

High-Volume TSP Sampler  
5-Point Calibration Record

Location : ASR 5  
 Calibrated by : P.F. Yeung  
 Date : 09/08/2017

Sampler

Model : TE-5170  
 Serial Number : S/N 0816

Calibration Orifice and Standard Calibration Relationship

Serial Number : 2454  
 Service Date : 20 March 2017  
 Slope (m) : 2.08464  
 Intercept (b) : -0.036840  
 Correlation Coefficient(r) : 0.99994

Standard Condition

Pstd (hpa) : 1013  
 Tstd (K) : 298.18

Calibration Condition

Pa (hpa) : 1005  
 Ta(K) : 305

Resistance Plate		dH [green liquid] (inch water)	Z	X=Qstd (cubic meter/min)	IC (chart)	Y (corrected)
1	18 holes	10.2	3.144	1.526	51	50.21
2	13 holes	8.8	2.921	1.419	45	44.30
3	10 holes	6.6	2.529	1.231	40	39.38
4	7 holes	4.4	2.065	1.008	34	33.47
5	5 holes	2.8	1.647	0.808	26	25.60

Notes:  $Z = \sqrt{dH(Pa/Pstd)(Tstd/Ta)}$ ,  $X = Z/m - b$ ,  $Y(\text{Corrected Flow}) = IC * \{\sqrt{Pa/Pstd}(Tstd/Ta)\}$

Sampler Calibration Relationship (Linear Regression)

Slope(m): 32.235      Intercept(b): -0.0361      Correlation Coefficient(r): 0.9991

Checked by: Magnum Fan

Date: 11/08/2017

High-Volume TSP Sampler  
5-Point Calibration Record

Location : ASR10  
 Calibrated by : P.F. Yeung  
 Date : 09/08/2017

Sampler

Model : TE-5170  
 Serial Number : S/N 8162

Calibration Orifice and Standard Calibration Relationship

Serial Number : 2454  
 Service Date : 20 March 2017  
 Slope (m) : 2.08464  
 Intercept (b) : -0.036840  
 Correlation Coefficient(r) : 0.99994

Standard Condition

Pstd (hpa) : 1013  
 Tstd (K) : 298.18

Calibration Condition

Pa (hpa) : 1005  
 Ta(K) : 305

Resistance Plate		dH [green liquid] (inch water)	Z	X=Qstd (cubic meter/min)	IC (chart)	Y (corrected)
1	18 holes	11.2	3.295	1.598	53	52.18
2	13 holes	9.2	2.986	1.450	48	47.26
3	10 holes	7.2	2.642	1.285	43	42.34
4	7 holes	4.7	2.134	1.042	35	34.46
5	5 holes	3.0	1.705	0.836	26	25.60

Notes:  $Z = \sqrt{dH(Pa/Pstd)(Tstd/Ta)}$ ,  $X = Z/m - b$ ,  $Y(\text{Corrected Flow}) = IC * \{\sqrt{Pa/Pstd}(Tstd/Ta)\}$

Sampler Calibration Relationship (Linear Regression)

Slope(m): 34.219      Intercept(b): -2.138      Correlation Coefficient(r): 0.9976

Checked by: Magnum Fan

Date: 11/08/17

High-Volume TSP Sampler  
5-Point Calibration Record

Location : AQMS1  
 Calibrated by : P.F. Yeung  
 Date : 09/08/2017

Sampler

Model : TE-5170  
 Serial Number : S/N 1253

Calibration Orifice and Standard Calibration Relationship

Serial Number : 2454  
 Service Date : 20 March 2017  
 Slope (m) : 2.08464  
 Intercept (b) : -0.036840  
 Correlation Coefficient(r) : 0.99994

Standard Condition

Pstd (hpa) : 1013  
 Tstd (K) : 298.18

Calibration Condition

Pa (hpa) : 1005  
 Ta(K) : 305

Resistance Plate		dH [green liquid] (inch water)	Z	X=Qstd (cubic meter/min)	IC (chart)	Y (corrected)
1	18 holes	12.1	3.425	1.661	52	51.20
2	13 holes	9.9	3.098	1.504	46	45.29
3	10 holes	7.5	2.696	1.311	40	39.38
4	7 holes	5.0	2.202	1.074	33	32.49
5	5 holes	3.1	1.733	0.849	27	26.58

