Envir	onm Ce		a I	<b>D</b> Certificatio	Call	<i>ion</i>	REC/ D Septen	ALIBRATION UE DATE: nber 11, 2021
Cal. Date:	September	r 11, 2020	Roots	meter S/N:	438320	Ta:	297	°K
Operator	lim Tisch					Pa	755 4	mm Hg
Calibration	Model #:	TE-5025A	Calil	prator S/N:	2154	10.	755.4	
		Vol. Init	Vol. Final	ΔVol.	ΔTime	ΔΡ	ΔΗ	]
	Run	(m3)	(m3)	(m3)	(min)	(mm Hg)	(in H2O)	
	1	1	2	1	1.4510	3.3	2.00	1
	2	3	4	1	1.0340	6.4	4.00	]
	3	5	6	1	0.9260	8.0	5.00	]
	4	7	8	1	0.8780	8.9	5.50	
	5	9	10	1	0.7250	13.0	8.00	
			E	Data Tabula	tion			
	Vstd	Qstd	$\sqrt{\Delta H \left(\frac{Pa}{Pstd}\right)}$	)( <u>Tstd</u> ) Ta)		Qa	$\sqrt{\Delta H(Ta/Pa)}$	
	(m3)	(x-axis)	(y-ax	is)	Va	(x-axis)	(y-axis)	
	0.9929	0.6843	1.412	23	0.9956	0.6862	0.8868	
	0.9888	0.9563	1.99	73	0.9915	0.9589	1.2541	
	0.9867	1.0656	2.23	30	0.9894	1.0685	1.4021	
	0.9855	1.1225	2.54	20 16	0.9882	1.1255	1.4705	
	0.5001		2.02	i08	0.3020	m=	1.32442	
	OSTD	b=	-0.029	962	OA	b=	-0.01860	
		r=	r= 0.99993		r=	0.99993		
				Calculatio	ns	-		
	Vstd=	$\Delta Vol((Pa-\Delta P))$	/Pstd)(Tstd/Ta	a)	Va=	ΔVol((Pa-Δl	P)/Pa)	
	Qstd=	Vstd/∆Time	atteración anteración anteración de la companya de		Qa=	Va/∆Time		
			For subsequ	ent flow ra	te calculation	ns:		
	Qstd=	1/m (( 1/DH(	Pa Pstd Tstd	-b)	Qa=	$1/m\left(\sqrt{\Delta F}\right)$	l(Ta/Pa))-b)	
	Standard Conditions							
Tstd	298.15	°К				RECA	LIBRATION	
Pstd	760	mm Hg				ammonds a	anual rocalibratic	on nor 1008
AH: calibrat	or manomor	ter reading /i	n H2O)		40 Code	of Federal F	Regulations Part 1	50 to 51
ΔP: rootsm	eter manom	eter reading	(mm Hg)		Appendix F	B to Part 50	. Reference Meth	nod for the
Ta: actual a	bsolute tem	perature (°K)	,		Determinat	tion of Susn	ended Particulate	e Matter in
Pa: actual b	arometric p	ressure (mm	Hg)		the	e Atmosphe	ere, 9.2.17, page	30
b: intercept		والمراجع المراجع					, , , , , , , , , , , , , , , , , , , ,	
m: slope								

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# FUGRO TECHNICAL SERVICES LIMITED

Room 723 & 725, 7/F, Block B, Profit Industrial Building, 1-15 Kwai Fung Crescent, Kwai Fong, Hong Kong.

