Annex A1

Calibration Certificates for Dust Monitoring Equipment



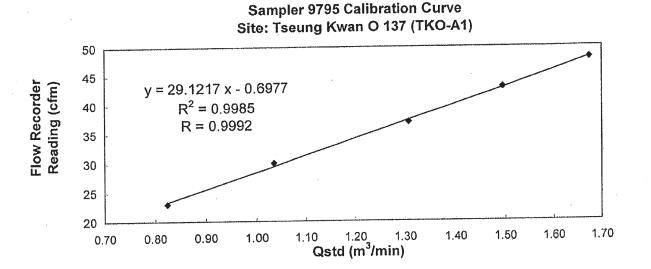
8/F Block B. Veristrong Industrial Centre, 34-36 Au Pui Wan Street, Fo Tan, Hong Kong

T: +852 2695 8318 F: +852 2695 3944 E: etl@ets-testconsult.com W: www.ets-testconsult.com

# <u>Calibration Report</u> of <u>High Volume Air Sampler</u>

Manufacturer	:	Graseby 105	Date of Calibra	tion	: <u>16 Ma</u>	y 2017	August
Serial No.	:	9795 (ET/EA/003/18)	Calibration Due	e Date	: <u>15 Jul</u>	y 2017	
Method	:	Five-point calibration by using standa Operations Manual	ard calibration kit	Tisch TE-{	5025A refe	r to the	
Desults		Flow recorder reading (cfm)	48	43	37	30	23
Results	•	34 + >	1.67	1 /0	1.31	1.03	0.82

Qstd (Actual flow rate,	m³/min)		1.67	1.49	1.31	1.03	0.82
Pressure :	759.06	mm Hg		Temp. :	299	к	



Acceptance Criteria : Correlation coefficient (r) of the calibration curve greater than 0.990 after a 5-point calibration

The high volume sampler complies\* / does not comply\* with the specified requirements and is deemed acceptable\*/ unacceptable\* for use.

Calibrated by :	Mak Kei War	
	MAK, Kei Wai	
	(Assistant Supervisor)	

Checked by

LAW, Sau Yee (Senior Environmental Officer)



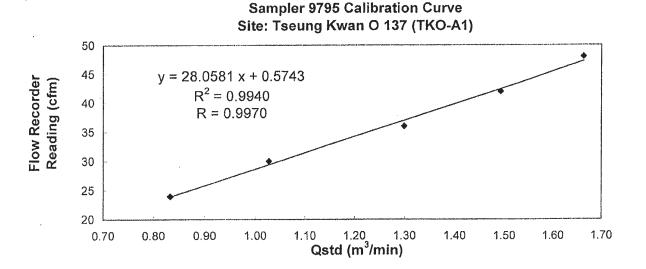
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# Calibration Report of High Volume Air Sampler

Manufacturer	:	Graseby 105	Date of Calibration	:	<u>14 Jul</u>	y 2017	
Serial No.	:	9795 (ET/EA/003/18)	Calibration Due Date	:	13 Se	ptember 20	)17
Method	:	Five-point calibration by using star Operations Manual	dard calibration kit Tisch Tl	E-50	25A refe	r to the	
Results	:	Flow recorder reading (cfm)	48 42		36	30	24

:	Flow recorder rea	ading (cfm)		48	42	36	30	24
	Qstd (Actual flow	rate, m³/min)		1.66	1.49	1.30	1.03	0.83
	Pressure :	756.06	mm Hg		Temp. :	302	к	



Acceptance Criteria : Correlation coefficient (r) of the calibration curve greater than 0.990 after a 5-point calibration

The high volume sampler complies\* / does not comply\* with the specified requirements and is deemed acceptable\*/ unacceptable\* for use.

