

# Certificate of Calibration

| Calibration Certification Information |                             |           |       |
|---------------------------------------|-----------------------------|-----------|-------|
| Cal. Date: January 16, 2023           | Rootsmeter S/N: 438320      | Ta: 293   | °K    |
| Operator: Jim Tisch                   |                             | Pa: 748.8 | mm Hg |
| Calibration Model #: TE-5025A         | Calibrator S/N: <b>0843</b> |           |       |

| Run | Vol. Init (m3) | Vol. Final (m3) | ΔVol. (m3) | ΔTime (min) | ΔP (mm Hg) | ΔH (in H2O) |
|-----|----------------|-----------------|------------|-------------|------------|-------------|
| 1   | 1              | 2               | 1          | 1.3860      | 3.2        | 2.00        |
| 2   | 3              | 4               | 1          | 0.9840      | 6.4        | 4.00        |
| 3   | 5              | 6               | 1          | 0.8780      | 8.0        | 5.00        |
| 4   | 7              | 8               | 1          | 0.8430      | 8.8        | 5.50        |
| 5   | 9              | 10              | 1          | 0.6950      | 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) | $\sqrt{\Delta H \left( \frac{Ta}{Pa} \right)}$ (y-axis) |  |
| 0.9978          | 0.7199        | 1.4157   | 0.9957    | 0.7184      | 0.8846  |  |
| 0.9935          | 1.0097        | 2.0021   | 0.9915    | 1.0076      | 1.2511  |  |
| 0.9914          | 1.1291        | 2.2384   | 0.9893    | 1.1268      | 1.3987  |  |
| 0.9903          | 1.1747        | 2.3476   | 0.9882    | 1.1723      | 1.4670  |  |
| 0.9851          | 1.4174        | 2.8313   | 0.9830    | 1.4144      | 1.7693  |  |
| <b>QSTD</b>     | m=            | <b>2.03196</b>   | <b>QA</b> | m=          | <b>1.27238</b>  |  |
|                 | b=            | <b>-0.04813</b>  |           | b=          | <b>-0.03007</b>   |  |
|                 | r=            | <b>0.99993</b>   |           | r=          | <b>0.99993</b>  |  |

| Calculations                           |   |     |  |
|--|---|-----|--|
| Vstd=                                  | $\Delta Vol \left( \frac{Pa - \Delta P}{Pstd} \right) \left( \frac{Tstd}{Ta} \right)$                                 | Va= | $\Delta Vol \left( \frac{Pa - \Delta P}{Pa} \right)$                                 |
| Qstd=                                  | Vstd/ΔTime  | Qa= | Va/ΔTime   |
| For subsequent flow rate calculations: |   |     |  |
| Qstd=                                  | $1/m \left( \left( \sqrt{\Delta H \left( \frac{Pa}{Pstd} \right) \left( \frac{Tstd}{Ta} \right)} \right) - b \right)$ | Qa= | $1/m \left( \left( \sqrt{\Delta H \left( \frac{Ta}{Pa} \right)} \right) - b \right)$ |

| Standard Conditions                       |           |
|---|-----------|
| Tstd:                                     | 298.15 °K |
| Pstd:                                     | 760 mm Hg |
| Key                                       |           |
| ΔH: calibrator manometer reading (in H2O) |           |
| ΔP: rootsmeter manometer reading (mm Hg)  |           |
| Ta: actual absolute temperature (°K)      |           |
| Pa: actual barometric pressure (mm Hg)    |           |
| b: intercept                              |           |
| m: slope                                  |           |

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

**AECOM Asia Company Limited**  
**Tisch TSP Mass Flow Controlled High Volume Air Sampler**  
**Field Calibration Report**

Station: Block B, Merit Industrial Centre (E-A14a)      Operator: Choi Wing Ho  
 Cal. Date: 4/9/2023      Next Due Date: 4/11/2023  
 Model No.: TE-5170      Serial No.: 10380  
 Equipment No.: A-001-15T

Station: **Block B, Merit Industrial Centre (E-A14a)**  
 Cal. Date: **4-Sep-23**  
 Next Due Date: **4-Nov-23**  
 Set Point (IC): **43.49**

| Ambient Condition   |       |                     |       |
|---------------------|-------|---------------------|-------|
| Temperature, Ta (K) | 305.0 | Pressure, Pa (mmHg) | 750.3 |

| Orifice Transfer Standard Information |           |   |         |               |          |
|---------------------------------------|-----------|---|---------|---------------|----------|
| Serial No:                            | 843       | Slope, mc   | 2.03196 | Intercept, bc | -0.04813 |
| Last Calibration Date:                | 16-Jan-23 | $mc \times Qstd + bc = [H \times (Pa/760) \times (298/Ta)]^{1/2}$ |         |               |          |
| Next Calibration Date:                | 16-Jan-24 |   |         |               |          |

| Calibration of TSP Sampler |                            |  |                                   |                             |  |
|----------------------------|----------------------------|--|-----------------------------------|-----------------------------|--|
| Resistance Plate No.       | Orifice                    |  |                                   | HVS Flow Recorder           |  |
|                            | DH (orifice), in. of water | $[DH \times (Pa/760) \times (298/Ta)]^{1/2}$ | Qstd (m <sup>3</sup> /min) X-axis | Flow Recorder Reading (CFM) | Continuous Flow Recorder Reading IC (CFM) Y-axis |
| 18                         | 7.1                        | 2.62   | 1.31                              | 44.0                        | 43.21  |
| 13                         | 6.0                        | 2.41   | 1.21                              | 39.0                        | 38.30  |
| 10                         | 5.1                        | 2.22   | 1.12                              | 35.0                        | 34.37  |
| 7                          | 4.1                        | 1.99   | 1.00                              | 30.0                        | 29.46  |
| 5                          | 3.2                        | 1.76   | 0.89                              | 24.0                        | 23.57  |

By Linear Regression of Y on X  
 Slope, mw = 45.7962      Intercept, bw = -16.8207  
 Correlation Coefficient\* = 0.9988  
 \*If Correlation Coefficient < 0.990, check and recalibrate.

