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

Station	Block B, Merit In	dustrial Centre (	E-A14a)	Operator:				
Cal. Date:	24/2/2025	24/2/2025			24/4/2025			
Model No.:	TE-5170	<del>_</del>	_ Serial No.			10280		
Equipment No.:	A-001-15T	_		•			•	
			Ambient (	I				
Temperatui	re, Ta (K)	292.0	Pressure, I	Pa (mmHg)		781.3		
			Orifice Transfer Sta	andard Information	1			
Serial	No:	988	Slope, mc	1	9898	Intercept, bc	-0.02055	
Last Calibra		17-Jul-24	сторо, то	1			0.02000	
Next Calibra		16-Jul-25	<u>.</u>	mc x Qstd + bo	: = [H x (Pa/760) x	(298/Ta)] <sup>1/2</sup>		
	L		l					
			Calibration of	TSP Sampler				
		(	Orfice		HV	S Flow Recorder		
Resistance Plate No.	DH (orifice), in. of water	[DH x (Pa/760) x (298/Ta)] <sup>1/2</sup>		Qstd (m³/min) <b>X</b> - axis	Flow Recorder Reading (CFM)	Continuous Flov Reading IC (CFI		
18	7.0		2.71	1.37	48.0	49.17	,	
13	6.0		2.51	1.27	42.0	43.02	!	
10	5.1		2.31	1.17	35.0	35.85		
7	4.0		2.05	1.04	29.0	29.70		
5	3.2		1.83	0.93	21.0	21.51		
By Linear Regress Slope , mw = Correlation Coeffi *If Correlation Coef	61.7476 icient* =		.9976 rate.	Intercept, bw =	-35.	2932	-	
			Set Point (	Calculation				
From the TSP Field From the Regression		Y" value accordi		[(Pa/760) x (298/Ta	a)] <sup>1/2</sup>			
Therefore, Set Poir	nt; IC = ( mw x Qs	td + bw ) x [( 760	) / Pa ) x ( Ta / 298 )	)] <sup>1/2</sup> =		43.91	-	
Remarks:								
OC Reviewer	WS CHAN		Signature:	71	Date:	24/2/2025		



RECALIBRATION DUE DATE:

July 17, 2025

# Certificate of Calibration

**Calibration Certification Information** 

Cal. Date: July 17, 2024

Rootsmeter S/N: 438320

Ta: 297

°K

Operator: Jim Tisch

Calibration Model #:

TE-5025A Calibrator S/N: 0988

**Pa:** 747.3 mm Hg

Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H2O)
1	1	2	1	1.3760	3.2	2.00
2	3	4	1	0.9730	6.4	4.00
3	5	6	1	0.8720	7.9	5.00
4	7	8	1	0.8310	8.8	5.50
5	9	10	1	0.6840	12.7	8.00

Data Tabulation								
Vstd	Qstd	$\sqrt{\Delta H \left(\frac{Pa}{Pstd}\right) \left(\frac{Tstd}{Ta}\right)}$		Qa	√∆H(Ta/Pa)			
(m3)	(x-axis)	(y-axis)	Va	(x-axis)	(y-axis)			
0.9823	0.7139	1.4047	0.9957	0.7236	0.8916			
0.9781	1.0053	1.9865	0.9914	1.0189	1.2609			
0.9761	1.1194	2.2210	0.9894	1.1347	1.4097			
0.9749	1.1732	2.3294	0.9882	1.1892	1.4785			
0.9698	1.4178	2.8094	0.9830	1.4371	1.7831			
	m=	1.99898		m=	1.25172			
QSTD	b=	-0.02055	QA I	b=	-0.01304			
	\$* cm	0.99997		r=	0.99997			

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

	Standard Conditions
Tstd:	298.15 °K
Pstd:	760 mm Hg
	Key
ΔH: calibrato	r manometer reading (in H2O)
ΔP: rootsmet	er manometer reading (mm Hg)
Ta: actual ab	solute temperature (°K)
Pa: actual ba	rometric pressure (mm Hg)
b: intercept	<del></del>
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

