

Appendix C

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.

Tel : (852)-24508238
Fax : (852)-24508032
Email : mcl@fugro.com.hk

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 ³ /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:

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

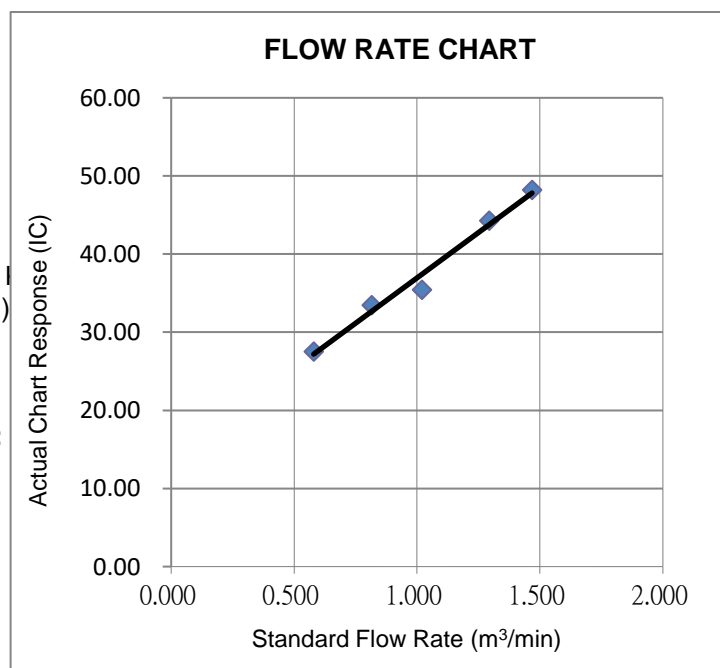
$$IC = I[\text{Sqrt}(Pa/Pstd)(Tstd/Ta)]$$

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





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TSP SAMPLER CALIBRATION CALCULATION SPREADSHEET

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

CONDITIONS

Sea Level Pressure (hPa): 1019
Corrected Pressure (mm Hg): 764
Temperature (°C): 17
Temperature (K): 290

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 ³ /min)	I (chart)	IC (corrected)	LINEAR REGRESSION
18	5.70	-5.90	11.600	1.649	59.00	59.97	Slope = 41.6255
13	4.50	-5.20	9.700	1.509	53.00	53.87	Intercept = -9.3892
10	3.90	-4.60	8.500	1.413	48.00	48.79	Corr. coeff.= 0.9917
7	3.10	-4.00	7.100	1.292	42.00	42.69	
5	2.40	-2.50	4.900	1.075	36.00	36.59	

Calculations:

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

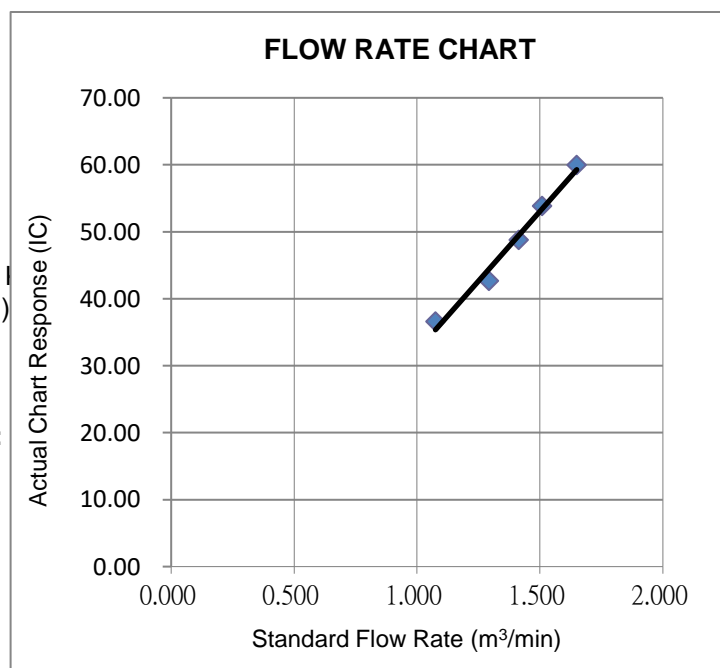
$$IC = I[\text{Sqrt}(Pa/Pstd)(Tstd/Ta)]$$

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
QSTD	m=	2.11005	QA	m=	1.32128
	b=	-0.01868		b=	-0.01172
	r=	0.99998		r=	0.99998

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
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

Report no. : 940891CA222379(3)

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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. : 114892

Specification Limit : NA

Next Calibration Date : 25-Aug-2023

Laboratory Information

Details of Reference Equipment -

Description : 1.Reference balance 2. TSP high Volume air sampler

Equipment ID / Serial no. : 1.C-065-5 2. 4350

Date of Calibration : 26-Aug-2022 Ambient Temperature : 33 °C

Calibration Location : Calibration Lab. of FTS

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 ³)	Total count for 1 hour	CPM (Count per minute)
0.0501	1531	25.52
0.0366	1075	17.92
0.0443	1290	21.50

Remarks:

1. The equipment being used in this calibration is traceable to recognized National Standards.
2. The interpolation equation : Concentration (mg/m³) = K x UUT reading (CPM) where K = 0.002014
3. Correlation coefficient (r) : 0.9936

 Checked by : Alex Date : 18/10-2022 Certified by : P.T. Leung Date : 19-10-2022

CA-R-297 (22/07/2009)

Leung Kwok Tai (Assistant Manager)

** End of Report **