**Set Point Calculation**

From the TSP Field Calibration Curve, take Qstd = 1.30m<sup>3</sup>/min  
 From the Regression Equation, the "Y" value according to

$$mw \times Qstd + bw = IC \times [(Pa/760) \times (298/Ta)]^{1/2}$$

Therefore, Set Point; IC =  $(mw \times Qstd + bw) \times [(760 / Pa) \times (Ta / 298)]^{1/2} =$  43.49

Remarks: \_\_\_\_\_

QC Reviewer: WS CHAN      Signature: [Signature]      Date: 04/09/23

| IC (CFM) | Qstd (m <sup>3</sup> /min) |
|----------|----------------------------|
| 24       | 0.891                      |
| 25       | 0.913                      |
| 26       | 0.935                      |
| 27       | 0.957                      |
| 28       | 0.979                      |
| 29       | 1.001                      |
| 30       | 1.022                      |
| 31       | 1.044                      |
| 32       | 1.066                      |
| 33       | 1.088                      |
| 34       | 1.110                      |
| 35       | 1.132                      |
| 36       | 1.153                      |
| 37       | 1.175                      |
| 38       | 1.197                      |
| 39       | 1.219                      |
| 40       | 1.241                      |
| 41       | 1.263                      |
| 42       | 1.284                      |
| 43       | 1.306                      |
| 44       | 1.328                      |
| 45       | 1.350                      |
| 46       | 1.372                      |
| 47       | 1.394                      |
| 48       | 1.415                      |
| 49       | 1.437                      |
| 50       | 1.459                      |
| 51       | 1.481                      |
| 52       | 1.503                      |
| 53       | 1.525                      |
| 54       | 1.546                      |
| 55       | 1.568                      |
| 56       | 1.590                      |
| 57       | 1.612                      |
| 58       | 1.634                      |
| 59       | 1.656                      |
| 60       | 1.677                      |
| 61       | 1.699                      |
| 62       | 1.721                      |
| 63       | 1.743                      |
| 64       | 1.765                      |
| 65       | 1.787                      |

## EQUIPMENT CALIBRATION RECORD

Type: Laser Dust Monitor  
 Manufacturer/Brand: SIBATA  
 Model No.: LD-3B  
 Equipment No.: A.005.16a  
 Sensitivity Adjustment Scale Setting: 521 CPM

Operator: WS CHAN

### Standard Equipment

Equipment: High Volume Sampler  
 Venue: Ma Wan Chung Village  
 Model No.: TE-5170  
 Serial No.: 3383  
 Last Calibration Date: 4-Aug-23

### Calibration Result

Sensitivity Adjustment Scale Setting (Before Calibration): 521 CPM  
 Sensitivity Adjustment Scale Setting (After Calibration): 521 CPM

| Hour | Date<br>(dd/mm/yy) | Time        | Ambient Condition |         | Concentration <sup>①</sup><br>(mg/m3)<br>Y-axis | Total Count <sup>②</sup> | Count/<br>Minute <sup>③</sup><br>X-axis |
|------|--------------------|-------------|-------------------|---------|---|--------------------------|---|
|      |                    |             | Temp (°C)         | R.H.(%) |   |                          |   |
| 1    | 15/08/23           | 9:00-10:00  | 32.0              | 80      | 0.038   | 1569                     | 26.15                                   |
| 2    | 15/08/23           | 11:30-12:30 | 32.0              | 80      | 0.035   | 1335                     | 22.25                                   |
| 3    | 15/08/23           | 13:50-14:50 | 32.0              | 80      | 0.041   | 1744                     | 29.07                                   |

Note: ① Monitoring data was measured by High Volume Sampler  
 ② Total Count was logged by Laser Dust Monitor  
 ③ Count/minute was calculated by (Total Count/60)

By Linear Regression of Y on X  
 Slope (K-factor): 0.0015  
 Correlation coefficient: 0.9981

Validity of Calibration Record: 15-Aug-24

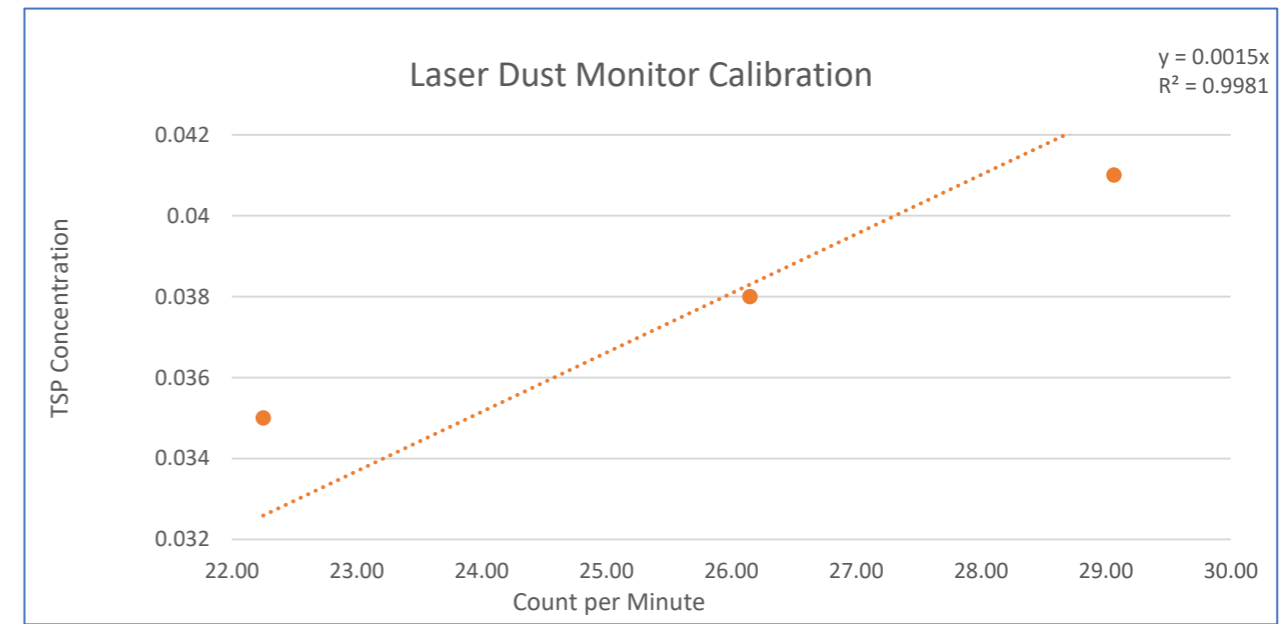
Remarks:  
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QC Reviewer: Y.W. Fung      Signature:       Date: 15-Aug-23

