

Appendix C Calibration Certificates of Monitoring Equipment



RECALIBRATION DUE DATE: February 13, 2019

Environmental Certificate of Calibration

		Calibration	Certificatio	on Informat	ion		
February 1	3, 2018	Roots	meter S/N:	438320	Ta:	293	°К
Jim Tisch				Pa:	763.3	mm Hg	
Model #:	TE-5025A	Calil	prator S/N:	1612			
	Vol. Init	Vol. Final	ΔVol.	ΔTime	ΔP	ΔH	
Run	(m3)	(m3)	(m3)	(min)	(mm Hg)	(in H2O)	
1	1	2	1	1.3970	3.2	2.00	
2	3	4	1	1.0000	6.3	4.00	
3	5	6	1	0.8900	7.9	5.00	
4	7	8	1	0.8440	8.7	5.50	
5	9	10	1	0.7010	12.6	8.00	
		[Data Tabula	tion]
Vstd	Qstd	$\sqrt{\Delta H \left(\frac{Pa}{Pstd}\right)}$)(<u>Tstd</u>)		Qa	$\sqrt{\Delta H (Ta/Pa)}$	
(m3)	(x-axis)	(y-ax	(is)	Va	(x-axis)	(y-axis)	
1.0172	0.7281	1.42	93	0.9958	0.7128	0.8762]
1.0130	1.0130	2.02	13	0.9917	0.9917	1.2392	
1.0109	1.1358	2.25	99	0.9896	1.1120	1.3854]
1.0098	1.1964	2.37	02	0.9886	1.1713	1.4530	
1.0046	1.4331	2.85	86	0.9835	1.4030	1.7524	
	m=	2.020)17		m=	1.26500	
	b=	-0.03	691	QA	b=	-0.02263	
	r=	0.999	988		r=	0.99988]
			Calculatio	ns			
Vstd=	ΔVol((Pa-ΔP)/Pstd)(Tstd/T	a)	Va= ΔVol((Pa-ΔP)/Pa)			4
Qstd=	Vstd/∆Time			Qa= Va/∆Time			-
		For subsequ	uent flow ra	te calculatio	ns:		4
Qstd= $1/m \left(\sqrt{\Delta H \left(\frac{Pa}{Pstd} \right) \left(\frac{Tstd}{Ta} \right)} \right)$			-))-b)	Qa=	$1/m\left(\sqrt{\Delta H}\right)$	H(Ta/Pa))-b)	
Standard	Conditions						
298.15	°K				RECA	LIBRATION	
760	mm Hg				o no no cur de -	nnual rosalibrati	00 00 100
	Key	(10.0)		US EPA rec	ommenas a	nnual recalibrati	on per 199
or manome	ter reading (In H2O)		40 Code	or Federal	Regulations Part	50 to 51,
eter manom	eter reading	(mm Hg)		Appendix	в to Part 50	, keterence Met	nod for the
aromotric n	ressure (mm	<u>)</u> На)		Determina	tion of Susp	ended Particula	te Matter i
Pa: actual barometric pressure (mm Hg)			4	l th	ne Atmosph	ere, 9.2.17, page	30
-			1	1			
	February 1 Jim Tisch Model #: Run 1 2 3 4 5 Vstd (m3) 1.0172 1.0130 1.0172 1.0130 1.0172 1.0130 1.0098 1.0046 QSTD Vstd= Qstd= Qstd= Standard 298.15 760 Cor manome eter manome bsolute tem arometric p	February 13, 2018 Jim Tisch Model #: TE-5025A Vol. Init (m3) 1 1 2 3 3 5 4 7 5 9 Vstd Qstd (m3) (x-axis) 1.0172 0.7281 1.0130 1.0130 1.0109 1.1358 1.0098 1.1964 1.0046 1.4331 Metage Vstd= $\Delta Vol((Pa-\Delta P)$ Qstd= $1/m ((\sqrt{\Delta H})$ Standard Conditions 298.15 °K Tom meter reading (eter manometer reading ter manom	CalibrationFebruary 13, 2018RootsJim TischModel #:TE-5025ACalilModel #:TE-5025ACalil2343564785910VstdQstd $\sqrt{\Delta