High-Volume TSP Sampler
5-Point Calibration Record

Location	:	ASR 5
Calibrated by	:	P.F.Yeung
Date	:	10/10/2015

Sampler

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

Calibration Orfice and Standard Calibration Relationship

Serial Number	:	2454
Service Date	:	24 Mar 2015
Slope (m)	:	2.09532
Intercept (b)	:	-0.03812
Correlation Coefficient(r)	:	0.99994

Standard Condition

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

Calibration Condition

Pa (hpa)	:	1014
Ta(K)	:	299

Resistance Plate		dH [green liquid] (inch water)	Z	X=Qstd (cubic meter/min)	IC (chart)	Y (corrected)
1	18 holes	11.8	3.431	1.656	55	54.94
2	13 holes	9.4	3.062	1.480	50	49.94
3	10 holes	7.0	2.643	1.279	44	43.95
4	7 holes	4.8	2.188	1.063	36	35.96
5	5 holes	2.8	1.671	0.816	28	27.97

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

Sampler Calibration Relationship (Linear Regression)

Slope(m):32.462 Intercept(b): 1.692 Correlation Coefficient(r): 0.9990

Checked by: Magnum Fan Date: 16/10/2015

High-Volume TSP Sampler
5-Point Calibration Record

Location	:	ASR10
Calibrated by	:	P.F.Yeung
Date	:	10/10/2015

Sampler

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

Calibration Orfice and Standard Calibration Relationship

Serial Number	:	2454
Service Date	:	24 Mar 2015
Slope (m)	:	2.09532
Intercept (b)	:	-0.03812
Correlation Coefficient(r)	:	0.99994

Standard Condition

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

Calibration Condition

Pa (hpa)	:	1014
Ta(K)	:	299

Resistance Plate		dH [green liquid] (inch water)	Z	X=Qstd (cubic meter/min)	IC (chart)	Y (corrected)
1	18 holes	11.6	3.402	1.642	57	56.93
2	13 holes	9.8	3.127	1.510	52	51.94
3	10 holes	7.6	2.754	1.332	46	45.95
4	7 holes	4.8	2.188	1.063	38	37.96
5	5 holes	2.93	1.710	0.834	30	29.96

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

Sampler Calibration Relationship (Linear Regression)

Slope(m):32.799 Intercept(b): 2.688 Correlation Coefficient(r): 0.9993

Checked by: Magnum Fan Date: 16/10/15

High-Volume TSP Sampler
5-Point Calibration Record

Location	:	AQMS1
Calibrated by	:	P.F.Yeung
Date	:	10/10/2015

Sampler

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

Calibration Orfice and Standard Calibration Relationship

Serial Number	:	2454
Service Date	:	24 Mar 2015
Slope (m)	:	2.09532
Intercept (b)	:	-0.03812
Correlation Coefficient(r)	:	0.99994

Standard Condition

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

Calibration Condition

Pa (hpa)	:	1014
Ta(K)	:	299

Resistance Plate		dH [green liquid] (inch water)	Z	X=Qstd (cubic meter/min)	IC (chart)	Y (corrected)
1	18 holes	11.6	3.402	1.642	53	52.94
2	13 holes	9.2	3.030	1.464	47	46.94
3	10 holes	6.6	2.566	1.243	40	39.95
4	7 holes	4.2	2.047	0.995	32	31.96
5	5 holes	2.9	1.701	0.830	26	25.97

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

Sampler Calibration Relationship (Linear Regression)

Slope(m):32.903 Intercept(b):-1.074 Correlation Coefficient(r): 0.9998

Checked by: Magnum Fan Date: 16/10/2015

High-Volume TSP Sampler
5-Point Calibration Record

Location	:	ASR 1
Calibrated by	:	P.F.Yeung
Date	:	10/10/2015

Sampler

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

Calibration Orfice and Standard Calibration Relationship

Serial Number	:	2454
Service Date	:	24 Mar 2015
Slope (m)	:	2.09532
Intercept (b)	:	-0.03812
Correlation Coefficient(r)	:	0.99994