### TSP SAMPLER CALIBRATION CALCULATION SPREADSHEET

Project : Cor	ntract No. HY	//2019/01 - He	ong Kong-Z	huhai-Macac	) Brid	ge		Date of	Calibration:	20-Apr-2
Location : Al	MS2							Next Calib	ration Date:	19-Jul-2
Brand: Tisch								-	Technician:	Ting Cha
Model: TE-5170 S/N:						-01				
				COND	ITIO	NS				
	Se	ea Level Pres	sure (hPa):	1013.2		Corre	ected Pressu	re (mm Hg):	760	
		Tempe	erature (°C):	23.4			Temp	perature (K):	297	
				CALIBRATI	ON C	ORIFICE				
		Make:		Tisch			Qstd Slope:		2.11508	
		Model:		TE-5025A		Qs	std Intercept:		-0.02962	
	Calib	ration Date:		11-Sep-20			Expiry Date:		11-Sep-21	
		S/N:		2154						
				CALIB	RATI	ON		-		
Plate No.	H2O (L)	H2O (R)	H2O	Qstd		I	IC		LINEAR	
	(in)	(in)	(in)	(m³/min)	(0	chart)	(corrected)	F	REGRESSIC	N
18	7.00	-3.00	10.000	1.513		60.00	60.15	Slope =	37.6465	
13	6.40	-2.70	9.100	1.444		58.00	58.14	Intercept =	3.2541	
10	5.50	-1.50	.50 7.000 1.268			50.00	50.12	Corr. coeff.=	0.9987	
7	4.00	-0.50	4.500	1.019		42.00	42.10			
5	3.20	0.30	2.900	0.821		34.00	34.08			
Calculation	S:									
	Sqrt(H2O(Pa	/Pstd)(Istd/I	a))-b]				FLO	OW RATE CH	IART	
IC = I[Sqrt(P)]	a/Pstd)(1std	/1a)]				70.00				
Qstd = stand	ard flow rate	<b>)</b>								
	ed chart resp	onse				60.00				
i = actual cha	art response	-								
n = calibrat	or Qsia siope	e			<u>(</u> )	50.00				
D = calibrato	or Usta Intera	cept during colibro	tion (dog K)		lse	40.00				
na – actual i Da – actual r	emperature i	ing calibration	(mm Ha)		bor	40.00				
r a – actual j Tstd – 298 d	lea K	ing calibration	i (iiiii iig)		Re	30.00		•		
Petd - 760 u	nm Ha				Jart					
For subsequent calculation of complex flow:						20.00				
1/m((1)[Sart()	298/Tav)(Pav	v/760)]-b)			lotue	10.00				
m = sample	er slope				∣◄	10.00				
b = sample	r intercept					0.00				
I = chart res	sponse					0	0.000 0.50	00 1.000	1.500	2.000
Tav = dailv a	verage temp	perature					Char	dord Flow Data	$(m^3/min)$	
Pav = daily average pressure							Stand	uard Flow Rate	(1119/1110)	

Tory

Wan Ka Ho **Project Consultant** 

Report Date: 22/4/2021

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# FUGRO TECHNICAL SERVICES LIMITED

Room 723 & 725, 7/F, Block B, Profit Industrial Building, 1-15 Kwai Fung Crescent, Kwai Fong, Hong Kong.

