# AECOM Asia Company Limited Tisch TSP Mass Flow Controlled High Volume Air Sampler Field Calibration Report

Station	Block B, Merit Industrial Centre ( E-A14a )			Operator:	Operator: Shum Kam Yuer			
Cal. Date:	26/10/2024	26/10/2024		Next Due Date:			-	
Model No.:	TE-5170			Serial No.		280		
Equipment No.:	A-001-15T						=	
			Ambient	Condition				
Temperatu	re, Ta (K)	301.0	Pressure,	Pa (mmHg)		764.6		
			"					
			Orifice Transfer St	andard Information	n			
Serial	No:	843	Slope, mc	2.02	2014	Intercept, bc	-0.04198	
Last Calibra	ntion Date:	15-Jan-24		may Ootel + be	a = (U v (Da/760) v	(200/Ta)1/2		
Next Calibra	ation Date:	16-Jan-25		mic x Qsta + bo	c = [H x (Pa/760) x	(298/1 a)] ···		
		V						
			Calibration of	TSP Sampler	. *			
			Orfice		HV	S Flow Recorder		
Resistance Plate	DH (orifice)			3		0	Б	
No.	DH (orifice), in. of water	[DH x (Pa/7	760) x (298/Ta)] <sup>1/2</sup>	Qstd (m³/min) X - axis	Flow Recorder Reading (CFM)	Continuous Flow		
				axis	Reading (Crivi)	Reading IC (CFI	vi) Y-axis	
18	6.9		2.62	1.32	45.0	44.91		
13	6.0		2.44	1.23	40.0	39.92		
10	5.2		2.28	1.15	35.0	34.93		
7	4.3		2.07	1.05	29.0	28.94		
5	3.0		1.73	0.88	21.0	20.96		
By Linear Regress	sion of Y on X							
Slope , mw =	54.5985			Intercept, bw =	-27.4	1102		
Correlation Coeffic		— ·	.9986	intercept, bw -	-21.4	+192	i)	
*If Correlation Coeff	-			-				
33113144311 33311	100111 - 0.000, 011	con and recalibr	ato.					
			Set Point C	alculation				
From the TSP Field	Calibration Curve	e, take Ostd = 1		alcalation				
From the Regressio								
and the greene	q,	raido docordii	.g to					
		mw >	Qstd + bw = IC x	[(Pa/760) x (298/Ta	)]1/2			
				, ( , , ,	<b>7.</b>			
Therefore, Set Point	t; IC = ( mw x Qst	d + bw ) x [( 760	/ Pa ) x ( Ta / 298 )	11/2=	_	43.65		
					·-			
Damada								
Remarks:								
				-				
QC Reviewer:	WS CHAN		Signature:	I-C	Date:	26/10/2024		



TE-5025A

# RECALIBRATION DUE DATE:

January 15, 2025

# Certificate of Calibration

**Calibration Certification Information** 

Cal. Date: January 15, 2024

Rootsmeter S/N: 438320

Calibrator S/N: 0843

**Ta:** 293 °K

Pa: 755.9

°K

Operator: Jim Tisch
Calibration Model #:

mm Hg

Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H2O)
1	1	2	1	1.3890	3.2	2.00
2	3	4	1	0.9890	6.4	4.00
3	5	6	1	0.8790	8.0	5.00
4	7	8	1	0.8430	8.8	5.50
5	9	10	1	0.6960	12.8	8.00

Data Tabulation							
Vstd	Qstd	$\sqrt{\Delta H \left(\frac{Pa}{Pstd}\right) \left(\frac{Tstd}{Ta}\right)}$		Qa	$\sqrt{\Delta H \Big(  Ta/Pa  \Big)}$		
(m3)	(x-axis)	(y-axis)	Va	(x-axis)	(y-axis)		
1.0073	0.7252	1.4224	0.9958	0.7169	0.8805		
1.0030	1.0142	2.0116	0.9915	1.0026	1.2452		
1.0009	1.1387	2.2490	0.9894	1.1256	1.3921		
0.9998	1.1860	2.3588	0.9884	1.1724	1.4601		
0.9945	1.4288	2.8448	0.9831	1.4125	1.7609		
	m=	2.02014		m=	1.26498		
QSTD[	b=	-0.04198	QA	b=	-0.02599		
	r=	0.99994		r=	0.99994		

