綜合試驗有限公司
SOILS & MATERIALS ENGINEERING CO., LTD.
香港新界葵涌永基路22-24號好爸爸創科大廈
Good Ba Ba Hitech Building, Nos. 22-24 Wing Kei Road, Kwai Chung, New Territories, Hong Kong
Tel: (852) 2873 6860 Fax: (852) 2555 7533 E-mail: smec@cigismec.com Website: www.cigismec.com

CERTIFICATE OF CALIBRATION

Certificate No.: 21CA1021 05-02 **Page:** 1 **of** 2

Item tested

Description:	Acoustical Calibrator (Class 1)
Manufacturer:	Honglim Co., Ltd.
Type/Model No.:	HLES-02
Serial/Equipment No.:	2019612534
Adaptors used:	-

Item submitted by

Curstomer:	Lam Environmental Services Limited.
Address of Customer:	-
Request No.:	-
Date of receipt:	21-Oct-2021

Date of test: 25-Oct-2021

Reference equipment used in the calibration

Description:	Model:	Serial No.	Expiry Date:	Traceable to:
Lab standard microphone	B&K 4180	2341427	04-May-2022	SCL
Preamplifier	B&K 2673	2239857	31-May-2022	CEPREI
Measuring amplifier	B&K 2610	2346941	01-Jun-2022	CEPREI
Signal generator	DS 360	33873	27-May-2022	CEPREI
Digital multi-meter	34401A	US36087050	27-May-2022	CEPREI
Audio analyzer	8903B	GB41300350	28-May-2022	CEPREI
Universal counter	53132A	MY40003662	02-Jun-2022	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.
3. The results are rounded to the nearest 0.01 dB and 0.1 Hz and have not been corrected for variations from a reference pressure of 1013.25 hectoPascals as the maker's information indicates that the instrument is insensitive to pressure changes.

Test results

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

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

Approved Signatory: Feng Junqi **Date:** 26-Oct-2021 **Company Chop:** SOILS AND MATERIALS ENGINEERING COMPANY LTD. 綜合試驗有限公司

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

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CERTIFICATE OF CALIBRATION

(Continuation Page)

Certificate No.: 21CA1021 05-02 **Page:** 2 **of** 2

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.

(Output level in dB re 20 μPa)

Frequency Shown Hz	Output Sound Pressure Level Setting dB	Measured Output Sound Pressure Level dB	Estimated Expanded Uncertainty dB
1000	94.00	94.02	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 = 0.011 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 = 998.27 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.

- End -

Calibrated by: Fung Chi Yip **Date:** 25-Oct-2021

Checked by: Chan Yuk Yiu **Date:** 26-Oct-2021

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.

綜合試驗有限公司
SOILS & MATERIALS ENGINEERING CO., LTD.
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CERTIFICATE OF CALIBRATION

Certificate No.: 21CA0326 03-02 **Page** 1 **of** 2

Item tested

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

Item submitted by

Customer Name:	Lam Environmental Services Limited.
Address of Customer:	-
Request No.:	-
Date of receipt:	26-Mar-2021

Date of test: 31-Mar-2021

Reference equipment used in the calibration

Description:	Model:	Serial No.	Expiry Date:	Traceable to:
Multi function sound calibrator	B&K 4226	2288444	23-Aug-2021	CIGISMEC
Signal generator	DS 360	33873	19-May-2021	CEPREI

Ambient conditions

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

Test specifications

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

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

3, The acoustic calibration was performed using an B&K 4226 sound calibrator and corrections was applied for the difference between the free-field and pressure 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: Feng Junqi **Date:** 07-Apr-2021 **Company Chop:**

SOILS AND MATERIALS ENGINEERING COMPANY LTD. 綜合試驗有限公司

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. The results apply to the item as received.

