TISCH Environmental

| RECALIBRATION DUE DATE: |
|---|
| November 20, 2018 |

# Certificate of Calibration

| Calibration Certification Information | | | | |
|---|---|---|---|---|
| **Cal. Date:** | November 20, 2017 | **Rootsmeter S/N:** 438320 | **Ta:** 294 | °K |
| **Operator:** | Jim Tisch | | **Pa:** 756.9 | mm Hg |
| **Calibration Model #:** | TE-5025A | **Calibrator S/N:** **2456** | | |

| Run | Vol. Init (m3) | Vol. Final (m3) | ΔVol. (m3) | ΔTime (min) | ΔP (mm Hg) | ΔH (in H2O) |
|---|---|---|---|---|---|---|
| 1 | 1 | 2 | 1 | 1.4440 | 3.2 | 2.00 |
| 2 | 3 | 4 | 1 | 1.0260 | 6.4 | 4.00 |
| 3 | 5 | 6 | 1 | 0.9130 | 7.8 | 5.00 |
| 4 | 7 | 8 | 1 | 0.8680 | 8.8 | 5.50 |
| 5 | 9 | 10 | 1 | 0.7190 | 12.7 | 8.00 |

**Data Tabulation**

| Vstd (m3) | Qstd (x-axis) | $\sqrt{\Delta H\left(\frac{Pa}{Pstd}\right)\left(\frac{Tstd}{Ta}\right)}$ (y-axis) | Va | Qa (x-axis) | $\sqrt{\Delta H\left(Ta/Pa\right)}$ (y-axis) |
|---|---|---|---|---|---|
| 1.0052 | 0.6961 | 1.4209 | 0.9958 | 0.6896 | 0.8814 |
| 1.0010 | 0.9756 | 2.0095 | 0.9915 | 0.9664 | 1.2465 |
| 0.9991 | 1.0943 | 2.2467 | 0.9897 | 1.0840 | 1.3936 |
| 0.9978 | 1.1495 | 2.3563 | 0.9884 | 1.1387 | 1.4616 |
| 0.9926 | 1.3805 | 2.8418 | 0.9832 | 1.3675 | 1.7628 |
| **QSTD** | **m=** | **2.07133** | **QA** | **m=** | **1.29703** |
| | **b=** | **-0.01892** | | **b=** | **-0.01173** |
| | **r=** | **0.99995** | | **r=** | **0.99995** |

**Calculations**

| | | | |
|---|---|---|---|
| **Vstd=** | ΔVol((Pa-ΔP)/Pstd)(Tstd/Ta) | **Va=** | ΔVol((Pa-ΔP)/Pa) |
| **Qstd=** | Vstd/ΔTime | **Qa=** | Va/ΔTime |

**For subsequent flow rate calculations:**

**Qstd=** $1/m\left(\left(\sqrt{\Delta H\left(\frac{Pa}{Pstd}\right)\left(\frac{Tstd}{Ta}\right)}\right)-b\right)$

**Qa=** $1/m\left(\left(\sqrt{\Delta H\left(Ta/Pa\right)}\right)-b\right)$

| Standard Conditions | |
|---|---|
| Tstd: | 298.15 °K |
| Pstd: | 760 mm Hg |

| Key |
|---|
| ΔH: calibrator manometer reading (in H2O) |
| ΔP: rootsmeter manometer reading (mm Hg) |
| Ta: actual absolute temperature (°K) |
| Pa: actual barometric pressure (mm Hg) |
| b: intercept |
| m: slope |

**RECALIBRATION**

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

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MaterialLab

## TSP SAMPLER CALIBRATION CALCULATION SPREADSHEET

Project : Environmantal Monitoring Works For Contract No. KLN/2015/07
Location : KER1b
Brand: Tisch
Model: TE-5170 S/N: 3482

Date of Calibration: 3-Jul-18
Next Calibration Date: 2-Oct-18
Technician: Toby Wan

### CONDITIONS

| | | | |
|---|---|---|---|
| Sea Level Pressure (hPa): | 1002.5 | Corrected Pressure (mm Hg): | 752 |
| Temperature (°C): | 30 | Temperature (K): | 303 |