Calibrated by :

KWAN, King Ming (Assistant Supervisor)

Checked by

LAW, Sau Yee (Senior Environmental Officer)



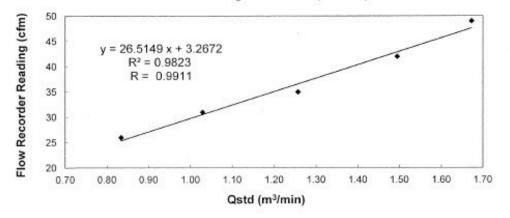


# Calibration Report of

#### High Volume Air Sampler

Manufacturer	1	Graseby 105	Date of Calibr	ation	; 11 Se	ptember 20	)17
Serial No.		9795 (ET/EA/003/18)	Calibration Due Date		: 10 November 2017		
Method		Five-point calibration by using stand Operations Manual	ard calibration kit	Tisch TE-	5025A refe	r to the	
Results		Flow recorder reading (cfm)	49	42	35	31	26
		Qstd (Actual flow rate, m <sup>3</sup> /min)	1.67	1.49	1.26	1.03	0.83
		Pressure : 763.56 mr	n Hg	Temp. :	304	к	

#### Sampler 9795 Calibration Curve Site: Tseung Kwan O 137 (TKO-A1)



Acceptance Criteria : Correlation coefficient (r) of the calibration curve greater than 0.990 after a 5-point calibration

The high volume sampler complies\* / does not comply\* with the specified requirements and is deemed acceptable\*/ unacceptable\* for use.

Calibrated by :	Make this Was
	MAK, Kei Wai
	(Assistant Supervisor)

Checked by LAW, Sau Yee

(Senior Environmental Officer)





Qstd (Actual flow rate, m3/min)

Pressure

6/F Block B, Ventering Industrial Center, 3d 38 Au Pul Wan Street, 15 Tax, Hong Kong T +052 2005 6016 P +952 2005 3944 S +0524 2005 3944 W www.eta-bastomault.com

0.82

Calibration Report of

### High Volume Air Sampler

Manufacturer	4	Graseby 105	Date of Calibration	1	10 No	vember 20	17
Serial No.	;	9795 (ET/EA/003/18)	Calibration Due Da	ate :	09 Jar	uary 2018	
Method	1	Five-point calibration by using sta Operations Manual	undard calibration kit Tisc	h TE-50	25A refe	r to the	
Results		Flow recorder reading (cfm)	49	42	35	31	26
							-

762.06 mm Hg

Sampler 9795 Calibration Curv	/e
Site: Tseung Kwan O 137 (TKO-	A1)

1.68

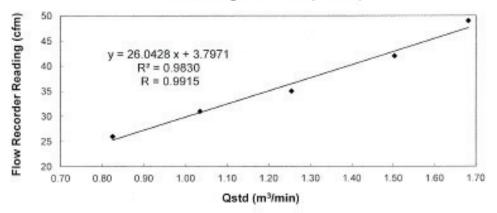
1.50

Temp.

1.25

300 K

1.03



Acceptance Criteria: Correlation coefficient (r) of the calibration curve greater than 0.990 after a 5-point calibration

The high volume sampler complies" / does not comply" with the specified requirements and is deemed acceptable"/ unacceptable" for use.

Calibrated by : CHAN, Wai Man (Technician)

Checked by LAW, Sau Yee

(Senior Environmental Officer)



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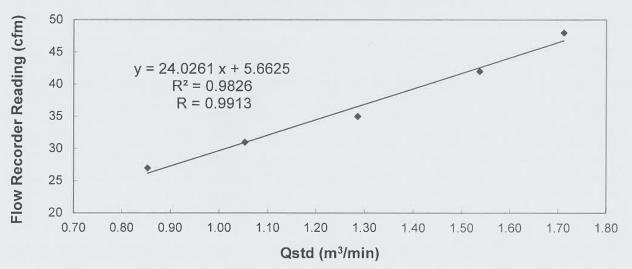
8/F Block B, Veristrong Industrial Centre, 34-36 Au Pui Wan Street, Fo Tan, Hong Kong

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# Calibration Report of High Volume Air Sampler

Manufacturer	:	Graseby 105	Date of Calibra	ation	. 08	January 2018		
Serial No.	*) *:	9795 (ET/EA/003/18)	Calibration Due Date		07	07 March 2018		
Method	ŝ	Five-point calibration by using standard of Operations Manual	calibration kit	Tisch TE-5	5025A re	efer to the		
Results	5	Flow recorder reading (cfm)	48	42	35	31	27	
		Qstd (Actual flow rate, m <sup>3</sup> /min)	1.71	1.54	1.29	1.05	0.85	
		Pressure 762.81 mm Hg	3	Temp. :	290	ĸ		





Acceptance Criteria: Correlation coefficient (r) of the calibration curve greater than 0.990 after a 5-point calibration

The high volume sampler complies\* / does not comply\* with the specified requirements and is deemed acceptable\*/ unacceptable\* for use.

