

Appendix C Calibration Certificates of Monitoring Equipment



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 - Ma Operator		5 Rootsmeter Orifice I.I	0/11	138320 1941	Ta (K) - Pa (mm) -	292 - 756.92
====== OR Run # 1 2 3 4 5	VOLUME START (m3) NA NA NA NA NA NA	VOLUME STOP (m3) NA NA NA NA NA NA	DIFF VOLUME (m3) 1.00 1.00 1.00 1.00 1.00	DIFF TIME (min) 1.4880 1.0510 0.9360 0.8920 0.7360	METER DIFF Hg (mm) 3.2 6.4 7.9 8.8 12.7	ORFICE DIFF H2O (in.) 2.00 4.00 5.00 5.50 8.00

DATA TABULATION

Vstd	(x axis) Qstd	(y axis)		Va	(x axis) Qa	(y axis)
1.0121 1.0078 1.0057 1.0046 0.9993	0.6802 0.9589 1.0745 1.1262 1.3578	1.4258 2.0163 2.2543 2.3644 2.8515		0.9958 0.9916 0.9895 0.9884 0.9832	0.6692 0.9434 1.0571 1.1080 1.3358	0.8784 1.2422 1.3888 1.4566 1.7568
Qstd slop intercep coefficie v axis =	t (b) = ent (r) =	2.10265 -0.00335 0.99999 Pa/760)(298/5	1	Qa slop intercep coefficio v axis =	t (b) =	1.31664 -0.00206 0.99999 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 = $1/m\{ [SQRT H2O(Ta/Pa)] - b \}$

TSP Sampler Calibration

SITE						
Location: Lian Tang 3 Sampler: TE-5170 MFC (Serial # : 2359)	Date: Tech:	September 5, 2015 Sam Wong				
CONDITIONS						

(in Hg):	39.80	Corrected Pressure	(mm Hg):	1011
(deg F):	88	Temperature	(deg K):	304
(in Hg):	39.80	Corrected Average	(mm Hg):	1011
(deg F):	88	Average Temp.	(deg K):	304
	(deg F): (in Hg):	(deg F): 88 (in Hg): 39.80	(deg F):88Temperature(in Hg):39.80Corrected Average	(deg F):88Temperature (deg K):(in Hg):39.80Corrected Average (mm Hg):

CALIBRATION ORIFICE					
Make: Model:	Tisch TE-5025A	Qstd Slope: Qstd Intercept:	2.10265 -0.00335		
Serial#:	1941	Date Certified:	March 24, 2015		

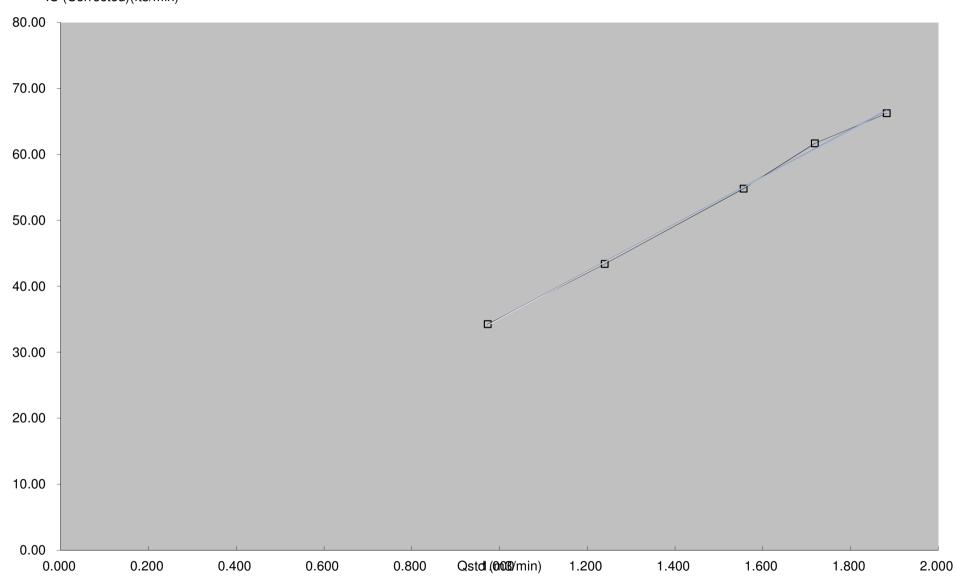
CALIBRATIONS							
Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION		
1	12.00	1.882	58.0	66.22	Slope =	35.7973	
2	10.00	1.719	54.0	61.65	Intercept =	-0.7061	
3	8.20	1.556	48.0	54.80	Corr. coeff.=	0.9992	
4	5.20	1.240	38.0	43.38			
5	3.20	0.973	30.0	34.25	# of Observations:	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



