

Appendix E

Calibration Certificates of Monitoring Equipments

High-Volume TSP Sampler
5-Point Calibration Record

Location : ASR8(A)
 Calibrated by : P.F. Yeung
 Date : 28/05/2017

Sampler

Model : TE-5170
 Serial Number : S/N 3956

Calibration Orifice and Standard Calibration Relationship

Serial Number : 2454
 Service Date : 20 Mar 2017
 Slope (m) : 2.08464
 Intercept (b) : -0.03684
 Correlation Coefficient(r) : 0.99994

Standard Condition

Pstd (hpa) : 1013
 Tstd (K) : 298.18

Calibration Condition

Pa (hpa) : 1010
 Ta(K) : 302

| Resistance Plate | dH [green liquid] (inch water) | Z | X=Qstd (cubic meter/min) | IC (chart) | Y (corrected) |
|------------------|-----------------------------------|-------|-----------------------------|---------------|------------------|
| 1 18 holes | 11.5 | 3.364 | 1.631 | 56 | 55.55 |
| 2 13 holes | 9.0 | 2.976 | 1.445 | 50 | 49.59 |
| 3 10 holes | 6.8 | 2.587 | 1.258 | 44 | 43.64 |
| 4 7 holes | 4.5 | 2.104 | 1.027 | 36 | 35.71 |
| 5 5 holes | 2.8 | 1.660 | 0.814 | 28 | 27.77 |

Notes: $Z = \sqrt{dH(Pa/Pstd)(Tstd/Ta)}$, $X = Z/m - b$, $Y(\text{Corrected Flow}) = IC * \{\sqrt{Pa/Pstd}(Tstd/Ta)\}$

Sampler Calibration Relationship (Linear Regression)

Slope(m): 33.865 Intercept(b): 0.626 Correlation Coefficient(r): 0.9994

Checked by: Magnum Fan

Date: 04/06/2017

High-Volume TSP Sampler
5-Point Calibration Record

Location : ASR9
 Calibrated by : P.F. Yeung
 Date : 28/05/2017

Sampler

Model : TE-5170
 Serial Number : S/N 3958

Calibration Orifice and Standard Calibration Relationship

Serial Number : 2454
 Service Date : 20 Mar 2017
 Slope (m) : 2.08464
 Intercept (b) : -0.03684
 Correlation Coefficient(r) : 0.99994

Standard Condition

Pstd (hpa) : 1013
 Tstd (K) : 298.18

Calibration Condition

Pa (hpa) : 1010
 Ta(K) : 302

| Resistance Plate | | dH [green liquid] (inch water) | Z | X=Qstd (cubic meter/min) | IC (chart) | Y (corrected) |
|------------------|----------|-----------------------------------|-------|-----------------------------|---------------|------------------|
| 1 | 18 holes | 12.0 | 3.436 | 1.666 | 55 | 54.55 |
| 2 | 13 holes | 9.6 | 3.073 | 1.492 | 49 | 48.60 |
| 3 | 10 holes | 7.0 | 2.624 | 1.277 | 43 | 42.65 |
| 4 | 7 holes | 4.6 | 2.127 | 1.038 | 36 | 35.71 |
| 5 | 5 holes | 2.4 | 1.537 | 0.755 | 26 | 25.79 |

Notes: $Z = \sqrt{dH(Pa/Pstd)(Tstd/Ta)}$, $X = Z/m - b$, $Y(\text{Corrected Flow}) = IC * \{\sqrt{Pa/Pstd}(Tstd/Ta)\}$

Sampler Calibration Relationship (Linear Regression)

Slope(m): 30.992 Intercept(b): 2.862 Correlation Coefficient(r): 0.9990

Checked by: Magnum Fan

Date: 04/06/2017



TISCH ENVIRONMENTAL, INC.
 145 SOUTH MIAMI AVE
 VILLAGE OF CLEVELS, OH
 45002
 513.467.9000
 877.263.7610 TOLL FREE
 513.467.9009 FAX

