

Appendix C Calibration Certificates of Monitoring Equipment



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

ORIFICE TRANSFER STANDARD CERTIFICATION WORKSHEET TE-5025A

| Date - Fe Operator | | 7 Rootsmeter Orifice I.I | | 438320 1941 | Ta (K) - Pa (mm) - | 294 - 750.57 |
|-----------------------|--|--|------------------------------|--|----------------------------------|--------------------------------------|
| PLATE | ====================================== | ====================================== | ======= DIFF | ====================================== | ======= METER DIFF | ORFICE DIFF |
| OR Run # | START (m3) | STOP (m3) | VOLUME (m3) | TIME (min) | Hg (mm) | H2O (in.) |
| 1 2 3 4 5 | NA NA NA NA NA | NA NA NA NA NA | 1.00 1.00 1.00 1.00 | 1.4600 1.0410 0.9280 0.8840 0.7290 | 3.2 6.4 7.9 8.7 12.7 | 2.00 4.00 5.00 5.50 8.00 |
| | 1 | | | 1 | | |

DATA TABULATION

| Vstd | (x axis) Qstd | (y axis) | | Va | (x axis) Qa | (y axis) |
|--|--|--|-------|--|--|--|
| 0.9967 0.9925 0.9904 0.9894 0.9840 | 0.6827 0.9534 1.0672 1.1192 1.3499 | 1.4149 2.0010 2.2372 2.3464 2.8299 | | 0.9957 0.9915 0.9894 0.9884 0.9830 | 0.6820 0.9524 1.0661 1.1181 1.3485 | 0.8851 1.2517 1.3995 1.4678 1.7702 |
| Qstd slop intercept coefficie | (b) = | 2.11965 -0.02696 0.99991 | n e r | Qa slope intercept coefficie | = (b) $=$ | 1.32729 -0.01686 0.99991 |
| y axis = | SQRT[H2O(F | a/760) (298/5 | ra)] | y axis = | SQRT [H2O (| [a/Pa)] |

CALCULATIONS

Vstd = Diff. Vol[(Pa-Diff. Hg)/760](298/Ta)
Qstd = Vstd/Time

Va = Diff Vol [(Pa-Diff Hg)/Pa]

Qa = Va/Time

For subsequent flow rate calculations:

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

TSP Sampler Calibration

SITE

Location: Lian Tang 3 Date: January 6, 2018 Sampler: TE-5170 MFC (Serial # : 2359) Tech: Sam Wong

CONDITIONS Barometric Pressure (in Hg): 39.99 Corrected Pressure (mm Hg): 1016 Temperature (deg F): 70 Temperature (deg K): 294 Average Press. (in Hg): 39.99 Corrected Average (mm Hg): 1016 Average Temp. (deg F): Average Temp. (deg K): 294

CALIBRATION ORIFICE Make: Tisch Qstd Slope: 2.11965 Model: TE-5025A Qstd Intercept: -0.02696

Date Certified:

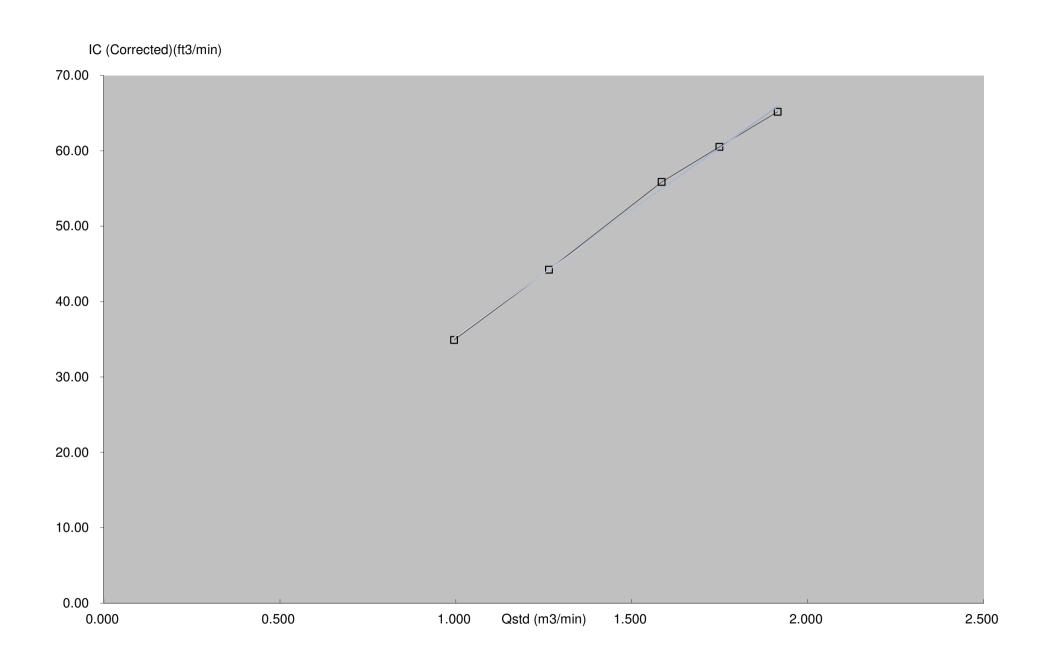
February 28, 2017

| | CALIBRATIONS | | | | | |
|--------------------|--------------|------------------|--------------|-------------------|----------------------|---------|
| Plate or Test # | H2O (in) | Qstd (m3/min) | I (chart) | IC (corrected) | LINEAR REGRESSION | |
| 1 | 12.00 | 1.915 | 56.0 | 65.17 | Slope = | 33.3004 |
| 2 | 10.00 | 1.749 | 52.0 | 60.51 | Intercept = | 2.1322 |
| 3 | 8.20 | 1.585 | 48.0 | 55.86 | Corr. coeff.= | 0.9987 |
| 4 | 5.20 | 1.265 | 38.0 | 44.22 | | |
| 5 | 3.20 | 0.995 | 30.0 | 34.91 | # of Observations: | 5 |

Calculations

Serial#:

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 KPstd = 760 mm Hg For subsequent calculation of sampler flow: 1/m((I)[Sqrt(298/Tav)(Pav/760)]-b) = sampler slope = sampler intercept m b = chart response Tav = daily average temperature Pav = daily average pressure





Certificate No. 708774 Page 1 of 2 Pages

Customer: Enovative Environmental Service Limited

Address: Flat 6, 3/F, Block E, Wah Lok Industrial Centre, 31-35 Shan Mei Street, Shatin, N.T., Hong Kong.

Order No.: Q73499 Date of receipt: 1-Sep-17

Item Tested

Description: Sound Level Calibrator

 Manufacturer : Rion
 I.D.
 : 2159O1

 Model
 : NC-74
 Serial No.
 : 34857296

Test Conditions

Date of Test: 4-Sep-17 Supply Voltage: --

Ambient Temperature : $(23 \pm 3)^{\circ}$ C Relative Humidity : (50 ± 25) %

Test Specifications

Calibration check.

Ref. Document/Procedure: F21, Z02, IEC 60942.

Test Results

All results were within the IEC 60942 Class 1 specification.

The results are shown in the attached page(s).

Main Test equipment used:

| Equipment No. | Description | Cert. No. | Traceable to |
|---------------|------------------------|-----------|---------------------|
| S014 | Spectrum Analyzer | 707126 | NIM-PRC & SCL-HKSAR |
| S240 | Sound Level Calibrator | 703741 | NIM-PRC & SCL-HKSAR |
| S041 | Universal Counter | 707135 | SCL-HKSAR |
| S206 | Sound Level Meter | 707129 | SCL-HKSAR |

The values given in this Calibration 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 environmental changes, vibration and shock during transportation, overloading, mis-handling, or the capability of any other laboratory to repeat the measurement. Hong Kong Calibration Ltd. 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 International System of Units (SI), or by reference to a natural constant. The test results apply to the above Unit-Under-Test only

| Calibrated by | : | Approved by : | H. C. |
|---------------|------------|---------------|----------|
| | Elva Chong | • | Alan Chu |

Date:

4-Sep-17

This Certificate is issued by:

Hong Kong Calibration Ltd.

Unit 8B, 24/F., Well Fung Industrial Centre, No. 58-76, Ta Chuen Ping Street, Kwai Chung, NT, Hong Kong.

Tel: 2425 8801 Fax: 2425 8646

Certificate No. 708774

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Results:

1. Level Accuracy (at 1 kHz)

| UUT Nominal Value | Measured Value | Mfr's Spec. |
|-------------------|----------------|-------------|
| 94 dB | 94.1 dB | ± 1 dB |

Uncertainty : \pm 0.2 dB

2. Frequency Accuracy

| UUT Nominal Value | Measured Value | Mfr's Spec. |
|-------------------|----------------|-------------|
| 1 kHz | 0.998 kHz | ± 2 % |