	Calculation	S			
Vstd=	ΔVoI((Pa-ΔP)/Pstd)(Tstd/Ta)	<b>Va</b> = ΔVol((Pa-ΔP)/Pa)			
Qstd=	Vstd/∆Time	Qa= Va/ΔTime			
For subsequent flow rate calculations:					
Qstd=	$1/m \left( \sqrt{\Delta H \left( \frac{Pa}{Pstd} \right) \left( \frac{Tstd}{Ta} \right)} \right) \cdot b $	$\mathbf{Qa} = 1/m \left( \left( \sqrt{\Delta H \left( \text{Ta/Pa} \right)} \right) - b \right)$			

	Standard	Conditions					
Tstd:	298.15	'K					
Pstd:	760	mm Hg					
	К	ey					
	ΔH: calibrator manometer reading (in H2O)						
		eter reading (mm Hg)					
Ta: actual ab	solute temp	perature (°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

# **EQUIPMENT CALIBRATION RECORD**

Type:			Laser Dust Monitor				_
Manufacti	urer/Brand:		SIBATA				-
Model No	.:		LD-3				•
Equipmen	t No.:		A.005.11a				-
	Adjustment Sca	le Setting:	799 CPM			•	
,	,	J					
Operator:			WS CHAN				-
Standard E	quimment						
Equipmen	t:		High Volu	me Samp	er		
Venue:			Ma Wan (	Chung Vill	age		-
Model No	.:		TE-5170				_
Serial No.:			5008				•
Last Calibr	ation Date:		27-Jun-24	ļ			-
							•
Calibration	n Result						
Sensitivity	Adjustment Sca	le Setting (Refo	re Calihrati	on).		799	СРМ
	Adjustment Sca			-		799	CPM
Schistervicy	Adjustinent sea	ie setting (Arter	Canbration	1).		,,,,	CITIVI
Hour	Date	Time	Ambient	Condition	Concentration ①	Total Count 2	Count/
	(dd/mm/yy)		Temp (°C)	R.H.(%)	(mg/m3)		Minute(3)
	, , ,,,,		, ,	. ,	Y-axis		X-axis
1	09/08/24	9:00-10:00	33.0	76	0.1280	5150	85.83
2	09/08/24	10:20-11:20	33.0	76	0.0615	2645	44.08
3	09/08/24	13:00-14:00	33.0	76	0.1590	5945	99.08
Note:	1 Monitoring	data was measu	red by Hig	h Volume	Sampler		<u>!</u>
	~	was logged by L			•		
	Ξ.	te was calculate			0)		
By Linear I	Regression of Y c	on X					
•	Slope (K-factor)		0.0015				
	Correlation coe		0.9978				
Validity of Calibration Record: 9-Aug-25							
Remarks:							
					N,		
QC	Reviewer:	Y.W. Fung	_ S	ignature:		Date:	9-Aug-24

# **EQUIPMENT CALIBRATION RECORD**

Type:			Laser Dus	t Monitor			
	ırer/Brand:		SIBATA				
Model No.	•		LD-3B				
Equipment	nent No.: A.005.13a						
	Adjustment Scal	e Setting:	643 CPM				
Operator:			WS CHAN				,
Standard E	quimment						
Equipment	t:		High Volu				1
Venue:			Ma Wan (	hung Villa	age		1
Model No.	:		TE-5170				
Serial No.:			5008				
Last Calibr	ation Date:		27-Jun-24				i
Calibration	Result						
-	Adjustment Scal	• ,		•		643	СРМ
Sensitivity	Adjustment Scal	e Setting (After	Calibration	n):		643	CPM
			1				
Hour	Date	Time		Condition	Concentration ①	Total Count 2	Count/
	(dd/mm/yy)		Temp (°C)	R.H.(%)	(mg/m3)		Minute ③
4	00/00/04	0.00.10.00	22.0	7.0	Y-axis	5225	X-axis
1	09/08/24	9:00-10:00	33.0	76	0.128	5325	88.75
2	09/08/24	10:20-11:20	33.0	76	0.062	2650	44.17
3	09/08/24	13:00-14:00	33.0	76	0.159	6120	102.00
Note:		data was measu			Sampler		
	=	was logged by L					
	(3) Count/minu	te was calculate	d by (Total	Count/60	)		
Ry Linear F	Regression of Y o	n X					
by Ellical I	Slope (K-factor):		0.0015				
	Correlation coef		0.9981				
	correlation coci	neiene.	0.5501				
Validity of Calibration Record:			9-Aug-25				
Remarks:							
					9/		
QC I	Reviewer:	Y.W. Fung		Signature:	/	Date:	9-Aug-24