Calibrated by MAK, Kei Wai

MAK, Kei Wai (Assistant Supervisor) Checked by

LAU, Chi Leung (Environmental Team Leader)



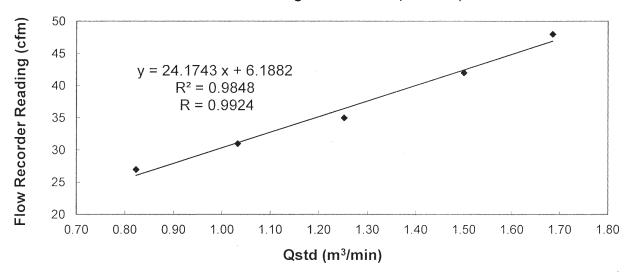
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# **Calibration Report** of **High Volume Air Sampler**

Manufacturer	:	Graseby 105	Date of Calibration	ation	;	05 Ma	arch 2018	
Serial No.	:	9795 (ET/EA/003/18)	Calibration Du	e Date	•	04 Ma	ay 2018	
Method	•	Five-point calibration by using standar Operations Manual	rd calibration kit	Tisch TE-5	502	5A refe	er to the	
Results	:	Flow recorder reading (cfm)	48	42		35	31	27
		Qstd (Actual flow rate, m <sup>3</sup> /min)	1.68	1.50		1.25	1.03	0.82
		Pressure : 763.56 mm	Hg	Temp. :		302	K	





Acceptance Criteria: Correlation coefficient (r) of the calibration curve greater than 0.990 after a 5-point calibration

The high volume sampler complies\* / does not comply\* with the specified requirements and is deemed acceptable\*/ unacceptable\* for use.

Calibrated by :	Mak Kei	War
	MAK, Kei Wai	

(Assistant Supervisor)

Checked by

LAU, Chi Leung (Environmental Team Leader)



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301

Κ

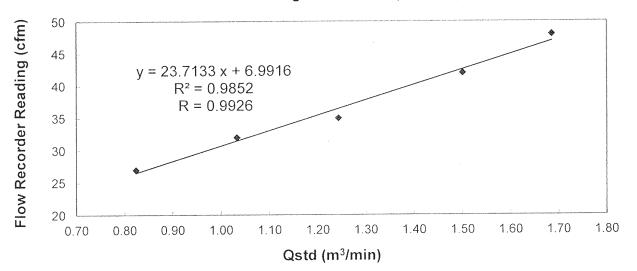
Temp. :

# Calibration Report of High Volume Air Sampler

Manufacturer	:	Graseby 105	Date of Calibra	ition	: <u>02 Ma</u>	ay 2018	
Serial No.	:	9795 (ET/EA/003/18)	Calibration Due	e Date	: <u>01 Ju</u>	y 2018	
Method	:	Five-point calibration by using standard Operations Manual	calibration kit	Tisch TE-5	025A refe	er to the	
Results	:	Flow recorder reading (cfm)	48	42	35	32	27
		Qstd (Actual flow rate, m <sup>3</sup> /min)	1.69	1.50	1.24	1.03	0.82

762.06 mm Hg

## Sampler 9795 Calibration Curve Site: Tseung Kwan O 137 (TKO-A1)



Acceptance Criteria : Correlation coefficient (r) of the calibration curve greater than 0.990 after a 5-point calibration

The high volume sampler complies\* / does not comply\* with the specified requirements and is deemed acceptable\*/ unacceptable\* for use.