FAX: (513)467-9009

# **EQUIPMENT CALIBRATION RECORD**

Type:			Laser Dus	<u>t M</u> onitor			_
Manufactu	urer/Brand:		SIBATA				-
Model No.	.:		LD-3				•
Equipmen	t No.:	.: A.005.11a				-	
	Adjustment Sca	le Setting:	799 CPM				•
,	.,	0					_
Operator:			WS CHAN				-
Standard E	quimment						
Equipmen	t:		High Volu	me Samp	er		
Venue:			Ma Wan (				-
Model No.	.:		TE-5170	<u> </u>	<u> </u>		-
Serial No.:			5008				=
	ation Date:		27-Jun-24	ļ			-
							•
Calibration	n Result						
C	Adl discoul Con	la Cautaa (Bafa	Calib .a.i	1		700	CDM
•	Adjustment Sca			-		799	CPM
Sensitivity	Adjustment Sca	le Setting (After	Calibration	n):		799	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	0.1280	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.	ite was calculate			0)		
By Linear I	Regression of Y c	nn X					
Dy Linear i	Slope (K-factor)		0.0015				
	Correlation coe		0.9978				
Validity of	Calibration Reco	ord:	9-Au	g_25			
validity of	Cambration Necc	nu.	J-Au	g-23			
Remarks:							
					M		
OCI	Reviewer:	Y.W. Fung	S	ignature:		Date:	9-Aug-24

# **EQUIPMENT CALIBRATION RECORD**

Type:			Laser Dus	t Monitor			_
	urer/Brand:		SIBATA				<u>-</u>
Model No.	:		LD-3B				_
Equipmen	t No.:		A.005.13a	1			-
Sensitivity	Adjustment Scal	e Setting:	643 CPM				<u>-</u>
Operator:			WS CHAN				<u>-</u>
a							
Standard E	quimment						
Equipmen	<b>+</b> ·		High Volu	me Samnl	er		
Venue:	·.		Ma Wan (				-
Model No.			TE-5170	chung viii	age		-
Serial No.:			5008				-
	ation Date:		27-Jun-24	<u> </u>			-
Last Calibi	ation bate.		27-3411-24	<u> </u>			<u>-</u>
Calibration	n Result						
Sensitivity	Adjustment Scal	e Setting (Befor	e Calibratio	on):		643	CPM
Sensitivity	Adjustment Scal	e Setting (After	Calibration	n):		643	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	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:	1 Monitoring	data was measu	red by High	n Volume :	Sampler		
	2 Total Count	was logged by L	aser Dust N	<b>Monitor</b>			
	③ Count/minu	te was calculate	d by (Total	Count/60	)		
By Linear F	Regression of Y o	n X					
	Slope (K-factor):		0.0015				
	Correlation coef	ficient:	0.9981				
	<b>.</b>						
Validity of	Calibration Reco	ord:	9-Au	g-25			
Domonto							
Remarks:							
					9/		
QC	Reviewer:	Y.W. Fung	S	Signature:		Date:	9-Aug-24
			•			-	

# **EQUIPMENT CALIBRATION RECORD**

Type:			Laser Dus	t Monitor	·		_
Manufactu	urer/Brand:		SIBATA				•
Model No.	•		LD-3B	•			
Equipmen			A.005.16a				•
	Adjustment Sca	le Setting:	521 CPM				•
SCHOLLAND	ajastinent sta	Jetting.	321 01 141				•
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	າ Result						
			6 111	,		=	
-	Adjustment Sca					521	CPM
Sensitivity	Adjustment Sca	le Setting (After	Calibration	n):		521	CPM
	<b>I</b>						
Hour	Date	Time	Ambient (		Concentration ①	Total Count 2	Count/
	(dd/mm/yy)		Temp (°C)	R.H.(%)	(mg/m3)		Minute ③
	00/00/0	0.00.10.00	22.2	7.	Y-axis	F440	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			Sampler		
	_	was logged by L					
	③ Count/minu	ite was calculate	ed by (Total	Count/60	))		
By Linear I	Regression of Y c	on X					
,	Slope (K-factor)		0.0015				
	Correlation coef		0.998		•		
		-			•		
Validity of	Calibration Reco	ord:	9-Au	g-25			
Remarks:							
c.marks.							
					1A		
					0/		
QC I	Reviewer:	Y.W. Fung	<u> </u>	ignature:		_ Date:	9-Aug-24



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



2



# CERTIFICATE OF CALIBRATION

Certificate No.:

24CA1031 03-02

Page

of

Item tested

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

Microphone **B&K** 

Preamp B&K ZC0032

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

Adaptors used:

2270 3007965 4189 2846461

17965

Item submitted by

Customer Name:

AECOM ASIA CO LIMITED

Address of Customer:

Request No.:

Date of receipt:

31-Oct-2024

Date of test:

06-Nov-2024

Reference equipment used in the calibration

Description:

B&K 4226

Serial No.

**Expiry Date:** 

Traceable to:

Multi function sound calibrator Signal generator

Model: DS 360

2288444 33873

28-Aug-2025

CIGISMEC CEPREL

06-Mar-2025

**Ambient conditions** 

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 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

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:

07-Nov-2024

Company Chop:

ENGINE

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.