# **EQUIPMENT CALIBRATION RECORD**

Type:			Laser Dust Monitor				_
Manufacti	urer/Brand:		SIBATA				•
Model No	.:		LD-3B				•
Equipmen	t No.:		A.005.16a				•
	Adjustment Sca	le Setting:	521 CPM	-			
			<u> </u>				•
Operator:			WS CHAN				
Standard E	quimment						
Equipmen	t:		High Volu	me Samp	ler		
Venue:			Ma Wan (	Chung Vill	age		
Model No	.:		TE-5170				
Serial No.:			5008				•
Last Calibr	ation Date:		27-Jun-24				•
							•
Calibration	n Result						
•							
Sensitivity	Adjustment Sca	le Setting (Befor	e Calibrati	on):		521	CPM
Sensitivity	Adjustment Sca	le Setting (After	Calibration	า):		521	СРМ
							•
Hour	Date	Time	Ambient	Condition	Concentration ①	Total Count 2	Count/
	(dd/mm/yy)		Temp (°C)	R.H.(%)	(mg/m3)		Minute(3)
	, , ,,,,		, ,	. ,	Y-axis		X-axis
1	09/08/24	9:00-10:00	33.0	76	0.128	5110	85.17
2	09/08/24	10:20-11:20	33.0	76	0.062	2645	44.08
3	09/08/24	13:00-14:00	33.0	76	0.159	5942	99.03
Note:		data was measu				3312	33.03
Note.	~	was logged by L			Jumpier		
	$\simeq$	ite was calculate			n)		
	(3) County Illino	ite was calculate	u by (Total	Countyou	)		
By Linear I	Regression of Y c	on X					
•	Slope (K-factor)		0.0015				
	Correlation coe		0.998		•		
		····oiciici	- 0.550		•		
Validity of Calibration Record: 9-Aug-25							
Remarks:							
nemarks.							
					M		
00	Daviaa	V.M. Fig. =	_	'lana akuus		D-4-	0.4 24
QC	Reviewer:	Y.W. Fung	<u>-</u> S	ignature:	<i>V</i>	Date:	9-Aug-24



# 綜合試驗有限公司

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.:

24CA0418 01-03

3006428 / N004.03

Page:

of

Item tested

Acoustical Calibrator (Class 1) Description: Manufacturer.

B & K Type/Model No.:

Serial/Equipment No.:

Adaptors used:

Item submitted by

Curstomer: Address of Customer:

Request No.:

Date of receipt

18-Apr-2024

AECOM

Date of test:

20-Apr-2024

#### Reference equipment used in the calibration

Description:Model:Lab standard microphoneB&K 4180PreamplifierB&K 2673Measuring amplifierB&K 2610Signal generatorDS 360Digital multi-meter34401AAudio analyzer8903BUniversal counter53132A	Serial No. 3257888 3353200 2346941 61227 US36087050 GB41300350 MY40003662	Expiry Date: 15-Aug-2024 13-Jun-2024 13-Jun-2024 28-Jun-2024 01-Jun-2024 13-Jun-2024	Traceable to: SCL CEPREI CEPREI CEPREI CEPREI CEPREI CEPREI CEPREI
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#### **Ambient conditions**

Temperature:

21 ± 1 °C 55 ± 10 %

Relative humidity: Air pressure:

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.
- The calibrator was tested with its axis vertical facing downwards at the specific frequency using insert voltage technique. 2.
- 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:

Date: 22-Apr-2024

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.

@ Soils & Materials Engineering Co., Ltd.