ORIFICE TRANSFER STANDARD CERTIFICATION WORKSHEET TE-5025A

Date - Mar 20, 2017 Rootsmeter S/N 0438320 Ta (K) - 293
 Operator Tisch Orifice I.D. - 2454 Pa (mm) - 759.46

| PLATE OR Run # | VOLUME START (m3) | VOLUME STOP (m3) | DIFF VOLUME (m3) | DIFF TIME (min) | METER | ORFICE |
|----------------------|-------------------------|------------------------|------------------------|-----------------------|--------------------|----------------------|
| | | | | | DIFF Hg (mm) | DIFF H2O (in.) |
| 1 | NA | NA | 1.00 | 1.4390 | 3.2 | 2.00 |
| 2 | NA | NA | 1.00 | 1.0240 | 6.4 | 4.00 |
| 3 | NA | NA | 1.00 | 0.9170 | 7.9 | 5.00 |
| 4 | NA | NA | 1.00 | 0.8730 | 8.8 | 5.50 |
| 5 | NA | NA | 1.00 | 0.7200 | 12.8 | 8.00 |

DATA TABULATION

| Vstd | (x axis) Qstd | (y axis) | Va | (x axis) Qa | (y axis) |
|-------------------------------------|------------------|----------|---------------------------|----------------|----------|
| 1.0120 | 0.7033 | 1.4257 | 0.9958 | 0.6920 | 0.8784 |
| 1.0078 | 0.9842 | 2.0163 | 0.9916 | 0.9683 | 1.2423 |
| 1.0057 | 1.0967 | 2.2543 | 0.9895 | 1.0791 | 1.3889 |
| 1.0045 | 1.1507 | 2.3643 | 0.9884 | 1.1322 | 1.4567 |
| 0.9992 | 1.3878 | 2.8514 | 0.9831 | 1.3654 | 1.7568 |
| Qstd slope (m) = 2.08464 | | | Qa slope (m) = 1.30537 | | |
| intercept (b) = -0.03684 | | | intercept (b) = -0.02270 | | |
| coefficient (r) = 0.99994 | | | coefficient (r) = 0.99994 | | |
| y axis = SQRT[H2O(Pa/760) (298/Ta)] | | | y axis = SQRT[H2O(Ta/Pa)] | | |

CALCULATIONS

$$Vstd = \text{Diff. Vol} [(Pa - \text{Diff. Hg}) / 760] (298 / Ta)$$

$$Qstd = Vstd / \text{Time}$$

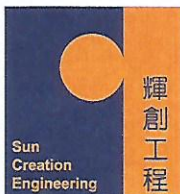
$$Va = \text{Diff Vol} [(Pa - \text{Diff Hg}) / Pa]$$

$$Qa = Va / \text{Time}$$

For subsequent flow rate calculations:

$$Qstd = 1/m \{ [\text{SQRT}(\text{H2O}(\text{Pa}/760) (298/\text{Ta}))] - b \}$$

$$Qa = 1/m \{ [\text{SQRT} \text{H2O}(\text{Ta}/\text{Pa})] - b \}$$



Certificate of Calibration 校正證書

Certificate No. : C171447
證書編號

ITEM TESTED / 送檢項目 (Job No. / 序引編號 : IC17-0633) Date of Receipt / 收件日期 : 16 March 2017

Description / 儀器名稱 : Sound Level Calibrator
Manufacturer / 製造商 : Rion
Model No. / 型號 : NC-73
Serial No. / 編號 : 10486660
Supplied By / 委託者 : Envirotech Services Co.
Room 113, 1/F, My Loft, 9 Hoi Wing Road, Tuen Mun,
New Territories, Hong Kong

TEST CONDITIONS / 測試條件

Temperature / 溫度 : (23 ± 2)°C Relative Humidity / 相對濕度 : (55 ± 20)%
Line Voltage / 電壓 : ---

TEST SPECIFICATIONS / 測試規範

Calibration check

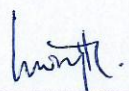
DATE OF TEST / 測試日期 : 17 March 2017


TEST RESULTS / 測試結果

The results apply to the particular unit-under-test only.
The results do not exceed manufacturer's specification.
The results are detailed in the subsequent page(s).