Notes:  $Z = \sqrt{dH(Pa/Pstd)(Tstd/Ta)}$ ,  $X = Z/m - b$ ,  $Y(\text{Corrected Flow}) = IC * \{\sqrt{Pa/Pstd}(Tstd/Ta)\}$

Sampler Calibration Relationship (Linear Regression)

Slope(m): 30.080      Intercept(b): 0.496      Correlation Coefficient(r): 0.9980

Checked by: Magnum Fan

Date: 11/08/2017

High-Volume TSP Sampler  
5-Point Calibration Record

Location : ASR 1  
 Calibrated by : P.F.Yeung  
 Date : 09/08/2017

Sampler

Model : TE-5170  
 Serial Number : S/N 0146

Calibration Orifice and Standard Calibration Relationship

Serial Number : 2454  
 Service Date : 20 March 2017  
 Slope (m) : 2.08464  
 Intercept (b) : -0.036840  
 Correlation Coefficient(r) : 0.99994

Standard Condition

Pstd (hpa) : 1013  
 Tstd (K) : 298.18

Calibration Condition

Pa (hpa) : 1005  
 Ta(K) : 305

Resistance Plate		dH [green liquid] (inch water)	Z	X=Qstd (cubic meter/min)	IC (chart)	Y (corrected)
1	18 holes	11.6	3.353	1.626	53	52.18
2	13 holes	9.8	3.082	1.496	48	47.26
3	10 holes	7.6	2.714	1.320	42	41.35
4	7 holes	5.0	2.202	1.074	36	35.44
5	5 holes	3.2	1.761	0.863	28	27.57

Notes:  $Z = \sqrt{dH(Pa/Pstd)(Tstd/Ta)}$ ,  $X = Z/m - b$ ,  $Y(\text{Corrected Flow}) = IC * \{\sqrt{Pa/Pstd}(Tstd/Ta)\}$

Sampler Calibration Relationship (Linear Regression)

Slope(m): 31.141                      Intercept(b): 1.034                      correlation Coefficient(r): 0.9972

Checked by: Magnum Fan

Date: 11/08/2017

High-Volume TSP Sampler  
5-Point Calibration Record

Location : ASR 6  
 Calibrated by : P.F. Yeung  
 Date : 09/08/2017

Sampler

Model : TE-5170  
 Serial Number : S/N 3957

Calibration Orifice and Standard Calibration Relationship

Serial Number : 2454  
 Service Date : 20 March 2017  
 Slope (m) : 2.08464  
 Intercept (b) : -0.036840  
 Correlation Coefficient(r) : 0.99994

Standard Condition

Pstd (hpa) : 1013  
 Tstd (K) : 298.18

Calibration Condition

Pa (hpa) : 1005  
 Ta(K) : 305

Resistance Plate	dH [green liquid] (inch water)	Z	X=Qstd (cubic meter/min)	IC (chart)	Y (corrected)
1   18 holes	12.8	3.522	1.707	54	53.17
2   13 holes	9.3	3.002	1.458	47	46.27
3   10 holes	7.0	2.605	1.267	41	40.37
4   7 holes	4.6	2.112	1.031	33	32.49
5   5 holes	3.2	1.761	0.863	27	26.58

Notes:  $Z = \sqrt{dH(Pa/Pstd)(Tstd/Ta)}$ ,  $X = Z/m - b$ ,  $Y(\text{Corrected Flow}) = IC * \{\sqrt{Pa/Pstd}(Tstd/Ta)\}$

Sampler Calibration Relationship (Linear Regression)

Slope(m): 31.557      Intercept(b): -0.148      Correlation Coefficient(r): 0.9988