## Laser Dust Monitor Calibration

Type: Laser Dust Monitor  
 Manufacturer/Brand: SIBATA  
 Model No.: LD-3B  
 Equipment No.: A.005.16a  
 Sensitivity Adjustment Scale Setting: 521 CPM

| Hour | Count/Minute<br>X-axis | Concentration (mg/m3)<br>Y-axis |
|------|------------------------|---------------------------------|
| 1    | 26.15                  | 0.038                           |
| 2    | 22.25                  | 0.035                           |
| 3    | 29.07                  | 0.041                           |



Prepare by: WS CHAN  
 Date: 15-Aug-23



## EQUIPMENT CALIBRATION RECORD

Type: Laser Dust Monitor  
 Manufacturer/Brand: SIBATA  
 Model No.: LD-3  
 Equipment No.: A.005.07a  
 Sensitivity Adjustment Scale Setting: 557CPM

Operator: WS CHAN

### Standard Equipment

Equipment: High Volume Sampler  
 Venue: Ma Wan Chung Village  
 Model No.: TE-5170  
 Serial No.: 3383  
 Last Calibration Date: 4-Aug-23

### Calibration Result

Sensitivity Adjustment Scale Setting (Before Calibration): 557 CPM  
 Sensitivity Adjustment Scale Setting (After Calibration): 557 CPM

| Hour | Date<br>(dd/mm/yy) | Time        | Ambient Condition |         | Concentration <sup>①</sup><br>(mg/m3)<br>Y-axis | Total Count <sup>②</sup> | Count/<br>Minute <sup>③</sup><br>X-axis |
|------|--------------------|-------------|-------------------|---------|---|--------------------------|---|
|      |                    |             | Temp (°C)         | R.H.(%) |   |                          |   |
| 1    | 15/08/23           | 9:00-10:00  | 32.0              | 80      | 0.038   | 1542                     | 25.70                                   |
| 2    | 15/08/23           | 11:30-12:30 | 32.0              | 80      | 0.035   | 1355                     | 22.58                                   |
| 3    | 15/08/23           | 13:50-14:50 | 32.0              | 80      | 0.041   | 1792                     | 29.87                                   |

- Note:
- ① Monitoring data was measured by High Volume Sampler
  - ② Total Count was logged by Laser Dust Monitor
  - ③ Count/minute was calculated by (Total Count/60)

By Linear Regression of Y on X  
 Slope (K-factor): 0.0015  
 Correlation coefficient: 0.9975

Validity of Calibration Record: 15-Aug-24

Remarks:  


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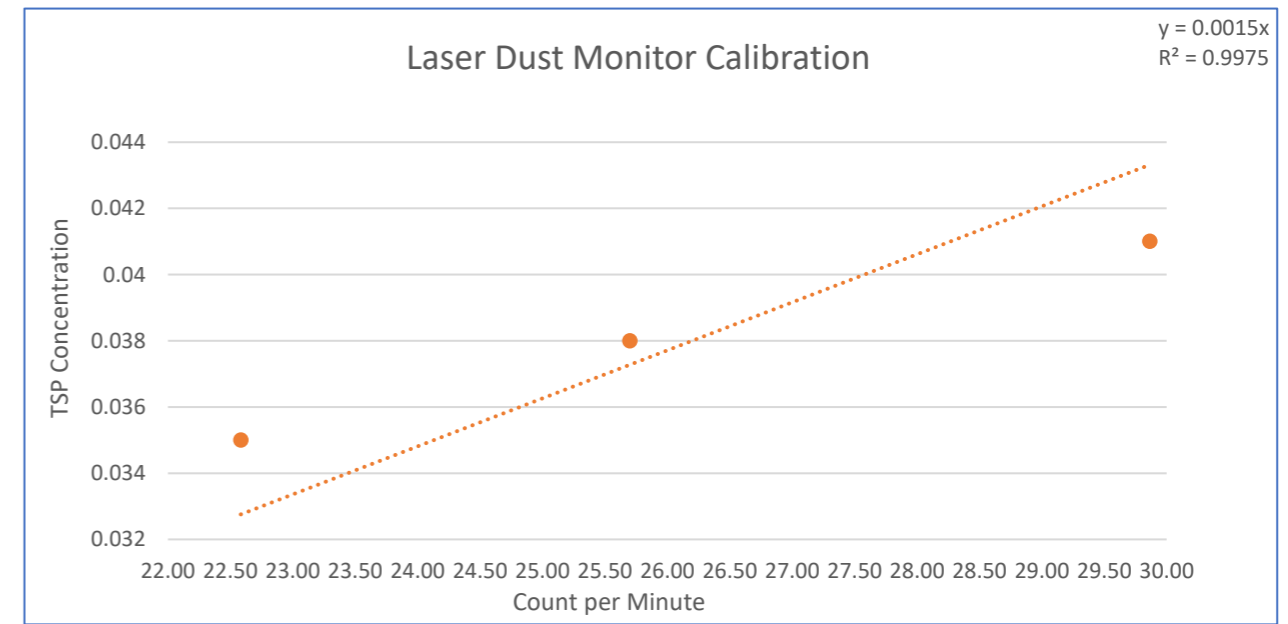

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QC Reviewer: Y.W. Fung      Signature:       Date: 15-Aug-23

## Laser Dust Monitor Calibration

Type: Laser Dust Monitor  
 Manufacturer/Brand: SIBATA  
 Model No.: LD-3  
 Equipment No.: A.005.07a  
 Sensitivity Adjustment Scale Setting: 557 CPM

| Hour | Count/Minute<br>X-axis | Concentration (mg/m3)<br>Y-axis |
|------|------------------------|---------------------------------|
| 1    | 25.70                  | 0.0380                          |
| 2    | 22.58                  | 0.0350                          |
| 3    | 29.87                  | 0.0410                          |