The test equipment used for calibration are traceable to National Standards via :

- The Government of The Hong Kong Special Administrative Region Standard & Calibration Laboratory
- Agilent Technologies / Keysight Technologies
- Rohde & Schwarz Laboratory, Germany
- Fluke Everett Service Center, USA

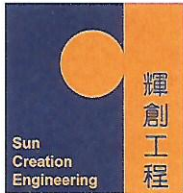
Tested By : 
測試 : H T Wong
Technical Officer

Certified By : 
核證 : K C Lee
Project Engineer

Date of Issue : 23 March 2017
簽發日期

The test equipment used for calibration are traceable to the Nation Standards as specified in this certificate. This certificate shall not be reproduced except in full, without the prior written approval of this laboratory.

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輝創工程有限公司

Sun Creation Engineering Limited

Calibration and Testing Laboratory

Certificate of Calibration 校正證書

Certificate No. : C171447

證書編號

- The unit-under-test (UUT) was allowed to stabilize in the laboratory for over 12 hours before the commencement of the test.
- The results presented are the mean of 3 measurements at each calibration point.
- Test equipment :

| <u>Equipment ID</u> | <u>Description</u> | <u>Certificate No.</u> |
|---------------------|-----------------------------------|------------------------|
| CL130 | Universal Counter | C163709 |
| CL281 | Multifunction Acoustic Calibrator | PA160023 |
| TST150A | Measuring Amplifier | C161175 |

- Test procedure : MA100N.

- Results :

5.1 Sound Level Accuracy

| UUT Nominal Value | Measured Value (dB) | Mfr's Spec. (dB) | Uncertainty of Measured Value (dB) |
|----------------------|------------------------|---------------------|---------------------------------------|
| 94 dB, 1 kHz | 93.6 | ± 0.5 | ± 0.2 |

5.2 Frequency Accuracy

| UUT Nominal Value (kHz) | Measured Value (kHz) | Mfr's Spec. | Uncertainty of Measured Value (Hz) |
|----------------------------|-------------------------|----------------|---------------------------------------|
| 1 | 0.987 | 1 kHz ± 2 % | ± 1 |

Remark : The uncertainties are for a confidence probability of not less than 95 %.

Note :

Only the original copy or the laboratory's certified true copy is valid.

The values given in this Certificate only relate to the values measured at the time of the test and any uncertainties quoted 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. Sun Creation Engineering Limited shall not be liable for any loss or damage resulting from the use of the equipment.

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Sun Creation Engineering Limited – Calibration & Testing Laboratory

c/o 4/F, Tsing Shan Wan Exchange Building, 1 Hing On Lane, Tuen Mun, New Territories, Hong Kong

輝創工程有限公司 – 校正及檢測實驗室

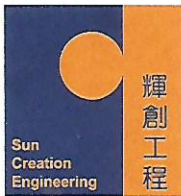
c/o 香港新界屯門興安里一號青山灣機樓四樓

Tel/電話: 2927 2606

Fax/傳真: 2744 8986

E-mail/電郵: callab@suncreation.com

Website/網址: www.suncreation.com



Certificate of Calibration 校正證書

Certificate No. : C163758
證書編號

ITEM TESTED / 送檢項目 (Job No. / 序引編號 : IC16-1465) Date of Receipt / 收件日期 : 29 June 2016
Description / 儀器名稱 : Sound Level Meter
Manufacturer / 製造商 : Rion
Model No. / 型號 : NL-31
Serial No. / 編號 : 00603867
Supplied By / 委託者 : Envirotech Services Co.
Room 113, 1/F, My Loft, 9 Hoi Wing Road, Tuen Mun,
New Territories, Hong Kong

TEST CONDITIONS / 測試條件

Temperature / 溫度 : $(23 \pm 2)^{\circ}\text{C}$ Relative Humidity / 相對濕度 : $(55 \pm 20)\%$
Line Voltage / 電壓 : ---

TEST SPECIFICATIONS / 測試規範

Calibration check

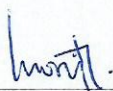
DATE OF TEST / 測試日期 : 11 July 2016

TEST RESULTS / 測試結果

The results apply to the particular unit-under-test only.
The results do not exceed manufacturer's specification.
The results are detailed in the subsequent page(s).