綜合試驗有限公司
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CERTIFICATE OF CALIBRATION

(Continuation Page)

Certificate No.: 21CA0326 03-02 **Page** 2 **of** 2

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 Uncertainty (dB)	Coverage Factor
Self-generated noise	A	Pass	0.3	
	C	Pass	0.8	2.1
	Lin	Pass	1.6	2.2
Linearity range for Leq	At reference range , Step 5 dB at 4 kHz	Pass	0.3	
	Reference SPL on all other ranges	Pass	0.3	
	2 dB below upper limit of each range	Pass	0.3	
	2 dB above lower limit of each range	Pass	0.3	
Linearity range for SPL	At reference range , Step 5 dB at 4 kHz	Pass	0.3	
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 $1/10^3$ at 4kHz	Pass	0.3	
	1 ms burst duty factor $1/10^4$ at 4kHz	Pass	0.3	
Pulse range	Single burst 10 ms at 4 kHz	Pass	0.4	
Sound exposure level	Single burst 10 ms at 4 kHz	Pass	0.4	
Overload indication	SPL	Pass	0.3	
	Leq	Pass	0.4	

2, Acoustic tests

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

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

3, Response to associated sound calibrator

N/A

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

- End -

Calibrated by: Fung Chi Yip **Date:** 31-Mar-2021

Checked by: Chan Yuk Yiu **Date:** 07-Apr-2021

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.

TISCH Environmental

RECALIBRATION DUE DATE:
February 3, 2022

Certificate of Calibration

Calibration Certification Information				
Cal. Date:	February 3, 2021	**Rootsmeter S/N:** 438320	**Ta:** 293	°K
Operator:	Jim Tisch		**Pa:** 750.6	mm Hg
Calibration Model #:	TE-5025A	**Calibrator S/N:** **3880**		

Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H2O)
1	1	2	1	1.4550	3.2	2.00
2	3	4	1	1.0280	6.4	4.00
3	5	6	1	0.9180	8.0	5.00
4	7	8	1	0.8750	8.8	5.50
5	9	10	1	0.7220	12.8	8.00

Data Tabulation

Vstd (m3)	Qstd (x-axis)	$\sqrt{\Delta H\left(\frac{Pa}{Pstd}\right)\left(\frac{Tstd}{Ta}\right)}$ (y-axis)	Va	Qa (x-axis)	$\sqrt{\Delta H\left(Ta/Pa\right)}$ (y-axis)
1.0002	0.6874	1.4174	0.9957	0.6844	0.8836
0.9959	0.9688	2.0044	0.9915	0.9645	1.2496
0.9937	1.0825	2.2410	0.9893	1.0777	1.3971
0.9927	1.1345	2.3504	0.9883	1.1295	1.4653
0.9873	1.3675	2.8347	0.9829	1.3614	1.7672
QSTD	**m=**	**2.08437**	**QA**	**m=**	**1.30520**
	b=	**-0.01508**		**b=**	**-0.00940**
	r=	**1.00000**		**r=**	**1.00000**

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: rootsmeter manometer reading (mm Hg)	
Ta: actual absolute temperature (°K)	
Pa: actual barometric pressure (mm Hg)	
b: intercept	
m: slope	

RECALIBRATION

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

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1600 Washington Blvd
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(541) 471-7111
(541) 471-7116 (Fax)
Service@metone.com

Calibration Certificate

The calibration results on this report certify that this instrument complies with the product specifications at the time of calibration. Calibration was performed according to accepted industry methods using equipment, procedures, and standards that are traceable to NIST and ISO.

Recommended calibration interval is 12 months from the first day of use.

Instrument Model# 831 **Instrument Serial#** R14332

Date of Calibration 2/18/2021 **Sensor #** 12228

J. Chester AT1
Calibration Technician

AT14 MAR 0 2 2021
Quality Check

Temperature 30 °C **Relative Humidity** 33 %

Test Procedure: 831-6100

PSL Size (µm)	Test Results	Test Spec.	Lot# NIST	Expiration
0.5	Pass	± 10%	219480	11/30/2022
0.7	Pass	± 10%	229561	08/31/2023
1.0	Pass	± 10%	229294	8/31/2023
2.5	Pass	± 10%	REF	NA
4.0	Pass	± 10%	REF	NA
5.0	Pass	± 10%	REF	NA
7.0	Pass	± 10%	REF	NA
10.0	Pass	± 10%	REF	NA

Standards	Model	SN	Cal Due
Flowmeter	DCL-M	103751	3/14/2021
DMM	189 Multimeter	92130180	10/26/2021
RH/TEMP SENSOR	083E-1-6	R20313	9/17/2021
Particle Counter	GT-526	M1760	5/19/2021

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Calibration Certificate

The calibration results on this report certify that this instrument complies with the product specifications at the time of calibration. Calibration was performed according to accepted industry methods using equipment, procedures, and standards that are traceable to NIST and ISO.

Recommended calibration interval is 12 months from the first day of use.

