

# Certificate of Calibration

Calibration Certification Information			
Cal. Date: October 21, 2019	Rootsmeter S/N: 438320	Ta: 295	°K
Operator: Jim Tisch		Pa: 744.2	mm Hg
Calibration Model #: TE-5025A	Calibrator S/N: <b>2456</b>		

Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H2O)
1	1	2	1	1.4200	3.2	2.00
2	3	4	1	1.0180	6.3	4.00
3	5	6	1	0.9030	7.9	5.00
4	7	8	1	0.8620	8.8	5.50
5	9	10	1	0.7120	12.6	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)	$\sqrt{\Delta H \left( \frac{Ta}{Pa} \right)}$ (y-axis)	
0.9849	0.6936	1.4066	0.9957	0.7012	0.8904	
0.9808	0.9635	1.9892	0.9915	0.9740	1.2592	
0.9787	1.0838	2.2240	0.9894	1.0957	1.4078	
0.9775	1.1340	2.3325	0.9882	1.1464	1.4765	
0.9724	1.3658	2.8131	0.9831	1.3807	1.7808	
<b>QSTD</b>	<b>m=</b>	<b>2.08799</b>	<b>QA</b>	<b>m=</b>	<b>1.30746</b>	
	<b>b=</b>	<b>-0.03545</b>		<b>b=</b>	<b>-0.02244</b>	
	<b>r=</b>	<b>0.99989</b>		<b>r=</b>	<b>0.99989</b>	

Calculations			
Vstd=	$\Delta Vol \left( \frac{Pa - \Delta P}{Pstd} \right) \left( \frac{Tstd}{Ta} \right)$	Va=	$\Delta Vol \left( \frac{Pa - \Delta P}{Pa} \right)$
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=	$1/m \left( \left( \sqrt{\Delta H \left( \frac{Ta}{Pa} \right)} \right) - b \right)$

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

## CALIBRATION REPORT OF WIND METER

<b>Project:</b> Contract No. HY/2019/01 - Hong Kong-Zhuhai-Macao Bridge <b>Location:</b> AMS3C  <b>Brand:</b> Global Water <b>Model:</b> GL500-7-2	<b>Date of Calibration:</b> 5-Feb-2020 <b>Next Calibration Date:</b> 4-Jul-2020 <b>Technician:</b> Sam Fong
<b>S/N:</b> 1847003409	
<b>Anemometer</b>	
<b>Brand:</b> Benetech <b>Model:</b> GM816	<b>Equipment ID:</b> 08
<b>Procedures:</b>	
<ol style="list-style-type: none"> <li>1. <b>Wind Still Test:</b> The wind speed sensor was held by hand until stabilized.</li> <li>2. <b>Wind Speed Test:</b> The wind meter was calibrated in-situ and compared with the Anemometer.</li> <li>3. <b>Wind Direction Test:</b> The wind meter was calibrated in-situ and compared with a marine compass from four directions.</li> </ol>	

**Wind Still Test:**

Wind Speed (m/s)
0.00

**Wind Speed Test:**

Global Water (m/s)	Anemometer (m/s)
2.3	2.6
3.0	2.8
3.4	3.0

**Wind Direction Test:**

	Marine Compass (o)
252	250
72	70
0	357
340	341



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**Wan Ka Ho**  
 Project Consultant

**Report Date:** \_\_\_\_\_ **14/2/2020**

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# MaterialLab

Report no.: 183057CA196181

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

Model No.

Serial No.

Next Calibration Date : 01-Oct-2020

Specification Limit : EN 61672: 2003 Type 1

Meter	Microphone	Preamplifier
CEL-63X	CE-251	CEL-495
1488272	02552	003942

### Laboratory Information

Details of Reference Equipment -

Description : B & K Acoustic Multifunction Calibrator 4226 (Traditional free field setting)

Equipment ID. : R-108-1

Date of Calibration : 02-Oct-2019 Ambient Temperature : 22 °C

Calibration Location : Calibration Laboratory of FTS

Method Used : By direct comparison

### Calibration Results :

Parameters	Mean Value (dB)	Specification Limit(dB)
A-weighting frequency response	4000Hz	2.0
	2000Hz	1.4
	1000Hz	0.0
	500Hz	-3.4
	250Hz	-8.8
	125Hz	-16.3
	63Hz	-26.3
	31.5Hz	-39.3
Differential level linearity	94dB-104dB	± 0.6
	104dB-114dB	± 0.6

### 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 equipment does comply with EN 61672: 2003 Type 1 sound level meter for the above measurement.
5. The values given in this Calibration Certificate only relate to the unit-under-test and the values measured at the time of the test. Uncertainties 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 : William Date : 4-10-2019 Certified by : KL Leung Date : 6-10-2019

CA-R-297 (22/07/2009)

Leung Kwok Tai (Assistant Manager)

\*\* End of Report \*\*

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Report no.: 183057CA195786(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

Model No.