The test equipment used for calibration are traceable to National Standards via :

- The Government of The Hong Kong Special Administrative Region Standard & Calibration Laboratory
- Agilent Technologies / Keysight Technologies
- Rohde & Schwarz Laboratory, Germany
- Fluke Everett Service Center, USA

Tested By : 
測試 : _____
H T Wong
Technical Officer

Certified By : 
核證 : _____
K C Lee
Project Engineer

Date of Issue : 12 July 2016
簽發日期

The test equipment used for calibration are traceable to the Nation Standards as specified in this certificate. This certificate shall not be reproduced except in full, without the prior written approval of this laboratory.

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Certificate of Calibration

校正證書

Certificate No. : C163758
證書編號

- The unit-under-test (UUT) was allowed to stabilize in the laboratory for over 12 hours, and switched on to warm up for over 10 minutes before the commencement of the test.
- Self-calibration was performed before the test.
- The results presented are the mean of 3 measurements at each calibration point.
- Test equipment :

| Equipment ID | Description | Certificate No. |
|--------------|-------------------------------------|-----------------|
| CL280 | 40 MHz Arbitrary Waveform Generator | C160077 |
| CL281 | Multifunction Acoustic Calibrator | PA160023 |

- Test procedure : MA101N.

- Results :

6.1 Sound Pressure Level

6.1.1 Reference Sound Pressure Level

| UUT Setting | | | | Applied Value | | UUT Reading | IEC 61672 Class 1 Spec. |
|-------------|----------------|---------------------|----------------|---------------|-------------|-------------|-------------------------|
| Range (dB) | Mode | Frequency Weighting | Time Weighting | Level (dB) | Freq. (kHz) | (dB) | (dB) |
| 30 - 120 | L _A | A | Fast | 94.00 | 1 | 93.4 | ± 1.1 |

6.1.2 Linearity

| UUT Setting | | | | Applied Value | | UUT Reading |
|-------------|----------------|---------------------|----------------|---------------|-------------|-------------|
| Range (dB) | Mode | Frequency Weighting | Time Weighting | Level (dB) | Freq. (kHz) | (dB) |
| 30 - 120 | L _A | A | Fast | 94.00 | 1 | 93.4 (Ref.) |
| | | | | 104.00 | | 103.4 |
| | | | | 114.00 | | 113.4 |

IEC 61672 Class 1 Spec. : ± 0.6 dB per 10 dB step and ± 1.1 dB for overall different.

6.2 Time Weighting

| UUT Setting | | | | Applied Value | | UUT Reading | IEC 61672 Class 1 Spec. |
|-------------|----------------|---------------------|----------------|---------------|-------------|-------------|-------------------------|
| Range (dB) | Mode | Frequency Weighting | Time Weighting | Level (dB) | Freq. (kHz) | (dB) | (dB) |
| 30 - 120 | L _A | A | Fast | 94.00 | 1 | 93.4 | Ref. |
| | | | Slow | | | 93.4 | ± 0.3 |

The test equipment used for calibration are traceable to the Nation Standards as specified in this certificate. This certificate shall not be reproduced except in full, without the prior written approval of this laboratory.

