

# **Appendix C**

## **Calibration Certificates of Monitoring Equipment**

ORIFICE TRANSFER STANDARD CERTIFICATION WORKSHEET TE-5025A

Date - Feb 28, 2017 Rootmeter S/N 0438320 Ta (K) - 294  
Operator Tisch Orifice I.D. - 1941 Pa (mm) - 750.57

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	1.4600	3.2	2.00
2	NA	NA	1.00	1.0410	6.4	4.00
3	NA	NA	1.00	0.9280	7.9	5.00
4	NA	NA	1.00	0.8840	8.7	5.50
5	NA	NA	1.00	0.7290	12.7	8.00

DATA TABULATION

Vstd	(x axis) Qstd	(y axis)	Va	(x axis) Qa	(y axis)
0.9967	0.6827	1.4149	0.9957	0.6820	0.8851
0.9925	0.9534	2.0010	0.9915	0.9524	1.2517
0.9904	1.0672	2.2372	0.9894	1.0661	1.3995
0.9894	1.1192	2.3464	0.9884	1.1181	1.4678
0.9840	1.3499	2.8299	0.9830	1.3485	1.7702
Qstd slope (m) = 2.11965			Qa slope (m) = 1.32729		
intercept (b) = -0.02696			intercept (b) = -0.01686		
coefficient (r) = 0.99991			coefficient (r) = 0.99991		
y axis = SQRT[H2O(Pa/760)(298/Ta)]			y axis = SQRT[H2O(Ta/Pa)]		

CALCULATIONS

$$Vstd = \text{Diff. Vol}[(Pa - \text{Diff. Hg})/760](298/Ta)$$

$$Qstd = Vstd/Time$$

$$Va = \text{Diff Vol} [(Pa - \text{Diff Hg})/Pa]$$

$$Qa = Va/Time$$

For subsequent flow rate calculations:

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

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

## TSP Sampler Calibration

### SITE

Location: Lian Tang 3      Date: March 6, 2017  
 Sampler: TE-5170 MFC (Serial # : 2359)      Tech: Sam Wong

### CONDITIONS

Barometric Pressure (in Hg):	39.92	Corrected Pressure (mm Hg):	1014
Temperature (deg F):	70	Temperature (deg K):	294
Average Press. (in Hg):	39.92	Corrected Average (mm Hg):	1014
Average Temp. (deg F):	70	Average Temp. (deg K):	294