Calibrated by CHAN, Wai Man (Technician)

Pressure :

Checked by

LĂU, Chi Leung (Environmental Team Leader)



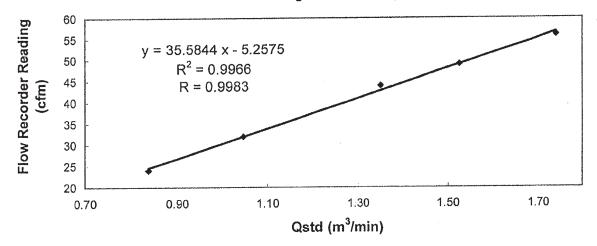
8/F Block B, Veristrong Industrial Centre, 34-36 Au Pul Wan Street, Fo Tan, Hong Kong

T: +852 2695 8318 F: +852 2695 3944 E: etl@ets-testconsult.com W: www.ets-testconsult.com

## <u>Calibration Report</u> of High Volume Air Sampler

Manufacturer	:	Andersen G1051	Date of Calib	oration	; .	16 Ma	ay 2017		
Serial No.	:	1176 (ET/EA/003/05)	Calibration D	ue Date	: .	15 Ju	ly 2017		
Method	;	Based on Operations Manual for the 5-point calibration using standard calibration kit manufactured by Tisch TE-5025 A							
Results	:	Flow recorder reading (cfm)	56	49		44	32	24	
		Qstd (Actual flow rate, m <sup>3</sup> /min)	1.74	1.52	1	.35	1.05	0.84	
		Pressure : 759.06 mm	Hg	Temp. :	2	299	К		

Sampler 1176 Calibration Curve Site: Tseung Kwan O 137 (TKO-A2a)



Acceptance Criteria : Correlation coefficient (r) of the calibration curve greater than 0.990 after a 5-point calibration

The high volume sampler complies\* / does not comply\* with the specified requirements and is deemed acceptable\* / unacceptable \* for use.

Calibrated by : <u>Muke Yui Wai</u> MAK, Kei Wai (Assistant Supervisor)

Checked by LAW, Sau Yee

(Senior Environmental Officer)



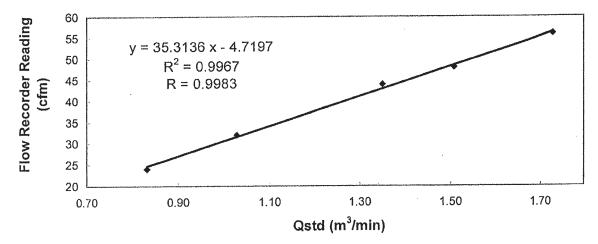
8/F Block B, Veristrong Industrial Centre, 34-36 Au Pul Wan Street, Fo Tan, Hong Kong

T: +852 2695 8318 F: +852 2695 3944 E: eti@ets-testconsult.com www.ets-testconsult.com

# **Calibration Report** of **High Volume Air Sampler**

Manufacturer	:	Andersen G1051	Date of Calib	oration	: <u>14 Ju</u>	ly 2017					
Serial No.	:	1176 (ET/EA/003/05)	Calibration E	ue Date	: <u>13 Se</u>	ptember 20	017				
Method	:	Based on Operations Manual for the 5- manufactured by Tisch TE-5025 A	point calibrati	on using sta	andard ca	libration kit					
Results	:	Flow recorder reading (cfm)	56	48	44	32	24				
		Qstd (Actual flow rate, m <sup>3</sup> /min)	1.73	1.51	1.35	1.03	0.83				
		Pressure : 756.06 mm	Hg	Temp. :	302	К					

Sampler 1176 Calibration Curve Site: Tseung Kwan O 137 (TKO-A2a)



Acceptance Criteria : Correlation coefficient (r) of the calibration curve greater than 0.990 after a 5-point calibration

The high volume sampler complies\* / does not comply\* with the specified requirements and is deemed acceptable\* / unacceptable \* for use.

Calibrated by :

KWAN, King Ming (Assistant Supervisor)

Pressure :

Checked by LAW, Sau Yee

(Senior Environmental Officer)



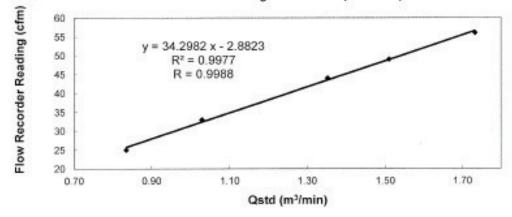


6/F Block B, Werbtong Instantial Contex, 34 dB A. Pal Wan Street, Po Tan, Hong Kong T +852 2008 3846 F1 +852 2008 3846 E: objgeta-testcomail.com W: swared-testcomail.com

