



TISCH ENVIRONMENTAL, INC.
 145 SOUTH MIAMI AVE
 VILLAGE OF CLEVELAND, 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. - 0005 Pa (mm) - 759.46

| PLATE OR Run # | VOLUME START (m3) | VOLUME STOP (m3) | DIFF VOLUME (m3) | DIFF TIME (min) | METER DIFF Hg (mm) | ORFICE DIFF H2O (in.) |
|----------------|-------------------|------------------|------------------|-----------------|--------------------|-----------------------|
| 1 | NA | NA | 1.00 | 1.3960 | 3.2 | 2.00 |
| 2 | NA | NA | 1.00 | 0.9970 | 6.4 | 4.00 |
| 3 | NA | NA | 1.00 | 0.8910 | 7.8 | 5.00 |
| 4 | NA | NA | 1.00 | 0.8500 | 8.7 | 5.50 |
| 5 | NA | NA | 1.00 | 0.6990 | 12.7 | 8.00 |

DATA TABULATION

| Vstd | (x axis) Qstd | (y axis) | Va | (x axis) Qa | (y axis) |
|------------------------------------|---------------|----------|---------------------------|-------------|----------|
| 1.0120 | 0.7249 | 1.4257 | 0.9958 | 0.7133 | 0.8784 |
| 1.0078 | 1.0108 | 2.0163 | 0.9916 | 0.9946 | 1.2423 |
| 1.0058 | 1.1288 | 2.2543 | 0.9896 | 1.1107 | 1.3889 |
| 1.0047 | 1.1820 | 2.3643 | 0.9885 | 1.1630 | 1.4567 |
| 0.9993 | 1.4296 | 2.8514 | 0.9832 | 1.4066 | 1.7568 |
| Qstd slope (m) = 2.02533 | | | Qa slope (m) = 1.26823 | | |
| intercept (b) = -0.03593 | | | intercept (b) = -0.02214 | | |
| coefficient (r) = 0.99983 | | | coefficient (r) = 0.99983 | | |
| 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:

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

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



Calibration Data for High Volume Sampler (TSP Sampler)

Location : CMA1b
 Equipment no. : HVS001

Calibration Date : 02-Aug-17
 Calibration Due Date : 02-Oct-17

CALIBRATION OF CONTINUOUS FLOW RECORDER

| Ambient Condition | | | |
|--------------------|-----|--------|-----------------|
| Temperature, T_a | 300 | Kelvin | Pressure, P_a |
| | | | 1002 mmHg |

| Orifice Transfer Standard Information | | | | | |
|---------------------------------------|-----------|--------------------------------------------------------------------------------|---------|------------------|----------|
| Equipment No. | Ori001 | Slope, m_c | 2.02533 | Intercept, b_c | -0.03593 |
| Last Calibration Date | 20-Mar-17 | $(H \times P_a / 1013.3 \times 298 / T_a)^{1/2}$ $m_c \times Q_{std} + b_c$ | | | |
| Next Calibration Date | 20-Mar-18 | | | | |

| Calibration of TSP | | | | | | |
|--------------------|-------------------|--------|--------------|------------------------------------------------|--------------------------------------|----------------------------------------------------------------|
| Calibration Point | Manometer Reading | | | Q_{std} ($m^3 / \text{min.}$) X-axis | Continuous Flow Recorder, W (CFM) | IC ($W(P_a/1013.3 \times 298/T_a)^{1/2}/35.31$) Y-axis |
| | (up) | (down) | (difference) | | | |
| 1 | 1.5 | 1.5 | 3.0 | 0.8653 | 26 | 25.7683 |
| 2 | 2.3 | 2.3 | 4.6 | 1.0673 | 35 | 34.6881 |
| 3 | 3.8 | 3.8 | 7.6 | 1.3668 | 45 | 44.5990 |
| 4 | 4.8 | 4.8 | 9.6 | 1.5339 | 52 | 51.5366 |
| 5 | 6.0 | 6.0 | 12.0 | 1.7129 | 59 | 58.4742 |

By Linear Regression of Y on X

Slope, m = 37.9321 Intercept, b = -6.6488
 Correlation Coefficient* = 0.9991
 Calibration Accepted = Yes/No**

* if Correlation Coefficient < 0.990, check and recalibration again.

** Delete as appropriate.

Remarks : As per client's provided information, the equipment reference no. of the calibrated High Volume Sampler has been re-assigned from EL452 to HVS001 with respect to the update in quality management system.

Calibrated by : Jackey MA
 Date : 02-Aug-17

Checked by : Pauline Wong
 Date : 02-Aug-17



Calibration Data for High Volume Sampler (TSP Sampler)

Location : CMA2a **Calibration Date** : 02-Aug-17
Equipment no. : HVS002 **Calibration Due Date** : 02-Oct-17

CALIBRATION OF CONTINUOUS FLOW RECORDER

| Ambient Condition | | | |
|--------------------|-----|--------|-----------------|
| Temperature, T_a | 300 | Kelvin | Pressure, P_a |
| | | | 1002 mmHg |

| Orifice Transfer Standard Information | | | | | |
|---------------------------------------|-----------|--------------------------------------------------------------------------------|---------|------------------|----------|
| Equipment No. | Ori001 | Slope, m_c | 2.02533 | Intercept, b_c | -0.03593 |
| Last Calibration Date | 20-Mar-17 | $(H \times P_a / 1013.3 \times 298 / T_a)^{1/2}$ $m_c \times Q_{std} + b_c$ | | | |
| Next Calibration Date | 20-Mar-18 | | | | |

| Calibration of TSP | | | | | | |
|--------------------|-------------------|--------|--------------|------------------------------------------------|--------------------------------------|----------------------------------------------------------------|
| Calibration Point | Manometer Reading | | | Q_{std} ($m^3 / \text{min.}$) X-axis | Continuous Flow Recorder, W (CFM) | IC ($W(P_a/1013.3 \times 298/T_a)^{1/2}/35.31$) Y-axis |
| | (up) | (down) | (difference) | | | |
| 1 | 1.5 | 1.5 | 3.0 | 0.8653 | 28 | 27.7505 |
| 2 | 2.5 | 2.5 | 5.0 | 1.1120 | 34 | 33.6970 |
| 3 | 4.0 | 4.0 | 8.0 | 1.4018 | 42 | 41.6257 |
| 4 | 5.1 | 5.1 | 10.2 | 1.5806 | 49 | 48.5633 |
| 5 | 6.3 | 6.3 | 12.6 | 1.7547 | 55 | 54.5099 |

By Linear Regression of Y on X

Slope, m = 30.1617 Intercept, b = 0.7255
 Correlation Coefficient* = 0.9959
 Calibration Accepted = Yes/No**

* if Correlation Coefficient < 0.990, check and recalibration again.

** Delete as appropriate.

Remarks : As per client's provided information, the equipment reference no. of the calibrated High Volume Sampler has been
 re-assigned from EL449 to HVS002 with respect to the update in quality management system.