IC (Corrected)(ft3/min)

TEST REPORT

for SOUND CALIBRATOR

Model :	NC - 74

Serial No. : 34857296

Condition : Temperature

25 °C

Humidity

64 %RH

Date :

September, 8, 2015

Signature :

Y. kitajima



NC-74 34857296

1. Sound Pressure Level	$94.0\ \pm\ 0.25\ dB$	94.00 dB
2. Frequency	1000 ± 7 Hz	1002.0 Hz
3. Distortion	3% or less	Pass
4. Alarm Function		Pass

5. Appearance

Pass

Applicable standards

JIS C 1515:2004 class1 IEC 60942:2003 class1





Certificate No.	505007		Page	1 of 4 Pages
Customer :	Enovative Environmental Service Lin	nited		
Address :	Flat 6, 3/F, Block E, Wah Lok Industr	rial Centre, 31-35	Shan Mei Stree	et, Shatin, N.T., Hong Kong.
Order No. :	Q51950		Date of receipt	: 11-Jun-15
Item Tested				
Manufacturer :	Sound Level Meter (N15-RION-006 Rion NL-52		Serial No.	: 01143483
Test Conditi	ons			
Date of Test : Ambient Temp	15-Jun-15		Supply Voltage Relative Humid	: ity: (50 ± 25) %
Test Specific	cations			
Calibration chec Ref. Document/	k. Procedure: Z01, IEC 61672.			
Test Results				
	within the IEC 61672 Type1 specifica shown in the attached page(s).	tion.		
Main Test equip	ment used:			
Equipment No. S017 S240	Multi-Function Generator C1	r <u>t. No.</u> 47450 0563		<u>Traceable to</u> SCL-HKSAR NIM-PRC & SCL-HKSAR
will not include allow overloading, mis-ha for any loss or dama The test equipment	this Calibration Certificate only relate to the va- vance for the equipment long term drift, variati ndling, or the capability of any other laboratory age resulting from the use of the equipment. used for calibration are traceable to Internationally to the above Unit-Under-Test only	ons with environmen y to repeat the measu	tal changes, vibratic urement. Hong Kon	on and shock during transportation,
Calibrated by	Dorothy Cheuk	Appr Date:	oved by :	Steve Kwan

This Certificate is issued by: Hong Kong Calibration Ltd.

Unit 8B, 24/F., Well Fung Industrial Centre, No. 58-76, Ta Chuen Ping Street,Kwai Chung, NT,Hong Kong. Tel: 2425 8801 Fax: 2425 8646

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



Certificate No. 505007

Page 2 of 4 Pages

Results :

1. Self-generated noise: 15.2 dBA (Mfr's Spec \leq 17 dBA)

2. Acoustical signal test

	UUT S				
	Frequency	Time	Applied	UUT	
Range (dB)	Weighting	Weighting	Filter	Value (dB)	Reading (dB)
30-130	А	F	OFF	94.0	93.9
		S	OFF		93.9
	С	F	OFF		93.9
	Z	F	OFF		93.9
	А	F	OFF	114.0	113.9
		S	OFF		113.9
	С	F	OFF]	113.9
	Z	F	OFF]	113.9

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

3 Electrical signal tests of frequency weightings (A weighting)

Frequency	Attenuation (dB)	IEC 61672 Type 1 Spec.		
31.5 Hz	-39.5	- 39.4 dB, ± 2 dB		
63 Hz	-26.2	- 26.2 dB, ± 1.5 dB		
125 Hz	-16.1	- 16.1 dB, ± 1.5 dB		
250 Hz	-8.6	- 8.6 dB, ± 1 dB		
500 Hz	-3.2	- $3.2 \text{ dB}, \pm 1.4 \text{ dB}$		
1 kHz	0.0 (Ref)	$0 \text{ dB}, \pm 1.1 \text{ dB}$		
2 kHz	+1.1	$+$ 1.2 dB, \pm 1.6 dB		
4 kHz	+0.7	$+$ 1.0 dB, \pm 1.6 dB		
8 kHz	-1.1	- 1.1 dB, + 2.1 dB ~ -3.1 dB		
16 kHz	-8.5	- 6.6 dB, + 3.5 dB ~ - 17.0 dB		