Instrument Model# *Aerocet 831* **Instrument Serial#** *Y23153*

Date of Calibration *9/9/2021* **Sensor #** *19493*

JGoddard AT 8
Calibration Technician

AT 1
Quality Check

Temperature *22* °C **Relative Humidity** *41* %

Test Procedure: *Aerocet 831-6100*

PSL Size (µm)	Test Results	Test Spec.	Lot# NIST	Expiration
0.3	Pass	± 10%	223077	04/30/2023
0.5	Pass	± 10%	219480	11/30/2022
1.0	Pass	± 10%	229294	8/31/2023
2.0	Pass	± 10%	REF	NA
5.0	Pass	± 10%	REF	NA
3.0	Pass	± 10%	REF	NA
5.0	Pass	± 10%	REF	NA
10.0	Pass	± 10%	REF	NA

Standards	Model	SN	Cal Due
RH/TEMP SENSOR	083E-1-35	U20080	11/23/2021
Flowmeter	DCL-M	103751	4/1/2022
RH/TEMP SENSOR	083E-1-6	R20313	9/17/2021
DMM	289	27720071	8/24/2022

Lam Environmental Services Limited

Calibration Data for High Volume Sampler (TSP Sampler)

Location	:	AMS1	**Calbration Date**	:	7-Sep-21
Equipment no.	:	HVS020	**Calbration Due Date**	:	7-Nov-21

CALIBRATION OF CONTINUOUS FLOW RECORDER

Ambient Condition					
Temperature, T_a	303.1	Kelvin	**Pressure, P_a**	1010	mmHg

Orifice Transfer Standard Information					
Equipment No.	**3166**	**Slope, m_c**	1.88375	**Intercept, bc**	0.03970
Last Calibration Date	3-Aug-21	$(H \times P_a / 1013.3 \times 298 / T_a)^{1/2}$			
Next Calibration Date	3-Aug-22	$= m_c \times Q_{std} + b_c$			

Calibration of TSP						
Calibration Point	**Manometer Reading H (inches of water)**			**Q_{std}** (m^3 / min.)	**Continuous Flow Recorder, W**	**IC** $(W(P_a/1013.3 \times 298/T_a)^{1/2}/35.31)$
	(up)	(down)	(difference)	**X-axis**	(CFM)	**Y-axis**
1	1.2	1.2	2.4	0.7932	40	39.6053
2	1.9	1.9	3.8	1.0035	46	45.5460
3	3.0	3.0	6.0	1.2664	52	51.4868
4	4.0	4.0	8.0	1.4656	57	56.4375
5	5.0	5.0	10.0	1.6411	61	60.3980

By Linear Regression of Y on X

Slope, m = 24.3271 Intercept, b = 20.6759

Correlation Coefficient* = 0.9993

Calibration Accepted = Yes/~~No~~**

* if Correlation Coefficient < 0.990, check and recalibration again.

** Delete as appropriate.

Remarks :

Calibrated by	:	Henry Lau	**Checked by**	:	James Chu
Date	:	7-Sep-21	**Date**	:	7-Sep-21

Lam Environmental Services Limited

Calibration Data for High Volume Sampler (TSP Sampler)

Location	:	AMS2	**Calbration Date**	:	7-Sep-21
Equipment no.	:	HVS019	**Calbration Due Date**	:	7-Nov-21

CALIBRATION OF CONTINUOUS FLOW RECORDER

Ambient Condition					
Temperature, T_a	303.1	Kelvin	**Pressure, P_a**	1010	mmHg

Orifice Transfer Standard Information					
Equipment No.	**3166**	**Slope, m_c**	1.88375	**Intercept, bc**	0.03970
Last Calibration Date	3-Aug-21	$(H \times P_a / 1013.3 \times 298 / T_a)^{1/2}$			
Next Calibration Date	3-Aug-22	$= m_c \times Q_{std} + b_c$			

Calibration of TSP						
Calibration Point	**Manometer Reading H (inches of water)**			**Q_{std}** (m^3 / min.)	**Continuous Flow Recorder, W**	**IC** $(W(P_a/1013.3 \times 298/T_a)^{1/2}/35.31)$
	(up)	(down)	(difference)	**X-axis**	(CFM)	**Y-axis**
1	1.6	1.6	3.2	0.9192	34	33.6645
2	2.5	2.5	5.0	1.1542	41	40.5954
3	3.7	3.7	7.4	1.4088	50	49.5066
4	4.6	4.6	9.2	1.5732	54	53.4671
5	5.7	5.7	11.4	1.7536	59	58.4177

By Linear Regression of Y on X

Slope, m = 30.0186 Intercept, b = 6.2510

Correlation Coefficient* = 0.9984

Calibration Accepted = Yes/~~No~~**

* if Correlation Coefficient < 0.990, check and recalibration again.