Calibrated by : Jackey MA **Checked by** : Pualine Wong
Date : 02-Aug-17 **Date** : 02-Aug-17



Calibration Data for High Volume Sampler (TSP Sampler)

Location : CMA3a
 Equipment no. : HVS012

Calibration Date : 07-Aug-17
 Calibration Due Date : 07-Oct-17

CALIBRATION OF CONTINUOUS FLOW RECORDER

| Ambient Condition | | | |
|--------------------|-----|--------|-----------------|
| Temperature, T_a | 304 | Kelvin | Pressure, P_a |
| | | | 1006 mmHg |

| Orifice Transfer Standard Information | | | | | |
|---------------------------------------|-----------|--------------------------------------------------------------------------------|---------|------------------|----------|
| Equipment No. | Ori001 | Slope, m_c | 2.02533 | Intercept, b_c | -0.03593 |
| Last Calibration Date | 20-Mar-17 | $(H \times P_a / 1013.3 \times 298 / T_a)^{1/2}$ $m_c \times Q_{std} + b_c$ | | | |
| Next Calibration Date | 20-Mar-18 | | | | |

| Calibration of TSP | | | | | | |
|--------------------|-------------------|--------|--------------|-----------------------------------------|--------------------------------------|----------------------------------------------------------------|
| Calibration Point | Manometer Reading | | | Q_{std} ($m^3 / min.$) X-axis | Continuous Flow Recorder, W (CFM) | IC ($W(P_a/1013.3 \times 298/T_a)^{1/2}/35.31$) Y-axis |
| | (up) | (down) | (difference) | | | |
| 1 | 1.3 | 1.3 | 2.6 | 0.8031 | 33 | 32.5548 |
| 2 | 2.0 | 2.0 | 4.0 | 0.9919 | 39 | 38.4739 |
| 3 | 3.2 | 3.2 | 6.4 | 1.2500 | 45 | 44.3929 |
| 4 | 4.4 | 4.4 | 8.8 | 1.4627 | 50 | 49.3255 |
| 5 | 5.9 | 5.9 | 11.8 | 1.6909 | 54 | 53.2715 |

By Linear Regression of Y on X

Slope, m = 23.2303 Intercept, b = 14.8045
 Correlation Coefficient* = 0.9955
 Calibration Accepted = Yes/No**

* if Correlation Coefficient < 0.990, check and recalibration again.

** Delete as appropriate.

Remarks : As per client's provided information, the equipment reference no. of the calibrated High Volume Sampler has been re-assigned from EL333 to HVS012 with respect to the update in quality management system.

Calibrated by : Jackey MA
 Date : 07-Aug-17

Checked by : Pauline Wong
 Date : 07-Aug-17



Calibration Data for High Volume Sampler (TSP Sampler)

Location : CMA4a
 Equipment no. : HVS004

Calibration Date : 07-Aug-17
 Calibration Due Date : 07-Oct-17

CALIBRATION OF CONTINUOUS FLOW RECORDER

| Ambient Condition | | | |
|--------------------|-----|--------|-----------------|
| Temperature, T_a | 304 | Kelvin | Pressure, P_a |
| | | | 1006 mmHg |

| Orifice Transfer Standard Information | | | | | |
|---------------------------------------|-----------|--------------------------------------------------------------------------------|---------|------------------|----------|
| Equipment No. | Ori001 | Slope, m_c | 2.02533 | Intercept, b_c | -0.03593 |
| Last Calibration Date | 20-Mar-17 | $(H \times P_a / 1013.3 \times 298 / T_a)^{1/2}$ $m_c \times Q_{std} + b_c$ | | | |
| Next Calibration Date | 20-Mar-18 | | | | |

| Calibration of TSP | | | | | | |
|--------------------|-------------------|--------|--------------|------------------------------------------------|----------------------------------------|-----------------------------------------------------------------------|
| Calibration Point | Manometer Reading | | | Q_{std} ($m^3 / min.$) X-axis | Continuous Flow Recorder, W (CFM) | IC ($W(P_a/1013.3 \times 298/T_a)^{1/2}/35.31$) Y-axis |
| | (up) | (down) | (difference) | | | |
| 1 | 1.4 | 1.4 | 2.8 | 0.8328 | 23 | 22.6897 |
| 2 | 2.4 | 2.4 | 4.8 | 1.0849 | 30 | 29.5953 |
| 3 | 3.7 | 3.7 | 7.4 | 1.3428 | 40 | 39.4604 |
| 4 | 4.7 | 4.7 | 9.4 | 1.5111 | 47 | 46.3660 |
| 5 | 5.8 | 5.8 | 11.6 | 1.6767 | 52 | 51.2985 |

By Linear Regression of Y on X

Slope, m = 34.9158 Intercept, b = -7.1472
 Correlation Coefficient* = 0.9977
 Calibration Accepted = Yes/No**

* if Correlation Coefficient < 0.990, check and recalibration again.

** Delete as appropriate.

Remarks : As per client's provided information, the equipment reference no. of the calibrated High Volume Sampler has been

re-assigned from EL390 to HVS004 with respect to the update in quality management system.

Calibrated by : Jackey MA

Checked by : Pauline Wong

Date : 07-Aug-17

Date : 07-Aug-17



Calibration Data for High Volume Sampler (TSP Sampler)

Location : CMA5b
 Equipment no. : HVS010

Calibration Date : 07-Aug-17
 Calibration Due Date : 07-Oct-17

CALIBRATION OF CONTINUOUS FLOW RECORDER

| Ambient Condition | | | |
|-----------------------------|-----|--------|--------------------------|
| Temperature, T _a | 304 | Kelvin | Pressure, P _a |
| | | | 1006 mmHg |

| Orifice Transfer Standard Information | | | | |
|---------------------------------------|-----------|-------------------------------------------------------------------------------|---------|---------------------------|
| Equipment No. | Ori001 | Slope, m _c | 2.02533 | Intercept, b _c |
| | | | | -0.03593 |
| Last Calibration Date | 20-Mar-17 | $(H \times P_a / 1013.3 \times 298 / T_a)^{1/2}$ $= m_c \times Q_{std} + b_c$ | | |
| Next Calibration Date | 20-Mar-18 | | | |

| Calibration of TSP | | | | | | |
|--------------------|-------------------|--------|--------------|-----------------------------------------------------------|--------------------------------------|-------------------------------------------------------------------------------------------|
| Calibration Point | Manometer Reading | | | Q _{std} (m ³ / min.) X-axis | Continuous Flow Recorder, W (CFM) | IC (W(P _a /1013.3x298/T _a) ^{1/2} /35.31) Y-axis |
| | (up) | (down) | (difference) | | | |
| 1 | 1.4 | 1.4 | 2.8 | 0.8328 | 33 | 32.5548 |
| 2 | 2.3 | 2.3 | 4.6 | 1.0624 | 40 | 39.4604 |
| 3 | 3.6 | 3.6 | 7.2 | 1.3247 | 48 | 47.3525 |
| 4 | 4.7 | 4.7 | 9.4 | 1.5111 | 54 | 53.2715 |
| 5 | 5.8 | 5.8 | 11.6 | 1.6767 | 58 | 57.2176 |

By Linear Regression of Y on X

Slope, m = 29.6169 Intercept, b = 8.0158
 Correlation Coefficient* = 0.9994
 Calibration Accepted = Yes/No**

* if Correlation Coefficient < 0.990, check and recalibration again.

** Delete as appropriate.

Remarks : As per client's provided information, the equipment reference no. of the calibrated High Volume Sampler has been re-assigned from EL222 to HVS010 with respect to the update in quality management system.