Form No CARP156-1/Issue 1/Rev D/01/03/2007

綜合試驗 有限公司

HKAS has accredited this laboratory (Reg. No. HOKLAS 028) under HOKLAS for specific calibration activities as listed in the HOKLAS directory of accredited laboratories. The results shown in this certificate are traceable to the International System of Units (SI) or recognised measurement standards. The results relate only to the item(s) calibrated. This certificate shall not be reproduced except in full without approval of the laboratory.



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# CERTIFICATE OF CALIBRATION

(Continuation Page)

Certificate No.:

24CA0418 01-03

Page:

of

#### 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) Estimated Expanded Measured Output Output Sound Pressure Frequency Level Setting Sound Pressure Level Uncertainty Shown dR 94.20 0.10 1000 94.00

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

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 = 0.017 dB

Estimated expanded uncertainty

0.005 dB

#### **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 = 1000.0 Hz

Estimated expanded uncertainty

Coverage factor k = 2.2

#### **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 = 0.9 %

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:

Date:

Fung Chi Yip 20-Apr-2024 Checked by

22-Apr-2024

Date:

The standard(s) and equipment used in the calibration are traceable to national or international recognised standards and are carry no implication regarding the long-term stability of the instrument. The results apply to the item as received.

- End

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Form No CARP156-2/Issue 1/Rev.C/01/05/2005



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# CERTIFICATE OF CALIBRATION

Certificate No.:

24CA0229 06-02

of

Item tested

Description: Manufacturer: Acoustical Calibrator (Class 1)

AECOM ASIA CO LIMITED

34246490 / N.004.10

Rion Co., Ltd. NC-74

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

Adaptors used:

Item submitted by

Curstomer:

Address of Customer: Request No.:

Date of receipt:

29-Feb-2024

Date of test:

04-Mar-2024

Reference equipment used in the calibration

**Expiry Date:** Traceable to: Serial No. Description: Model: 15-Aug-2024 Lab standard microphone B&K 4180 3257888 CEPREI 3353200 13-Jun-2024 B&K 2673 Preamplifier **CEPREI** Measuring amplifier B&K 2610 2346941 13-Jun-2024 **CEPREI** 61227 28-Jun-2024 DS 360 Signal generator 01-Jun-2024 CEPREI 34401A US36087050 Digital multi-meter **CEPREI** 8903B GB41300350 13-Jun-2024 Audio analyzer **CEPREI** 07-Jun-2024 MY40003662 53132A Universal counter

#### **Ambient conditions**

Temperature:

20 ± 1 °C

Relative humidity:

60 ± 10 %

Air pressure: 1010 ± 5 hPa

#### Test specifications

- The Sound Calibrator has been calibrated in accordance with the requirements as specified in IEC 60942 1997 Annex B and the lab calibration procedure SMTP004-CA-156.
- The calibrator was tested with its axis vertical facing downwards at the specific frequency using insert voltage technique. 2.
- 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

#### Test results

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

**Approved Signatory:** 

05-Mar-2024

**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. The results apply to the item as received.

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Form No.CARP156-1/Issue 1/Rev.D/01/03/2007

綜合試驗

有限公司

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# CERTIFICATE OF CALIBRATION

(Continuation Page)

Certificate No.:

24CA0229 06-02

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of

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) Estimated Expanded Measured Output **Output Sound Pressure** Frequency Level Setting Sound Pressure Level Uncertainty Shown 94.43 0.10 1000 94.00

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 = 0.009 dB

Estimated expanded uncertainty

0.005 dB

**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 = 1002.1

Estimated expanded uncertainty

Coverage factor k = 2.2

**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 = 1.8 %

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: Date:

Fung Chi Yin 04-Mar-2024 Checked by

05-Mar-2024

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 CARP156-2/Issue 1/Rev.C/01/05/2005



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# CERTIFICATE OF CALIBRATION

Certificate No.:

23CA1030 01-03

Page:

of

Item tested

Description:

Acoustical Calibrator (Class 1)

Manufacturer: Type/Model No.:

CAL21

Serial/Equipment No.:

34113610(2011) / N.004.11

Adaptors used:

Yes (BAC21)

Item submitted by

Curstomer: Address of Customer: AECOM ASIA CO., LTD.