### CALIBRATION ORIFICE

| | | | |
|---|---|---|---|
| Make: | Tisch | Qstd Slope: | 2.07013 |
| Model: | TE-5025A | Qstd Intercept: | -0.01892 |
| Calibration Date: | 20-Nov-17 | Expiry Date: | 20-Nov-18 |
| S/N: | 2456 | | |

### CALIBRATIONS

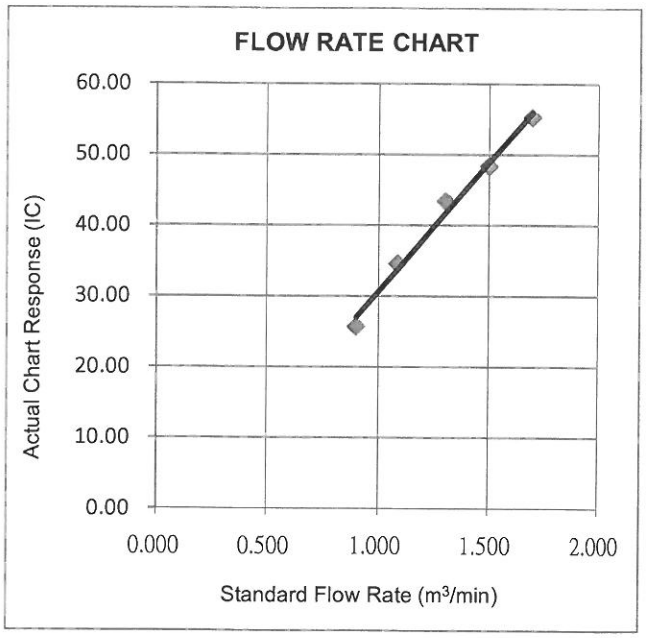
| Plate No. | H2O (L) (in) | H2O (R) (in) | H2O (in) | Qstd ($m^3$/min) | I (chart) | IC (corrected) | LINEAR REGRESSION | |
|---|---|---|---|---|---|---|---|---|
| 18 | 4.10 | -8.40 | 12.500 | 1.694 | 56.00 | 55.24 | Slope = | 36.4591 |
| 13 | 2.80 | -7.00 | 9.800 | 1.501 | 49.00 | 48.34 | Intercept = | -5.8642 |
| 10 | 1.20 | -6.20 | 7.400 | 1.305 | 44.00 | 43.41 | Corr. coeff.= | 0.9945 |
| 7 | 0.50 | -4.60 | 5.100 | 1.085 | 35.00 | 34.53 | | |
| 5 | -0.10 | -3.60 | 3.500 | 0.901 | 26.00 | 25.65 | | |

**Calculations:**

Qstd = 1/m[Sqrt(H2O(Pa/Pstd)(Tstd/Ta))-b]
IC = I[Sqrt(Pa/Pstd)(Tstd/Ta)]
Qstd = standard flow rate
IC = corrected chart response
I = actual chart response
m = calibrator Qstd slope
b = calibrator Qstd intercept
Ta = actual temperature during calibration (deg K)
Pa = actual pressure during calibration (mm Hg)
Tstd = 298 deg K
Pstd = 760 mm Hg

**For subsequent calculation of sampler flow:**

1/m((I)[Sqrt(298/Tav)(Pav/760)]-b)
m = sampler slope
b = sampler intercept
I = chart response
Tav = daily average temperature
Pav = daily average pressure




**CHOI KAM HO**
Project Consultant

**Report Date:** 3rd July, 2018

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MaterialLab

## TSP SAMPLER CALIBRATION CALCULATION SPREADSHEET

Project : Environmantal Monitoring Works For Contract No. KLN/2015/07
Location : KTD1a
Brand: Tisch
Model: TE-5170 S/N: 4037

Date of Calibration: 3-Jul-18
Next Calibration Date: 2-Oct-18
Technician: Toby Wan