# TSP SAMPLER CALIBRATION CALCULATION SPREADSHEET

Project : Cor	ntract No. HY	(/2019/01 - H	ong Kong-Z	huhai-Macac	Bridg	e		Date of	Calibration: 2	0-Apr-2
Location : Al	MS3C							Next Calib	ration Date: 1	9-Jul-2
Brand:		Tisch							Technician: T	ing Ch
Model: TE-5170 S/N:						02				
				COND	ITION	S				
	Se	ea Level Pres	sure (hPa):		Corre	ected Pressu	re (mm Hg):	760		
		Tempe	erature (°C):	23.4			Tem	perature (K):	297	
				CALIBRATI	ON O	RIFICE				
		Make:		Tisch			Qstd Slope:		2.11508	
		Model:		TE-5025A		Qs	std Intercept:		-0.02962	
	Calib	oration Date:		11-Sep-20			Expiry Date:		11-Sep-21	
		S/N:		2154						
				CALIB	RATIC	N				
Plate No	H2O (L)	H2O (R)	H2O	Qstd		I	IC		LINEAR	
i lato i to:	(in)	(in)	(in)	(m³/min)	(cl	nart)	(corrected)	F	REGRESSION	N
18	7.50	-4.80	12.300	1.676		60.00	60.15	Slope =	32.6644	
13	6.40	-3.50	9.900	1.505		52.00	52.13	Intercept =	4.0267	
10	5.10	-2.40	-2.40 7.500 1.3			46.00	46.11	Corr. coeff.=	0.9956	
7	3.80	-1.00	4.800	1.052	:	38.00	38.09			
5	2.90	-0.10	3.000	0.835	;	32.00	32.08			
Calculation	S:									
Qstd = 1/m[	Sqrt(H2O(Pa	/Pstd)(Tstd/T	a))-b]				FLO	OW RATE CH	HART	
C = I[Sqrt(P	Pa/Pstd)(Tstd	/Ta)]				70.00				
Jstd = stand	dard flow rate	9				, 0.00				
C = correcte	ed chart resp	onse				60.00				
= actual ch	art response									
n = calibrat	tor Qstd slop	e			<u>í</u>	50.00				
o = calibrato	or Qstd interd	cept			se (	40.00				
a = actual 1	temperature	during calibra	ation (deg K)		lod	40.00				
a = actual   Tota = 208 c	pressure aur	ing calibration	n (mm Hg)		Res	30.00				
1 Slu = 290 ( Dotd - 760 r	uey n mm ⊔a			art						
Psta = 760 mm Hg						20.00				
ror subsequent calculation of sampler flow:						10.00				
n – samol	_230/1 av)(Pa er slone	v//00)]-D)			¥	10.00				
n - sample	ar intercent					0.00				
= chart re	snonse					0	.000 0.50	00 1.000	1.500	2.000
Fav = daily a	average tem	perature					-			
Pav = daily a	average nres	sure					Stand	dard Flow Rate	(m <sup>3</sup> /min)	
Pav = dally average pressure										

Tory

Wan Ka Ho **Project Consultant** 

Report Date: 22/4/2021

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# CALIBRATION REPORT OF WIND METER

Project: Contract No. HY/2019/01 - Hong Kong-Zhuhai-Macao Bridge Date of Calibration: 31-Dec-2020 Location: AMS3C Next Calibration Date: 30-Jun-2021 Technician: Sam Fong **Global Water** Brand: GL500-7-2 Model: Anemometer Brand: Benetech Model: GM816 Equipment ID: 08 Procedures: 1. Wind Still Test: The wind speed sensor was held by hand until stabilized. 2. Wind Speed Test: The wind meter was calibrated in-situ and compared with the Anemometer. 3. Wind Direction Test: The wind meter was calibrated in-situ and compared with a marine compass from four directions.

Wind Still Test:

Wind Speed (m/s)	
0.00	

Wind Speed Test:

Global Water (m/s)	Anemometer (m/s)
1.2	1.0
1.5	1.2
2.8	2.6

Wind Direction Test:

	Marine Compass (o)
358	0
266	262
154	152
18	18

Cory

 Report Date:
 5/1/2021

Wan Ka Ho Project Consultant

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Report no.: 940891CA202793(1)

Page 1 of 1

# CALIBRATION CERTIFICATE OF DUST METER

Client : Fugro Technical Services Limited

Project : Calibration Services

#### **Client Supplied Information**

Details of Unit Under Test, UUT

: Laser dust monitor
: SIBATA
: LD-5R
: 761106
: NA
: 26-Nov-2021

### Laboratory Information

Description	: 1. Balance	2. TSP high volume air sampler
Equipment ID. / Seria	al no. : 1. C-065-9	2. 4350
Date of Calibration	: 27-Nov-2020	Ambient Temperature : 25 ± 10 °C
Calibration Location	: General Chemical La	aboratory of FTS and Ma Wan A1 Site Boundary
Method Used	: By direct comparison	the weight of dust particle trapped in a filter paper using high
	volume sampler (TSI	P method) for a certain period, with the reading of the UUT. They
2	should be placed at t	he same location and powered on and off at the same time.