Prepare by: WS CHAN  
 Date: 15-Aug-23

## EQUIPMENT CALIBRATION RECORD

Type: Laser Dust Monitor  
 Manufacturer/Brand: SIBATA  
 Model No.: LD-3  
 Equipment No.: A.005.09a  
 Sensitivity Adjustment Scale Setting: 797 CPM

Operator: WS CHAN

### Standard Equipment

Equipment: High Volume Sampler  
 Venue: Ma Wan Chung Village  
 Model No.: TE-5170  
 Serial No.: 3383  
 Last Calibration Date: 4-Aug-23

### Calibration Result

Sensitivity Adjustment Scale Setting (Before Calibration): 797 CPM  
 Sensitivity Adjustment Scale Setting (After Calibration): 797 CPM

| Hour | Date<br>(dd/mm/yy) | Time        | Ambient Condition |         | Concentration <sup>①</sup><br>(mg/m3)<br>Y-axis | Total Count <sup>②</sup> | Count/<br>Minute <sup>③</sup><br>X-axis |
|------|--------------------|-------------|-------------------|---------|---|--------------------------|---|
|      |                    |             | Temp (°C)         | R.H.(%) |   |                          |   |
| 1    | 15/08/23           | 9:00-10:00  | 32.0              | 80      | 0.038   | 1580                     | 26.33                                   |
| 2    | 15/08/23           | 11:30-12:30 | 32.0              | 80      | 0.035   | 1360                     | 22.67                                   |
| 3    | 15/08/23           | 13:50-14:50 | 32.0              | 80      | 0.041   | 1752                     | 29.20                                   |

Note: ① Monitoring data was measured by High Volume Sampler  
 ② Total Count was logged by Laser Dust Monitor  
 ③ Count/minute was calculated by (Total Count/60)

By Linear Regression of Y on X  
 Slope (K-factor): 0.0015  
 Correlation coefficient: 0.9985

Validity of Calibration Record: 15-Aug-24

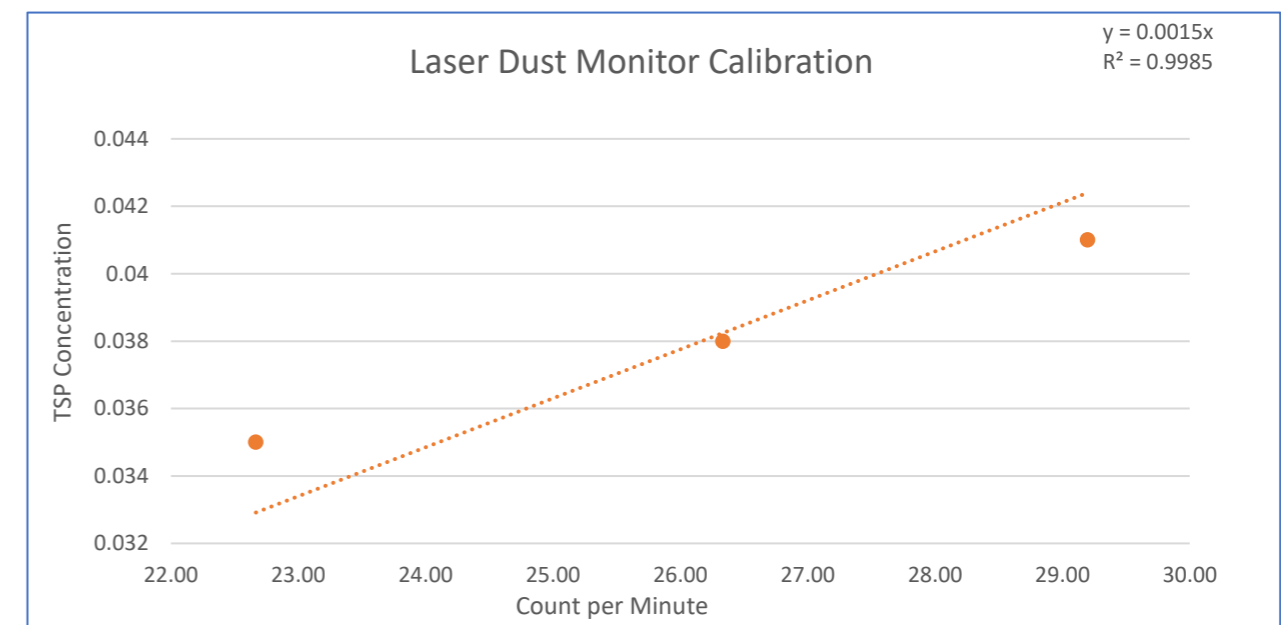
Remarks:  
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QC Reviewer: Y.W. Fung      Signature:       Date: 15-Aug-23

## Laser Dust Monitor Calibration

Type: Laser Dust Monitor  
 Manufacturer/Brand: SIBATA  
 Model No.: LD-3  
 Equipment No.: A.005.09a  
 Sensitivity Adjustment Scale Setting: 797 CPM

| Hour | Count/Minute<br>X-axis | Concentration (mg/m3)<br>Y-axis |
|------|------------------------|---------------------------------|
| 1    | 26.33                  | 0.0380                          |
| 2    | 22.67                  | 0.0350                          |
| 3    | 29.20                  | 0.0410                          |



Prepare by: WS CHAN  
 Date: 15-Aug-23

## EQUIPMENT CALIBRATION RECORD

Type: Laser Dust Monitor  
 Manufacturer/Brand: SIBATA  
 Model No.: LD-3  
 Equipment No.: A.005.10a  
 Sensitivity Adjustment Scale Setting: 753 CPM

Operator: WS CHAN

### Standard Equipment

Equipment: High Volume Sampler  
 Venue: Ma Wan Chung Village  
 Model No.: TE-5170  
 Serial No.: 3383  
 Last Calibration Date: 4-Aug-23

