

# Appendix C

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Calibration Certificate for  
Construction Dust Monitoring  
Equipment



# FUGRO TECHNICAL SERVICES LIMITED

Room 723 - 726, 7/F, Block B,  
Profit Industrial Building,  
1-15 Kwai Fung Crescent, Kwai Fong,  
Hong Kong.

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## TSP SAMPLER CALIBRATION CALCULATION SPREADSHEET

Location : M-A3  
Date of Calibration: 24-Jun-22  
Location : S.K.H Tsoi Kung Po Secondary School  
Next Calibration Date: 23-Sep-22  
Make: Tisch  
Technician: Mike Kan  
Model: TE-5170  
S/N: 4388

### CONDITIONS

Sea Level Pressure (hPa): 1009      Corrected Pressure (mm Hg): 767  
Temperature (°C): 30      Temperature (K): 303

### CALIBRATION ORIFICE

Make: Tisch      Qstd Slope: 2.11005  
Model: TE-5025A      Qstd Intercept: -0.01868  
Calibration Date: 24-Mar-22      Expiry Date: 24-Mar-23  
S/N: 2154

### CALIBRATIONS

| Plate No. | H2O (L) (in) | H2O (R) (in) | H2O (in) | Qstd (m <sup>3</sup> /min) | I (chart) | IC (corrected) | LINEAR REGRESSION    |
|-----------|--------------|--------------|----------|----------------------------|-----------|----------------|----------------------|
| 18        | 8.20         | -7.50        | 15.700   | 1.880                      | 58.00     | 57.78          | Slope = 61.2950      |
| 13        | 7.20         | -6.50        | 13.700   | 1.756                      | 50.00     | 49.81          | Intercept = -57.7485 |
| 10        | 6.60         | -5.70        | 12.300   | 1.665                      | 45.00     | 44.83          | Corr. coeff.= 0.9971 |
| 7         | 5.90         | -5.00        | 10.900   | 1.568                      | 37.00     | 36.86          |                      |
| 5         | 4.50         | -4.00        | 8.500    | 1.385                      | 28.00     | 27.90          |                      |

### Calculations:

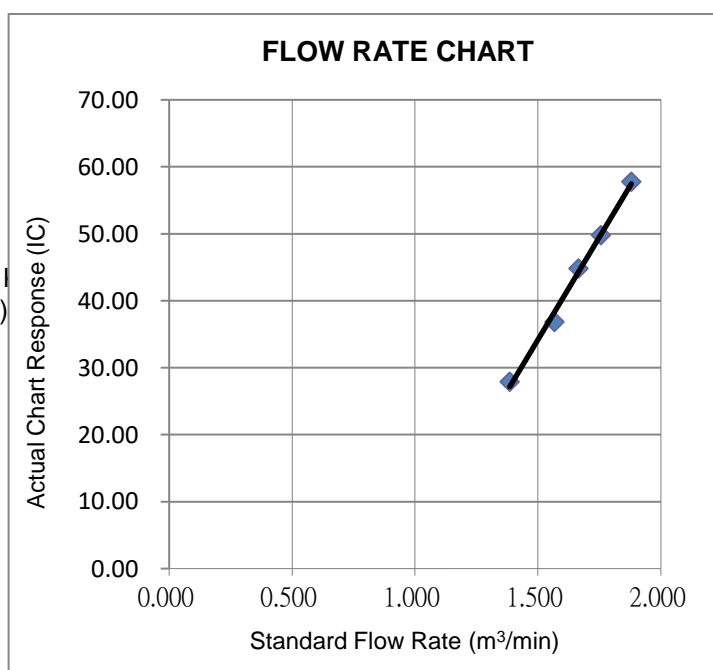
$$Qstd = 1/m[\text{Sqrt}(H2O(Pa/Pstd)(Tstd/Ta))-b]$$

$$IC = I[\text{Sqrt}(Pa/Pstd)(Tstd/Ta)]$$

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

**For subsequent calculation of sampler flow:**  
 $1/m((I)[\text{Sqrt}(298/Tav)(Pav/760)]-b)$

m = sampler slope  
b = sampler intercept  
I = chart response  
Tav = daily average temperature  
Pav = daily average pressure





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## TSP SAMPLER CALIBRATION CALCULATION SPREADSHEET

Location : M-A3  
Location : S.K.H Tsoi Kung Po Secondary School  
Make:   
Model:  S/N:   
Date of Calibration: 26-Sep-22  
Next Calibration Date: 25-Dec-22  
Technician: Eve Ma

### CONDITIONS

Sea Level Pressure (hPa): 1009.1 Corrected Pressure (mm Hg): 757  
Temperature (°C): 33.7 Temperature (K): 307