Uncertainty: ± 0.1 %

3. Level Stability: 0.0 dB Uncertainty: ± 0.01 dB

4. Total Harmonic Distortion: < 1.5%

Mfr's Spec. : < 3 %

Uncertainty: ± 2.3 % of reading

Remarks: 1. UUT: Unit-Under-Test

2. The uncertainty claimed is for a confidence probability of not less than 95%.

3. Atmospheric Pressure: 1 025 hPa

----- END -----



| Certificate No. 70877 | 3 | | Page | e 1 of 3 Pages |
|--|--|--|---------------------------|---|
| Customer: Enovative | e Environmental Serv | ice Limited | | |
| Address : Flat 6, 3/ | F, Block E, Wah Lok | Industrial Centre, 3 | 31-35 Shan Mei Str | reet, Shatin, N.T., Hong Kong. |
| Order No. : Q73499 | | | Date of receip | pt : 1-Sep-17 |
| Item Tested | | | | |
| Description : Sound Le | evel Meter | | | |
| Manufacturer : Rion | | | I.D. | : |
| Model : NL-52 | | | Serial No. | : 00821072 |
| Test Conditions | | | | |
| Date of Test: 5-Sep- | 17 | | Supply Voltag | ge : |
| Ambient Temperature : | (23 ± 3)°C | | Relative Hum | nidity: (50 ± 25) % |
| Test Specifications | | | | |
| Calibration check. Ref. Document/Procedure | e: Z01, IEC 61672. | | | |
| Test Results | - | | | |
| All results were within the The results are shown in | • • | | pecification. | |
| Main Test equipment use | d: | | | |
| Equipment No. Descripti | <u>on</u> | Cert. No. | | Traceable to |
| S017 Multi-Fur | nction Generator | C170120 | | SCL-HKSAR |
| S240 Sound Lo | evel Calibrator | 703741 | | NIM-PRC & SCL-HKSAR |
| | | | | |
| | e equipment long term drif e capability of any other la | t, variations with enviro aboratory to repeat the | nmental changes, vibra | and any uncertainties quoted ation and shock during transportation, (ong Calibration Ltd. shall not be liable |
| The test equipment used for ca | | nternational System of | Units (SI), or by referer | nce to a natural constant. |

Calibrated by : _____ Elva Chong This Certificate is issued by:

Approved by : _ Alan Chu

5-Sep-17

Date:

Hong Kong Calibration Ltd.

Unit 8B, 24/F., Well Fung Industrial Centre, No. 58-76, Ta Chuen Ping Street, Kwai Chung, NT, Hong Kong.

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Results:

1. Self-generated noise: 16.4 dBA (Mfr's Spec ≤ 17 dBA)

2. Acoustical signal test

| | UUT S | | | | |
|------------|-----------|-----------|--------|------------|--------------|
| | Frequency | Time | Octave | Applied | UUT |
| Range (dB) | Weighting | Weighting | Filter | Value (dB) | Reading (dB) |
| 20-130 | A | F | OFF | 94.0 | 94.1 |
| | | S | OFF | | 94.1 |
| | С | F | OFF | | 94.1 |
| | Z | F | OFF | | 94.1 |
| | A | F | OFF | 114.0 | 114.1 |
| | | S | OFF | | 114.1 |
| | С | F | OFF | | 114.1 |
| | Z | F | OFF | | 114.1 |

IEC 61672 Type 1 Spec. : ± 1.1 dB

Uncertainty: $\pm 0.1 \text{ dB}$

3 Electrical signal tests of frequency weightings (A weighting)

| Frequency | Attenuation (dB) | IEC 61672 Type 1 Spec. |
|-----------|------------------|---|
| 31.5 Hz | -39.7 | - 39.4 dB, ± 2 dB |
| 63 Hz | -26.2 | - 26.2 dB, ± 1.5 dB |
| 125 Hz | -16.2 | - 16.1 dB, ± 1.5 dB |
| 250 Hz | -8.7 | - 8.6 dB, ± 1 dB |
| 500 Hz | -3.2 | - 3.2 dB, ± 1.4 dB |
| 1 kHz | 0.0 (Ref) | $0 \text{ dB}, \pm 1.1 \text{ dB}$ |
| 2 kHz | +1.2 | + 1.2 dB, ± 1.6 dB |
| 4 kHz | +1.0 | + 1.0 dB, ± 1.6 dB |
| 8 kHz | -1.1 | - 1.1 dB , + $2.1 \text{ dB} \sim -3.1 \text{ dB}$ |
| 16 kHz | -8.0 | - 6.6 dB , + $3.5 \text{ dB} \sim -17.0 \text{ dB}$ |

Uncertainty: $\pm 0.1 \text{ dB}$

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4. Frequency & Time weightings at 1 kHz

4.1 Frequency Weighting (Fast)

| | · | | | |
|---------|------------|--------------|------------|--------------|
| UUT | Applied | UUT | Difference | IEC 61672 |
| Setting | Value (dB) | Reading (dB) | (dB) | Type 1 Spec. |
| A | 94.0 | 94.0 (Ref.) | | ± 0.4 dB |
| С | 94.0 | 94.0 | 0.0 | |
| Z | 94.0 | 94.0 | 0.0 | |

4.2 Time Weighting (A-weighted)

| UUT | Applied | UUT | Difference | IEC 61672 |
|----------------|------------|--------------|------------|--------------|
| Setting | Value (dB) | Reading (dB) | (dB) | Type 1 Spec. |
| Fast | 94.0 | 94.0 (Ref.) | | ± 0.3 dB |
| Slow | 94.0 | 94.0 | 0.0 | |
| Time-averaging | 94.0 | 94.0 | 0.0 | |

Uncertainty: ± 0.1 dB

Remarks: 1. UUT: Unit-Under-Test

2. The uncertainty claimed is for a confidence probability of not less than 95%.

3. Atmospheric Pressure: 1 028hPa.

4. Preamplifier model: NH-25, S/N: 10553 5. Microphone model: UC-59, S/N: 07040

6. Power Supply Check: OK

7. The UUT was adjusted with the supplied sound calibrator at the reference sound pressure level before the calibration.

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