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Certificate of Calibration

校正證書

Certificate No. : C163758
證書編號

6.3 Frequency Weighting

6.3.1 A-Weighting

| UUT Setting | | | | Applied Value | | UUT Reading (dB) | IEC 61672 Class 1 Spec. (dB) |
|-------------|----------------|---------------------|----------------|---------------|----------|------------------|------------------------------|
| Range (dB) | Mode | Frequency Weighting | Time Weighting | Level (dB) | Freq. | | |
| 30 - 120 | L _A | A | Fast | 94.00 | 63 Hz | 67.1 | -26.2 ± 1.5 |
| | | | | | 125 Hz | 77.1 | -16.1 ± 1.5 |
| | | | | | 250 Hz | 84.7 | -8.6 ± 1.4 |
| | | | | | 500 Hz | 90.1 | -3.2 ± 1.4 |
| | | | | | 1 kHz | 93.4 | Ref. |
| | | | | | 2 kHz | 94.7 | +1.2 ± 1.6 |
| | | | | | 4 kHz | 94.5 | +1.0 ± 1.6 |
| | | | | | 8 kHz | 92.4 | -1.1 (+2.1 ; -3.1) |
| | | | | | 12.5 kHz | 89.5 | -4.3 (+3.0 ; -6.0) |

6.3.2 C-Weighting

| UUT Setting | | | | Applied Value | | UUT Reading (dB) | IEC 61672 Class 1 Spec. (dB) |
|-------------|----------------|---------------------|----------------|---------------|----------|------------------|------------------------------|
| Range (dB) | Mode | Frequency Weighting | Time Weighting | Level (dB) | Freq. | | |
| 30 - 120 | L _C | C | Fast | 94.00 | 63 Hz | 92.5 | -0.8 ± 1.5 |
| | | | | | 125 Hz | 93.2 | -0.2 ± 1.5 |
| | | | | | 250 Hz | 93.4 | 0.0 ± 1.4 |
| | | | | | 500 Hz | 93.4 | 0.0 ± 1.4 |
| | | | | | 1 kHz | 93.4 | Ref. |
| | | | | | 2 kHz | 93.3 | -0.2 ± 1.6 |
| | | | | | 4 kHz | 92.7 | -0.8 ± 1.6 |
| | | | | | 8 kHz | 90.5 | -3.0 (+2.1 ; -3.1) |
| | | | | | 12.5 kHz | 87.6 | -6.2 (+3.0 ; -6.0) |

Remarks : - UUT Microphone Model No. : UC-53A & S/N : 316987

- Mfr's Spec. : IEC 61672 Class 1

- Uncertainties of Applied Value : 94 dB : 63 Hz - 125 Hz : ± 0.35 dB
 250 Hz - 500 Hz : ± 0.30 dB
 1 kHz : ± 0.20 dB
 2 kHz - 4 kHz : ± 0.35 dB
 8 kHz : ± 0.45 dB
 12.5 kHz : ± 0.70 dB
 104 dB : 1 kHz : ± 0.10 dB (Ref. 94 dB)
 114 dB : 1 kHz : ± 0.10 dB (Ref. 94 dB)

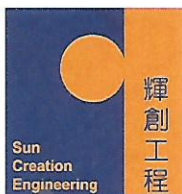
- The uncertainties are for a confidence probability of not less than 95 %.

Note :

The values given in this Certificate only relate to the values measured at the time of the test and any uncertainties quoted 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. Sun Creation Engineering Limited shall not be liable for any loss or damage resulting from the use of the equipment.

The test equipment used for calibration are traceable to the Nation Standards as specified in this certificate. This certificate shall not be reproduced except in full, without the prior written approval of this laboratory.

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Certificate of Calibration 校正證書

Certificate No. : C165934
證書編號

ITEM TESTED / 送檢項目 (Job No. / 序引編號 : IC16-2438) Date of Receipt / 收件日期 : 26 October 2016

Description / 儀器名稱 : Anemometer
Manufacturer / 製造商 : Lutron
Model No. / 型號 : AM-4201
Serial No. / 編號 : AF.27513
Supplied By / 委託者 : Envirotech Services Co.
Room 113, 1/F, My Loft, 9 Hoi Wing Road, Tuen Mun,
New Territories, Hong Kong

TEST CONDITIONS / 測試條件

Temperature / 溫度 : (23 ± 2)°C Relative Humidity / 相對濕度 : (55 ± 20)%
Line Voltage / 電壓 : ---

TEST SPECIFICATIONS / 測試規範


Calibration check

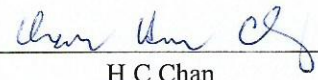
DATE OF TEST / 測試日期 : 27 October 2016

TEST RESULTS / 測試結果

The results apply to the particular unit-under-test only.
The results are detailed in the subsequent page(s).

