

Annex D1

Calibration Certificates for Dust Monitoring Equipment

TSP SAMPLER CALIBRATION CACULATION SPREADSHEET

Location ID: AM1 Name and Model : TISCH HVS Model TE-5170	Date of Calibration: 24-Aug-23 Next Calibration Date: 23-Oct-23 Operator: P.F.Yeung							
CONDITIONS								
Sea Level Pressure (hpa) Temperature (°C)	<table border="1" style="display: inline-table; vertical-align: middle;"> <tr><td>1007</td></tr> <tr><td>29.0</td></tr> </table>	1007	29.0	Corrected Pressure (mm Hg) Temperature (K)	<table border="1" style="display: inline-table; vertical-align: middle;"> <tr><td>755.3</td></tr> <tr><td>302</td></tr> </table>	755.3	302	
1007								
29.0								
755.3								
302								
CALIBRATION ORIFICE								
Make: Model: Serial#:	<table border="1" style="display: inline-table; vertical-align: middle;"> <tr><td>TISCH</td></tr> <tr><td>TE-5025A</td></tr> <tr><td>2454</td></tr> </table>	TISCH	TE-5025A	2454	Qstd Slope Qstd Intercept	<table border="1" style="display: inline-table; vertical-align: middle;"> <tr><td>2.06918</td></tr> <tr><td>-0.04220</td></tr> </table>	2.06918	-0.04220
TISCH								
TE-5025A								
2454								
2.06918								
-0.04220								
CALIBRATION								
Plate No.	H2O(L) (in)	H2O(R) (in)	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION	
18	5.7	5.7	11.4	1.637	55	54.48	Slope= 29.245	
13	4.5	4.5	9.0	1.457	49	48.54	Intercept= 6.549	
10	3.1	3.1	6.2	1.212	43	42.59	Corr. Coeff.= 0.9985	
7	2.0	2.0	4.0	0.978	36	35.66		
5	1.3	1.2	2.5	0.777	29	28.73		

Calulations:

$Q_{std} = 1/m[\sqrt{H_2O(P_a/P_{std})(T_{std}/T_a)} - b]$

$IC = I[\sqrt{P_a/P_{std}}(T_{std}/T_a)]$

Q_{std} = standard flow rate
 IC = corrected chart response
 I = actual chart response
 m = calibrator Q_{std} slope
 b = calibrator Q_{std} intercept
 T_a = actual temperature during calibration (deg K)
 P_a = actual pressure during calibration (mm Hg)

For subsequent calculation of sampler flow:

$1/m(I)[\sqrt{(298/T_{avg})(P_{avg}/760)}] - b$

m = sampler slope
 b = sampler intercept
 I = chart response
 T_{avg} = daily average temperature
 P_{avg} = daily average pressure

Qstd (m³/min)	IC
0.8	28
1.0	35
1.2	43
1.5	49

TSP SAMPLER CALIBRATION CACULATION SPREADSHEET

Location ID: AM2 Name and Model : TISCH HVS Model TE-5170	Date of Calibration: 24-Aug-23 Next Calibration Date: 23-Oct-23 Operator: P.F.Yeung							
CONDITIONS								
Sea Level Pressure (hpa) Temperature (°C)	<table border="1" style="display: inline-table; vertical-align: middle;"> <tr><td>1007</td></tr> <tr><td>29.0</td></tr> </table>	1007	29.0	Corrected Pressure (mm Hg) Temperature (K)	<table border="1" style="display: inline-table; vertical-align: middle;"> <tr><td>755.3</td></tr> <tr><td>302</td></tr> </table>	755.3	302	
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CALIBRATION ORIFICE								
Make: Model: Serial#:	<table border="1" style="display: inline-table; vertical-align: middle;"> <tr><td>TISCH</td></tr> <tr><td>TE-5025A</td></tr> <tr><td>2454</td></tr> </table>	TISCH	TE-5025A	2454	Qstd Slope Qstd Intercept	<table border="1" style="display: inline-table; vertical-align: middle;"> <tr><td>2.06918</td></tr> <tr><td>-0.04220</td></tr> </table>	2.06918	-0.04220
TISCH								
TE-5025A								
2454								
2.06918								
-0.04220								
CALIBRATION								
Plate No.	H2O(L) (in)	H2O(R) (in)	H2O (in)	Qstd (m ³ /min)	I (chart)	IC (corrected)	LINEAR REGRESSION	
18	6.1	6.1	12.2	1.692	53	52.50	Slope= 27.924	
13	4.9	4.8	9.7	1.511	48	47.55	Intercept= 5.641	
10	3.1	3.2	6.3	1.222	41	40.61	Corr. Coeff.= 0.9951	
7	2.3	2.2	4.5	1.036	36	35.66		
5	1.4	1.5	2.9	0.836	28	27.74		

