration Date		19-Jan-1	9			m	$x Q_{std} + b_c$		
				Calibratio	n of TSP				
Calibration	Mar	nometer Re	ading	٥	440	Con	tinuous Flow		IC .
Point	н (inches of v	vater)	(m ⁹ / min.)		R	Recorder, W		1013-3×298/T _a) ⁴⁰ /35-31)
	(up)	(down)	(difference)	X-	axis		(CFM)		Y-axis
1	1.3	1.3	2.6	0.7	7906 33		33		33.1079
2	2.0	2.0	4.0	0.9	9738 38		38		38.1243
3	3.2	3.2	6.4	12	2243		45		45.1472
4	4.2	4.2	8.4	1.3	1984		50		50.1635
5	5.3	5.3	10.6	1.5	674		55		55.1799
By Linear Regression of Y	ın X								
	Slope, m	7.	28.1	3797	In	tercept, b	= 1	0.5471	
Correlation C	coefficient*	=	0.9	999					
Calibration	Accepted		Yes	No"					
* if Correlation Coefficient <	0.990, che	eck and rec	alibration aga	sin.					
** Delete as appropriate.									
CONTRACTOR	provided i	nformation	the equipme	ent reference	no. of the ca	librated Hig	h Volume Sample	r has bee	n
re-assigned fr	om EL222	to HVS010	with respect	to the update	e in quality ma	anagement	system.		
Calibrated by	-	Ray Lee				Check	ed by		Pualine Wong
7753078V05050700	- 1	9-Oct-18				Date		8	19-Oct-18



Calibration Data for High Volume Sampler (TSP Sampler)

CALIBRATION OF CONTINUOUS FLOW RECORDER Ambient Condition Temperature, T., 297.2 Keivin Pressure, P., 1017 Orifice Transfer Standard Information	9-Oct-18
Ambient Condition	19-Dec-18
Temperature, T _s	
Orifice Transfer Standard Information Equipment No. Ori002 Slope, m _s 2.12231 Intercept, bc - Last Calibration Date 19-Jan-18 (H x P ₊ / 1013.3 x 298 / T ₊) 1/2	
Equipment No. Ori002 Slope, ms. 2.12231 Intercept, bc - Last Calibration Date 19-Jan-18 (HxP*/1013.3 x 298/T*) 1/2	mmHg
Last Calibration Date 19-Jan-18 (H x P * / 1013.3 x 298 / T *) 1/2	
	-0.06016
Next Calibration Date 19-Jan-19 $m_c \times Q_{sld} + b_c$	
Calibration of TSP	
Calibration Manometer Reading Q at Continuous Flow	IC
Point H (inches of water) (m ³ / min.) Recorder, W (W(P _e /1013.3	3×298/T ₄) ¹⁰ /35.31)
(up) (down) (difference) X-axis (CFM) Y	r-axis
1 1.4 1.4 2.8 0.8194 30 30	0.0981
2 2.3 2.3 4.6 1.0422 36 36	8.1177
3 3.7 3.7 7.4 1.3143 44 44	4.1439
4 4.8 4.8 9.6 1.4930 48 48	8.1570
5 6.1 6.1 12.2 1.6795 54 54	4.1766
By Linear Regression of Y on X Slope, m = 27.7403 Intercept, b = 7.3172 Correlation Coefficient* = 0.9992 Calibration Accepted = Yes/Ne**	
* if Correlation Coefficient < 0.990, check and recalibration again. ** Delete as appropriate. Remarks: As per client's provided information, the equipment reference no. of the calibrated High Volume Sampler has been re-assigned from EL551 to HVS013 with respect to the update in quality management system.	
- Paulee Charled by Pu	aline Wong
Camprated by	19-Oct-18



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CERTIFICATE OF CALIBRATION

Certificate No.:

18CA0322 01

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of

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Item tested

Description:

Sound Level Meter (Type 1)

Microphone

Manufacturer:

Larson Davis

PCB

Type/Model No.:

LxT1

Serial/Equipment No.:

377B02 171529

Adaptors used:

0003737

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:

Multi function sound calibrator

Model: B&K 4226 Serial No.

Expiry Date:

Traceable to:

Signal generator

DS 360

2288444 61227

08-Sep-2018 01-Apr-2018

CIGISMEC CEPREI

Ambient conditions

Temperature:

Air pressure:

21 ± 1 °C

Relative humidity:

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 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 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.

C Soils & Materials Engineering Co., Ltd

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



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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	Α	Pass	0.3	
	С	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	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	
	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:

End

Fung Chi Yip 28-Mar-2018 Checked by:

Date:

Lam Tze Wai 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.

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



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CERTIFICATE OF CALIBRATION

Certificate No.:

17CA1124 02

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Item tested

Description:

Acoustical Calibrator (Class 1)

Manufacturer: Type/Model No.: Larson Davis CAL200

Serial/Equipment No.: Adaptors used: 13128

Item submitted by

Curstomer:

Lam Environmental Service Ltd.

Address of Customer:

Request No.:

1000

Date of receipt:

24-Nov-2017

Date of test:

30-Nov-2017

Reference equipment used in the calibration

Description:	Model:	Serial No.	Expiry Date:	Traceable to:
Lab standard microphone	B&K 4180	2341427	11-Apr-2018	SCL
Preamplifier	B&K 2673	2239857	05-May-2018	CEPREI
Measuring amplifier	B&K 2610	2346941	03-May-2018	CEPREI
Signal generator	DS 360	61227	01-Apr-2018	CEPREI
Digital multi-meter	34401A	US36087050	25-Apr-2018	CEPREI
Audio analyzer	8903B	GB41300350	21-Apr-2018	CEPREI
Universal counter	53132A	MY40003662	22-Apr-2018	CEPREI

Ambient conditions

Temperature:

22 ± 1 °C

Relative humidity: Air pressure: 50 ± 10 % 1005 ± 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.

Feng

Approved Signatory:

Date: 30-Nov-2017

Company Chop:

SENGINESS STOS H OLL

Comments: The results reported in this confined 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 CARP156-1/Issue 1-Rev D-01-03-2007



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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	Output Sound Pressure	Measured Output	(Output level in dB re 20 µPa) Estimated Expanded Uncertainty dB
Shown	Level Setting	Sound Pressure Level	
Hz	dB	dB	
1000	94.0	94.01	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 = 0.010 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 = 999.5 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 = 0.5 %

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

Fung Chi Yip

Checked by

Lam Tze Wai

Date:

\$0-Nov-2017

Date:

30-Nov-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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