#### Calibration Results :

Reference concentration (mg/m <sup>3</sup> )	Total count for 1 hour	CPM (Count per minute)		
0.3486	5134	85.57		
0.1257	4394	73.23		
0.0943	4408	73.47		

#### Remarks:

1. The equipment being used in this calibration is traceable to recognized National Standards.

- 2. The interpolation equation : Concentration  $(mg/m^3) = K \times [UUT reading (CPM)]$ , where K = 0.002448
- 3. Correlation coefficient (r): 0.9916

Checked by :	Conny	_Date :_	30-12-2020	_ Certified by :_	K.T. Leung	Date :	5-1-2021
CA-R-297 (22/07/20	09)			Leung	Kwok Tai (Assist	ant Mana	ger)

\*\* End of Report \*\*

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Report no.: 940891CA202730(7)

Page 1 of 1

# CALIBRATION CERTIFICATE OF DUST METER

Client : Fugro Technical Services Limited

Project : Calibration Services

#### **Client Supplied Information**

Details of Unit Under Test, UUT

: Laser dust monitor
: SIBATA
: LD-5R
: 882146
: NA
: 22-Nov-2021

#### Laboratory Information

Description	:	1. Balance		2. TSP high volume air sampler
Equipment ID. / Seria	10. :	1. C-065-9		2. 4350
Date of Calibration	23-1	Nov-2020	А	mbient Temperature : 25 ± 10 °C
Calibration Location	Gene	eral Chemical	Lab	oratory of FTS and Ma Wan A1 Site Boundary
Method Used	By di	rect comparis	on tl	ne weight of dust particle trapped in a filter paper using high
	volun	ne sampler (T	SP	method) for a certain period, with the reading of the UUT. They
	shou	ld be placed a	t the	e same location and powered on and off at the same time.

#### Calibration Results :

Reference concentration (mg/m <sup>3</sup> )	Total count for 1 hour	CPM (Count per minute)
0.0915	2788	46.47
0.0469	2287	38.12
0.1172	3129	52.15

#### **Remarks:**

1. The equipment being used in this calibration is traceable to recognized National Standards.

- 2. The interpolation equation : Concentration  $(mg/m^3) = K \times [UUT reading (CPM)]$ , where K = 0.001869
- 3. Correlation coefficient (r): 0.9990

Checked by :	Civing	Date :	15-12-2020	_ Certified by :_	K.T. Leung	Date : 15-12-2020
CA-R-297 (22/07/20	009)			Leung	Kwok Tai (Assista	ant Manager)
				CALLER AND ANY ANY ANY ANY	The second se	

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5 Lok Yi Street, Tai Lam Tuen Mun, NT Hong Kong

Report no.: 203258CA202302(1)

Page 1 of 1

# **CALIBRATION CERTIFICATE OF SOUND LEVEL METER**

**Client Supplied Information** 

Client : Fugro Technical Services Ltd.

Project : Calibration Services

Details of Unit Under Test, UUT

Description	: Sound Level Meter	
Manufacturer	: Casella	
	Meter	
8.4. I. I. N.I.		

		Meter	Microphone	Preamplifier
Model No.	;	CEL-63X	CE-251	CEL-495
Serial No.	:	1488295	02795	003538
Equipment ID	:	N-54		
vt Calibration Date		29-Oct-2021		

Next Calibration Date		29-Oct-2021
Specification Limit	:	EN 61672-1: 2003 Class 1

#### Laboratory Information

Details of Reference Equipment -

Description	:	B & K Acoustic Multifunction Calib	rator 4226 (Traditional fr	ee t	field setting)
Equipment ID.	:	R-108-1			
Date of Calibration	:	30-Oct-2020			
<b>Calibration Location</b>	:	Calibration Laboratory of FTS	Ambient Temperature	;	20±2 °C
Method Used		By direct comparison	Relative Humidity	:	<80% R.H.