### CALIBRATION ORIFICE

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

### CALIBRATIONS

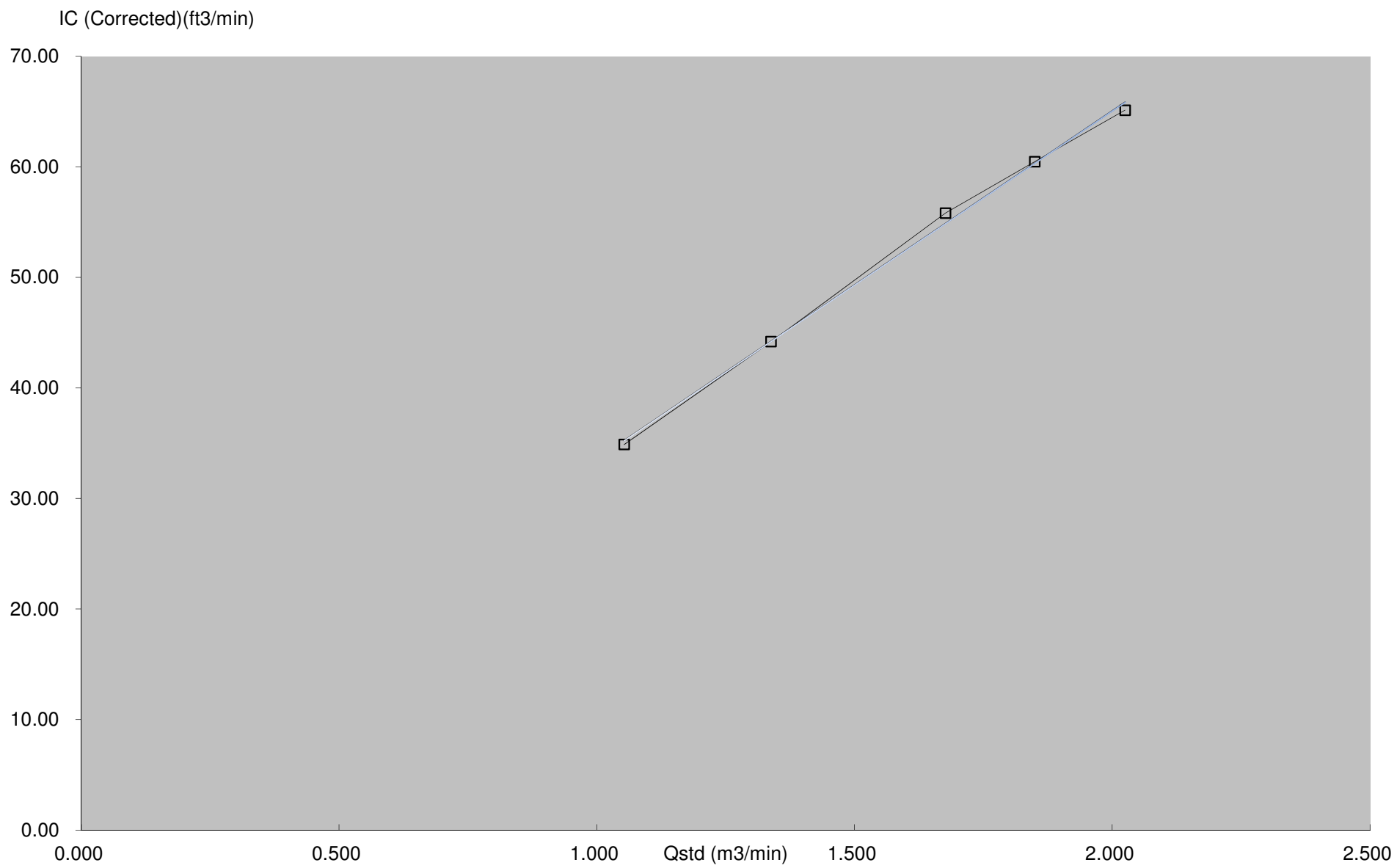
Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	LINEAR REGRESSION
1	12.00	2.025	56.0	65.11	
2	10.00	1.850	52.0	60.46	Slope = 31.4853
3	8.20	1.677	48.0	55.81	Intercept = 2.0729
4	5.20	1.338	38.0	44.18	Corr. coeff.= 0.9987
5	3.20	1.053	30.0	34.88	# of Observations: 5

#### Calculations

$Qstd = 1/m[\text{Sqrt}(H2O(Pa/Pstd)(Tstd/Ta)) - b]$   
 $IC = I[\text{Sqrt}(Pa/Pstd)(Tstd/Ta)]$

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:  
 $1/m((I)[\text{Sqrt}(298/Tav)(Pav/760)] - b)$

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





# Calibration Certificate

Certificate No. 607984

Page 1 of 2 Pages

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

**Relative Humidity :**  $(50 \pm 25) \%$

## 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.	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 :**

Kin Wong

**Approved by :**

Alan Chu

**Date:** 23-Sep-16

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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# Calibration Certificate

Certificate No. 607984

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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	$\pm 0.4$ dB

Uncertainty :  $\pm 0.1$  dB

## 2. Short-term Level Fluctuation : 0.0 dB

IEC 60942 Class 1 Spec. :  $\pm 0.1$  dB

Uncertainty :  $\pm 0.01$  dB

## 3. Frequency

UUT Nominal Value (kHz)	Measured Value (kHz)	IEC 60942 Class 1 Spec.
1	1.002 1	$\pm 1$ %

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.

----- END -----





# Calibration Certificate

Certificate No. **608737**

Page 1 of 3 Pages

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

**Relative Humidity :**  $(50 \pm 25) \%$

## 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:

<u>Equipment No.</u>	<u>Description</u>	<u>Cert. No.</u>	<u>Traceable to</u>
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 :**   
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

**Date:** 3-Oct-16



# Calibration Certificate

Certificate No. 608737

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Results :

## 1. SPL Accuracy

UUT Setting				Applied Value (dB)	UUT Reading (dB)
Range	Freq. Wgt.	Bandwith	Center Freq.		
20 ~ 100	A	BB/F	--	94.0	94.0
	A	BB/S	--		94.0
	C	BB/F	--		94.0
40 ~ 120	A	BB/F	--	94.0	94.0
	A	BB/F	--	114.0	114.2