### CALIBRATION ORIFICE

Make:  Qstd Slope:   
Model:  Qstd Intercept:   
Calibration Date:  Expiry Date:   
S/N:

### CALIBRATIONS

| Plate No. | H2O (L) (in) | H2O (R) (in) | H2O (in) | Qstd (m <sup>3</sup> /min) | I (chart) | IC (corrected) | LINEAR REGRESSION    |
|-----------|--------------|--------------|----------|----------------------------|-----------|----------------|----------------------|
| 18        | -4.50        | -14.30       | 9.800    | 1.468                      | 49.00     | 48.20          | Slope = 23.2108      |
| 13        | -5.10        | -12.70       | 7.600    | 1.294                      | 45.00     | 44.27          | Intercept = 13.7367  |
| 10        | -6.30        | -11.00       | 4.700    | 1.020                      | 36.00     | 35.41          | Corr. coeff.= 0.9909 |
| 7         | -7.60        | -10.60       | 3.000    | 0.816                      | 34.00     | 33.45          |                      |
| 5         | -8.50        | -10.00       | 1.500    | 0.580                      | 28.00     | 27.54          |                      |

### Calculations:

$$Qstd = 1/m[\text{Sqrt}(H2O(Pa/Pstd)(Tstd/Ta))-b]$$

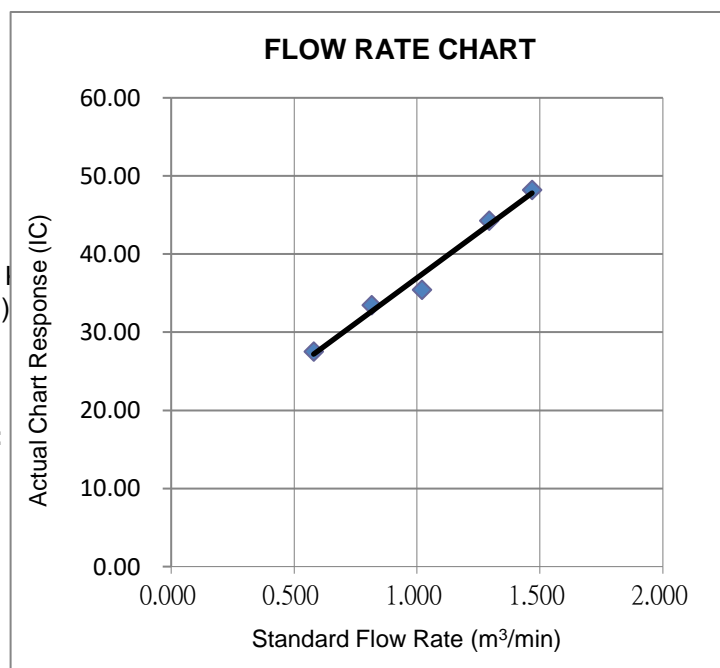
$$IC = I[\text{Sqrt}(Pa/Pstd)(Tstd/Ta)]$$

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

### For subsequent calculation of sampler flow:

$$1/m((I)[\text{Sqrt}(298/Tav)(Pav/760)]-b)$$

m = sampler slope  
b = sampler intercept  
I = chart response  
Tav = daily average temperature  
Pav = daily average pressure



# Certificate of Calibration

| Calibration Certification Information |                        |           |       |
|---------------------------------------|------------------------|-----------|-------|
| Cal. Date: April 24, 2022             | Rootsmeter S/N: 438320 | Ta: 295   | °K    |
| Operator: Jim Tisch                   |                        | Pa: 751.1 | mm Hg |
| Calibration Model #: TE-5025A         | Calibrator S/N: 2154   |           |       |