### Calibration Report of High Volume Air Sampler

Manufacturer		Andersen G1051	Date of Calif	oration	11 Se	eptember 20	017
Serial No.		1176 (ET/EA/003/05)	Calibration I	ue Date	10 N	ovember 2	017
Method		Based on Operations Manual for the manufactured by Tisch TE-5025 A	a 5-point calibrat	ion using sta	andard ca	libration kit	
Results	1	Flow recorder reading (cfm)	56	49	44	33	25
1 YE W WITH W					1.35	1.03	0.00
		Qstd (Actual flow rate, m <sup>3</sup> /min)	1.73	1.51	1.30	1,03	0.83





Acceptance Criteria : Correlation coefficient (r) of the calibration curve greater than 0.990 after a 5-point calibration

The high volume sampler complies" / does not comply\* with the specified requirements and is deemed acceptable" / unacceptable " for use.

Calibrated by : <u>Mak Tei Wai</u> MAK, Kei Wai (Assistant Supervisor)

Checked by LAW, Sau Yee (Senior Environmental Officer)



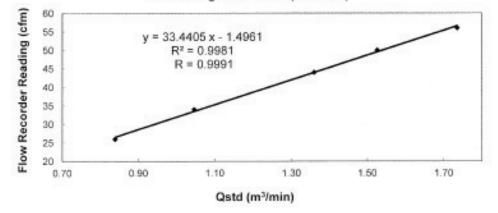


# Calibration Report of

#### High Volume Air Sampler

Manufacturer	÷	Andersen G1051	Date of Calif	bration	: 10	November 20	017
Serial No.	:	1176 (ET/EA/003/06)	Calibration E	Oue Date	: 09	January 2018	3
Method	1	Based on Operations Manual for the manufactured by Tisch TE-5025 A	5-point calibrati	ion using st	andard	calibration kit	
Results	1	Flow recorder reading (cfm)	56	50	44	34	26
		Qstd (Actual flow rate, m <sup>3</sup> /min)	1.73	1.53	1.3	1.05	0.84
		Pressure : 762.06 m	m Hg	Temp. :	300	к	

#### Sampler 1176 Calibration Curve Site: Tseung Kwan O 137 (TKO-A2a)



Acceptance Criteria : Correlation coefficient (r) of the calibration curve greater than 0.990 after a 5-point calibration

The high volume sampler complies" / does not comply" with the specified requirements and is deemed acceptable " / unacceptable " for use.

Calibrated by : CHAN, Wai Man (Technician)

Checked by LAW, Sau Yee

(Senior Environmental Officer)



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8/F Block B, Veristrong Industrial Centre, 34-36 Au Pui Wan Street, Fo Tan, Hong Kong

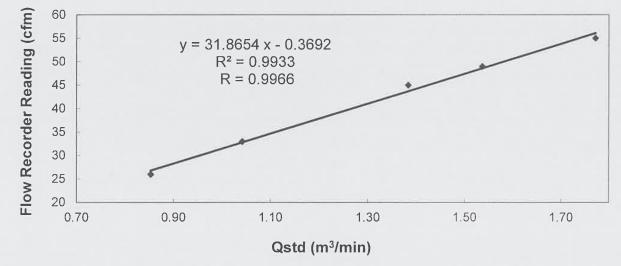
T: +852 2695 8318 F: +852 2695 3944 E: eti@ets-testconsult.com W: www.ets-testconsult.com

# **Calibration Report** of **High Volume Air Sampler**

Manufacturer	3	Andersen G1051	Date of Calibration 08 January 2018				
Serial No.	3	1176 (ET/EA/003/05)	Calibration D	ue Date	07 M	arch 2018	
Method	;	Based on Operations Manual for the 5-p manufactured by Tisch TE-5025 A	oint calibratio	on using sta	andard ca	alibration kit	
Results	4	Flow recorder reading (cfm)	55	49	45	33	26
		Qstd (Actual flow rate, m <sup>3</sup> /min)	1.77	1.54	1.38	1.04	0.85
		Pressure: 762.81 mm H	q	Temp	290	К	

Sampler 1176 Calibration Curve Site: Tseung Kwan O 137 (TKO-A2a)

762.81 mm Hg



Acceptance Criteria: Correlation coefficient (r) of the calibration curve greater than 0.990 after a 5-point calibration

The high volume sampler complies\* / does not comply\* with the specified requirements and is deemed acceptable\* / unacceptable \* for use.