H} \left(\frac{Pa}{Pstc} \right)$ (m3)(x-axis)(y-axis)(m3)(x-axis)(y-axis)1.01720.72811.421.01091.13582.251.00981.19642.371.00461.43312.85m= 2.020b= -0.03r= 0.999Vstd= $\Delta Vol((Pa-\Delta P)/Pstd)(Tstd/T)$ Qstd= $\Delta Vol((Pa-\Delta P)/Pstd)(Tstd/T)$ Qstd= $\Delta Vol((Pa-\Delta P)/Pstd)(Tstd/T)$ Qstd= $1/m ((\sqrt{\Delta H} (\frac{Pa}{Pstd}) (\frac{Tstd}{Ta}))$ Standard Conditions298.15 °K298.15 °K298.15 °K298.15 °KTo manometer reading (in H2O)teter manometer reading (mm Hg)bolute temperature (°K)arometric pressure (mm Hg)	Calibration Certification February 13, 2018 Rootsmeter S/N: Jim Tisch Model #: TE-5025A Calibrator S/N: Model #: TE-5025A Calibrator S/N: Image: Colspan="2">Calibrator S/N: Model #: TE-5025A Calibrator S/N: Image: Colspan="2">Colspan="2">Calibrator S/N: Image: Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2"Colspa="2"Colspa="2"Colspan="2"Colspan="2"Colspan="2"Colspan="2"Colsp	Calibration Certification Informat February 13, 2018 Rootsmeter S/N: 438320 Jim Tisch Model #: TE-5025A Calibrator S/N: 1612 Image: Colspan="2">Vol. Init Vol. Final AVol. ATime (min) Image: Colspan="2">A Calibrator S/N: 1612 Image: Colspan="2">Vol. Init Vol. Final AVol. ATime (min) Image: Colspan="2">Image: Colspan="2">AVol. ATime (min) Image: Colspan="2">Image: Colspan="2">A Calibrator S/N: 1612 Image: Colspan="2">Testor S/N: 1612 Colspan="2">Atom (min) Image: Colspan="2">Image: Colspan="2">Atom (min) Image: Colspan="2">Testor (Table (Colspan="2") Vstd Qstd $\sqrt{\Delta H \begin{pmatrix} Pa \\ Pstd \end{pmatrix} \begin{pmatrix}$	Calibration Certification Information February 13, 2018 Rootsmeter S/N: 438320 Ta: Jim Tisch Pa: Model #: TE-5025A Calibrator S/N: 1612 Im Tisch A Quarter S/N: 1612 Calibrator S/N: 1612 Model #: TE-5025A Calibrator S/N: 1612 Quarter S/N: 1612 Quarter S/N: 1612 Calibrator S/N: 1612 Quarter S/N: 1612 Data Tabulation Quarter S/N: 1612 Qata Tabulation Vstd Qata Value (Mm Hg) Vstd Qata (x-axis) Qata Tabulation Vstd Qata (x-axis) 1.0172	Calibration Certification Information February 13, 2018 Rootsmeter S/N: 438320 Ta: 293 Jim Tisch Pa: 763.3 Model #: TE-5025A Calibrator S/N: 1612 Wol. Init Vol. Init Vol. Final Δ Vol. Δ H Run (m3) (mm Hg) (in H2O) 1 1 2 1 1.3970 3.2 2.00 2 3 4 1 0.000 6.3 4.00 3 5 6 1 0.8900 7.9 5.00 4 7 8 1 0.8440 8.7 5.50 5 9 10 1 0.7010 12.6 8.00 Data Tabulation Wold (Y-AH($\frac{Pa}{Psid})(\frac{Tsid}{Ta})$ Qa ($\Delta H(Ta/Pa)$ (m3) (x-axis) (y-axis) Va (x-axis) (y-axis) 1.0172

Tisch Environmental, Inc.

