

# Appendix C Calibration Certificates of Monitoring Equipment



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## ORIFICE TRANSFER STANDARD CERTIFICATION WORKSHEET TE-5025A

Operator		Rootsmeter Orifice I.I		438320 1612	Ta (K) - Pa (mm) -	295 - 745.49
PLATE OR Run #	VOLUME START (m3)	VOLUME STOP (m3)	DIFF VOLUME (m3)	DIFF TIME (min)	METER DIFF Hg (mm)	ORFICE DIFF H2O (in.)
1 2 3 4 5	NA NA NA NA	NA NA NA NA NA	1.00 1.00 1.00 1.00	1.3770 0.9710 0.8710 0.8310 0.6860	3.2 6.4 7.8 8.7 12.6	2.00 4.00 5.00 5.50 8.00

### DATA TABULATION

Vstd	(x axis) Qstd	(y axis)		Va	(x axis) Qa	(y axis)
0.9866 0.9824 0.9804 0.9793 0.9741	0.7165 1.0117 1.1256 1.1785 1.4200	1.4078 1.9909 2.2259 2.3345 2.8155		0.9957 0.9914 0.9894 0.9883 0.9830	0.7231 1.0210 1.1360 1.1893 1.4330	0.8896 1.2581 1.4066 1.4753 1.7792
Qstd slop intercept coefficie	(b) =	2.00411 -0.03059 0.99995	n e n	Qa slope intercept coefficie	= (b) $=$	1.25494 -0.01933 0.99995
y axis =	SQRT[H20(E	Pa/760) (298/5	ra)]	y axis =	SQRT[H2O(	[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 =  $1/m\{[SQRT(H2O(Pa/760)(298/Ta))] - b\}$ 

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

#### TSP Sampler Calibration

#### SITE

Location: Lian Tang 3
Sampler: TE-5170 MFC (Serial # : 2359) Date: November 5, 2016 Sam Wong Tech:

#### CONDITIONS Barometric Pressure (in Hg): 39.90 Corrected Pressure (mm Hg): 1013 Temperature (deg F): Temperature (deg K): 299 Average Press. (in Hg): 39.90 Corrected Average (mm Hg): 1013 Average Temp. (deg F): Average Temp. (deg K):

#### CALIBRATION ORIFICE

Make: Tisch Qstd Slope: 2.00411 Model: TE-5025A Qstd Intercept: -0.03059 Serial#: 1612 Date Certified: March 14, 2016

	CALIBRATIONS						
Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION		
1	12.00	2.009	56.0	64.61	Slope =	31.4853	
2	10.00	1.836	52.0	59.99	Intercept =	2.0532	
3	8.20	1.664	48.0	55.38	Corr. coeff.=	0.9987	
4	5.20	1.328	38.0	43.84			
5	3.20	1.045	30.0	34.61	# of Observations:	5	

## Calculations

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

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:

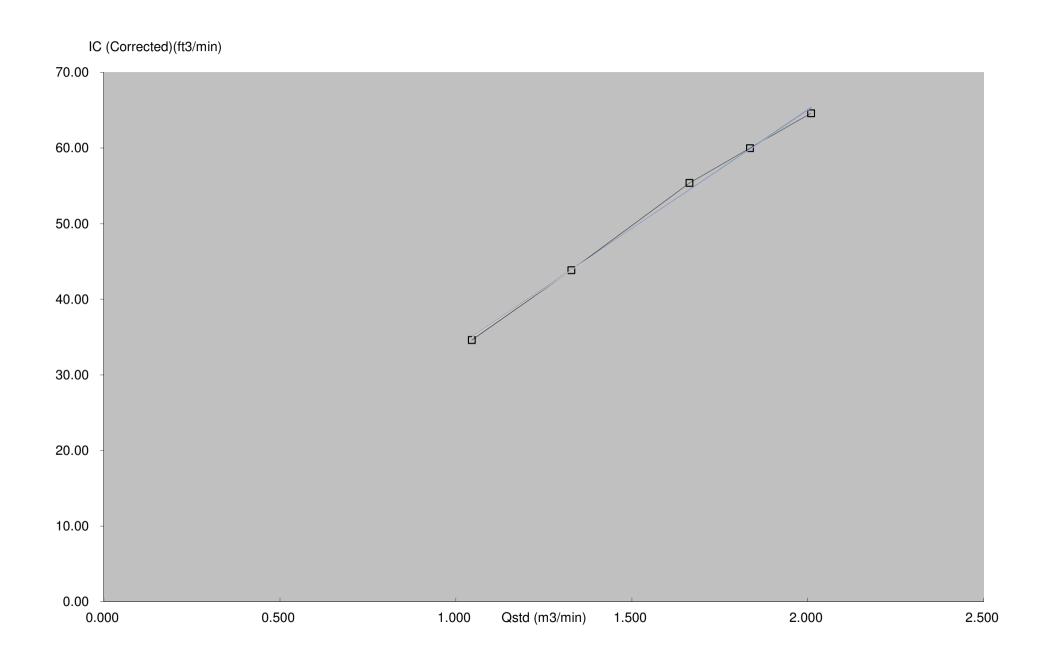
1/m((I)[Sqrt(298/Tav)(Pav/760)]-b)