Serial No.

Next Calibration Date

Specification Limit

Meter	Microphone	Preamplifier
CEL-63X	CE-251	CEL-495
2451082	01378	002317

16-Jun-2020

EN 61672: 2003 Type 1

### Laboratory Information

Description : B & K Acoustic Multifunction Calibrator 4226 (Traditional free field setting)

Equipment ID. : R-108-1

Date of Calibration : 17-Jun-2019 Ambient Temperature : 22 °C

Calibration Location : Calibration Laboratory of FTS

Method Used : By direct comparison

### Calibration Results :

Parameters		Mean Value (dB)	Specification Limit(dB)
A-weighting frequency response	4000Hz	1.4	2.6 to -0.6
	2000Hz	0.9	2.8 to -0.4
	1000Hz	0.0	1.1 to -1.1
	500Hz	-3.2	-1.8 to -4.6
	250Hz	-8.4	-7.2 to -10.0
	125Hz	-15.7	-14.6 to -17.6
	63Hz	-25.8	-24.7 to -27.7
	31.5Hz	-38.8	-37.4 to -41.4
Differential level linearity	94dB-104dB	0.0	± 0.6
	104dB-114dB	0.0	± 0.6

### 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 equipment does comply with EN 61672: 2003 Type 1 sound level meter for the above measurement.
5. The values given in this Calibration Certificate only relate to the unit-under-test and the values measured at the time of the test. Uncertainties 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 : William Date : 21-6-2019 Certified by : Leung Kwok Tai Date : 21-6-2019

CA-R-297 (22/07/2009)

Leung Kwok Tai (Assistant Manager)

\*\* End of Report \*\*

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Report no.: 183057CA196275

Page 1 of 1

## CALIBRATION CERTIFICATE OF SOUND CALIBRATOR

### Client Supplied Information

Client : Fugro Technical Services Ltd.

Project : Calibration Services

Details of Unit Under Test, UUT

Description : Sound Calibrator  
Manufacturer : Casella (Model CEL-120/1)  
Serial No. : 2383852  
Equipment ID : N/A

Next Calibration Date : 15-Oct-2020

Specification Limit : EN 60942: 2003 Type 1

### Laboratory Information

Details of Reference Equipment -

Description : Reference Sound level meter  
Equipment ID. : R-119-1

Date of Calibration : 16-Oct-2019 Ambient Temperature : 22 °C

Calibration Location : Calibration Laboratory of FTS

Method Used : By direct comparison

### Calibration Results :

Parameters (Setting of UUT)	Mean Value (error of measurement)	Specification Limit(dB)
94dB	0.0 dB	±0.4dB
114dB	0.0 dB	

### 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 transportation, overloading, mis-handling or the capability of any other laboratory to repeat the measurement.

Checked by : William Date : 22-10-2019 Certified by : Leung Kwok Tai Date : 22-10-2019  
CA-R-297 (22/07/2009) Leung Kwok Tai (Assistant Manager)

\*\* End of Report \*\*

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Report no.: 183057CA195873(2)

Page 1 of 1

## CALIBRATION CERTIFICATE OF SOUND CALIBRATOR

### Client Supplied Information

Client : Fugro Technical Services Ltd.

Project : Calibration Services

Details of Unit Under Test, UUT

Description : Sound Calibrator  
Manufacturer : Casella (Model CEL-120/1)  
Serial No. : 4358250  
Equipment ID : N-33  
Next Calibration Date : 25-Jul-2020  
Specification Limit : EN 60942: 2003 Type 1

### Laboratory Information

Description : Reference Sound level meter  
Equipment ID. : R-119-1  
Date of Calibration : 26-Jul-2019 Ambient Temperature : 22 °C  
Calibration Location : Calibration Laboratory of FTS  
Method Used : By direct comparison

### Calibration Results :

Parameters (Setting of UUT)	Mean Value (error of measurement)	Specification Limit(dB)
94dB	0.0 dB	±0.4dB
114dB	0.0 dB	

### 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 transportation, overloading, mis-handling or the capability of any other laboratory to repeat the measurement.

Checked by : William Date : 26-7-2019 Certified by : F. T. Leung Date : 26-7-2019  
CA-R-297 (22/07/2009) Leung Kwok Tai (Assistant Manager)

\*\* End of Report \*\*