Calulations:

$Q_{std} = 1/m[\sqrt{H_2O(P_a/P_{std})(T_{std}/T_a)} - b]$

$IC = I[\sqrt{P_a/P_{std}}(T_{std}/T_a)]$

Q_{std} = standard flow rate
 IC = corrected chart response
 I = actual chart response
 m = calibrator Q_{std} slope
 b = calibrator Q_{std} intercept
 T_a = actual temperature during calibration (deg K)
 P_a = actual pressure during calibration (mm Hg)

For subsequent calculation of sampler flow:

$1/m(I)[\sqrt{(298/T_{avg})(P_{avg}/760)}] - b$

m = sampler slope
 b = sampler intercept
 I = chart response
 T_{avg} = daily average temperature
 P_{avg} = daily average pressure

Flow Rate

Qstd (m ³ /min)	IC
0.836	27.74
1.036	35.66
1.222	40.61

TSP SAMPLER CALIBRATION CACULATION SPREADSHEET

Location ID: AM3	Date of Calibration:	24-Aug-23
Name and Model : TISCH HVS Model TE-5170	Next Calibration Date:	23-Oct-23
	Operator:	P.F.Yeung

CONDITIONS

Sea Level Pressure (hpa) 1007
 Temperature (°C) 29.0

Corrected Pressure (mm Hg) 755.3
 Temperature (K) 302

CALIBRATION ORIFICE

Make: TISCH
 Model: TE-5025A
 Serial#: 2454

Qstd Slope 2.06918
 Qstd Intercept -0.04220

CALIBRATION

Plate No.	H2O(L) (in)	H2O(R) (in)	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION
18	6.0	5.9	11.9	1.672	61	60.42	Slope= 28.952
13	4.7	4.6	9.3	1.480	55	54.48	Intercept= 12.085
10	3.5	3.4	6.9	1.278	50	49.53	Corr. Coeff.= 0.9979
7	2.1	2.0	4.1	0.990	42	41.60	
5	1.4	1.3	2.7	0.807	35	34.67	

Calulations:

$$Q_{std} = 1/m[\sqrt{H_2O(P_a/P_{std})(T_{std}/T_a)} - b]$$

$$IC = I[\sqrt{P_a/P_{std}}(T_{std}/T_a)]$$

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)

For subsequent calculation of sampler flow:

$$1/m(I)[\sqrt{(298/T_{avg})(P_{avg}/760)}] - b$$

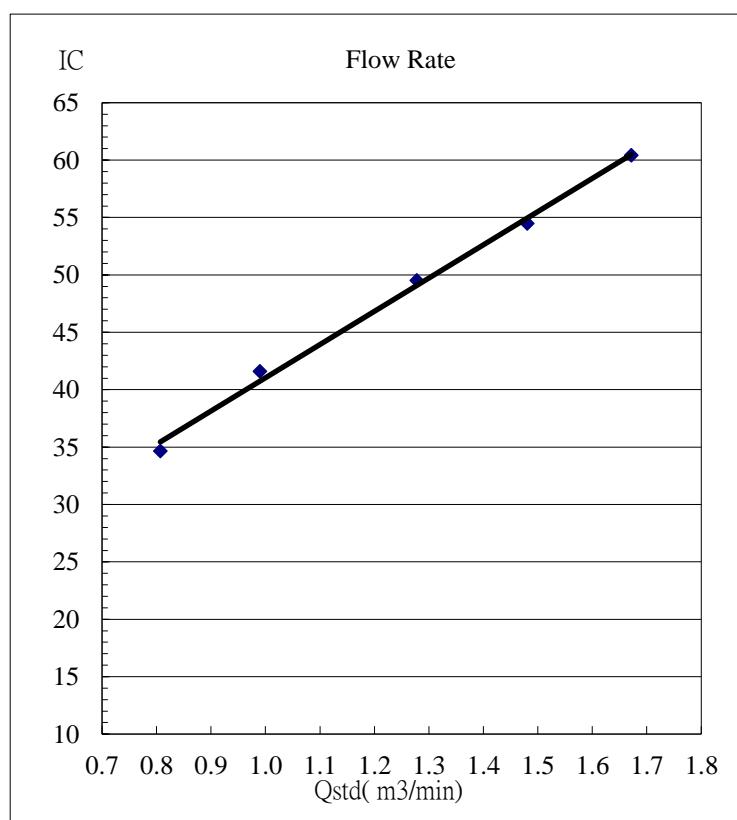
m = sampler slope

b = sampler intercept

I = chart response

Tavg = daily average temperature

Pavg = daily average pressure



TSP SAMPLER CALIBRATION CACULATION SPREADSHEET

Location ID: AM4 Name and Model : TISCH HVS Model TE-5170	Date of Calibration: 24-Aug-23 Next Calibration Date: 23-Oct-23 Operator: P.F.Yeung							
CONDITIONS								
Sea Level Pressure (hpa) Temperature (°C)	<table border="1" style="display: inline-table; vertical-align: middle;"> <tr><td>1007</td></tr> <tr><td>29.0</td></tr> </table>	1007	29.0	Corrected Pressure (mm Hg) Temperature (K)	<table border="1" style="display: inline-table; vertical-align: middle;"> <tr><td>755.3</td></tr> <tr><td>302</td></tr> </table>	755.3	302	
1007								
29.0								
755.3								
302								
CALIBRATION ORIFICE								
Make: Model: Serial#:	<table border="1" style="display: inline-table; vertical-align: middle;"> <tr><td>TISCH</td></tr> <tr><td>TE-5025A</td></tr> <tr><td>2454</td></tr> </table>	TISCH	TE-5025A	2454	Qstd Slope Qstd Intercept	<table border="1" style="display: inline-table; vertical-align: middle;"> <tr><td>2.06918</td></tr> <tr><td>-0.04220</td></tr> </table>	2.06918	-0.04220
TISCH								
TE-5025A								
2454								
2.06918								
-0.04220								
CALIBRATION								
Plate No.	H2O(L) (in)	H2O(R) (in)	H2O (in)	Qstd (m ³ /min)	I (chart)	IC (corrected)	LINEAR REGRESSION	
18	6.1	6.1	12.2	1.692	57	56.46	Slope= 31.858	
13	4.5	4.5	9.0	1.457	52	51.51	Intercept= 3.629	
10	3.6	3.6	7.2	1.305	45	44.57	Corr. Coeff.= 0.9933	
7	2.2	2.2	4.4	1.025	38	37.64		
5	1.3	1.3	2.6	0.792	28	27.74		

Calulations:

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

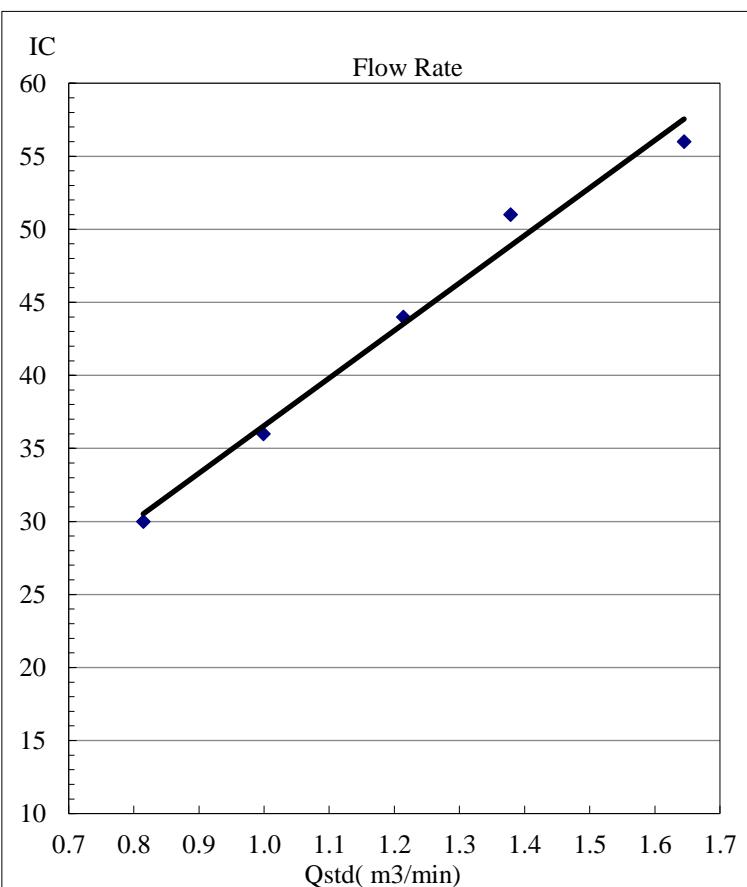
Qstd = standard flow rate
 IC = corrected chart response
 I = actual chart response
 m = calibrator Qstd slope
 b = calibrator Qstd intercept
 Ta = actual temperature during calibration (deg K)
 Pa = actual pressure during calibration (mm Hg)

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

Qstd (m³/min)	IC
0.80	28
1.02	38
1.30	45
1.45	52
1.70	57

TSP SAMPLER CALIBRATION CACULATION SPREADSHEET

Location ID: AM1 Name and Model : TISCH HVS Model TE-5170		Date of Calibration: 24-Oct-23 Next Calibration Date: 23-Dec-23 Operator: P.F.Yeung					
CONDITIONS							
Sea Level Pressure (hpa) Temperature (°C)	1016 20.6	Corrected Pressure (mm Hg) Temperature (K)	762.1 299				
CALIBRATION ORIFICE							
Make: Model: Serial#:	TISCH TE-5025A 2454	Qstd Slope Qstd Intercept	2.06918 -0.04220				
CALIBRATION							
Plate No.	H2O(L) (in)	H2O(R) (in)	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION
18	5.6	5.7	11.3	1.645	56	56.00	Slope= 32.550
13	4.0	3.9	7.9	1.379	51	51.00	Intercept= 4.006
10	3.1	3.0	6.1	1.214	44	44.00	Corr. Coeff.= 0.9915
7	2.1	2.0	4.1	0.999	36	36.00	
5	1.4	1.3	2.7	0.814	30	30.00	
Calulations:							
$Q_{std} = 1/m[\sqrt{H_2O(P_a/P_{std})(T_{std}/T_a)} - b]$							
$IC = I[\sqrt{P_a/P_{std}}(T_{std}/T_a)]$							
<p>Q_{std} = standard flow rate IC = corrected chart response I = actual chart response m = calibrator Q_{std} slope b = calibrator Q_{std} intercept T_a = actual temperature during calibration (deg K) P_a = actual pressure during calibration (mm Hg)</p>							
<p>For subsequent calculation of sampler flow:</p> $1/m((I)[\sqrt{298/T_{avg}}(\bar{P}_a/760)] - b)$ <p>m = sampler slope b = sampler intercept I = chart response T_{avg} = daily average temperature \bar{P}_a = daily average pressure</p>							
							