= sampler slope = sampler intercept m

b

= chart response

Tav = daily average temperature Pav = daily average pressure





Certificate No. 607984

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Customer: Enovative Environmental Service Limited

Address: Flat 6, 3/F, Block E, Wah Lok Industrial Centre, 31-35 Shan Mei Street, Shatin, N.T., Hong Kong.

Order No.: Q63261

Date of receipt

6-Sep-16

## **Item Tested**

**Description**: Sound Level Calibrator

Manufacturer: Rion

I.D.

: 215901

Model

: NC-74

Serial No.

: 34857296

## **Test Conditions**

Date of Test: 23-Sep-16

Supply Voltage : --

**Ambient Temperature:** 

 $(23 \pm 3)^{\circ}C$ 

Relative Humidity: (50 ± 25) %

## **Test Specifications**

Calibration check.

Ref. Document/Procedure: F21, Z02, IEC 60942.

## **Test Results**

All results were within the IEC 60942 Class 1 specification.

The results are shown in the attached page(s).

Main Test equipment used:

Equipment No	o. Description	Cert. No.	Traceable to
S014	Spectrum Analyzer	605758	NIM-PRC & SCL-HKSAR
S240	Sound Level Calibrator	601604	NIM-PRC & SCL-HKSAR
S041	Universal Counter	607883	SCL-HKSAR
S206	Sound Level Meter	605757	SCL-HKSAR

The values given in this Calibration 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 environmental changes, vibration and shock during transportation, overloading, mis-handling, or the capability of any other laboratory to repeat the measurement. Hong Kong Calibration Ltd. 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 International System of Units (SI), or by reference to a natural constant. The test results apply to the above Unit-Under-Test only

Calibrated by :

Approved by:

23-Sep-16

Alan Chu

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

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Results:

## 1. Generated Sound Pressure Level

UUT Nominal Value (dB)	Measured Value (dB)	IEC 60942 Class 1 Spec.
94	94.1	± 0.4 dB

Uncertainty: ± 0.1 dB

2. 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	1.002 1	± 1 %

Uncertainty:  $\pm 3.6 \times 10^{-6}$ 

4. Total Distortion : < 1.3 %

IEC 60942 Class 1 Spec. : < 3 % Uncertainty :  $\pm$  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: 1018 hPa.

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Customer: Enovative Environmental Service Limited

Address: Flat 6, 3/F, Block E, Wah Lok Industrial Centre, 31-35 Shan Mei Street, Shatin, N.T., Hong Kong.

Order No.: Q63459

Date of receipt

22-Sep-16

Item Tested

**Description**: Sound Level Meter

Manufacturer: B&K

I.D.

Model

: 2238

Serial No.

: 2694908

**Test Conditions** 

Date of Test:

3-Oct-16

Supply Voltage : --

Ambient Temperature :

 $(23 \pm 3)^{\circ}C$ 

Relative Humidity: (50 ± 25) %

**Test Specifications** 

Calibration check.

Ref. Document/Procedure: Z01, IEC 651 and IEC 804.