Calibrated by : TILas MAK, Kei Wai (Assistant Supervisor)

Pressure :

Checked by

Temp.

LAU, Chi Leung (Environmental Team Leader)



8/F Block B, Veristrong Industrial Centre, 34-36 Au Pui Wan Street, Fo Tan, Hong Kong

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# Calibration Report of High Volume Air Sampler

Manufacturer	:	Andersen G1051	Date of Calibr	ation	:	05 Ma	rch 2018	
Serial No.	:	1176 (ET/EA/003/05)	Calibration Du	ie Date	:	<u>04 Ma</u>	y 2018	
Method		Based on Operations Manual for the smanufactured by Tisch TE-5025 A	5-point calibratio	n using st	anc	lard cali	ibration kit	
Results	:	Flow recorder reading (cfm)	56	50		44	35	27
		Qstd (Actual flow rate, m <sup>3</sup> /min)	1.73	1.53		1.35	1.03	0.84

763.56 mm Hg

Temp. :

302

Κ

Sampler 1176 Calibration Curve Site: Tseung Kwan O 137 (TKO-A2a) Flow Recorder Reading (cfm) 60 55 y = 31.8774 x + 1.109050  $R^2 = 0.9969$ R = 0.998445 40 35 30 25 20 0.70 0.90 1.10 1.30 1.50 1.70 Qstd (m<sup>3</sup>/min)

Acceptance Criteria : Correlation coefficient (r) of the calibration curve greater than 0.990 after a 5-point calibration

The high volume sampler complies\* / does not comply\* with the specified requirements and is deemed acceptable\* / unacceptable \* for use.

Calibrated by : Muk Her MAK, Kei Wai (Assistant Supervisor)

Pressure

Checked by LAU, Chi Leung

(Environmental Team Leader)



# 東業德勤測試顧問有限公司 ETS-TESTCONSULT LTD.

8/F Block B, Veristrong Industrial Centre, 34-36 Au Pui Wan Street, Fo Tan, Hong Kong

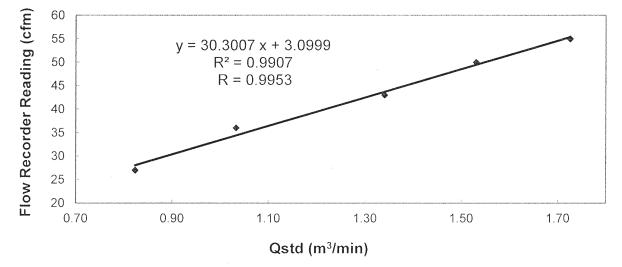
T: +852 2695 8318 F: +852 2695 3944 E: etl@ets-testconsult.com W: www.ets-testconsult.com

# <u>Calibration Report</u> of

High Volume Air Sampler

Manufacturer	:	Andersen G1051	Date of Calil	oration	:	02 May 2018		
Serial No.	:	1176 (ET/EA/003/05)	Calibration E	Due Date	:	01 Ju	ıly 2018	
Method		Based on Operations Manual for the 5-po manufactured by Tisch TE-5025 A	oint calibrati	on using st	and	lard ca	libration kit	
Results	:	Flow recorder reading (cfm) Qstd (Actual flow rate, m <sup>3</sup> /min)	55	50 1.53		43 1.34	36	27 0.82
		Pressure : 762.06 mm Hg		Temp. :	l	301	K	0.02

Sampler 1176 Calibration Curve Site: Tseung Kwan O 137 (TKO-A2a)



Acceptance Criteria : Correlation coefficient (r) of the calibration curve greater than 0.990 after a 5-point calibration

The high volume sampler complies\* / does not comply\* with the specified requirements and is deemed acceptable\* / unacceptable \* for use.