Checked by: Magnum Fan

Date: 11/08/2017

High-Volume TSP Sampler  
5-Point Calibration Record

Location : ASR 5  
 Calibrated by : P.F. Yeung  
 Date : 09/10/2017

Sampler

Model : TE-5170  
 Serial Number : S/N 0816

Calibration Orifice and Standard Calibration Relationship

Serial Number : 2454  
 Service Date : 20 March 2017  
 Slope (m) : 2.08464  
 Intercept (b) : -0.036840  
 Correlation Coefficient(r) : 0.99994

Standard Condition

Pstd (hpa) : 1013  
 Tstd (K) : 298.18

Calibration Condition

Pa (hpa) : 1009  
 Ta(K) : 302

Resistance Plate		dH [green liquid] (inch water)	Z	X=Qstd (cubic meter/min)	IC (chart)	Y (corrected)
1	18 holes	10.0	3.135	1.522	54	53.54
2	13 holes	8.0	2.804	1.363	49	48.58
3	10 holes	5.8	2.388	1.163	43	42.63
4	7 holes	3.8	1.933	0.945	38	37.67
5	5 holes	2.5	1.568	0.770	30	29.74

Notes:  $Z = \sqrt{dH(Pa/Pstd)(Tstd/Ta)}$ ,  $X = Z/m - b$ ,  $Y(\text{Corrected Flow}) = IC * \{\sqrt{Pa/Pstd}(Tstd/Ta)\}$

Sampler Calibration Relationship (Linear Regression)

Slope(m): 30.353                      Intercept(b): 7.454                      Correlation Coefficient(r): 0.9947

Checked by: Magnum Fan

Date: 12/10/2017

High-Volume TSP Sampler  
5-Point Calibration Record

Location : ASR10  
 Calibrated by : P.F. Yeung  
 Date : 09/10/2017

Sampler

Model : TE-5170  
 Serial Number : S/N 8162

Calibration Orifice and Standard Calibration Relationship

Serial Number : 2454  
 Service Date : 20 March 2017  
 Slope (m) : 2.08464  
 Intercept (b) : -0.036840  
 Correlation Coefficient(r) : 0.99994

Standard Condition

Pstd (hpa) : 1013  
 Tstd (K) : 298.18

Calibration Condition

Pa (hpa) : 1009  
 Ta(K) : 302

Resistance Plate		dH [green liquid] (inch water)	Z	X=Qstd (cubic meter/min)	IC (chart)	Y (corrected)
1	18 holes	11	3.288	1.595	57	56.51
2	13 holes	8	2.804	1.363	50	49.57
3	10 holes	6	2.428	1.183	44	43.62
4	7 holes	4.2	2.032	0.992	37	36.68
5	5 holes	2.8	1.659	0.813	29	28.75

Notes:  $Z = \sqrt{dH(Pa/Pstd)(Tstd/Ta)}$ ,  $X = Z/m - b$ ,  $Y(\text{Corrected Flow}) = IC * \{\sqrt{Pa/Pstd}(Tstd/Ta)\}$

Sampler Calibration Relationship (Linear Regression)

Slope(m): 35.265                      Intercept(b): 1.089                      Correlation Coefficient(r): 0.9968

Checked by: Magnum Fan

Date: 12/10/17

High-Volume TSP Sampler  
5-Point Calibration Record

Location : AQMS1  
 Calibrated by : P.F. Yeung  
 Date : 09/10/2017

Sampler

Model : TE-5170  
 Serial Number : S/N 1253

Calibration Orifice and Standard Calibration Relationship

Serial Number : 2454  
 Service Date : 20 March 2017  
 Slope (m) : 2.08464  
 Intercept (b) : -0.036840  
 Correlation Coefficient(r) : 0.99994

Standard Condition

Pstd (hpa) : 1013  
 Tstd (K) : 298.18

Calibration Condition

Pa (hpa) : 1009  
 Ta(K) : 302

Resistance Plate		dH [green liquid] (inch water)	Z	X=Qstd (cubic meter/min)	IC (chart)	Y (corrected)
1	18 holes	12.7	3.533	1.712	51	50.56
2	13 holes	9.3	3.023	1.468	45	44.61
3	10 holes	7.6	2.733	1.329	40	39.66
4	7 holes	4.8	2.172	1.060	34	33.71
5	5 holes	3.1	1.746	0.855	28	27.76