Calibrated by : Jackey MA
 Date : 07-Aug-17

Checked by : Pauline Wong
 Date : 07-Aug-17



Calibration Data for High Volume Sampler (TSP Sampler)

Location : MA1e
 Equipment no. : HVS007

Calibration Date : 07-Aug-17
 Calibration Due Date : 07-Oct-17

CALIBRATION OF CONTINUOUS FLOW RECORDER

| Ambient Condition | | | |
|-----------------------------|-----|--------|--------------------------|
| Temperature, T _a | 304 | Kelvin | Pressure, P _a |
| | | | 1006 mmHg |

| Orifice Transfer Standard Information | | | |
|---------------------------------------|-----------|--------------------------------------------------------------------------------|----------|
| Equipment No. | Ori001 | Slope, m _c | 2.02533 |
| | | Intercept, b _c | -0.03593 |
| Last Calibration Date | 20-Mar-17 | $(H \times P_a / 1013.3 \times 298 / T_a)^{1/2}$ $m_c \times Q_{std} + b_c$ | |
| Next Calibration Date | 20-Mar-18 | | |

| Calibration of TSP | | | | | | |
|--------------------|-------------------|--------|--------------|-----------------------------------------------------------|--------------------------------------|----------------------------------------------------------------------|
| Calibration Point | Manometer Reading | | | Q _{std} (m ³ / min.) X-axis | Continuous Flow Recorder, W (CFM) | IC $(W(P_a/1013.3 \times 298/T_a)^{1/2}/35.31)$ Y-axis |
| | (up) | (down) | (difference) | | | |
| 1 | 1.5 | 1.5 | 3.0 | 0.8614 | 29 | 28.6088 |
| 2 | 2.5 | 2.5 | 5.0 | 1.1069 | 38 | 37.4874 |
| 3 | 3.8 | 3.8 | 7.6 | 1.3605 | 45 | 44.3929 |
| 4 | 4.9 | 4.9 | 9.8 | 1.5426 | 53 | 52.2850 |
| 5 | 6.0 | 6.0 | 12.0 | 1.7051 | 61 | 60.1771 |

By Linear Regression of Y on X

Slope, m = 36.3667 Intercept, b = -3.2426
 Correlation Coefficient* = 0.9949
 Calibration Accepted = Yes/No**

* if Correlation Coefficient < 0.990, check and recalibration again.

Remarks : As per client's provided information, the equipment reference no. of the calibrated High Volume Sampler has been re-assigned from EL455 to HVS007 with respect to the update in quality management system.

Calibrated by : Jackey MA
 Date : 07-Aug-17

Checked by : Pauline Wong
 Date : 07-Aug-17



Calibration Data for High Volume Sampler (TSP Sampler)

Location : MA1w
 Equipment no. : HVS008

Calibration Date : 07-Aug-17
 Calibration Due Date : 07-Oct-17

CALIBRATION OF CONTINUOUS FLOW RECORDER

| Ambient Condition | | | |
|-----------------------------|-----|--------|--------------------------|
| Temperature, T _a | 304 | Kelvin | Pressure, P _a |
| | | | 1006 mmHg |

| Orifice Transfer Standard Information | | | |
|---------------------------------------|-----------|-------------------------------------------------------------------------------|----------|
| Equipment No. | Ori001 | Slope, m _c | 2.02533 |
| | | Intercept, b _c | -0.03593 |
| Last Calibration Date | 20-Mar-17 | $(H \times P_a / 1013.3 \times 298 / T_a)^{1/2}$ $= m_c \times Q_{std} + b_c$ | |
| Next Calibration Date | 20-Mar-18 | | |

| Calibration of TSP | | | | | | |
|--------------------|---------------------|--------|--------------|---------------------------------------------|--------------------------------------|-----------------------------------------------------------------------------|
| Calibration Point | Manometer Reading | | | Q _{std} (m ³ / min.) | Continuous Flow Recorder, W (CFM) | IC (W(P _a /1013.3x298/T _a) ^{1/2} /35.31) |
| | H (inches of water) | | | | | |
| | (up) | (down) | (difference) | | | |
| 1 | 1.6 | 1.6 | 3.2 | 0.8891 | 22 | 21.7032 |
| 2 | 2.5 | 2.5 | 5.0 | 1.1069 | 30 | 29.5953 |
| 3 | 4.0 | 4.0 | 8.0 | 1.3954 | 40 | 39.4604 |
| 4 | 5.0 | 5.0 | 10.0 | 1.5580 | 45 | 44.3929 |
| 5 | 6.2 | 6.2 | 12.4 | 1.7329 | 50 | 49.3255 |

By Linear Regression of Y on X

Slope, m = 32.8846 Intercept, b = -7.0540
 Correlation Coefficient* = 0.9989
 Calibration Accepted = Yes/No**

* if Correlation Coefficient < 0.990, check and recalibration again.

Remarks : As per client's provided information, the equipment reference no. of the calibrated High Volume Sampler has been re-assigned from EL080 to HVS008 with respect to the update in quality management system.

Calibrated by : Jackey MA
 Date : 07-Aug-17

Checked by : Pauline Wong
 Date : 07-Aug-17



CERTIFICATE OF CALIBRATION

Certificate No.: 17CA0426 01-02 Page 1 of 2

Item tested

| | | |
|-----------------------|----------------------------|--------------|
| Description: | Sound Level Meter (Type 1) | , Microphone |
| Manufacturer: | Larson Davis | , PCB |
| Type/Model No.: | LxT1 | , 377B02 |
| Serial/Equipment No.: | 0003737 | , 171529 |
| Adaptors used: | - | , - |

Item submitted by

| | |
|----------------------|--------------------------------|
| Customer Name: | Lam Environmental Service Ltd. |
| Address of Customer: | - |
| Request No.: | - |
| Date of receipt: | 26-Apr-2017 |

Date of test: 28-Apr-2017

Reference equipment used in the calibration

| Description: | Model: | Serial No. | Expiry Date: | Traceable to: |
|---------------------------------|----------|------------|--------------|---------------|
| Multi function sound calibrator | B&K 4226 | 2288444 | 18-Jun-2017 | CIGISMEC |
| Signal generator | DS 360 | 61227 | 01-Apr-2018 | CEPREI |

Ambient conditions

| | |
|--------------------|--------------|
| Temperature: | 21 ± 1 °C |
| Relative humidity: | 50 ± 10 % |
| Air pressure: | 1010 ± 5 hPa |

Test specifications

- 1, The Sound Level Meter has been calibrated in accordance with the requirements as specified in BS 7580: Part 1: 1997 and the lab calibration procedure SMTP004-CA-152.
- 2, The electrical tests were performed using an electrical signal substituted for the microphone which was removed and replaced by an equivalent capacitance within a tolerance of ±20%.
- 3, The acoustic calibration was performed using an B&K 4226 sound calibrator and corrections was applied for the difference between the free-field and pressure responsiveness of the Sound Level Meter.

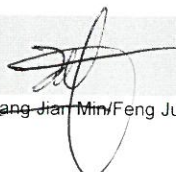
Test results

This is to certify that the Sound Level Meter conforms to BS 7580: Part 1: 1997 for the conditions under which the test was performed.

Details of the performed measurements are presented on page 2 of this certificate.

Actual Measurement data are documented on worksheets.

Approved Signatory:


Huang Jian Min/Feng Jun Qi

Date: 04-May-2017

Company Chop:



Comments: The results reported in this certificate refer to the condition of the instrument on the date of calibration and carry no implication regarding the long-term stability of the instrument.