### Calibration Result

Sensitivity Adjustment Scale Setting (Before Calibration): 753 CPM  
 Sensitivity Adjustment Scale Setting (After Calibration): 753 CPM

| Hour | Date<br>(dd/mm/yy) | Time        | Ambient Condition |         | Concentration <sup>①</sup><br>(mg/m3)<br>Y-axis | Total Count <sup>②</sup> | Count/<br>Minute <sup>③</sup><br>X-axis |
|------|--------------------|-------------|-------------------|---------|---|--------------------------|---|
|      |                    |             | Temp (°C)         | R.H.(%) |   |                          |   |
| 1    | 15/08/23           | 9:00-10:00  | 32.0              | 80      | 0.0380  | 1598                     | 26.63                                   |
| 2    | 15/08/23           | 11:30-12:30 | 32.0              | 80      | 0.0350  | 1322                     | 22.03                                   |
| 3    | 15/08/23           | 13:50-14:50 | 32.0              | 80      | 0.0410  | 1713                     | 28.55                                   |

Note: ① Monitoring data was measured by High Volume Sampler  
 ② Total Count was logged by Laser Dust Monitor  
 ③ Count/minute was calculated by (Total Count/60)

By Linear Regression of Y on X  
 Slope (K-factor): 0.0015  
 Correlation coefficient: 0.9979

Validity of Calibration Record: 15-Aug-24

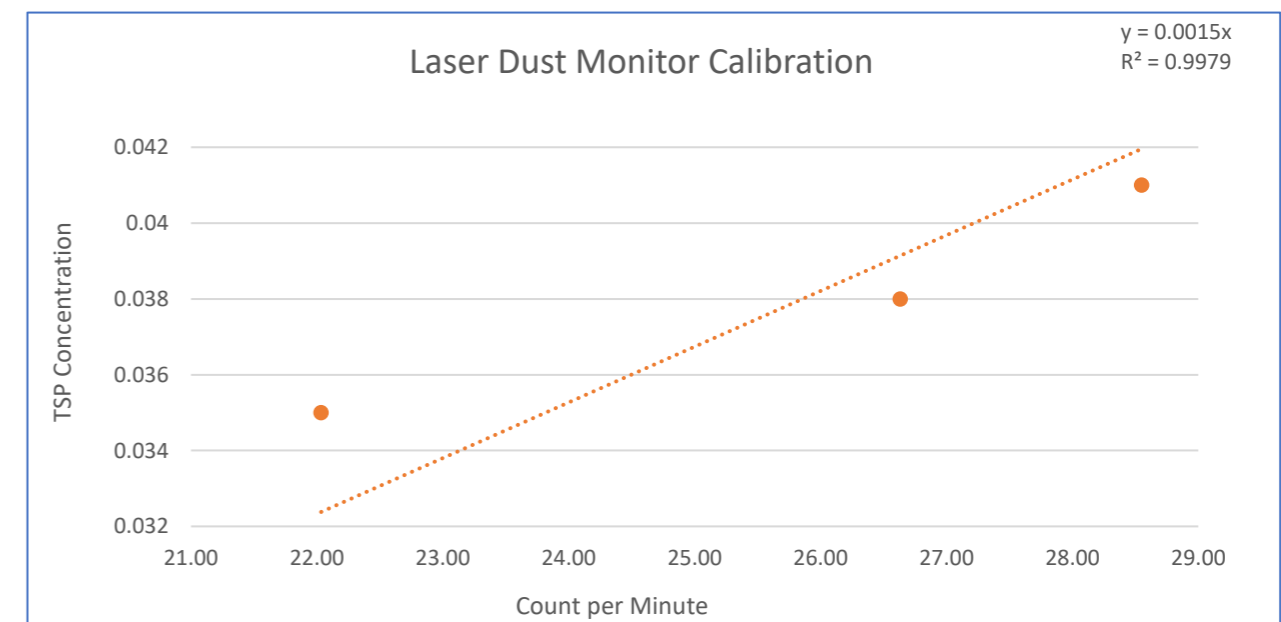
Remarks:  
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QC Reviewer: Y.W. Fung      Signature:       Date: 15-Aug-23

## Laser Dust Monitor Calibration

Type: Laser Dust Monitor  
 Manufacturer/Brand: SIBATA  
 Model No.: LD-3  
 Equipment No.: A.005.10a  
 Sensitivity Adjustment Scale Setting: 753 CPM

| Hour | Count/Minute<br>X-axis | Concentration (mg/m3)<br>Y-axis |
|------|------------------------|---------------------------------|
| 1    | 26.63                  | 0.0380                          |
| 2    | 22.03                  | 0.0350                          |
| 3    | 28.55                  | 0.0410                          |



Prepare by: WS CHAN  
 Date: 15-Aug-23

## EQUIPMENT CALIBRATION RECORD

Type: Laser Dust Monitor  
 Manufacturer/Brand: SIBATA  
 Model No.: LD-3  
 Equipment No.: A.005.11a  
 Sensitivity Adjustment Scale Setting: 799 CPM

Operator: WS CHAN

### Standard Equipment

Equipment: High Volume Sampler  
 Venue: Ma Wan Chung Village  
 Model No.: TE-5170  
 Serial No.: 3383  
 Last Calibration Date: 4-Aug-23

### Calibration Result

Sensitivity Adjustment Scale Setting (Before Calibration): 799 CPM  
 Sensitivity Adjustment Scale Setting (After Calibration): 799 CPM

| Hour | Date<br>(dd/mm/yy) | Time        | Ambient Condition |         | Concentration <sup>①</sup><br>(mg/m3)<br>Y-axis | Total Count <sup>②</sup> | Count/<br>Minute <sup>③</sup><br>X-axis |
|------|--------------------|-------------|-------------------|---------|---|--------------------------|---|
|      |                    |             | Temp (°C)         | R.H.(%) |   |                          |   |
| 1    | 15/08/23           | 9:00-10:00  | 32.0              | 80      | 0.038   | 1536                     | 25.60                                   |
| 2    | 15/08/23           | 11:30-12:30 | 32.0              | 80      | 0.035   | 1321                     | 22.02                                   |
| 3    | 15/08/23           | 13:50-14:50 | 32.0              | 80      | 0.041   | 1721                     | 28.68                                   |

- Note:
- ① Monitoring data was measured by High Volume Sampler
  - ② Total Count was logged by Laser Dust Monitor
  - ③ Count/minute was calculated by (Total Count/60)