The test equipment used for calibration are traceable to National Standards via :
- Testo Industrial Services GmbH, Germany

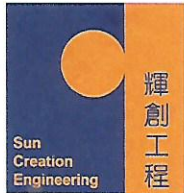
Tested By : 
測試 : _____
T L Shek
Assistant Engineer

Certified By : 
核證 : _____
H C Chan
Engineer

Date of Issue : 28 October 2016
簽發日期

The test equipment used for calibration are traceable to the Nation Standards as specified in this certificate. This certificate shall not be reproduced except in full, without the prior written approval of this laboratory.

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輝創工程有限公司

Sun Creation Engineering Limited

Calibration and Testing Laboratory

Certificate of Calibration 校正證書

Certificate No. : C165934
證書編號

- The unit-under-test (UUT) was allowed to stabilize in the laboratory for over 12 hours before the commencement of the test.
- The results presented are the mean of 10 measurements at each calibration point.
- Test equipment :

| <u>Equipment ID</u> | <u>Description</u> | <u>Certificate No.</u> |
|---------------------|-------------------------------------|------------------------|
| CL386 | Multi-function Measuring Instrument | S12109 |

- Test procedure : MA130N.
- Results :

Air Velocity

| Applied Value (m/s) | UUT Reading (m/s) | Measured Correction | | |
|---------------------|-------------------|---------------------|----------------------------|-----------------|
| | | Value (m/s) | Measurement Uncertainty | |
| | | | Expanded Uncertainty (m/s) | Coverage Factor |
| 2.0 | 1.8 | +0.2 | 0.2 | 2.0 |
| 4.0 | 3.8 | +0.2 | 0.2 | 2.0 |
| 6.0 | 5.8 | +0.2 | 0.3 | 2.0 |
| 8.1 | 8.0 | +0.1 | 0.3 | 2.0 |
| 10.0 | 10.0 | 0.0 | 0.4 | 2.0 |

Remarks : - The Measured Corrections are defined as :
Value = Applied Value - UUT Reading

- The expanded uncertainties are for a level of confidence of 95 %.

Note :

Only the original copy or the laboratory's certified true copy is valid.

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Sun Creation Engineering Limited – Calibration & Testing Laboratory

c/o 4/F, Tsing Shan Wan Exchange Building, 1 Hing On Lane, Tuen Mun, New Territories, Hong Kong

輝創工程有限公司 – 校正及檢測實驗室

c/o 香港新界屯門興安里一號青山灣機樓四樓

Tel/電話: 2927 2606

Fax/傳真: 2744 8986

E-mail/電郵: callab@suncreation.com

Website/網址: www.suncreation.com

ENVIROTECH SERVICES CO.

Calibration Report of Wind Meter

Date of Calibration : 18 April 2017

Brand of Test Meter: Global Water

Model: Speed Sensor: WE550 (S/N:E1337005099)

Direction Sensor: WE570 (S/N:153500564)

Location : Pak Mong, Siu Ho Wan

Procedures :

- 1. Wind Still Test: The wind speed sensor was hold by hand until it keep still
- 2. Wind Speed Test: The wind meter was on-site calibrated against the Anemometer
- 3. Wind Direction Test : The wind meter was on-site calibrated against the marine compass at four directions

Results:

Wind Still Test

| Wind Speed (m/s) |
|------------------|
| 0.00 |

Wind Speed Test

| Global Wate (m/s) | Anemometer (m/s) |
|-------------------|------------------|
| 1.65 | 1.8 |
| 1.11 | 1.3 |
| 0.71 | 0.6 |

Wind Direction Test

| Global Wate (o) | Marine Compass (o) |
|-----------------|--------------------|
| 271.05 | 270 |
| 0.05 | 0 |
| 90.31 | 90 |
| 181.07 | 180 |

Calibrated by: Ho
Yeung Ping Fai
(Technical Officer)

Checked by: Fat
Ho Kam Fat
(Senior Technical Officer)