Standard Condition

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

Calibration Condition

Pa (hpa)	:	1014
Ta(K)	:	299

Resistance Plate		dH [green liquid] (inch water)	Z	X=Qstd (cubic meter/min)	IC (chart)	Y (corrected)
1	18 holes	11.8	3.431	1.656	55	54.94
2	13 holes	9.4	3.062	1.480	50	49.94
3	10 holes	7.0	2.643	1.279	44	43.95
4	7 holes	4.8	2.188	1.063	36	35.96
5	5 holes	2.8	1.671	0.816	28	27.97

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

Sampler Calibration Relationship (Linear Regression)

Slope(m):32.462 Intercept(b): 1.692 Correlation Coefficient(r): 0.9990

Checked by: Magnum Fan Date: 16/10/2015

High-Volume TSP Sampler
5-Point Calibration Record

Location	:	ASR 6
Calibrated by	:	P.F.Yeung
Date	:	10/10/2015

Sampler

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

Calibration Orfice and Standard Calibration Relationship

Serial Number	:	2454
Service Date	:	24 Mar 2015
Slope (m)	:	2.09532
Intercept (b)	:	-0.03812
Correlation Coefficient(r)	:	0.99994

Standard Condition

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

Calibration Condition

Pa (hpa)	:	1014
Ta(K)	:	299

Resistance Plate		dH [green liquid] (inch water)	Z	X=Qstd (cubic meter/min)	IC (chart)	Y (corrected)
1	18 holes	12.0	3.460	1.669	54	53.94
2	13 holes	9.8	3.127	1.510	48	47.94
3	10 holes	7.1	2.661	1.288	41	40.95
4	7 holes	4.5	2.119	1.029	33	32.96
5	5 holes	2.8	1.671	0.816	26	25.97

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

Sampler Calibration Relationship (Linear Regression)

Slope(m):32.335 Intercept(b): -0.477 Correlation Coefficient(r): 0.9995

Checked by: Magnum Fan Date: 16/10/2015

High-Volume TSP Sampler
5-Point Calibration Record

Location	:	ASR 5
Calibrated by	:	P.F.Yeung
Date	:	10/12/2015

Sampler

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

Calibration Orfice and Standard Calibration Relationship

Serial Number	:	2454
Service Date	:	14 Mar 2015
Slope (m)	:	2.09532
Intercept (b)	:	-0.03812
Correlation Coefficient(r)	:	0.99994

Standard Condition

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

Calibration Condition

Pa (hpa)	:	1016
Ta(K)	:	293

Resistance Plate		dH [green liquid] (inch water)	Z	X=Qstd (cubic meter/min)	IC (chart)	Y (corrected)
1	18 holes	11.8	3.469	1.674	56	56.56
2	13 holes	9.7	3.146	1.519	51	51.51
3	10 holes	7.2	2.710	1.312	44	44.44
4	7 holes	4.8	2.213	1.074	37	37.37
5	5 holes	2.8	1.690	0.825	28	28.28

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

Sampler Calibration Relationship (Linear Regression)

Slope(m):32.998 Intercept(b): 1.367 Correlation Coefficient(r): 0.9995

Checked by: Magnum Fan Date: 15/12/2015

High-Volume TSP Sampler
5-Point Calibration Record

Location	:	ASR10
Calibrated by	:	P.F.Yeung
Date	:	10/12/2015

Sampler

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

Calibration Orfice and Standard Calibration Relationship

Serial Number	:	2454
Service Date	:	14 Mar 2015
Slope (m)	:	2.09532
Intercept (b)	:	-0.03812
Correlation Coefficient(r)	:	0.99994