| Run | Vol. Init (m3) | Vol. Final (m3) | ΔVol. (m3) | ΔTime (min) | ΔP (mm Hg) | ΔH (in H2O) |
|-----|----------------|-----------------|------------|-------------|------------|-------------|
| 1   | 1              | 2               | 1          | 1.4680      | 3.2        | 2.00        |
| 2   | 3              | 4               | 1          | 1.0350      | 6.4        | 4.00        |
| 3   | 5              | 6               | 1          | 0.9240      | 8.0        | 5.00        |
| 4   | 7              | 8               | 1          | 0.8800      | 8.8        | 5.50        |
| 5   | 9              | 10              | 1          | 0.7290      | 12.8       | 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) |
| 0.9941          | 0.6772        | 1.4130   | 0.9957    | 0.6783      | 0.8863  |
| 0.9898          | 0.9563        | 1.9983   | 0.9915    | 0.9580      | 1.2534  |
| 0.9877          | 1.0689        | 2.2342   | 0.9893    | 1.0707      | 1.4014  |
| 0.9866          | 1.1212        | 2.3432   | 0.9883    | 1.1230      | 1.4698  |
| 0.9813          | 1.3461        | 2.8260   | 0.9830    | 1.3484      | 1.7726  |
| <b>QSTD</b>     | m=            | <b>2.11005</b>   | <b>QA</b> | m=          | <b>1.32128</b>  |
|                 | b=            | <b>-0.01868</b>  |           | b=          | <b>-0.01172</b>   |
|                 | r=            | <b>0.99998</b>   |           | r=          | <b>0.99998</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= $Vstd / \Delta Time$  | Qa= $Va / \Delta Time$   |  |  |
| 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 |
| <b>Key</b>                                |           |
| ΔH: calibrator manometer reading (in H2O) |           |
| ΔP: rootsmeter manometer reading (mm Hg)  |           |
| Ta: actual absolute temperature (°K)      |           |
| Pa: actual barometric pressure (mm Hg)    |           |
| b: intercept                              |           |
| m: slope                                  |           |

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

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## CALIBRATION CERTIFICATE OF DUST METER

Client : Fugro Technical Services Limited

Project : Calibration Services

### Client Supplied Information

Details of Unit Under Test, UUT

Description : Laser dust monitor  
 Manufacturer : SIBATA  
 Model No. : LD-5R  
 Serial No. : 155717  
 Specification Limit : NA  
 Next Calibration Date : 02-Sep-2022

### Laboratory Information

Description : 1. Balance 2. TSP high volume air sampler  
 Equipment ID. / Serial no. : 1. C-065-9 2. 4350  
 Date of Calibration : 03-Sep-2021 Ambient Temperature : 25 ± 10 °C  
 Calibration Location : General Chemical Laboratory of FTS and Ma Wan A1 Site Boundary  
 Method Used : By direct comparison the weight of dust particle trapped in a filter paper using high volume sampler (TSP method) for a certain period, with the reading of the UUT. They should be placed at the same location and powered on and off at the same time.

### Calibration Results :

| Reference concentration (mg/m <sup>3</sup> ) | Total count for 1 hour | CPM (Count per minute) |
|--|------------------------|------------------------|
| 0.0416                                       | 672                    | 11.20                  |
| 0.0388                                       | 650                    | 10.83                  |
| 0.0266                                       | 597                    | 9.95                   |

### Remarks:

1. The equipment being used in this calibration is traceable to recognized National Standards.
2. The interpolation equation : Concentration (mg/m<sup>3</sup>) = K x [ UUT reading (CPM) ], where K = 0.003345
3. Correlation coefficient (r) : 0.9940

Checked by : Cenny Date : 28-9-2021 Certified by : Chan Chun Wai Date : 28-9-2021  
 CA-R-297 (22/07/2009) Chan Chun Wai (Manager)

\*\* End of Report \*\*



Report no. : 940891CA220067

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**CALIBRATION CERTIFICATE OF DUST METER**

Client : Fugro Technical Services Limited

Project : Calibration Services

**Client Supplied Information**

Details of Unit Under Test, UUT

Description : Laser dust monitor  
Manufacturer : SIBATA  
Model No. : LD-5R  
Serial No. : 620408  
Specification Limit : NA  
Next Calibration Date : 07-Dec-2022

**Laboratory Information**

Description : 1. Balance 2. TSP high volume air sampler  
Equipment ID. / Serial no : 1. C-065-5 2. 4350  
Date of Calibration : 08-Dec-2021 Ambient Temperature : 23 ± 5 °C  
Calibration Location : General Chemical Laboratory of FTS and Ma Wan A1 Site Boundary  
Method Used : By direct comparison the weight of dust particle trapped in a filter paper using high volume sampler (TSP method) for a certain period, with the reading of the UUT. They should be placed at the same location and powered on and off at the same time.

**Calibration Results :**

| Reference concentration (mg/m <sup>3</sup> ) | Total count for 1 hour | CPM (Count per minute) |
|--|------------------------|------------------------|
| 0.0757                                       | 2041                   | 34.02                  |
| 0.0820                                       | 2112                   | 35.20                  |
| 0.0907                                       | 2256                   | 37.60                  |

**Remarks:**

1. The equipment being used in this calibration is traceable to recognized National Standards.
2. The interpolation equation : Concentration (mg/m<sup>3</sup>) = K x [ UUT reading (CPM) ], where K = 0.002326
3. Correlation coefficient (r) : 0.9953

Checked by : Curry Date : 11-1-2022 Certified by : K.T. Leung Date : 11-1-2022  
CA-R-297 (22/07/2009) Leung Kwok Tai (Assistant Manager)

**\*\* End of Report \*\***