145 South Miami Avenue

Village of Cleves, OH 45002

www.tisch-env.cor TOLL FREE: (877)263-761(FAX: (513)467-900

TSP Sampler Calibration

SITE	
Location: Lian Tang 3 Sampler: TE-5170 MFC (Serial # : 2359)	Date: January 5, 2019 Tech: Sam Wong

			CONDITIONS		
Barometric Pressure	(in Hg):	40.15	Corrected Pressure	(mm Hg):	1020
Temperature	(deg F):	66	Temperature	(deg K):	292
Average Press.	(in Hg):	40.15	Corrected Average	(mm Hg):	1020
Average Temp.	(deg F):	66	Average Temp.	(deg K):	292

		CALIBRATION ORIFICE	
Make:	Tisch	Qstd Slope:	2.02017
Model:	TE-5025A	Qstd Intercept:	-0.03691
Serial#:	1612	Date Certified:	February 13, 2018

CALIBRATIONS						
Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION	
1	12.00	2.025	56.0	65.55	Slope =	31.7376
2	10.00	1.850	52.0	60.86	Intercept =	1.9907
3	8.20	1.677	48.0	56.18	Corr. coeff.=	0.9987
4	5.20	1.339	38.0	44.48		
5	3.20	1.055	30.0	35.11	# of Observations:	5

Calculations

IC = I[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)[Sqrt(298/Tav)(Pav/760)]-b)

Qstd = 1/m[Sqrt(H2O(Pa/Pstd)(Tstd/Ta))-b]

m = sampler slope b = sampler intercept I = chart response Tav = daily average temperature Pav = daily average pressure



TSP Sampler Calibration

	SITE	
Location: Lian Tang 3 Sampler: TE-5170 MFC (Seri	Date: .al # : 2359) Tech:	March 5, 2019 Sam Wong

			CONDITIONS		
Barometric Pressure	(in Hg):	39.90	Corrected Pressure	(mm Hg):	1013
Temperature	(deg F):	72	Temperature	(deg K):	295
Average Press.	(in Hg):	39.90	Corrected Average	(mm Hg):	1013
Average Temp.	(deg F):	72	Average Temp.	(deg K):	295

		CALIBRATION ORIFICE	
Make:	Tisch	Qstd Slope:	2.09680
Model:	TE-5025A	Qstd Intercept:	-0.00065
Serial#:	1941	Date Certified:	February 5, 2019

CALIBRATIONS						
Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION	
1	12.00	1.917	56.0	64.97	Slope =	32.9414
2	10.00	1.750	52.0	60.33	Intercept =	2.5378
3	8.20	1.585	48.0	55.69	Corr. coeff.=	0.9987
4	5.20	1.262	38.0	44.09		
5	3.20	0.990	30.0	34.81	<pre># of Observations:</pre>	5

Calculations

IC = I[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)[Sqrt(298/Tav)(Pav/760)]-b)

Qstd = 1/m[Sqrt(H2O(Pa/Pstd)(Tstd/Ta))-b]

m = sampler slope b = sampler intercept I = chart response Tav = daily average temperature Pav = daily average pressure