Calibrated by :

CHAN, Wai Man (Technician)

Checked by LAU, Chi Leung

LAU, Chi Leung (Environmental Team Leader)

ET/EA/004/14

8.00



NA

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

#### ORIFICE TRANSFER STANDARD CERTIFICATION WORKSHEET TE-5025A Date - Apr 03, 2017 Rootsmeter S/N 0438320 Ta (K) -295 Operator Tisch Orifice I.D. -3297 Pa (mm) -748.03 METER ORFICE PLATE VOLUME VOLUME DIFF DIFF DIFF DIFF OR START STOP VOLUME TIME Hg H2O Run # (m3) (m3) (m3) (min) (mm) (in.) ------. ... ... ... ... -------------------1 NA NA 1.00 1.4360 3.2 2.00 2 NA 1.00 NA 1.0230 6.4 4.00 3 NA NA 1.00 0.9170 7.9 5.00 4 NA NA 1.00 0.8720 8.8 5.50 5

#### DATA TABULATION

1.00

0.7180

12.7

NA

Vstd	(x axis) Qstd	(y axis)		Va	(x axis) Qa	(y axis)
0.9900 0.9858 0.9837 0.9825 0.9773	0.6894 0.9636 1.0727 1.1268 1.3612	1.4101 1.9943 2.2296 2.3385 2.8203		0.9957 0.9915 0.9893 0.9882 0.9830	0.6934 0.9692 1.0789 1.1333 1.3691	0.8881 1.2560 1.4042 1.4728 1.7762
Qstd slop intercept coefficie	(b) =	2.10166 -0.03302 0.99984	ner	Qa slope intercept coefficie	c (b) =	1.31603 -0.02080 0.99984
y axis =	SQRT [H2O (H	Pa/760) (298/5	[a)]	'y axis =	SQRT [H20 (1	[a/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:

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

Envir	and a state of the	_	a I		Cal	[ libra	D	ALIBRATION OUE DATE: ch 21, 2019
			Calibration (	·	on Informat	ion		
Cal. Date: Operator:	March 21, Jim Tisch	2018		neter S/N:		Ta: 2 Pa: 2		°K mm Hg
Calibration	Model #:	TE-5025A	Calib	orator S/N:	3480			
	Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	∆Time (min)	ΔP (mm Hg)	ΔH (in H2O)	]
	1	1	2	1	1.4200	3.2	2.00	
	2	3	4	1	1.0000	6.4	4.00	]
	3	5	6	1	0.8950	7.9	5.00	-
	4	7	8	1	0.8570	8.8	5.50	-4
	5	9	10	1	0.7070	12.7	8.00	4
			D	ata Tabula	tion			
	Vstd	Qstd	$\sqrt{\Delta H \left(\frac{Pa}{Pstd}\right)}$	)( <u>Tstd</u> ) Ta)		Qa 1	ΔH(Ta/Pa)	
	(m3)	(x-axis)	(y-axi	s)	Va	(x-axis)	(y-axis)	
	1.0087	0.7103	1.423	33	0.9958	0.7012	0.8799	
	1.0044	1.0044	2.012		0.9915	0.9915	1.2443	4
	1.0024	1.1200	2.250		0.9896	1.1057	1.3912	-
	1.0012 0.9959	1.1682	2.360		0.9884	1.1533	1.4591	4
	0.9959	1.4087 m=	2.846		0.9652		1.7598 <b>1.27812</b>	
	QSTD	b=	-0.030		QA	b=	-0.01879	
	Q010	r=	0.999			r=	0.99994	
	[		*****	Calculatio	t			1
	Vstd=		/Pstd)(Tstd/Ta			ΔVol((Pa-ΔP)	/Pa)	-
		Vstd/ATime	,	·,		Va/ΔTime	,,	-
	l		For subsequ	ent flow ra			an a	1
	Qstd=	$1/m \left( \sqrt{\Delta H} \right)$	Pa <u>(Tstd</u> Pstd Ta	)-b)	Qa=	//	Ta/Pa))-b)	
	Standard	Conditions						
Tstd	1			[		RECAL	BRATION	
Pstd		mm Hg			US EPA reco	mmends and	nual recalibratio	on per 1998
All calibrat		(ey er reading (i	H20)				egulations Part	
		eter reading (in					Reference Meth	
Ta: actual a	osolute tem	perature (°K)					nded Particulat	
Pa: actual b	arometric pr	essure (mm	Hg)			•	e, 9.2.17, page	
b: intercept							,	
m: slope				L				

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