By Linear Regression of Y on X  
 Slope (K-factor): 0.0015  
 Correlation coefficient: 0.9982

Validity of Calibration Record: 15-Aug-24

Remarks:  


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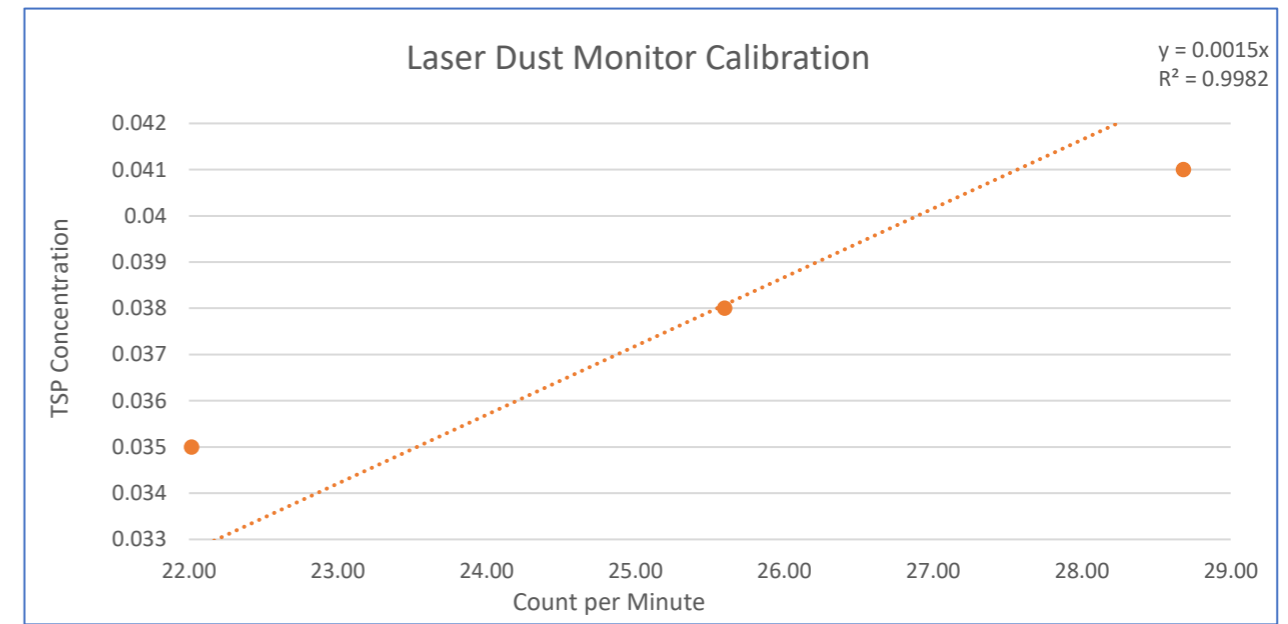

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QC Reviewer: Y.W. Fung      Signature:       Date: 15-Aug-23

## Laser Dust Monitor Calibration

Type: Laser Dust Monitor  
 Manufacturer/Brand: SIBATA  
 Model No.: LD-3  
 Equipment No.: A.005.11a  
 Sensitivity Adjustment Scale Setting: 799 CPM

| Hour | Count/Minute<br>X-axis | Concentration (mg/m3)<br>Y-axis |
|------|------------------------|---------------------------------|
| 1    | 25.60                  | 0.0380                          |
| 2    | 22.02                  | 0.0350                          |
| 3    | 28.68                  | 0.0410                          |



Prepare by: WS CHAN  
 Date: 15-Aug-23

## EQUIPMENT CALIBRATION RECORD

Type: Laser Dust Monitor  
 Manufacturer/Brand: SIBATA  
 Model No.: LD-3B  
 Equipment No.: A.005.13a  
 Sensitivity Adjustment Scale Setting: 643 CPM

Operator: WS CHAN

Standard Equipment

Equipment: High Volume Sampler  
 Venue: Ma Wan Chung Village  
 Model No.: TE-5170  
 Serial No.: 3383  
 Last Calibration Date: 4-Aug-23

Calibration Result

Sensitivity Adjustment Scale Setting (Before Calibration): 643 CPM  
 Sensitivity Adjustment Scale Setting (After Calibration): 643 CPM


| Hour | Date<br>(dd/mm/yy) | Time        | Ambient Condition |         | Concentration <sup>①</sup><br>(mg/m3)<br>Y-axis | Total Count <sup>②</sup> | Count/<br>Minute <sup>③</sup><br>X-axis |
|------|--------------------|-------------|-------------------|---------|---|--------------------------|---|
|      |                    |             | Temp (°C)         | R.H.(%) |   |                          |   |
| 1    | 15/08/23           | 9:00-10:00  | 32.0              | 80      | 0.038   | 1512                     | 25.20                                   |
| 2    | 15/08/23           | 11:30-12:30 | 32.0              | 80      | 0.035   | 1338                     | 22.30                                   |
| 3    | 15/08/23           | 13:50-14:50 | 32.0              | 80      | 0.041   | 1703                     | 28.38                                   |

Note: ① Monitoring data was measured by High Volume Sampler  
 ② Total Count was logged by Laser Dust Monitor  
 ③ Count/minute was calculated by (Total Count/60)

By Linear Regression of Y on X  
 Slope (K-factor): 0.0015  
 Correlation coefficient: 0.9989