CERTIFICATE OF CALIBRATION

(Continuation Page)

Certificate No.: 17CA0426 01-02 Page 2 of 2

1, Electrical Tests

The electrical tests were performed using an equivalent capacitance substituted for the microphone. The results are given in below with test status and the estimated uncertainties. The "Pass" means the result of the test is inside the tolerances stated in the test specifications. The "-" means the result of test is outside these tolerances.

| Test: | Subtest: | Status: | Expanded Uncertainty (dB) | Coverage Factor |
|-------------------------|--------------------------------------------------|---------|---------------------------|-----------------|
| Self-generated noise | A | Pass | 0.3 | 2.1 |
| | C | Pass | 0.8 | |
| | Lin | Pass | 1.6 | |
| Linearity range for Leq | At reference range, Step 5 dB at 4 kHz | Pass | 0.3 | 2.2 |
| | Reference SPL on all other ranges | Pass | 0.3 | |
| | 2 dB below upper limit of each range | Pass | 0.3 | |
| | 2 dB above lower limit of each range | Pass | 0.3 | |
| Linearity range for SPL | At reference range, Step 5 dB at 4 kHz | Pass | 0.3 | |
| | Frequency weightings | | | |
| Time weightings | A | Pass | 0.3 | |
| | C | Pass | 0.3 | |
| | Lin | Pass | 0.3 | |
| Peak response | Single Burst Fast | Pass | 0.3 | |
| | Single Burst Slow | Pass | 0.3 | |
| R.M.S. accuracy | Single 100µs rectangular pulse | N/A | N/A | |
| Time weighting I | Crest factor of 3 | Pass | 0.3 | |
| | Single burst 5 ms at 2000 Hz | Pass | 0.3 | |
| | Repeated at frequency of 100 Hz | Pass | 0.3 | |
| Time averaging | 1 ms burst duty factor 1/10 ³ at 4kHz | Pass | 0.3 | |
| | 1 ms burst duty factor 1/10 ⁴ at 4kHz | Pass | 0.3 | |
| Pulse range | Single burst 10 ms at 4 kHz | Pass | 0.4 | |
| Sound exposure level | Single burst 10 ms at 4 kHz | Pass | 0.4 | |
| Overload indication | SPL | Pass | 0.3 | |
| | Leq | Pass | 0.4 | |

2, Acoustic tests

The complete sound level meter was calibrated on the reference range using a B&K 4226 acoustic calibrator with 1000Hz and SPL 94 dB. The sensitivity of the sound level meter was adjusted. The test result at 125 Hz and 8000 Hz are given in below with test status and the estimated uncertainties.

| Test: | Subtest | Status | Expanded Uncertainty (dB) | Coverage Factor |
|-------------------|------------------------|--------|---------------------------|-----------------|
| Acoustic response | Weighting A at 125 Hz | Pass | 0.3 | |
| | Weighting A at 8000 Hz | Pass | 0.5 | |

3, Response to associated sound calibrator

N/A

The expanded uncertainties have been calculated in accordance with the ISO Publication "Guide to the expression of uncertainty in measurement", and gives an interval estimated to have a level of confidence of 95%. A coverage factor of 2 is assumed unless explicitly stated.

- End -

Calibrated by:

Lai Sheng Jie
Date: 28-Apr-2017

Checked by:

Fung Chi Yip
Date: 04-May-2017

The standard(s) and equipment used in the calibration are traceable to national or international recognised standards and are calibrated on a schedule to maintain the required accuracy level.



CERTIFICATE OF CALIBRATION

Certificate No.: 17CA0221 02 Page 1 of 2

Item tested

| | | | |
|-----------------------|----------------------------|------------|--------|
| Description: | Sound Level Meter (Type 1) | Microphone | Preamp |
| Manufacturer: | B & K | B & K | B & K |
| Type/Model No.: | 2250-L | 4950 | ZC0032 |
| Serial/Equipment No.: | 2701778 | 2755097 | 19223 |
| Adaptors used: | - | - | - |

Item submitted by

Customer Name: Lam Geotechnics Limited
Address of Customer: -
Request No.: -
Date of receipt: 22-Feb-2017

Date of test: 02-Mar-2017

Reference equipment used in the calibration

| Description: | Model: | Serial No. | Expiry Date: | Traceable to: |
|---------------------------------|----------|------------|--------------|---------------|
| Multi function sound calibrator | B&K 4226 | 2288444 | 18-Jun-2017 | CIGISMEC |
| Signal generator | DS 360 | 33873 | 18-Apr-2017 | CEPREI |
| Signal generator | DS 360 | 61227 | 18-Apr-2017 | CEPREI |

Ambient conditions

Temperature: 20 ± 1 °C
Relative humidity: 60 ± 10 %
Air pressure: 1010 ± 5 hPa

Test specifications

- 1, The Sound Level Meter has been calibrated in accordance with the requirements as specified in BS 7580: Part 1: 1997 and the lab calibration procedure SMTP004-CA-152.
- 2, The electrical tests were performed using an electrical signal substituted for the microphone which was removed and replaced by an equivalent capacitance within a tolerance of $\pm 20\%$.
- 3, The acoustic calibration was performed using an B&K 4226 sound calibrator and corrections was applied for the difference between the free-field and pressure response of the Sound Level Meter.

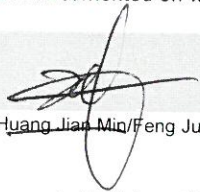
Test results

This is to certify that the Sound Level Meter conforms to BS 7580: Part 1: 1997 for the conditions under which the test was performed.

Details of the performed measurements are presented on page 2 of this certificate.

Actual Measurement data are documented on worksheets.

Approved Signatory:


Huang Jian Min/Feng Jun Qi

Date: 06-Mar-2017

Company Chop:



Comments: The results reported in this certificate refer to the condition of the instrument on the date of calibration and carry no implication regarding the long-term stability of the instrument.



CERTIFICATE OF CALIBRATION

(Continuation Page)

Certificate No.: 17CA0221 02 Page 2 of 2

1, Electrical Tests

The electrical tests were performed using an equivalent capacitance substituted for the microphone. The results are given in below with test status and the estimated uncertainties. The "Pass" means the result of the test is inside the tolerances stated in the test specifications. The "-" means the result of test is outside these tolerances.

| Test: | Subtest: | Status: | Expanded Uncertainty (dB) | Coverage Factor |
|-------------------------|--------------------------------------------------|---------|---------------------------|-----------------|
| Self-generated noise | A | Pass | 0.3 | |
| | C | Pass | 0.8 | |
| | Lin | Pass | 1.6 | |
| Linearity range for Leq | At reference range, Step 5 dB at 4 kHz | Pass | 0.3 | |
| | Reference SPL on all other ranges | Pass | 0.3 | |
| | 2 dB below upper limit of each range | Pass | 0.3 | |
| | 2 dB above lower limit of each range | Pass | 0.3 | |
| | At reference range, Step 5 dB at 4 kHz | Pass | 0.3 | |
| Linearity range for SPL | A | Pass | 0.3 | |
| | C | Pass | 0.3 | |
| | Lin | Pass | 0.3 | |
| Time weightings | Single Burst Fast | Pass | 0.3 | |
| | Single Burst Slow | Pass | 0.3 | |
| Peak response | Single 100µs rectangular pulse | Pass | 0.3 | |
| R.M.S. accuracy | Crest factor of 3 | Pass | 0.3 | |
| Time weighting I | Single burst 5 ms at 2000 Hz | Pass | 0.3 | |
| | Repeated at frequency of 100 Hz | Pass | 0.3 | |
| Time averaging | 1 ms burst duty factor 1/10 ³ at 4kHz | Pass | 0.3 | |
| | 1 ms burst duty factor 1/10 ⁴ at 4kHz | Pass | 0.3 | |
| Pulse range | Single burst 10 ms at 4 kHz | Pass | 0.4 | |
| Sound exposure level | Single burst 10 ms at 4 kHz | Pass | 0.4 | |
| Overload indication | SPL | Pass | 0.3 | |
| | Leq | Pass | 0.4 | |

2, Acoustic tests

The complete sound level meter was calibrated on the reference range using a B&K 4226 acoustic calibrator with 1000Hz and SPL 94 dB. The sensitivity of the sound level meter was adjusted. The test result at 125 Hz and 8000 Hz are given in below with test status and the estimated uncertainties.

| Test: | Subtest | Status | Expanded Uncertainty (dB) | Coverage Factor |
|-------------------|------------------------|--------|---------------------------|-----------------|
| Acoustic response | Weighting A at 125 Hz | Pass | 0.3 | |
| | Weighting A at 8000 Hz | Pass | 0.5 | |

3, Response to associated sound calibrator

N/A

The expanded uncertainties have been calculated in accordance with the ISO Publication "Guide to the expression of uncertainty in measurement", and gives an interval estimated to have a level of confidence of 95%. A coverage factor of 2 is assumed unless explicitly stated.