TSP SAMPLER CALIBRATION CACULATION SPREADSHEET

Location ID: AM2 Name and Model : TISCH HVS Model TE-5170	Date of Calibration: 24-Oct-23 Next Calibration Date: 23-Dec-23 Operator: P.F.Yeung							
CONDITIONS								
Sea Level Pressure (hpa) Temperature (°C)	<table border="1" style="display: inline-table; vertical-align: middle;"> <tr><td>1016</td></tr> <tr><td>26.0</td></tr> </table>	1016	26.0	Corrected Pressure (mm Hg) Temperature (K)	<table border="1" style="display: inline-table; vertical-align: middle;"> <tr><td>762.1</td></tr> <tr><td>299</td></tr> </table>	762.1	299	
1016								
26.0								
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TE-5025A								
2454								
2.06918								
-0.04220								
CALIBRATION								
Plate No.	H2O(L) (in)	H2O(R) (in)	H2O (in)	Qstd (m ³ /min)	I (chart)	IC (corrected)	LINEAR REGRESSION	
18	6.0	5.9	11.9	1.687	53	53.00	Slope= 25.811	
13	4.4	4.3	8.7	1.446	48	48.00	Intercept= 10.384	
10	3.0	3.0	6.0	1.204	43	43.00	Corr. Coeff.= 0.9935	
7	2.0	2.0	4.0	0.987	36	36.00		
5	1.3	1.3	2.6	0.800	30	30.00		

Calulations:

$Q_{std} = 1/m[\sqrt{H_2O(P_a/P_{std})(T_{std}/T_a)} - b]$

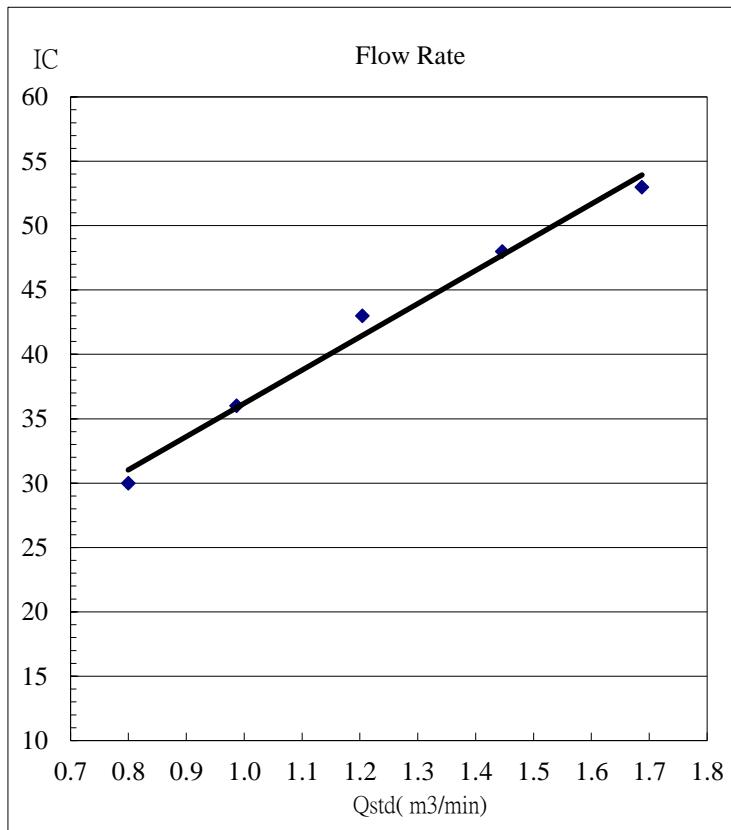
$IC = I[\sqrt{P_a/P_{std}}(T_{std}/T_a)]$

Q_{std} = standard flow rate
 IC = corrected chart response
 I = actual chart response
 m = calibrator Q_{std} slope
 b = calibrator Q_{std} intercept
 T_a = actual temperature during calibration (deg K)
 P_a = actual pressure during calibration (mm Hg)

For subsequent calculation of sampler flow:

$1/m(I)[\sqrt{(298/T_{avg})(P_{avg}/760)}] - b$

m = sampler slope
 b = sampler intercept
 I = chart response
 T_{avg} = daily average temperature
 P_{avg} = daily average pressure