** Delete as appropriate.

Remarks :

Calibrated by	:	Henry Lau	**Checked by**	:	James Chu
Date	:	7-Sep-21	**Date**	:	7-Sep-21

Lam Environmental Services Limited

Calibration Data for High Volume Sampler (TSP Sampler)

Location	:	AMS1	**Calbration Date**	:	8-Nov-21
Equipment no.	:	HVS020	**Calbration Due Date**	:	8-Jan-22

CALIBRATION OF CONTINUOUS FLOW RECORDER

Ambient Condition					
Temperature, T_a	303.1	Kelvin	**Pressure, P_a**	1010	mmHg

Orifice Transfer Standard Information					
Equipment No.	**3166**	**Slope, m_c**	1.88375	**Intercept, bc**	0.03970
Last Calibration Date	3-Aug-21	$(H \times P_a / 1013.3 \times 298 / T_a)^{1/2}$			
Next Calibration Date	3-Aug-22	$= m_c \times Q_{std} + b_c$			

Calibration of TSP						
Calibration Point	**Manometer Reading H (inches of water)**			**Q_{std}** (m^3 / min.) **X-axis**	**Continuous Flow Recorder, W** (CFM)	**IC** $(W(P_a/1013.3 \times 298/T_a)^{1/2}/35.31)$ **Y-axis**
	(up)	(down)	(difference)			
1	1.5	1.5	3.0	0.8893	24	23.7632
2	2.6	2.6	5.2	1.1775	35	34.6546
3	3.5	3.5	7.0	1.3696	46	45.5460
4	4.6	4.6	9.2	1.5732	56	55.4474
5	5.5	5.5	11.0	1.7222	66	65.3487

By Linear Regression of Y on X

Slope, m = 49.8862 Intercept, b = -22.2130

Correlation Coefficient* = 0.9955

Calibration Accepted = Yes/~~No~~**

* if Correlation Coefficient < 0.990, check and recalibration again.

** Delete as appropriate.

Remarks : _____

Calibrated by	:	Alan Ng	**Checked by**	:	Garry Yu
Date	:	8-Nov-21	**Date**	:	8-Nov-21

Lam Environmental Services Limited

Calibration Data for High Volume Sampler (TSP Sampler)

Location	:	AMS2	**Calbration Date**	:	8-Nov-21
Equipment no.	:	HVS019	**Calbration Due Date**	:	8-Jan-22

CALIBRATION OF CONTINUOUS FLOW RECORDER

Ambient Condition					
Temperature, T_a	303.1	Kelvin	**Pressure, P_a**	1010	mmHg

Orifice Transfer Standard Information					
Equipment No.	**3166**	**Slope, m_c**	1.88375	**Intercept, bc**	0.03970
Last Calibration Date	3-Aug-21	$(H \times P_a / 1013.3 \times 298 / T_a)^{1/2}$			
Next Calibration Date	3-Aug-22	$= m_c \times Q_{std} + b_c$			

Calibration of TSP						
Calibration Point	**Manometer Reading H (inches of water)** (up)	(down)	(difference)	**Q_{std}** (m^3 / min.) **X-axis**	**Continuous Flow Recorder, W** (CFM)	**IC** ($W(P_a/1013.3 \times 298/T_a)^{1/2}/35.31$) **Y-axis**
1	1.6	1.6	3.2	0.9192	25	24.7533
2	2.7	2.7	5.4	1.2003	37	36.6349
3	3.7	3.7	7.4	1.4088	46	45.5460
4	4.5	4.5	9.0	1.5558	55	54.4572
5	5.7	5.7	11.4	1.7536	64	63.3684

By Linear Regression of Y on X

Slope, m	=	46.6577	Intercept, b	=	-18.8541
Correlation Coefficient*	=	0.9982			
Calibration Accepted	=	Yes/~~No~~**			

* if Correlation Coefficient < 0.990, check and recalibration again.

** Delete as appropriate.

Remarks : _____

Calibrated by	:	Alan Ng	**Checked by**	:	Garry Yu
Date	:	8-Nov-21	**Date**	:	8-Nov-21