- End -

Calibrated by:

Date:

Fung Chi Yip
02-Mar-2017

Checked by:

Date:

Lam Tze Wai
06-Mar-2017

The standard(s) and equipment used in the calibration are traceable to national or international recognised standards and are calibrated on a schedule to maintain the required accuracy level.



CERTIFICATE OF CALIBRATION

Certificate No.: 17CA0320 02 Page 1 of 2

Item tested

| | | | |
|-----------------------|----------------------------|------------|--------|
| Description: | Sound Level Meter (Type 1) | Microphone | Preamp |
| Manufacturer: | B & K | B & K | B & K |
| Type/Model No.: | 2250-L | 4950 | ZC0032 |
| Serial/Equipment No.: | 2722310 | 2698702 | 13318 |
| Adaptors used: | - | - | - |

Item submitted by

Customer Name: Lam Geotechnics Ltd.
Address of Customer: -
Request No.: -
Date of receipt: 20-Mar-2017

Date of test: 23-Mar-2017

Reference equipment used in the calibration

| Description: | Model: | Serial No. | Expiry Date: | Traceable to: |
|---------------------------------|----------|------------|--------------|---------------|
| Multi function sound calibrator | B&K 4226 | 2288444 | 18-Jun-2017 | CIGISMEC |
| Signal generator | DS 360 | 33873 | 18-Apr-2017 | CEPREI |
| Signal generator | DS 360 | 61227 | 18-Apr-2017 | CEPREI |

Ambient conditions

Temperature: 21 ± 1 °C
Relative humidity: 60 ± 10 %
Air pressure: 1010 ± 5 hPa

Test specifications

- 1, The Sound Level Meter has been calibrated in accordance with the requirements as specified in BS 7580: Part 1: 1997 and the lab calibration procedure SMTP004-CA-152.
- 2, The electrical tests were performed using an electrical signal substituted for the microphone which was removed and replaced by an equivalent capacitance within a tolerance of $\pm 20\%$.
- 3, The acoustic calibration was performed using an B&K 4226 sound calibrator and corrections was applied for the difference between the free-field and pressure responsess of the Sound Level Meter.

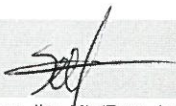
Test results

This is to certify that the Sound Level Meter conforms to BS 7580: Part 1: 1997 for the conditions under which the test was performed.

Details of the performed measurements are presented on page 2 of this certificate.

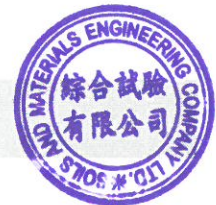
Actual Measurement data are documented on worksheets.

Approved Signatory:


Huang Jian Min/Feng Jun Qi

Date: 24-Mar-2017

Company Chop:



Comments: The results reported in this certificate refer to the condition of the instrument on the date of calibration and carry no implication regarding the long-term stability of the instrument.



CERTIFICATE OF CALIBRATION

(Continuation Page)

Certificate No.: 17CA0320 02 - Page 2 of 2

1, Electrical Tests

The electrical tests were performed using an equivalent capacitance substituted for the microphone. The results are given in below with test status and the estimated uncertainties. The "Pass" means the result of the test is inside the tolerances stated in the test specifications. The "-" means the result of test is outside these tolerances.

| Test: | Subtest: | Status: | Expanded Uncertainty (dB) | Coverage Factor |
|-------------------------|--------------------------------------------------|-----------------------------|---------------------------|-----------------|
| Self-generated noise | A | Pass | 0.3 | |
| | C | Pass | 0.8 | |
| | Lin | Pass | 1.6 | |
| Linearity range for Leq | At reference range, Step 5 dB at 4 kHz | Pass | 0.3 | |
| | Reference SPL on all other ranges | Pass | 0.3 | |
| | 2 dB below upper limit of each range | Pass | 0.3 | |
| | 2 dB above lower limit of each range | Pass | 0.3 | |
| Linearity range for SPL | At reference range, Step 5 dB at 4 kHz | Pass | 0.3 | |
| | A | Pass | 0.3 | |
| | C | Pass | 0.3 | |
| Frequency weightings | Lin | Pass | 0.3 | |
| | Single Burst Fast | Pass | 0.3 | |
| | Single Burst Slow | Pass | 0.3 | |
| Peak response | Single 100µs rectangular pulse | Pass | 0.3 | |
| | R.M.S. accuracy | Crest factor of 3 | Pass | 0.3 |
| Time weighting I | Single burst 5 ms at 2000 Hz | Pass | 0.3 | |
| | Repeated at frequency of 100 Hz | Pass | 0.3 | |
| Time averaging | 1 ms burst duty factor 1/10 ³ at 4kHz | Pass | 0.3 | |
| | 1 ms burst duty factor 1/10 ⁴ at 4kHz | Pass | 0.3 | |
| Pulse range | Single burst 10 ms at 4 kHz | Pass | 0.4 | |
| | Sound exposure level | Single burst 10 ms at 4 kHz | Pass | 0.4 |
| Overload indication | SPL | Pass | 0.3 | |
| | Leq | Pass | 0.4 | |

2, Acoustic tests

The complete sound level meter was calibrated on the reference range using a B&K 4226 acoustic calibrator with 1000Hz and SPL 94 dB. The sensitivity of the sound level meter was adjusted. The test result at 125 Hz and 8000 Hz are given in below with test status and the estimated uncertainties.

| Test: | Subtest | Status | Expanded Uncertainty (dB) | Coverage Factor |
|-------------------|------------------------|--------|---------------------------|-----------------|
| Acoustic response | Weighting A at 125 Hz | Pass | 0.3 | |
| | Weighting A at 8000 Hz | Pass | 0.5 | |

3, Response to associated sound calibrator

N/A

The expanded uncertainties have been calculated in accordance with the ISO Publication "Guide to the expression of uncertainty in measurement", and gives an interval estimated to have a level of confidence of 95%. A coverage factor of 2 is assumed unless explicitly stated.

- End -

Calibrated by:

Lai Sheng Jie

Date: 23-Mar-2017

Checked by:

Fung Chi Yip

Date: 24-Mar-2017

The standard(s) and equipment used in the calibration are traceable to national or international recognised standards and are calibrated on a schedule to maintain the required accuracy level.



CERTIFICATE OF CALIBRATION

Certificate No.: 17CA0505 01 Page 1 of 2

Item tested

| | | | |
|-----------------------|----------------------------|------------|--------|
| Description: | Sound Level Meter (Type 1) | Microphone | Preamp |
| Manufacturer: | B & K | B & K | B & K |
| Type/Model No.: | 2250-L | 4950 | ZC0032 |
| Serial/Equipment No.: | 2722311 | 2698703 | 13321 |
| Adaptors used: | - | - | - |

Item submitted by

Customer Name: Lam Geotechnics Ltd.
Address of Customer: -
Request No.: -
Date of receipt: 05-May-2017

Date of test: 06-May-2017

Reference equipment used in the calibration

| Description: | Model: | Serial No. | Expiry Date: | Traceable to: |
|---------------------------------|----------|------------|--------------|---------------|
| Multi function sound calibrator | B&K 4226 | 2288444 | 18-Jun-2017 | CIGISMEC |
| Signal generator | DS 360 | 61227 | 01-Apr-2018 | CEPREI |

Ambient conditions

Temperature: 22 ± 1 °C
Relative humidity: 50 ± 10 %
Air pressure: 1010 ± 5 hPa

Test specifications

- 1, The Sound Level Meter has been calibrated in accordance with the requirements as specified in BS 7580: Part 1: 1997 and the lab calibration procedure SMTP004-CA-152.
- 2, The electrical tests were performed using an electrical signal substituted for the microphone which was removed and replaced by an equivalent capacitance within a tolerance of $\pm 20\%$.
- 3, The acoustic calibration was performed using an B&K 4226 sound calibrator and corrections was applied for the difference between the free-field and pressure responses of the Sound Level Meter.