### CONDITIONS

| | | | |
|---|---|---|---|
| Sea Level Pressure (hPa): | 1002.5 | Corrected Pressure (mm Hg): | 752 |
| Temperature (°C): | 30 | Temperature (K): | 303 |

### CALIBRATION ORIFICE

| | | | |
|---|---|---|---|
| Make: | Tisch | Qstd Slope: | 2.07013 |
| Model: | TE-5025A | Qstd Intercept: | -0.01892 |
| Calibration Date: | 20-Nov-17 | Expiry Date: | 20-Nov-18 |
| S/N: | 2456 | | |

### CALIBRATIONS

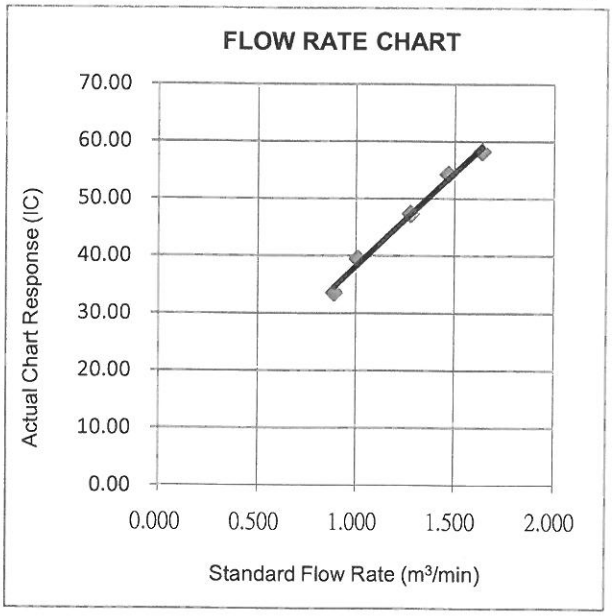
| Plate No. | H2O (L) (in) | H2O (R) (in) | H2O (in) | Qstd ($m^3$/min) | I (chart) | IC (corrected) | LINEAR REGRESSION | |
|---|---|---|---|---|---|---|---|---|
| 18 | 3.80 | -7.90 | 11.700 | 1.639 | 59.00 | 58.20 | Slope = | 32.5139 |
| 13 | 2.60 | -6.80 | 9.400 | 1.470 | 55.00 | 54.26 | Intercept = | 5.6937 |
| 10 | 1.50 | -5.60 | 7.100 | 1.279 | 48.00 | 47.35 | Corr. coeff.= | 0.9962 |
| 7 | 0.20 | -4.20 | 4.400 | 1.009 | 40.00 | 39.46 | | |
| 5 | -0.30 | -3.70 | 3.400 | 0.888 | 34.00 | 33.54 | | |

**Calculations:**

Qstd = 1/m[Sqrt(H2O(Pa/Pstd)(Tstd/Ta))-b]
IC = I[Sqrt(Pa/Pstd)(Tstd/Ta)]
Qstd = standard flow rate
IC = corrected chart response
I = actual chart response
m = calibrator Qstd slope
b = calibrator Qstd intercept
Ta = actual temperature during calibration (deg K)
Pa = actual pressure during calibration (mm Hg)
Tstd = 298 deg K
Pstd = 760 mm Hg

**For subsequent calculation of sampler flow:**

1/m((I)[Sqrt(298/Tav)(Pav/760)]-b)
m = sampler slope
b = sampler intercept
I = chart response
Tav = daily average temperature
Pav = daily average pressure




**CHOI KAM HO**
Project Consultant

**Report Date:** 3rd July, 2018

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## TSP SAMPLER CALIBRATION CALCULATION SPREADSHEET

Project : Environmantal Monitoring Works For Contract No. KLN/2015/07
Location : KTD2b
Brand: Tisch
Model: TE-5170 S/N: 3838

Date of Calibration: 9-Aug-18
Next Calibration Date: 8-Nov-18
Technician: Toby Wan

### CONDITIONS

| | | | |
|---|---|---|---|
| Sea Level Pressure (hPa): | 1003.3 | Corrected Pressure (mm Hg): | 753 |
| Temperature (°C): | 30 | Temperature (K): | 303 |