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



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# CERTIFICATE OF CALIBRATION

Certificate No.:

24CA1031 03-03

Page

of

2

Item tested

Description:

Sound Level Meter (Class 1) B & K

Microphone B & K Preamp B & K

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

2270 2644597

4189 2879980 ZC0032 29398

Adaptors used:

\_

287998

29398

Item submitted by

Customer Name:

AECOM ASIA CO LIMITED

Address of Customer:

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:

Multi function sound calibrator Signal generator B&K 4226 DS 360 2288444 33873 28-Aug-2025 06-Mar-2025 CIGISMEC 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 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.

Feng Junqi

Actual Measurement data are documented on worksheets.

Approved Signatory:

Date:

07-Nov-2024

Company Chop:

综合試驗 SONOS ※ OLL SONOS \* OLL

ENGINE

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.CARP152-1/Issue 1/Rev.C/01/02/2007



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# CERTIFICATE OF CALIBRATION

Certificate No.:	
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24CA1031 03-01

Item tested

Description: Manufacturer:

B&K

Type/Model No.:

2250

Serial/Equipment No.: Adaptors used:

3001291/N011.05

Sound Level Meter (Class 1)

**B&K** 4189 3005374

Microphone

ZC0032 31351

Traceable to:

CIGISMEC

CEPREI

**B&K** 

Preamp

of

Item submitted by

**Customer Name:** 

AECOM ASIA CO LIMITED

Address of Customer: Request No .:

Date of receipt:

31-Oct-2024

Date of test:

06-Nov-2024

# Reference equipment used in the calibration

Description:

Signal generator

Multi function sound calibrator

Serial No. B&K 4226

2288444 33873

**Expiry Date:** 28-Aug-2025 06-Mar-2025

#### Ambient conditions

Temperature:

21 ± 1 °C

Model:

DS 360

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 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

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

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.



# 合試驗有限公司

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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	
	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	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	
Time traigiting	Repeated at frequency of 100 Hz	Pass	0.3	
Time averaging	1 ms burst duty factor 1/103 at 4kHz	Pass	0.3	
Timo aronaging	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	
, todadio raspanas	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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Form No.CARP152-2/Issue 1/Rev.C/01/02/2007

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# **CERTIFICATE OF CALIBRATION**

Certificate No.:

24CA1031 03-04

of.

Item tested

Description:

Acoustical Calibrator (Class 1)

Manufacturer:

MVI

Type/Model No.: Serial/Equipment No.: CAL21 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

Model:	Serial No.	Expiry Date:	Traceable to:
B&K 4180	3257888	30-Jul-2025	SCL
B&K 2673	3353200	29-Jun-2025	CEPREI
B&K 2610	2346941	27-Jun-2025	CEPREI
DS 360	33873	06-Mar-2025	CEPREI
34401A	US36087050	20-Jun-2025	CEPREI
8903B	GB41300350	19-Jun-2025	CEPREI
53132A	MY40003662	26-Jun-2025	CEPREI
	B&K 4180 B&K 2673 B&K 2610 DS 360 34401A 8903B	B&K 4180       3257888         B&K 2673       3353200         B&K 2610       2346941         DS 360       33873         34401A       US36087050         8903B       GB41300350	B&K 4180       3257888       30-Jul-2025         B&K 2673       3353200       29-Jun-2025         B&K 2610       2346941       27-Jun-2025         DS 360       33873       06-Mar-2025         34401A       US36087050       20-Jun-2025         8903B       GB41300350       19-Jun-2025

#### **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.
- 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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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**

(Continuation Page)

Certificate No.:

24CA1031 03-04

Page:

of

2

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.

(Output level in dB re 20 µPa)

Frequency	Output Sound Pressure	Measured Output	Estimated Expanded
Shown	Level Setting	Sound Pressure Level	Uncertainty
Hz	dB	dB	dB
1000	94.00	94.11	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

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.:

24CA0418 01-03

Page:

of

Item tested

Description: Manufacturer. Acoustical Calibrator (Class 1)

Type/Model No.:

B & K

Serial/Equipment No.:

3006428 / N004.03

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

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. 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.

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

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# CERTIFICATE OF CALIBRATION

(Continuation Page)

of 24CA0418 01-03 Page: Certificate No.:

#### 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:

STF = 0.017 dB At 1000 Hz

0.005 dB Estimated expanded uncertainty

#### **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:

Actual Frequency = 1000.0 Hz At 1000 Hz

Coverage factor k = 2.2 Estimated expanded uncertainty

#### **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:

TND = 0.9 % At 1000 Hz

0.7 % Estimated expanded uncertainty

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 Date: 20-Apr-2024 Checked by

Date: 22-Apr-2024

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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