Request No.:

Date of receipt:

30-Oct-2023

Date of test:

01-Nov-2023

#### Reference equipment used in the calibration

Description:	Model:	Serial No.	Expiry Date:	Traceable to:
Lab standard microphone	B&K 4180	3257888	15-Aug-2024	SCL
Preamplifier	B&K 2673	3353200	13-Jun-2024	CEPREI
Measuring amplifier	B&K 2610	2346941	13-Jun-2024	CEPREI
Signal generator	DS 360	33873	31-Jan-2024	CEPREI
Digital multi-meter	34401A	US36087050	01-Jun-2024	CEPREI
Audio analyzer	8903B	GB41300350	13-Jun-2024	CEPREI
Universal counter	53132A	MY40003662	07-Jun-2024	CEPREI

#### Ambient conditions

Temperature:

22 ± 1 °C

Relative humidity: Air pressure:

55 ± 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.
- The calibrator was tested with its axis vertical facing downwards at the specific frequency using insert voltage technique.
- The results are rounded to the nearest 0.01 dB and 0.1 Hz and have not been corrected for variations from a reference pressure of 1013.25 hectoPascals as the maker's information indicates that the instrument is insensitive to pressure changes

#### Test results

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

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

Approved Signatory:

Fena Juna

Date: 02-Nov-2023

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. The results apply to the item as received.

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Form No CARP156-1/Issue 1/Rev D/01/03/2007

合試縣

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# CERTIFICATE OF CALIBRATION

(Continuation Page)

Certificate No.: 23CA1030 01-03 Page:

of 2

#### 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	94.14	0.10

#### 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 = 0.013 dB

Estimated expanded uncertainty

0.005 dB

#### **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 = 1002.4 Hz

Estimated expanded uncertainty

Coverage factor k = 2.2

#### **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 = 1.7 %

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:

Date:

ung Chi Yip 01-Nov-2023 Checked by

End -

Chan Yuk Yiu

Date:

02-Nov-2023

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**

Cer	tifica	te N	0.:

24CA1031 03-04

of.

#### Item tested

Description: Manufacturer: Acoustical Calibrator (Class 1)

Type/Model No.:

MVI

CAL21

Serial/Equipment No.:

34113610(2011) / N.004.11 Yes (BAC21)

Adaptors used:

Item submitted by

Curstomer: Address of Customer

AECOM ASIA CO., LTD.

Request No .:

Date of receipt:

31-Oct-2024

Date of test:

06-Nov-2024

#### Reference equipment used in the calibration

Description:	Model:	Serial No.	Expiry Date:	Traceable to:
Lab standard microphone	B&K 4180	3257888	30-Jul-2025	SCL
Preamplifier	B&K 2673	3353200	29-Jun-2025	CEPREI
Measuring amplifier	B&K 2610	2346941	27-Jun-2025	CEPREI
Signal generator	DS 360	33873	06-Mar-2025	CEPREI
Digital multi-meter	34401A	US36087050	20-Jun-2025	CEPREI
Audio analyzer	8903B	GB41300350	19-Jun-2025	CEPREI
Universal counter	53132A	MY40003662	26-Jun-2025	CEPREI

#### **Ambient conditions**

Temperature: Relative humidity:

Air pressure:

21 ± 1 °C 55 ± 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.
- 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:** 

07-Nov-2024

**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. The results apply to the item as received.

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# **CERTIFICATE OF CALIBRATION**

(Continuation Page)

Certificate No.:

24CA1031 03-04

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#### 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	94.11	

#### 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 = 0.013 dB

Estimated expanded uncertainty

0.005 dB

#### **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 = 1002.4 Hz

Estimated expanded uncertainty

0.1 Hz

Coverage factor k = 2.2

#### **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 = 1.6 %

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:

Date:

Funa Chi Yip 06-Nov-2024 Checked by

Date:

Chan Yuk Yiu 07-Nov-2024

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.:

23CA1109 04-01

Page

of

Item tested

Description: Manufacturer: Sound Level Meter (Class 1)

Type/Model No. Serial/Equipment No .:

3001291/ N011.05

Adaptors used:

2250

B&K 4189 3005374

Microphone

Preamp B&K ZC0032 31351

Item submitted by

Customer Name:

AECOM ASIA CO LIMITED

Address of Customer: Request No.:

09-Nov-2023

Date of test:

Date of receipt:

13-Nov-2023

Reference equipment used in the calibration

Multi function sound calibrator Signal generator

Model: B&K 4226 DS 360

Serial No. 2288444 33873

**Expiry Date:** 28-Aug-2024 31-Jan-2024

Traceable to: CIGISMEC CEPREI

**Ambient conditions** 

Temperature: Relative humidity: 21 ± 1 °C 60 ± 10 % 1010 ± 5 hPa

Air pressure:

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.