Test results

This is to certify that the Sound Level Meter conforms to BS 7580: Part 1: 1997 for the conditions under which the test was performed.

Details of the performed measurements are presented on page 2 of this certificate.

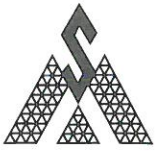
Actual Measurement data are documented on worksheets.

Approved Signatory:  Date: 09-May-2017 Company Chop:

Huang Jianmin / Feng Junqi



Comments: The results reported in this certificate refer to the condition of the instrument on the date of calibration and carry no implication regarding the long-term stability of the instrument.



CERTIFICATE OF CALIBRATION

(Continuation Page)

Certificate No.: 17CA0505 01 Page 2 of 2

1, Electrical Tests

The electrical tests were performed using an equivalent capacitance substituted for the microphone. The results are given in below with test status and the estimated uncertainties. The "Pass" means the result of the test is inside the tolerances stated in the test specifications. The "-" means the result of test is outside these tolerances.

| Test: | Subtest: | Status: | Expanded Uncertainty (dB) | Coverage Factor |
|-------------------------|--------------------------------------------------|-------------------|---------------------------|-----------------|
| Self-generated noise | A | Pass | 0.3 | |
| | C | Pass | 0.8 | |
| | Lin | Pass | 1.6 | |
| Linearity range for Leq | At reference range, Step 5 dB at 4 kHz | Pass | 0.3 | |
| | Reference SPL on all other ranges | Pass | 0.3 | |
| | 2 dB below upper limit of each range | Pass | 0.3 | |
| | 2 dB above lower limit of each range | Pass | 0.3 | |
| Linearity range for SPL | At reference range, Step 5 dB at 4 kHz | Pass | 0.3 | |
| | A | Pass | 0.3 | |
| | C | Pass | 0.3 | |
| Frequency weightings | Lin | Pass | 0.3 | |
| | Time weightings | Single Burst Fast | Pass | 0.3 |
| | Single Burst Slow | Pass | 0.3 | |
| Peak response | Single 100µs rectangular pulse | Pass | 0.3 | |
| | R.M.S. accuracy | Crest factor of 3 | Pass | 0.3 |
| Time weighting I | Single burst 5 ms at 2000 Hz | Pass | 0.3 | |
| | Repeated at frequency of 100 Hz | Pass | 0.3 | |
| Time averaging | 1 ms burst duty factor 1/10 ³ at 4kHz | Pass | 0.3 | |
| | 1 ms burst duty factor 1/10 ⁴ at 4kHz | Pass | 0.3 | |
| Pulse range | Single burst 10 ms at 4 kHz | Pass | 0.4 | |
| Sound exposure level | Single burst 10 ms at 4 kHz | Pass | 0.4 | |
| Overload indication | SPL | Pass | 0.3 | |
| | Leq | Pass | 0.4 | |

2, Acoustic tests

The complete sound level meter was calibrated on the reference range using a B&K 4226 acoustic calibrator with 1000Hz and SPL 94 dB. The sensitivity of the sound level meter was adjusted. The test result at 125 Hz and 8000 Hz are given in below with test status and the estimated uncertainties.

| Test: | Subtest | Status | Expanded Uncertainty (dB) | Coverage Factor |
|-------------------|------------------------|--------|---------------------------|-----------------|
| Acoustic response | Weighting A at 125 Hz | Pass | 0.3 | |
| | Weighting A at 8000 Hz | Pass | 0.5 | |

3, Response to associated sound calibrator

N/A

The expanded uncertainties have been calculated in accordance with the ISO Publication "Guide to the expression of uncertainty in measurement", and gives an interval estimated to have a level of confidence of 95%. A coverage factor of 2 is assumed unless explicitly stated.

- End -

Calibrated by:

Lai Sheng Jie

Date: 06-May-2017

Checked by:

Fung Chi Yip

Date: 09-May-2017

The standard(s) and equipment used in the calibration are traceable to national or international recognised standards and are calibrated on a schedule to maintain the required accuracy level.



CERTIFICATE OF CALIBRATION

Certificate No.: 17CA0119 01 Page 1 of 2

Item tested

| | | | |
|-----------------------|----------------------------|------------|--------|
| Description: | Sound Level Meter (Type 1) | Microphone | Preamp |
| Manufacturer: | B & K | B & K | B & K |
| Type/Model No.: | 2250-L | 4950 | ZC0032 |
| Serial/Equipment No.: | 3002695 | 2940839 | 18582 |
| Adaptors used: | - | - | - |

Item submitted by

Customer Name: Lam Geotechnics Limited
Address of Customer: -
Request No.: -
Date of receipt: 19-Jan-2017

Date of test: 20-Jan-2017

Reference equipment used in the calibration

| Description: | Model: | Serial No. | Expiry Date: | Traceable to: |
|---------------------------------|----------|------------|--------------|---------------|
| Multi function sound calibrator | B&K 4226 | 2288444 | 18-Jun-2017 | CIGISMEC |
| Signal generator | DS 360 | 33873 | 18-Apr-2017 | CEPREI |
| Signal generator | DS 360 | 61227 | 18-Apr-2017 | CEPREI |

Ambient conditions

Temperature: 21 ± 1 °C
Relative humidity: 40 ± 10 %
Air pressure: 1010 ± 5 hPa

Test specifications

- 1, The Sound Level Meter has been calibrated in accordance with the requirements as specified in BS 7580: Part 1: 1997 and the lab calibration procedure SMTP004-CA-152.
- 2, The electrical tests were performed using an electrical signal substituted for the microphone which was removed and replaced by an equivalent capacitance within a tolerance of $\pm 20\%$.
- 3, The acoustic calibration was performed using an B&K 4226 sound calibrator and corrections was applied for the difference between the free-field and pressure responsiveness of the Sound Level Meter.

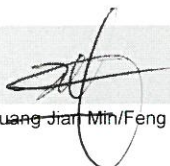
Test results

This is to certify that the Sound Level Meter conforms to BS 7580: Part 1: 1997 for the conditions under which the test was performed.

Details of the performed measurements are presented on page 2 of this certificate.

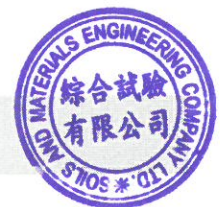
Actual Measurement data are documented on worksheets.

Approved Signatory:


Huang Jian Min/Feng Jun Qi

Date: 23-Jan-2017

Company Chop:



Comments: The results reported in this certificate refer to the condition of the instrument on the date of calibration and carry no implication regarding the long-term stability of the instrument.