### CALIBRATION ORIFICE

| | | | |
|---|---|---|---|
| Make: | Tisch | Qstd Slope: | 2.07013 |
| Model: | TE-5025A | Qstd Intercept: | -0.01892 |
| Calibration Date: | 20-Nov-17 | Expiry Date: | 20-Nov-18 |
| S/N: | 2456 | | |

### CALIBRATIONS

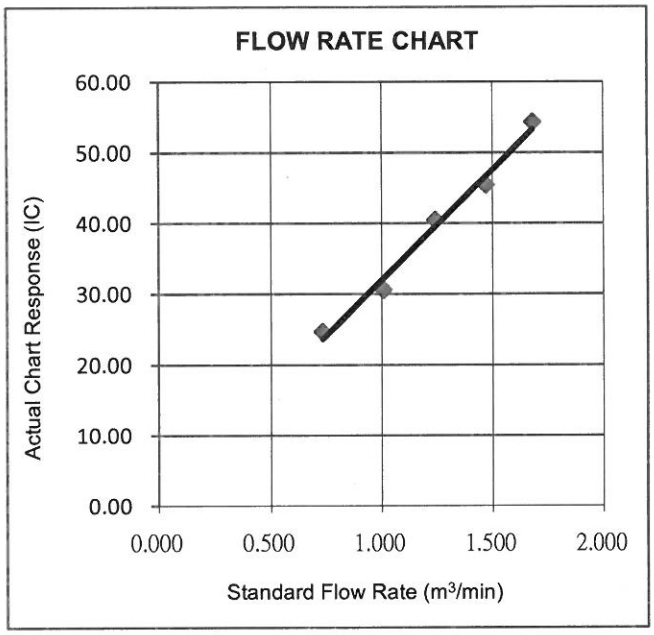
| Plate No. | H2O (L) (in) | H2O (R) (in) | H2O (in) | Qstd ($m^3$/min) | I (chart) | IC (corrected) | LINEAR REGRESSION | |
|---|---|---|---|---|---|---|---|---|
| 18 | 3.80 | -8.50 | 12.300 | 1.682 | 55.00 | 54.29 | Slope = | 31.2460 |
| 13 | 2.90 | -6.50 | 9.400 | 1.471 | 46.00 | 45.41 | Intercept = | 0.7345 |
| 10 | 1.00 | -5.70 | 6.700 | 1.243 | 41.00 | 40.47 | Corr. coeff.: | 0.9933 |
| 7 | 0.20 | -4.20 | 4.400 | 1.009 | 31.00 | 30.60 | | |
| 5 | -0.80 | -3.10 | 2.300 | 0.732 | 25.00 | 24.68 | | |

**Calculations:**

Qstd = 1/m[Sqrt(H2O(Pa/Pstd)(Tstd/Ta))-b]
IC = I[Sqrt(Pa/Pstd)(Tstd/Ta)]
Qstd = standard flow rate
IC = corrected chart response
I = actual chart response
m = calibrator Qstd slope
b = calibrator Qstd intercept
Ta = actual temperature during calibration (deg K)
Pa = actual pressure during calibration (mm Hg)
Tstd = 298 deg K
Pstd = 760 mm Hg

**For subsequent calculation of sampler flow:**

1/m((I)[Sqrt(298/Tav)(Pav/760)]-b)
m = sampler slope
b = sampler intercept
I = chart response
Tav = daily average temperature
Pav = daily average pressure




**CHOI KAM HO**
Project Consultant

**Report Date:** 9th August, 2018

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MateriaLab

Report no.: 172379CA185011A



# CALIBRATION CERTIFICATE OF SOUND LEVEL METER

**Client Supplied Information**

Client : MateriaLab Consultants Ltd.

Address : Room 723 & 725, 7/F., Block B, Profit Industrial Building, 1-15 Kwai Fung Crescent, Kwai Chung, N.T.