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



Hong Kong Calibration Ltd. 香港校正有限公司

Calibration Certificate

Certificate No. 505007

Page 3 of 4 Pages

4. Frequency & Time weightings at 1 kHz

4.1 Frequency Weighting (Fast)

III I I I I I I I I I I I I I I I I I				
UUT	Applied	UUT	Difference	IEC 61672
Setting	Value (dB)	Reading (dB)	(dB)	Type 1 Spec.
А	94.0	94.0 (Ref.)		± 0.4 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.)		± 0.3 dB
Slow	94.0	94.0	0.0	
Time-averaging	94.0	94.0	0.0	

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

5. Level linearity on the reference level range

	Applied		e ^{rit}	
UUT Range	Value (dB)	UUT Reading (dB)	Difference (dB)	IEC 61672 Type 1 Spec.
30-130 dB	129.0	129.0	0.0	± 1.1 dB
(Ref Level)	124.0	124.0	0.0	
	119.0	119.0	0.0	
	114.0	114.0 (Ref)		
	109.0	109.0	0.0	
	104.0	104.0	0.0	- -
	99.0	99.9	0.0	
	94.0	94.0	0.0	
	89.0	89.0	0.0	
	84.0	84.0	0.0	
	79.0	79.0	0.0	· · · ·
	74.0	74.0	0.0	,
	69.0	69.0	0.0	
	64.0	63.9	-0.1	
	59.0	59.0	0.0	
~	54.0	54.0	0.0	
	49.0	49.0	0.0	
	44.0	44.0	0.0	

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

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



Hong Kong Calibration Ltd. 香港校正有限公司

Calibration Certificate

Certificate No. 505007

Page 4 of 4 Pages

6. Toneburst response (4kHz)

UUT	Tone Burst	UUT	Difference	IEC (1(72
				IEC 61672
Setting	Duration(ms)	Reading(dB)	(dB)	Type 1 Spec.
Fast	Steady	127.0(Ref)		
	200	126.0	-1.0	-1.0 ± 0.8 dB
	2	109.0	-18.0	-18.0, +1.3 dB ~ -1.8 dB
	0.25	99.9	-27.1	-27.0, +1.3 dB ~ -3.3 dB
Slow	Steady	127.0(Ref)		
	200	119.6	-7.4	-7.4 ± 0.8 dB
	2	100.0	-27.0	-27.0, +1.3 dB ~ -3.3 dB
Time	Steady	127.0(Ref)		
averaging	200	120.0	-7.0	-7.0±0.8dB
	2	99.7	-27.3	-27.0, +1.3 dB ~ -1.8 dB
	0.25	90.1	-36.9	-36.0, +1.3 dB ~ -3.3 dB

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

7. Overload indication (30-130 dB range, A-weighted, Time-average, 4kHz)

UUT Reading	at overload (dB)		
+ ve one half cycle	- ve one half cycle	Difference (dB)	IEC 61672 Type 1 Spec.
137.1	137.2	0.1	< 1.8 dB

The overload indicator latched on until reset

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 : 998 hPa.

