

# Appendix C

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Calibration Certificate for  
Construction Dust Monitoring  
Equipment



# FUGRO TECHNICAL SERVICES LIMITED

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## TSP SAMPLER CALIBRATION CALCULATION SPREADSHEET

Location : M-A3  
Date of Calibration: 28-Nov-19  
Location : S.K.H Tsoi Kung Po Secondary School  
Next Calibration Date: 27-Feb-20  
Make: Tisch  
Technician: Tony Wan  
Model: TE-5170  
S/N: 4388

### CONDITIONS

Sea Level Pressure (hPa): 1021.90  
Corrected Pressure (mm Hg): 766  
Temperature (°C): 20  
Temperature (K): 293

### CALIBRATION ORIFICE

Make: Tisch  
Qstd Slope: 2.08799  
Model: TE-5025A  
Qstd Intercept: -0.03545  
Calibration Date: 21-Oct-19  
Expiry Date: 21-Oct-20  
S/N: 2456

### CALIBRATIONS

Plate No.	H2O (L) (in)	H2O (R) (in)	H2O (in)	Qstd (m <sup>3</sup> /min)	I (chart)	IC (corrected)	LINEAR REGRESSION
18	6.60	-5.60	12.200	1.711	55.00	55.70	Slope = 28.5972
13	5.10	-4.90	10.000	1.551	52.00	52.67	Intercept = 7.4324
10	4.20	-3.30	7.500	1.345	46.00	46.59	Corr. coeff.= 0.9950
7	2.40	-2.90	5.300	1.134	38.00	38.49	
5	1.20	-1.80	3.000	0.857	32.00	32.41	

### Calculations:

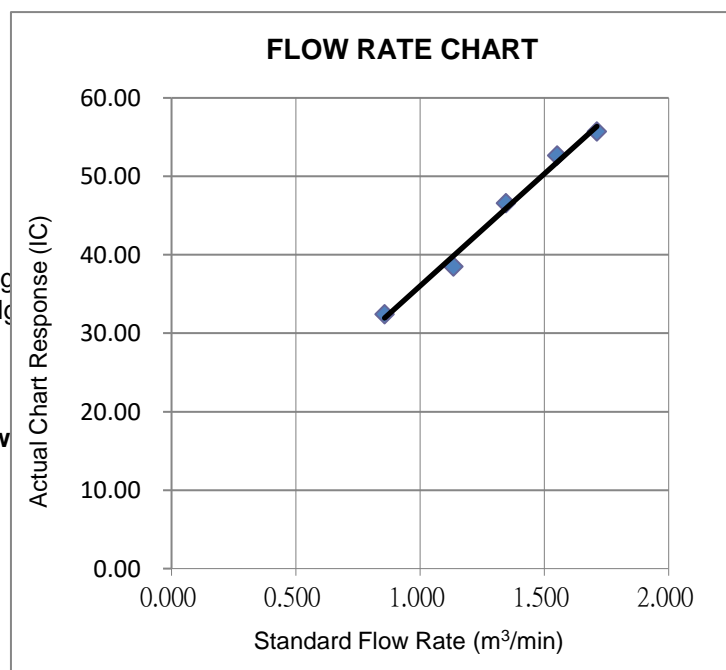
$$Qstd = 1/m[\text{Sqrt}(H2O(Pa/Pstd)(Tstd/Ta))-b]$$

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

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 C)  
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





**TSP SAMPLER CALIBRATION CALCULATION SPREADSHEET**

Location : M-A3	Date of Calibration: 18-Feb-20
Location : S.K.H Tsoi Kung Po Secondary School	Next Calibration Date: 17-May-20
Make: <input type="text" value="Tisch"/>	Technician: Tony Wan
Model: <input type="text" value="TE-5170"/>	S/N: <input type="text" value="4388"/>

CONDITIONS			
Sea Level Pressure (hPa):	1026.4	Corrected Pressure (mm Hg):	770
Temperature (°C):	14.7	Temperature (K):	288

CALIBRATION ORIFICE			
Make:	<input type="text" value="Tisch"/>	Qstd Slope:	<input type="text" value="2.08799"/>
Model:	<input type="text" value="TE-5025A"/>	Qstd Intercept:	<input type="text" value="-0.03545"/>
Calibration Date:	<input type="text" value="21-Oct-19"/>	Expiry Date:	<input type="text" value="21-Oct-20"/>
S/N:	<input type="text" value="2456"/>		