CERTIFICATE OF CALIBRATION

(Continuation Page)

Certificate No.: 17CA0119 01 Page 2 of 2

1, Electrical Tests

The electrical tests were performed using an equivalent capacitance substituted for the microphone. The results are given in below with test status and the estimated uncertainties. The "Pass" means the result of the test is inside the tolerances stated in the test specifications. The "-" means the result of test is outside these tolerances.

| Test: | Subtest: | Status: | Expanded Uncertainty (dB) | Coverage Factor |
|-------------------------|--------------------------------------------------|---------|---------------------------|-----------------|
| Self-generated noise | A | Pass | 0.3 | |
| | C | Pass | 0.8 | |
| | Lin | Pass | 1.6 | |
| Linearity range for Leq | At reference range , Step 5 dB at 4 kHz | Pass | 0.3 | |
| | Reference SPL on all other ranges | Pass | 0.3 | |
| | 2 dB below upper limit of each range | Pass | 0.3 | |
| | 2 dB above lower limit of each range | Pass | 0.3 | |
| Linearity range for SPL | At reference range , Step 5 dB at 4 kHz | Pass | 0.3 | |
| | Frequency weightings | | | |
| Frequency weightings | A | Pass | 0.3 | |
| | C | Pass | 0.3 | |
| | Lin | Pass | 0.3 | |
| Time weightings | Single Burst Fast | Pass | 0.3 | |
| | Single Burst Slow | Pass | 0.3 | |
| Peak response | Single 100µs rectangular pulse | Pass | 0.3 | |
| R.M.S. accuracy | Crest factor of 3 | Pass | 0.3 | |
| Time weighting I | Single burst 5 ms at 2000 Hz | Pass | 0.3 | |
| | Repeated at frequency of 100 Hz | Pass | 0.3 | |
| Time averaging | 1 ms burst duty factor 1/10 ³ at 4kHz | Pass | 0.3 | |
| | 1 ms burst duty factor 1/10 ⁴ at 4kHz | Pass | 0.3 | |
| Pulse range | Single burst 10 ms at 4 kHz | Pass | 0.4 | |
| Sound exposure level | Single burst 10 ms at 4 kHz | Pass | 0.4 | |
| Overload indication | SPL | Pass | 0.3 | |
| | Leq | Pass | 0.4 | |

2, Acoustic tests

The complete sound level meter was calibrated on the reference range using a B&K 4226 acoustic calibrator with 1000Hz and SPL 94 dB. The sensitivity of the sound level meter was adjusted. The test result at 125 Hz and 8000 Hz are given in below with test status and the estimated uncertainties.

| Test: | Subtest | Status | Expanded Uncertainty (dB) | Coverage Factor |
|-------------------|------------------------|--------|---------------------------|-----------------|
| Acoustic response | Weighting A at 125 Hz | Pass | 0.3 | |
| | Weighting A at 8000 Hz | Pass | 0.5 | |

3, Response to associated sound calibrator

N/A

The expanded uncertainties have been calculated in accordance with the ISO Publication "Guide to the expression of uncertainty in measurement", and gives an interval estimated to have a level of confidence of 95%. A coverage factor of 2 is assumed unless explicitly stated.

- End -

Calibrated by:

Date:

Fung Chi Yip
20-Jan-2017

Checked by:

Date:

Lam Tze Wai
23-Jan-2017

The standard(s) and equipment used in the calibration are traceable to national or international recognised standards and are calibrated on a schedule to maintain the required accuracy level.



CERTIFICATE OF CALIBRATION

Certificate No.: 16CA1117 01-02

Page: 1 of 2

Item tested

Description: Acoustical Calibrator (Class 1)
Manufacturer: Rion Co., Ltd.
Type/Model No.: NC-73
Serial/Equipment No.: 10707358
Adaptors used: -

Item submitted by

Customer: Lam Geotechnics Ltd.
Address of Customer: -
Request No.: -
Date of receipt: 17-Nov-2016

Date of test: 18-Nov-2016

Reference equipment used in the calibration

| Description: | Model: | Serial No. | Expiry Date: | Traceable to: |
|-------------------------|----------|------------|--------------|---------------|
| Lab standard microphone | B&K 4180 | 2412857 | 14-Apr-2017 | SCL |
| Preamplifier | B&K 2673 | 2239857 | 28-Apr-2017 | CEPREI |
| Measuring amplifier | B&K 2610 | 2346941 | 26-Apr-2017 | CEPREI |
| Signal generator | DS 360 | 61227 | 18-Apr-2017 | CEPREI |
| Digital multi-meter | 34401A | US36087050 | 18-Apr-2017 | CEPREI |
| Audio analyzer | 8903B | GB41300350 | 19-Apr-2017 | CEPREI |
| Universal counter | 53132A | MY40003662 | 19-Apr-2017 | CEPREI |

Ambient conditions

Temperature: 23 ± 1 °C
Relative humidity: 50 ± 10 %
Air pressure: 1005 ± 5 hPa

Test specifications

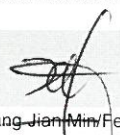
- 1, The Sound Calibrator has been calibrated in accordance with the requirements as specified in IEC 60942 1997 Annex B and the lab calibration procedure SMTP004-CA-156.
- 2, The calibrator was tested with its axis vertical facing downwards at the specific frequency using insert voltage technique.
- 3, The results are rounded to the nearest 0.01 dB and 0.1 Hz and have not been corrected for variations from a reference pressure of 1013.25 hectoPascals as the maker's information indicates that the instrument is insensitive to pressure changes.

Test results

This is to certify that the sound calibrator conforms to the requirements of annex B of IEC 60942: 1997 for the conditions under which the test was performed. This does not imply that the sound calibrator meets IEC 60942 under any other conditions.

Details of the performed measurements are presented on **page 2** of this certificate.

Approved Signatory:


Huang Jian Min/Feng Jun Qi

Date: 21-Nov-2016

Company Chop:



Comments: The results reported in this certificate refer to the condition of the instrument on the date of calibration and carry no implication regarding the long-term stability of the instrument.



CERTIFICATE OF CALIBRATION

(Continuation Page)

Certificate No.: 16CA1117 01-02

Page: 2 of 2

1, Measured Sound Pressure Level

The output Sound Pressure Level in the calibrator head was measured at the setting and frequency shown using a calibrated laboratory standard microphone and insert voltage technique. The results are given in below with the estimated uncertainties.

| Frequency Shown Hz | Output Sound Pressure Level Setting dB | Measured Output Sound Pressure Level dB | (Output level in dB re 20 μ Pa) | |
|-----------------------|-------------------------------------------|--------------------------------------------|-------------------------------------|----------------------------|
| | | | Estimated Uncertainty dB | Expanded Uncertainty dB |
| 1000 | 94.00 | 94.12 | 0.10 | |

2, Sound Pressure Level Stability - Short Term Fluctuations

The Short Term Fluctuations was determined by measuring the maximum and minimum of the fast weighted DC output of the B&K 2610 measuring amplifier over a 20 second time interval as required in the standard. The Short Term Fluctuation was found to be:

At 1000 Hz **STF = 0.002 dB**

Estimated expanded uncertainty 0.005 dB

3, Actual Output Frequency

The determination of actual output frequency was made using a B&K 4180 microphone together with a B&K 2673 preamplifier connected to a B&K 2610 measuring amplifier. The AC output of the B&K 2610 was taken to an universal counter which was used to determine the frequency averaged over 20 second of operation as required by the standard. The actual output frequency at 1 KHz was:

At 1000 Hz **Actual Frequency = 991.6 Hz**

Estimated expanded uncertainty 0.1 Hz Coverage factor k = 2.2

4, Total Noise and Distortion

For the Total Noise and Distortion measurement, the unfiltered AC output of the B&K 2610 measuring amplifier was connected to an Agilent Type 8903 B distortion analyser. The TND result at 1 KHz was:

At 1000 Hz **TND = 0.6 %**

Estimated expanded uncertainty 0.7 %

The expanded uncertainties have been calculated in accordance with the ISO Publication "Guide to the expression of uncertainty in measurement", and gives an interval estimated to have a level of confidence of 95%. A coverage factor of 2 is assumed unless explicitly stated.