### Calibration Results :

Parameters		Mean Value (dB)	Specific	ation	Limit(dB)
	4000Hz	1.0	2.6	to	-0.6
	2000Hz	-0.2	2.8	to	-0.4
	1000Hz	0.0	1.1	to	-1.1
A-weigthing frequency response	500Hz	-3.3	-1.8	to	-4.6
	250Hz	-8.7	-7.2	to	-10.0
	125Hz	-16.2	-14.6	to	-17.6
	63Hz	-26.1	-24.7	to	-27.7
	31.5Hz	-38.7	-37.4	to	-41.4
Differential level	94dB-104dB	0.0		± 0.6	3
linearity	104dB-114dB	0.1		± 0.6	3

#### **Remarks**:

- 1. The equipment used in this calibration is traceable to recognized National Standards.
- 2. The mean value is the average of four measurements.
- 3. For calibration: Reference SPL are 94, 104 & 114dB, range setting is 20-140dB & time weighting is fast.
- 4. The UUT does comply with EN 61672-1: 2003 Class 1 sound level meter for the above measurement.
- 5 The values given in this Calibration Certificate only relate to the values at the time of the test and any uncertainties will not include allowance for the equipment long term drift, variations with environment changes, vibration and shock during tranportation, overloading, mis-handling or the capability of any other laboratory to repeat the measurement.

Checked by :	Lilliam	Date :	4-11-2020	_ Certified by : _	K.T. Toung	_ Date : _	4.11.2020
CA-R-297 (22/07/2009	)			Leung I	Kwok Tai (Assista	nt Manager	)
			** E	Ind of Report **			



Fugro Development Centre 5 Lok Yi Street, Tai Lam Tuen Mun, NT Hong Kong

#### Report no.: 203258CA202083(1)

Page 1 of 1

# **CALIBRATION CERTIFICATE OF SOUND LEVEL METER**

**Client Supplied Information** 

Client : Fugro Technical Services Ltd.

Project : Calibration Services

Details of Unit Under Test, UUT

Description	:	Sound Level Meter
Manufacturer	:	Casella

		And an		
		Meter	Microphone	Preamplifier
Model No.	:	CEL-63X	CE-251	CEL-495
Serial No.	;	1488300	03456	002850
Equipment ID	:	N/A		
Next Calibration Date	:	04-Oct-2021		
Specification Limit	:	EN 61672-1: 2003 Class	1	

#### Laboratory Information

#### **Details of Reference Equipment -**

Description :	B & K Acoustic Multifunction Calib	rator 4226 (Traditional fr	ee	field setting)
Equipment ID. :	R-108-1			
Date of Calibration	05-Oct-2020			
Calibration Location :	Calibration Laboratory of FTS	Ambient Temperature	:	20±2 °C
Method Used :	By direct comparison	Relative Humidity	:	<80% R.H.

#### **Calibration Results :**

Parameters		Mean Value (dB)	Specific	ation	Limit(dB)
	4000Hz	0.8	2.6	to	-0.6
	2000Hz	1.2	2.8	to	-0.4
	1000Hz	0.0	1.1	to	-1.1
A-weigthing	500Hz	-3.3	-1.8	to	-4.6
response	250Hz	-8.7	-7.2	to	-10.0
	125Hz	-16.1	-14.6	to	-17.6
	63Hz	-26.2	-24.7	to	-27.7
	31.5Hz	-39.2	-37.4	to	-41.4
Differential level	94dB-104dB	0.1		± 0.6	3
linearity	104dB-114dB	0.0		± 0.6	3

#### Remarks :

- 1. The equipment used in this calibration is traceable to recognized National Standards.
- 2. The mean value is the average of four measurements.
- 3. For calibration: Reference SPL are 94, 104 & 114dB, range setting is 20-140dB & time weighting is fast.
- 4. The UUT does comply with EN 61672-1: 2003 Class 1 sound level meter for the above measurement.
- 5 The values given in this Calibration Certificate only relate to the values at the time of the test and any uncertainties will not include allowance for the equipment long term drift, variations with environment changes, vibration and shock during tranportation, overloading, mis-handling or the capability of any other laboratory to repeat the measurement.