Notes:  $Z = \sqrt{dH(Pa/Pstd)(Tstd/Ta)}$ ,  $X = Z/m - b$ ,  $Y(\text{Corrected Flow}) = IC * \{\sqrt{Pa/Pstd}(Tstd/Ta)\}$

Sampler Calibration Relationship (Linear Regression)

Slope(m): 26.496                      Intercept(b): 5.218                      Correlation Coefficient(r): 0.9984

Checked by: Magnum Fan

Date: 12/10/2017



High-Volume TSP Sampler  
5-Point Calibration Record

Location : ASR 1  
 Calibrated by : P.F.Yeung  
 Date : 09/10/2017

Sampler

Model : TE-5170  
 Serial Number : S/N 0146

Calibration Orifice and Standard Calibration Relationship

Serial Number : 2454  
 Service Date : 20 March 2017  
 Slope (m) : 2.08464  
 Intercept (b) : -0.036840  
 Correlation Coefficient(r) : 0.99994

Standard Condition

Pstd (hpa) : 1013  
 Tstd (K) : 298.18

Calibration Condition

Pa (hpa) : 1009  
 Ta(K) : 302

Resistance Plate	dH [green liquid] (inch water)	Z	X=Qstd (cubic meter/min)	IC (chart)	Y (corrected)
1   18 holes	11.7	3.391	1.644	52	51.55
2   13 holes	9.6	3.072	1.491	47	46.60
3   10 holes	6.2	2.469	1.202	42	41.64
4   7 holes	4.2	2.032	0.992	34	33.71
5   5 holes	2.6	1.599	0.785	29	28.75

Notes:  $Z = \sqrt{dH(Pa/Pstd)(Tstd/Ta)}$ ,  $X = Z/m - b$ ,  $Y(\text{Corrected Flow}) = IC * \{\sqrt{Pa/Pstd}(Tstd/Ta)\}$

Sampler Calibration Relationship (Linear Regression)

Slope(m): 26.214                      Intercept(b): 8.393                      correlation Coefficient(r): 0.9937

Checked by: Magnum Fan

Date: 12/10/2017

High-Volume TSP Sampler  
5-Point Calibration Record

Location : ASR 6  
 Calibrated by : P.F. Yeung  
 Date : 09/10/2017

Sampler

Model : TE-5170  
 Serial Number : S/N 3957

Calibration Orifice and Standard Calibration Relationship

Serial Number : 2454  
 Service Date : 20 March 2017  
 Slope (m) : 2.08464  
 Intercept (b) : -0.036840  
 Correlation Coefficient(r) : 0.99994

Standard Condition

Pstd (hpa) : 1013  
 Tstd (K) : 298.18

Calibration Condition

Pa (hpa) : 1009  
 Ta(K) : 302

Resistance Plate		dH [green liquid] (inch water)	Z	X=Qstd (cubic meter/min)	IC (chart)	Y (corrected)
1	18 holes	12.3	3.477	1.686	54	53.54
2	13 holes	9.0	2.974	1.444	48	47.59
3	10 holes	7.0	2.623	1.276	42	41.64
4	7 holes	4.5	2.103	1.027	35	34.70
5	5 holes	2.8	1.659	0.813	27	26.77

Notes:  $Z = \sqrt{dH(Pa/Pstd)(Tstd/Ta)}$ ,  $X = Z/m - b$ ,  $Y(\text{Corrected Flow}) = IC * \{\sqrt{Pa/Pstd}(Tstd/Ta)\}$

Sampler Calibration Relationship (Linear Regression)

Slope(m): 30.676                      Intercept(b): 2.526                      Correlation Coefficient(r): 0.9977