Validity of Calibration Record: 15-Aug-24

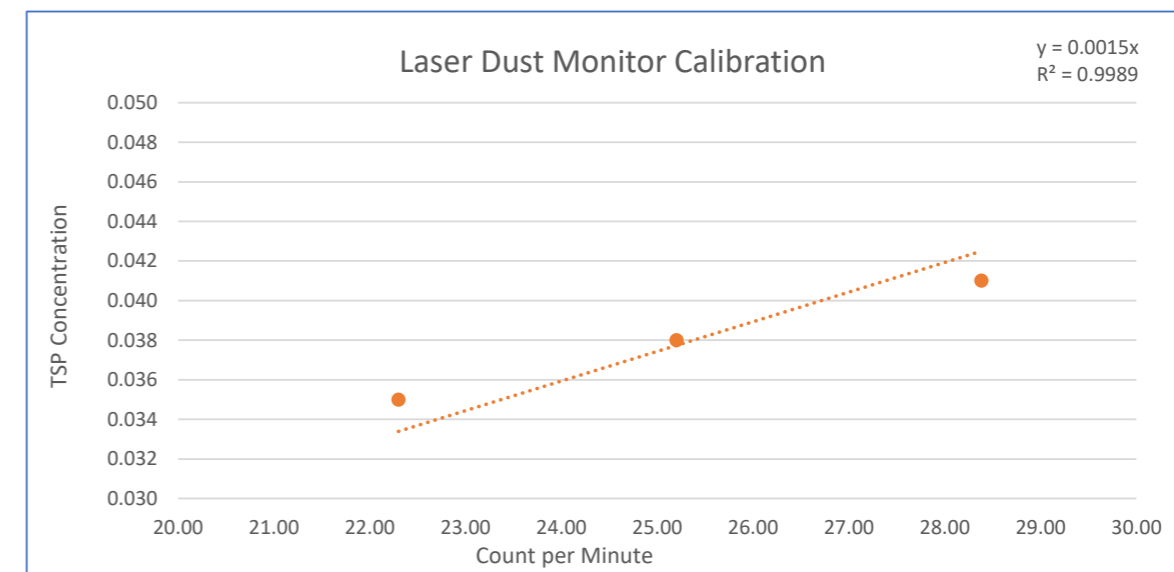
Remarks:

QC Reviewer: Y.W. Fung Signature:  Date: 15-Aug-23

## Laser Dust Monitor Calibration

Type: Laser Dust Monitor  
 Manufacturer/Brand: SIBATA  
 Model No.: LD-3B  
 Equipment No.: A.005.13a  
 Sensitivity Adjustment Scale Setting: 643 CPM

| Hour | Count/Minute<br>X-axis | Concentration (mg/m3)<br>Y-axis |
|------|------------------------|---------------------------------|
|      | 0.00                   | 0.0000                          |
| 1    | 25.20                  | 0.0380                          |
| 2    | 22.30                  | 0.0350                          |
| 3    | 28.38                  | 0.0410                          |



Prepare by: WS CHAN  
 Date: 15-Aug-23





## CERTIFICATE OF CALIBRATION

Certificate No.: 22CA1110 01-01 Page 1 of 2

### Item tested

|                       |                             |            |        |
|-----------------------|-----------------------------|------------|--------|
| Description:          | Sound Level Meter (Class 1) | Microphone | Preamp |
| Manufacturer:         | B & K                       | B & K      | B & K  |
| Type/Model No.:       | 2250                        | 4950       | ZC0032 |
| Serial/Equipment No.: | 3001291                     | 3005374    | 31351  |
| Adaptors used:        | -                           | -          | -      |

### Item submitted by

|                      |                       |
|----------------------|-----------------------|
| Customer Name:       | AECOM ASIA CO LIMITED |
| Address of Customer: | -                     |
| Request No.:         | -                     |
| Date of receipt:     | 10-Nov-2022           |

Date of test: 11-Nov-2022

### Reference equipment used in the calibration

| Description:                    | Model:   | Serial No. | Expiry Date: | Traceable to: |
|---------------------------------|----------|------------|--------------|---------------|
| Multi function sound calibrator | B&K 4226 | 2288444    | 23-Aug-2023  | CIGISMEC      |
| Signal generator                | DS 360   | 33873      | 21-Jan-2023  | CEPREI        |

### Ambient conditions

|                    |              |
|--------------------|--------------|
| Temperature:       | 22 ± 1 °C    |
| Relative humidity: | 55 ± 10 %    |
| Air pressure:      | 1005 ± 5 hPa |

### Test specifications

- 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.
- 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%.
- 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: \_\_\_\_\_ Date: 12-Nov-2022 Company Chop: \_\_\_\_\_

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. The results apply to the item as received.



## CERTIFICATE OF CALIBRATION

(Continuation Page)

Certificate No.: 22CA1110 01-01 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                       |                 |
| Time 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                                  | 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                       |                 |
|                         | 1 ms burst duty factor 1/10 <sup>3</sup> at 4kHz | Pass    | 0.3                       |                 |
| Time averaging          | 1 ms burst duty factor 1/10 <sup>4</sup> at 4kHz | Pass    | 0.3                       |                 |
|                         | Single burst 10 ms at 4 kHz                      | Pass    | 0.4                       |                 |
| Pulse range             | Single burst 10 ms at 4 kHz                      | Pass    | 0.4                       |                 |
|                         | 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.

Calibrated by: \_\_\_\_\_  
Fung Chi Yip  
Date: 11-Nov-2022

- End -

Checked by: \_\_\_\_\_  
Chan Yuk Yiu  
Date: 12-Nov-2022

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.: 23CA0307 02 Page 1 of 2

### Item tested

|                       |                             |            |        |
|-----------------------|-----------------------------|------------|--------|
| Description:          | Sound Level Meter (Class 1) | Microphone | Preamp |
| Manufacturer:         | B & K                       | B & K      | B & K  |
| Type/Model No.:       | 2250-L                      | 4950       | ZC0032 |
| Serial/Equipment No.: | 2681366                     | 2665582    | 17190  |
| Adaptors used:        | -                           | -          | -      |

### Item submitted by

|                      |                   |
|----------------------|-------------------|
| Customer Name:       | AECOM ASIA CO LTD |
| Address of Customer: | -                 |
| Request No.:         | -                 |
| Date of receipt:     | 07-Mar-2023       |

Date of test: 08-Mar-2023

### Reference equipment used in the calibration

| Description:                    | Model:   | Serial No. | Expiry Date: | Traceable to: |
|---------------------------------|----------|------------|--------------|---------------|
| Multi function sound calibrator | B&K 4226 | 2288444    | 23-Aug-2023  | CIGISMEC      |
| Signal generator                | DS 360   | 61227      | 08-Jun-2023  | CEPREI        |

### Ambient conditions

|                    |              |
|--------------------|--------------|
| Temperature:       | 22 ± 1 °C    |
| Relative humidity: | 55 ± 10 %    |
| Air pressure:      | 1010 ± 5 hPa |

### Test specifications


- 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.
- 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%.
- 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: 13-Mar-2023 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. The results apply to the item as received.