Approved Signatory:

Date:

14-Nov-2023

Company Chop:

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.

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# CERTIFICATE OF CALIBRATION

(Continuation Page)

Certificate No.: 23CA1109 04-01

#### **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 Leg	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	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	

#### 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

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 13-Nov-2023-

calibrated on a schedule to maintain the required accuracy level.

Date: 14-Nov-2023

The standard(s) and equipment used in the calibration are traceable to national or international recognised standards and are

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# CERTIFICATE OF CALIBRATION

CEI	LITTLE	ale	140

24CA1031 03-01

Microphone

**B&K** 

4189

3005374

of

Preamp

ZC0032

**B&K** 

31351

#### Item tested

Description: Manufacturer:

Type/Model No.:

Sound Level Meter (Class 1)

B&K 2250

3001291/N011.05

AECOM ASIA CO LIMITED

**Customer Name:** Address of Customer:

Serial/Equipment No.: Adaptors used:

Item submitted by

Request No .: 31-Oct-2024 Date of receipt:

Date of test:

06-Nov-2024

# Reference equipment used in the calibration

Description:

Signal generator

Model: B&K 4226 DS 360

Serial No. 2288444

06-Mar-2025 33873

**Expiry Date:** 28-Aug-2025

Traceable to: CIGISMEC CEPREI

#### Ambient conditions

Multi function sound calibrator

Temperature:

21 ± 1 °C 55 + 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.
- 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:

07-Nov-2024

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. The results apply to the item as received.

Soils & Materials Engineering Co., Ltd

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# CERTIFICATE OF CALIBRATION

(Continuation Page)

Certificate No.:

24CA1031 03-01

#### **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	
Sell-generated hoise	Ĉ	Pass	0.8	
	Lin	Pass	1.6	
Linearity range for Leq	At reference range , Step 5 dB at 4 kHz	Pass	0.3	
Ellicanty range for Esq	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	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	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	

#### 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	
7.0000.0 70000.00	Weighting A at 8000 Hz	Pass	0.5	

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 Checked by Calibrated by: Chan Yuk Yiu Fung Chi Yip 07-Nov-2024 06-Nov-2024 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.:

24CA0229 06-01

Microphone

**B&K** 

4950

2665582

of

Preamp

ZC0032

**B&K** 

17190

Item tested

Description: Manufacturer: Sound Level Meter (Class 1)

AECOM ASIA CO LTD

2250-L 2681366/ N011.01

Serial/Equipment No.:

Adaptors used:

Type/Model No.:

Item submitted by

**Customer Name:** Address of Customer:

Request No.:

29-Feb-2024 Date of receipt:

Date of test:

04-Mar-2024

Reference equipment used in the calibration

Description:

Multi function sound calibrator Signal generator

Model: B&K 4226 DS 360

Serial No. 2288444

61227

**Expiry Date:** 28-Aug-2024 28-Jun-2024

Traceable to: CIGISMEC CEPREL

**Ambient conditions** 

Temperature:

20 ± 1 °C

Relative humidity: Air pressure:

55 ± 10 % 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 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:** 

05-Mar-2024

Company Chop:

綜合試驗

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.

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# **CERTIFICATE OF CALIBRATION**

(Continuation Page)

24CA0229 06-01 of Certificate No.:

#### **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	
con gonerates noise	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	Α	Pass	0.3	
, , , , ,	С	Pass	0.3	
	Lin	Pass	0.3	
Time weightings	Single Burst Fast	Pass	0.3	
5 5	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	
5 5	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	

#### 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.

certanity (dB)	Factor
0.3	
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:

Fung Chi Yip 04-Mar-2024 Date:

Checked by

Date:

Chan Yuk Yiu 05-Mar-2024

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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