Standard Condition

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

Calibration Condition

Pa (hpa)	:	1016
Ta(K)	:	293

Resistance Plate		dH [green liquid] (inch water)	Z	X=Qstd (cubic meter/min)	IC (chart)	Y (corrected)
1	18 holes	11.8	3.469	1.674	56	56.56
2	13 holes	9.5	3.113	1.504	50	50.50
3	10 holes	6.8	2.634	1.275	44	44.44
4	7 holes	4.5	2.143	1.041	37	37.37
5	5 holes	2.8	1.690	0.825	30	30.30

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

Sampler Calibration Relationship (Linear Regression)

Slope(m):30.331 Intercept(b): 5.505 Correlation Coefficient(r): 0.9992

Checked by: Magnum Fan Date: 15/12/15

High-Volume TSP Sampler
5-Point Calibration Record

Location	:	AQMS1
Calibrated by	:	P.F.Yeung
Date	:	10/12/2015

Sampler

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

Calibration Orfice and Standard Calibration Relationship

Serial Number	:	2454
Service Date	:	14 Mar 2015
Slope (m)	:	2.09532
Intercept (b)	:	-0.03812
Correlation Coefficient(r)	:	0.99994

Standard Condition

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

Calibration Condition

Pa (hpa)	:	1016
Ta(K)	:	293

Resistance Plate		dH [green liquid] (inch water)	Z	X=Qstd (cubic meter/min)	IC (chart)	Y (corrected)
1	18 holes	11.7	3.454	1.667	55	55.55
2	13 holes	9.7	3.146	1.519	50	50.50
3	10 holes	7.2	2.710	1.312	44	44.44
4	7 holes	4.5	2.143	1.041	36	36.36
5	5 holes	2.7	1.660	0.810	28	28.28

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

Sampler Calibration Relationship (Linear Regression)

Slope(m):31.314 Intercept(b):3.263 Correlation Coefficient(r): 0.9994

Checked by: Magnum Fan Date: 15/12/2015

High-Volume TSP Sampler
5-Point Calibration Record

Location	:	ASR 1
Calibrated by	:	P.F.Yeung
Date	:	10/12/2015

Sampler

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

Calibration Orfice and Standard Calibration Relationship

Serial Number	:	2454
Service Date	:	24 Mar 2015
Slope (m)	:	2.09532
Intercept (b)	:	-0.03812
Correlation Coefficient(r)	:	0.99994

Standard Condition

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

Calibration Condition

Pa (hpa)	:	1016
Ta(K)	:	293

Resistance Plate		dH [green liquid] (inch water)	Z	X=Qstd (cubic meter/min)	IC (chart)	Y (corrected)
1	18 holes	11.5	3.425	1.653	55	55.55
2	13 holes	9.0	3.030	1.465	48	48.48
3	10 holes	6.6	2.595	1.257	42	42.42
4	7 holes	4.6	2.166	1.052	34	34.34
5	5 holes	2.8	1.690	0.825	26	26.26

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

Sampler Calibration Relationship (Linear Regression)

Slope(m):35.166 Intercept(b): -2.551 Correlation Coefficient(r): 0.9991

Checked by: Magnum Fan Date: 15/12/2015

High-Volume TSP Sampler
5-Point Calibration Record

Location	:	ASR 6
Calibrated by	:	P.F.Yeung
Date	:	10/12/2015

Sampler

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

Calibration Orfice and Standard Calibration Relationship

Serial Number	:	2454
Service Date	:	24 Mar 2015
Slope (m)	:	2.09532
Intercept (b)	:	-0.03812
Correlation Coefficient(r)	:	0.99994

Standard Condition

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

Calibration Condition

Pa (hpa)	:	1016
Ta(K)	:	293

Resistance Plate		dH [green liquid] (inch water)	Z	X=Qstd (cubic meter/min)	IC (chart)	Y (corrected)
1	18 holes	12.2	3.528	1.702	54	54.54
2	13 holes	9.2	3.063	1.480	48	48.48
3	10 holes	6.7	2.614	1.266	41	41.41
4	7 holes	4.4	2.119	1.029	34	34.34
5	5 holes	2.6	1.629	0.795	27	27.27

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

Sampler Calibration Relationship (Linear Regression)

Slope(m):30.338 Intercept(b): 3.148 Correlation Coefficient(r): 0.9997

Checked by: Magnum Fan Date: 15/12/2015

ENVIROTECH SERVICES CO.