CALIBRATIONS							
Plate No.	H2O (L) (in)	H2O (R) (in)	H2O (in)	Qstd (m <sup>3</sup> /min)	I (chart)	IC (corrected)	LINEAR REGRESSION
18	4.80	-7.80	12.600	1.758	57.00	58.39	Slope = 27.9500 Intercept = 7.5966 Corr. coeff.= 0.9925
13	3.90	-6.90	10.800	1.629	51.00	52.24	
10	2.80	-5.00	7.800	1.387	44.00	45.07	
7	1.20	-4.00	5.200	1.136	38.00	38.92	
5	0.20	-2.80	3.000	0.867	32.00	32.78	

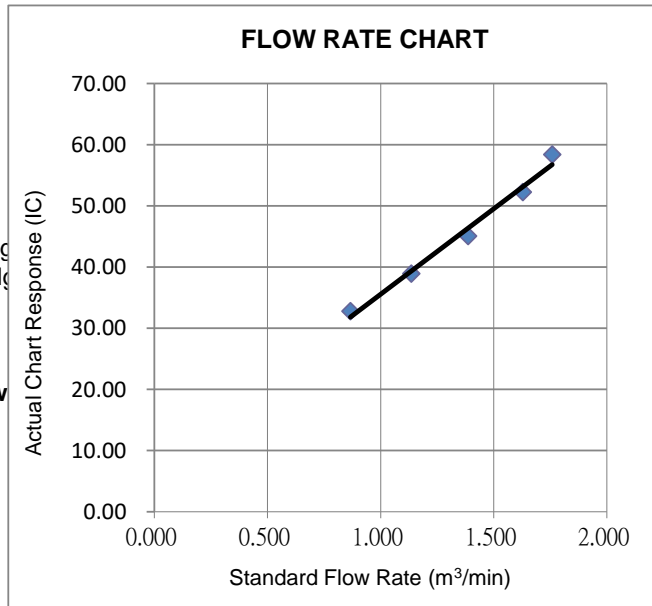
**Calculations:**

Qstd = 1/m[Sqrt(H2O(Pa/Pstd)(Tstd/Ta))-b]  
IC = I[Sqrt(Pa/Pstd)(Tstd/Ta)]

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

**For subsequent calculation of sampler flow**  
1/m((I)[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: October 21, 2019	Rootsmeter S/N: 438320	Ta: 295	°K
Operator: Jim Tisch		Pa: 744.2	mm Hg
Calibration Model #: TE-5025A	Calibrator S/N: <b>2456</b>		

Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H2O)
1	1	2	1	1.4200	3.2	2.00
2	3	4	1	1.0180	6.3	4.00
3	5	6	1	0.9030	7.9	5.00
4	7	8	1	0.8620	8.8	5.50
5	9	10	1	0.7120	12.6	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)	$\sqrt{\Delta H \left( Ta/Pa \right)}$ (y-axis)	
0.9849	0.6936	1.4066	0.9957	0.7012	0.8904	
0.9808	0.9635	1.9892	0.9915	0.9740	1.2592	
0.9787	1.0838	2.2240	0.9894	1.0957	1.4078	
0.9775	1.1340	2.3325	0.9882	1.1464	1.4765	
0.9724	1.3658	2.8131	0.9831	1.3807	1.7808	
<b>QSTD</b>	m=	<b>2.08799</b>	<b>QA</b>	m=	<b>1.30746</b>	
	b=	<b>-0.03545</b>		b=	<b>-0.02244</b>	
	r=	<b>0.99989</b>		r=	<b>0.99989</b>	

Calculations			
Vstd=	$\Delta Vol((Pa-\Delta P)/Pstd)(Tstd/Ta)$	Va=	$\Delta Vol((Pa-\Delta P)/Pa)$
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=	$1/m \left( \left( \sqrt{\Delta H \left( Ta/Pa \right)} \right) - b \right)$

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 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

## CALIBRATION CERTIFICATE

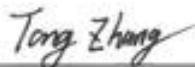
Date: May 28th, 2019

Equipment Name	:	Digital Dust Indicator, Model LD-3B
Code No.	:	080000-42
Quantity	:	1 unit
Serial No.	:	647594
Sensitivity	:	0.001 mg/m <sup>3</sup>
Sensitivity Adjustment	:	752CPM
Scale Setting	:	May 24th, 2019

We hereby certify that the above mentioned instrment has been calibrated satisfactory.

Sincerely

**SIBATA SCIENTIFIC TECHNOLOGY LTD.**



Tong Zhang  
Overseas & New Business Group  
Overseas Sales Department