4. Preamplifier model : NH-25, S/N : 43399

5. Firmware Version: 1.5

6. Power Supply Check: OK

7. The UUT's internal calibration was performed before the calibration .

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



Certificate No.	508784		Page 1 of 3 Pages	
Customer :	Enovative Environmental Serv	vice Limited		
			31-35 Shan Mei Street, Shatin, N.T., Hong Kon	j .
Order No. :			Date of receipt : 8-Oct-15	
Item Tested				
Description :	Sound Level Meter			
Manufacturer :				
	2238		Serial No. : 2694908	
Test Conditi	ons			
Date of Test :	15-Oct-15		Supply Voltage :	
Ambient Temp			Relative Humidity : (50 ± 25) %	
Test Specifi				
Calibration chec				
	Procedure: Z01, IEC 651 and	IEC 804.		
Rei. Document				
Test Results	3			
	within the IEC 651 Typo1 and	IEC 804 Type1 sr	pecification after adjustment	
	within the IEC 651 Type1 and shown in the attached page(s			
The results are	Shown in the attached page(5).		
Main Test equip	oment used:			
Equipment No.		Cert. No.	Traceable to	
S017	Multi-Function Generator	C147450	SCL-HKSAR	
S240	Sound Level Calibrator	500563	NIM-PRC & SCL-HKSAF	ł.
will not include allo overloading, mis-h	wance for the equipment long term d	rift, variations with envi laboratory to repeat th	red at the time of the test and any uncertainties quoted ironmental changes, vibration and shock during transportat e measurement. Hong Kong Calibration Ltd. shall not be li	ion, able
The test equipmer The test results ap	nt used for calibration are traceable to ply to the above Unit-Under-Test only	International System o	of Units (SI).	
Calibrated by	:Alan ^c Chu		Approved by :	
This Certificate is issued	V		Date: 15-Oct-15	
Hong Kong Calibration L	.td. g Industrial Centre, No. 58-76, Ta Chuen Ping Str	eet,Kwai Chung, NT,Hong Ko	ng.	
	tificate is owned by Hong Kong Calibration Ltd It	t may not be reproduced except	pt in full.	E



Certificate No. 508784

Page 2 of 3 Pages

Results :

1. SPL Accuracy

	UUT Setting			Applied Value	UU	JT
				(dB)	Readin	g (dB)
Range	Freq. Wgt.	Bandwith	Center Freq.		Before adjust	After adjust
20~100	A	BB/F		94.0	*91.6	93.8
	A	BB/S				93.8
	С	BB/F				93.8
40~120	А	BB/F		94.0		93.9
	A	BB/F		114.0		113.8

IEC 651 Type 1 Spec. : \pm 0.7 dB Uncertainty : \pm 0.1 dB

Level Stability : 0.0 dB
 IEC 651 Type 1 Spec. : ± 0.3 dB
 Uncertainty : ± 0.1 dB

3. Linearity

3.1 Level Linearity

UUT Range	Applied	UUT Reading	Variation	IEC 651 Type 1 Spec.
(dB)	Value (dB)	(dB)	(dB)	(Primary Indicator Range)
140	114.0	113.9	0.0	$\pm 0.7 \text{ dB}$
130	104.0	103.9	0.0	
120	94.0	93.9 (Ref.)		
110	84.0	83.9	0.0	
100	74.0	73.9	0.0	-
90	64.0	63.9	0.0	
80	54.0	53.8	-0.1	4

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

3.2 Differential level linearity

UUT Range	Applied	UUT Reading		
(dB)	Value (dB)	(dB)	Variation (dB)	IEC 651 Type 1 Spec.
120	84.0	84.0	+ 0.1	± 0.4 dB
	94.0	93.9 (Ref.)		
	95.0	94.9	0.0	± 0.2 dB

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

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



Certificate No. 508784

Page 3 of 3 Pages

4. Frequency Weighting

A weighting

Frequency	Attenuation (dB)	IEC 651 Type 1 Spec.
31.5 Hz	- 39.3	- 39.4 dB, ± 1.5 dB
63 Hz	- 26.2	- 26.2 dB, ± 1.5 dB
125 Hz	- 16.2	- 16.1 dB, ± 1 dB
250 Hz	- 8.7	- $8.6 \text{ dB}, \pm 1 \text{ dB}$
500 Hz	- 3.2	- $3.2 \text{ dB}, \pm 1 \text{ dB}$
1 kHz	0.0 (Ref)	$0 \text{ dB}, \pm 1 \text{ dB}$
2 kHz	+ 1.2	$+$ 1.2 dB, ± 1 dB
4 kHz	+ 1.0	$+ 1.0 \text{ dB}, \pm 1 \text{ dB}$
8 kHz	- 1.2	- 1.1 dB , + $1.5 \text{ dB} \sim -3 \text{ dB}$
16 kHz	- 6.7	- 6.6 dB, + 3 dB \sim - ∞

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

5. Time Averaging

Applied Burst duty Factor	Applied Leq Value (dB)	UUT Reading (dB)	IEC 804 Type 1 Spec.
continuous	40.0	40.0	
1/10	40.0	39.9	$\pm 0.5 \text{ dB}$
1/10 ²	40.0	39.9	
$1/10^{3}$	40.0	39.9	± 1.0 dB
1/10 ⁴	40.0	39.8	

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 : 1008 hPa
- 4. The UUT was adjusted with the laboratory's sound calibrator at the reference sound pressure level before the calibration.

5. * Out of specification.

----- END -----

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