Calibration Report of Wind Meter

Date of Calibration : 29 June 2015

Brand of Test Meter: Davis

Model: Weather Wizard III (s/n: WE90911A30)

Location : ASR5

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)	Anemomete (m/s)
1.9	1.8
2.4	2.2
2.9	3.1

Wind Direction Test

Davis (o)	Marine Compass (o)
269	270
1	0
88	90
181	180

Calibrated by: Fai

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 : 10 November 2015

Brand of Test Meter: Davis

Model: Weather Wizard III (s/n: WE90911A30)

Location : ASR5

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)	Anemomete (m/s)
1.6	1.4
2.1	2.5
2.5	2.9

Wind Direction Test

Davis (o)	Marine Compass (o)
271	270
2	0
91	90
179	180

Calibrated by: Fai

Yeung Ping Fai
(Technical Officer)

Checked by : FAT

Ho Kam Fat
(Senior Technical Officer)

TISCH ENVIRONMENTAL, INC.
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VILLAGE OF CLEVES, OH
45002
513.467.9000
877.263.7610 TOLL FREE
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ORIFICE TRANSFER STANDARD CERTIFICATION WORKSHEET TE-5025A

Date - Mar 24, 2015 Rootsmeter S/N 0438320 Ta (K) - 292
Operator Tisch Orifice I.D. - 2454 Pa (mm) - 756.92

PLATE OR Run #	VOLUME START (m3)	VOLUME STOP (m3)	DIFF VOLUME (m3)	DIFF TIME (min)	METER DIFF Hg (mm)	ORFICE DIFF H2O (in.)
1	NA	NA	1.00	1.4460	3.2	2.00
2	NA	NA	1.00	1.0300	6.4	4.00
3	NA	NA	1.00	0.9180	7.9	5.00
4	NA	NA	1.00	0.8780	8.7	5.50
5	NA	NA	1.00	0.7240	12.6	8.00

DATA TABULATION

Vstd	(x axis) Qstd	(y axis)		Va	(x axis) Qa	(y axis)
1.0121	0.6999	1.4258		0.9958	0.6886	0.8784
1.0078	0.9785	2.0163		0.9916	0.9627	1.2422
1.0057	1.0955	2.2543		0.9895	1.0779	1.3888
1.0047	1.1443	2.3644		0.9885	1.1258	1.4566
0.9994	1.3805	2.8515		0.9833	1.3582	1.7568
Qstd slope (m) =		2.09532		Qa slope (m) =		1.31205
intercept (b) =		-0.03812		intercept (b) =		-0.02349
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}

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. : C153422
證書編號

ITEM TESTED / 送檢項目 (Job No. / 序引編號 : IC15-1330) Date of Receipt / 收件日期 : 10 June 2015

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.
Shop 6, G/F., Casio Mansion, 209 Shaukeiwan Road,
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 : 23 June 2015

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 : C F Leung
Project Engineer

Certified By 核證 : H C Chan
Engineer

Date of Issue 簽發日期 : 23 June 2015

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. : C153422
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 :

Equipment ID	Description	Certificate No.
CL386	Multi-function Measuring Instrument	S12109

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	1.8	+0.1	0.2	2.0
4.0	3.9	+0.1	0.2	2.0
6.0	6.0	0.0	0.3	2.0
8.0	8.1	-0.1	0.3	2.0
10.0	10.3	-0.3	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 :
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.

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