Qstd (m ³ /min)	IC
0.800	30.00
1.046	35.00
1.204	43.00
1.687	53.00

TSP SAMPLER CALIBRATION CACULATION SPREADSHEET

Location ID: AM3 Name and Model : TISCH HVS Model TE-5170	Date of Calibration: 24-Oct-23 Next Calibration Date: 23-Dec-23 Operator: P.F.Yeung							
CONDITIONS								
Sea Level Pressure (hpa) Temperature (°C)	<table border="1" style="display: inline-table; vertical-align: middle;"> <tr><td>1016</td></tr> <tr><td>26.0</td></tr> </table>	1016	26.0	Corrected Pressure (mm Hg) Temperature (K)	<table border="1" style="display: inline-table; vertical-align: middle;"> <tr><td>762.1</td></tr> <tr><td>299</td></tr> </table>	762.1	299	
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Make: Model: Serial#:	<table border="1" style="display: inline-table; vertical-align: middle;"> <tr><td>TISCH</td></tr> <tr><td>TE-5025A</td></tr> <tr><td>2454</td></tr> </table>	TISCH	TE-5025A	2454	Qstd Slope Qstd Intercept	<table border="1" style="display: inline-table; vertical-align: middle;"> <tr><td>2.06918</td></tr> <tr><td>-0.04220</td></tr> </table>	2.06918	-0.04220
TISCH								
TE-5025A								
2454								
2.06918								
-0.04220								
CALIBRATION								
Plate No.	H2O(L) (in)	H2O(R) (in)	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION	
18	5.9	5.8	11.7	1.673	57	57.00	Slope= 27.980	
13	4.6	4.5	9.1	1.478	52	52.00	Intercept= 10.675	
10	3.2	3.2	6.4	1.243	46	46.00	Corr. Coeff.= 0.9964	
7	2.1	2.1	4.2	1.011	40	40.00		
5	1.3	1.3	2.6	0.800	32	32.00		

Calulations:

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)

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

Qstd (m3/min)	IC
0.80	33.0
1.00	40.0
1.20	46.0
1.50	52.0
1.70	57.0

TSP SAMPLER CALIBRATION CACULATION SPREADSHEET

Location ID: AM4 Name and Model : TISCH HVS Model TE-5170		Date of Calibration: 24-Oct-23 Next Calibration Date: 23-Dec-23 Operator: P.F.Yeung					
CONDITIONS							
Sea Level Pressure (hpa) Temperature (°C)	1016 26.0	Corrected Pressure (mm Hg) Temperature (K)	762.1 299				
CALIBRATION ORIFICE							
Make: Model: Serial#:	TISCH TE-5025A 2454	Qstd Slope Qstd Intercept	2.06918 -0.04220				
CALIBRATION							
Plate No.	H2O(L) (in)	H2O(R) (in)	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION
18	6.1	6.2	12.3	1.715	58	58.00	Slope= 31.691
13	4.8	4.8	9.6	1.518	52	52.00	Intercept= 3.979
10	3.5	3.5	7.0	1.299	46	46.00	Corr. Coeff.= 0.9991
7	2.4	2.4	4.8	1.079	38	38.00	
5	1.4	1.4	2.8	0.829	30	30.00	
Calulations:							
$Q_{std} = 1/m[\sqrt{H_2O(Pa/Pstd)(Tstd/Ta)} - b]$							
$IC = I[\sqrt{Pa/Pstd}(Tstd/Ta)]$							
<p>Q_{std} = standard flow rate IC = corrected chart response I = actual chart response m = calibrator Q_{std} slope b = calibrator Q_{std} intercept Ta = actual temperature during calibration (deg K) Pa = actual pressure during calibration (mm Hg)</p>							
<p>For subsequent calculation of sampler flow:</p> $1/m(I)[\sqrt{(298/Tav)(Pav/760)}] - b$ <p>m = sampler slope b = sampler intercept I = chart response Tav = daily average temperature Pav = daily average pressure</p>							