Project : Calibration Services

Details of Unit Under Test, UUT

Description : Sound Level Meter

Manufacturer : Casella

| | Meter | Microphone | Preamplifier |
|---|---|---|---|
| Model No. : | CEL-63X | CE-251 | CEL-495 |
| Serial No. : | 3148029 | 01910 | 003318 |

Next Calibration Date : 12-Apr-2019

Specification Limit : 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 : 13-Apr-2018 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-weighing frequency response | 4000Hz | 1.7 | 2.6 to -0.6 |
| | 2000Hz | 1.4 | 2.8 to -0.4 |
| | 1000Hz | 0.0 | 1.1 to -1.1 |
| | 500Hz | -3.4 | -1.8 to -4.6 |
| | 250Hz | -8.8 | -7.2 to -10.0 |
| | 125Hz | -16.2 | -14.6 to -17.6 |
| | 63Hz | -26.2 | -24.7 to -27.7 |
| | 31.5Hz | -39.1 | -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 weighing is fast
4. The equipment does comply with EN 61672: 2003 Type 1 sound level meter for the above measurement.
5. This is to supersede the previous report no. 172379CA185011.

Checked by : _____ Date : 5-7-2018 Certified by : _____ Date : 7-7-2018

Leung Kwok Tai (Assistant Manager)

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

** End of Report **

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Website : www.fugro.com

MateriaLab

Report no.: 172379CA180329



# CALIBRATION CERTIFICATE OF SOUND LEVEL METER

**Client Supplied Information**

Client : MateriaLab Consultants Ltd.

Address : Room 723 & 725, 7/F., Block B Profit Industrial Building, 1-15 Kwai Fung Crescent, Kwai Chung, N.T.

Project : Calibration Services

Details of Unit Under Test, UUT

Description : Sound Level Meter

Manufacturer : Casella

| | Meter | Microphone | Preamplifier |
|---|---|---|---|
| Model No. | CL63X | CE-251 | CEL-495 |
| Serial No. : | 1057055 | 00995 | 002317 |

Next Calibration Date : 12-Feb-2019

Specification Limit : 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 : 13-Feb-2018 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-weighing frequency response | 4000Hz | 0.4 | 2.6 to -0.6 |
| | 2000Hz | 1.0 | 2.8 to -0.4 |
| | 1000Hz | 0.2 | 1.1 to -1.1 |
| | 500Hz | -3.0 | -1.8 to -4.6 |
| | 250Hz | -8.3 | -7.2 to -10.0 |
| | 125Hz | -15.7 | -14.6 to -17.6 |
| | 63Hz | -25.7 | -24.7 to -27.7 |
| | 31.5Hz | -38.7 | -37.4 to -41.4 |
| Differential level linearity | 94dB-104dB | 0.1 | ± 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 weighing is fast
4. The equipment does comply with EN 61672: 2003 Type 1 sound level meter for the above measurement.

Checked by : _____ Date : 14-2-2018 Certified by : _____ Date : 16.2.2018

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

Chan Chun Wai (Manager)

** End of Report **

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MateriaLab

Report no.: 172379CA185066A



# CALIBRATION CERTIFICATE OF SOUND LEVEL METER

**Client Supplied Information**

Client : MateriaLab Consultants Ltd.

Address : Room 723 & 725, 7/F., Block B Profit Industrial Building, 1-15 Kwai Fung Crescent, Kwai Chung, N.T.

Project : Calibration Services

Details of Unit Under Test, UUT

Description : Sound Level Meter

Manufacturer : Casella

| | Meter | Microphone | Preamplifier |
|---|---|---|---|
| Model No. : | CEL-63X | CE-251 | CEL-495 |
| Serial No. : | 0873599 | 01801 | 003341 |

Next Calibration Date : 26-Apr-2019

Specification Limit : 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 : 27-Apr-2018 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-weighing frequency response | 4000Hz | 1.9 | 2.6 to -0.6 |
| | 2000Hz | 1.3 | 2.8 to -0.4 |
| | 1000Hz | -0.1 | 1.1 to -1.1 |
| | 500Hz | -3.5 | -1.8 to -4.6 |
| | 250Hz | -8.9 | -7.2 to -10.0 |
| | 125Hz | -16.4 | -14.6 to -17.6 |
| | 63Hz | -26.4 | -24.7 to -27.7 |
| | 31.5Hz | -39.3 | -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 weighing is fast
4. The equipment does comply with EN 61672: 2003 Type 1 sound level meter for the above measurement.
5. This is to supersede the previous report no. 172379CA185066.