Checked by: Magnum Fan

Date: 12/10/2017



TISCH ENVIRONMENTAL, INC.  
 145 SOUTH MIAMI AVE  
 VILLAGE OF CLEVELAND, OH  
 45002  
 513.467.9000  
 877.263.7610 TOLL FREE  
 513.467.9009 FAX

ORIFICE TRANSFER STANDARD CERTIFICATION WORKSHEET TE-5025A

Date - Mar 20, 2017 Rootsmeter S/N 0438320 Ta (K) - 293  
 Operator Tisch Orifice I.D. - 2454 Pa (mm) - 759.46

PLATE OR Run #	VOLUME START (m3)	VOLUME STOP (m3)	DIFF VOLUME (m3)	DIFF TIME (min)	METER	ORFICE
					DIFF Hg (mm)	DIFF H2O (in.)
1	NA	NA	1.00	1.4390	3.2	2.00
2	NA	NA	1.00	1.0240	6.4	4.00
3	NA	NA	1.00	0.9170	7.9	5.00
4	NA	NA	1.00	0.8730	8.8	5.50
5	NA	NA	1.00	0.7200	12.8	8.00

DATA TABULATION

Vstd	(x axis) Qstd	(y axis)	Va	(x axis) Qa	(y axis)
1.0120	0.7033	1.4257	0.9958	0.6920	0.8784
1.0078	0.9842	2.0163	0.9916	0.9683	1.2423
1.0057	1.0967	2.2543	0.9895	1.0791	1.3889
1.0045	1.1507	2.3643	0.9884	1.1322	1.4567
0.9992	1.3878	2.8514	0.9831	1.3654	1.7568
Qstd slope (m) = 2.08464			Qa slope (m) = 1.30537		
intercept (b) = -0.03684			intercept (b) = -0.02270		
coefficient (r) = 0.99994			coefficient (r) = 0.99994		
y axis = SQRT[H2O(Pa/760) (298/Ta)]			y axis = SQRT[H2O(Ta/Pa)]		

CALCULATIONS

Vstd = Diff. Vol [(Pa-Diff. Hg)/760] (298/Ta)  
 Qstd = Vstd/Time

Va = Diff Vol [(Pa-Diff Hg)/Pa]  
 Qa = Va/Time

For subsequent flow rate calculations:

Qstd = 1/m{ [SQRT(H2O(Pa/760) (298/Ta))] - b}  
 Qa = 1/m{ [SQRT H2O(Ta/Pa)] - b}

**ENVIROTECH SERVICES CO.**

**Calibration Report of Wind Meter**

Date of Calibration : 18 April 2017

Brand of Test Meter: Davis

Model: Vantage Pro 2 ( s/n: AS160104014)

Location : Roof of Tuen Mun Firestation

Procedures :

- 1. Wind Still Test: The wind speed sensor was hold by hand until it keep still
- 2. Wind Speed Test: The wind meter was on-site calibrated against the Anemometer
- 3. Wind Direction Test : The wind meter was on-site calibrated against the marine compass at four directions

Results:

Wind Still Test

Wind Speed (m/s)
0.00

Wind Speed Test

Davis (m/s)	Anemometer (m/s)
0.5	0.6
1.0	1.1
2.1	2.3

Wind Direction Test

Davis (o)	Marine Compass (o)
269	270
359	0
91	90
180	180

Calibrated by: AP

Yeung Ping Fai  
(Technical Officer)

Checked by : Fat

Ho Kam Fat  
(Senior Technical Officer)

**ENVIROTECH SERVICES CO.**

**Calibration Report of Wind Meter**

Date of Calibration : 18 October 2017

Brand of Test Meter: Davis

Model: Vantage Pro 2 ( s/n: AS160104014)

Location : Roof of Tuen Mun Firestation

Procedures :

- 1. Wind Still Test : The wind speed sensor was hold by hand until it keep still
- 2. Wind Speed Test : The wind meter was on-site calibrated against the Anemometer
- 3. Wind Direction Test : The wind meter was on-site calibrated against the marine compass at four directions

Results:

Wind Still Test


Wind Speed (m/s)
0.00


Wind Speed Test

Davis (m/s)	Anemometer (m/s)
0.7	0.8
1.2	1.4
2.5	2.8

Wind Direction Test

Davis (o)	Marine Compass (o)
272	270
1	0
91	90
181	180

Calibrated by:   
Yeung Ping Fai  
(Technical Officer)

Checked by :   
Ho Kam Fat  
(Senior Technical Officer)



輝創工程有限公司

Sun Creation Engineering Limited

Calibration and Testing Laboratory

# Certificate of Calibration 校正證書

Certificate No. : C175727  
證書編號

ITEM TESTED / 送檢項目 (Job No. / 序引編號 : IC17-2277)      Date of Receipt / 收件日期 : 3 October 2017

Description / 儀器名稱 : Anemometer  
Manufacturer / 製造商 : Lutron  
Model No. / 型號 : AM-4201  
Serial No. / 編號 : AF.27513  
Supplied By / 委託者 : Envirotech Services Co.  
Room 113, 1/F, My Loft, 9 Hoi Wing Road, Tuen Mun,  
New Territories, Hong Kong

## TEST CONDITIONS / 測試條件

Temperature / 溫度 : (23 ± 2)°C      Relative Humidity / 相對濕度 : (55 ± 20)%  
Line Voltage / 電壓 : ---

## TEST SPECIFICATIONS / 測試規範


Calibration check


DATE OF TEST / 測試日期 : 13 October 2017

## TEST RESULTS / 測試結果

The results apply to the particular unit-under-test only.  
The results are detailed in the subsequent page(s).

The test equipment used for calibration are traceable to National Standards via :  
- Testo Industrial Services GmbH, Germany

Tested By :   
測試 H C Chan  
Engineer

Certified By :   
核證 K C Lee  
Engineer

Date of Issue : 16 October 2017  
簽發日期

The test equipment used for calibration are traceable to the Nation Standards as specified in this certificate. This certificate shall not be reproduced except in full, without the prior written approval of this laboratory.  
本證書所載校正用之測試器材均可溯源至國際標準。局部複印本證書需先獲本實驗室書面批准。

# Certificate of Calibration

## 校正證書

Certificate No. : C175727

證書編號

1. The unit-under-test (UUT) was allowed to stabilize in the laboratory for over 12 hours before the commencement of the test.
2. The results presented are the mean of 10 measurements at each calibration point.
3. Test equipment :

<u>Equipment ID</u>	<u>Description</u>	<u>Certificate No.</u>
CL386	Multi-function Measuring Instrument	S16493

4. Test procedure : MA130N.

5. Results :

### Air Velocity

Applied Value (m/s)	UUT Reading (m/s)	Measured Correction		
		Value (m/s)	Measurement Uncertainty	
			Expanded Uncertainty (m/s)	Coverage Factor
1.9	1.7	+0.2	0.2	2.0
4.0	3.8	+0.2	0.2	2.0
6.0	5.9	+0.1	0.3	2.0
8.0	8.0	0.0	0.3	2.0
10.0	10.1	-0.1	0.4	2.0

Remarks : - The Measured Corrections are defined as :  
Value = Applied Value - UUT Reading

- The expanded uncertainties are for a level of confidence of 95 %.

### Note :

Only the original copy or the laboratory's certified true copy is valid.

The values given in this Certificate only relate to the values measured at the time of the test and any uncertainties quoted will not include allowance for the equipment long term drift, variations with environment changes, vibration and shock during transportation, overloading, mis-handling, or the capability of any other laboratory to repeat the measurement. Sun Creation Engineering Limited shall not be liable for any loss or damage resulting from the use of the equipment.

The test equipment used for calibration are traceable to the Nation Standards as specified in this certificate. This certificate shall not be reproduced except in full, without the prior written approval of this laboratory.

本證書所載校正用之測試器材均可溯源至國際標準。局部深印本證書需先獲本實驗室書面批准。

Sun Creation Engineering Limited Calibration & Testing Laboratory

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