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

Uncertainty :  $\pm 0.1$  dB

## 2. Level Stability : 0.0 dB

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

Uncertainty :  $\pm 0.1$  dB

## 3. Linearity

### 3.1 Level Linearity

UUT Range (dB)	Applied Value (dB)	UUT Reading (dB)	Variation (dB)	IEC 60651 Type 1 Spec. (Primary Indicator Range)
140	114.0	114.0	0.0	$\pm 0.7$ 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 :  $\pm 0.1$  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	$\pm 0.4$ dB
	94.0	93.9 (Ref.)	--	
	95.0	95.0	0.0	$\pm 0.2$ dB

Uncertainty :  $\pm 0.1$  dB





# Calibration Certificate

Certificate No. 608737

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## 4. Frequency Weighting

A weighting

Frequency	Attenuation (dB)	IEC 60651 Type 1 Spec.
31.5 Hz	-39.3	- 39.4 dB, $\pm 1.5$ dB
63 Hz	-26.2	- 26.2 dB, $\pm 1.5$ dB
125 Hz	-16.2	- 16.1 dB, $\pm 1$ dB
250 Hz	-8.7	- 8.6 dB, $\pm 1$ dB
500 Hz	-3.2	- 3.2 dB, $\pm 1$ dB
1 kHz	0.0 (Ref)	0 dB, $\pm 1$ dB
2 kHz	+1.2	+ 1.2 dB, $\pm 1$ dB
4 kHz	+1.0	+ 1.0 dB, $\pm 1$ dB
8 kHz	-1.2	- 1.1 dB, + 1.5 dB $\sim$ -3 dB
16 kHz	-6.7	- 6.6 dB, + 3 dB $\sim$ $-\infty$

Uncertainty :  $\pm 0.1$  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	$\pm 0.5$ dB
1/10 <sup>2</sup>	40.0	39.9	
1/10 <sup>3</sup>	40.0	39.9	$\pm 1.0$ dB
1/10 <sup>4</sup>	40.0	39.5	

Uncertainty :  $\pm 0.1$  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.

----- END -----



專業化驗有限公司

QUALITY PRO TEST-CONSULT LIMITED

Unit 10, 14/F, Wah Wai Centre, 38-40 Au Pui Wan St., Fofan, Hong Kong

Email: info@qualityprotest.com; Website: www.qualityprotest.com

Tel: (852) 3956 8717; Fax: (852) 3956 3928

## CALIBRATION REPORT

Test Report No. : AG030104  
Date of Issue : March 17, 2017  
Page No. : 1 of 1

### PART A – CUSTOMER INFORMATION

Enovative Environmental Service Ltd.  
Rm 811, Hin Pui House,  
Hin Keng Estate, Tai Wai  
New Territories, Hong Kong  
Attn: Mr. Thomas Wong

### PART B – SAMPLE INFORMATION

Description of Samples : HACH 2100Q Portable Turbidimeter  
Brand Name : HACH  
Model Number : 2100Q  
Serial Number : 13120C004242  
Equipment Number : --  
Date of Received : Mar 16, 2017  
Date of Calibration : Mar 16, 2017  
Date of Next Calibration<sup>(a)</sup> : Jun 16, 2017

### PART C – CALIBRATION REQUESTED

<u>Parameter</u>	<u>Reference Method</u>
Turbidity	APHA 21e 2130 B

### PART D – RESULT<sup>(bc)</sup>

#### Turbidity

Expected Reading (NTU)	Displayed Reading <sup>(d)</sup> (NTU)	Tolerance <sup>(e)</sup> (%)	Results
0	0	--	Satisfactory
4	4.05	+1.3	Satisfactory
20	20.9	+4.5	Satisfactory
100	107	+7.0	Satisfactory
800	783	-2.1	Satisfactory

Tolerance limit of turbidity should be less than  $\pm 10.0$  (%)

~ END OF REPORT ~

#### Remark(s)

<sup>(a)</sup> The "Date of Next Calibration" is recommended according to best practice principals as practiced by Quality Pro Test-Consult Ltd. or quoted from relevant international standards.

<sup>(b)</sup> The results relate only to the tested sample as received

<sup>(c)</sup> the performance of the equipment stated in this report is checked with independent reference material and results compared against a calibrated secondary source.

<sup>(d)</sup> "Displayed Reading" presents the figures shown on item under calibration/ checking regardless of equipment precision or significant figures.

<sup>(e)</sup> The "Tolerance Limit" mentioned is the acceptance criteria applicable for similar equipment used by Quality Pro Test-Consult Ltd. or quoted from relevant international standards.