Checked by : _____ Date : 5-7-2018 Certified by : _____ Date : 7.7-2018

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

Leung Kwok Tai (Assistant Manager)

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MateriaLab

Report no.: 172379CA180671(1)



# CALIBRATION CERTIFICATE OF SOUND CALIBRATOR

**Client Supplied Information**

Client : MateriaLab Consultants Ltd.

Address : Room 723 & 725, 7/F., Block B Profit Industrial Building, 1-15 Kwai Fung Crescent, Kwai Chung, N.T.

Project : Calibration Services

Details of Unit Under Test, UUT

| | | |
|---|---|---|
| Description | : | Sound Calibrator |
| Manufacturer | : | Casella (Model no. CEL-120/1) |
| Serial No. | : | 5230742 |
| Next Calibration Date | : | 10-Apr-2019 |
| Specification Limit | : | EN 60942: 2003 Type 1 |

**Laboratory Information**

Description : Reference Sound Level Meter

Equipment ID. : R-119-1

Date of Calibration : 11-Apr-2018 Ambient Temperature : 21 °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 | -0.4 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.

Checked by : _____ Date : 16.4.2018 Certified by : _____ Date : 16.4.2018

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

Chan Chun Wai (Manager)

** End of Report **

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MateriaLab

Report no.: 172379CA180517(1)



# CALIBRATION CERTIFICATE OF SOUND CALIBRATOR

**Client Supplied Information**

Client : MateriaLab Consultants Ltd.

Project : Calibration Services

Details of Unit Under Test, UUT

| | | |
|---|---|---|
| Description | : | Sound Calibrator |
| Manufacturer | : | Casella (Model no. CEL-120/1) |
| Serial No. | : | 5230758 |
| Equipment ID | : | FY-SLC-01 |
| Next Calibration Date | : | 11-Mar-2019 |
| Specification Limit | : | EN 60942: 2003 Type 1 |

**Laboratory Information**

| | | |
|---|---|---|
| Description | : | Reference Sound level meter |
| Equipment ID. | : | R-119-1 |
| Date of Calibration : | 12-Mar-2018 | 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 | -0.4 dB | ±0.4dB |
| 114dB | -0.3 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.

Checked by : _____ Date : 13.3.2018 Certified by : _____ Date : 13.3.2018.

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

Chan Chun Wai (Manager)

** End of Report **

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MateriaLab

Report No. : 183057CA185180(1)



# CALIBRATION CERTIFICATE OF ANEMOMETER

**Client Supplied Information**

Client : MateriaLab Consultants Ltd.

Project : Calibration Services

**Details of Unit Under Test, UUT**

Description : Anemometer

Manufacturer : Benetech

Model No. : GM816

Serial No. : 13372555

Equipment ID. : N/A

Next Calibration Date : 08-Jun-2019

**Laboratory Information**

Details of Reference Equipment –

Description : Reference Anemometer

Equipment ID. : R-101-4

Date of Calibration : 09-Jun-2018 Ambient Temperature : 22 °C

Calibration Location : Calibration Laboratory of FTS

Method Used : By direct Comparison

**Calibration Results :**

| Reference Reading (m/s) | UUT Reading (m/s) | Error (m/s) |
|---|---|---|
| 1.96 | 2.2 | 0.2 |
| 4.04 | 4.1 | 0.1 |
| 6.05 | 6.2 | 0.2 |
| 8.02 | 7.9 | -0.1 |
| 10.06 | 9.7 | -0.4 |

**Remark :**

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

Checked by : William Date : 12-6-2018 Certified by : Date : 13.6.2018

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

Chan Chun Wai (Manager)

** End of Report **

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