## CERTIFICATE OF CALIBRATION

(Continuation Page)

Certificate No.: 23CA0307 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                       |                 |
| 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                       |                 |
|                         | Single 100µs rectangular pulse                   | Pass    | 0.3                       |                 |
| Peak response           | R.M.S. accuracy                                  | Pass    | 0.3                       |                 |
|                         | Crest factor of 3                                | Pass    | 0.3                       |                 |
|                         | Time weighting I                                 | Pass    | 0.3                       |                 |
| Time averaging          | Repeated at frequency of 100 Hz                  | Pass    | 0.3                       |                 |
|                         | 1 ms burst duty factor 1/10 <sup>3</sup> at 4kHz | Pass    | 0.3                       |                 |
|                         | 1 ms burst duty factor 1/10 <sup>4</sup> at 4kHz | Pass    | 0.3                       |                 |
| Pulse range             | Single burst 10 ms at 4 kHz                      | Pass    | 0.4                       |                 |
|                         | Single burst 10 ms at 4 kHz                      | Pass    | 0.4                       |                 |
| Sound exposure level    | SPL  | Pass    | 0.3                       |                 |
|                         | Leq  | 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.

Calibrated by:  Date: 08-Mar-2023

Checked by:  Date: 13-Mar-2023

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.: 22CA1110 01-02 Page: 1 of 2

### Item tested

Description: Acoustical Calibrator (Class 1)  
Manufacturer: B & K  
Type/Model No.: 4231  
Serial/Equipment No.: 3014024 / N004.04  
Adaptors used: -

### Item submitted by

Customer: AECOM ASIA CO LIMITED  
Address of Customer: -  
Request No.: -  
Date of receipt: 10-Nov-2022

Date of test: 11-Nov-2022

### Reference equipment used in the calibration

| Description:            | Model:   | Serial No. | Expiry Date: | Traceable to: |
|-------------------------|----------|------------|--------------|---------------|
| Lab standard microphone | B&K 4180 | 2412857    | 23-May-2023  | SCL           |
| Preamplifier            | B&K 2673 | 2743150    | 28-Jun-2023  | CEPREI        |
| Measuring amplifier     | B&K 2610 | 2346941    | 30-Jun-2023  | CEPREI        |
| Signal generator        | DS 360   | 33873      | 21-Jan-2023  | CEPREI        |
| Digital multi-meter     | 34401A   | US36087050 | 30-May-2023  | CEPREI        |
| Audio analyzer          | 8903B    | GB41300350 | 06-Jul-2023  | CEPREI        |
| Universal counter       | 53132A   | MY40003662 | 13-Jun-2023  | CEPREI        |

### Ambient conditions

Temperature: 22 ± 1 °C  
Relative humidity: 55 ± 10 %  
Air pressure: 1005 ± 5 hPa

### Test specifications

- 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.
- The calibrator was tested with its axis vertical facing downwards at the specific frequency using insert voltage technique.
- 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:  Date: 12-Nov-2022 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. The results apply to the item as received.

## CERTIFICATE OF CALIBRATION

(Continuation Page)

Certificate No.: 22CA1110 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<br>Hz | Output Sound Pressure Level Setting<br>dB | Measured Output Sound Pressure Level<br>dB | Estimated Expanded Uncertainty<br>dB |
|-----------------------|---|--|--------------------------------------|
| 1000                  | 94.00                                     | 94.03                                      | 0.10                                 |

(Output level in dB re 20 µPa)

### 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 = 0.014 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 = 1000.0 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.

Calibrated by:  Date: 11-Nov-2022

- End -  
Checked by:  Date: 12-Nov-2022

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.: 22CA1110 01-03 Page: 1 of 2

### Item tested

Description: Acoustical Calibrator (Class 1)  
Manufacturer: Rion Co., Ltd.  
Type/Model No.: NC-74  
Serial/Equipment No.: 34246490 / N.004.10  
Adaptors used: -

### Item submitted by

Customer: AECOM ASIA CO LIMITED  
Address of Customer: -  
Request No.: -  
Date of receipt: 10-Nov-2022

Date of test: 11-Nov-2022

### Reference equipment used in the calibration

| Description:            | Model:   | Serial No. | Expiry Date: | Traceable to: |
|-------------------------|----------|------------|--------------|---------------|
| Lab standard microphone | B&K 4180 | 2412857    | 23-May-2023  | SCL           |
| Preamplifier            | B&K 2673 | 2743150    | 28-Jun-2023  | CEPREI        |
| Measuring amplifier     | B&K 2610 | 2346941    | 30-Jun-2023  | CEPREI        |
| Signal generator        | DS 360   | 33873      | 21-Jan-2023  | CEPREI        |
| Digital multi-meter     | 34401A   | US36087050 | 30-May-2023  | CEPREI        |
| Audio analyzer          | 8903B    | GB41300350 | 06-Jul-2023  | CEPREI        |
| Universal counter       | 53132A   | MY40003662 | 13-Jun-2023  | CEPREI        |

### Ambient conditions

Temperature: 22 ± 1 °C  
Relative humidity: 55 ± 10 %  
Air pressure: 1005 ± 5 hPa

### Test specifications

- 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.
- The calibrator was tested with its axis vertical facing downwards at the specific frequency using insert voltage technique.
- 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:  Date: 12-Nov-2022 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. The results apply to the item as received.



## CERTIFICATE OF CALIBRATION

(Continuation Page)

Certificate No.: 22CA1110 01-03 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<br>Hz | Output Sound Pressure Level Setting<br>dB | Measured Output Sound Pressure Level<br>dB | (Output level in dB re 20 µPa)       |
|-----------------------|---|--|--------------------------------------|
|                       |   |  | Estimated Expanded Uncertainty<br>dB |
| 1000                  | 94.00                                     | 93.98                                      | 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 = 0.011 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 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 = 1002.1

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 = 1.6 %

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: 11-Nov-2022

Checked by: 

Date: 12-Nov-2022

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.