Customer : Enovative Environmental	Service Limited	8	
	e e i i i e e e e e e e e e e e e e e e		
Address : Flat 6, 3/F, Block E, Wah Lo	ok Industrial Centre, 31-35 Shan I	Mei Street, Shatin, N	I.T., Hong Kong
Order No.: Q81437	Da	ate of receipt :	13-Apr-18
Item Tested			
Description : Sound Level Calibrator			
Manufacturer : Rion	LD)	217656
Model : NC-74	Se	rial No.	34678506
Test Conditions			
Date of Test : 20-Apr-18	C.	upply Voltago	
Ambient Temperature : $(23 + 3)^{\circ}$	Su	ppiy voltage :	(50 + 25) %
Test Specifications			(50 ± 25) %
rest opecifications			
Calibration check.			
Ref. Document/Procedure : F21, Z02.			
Test Results			
All results were within the IEC 60942 Clas	s 1 specifications.		
The results are shown in the attached pag	e(S).		
Main Tast aquinment used:			
Fauinment No. Description	Cort No	Tro	
S014 Spectrum Analyzer	707126	NIM	
S240 Sound Level Calibrator	707720	NIM	PRC & SCL-HKSAR
S041 Universal Counter	802061	NIIVI SCI	
S206 Sound Level Meter	707129	SCL	
	101120	00L	-IINOAN
The values given in this Calibration Certificate only re will not include allowance for the equipment long terr overloading, mis-handling, or the capability of any ot for any loss or damage resulting from the use of the	elate to the values measured at the ti m drift, variations with environmental her laboratory to repeat the measurer equipment.	me of the test and any changes, vibration and ment. Hong Kong Cali	uncertainties quoted I shock during transportation, bration Ltd. shall not be liable
The test equipment used for calibration are traceable The test results apply to the above Unit-Under-Test	e to International System of Units (SI) only	, or by reference to a n	natural constant.
AA		/	1
Calibrated by :	Approv	ed by :	1A
Elva Chong	, (PP) 04	Kin \	Wong
Litta offortig			i i qi i g
'his Certificate is issued by:	Date:	20-Apr-18	, tong

The copyright of this certificate is owned by Hong Kong Calibration Ltd It may not be reproduced except in full



Certificate No. 803615

Page 2 of 2 Pages

Results :

1. Generated Sound Pressure Level

UUT Nominal Value (dB)	Measured Value (dB)	IEC 60942 Class 1 Spec.
94.0	94.2	± 0.4 dB

Uncertainty : $\pm 0.2 \text{ dB}$

 Short-term Level Fluctuation : 0.0 dB IEC 60942 Class 1 Spec. : ± 0.1 dB Uncertainty : ± 0.01 dB

3. Frequency

UUT Nominal Value (kHz)	Measured Value (kHz)	IEC 60942 Class 1 Spec.
1	0.999	± 1 %

Uncertainty : \pm 3.6 x 10 ⁻⁶

4. Total Distortion : < 1.1 % IEC 60942 Class 1 Spec. : < 4 % Uncertainty : ± 2.3 % of reading

Remark : 1. UUT : Unit-Under-Test

2. The uncertainty claimed is for a confidence probability of not less than 95%.

3. Atmospheric Pressure : 1 016 hPa.

----- END -----

The copyright of this certificate is owned by Hong Kong Calibration Ltd., It may not be reproduced except in full.



Certificate No.	804605		Page	1	of 3	Pages
Customer :	Enovative Environmental Servic	e Limited	ж. Т			
Address :	Flat 6, 3/F, Block E, Wah Lok Indus	strial Centre, 31-35 Sha	an Mei Street, Shati	in, N.	T., Hong	g Kong.
Order No. :	Q81807		Date of receipt	:		9-May-18
Item Tested						
Description :	Sound Level Meter					
Manufacturer :	Rion		I.D.	:		
Model :	NL-52		Serial No.	: (011434	84
Test Conditi	ons					
Date of Test :	15-May-18		Supply Voltage :			
Ambient Temp	erature: (23 ± 3)°C		Relative Humidi	ty : (50 ± 2	5) %
Test Specific	cations					
Calibration chec Ref. Document/	k. Procedure: Z01, IEC 61672.					
Test Results						
All results were The results are	within the IEC 61672 Type1 or n shown in the attached page(s).	nanufacturer's specif	fication.			
Main Test equip	ment used:					
Equipment No.	Description	<u>Cert. No.</u>	-	Trace	eable to	2
S017	Multi-Function Generator	C170120	S	SCL-	HKSAF	२
S240	Sound Level Calibrator	803357	1	NIM-I	PRC &	SCL-HKSAR
The values given in will not include allow overloading, mis-ha for any loss or dama	this Calibration Certificate only relate to vance for the equipment long term drift, v ndling, or the capability of any other labo age resulting from the use of the equipm	the values measured at the values measured at the variations with environment oratory to repeat the mease ent.	he time of the test and ntal changes, vibration surement. Hong Kong	d any t n and s r Calib	uncertain shock du ration Lte	ties quoted iring transportation, d. shall not be liable
The test equipment The test results app	used for calibration are traceable to Inte ly to the above Unit-Under-Test only	rnational System of Units	(SI), or by reference t	to a na	atural co	nstant.