- End -

Calibrated by:

Date: 18-Nov-2016

Fung Chi Yip

Checked by:

Date: 21-Nov-2016

Lam Tze Wai

The standard(s) and equipment used in the calibration are traceable to national or international recognised standards and are calibrated on a schedule to maintain the required accuracy level.

Calibration Certificate

Certificate Number 2016009653

Customer: _____

| | | | |
|--------------------------|-----------------------------------------|-------------------------|-------------------|
| Model Number | CAL200 | Procedure Number | D0001.8386 |
| Serial Number | 13437 | Technician | Scott Montgomery |
| Test Results | Pass | Calibration Date | 2 Nov 2016 |
| Initial Condition | As Manufactured | Calibration Due | |
| Description | Larson Davis CAL200 Acoustic Calibrator | Temperature | 25 °C ± 0.3 °C |
| | | Humidity | 28 %RH ± 3 %RH |
| | | Static Pressure | 101.2 kPa ± 1 kPa |

Evaluation Method The data is acquired by the insert voltage calibration method using the reference microphone's open circuit sensitivity. Data reported in dB re 20 µPa.

Compliance Standards Compliant to Manufacturer Specifications per D0001.8190 and the following standards:
IEC 60942:2003 ANSI S1.40-2006

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the SI through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2005. **Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.**

The quality system is registered to ISO 9001:2008.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

This report may not be reproduced, except in full, unless permission for the publication of an approved abstract is obtained in writing from the organization issuing this report.

Standards Used

| Description | Cal Date | Cal Due | Cal Standard |
|-------------------------------------------|------------|------------|--------------|
| Agilent 34401A DMM | 09/07/2016 | 09/07/2017 | 001021 |
| Sound Level Meter / Real Time Analyzer | 04/07/2016 | 04/07/2017 | 001051 |
| Microphone Calibration System | 08/17/2016 | 08/17/2017 | 005446 |
| 1/2" Preamplifier | 10/06/2016 | 10/06/2017 | 006506 |
| Larson Davis 1/2" Preamplifier 7-pin LEMO | 08/22/2016 | 08/22/2017 | 006507 |
| 1/2 inch Microphone - RI - 200V | 03/15/2016 | 03/15/2017 | 006510 |
| Pressure Transducer | 07/01/2016 | 07/01/2017 | 007368 |

Larson Davis, a division of PCB Piezotronics, Inc
1681 West 820 North
Provo, UT 84601, United States
716-684-0001



Output Level

| Nominal Level [dB] | Pressure [kPa] | Test Result [dB] | Lower limit [dB] | Upper limit [dB] | Expanded Uncertainty [dB] | Result |
|-----------------------|-------------------|---------------------|---------------------|---------------------|------------------------------|--------|
| 94 | 101.2 | 94.01 | 93.80 | 94.20 | 0.14 | Pass |
| 114 | 101.5 | 114.01 | 113.80 | 114.20 | 0.13 | Pass |

-- End of measurement results--

Frequency

| Nominal Level [dB] | Pressure [kPa] | Test Result [Hz] | Lower limit [Hz] | Upper limit [Hz] | Expanded Uncertainty [Hz] | Result |
|-----------------------|-------------------|---------------------|---------------------|---------------------|------------------------------|--------|
| 94 | 101.2 | 1,000.15 | 990.00 | 1,010.00 | 0.20 | Pass |
| 114 | 101.5 | 1,000.11 | 990.00 | 1,010.00 | 0.20 | Pass |

-- End of measurement results--

Total Harmonic Distortion + Noise (THD+N)

| Nominal Level [dB] | Pressure [kPa] | Test Result [%] | Lower limit [%] | Upper limit [%] | Expanded Uncertainty [%] | Result |
|-----------------------|-------------------|--------------------|--------------------|--------------------|-----------------------------|--------|
| 94 | 101.2 | 0.69 | 0.00 | 2.00 | 0.25 | Pass |
| 114 | 101.5 | 0.38 | 0.00 | 2.00 | 0.25 | Pass |

-- End of measurement results--

Level Change Over Pressure

Tested at: 114 dB, 22 °C, 33 %RH

| Nominal Pressure [kPa] | Pressure [kPa] | Test Result [dB] | Lower limit [dB] | Upper limit [dB] | Expanded Uncertainty [dB] | Result |
|---------------------------|-------------------|---------------------|---------------------|---------------------|------------------------------|--------|
| 101.3 | 101.3 | 0.00 | -0.30 | 0.30 | 0.04 ‡ | Pass |
| 92.0 | 91.5 | 0.00 | -0.30 | 0.30 | 0.04 ‡ | Pass |
| 108.0 | 107.8 | -0.01 | -0.30 | 0.30 | 0.04 ‡ | Pass |
| 83.0 | 83.1 | -0.02 | -0.30 | 0.30 | 0.04 ‡ | Pass |
| 74.0 | 73.9 | -0.08 | -0.30 | 0.30 | 0.04 ‡ | Pass |
| 65.0 | 64.9 | -0.17 | -0.30 | 0.30 | 0.04 ‡ | Pass |

-- End of measurement results--

Frequency Change Over Pressure

Tested at: 114 dB, 22 °C, 33 %RH

| Nominal Pressure [kPa] | Pressure [kPa] | Test Result [Hz] | Lower limit [Hz] | Upper limit [Hz] | Expanded Uncertainty [Hz] | Result |
|---------------------------|-------------------|---------------------|---------------------|---------------------|------------------------------|--------|
| 108.0 | 107.8 | 0.00 | -10.00 | 10.00 | 0.20 ‡ | Pass |
| 101.3 | 101.3 | 0.00 | -10.00 | 10.00 | 0.20 ‡ | Pass |
| 92.0 | 91.5 | 0.00 | -10.00 | 10.00 | 0.20 ‡ | Pass |
| 83.0 | 83.1 | -0.01 | -10.00 | 10.00 | 0.20 ‡ | Pass |
| 74.0 | 73.9 | -0.01 | -10.00 | 10.00 | 0.20 ‡ | Pass |
| 65.0 | 64.9 | -0.01 | -10.00 | 10.00 | 0.20 ‡ | Pass |

-- End of measurement results--

Total Harmonic Distortion + Noise (THD+N) Over Pressure

Tested at: 114 dB, 22 °C, 33 %RH

| Nominal Pressure [kPa] | Pressure [kPa] | Test Result [%] | Lower limit [%] | Upper limit [%] | Expanded Uncertainty [%] | Result |
|---------------------------|-------------------|--------------------|--------------------|--------------------|-----------------------------|--------|
| 83.0 | 83.1 | 0.40 | 0.00 | 2.00 | 0.25 ± | Pass |
| 108.0 | 107.8 | 0.36 | 0.00 | 2.00 | 0.25 ± | Pass |
| 101.3 | 101.3 | 0.37 | 0.00 | 2.00 | 0.25 ± | Pass |
| 92.0 | 91.5 | 0.39 | 0.00 | 2.00 | 0.25 ± | Pass |
| 74.0 | 73.9 | 0.43 | 0.00 | 2.00 | 0.25 ± | Pass |
| 65.0 | 64.9 | 0.47 | 0.00 | 2.00 | 0.25 ± | Pass |

-- End of measurement results--

Signatory: Scott Montgomery

Larson Davis, a division of PCB Piezotronics, Inc
 1681 West 820 North
 Provo, UT 84601, United States
 716-684-0001