Checked by :	Kulliam	Date :	<u>7- 10 - 2010</u> Certified by :	KT	Tema	Date :	8-10	.2020
CA-R-297 (22/07/2009	)		Leung	Kwok Ta	i (Assistan	t Manager	)	
			** End of Report *	*	$\checkmark$			

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Fugro Development Centre 5 Lok Yi Street, Tai Lam Tuen Mun, NT Hong Kong

Report no.: 203258CA202146(2)

# **CALIBRATION CERTIFICATE OF SOUND CALIBRATOR**

Page 1 of 1

Client : Fugro Technical Services Ltd.

Project : Calibration Services

### **Client Supplied Information**

### Details of Unit Under Test, UUT

Description		: S	ound Calibrator
Manufacturer		: C	asella (Model CEL-120/1)
Serial No.		: 23	383707
Equipment ID		: N	/A
Next Calibration Date	:	14-0	ct-2021
Specification Limit		EN 6	0942: 2003 Class 1

# Laboratory Information

### **Details of Calibration Equipment**

Description :	Reference Sound level meter	
Equipment ID. :	R-119-1	
Date of Calibration :	15-Oct-2020	
Calibration Location :	Calibration Laboratory of FTS	Ambient Temperature : 20±2 °C
Method Used :	By direct comparison	Relative Humidity : <80% R.H.

# Calibration Results :

Parameters (Setting of UUT)	Mean Value (error of measurement)	Specification Limit(dB)		
94dB	-0.1 dB			
114dB	-0.2 dB	1 ±0.40B		

#### Remarks :

- 1. The equipment used in this calibration is traceable to recognized National Standards.
- 2. The mean value is the average of four measurements.
- 3. The unit under test complies with the specification limit.
- 4. The values given in this Calibration Certificate only relate to the unit-under-test and the values measured at the time of the test. Any uncertainties quoted will not include allowances for the environmental changes, variation and shock during transportation, or the capability of any other laboratory to repeat the measurement.

Checked by :	Lulliam	Date :	19-10-2020	_Certified by :	K.T. Teun (	Date :	19-10-2020
CA-R-297 (22/07/2009	))			Leung	Kwok Tai (Assist	ant Manag	jer)

\*\* End of Report \*\*



5 Lok Yi Street, Tai Lam Tuen Mun, NT Hong Kong

Report no.: 203258CA202018(1)

# **CALIBRATION CERTIFICATE OF SOUND CALIBRATOR**

Page 1 of 1

°C

#### **Client Supplied Information**

Client : Fugro Technical Services Ltd.

### **Project : Calibration Services**

#### Details of Unit Under Test, UUT

Description	:	Sound Calibrator				
Manufacturer	:	Casella (Model CEL-120/				
Serial No.	:	2383982				
Equipment ID	:	N/A				
Next Calibration Date		28-Sep-2021				
Specification Limit	:	EN 60942: 2003 Class 1				

#### Laboratory Information

Description :	Reference Sound level meter	
Equipment ID. :	R-119-1	
Date of Calibration	: 29-Sep-2020	Ambient Temperature : 22 °C
Calibration Location	a: Calibration Laboratory of FTS	Relative Humidity : 80% R.H.
Method Used :	By direct comparison	

#### **Calibration Results :**

Parameters (Setting of UUT)	Mean Value (error of measurement)	Specification Limit(dB)		
94dB	-0.1 dB			
114dB	-0.2 dB	±0.40B		

### **Remarks**:

- 1. The equipment used in this calibration is traceable to recognized National Standards.
- 2. The mean value is the average of four measurements.
- 3. The equipment does comply with the specification limit.
- 4. The values given in this Calibration Certificate only relate to the values at the time of the test and any uncertainties will not include allowance for the equipment long term drift, variations with environment changes, vibration and shock during tranportation, overloading, mis-handling or the capability of any other laboratory to repeat the measurement.

Checked by :	Lilliam	Date :_	6-10-2020	Certi	fied by :	K.	J. Leuna	_ Date :	6-10-	2020
CA-R-297 (22/07/2009	)				Leu	ing Kwo	ok Tai (Assis	tant Mana	iger)	
			deale							

\*\* End of Report \*\*