APPROVED SIGNATORY :

  
FUNG Yuen-ching Aries  
Laboratory Manager



專業化驗有限公司

QUALITY PRO TEST-CONSULT LIMITED

Unit 10, 14/F, Wah Wai Centre, 38-40 Au Pui Wan St., Fotan, Hong Kong

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## CALIBRATION REPORT

Report No. : AG030101  
Date of Issue : March 17, 2017  
Page No. : 1 of 2

### PART A – CUSTOMER INFORMATION

Enovative Environmental Service Ltd.  
Rm 811, Hin Pui House,  
Hin Keng Estate, Tai Wai  
New Territories, Hong Kong  
Attn: Mr. Thomas WONG

### PART B – DESCRIPTION

Name of Equipment : YSI Pro Plus (Multi-Parameters)  
Manufacturer : YSI (a xylem brand)  
Serial Number : IOD101566  
Date of Received : Mar 16, 2017  
Date of Calibration : Mar 16, 2017  
Date of Next Calibration<sup>(a)</sup> : Jun 16, 2017

### PART C – REFERENCE METHODS/ DOCUMENTS FOR THE CALIBRATION

Parameter	Reference Method
pH at 25°C	APHA 21e 4500-H <sup>+</sup> B
Dissolved Oxygen	APHA 21e 4500-O G
Conductivity at 25°C	APHA 21e 2510 B
Salinity	APHA 21e 2520 B
Temperature	Section 6 of international Accreditation New Zealand Technical Guide no. 3 Second edition March 2008: Working Thermometer Calibration Procedure.

### PART D – CALIBRATION RESULTS<sup>(b,c)</sup>

#### (1) pH at 25°C

Target (pH unit)	Displayed Reading <sup>(d)</sup> (pH Unit)	Tolerance <sup>(e)</sup> (pH Unit)	Results
4.00	4.09	+0.09	Satisfactory
7.42	7.45	+0.03	Satisfactory
10.01	10.08	+0.07	Satisfactory

Tolerance of pH should be less than  $\pm 0.10$  (pH unit)

#### (2) Temperature

Reading of Ref. thermometer (°C)	Displayed Reading (°C)	Tolerance (°C)	Results
10.0	9.9	-0.1	Satisfactory
22.0	21.7	-0.3	Satisfactory
35.0	37.30	+2.3	Satisfactory


Tolerance limit of temperature should be less than  $\pm 2.0$  (°C)

~ CONTINUED ON NEXT PAGE ~

#### Remark(s): -

- <sup>(a)</sup> The "Date of Next Calibration" is recommended according to best practice principals as practiced by QPT or quoted from relevant international standards.  
<sup>(b)</sup> The results relate only to the calibrated equipment as received  
<sup>(c)</sup> The performance of the equipment stated in this report is checked with independent reference material and results compared against a calibrated secondary source.  
<sup>(d)</sup> "Displayed Reading" denotes the figure shown on item under calibration/ checking regardless of equipment precision or significant figures.  
<sup>(e)</sup> The "Tolerance Limit" mentioned is the acceptance criteria applicable for similar equipment used by QPT or quoted from relevant international standards.

APPROVED SIGNATORY :

  
FUNG Yuen-ching Aries  
Laboratory Manager





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## CALIBRATION REPORT

Report No. : AG030101  
Date of Issue : March 17, 2017  
Page No. : 2 of 2

### PART D – CALIBRATION RESULTS (Cont'd)

#### (3) Dissolved Oxygen

Expected Reading (mg/L)	Displayed Reading (mg/L)	Tolerance (mg/L)	Results
0.16	0.19	+0.03	Satisfactory
4.38	4.31	-0.07	Satisfactory
8.51	8.56	+0.05	Satisfactory

Tolerance limit of dissolved oxygen should be less than  $\pm 0.20$  (mg/L)

#### (4) Conductivity at 25°C

Expected Reading ( $\mu\text{S/cm}$ )	Displayed Reading ( $\mu\text{S/cm}$ )	Tolerance (%)	Results
146.9	149.8	+2.0	Satisfactory
1412	1431	+1.3	Satisfactory
12890	12286	-4.7	Satisfactory
58670	57728	-1.6	Satisfactory
111900	109852	-1.8	Satisfactory

Tolerance limit of conductivity should be less than  $\pm 10.0$  (%)

#### (5) Salinity

Expected Reading (g/L)	Displayed Reading (g/L)	Tolerance (%)	Results
10	9.92	-0.8	Satisfactory
20	19.88	-0.6	Satisfactory
30	29.81	-0.6	Satisfactory

Tolerance limit of salinity should be less than  $\pm 10.0$  (%)

~ END OF REPORT ~