Calibrated by :	Appro	oved by :	Kinduana
Elva Chong			Kin wong
This Certificate is issued by:	Date:	15-May-18	
Hong Kong Calibration Ltd.			
Unit OD DAVE Mult Europ Industrial Cantes No EO 76 To Obuse Dise Obert Kust Obuse NT User			



Certificate No. 804605

Page 2 of 3 Pages

Results :

1. Self-generated noise: 16.0 dBA (Mfr's Spec \leq 17 dBA)

2. Acoustical signal test

	UUT S	letting			
	Frequency	Time	Octave	Applied	UUT
Range (dB)	Weighting	Weighting	Filter	Value (dB)	Reading (dB)
20-130	A	F	OFF	94.0	94.0
		S	OFF		94.0
	С	F	OFF		94.0
	Z	F	OFF		94.0
	А	F	OFF	114.0	114.1
		S	OFF		114.1
	С	F	OFF		114.1
	Z	F	OFF		114.1

IEC 61672 Type 1 Spec. : \pm 1.1 dB Uncertainty : \pm 0.1 dB

Attenuation (dB) IEC 61672 Type 1 Spec. Frequency 31.5 Hz -39.6 - 39.4 dB, ± 2 dB -26.2 - 26.2 dB, ± 1.5 dB 63 Hz -16.2 125 Hz - 16.1 dB, ± 1.5 dB -8.7 - 8.6 dB, ± 1 dB 250 Hz -3.2 500 Hz - $3.2 \text{ dB}, \pm 1.4 \text{ dB}$ 1 kHz 0.0 (Ref) $0 \, dB, \pm 1.1$ dB 2 kHz +1.0+ 1.2 dB, ± 1.6 dB +0.7+ $1.0 \text{ dB}, \pm 1.6 \text{ dB}$ 4 kHz - 1.1 dB, + $2.1 \text{ dB} \sim -3.1 \text{ dB}$ 8 kHz -1.26.6 dB, + 3.5 dB ~ - 17.0 dB 16 kHz -8.6 -

3 Electrical signal tests of frequency weightings (A weighting)

Uncertainty : $\pm 0.1 \text{ dB}$



Certificate No. 804605

Page 3 of 3 Pages

4. Frequency & Time weightings at 1 kHz

4.1 Frequency Weighting (Fast)

UUT	Applied	UUT	Difference	IEC 61672
Setting	Value (dB)	Reading (dB)	(dB)	Type 1 Spec.
A	94.0	94.0 (Ref.)		$\pm 0.4 \text{ dB}$
С	94.0	94.0	0.0	
Z	94.0	94.0	0.0	

4.2 Time Weighting (A-weighted)

UUT	Applied	UUT	Difference	IEC 61672
Setting	Value (dB)	Reading (dB)	(dB)	Type 1 Spec.
Fast	94.0	94.0 (Ref.)		$\pm 0.3 \text{ dB}$
Slow	94.0	94.0	0.0	
Time-averaging	94.0	94.0	0.0	

Uncertainty : $\pm 0.1 \text{ dB}$

Remarks : 1. UUT : Unit-Under-Test

- 2. The uncertainty claimed is for a confidence probability of not less than 95%.
- 3. Atmospheric Pressure : 1 009 hPa.
- 4. Preamplifier model : NH-25, S/N : 21113
- 5. Firmware Version: 1.8
- 6. Power Supply Check: OK
- 7. The UUT was adjusted with the laboratory's sound calibrator at the reference sound pressure level before the calibration.

----- END ------