### **Test Results**

All results were within the IEC 651 Type1 and IEC 804 Type1 specification.

The results are shown in the attached page(s).

Main Test equipment used:

Equipment No. Description

Cert. No.

Traceable to

S017

Multi-Function Generator

C147450

SCL-HKSAR

S240

Sound Level Calibrator

601604

NIM-PRC & SCL-HKSAR

The values given in this Calibration 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 environmental changes, vibration and shock during transportation, overloading, mis-handling, or the capability of any other laboratory to repeat the measurement. Hong Kong Calibration Ltd. 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 International System of Units (SI), or by reference to a natural constant. The test results apply to the above Unit-Under-Test only

Calibrated by :

Kin Wong

Approved by:

This Certificate is issued by

Hong Kong Calibration Ltd.

Date:

3-Oct-16

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



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Results:

## 1. SPL Accuracy

UUT Setting			Applied Value	UUT	
Range	Freq. Wgt.	Bandwith	Center Freq.	(dB)	Reading (dB)
$20 \sim 100$	A	BB/F		94.0	94.0
	A	BB/S			94.0
	C	BB/F			94.0
$40\sim120$	A	BB/F		94.0	94.0
	A	BB/F		114.0	114.2

IEC 60651 Type 1 Spec. :  $\pm$  0.7 dB

Uncertainty: ± 0.1 dB

2. Level Stability: 0.0 dB

IEC 60651 Type 1 Spec. :  $\pm$  0.3 dB

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

## 3. Linearity

## 3.1 Level Linearity

UUT Range (dB)	Applied Value (dB)	UUT Reading	Variation	IEC 60651 Type 1 Spec.
		(dB)	(dB)	(Primary Indicator Range)
140	114.0	114.0	0.0	± 0.7 dB
130	104.0	104.0	0.0	
120	94.0	94.0 (Ref.)		
110	84.0	84.0	0.0	
100	74.0	74.0	0.0	
90	64.0	64.0	0.0	
80	54.0	54.0	0.0	

Uncertainty: ± 0.1 dB

## 3.2 Differential level linearity

UUT Range (dB)	Applied Value (dB)	UUT Reading (dB)	Variation (dB)	IEC 60651 Type 1 Spec.
120	84.0	84.1	+0.1	± 0.4 dB
	94.0	93.9 (Ref.)		
	95.0	95.0	0.0	± 0.2 dB

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



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## 4. Frequency Weighting

A weighting

Frequenc	y Attenuati	on (dB)	EC 60651 Type 1	Spec.
31.5 H	-39	.3	- 39.4 dB, ± 1.5	5 dB
63 H	-26	.2	- 26.2 dB, ± 1.5	5 dB
125 H	z -16	.2	- 16.1 dB, ± 1	dB
250 H	-8	.7	- 8.6 dB, ± 1	dB
500 H	-3	.2	- $3.2 \text{ dB}, \pm 1$	dB
1 kH	$\tilde{z}$ 0	.0 (Ref)	$0 \text{ dB}, \pm 1$	dB
2 kH	z +1	.2	+ 1.2 dB, ± 1	dB
4 kH	z +1	.0	$+$ 1.0 dB, $\pm$ 1	dB
8 kH	Z -1	.2 -	1.1 dB, + 1.5 dB	~ -3 dB
16 kH	-6	.7	- 6.6 dB, + 3 dB	~- ∞

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

## 5. Time Averaging

Applied Burst duty Factor	Applied Leq Value (dB)	UUT Reading (dB)	IEC 60804 Type 1 Spec.
continuous	40.0	40.0	
1/10	40.0	39.9	± 0.5 dB
$1/10^2$	40.0	39.9	
$1/10^3$	40.0	39.9	± 1.0 dB
$1/10^4$	40.0	39.5	

Uncertainty: ± 0.1 dB

Remarks:

- 1. UUT: Unit-Under-Test
- 2. The uncertainty claimed is for a confidence probability of not less than 95%.
- 3. Atmospheric Pressure: 1013 hPa
- 4. The UUT was adjusted with the laboratory's sound calibrator at the reference sound pressure level before the calibration.

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